JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)
THE REPUBLIC OF PERU

THE PREPARATORY SURVEY ON SOLID WASTE MANAGEMENT PROGRAM IN THE REPUBLIC OF PERU

FINAL REPORT

Volume-1: Main Report

MAY 2011

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Map of the Study Area

THE PREPARATORY SURVEY ON SOLID WASTE MANAGEMENT PROGRAM IN THE REPUBLIC OF PERU

FINAL REPORT

COMPOSITION OF THE REPORT

Currency Exchange Rate
PEN(S/.) 1 = JPY 29.3
USD 1 = PEN 2.82
(As of March 2011)
PEN: Peruvian Nuevo Sol
USD: United States Dollar
JPY: Japanese Yen

ABBREVIATIONS and ACRONYM

ACRONYM	
BOD	Biochemical Oxygen Demand
CDM	Clean Development Mechanisms
CO	Operative Consultant
CODECO	Community Development Commission
CS	Supervisor Consultant
DGCP	General Directorate of Public Credit
DGPM	General Directorate of Multiannual Programming of MEF
DIGESA	Directorate of Environmental Health
DIRESA	Regional Directorate of Health
DNEP	National Directorate of Public Indebtness
EAP	Economically Active Population
EC-RS	Company selling solid waste
EQS	Environmental Quality Standard
EPS	Companies providers of drinking water and sewage services
ESSALUD	Social Health Insurance
EUP	Executing Unit of the Program
EU	Executing Unit
FONAM	Environmental National Fund
FONCOMUN	Municipal Compensation Fund
FONIPREL	Fund for the Promotion of Regional and Local Investment
FS	Feasibility Study
GAT	Tax Administration Management
GDP	Gross Domestic Product
GNP	Gross National Product
GTZ	German Technical Cooperation
INC	National Institute of Culture
INEI	National Institute of Statistics and Computing
ICB	International Competitive Bidding
IDB	Inter - American Development Bank
SIS	Integral Health Insurance
INEI	National Statistics and Informatics Institute
JBIC	Japan Bank for International Cooperation
L/A	Loan Agreement
MEF	Ministry of Economy and Finance
MINSA	Ministry of Health
MINCETUR	Ministry of Foreign Trade and Tourism
MINCU	Ministry of Culture
MOP	Operation Manual
MPL	Maximum Permissible Limits
NGO	Non-Governmental Organization
O&M	Operation and Maintenance
OGPP	General Office of Planning and Budget
OPI	Office of Investments Programming
PENTUR	National Strategic Plan for Tourism
PIP(s)	Public Investment Project(s)

ACRONYM	
PIGARS	Integral Plan of Solid Waste Environmental Management
PCM	Presidency of the Ministries Council
PMB	Program Management Board
PMM	Program of Municipal Modernization
PPE	Personal Protective Equipment
AOP	Annual Operating Plan
SAT	Tax Administration Service
SNIP	National System of Public Investment
GOJ	Government of Japan
GOP	Government of Peru
SEIA	System of Environmental Impact Analysis
SW	Solid Waste
SWPIP	Solid Waste Public Investment Program
SWM	Solid Waste Management
TOR	Terms of Reference
TUPA	Unified Text of Administrative Procedure
UNDP	United Nations Development Programme
USEP	Sub Executing Units of the Program
VAT	Value Added Tax
CER	Cost Effectiveness Ratio

EXECUTIVE SUMMARY (THE PROGRAM FS)

1. NAME OF THE PROGRAM

Program of Development of Solid Waste Management Systems in the Priority Areas of Puno, Piura, Ancash, Tumbes, Apurimac, Ica, Huánuco, Puerto Maldonado, San Martin, Junin, Lambayeque, Loreto, Ayacucho, Amazonas,Lima And Pasco.

2. OBJECTIVE OF THE PROGRAM

Improvement of the environmental quality through an efficient and sustainable solid waste management in the priority areas of Peru.

3. DEMAND AND SUPPLY OF THE SERVICE

(1) Demand

1) Solid Waste Storage

The public storage demand of solid waste in each of the projects has been established after identifying the necessary storage places and the current loading capacity, with an updated average capacity per year, and expressed in tons. Current projection is based taking into account the population growth rate during a 10-year period.

2) Street Sweeping

In order to calculate the demand of street sweeping and collection of solid waste dumped in parks and public places in areas with heavy transit of people and commercial areas. The performance of each worker has been established taking into account the time and amount of waste collected per day and projected annually in tons, considering the length of the streets to sweep using the percentage formula of urban spaces projection.

3) Collection and Transportion

In order to establish the demand, the following information have been taking into account:

- Collection: It refers to the process of collecting the waste at origin and then transport them to the final destination. It is important to establish the features, condition and amount fo waste to be collected in the vehicles. For that purpose, the daily amount of waste load is established and then projected based on an annual weighted average.
- Transporation: This calculation is done based on the type of vehicle, tons to be transported, number of trips, time, age and maintenance of the vehicle. Furthermore, per capita production is related to the amount of generators in each of the cities of the program.

4) Recovery

The demand of the service to reuse organic and inorganic solid waste has been calculated from the results of the characterization study carried out in each city.

The objective would be to reuse an average of 30% of all recyclable inorganic waste at 10th year of the operation. In the case of organic waste, in the beginning 200 kg/day of organic waste from markets will be recovered.

The recovery of inorganic solid waste, such as paper, glass, plastic, carton and metals, among others will take place through promoting segregation at source, selective collection and reuse

of a fraction of recyclable solid waste. The starting point will be a first stage or a pilot project, which will include 5% of the population of each city. During the execution of the program, the recovery goal will depend on the size of the cities, being these large, medium and small.

For the organic solid waste, it is considered the solid waste generated in the markets of each city, and occasionally, some cities will also include waste generated in the restaurants.

- In the first two years, a pilot test will be implemented and a demand of 200 kg of market waste will be considered.
- For the 3rd, 4th and 5th year of the project implementation, all solid waste generated in the markets will be reused, up to a maximum of 4 t/day.
- From 6th to 10th year, all solid waste generated in the markets will be reused, up to a maximum of 7 t/day. In some cities, solid waste from restaurants and households from pilot areas could be also reused.

During the pilot stage, that is, the first two years of the project, at the sorting plant of inorganic waste, composting activities and reciclable waste will be classified.

5) Final Disposal

The current demand of solid waste final disposal is the total municipal solid waste generated based on the growth of municipal solid waste generation and current population growth. The amount of solid waste to be disposed could decrease depending on the amount effectively reused, thus increasing the life cycle of the sanitary landfill.

(2) Supply

The analysis of the current supply is based on the generation of each city included in the program, which refers to services that are not provided comprehensively.

1) Solid Waste Storage

The supply for this service depends on the current amount of containers installed to store solid waste generated in medium transit areas and public spaces (avenues, squares, parks, boulevards, etc).

2) Street Sweeping

The supply regarding the solid waste sweeping is based on the amount of street sweepers and their performance considering the equipment and working conditions. That is to say, in the amount of linear kilometers swept per day and the annual projection.

3) Collection and Transportation

As for collection and transportation of solid waste, the service is provided using compactor trucks, dump trucks, hopper trucks, vans, and in some cases, adapted vans. However, most of the times the vehicles are rather old.

4) Recovery

Although most of the cities included in the program are not carrying out this component, some of them perform this activity informally, which originates a small amount of organic

and inorganic solid waste treatment per year. However, this activity is performed under poor conditions, so it can not be considered a supply.

5) Final Disposal

The main problema identify in the cities included in the program is the inadequate final disposal of solid waste. In fact, none of the cities has a sanitary landfill, so the supply for the final disposal service is analysed as 0 t/year.

(3) Balance of Supply and Demand

The supply demand balance shows the existing gap in the service as part of the development program of solid waste management service in priority areas. The program is expected to care for the whole deficit. The following table summarize the balance of demand and supply.

Balance of Deamand and Supply of System of Solid Waste Management

Nº	Year	Population	Generation	Public Storage			Sweeping of streets			Collection and Transportation			Recovery of inorganic solid waste			Recovery of Organic solid waste			Final Disposal		
			t/year	t / year			km / year			t / year			t / year			t / year			m3 / year		
				Demand	Supply	Deficit	Demand	Supply	Deficit	Demand	Optimized supply	Deficit	Demand	Supply	Deficit	Demanda	Supply	Deficit	Demand	Supply	Deficit
0	2010	2,335,526	610,437.95	13,019.18	4,759.29	8,259.89	640,411.85	500,158.91	140,252.94	611,003.60	25,273.94	585,729.66	13,839.16	36.43	2,335,526	610,437.95	13,019.18	4,759.29	8,259.89	640,411.85	500,158.91
1	2011	2,383,978	627,107.32	13,294.19	4,762.33	8,531.85	653,369.84	500,158.91	153,210.93	627,691.53	19,284.61	608,406.92	14,512.84	37.92	2,383,978	627,107.32	13,294.19	4,762.33	8,531.85	653,369.84	500,158.91
2	2012	2,433,714	644,340.09	13,581.60	4,765.46	8,816.14	666,645.11	500,158.91	166,486.19	644,943.45	19,357.18	625,586.27	14,798.25	38.22	2,433,714	644,340.09	13,581.60	4,765.46	8,816.14	666,645.11	500,158.91
3	2013	2,484,772	662,130.24	13,875.42	4,768.67	9,106.75	680,244.01	500,158.91	180,085.10	662,753.39	19,432.63	643,320.76	19,281.30	38.52	2,484,772	662,130.24	13,875.42	4,768.67	9,106.75	680,244.01	500,158.91
4	2014	2,537,196	680,493.36	14,176.57	4,771.97	9,404.60	694,063.96	500,158.91	193,905.05	681,136.95	19,510.16	661,626.80	19,660.94	38.83	2,537,196	680,493.36	14,176.57	4,771.97	9,404.60	694,063.96	500,158.91
5	2015	2,591,034	699,456.50	14,486.07	4,775.36	9,710.71	707,977.23	500,158.91	207,818.31	700,121.19	19,588.83	680,532.36	27,557.24	39.15	2,591,034	699,456.50	14,486.07	4,775.36	9,710.71	707,977.23	500,158.91
6	2016	2,646,332	719,045.18	14,805.05	4,778.84	10,026.21	722,247.08	500,158.91	222,088.16	719,731.68	14,560.77	705,170.91	27,966.67	39.48	2,646,332	719,045.18	14,805.05	4,778.84	10,026.21	722,247.08	500,158.91
7	2017	2,703,142	739,275.89	15,133.80	4,782.41	10,351.39	736,885.42	500,158.91	236,726.51	739,984.89	14,646.20	725,338.70	36,206.75	39.82	2,703,142	739,275.89	15,133.80	4,782.41	10,351.39	736,885.42	500,158.91
8	2018	2,761,509	760,179.57	15,473.41	4,786.08	10,687.32	751,904.64	500,158.91	251,745.73	760,911.83	14,735.15	746,176.67	36,648.43	40.16	2,761,509	760,179.57	15,473.41	4,786.08	10,687.32	751,904.64	500,158.91
9	2019	2,821,493	781,778.95	15,820.67	4,789.86	11,030.82	767,317.67	500,158.91	267,158.76	782,535.22	14,827.90	767,707.32	52,747.59	40.52	2,821,493	781,778.95	15,820.67	4,789.86	11,030.82	767,317.67	500,158.91
10	2020	2,883,145	804,096.39	16,176.58	4,793.73	11,382.85	783,141.62	500,158.91	282,982.70	804,877.47	14,924.61	789,952.86	53,224.33	40.89	2,883,145	804,096.39	16,176.58	4,793.73	11,382.85	783,141.62	500,158.91

	Service Coverage Deficit :	Public Storage	Sweeping of streets	Collection and Transportation	Recovery of inorganic solid waste	Recovery of Organic solid waste	Final Disposal
	Year 0	63.4%	21.9%	95.9%	99.7%	63.4%	100.0%
	Year 10	70.4%	36.1%	98.1%	99.9%	70.4%	100.0%
	Project Goals (tn/Year)	44.32	2,145.59	2,205.14	145.82	44.32	32,988.02

Source: JICA Survey Team

4. TECHNICAL DESCRIPTION OF THE PROGRAM

Each of the PIPs has been elaborated and evaluated in order to develop alternatives that are both feasible and comparable from the technical point of view to solve the main problem caused by the following reason: 1) Inadequate storage and sweeping of streets, 2) inadequate operating capacity of collection and transportation, 3) inadequate recovery of solid waste, 4) inadequate final disposal, 5) poor administrative and financial management, 6) wrong habits of the population. The most critical issue of the municipalities is the final disposal of solid wate. Therefore, it has been selected an integrated approach that demonstrates technical, economic, social and environmental sustainability, which will increase the quality and cover of the services of each stage. Among other actions, this will require to implement permanent environmental education programs in schools and people in general, to implement pilot programs for segregated collection and recovery of organic and inorganic material, as well as plans to strengthen the technical department in charge of SWM, and the department in charge of tax collection for public cleaning.

(1) Solid Waste Storage, Collection and Transportation

As for storage, sweeping and collection, the program foresees to purchase the following equipment: 50 liter waste bins placed at some distance from the medium and high pedestrian traffic strategic places, 120 liter movable trash containers made of high density polyethylene. To provide collection service, there are compactor trucks of 15 m^3, 12 m^3, 10 m^3, 7m^3 and 6 m^3 with hydraulic compacting system of dump trucks with only one axis of 10 m^3 and 19 m^3; trimovils of 0.50 t, apart from basic tools such as shovels, grooms, and personal protection equipment. Regarding the recovery and utilization of materials, there will be proper facilities, such as segregation and composting plants, with a two year pilot test, and the extend the service to other sectors in the city.

(2) Material Utilization: Material Recovery and Composting

The estimation of capacity of the sorting plants depends on the receiving amount of inorganic waste through the segregated waste collection, which is controlled by target area of source segregated collection. It is important to mention that the segregation plants will be built in the year 0 , and the composting plant in the year 2 or 5, depending on the amount of waste from the markets (1.1, 4 or 7 t/day). The operation will be manual, except for the city of Piura, where a belt conveyor will be used in the year 9 if more than 10 t/day are treated. The composting plant will use a small wheel loader and in the cities with more than 7 t/day to treat of organic waste, a vibratory sieve is planned in the reinvestment stage.

(3) Final Disposal

The final disposal will include construction of 31 sanitary landfills, and the size will depend on the tons disposed each day. In short, 10 manual sanitary landfills will be built (less than 20 ton/day), 9 semi mechanized (between 20 and 50 ton/day) and 12 mechanized (more than 50 ton/day). The construction will be done in 2 or 3 phases, depending on the size of the facility and will have the following areas: surveillance and monitoring stand, administrative office, warehouse to store materials and tools, cafeteria and kitchen, registration and, weighing stand, internal and external access roads, parking lot for the machinery, leachate collection drainages, chimneys, leachate ponds, monitoring wells, construction of a safety and life fences. The operations in the sanitary landfill will have a weighing scale of 40 to 60t., with different equipment depending on the type: manual landfills will have a mini bulldozer of 1.1 t; semimechanized facility will use a bulldozer 10 to 15 t. The mechanized facility will use a bulldozer of 21 t., a front loader of 1.9 – 2.7 m^3 and a dump truck of 15 t.

(4) Capacity Development and Awareness Raising

For efficient service, it is necessary to strenghten the administrative and financial management of the municipality and that of citizens regarding the following issues: specialized management, supervision and monitoring of the service, costing system of the services, deciding amount of service charge, design of a strategic plan to increase and to monitor tax collection.

Regarding the environmental education, it is planned to provide basic information to the population, foster good practices in schools and a pilot plan to reduce, use and recycle aimed at the population.

5. PROGRAM COSTS

The costs for the investment and the operation and maintenance are summarized below:

- Direct costs total S/. 209.30 million
- General expenses S/. 7.79 million
- Profit S/. 8.60 million
- Technical service S/. 10.37 million
- Supervision S/. 10.68 million
- Executing Unit of the Program S/. 12.01 million
- Investment of the program S/. 274.65 million

The total investment of the 23 projects which would be financed with JICA resources is S/. 192.89million and up to 80% could be financed by the loan (S/. 154.31million) and the rest with the national counterpart, which totals S/. 38.58 million.

In the case of the eight projects which would be financed by IDB, the estimated investment is S/. 53.79 million. The same as with JICA, up to 80% will be financed with loan resources (S/. 43.04millon) and the counterpart is S/. 10’76 million.

Table Investment Cost at of the Sub-Projects Market Price

Nº	PROJECT	DIRECT COST	GENERAL EXPENSES (% OF THE COST´S WORK)	PROFIT (%OF THE COST´S WORK)	TECHNICAL SERVICE	SUPERVISION	TOTAL
1	JICA - DISTRICT MUNICIPALITY OF NUEVO CHIMBOTE	7,892,562	219,130	219,130	394,628	394,628	9,120,079
2	JICA - DISTRICT MUNICIPALITY OF SANTIAGO	2,320,854	116,325	116,325	116,043	116,043	2,785,590
3	JICA - PROVINCIAL MUNICIPALITYOFAYMARAES - CHALHUANCA	1,808,905	101,803	101,803	90,445	90,445	2,193,401
4	JICA - PROVINCIAL MUNICIPALITYOFAZANGARO	2,007,433	141,798	141,798	100,372	100,372	2,491,772
5	JICA - PROVINCIAL MUNICIPALITY OF CHACHAPOYAS	4,066,952	168,228	168,228	203,348	203,348	4,810,104
6	JICA - PROVINCIAL MUNICIPALITYOFCHINCHA - CHINCHA ALTA	4,789,288	234,036	234,036	239,464	239,464	5,736,289
7	JICA - PROVINCIAL MUNICIPALITY OF FERREÑAFE	4,712,075	205,316	205,316	235,604	235,604	5,593,914
8	JICA - PROVINCIAL MUNICIPALITYOFHUACHO	8,466,268	299,592	315,890	411,000	411,000	9,903,751
9	JICA - PROVINCIAL MUNICIPALITY OF HUANUCO	10,382,110	348,698	398,537	504,354	504,354	12,138,053
10	JICA - PROVINCIAL MUNICIPALITY OF MOYOBAMBA	6,823,845	314,592	341,390	335,909	335,909	8,151,646
11	JICA - PROVINCIAL MUNICIPALITY OF PAITA	5,258,489	222,381	234,747	273,000	273,000	6,261,616
12	JICA - PROVINCIAL MUNICIPALITY OF PIURA	19,022,595	735,708	868,970	934,900	934,900	22,497,073
13	JICA - PROVINCIAL MUNICIPALITYOFPUNO	10,311,951	396,565	428,296	490,000	490,000	12,116,812
14	JICA - PROVINCIAL MUNICIPALITY OF SAN MARTIN - TARAPOTO	9,961,077	307,592	356,248	473,500	473,500	11,571,917
15	JICA - PROVINCIAL MUNICIPALITYOFSAN ROMAN - JULIACA	15,096,424	437,015	665,437	731,400	731,400	17,661,676
16	JICA - PROVINCIAL MUNICIPALITY OF SECHURA	5,046,679	199,275	216,437	306,700	306,700	6,075,791
17	JICA - PROVINCIAL MUNICIPALITY OF SULLANA	10,092,337	314,592	357,848	475,500	475,500	11,715,777
18	JICA - PROVINCIAL MUNICIPALITYOFTALARA - PARIÑAS	7,837,251	182,275	205,551	371,500	371,500	8,968,077
19	JICA- PROVINCIAL MUNICIPALITYOFABANCAY	4,968,067	166,778	166,778	248,403	248,403	5,798,430
20	JICA- PROVINCIAL MUNICIPALITY OF ILAVE	2,510,489	144,711	144,711	125,524	125,524	3,050,959
21	JICA- PROVINCIAL MUNICIPALITYOFTAMBOPATA	8,461,397	226,797	387,480	406,500	406,500	9,888,674
22	JICA- PROVINCIAL MUNICIPALITYOFTARMA	4,586,536	168,873	168,873	229,327	229,327	5,382,935
23	JICA - PROVINCIAL MUNICIPALITYOFTUMBES	7,749,755	222,275	242,062	381,402	381,402	8,976,897
TOTAL JICA		**164,173,340**	**5,874,356**	**6,685,891**	**8,078,823**	**8,078,823**	**192,891,234**
24	IDB - DISTRICT MUNICIPALITY OF CHANCAY	5,136,183			456,793	560,341	**6,153,317**
25	IDB - DISTRICT MUNICIPALITY OF POZUZO	2,083,553	129,046	129,046	83,339	104,174	**2,529,158**
26	IDB- DISTRICT MUNICIPALITY OF OF YAUYOS	1,239,323	84,807	84,807	49,573	61,966	**1,520,476**
27	IDB - PROVINCIAL MUNICIPALITYOF BAGUA - LA PECA	4,631,496	244,169	244,169	185,260	231,575	**5,536,669**
28	IDB - PROVINCIAL MUNICIPALITY OF HUAMANGA	15,426,719	652,837	652,837	771,336	771,336	**18,275,065**
29	IDB - PROVINCIAL MUNICIPALITY OF OXAPAMPA	4,074,826	179,653	179,653	162,980	203,723	**4,800,835**
30	IDB- DISTRICT MUNICIPALITY OF SAN JUAN BAUTISTA	7,683,408	318,119	318,119	384,170	384,170	**9,087,988**
31	IDB- PROVINCIAL MUNICIPALITY OF ANDAHUAYLAS	4,850,213	304,196	304,196	194,009	242,511	**5,895,125**
	TOTAL IDB	**45,125,721**	**1,912,828**	**1,912,828**	**2,287,460**	**2,559,796**	**53,798,633**
TOTAL		**209,299,062**	**7,787,184**	**8,598,720**	**10,366,283**	**10,638,619**	**246,689,867**

6. BENEFITS

There are 31 municipalities included in the program, which includes 2.94million beneficiaries, with the following break down:

Number of Berificiaries

Nº	PROJECT	BASE YEAR (2013)
1	JICA - DISTRICT MUNICIPALITY OF NUEVO CHIMBOTE	139,089
2	JICA - DISTRICT MUNICIPALITY OF SANTIAGO	19,394
3	JICA - PROVINCIAL MUNICIPALITY OF AYMARAES - CHALHUANCA	6,581
4	JICA - PROVINCIAL MUNICIPALITY OF DE AZANGARO	19,092
5	JICA - PROVINCIAL MUNICIPALITY OF DE CHACHAPOYAS	30,414
6	JICA - PROVINCIAL MUNICIPALITY OF CHINCHA - CHINCHA ALTA	66,037
7	JICA - PROVINCIAL MUNICIPALITY OF FERREÑAFE	48,165
8	JICA - PROVINCIAL MUNICIPALITY OF HUACHO	178,234
9	JICA - PROVINCIAL MUNICIPALITY OF HUANUCO	157,964
10	JICA - PROVINCIAL MUNICIPALITY OF MOYOBAMBA	79,418
11	JICA - PROVINCIAL MUNICIPALITY OF PAITA	92,476
12	JICA - PROVINCIAL MUNICIPALITY OF PIURA	440,652
13	JICA - PROVINCIAL MUNICIPALITY OF PUNO	140,202
14	JICA - PROVINCIAL MUNICIPALITY OF SAN MARTIN - TARAPOTO	154,653
15	JICA - PROVINCIAL MUNICIPALITY OF SAN ROMAN - JULIACA	252,830
16	JICA - PROVINCIAL MUNICIPALITY OF DE SECHURA	73,927
17	JICA - PROVINCIAL MUNICIPALITY OF SULLANA	205,434
18	JICA - PROVINCIAL MUNICIPALITY OF TALARA - PARIÑAS	90,862
19	JICA- PROVINCIAL MUNICIPALITY OF ABANCAY	46,486
20	JICA- PROVINCIAL MUNICIPALITY OF ILAVE	27,749
21	JICA- PROVINCIAL MUNICIPALITY OF TAMBOPATA	89,206
22	JICA- PROVINCIAL MUNICIPALITY OF TARMA	44,795
23	JICA - PROVINCIAL MUNICIPALITY OF TUMBES	149,244
TOTAL JICA		**2,552,905**
24	IDB – DISTRICT MUNICIPALITY OF CHANCAY	59,798
25	IDB - DISTRICT MUNICIPALITY OF POZUZO	9,084
26	IDB - DISTRICT MUNICIPALITY OF YAUYOS	9,835
27	IDB – PROVINCIAL MUNICIPALITY OF BAGUA - LA PECA	52,378
28	IDB - PROVINCIAL MUNICIPALITY OF HUAMANGA	197,175
29	IDB - PROVINCIAL MUNICIPALITY OF OXAPAMPA	9,294
30	IDB- DISTRICT MUNICIPALITY OF SAN JUAN BAUTISTA	103,900
31	IDB- PROVINCIAL MUNICIPALITY OF ANDAHUAYLAS	48,433
TOTAL IDB		489,897
TOTAL		**3,042,803**

Source: prepared by JICA Survey Team based on INEI data

Taking into account the large number of beneficiaries, it is important to mention that the main scope of the project is to provide not only a solid waste management nationwide, but also to include many cities, both rural and urban areas. Then, beneficiaries will have real integrated sysems of SWM under operating technical management, adapted to the real context of each city and considering the different nuances socioeconomic demographic, environmental, ensuring people live in harmony with the environment.

Another benefit is related to the strengthening capacity of municipalities, specially related to collection for public cleaning, in the form of public auction of reusable materials.

7. SOCIAL EVALUATION

The social evaluation was carried out using the methodology cost/effectiveness through the 10-year horizon of the project, including the operation and maintenance stages.

Regarding the evaluation of the alternative at social prices and including a discount rate of 11% for market costs (according to National System of Public Investment SNIP) stated a cost effectiveness of S/.65.83 ton/inhabitant.

In the case of the vulnerability analysis, the variable used for this matter was the cost of investment. Variations were analyzed in order to identify the impact in the ratio cost-effectiveness, since an increase or decrease of the market prices of the PIPs will impact the investment cost.

Variable -Cost of Investment and Generation

VARIATION	INVESTMENT COST (S/.)	VA GENERATION T/YEAR	VACS (S/)	COST-EFFECTIVENESS	
				CE VARIATION (INVESTMENT)	CE VARIATION (GENERATION)
-30%	140,914,963	3,766,793	293,844,952	S/. 54.61	S/. 78.01
-25%	150,980,318	4,035,850	303,910,307	S/. 56.48	S/. 75.30
-20%	161,045,672	4,304,906	313,975,661	S/. 58.35	S/. 72.93
-15%	171,111,027	4,573,963	324,041,016	S/. 60.22	S/. 70.84
-10%	181,176,381	4,843,020	334,106,370	S/. 62.09	S/. 68.99
-5%	191,241,736	5,112,076	344,171,725	S/. 63.96	S/. 67.33
0%	**201,307,090**	**5,381,133**	**354,237,079**	**S/. 65.83**	**S/. 65.83**
5%	211,372,445	5,650,190	364,302,434	S/. 67.70	S/. 64.48
10%	221,437,799	5,919,246	374,367,788	S/. 69.57	S/. 63.25
15%	231,503,154	6,188,303	384,433,143	S/. 71.44	S/. 62.12
20%	241,568,508	6,457,360	394,498,497	S/. 73.31	S/. 61.09
25%	251,633,863	6,726,416	404,563,852	S/. 75.18	S/. 60.15
30%	261,699,217	6,995,473	414,629,206	S/. 77.05	S/. 59.27

Source: JICA Survey Team

8. SUSTAINABILITY

8.1 Institutional planned arrengements for the operation and maintenance stages

The municipalities are responsable for the operation, maintenance and reinvestment. Therefore, it is planned to make a fund trust agreement, called as FIDEICOMISO, between the Ministry of Environment and each participating municipality of the program.

The fund trust agreement is a financial tool to guarantee the sustainability of the program. It is the measure to guarantee the operation and maintenance costs of the 31 PIPs and to ensure the financing of the reinvestment originated by the execution of the program.

8.2 Management capacity of the organization executing the project operation

The program has considered to execute the activities focused on the strengthening of technical, administrative, economic and financial management of the public cleaning service, then improving the capacity of municipality for operation.

If necessary, the municipal council must change the structure of the municipality so that it fits the missions and duties, which are listed below:

- Planning and operation of the public cleaning service
- Planning and execution of the best practices to segregate waste at source.
- Elaboration of technical requirements and procurement requirements for minor equipment and inputs (tools, maintenance service for machinery, spare parts, fuel, computing replacement equipment,furniture, etc)
- Quality control of the equipment, inputs and services hired by the municipality for the sector, in compliance with the standards already established.
- Program execution of personal training
- Execution of awareness programs for the citizens
- Execution of social communication programs
- Execution of programs to improve collection
- Administration of the human resources involved in the project
- Establish the operating costs of the service
- Relation with other subdirectorates
- Link with the executing unit of the program of the Ministry of Environment

8.3 Financing of operating, maintenance and reinvestment costs

The municipalities are in charge of financing of the operating, maintenance and reinvestment costs of the PIPs included in the program. These activities will be financed with a fund trust (FIDEICOMISO) agreement signed by MINAM, the municipalities and the Banco de la Nacion. It is assumed that FONCOMUN will be a source of FIDEICOMISO. Following is the support for this decision.

Law of Public Sector Budget for financial year 2010 (Law N° 29465) set up the Program of Municipal Modernization (PMM) and the Plan of Incentives to improve municipal management (PI). MEF is implementing these progtam. The PMM seeks to improve the conditions contributing to the growth and sustainable growth of the local economy, thus prompting municipalities to:

a) Increase municipal tax collection by improving financial management
b) Create good business environment by improving the public services, basic infrastructure and reduction of burocracy, among others.

PI promotes conditions for the sustainable development of local economy, fostering municipalities to:

a) Increase collection rates of municipal tax, so that estability will be strenghened and also the perception regarding tax.
b) Improve the execution of the investment projects, considering the improvement policies related to the quality of the expenses.
c) Reduce the chronic infant malnutrition in the country.

It is expectedthat capacity of munitipalisitie will be improved through these program before implementation of the projects.

8.4 Promotion of Contriution of the Beneficiaries

The beneficiaries have to pay the service fee for SWM, and each project will carry out activities in the investment stage to raise awareness of beneficiaries and improve both the payment and the collection rate of the SWM Service fee.

The strategies to increase fee collection are focused on the municipality and beneficiaries.

The first strategy has an immediate impact, whereas the second takes longer, since it is linked to cultural issues, medium and long term.

However, a combination of both activities will provide better results regarding collection and will ensure said results remain throughout the life cycle of the Project. Therefore, strategies must long beyond the design of the project.

The strategies based on the population must focus on the cultural change necessary so that inhabitants are aware that they must conservate the environment by paying the corresponding tax for the public cleaning service.

Regarding environmental education, the measures to be adopted within the framework of the awareness program are explained.

The tax collection in the municipalities is important because it helps to operate and run the municipality. The same applies for tax collection from public cleaning service.

Tax related to this service are included in the current expenses of the municipality. Therefore, the financing must come from the own resources of the municipality. This does not imply the project may finance other activities during the implementation stage that may increase the potentiality.

The economic resourses necessary to finance these activities may come from the resources available at PMM, IP programs of the municipality.

Depending on each municipality, measures will be implemented to improve tax collection for the service, then using several strategies that are further explained in the document, such as:

At the same time, by implementing this project the service coverage will increase and this will generate more willingness to pay from the people.

9. ENVIRONMENTAL IMPACT ANALYSIS

The evaluation of the 31 PIPs included in the program show that it is positive since risks of environmental polllution for air, soil and water will decrease. The positive impact on the environment means a better quality of life for the inhabitants thanks to a proper disposal of solid waste and promotion of recycling.

(1) Investment Stage

Temporal negative environmental impacts will be generated due to infrastructure works that will be executed for the solid waste management such as waste sorting plant for inorganic waste, composting plant and sanitary landfill. Most definetly, earthmoving and construction works will generate waste although only temporarily. When the construction stage is finished,

those inconvenients will disappear. During the construction stage,mitigation measures will be adopted, such as irrigation of the area, safety measures, management of solid waste generated by means of a provider of solid waste services, among others.

(2) Post Investment Stage

Negative environmental impact will occur, although negative impacts will be temporary, periodic, local and mild. The air will be mostly affected by particles in suspension caused by the sanitary landfill.

The transportation of waste could affect the soil in all cities, unless vehicles are properly maintained (for instance, hopper is broken, leachate leak, among others) So, periodic maintenance programs have been planned.

There is the risk also of water pollution during the operation and maintenance of the components of the program, although the impact will be temporary, local and moderate. Therefore, drains will be installed to collect and treat leachate. Besides, a monitoring system will be installed to check the quality of groundwater for necessary sites.

As for air environment, gas emissions and bad odor may occur due to decomposition of organic matter in all cases, having mild consequences.

The sanitary landfill will generate gas(CH_4 methane, H_2S hydrogen sulphide, CO_2 carbon dioxide) in all cases. This is the reason why a project of Clean Development Mechanism could be implemented. Then, final disposal facilities for solid waste will have an gas treatment facility (chimneys).

Regarding fauna, in many cases, animals could enter the final disposal area, so a life fence will be built to keep animals away. Likewise, mechanisms of biological control could be used, too.

In the case of socioeconomic and cultural impacts, inhabitants could reject the use of containers in publica reas, hence the importance of an environmental education program. A timely collection of solid waste will solve risks for public health in all cities. Then, it is important to observe the collection times.

Traffic could be affected in all cases temporaly. Thus, it is important to design an optimized route schedule to assess which is the most suitable time to collect waste.

Those informal waste pickers that may loose their jobs after installing the sorting plant would be hire through a formalization plan. The aim of said plan is to include informal waste pickers in the productive chain, as well as promote segregation at source and selective collection of solid waste.

As it happens with any other source of work or income, the installation of the sanitary landfills could prone migration of people to the nearby areas. So it is very important to control the sanitary landfill site in order to prevent squattering. The land zone division must be fit for the proper use of soil.

10. ORGANIZATION AND MANAGEMENT

The program will be managed through the executing unit of the program (UEP) regarding tasks related to administration, finance, accountancy and technical coordination. Furthermore,

they will be supported by the subexecuting units formed by the municipalities, in order to implement some activities related to the program.

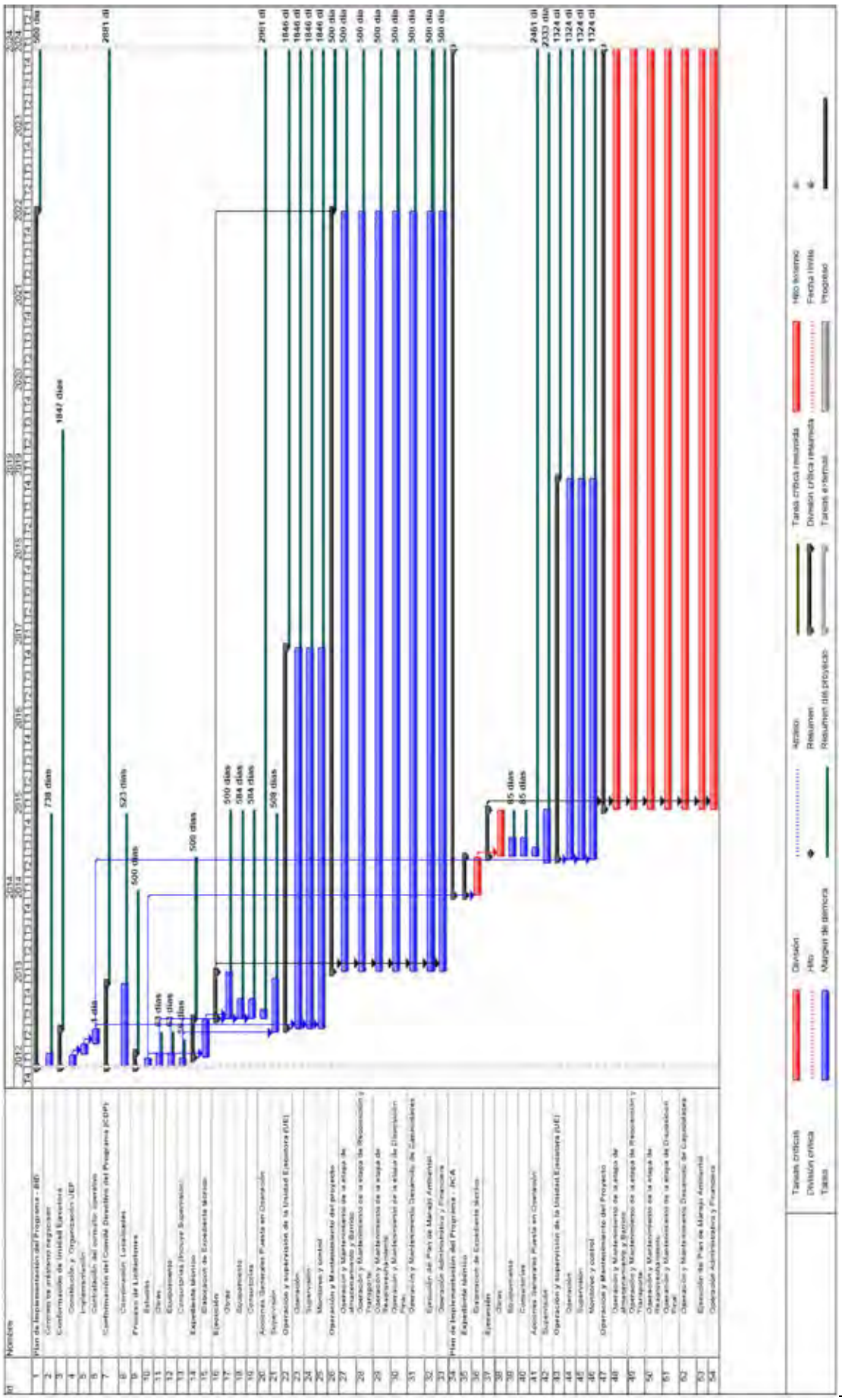
The Ministry of Environment is the agency responsible to promote the environment conservation and the sustainable use of natural resources. The main duties and responsibilities are:

1. Articulate with those in charge of the program, such as the executing unit of the program and the subexecuting units.
2. MINAM has its own budget and must coordinate all budget issues that the program may need.

At the same time, each municipality included in the program will become subexecuting units that shall implement the specific projects of each city, and will be responsible that the solid waste management work. The subexecuting units represented by the municipalities will form subexecuting units of the projects in order to execute the planned investments in those municipalities within the framework of the program in accordance with the provisions in force.

11. IMPLEMENTATION PLAN

The executing unit of the viceministry of Environmental Management of the Ministry of Environment will manage the loan from JICA and IDB.



Source: JICA survey team

Figure Schedule of Activities for the Program

12. FINANCING

The resources to implement the program come from international donors who are through the JICA and the IDB. It is anticipated that, JICA would finance 23 projects and IDB would 8 projects.

The MEF shall pay the loans in order to guarantee that the country benefits from the Program.

The disbursement period starts once the loan becomes effective, taking into consideration the different periods of grace. The loan conditions will be agreed with the National Directorate of Public Indebtedness (DNEP) at the Ministry of Economy.

In the case of Santiago, the canon totals almost S/. 7 million. Additionally, there are remaining balance low and this municipality occupies the third fifth of the poverty map by FONCODES. Therefore, this municipality shall not bear counterpart.

As for Andahuaylas, the municipality has important remaining balance. However, the canon collected is very low, and this municipality occupies the second fifith of the poverty map by FONCODES. Then, this municipality will pay 10% of the counterpart.

It is imporant to mention that the participation of said capital will be coordinated and agreed between MINAM and each of the municipalities.

13. CONCLUSIONS AND RECOMMENDATIONS

- The feasibility analysis of the program shows that it is necessary to implement infrastructure, equipment, management training and awareness campaigns regarding the solid waste management of the cities selected. The main problem is the damage of environmental quality caused by the poor and unsustainable solid waste management in the priority areas in Peru.
- The selected alternative allows using different strategies and techniques for solid waste management according to the different features of the 31 projects included in the Program, with an effectiveness coefficient of S/.65.83 per ton treated. This value falls into the rate parameters to apply to the end users in each of the projects, which are then viable.
- The PIP of the program considers 31 priority cities in the investment analysis, with a total investment amount at market prices of S/. 274.65 milloion.
- To implement the program, the Ministry of Environment will set up a executing unit so that the objectives of the program are to be accomplished.
- Considering the characteristics of the service (public storage, street sweeping, collection, transportation, reuse and final disposal), the participation of the private sector will be assessed. Furthermore, in the near future, the program would access to a clean development mechanism CDM to reduce emissions and then access to carbon credits.
- According to the analysis performed and gathering of primary information to sustain the figures and data, the execution is then recommended.

THE PREPARATORY SURVEY ON SOLID WASTE MANAGEMENT PROGRAM IN THE REPUBLIC OF PERU

FINAL REPORT
VOLUME I: MAIN REPORT

PART I: OUTLINE OF THE PREPARATORY SURVEY

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CHAPTER 1 GENERAL

1.1 BACKGROUND

In Peru, approximately 22,475 tons of generated solid waste are being discharged every day all over the country. Its volume is increasing year by year and especially in the last seven years, the increase is 6.15% annually. Of the discharged volume, only approximately 70% is collected and 26% is disposed appropriately. Since there are only nine sanitary landfill sites nationwide, five of which are located in Lima metropolitan areas, the solid waste management (SWM) system is not sufficiently developed in the rural areas. These inadequate SWM systems are closely connected with the environmental deterioration and living conditions of the people in the regions. Therefore, it is highly recommended to develop appropriate SWM systems throughout the regions. Nevertheless, there has not been any action that has tackled these problems nationwide, because the responsibility to establish a SWM system corresponds to the respective local governments (*Municipalidad Provincial/Municipalidad Distrital*).

Within this context, the Ministry of Environment (MINAM) was established in May 2008. MINAM has committed to solve those problems on SWM and has requested two SWM programs (which are JICA ODA loan projects) to the Government of Japan (GOJ) through the Ministry of Economy and Finance (MEF). In response to this request, the Government of Peru (GOP) and the Japan International Cooperation Agency (JICA) held several preliminary discussions to identify a priority program in the field of SWM and agreed to conduct the necessary preparations regarding the SWM program, which will be implemented as the first phase program (*Programa de Desarrollo de Sistemas de Gestion de Residuos Solidos en Zonas Prioritarias:* the Program).

The program aims at establishing the integrated SWM system from generation to final disposal, targeting at prioritized districts through improving the SWM system by constructing and/or rehabilitating solid waste infrastructures as well as developing solid waste collection and recycling/recovering systems, thereby contributing to the improvement of the living standard of the people in the regions. The fundamental scope of the Program has been set as follows:

a) Program site: selected 31 sites (as of the end of November 2010, see map on the top)
b) Program scope:
   - Civil works: construction, rehabilitation or expansion of the SWM infrastructures
   - Procurement of equipments and machineries
   - Capacity development
   - Consulting services
c) Executive agency: MINAM

Accordingly, JICA dispatched a mission for the program to the Republic of Peru from December 10 to 11, 2009 in order to develop the scope and implementing arrangements of a further survey to review the feasibility and establish the framework of the program. The Preparatory Survey covers the program and selected individual 23 sites (projects), which are planned to be implemented by the yen loan.

The GOP has a national system of public investment, namely *Sistema Nacional de Inversión Pública* (SNIP) in order to optimize the use of public resources by means of establishment of principles, processes, methodologies and practical standards for various phases of the investment projects. In principle, all public investment projects (PIPs) need to be examined and approved through the SNIP process depending on the investment amount. In the case of foreign

borrowing PIPs need to obtain "*aprobación*" from sector ministry in charge1 and "*viabilidad*" from MEF. The preparatory survey also supports MINAM for its approval process in SNIP.

1.2 OBJECTIVES OF THE PREPARATORY SURVEY

The preparatory survey has been conducted bearing in mind two broad objectives. Firstly, the preparatory survey assists MINAM in the approval process of the SNIP program by preparing the *Factibilidad* program level (Feasibility Study: FS) and project level pre-investment studies (*Perfil* (Profile), *Prefactibilidad* (Pre-FS), or FS depending on the requirements by SNIP. Secondly, the preparatory survey assists MINAM in establishing the framework of the program scheme to manage the program effectively in order to apply JICA ODA loan.

The more tangible objectives of the Preparatory Survey are:

a) To review the existing *Perfils* of the Program and 23 projects,

b) To conduct necessary field surveys required in the SNIP, including environment and social considerations surveys,

c) To update/prepare *Perfil* and Pre-FS and FS of the Program and 23 sub-projects in conformity with the requirements of SNIP process, and

d) To support MINAM to ensure a smooth transition from the pre-investment stage to the investment stage through the project formulation for firm and smooth implementation under the JICA ODA loan.

1.3 SCOPE OF THE PREPARATORY SURVEY

1.3.1 Scope of the Preparatory Survey

The main scope of the preparatory survey is to prepare the necessary pre-investment studies in accordance with the requirements stated in the SNIP procedure, such as Profile (*Perfil*), Pre-FS and FS of the Program and 23 sub-projects to improve the SWM in each project site. The Preparatory Survey is being carried out in compliance with the following scope.

(1) Support for Approval of the Perfil of the Program

a) To collect basic information regarding SWM issues in Peru and at the target project sites.

b) To compile information and data regarding SWM such as natural/social conditions and current situation at the target project sites by reviewing the existing *Perfils* of the sub-projects and relevant materials.

c) To consider the relevance of the existing *Perfil* of the Program and to make necessary updates and improvements of the *Perfil*, taking into account the collected and compiled information and data which are required to obtain the"*salto* (skip)" within the SNIP procedure.

d) To assist MINAM and the authorities in charge of the approvals, i.e. *Dirección General de Salud Ambiental* (DIGESA), OPI-MINSA and MEF regarding the SNIP procedure.

[1] In case of solid waste management, the *Oficina de Programación e Inversión* (OPI) at the Ministry of Health (MINSA) is the sector ministry in charge.

(2) Support for Approval of Pre-investment Studies of the Projects

a) To conduct necessary surveys for the projects which are required to obtain *"SALTO"* or *"viabilidad"* in line with the items required both in appraisal for JICA ODA project and in SNIP procedure.

b) To conduct environmental and social consideration surveys in accordance with the requirements of *the Sistema Nacional de Evaluación de Impacto Ambiental* (SEIA) for those projects requiring an FS study within the SNIP procedure.

c) To review the contents of the existing pre-investment studies of the projects and to make the necessary updates and improvements of said studies, taking into account the comments from the authorities in charge of the approvals.

d) To assist MINAM and the authorities in charge of the approvals in SNIP procedure.

(3) Support for Approval of FS of the Program

a) To compile the results of the surveys and consider the contents of FS of the program for smooth implementation and management as JICA ODA project.

b) To prepare FS of the Program within the SNIP procedure.

c) To assist MINAM dealing with comments from the authorities that issue the approvals to the results of FS within the line frame of the preparatory survey.

(4) Consideration of Capacity Development Component

To consider the capacity development components to enhance each municipalities' capacity on SWM and also to develop MINAM's capacity for supervising and monitoring the program implementation

1.3.2 Targets of the Preparatory Survey

(1) Target Projects

Among the 31 projects in the program, the preparatory survey covers 23 projects which have possibility to be implemented under the JICA ODA loan as shown in Table 1.3-1. However, the surveys for Nuevo Chimbote have been limited because the site(s) for SWM infrastructures (ex. landfill site) has (have) not been identified as of March 2011. As for the EIA studies, they are conducted only for those projects which require FS under the SNIP process in the Preparatory Survey.

Table 1.3-1 Target Sub-Projects of the Preparatory Survey

No.	Project Name[*1]	Required Study in SNIP	EIA[*2]
1	Puno	FS*[4]	Yes
2	Juliaca	FS	Yes
3	Piura	FS	Yes
4	Nuevo Chimbote*[3]	Pre-FS	-
5	Tumbes	Pre-FS	-
6	Sullana	FS	Yes
7	Abancay	*Perfil*	-
8	Huanuco	FS	Yes

No.	Project Name[*1]	Required Study in SNIP	EIA[*2]
9	Paita	Pre-FS*[5]	-
10	Pto Maldonado	Pre-FS*[5]	-
11	Talara	Pre-FS*[6]	-
12	Moyobamba	Pre-FS	-
13	Tarapoto	FS	Yes
14	Chachapoyas	*Perfil*	-
15	Ilave	*Perfil*	-
16	Azangaro	*Perfil*	-
17	Chincha	*Perfil*	-
18	Sechura	Pre-FS*[7]	-
19	Huacho	Pre-FS	-
20	Tarma	*Perfil*	-
21	Ferrenafe	*Perfil*	-
22	Santiago	*Perfil*	-
23	Aymaraes	*Perfil*	-

*Note: *1 Project names are indicated by using the name of representative provincial or district municipality of the projects.*

**2 EIA means EIA-d study which is defined in SEIA in Peru.*

**3 Nuevo Chimbote may be excluded from the preparatory survey.*

**4 Since the past pre-investment study is effective, only FS is required in the SNIP process (Perfil and Pre-FS are not required this time).*

**5 Since the past pre-investment studies are effective, only Pre-FS is required in the SNIP process (Perfil is not required this time).*

**6 Although the investment amount may slightly exceed S/.6,000,000, Perfil is enough in the SNIP process (then, Pre-FS is not required) according to OPI-MINSA because the Perfil being prepared includes enough information, practically the same as the Pre-FS.*

**7 Although Perfil could be enough/sufficient under the SNIP process because the investment amount has dropped below S/.6,000,000, Pre-FS was prepared as originally planned.*

At the beginning of the study, the preparatory survey intended to assist MINAM to prepare the necessary studies so that "*viabilidad*" is obtained in line with the items required both in appraisals for JICA ODA project and in SNIP procedure. The studies are namely i) FS of the program and ii) pre-investment studies of those projects whose total investment costs are higher than 50% of the program cost (precedent projects). Though the preparatory survey has prepared pre-investment studies including EIA for FS level project for all projects except for Nuevo Chimbote, the *perfil* of all projects as well as program have not been gotten *approvacion* from OP-MINSA as of March 2011 due to the delay of evaluation procedure in SNIP.

(2) Target Solid Waste

Municipal solid waste generated in the each site corresponds with the target waste of the program, while hazardous waste and infectious waste from industries and hospitals are not included in this case. Accordingly, municipal solid waste is the target waste in the preparatory survey as well.

1.4 SCHEDULE OF THE PREPARATORY SURVEY

The Preparatory Survey team started the works in each home country (Japan or Argentine) by the middle of March 2010 and arrived in Peru on March 23, 2010. The team immediately started a series of field surveys including questionnaire survey, review of existing PIPs documents and held discussions with the executing agency, MINAM, related agencies such as

DIGESA, OPI-MINSA and MEF, and local governments of projects sites to be involved in the program. The preparatory survey will continue to work until the mid of May 2011.

1.5 ORGANIZATION OF THE PREPARATORY SURVEY TEAM

The preparatory survey team dispatched by JICA is formed by the following experts.

Table 1.5-1 Member of the JICA Preparatory Survey Team

Title	Name	Organization
Team Leader/Solid Waste Management Plan	Toshiyuki UJIIE	Nippon Koei Co., Ltd.
Deputy Team Leader/Plan and Design of Solid Waste Management Equipments and Facilities (1)	Takahiro KAMISHITA	Nippon Koei Co., Ltd.
Plan and Design of Solid Waste Management Equipments and Facilities (2)	Masahiro SAITO	Yachiyo Engineering Co., Ltd.
Plan and Design of Solid Waste Management Equipments and Facilities (3)	Seiichi OYAMADA	Yachiyo Engineering Co., Ltd.
Social Condition Survey, and Environment and Social Considerations (1)	Choshin HANEJI/ Satoshi HIGASHINAKAGAWA	Nippon Koei Latin America-Caribbean Co., Ltd./ Nippon Koei Co., Ltd.
Social Condition Survey, and Environment and Social Considerations (2)	Yukinori WATANABE	Nippon Koei Co., Ltd.
Topographic and Geological Survey (1)	Jenny Blanco GUZMAN	Nippon Koei Latin America-Caribbean Co., Ltd.
Operation and Maintenance Plan/ Topographic and Geological Survey (2)	Juan Martin KOUTOUDJIAN	Nippon Koei Latin America-Caribbean Co., Ltd.
Economic and Financial Analysis	Noboru OSAKABE	Yachiyo Engineering Co., Ltd.
Construction and Procurement Plan (1)	Shigeru KANAYA	Nippon Koei Co.,Ltd.
Construction and Procurement Plan (2)	Yoshinosuke HAMADA/ Tomonori SAWANOBORI	Yachiyo Engineering Co.,Ltd./ Nippon Koei Co., Ltd.

Grupo Ciudad Saludable in association with Peru Waste Innovation SAC has been selected as the national consultant team to conduct field surveys, preparation of PIP documents and related works together with the JICA survey team.

CHAPTER 2 OUTLINE OF THE SURVEY

2.1 OUTLINE OF NATIONAL SYSTEM OF PUBLIC INVESTMENT

2.1.1 National System of Public Investment

(1) Objective of the System

National System of Public Investment (SNIP) was first established by the Law No. 27293, enacted in 2000, with modifications in 2005 and 2006. According to this law, the SNIP focuses on optimizing the use of the public resources for public investment, by establishing principles, processes, methodologies and practical standards for the different stages of the investment projects.

Directorial Resolution No. 002-2009-EF/68.01 was approved to be compulsorily observed for all stages, in compliance with the SNIP. DGPM of MEF are mainly responsible for the SNIP and the organizations of Ministry of Health (MINSA) such as OPI-MINSA and DIGESA are related to the SNIP process for the project in SWM sector.

(2) Evaluation of Public Investments at Pre-investment Stage

The timeframe of Public Investment Project (PIP) is divided into three stages, which are pre-investment stage, investment stage and post investment stage. A PIP needs to be reviewed and approved through the process directed in the law at pre-investment stage. It is noted that the *Viabilidad* (Declaration of Viability) given through the SNIP shall not ensure/guarantee the implementation of the public investment for which the declaration of viability has been given. The finance shall be arranged separately by itself.

A PIP may be reviewed individually, or with a set of PIPs and/or '*Conglomerates*' that are designed to attain a common objective/goal. In the case a PIP is implemented individually, each project shall be subject to the SNIP evaluation process. If an investment program consists of many projects sharing a common goal, the program itself is subject to the SNIP evaluation process, in addition to the process for individual projects included in the program.

2.1.2 Required Studies and Documents

(1) Required Studies under the SNIP Procedure

The level of the study for public investment required by SNIP depends on the estimated investment cost.

In the case of a very small size project, under S/.1.2 million of investment, a simple profile (simple *Perfil*) is necessary to obtain the *Viabilidad*. For small size project costing more than S/.1.2 million and less than S/.6 million of investment cost, a Profile (*Perfil*) is necessary to obtain the *Viabilidad*. For middle-sized project above S/.6 million and below S/.10 million of investment cost, Pre-FS study is necessary to obtain the *Viabilidad*. For large-sized project more than 10 million of investment cost, an FS study is necessary to obtain the *Viabilidad*. The necessary study level is summarized in the following table.

Table 2.1-1 Necessary Study Required According to Investment Amount

Project Size	Investment Cost (S/.)	Necessary Study
Very small size	～ 1,200,000	Simple Profile (simple *Perfil*)
Small size	1,200,001 ～ 6,000,000	Profile (*Perfil*)
Medium size	6,000,001 ～ 10,000,000	Pre-FS
Large size	10,000,001 ～	FS

While only *Perfil* study and document is necessary for SNIP approval in case of *Perfil* level project, PreFS and FS level project are required to conduct and prepare *Perfil* study and document prior to PreFS. As for FS level projects, FS can be started after evaluation of PreFS by sector OPI. There are cases where MEF accepts the "skip (*salto*)" of the PreFS studies for the FS level project/program, if OPI evaluation decides that the *Perfil* is appropriate and equivalent to the PreFS studies.

After the SNIP approval, investment stage and post investment stage will follow. The necessary studies and works for pre-investment, investment and post-investment stages are shown in the following figure.

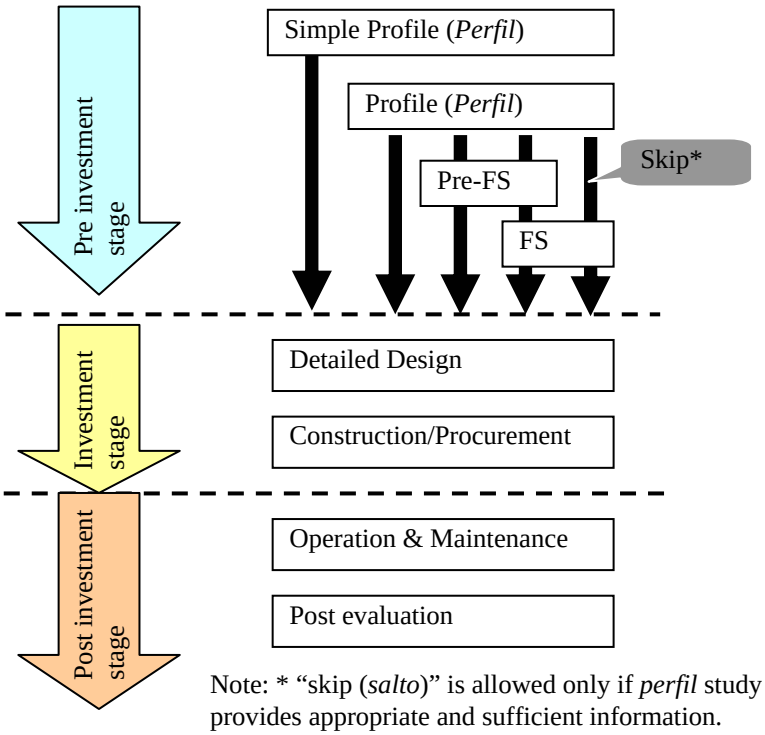


Figure 2.1-1 Procedure in National System of Public Investment (SNIP)

The following table shows the maximum number of days which OPI and the DGPM-MEF can spend to evaluate the study. DGPM of MEF evaluates the final level of the SNIP study of PIPs to obtained the viability declaration. For instance, the DGPM only evaluates FS in the case of FS level project/program.

Table 2.1-2 Maximum Number of Dates to Evaluate PIPs

SNIP Study	Maximum Working Days for Evaluation	
	Sector OPI	DGPM-MEF
Simple *Perfil*	10	-
Perfil	20	20
Pre-FS	30	30
FS	40	40

(2) Requirements for SNIP Studies

Annex 5A, 5B, 6 and 7 of the General Directive of the National System of Public Investment (No. 001-2009-EF/68.01) provides the minimum requirements of the study for each PIP level document, such as *Perfil*, Pre-FS and FS, as shown in the following table.

The SNIP guidelines for the only *Perfil* level study are available in the SWM sector. Documents of the study have been prepared according to the above mentioned Annexes and the *Perfil* guidelines, as well as rules and regulations on SWM.

Table 2.1-3 Minimum Requirements of SNIP Study

Study	Technical Aspect	Social and Financial Aspect	Environmental Study
Perfil	Planning level (Current situation and identified issues and solutions, alternative options, demand and supply analysis, waste characterization surveys, site selection surveys, market surveys, public consultation workshop)	Planning level (cost and benefit, preliminary financial analysis, environmental sustainability)	DIA, EIA-sd or EIA-d based on the SEIA system in Peru
Pre-FS	Pre-FS level (Current situation and identified issues and solutions, alternative options, demand and supply analysis, preliminary design based on the topographic and geological survey, waste characterization surveys, site selection surveys, market surveys, public consultation workshop)	Pre-FS level (cost and benefit, financial analysis, environmental impact, sustainability)	
FS	FS level (Current situation and identified issues and solutions, alternative options, demand and supply analysis, basic design based on the topographic and geological survey, waste characterization surveys, site selection surveys, market surveys, public consultation workshop)	FS level (cost and benefit, financial analysis, environmental impact, sustainability, risk analysis, private evaluation, implementation plan, funding plan)	EIA-d based on the SEIA system in Peru

Source: General Directive of the National System of Public Investment (No. 001-2009-EF/68.01)

2.1.3 Review of the Existing Documents

MINAM has drafted the *Perfil* for the projects and the program in 2009. In addition to the *perfil* study, site selection surveys for each project have also been conducted by a local consultancy firm.

The JICA survey team has reviewed these documents at the beginning of the survey. The summary of the information in *perfil* and site selection survey in 2009 is shown in Table 2.1-4.

As the results of reviewing the existing documents and observations at the site visits, it was recognized that some substantial revisions were necessary for the existing documents such as

discrepancy of location of project sites, insufficient information of present situations and these analysis.

Table 2.1-4 Descriptions on the Existing *Perfil* and Site Selection Survey

No.	Region	Province	District	infrastructure	selected site (ha)	type/required extension (ha)	required capacity (design capacity)
1	Puno	Puno	Puno	Composting	site not identified	mechanized	66.8-86.5 t/d
				Recycling	site not identified	mechanized	55.9-72.3 t/d
				Landfill site	Pichurasi (22)	semi-mechanized (35.7)	152-191 t/d
2	Puno	San Román	Juliaca	Composting	site not identified	mechanized	129-154 t/d
				Recycling	site not identified	semi-mechanized	63.0-76.6 t/d
				Landfill site	Chingora (32)	semi-mechanized (29.4)	130-152 t/d
3	Piura	Piura	Piura, Castilla	Composting	plant in industrial area (0.6)	semi-mechanized	94.9-130 (31) t/d
				Recycling	plant inside landfill site	semi-mechanized	43.2-59.4 (14) t/d
				Landfill site	(81)	mechanized (57.5)	240-329 t/d
4	Ancash	Santa	Nuevo Chimbote	Composting	Zona de la Planta	manual	19.6-26.0 t/d
				Recycling	Zona de la Planta	mechanized	8.8-11.7 t/d
				Landfill site	Zona de la Planta (32.3)	mechanized (19.2)	63.5-84.4 t/d
5	Tumbes	Tumbes	Tumbes, Corrales, La Cruz, Pampas de Hospital, San Jacinto, San Juan de La Virgen	Composting	Zona Señal San Juan	manual	24.7-30.0 (30.0) t/d
				Recycling	Zona Señal San Juan	manual	11.9-14.5 (14.5) t/d
				Landfill site	Zona Señal San Juan (11.9)	semi-mechanized (13.5)	63.6-76.8 (142) t/d
6	Piura	Sullana	Sullana, Bellavista	Composting	La Capilla	semi-mechanized	12.2-15.8 t/d
				Recycling	La Capilla	semi-mechanized	9.1-11.8 t/d
				Landfill site	La Capilla (15)	semi-mechanized (42.1)	182-222 t/d
7	Apurímac	Abancay	Abancay, Tamburco	Composting	Lomada Sahuinto	manual/mechanized	14.1-23.5 t/d
				Recycling	Lomada Sahuinto	mechanized	12.7-14.1 t/d
				Landfill site	Lomada Sahuinto (20)	mechanized (4.8)	30.3-53.9 t/d
8	Huánuco	Huanuco	Huanuco, Amarilis, Pillco Marca, Santa María del Valle	Composting	Santa María del Valle	manual	34.1-42.9 t/d
				Recycling	Santa María del Valle	mechanized	16.2-19.6 t/d
				Landfill site	Aucalla (20.1)	mechanized (22.1)	76.5-93.6 t/d
9	Piura	Paita	Paita	Composting	Zona de Colan	mechanized	8.5-12.1 t/d
				Recycling	Zona de Colan	mechanized	2.9-4.1 t/d
				Landfill site	Zona de Colan (50)	semi-mechanized (13.8)	47.6-67.4 t/d

No.	Region	Province	District	infrastructure	selected site (ha)	type/required extension (ha)	required capacity (design capacity)
10	Madre de Dios	Tambopata	Puerto Maldonado	Composting	Zona del Prado	manual	6.5-10.2 (5.3) t/d
				Recycling	Zona del Prado	semi-mechanized	13.2-20.8 t/d
				Landfill site	Zona del Prado (29.7)	semi-mechanized (29.6)	34.8-55.0 t/d
11	Piura	Talara	Pariñas	Composting	site not identified	mechanized	9.5-11.6 t/d
				Recycling	site not identified	semi-mechanized	5.3-6.4 t/d
				Landfill site	Zona La Cantera (12.3)	semi-mechanized (17.9)	67.6-82.5 t/d
12	San Martín	Moyobamba	Moyobamba, Yantalo, Calzada, Habana, Jepelacio, Soritor	Composting	El Paraíso	mechanized	26.3-43.1 (43.1) t/d
				Recycling	El Paraíso	manual	9.4-15.3 (15.3) t/d
				Landfill site	El Paraíso (14.1)	mechanized (17.4)	76.1-125 t/d
13	San Martín	San Martín	Tarapoto, Morales, La Banda de Shilcayo, Catacachi	Composting	Morales	mechanized	44.6-54.9 t/d
				Recycling	Morales	mechanized	14.7-17.6 t/d
				Landfill site	Quinillal (135)	mechanized (27.8)	97.4-116 t/d
14	Amazonas	Chachapoyas	Chachapoyas	Composting	Mezapata	mechanized	9.2-11.5 t/d
				Recycling	Mezapata	manual	5.3-6.5 t/d
				Landfill site	Mezapata (21.2)	manual (3.7 ha)	15.8-19.4 t/d
15	Puno	Collao	Ilave	Composting	site not identified	mechanized	3.0-3.9 t/d
				Recycling	site not identified	mechanized	3.7-4.7 t/d
				Landfill site	Acachuco (7.9)	semi-mechanized (6.3)	8.9-11.3 t/d
16	Puno	Azangaro	Azangaro	Composting	site not identified	mechanized	3.9-5.0 t/d
				Recycling	site not identified	mechanized	3.6-4.0 t/d
				Landfill site	Ccarahuire (11)	mechanized (9.4)	8.7-11.0 t/d
17	Ica	Chincha	Chincha Alta	Composting	Pampa Satélite	mechanized	15.5-19.5 t/d
				Recycling	Pampa Satélite	mechanized	15.5-18.6 t/d
				Landfill site	Pampa Satélite (16.7)	semi-mechanized (10.2)	35.8-44.4 t/d
18	Piura	Sechura	Sechura, Bellavista de la Unión, Bernal, Cristo Nos Valga, Rinconada Llicuar, Vice	Composting	Yapato 2	mechanized	2.6-3.5 t/d
				Recycling	Yapato 2	mechanized	2.3-3.1 t/d
				Landfill site	Yapato 2 (20)	semi-mechanized (7.4)	26.4-35.6 t/d
19	Junín	Tarma	Tarma	Composting	Cumbre Alta	manual	12.1-13.4 (4.7) t/d
				Recycling	Cumbre Alta	semi-mechanized	2.9-3.2 (1.4) t/d
				Landfill site	Cumbre Alta (20)	semi-mechanized (7.0)	25.4-28.0 t/d
20	Lambayeque	Ferreñafe	Ferreñafe, Pueblo Nuevo	Composting	inside landfill site	manual	19.3-25.7 t/d
				Recycling	inside landfill site	manual	3.2-3.8 t/d
				Landfill site	Cantera El Hoyo (500)	semi-mechanized (9.6)	39.8-52.6 t/d

No.	Region	Province	District	infrastructure	selected site (ha)	type/required extension (ha)	required capacity (design capacity)
21	Lima	Huaura	Huacho, Hualmay, Huaura, Santa María, Végueta, Carquín	Composting	Quebrada Callejones	manual	17.1-23.3 t/d
				Recycling	Quebrada Callejones	manual	5.1-6.9 t/d
				Landfill site	Quebrada Callejones (212)	mechanized (29.5)	96.5-130 t/d

Source: Prepared by JICA survey team based on the Perfil and Site Selection Surveys prepared by MINAM in 2009
Note: Perfils for Santiago and Aymaraes did not exist at the beginning of the survey, because these two projects have been included in the program once the survey had started.

2.1.4 Submission of the PIPs of the Projects and the Program

shows the date of submission and the date when DIGESA and OPI-MINSA sent their comments. As DIGESA is actually in charge of reviewing every technical aspect of the PIPs, it is necessary to consider DIGESA's comments in the SNIP of SWM sector.

The draft *perfil* study and survey prepared in 2009 were reviewed again by MINAM in May 2010. Then those PIPs were submitted from MINAM to OPI-MINSA officially. Since the JICA survey team did not complete to confirm the status of all projects sites by that time, it did not review the existing *perfil* thoroughly before the submission.

After review and all revision on the existing *perfils* after many discussion with MINAM and other related authorities, MINAM have submitted the revised *perfils* which JICA survey team prepared together with MINAM.

Table 2.1-5 Submission Date of *Perfils* and Comments from MINSA

Project name		SNIP Level	Perfil prepared in 2009			Revised perfil in this survey		
			Submission to MINSA	DIGESA Comments	OPI-MINSA Comments	Submission to MINSA	DIGESA Comments	OPI-MINSA Comments
1	Puno *1	FS	June 1	July 2		Feb 3		
2	Juliaca	FS	-	-	-	Mar 1		
3	Piura	FS	May 7	July 2		Dec 29	Feb 28	
4	Nuevo Chimbote	Pre-FS	May 7	June 4	June 23,			
5	Tumbes	Pre-FS	May 7	May 27	June 18	Feb 24	Mar 18	
6	Sullana	FS	May 7	July 2		Dec 28		
7	Abancay	Perfil	May 7	July 1	July 13	Mar 9		
8	Huanuco	FS	June 1	July 2		Dec 29	Feb 23	
9	Paita *1	Pre-FS	-	-	-	Feb 28		
10	Puerto Maldonado *1	Pre-FS	May 7	June 10	July 11			
11	Talara	Pre-FS	May 18	July 2		Feb 25		
12	Moyobamba	Pre-FS	May 7	June 10	June 18	Feb 25		
13	Tarapoto	FS	May 7	July 2	July 16	Dec 28		
14	Chachapoyas	Perfil	May 7	July 5	July 12	Mar 11		
15	Ilave	Perfil	May 7	July 1	July 11	Oct 22	Nov 23	Dec 28
16	Azangaro	Perfil	May 7	June 25	July 11	Oct 22	Nov 24	Dec 17
17	Chincha	Perfil	May 7	June 10	June 20	Mar 8		
18	Sechura *1	Pre-FS	May 7	July 5	July 12	Oct 22		
19	Huacho	Pre-FS	May 7	June 10	June 18			
20	Tarma	Perfil	June 1	July 2	July 16	Jan 19		
21	Ferrenafe	Perfil	May 7	June 25	July 11			

Project name		SNIP Level	Perfil prepared in 2009			Revised perfil in this survey		
			Submission to MINSA	DIGESA Comments	OPI-MINSA Comments	Submission to MINSA	DIGESA Comments	OPI-MINSA Comments
22	Santiago	Perfil	-	-	-	Mar 2		
23	Aymaraes	Perfil	-	-	-	Mar 1	-	-
	Program	FS	May			Nov 4	Dec 29	Jan 5

Source: prepared by JICA survey team

Note:1) These projects have the same SNIP code with which they obtained viabilidad and cancelled it to participatein the program. These projects only need to conduct final level of study, as required in the SNIP to obtain viabilidad.

2.1.5 Conditions of Approval and Viability Declaration in SNIP for the Program and Projects

The MINAM has submitted the revised *perfil* OPI-MINSA as shown above. The OPI-MINSA has not approved the program *perfil* yet and the *perfils* of projects.

The following conditions for the approval of PIPs of the program and projects have been confirmed with OPI-MINSA and MEF which are the agencies in charge of evaluation of PIPs.

- *Pefil* of all 31 projects are to be submitted for evaluation of the program *perfil*
- Six projects, which are Piura, Huanuco, Talara, Ilave, Tarma and Santiago, have been chosen as model projects which represent the project type included in the program
- Approval (*approvacion*) of the six model projects' *perfil* are necessary for *approvacion* of the program *perfil*
- Viability declaration (*viabilidad*) of projects whose investment cost are equivalent to more than 50% of the total investment cost of 31 projects are necessary for *viabilidad* of the program FS.

2.2 INVOLVED ORGANIZATIONS AND ACTIVITY

2.2.1 Ministry of Environment (MINAM)

(1) General

The mission of the Ministry of Environment (MINAM) is to maintain the environmental quality and ensure for present and future generations the right of enjoy a good and balanced environment for the proper development of their life. For this purpose, ensures the sustainable, responsible, rational and ethic use of natural resources and contributes for the social, economic and cultural development of the human being, in perfect harmony with its environment. It is the controller of national environmental policies and inside of the Integral Management Program of Urban Wastes (GIRSU) it has developed a whole range of activities to support in several cities of the country to improvement of their solid waste management system.

(2) Personnel concerned with the Program

The personnel and his/her position shown in the following table are mainly concerned with the program.

Position	Name
Minister	Antonio Brack Egg
Vice Minister of Environmental Management	Ana María González del Valle Begazo
Advisor of the Vice Minister Office	Jorge Villena Chávez
General Director of Environmental Quality	Juan Narciso Cháves
General Directorate of Environmental Quality Coordinator of Solid Waste Management	Miriam Arista Alarcón Karla Bolaño Sonia Aranibar

(3) Activities and Budget of the MIANM

Annual budget of MINAM for SWM sector is shown in Table 2.2-1 and Table2.2-2. In 2011, the amount of budget for SWM occupies 8.7% of total budget of MINAM. The amount and ratio of SWM to total budget have been increasing in last 3 years.

Table 2.2-1 Budget of Ministry of Environment (2009, 2010 and 2011)

Year	Total	Environmental Quality Management					
		Solid Waste Sector		Others		Sub total	
	S/.	S/.	Ratio to total	S/.	Ratio to total	S/.	Ratio to total
2009	33,470,801	170,000	0.5%	2,879,000	8.6%	2,709,000	8.1%
2010	69,757,602	899,450	1.3%	6,317,535	9.1%	5,418,085	7.8%
2011	76,410,000	6,625,002	8.7%	10,865,839	14.2%	4,240,837	5.6%

Table 2.2-2 Budget for Solid Waste Sector of Ministry of Environment in 2011

Objective		Actions and Tasks		Budget (S/.)
Implementation Actions for the Solid Waste Program				
	Implementation of the Solid Waste Management Program (counterpart fund for JICA and IDB loan)	a	National Project of Solid Waste Management: IDB	5,000,000
		b	National Project of Solid Waste Management: JICA	
Reduction of municipal solid waste volume				
	Local governments with ecoefficient solid waste management	a	Technical assistance to local governments on SWM	1,132,968
		b	Solid Waste Program	
		c	Environmental quality promotion for SWM	
		d	Contract of administration service	
	Competent officials with adequate capacities to control, monitor, and support municipal solid waste management	a	Capacity building on municipal SWM	360,858
		b	Awareness and public relations for recyclers	
		c	Contract of administration service	
	Competent officials with adequate capacities to control, monitor, and support non- municipal solid waste management	a	Rules and instruments to manage solid waste	131,176
		b	Contract of administration service	
	Subtotal			1,625,002
Total				6,625,002

2.2.2 Ministry of Economy and Finance (MEF)

(1) General

MEF is governmental entity in charge of planning, managing, and controlling all issues related to budget, treasury, indebtedness, accounting, taxation policies, public investment and economic policies.

The General Directorate of Multi-Annual Programming of the public sector (DGPM) is the department responsible for guiding, integrating and monitoring the Strategic Multi-Annual Plans of the Public Sector, including the programming of the public investment and the promotion of development in less developed areas. The DGPM issues the viability and execution of the projects as public investment execution or with the participation of private sector.

The General Management of Public Budget (DGPP) is responsible for the national budget system, in charge of program, manage, coordinate, control and evaluate the budget management of the public sector. DGPP reports to the Vice Ministry of Finance. Personnel concerned with the Program

The personnel and his/her position shown in the following table are concerned with the program.

Position	Name
General Director of DGPM (General Directorate of Multi-Annual Programming)	Carlos Giesecke Sara-Lafosse
Sanitation and Urban Development Specialist, DGPM	Jorge Guibu, Omar Concepción
General Director of DNEP (National Directorate of Public Indebtedness for the project of solid waste)	Betty Armida Sotelo Bazán
General Director of DGPP (General Directorate of Public Budget for the project of solid waste)	Roger Diaz Alarcón
Indebtedness Department, DNEP	Marco Félix
Indebtedness Department, DNEP	Marco Félix

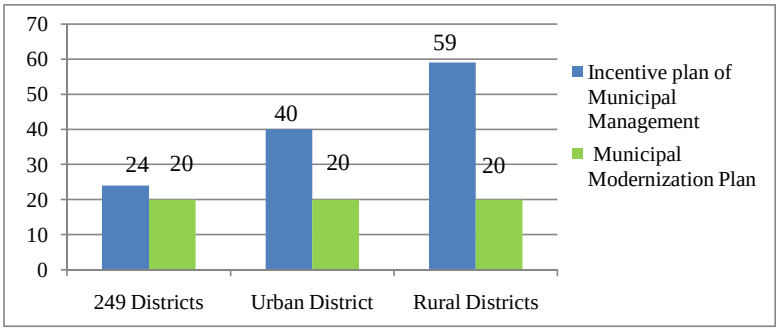
(2) On-going Program for Capacity Development of Municipalities

The MEF is executing the program for capacity development of municipalities such as Initiative Plan for the improvement of Municipal Management and Municipal Modernization Program. In these programs, it is intended to improve administrative system/capacity, taxation system and tax collection etc. MEF provide the software for administrative management and consulting service for training of municipality staff. The participating municipalities could get incentive once the objective are achieved through the execution of the program.

It is recognized that these programs are strongly related with improvement of SWM service which is defined in Peru as a service to be operated and maintained by collected service fee. Promotion of waste segregation at generation source as well as improvement of service fee collection is included as components of the programs.

Table 2.2-3 Summary of Municipal Modernization Program

<table>
<tr><th colspan="2">Program</th><th>Initiative Plan for the improvement of Municipal Management</th><th>Municipal Modernization Program</th></tr>
<tr><td rowspan="3">General Information</td><td>Legal Basis</td><td>•Law No 29332: law that establishes the incentive plan to improve municipal management
•Budget Law of Public Sector 2010
•DU. N° 119-2009
•DS. N° 003-2010-EF</td><td>•Budget Law of Public Sector 2010
•DU. N° 119-2009
•DS. N° 002-2010-EF</td></tr>
<tr><td>Allocated Resources 2010</td><td>S/. 700 millions</td><td>S/. 600 millions</td></tr>
<tr><td>Period</td><td>Permanent</td><td>2010 - 2013</td></tr>
<tr><td colspan="2">Background</td><td colspan="2">•Financial weakness: the average of municipal taxes represents less than 10% of the total income.
•Problems to public service provided and facility. Public insecurity, mismanagement of solid waste, poor and insufficient quality of infrastructure.
•Obstacle to formalization. In Peru, to set up a company it takes 41 days and costs 25% of GDP. Half of said obstacles are municipal-related issues.
•Investment obstacles: In Peru, to obtain a construction permit it takes 205 days and costs 130% of GDP. Almost half of said obstacles are municipal-related issues.</td></tr>
<tr><td colspan="2">Objective</td><td>Growth and sustainable growth of local economy
- Increase collection of property tax (regarding perception of efficiency and stability
- Improve execution of investment project
- Reduce child chronic malnutrition</td><td>Growth and sustainable growth of local economy
- Increase collection of property tax
- Foster proper business conditions (improvement of public services, basic facilities and reduction of procedures)</td></tr>
<tr><td rowspan="3">Strategies</td><td>1. Break down of municipalities:</td><td colspan="2">•Take into account existing differences among districts, from 2 classification criteria:
–Size: depending on number of urban households
–Needs
Table Number of Municipalities and percentage
<table>
<tr><th>Municipal group</th><th>Number of districts</th><th>%</th></tr>
<tr><td>Municipalities of main cities</td><td>249</td><td>14</td></tr>
<tr><td>-Type A</td><td>40</td><td>2</td></tr>
<tr><td>-Type B</td><td>209</td><td>12</td></tr>
<tr><td>Rest of municipalities</td><td>1,585</td><td>86</td></tr>
<tr><td>-More than 500 urban households</td><td>555</td><td>30</td></tr>
<tr><td>-Less than 500 urban households</td><td>1,030</td><td>56</td></tr>
<tr><td>Total</td><td>1,834</td><td>100</td></tr>
</table></td></tr>
<tr><td>2. Goals based on resources</td><td>- Specific collection goals for type A and type B municipalities</td><td>- Transparency of web information and content of information
- Information on current collection and previous years, emission, etc.
- Minimum standards: bank collection, sending bills to households, purchase orders</td></tr>
<tr><td>3.Ditribution Criteria: Pre-set amounts</td><td>Distribution according to the FONCOMUN criteria</td><td>Distribution according to the number of inhabitants</td></tr>
</table>

Program		Initiative Plan for the improvement of Municipal Management	Municipal Modernization Program
Strategies			
	4. Fund allocation according to type of goal 2010		

	Number of Districts	Predial Tax Collection	Sanitation and Health expenses	Household Targeting System	Total
Municipalities of CP	249	50 %	25%	25%	100 %
Districts of VRAE Area	31	NA	70%	30%	100 %
More than 500 Urban Households	539	NA	100 %	NA	100 %
Less than 500 Urban Households	1,015	NA	100 %	NA	100 %
Total	1,834				

	Number of Districts	Financial management	Business facilities	Public services and infrastructure	Total
Main cities Type "A"	40	20 %	60 %	20%	100%
Main cities Type "B"	209	30 %	40 %	30%	100%
More than 500 urban households	555	40 %	20 %	40%	100%
Less than 500 urban households	1,030	30 %	NA	70%	100%

2.2.3 Ministry of Health (MINSA)

(1) General

According to the Ministerial Resolution: N° 007-2001-SA-DM, the department of investment programming at the General Office of Budget Planning of the Ministry of Health (OPI-MINSA) carries out the duties of the Department of Health Investment Programming. This is a technical organization of the National System of Public Investment in the health Area, in charge of leading the process of public investment. N° 27293.

General Direction Management of Environmental Health (DIGESA) is the technical organization related to basic sanitation, occupational health, food hygiene and solid wastes.

(2) Personnel concerned with the Program

The personnel and his/her position shown in the following table are mainly concerned with the program.

Position	Name
Executive Director, OPI General Office of Planning and Budget	Ricardo Zuñiga Cardenas
Planning and Budget Office - Sub Director, OPI	Fabiola Luna Andrade
OPI analysts	Miguel Merino Roxanna Villa Paola Huertas Miriam Marimon Efrain Licuona Ana Mendoza
Executive Sanitation Manager, DIGESA	Marco Antonio Valverde Cribillero
Coordinator of Solid Waste Management, DIGESA	Sonia Álvarez Betty Peña Yuliana Vidal

2.2.4 International Cooperation in Solid Waste Management Sector

The projects and activities of SWM which are assisted by international donors are shown in the following table. In addition to JICA and IDB which are going to make loan to this program, USAID and Switzerland are coordinating for SWM.

Table 2.2-4 Summary of Donations for Solid Waste Management

	Donor	Name of the project	Implementing Organization	Sum (USD)	Beneficiaries	Backgrounds	Aim	Schedule	Project site
1	USAID STEM	Technical support programme over profile formulations of public investments projects on solid waste	Ministry of the Environment	880,000	Municipalities	The need to protect the health of the people and preserve the Environmental quality , social responsability to prevent and mitigate the effects of the climate change.	Form qualified specialists in PIPs environmentals, generate an PIPs portfolio adapted to the reality.	2008 - 2013	Amazonas, Ancash, Apurimac, Arequipa, Ayacucho, Cajamarca, Callao, Cusco, Huancavelica, Huanuco, Ica, Junin, La Libertad, Lambayeque, Lima, Loreto, Pasco, Piura, Puno, San Martin, Tacna. Tumbes, Ucayali.
2	IDB	Market development of integral management of recycling solid waste	Ciudad Saludable (NGO)	1,110,500	Recyclers	The need to promote the recycling market development. Develop organizational capacities and recyclers techniques. Establish alliances with companies that help to recycle.	Strengthen recyclers, their associations and the management of solid waste recycling of micro and small business.	June 2009 - Decembre 2011	Villa El Salvador, San Juan de Miraflores, Villa María del Triunfo y Lima
3	IDB	Development support programme of solid wastes sector in Peru.	Ministry of Economy and Finance	690,000	Municipalities	The stregtheing of the state regulatory functions, Sanitary Environmental monitoring , Formulation of pilot projects.	Fortify the regulatory framework and management to the municipals solid waste administration nationwide.	2010 - 2011 (21 months)	Valle del Mantaro, Altiplano, Cusco, North border of the country.
4	State Secretariat for Economic Affairs SECO / Switzerland	Corporate Social Responsibility for the Electronic Solid Waste Management in Perú.	EMPA (The Swiss Federal Laboratories for Materials Testing and Research , Dubendorf / Switzerland) IPES (Promotion of the Sustainable Development)	696,000	Private companies, Information Technologies Commitee, etc.	The management and control of the increasing volumens of appliances and electric components obsoletes, particularly lthose that come from telecommunication and Informatics.	Improve living conditions of local population.	August 2008 - Decembre 2010	Lima
5	Swiss Cooperation	Integral management project of solid waste in Peru.	Under the process of tender	11,000,000	Municipality of Chiclayo	The reduction of national solid wastes production, control of sanitary and environmental associated risks.	Evaluate the feasibility of an integral project of management and determine the approach of implementation of project.	2008 - 2012	Chiclayo

2.3 FIELD SURVEY

2.3.1 Contents of the Field Survey

The field surveys were conducted to obtain necessary primary information to conduct feasibility study for the program. The required level of study in SNIP is decided according to invest amount. It is recognized that design drawings of facilities are not prepared at *perfil* level. Considering the existing case of pre-investment studies, JICA survey team decided the contents of field survey.

Contents of the field survey, consisting of topographic survey, solid waste characterization and environmental survey, are shown in Table 2.3-1.

Table 2.3-1 Contents of Field Survey in each Municipality

Project name	Topographic and geological survey	Solid waste characterization survey	Environmental Survey
1. Puno	X	X	X
2. Juliaca	X	X	X
3. Piura	X	X	X
4. Nuevo Chimbote	-	-	-
5. Tumbes	X	-	-
6. Sullana	X	X	X
7. Abancay	-	X	-
8. Huanuco	X	X	X
9. Paita	X	X	-
10.Puerto Maldonado	X	-	-
11.Talara	X	X	-
12.Moyobamba	X	X	-
13.Tarapoto	X	X	X
14.Chachapoyas	-	-	-
15.Ilave	-	-	-
16.Azangaro	-	X	-
17.Chincha	X*	X	-
18.Sechura	X	-	-
19.Huacho	X	X	-
20.Tarma	-	X	-
21.Ferrenafe	-	-	-
22.Santiago	-	X	-
23.Aymaraes	-	X	-
Remarks	Primary data to conduct facility design and cost estimate	Requirement by perfil guide for SWM sector.	Primary data necessary for EIA of FS projects

Source: JICA survey team

Note 1) "X": Survey had finished, "-": Survey is not implemented

2) At first, Solid waste characterization survey was planed for the project which had not conducted this survey. In addition, the complementary survey was conducted according to technical comments from DIGESA.

*3) * Geology survey was not implemented due to issue of land ownership of the project site*

2.3.2 Results of the Field Survey

(1) Topographic Survey

1) General Information

General information of the topographic survey in each municipality, which includes the date of survey, project area, perimeter and access road, is shown in Table 2.3-2.

Table 2.3-2 General Information of Topographic Survey in each Municipality

Project name	Date of Survey	Project area	Perimeter	Access road
1. Puno	May 5 to 7, 2010	21.6 ha	1,896 m	-
2. Juliaca	December 15, 2010 to January 15, 2011	46.69ha	3, 759 m	-
3. Piura	May 11, 2010	100 ha	4,000 m	-
4. Nuevo Chimbote	-	-	-	-
5. Tumbes	September 27 2010	20.47 ha	1851m	3000 m
6. Sullana	May 17, 2010	50 ha	3,000 m	1,971 m
7. Abancay	-	-	-	-
8. Huanuco	September 24, 2010	24.47 ha	2,104 m	-
9. Paita	May 13, 2010	20 ha	1,800 m	200 m
10.Puerto Maldonado	May 31 to June 3, 2010	24.55 ha	2,568 m.	-
11.Talara	-	21.4 ha	2,147 m.	-
12.Moyobamba	May 17, 2010	20.276 ha	2,233 m	200 m.
13.Tarapoto	May 5, 2010	30.40 ha	2,847 m	1,000 m
14.Chachapoyas	-	-	-	-
15.Ilave	-	-	-	-
16.Azangaro	-	-	-	-
17.Chincha	June 4, 2010	30.0 ha	5,080 m	-
18.Sechura	May 19, 2010	20 ha	1,800 m	2,326 m
19.Huacho	June 16, 2010.	48.5 ha	1,800 m	3,359 m.
20.Tarma	-	-	-	-
21.Ferrenafe	-	-	-	-
22.Santiago	-	-	-	-
23.Aymaraes	-	-	-	-

Source: prepared by JICA survey team
Note: "-": Survey is not implemented.

2) Methodology of the Topographic Survey

The survey of the plot of land has been performed through the method of radiation topography based upon a closed polygon which sides and internal angles have been assessed by the coordinate methods. From this main polygon, further stations have been implemented to comprehensively carry out the topographic landfill.

The starting elevation for the topographic survey has been obtained through performed by GPS and national cartography surveyed by the National Geographic Institute (IGN), valid procedures for the studied typology.

Equipments, tools and materials for the topographic survey are shown in Table 2.3-3.

Table 2.3-3 Equipments, Tools and Materials for the Topographic Survey

Total Station TOPCON	Model: GTS 236 Precision: ± (3 mm +5 ppm) meters over sea level (-10°C a +50°C / +14°F a +122°F) ± (5 mm +5 ppm) meters over sea level (-20°C a +10°C / +14°F a +14°F) Measurement minimum calculation Type of fine definition : 1 mm (0,005 feet) (For stations, turning points, and polygonal vertices) Type of gross measurement: 10 mm (0,02 feet) / 1 mm (0,005 feet) (for in field landfill) Type of tracking measurement : 10 mm (0,02 feet) Visualization of the measurement: 9 digits: max. 999999,999
Total Station SOKKIA	Model: GTS 236 Accuracy: ± (3 mm +5 ppm) m.s.e. (-10°C a +50°C / +14°F a +122°F) ± (5 mm +5 ppm) m.s.e. (-20°C a +10°C / +14°F a +14°F) Minimum Computing of Measurement Fine metering mode: 1 mm (0,005 feet) (For Stations, shift points and vertices of the polygon) Thick metering mode : 10 mm (0,02 feet) / 1 mm (0,005 feet) (to fill in field) Tracking metering mode: 10 mm (0,02 feet) Display of measurement: 5 digits: max. 99999,999
TOPCON Prisms	
GPS Receiver, GARMIN Etrex Vista HCX Browser	
T5525 Motorola radios	
SONY digital camera	

Source: prepared by JICA survey team

3) Result of Topographic Survey

Result of topographic survey is attached in Appendix-1.

(2) Geological Survey and Soil Test

1) General Information

In accordance with the items required for the evaluation of the projects of SNIP procedures and yen loan, it is necessary to carry on geological survey and soil test in order to get approvals from OPI and viability from MEF.

The objectives of said survey are shown below:

- Understand the geomorphology and highlight the accidents caused by the different stages in geological evolution in this particular part of the jungle.
- Identify the different formations brought to the surface in the area and correlate them for a soil survey base.
- Describe the main features that provide the transmissivity of agents that may contaminate both the rocks and sediments of the area.

- Field and laboratory tests were carried out, and when correlating them, it is possible to understand the hydrologic and geological features of the proposed site, and it also allows establishing the geological features of each layer required for the design.

2) Methodology of the Geological Survey and Soil Test

The Contractor shall conduct the Geological Survey and Soil Test, using only licensed (geological and/or geotechnical) surveyors as follows:

a) Field Investigation

- Number of borings and anticipated depths of the borings are shown in Table 2.3-9. In case that bearing stratum with N-values not less than 30 in consecutive five (5) meters is not found, the depth of boring shall be extended deeper upon consultation with the JICA Survey Team;
- Standard Penetration Test (SPT) shall be carried out at interval of 1m depth for all boreholes. In case that N-value more than 30 is confirmed in consecutive five (5) meters, SPT may not be continued further, upon consultation with the JICA Survey Team[1];
- The groundwater level shall be identified three times in each borehole during the survey period;
- Thin-walled tube (undisturbed) samples shall be collected every five (5) meters for the laboratory tests, in principle; and
- The permeability test shall be conducted every five (5) meters, in principle.

Table 2.3-4 Depth of Borehole and Number of STP

No.	Individual Project Sites	Depth of Borehole (m)			SPT (No.)	Permeable test (soil layer) or lugeon test (rock layer)
		1	2	3		
1	Puno	7	7	7	2	3
2	Juliaca	10	8	-	14	4
3	Piura	25	25	25	42	15
5	Tumbes	25	25	25	17	15
6	Sullana	25	25	25	19	15
8	Huanuco	15	10	-	28	8
9	Paita	25	25	25	64	15
10	Pto Maldonado	14	10	-	16	4
11	Talara	11	-	-	8	4
12	Moyobamba	12	10	-	13	4
13	Tarapoto	11	10	-	16	5
18	Sechura	13	10	-	18	6
19	Huacho	10	10	-	20	5

Source: JICA survey team

b) Laboratory Soil Test

The Contractor shall designate a highly qualified laboratory which is certified by INDECOPI. The laboratory tests shall comprise the following tests, while the anticipated quantity of each test is summarized in Table 2.3-10.

- Density test
- Water content test

[1] SPT shall be conducted at sites except for rocky sites like in the Andean areas.

- Grain size analysis
- Consistency limit (Liquid Limit & Plastic Limit) test
- Unconfined compression test
- Consolidation test
- Bearing capacity

Table 2.3-5 Quantity of Laboratory Soil Tests

No.	Individual Project Sites	Density Test	Water Content Test	Grain Size Analysis	Consistency Limit Test	Unconfined Compression Test	Consolidation Test	Bearing capacity
1	Puno	5	5	5	5	2	2	-
2	Juliaca	8	8	6	6	2	4	-
3	Piura	5	5	15	13	1	*2	-
5	Tumbes	8	12	16	16	5	7	-
6	Sullana	3	3	8	8	0	*2	-
8	Huanuco	8	8	16	12	6	8	-
9	Paita	5	5	13	12	2	*2	-
10	Pto Maldonado	8	8	12	12	4	4	-
11	Talara	3	3	6	6	*1	3	-
12	Moyobamba	5	8	12	12	3	4	-
13	Tarapoto	8	8	12	12	4	4	-
18	Sechura	5	5	7	7	3	2	-
19	Huacho	3	3	7	7	*1	3	-
20	Tarma	-	-	-	-	-	-	1
22	Santiago	-	-	-	-	-	-	1

Source: JICA survey team
*Note: *1) Test is not conducted because of the soil is composed of only gravel.*
**2) Test is not conducted because of the soil is composed of only sand.*

3) Result of Geological Survey and Soil Test

Result of geological survey and soil test is attached in Appendix-2.

(3) Solid Waste Characterization

1) Survey Parameters

Solid waste characterization is surveyed following parameters of solid waste: per capita generation (GPC), density, physical composition

2) Survey Type and Date in each Municipality

Survey type and date for solid waste characterization in each municipality are shown in Table 2.3-6. Survey types include surveys of domestic waste and those of non domestic waste such as commercial waste, restaurants waste, hotels waste, markets waste, institutions waste and sweeping waste.

Complementary survey includes commercial waste, restaurants waste, hotels waste, markets waste, institutions waste and sweeping waste.

Table 2.3-6 Survey Type and Date for Solid Waste Characterization in each Municipality

Project name	Survey type*1	Solid waste characterization survey
1. Puno	Complete	May 3-12
2. Juliaca	Complete	May 13-20
3. Piura	Complete	July 17-21
4. Nuevo Chimbote	-	-
5. Tumbes	-	-
6. Sullana	Complementary	July 02-09
7. Abancay	Complete	June 21-28
8. Huanuco	Complementary	September 24 – October 1
9. Paita	Complete	June 07-16
10.Puerto Maldonado	-	-
11.Talara	Complementary	June 20-27
12.Moyobamba	Complete	June 02-09
13.Tarapoto	Complementary	June 21-29
14.Chachapoyas	-	-
15.Ilave	-	-
16.Azangaro	Complementary	June 18-26
17.Chincha	Complementary	June 18-16
18.Sechura	-	-
19.Huacho	Complementary	June 23to July 1
20.Tarma	Complete	May 28to June 05
21.Ferrenafe	-	-
22.Santiago	Complete	June 5-12
23.Aymaraes	Complete	June 1-08

Source: JICA survey team
*Note *1:Complete: complete survey for domestic and non-domestic waste Complementary: complementary survey for non-domestic waste.*

3) Survey Methodology

a) Domestic Waste

In order to characterize household waste, the following steps have been taken:

i) Zoning by Socioeconomic Status

The zoning district allowed to establish homogeneous or similar areas. In order to do this, we used the classification of the Revenue Management? has been used, where zoning district are split into three zones.

Table 2.3-7 Zoning by Socioeconomic Status

Zone A	Zone B	Zone C
Residential units located in the center of the district. They all have urban services and other complementary services. People included in this segment enjoy higher incomes.	Popular neighbourhoods are heavily populated. They have basic services with better conditions than the low stratum. Income slightly higher or equal to the legal minimum wage.	Slums of rustic material are located in the outskirts of the district. They lack basic services. Consolidation area. Family income below the minimum legal wage.

Source: JICA survey team

ii) Determination and Projection of Current Population

In order to determine the current population of each district, the last INEI Census 2007 has been taken into account and the growth rates identified for this purpose.

iii) Distribution of the Current Population per Zone

Using the plat granted by the District Municipality, it is necessary to determine the population of each of the zones.

iv) Determination of Sample Number

To determine the number of samples, the following equation applies:

$$n = \frac{v^2}{\left(\frac{(E)^2}{(1.96)^2} + \frac{v^2}{N}\right)}$$

Where:
n = Number of samples (homes)
v = Standard deviation of the variable X_i (X_i = CSF housing i) (gr/person/day)
E = Allowed error in the estimation of CSF (gr / person / day)
N = Total number of households in the target social class

Recommended Values:

For the purpose of expediting the calculations of the formula, the following values were used:

Allowable error: 50 gr./person-day.
Reliability 95%: 1.96.
Standard deviation : 200 gr./person - day

v) Determination of the Representative Zones through Socioeconomic Level

Once the number of samples per area is determined, the parts of the district where the samples will be taken are chosen, identifying the blocks and housing where to work.

vi) Sensitization and Training in Selected Population.

To start collecting activities of the samples, a survey is applied to all selected households to collect qualitative data on their perception of waste management system and quantitative information on the number of people living in the housing and request your confirmation of participation in the study. Additionally bags are delivered to homes showing their willingness to participate in the study.

vii) Sampling

Samples were taken during 8 days, where a plastic bag was handed in to each representative of the house, codified in exchange for the garbage bag.

At each selected household, the main person responsible of the house, either a man or a woman, have to place in the bag the trash generated during the day from the different activities generated in the house.

Then, proceed to the daily collection of waste bags from home. Completing housing collection moves into the designated area for weighing, measuring the density and waste characterization.

Samples were taken from eight consecutive days, and information taken the first day is discarded, since it is impossible to know the amount of waste stored in the previous days.

viii)Generation per Capita (GPC)

Once the routing of collection bags is done, take samples to the designated area for weighing.

The weighing is performed after code or number identification of each sample; weights were recorded in the appropriate format.

Once the average weight of waste generated in each household is obtained, the results are processed to obtain the GPC average of each social class.

After obtaining the results of each layer, determine the district GPC.

$$n = \frac{v^2}{\left(\frac{(E)^2}{(1.96)^2} + \frac{v^2}{N}\right)}$$

ix) Density

Capacity of a container is set as 200 liter. Bags are chosen at random from the households already registered, the bag is weighted and the contents are emptied into a container. Once filled, the container is lifted 20 cm above the surface and shake three times, in order to compact the waste. Then the clearance is measured and data is recorded in the respective format.

The density calculation is done in-house using the following formula:

$$S = \frac{W}{V} = \frac{W}{N\,(D/2)^2\,(H-h)}$$

Where:

S:	Density of solid waste
W:	Weight of solid waste
V:	Volume of solid waste
D:	Cylinder diameter
H:	Total height of the cylinder
h:	Height of solid waste
N:	Constant (3.1416)

x) Determination of the Solid Waste composition

The cylindrical method is used, which consists of:

Empty the contents of the container to estimate the density, and then the components are then separated according to the type of waste.

Discrete components, placed in bags; while the remaining residues were sieved to obtain inert matter, and, while still recovering segregated materials.

After the classification of components, we performed the weighing and recording of data in the appropriate format.

For this study, segregation of the following components was considered:

xi) Recyclable waste

Composting

- Organic waste: hard fiber plant, bone, wood
- Food waste (food scraps, fruit)
- Yard waste (trimmings from gardens or green areas)
- Leather
- Cotton
- Feather (hair)

Recycling

- Paper: white paper, newsprint, mixed paper, plastic wrap.
- Cardboard: brown cardboard, white cardboard, mixed.cardboard
- Glass: clear glass, brown glass, green glass.
- Plastic: PET (Polyethylene terephthalate), HDPE (High Density Polyethylene), PVC (Polyvinyl Chloride), LDPE (Low Density Polyethylene), PP (Polypropylene), PS (polystyrene), ABS (Acrylonitrile Butadiene Styrene)
- Tetra pack
- Can (Aluminium)
- Iron

xii) Unusable Waste

Includes plastic bags (pouches), candy wrapper, tecknopor, battery, coal, ash, cloth, textiles, porcelain, china, construction waste, copper, rubber, inert material (earth, stones).

xiii)Hazardous Solid Waste

Includes packages with burned oil, containers of reagents, containers of pesticides, light bulbs, fluorescent, painting, ceramics, toilet paper, sanitary napkins and diapers.

b) Commercial Waste

The methodology used to determine the projection of commercial waste generation is presented below:

- It identifies all commercial establishments in the district.
- Establishments are classified by size (small, medium and large) and determine the percentage of small commercial establishments, medium and large this percentage is used for calculations throughout the district.
- Select a representative number of commercial establishments.

- In each of these selected establishments the waste generated is collected during eight days. Waste generated in the first day is not used for analysis.
- Obtained data is averaged and then projected by the total number of establishments by size.
- The data obtained are compared and validated with information from the cleaning area of each municipality.
- Determine the physical composition and density of solid waste from commercial origin.

c) Market Waste

The methodology used to determine the projection of waste generation markets, is as follows:

- Identify all food markets of the district (name, address and number of partners).
- Validate the information provided by the municipality with some field visits and interviews with representatives of associations of the district markets.
- Visit the markets of the district and determine the number of posts in each one of them.
- Select a representative market for the study and establish, along with leaders, time and method of sampling to be developed.
- In the selected market, the waste generated during seven days is weighed.
- Calculate the amount of solid waste generated per collection point to project them by the total number of collection points in each of the markets.

d) Schools Waste

The methodology used to determine the projection of waste generation from schools is as follows:

- Identify all schools in the district, information that can be obtained from the website of the Ministry of Education.
- Select the most representative schools for each level; then talk with principals to explain the importance of the project. The information requested is the total number of students, faculty and campus administration to determine the PCG per student and project total generation of educational institutions in the district.
- During eight days, each of the schools collects daily solid waste generated, excluding the first day.

e) Organizations Waste

The methodology used to determine the projection of waste generation of organizations was to select the most representative organizations in the district.

- Collect daily waste generated during eight days, discarding the sample from the first day.
- Calculate the generation of solid waste.

f) Street Sweeping Waste.

The methodology used to determine the projection of waste generation of street sweeping is as follows:

- Weight the generated waste daily of two routes, that for a period of seven days. It is believed that sweeping routes have the same distance, so the projection of the generation will be performed multiplying the total of routes by the average generated on each analyzed route.

4) Results

Result of solid waste characterization is attached in Appendix-3 and 4.

(4) Environmental Survey

1) Survey Parameter and Methodologies

a) Water Quality

Effluent standards for SWM facilities are not yet established, while MINSA has proposed some standards to be approved by MINAM. Water quality standards are stipulated by MINAM Decree (D. S. No. 002-2008-MINAM) depending of water usage preventing risk for human health and preserving environmental resilience. Water quality standards are established for four (4) categories. Category 3, which is water for vegetable irrigation and animal beverage, is considered as water quality standard in this environmental survey. Survey parameter, methodologies and the water quality standard for Category 3 for water quality are shown in Table 2.3-8.

Table 2.3-8 Survey Parameter, Methodologies and the Proposed Standard for Water Quality

Parameter	units	Method Norm APHA 2005	Equipment / materials	Procedures	Water quality standard for Category 3
Temperature	°C	2550 B	Liquid in glass thermometer	The temperature is taken directly from the sample. Field measurement	-
pH	pH	4500 H+ B	HACH SESION 156 SENSION 156. Buffer: 4, 7, 10	Calibration of the equipment in the laboratory and field, by Patrón Buffer, direct reading. Field measurement.	6.5 – 8.5
Dissolved Oxygen	mg/L	4500 C	HACH SESION 156 Multi-parameter SENSION 156	Calibration of the equipment in the laboratory and field, it is verified before being used.	<5
Electrical Conductivity	uS/cm	2510 B	HACH SESION 156 Multi-parameter SENSION 156	Calibration of the equipment in the laboratory and field, it is verified before being used.	<=5,000
Total Solids		2540 B	Analytical balance, oven, Colorimetric desiccator, magnetic stirrer.	weigh a porcelain, put the sample in the magnetic stirrer, pipette a representative sample, and put the sample in the porcelain, evaporate the sample to 103°C-105°C, put in an oven for 1 hour, and weigh to 103°C-105°C, weigh it until it has a constant weigh.	-
Total Suspended Solids (TSS)	mg/L	2540 D	Analytical balance, oven, suction pump, Gelman Sciens magnetic filter funnel, glass material, colorimetric desiccator, magnetic stirrer.	Tare the filter, shake the sample. aliquot taken, filter through a suction funnel, dry the filter at a temperature of 103 to 105 ° C, cool in desiccator, weigh the capsule and obtain the weight by its difference.	-
TDS		2540 C	Analytical balance, oven, Colorimetric desiccator, magnetic stirrer.	A sample is filtered through a filter faucet standard fiberglass, the filtrate evaporated to dryness in a heavy plate and dried to constant weight at 180 º c	-

Parameter	units	Method Norm APHA 2005	Equipment / materials	Procedures	Water quality standard for Category 3
Hardness		2340 C	Orion Potentiometer, 25 and/or 10 ml. Burette certified. Calibrated glass material.	Verification of pH 10.0 with buffer, subsequent titration with EDTA	-
Nitrates	mg/L	4500 NO_3 E	Reduction column UV spectrophotometer. 1201 V. SHIMADZU, Analytical Balance, material of glass.	Nitrate is reduced to nitrite (NO2-) quantitatively in the cadmiu's presence.	10
BOD	mg/L	5210B	Controlled incubator at 20°C ± 1°C 25 ml Burette, glass material.	Determine Disolved oxygen; Prepare dilution water, plant in a Winkler bottle, and incubate for 5 days at 20ºC ±1ºC.	<=15
COD	mg/L	5220 D	Espectrofotómetro UV 120 V SHIMADZU. Estufa MEMMERT UM 400.	Se somete a reflujo una muestra en una solución ácida fuerte, con un exceso conocido de dicromato de potasio por 2 horas luego se determina espectrofotometricamente la reducción del dicromato.	40
Fecal coliforms	MPN/ 100 mL	9221 E	Incubator	With the samples that resulted positive in the total coliform, prepare 3 batteries of 3 tubes containing nutrients for bacterial growth, each cell corresponds to a dilution, A Duren inverted bell is introduced in order to the gas generated during microbial growth stays trapped, and incubated for 18 hours at 44 ° C + 0.5 ° C. the tube in which the gas was present is considered positive. Compare with the table and report it.	-
Total coliforms	MPN/ 100 mL	9221 B	Incubator	Prepare 3 batteries of 3 tubes containing nutrients for bacterial growth, each bacterium corresponds to a dilution, a Duren inverted bell is introduced in order to the gas generated during microbial growth stays trapped and incubated for 18 hours at 37 ° C + 0.5 ° C. the tube is considered positive in which the gas was present. Compare with the table and reported it	5,000
Heterotrophic count	UFC/ mL	9215 D	Memmert um 400 oven	The rhp is used as a means, ´pour 5 ml in petri plates, allow to solidify, filter the sample and on the filter put it medium, in the plate incubate at 35 + 05 ° C for 48 hours, do the counting, register and calculation.	-

Source: prepared by JICA survey team

b) Air Quality

Air Quality Standards (ECA-air) have been established by the Cabinet Decree (D. S. No. 074-2001-PCM) and its amendments (D. D. No. 069-2003-PCM and R. M. No. 138-2008-MINCETUR/DM). Emission standards (Maximum Permitted Limits) for SWM facilities have not established.

Survey parameter, methodologies and environmental quality standard for air quality are shown in Table 2.3-9.

Table 2.3-9 Survey Parameter, Methodologies and Environmental Standards for Air Quality

Parameter	Sampling Method / Equipment	Analysis Method	Sampling period	Environmental Quality Standards			
				Period	Value	Format	Analysis Method
PM_{10}	Capture in Filter / PM10,	Inertial/Filtration Separation - Gravimetry	24 hours	Yearly	50	Annual arithmetic average	Inertial /filtration Separation Gravimetry
				24 hours	150	Not Exceed more than 3 times per year	
PM2.5	Capture in Filter / PM2.5	Inertial/Filtration Separation - Gravimetry	24hours	24 hours	25	Annual arithmetic average	Inertial /filtration Separation Gravimetry
Sulfur Dioxide SO2	for absorption / sampling train	Gaeke & West	24 horas	Anual	80	Media aritmética anual	UV Fluorescence (automated method)
				24 hours	20	Not Exceed more than once per year	
Dioxido de Nitrogeno(NO_2)	for absorption / sampling train	Greiss Saltzman modified method	24 horas	Yearly	100	Annual arithmetic average	Chemiluminescence (Automated method)
				1 hour	200	Not Exceed more than 24 times per year	
Hidrogeno sulfurado (H_2S)	for absorption / sampling train	Methylene Blue Method (Jacob)	1 Hour	24 hours	150	Annual arithmetic average	Inertial /Filtration Separation Gravimetry

Source: prepared by JICA survey team

d) Noise

Cabinet Decree for environmental noise standards (D. S. No. 085-2003-PCM) establishes national standards for residential, commercial, industrial and special protection zones fixing permitted limits for continuous sound pressure level in terms of "Equivalent A-weighted Level" (L_{Aeq}).

In all cases, locations of facilities in the projects are outside of special protection, residential, commercial or industrial zones. Accordingly, it is understood that these standards are not applied for the facilities. In this environmental survey, the standard values for industrial area are referred for comparison with the surveyed values. Survey parameter, methodologies and environmental quality standard for noise are shown in Table 2.3-10.

Table 2.3-10 Survey Parameter, Methodologies and Environmental Standards for Noise

Parameter	Sampling Method / Equipment	Sampling period	Environmental Quality Standards		
			Zone	Daytime value	Nighttime value
Noise Level	Sound level meter	Four days	Residential	60	50
			Commercial	70	60
			Industrial	80	70
			Special protection	50	40

Source: D.S.N. No. 085-2003-PCM

2) Results and Description

a) Water Quality

The survey has been conducted where there are surface water and ground water. In Piura, the result of analysis of ground water indicated that that electrical conductivity and nitrates are higher than the standard. Significant environmental contaminations are not expected in other sites and other parameters. Result of water quality is attached in Appendix-5.

b) Air Quality

According to stipulation of Administrative Directive bill of DIGESA, air quality was measured for baseline data at project sites, which indicate lower than the standard of the industrial zones except PM10 of leeward in Piura. The value of PM10 of leeward which was measured in Piura is 211,94 μg/m3, which is higher than standard 150 μg/m3. Result of air quality is attached in Appendix-6.

c) Noise

The result of survey indicates that noise level at the projects sites is lower than 80 dB which is the standard value for industrial zone shown in the Administrative Directive bill of DIGESA. Result of noise survey is attached in Appendix-7.

2.3.3 Present Situation of Solid Waste Management in each Municipality

JICA survey team conducted site survey to observe and confirm the current situation of SWM in the municipalities. The situation varies by municipalities. The following tables shows summery of confirmations by components of SWM.

Table 2.3-11 Present Situation of the Existing Landfills and Operation

No.	Project name	Office at site	Access control at the gate	Weighing Scale	Embankment	Leachate collection and treatment
1	Puno	Yes	No	No	No	No
2	Juliaca		Yes	No	Wall	No
3	Piura	Yes	Yes	No	Soil	No
4	Nuevo Chimbote	Yes (Not in use)	No	No	No	No
5	Tumbes	No	No	No	No	No
6	Sullana	No	No	No	No	No
7	Abancay	No	No	No	No	No
8	Huanuco	No	No	No	No	No
9	Paita	Yes	Yes	No	No	No
10	Puerto Maldonado	Yes	Yes	No	Soil	No
11	Talara	No	No	No	No	No
12	Moyobamba	No	No	No	No	Yes for new cells
13	Tarapoto	No	No	No	No	No
14	Chachapoyas	No	No	No	No	No
15	Ilave	No	Yes	No	No	No
16	Azangaro					
17	Chincha	No	No	No	No	No
18	Sechura	No	No	No	No	No
19	Huacho	No	No	No	No	No
20	Tarma	Yes	Yes	No	Soil	Yes (Recirculation)

No.	Project name	Office at site	Access control at the gate	Weighing Scale	Embankment	Leachate collection and treatment
21	Ferrenafe	No	No	No	Yes, no function	No
22	Santiago	No	No	No	No	No
23	Aymaraes	No	No	No	No	No

Source: JICA survey team

No.	Project name	Soil cover on the waste	Bulldozer	Wheel loader	Gas release pipe	Waste hauling to the sites
1	Puno	No	In operation	No	No	Everyday
2	Juliaca	Partly	In operation	at workshop	No	Except Sunday
3	Piura	For closure of dumping site	In operation	at workshop	Yes for closed areas	Everyday
4	Nuevo Chimbote	No	No	at workshop	No	Everyday
5	Tumbes	Yes	In operation	No	No	Everyday
6	Sullana	No	In operation	at workshop	No	Everyday
7	Abancay	Partly	No	In operation	No	Except Sunday
8	Huanuco	No	at workshop	at workshop	No	Except Sunday
9	Paita	No	at workshop	at workshop	No	Everyday
10	Puerto Maldonado	Only for closure of dumping site	In operation	In operation	Yes	Except Sunday
11	Talara	No	No	No	No	Everyday
12	Moyobamba	Partly	In operation	In operation	No	Everyday
13	Tarapoto	Access road	In operation	No	No	
14	Chachapoyas	No	No	No	No	Except Sunday
15	Ilave	No	No	at workshop	No	Everyday
16	Azangaro	Partly	No	at workshop	No	Everyday
17	Chincha	No	No	at workshop	No	Except Sunday
18	Sechura	No	No	No	No	Everyday
19	Huacho	No	at workshop	No	No	Everyday
20	Tarma	Yes	No	In operation	Yes	Everyday
21	Ferrenafe	Yes	Occasionally used	No	No	Everyday
22	Santiago	No	No	No	No	Except Sunday
23	Aymaraes	No	Once a week	at workshop	No	Mon, Wed, Fri

Source: JICA survey team

Table 2.3-12 Present Situation of the Material Recovery and Composting

No.	Project name	Material Recovery in city area	Material Recovery at dumping sites	Private junk shop	Composting
1	Puno	Informal association	Informal	No	No
2	Juliaca	Informal	No	No	By municipality
3	Piura	Formal association	Formal association	Yes	No
4	Nuevo Chimbote	Informal	Formal association	with scale and crusher	By municipality (1-3 t / month)
5	Tumbes	Formal association	Formal association	Yes	Under development in La Cruz
6	Sullana	Informal	Informal	with scale and crusher	No
7	Abancay	Informal	Informal	with scale, crusher, molding	No

No.	Project name	Material Recovery in city area	Material Recovery at dumping sites	Private junk shop	Composting
8	Huanuco	Informal	Informal	Yes	No
9	Paita	Informal	Informal	Only scale	No
10	Puerto Maldonado	Informal	No	No	No
11	Talara	Informal	Informal	Only scale	No
12	Moyobamba	Informal	Informal	with crusher	No
13	Tarapoto	Informal	Association	with press and crusher	No
14	Chachapoyas	Informal	Informal (1 household)	Only scale	Households in area outside collection
15	Ilave	Informal	No	No, Junk buyers comes and buy	No
16	Azangaro	No	Informal (1 person)	No	No
17	Chincha	Informal	Informal	No	No
18	Sechura	Formal	Informal	No	No
19	Huacho	Informal	Informal	with scale and crusher	No
20	Tarma	Informal	No	Only scale	By municipality
21	Ferrenafe	Informal	Informal	Yes	No
22	Santiago	No	Informal	No	No
23	Aymaraes	No	Informal	No, waste pickers bring to Cusco	No

Source: JICA survey team

Table 2.3-13 Present Situation of Collection and Transportation

No.	Project name	Household	Street	Collection point
1	Puno	Door to door	Sweeping and container	Exist
2	Juliaca	Door to door	Sweeping and tricycle	Exist
3	Piura	Door to door	Sweeping, tricycle and hand carrier	Exist
4	Nuevo Chimbote	Door to door	Sweeping and hand carrier	Exist
5	Tumbes	Door to door	Sweeping and tricycle	Exist
6	Sullana	Door to door	Sweeping and tricycle	Exist
7	Abancay	Door to door	Sweeping	Exist
8	Huanuco	Door to door	Sweeping, tricycle, hand carrier	Exist
9	Paita	Door to door	Sweeping and hand carrier	Exist
10	Puerto Maldonado	Door to door	Sweeping and hand carrier	Exist
11	Talara	Door to door	Sweeping and container	Exist
12	Moyobamba	Door to door	Sweeping, container and tricycle	Exist
13	Tarapoto	Door to door	Sweeping and hand carrier (cylinder)	Exist
14	Chachapoyas	Door to door	Sweeping	Exist
15	Ilave	Door to door	Sweeping and tricycle	Exist
16	Azangaro	Door to door	Sweeping and hand carrier	No
17	Chincha	Door to door	Sweeping and hand carrier	Exist
18	Sechura	Door to door	Sweeping and tricycle	Exist
19	Huacho	Door to door	Sweeping and tricycle	Exist
20	Tarma	Door to door	Sweeping, tricycle and container	Exist
21	Ferrenafe	Door to door	Sweeping and container	Exist
22	Santiago	Door to door	Sweeping and hand carrier	Exist
23	Aymaraes	Door to door	Sweeping and hand carrier	Exist

Source: JICA survey team

2.4 PROPSOED DESIGN CONCEPT OF THE FACILITIES AND EQUIPMENTS

2.4.1 Conditions considered in the Design Concept

(1) Targeted Period of Operation of Facility and Equipment

Based on the guidelines of SNIP, the targeted periods of operation of sub-projects have been set as ten years. It is assumed that 2014 or 2015 will be the year of commencement of operation with the following conditions.

- The detailed design necessary for the bidding document will be prepared by counterpart fund for the yen loan under full supervision by MINAM to the municipalities.

- MINAM will prepare TOR for procurement of international consultant and communicate with JICA closely in order to shorten the necessary time for the yen loan procedure prior to the commencement of works by contractors

- The procured international consultant will not prepare but review the detailed design

(2) Components in the Projects

Since the program envisages the integral SWM in the prioritized municipalities, the projects cover all components of SWM such as collection, treatment including material recovery and utilization, final disposal. The following facilities and equipment are included for all individual projects; landfill site, sorting plant, composting plant, waste collection and transportation vehicles, tools for waste sweeping and collection.

There are two types of projects in terms of beneficial districts; one is integrated SWM for one district, the other is for integrated management for one district and final disposal for plural districts. As for latter cases, the capacities of landfill sites have been decided based on the waste amount from plural district because main district, which is the target of the integrated SWM, is the provincial district. A province is responsible for provision of final disposal service to districts in its province if the other districts need.

(3) Progressive Developments

Progressive development is considered for landfill sites, sorting and composting plant to be developed under the program in order to avoid excess investment at the beginning of operation.

(4) Targeted Rate of Material Utilization recovered from Solid Waste

The target rate of material utilization is set for inorganic recyclables wastes but that is not for organic wastes.

- MIMAM assume the adoption of waste segregation at source and the introduction of segregated waste collection by waste types. Therefore, wastes would be transported by waste type to the facility so that the sorting machinery such as trommel would not be installed.
- Design capacity of sorting plant for inorganic recyclables is decided to achieve 30% of material utilization of total recyclables in 10th year.
- Target rate of utilization of organic waste has not been identified although this component is included in the projects.

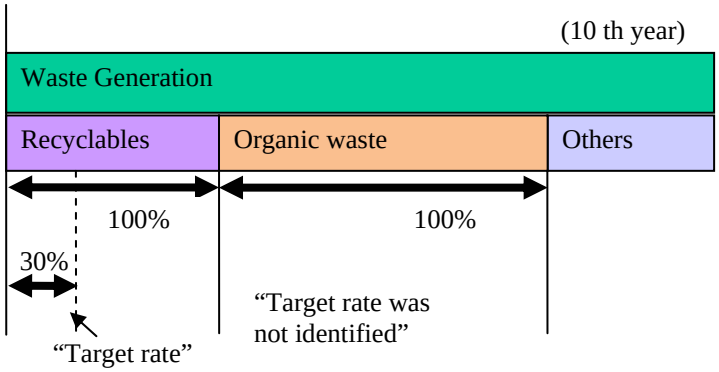


Figure 2.4-1 Target Rate of Material Utilization from Solid Waste

While it is widely recognized that the one of major benefits by material utilization from solid waste is contribution to reduce the capacity necessary for final disposal site, this effect is not considered in the facility design due to technical instruction by DIGESA.

At the beginning of the survey, JICA survey team strongly recommended MINAM to adopt a trammel as a sorting machine in receiving waste because methodology of waste segregation at generation source and segregated waste collection have not been commonly practiced in Peru. While MINAM had agreed with this recommendation once, they changed their idea to introduce the waste segregation at source which is promoted in their policy nowadays. MINAM has to recognize that execution of the project will be responsibility of municipalities and the waste segregation and collection would not be successful without strong and active initiative and participation of municipalities themselves.

(5) Lifespan of the Vehicles

According to the regulation of Peru, the following conditions are set for the waste collection vehicles.

- Life time of the existing vehicles
  - ✓ The currently existing vehicles will finish their operation life before 2014.
- Procurement of new vehicle
  - ✓ Necessary capacity of waste collection and number of vehicle are decided based on needs in 2015
  - ✓ Additional needs according to increase of waste generation will be covered by additional vehicle which will be procured progressively by each municipality
- Replacement of collection vehicles
  - ✓ The procured vehicle in 2015 will be replaced every 5 years which is considered as reinvestment.

2.4.2 Waste generation and flow

(1) Waste Generation

The municipal solid waste is composed of the domestic waste and non-domestic waste. Domestic waste is generated from daily life in households and non-domestic waste from other sources such as institution, business, commerce and market.

The waste generation to be dealt with in the projects is illustrated by the formula shown below:

■ $WG_i = WGD_i + WGnD_i$

Where *WGi* is targeted waste generation in year *i*.
WGDi is the generation of domestic waste in year *i*.
WGnDi is the generation of non-domestic waste in year *i*.

1) Domestic Waste

By using waste generation rate obtained by the results of solid waste characterization survey and the targeted population for the service, waste generation amount from households is calculated. The generation of domestic waste in each year is calculated by the following formula.

The growth rate of the urban population is set based on the available statistic data of the population of the targeted municipality or province.

■ $WGDi = GPCi * POPi = GPC_{i-1} * (1 + R_w) * POP_{i-1} * (1 + R_p)$

$= GPC0 * POP0 * \prod_{k=1}^{k=i} [(1 + R_w)^k * (1 + R_p)^k \ ]$

Where WGDi is domestic waste generation in year i.
GPCi is the per capita waste generation in year i.
GPC0 is the per capita waste generation in initial year (2014).
POP0 is the population in the initial year (2014).
R_w is the growth rate of the domestic waste generation rate.
R_p is the growth rate of the urban population.

2) Non-Domestic waste

Generation of non-domestic waste is calculated by using the data of generation of non-domestic waste obtained by the solid waste characterization survey and estimated increase rate of generation as shown in the following formula.

■ $WGnDi = WGnD0 * \prod_{k=1}^{k=i} (1 + R_{nd})^k$

Where *WGnDi* is non-domestic waste generation in year *i*.
WGnD0 is non-domestic waste generation in initial year (2014).
R_{nd} is the growth rate of the non-domestic waste generation rate.

Table 2.4-1 shows the projected amount of waste generation for each projects site.

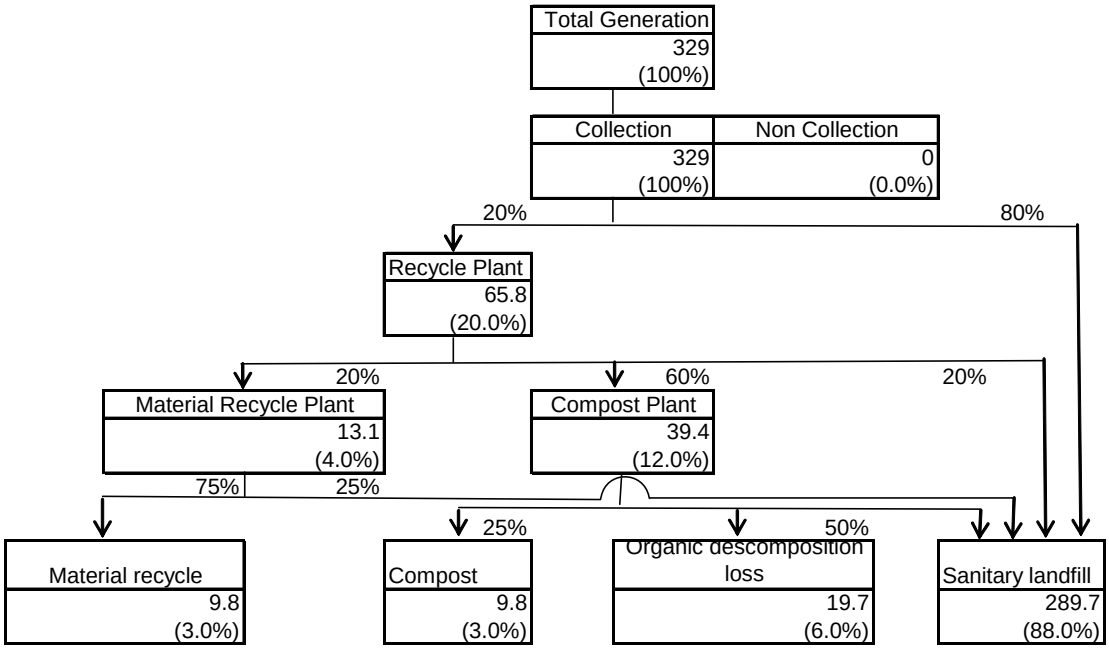
Table 2.4-1 Projected Amount of Waste Generation of the Project Sites (ton/day)

Projects Name		Project Total		Main District	
		2015	2024	2015	2024
1	Puno	91	116	91	116
2	Juliaca	188	238	188	238
3	Piura	406	516	277	355
4	Nuevo Chimbote	72	100	72	100
5	Tumbes	64	79	46	58
6	Sullana	130	161	105	132
7	Abancay	47	50	47	50
8	Huanuco	110	122	51	56
9	Paita	44	63	44	63
10	Puerto Maldonado	52	93	52	93
11	Talara	63	71	63	71
12	Moyobamba	60	88	42	60
13	Tarapoto	158	201	78	94
14	Chachapoyas	20	28	19	26
15	Ilave	13	18	13	18
16	Azangaro	7	10	7	10
17	Chincha	48	58	48	58
18	Sechura	25	36	15	23
19	Huacho	147	186	48	54
20	Tarma	29	32	29	32
21	Ferrenafe	45	53	32	37
22	Santiago	7	9	7	9
23	Aymaraes	4	4	2	3

Source: JICA survey team

(2) Waste Flow

In order to grasp the waste amount at the each stages of SWM, the waste flow is prepared. The example of waste flow shown below illustrates the necessary capacity of each facility except the landfill site because the landfill site will receive waste from plural districts in some projects and the capacity of landfill is decided without consideration of the effect of material utilizations such as recycling and composting.



Source: JICA survey team

Figure 2.4-2 Flow of Solid Waste (Example)

2.4.3 Design Concept of Waste Collection and Transportation

(1) Target Waste

All generated waste in the targeted area should be collected and transported out from urban area.

(2) Number of Equipment for Waste Collection and Transportation

The necessary number of the equipment for waste collection and transportation by type is calculated by the formula shown below.

■ $NUMi = WGi / DEN / LOADi / TRIPi / EFFi$

Where *NUMi* is necessary number of equipment type *i*
WGi is waste to be collected by equipment type *i*.
DENi is bulk density of waste applied to equipment type *i*.
*LOADi*is the loading capacity of equipment type *i*.
*TRIPi*is the number of trip of equipment type *i*.
EFFi is the effectiveness of waste loading of equipment type *i*.

The equipment used for this purpose is decided considering size of municipality, condition of road and street, the equipment type being used, and appropriateness to the SWM system. Table 2.4-2 shows the number of existing equipment for waste collection and transportation.

Table 2.4-3 shows the necessary number of equipment for waste collection and transportation.

Table 2.4-2 Number of Existing Equipment for Waste Collection and Transportations

Purchase Year		Before 2007				2008-2010				Total			
Capacity (m^3)		-10	11-15	15-19	20-	-10	11-15	15-19	20-	-10	11-15	15-19	20-
1	Puno	2	5	0	0	0	0	0	0	2	5	0	0
2	Juliaca	2	3	0	2	0	0	0	0	2	3	0	2
3	Piura	1	6	0	0	0	7	0	0	1	13	0	0
4	Nuevo Chimbote	4	0	0	0	0	0	0	0	4	0	0	0
5	Tumbes	13	2	0	0	0	1	0	0	13	3	0	0
6	Sullana	3	5	0	1	0	1	0	0	3	6	0	1
7	Abancay	3	1	0	0	2	0	0	0	5	1	0	0
8	Huanuco	0	2	0	0	0	4	0	0	0	6	0	0
9	Paita	1	4	0	1	0	0	0	0	1	4	0	1
10	Puerto Maldonado	1	2	0	0	0	0	2	0	1	2	2	0
11	Talara	0	7	0	0	0	0	0	0	0	7	0	0
12	Moyobamba	1	0	0	0	0	1	0	0	1	1	0	0
13	Tarapoto	0	5	0	0	0	0	0	0	0	5	0	0
14	Chachapoyas	1	2	0	0	0	1	0	0	1	3	0	0
15	Ilave	2	0	0	0	0	0	0	0	2	0	0	0
16	Azangaro	0	0	0	0	0	1	0	0	0	1	0	0
17	Chincha	1	0	0	1	3	0	0	0	4	0	0	1
18	Sechura	0	3	0	0	0	0	0	0	0	3	0	0
19	Huacho	0	1	0	0	0	1	0	0	0	2	0	0
20	Tarma	2	0	0	1	0	2	0	0	2	2	0	1
21	Ferrenafe	2	0	0	0	0	0	0	0	2	0	0	0
22	Santiago	0	1	0	0	0	0	0	0	0	1	0	0
23	Aymaraes	0	1	0	0	0	0	0	0	0	1	0	0
		39	50	0	6	5	19	2	0	44	69	2	6

Source: JICA survey team

Table 2.4-3 Necessary Number of Equipment for Waste Collection and Transportations

Project Name		Compactor truck			Truck
		$15m^3$	$12m^3$	$7m^3$	$19m^3$
1	Puno	5	0	0	1
2	Juliaca	9	0	0	1
3	Piura	3	10	0	1
4	Nuevo Chimbote	0	5	0	1
5	Tumbes	2	2	0	1
6	Sullana	0	6	0	1
7	Abancay	1	3	0	0
8	Huanuco	0	6	0	1
9	Paita	0	3	0	1
10	Puerto Maldonado	0	6	0	1
11	Talara	0	5	0	1
12	Moyobamba	0	4	0	1
13	Tarapoto	6	0	0	1
14	Chachapoyas	0	2	1	1
15	Ilave	0	0	2	0
16	Azangaro	0	0	1	0
17	Chincha	2	0	0	1
18	Sechura	0	3	0	0
19	Huacho	4	0	0	1
20	Tarma	0	3	1	1
21	Ferrenafe	0	3	0	0

Project Name		Compactor truck			Truck
		$15m^3$	$12m^3$	$7m^3$	$19m^3$
22	Santiago	0	1	0	0
23	Aymaraes	0	0	1	0
	Total	32	62	6	16

Source: JICA survey team

2.4.4 Design Concept of Sorting Plant and Composting Plant

(1) Target Rate of Material Utilization

MINAM set that the target of the program is to utilize 30% of inorganic recyclable materials on a project-wide average in 10th year. The capacity of sorting plants is to be set to achieve this target rate.

There is a significant difference in the amount of waste generation among 23 projects. Taking into consideration an appropriate management and the feasibility of the operation and maintenance of this recycling program, it is necessary to prevent an excessive burden of construction and operation cost on the project with a large waste generation amount. Therefore, the program classifies the projects into four categories depending on the amount of waste generation and sets category-specific rate of source segregation and the segregated waste collection. The set application rates of segregated waste collection are: 10% for the projects with the largest waste amount, 20% for those with large waste amount, 40% for those with medium-waste amount, and 60% for those with a smallest waste amount (Refer to Table 2.4-4).

On the other hand, the target rate of utilization of organic waste is not decided while this component will be adopted for all projects in order to promote environmental benefit of it.

Table 2.4-4 Waste Receiving Rate for Sorting Plant

Waste amount (ton/day in 2015)	Ratio of Introduction of Waste Segregation at Source and Segregated Waste Collection
Less than 20	60%
21-100	40%
101 -300	20%
More than 301	10%

Source: JICA survey team

(2) Introduction of Waste Segregation at Source

1) Category of waste segregation

- 2-category of waste segregation (inorganic and others) will be started in Yr1 in the priority area of all project sites. The priority area will be expanded progressively.
- 3-category of waste segregation (inorganic, organic and others) will be applied from Yr 5, as necessary to get organic waste for composting, except Piura, Tarapoto and Huanuco, where there is much organic waste from market

2) Expansion of waste segregation

- Population of the priority area in Yr1-2: 5% of the population considering the criteria of MEF program which promotes waste segregation at source. And, for small population municipalities where 5% of population will be too small to conduct pilot scale trial, minimum population for the priority area in Yr1-2 is set as 2,000.

- 30% of processing of inorganic waste against total generation of inorganic waste in average in the program is to be achieved in Year10.
- Target area will be expanded gradually to achieve inorganic waste amount of Year 10.

Table 2.4-5 Utilization Rate of Inorganic Recyclables in 10th year

	Name of Project	Target rate of source segregation in Yr10	Waste generation in main district (t/d)				Inorganic	Inorganic Amount	Inorganic waste from waste separation at source (t/d)										
			2015			2024			Priority	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
			Population	G/capita	Total	Total	%	2024	Population in Yr1	1	2	3	4	5	6	7	8	9	10
1	PUNO	40%	140,202	0.536	90.92	116.45	15.52	18.07	7,000	0.58	0.58	1.44	1.44	2.88	2.88	4.32	4.32	7.20	7.20
2	JULIACA	20%	252,830	0.526	187.75	238.11	18.82	44.81	13,000	1.29	1.29	1.80	1.80	3.60	3.60	5.40	5.40	9.00	9.00
3	PIURA	10%	300,050	0.660	276.53	354.54	28.80	102.11	15,000	2.85	2.85	2.85	2.85	4.00	4.00	6.00	6.00	10.00	10.00
4	NUEVO CHIMBOTE	40%	139,089	0.482	72.01	99.65	18.52	18.46	7,000	0.63	0.63	1.48	1.48	2.96	2.96	4.44	4.44	7.40	7.40
5	TUMBES	40%	108,413	0.331	46.19	57.66	25.51	14.71	5,000	0.42	0.42	1.18	1.18	2.36	2.36	3.54	3.54	5.90	5.90
6	SULLANA	20%	166,721	0.540	105.36	132.24	25.73	34.03	8,000	1.11	1.11	1.36	1.36	2.72	2.72	4.08	4.08	6.80	6.80
7	ABANCAY	40%	46,486	0.584	46.87	50.17	6.60	3.31	2,000	0.08	0.08	0.26	0.26	0.52	0.52	0.78	0.78	1.30	1.30
8	HUANUCO	40%	74,004	0.368	51.47	55.98	17.87	10.00	4,000	0.26	0.26	0.80	0.80	1.60	1.60	2.40	2.40	4.00	4.00
9	PAITA	40%	92,476	0.420	44.14	62.82	19.24	12.09	5,000	0.40	0.40	0.96	0.96	1.92	1.92	2.88	2.88	4.80	4.80
10	PUERTO MALDONADO	40%	89,206	0.417	51.75	92.54	21.20	19.62	4,000	0.35	0.35	1.56	1.56	3.12	3.12	4.68	4.68	7.80	7.80
11	TALARA	40%	90,862	0.568	63.11	70.77	25.95	18.37	5,000	0.74	0.74	1.46	1.46	2.92	2.92	4.38	4.38	7.30	7.30
12	MOYOBAMBA	40%	55,393	0.651	41.54	60.22	10.20	6.14	3,000	0.20	0.20	0.50	0.50	1.00	1.00	1.50	1.50	2.50	2.50
13	TARAPOTO	40%	76,660	0.572	78.19	94.44	15.48	14.62	4,000	0.35	0.35	1.16	1.16	2.32	2.32	3.48	3.48	5.80	5.80
14	CHACHAPOYAS	60%	28,914	0.487	19.08	26.13	16.56	4.33	2,000	0.16	0.16	0.52	0.52	1.04	1.04	1.56	1.56	2.60	2.60
15	ILAVE	60%	27,749	0.335	13.01	17.89	33.53	6.00	2,000	0.22	0.22	0.72	0.72	1.44	1.44	2.16	2.16	3.60	3.60
16	AZANGARO	60%	19,092	0.299	7.33	9.57	28.40	2.72	2,000	0.17	0.17	0.32	0.32	0.64	0.64	0.96	0.96	1.60	1.60
17	CHINCHA	40%	66,037	0.533	48.05	57.66	14.98	8.64	3,000	0.24	0.24	0.70	0.70	1.40	1.40	2.10	2.10	3.50	3.50
18	SECHURA	60%	43,685	0.328	14.84	22.84	27.50	6.28	2,000	0.18	0.18	0.76	0.76	1.52	1.52	2.28	2.28	3.80	3.80
19	HUACHO	40%	57,664	0.426	47.52	53.64	17.54	9.41	3,000	0.22	0.22	0.76	0.76	1.52	1.52	2.28	2.28	3.80	3.80
20	TARMA	40%	44,795	0.424	29.39	32.49	17.64	5.73	2,000	0.15	0.15	0.46	0.46	0.92	0.92	1.38	1.38	2.30	2.30
21	FERRENAFE	40%	33,654	0.582	31.50	35.55	13.71	4.87	2,000	0.16	0.16	0.38	0.38	0.76	0.76	1.14	1.14	1.90	1.90
22	SANTIAGO	60%	19,394	0.320	7.13	9.16	31.34	2.87	2,000	0.20	0.20	0.34	0.34	0.68	0.68	1.02	1.02	1.70	1.70
23	AYMARAES	60%	3,797	0.492	2.16	2.45	5.61	0.14	2,000	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.10	0.10
							Total	367.31										Total	114.7
																		Recovery rate	31%

Source: JICA survey team

(3) Sorting Plant

1) Planning Condition

Planning conditions of sorting plant are summarized in Table 2.4-6.

a) Receiving Waste

The sorting plant is planned to receive inorganic recyclables (excluding medical and hazardous waste) is segregated at home. Projected treatment amount is as shown in Table 2.4-5.

b) Treatment System

For efficient operation, mechanized system will be applied to the plant with the treatment capacity of more than 10t/day, while a manual system will be applied to the plant with the treatment capacity of less than 10t/day. Recyclable material is segregated by hand on a belt conveyor in the mechanized system, and segregated by hand not using a belt conveyor in the manual system.

As shown in Table 2.4-5, Piura is the only plant where the recyclables amount is estimated to be over 10t/day for 2024, and mechanized treatment system will be applied.

Table 2.4-6 Planning Conditions of Sorting Plant

Item	Conditions
Target year (operation period)	2024 (2015 -2024)
Receiving waste	Inorganic recyclables segregated at generation source (excluding Medical and Hazardous Waste)
Treatment system	Capacity : over 10t/day Mechanized (with belt conveyer) Capacity : under 10t/day Manual

Source: JICA survey team

c) Facility Layout Plan

- Layout of the sorting plant was designed to secure an efficient traffic line and rational layout of equipments for effective operation
- Facility layout was designed to realize an easy import of waste, and an easy export of segregated valuables

d) Phase-wise facility development plan

Mechanized treatment system (Piura project): It is planned to construct the main building and storage facility with the sufficient capacity for estimated recycling treatment amount for 2024 first, and then expand its capacity in phases. A belt conveyor will be installed by 2023 when the treatment amount is estimated to be over 10t.day.

Manual treatment system (Other projects than Piura): It is planned to construct facilities necessary to treat the projected recyclable amounts for 2024. No expansion will be done afterwards. However, in Ayamaraes, recycling activities will be carried out in the storage area of the compost plant due to very small amount of recyclables.

2) Facility Design

a) Facility Design for Mechanized System (Piura project)

Plant for mechanized recycling system will be divided into 3 area, namely, waste receiving area, mechanical segregation area and storage area.

The mechanical segregation area will be equipped with a belt conveyor. However, it will not be installed until 2022, as the treatment amount is estimated to be below 10t/day for 2015 to 2022. Therefore, hand sorting will be conducted in the mechanical segregation area without belt conveyor until 2022.

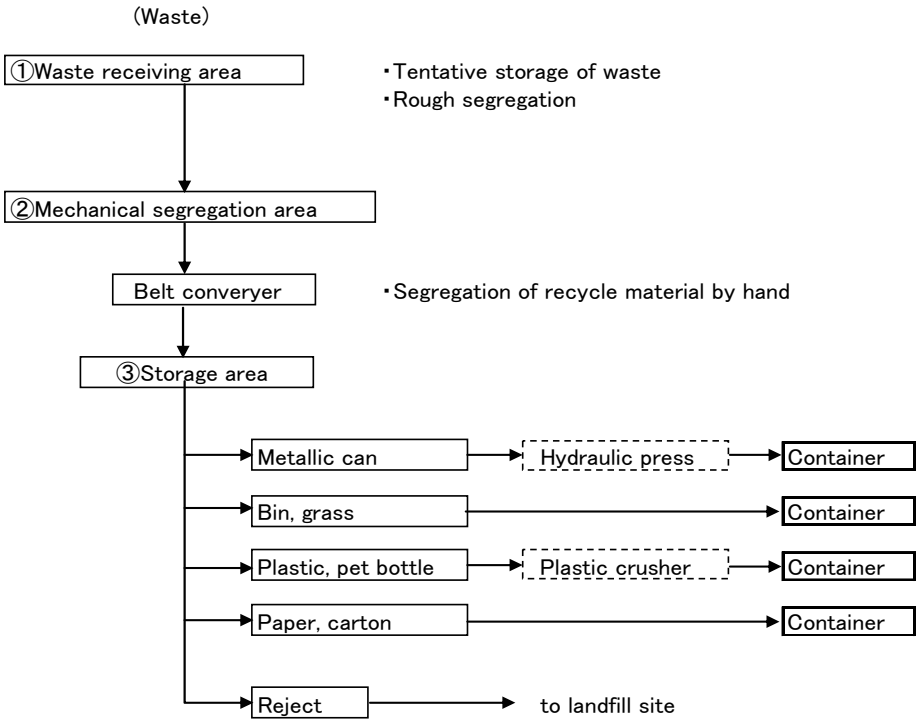
The function and structure of each plant area are as shown in Table 2.4-7. A system flow and a facility layout plan for mechanized system after 2023 are as shown in Figure 2.4-3 and Figure 2.4-4 respectively. A recycling system flow and a facility layout plan for mechanized system for 2015 to 2022 are as shown in Figure 2.4-5 and Figure 2.4-6 respectively.

Table 2.4-7 Function and Structure of the Facility for Mechanized System

Process	Function and structure
Waste receiving	Waste will be brought to waste receiving area by compactor trucks Tentative storage of waste and primary segregation will be done in the receiving area. Waste on receiving area will be moved into trommel by wheel loader or hand. Concrete floor will be provided for workability. Roof shed will not be provided for this area.
Mechanical segregation	Mechanical segregation will be conducted in this area (However, recycling activities by hand sorting without belt conveyor will be carried out in this area by 2022) Belt conveyor and chute will be placed in this area. Belt conveyor and chute will be installed by 2023. Roof shed will be provided. External wall with some opening for ventilation will be provided. Height clearance of 6.0m is required for handling recycling waste. Concrete floor will be provided for workability. Less internal columns are preferable for workability.

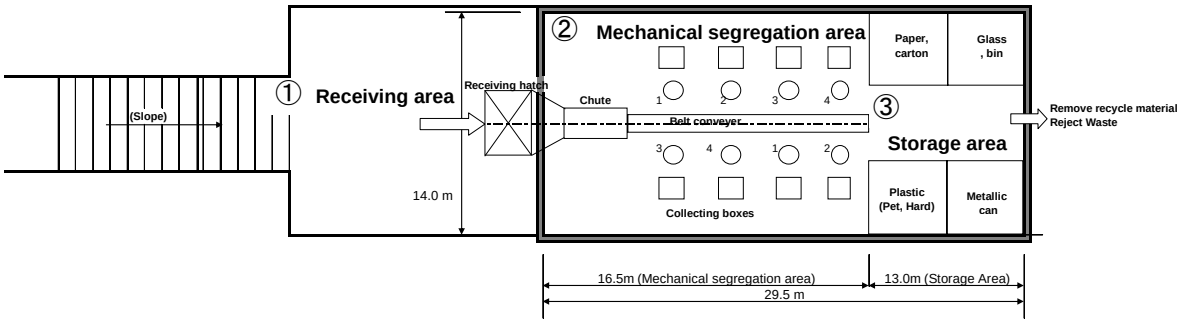
Process	Function and structure
Storage	In this area, metallic can, glass, plastic, PET bottle, paper and carton will be stored. Storage period is planned to be more than two weeks. Roof shed will be provided. External wall with some opening for ventilation will be provided. Height clearance of 6.0m is required for handling recycling waste. Concrete floor will be provided for workability. Less internal columns are preferable for workability. Hydraulic press and Plastic crusher will be installed by municipality as needed

Source: JICA survey team



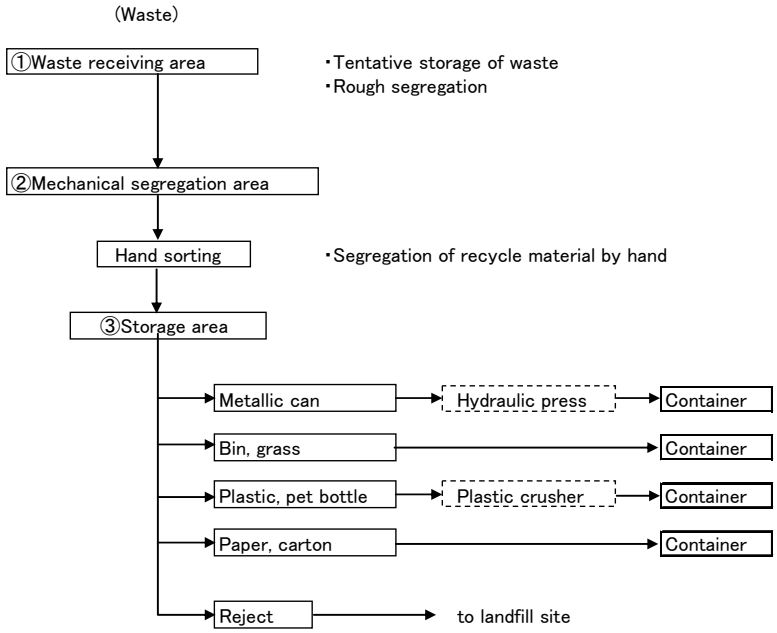
Source: JICA survey team

Figure 2.4-3 System flow diagram for sorting plant with mechanized system (after 2023)



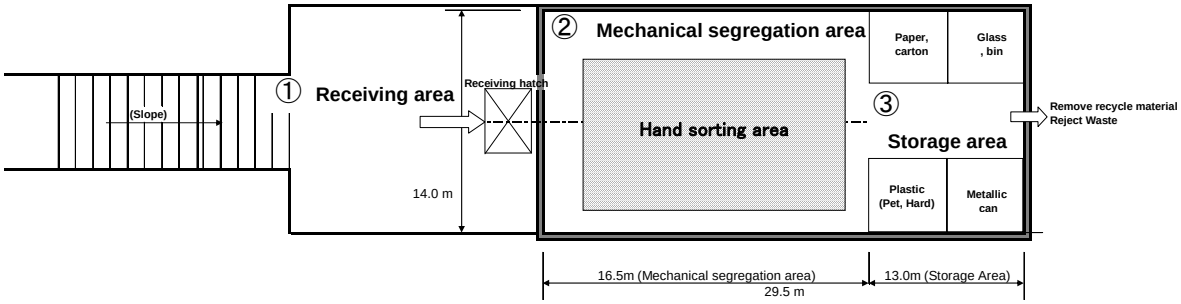
Source: JICA survey team

Figure 2.4-4 Typical layout plan of sorting plant with mechanized system (after 2023)



Source: JICA survey team

Figure 2.4-5 System flow diagram for sorting plant with mechanized system (2015 – 2022)



Source: JICA survey team

Figure 2.4-6 Typical layout plan for recycling plant with mechanized system (2015 – 2022)

b) Facility Design for Manual System (except for Piura project)

Proposed plants for manual system are classified into two types by the projected treatment amount for 2024: i.e., plant with treatment amount of over 5t/day (Type-A) and plant with less than 5t/day (Type-B), and different facility designs were prepared for each type.

Table 2.4-8 shows the type and scale of the proposed plant for each project.

Plant for manual recycling system can be divided into two area, i.e., hand sorting area and storage area. The function and structure of each plant area are as shown in Table 2.4-9.

Figure 2.4-7 shows the system flow diagram of the plant. A layout plan for Type-A plant and for Type-B plant are as shown in Figure 2.4-8 and Figure 2.4-9, respectively.

Table 2.4-8 Type and capacity of the facilities in each project

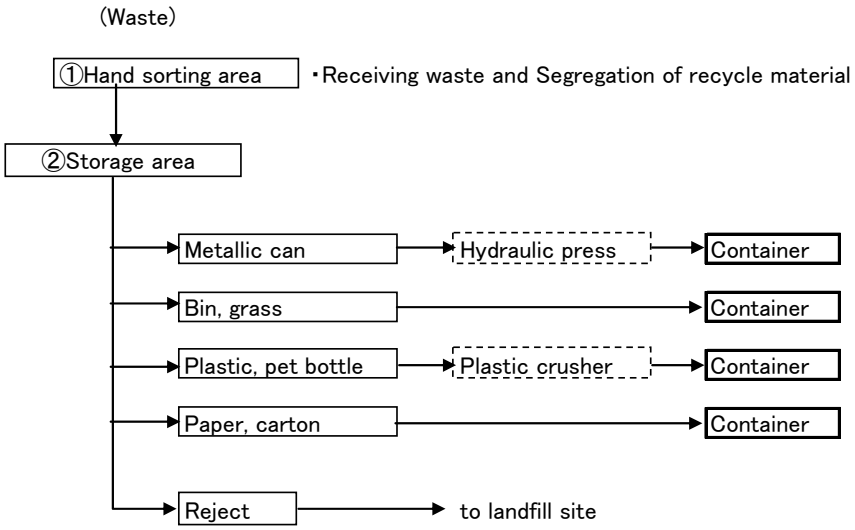
	Name of municipality	(1) Inorganic waste in 2004 (t/d)	(2) Facility type	(3) Specific weight of SW on hand sorting area (t/m^3)	(4) Thickness of SW on hand sorting area (m)	(5) Cycle time of hand sorting work per day (times /day)	(6) Area for SW on hand sorting area (m^2) (1)/(3)/(4) /(5)	(7) Area for recycable material storage area (1)*0.5t/m3*7day (m^2)	(8) Vehicle Passage area (m2) ((6)+(7))^.5*3m	(9) Total necessary area (6)+(7)+(8) (m^2)	(10) Dimension of Facility area (m) (a) × (b)
1	Puno	7.2	**B**	0.3	0.3	2	40.0	100.8	35.6	176.4	11 × 20
2	Juliaca	9.0	**B**	0.3	0.3	2	50.0	126.0	39.8	215.8	11 × 20
4	Nuevo Chimbote	7.4	**B**	0.3	0.3	2	41.1	103.6	36.1	180.8	11 × 20
5	Tumbes	5.9	**B**	0.3	0.3	2	32.8	82.6	32.2	147.6	11 × 20
6	Sullana	6.8	**B**	0.3	0.3	2	37.8	95.2	34.6	167.6	11 × 20
7	Abancay	1.3	**A**	0.3	0.3	2	7.2	18.2	15.1	40.5	11 × 12
8	Huanuco	4.0	**A**	0.3	0.3	2	22.2	56.0	26.5	104.8	11 × 12
9	Paita	4.8	**A**	0.3	0.3	2	26.7	67.2	29.1	122.9	11 × 12
10	Puerto Maldonado	7.8	**B**	0.3	0.3	2	43.3	109.2	37.1	189.6	11 × 20
11	Talara	7.3	**B**	0.3	0.3	2	40.6	102.2	35.8	178.6	11 × 20
12	Moyobamba	2.5	**A**	0.3	0.3	2	13.9	35.0	21.0	69.9	11 × 12
13	Tarapoto	5.8	**B**	0.3	0.3	2	32.2	81.2	31.9	145.4	11 × 20
14	Chachapoyas	2.6	**A**	0.3	0.3	2	14.4	36.4	21.4	72.2	11 × 12
15	Ilave	3.6	**A**	0.3	0.3	2	20.0	50.4	25.2	95.6	11 × 12
16	Azangaro	1.6	**A**	0.3	0.3	2	8.9	22.4	16.8	48.1	11 × 12
17	Chincha	3.5	**A**	0.3	0.3	2	19.4	49.0	24.8	93.3	11 × 12
18	Sechura	3.8	**A**	0.3	0.3	2	21.1	53.2	25.9	100.2	11 × 12
19	Huacho	3.8	**A**	0.3	0.3	2	21.1	53.2	25.9	100.2	11 × 12
20	Tarma	2.3	**A**	0.3	0.3	2	12.8	32.2	20.1	65.1	11 × 12
21	Ferrenafe	1.9	**A**	0.3	0.3	2	10.6	26.6	18.3	55.4	11 × 12
22	Santiago	1.7	**A**	0.3	0.3	2	9.4	23.8	17.3	50.5	11 × 12
23	Aymaraes	0.1		0.3	0.3	2	0.6	1.4	4.2	6.2	

*1) Capacity for the Type-A plant was determined based on the capacity of the plant in Paita which has the largest capacity under 5t/day.
*2) Capacity for the Type-b plant was determined based on the capacity of the plant in Juliaca which has the largest capacity over 5t/day.
*3) In Aymaraes, treatment amount is estimated to be very small, hence, recycling work will be done in the storage area of the compost plant.

Table 2.4-9 Function and Structure of the Facility for Manual System

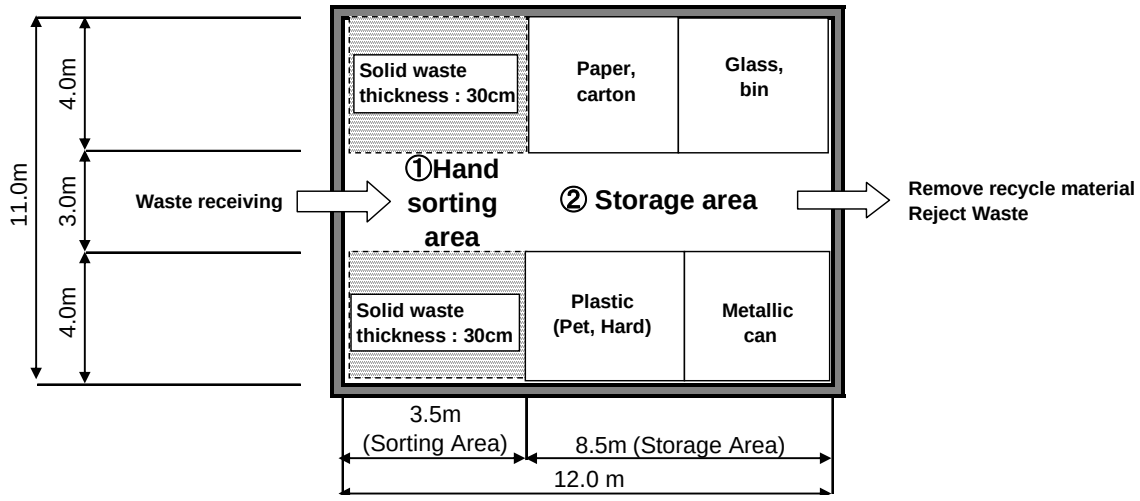
Process	Function and structure
Hand sorting area	Hand sorting of recycle/non-recycle material will be done in this area. Hand sorting of recyclable/non-recyclable material will be done on the concrete floor spreading waste 30cm thickness. Height clearance of 6.0m for mechanized system is required for moving compactor and small truck. Roof shed will be provided. 1.2 m high external wall will be provided to avoid waste being blown away by the wind. Upper part will be kept open for ventilation.
Storage area	Metallic can, glass, plastic, PET bottle, paper and carton are stored in this area. The above materials will be stored for more than two weeks. Roof shed will be provided. External wall with some opening for ventilation will be provided. Height clearance of 6.0m is required for handling recycling waste. Concrete floor will be provided for workability. Less internal columns are preferable for workability. Hydraulic press and Plastic crusher will be installed by municipality as needed.

Source: JICA survey team



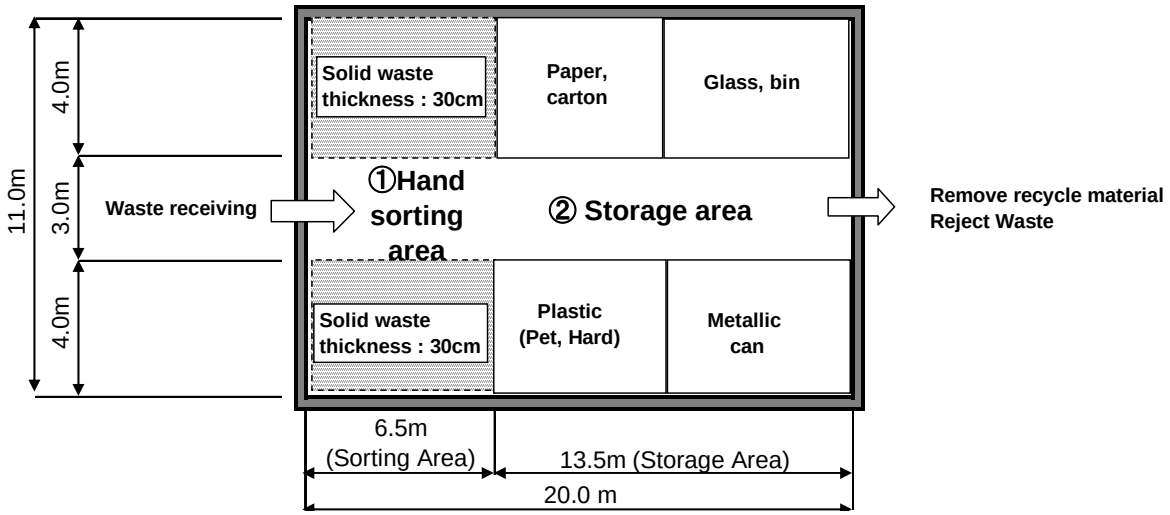
Source: JICA survey team

Figure 2.4-7 System Flow of Sorting Plant for Manual System



Source: JICA survey team

Figure 2.4-8 Typical layout plan for sorting plant with manual system (Type-A)



Source: JICA survey team

Figure 2.4-9 Typical layout plan for sorting plant with manual system (Type-B)

3) Necessary Equipment for Sorting Plant

Sorting plant will be designed either with mechanized system or manual system depending on the amount of receiving waste. Table 2.4-10 shows the function, types, and number of equipments required for each system.

a) Belt conveyor

Under mechanized system in Piura, a belt conveyor will be installed to segregate recyclable material from mixed waste. This belt conveyor will be installed by 2023 when the recycling amount is projected to be over 10t/day.

b) Plastic Crusher and Hydraulic Press

When needed, municipality will install a plastic crusher and hydraulic press.

Table 2.4-10 Equipment for Sorting Plant

Equipment		Q'ty	Capacity of plant	
Name	Capacity		Over 10t/day (Mechanized)	Under 10t/day (Manual)
Belt conveyer	50t/day, 2.2kW	1	x	
Plastic crusher	3.2t/day, 15HP	1	Will be prepared by municipality if necessary	
Hydraulic press	1.6t/day, 10HP	1		

Source: JICA survey team

(4) Composting Plant

1) Planning Conditions

Planning conditions of composting plant are summarized in Table 2.4-11.

Table 2.4-11 Planning Conditions

Item	Conditions
Target year (operation period)	2024 (2015 -2024)
Receiving compost material	Organic material from waste separation at source and Market material
Treatment system	Windrow system

Source: JICA survey team

a) Method of composting

Composting is a natural biological process of degradation of organic waste to manure, carried out under controlled aerobic conditions. In this process, various micro-organisms, including bacteria and fungi, break down organic matter into simpler substances.

The decomposition process takes place in the presence of air and results in elevated process temperatures, the production of carbon dioxide, water and a stabilized residue, known as humus. A high degree of stabilization can generally be achieved in 3-6 weeks, however further 'curing' of the humus is normally carried out. For composting to occur in an optimum manner, the following key factors need to be controlled; i.e. oxygen, temperature, moisture, material disturbance, organic matter and the size and activity of microbial populations.

There are various methods available for composting such as windrow composting, vermi-composting, and in-vessel composting. Among these, the windrow composting is proposed for this program, because it has the following advantages over others.

- Handling large quantity of solid waste
- Low cost intensive
- Easier operation as lesser controlling parameters are required to be handled
- Acceptable worldwide

Turn over for aeration in the windrow process will be done using a wheel loader, or a mini bulldozer (which has been used for landfill operation) in the projects with small treatment amount.

b) Receiving Waste

The plant will receive organic waste from household and market. Table 2.4-12 shows the projection of waste treatment amount for 2015 to 2024.

c) Treatment System

For efficient operation, the projects with the waste treatment amount more than 10t/day adopt the mechanized system under which a wheel loader is used for turning over of organic material in composting process for aeration during windrow process and a vibro-screen is used for refining of compost product.

The projects with the waste amount less than 10t/day adopts the manual system under which the above-mentioned operation is performed manually.

Table 2.4-12 Amount of Organic Waste to be processed at the Composting Plants

	Name of Project	Waste generation in main district (t/d)				Organic	Organic Amount	Treatment capacity of organic waste (t/d)										
		2015			2024			Pilot amount (kg) in Yr1	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
		Population	G/capita	Total	Total	%	2024		1	2	3	4	5	6	7	8	9	10
1	PUNO	140,202	0.536	90.92	116.45	62.82	73.15	200	0.20	0.20	3.82	3.82	3.82	4.00	4.00	4.00	4.00	4.00
2	JULIACA	252,830	0.526	187.75	238.11	45.70	108.81	200	0.20	0.20	3.18	3.18	3.18	4.00	4.00	4.00	4.00	4.00
3	PIURA	300,050	0.660	276.53	354.54	48.90	173.37	200	0.20	0.20	4.00	4.00	4.00	7.00	7.00	7.00	7.00	7.00
4	NUEVO CHIMBOTE	139,089	0.482	72.01	99.65	41.59	41.45	200	0.20	0.20	4.00	4.00	4.00	7.00	7.00	7.00	7.00	7.00
5	TUMBES	108,413	0.331	46.19	57.66	53.85	31.05	200	0.20	0.20	4.00	4.00	4.00	7.00	7.00	7.00	7.00	7.00
6	SULLANA	166,721	0.540	105.36	132.24	38.79	51.30	200	0.20	0.20	2.37	2.37	2.37	4.00	4.00	4.00	4.00	4.00
7	ABANCAY	46,486	0.584	46.87	50.17	52.00	26.09	200	0.20	0.20	1.25	1.25	1.25	4.00	4.00	4.00	4.00	4.00
8	HUANUCO	74,004	0.368	51.47	55.98	63.64	35.62	200	0.20	0.20	4.00	4.00	4.00	7.00	7.00	7.00	7.00	7.00
9	PAITA	92,476	0.420	44.14	62.82	44.42	27.91	200	0.20	0.20	1.56	1.56	1.56	4.00	4.00	4.00	4.00	4.00
10	PUERTO MALDONADO	89,206	0.417	51.75	92.54	54.80	50.71	200	0.20	0.20	3.71	3.71	3.71	4.00	4.00	4.00	4.00	4.00
11	TALARA	90,862	0.568	63.11	70.77	47.02	33.28	200	0.20	0.20	1.88	1.88	1.88	4.00	4.00	4.00	4.00	4.00
12	MOYOBAMBA	55,393	0.651	41.54	60.22	76.99	46.36	200	0.20	0.20	2.39	2.39	2.39	4.00	4.00	4.00	4.00	4.00
13	TARAPOTO	76,660	0.572	78.19	94.44	63.50	59.97	200	0.20	0.20	4.00	4.00	4.00	7.00	7.00	7.00	7.00	7.00
14	CHACHAPOYAS	28,914	0.487	19.08	26.13	47.50	12.41	200	0.20	0.20	1.30	1.30	1.30	4.00	4.00	4.00	4.00	4.00
15	ILAVE	27,749	0.335	13.01	17.89	42.69	7.64	200	0.20	0.20	0.86	0.86	0.86	1.10	1.10	1.10	1.10	1.10
16	AZANGARO	19,092	0.299	7.33	9.57	42.69	4.09	200	0.20	0.20	0.35	0.35	0.35	1.10	1.10	1.10	1.10	1.10
17	CHINCHA	66,037	0.533	48.05	57.66	48.93	28.21	200	0.20	0.20	1.67	1.67	1.67	4.00	4.00	4.00	4.00	4.00
18	SECHURA	43,685	0.328	14.84	22.84	32.61	7.45	200	0.20	0.20	0.24	0.24	0.24	1.10	1.10	1.10	1.10	1.10
19	HUACHO	57,664	0.426	47.52	53.64	59.35	31.84	200	0.20	0.20	2.19	2.19	2.19	4.00	4.00	4.00	4.00	4.00
20	TARMA	44,795	0.424	29.39	32.49	59.13	19.21	200	0.20	0.20	2.48	2.48	2.48	4.00	4.00	4.00	4.00	4.00
21	FERRENAFE	33,654	0.582	31.50	35.55	33.17	11.79	200	0.20	0.20	2.00	2.00	2.00	4.00	4.00	4.00	4.00	4.00
22	SANTIAGO	19,394	0.320	7.13	9.16	23.18	2.12	200	0.02	0.02	0.02	0.02	0.02	1.10	1.10	1.10	1.10	1.10
23	AYMARAES	3,797	0.492	2.16	2.45	52.44	1.28	200	0.12	0.12	0.12	0.12	0.12	1.10	1.10	1.10	1.10	1.10
						Total	885.1										Total	92.5

Source: JICA survey team

d) Facility Layout Plan

- Facility layout is designed to secure an efficient traffic line and operation of the plant.
- Facility layout is designed to realize easy transfer of segregated recyclables and compost products.

e) Phase-wise development plan

During the pilot project period (2015 and 2016), composting process will be carried out at a sorting plant, as the treatment amount is estimated to be very small. However, in Aymaraes, a compost plant will be in operation even from the pilot project period, as no sorting plant will be constructed there due to small amount of recyclables. After the pilot project period, treatment facilities will be phased in according to actual treatment amount. Table 2.4-13 shows the number of construction phases in each project, and its time schedule.

Table 2.4-13 Number of construction phases in each project and time schedule for each phase

Name of Municipality	Phase	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
1. Puno	1			●1st								
2. Juliaca	1			●1st								
3. Piura	2			●1st			▲2nd					
4. Nuevo Chimbote	2			●1st			▲2nd					
5. Tumbes	2			●1st			▲2nd					
6. Sullana	1			●1st								
7. Abancay	2			●1st			▲2nd					
8. Huanuco	2			●1st			▲2nd					
9. Paita	2			●1st			▲2nd					
10.Puerto Maldonado	1			●1st								
11.Talara	1			●1st								
12.Moyobamba	1			●1st								
13.Tarapoto	2			●1st			▲2nd					
14.Chachapoyas	2			●1st			▲2nd					
15.Ilave	1			●1st								

Name of Municipality	Phase	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
16.Azangaro	1			●1st								
17.Chincha	2			●1st			▲2nd					
18.Sechura	1						●1st					
19.Huacho	1			●1st								
20.Tarma	1			●1st								
21.Ferrenafe	1			●1st								
22.Santiago	1						●1st					
23.Aymaraes	1	●1st					▲2nd					

Legend : ●1st *: 1st phase of construction ,* ▲2nd *: 2nd phase of construction*
Source: JICA survey team

f) Project-specific facility plan

Facility is designed based on the amount of organic material generated in targeted municipality, and the climate that varies widely by region. For example, windbreak walls will be installed in windy-costal area, and roof shed will be installed in rainy area.

2) Facility Design

a) Function and structure of facilities

Basically, composting procedures are divided into 3 processes according to the functions, i.e., windrow process, curing process and refining process.

The function and structure of each process for mechanized system is as shown in Table 2.4-14.

b) Capacity and type of facilities

By the projected treatment amount for 2024, proposed compost plants are classified into three types, i.e., 1) 7.0 t/day (Type-A), 2) 4.0 t/day (Type-B) and 3) 1.1 t/day (Type-C). Table 2.4-15 shows the type and capacity of the planned facilities for each project.

Figure 2.4-10 shows a system flow of the planned facility. A layout plan for Type-A plant, for Type-B plant, and for Type-C are as drown in Figure 2.4-11, Figure 2.4-12 and Figure 2.4-13, respectively.

c) Capacity and type of facilities

Piura project is estimated to have the largest amount of composting material and recycling material during the pilot project period. The scale of facility required to treat this amount is estimated to be10.7 m x 11.5m as shown in Figure 2.4-14, which is smaller than the minimum scale for the sorting plant, 11.0 m x 12.0m. Therefore, both composting process and recycling process will be carried out in a sorting plant during the pilot project period.

Table 2.4-14 Function and Structure of the Facility for Mechanized System

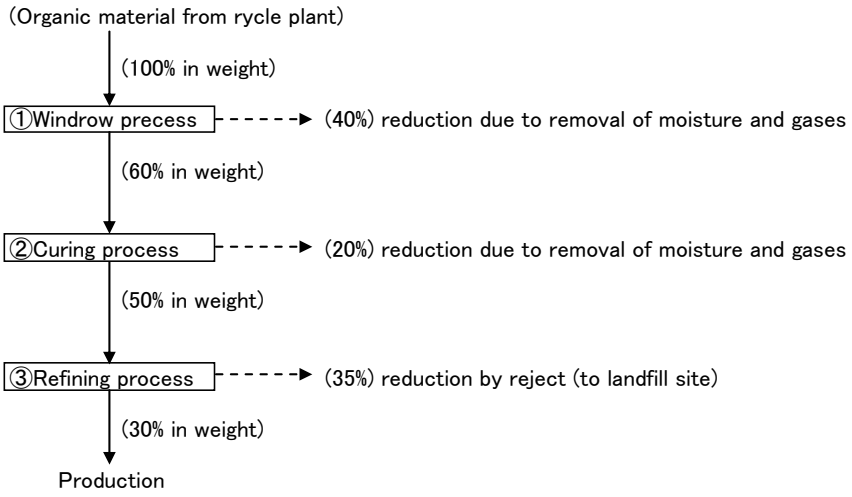
Process	Function and structure
Windrow process	Segregated organic waste will be transferred from sorting plant by wheel loader or other vehicle Wheel loader will be used for turning over of composting material for aeration in windrow process. Roof shed will be provided only in the rainy area Height clearance of 4.5m is required for turning, scooping, shifting windrows by wheel loader in rainy area. Organic waste brought in will be piled up for a week at one place and shifted to the second place so that next waste can be received. Shifting will be carried out for three times, and the volume will decrease by 20% in a week. Windrow will be turned twice a week (on 4^{th} day on its own place and on 7^{th} day to new place as next week windrow by wheel loader). It takes 28 days for the process. Concrete floor will be provided to prevent leachate penetration into ground, and depression in the ground by the wheel loader. Slope and drain gutter with heavy duty covers is required on the concrete floor for collecting leachate. Collected leachate will be used again for moisturing compost in windrow process or transferred to leachate pond for landfill site. 1.2 m high external brick wall will be provided to avoid wastes being blown away by the wind. Upper part will be kept open for ventilation. Low wall will be provided to facilitate turning, scooping and shifting activities by wheel loader. Less internal columns are preferable for free movement of wheel loaders. Access for wheel loader will be secured in mechanized system, and its width will be 5.0m.
Curing process	Composting material will be transferred to curing area by wheel loader after windrow process. Composting material will be stacked in the curing area to remove moisture from waste. It takes 2month for the process. Roof shed is required to protect from rain and sunshine. External wall with some opening for ventilation will be provided. Concrete floor will be provided for workability.
Refining process	Vibro screen (6mm) for sieving will be used for refining process(treatment amount $\geqq$7t). Manual screen mesh for sieving will be used in the process of refining of compost material (treatment amount < 7t).. Vibro and Manual-screen (6mm) rejects material above 6mm Roof shed is required to protect from rain and sunshine and for workability. Concrete floor will be provided for stacking and removing moisture. External wall with some opening for ventilation will be provided. Reject from sorting plant will be transferred and disposed to landfill site by tractor with trailer.

Source: JICA survey team

Table 2.4-15 Type and Capacity of the Facilities in each Project

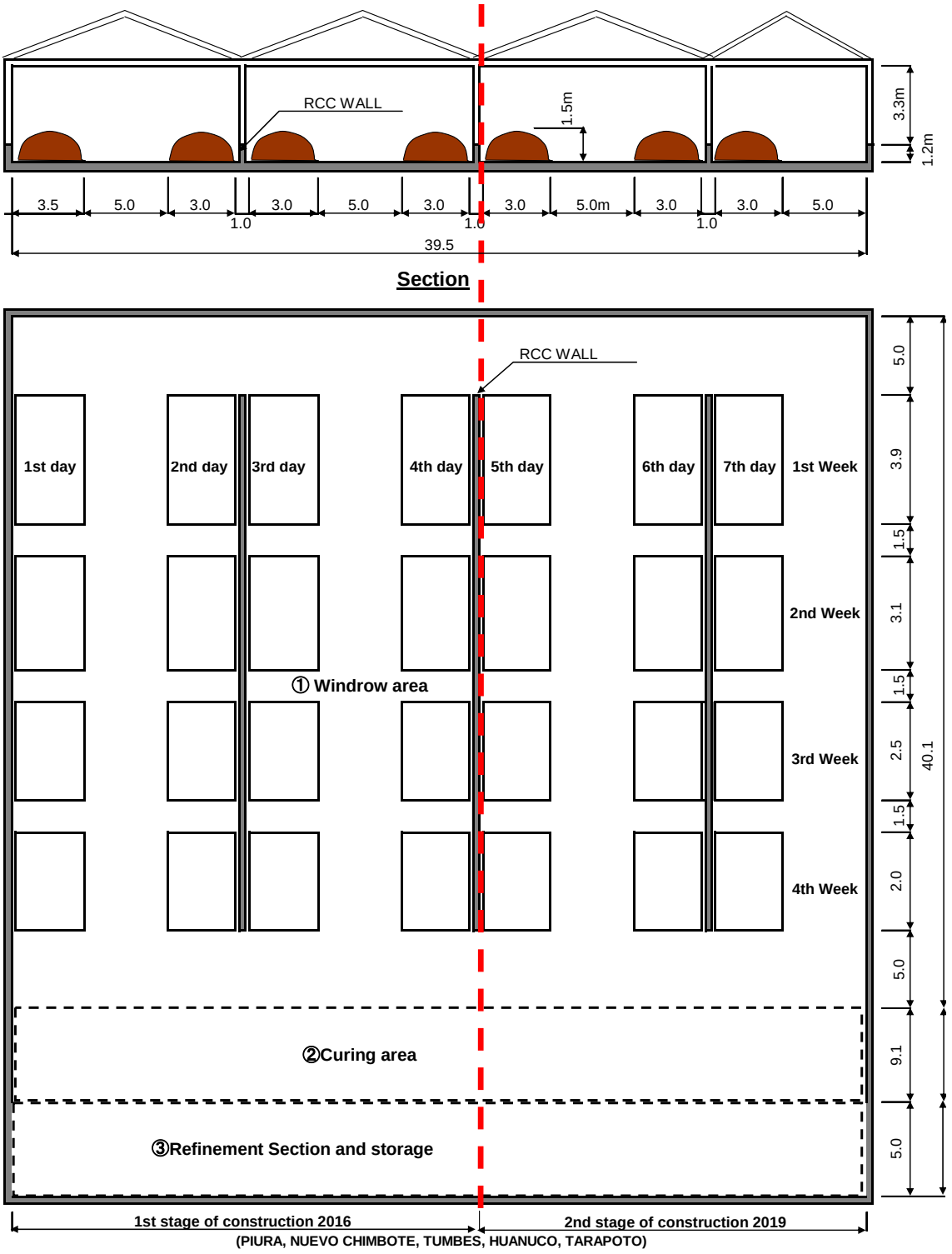
Name of municipality	(1) Design capacity of CP plant (t/d) in 2024	(2) Facility type	(3) Unit weight (t/m^3)	(4) Volume (m^3) (5)/(6)	Waste cell			(8) Width (m)	Length of windrow area						(15) Length of curing area E(m) (5)*(12)*60/(8)	(16) Length of refine and storage area Max.5m or (15) (m)	(17) Total length (m)
					(5) Width (m)	(6) Height (m)	(7) Filling rate		1st cell	2nd cell	3rd cell	4th cell	Working space	(14) Total (m) (9)+(10)+(11)+(12)+(13)			
									(9) A (m) (4)/(5)/(6)/(7)	(10) B (m) = A x 80%	(11) C (m) = B x 80%	(12) D (m) = C x 80%	(13) (1) = 4t,7t 5.0*2+1.5*3 (1) = 1.1t 5.0*2+1.0*3 (m)				
1 PUNO	4.00	**B**	0.5	8.0	3	1.5	80%	39.5	2.20	1.80	1.40	1.10	14.5	21.0	5.0	5.0	31.0
2 JULIACA	4.00	**B**	0.5	8.0	3	1.5	80%	39.5	2.20	1.80	1.40	1.10	14.5	21.0	5.0	5.0	31.0
3 PIURA	7.00	**A**	0.5	14.0	3	1.5	80%	39.5	3.90	3.10	2.50	2.00	14.5	26.0	9.1	5.0	40.1
4 NUEVO CHIMBOTE	7.00	**A**	0.5	14.0	3	1.5	80%	39.5	3.90	3.10	2.50	2.00	14.5	26.0	9.1	5.0	40.1
5 TUMBES	7.00	**A**	0.5	14.0	3	1.5	80%	39.5	3.90	3.10	2.50	2.00	14.5	26.0	9.1	5.0	40.1
6 SULLANA	4.00	**B**	0.5	8.0	3	1.5	80%	39.5	2.20	1.80	1.40	1.10	14.5	21.0	5.0	5.0	31.0
7 ABANCAY	4.00	**B**	0.5	8.0	3	1.5	80%	39.5	2.20	1.80	1.40	1.10	14.5	21.0	5.0	5.0	31.0
8 HUANUCO	7.00	**A**	0.5	14.0	3	1.5	80%	39.5	3.90	3.10	2.50	2.00	14.5	26.0	9.1	5.0	40.1
9 PAITA	4.00	**B**	0.5	8.0	3	1.5	80%	39.5	2.20	1.80	1.40	1.10	14.5	21.0	5.0	5.0	31.0
10 PUERTO MALDONADO	4.00	**B**	0.5	8.0	3	1.5	80%	39.5	2.20	1.80	1.40	1.10	14.5	21.0	5.0	5.0	31.0
11 TALARA	4.00	**B**	0.5	8.0	3	1.5	80%	39.5	2.20	1.80	1.40	1.10	14.5	21.0	5.0	5.0	31.0
12 MOYOBAMBA	4.00	**B**	0.5	8.0	3	1.5	80%	39.5	2.20	1.80	1.40	1.10	14.5	21.0	5.0	5.0	31.0
13 TARAPOTO	7.00	**A**	0.5	14.0	3	1.5	80%	39.5	3.90	3.10	2.50	2.00	14.5	26.0	9.1	5.0	40.1
14 CHACHAPOYAS	4.00	**B**	0.5	8.0	3	1.5	80%	39.5	2.20	1.80	1.40	1.10	14.5	21.0	5.0	5.0	31.0
15 ILAVE	1.10	**C**	0.5	2.2	2	1.0	80%	32.5	1.40	1.10	0.90	0.70	13.0	17.1	3.0	3.0	23.1
16 AZANGARO	1.10	**C**	0.5	2.2	2	1.0	80%	32.5	1.40	1.10	0.90	0.70	13.0	17.1	3.0	3.0	23.1
17 CHINCHA	4.00	**B**	0.5	8.0	3	1.5	80%	39.5	2.20	1.80	1.40	1.10	14.5	21.0	5.0	5.0	31.0
18 SECHURA	1.10	**C**	0.5	2.2	2	1.0	80%	32.5	1.40	1.10	0.90	0.70	13.0	17.1	3.0	3.0	23.1
19 HUACHO	4.00	**B**	0.5	8.0	3	1.5	80%	39.5	2.20	1.80	1.40	1.10	14.5	21.0	5.0	5.0	31.0
20 TARMA	4.00	**B**	0.5	8.0	3	1.5	80%	39.5	2.20	1.80	1.40	1.10	14.5	21.0	5.0	5.0	31.0
21 FERRENAFE	4.00	**B**	0.5	8.0	3	1.5	80%	39.5	2.20	1.80	1.40	1.10	14.5	21.0	5.0	5.0	31.0
22 SANTIAGO	1.10	**C**	0.5	2.2	2	1.0	80%	32.5	1.40	1.10	0.90	0.70	13.0	17.1	3.0	3.0	23.1
23 AYMARAES	1.10	**C**	0.5	2.2	1.2	0.7	80%	26.9	3.30	2.60	2.10	1.70	13.0	22.7	4.6	4.6	31.8

Source: JICA survey team



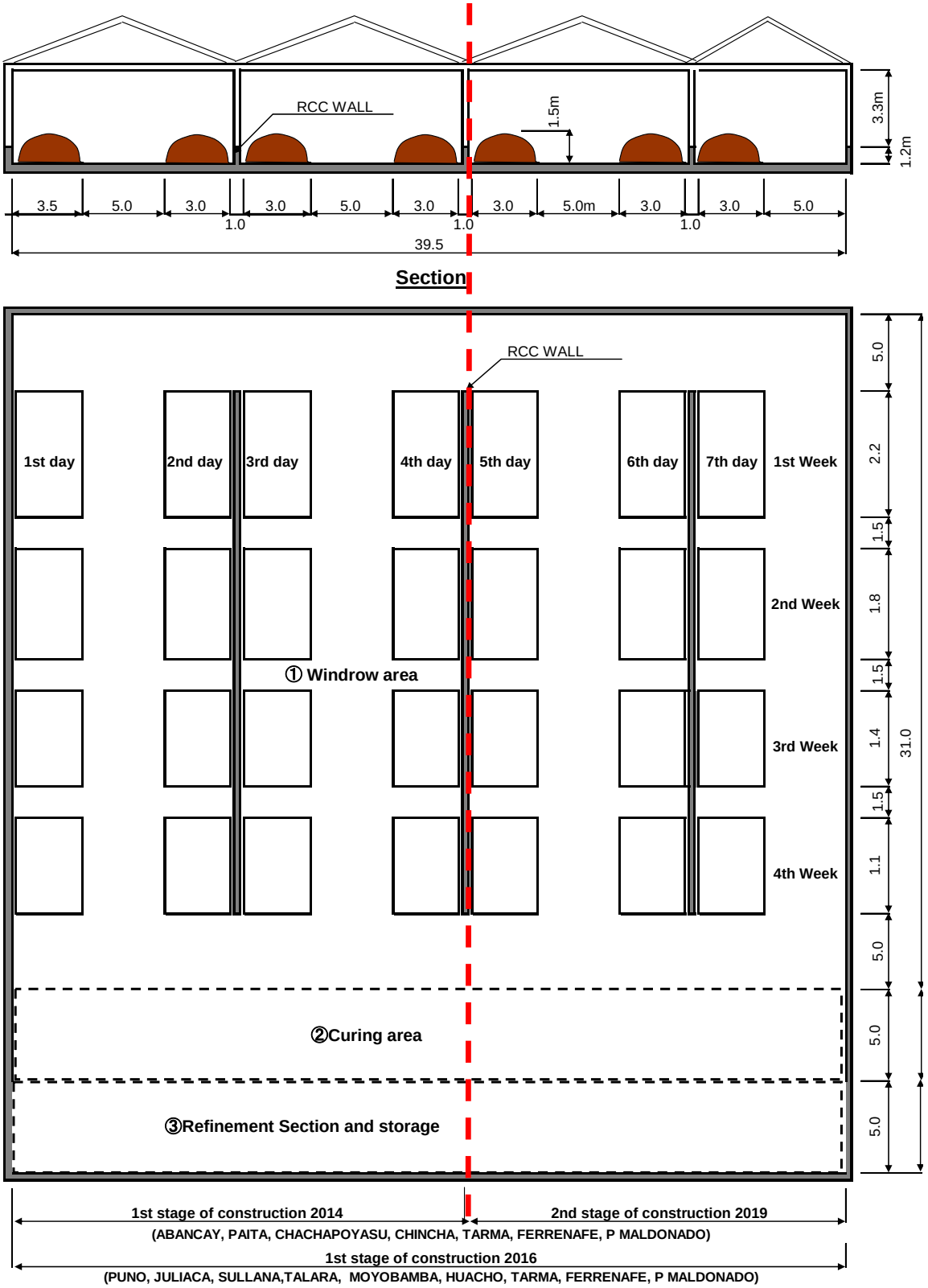
Source: JICA survey team

Figure 2.4-10 System Flow of Composting Plant for Mechanized and Manual System



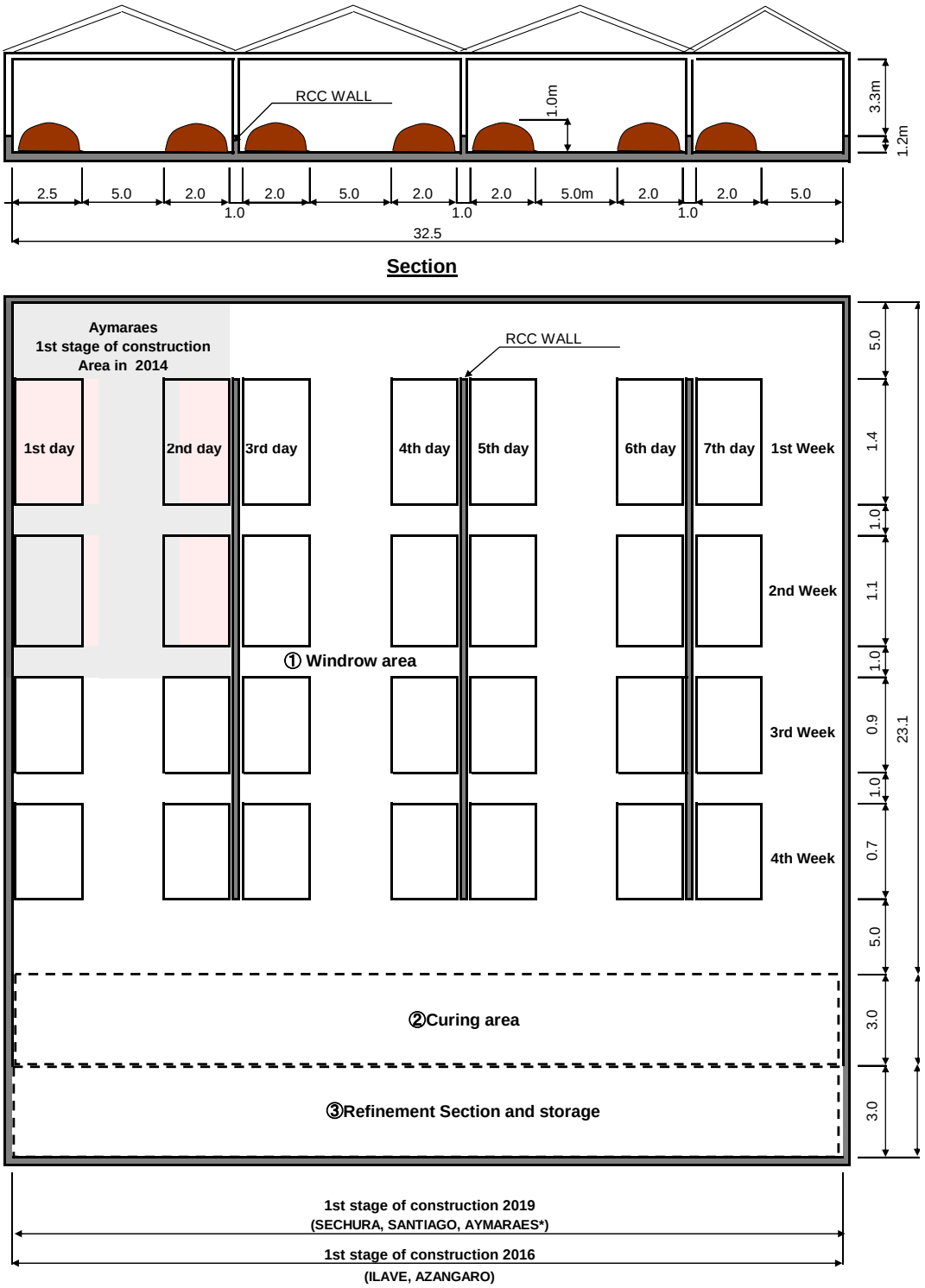
Source: JICA survey team

Figure 2.4-11 Typical layout plan of compost plant (Type-A)



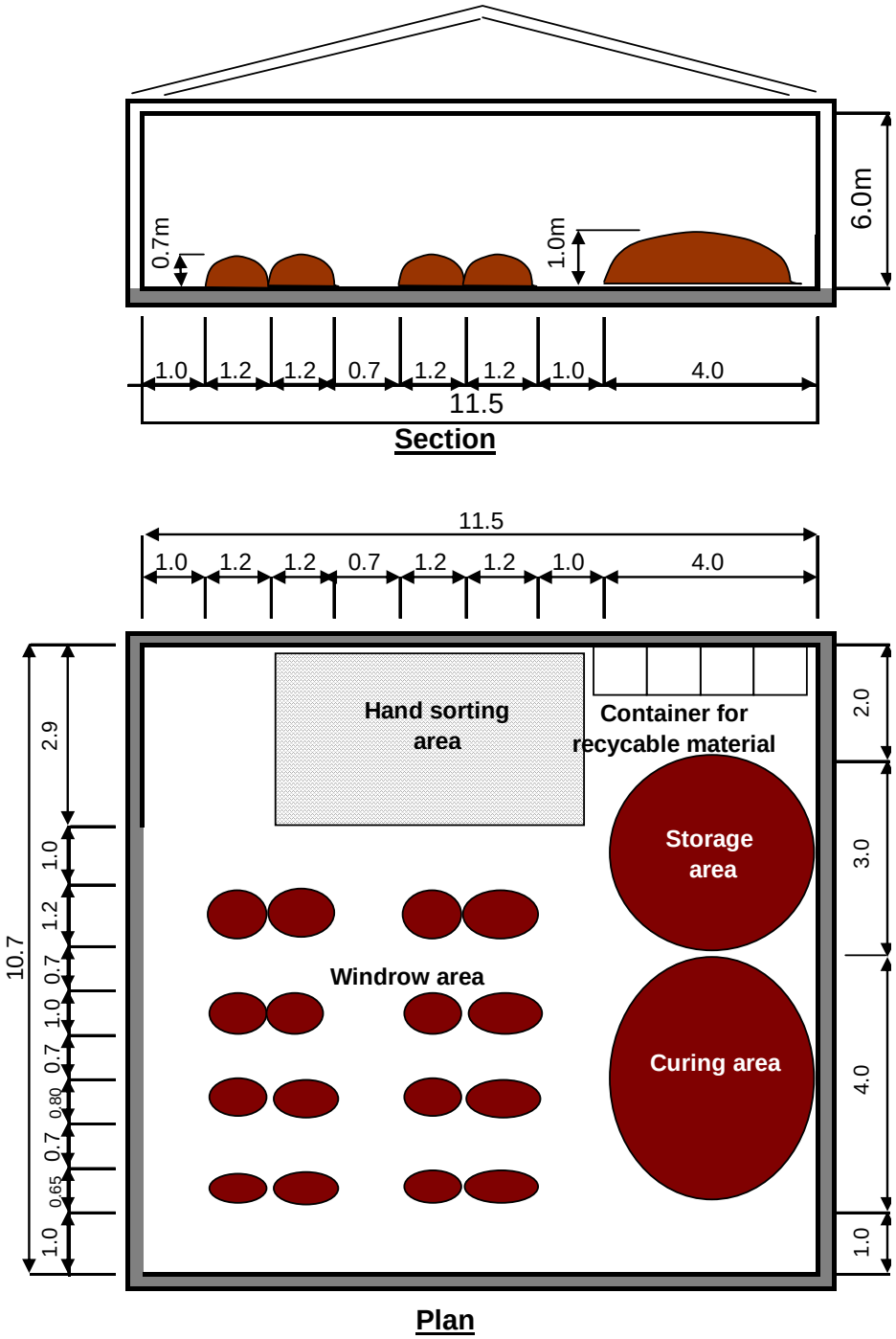
Source: JICA survey team

Figure 2.4-12 Typical layout plan of compost plant (Type-B)



Source: JICA survey team

Figure 2.4-13 Typical layout plan of compost plant (Type-C)



* Since the composting treatment amount is as small as 0.2t/day, one compost cell will store two days' worth of waste.

Source: JICA survey team

Figure 2.4-14 Typical layout of compost plant in pilot period (capacity:0.2t/day)

3) Necessary Equipment for Composting Plant

As previously mentioned, compost plant is categorized into 3 Types by its estimated treatment amount, and the plant design and equipment planning are made accordingly.

Table 2.4-16 shows the equipments to be installed in each plant

a) Mini wheel loader

Mini wheel loader will be introduced in Type-A and Type-B to turn over waste for aeration during windrow process.

b) Vibro screen

Vibro screen will be installed in Type-A for refining of compost products.

c) Water facility

To maintain the humidity in compost materials during windrow process, water facility such as pump, tank and piping will be installed in all Types.

Table 2.4-16 Equipment for Composting Plant

Equipment		Q'ty	Capacity of plant		
Name	Capacity		Type-A (7t/day)	Type-B (4t/day)	Type-C (1.1t/day)
Mini wheel loader	0.45m^3, 73HP	1	x	x	
Vibro screen	22kW class	1	x		
Water facility for moisturing Such as pump, tank, piping	Tank : 5m^3 Pump : 3HP	1	x	x	x

Source: JICA survey team

2.4.5 Design concept of Sanitary Landfill Site

(1) Planning Condition

Planning conditions of sanitary landfill sites are summarized in .Table 2.4-17.

Table 2.4-17 Planning Conditions of Sanitary Landfill Site

Item	Conditions
Target year (operation period)	2024 (2015 -2024)
Design landfill volume	Landfill volume shall be designed to secure a 10-year landfill period. For the landfill volume in each project, see Table 2.4-17
Landfill type	Sanitary landfill system, Semi-aerobic type
Landfill method	Cell method
Type of dispose waste	Municipal waste (excluding Medical and Hazardous Waste)
Effluent standard	MINAM's draft effluent standards
Regulations /Guidelines for design	DS057-04-PCM(Regulation of the SW general Low)（hereinafter referred to as "SW General Regulation"）& Regulation for Design, Operation and Maintenance of SW Final Disposal facilities in the Municipal area(Draft), (hereinafter referred to as "SW Landfill Regulation") To those not stated in the above regulations, Japanese regulations/guidelines shall be applied.

Source: JICA survey team

1) Facility Layout Plan

Facility layout will be established taking into consideration smooth traffic flow within the site.

- Disposal area shall be separated from administrative area.
- In a landfill site in rainy region, block embankment shall be installed to subdivide the landfill area into several blocks, in order to reduce the leachate generation. Table 2.4-18 shows the number of blocks to be installed within landfill area in each project.

2) Phase-wise site development

In order to hold down initial investment, landfill site will be developed in phases. Landfill site with area more than 3ha will be developed in three phases, and those with area up to 3ha will be constructed in two phases. Table 2.4-18 and Table 2.4-19 shows the number of construction phases in each project and time schedule for construction, respectively.

3) Region-specific facility plan

Peru has three major classifications of region in its jurisdiction, namely, Costa, Sierra and Selva Region. As climate and geological condition vary regionally, facility structure should be adjusted taking into consideration the regional condition. Waste height in landfill area will also be tailored to regional condition; 10m in high rainfall region (Sierra and Selva), and 20m in low rainfall region (Costa) in principle (see Table 2.4-19). Table 2.4-18 Waste Disposal Amount of the Projects

Table 2.4-18 Waste Disposal Amount of the Project

	Project name	Waste amount													Soil cover (Waste x 20%) (m3)	Total (m3)
		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	SUB-Total (t)	Compacted Waste Density (t/m3)	SUB-Total (m3)		
1	PUNO	33,184	34,107	35,056	36,033	37,037	38,069	39,131	40,223	41,346	42,502	376,688	0.8	470,860	94,172	565,032
2	JULIACA	68,530	70,358	72,235	74,165	76,147	78,184	80,277	82,428	84,638	86,909	773,870	0.8	967,338	193,468	1,160,806
3	PIURA	148,228	152,206	156,294	160,496	164,814	169,253	173,814	178,503	183,322	188,275	1,675,206	0.8	2,094,007	418,801	2,512,809
4	NUEVO CHIMBOTE	26,285	27,251	28,252	29,290	30,366	31,482	32,639	33,839	35,083	36,373	310,860	0.8	388,575	77,715	466,290
5	TUMBES	23,207	23,769	24,346	24,937	25,543	26,164	26,801	27,454	28,123	28,809	259,153	0.8	323,941	64,788	388,729
6	SULLANA	47,385	48,523	49,689	50,885	52,110	53,366	54,653	55,972	57,325	58,711	528,619	0.8	660,774	132,155	792,929
7	ABANCAY	17,107	17,235	17,365	17,496	17,628	17,762	17,897	18,034	18,172	18,312	177,008	0.8	221,260	44,252	265,512
8	HUANUCO	40,055	40,515	40,981	41,453	41,932	42,418	42,911	43,411	43,918	44,432	422,027	0.8	527,534	105,507	633,041
9	PAITA	16,112	16,756	17,425	18,122	18,846	19,600	20,384	21,200	22,048	22,931	193,424	0.8	241,780	48,356	290,135
10	PUERTO MALDONADO	18,887	20,146	21,489	22,922	24,451	26,082	27,823	29,681	31,663	33,779	256,922	0.8	321,152	64,230	385,383
11	TALARA	23,034	23,328	23,626	23,929	24,235	24,546	24,861	25,180	25,504	25,833	244,077	0.8	305,096	61,019	366,115
12	MOYOBAMBA	21,740	22,692	23,687	24,727	25,814	26,950	28,137	29,378	30,675	32,030	265,829	0.8	332,286	66,457	398,743
13	TARAPOTO	57,573	59,126	60,729	62,382	64,089	65,851	67,669	69,547	71,487	73,490	651,943	0.8	814,929	162,986	977,915
14	CHACHAPOYAS	7,324	7,604	7,895	8,198	8,515	8,845	9,190	9,549	9,925	10,317	87,362	0.8	109,202	21,840	131,043
15	ILAVE	4,750	4,921	5,098	5,281	5,471	5,668	5,872	6,084	6,303	6,531	55,979	0.6	93,299	18,660	111,959
16	AZANGARO	2,675	2,755	2,838	2,923	3,011	3,102	3,195	3,291	3,390	3,493	30,673	0.6	51,121	10,224	61,345
17	CHINCHA	17,539	17,896	18,261	18,634	19,015	19,404	19,801	20,207	20,622	21,045	192,425	0.8	240,531	48,106	288,637
18	SECHURA	9,168	9,537	9,921	10,323	10,741	11,179	11,635	12,111	12,608	13,120	110,343	0.8	137,929	27,586	165,514
19	HUACHO	53,601	54,984	56,412	57,887	59,410	60,985	62,613	64,296	66,036	67,837	604,061	0.8	755,077	151,015	906,092
20	TARMA	10,728	10,847	10,968	11,090	11,214	11,340	11,467	11,597	11,727	11,860	112,839	0.8	141,049	28,210	169,258
21	FERRENAFE	16,383	16,671	16,964	17,263	17,566	17,875	18,189	18,508	18,833	19,163	177,416	0.8	221,770	44,354	266,123
22	SANTIAGO	2,602	2,676	2,751	2,829	2,909	2,991	3,076	3,163	3,252	3,345	29,595	0.6	49,325	9,865	59,190
23	AYMARAES	1,354	1,374	1,395	1,416	1,438	1,460	1,482	1,505	1,528	1,551	14,503	0.6	24,172	4,834	29,007

Notes: 1. In Ilave, Santiago and Aymaraes, where the disposal waste amount is small and heavy machines with low compaction capacity are used, density of compacted waste is estimated to be 0.6 t/m^3. In other area, the density of compacted waste is estimated to be 0.8/m^3, as heavy machines with high compaction capacity are used.

2. Requirement of Covering Soil (Daily, Intermediate and Final) is calculated as 20% of Incoming Waste Volume.

Source: JICA survey team

Table 2.4-19 Landfill Volume, Waste Height, Number of Construction Phases and Block of Sanitary Landfills of the Project

	Project Name	Landfill Volume (m3)	Waste height (m)	Landfill Area (ha)	Number of construction phases	Extension Direction	Proportion of each phase to the total area, and number of blooks landfill area							
							Phase-1		Phase-2		Phase-3		Total	
							Ratio	No. of Block	Ratio	No. of Block	Ratio	No. of Block	Ratio	No. of Block
1	PUNO	565,032	10	6.51	3	Transverse →	33.3%	4	33.3%	4	33.3%	4	100%	12
2	JULIACA	1,160,806	10	12.92	3	Transverse →	33.3%		33.3%		33.3%		100%	0
3	PIURA	2,512,809	20	16.24	3	Vertical ↑	33.3%	1	33.3%	1	33.3%	1	100%	3
4	NUEVO CHIMBOTE	466,290	20	4.80	3	Vertical ↑	33.3%	1	33.3%	1	33.3%	1	100%	3
5	TUMBES	388,729	20	3.36	3	Vertical ↑	33.3%	1	33.3%	1	33.3%	1	100%	3
6	SULLANA	792,929	20	6.30	3	Vertical ↑	33.3%	1	33.3%	1	33.3%	1	100%	3
7	ABANCAY	265,512	10	3.36	3	Transverse →	33.3%	3	33.3%	3	33.3%	3	100%	9
8	HUANUCO	633,041	20	5.96	3	Vertical ↑	33.3%	1	33.3%	1	33.3%	1	100%	3
9	PAITA	290,135	20	2.46	2	Vertical ↑	66.7%	1	33.3%	1	-	-	100%	2
10	PUERTO MALDONADO	385,383	10	4.50	3	Transverse →	33.3%	4	33.3%	4	33.3%	4	100%	12
11	TALARA	366,115	20	3.22	3	Vertical ↑	33.3%	1	33.3%	1	33.3%	1	100%	3
12	MOYOBAMBA	398,743	10	4.69	3	Transverse →	33.3%	4	33.3%	4	33.3%	4	100%	12
13	TARAPOTO	977,915	20	6.84	3	Vertical ↑	33.3%	4	33.3%	4	33.3%	4	100%	12
14	CHACHAPOYAS	131,043	10	1.56	2	Vertical ↑	66.7%	2	33.3%	1	-	-	100%	3
15	ILAVE	111,959	10	1.43	2	Vertical ↑	66.7%	2	33.3%	1	-	-	100%	3
16	AZANGARO	61,345	10	0.83	2	Vertical ↑	66.7%	2	33.3%	1	-	-	100%	3
17	CHINCHA	288,637	20	2.52	2	Vertical ↑	66.7%	1	33.3%	1	-	-	100%	2
18	SECHURA	165,514	15	1.68	2	Vertical ↑	66.7%	1	33.3%	1	-	-	100%	2
19	HUACHO	906,092	20	6.48	3	Vertical ↑	33.3%	1	33.3%	1	33.3%	1	100%	3
20	TARMA	169,258	10	2.03	2	Vertical ↑	66.7%	2	33.3%	1	-	-	100%	3
21	FERRENAFE	266,123	20	2.46	3	Vertical ↑	33.3%	1	33.3%	1	33.3%	1	100%	3
22	SANTIAGO	59,190	10	0.77	2	Vertical ↑	66.7%	1	33.3%	1	-	-	100%	2
23	AYMARAES	29,007	8	0.46	2	Vertical ↑	66.7%	2	33.3%	1	-	-	100%	3

Source: JICA survey team

Table 2.4-20 Time Schedule for Each Construction Phase in Each Project

Name of municipality	Waste height (m)	Phase	0	1	2	3	4	5	6	7	8	9	10
1 Puno	10	3	●1st		▲2nd				■3rd				
2 Juliaca	10	3	●1st		▲2nd				■3rd				
3 Piura	20	3	●1st			▲2nd			■3rd				
4 Nuevo Chimbote	20	3	●1st			▲2nd			■3rd				
5 Tumbes	20	2	●1st			▲2nd							
6 Sullana	20	3	●1st			▲2nd			■3rd				
7 Abancay	10	3	●1st		▲2nd				■3rd				
8 Huanuco	20	3	●1st			▲2nd			■3rd				
9 Paita	20	2	●1st			▲2nd							
10 Puerto Maldonado	10	3	●1st		▲2nd				■3rd				
11 Talara	20	2	●1st			▲2nd							
12 Moyobamba	10	3	●1st		▲2nd				■3rd				
13 Tarapoto	10	3	●1st		▲2nd				■3rd				
14 Chachapoyas	10	2	●1st					▲2nd					
15 Ilave	10	2	●1st					▲2nd					
16 Azangaro	10	2	●1st					▲2nd					
17 Chincha	20	2	●1st			▲2nd							
18 Sechura	15	2	●1st			▲2nd							
19 Huacho	20	3	●1st			▲2nd			■3rd				
20 Tarma	10	2	●1st					▲2nd					
21 Ferrenafe	20	3	●1st			▲2nd			■3rd				
22 Santiago	15	2	●1st			▲2nd							
23 Aymaraes	10	2	●1st					▲2nd					

Life span of landfill

		1st Phase		2nd Phase		3rd Pahse	
	H=	10~15	15~20	10~14	15~20	10~14	15~20
Phasing	3	2yr	3yr	6yr	6yr	10yr	10yr
	2	5yr	3yr	10yr	10yr	-	-

(2) Facility Design

1) Soil works

a) General part

In line with SW landfill regulation, slope gradients of banking and excavation are determined as shown below.

Table 2.4-21 Slope of Banking

Material Type	Slopes	
	Vertical	Horizontal
Loose Rock	4.0	1.0
Conglomerate	3.0	1.0
Compacted Soil	2.0	1.0
Sand	0.5	1.0

Source: JICA survey team

Table 2.4-22 Slope of Excavation

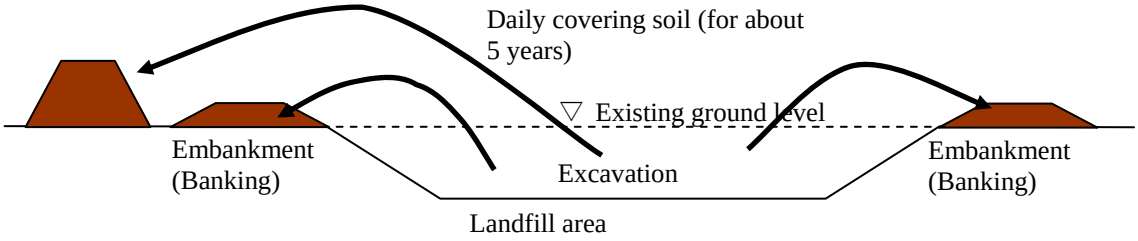
Material Type	Slopes	
	Vertical	Horizontal
Compacted Soil	4.0	1.0
Sand	3.0	1.0
Solid Waste	2.0	1.0

Source: JICA survey team

b) Landfill Area

i) Depth

Regarding the depth of excavating landfill area, the excavation volume shall balance with the volumes of banking and daily covering soil for about 5 years.



ii) Bottom Slope

Bottom slope shall be set up only in the case of installing a leachate collection pipe in the landfill. In this case, the bottom slope shall be set only in the longitudinal section, not in the cross-section. The gradient of bottom slope shall be 2% according to the gradient of the leachate collection pipe.

b) Liner System Part

i) Clay

In case that clay shall be used for slope, the slope gradient shall be 1:2 in terms of workability.

ii) Geo-membrane

In case that Geo-membrane shall be used for slope, the gradient shall be 1:2 in terms of workability as same as the clay case.

2) Landfill Facility

Facilities for landfill site are classified into three categories; main facilities, administrative facilities, and related facilities. Basically, facilities will be designed in accordance with SW general regulation and SW landfill regulation. The function and structure of each facility are as shown in Table 2.4-23.

Table 2.4-23 Function and Structure of the Facilities

Items	Function	Structure
Main Facilities		
1.Waste storage facility		
Embankment	In order to prevent waste out-flow from the landfill site and maintain the waste accumulation at a certain height during landfill operation, embankment shall be constructed around the landfill site.	Construction of embankment with excavated soil. Shape is a trapezoid, upper base is 5m and slope is 1:2.
Block Embankment	Block embankment will be provided along the center of the disposal area for leachate reduction, and efficient landfill operation.	Construction of embankment with soil. Shape is a trapezoid, upper base is 3m and slope is 1:3.
2.Liner facility	Impermeable facility within the landfill for preventing leachate from infiltrating into ground and flowing into a river.	Rocky ground falls under Type-A, the rest falls under Type-B. (1)Type-A From the ground , Protection layer of clay soil (t = 20cm), Geotextile layer (W=500g/m2), Geo-membrane liner (t = 1.5mm), Geotextile layer (W=500m/m2), protection layer of clay soil (t = 50cm) (2)Type-B From the ground ,Geotextile layer (W=500g/m2), Geo-membrane liner (t = 1.5mm), Geotextile layer (W=500m/m2), protection layer of clay soil (t = 50cm) Refer to Table 2.4-23
3.Stormwater drainage facility	To drain the rain water running off the embankment slopes and prevent rainwater collected to access the waste areas.	Facility structure will be modified depending on the rainfall capacity in a target area. Refer to Table 2.4-23.
4.Leachate collection	A facility installed above the liner facility to collect leachate and convey it to a leachate treatment facility. The leachate collection system, in combination with the landfill gas collection vents will serve to convey air into the waste layers to enhance semi-aerobic conditions.	Facility structure will be modified depending on the rainfall capacity in a target area. Refer to Table 2.4-23.

Items		Function	Structure
	5.Leachate treatment	This facility will treat/ purify leachate to meet the effluent standard (Draft). In Peru, effluent standard has not yet been established. MINAM is now preparing a draft effluent standard.	In a low-rainfall area such as Costa Region, re-circulation in a small retention pond will be applied. In rainy area such as *Sierra* and *Selva* Region, re-circulation in a large retention pond will be employed. Anaerobic and aerobic treatment will be applied in some projects. For more details, refer to "C. Examination of Capacity and Method of Leachate Treatment System".
	6.Leachate Re-circulation facility	This facility will re-circulate leachate back to disposal site, contributing to reduction of the leachate amount, and providing further treatment of leachate under semi-aerobic conditions.	Installation of re-circulation pump of capacity 5KW, sprinkler and portable flexible hose pipes (80mm dia.). Refer to Table 2.4-23.
	7.Gas collection facility	In order to prevent fire and/or explosion hazards, impact on ecological system, and offensive odor to surrounding areas caused by produced gases; i.e. methane carbonic acid, nitrogen, ammonia, etc., gas removal facilities shall be installed.	Install perforated RC pipes of dia. 150mm vertically at 40m spacing and surrounded by stone boulders inserted within encircled wire mesh (of tot. 300mm day). Refer to Table 2.4-23.
Administrative Facilities			
	1. Administration building	A building office for the site staff, including space for visitors.	One-story RC structure with area of $50m^2$
	2. Management road	Roads are built along the landfill perimeter for construction and landfill operation purposes.	Construction of permanent asphalt paved roads with carriageway widths of 5m + 1.5 m shoulder on either side at the entrance and accessing the facilities as well as surrounding the site.
	3. Weighbridge	Measures the gross weight of trucks loaded with waste and measures the tare weight again after they dump the waste to control the landfill volume.	Installation of weighbridge by 1set. The specification for max. capacity of 40 tons. The foundation has concrete piles.
Related Facilities			
	1. Enclosure facility	Enclosure facility is built along the boundary of landfill site premises and the outer circumference of the landfill to provide access control and prevent waste scattering.	Structure is Barbed wire with Wood support and Height is 1,800mm. Gates at the site entrance Refer to Table 2.4-23.
	2. Green belt	Green belt is developed to mitigate solid waste odor and machine noise. However, there is no need to have green belt in low rainfall regions where it is difficult to manage planting.	Selection of trees for green belt will be made taking into consideration the regional characteristic, including soil condition and climate.

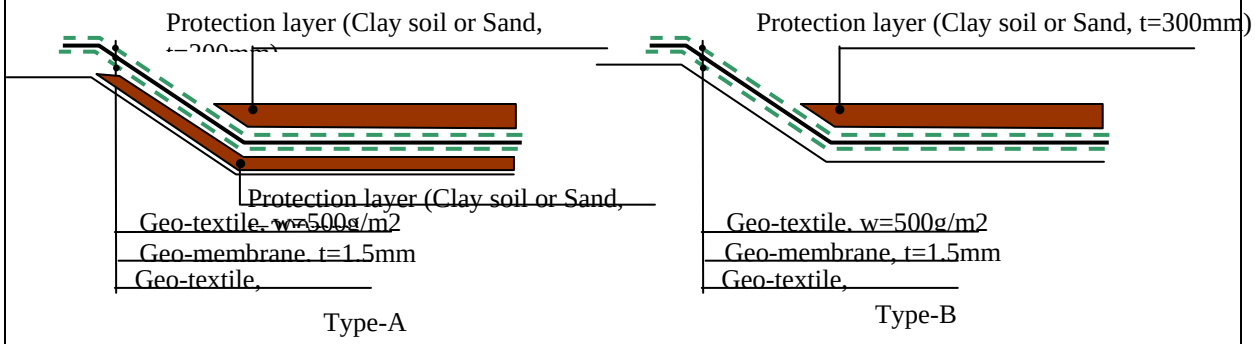
Source: JICA survey team

Table 2.4-24 Reference Drawing of Facilities

Structure

Main Facilities

1.Liner facility

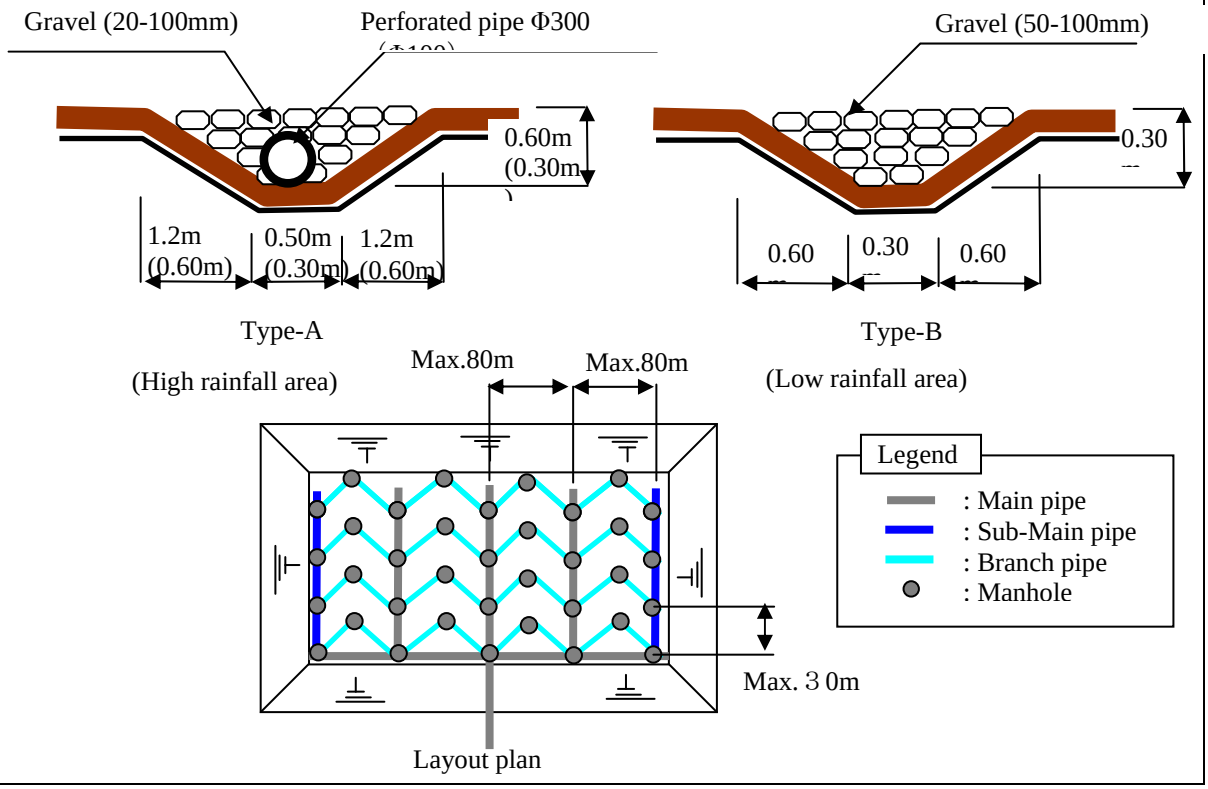


2.Stormwater drainage facility

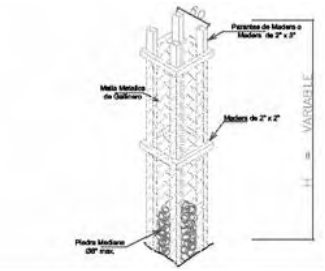
Type-A
(Concrete ditch)
(High rainfall area)

Type-B
(Open ditch)
(Low rainfall area)

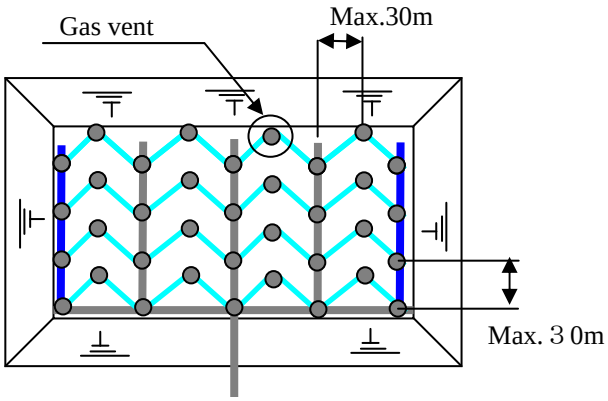
3.Leachate collection



Structure
7.Gas collection facility

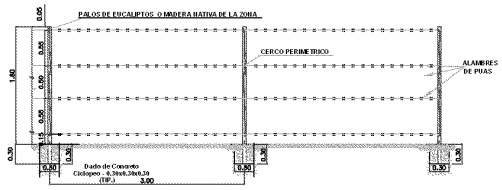


Gas vent pipe

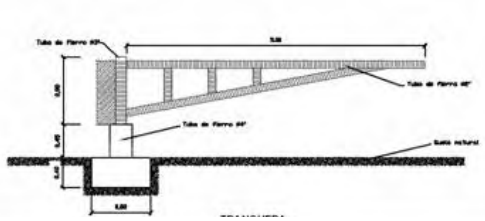


Layout plan

Related Facilities
Enclosure facility



Fence



Gate

3) Study of Leachate Treatment System

a) Calculation of Leachate Volume

Leachate volume can be calculated in consideration of the following two generation sources:

- Generated by precipitation percolating through waste deposited in a landfill.
- Generated by the decomposition of organic matter and humidity content of waste.

i) Calculation Formula for Leachate Volume generated by Precipitation Percolating

Leachate volume is calculated using the formula below. Generation volume is the sum of leachate generated by precipitation percolating through waste and leachate generated by the decomposition of organic matter, after subtracting the volume of treated leachate.

$$Q = 1 / 1{,}000 \times (C1 \times A1 + C2 \times A2) \times I + Q1 - Q2 \quad \cdots \text{Rational formula}$$

Where

Q : Leachate volume (m^3/day)
Q1: Generated by decomposition of organic matter and humidity content of waste (m^3/day)
Q2: Leachate treatment capacity or evaporation (m^3/day)
C1 : Coefficient for seepage into disposal area
C2 : Coefficient for seepage into soil covered area (C2 = C1 x 20%)
A1 : Waste disposal area (m^2)
A2 : Soil covered area (m^2)
I : Daily rainfall (mm) : in the past 10 years

$C = (I - E_{PT}) / I$
Where
C: Coefficient for monthly seepage
I: Monthly rainfall
E_{PT}: Monthly Evaporation

$E_{PT} = 25.4 \times K \times C \times t$ ····· Blaney and Criddle
Where
E_{PT} : Monthly Evaporation
K : Empirical crop and meteorological coefficient (Landfill : 0.7)
C : Monthly percent of annual sunshine hours
t : Monthly average temperature (°F)

The detailed calculation of leachate volume is shown in Appendix-8.

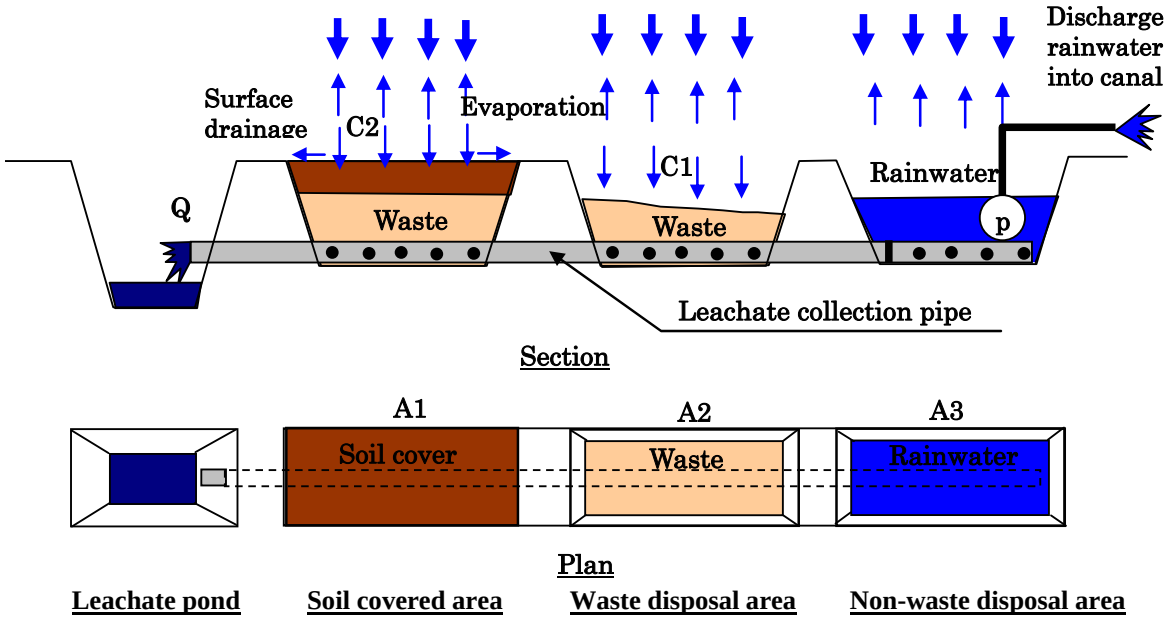


Figure 2.4-15 Schematic view of leachate generation

ii) Calculation of Seepage Coefficient

Seepage coefficient is calculated by Blaney and Criddle formula as mentioned above. Table 2.4-25 shows the calculated seepage coefficient at each project site. The calculation result revealed the monthly seepage coefficient is about 0 all through the year, indicating that leachate generation is not caused by rainwater. In the project site marked with yellow in Table 2.4-26, it can be considered that there is no leachate generation caused by the "precipitation percolating through waste deposited in a landfill."

ii) Target Seepage Area

Target seepage area in each project site is as described in the Table below;

Table 2.4-25 Target Seepage Area

Name of Municipality	Landfill area (ha)	Number of Construction phase	Phase-1 Area (ha)	Phase-2 Area (ha)	Phase-3 Area (ha)	Target Seepage Area (ha)				
						Target Seepage Area	Block		A1 Disposal Area	A2 Soil Cover Area
							No.	Area of 1 block		
1. Puno	6.51	3	2.17	2.17	2.17	2.17	4	0.54	0.54	1.63
2. Juliaca	12.93	3	4.31	4.31	4.31	4.31	6	0.71	0.71	3.60
7. Abancay	3.36	3	1.08	1.08	1.08	1.08	3	0.36	0.36	0.72
10.Puerto Maldonado	4.50	3	1.50	1.50	1.50	1.50	4	0.375	0.375	1.125
12.Moyobamba	4.69	3	1.57	1.56	1.56	1.57	4	0.40	0.40	1.17
14.Chachapoyas	1.56	2	1.04	0.52	-	1.56	2	-	0.52	1.04
15.Ilave	1.43	2	0.99	0.44	-	1.43	2	-	0.44	0.99
16.Azangaro	0.83	2	0.55	0.28	-	0.83	2	-	0.28	0.55
20.Tarma	2.03	2	1.35	0.68	-	2.03	2	-	0.68	1.35
23.Aymaraes	0.46	2	0.31	0.15	-	0.46	2	-	0.15	0.31

Source: JICA survey team

Table 2.4-26 Calculation Result of Monthly Seepage Coefficient at Each Project

Project		Jan.	Feb.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1 Puno	Rainfall	188.0	173.0	133.9	43.7	6.4	5.5	8.4	9.8	15.9	32.2	33.4	91.3	741.2
	Evaporation	56.8	54.6	63.0	69.9	75.3	69.8	71.5	73.9	73.9	77.8	75.9	69.7	832.0
	Seepage	0.69	0.68	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	-
2 Juliaca	Rainfall	188.0	173.0	133.9	43.7	6.4	5.5	8.4	9.8	15.9	32.2	33.4	91.3	741.2
	Evaporation	56.8	54.6	63.0	69.9	75.3	69.8	71.5	73.9	73.9	77.8	75.9	69.7	832.0
	Seepage	0.69	0.68	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	-
3 Piura	Rainfall	5.0	26.0	31.1	15.7	0.4	0.2	0.2	0.0	0.0	0.3	1.1	2.8	82.9
	Evaporation	127.2	98.0	124.9	127.8	123.3	92.2	96.4	104.3	116.2	122.0	119.1	121.7	1,373.0
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
4 Nuevo Chimbote	Rainfall	0.8	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	1.5
	Evaporation	118.1	109.2	123.9	119.8	107.1	66.4	65.8	75.4	78.0	100.2	107.1	117.6	1,188.7
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
5 Tumbes	Rainfall	34.9	94.4	98.4	46.8	17.4	0.5	1.1	0.4	0.7	0.6	1.5	3.7	300.5
	Evaporation	131.7	104.1	154.3	154.2	144.7	97.0	94.2	79.8	74.0	88.0	113.6	117.0	1,352.6
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
6 Sullana	Rainfall	47.5	68.7	90.9	25.5	5.1	0.6	0.1	0.0	0.1	1.4	1.9	18.9	260.5
	Evaporation	117.8	101.2	125.3	127.5	124.3	92.0	101.8	109.8	119.1	130.2	119.1	117.1	1,385.2
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
7 Abancay	Rainfall	182.0	186.1	138.4	52.7	15.1	7.6	14.8	17.7	22.3	60.8	65.2	125.2	887.7
	Evaporation	60.0	59.8	67.8	81.8	102.4	103.0	95.4	96.7	101.8	106.9	120.3	81.9	1,077.7
	Seepage	0.67	0.67	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	-
8 Huanuco	Rainfall	52.6	62.0	75.6	34.9	12.3	6.2	4.0	7.1	13.6	38.3	50.5	55.8	412.9
	Evaporation	78.6	68.2	75.4	99.1	122.7	123.4	128.4	123.1	103.8	102.9	95.4	86.4	1,207.5
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
9 Paita	Rainfall	1.1	4.8	4.3	1.6	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.5	12.8
	Evaporation	118.3	107.4	125.0	124.3	118.3	94.7	99.1	104.0	106.6	109.0	110.4	116.6	1,333.7
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
10 Puerto Maldonado	Rainfall	588.3	530.8	562.1	371.2	231.2	226.7	179.9	141.8	174.0	467.7	421.5	552.7	4,448.0
	Evaporation	123.2	72.5	115.9	107.5	100.4	101.0	114.9	165.8	147.3	137.7	98.7	95.1	1,379.8
	Seepage	0.79	0.86	0.79	0.71	0.56	0.55	0.36	0.00	0.15	0.70	0.76	0.82	-
11 Talara	Rainfall	9.9	23.8	27.5	16.2	1.1	0.5	0.3	0.0	0.3	0.0	0.7	0.3	80.7
	Evaporation	171.0	136.9	172.3	173.1	175.6	166.7	181.3	174.3	177.4	179.3	181.7	182.9	2,072.4
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
12 Moyobamba	Rainfall	102.8	183.0	178.3	164.9	105.9	83.2	70.2	61.4	114.8	176.7	171.0	141.7	1,553.7
	Evaporation	82.0	63.0	71.6	102.0	117.4	124.2	132.4	158.2	125.8	132.6	119.4	91.0	1,319.6
	Seepage	0.20	0.65	0.59	0.38	0.00	0.00	0.00	0.00	0.00	0.24	0.30	0.35	-
13 Tarapoto	Rainfall	44.6	56.3	68.9	90.8	57.2	41.3	48.6	38.8	60.3	59.3	50.5	43.7	660.2
	Evaporation	116.8	89.7	94.1	99.1	115.6	126.9	131.7	140.7	128.2	134.6	126.7	127.6	1,431.8
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
14 Chachapoyas	Rainfall	35.0	64.3	92.3	103.3	73.5	70.4	55.4	41.4	65.1	96.4	61.9	62.4	821.3
	Evaporation	91.3	70.7	71.0	89.3	102.7	112.4	111.6	119.2	109.6	113.6	124.2	111.2	1,226.7
	Seepage	0.00	0.00	0.23	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
15 Ilave	Rainfall	188.0	173.0	133.9	43.7	6.4	5.5	8.4	9.8	15.9	32.2	33.4	91.3	741.2
	Evaporation	56.8	54.6	63.0	69.9	75.3	69.8	71.5	73.9	73.9	77.8	75.9	69.7	832.0
	Seepage	0.69	0.68	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	-
16 Azangaro	Rainfall	147.7	135.4	121.8	51.6	8.4	1.9	3.3	7.0	16.8	50.8	58.7	127.5	731.1
	Evaporation	42.3	45.8	55.7	68.4	73.5	66.7	68.8	72.4	73.2	73.9	70.7	56.3	767.7
	Seepage	0.71	0.66	0.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	-
17 Chincha	Rainfall	1.4	2.8	1.0	0.9	1.8	3.1	2.4	3.3	2.9	0.8	1.6	0.3	22.1
	Evaporation	153.5	153.3	183.7	175.6	118.5	43.5	35.5	30.8	45.4	83.7	101.9	127.7	1,253.1
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
18 Sechura	Rainfall	39.1	27.4	21.8	8.7	0.6	0.2	0.1	0.0	0.1	0.3	0.8	4.6	103.8
	Evaporation	138.2	118.4	130.6	131.4	120.4	82.6	78.5	89.4	101.5	107.1	115.7	129.6	1,343.3
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
19 Huacho	Rainfall	0.5	1.0	0.5	0.2	0.2	0.9	0.7	1.0	0.5	0.2	0.3	0.2	6.2
	Evaporation	132.6	137.1	161.2	161.2	116.7	51.7	45.1	46.9	63.7	96.9	105.7	118.9	1,237.6
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
20 Tarma	Rainfall	102.9	108.9	116.0	45.8	13.8	4.1	3.7	5.4	25.0	59.6	64.1	94.7	643.9
	Evaporation	59.2	49.9	54.4	72.6	96.8	96.2	97.3	99.7	80.9	78.6	80.9	62.4	928.9
	Seepage	0.42	0.54	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	-
21 Ferrenafe	Rainfall	1.3	5.9	13.9	3.0	0.2	1.1	0.1	0.0	0.6	0.5	2.3	1.6	30.3
	Evaporation	124.3	98.7	125.7	115.9	110.6	76.5	79.1	85.2	101.1	115.7	110.6	115.9	1,259.3
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
22 Santiago	Rainfall	3.8	3.9	0.3	0.2	0.0	0.4	0.5	0.4	0.1	0.0	0.1	0.3	9.9
	Evaporation	96.2	90.1	116.7	124.3	121.2	89.0	84.4	92.0	105.5	119.5	115.2	102.9	1,257.0
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
23 Aymaraes	Rainfall	188.0	173.0	133.9	43.7	6.4	5.5	8.4	9.8	15.9	32.2	33.4	91.3	741.2
	Evaporation	56.8	54.6	63.0	69.9	75.3	69.8	71.5	73.9	73.9	77.8	75.9	69.7	832.0
	Seepage	0.69	0.68	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	-

Source: JICA survey team

iv) Leachate generated from decomposition of organic matter and humidity content of waste.
The volume of leachate generated from organic matter and humidity of waste can be calculated in the same manner used in the project in past. The calculation results are as shown in Table 2.4-27. The detailed calculation of leachate volume is shown in Appendix-8.

Table 2.4-27 Calculation Result of the Leachate Generation by Organic

Project Name	Organic waste amount (m^3/year)		Leachate generation (m^3/day)	
	2015	2024	2015	2024
1. Puno	20,682	26,177	0.9	1.2
2. Juliaca	32,033	41,600	1.7	2.2
3. Piura	72,643	92,047	6.1	7.8
4. Nuevo Chimbote	13,146	16,142	6.5	7.2
5. Tumbes	12,573	15,664	0.9	1.1
6. Sullana	18,296	22,539	2.2	2.7
7. Abancay	10,402	11,705	0.6	0.6
8. Huanuco	19,272	21,918	1.0	1.1
9. Paita	6,825	9,164	3.4	4.5
10.Puerto Maldonado	8,511	11,815	0.7	0.9
11.Talara	10,884	12,308	5.4	6.1
12.Moyobamba	16,847	24,967	2.3	3.3
13.Tarapoto	35,978	44,063	1.8	2.2
14.Chachapoyas	3,499	4,888	0.2	0.3
15.Ilave	1,779	2,100	0.2	0.2
16.Azangaro	1,246	1,597	0.1	0.1
17.Chincha	8,548	10,193	4.3	5.1
18.Sechura	2,843	3,827	1.4	1.8
19.Huacho	52,002	59,721	8.5	9.7
20.Tarma	6,272	6,889	0.7	0.6
21.Ferrenafe	4,810	5,721	2.3	2.8
22.Santiago	633	837	0.3	0.4
23.Aymaraes	722	845	0.1	0.1

Source: JICA survey team

b) Study of Treatment Method

i) Evaporation Treatment

As a leachate treatment method, evaporation treatment method was studied first because it is the most economical method. This method is to collect leachate from a landfill area into a leachate pond, and to re-inject collected leachate into the landfill area. It is planned that 100m3 of leachate will be re-injected daily, expecting 10m3/day of leachate vaporization. It is also planned to spray the collected leachate to composting waste in a composting plant in summer.

Table 2.4-28 shows the calculation result. As for the projects marked with yellow in Table 2.4-28**,** its volume of leachate generation by the rainfall percolating through the disposed waste is expected to be 0, and volume of leachate generation from organic waste and water content of waste is expected to be smaller than evaporation volume ($10m^3$/day). Therefore, these projects can apply evaporation treatment system with a small leachate pond, in which leachate generated is collected in a small pond and then re-injected into landfill for evaporation. It is expected that the evaporation treatment is effective for the project marked with greenish yellow, too, but a large-sized pond is needed for these projects.

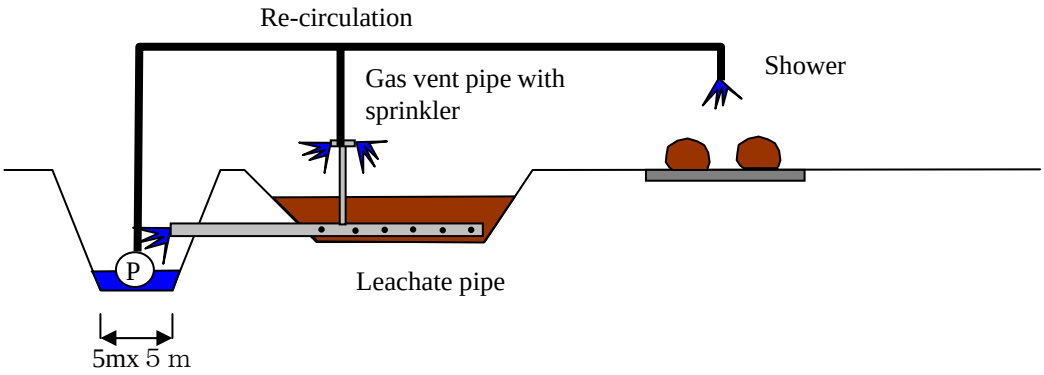


Figure 2.4-16 Schematic View of Evaporation Treatment

Table 2.4-28 Calculated Leachate Volume Requirement for Evaporation Treatment

Name of Municipality	Leachate volume requirement*1 (m3)	Remark
1. Puno	2,900	
2. Juliaca	x	Evaporation treatment is not applicable.
3. Piura	30	
4. Nuevo Chimbote	30	
5. Tumbes	30	
6. Sullana	30	
7. Abancay	1,260	
8. Huanuco	30	
9. Paita	30	
10.Puerto Maldonado	x	Evaporation treatment is not applicable.
11.Talara	30	
12.Moyobamba	1,200	
13.Tarapoto	30	
14.Chachapoyas	140	
15.Ilave	1,530	
16.Azangaro	320	
17.Chincha	30	
18.Sechura	30	
19.Huacho	30	
20.Tarma	400	
21.Ferrenafe	30	
22.Santiago	30	
23.Aymaraes	280	

*1: As for the projects with the leachate volume requirements of 30m^3, the figure given in the above table represents a minimum volume needed because these projects has only small leachate generation. Leachate volume requirements were calculated on the assumption that the size of leachate pond is minimum size which can be constructed using heavy machines.

Source: JICA survey team

ii) Leachate Treatment System

As shown in Table 2.4-28, Juliaca and Puerto Maldonado needs to install leachate treatment facilities.

(i) Applied effluent standard

Since there are currently no effluent standard for leachate treatment in Peru, the project will comply with DEGESA's draft Effluent Standard. As for BOD, however, it will comply with the Draft Effluent Standard that MINAM has under discussion, which defines the standard value of BOD as 100mg/l.

(ii) Influent quality

Comparing the quality of leachate of landfill in Lima City to the above-mentioned Draft Effluent Standard, parameters exceeding the Effluent Standard were determined as parameters of influent quality, which are BOD and SS. Based on the quality of leachate from LIMA landfill, the concentration of BOD and SS are set to 3,500 mg/l and 1,000mg/l, respectively.

(iii) Calculation of the capacity of leachate treatment facility

Capacity of leachate treatment facility is calculated using the aforementioned rational formula. Leachate treatment facility should have a capacity enough to cover the daily rainfall calculated from the monthly maximum rainfall.

$Q = 1 / 1{,}000 \times (C1 \times A1 + C2 \times A2) \times I + Q1$ ・・・Rational formula

Where

- Q : Capacity of Leachate treatment (m^3/day)
- Q1: Generated by decomposition of organic matter and humidity content of waste (m^3/day)
- C1 : Coefficient for seepage into disposal area
- C2 : Coefficient for seepage into soil covered area (C2 = C1 X 20%)
- A1 : Waste disposal area (m^2) A2 : Soil covered area (m^2)
- I : Daily rainfall calculated from the monthly maximum rainfall (mm): in the past 10 years

Using the equation above, the capacity of leachate treatment facility is calculated to be $60m^3$/day.

(iv) Calculation of leachate pond capacity

In order to set necessary pond volume (capacity of leachate pond), daily water budget shall be calculated from daily rainfall in the past 10 years and each assumed capability of leachate treatment. Capacity of leachate pond is calculated using the rational formula shown below;

$V = 1 / 1000 \times (C1 \times A1 + C2 \times A2) \times I + Q1 - Q$ ・・・Rational formula

Where

- V : Capacity of leachate pond (m^3)
- Q : Capability of leachate treatment or Evaporation by re-circulation (m^3/day)
- Q1: Generated by decomposition of organic matter and humidity content of waste (m^3/day)
- C1 : Coefficient for seepage into disposal area:0.80
- C2 : Coefficient for seepage into soil covered area :0.48 (C^2 = C1 X 20%)
- A1 : Waste disposal area (m^2) A2 : Soil covered area (m^2)
- I : Daily rainfall (mm): past 10 years

Figure 2.4-17 shows the capacity of leachate pond in Puerto Maldonado calculated using the above formula, which is $1{,}850m^3$.

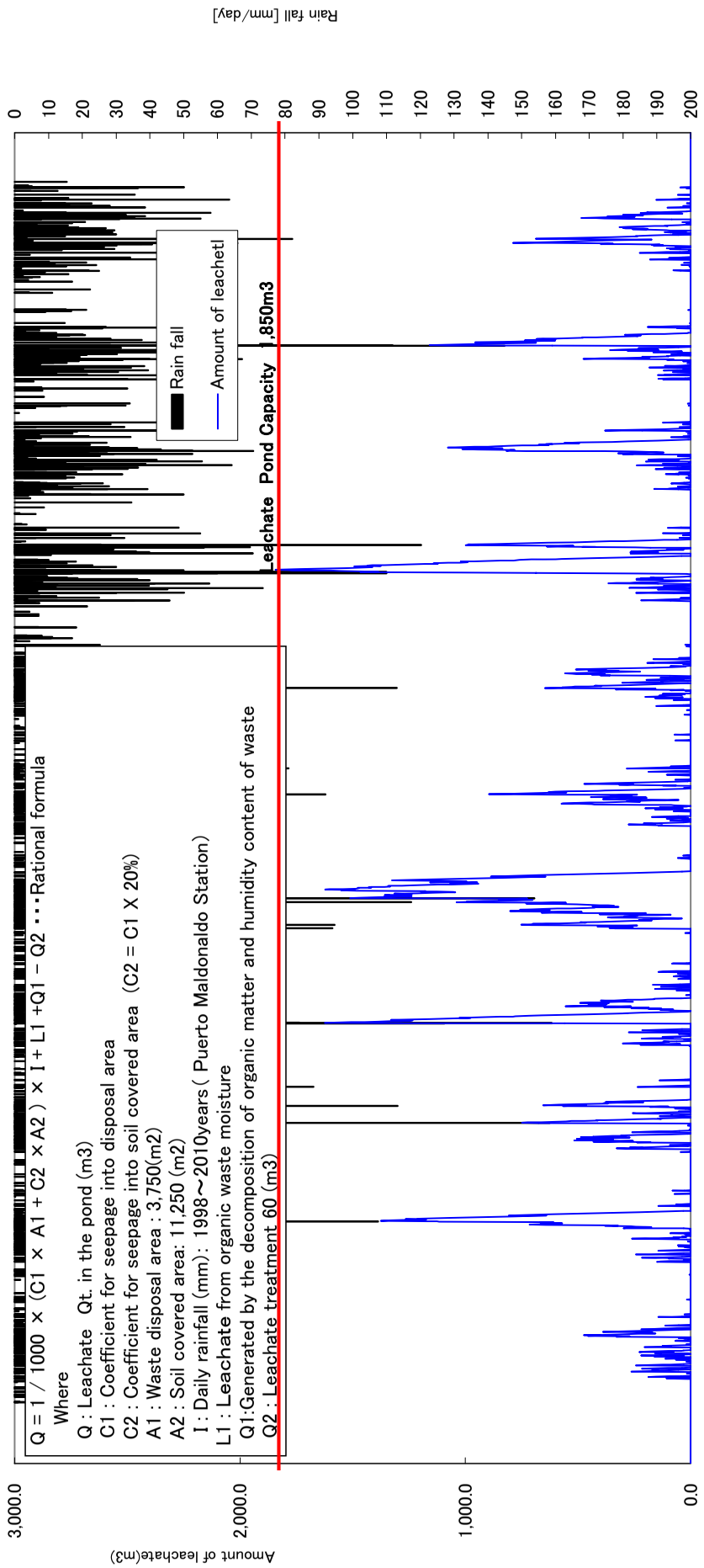


Figure 2.4-17 Result of Calculation for Leachate Volume Requirement in Puerto Maldonado (With the assumption that leachate treatment capacity is 60m^3/day)

(v) Examination of leachate treatment method

As previously mentioned, substances to be removed are BOD and SS. Since most SS settle out in the leachate pond, a major treatment process would be removal of BOD. Although aeration treatment is considered to be the most excellent method to remove BOD, it requires quite high cost of operation and maintenance. Therefore MINAM requested to combine aerobic and anaerobic treatment system. Thus, we examined the treatment method with a combination of aerobic and anaerobic treatment system.

There are two types in anaerobic treatment system, i.e., normal type and UASB (Upflow Anaerobic Sludge Blanket). UASB is a proven system in Peru, while there is no precedent for the normal type in Peru. In addition, UNI (*Universidad Nacional de Ingenieria*) is promoting research on UASB and the project can receive support from UNI for facility design through MINAM. Therefore, UASB was selected for this project.

Major types of aerobic treatment system include activated sludge process, trickling filter process and rotating disc process. Among these, rotating disc process was eliminated from the examination because there is no precedent in Peru. Compared to activated sludge process, trickling filter process requires lower construction cost and O&M cost, but is inferior in removal performance. Still, trickling filter process is applicable to the target area because Puerto Maldonado has high rainfall and it would be possible to dilute leachate by adding rainwater before treatment. Hence, trickling filter process was selected as aerobic treatment system for the project. Table 2.4-29 shows the outlines of the treatment methods.

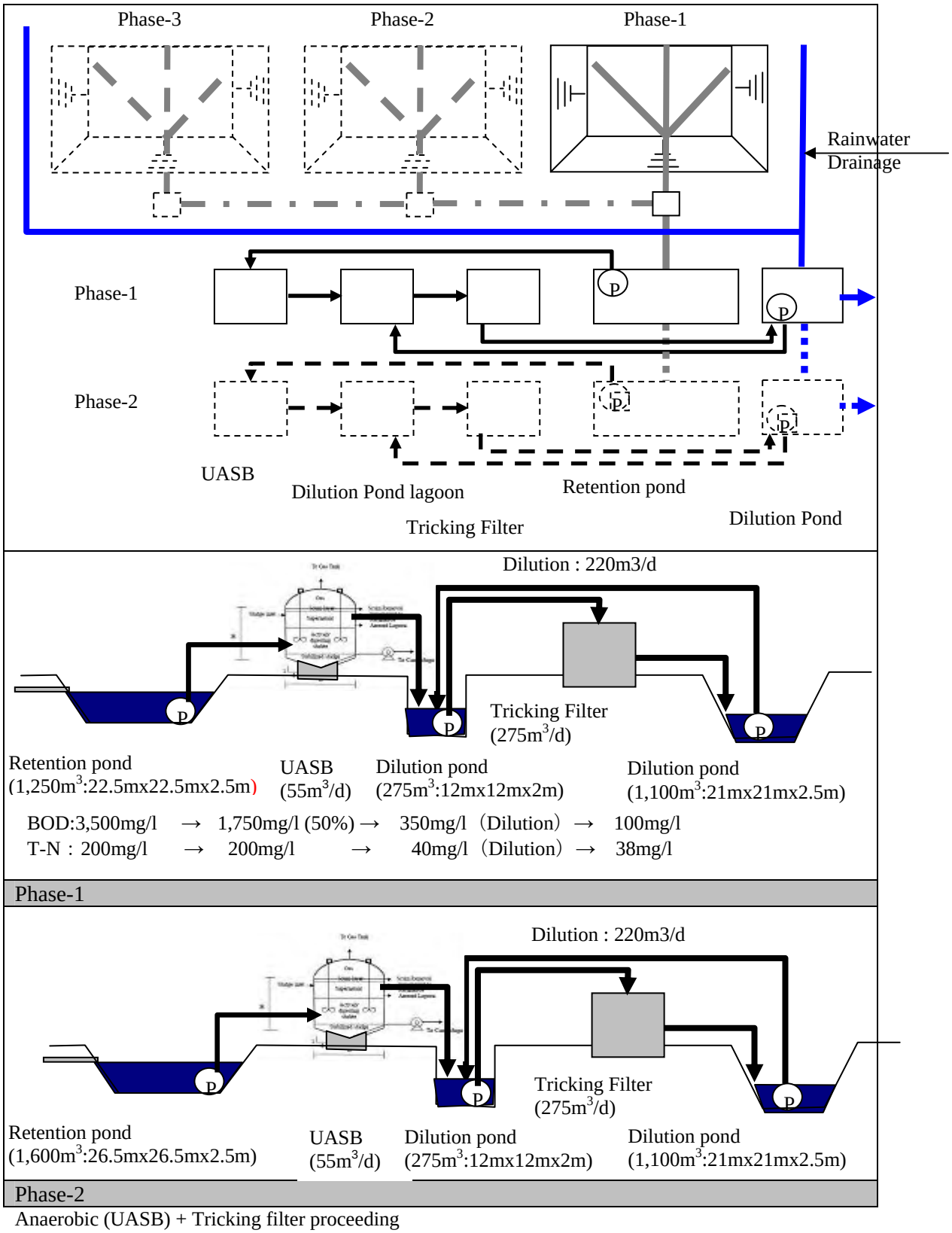
Table 2.4-29 Outlines of the Treatment Methods

Treatment System	Anaerobic Treatment System		Aerobic Treatment System		
	Normal	UASB	Activated sludge	Trickling filter	Rotating disc
Precedent cases	No	1 case under construction, 1 case in trial operation by UNI	Many	Few	No
Operation management	Easy	Easy	Difficult	Easy	Easy
Construction cost	Low	Low	High	Middle	Middle
O&M cost	Low	Low	High	Middle	Middle
Manufacturer	No	No	Yes	Yes	No

Source: JICA survey team

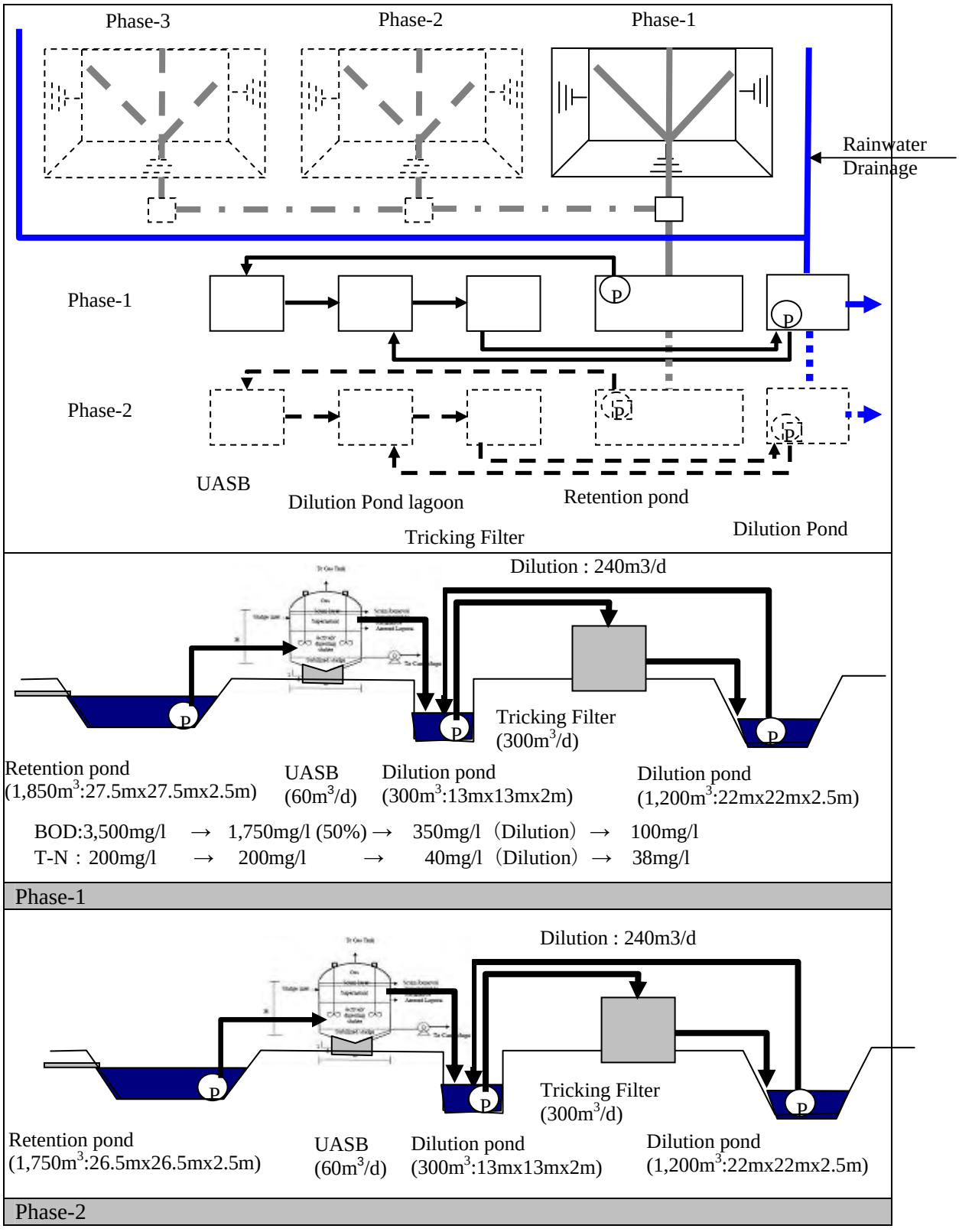
(vi) Summary of leachate treatment system

Table 2.4-30 outlines the proposed leachate treatment system for the projects.



Anaerobic (UASB) + Tricking filter proceeding

Figure 2.4-18 Proposed Leachate Treatment System in Juliaca



Anaerobic (UASB) + Tricking filter proceeding

Figure 2.4-19 Proposed Leachate Treatment System in Puerto Maldonado

Table 2.4-30 Proposed Leachate Treatment System for Each Project

	Name of municipality	Disposed Area	Method	Number of Construction phase	Retantion Pond					Re-circulation pump				
					Num. of pond			Size or capacity	Liner system	Num. of pump			Capacity (m3/min)	Head (m)
					Phase1	Phase2	Phase3			Phase1	Phase2	Phase3		
1	Puno	6.51	Re-circulation	3	1	1	1	2,900	Geo-membrane	2	1	1	0.07	20
2	Juliaca	12.92	**Refer to Fig.2.4-18**											
3	Piura	16.24	Re-circulation	1	1	-	-	30	Reinforced concrete	1	-	-	0.07	30
4	Nuevo Chimbote	4.80	Re-circulation	1	1	-	-	30	Reinforced concrete	1	-	-	0.07	30
5	Tumbes	3.36	Re-circulation	1	1	-	-	30	Reinforced concrete	1	-	-	0.07	30
6	Sullana	6.30	Re-circulation	1	1	-	-	30	Reinforced concrete	1	-	-	0.07	30
7	Abancay	3.36	Re-circulation	3	1	1	1	1,260	Geo-membrane	2	1	1	0.07	20
8	Huanuco	5.96	Re-circulation	1	1	-	-	30	Reinforced concrete	1	-	-	0.07	30
9	Paita	2.46	Re-circulation	1	1	-	-	30	Reinforced concrete	1	-	-	0.07	30
10	Puerto Maldonado	4.50	**Refer to Fig.2.4-19**											
11	Talara	3.22	Re-circulation	1	1	-	-	30	Reinforced concrete	1	-	-	0.07	30
12	Moyobamba	4.69	Re-circulation	3	1	1	1	1,200	Geo-membrane	2	1	1	0.07	20
13	Tarapoto	6.84	Re-circulation	1	1	-	-	30	Reinforced concrete	1	-	-	0.07	30
14	Chachapoyas	1.56	Re-circulation	1	1	-	-	140	Geo-membrane	2	-	-	0.07	20
15	Ilave	1.43	Re-circulation	1	1	-	-	1,800	Geo-membrane	2	-	-	0.07	20
16	Azangaro	0.83	Re-circulation	1	1	-	-	470	Geo-membrane	2	-	-	0.07	20
17	Chincha	2.52	Re-circulation	1	1	-	-	30	Reinforced concrete	1	-	-	0.07	30
18	Sechura	1.68	Re-circulation	1	1	-	-	30	Reinforced concrete	1	-	-	0.07	30
19	Huacho	6.48	Re-circulation	1	1	-	-	30	Reinforced concrete	1	-	-	0.07	30
20	Tarma	2.03	Re-circulation	1	1	-	-	400	Geo-membrane	2	-	-	0.07	20
21	Ferrenafe	2.46	Re-circulation	1	1	-	-	30	Reinforced concrete	1	-	-	0.07	30
22	Santiago	0.77	Re-circulation	1	1	-	-	30	Reinforced concrete	1	-	-	0.07	30
23	Aymaraes	0.46	Re-circulation	1	1	-	-	280	Geo-membrane	2	-	-	0.07	20

(3) Environmental measures

Environmental measures for the surrounding residents are as follows.

Table 2.4-31 Environmental Measures at Sanitary Landfill Site

	Item	Measure
1)	Groundwater pollution Prevention	Installation of geo-membrane liner with min.1.5mm thickness and leachate collection pipes.
2)	Surface water pollution prevention	Block embankment is installed within the landfill area to reduce leachate generation by making landfill area smaller, and eventually to complete leachate treatment just by vaporization in the landfill area as much as possible. Leachate treatment should be carried out in accordance with the effluent standard that MINAM has under discussion.。
3)	Scattering of waste prevention	Daily soil cover will be applied with sufficient waste compaction.
4)	Offensive odor prevention	Daily soil cover will be applied and the buffer zone will be secured.
5)	Fire prevention	Daily soil cover will be applied with installation of gas vent pipe
6)	Vectors prevention	Daily soil cover will be applied
7)	Stabilization of waste	Adoption of Semi-aerobic Landfill system where stabilization of waste will be early
8)	Noise and Vibration prevention	The green belt will be secured Operation hours will be set considering minimum disruptions
9)	Waste adhering to collection trucks tires	Truck tire wash basins are located at the site exit to clean the tires
10)	Environmental monitoring	Ground water, surface water, landfill gas samples will be collected and analyzed or a pre-determined schedule.

Source: JICA survey team

(4) Necessary Equipment for Sanitary Landfill

1) Determination of Landfill Type

SW landfill regulation defines the landfill type according to daily amount of disposal waste, and stipulates the type and number of heavy machines for waste disposal for each landfill type. Table 2.4-32 shows the categorization of the landfill by disposal amount.

Table 2.4-32 Landfill Categorizations by Disposal Amount

Type	Disposal Amount
A. Manual	< 20t/day
B. Semi-Mechanized	20t/day – 50t/day
C. Mechanized	> 50t/day

Source: JICA survey team

2) Equipments necessary for each landfill type

Table 2.4-33 and Table 2.4-34 show the capacity, type and number of equipments required for each landfill type; and function of each equipment, respectively. SW landfill regulation stipulates that waste landfill operation should be conducted manually in Type-A manual landfill. However, manual operation is unable to sufficiently compact waste and/or smoothly carry out landfilling work in rainy season. Therefore, it is decided to purchase a small bulldozer. Table 2.4-35 shows heavy equipments required for the projects.

Table 2.4-33 Equipments for Each Landfill Type

Equipment		Q'ty	Disposal amount (t/day)		
			< 20 t/d	20 – 60 t/d	60 t/d <
Name	Capacity		Type-A	Type-B	Type-C
Bulldozer	21t class, 220HP	1			X
Bulldozer	10-14t class, 100-150HP	1		X	
Bulldozer	4t class, 80HP	1	X		
Wheel loader	1.9-2.7m^3 class, 150HP	1			X
Dump truck	15t class	1			X

Source: JICA survey team

Table 2.4-34 Function of Equipment

No	Equipment	Function
1	Bulldozer	Waste spreading and compacting. Bulldozer of Type- A performs turning of compost in Composting plant.
2	Wheel loader	Push waste to the disposal area, and spreading, transport soil cover materials to the waste operating cell, etc.
3	Dump truck	Transport materials for soil cover, other functions as equipment and labor transport, etc.

Source: JICA survey team

Table 2.4-35 Necessary Equipment of Sanitary Landfills

Municipality name	Disposal amount (t/d)	Landfill type	Bulldozer			Wheel loader	Dump truck
	2015 year		21t class	10-15 t class	4t class	1.9-2.7m3 class	15 t class
(1) PUNO	91	C	1			1	1
(2) JULIACA	188	C	1			1	1
(3) PIURA	406	C	1			1	1
(4) NUEVO CHIMBOTE	72	C	1			1	1
(5) TUMBES	64	C	1			1	1
(6) SULLANA	130	C	1			1	1
(7) ABANCAY	47	B		1			
(8) HUANUCO	110	C	1			1	1
(9) PAITA	44	B		1			
(10) PUERTO MALDONADO	52	B		1			
(11) TALARA	63	B		1			
(12) MOYOBAMBA	60	C	1			1	1
(13) TARAPOTO	158	C	1			1	1
(14) CHACHAPOYAS	20	B		1			
(15) ILAVE	13	A			1		
(16) AZANGARO	7	A			1		
(17) CHINCHA	48	B		1			
(18) SECHURA	25	B		1			
(19) HUACHO	148	C	1			1	1
(20) TARMA	29	B		1			
(21) FERRENAFE	45	B		1			
(22) SANTIAGO	7	A			1		
(23) AYMARAES	4	A			1		
Total			10	9	4	10	10

Source: JICA survey team

Note: A: Manual sanitary landfill, B: Semi-Mechanized sanitary landfill, C: Mechanized Sanitary Landfill

2.5 PROPOSED EQUIPMENT AND MATERIAL PROCURMENT, AND CONSTRAUCTION METHODOLOGIES

Based on the proposed concepts for the improvements of SWM, the following equipment and materials and associated construction works will be carried out utilizing the yen loan project.

2.5.1 Equipment and Material

The following materials and equipment necessary for the implementation of the program are as follows.

No.	Name	Note
	Small Equipment, tools and Consumable	
1	Waste bin	FRP/Steel
2	Sweeping cart (120L)	
3	Tools (fork, picker, broom, dustpan, safety cone, rake, shovel, spade, etc)	
4	Nylon blanket	
5	Plastic sheet	For use in landfill operation
6	Generator	
7	Pump	
8	Locker	For use in administration building
9	Wheelbarrow	
10	Uniform and safety equipment	For operational workers -collection and transportation -landfill operation - recycling and composting plant
11	Table for segregation	
	Equipment for Collection and Transportation	
1	Motorcycle (125cc)	
2	Trimobile collector (125cc)	
3	Dump truck (19m^3, 2ton)	Import
4	Truck with container box (19.8m^3)	Import
5	Compactor truck (7 m^3, 12 m^3, 15 m^3)	Import
	Equipment for Landfill Operation	
1	Bulldozer (200hp, 100hp)	Import
2	Front loader (150hp)	Import
3	Mini bulldozer (60hp)	Import
4	Dump truck (15ton)	Import
5	Weighing scale (40ton)	Import
	Equipment for Sorting and Composting	
1	Mini wheel loader	Import
2	Vibrating screen	Import

Source: JICA survey team

2.5.2 Construction Work

The following construction works are required in the projects.

No.	Name	Note
	Construction of Administration Facilities	
1	Buildings (Office, booth for registration and weighing, guard house, storage, toilet and changing room, generator house, kitchen)	Reinforced concrete structure with metal roof and brick wall.
2	Site preparation	
3	External fence and planting	Barbed wire fence with wooden pole
4	Internal and external access roads to project site	Including repair works of the existing roads
5	Power supply	-Commercial power source or -Generators
6	Digital weighing scale (40ton)	Import
7	External lighting system	
8	Elevated water tank ,septic and cesspool	
	Construction of Sanitary Landfill	
1	Sanitary landfill with leachate collection system and gas extraction pipes	Including 1.5mm liner sheet
2	Leachate pond and piping	-Liner sheet or -Reinforced Concrete
3	Leachate treatment plant with UASB, retention pond, aeration lagoon, Dilution pond, tricking filter , circulation pump, control panel, etc.	Puerto Maldonado and Juliaca
4	Circulation pump and piping for leachate pond	
	Construction of Sorting plant	
1	Building of recycling facilities and operation yard	Reinforced concrete structure with metal roof and brick wall.
2	Site preparation	
3	Lighting system including external lighting	
4	External fence	Barbed wire fence with wooden pole
5	Power supply	
	Construction of Composting plant	
1	Shed of composting facilities and operation yard	Steel and wooden structure with metal roof and brick wall.
2	Site preparation	
3	Lighting system including external lighting	
4	Elevated water tank	
5	External fence	Barbed wire fence with wooden pole
6	Power supply	

Source: JICA survey team

2.5.3 Methodologies of Procurement of Construction and Equipment

(1) Contract Package

For the smooth implementation of the projects, the following eight bidding packages (four packages for construction works and four packages for procurement) are proposed for international bidding in consideration of the local market conditions and the capability of local contractors in Peru. The combination of each package for the construction work is prepared according to the location of the project sites as well as the characteristics of climate conditions of the project sites. As for the projects in the tropical rain forest area (*Selva*), four projects are

combined into one contract package (package D). The other projects are classified as northern area (package A), central area in the middle of country (package B) and southern area (package C) respectively.

Bidding packages planned for the material procurement consist of four packages according to the classification of kind of materials and categories such as 1) small equipment, tools and consumable, 2) equipment for collection and transportation (Dump truck and motor cycle), 3) equipment for landfill operation, and 4) equipment for collection and transportation (Compactor truck) as shown below. More than 40 kinds of materials and equipment will be procured in the projects. In order to ensure smooth procurement through the market and delivery of materials to each site on time, a combination of packages shall be decided by taking into consideration of the market and accessibility and conditions of sales agents/trading company.

1) Packages of Construction Works

Package	Project Distribution	Note
A	Piura,Tumbes,Sullana,Paita, Talara, Sechura, Ferrenafe	7 sites
B	Huanuco, Chincha, Huacho, Tarma, Santiago, Nuevo Chimbote	6 sites
C	Puno, Juliaca, Abancay, Ilave, Azangaro, Aymaraes	6 sites
D	Moyobamba, Tarapoto, Chachapoyas, Puerto Maldonado	4 sites

Source: JICA survey team

2) Packages of Equipment Procurement

Package	Materials and Equipment	Note
E	Small Equipment, tools and Consumable	Refer to 2.5.1
F	Equipment for Collection and Transportation (Dump truck and motor cycle)	Refer to 2.5.1
G	Equipment for Landfill Operation	Refer to 2.5.1
H	Equipment for Collection and Transportation (Compactor truck)	Refer to 2.5.1

Source: JICA survey team

3) Bidding

By taking into account the characteristics, magnitude and physical conditions of the projects including the technology for semi-aerobic sanitary landfill, JICA survey team recommends that International Competitive Bidding (ICB) method should be adopted for the contracts of the project component of material procurement. As for the construction work, there are many local contractors in Peru who have sufficient capability as far as construction of landfill and building works is concerned. Therefore it is recommended that a tender for local contractors for construction package A, B, C and D be held under the JICA's regulation.

2.6 PROPSOED IMPLEMENTTION ORGANIZATION OF THE PROGRAM

2.6.1 Proposed Implementation Organization of the Program

The MINAM will be the executing agency of the program, through the executing unit of the program (UEP) to be set up, in order to achieve the program goals, in compliance with the budget and time frame established for that matter. The UEP will be independent from the administrative standpoint in accordance to the law in force and effect, be flexible to solve and decide about issues that make the program progress. It will depend directly on the Vice Ministry of Environmental Management of the MINAM.

Likewise, a Program Management Committee (CDP) will be established in order to offer an integral management to execute the program. The CDP will be formed by MINAM representatives that will chair the board, representatives from MEF and four representatives of the municipalities involved in the Program.

Each of the 31 municipalities will set up Projects Sub Executing Units (USEP), in order to execute the investments in those municipalities, within the framework of the program and will report directly to the UEP.

For that purpose, the municipalities will be grouped in four areas of work: Northern area, Southern Area, Central Area and Western Area. Each area will choose a representative that will be a member of the CDP. The following chart shows the proposed organization, and the map states the geographical borders of the four areas of work.

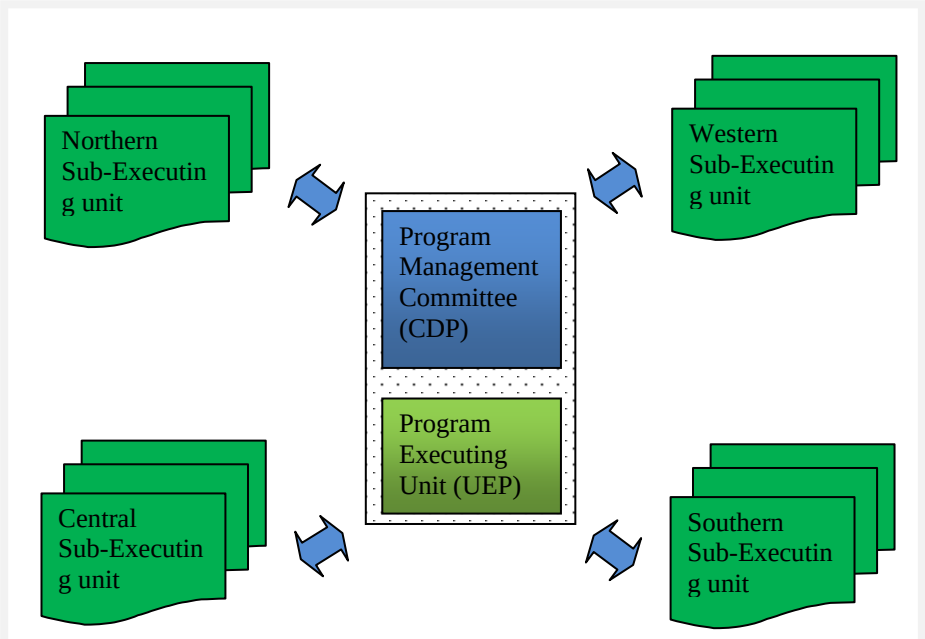


Figure 2.6-1 Organization of the Program Management

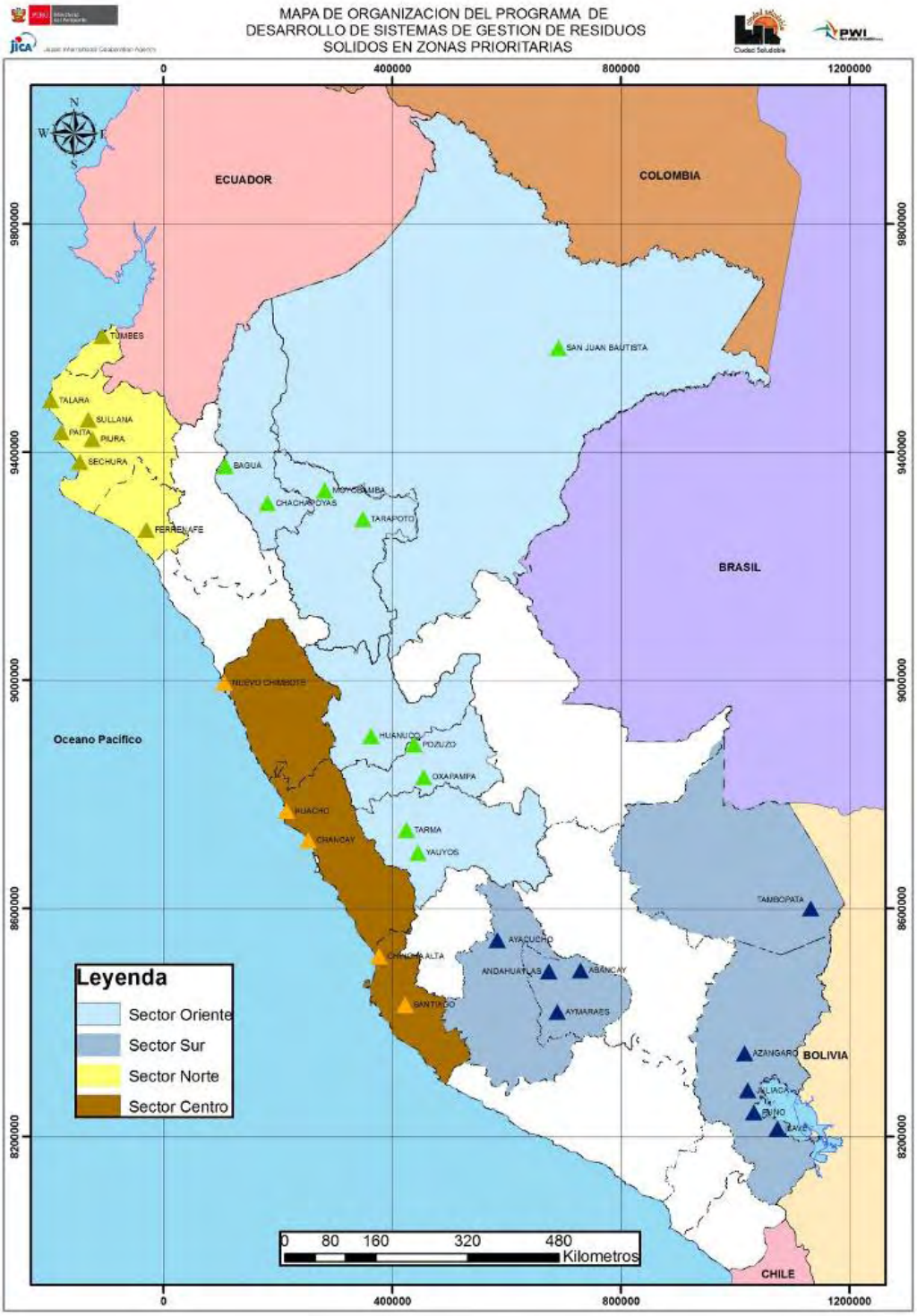


Figure 2.6-2 Map of Sectors in the Program

2.6.2 Role and Responsibility in the Program Implementation

(1) Program Management Committee (COP)

The CDP will be in charge of the following activities:

- Approve the Operating Annual Plan and the program procurement plan (PP). It is important to mention that the PP is flexible and the borrower must update it every year or whenever is convenient throughout the program. The borrower must ensure the PP is executed according to JICA and IDB.
- Establish guidelines to select general coordinator of the program, through a fair process in accordance with regulations of cooperating agencies.
- Approve General Operations Manual of the program and any modification, if necessary.
- Approve the annual report of the program
- Be aware of the quarterly and semester reports of the execution of components and activities of the program, contributing if necessary.
- Ensure the program and other bilateral agreements related to the program are complied with.
- Organize frequent meetings and consultations with civil society, in order to inform the Program actions and get feedback on the results reached, when appropriate.
- Review and evaluate the overall performance of the UEP.

(2) Executing Unit of the Program

The executing unit of the program, approved by law within the framework of loans between JICA and IDB to implement the program, is the management organization of the program. It will be established by MINAM, it has its own budget in order to carry out technical, administrative duties (specially related to budget, schedule, accountancy, treasury and procurement, applying regulations and procedures from JICA and IDB). The UEP also performs economic and financial activities, such as planning, execution, monitoring and evaluation of the program. At the same time, it is responsible to transfer the resources of the program to the municipalities. For that purpose, the UEP supports municipalities from the technical standpoint so that they can prove that they are capable of executing works and studies.

The UEP will be responsible to manage resources from JICA and IDB, and operate under the supervision of the Vice Ministry of Environmental Management.

The UEP will work closely with the municipalities participating in the Program. For that matter, it will sign management agreements with local government in order to establish under which methods resources to finance the program will be executed, The UEP will estate mutual obligations related to technical assistance, supervision and monitoring the program shall perform in order to guarantee that the execution and its results are transparent. Furthermore, the program shall channel, when appropriate, the funds of the projects for the trust accounts (FIDEICOMISO) established with the municipalities. Besides, network coordinators will be responsible to manage work programs at the co-executing units.

The UEP will have the following responsibilities:

- Execute the program in accordance with loan agreements that will finance the program
- Execute works, procure goods and hire services, according to the program requirements
- Coordinate and execute the program, coordinating with the sub-executing units.
- Establish proper accounting, financial and internal control systems to manage the Program´s resources.
- Write and submit the disbursement request and explain the use of resources and reports requested by the Program, thus consolidating the information from the sub-executing units.
- Act as the technical secretariat of the CDP
- Draft management documents such as the Annual Operating Plan and the PP

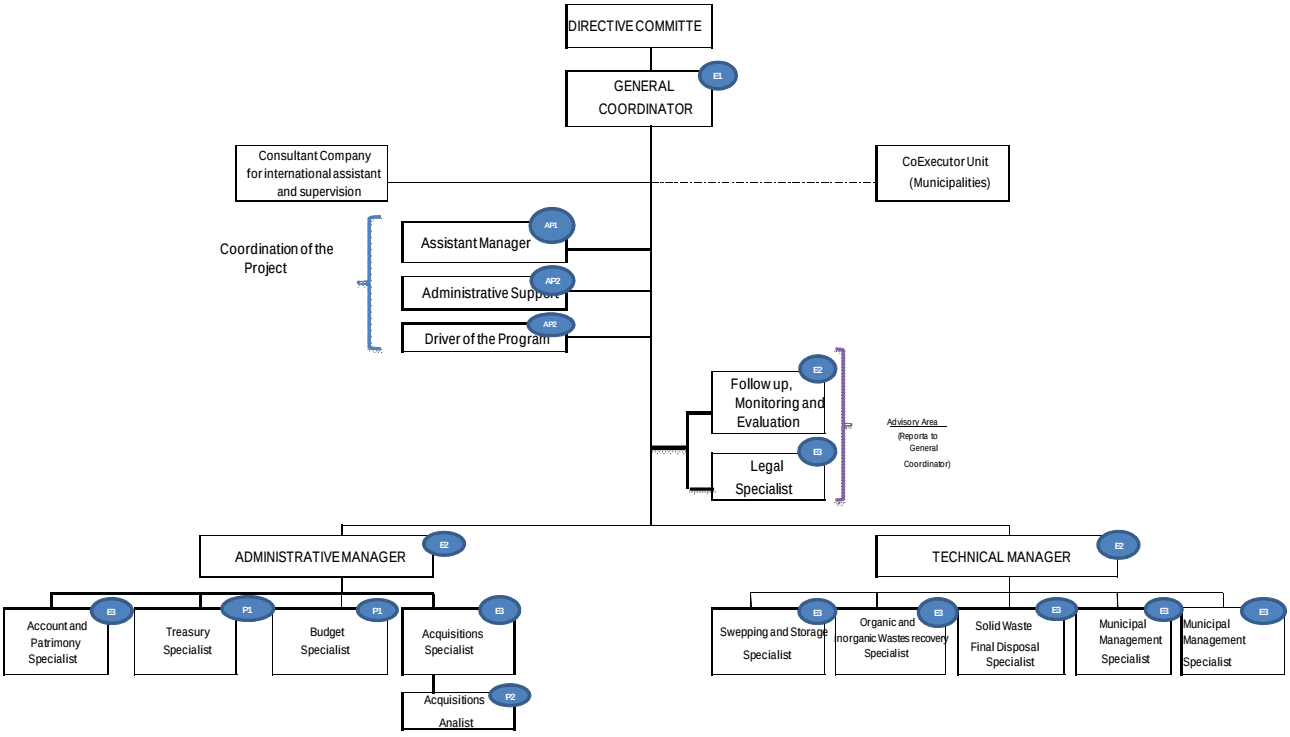


Figure 2.6-3 Executing Unit of the Program

Mission and Duties of the UEP

Taking into consideration that the UEP is responsible for the proper execution of the program, it is appropriate to mention the main mission and duties of this agency, both in the investment and during the post investment stage:

- Planning, follow up and control all activities related to the 31 projects involved in the program
- Foster municipalities included in the program, so that they implement better practices to segregate waste at generation source.

- Elaboration of the technical specifications and invitation to tender locally or internationally to execute the infrastructure works for each of the projects
- Elaboration of the technical specifications and procurement requirements (either locally or abroad), heavy equipment to be used in the 31 projects (heavy equipment, trucks, vehicles, etc)
- Quality control of the equipments, inputs and services hired, before these are provided to the municipalities, in accordance with the standards previously established.
- Supervision of the training programs for the personnel
- Supervision of the awareness and social communication programs
- Supervision of the ongoing improvement programs of the collection for each municipality
- Deciding the operating costs used as a reference for the public cleaning service
- Links with other national and/or provincial organizations participating in the program (MINSA, DIGESA, MEF, INDECI, etc)

(3) Sub Executing Units of the Project

It is important to mention that although the UEP under MINAM will manage the program, the activities to perform in each solid waste project will depend on the responsible offices of each local government. The sub-executing units of the project (USEP) to be established in each municipality will have the following responsibilities:

- Each of the municipalities of the Program will become a sub-executing unit, responsible to implement the specific projects of each city, and will be responsible of the integral management of solid waste.
- Each participating municipality will appoint a network coordinator who will represent the municipality for a period of time, working towards the development of the Program activities. Network coordinators will be the local responsible to execute specific project of solid waste, coordinating with the UEP the necessary actions.
- Moreover, each network coordinator will have the following responsibilities:
- Promote the program and schedule investments in coordination with the municipality.
- With the support of the UEP, organize tenders until the scheduled procurements are allocated.
- Approve terms of reference or technical specifications
- Support evaluating committees during procurement.
- Review and approve products submitted to suppliers of goods or services hired by the Program, and deliver information or inputs to suppliers in a a period of time no longer than fifteen working days. After this term, and under network coordinator responsibility, the municipality will be supposed to have agreed or accepted the good or service hired, and the UEP shall cancel obligations with the corresponding provider.

- Administer agreements and contracts with municipalities
- Supervise and submit reports regarding execution of several components of the program
- Coordinate investment execution in each municipality included in the Program.
- Submit reports to UEP on physical and financial progress of investments assigned to it.
- Submit the annual operating plan and procurement program to UEP, in accordance with Operating Manual of the Program.

2.7 ENVIRONMNETAL AND SOCIAL CONSIDERATIONS OF THE PROGRAM

2.7.1 Legal and Institutional Framework of Environmental Impact Assessment

(1) Environmental Impact Assessment System for Municipal Solid Waste Facilities

1) National System of Environment Impact Evaluation

The system for environmental impact assessment in Peru is regulated by MINAM and conducted by the sector Ministries, institutions and local governments. The system known as SEIA (*Sistema Nacional de Evaluación de Impacto Ambiental*) has been reorganized in April 2001 under the Law No. 27446.

The Law established three categories of Environmental Impact Assessment (EIA) depending on the level of anticipated impact and influence extension due to the execution of planned activities. The categories are constituted as shown in Table 2.7-1.

Table 2.7-1 Categorization of EIA

Categories	Required Study of EIA
Category I	Environmental Impact Declaration (DIA: *Declaración de Impacto Ambiental*)
Category II	Semi-detailed Environmental Impact Study (EIA-sd: *Estudio de Impacto Ambiental Semi-detallado*)
Category III	Detailed Environmental Impact Study (EIA-d: *Estudio de Impacto Ambiental Detallado*)

Source: SEIA (Sistema Nacional de Evaluación de Impacto Ambiental)

2) Strategic Environmental Assessment

SEIA has adopted a concept for Strategic Environmental Assessment (EAE) that is also to be regulated by MINAM to deal with environmental impact assessment for policies, programs and plans of sector, regional and local administrations. Due to implementation procedure still in analysis under General Directorate of Policies, Norms and Instruments for Environmental Management of the Vice ministry of Environmental Management of MINAM, EAE has not been conducted.

3) Screening of Activity

Screened sectors in SEIA are listed in Annex II of Ministerial Decree No. 019 of year 2009 (D.S. No. 019-2009-MINAM), involving following sectors:

- agriculture;
- external trade and tourism;
- defense;
- energy and mines;
- production;
- transportation and communication;
- health; and
- housing, construction and sanitation.

The decree authorizes sector Ministries to define detail screening criteria of activities for the above mentioned sectors.

Ministry of Health (MINSA) has the authority to regulate and manage the SEIA for the construction of following facilities:

- infrastructure of solid waste commercialization;
- municipal solid waste1 transfer station;
- municipal and non-municipal solid2 waste treatment plant;
- infrastructure for final disposal of municipal and non-municipal solid wastes;
- hospital and health assistance establishment; and
- cemetery and crematory.

MINSA delegated to General Directorate of Environmental Sanitation (DIGESA) to regulate EIA process for infrastructures regarding SWM.

1) Pre-requisites for EIA Evaluation

Under the Unique Text for Administrative Procedurals (TUPA), DIGESA manages EIA process for projects composed by construction of transfer stations, treatment plants and final disposal facilities, requesting as pre-requisites for EIA evaluation the following documents:

Table 2.7-2 Pre-requisites for EIA Evaluation

Contents
- Certification of land use compatibility by the respective Provincial Municipality. Criteria (D.S. No. 057-2004-PCM, Article 67) for the certification are as follows: compatibility with soil use and urban planning; compatibility with provincial plan for the integrated management of wastes; minimization and prevention of social and environmental impacts during construction, operation and closure stages; considerations on climatic, topographical, geological, geomorphological and hydrological factors; prevention of sanitary and environmental risks; conservation of archeological, cultural and monuments in the area; vulnerability against natural disasters; and other relevant aspects.
- Certification of non-encompassing protected areas by the National Natural Protected Areas Agency (SERNANP, former INRENA). In case of the target area is totally or partially overlapped in protected areas or buffer zones, technical opinion from SERNANP will be necessary;
- Report on non-encompassing natural disaster vulnerable area by the National Civil Defense Institute (INDECI);
- Certification of non-encompassing archeological valuable area by the Ministry of culture (MINCU);
- Favorable opinion by the correspondent Regional Directorate of Health (DIRESA) on the site selection report;
- Monitoring data -by accredited laboratory3- of air, water and soil aging not more than one year;
- Survey report on topography, geology and geotechnical features of the target area
- Survey report on hydrology and hydrogeology of the target area (additionally for final disposal facility projects).

Source: Unique Text for Administrative Procedurals (TUPA), DIGESA

[1] Amendment of Law No. 27314, Legislative Decree No. 1065 (June 28, 2008) stipulates responsibility of Municipalities to manage solid wastes generated from households, commercial shops and similar solids wastes from other activities within their jurisdiction.
[2] Non municipal solid waste is defined as dangerous and non-dangerous waste generated by industrial and other specified activities (D.S. No. 57-2004-PCM, Article 24).
[3] Registered in National Institute for the Defense of Competition and Intellectual Property (INDECOPI)

Criteria for favorable opinion are not officially established at DIRESA level, nevertheless, technical requirements are established in the regulation (D.S. No. 057-2004-PCM, Articles 67, 69, 85) of General Law on Solid Waste (Law No. 27314) as shown in Table 2.7-3.

Table 2.7-3 Technical Criteria for Site Selection of Waste Management Facilities

Transfer Station	Treatment Plants	Final Disposal Facilities
Location outside of zones established for residence, commerce or recreation Minimization of transportation costs Optimization of collection vehicles use Optimization of waste flow and control Holding time less than 12 hours	Location outside of zones established for residence, commerce or recreation Focused for reuse of recoverable materials Facilitation of final disposal Efficiently Safety Healthy	Current dumping site are restricted* No objection by surrounding population Storage capacity at least for 5 years (SNIP requires at least 10 years) Distance from settlements and farms longer than 1,000 m Depth of water table > 3 m from landfill bottom level

**Reasons rely on: 1) construction of infrastructure is prohibited over dumping sites after their remediation efforts; 2) definition of infrastructure includes sanitary landfill; 3) monitoring program of five to ten years after remediation efforts are required to assure stabilization.*

4) Categorization of Waste Management Facility

MINSA/DIGESA is preparing an internal administrative directive bill regarding EIA categorization for waste management infrastructures managed by the Municipalities, with screening criteria as shown in Table 2.7-4.

Table 2.7-4 EIA Categorization of Waste Management Facility managed by the Municipalities (Draft Administrative Directive of MINSA/DIGESA)

EIA-d (Category III)	EIA-sd (Category II)	DIA (Category I)
Mechanized sanitary landfill Treatment plants with capacity larger than 10 t/d Transfer station handling provincial area coverage Other infrastructure generator of significant impact to the environment determined by DIGESA	Manual and semi-mechanized sanitary landfills Treatment plants with capacity less than 10 t/d Transfer station handling communal and district areas coverage Other infrastructure generator of moderate impact to the environment determined by DIGESA	Solid waste trading facility Other infrastructure generator of small negative impact to the environment determined by DIGESA

Regulation (D.S. No. 57-20040-PCM) of the General Law on Solid Waste classifies sanitary landfill as follows:

- Manual sanitary landfill: hauling capacity lower than 20 t/d;
- Semi-mechanized sanitary landfill: hauling capacity between 20 t/d and 50 t/d; and
- Mechanized sanitary landfill: hauling capacity bigger than 50 t/d.

5) Requirements of Basic TORs of EIA Procedure and Requirement of DIA

Regulation of Law No. 27446 (D.S. No. 019-2009-MINAM) establishes Basic Terms of Reference (ToR) for EIA-d and EIA-sd and requirements for DIA. Table 2.7-5 shows the context of respective requirements.

Table 2.7-5 Basic TORs of EIA Procedure and Requirement of DIA

<table>
<tr><th>Item</th><th>EIA-d (category III)</th><th>EIA-sd (category II)</th><th>DIA (category I)</th></tr>
<tr><td>Source</td><td>Annex IV</td><td>Annex III</td><td>Annex VI</td></tr>
<tr><td rowspan="2">Executive Summary</td><td colspan="2">A summary of EIA understandable for non-specialists</td><td></td></tr>
<tr><td>Index of EIA-d</td><td>Index of EIA-sd</td><td></td></tr>
<tr><td rowspan="14">Project Description</td><td colspan="3">Project name and legal identification of the proponent</td></tr>
<tr><td colspan="2">Concerned legal and administrative references</td><td rowspan="14">Description of:
Planning stage
Construction stage
Operation stage
Maintenance stage
Closure stage
Existent infrastructure
Raw materials and consumables
Process
Products
Services
Personnel
Effluents
Solid wastes
Management of dangerous materials
Air emissions
Emissions of noise, vibration and radiation</td></tr>
<tr><td colspan="2">Project objective and justification</td></tr>
<tr><td colspan="2">Geographical location referred by UTM coordinates with appropriate scale map and legal jurisdiction</td></tr>
<tr><td colspan="2">Project description with chronological sequence</td></tr>
<tr><td>Required areal extension with information of design and layout of infrastructures</td><td rowspan="3">Project scale and potential environmental impacts in direct and indirect influence area</td></tr>
<tr><td>Determination of direct and indirect influence area extension of environmental impacts</td></tr>
<tr><td>Project alternative evaluation and selection of foremost environmentally, socially and economically efficient option</td></tr>
<tr><td colspan="2">Project life and investment amount</td></tr>
<tr><td colspan="2">Data on land characteristics and description of necessary data for the detail engineering</td></tr>
<tr><td colspan="2">Description of construction stage: materials, machinery, equipments, camps, personnel and logistic requirements such as construction of access roads</td></tr>
<tr><td colspan="2">Description of operation and maintenance stages with detail information of production or transformation processes</td></tr>
<tr><td colspan="2">Description of closure or abandonment stage, including general actions to be implemented</td></tr>
<tr><td rowspan="3">Base Line</td><td colspan="2">Description of project location and extension, identifying and defining direct and indirect influence area, considering macro/micro landscapes; relation with natural protected areas and buffer zones.</td><td rowspan="3">Description of physical, biotical, social, cultural and economical environments of the influence area</td></tr>
<tr><td colspan="2">Description of physical environment:
meteorology, climate and life zones
geology, geomorphology,
hydrography, hydrology, hydrogeology and water balance
soil, main land use capacity and current land use
air, soil and water qualities
other activities existent in the project area
other aspects defined by the authority</td></tr>
<tr><td>stratigraphy and geochemistry</td><td></td></tr>
</table>

Item	EIA-d (category III)	EIA-sd (category II)	DIA (category I)
	Description of biological environment: biological diversity flora and fauna abundance, distribution, conservation status for the endangered species and endemism Vulnerable ecosystems such as deserts, semiarid, mountainous, swamps, marshlands, bays, small islands, wetlands, Andean lagoons, coastal hills, cloud forests, etc. Natural Protected Areas or buffer zones Project area landscapes Endangering factor for the conservation of identified habitats or ecosystems		
	Description of social, economical, cultural and anthropological issues considering following aspects: demography and labor occupancy basic service infrastructure and quality of life of communities current land use and land tenancy other aspects defined by the authority		
	geographical distribution and spatial structure existence of economical activities depending on natural resources at individual and associative levels		
	Presence of archeological, historical and cultural heritages remains		
	Identification of natural or anthropogenic origin vulnerability and risks		
	Project location map with baseline data		
Public Participation Plan	Formulation of public participation plan based on sector stipulations and norms established in D.S. 002-2009-MINAM title IV		Formulation of public participation plan
Environmental Impacts	Applicable quantitative methods: Analysis of expected impact comparing with the previous baseline situation Estimation of direct and indirect, accumulative and synergic impacts and their induced risks on the environmental components, landscapes, social, cultural and health of the population Use of representative environmental variables, justifying scales, level of resolution, volume of data and reproducibility of information with adequate mathematical models for the determination of significant impacts and definition of impact thresholds Use of prevailing environmental standards (ECA) and maximum permitted values (LMP) and international standards approved by MINAM in case of absence		Estimation of principal environmental impacts
	Relevancy of quantification methodologies considering 1) introduced actions, 2) affected environmental variables and 3) areal environmental features		

Item	EIA-d (category III)	EIA-sd (category II)	DIA (category I)
	Identification and valuation: Physical environment parameters includes climate, geomorphological stability of soil, geological, hydrogeological and edaphological conditions, noise emission, electromagnetic field vibration and radiation levels, air quality, water quality and quantity of rivers, lagoon, lakes and sea, ecosystems and watersheds, current quality and use of soil and natural resources* Biological environment parameters includes, influence on ecosystem and habitats, their structure and functions, resilience and sustainability, fauna and flora; vulnerability, endemism and extinction risks* Social, economical and cultural aspects should consider impacts on quality of life of affected communities emphasizing communities protected by special legislation Relation with land management plans or officially protected areas Impact on existent infrastructures such as roads, railroads, ports, recreational spaces, urban areas, etc. Soil potential and current soil use Landscape and tourism aspects other aspects defined by the authority * Underlined issues requested only in detail EIA.		
	Valuation of identified impacts: positive, negative of neutral features scale of disturbance environmental relevancy occurrence risk probability regional, local or zonal extension permanency of impact reversibility of impact restoration effects		
Environmental Management Strategy	Environmental Management Plan		Control and Mitigation Plan
	Environmental Monitoring Plan		Monitoring Plan
	Compensation Plan		
	Communities Relations Plan		
	Contingency Plan		
	Closure Plan		
	Chronogram and Budget		
	Summary Table		
Economical Valuation	Economical valuation of environmental impacts in the affected area		
Consulting Firm	Name of consulting firm and professionals participated in the elaboration of EIA document		
Others	Other items defined by the authority		
Annexes	Additional supporting information supporting maps laboratory analysis reports calculation sheets pictures, videos and others		Public registry of land 1/5000 scale location map Design sheets

Requirements in Table 2.7-5 are general issues for the formulation of EIA reports requiring complementary issues depending of activity type. In case of projects on waste management, above mentioned DIGESA pre-requisites are also necessary.

In addition, technical requirements established in D.S. No. 057-2004-PCM and proposed in the concerned Administrative Directive bill -under preparation in MINSA/DIGESA for the sanitary landfill are as follows:

- Permeability coefficient of the basement and slopes lower than 10^{-6} cm/s
- Leachate collection, close circuit or treatment and discharge systems
- Gas flow, exhaust piping and combustion of gases by burning at end-off-pipe
- Storm-water and runoff deviation channels and discharge methods
- Sanitary barriers (fence)
- Monitoring wells for groundwater
- Monitoring and control systems for gas and leachate
- Weighting and registering systems
- Closure plan

SEIA establishes that sector institutions must implement technical guidelines for the formulation of EIA reports. Nevertheless, MINSA/DIGESA continues the formulation of the related Administrative Directive. Regardless of official enactment of the Directive is still in standby, DIGESA officials in charge of EIA procedure informed these evaluation criteria are valid for the purpose of evaluation of program's EIA documents. Table 2.6-6 shows these criteria categorized in the same sense of MINAM's SEIA ToR shown in Table 2.6-5. According to abovementioned, EIA-d reports in Puno, Juliaca, Piura, Sullana, Huanuco and Tarapoto have been prepared based on Table 2.7-6.

Table 2.7-6 EIA Procedure and Requirement of DIA for Municipal SWM Facilities (Proposed by MINSA/DIGESA Administrative Directive Bill)

Item	EIA-d (category III)	EIA-sd (category II)	DIA (category I)
Pre-requisites	-Certification of land use compatibility by the respective Provincial Municipality Certification of non-encompassing protected areas by the National Natural Protected Areas Agency (SERNANP). In case of the target area is totally or partially overlapped in protected areas or buffer zones, technical opinion from SERNANP will be necessary Report on non-encompassing natural disaster vulnerable area by the National Civil Defense Institute (INDECI); Certification of non-encompassing archeological valuable area by the Ministry of Culture (MINCU) Favorable opinion by the correspondent Directorate of Health on the site selection report Monitoring data -by accredited laboratory- of air, water and soil aging not more than one year; Survey report on topography, geology and geotechnical features of the target area Survey report on hydrology and hydrogeology of the target area (additionally for sanitary landfill projects)		- Certification of land use compatibility by the respective Municipality Basic environmental analysis: water, air and soil measured by accredited laboratory

Item	EIA-d (category III)	EIA-sd (category II)	DIA (category I)
Report Structure	Name of environmental study Index Executive summary Project description Baseline information Public participation plan Environmental impact characterization		
	Environmental management strategy		Prevention, mitigation and correction measures against environmental impacts Monitoring and control plan Contingency plan Closure plan Implementation and investment schedule
	Environmental management plan		
	Environmental monitoring plan		
	Compensation plan		
	Community relations plan		
	Contingency plan		
	Closure plan		
	Implementation and investment schedule		
	Environmental agreement resume		
	Name and signature of technical professionals and consulting firm participated in the formulation of report Annexes		
Project Description	Background Project name Project objectives and justification Geographical location (UTM Datum WGS 84) Legal framework Correspondent authorities Project scale estimating direct and indirect influenced areas of environmental impacts Estimated investment amount Type of infrastructure (description of components) Quantity and characteristics of solid waste to handle Project general layout Accessibility to the project area		
	Sanitary barrier (for treatment and final disposal facilities)		
	Peripheral fence		
	Project life for sanitary landfill, treatment plants or transfer stations (for sanitary landfill not shorter than 5 years)		
	Signboards Fire prevention system and security devices Weighting and register system Water supply and wastewater discharge systems		
			Vehicles cleaning system Treatment and discharge systems for wastewater generated in solid waste conditioning operations
	Collateral facilities (control station, administrative office, energy supply, warehouse, etc.) Estimation of leachate generation		
	Estimation of gases		Estimation of gases and vapors
Project Stages Description	Planning stage Construction stage Operation and maintenance stage Closure stage Post-closure stage		

Item	EIA-d (category III)	EIA-sd (category II)	DIA (category I)
Baseline Information	Location and range		
	Physical environment		
	Site selection		
	Soil (Type, structure, current soil usage and capacity for major usage of project site and direct/indirect influence areas)		
	Topography (Resume of topographic study indicating heights, curves, contour lines of the project area)*		
	Geology, geomorphology and geotechnical features (Resume of geologic, geomorphologic and geotechnical studies of the project area defining soil type, composition, stratigraphy, soil permeability, plasticity, humidity; slopes, internal/external geodynamics; number and locations of trial-pit digs must be justified according to project area extension, layout of civil constructions and roads)*		
	Hydrology and hydrogeology (Description of watersheds for mainstream and tributaries, lakes, swamps, marshlands, etc. of project influence areas with indication of their distances from the project area and aquifers inside project area and water balance)*		
	Meteorology, climate and habitats (Data of climate type, rainfall, temperature, relative humidity and wind velocity/direction recorded at closer SENAMHI's meteorological station; life zones of the project influence areas)*		
	Basic environmental monitoring results (Interpretation of environmental monitoring results of water, air and soil qualities in project area and project influence areas measured by laboratory accredited by INDECOPI)*		
	Vulnerability against natural phenomena (Description of vulnerability of the project area against flooding, landslide, earthquake, etc.)*		
	Biological environment		
	Description of ecosystems (Description of landscape units, aspects of factors endangering preservation of habitat or ecosystems and vulnerable ecosystems)		
	Natural vegetation (Type of terrestrial/aquatic vegetation, diversity, abundance, dominant species, commercial interest species, endemic species, endangered species referred in scientific and common nomenclatures)		
	General fauna (Type of terrestrial/aquatic vegetation, diversity, abundance, migratory species, endemic species, endangered species, major reported plague and/or harmful species referred in scientific and common nomenclatures)		
	Natural protected areas (Description of overlapping situation of project site with natural protected areas or their buffer zones referring to the report or technical opinion of SERNANP)		
	Social, economical, cultural and anthropological environment		
	Social environment (Demographic information of the project influence areas, housing and basic services: water supply, sewerage, solid waste handling and disposal, electricity, main economical activity, tourism, recreation, sports, infrastructure: communication facilities, transportation, education, roads, railways, accessibility, etc.)		
	Economical environment (Employment by activity sector, income per capita, availability of local enterprises for goods and services supply required by the project, level of dependency of the local population to the project, etc.)		
	Cultural environment (Existence of archeological, historical, scientifically, religiously, landscape, parks, reserves, etc. sites that can be affected by the project)		
	Existence of archeological remains (Explanation on the existence of archeological remains in the project area)		
	Health and morbidity (Epidemiologic analysis for the population in the project affected areas including health benefits and risks)		
	General cartography (Location and thematic maps and charts with relevant baseline information)		
	Current land use (Considering land availability and tenure)		
	Vulnerability against anthropological activities		

Item	EIA-d (category III)	EIA-sd (category II)	DIA (category I)
Public Participation Plan*	Formulation of plan following stipulations on Title IV of Supreme Decree No. 002-2009-MINAM		
Environmental Impact Characterization*	Determination of principal environmental and social impacts for planning, construction, operation, closure and post-closure stages based on the abovementioned baseline information		
Environmental Management Strategy			
Environmental management plan	Determination of measures for prevention, mitigation and correction of environmental impacts Fulfillment of Environmental Quality Standards (ECAs) and Maximum Permissible Limits (LMPs) Qualitative issues		
Sanitary and environmental monitoring plan	Detection of changes in air, noise, soil and water qualities Use of prevailing monitoring protocols Selection of monitoring parameters (should be same of basic environmental monitoring) Determination of monitoring points Frequency of measurement Analysis methods		
Compensation Plan	Concordant with Law of Environment (Law No. 28611)		
Community Relations Plan	Plan for relations with the communities of project influence areas for the construction, operation and maintenance and closure stages		
Contingency Plan	Formulation of contingency plan for construction, operation and maintenance, closure and post-closure stages against fires, explosions, earthquakes, leachate and biogas spills, leachete plant malfunctions, impossibility of access, odors and floods		
Closure Plan	Appropriate coverage design (final disposal facility)		
	Gas control Leachate and effluents control and treatment Environmental monitoring program Contingency measures Progressive/partial, final and post-closure measures Dismantling of facilities Social and environmental assessment of final closure and post-closure measures Monthly schedule of final closure and post-closure measures Potential use of the area after closure		
	Post-closure program: not shorter than 10 years for final disposal facilities not shorter than 5 years for the rest of facilities		Post-closure program not shorter than 5 years
	Other studies established by correspondent authority		
Implementation and Investment Schedule	Monitoring and control plan schedule Frequency of report submission		
Resume Table	Environmental agreements involved with Environmental Management Strategy Responsible identification Associated costs		
Economical Valuation of Environmental Impacts	Economical valuation of environmental impacts in the project area and its influence area using applicative methodologies		

Item	EIA-d (category III)	EIA-sd (category II)	DIA (category I)
Prevention, Mitigation and Correction Measures			Determination of measures for prevention, mitigation and correction of environmental impacts for planning, construction, operation, closure and post-closure stages
Monitoring and Control Plan			Development of plan for monitoring and control for effluents, soil and gases (odor) Fulfillment of maximum permitted limits
Annexes	Geo-referenced chart (UTM Datum WGS 84) with direct and indirect influence areas showing distances to closer villages		Geo-referenced chart (UTM Datum WGS 84) with direct and indirect influence areas showing distances to closer houses/villages
	1:5,000 scaled chart of the project location		1:5,000 scaled chart of the location of facility and administrative office
	Topographic chart of the project area referred in UTM Datum WGS 84 coordinates		
	Geo-referenced chart for the location of filling material pit in UTM Datum WGS 84 coordinates		
			1:100 scaled chart of the facility and administrative office layouts Elevations chart of plant layouts in appropriate scale Chart of location of security devices and fire control Chart of water supply and sewage systems including wastewater treatment and discharge Chart of vehicle cleaning system Chart of treatment and discharge systems of wastewater generated by solid waste conditioning operations
	Other correspondent charts		

** Complementary/additional requirements are described in Table 2.7-7*

Table 2.7-7 Complementary and Additional Requirements for Table 2.7-6
(Proposed by MINSA/DIGESA Administrative Directive Bill)

<table>
<tr><th>Item</th><th>EIA-d (category III)</th><th>EIA-sd (category II)</th><th>DIA (category I)</th></tr>
<tr><td colspan="4">Baseline Information</td></tr>
<tr><td>Topography</td><td colspan="2">Topographical measures must referred to official benchmark using high accuracy level equipment
Data showed on geo-referred chart</td><td></td></tr>
<tr><td>Geology, geomorphology and geotechnical features</td><td colspan="2">Data must be correlated to soil analysis conducted by accredited laboratory
Study report must be certified by a professional engineer in the specialty</td><td></td></tr>
<tr><td>Hydrology and hydrogeology</td><td colspan="2">Ground plan chart
Geophysical profiles for the aquifers justified by geophysical study signed by a professional engineer of the specialty in case of sanitary landfill construction</td><td></td></tr>
<tr><td rowspan="2">Meteorology, climate and habitats</td><td>Rainfall, temperature and relative humidity: monthly maximum, minimum and median values and monthly averages for at least 24 months</td><td colspan="2">Rainfall, temperature and relative humidity: monthly maximum, minimum and median values and monthly averages for at least 12 months</td></tr>
<tr><td colspan="3">Wind velocity/direction measured for at least 48 consecutive hours indicating direction with respect of closer population</td></tr>
<tr><td rowspan="6">Basic environmental monitoring results (Analysis must conduct at laboratory accredited by INDECOPI. DIGESA requests validation for each analysis parameter method)</td><td colspan="3">Air quality parameters:
Particulate matter PM10
PM2.5
H_2S
SO_2</td></tr>
<tr><td colspan="2">CH_4 (only for final disposal facilities)</td><td></td></tr>
<tr><td colspan="3">NO_X</td></tr>
<tr><td colspan="2"></td><td>Pb
Others depending of type of residue to handle</td></tr>
<tr><td colspan="3">Noise level in dB</td></tr>
<tr><td colspan="3">Surface water parameters:
Turbidity
Alkalinity
Sulfates
Total suspended solids
Metals (Cd, Hg, Pb, As, Cu, Fe, Mn, Zn)
Nitrates
Total coliforms
Thermo-tolerant coliforms
Biochemical oxygen demand (BOD)
Dissolved oxygen</td></tr>
<tr><td colspan="3">Groundwater parameters:
Metals (Cd, Hg, Pb, As, Cu, Fe, Mn, Zn)
Nitrates
Sulfates
Total coliforms
Thermo-tolerant coliforms
BOD</td></tr>
</table>

Item	EIA-d (category III)	EIA-sd (category II)	DIA (category I)
	Effluent parameters: Grease Sedimentable suspended solids BOD pH Temperature		
Vulnerability against natural phenomena	Assessment conducted by competent institution of National Civil Defense System		
Public Participation Plan			
Public Audience	Records of observations claimed by the participants and the correspondent replies should be submitted.	In case of Authority establishes requirement of public audience, records of observations required by the participants and the correspondent replies should be submitted.	
Environmental Impact Characterization			
Procedure	Identification, evaluation, valuation and classification of negative and positive environmental impacts using internationally accepted methodologies considering following factors: Comparison of expected scenario with the situation of baseline information Prevention of direct/indirect, cumulative and synergic impacts and assessment of induced risks Environmental Quality Standards (ECA) and Maximum Permissible Limits (LMP)		

Furthermore, the Administrative Directive bill stipulates additional requirements for the project description inherent to infrastructures of sanitary landfills as described in Table 2.7-8.

Table 2.7-8 Project Description for Sanitary Landfill
(Proposed by MINSA/DIGESA Administrative Directive Bill)

Item	EIA-d (category III)	EIA-sd (category II)
Project Description for Sanitary Landfill	Estimation of required filling material describing material source, extraction point and availability Landfill bottom and slope waterproofing Leachate collection and handling system Gases collection and handling system Run-off water collection and drainage system Observation well for leachate	

2.7.2 Procedures of Environmental Impact Assessment

(1) Evaluation Process

D.S. No. 019-2009-MINAM establishes that EIA documents must be formulated by professional entity (individual or group) certified and registered at correspondent institution. However, due to MINSA/DIGESA had not implemented the register system for this purpose, current EIA process for waste management project are not conditioned.

Regarding approval schedules for EIA process, D.S. No. 019-2009-MINAM establishes evaluation periods as follows:

For EIA-sd cases 90 working days for the evaluation staged by 40 working days for initial evaluation, 30 working days for evaluation of corrections and 20 working days for the issuance of the respective judgment.

For EIA-d cases 120 working days for the evaluation staged by 70 working days for initial evaluation, 30 working days for evaluation of corrections and 20 working days for the issuance of the respective judgment.

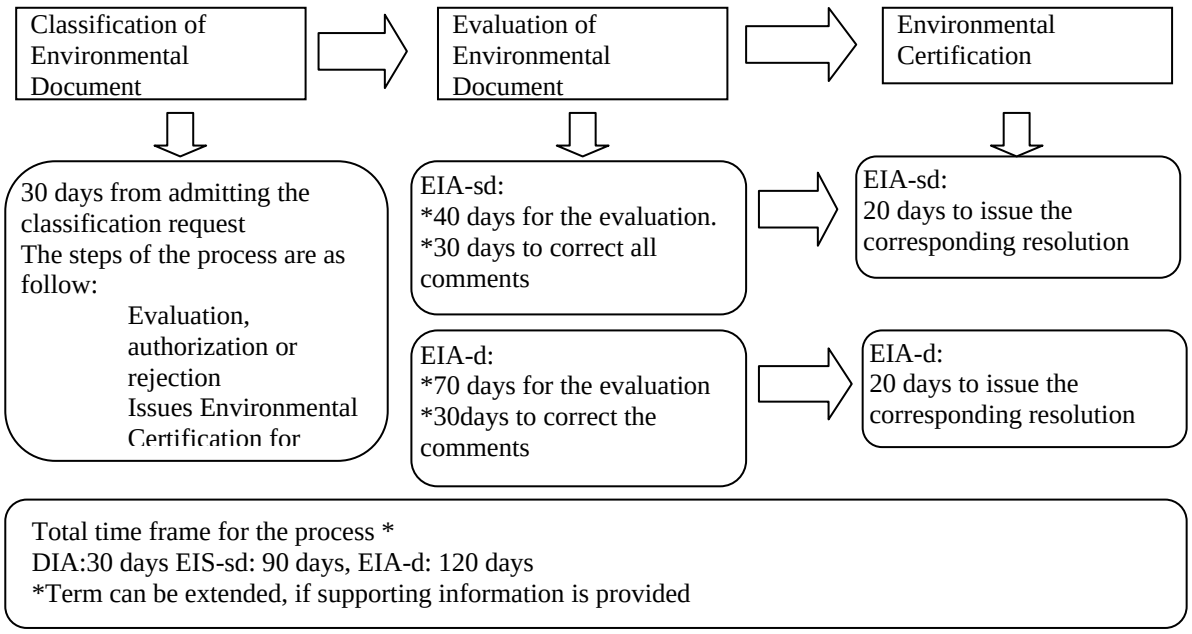


Figure 2.7-1 Schedule and Process of Environmental Certification

While MINSA/DIGESA has not defined SEIA categorization for waste management facilities, EIA approval process is being practiced without official norms. DIGESA's TUPA does not discriminate SEIA screening criteria for infrastructures of solid waste transfer, treatment and final disposal. Accordingly EIA has been required for all of solid waste facilities, requiring 30 days for the initial evaluation. It is expected that this situation can be improved after enactment of Administrative Directive for Elaboration of Environmental Studies on Municipality Managed Infrastructures of Solid Wastes.

Office in charge of the evaluation of EIA concerning waste management infrastructures is DIGESA's Executive Directorate of Basic Sanitation. In case of confutation of the evaluation result, General Director of DIGESA will issue the definitive judgment.

According to cases in past, a project containing some of the waste management facilities said transfer station, treatment plants and final disposal site located in plural sites requires separate EIA studies and reports for each site.

(2) EIA Requirements in SNIP Procedures

SNIP discriminates requirements of PIPs evaluation procedures depending on their investment amounts. Following this criteria, comprehensiveness of EIA requirements are involved. By the

other hand, SNIP process requests minimum duties permitting to the respective ministries and institutions to add complementary exigencies.

As mentioned above, EIA evaluation of waste management project is a competence of DIGESA. Following the leading cases, projects containing a component of final disposal of waste require EIA-d level evaluation. Components of transfer and treatment are still uncertain. However, SEIA categorization criteria proposed in the MINSA/DIGESA administrative directive bill are actually used (see Table 2.7-4).

Table 2.7-9 shows the contents of environmental studies required for the SWM projects in function of investment amounts.

Table 2.7-9 Environmental Analysis required for SNIP SWM Projects

Investment Amount	Lower than S/.6 million	Between S/.6 million and S/.10 million	Bigger than S/.10 million
Required PIP study level	Profile	Pre-feasibility study	Feasibility study
SEIA categorization	Not specified		
SNIP requirement	Not specified		EIA-d
Contents of environmental impact assessment required for PIP approval/viability evaluation	Identification of affected environmental variables Description of positive and negative impacts Mitigation measures for negative impacts Cost estimation of mitigation measures	Description of positive and negative impacts Mitigation measures for negative impacts Cost estimation of mitigation measures	Incorporation of approved EIA by DIGESA Inclusion of costs for mitigation measures referred in approved EIA
Special considerations for JICA Survey Projects	Nil		Incorporation of EIA submitted to DIGESA Submission of approved EIA by DIGESA as condition of FS approval by MINSA-OPI
Sources:	Annex SNIP 05 A	Annex SNIP 06	Annex SNIP 07

2.7.3 Provisional Environmental and Social Consideration Checklists

To be undertaken appropriate environmental and social considerations, it is required to prepare the Environmental and Social Consideration Checklists in projects which JICA funds. As per JICA request, the preparatory survey which was started before 30th June, 2010 is prepared the checklists according to JBIC Guideline for Environmental and Social Consideration of 2002[1].

SWM project as this survey is necessary to prepare the checklists based on "Wastes Management and Disposal" and "Forestry project". The checklists will be used for making JICA decisions for the loan agreement.

This provisional checklists is prepared for the program which is consisted of 23 projects. The checklists is attached Appendix-9 and 10.

[1] Japan Bank for International Cooperation Guidelines for Confirmation of Environmental and Social Considerations, April 2002, Japan Bank for International Cooperation

2.7.4 Preparation of EIA in the Preparatory Survey

(1) EIA Categorization of Projects

A project containing any of the waste management facilities said transfer station, treatment plants and final disposal site in different locations requires submission of EIA reports in separate. However, waste management facilities of all projects are designed in same locations, and preparation of one EIA report is required. Therefore, the highest EIA categorization among waste management facilities in same location is required for EIA study. According to Table 2.7-4 and Table 2.7-9, EIA categorization of projects are shown in Table 2.7-10.

In this study, preparation of EIA-d reports is assisted by JICA survey team in six (6) projects which are required FS level in SNIP procedure such as Puno, Juliaca, Piura, Sullana, Huanuco and Tarapoto. EIA-d or EIA-sd reports of remaining 17 projects are to be prepared by each municipality in pre-investment stage.

Table 2.7-10 EIA Categorization of Projects

Project name	Required PIP study level	Disposal amount (t/d) 2015 year	Landfill type*1	Capacity of Sorting plant (t/d)	Capacity of Composting plant (t/d)	EIA Categorization
1. Puno*2	FS	91	C	7.20	4.00	EIA-d
2. Juliaca*2	FS	188	C	9.00	4.00	EIA-d
3. Piura*2	FS	406	C	10.00	7.00	EIA-d
4. Nuevo Chimbote	Pre-FS	72	C	7.40	7.00	EIA-d
5. Tumbes	Pre-FS	64	C	5.90	7.00	EIA-d
6. Sullana*2	FS	130	C	6.80	4.00	EIA-d
7. Abancay	Perfil	47	B	1.30	4.00	EIA-sd
8. Huanuco*2	FS	110	C	4.00	7.00	EIA-d
9. Paita	Pre-FS	44	B	4.80	4.00	EIA-sd
10.Puerto Maldonado	Pre-FS	52	C	7.80	4.00	EIA-d
11.Talara	Pre-FS	63	C	7.30	4.00	EIA-d
12.Moyobamba	Pre-FS	60	C	2.50	4.00	EIA-d
13.Tarapoto*2	FS	158	C	5.80	7.00	EIA-d
14.Chachapoyas	Perfil	20	B	2.60	4.00	EIA-sd
15.Ilave	Perfil	13	A	3.60	1.10	EIA-sd
16.Azangaro	Perfil	7	A	1.60	1.10	EIA-sd
17.Chincha	Perfil	48	B	3.50	4.00	EIA-sd
18.Sechura	Pre-FS	25	B	3.80	1.10	EIA-sd
19.Huacho	Pre-FS	147	C	3.80	4.00	EIA-d
20.Tarma	Perfil	29	B	2.30	4.00	EIA-sd
21.Ferrenafe	Perfil	45	B	1.90	4.00	EIA-sd
22.Santiago	Perfil	7	A	1.70	1.10	EIA-sd
23.Aymaraes	Perfil	4	A	0.10	1.10	EIA-sd

Source: JICA survey team

*Note *1: A: Manual sanitary landfill, B: Semi-Mechanized sanitary landfill, C: Mechanized Sanitary Landfill*
**2: EIA-d report has been prepared for these projects which are FS level projects in SNIP procedure.*

(2) Situation and Schedule

Since July 2010, EIA reports for six (6) projects have been prepared according to the draft Administrative Directive in this survey whose contents had been previously confirmed with DIGESA based on regulation of Law No. 27446. EIA reports except Juliaca were submitted to DIGESA. Progress and situation of preparation of each EIA are shown in Table 2.7-11.

Table 2.7-11 Progress and Situation of Preparation of each EIA

City	Submission to DIGESA	Site Inspection by DIGESA	Comment from DIGESA	Resubmission to DIGESA	Situation
Tarapoto	Nov. 26th	Jan. 25th	Mar. 4th	Mar. 23th	Revising report based on comments from DIGESA to be approved.
Piura	Jan. 17th	Feb. 24th	Mar. 25th (un official date)	(middle of April)	Revising report based on comments from DIGESA to be approved
Puno	Mar. 3rd	Apr. 15th	-	-	Waiting for comments from DIGESA
Sullana	Mar. 25th	-	-	-	Waiting for comments from DIGESA
Huanuco	Mar. 25th	-	-	-	Waiting for comments from DIGESA
Juliaca	Not yet	-	-	-	Waiting for certification of CIRA After receiving the certification, it will be submitted to DIGESA.

Source: JICA survey team

Approval of six (6) EIA reports is expected by middle September 2011 according to the evaluation process in Peru. Estimated schedule until the approval is show in Figure 2.7-2.

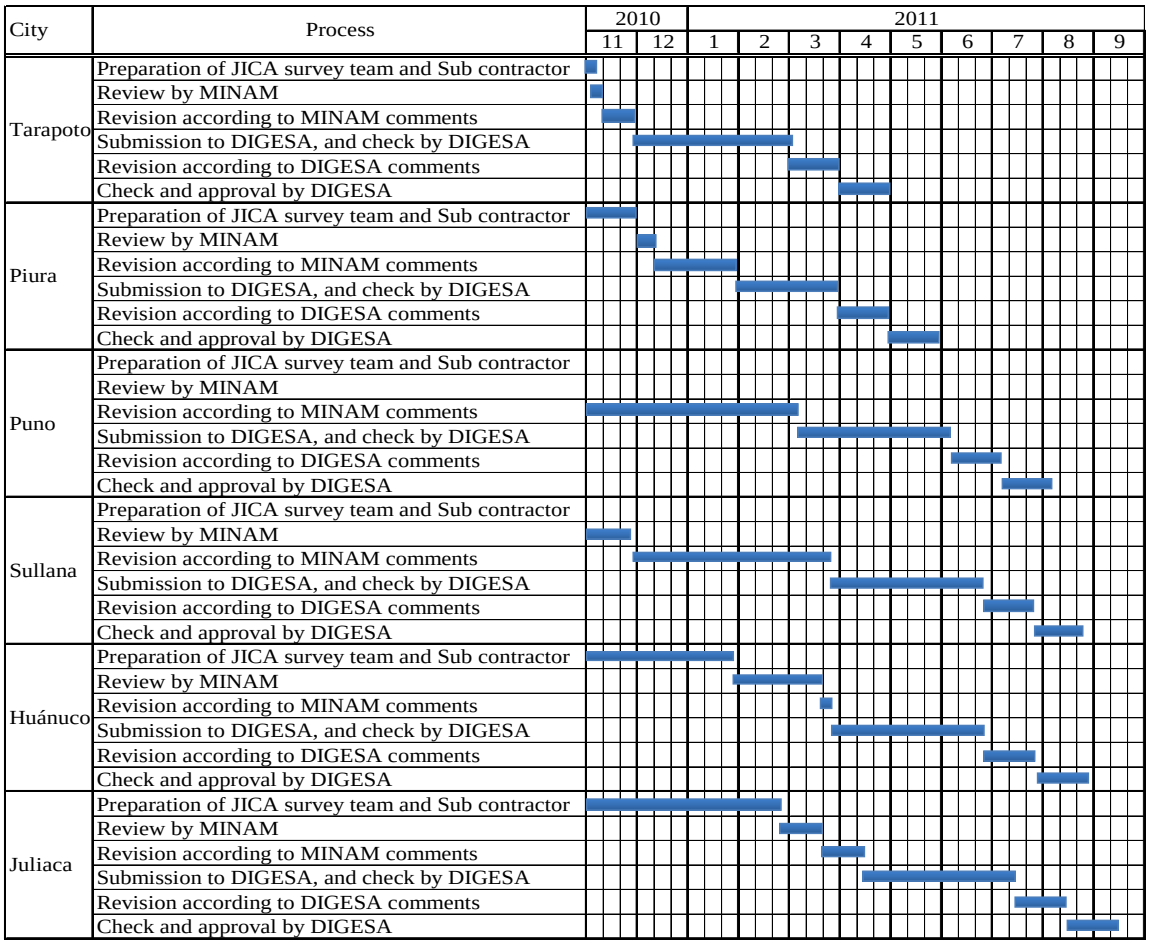


Figure 2.7-2 Estimated Schedule until Approval

2.8 COST ESTIMATE

2.8.1 Methodology of Cost Estimate

The following conditions and assumption are considered in the cost estimate.

- The price level of the estimate is set at February 2011 where the exchange rate between Peruvian Nuevo Sole and Japanese Yen is PEN(S/.)=JPY29.3, and USD1=2.82 PEN.
- The cost of the projects includes 1) equipment and materials, 2) construction of facilities 3) capacity development & awareness raising, 4) consulting services and 5) tax (IGV).
- For the construction, administration cost is calculated 20% of cost as practiced in Peru.
- The unit prices of construction works are estimated by referring to in house data and past experiences and current market prices applied and adopted in other government projects.
- The work quantities are calculated based on the design prepared in this survey.
- Cost of international consultant is estimated for necessary service initial investment.
- Tax and custom duties have been added to the direct cost by applying the tax rate (IGV=19%).
- The fee of local consultant for detailed engineering design work which is to be hired by Peru side is not included.
- The land acquisition shall be completed by each project executing agency (municipalities or the central government) therefore, these costs are not included in the cost estimate.
- Price escalation and physical contingency are not considered in PIPs. These indirect factors are to be considered for yen loan project. The cost estimate for yen loan is shown in Chapter 3.2.4

As for the equipment and materials which is urgently required for the operation, such components would be purchased by the fund prepared by Peru side before implementation of yen loan project. However, the cost estimate includes all materials required in the proposed 23 projects because it has not been clear yet what components can be funded and executed by Peru side.

2.8.2 Cost Estimate of Investment for the Program FS

(1) Investment Cost the Program

The program cost indicated in the program FS is shown inTable 2.8-1. Total investment cost for the program was estimated as S/. 83.63million. The estimated investment cost of 23 projects under JICA is S/. 65.39 million.

Table 2.8-1 Investment Cost of Program FS (Million S/.)

No.	Items	JICA (23 project)	IDB (8 project)	Total
1	Direct cost	164.17	45.13	191.3
2	Administration	12.56	3.82	16.38
3	Technical service	8.08	2.29	10.37
4	Supervision	8.08	2.56	10.64
Sub-Total (million S/.)		192.89	53.80	246.69
Sub-Total (million USD)		65.39	18.24	83.63

No.	Items	JICA (23 project)	IDB (8 project)	Total
5	UEP	9.4	2.6	12.0
6	Consulting service (international)	14.6	1.3	15.9
Total (million S/.)		216.9	57.7	274.6
Total (converted to million USD)		73.52	19.56	93.08

Source: Program FS submitted in April 2011

Note: Different exchange rate (USD1= PEN 2.95) is used in the program FS since the SNIP procedure was started in June 2010.

(2) Investment Cost of the Project

Investment cost of each project is estimated as shown in Table 2.8-2

Table 2.8-2 Investment Cost of each Project (Million S/.)

	Project	Direct Cost	Administration	Technical Service	Supervision	Total
1	Puno	10.31	0.82	0.49	0.49	12.12
2	Juliaca	15.10	1.10	0.73	0.73	17.66
3	Piura	19.02	1.60	0.93	0.93	22.50
4	Nuevo Chimbote	7.89	0.44	0.39	0.39	9.12
5	Tumbes	7.75	0.46	0.38	0.38	8.98
6	Sullana	10.09	0.67	0.48	0.48	11.72
7	Abancay	4.97	0.33	0.25	0.25	5.80
8	Huanuco	10.38	0.75	0.50	0.50	12.14
9	Paita	5.26	0.46	0.27	0.27	6.26
10	Puerto Maldonado	8.46	0.61	0.41	0.41	9.89
11	Talara	7.84	0.39	0.37	0.37	8.97
12	Moyobamba	6.82	0.66	0.34	0.34	8.15
13	Tarapoto	9.96	0.66	0.47	0.47	11.57
14	Chachapoyas	4.07	0.34	0.20	0.20	4.81
15	Ilave	2.51	0.29	0.13	0.13	3.05
16	Azangaro	2.01	0.28	0.10	0.10	2.49
17	Chincha	4.79	0.47	0.24	0.24	5.74
18	Sechura	5.05	0.42	0.31	0.31	6.08
19	Huacho	8.47	0.62	0.41	0.41	9.90
20	Tarma	4.59	0.34	0.23	0.23	5.38
21	Ferrenafe	4.71	0.41	0.24	0.24	5.59
22	Santiago	2.32	0.23	0.12	0.12	2.79
23	Aymaraes	1.81	0.20	0.09	0.09	2.19
	Total (JICA)	164.17	12.56	8.08	8.08	192.89
1	Chancay	5.14	0.00	0.46	0.56	6.15
2	Pozuzo	2.08	0.26	0.08	0.10	2.53
3	Yauyos	1.24	0.17	0.05	0.06	1.52
4	Bagua	4.63	0.49	0.19	0.23	5.54
5	Huamanga	15.43	1.31	0.77	0.77	18.28
6	Oxapampa	4.07	0.36	0.16	0.20	4.80
7	San Juan Bautista	7.68	0.64	0.38	0.38	9.09
8	Andahuaylas	4.85	0.61	0.19	0.24	5.90
	Total (IDB)	45.13	3.83	2.29	2.56	53.80
	TOTAL	209.30	16.39	10.37	10.64	246.69

Source: Program FS submitted in April 2011

Note: Different exchange rate (USD1= PEN 2.95) is used in the program FS since the SNIP procedure was started in June 2010.

2.9 FINANCIAL PLAN

2.9.1 Basic Condition of the Financial Plan

(1) Program Cost

Program cost means the cost of Program F/S consolidating 23 JICA projects and 8 IDB projects. The Program cost consists of 4 categories: i.e. investment cost, re-investment cost, operation and maintenance (O&M) cost, and administration/consulting cost. The re-investment cost includes the extension of landfill site, the phased construction of composting plants and the replacement of equipment. The sum of the Program cost amounts to S/.1,068.6 million as shown in Table 2.9-1.

Table 2.9-1 Sum of Program F/S Cost (million S/.)

Project by	Cost by Item	Cost by Year											
		Investment	Post Investment										Total
		0	1	2	3	4	5	6	7	8	9	10	
JICA	Investment	192.9	-	-	-	-	-	-	-	-	-	-	192.9
	Re-investment	-	-	9.0	30.7	-	64.0	31.7	-	0.1	1.1	-	136.6
	O & M [1)]	-	46.9	46.9	48.1	49.5	49.7	54.3	55.2	55.2	55.2	56.0	516.8
	UEP[2)]	9.4	-	-	-	-	-	-	-	-	-	-	9.4
	Consulting [3)]	14.6	-	-	-	-	-	-	-	-	-	-	14.6
	Total	216.9	46.9	55.9	78.7	49.5	113.7	86.0	55.2	55.2	56.3	56.0	870.3
IDB	Investment	53.8	-	-	-	-	-	-	-	-	-	-	53.8
	Re-investment	-	-	0.1	7.1	2.7	12.8	8.0	-	-	0.1	-	30.8
	O & M [1)]	-	10.4	10.5	10.5	10.6	10.8	11.2	11.3	11.4	11.4	11.6	109.7
	UEP[2)]	2.6	-	-	-	-	-	-	-	-	-	-	2.6
	Consulting [3)]	1.3	-	-	-	-	-	-	-	-	-	-	1.3
	Total	57.7	10.4	10.6	17.6	13.3	23.6	19.2	11.3	11.4	11.5	11.6	198.2
Total	Investment	246.7	-	-	-	-	-	-	-	-	-	-	246.7
	Re-investment	-	-	9.1	37.8	2.7	76.8	39.7	-	0.1	1.2	-	167.4
	O & M [1)]	-	57.3	57.4	58.6	60.1	60.5	65.5	66.5	66.6	66.6	67.6	626.5
	UEP[2)]	12.0	-	-	-	-	-	-	-	-	-	-	12.0
	Consulting [3)]	15.9	-	-	-	-	-	-	-	-	-	-	15.9
	Total	274.6	57.3	66.5	96.3	62.8	137.3	105.2	66.5	66.6	67.8	67.6	1,068.6

Note: 1) Not incremental cost, but absolute cost because of applying such concept of replacing current system totally with new system. 2) Administration cost by UEP (The duration of UEP is to be 4 years). The cost is apportioned to JICA projects and IDB projects in line with respective investment amount. 3) International consulting service cost

Source: Program F/S (draft=drafted in April 2011)

(2) Financial Resource for Program Cost

The resource for the Program cost has been discussed among the parties concerned and currently is planned as follows.

1. Investment Cost	: Peruvian counterparts (Local Governments and MINAM) and Loan from Japanese Government and IDB
2. Administration cost of UEP and international consulting service cost	: Peruvian Local Governments
3. O&M Cost	: Peruvian Local Governments
4. Interest and Amortization of Loan	: Peruvian Central Government (MEF)

2.9.2 Financial Plan

(1) Investment Cost

In principle, each municipality is required to pay 20% of investment cost of its own project. However, the financial conditions of said municipalities are different; that is, some municipalities may pay 20% or more; on the other hand another cannot afford it. So, adequate share of each municipality was discussed from the view point of "Municipality Year-end Budget Surplus" or distributed amount of CANON in year 2010 according to the MEF suggestion. As a result of it, 31 municipalities were preliminarily classified into 4 types below.

Table 2.9-2 Preliminary Concept of Investment Cost Sharing

Type	Share of Investment Cost			Criteria for Sharing		Municipalities 1) (23 JICA Projects)
	Municipality	MINAM	JICA Loan	How many times the Budget Surplus is larger than Investment Cost.	or Distribution amount of CANON in 2010	
1	50%	-	50%	Larger than 2.0 times	More than 40 million S/.	Paita, Piura, Talara, Tumbes (4)
2	30%	-	70%	Larger than 1.3 times and less than 2.0 times	Between 20 and 40 million S/.	Chincha alta, Juliaca, Moyobamba, N. Chimbote, Sechura, Sullana (6)
3	20%	-	80%	Larger than 0.7 times and less than 1.3 times	Between 7 and 20 million S/.	Abancay, Azangaro, Huacho, Ilave, Puno (5)
4	0%	20%	80%	Less than 0.7 times	Less than 7 million S/.	Aymaraes, Chachapoyas, Ferrenafe, Huanuco, P.Maldonado, Santiago, Tarapoto, Tarma (8)

Note: 1) Classification of 8 IDB projects: Type 1 (1 municipality), Type 2 (zero), Type 3 (3 municipalities), Type 4 (3 municipalities) and 10% (1 municipality)
Source: Program F/S (draft)

(2) Re-investment Cost

Principally, FONCOMUN (*Fondo de Compensacion Municipal*: see the box-1 in detail) is to be apportioned to the re-investment cost.

(3) O&M Cost

Collected SWM service charges of each municipality are primary resource to cover the O&M cost of each municipality. However, the collected amount of charges is presently in a low level as mentioned in following Chapter 2.9.3 (see Table 2.9-3and Table 2.9-4 in detail), and may not be expected largely to cover entirely the O&M cost despite the collection improvement measures to be taken over the period of Program. Accordingly, FONCOMUN is also to be utilized for the uncovered portion of O&M cost, which is definite consent among the concerned parties.

Box-1 What is FONCOMUN (Fondo de Compensacion Municipal)?

1. FONCOMUN is established originally to promote investment in municipalities according to the Peru Political Constitution (article No. 196) in 1993. Afterwards, the Law 27630, issued on 12th of January 2002, enables FONCOMUN to be utilized for recurrent expenditures and debt payment.

- Resources: IPM (*Impost Promocion Municipal*) composes a great portion: 94% in 2005. IPM is distributed from consumption tax what is called IGV (*Impuesto General a las Ventas*). Taxation rate of IGV was 19% until February 2011 and changed to 18% from March 2011; of which 2% is distributed to IPM that is more than 10% of collected IGV.
- Allocation: 20% to provincial municipalities and 80% to district municipalities: among these, to be allocated to each municipality according to the indicators such as population and poverty.

FONCOMUN shared around 28% of the all local municipality's financial resources in 2008; on the other hand, 37% for the main municipalities of the 23 projects in 2009 (see Table 2.8-2).

2. FONCOMUN for SWM service

Previously, up to 30% of FONCOMUN should be distributed to SWM service. Currently, there is no limitation of the percentage in accordance with the following legislative decree.

- Chapter III, article 4 of Legislative Decree which modifies Law No. 27314 Solid Waste General Law: "The provincial and district municipalities will evaluate the necessity of assigning a percentage of the resources which they receive from FONCOMN for the SWM handling."

2.9.3 Financial Conditions of Municipalities of 23 JICA Projects

(1) Main Municipalities of 23 Projects

Table 2.9-3 shows the sum of financial figures of the main municipalities of 23 projects. The revenues of these municipalities largely depend on the distribution from the Central Government such as FONCOMUN and CANON. Taxes/charges/fees collected from the citizen and beneficiaries are only 20% of the total revenues of the municipalities.

Table 2.9-3 Financial Results and Budget: Sum of 23 Main Municipalities (million S/.)

Financial Items		Actual				Budget (PIM)
		2007	2008	2009		2010
Revenue	1. Taxes	n/a		65.7	7.7%	69.0
	2. Charges and Fees			107.0	12.5%	108.1
	3. FONCOMUN			318.7	37.2%	301.9
	4. CANON, etc			365.1	42.6%	248.2
	Total			856.5	100.0%	771.7
Expenditure	1. Recurrent	272.5	330.1	363.5	42.6%	358.6
	2. Capital	213.4	381.8	480.2	56.2%	481.2
	4. Debt payment	6.1	6.6	10.2	1.2%	12.4
	Total	492.0	718.5	853.9	100.0%	852.2
Balance		n/a		2.6	-	-80.5

Note: PIM = Prespuesto Institusional Modificado (Revised Budget as of June-July 2010)
Source: MEF website

(2) SWM Sector

Table 2.9-4 shows the cash flow of the SWM sector of the main municipalities. Collected SWM charges cover only some 30% - 40% of the entire O&M cost (see the coverage ratio of the table) because of the low collection rate. A part of FONCOMUN and CANON distributed to the municipalities from Central Government covers the rest of cost.

Table 2.9-4 Cash Flow of SWM Sector of 23 Main Municipalities (million S/.)

Cash Flow Items		Actual			Budget (PIM)
		2007	2008	2009	2010
Financial Resources	SWM charges (a)	12.3	15.9	13.6	17.5
	FONCOMUN (b)	14.0	20.0	19.9	14.9
	CANON, etc	7.5	4.8	9.0	10.6
	Total (c)	33.8	40.8	42.5	43.0
Expenditure	Personnel	20.2	24.3	25.7	27.2
	Fuel	4.4	5.9	5.8	4.5
	Others	9.2	10.6	11.0	11.3
	Total	33.8	40.8	42.5	43.0
Coverage Ratio: (a)÷(c)		36%	40%	32%	41%
Dependency on FONCOMUN: (b)÷(c)		41%	49%	47%	35%
Allocation ratio of FONCOMUN to SWM = (b) ÷ (Total FONCOMUN of municipality 318.7)				6%	-

Source: MEF website and elaboration by JICA survey team

(3) Improvement Measures for Collection of SWM Service Charges

In principle, the O&M cost generated from SWM service must be covered with users' charges. However, the O&M cost is actually covered only 30% - 40% in the 23 main municipalities as previously described.

In order to understand the current system related to SWM service charges collection, an interview survey was carried out in the 23 municipalities in December 2010 and February 2011. The result of the survey is presented in Table 2.9-5 and summarized below.

- 10 municipalities have established the registration system of such as land, building and domiciliary: e.g. Tarapoto in 1990 and Ferrenafe in 2010. However, 13 municipalities have not established the said system yet.
- 7 municipalities do not calculate the SWM cost regularly.
- Most of municipalities issue the invoice of SWM service charges and deliver it to the citizen together with building tax invoice usually in late January of the year.
- The payment place is only municipality head office in most of municipalities. Bank payment is possible in only 3 municipalities.
- SAT (Sistema de Administracion Tributaria**),** particular tax collection agency as presented in Box-2, is established in 2 municipalities: Piura and Tarapoto. The collection rate has been improving according to SAT Piura.
- Most of municipalities own PR section and have publicized tax/charges payment promotion.

Table 2.9-5 Result of Interview Survey to 23 Municipalities

Questionnaire	Answers			Answer "NO"
	YES	NO	Total	
1. Whether registration system (such as land, building, and domiciliary) exists or not	10	13	23	56 %
2. Whether calculates SWM cost or not	16	7	23	30 %
3. Whether issues invoice of SWM charges or not	20	1	21	5 %
4. Whether delivers the invoice together with building tax invoice or not	16	5	21	24 %
5. Whether any incentives for early payment exist or not	15	5	20	25 %
6. Whether any penalties for un-payment exist or not	13	7	20	35 %
7. Payment place: whether only at head office	18	4	22	18 %
8. Whether payment is possibly at bank or not	3	20	23	87 %
9. Whether is collected by SAT or not	2	21	23	91 %
10. Whether PR section exists in municipality or not	21	2	23	9 %
11. Whether has made payment promotion or not	16	3	19	16 %
12. Whether has made any SWM publication or not	14	9	23	39 %
13. Whether has utilized media for publication or not	20	3	23	13 %

Source: Interview Survey by JICA survey team

Accordingly, the Program suggests the collection rate improvement plan and actions during the project period as shown in Table 2.9-6.

Table 2.9-6 Summary of Improvement Plan on SWM Service Charges Collection

Plans	Actions		Period
1. Enhancement of administrative management including financial	Utilization of MEF assistance Program	Application of PMM and PI	Pre-investment
2. Strengthening charges collection system	Improvement of inhabitant registration book		Pre- and beginning of post- investment
	Capacity development	Clarify accurate cost and appropriate charges	
	Improvement of collection system	Establish invoice system	
		Adopt bank payment system	
		Establish collection agency (SAT)	
3. Public awareness	PRs for service improvement by project	Invitation to site visit Media	Continuously post-investment
	To convince how much the cost is and users' pay	Public meeting Publishing Media Campaign	

Note: PMM = Programa de Modernizacion de Municipal, PI = Plan de Incentivos a la mejor de la Gestion Municipal
Source: Complied by JICA survey team from PIP of 23 projects and Program F/S (draft)

The interview survey revealed that MEF committed 22 municipalities the disbursement of S/.100 million for PMM and PI. And S/.58 million was executed until 2010 to improve the collection of taxes/charges/fees: e.g. newly deployment of consultancy desks for citizen at the entrance hole of municipality building, renovation of waiting room for payers, procurement of computers and increasing staff of tax section.

Thus, the coverage ratio of the collected service charges to the expenditures is projected to increase from 32% in 2009 to 70% (target) in 2024. The financial dependency of SWM sector on FONCOMUN is expected to decrease from 48% in 2009 to 31% in 2024 (see Appendix-11).

Incidentally, FONCOMUN apportioned to SWM sector was only 6% in 2009 among total FNCOMUN of the municipalities. In 2024, it is expected to decrease to 5% despite of increasing of SWM expenditures from S/.42 million in 2009 to S/.56 million in 2024 (see Appendix-11).

BOX-2 What is SAT (*Sistema de Administracion Tributaria*) System?
In Peru, SAT was established in 9 municipalities in order to improve tax collection and to have municipality human recourses concentrate on its own services other than tax collection: 1996 in Lima (the 1st SAT in Peru), 2000 in Piura (the 3rd) and 2007 in Tarapoto. SAT is public entity with administrative and financial autonomy owned by the municipality. In general, mayor is president of the directorate.
Example: SAT Piura (SATP)
Business activities: Collection of every kind of taxes, charges and fees in the jurisdiction of Piura Municipality
Staff: Regular 56, contract 65, and temporary deliveryman 30 to 40
Revenue: 6% on collected amount
Operation Cost: 4.4 million soles (2010 budget)
Source of Data: Piura Municipality provides data/information necessary to handle
Billing to citizen: Deliver by hand at the end of January or beginning of February
Payment by citizen: 4 types (head office of SATP and municipality, bank and internet)
Incentive to payers: 10% discount for early payers
Penalty or fine: 6% of interest on delayed payment. Existing of compulsory execution system.
Collection rate: Improving every year - 60% in 2010
Other Activities: According to request of SAT Association, SATP makes consultations to other municipalities with nonexistence of SAT
Source: Interview to SATP on February 10, 2011

2.9.4 Financial Sustainability of Municipalities of 23 JICA Projects

The financial sustainability is studied from the viewpoint of the affordability of municipalities both for investment cost and post investment cost such as re-investment and O&M.

(1) Affordability for Investment Cost

As described in Chapter 2.9.2 (1), a part of the investment cost is to be paid by municipalities: i.e. the richer municipalities are expected to pay 20% or more of the cost, and the rest of municipalities to pay less than 20%. According to this criteria, the total amount payable of municipalities are estimated at S/.47.6 million as presented in Table 2.9-7.

Taxes, charges, fees, FONCOMUN and CANON are important and major municipality revenues, and these revenues are spent to current expenditures and capital expenditures. The municipality fiscal balance, i.e. annual difference between revenue and expenditure, is studied through MEF web site; most of the municipalities have recorded substantial amount of surplus since years before. General outlook by MEF suggests that this sort of surplus would continue because of growing national economy and luck of capital investment planning capability in municipalities. Therefore, the affordability for investment cost of each municipality is analyzed based on the fiscal surplus; according to MEF, the average of last 2 years from 2009 to 2010 was calculated from the website of MEF as presented in Table 2.9-7. The investment cost payable by municipalities sums to S/.47.6 million, equivalent to 26% of the fiscal surplus, which is judged to be a permissible level for municipalities.

Table 2.9-7 Affordability for Investment Cost

Items	Source of Funds		Million S/.	Share
1. Investment Cost of Program			216.9	100%
2. Cost Sharing	Counterpart	23 Municipalities	47.6	22%
		MINAM	12.5	6%
		Total	51.1	28%
	Loan	(MEF)	156.8	72%
3. Fiscal Year-end Surplus of 23 Municipalities*			184.7	
4. Ratio: Cost Sharing of Municipalities to Fiscal Surplus			26%	

*Note: * Average of 2 years from 2009 to 2010*
Source: PIP of 23 projects, Program F/S (draft) and MEF website

(2) Affordability for Re-investment and O&M Cost

The sum of re-investment and O&M cost is estimated at S/.653.4 million in 10 years. On the other hand, the SWM service charges are considered to be the same collection level of year 2009 and estimated at S/.135.9 million also in 10 years. The negative balance of S/.517.5 million would be covered with FONCOMUN.

The sum of FONCOMUN distributed from Central Government in 10 years is projected at S/.3,187.0million based on the distribution amount of year 2009. The coverage ratio of the negative balance to FONCOMUN would account for 16%, which could be considered a permissible level for the municipalities.

Table 2.9-8 Affordability for Re-investment and O&M cost

Items		Million S/.
1. Disbursement 1)	Re-investment Cost	136.6
	O&M Cost	516.8
	Total	653.4
2. Revenue 2)	Collected Charges	135.9
3. Balance		- 517.5
4. FONCOMUN to be appropriated for negative balance		517.5
5. Ratio to Total FONCOMN =4/5		16%
6. FONCOMN 3) distributed to 23 municipalities from Central Government		3,187.0

Note: 1) Total amount of disbursement over the project period of 10 years, 2) Estimate of 10 years = actually collected amount of 2009 x 10 years, and 3) Estimate of 10 years = actually distributed amount of 2009 x 10 years
Source: PIP of 23 projects, Program F/S (draft) and MEF website

In addition, a trust contract "FIDEICOMISO" is suggested to set up between municipalities and trust bank under the supervision of MINAM to make the municipalities secure the payment of re-investment and O&M cost during the project period.

Note: FIDEICOMISO
This is a legal relationship called trust fund that is regulated by SBS (*Superintendencia de Banca, Segruros y Adminstradores de Fondos de Pensiones*). A trustor (i.e. 23 municipalities) transfers its property (i.e. a part of FONCOMUN) in trust with another party called trustee such as trust bank. The trustee holds the title of trust property for the benefit of another usually specified by the trustor (i.e. disbursement to SWM services). The trust lasts at least during the project period of 10 years.

2.10 EVALUATION OF THE PROGRAM

The Program contains 31 projects: 23 of JICA and 8 of IDB. In this Preparatory Survey, the economic evaluation is conducted only for 23 project of JICA.

SNIP requires the least-cost method between two-alternative plan for economic evaluation of Project and Program. This Preparatory Survey applies the cost-benefit method for the economic evaluation by indicating Economic Rate of Return (EIRR) and Net Present Value (NPV) based on the selected alternative plan.

2.10.1 Base Data

The base data necessary for economic evaluation is assumed and projected as described below.

(1) Benefit

The benefit measurable in monetary basis to be utilizes for the evaluation is set as shown in Table 2.10-1.

Table 2.10-1 Concept of Benefit

Program Effects measurable in Monetary Basis		Benefit
1. Prevention of living environment and sanitary conditions	Remove and dispose of waste properly and sanitarily	Ability-to-pay of beneficiaries
2. Production of recyclable materials		Sale of recyclable materials
3. Prevention of natural environment	Reduction of greenhouse gas emission by recycling and composting	Reduction of CO2 emission
	Reduction of greenhouse gas emission by sanitary landfill system	

Source: JICA survey team

Methodology for benefit calculation is presented respectively in Table 2.10-2.

Table 2.10-2 Calculation of Benefit

Benefit	Measurable Indicator	Rationale
1. Ability-to-pay of beneficiaries	1) Indicator of 2% on year-wise household income of each municipality (The indicator is commonly recognized as benchmark for SWM project evaluation.)	(1) Household income of 23 municipalities was surveyed respectively in middle of 2010. (2) The average of the survey result was S/.710 per month. (3) Year-wise household number of each municipality was estimated based on the population projection.

Benefit	Measurable Indicator	Rationale
2. Sale of recyclable materials	1) Sale of paper, cardboard and plastic including PET	(1) Waste characterization survey was carried out in July 2010. (2) Waste amount of paper, cardboard and plastic was calculated on the basis of the characterization survey result. (3) Sale price was interviewed directly to the recyclers in the municipalities during 3 months from April and June of 2010: i.e. paper 0.51soles/kg, cardboard 0.11 and plastic 0.60.
3. Reduction of CO_2 emission	1) Measurable target waste such as food, paper, textile and wood 2) Such reduction of CO2 emission - derived from the introduction of semi-aerobic landfill - derived from recycling and composting	(1) Based on the above waste characterization survey (2) Calculated according to the 2006 IPCC Guidelines - Solid Waste Disposal - , and the CO2 emission calculation manual of Ministry of Environment of Japan in 2010 (3) At the price of 11.81 Euro/ton: price of sCER (secondary Certificate of Emission Right) of OTC Future of December 2011 as of February 28th of 2011 (4) Exchange rate of 3.802 S/.per Euro: medium rate as of February 24th of 2011 announced by BCRP (Bank Central de Reserva del Peru)

Source: JICA survey team

(2) Economic Cost

The Program cost presented in Chapter 2.9.1 is estimated at market price. For economic evaluation, therefore, this Program cost has to be converted into economic cost (or social cost here in Peru) by using so called conversion factor. Table 2.10-3 shows the conversion factors that SNIP requires for economic evaluation. This Preparatory Survey applies also the same conversion factors.

Table 2.10-3 Conversion Factors required by SNIP

Cost		Conversion Factor
1. Procurement of Goods	Domestic	0.84
	Import	0.81
2. Fuel		0.66
3. Administration and Engineering		0.84
4. Worker	Skilled	0.91
	Non-skilled: urban coastal area	0.68
	Non-skilled: urban mountain area	0.60
	Non-skilled: urban forest area	0.63

Source: SNIP Annex 9, MEF

(3) Discount Rate

SNIP requires 11% of discount rate for economic evaluation, which is applied to Project and Program. Consequently this Preparatory Survey will apply also the same discount rate of 11% for economic evaluation.

(4) Time Horizon

The period of the Program is set at 11 years including 1 year of investment stage and 10 years of post investment stage. The Program is evaluated in line with this period: i.e. 10 years of time

horizon. Salvaged value is not considered at the end of Program year because of no remaining of substantial value.

2.10.2 Result of Economic Evaluation

(1) Economic Internal Rate of Return (EIRR) and Net Present Value (NPV)

Economic evaluation of the Program was conducted to compute EIRR and NPV applying all above criteria described in the previous Chapter of 2.10.1. Consequently, as shown in, EIRR of the Program F/S resulted in 33%, above the level of discount rate of 11%, and NPV resulted in positive figure of S/.205.9 million (see Appendix-12). Thus, the Program is judged to be feasible from the economic point of view.

Incidentally, this Preparatory Survey conducted also economic evaluation separately in 3 categories: i.e. 1) consolidation of 23 projects, 2) SNIP level consolidation of 23 projects – F/S, Pre F/S and Perfil, and 3) each of 23 projects. The result is also presented in Table 2.10-4 and summarized as follows.

- Consolidation of 23 projects: indicates 38% of EIRR, above the level of discount rate of 11%

- Consolidation of SNIP level of F/S, Per-F/S and Perfil: indicates 48%, 33% and 19% of EIRR, also above the level of discount rate of 11% respectively

- Generally, F/S projects indicate larger EIRR because of higher cost effectiveness derived from economic scale; that is, relatively lower project cost compared with high level of waste amount generated by the larger population size in the areas.

- In contrary, perfil projects indicate smaller EIRR because of lower cost effectiveness. As is obvious, the project of Aymaraes, only one municipality with a result of negative EIRR, is a typical example.

Table 2.10-4 Result of Economic Evaluation

Classification			NPV (S/.000)			EIRR	Sensitivity Analysis (variation to reach the breakeven EIRR of 11%)	
			Cost	Benefit	Net		Cost increase	Benefit decrease
Program (Draft)			470,384	676,253	205,870	33%	43%	-30%
Consolidation of 23 JICA projects			447,857	676,253	228,396	38%	50%	-33%
a	Consolidation of 6 F/S level projects		218,622	363,480	144,858	48%	66%	-39%
b	Consolidation of 9 Pre-F/S level projects		167,235	239,310	72,075	33%	42%	-29%
c	Consolidation of 8 Perfil level projects		62,000	73,463	11,463	19%	18%	-15%
Each of 23 JICA projects								
1	PUNO	F/S	30,155	57,553	27,398	60%	91%	-48%
2	JULIACA	F/S	43,955	84,642	40,687	60%	92%	-48%
3	PIURA	F/S	63,094	107,165	44,071	56%	70%	-41%
4	NUEVO CHIMBOTE	Pre F/S	19,168	34,012	14,844	48%	77%	-44%
5	TUMBES	Pre F/S	24,630	41,016	16,386	51%	67%	-40%
6	SULLANA	F/S	34,454	46,996	12,542	36%	36%	-27%
7	ABANCAY	Perfil	13,205	17,900	4,695	30%	35%	-26%
8	HUANUCO	F/S	21,592	31,909	10,317	32%	48%	-32%
9	PAITA	Pre F/S	14,915	24,010	9,095	44%	61%	38%
10	P. MALDONADO	Pre F/S	20,610	23,129	2,519	17%	12%	-11%
11	TALARA	Pre F/S	19,524	25,313	5,789	26%	29%	-22%
12	MOYOBAMBA	Pre F/S	15,584	19,776	4,192	23%	27%	-21%
13	TARAPOTO	F/S	25,373	35,216	9,842	31%	38%	-28%
14	CHACHAPOYAS	Perfil	9,103	9,724	621	14%	6%	-5%
15	ILAVE	Perfil	6,119	11,347	5,228	47%	85%	-46%
16	AZANGARO	Perfil	4,542	5,411	869	19%	19%	-16%
17	CHINCHA	Perfil	16,828	18,290	1,461	17%	8%	-8%
18	SECHURA	Pre F/S	11,388	17,466	6,078	34%	53%	-34%
19	HUACHO	Pre F/S	24,588	36,299	11,711	39%	47%	-32%
20	TARMA	Perfil	11,109	11,830	721	15%	5%	-5%
21	FERRENAFE	Perfil	10,049	10,049	0	11%	-	-
22	SANTIAGO	Perfil	4,339	5,641	1,303	23%	29%	-22%
23	AYMARAES	Perfil	3,535	1,561	-1,973	-	-	-

Note: Cost of administration by UEP and international consultant service is included in the Program, but not in the Projects.
Source: PIP of 23 projects and Program F/S (draft)

(2) Sensitivity Analysis

The following methodology was applied for sensitivity analysis in this Preparatory Survey.

Variation 1: increase of Program cost
Variation 2: decrease of Program benefit

Both variations are apportioned respectively to define the breakeven point of EIRR until reaching 11%. The variation resulted from this analysis is presented also in Table 2.10-4. Thus, the Program could be judged to afford a cost increase up to 43% and a benefit decrease up to 30% respectively.

2.11 SUBMITTED REPORTS DURING THE PREPARATORY SURVEY

Submitted PIPs reports to MINAM from JICA survey team during the preparatory survey are shown in a following table.

Table 2.11-1 Submitted Reports to MINAM during the Preparatory Survey

No.	Project Name	SNIP Level	Perfil	PreFS	FS	EIA
1	Puno	F/S	*1	–	Mar 28, 2011	Mar 31, 2011
2	Juliaca	F/S	Mar 2, 2011	–	Mar 31, 2011	April 6, 2011
3	Piura	F/S	Feb 21, 2011	–	Mar 28, 2011	Mar 31, 2011
4	Nuevo Chimbote	Pre-F/S	Mar 11, 2011	–	–	–
5	Tumbes	Pre-F/S	Feb 04, 2011	Mar 31, 2011	–	–
6	Sullana	F/S	Feb 04, 2011	–	Mar 28, 2011	Mar 31, 2011
7	Abancay	Perfil	Feb 2, 2011	–	–	–
8	Huanuco	F/S	Feb 21, 2011	–	Mar 31, 2011	April 6, 2011
9	Paita	Pre-F/S	*1	Mar 31, 2011	–	–
10	Pto Maldonado	Pre-F/S	*1	Mar 31, 2011	–	–
11	Talara	Pre-F/S	Feb 21, 2011	Mar 31, 2011	–	–
12	Moyobamba	Pre-F/S	Feb 04, 2011	Mar 31, 2011	–	–
13	Tarapoto	F/S	Feb 17, 2011		Mar 31, 2011	April 6, 2011
14	Chachapoyas	Perfil	Feb 2, 2011	–	–	–
15	Ilave	Perfil	Feb 2, 2011	–	–	–
16	Azangaro	Perfil	Feb 2, 2011	–	–	–
17	Chincha	Perfil	Feb 2, 2011	–	–	–
18	Sechura	Pre-F/S	*1	Mar 31, 2011	–	–
19	Huacho	Pre-F/S	Feb 4, 2011	Mar 31, 2011		
20	Tarma	Perfil	Feb 2, 2011	–	–	–
21	Ferrenafe	Perfil	Feb 11, 2011	–	–	–
22	Santiago	Perfil	Mar 2, 2011	–	–	–
23	Aymaraes	Perfil	Feb 18, 2011	–	–	–
	Program		Mar 16, 2011	–	Mar 25, 2011	–

Source: JICA survey team
*Note:*1)Perfil is not necessary for these four projects*
**2) the PIPs reports especially perfils have been submitted several times from JICA survey team to MINAM. The dates indicated in the table above are those of last submission during the survey.*

CHAPTER 3 PROPOSED PROJECT SCOPE OF THE YEN LOAN PROJECT

3.1 CONDITIONS TO DECIDE SCOPE OF THE YEN LOAN PROJECT

3.1.1 Understanding of loan utilization for the project

This program has been initiated by MINAM with mutual understanding with JICA and IDB that the program and projects, after appraisal of them, would be implemented by using loan of these two donors.

This program will be also implemented according to the loan plan prepared by MEF. While the amount of loan will be decided after negotiation between donors and Peruvian Government, the Central Government contemplates USD56million as maximum from Yen loan. The planed amount for the program is shown in Table 3.1-1. This program is recognized as phase 1 of the national SWM program in Peru. All governmental entities involved in the program preparation regards the figures of loan shown in table as maximum. So, if the program may cost more than planned, Peruvian Government have to increase the amount and portion of counterpart fund unless some projects would be eliminated from the program.

As seen in Table 3.1-1 Peruvian counterpart funds have to be allocated for implementation of the program. It is assumed that the funds will mainly cover IGV for which loan money can not be used.

Table 3.1-1 Planned Cost and Loan Amount for the Program

Phase	Loan amount (USD)		Counterpart funds (USD)	Total
First phase (This program)	JICA	56.00	14.00	70.00
	IDB	15.00	3.75	18.75
Second phase	JICA	30.00	7.50	37.50
Total		101.00	25.25	126.25

Source: Ministry of Economy and Finance
Note: Separate loan agreement would be made for Second phase which would target the closure of the existing open dump site in cities and improvement of SWM in smaller cities.

3.1.2 Options of Scope of the Yen Loan Project

Peruvian entities assume that yen loan would be used for only investment of the projects, and municipalities will be responsible for conducting the reinvestment including expansion of sanitary landfill and composting plant

However, the money of yen loan can be disbursed within the grace period of the loan. The grace period for a standard loan for the upper-middle-income countries is 7 years which is defined in the Terms and Conditions of the yen loan project. Accordingly, it may be possible to disburse loan for reinvestment in addition to the initial investment.

Therefore, JICA survey team has studied three options of scope based on the Terms and Conditions of Yen loans for upper middle-income countries. For, the condition of the loan and exact amount of loan will be discussed and decided between Peruvian Government and JICA in future.

Three options of scope are proposed by possibility of disbursement of loan money. It is recognized that the terms for disbursement will be after loan agreement and until end of grace period of loan. Duration of grace period varies according to loan conditions.

From the viewpoint of donors the assisted projects must be sustainable and be continuously implemented by borrowers with the expected or more benefit. In the projects, progressive development of facilities is adopted so that excessive initial investment might be avoided. However, on the other hand, the project may face difficulty of continuous operation if each municipality would not able to allocate enough budget for reinvestment such as expansion of cell of sanitary landfill. Disbursement of loan for the reinvestment is included in three options as described below.

Option 1: Initial Investment
Option 2: Option 1 + reinvestment until the project year 2
Option 3: Option 2 + reinvestment for composting until the project year 5

Table 3.1-2 Disbursement Period of Loan by Option of Project Scope

Option	Grace period	Investment (2012-2016)	Reinvestment (2016)	Reinvestment (2017-2018)
Option 1	–	x		
Option 2	5 years	x	x	
Option 3	7 years	x	x	x

Source: JICA survey team

3.2 PROPOSED IMPLEMENTATION PLAN

3.2.1 Project Scope

In accordance with progressive development of composting plant and sanitary landfill as described in Chapter 2.4, the scope of project by option is proposed as shown in Table 3.2-1.

Table 3.2-1 Scope of Yen Loan Project (3 options)

Component		Year	Option		
			1	2	3
Sweeping and storage	Investment	2012-2016	x	x	x
Sanitary landfill	Investment (Phase1)	2012-2016	x	x	x
	Reinvestment (Phase2, *perfil* levels project)	2016		x	x
	Reinvestment (Phase2, other level project)	2017-2018			x
Collection and transportation	Investment	2012-2016	x	x	x
Sorting	Investment	2012-2016	x	x	x
Composting	Investment (Aymaraes only)	2012-2016	x	x	x
	Reinvestment (Phase1, *perfil* level project)	2016		x	x
	Reinvestment (Phase1, other levels project)	2017-2018			x
Capacity development & awareness raising	Investment	2012-2016	x	x	x
Consulting service	Investment	2012-2016	x	x	x

Source: JICA survey team

3.2.2 Scope of Consulting Services

Necessary consulting services under yen loan project are proposed as follows. These services are required to prepare and implement the facility development as well as improvement of capacity of municipalities to operate the facilities and equipment. The international consulting company consists of international as well as national consultants will be hired by the UEP.

Since MINAM has proposed JICA that the detail design work of construction works such as a) detail design of the facilities b) preparation of drawing and specifications including bill of materials, and c) tender documents, will be prepared by the local consultant which will be hired by Peru side, the international consultant hired for yen loan project will review the detailed design and related documents prepared by the local consultant.. The performance and output of the local consultant shall be managed by MINAM so that all output could satisfy requirements for international bidding and JICA guideline for the contract of yen loan. Table 3.2-2 shows TOR of the consultant for yen loan project and ones of detailed design consultant hired to be by Peru side.

Table 3.2-2 TOR of Yen Loan Consultant and National Consultant for Detailed Design

TOR of the yen loan consultant	TOR of the consultant for detailed design
➢ Review of detailed design and bidding documents prepared by Peru side under supervision of MINAM ➢ Preparation of specifications and bill of quantity for proposed materials/equipment ➢ Preparation of bid package and bidding documents (construction work and materials procurement) ➢ Technical and cost evaluation of bidding ➢ Assistance of bidding procedures ➢ Supervision and management of construction work and materials/equipment procurement ➢ Project management including payment control and reporting ➢ Soft component to develop capacity of municipalities for operation of the facilities	➢ Detailed design of facilities for the project ➢ Preparation of drawings and specifications including bill of materials ➢ Preparation of bidding documents ➢ Cost estimate of bidding ➢ Structural analysis and calculations ➢ Study of design conditions including demand calculation of utilities ➢ Design of leachate treatment system ➢ Preparation of necessary applications for construction work according to the government regulations. ➢ Supplemental field survey (environmental monitoring, geological survey, topographic survey, water analysis etc.), by subcontract ➢ Preparation of report required by regulations of EIA ➢ Revision of documents shown above according to instructions by the yen loan consultant

Source: JICA survey team

(1) Review of Detail Design prepared by Peru Side

The consultant for yen loan project will be responsible in carrying out the review of documents prepared by the local consultant according to the JICA's regulations and authorized international codes and standards. For smooth implementation of facilities extension of the projects as reinvestment, it is recommended that detail design and related works required for extensions should be included in the consulting service under yen loan.

(2) Assistance of Bidding

In the case of yen loan project, MINAM shall carry out the bidding activity according to JICA's bidding procedures. International consultant will provide assistance of bidding procedure for MINAM and concerned government organizations for the proposed construction works and materials procurement. Assistance work shall cover the following:

- Preparation of bid packages
- Technical and cost evaluation
- Assistance of bidding procedures

(3) Supervision of Construction Work

Management and supervision of construction work in each project site will be done by the consultant service. Yen loan consultant will carry out the necessary construction management and supervision activities according to the JICA's regulations and authorized international codes and standards.

During construction period, civil engineer will be appointed and assigned for each project site in order to supervise and inspect the construction work directly under the consulting service.

(4) Soft Component

The yen loan consultant shall provide the following consulting services regarding capacity development and organizational development for the operation of SWM for targeted projects.

- Preparation of training programs for landfill operation including leachate treatment system
- Preparation of training programs for operation of sorting and composting
- Preparation of training programs for monitoring activities of the landfill site
- Supporting consultation for communication with the public
- Supporting consultation of organizational development

3.2.3 Implementation Schedule

(1) Conditions of Execution Schedule

The implementation schedule of yen loan project is prepared based on a standard schedule for execution of yen loan project.

MINAM will select international consultant to conduct review of detail design prepared by local consultant, supervision of construction work, preparation of tender document for material procurement, management of material procurement and other related consulting service work. MIAM have to start discussion and negotiation with JICA on the TOR as soon as it is possible to do. Otherwise it is not possible to start construction in accordance with the proposed schedule.

The following figure shows the implementation schedule of the proposed yen loan project. All of the construction work will be completed by July 2015, and also materials/equipment procurement will be completed during this period.

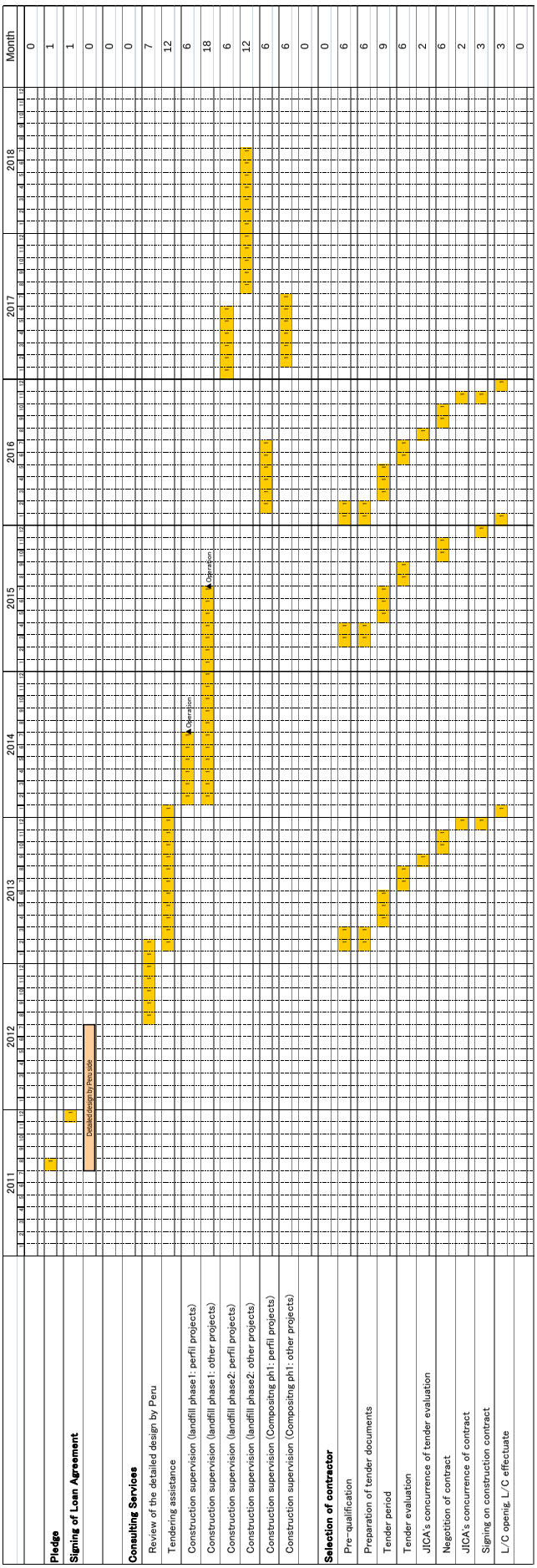


Figure 3.2-1 Implementation Schedule

		Position	2012												2013												2014												2015												Total
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
										Review ENG.																		Construction Work																								
		Pro-A International consultants																																																0
A	1	Project manager								1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						34
A	2	Solid waste facility engineer								1	1	1																1										1							1	1						7
A	3	Leachate treatment engineer									1	1																										1								1						4
A	4	Civil engineer								1	1	1	1	1														1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						23
A	5	Geotechnical engineer								1	1																																								2
A	6	Electrical engineer									1																											1								1						3
A	7	Mechanical engineer									1																											1								1						3
A	8	Structural engineer									1	1	1																																						3
A	9	Financial expert																																				1														2
A	10	Environmental expert								1	1																																					1					3
A	11	Procurement expert											1	1	1	1											1	1	1																			1	1					9
A	12	Env. Education, Organization Development Expert																												1	1					1	1											1	1					6
		Pro-B Local Consultant																																																		0
B	1	Deputy project manager																										1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						18
B	2	Civil engineer																										4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4						72
B	3	Solid waste facility engineer																										2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2						36
B	4	Leachate treatment engineer																										1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						18
B	5	Env. Education, Organization Development Expert																										4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4						72
B	6	Structural engineer																										2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2						36
B	7	Inspector/Civil																										18	18	18	18	18	18	18	11	11	11	11	11	11	11	11	11	11	11	11						240
B	8	Electrical engineer																										2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2						36
B	9	Mechanical engineer																										2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2						36
B	10	Environmental expert								1	1																																					1					3
B	11	Procurement expert								2	2	2	2	2	2															1	1						1	1											2	2					20
																																																			0
																																																				0
		[Total of Pro-A]	**26**												**13**												**35**												**25**												**99**
		[Total of Pro-B]	**12**												**2**												**365**												**208**												**587**
		[Total of Pro-A+Pro-B]	38												15												400												233												686
		Total Cost of FC for Each Month(Pro-A)	0												0												0												0												0
		Total Cost of FC for Each Month(Pro-B)	0												0												0												0												0
		Total Cost of LC for Each Month(Pro-A)	0												0												0												0												0
		Total Cost of LC for Each Month(Pro-B)	0												0												0												0												0
																																																			0
C	1	Translation/Interpreater								2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2						58
C	2	Secretary/Accountant								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3						68
C	3	Auto Cad operator								2	2	2	2	2	2	1																																						13
C	4	Office staff								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						36
C	5	Driver								2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	2	2	1	1	1	1	1	1	2	2						47
C	6	Security								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						36
																																																			0
																																																				0
		[Total of Supporting Staff]	**45**												**64**												**91**												**58**												**258**
		Total Cost of LC for Each Month(SS)	0												0												0												0												0
		Grand Total	**83**												**79**												**491**												**291**												**944**

Figure 3.2-2 Manning Schedule of the Consultant for Yen Loan Project

(2) Consulting Service

Following Table shows the international as well as notional consultant required to provide the consulting service input schedule. Upon signing of construction contract between the UEP and the contractor, supervision of work will be carried out by the consultant.

3.2.4 Cost Estimate for the Yen Loan Project

(1) Conditions of Cost Estimate of Loan Amount

The following conditions are considered in the cost estimate for the yen loan.

- Cost of initial investment calculated in the cost estimate described in 2.8 is used.
- Cost estimate for yen loan is carried out for 3 options of yen loan project which are described in 3.2.1.
- The following indirect costs are added for cost structure of the yen loan.
  - Physical contingency (10% on construction work)
  - Price escalation calculated by the methodology shown below
    1. Foreign currency (F.C.) portion: 1.8% - geometric mean of last 5 years' WPI and CPI in G7 countries
    2. Domestic (Local) currency (L.C.) portion: 4.4% = A – B

    A: Calculate mean rate of last 5 years' WPI and of last 5 years' CPI"; then calculate average of these 2 rates.

    B: Calculate first the last 5 years' historical volatility of PEN respectively against USD, Euro, Yen, GBP and CAD; then calculate the mean volatility of 5 currencies.

(2) Cost of the Proposed Yen Loan Project

The construction of the sanitary landfill and composting plants is planned to be conducted in plural phase according to the necessary capacity of these facilities.

The expansion of cell of sanitary landfill, once or twice depending on the project, will be constructed as re-investment as described in the PIPs. The composting plants will be developed as reinvestment except Aymaraes after composting practice at pilot scale. One or 2 phasing is considered for each project. The cost estimate for the proposed project is summarized in Table 3.2-3 to Table 3.2-5.

Table 3.2-3 Cost Estimate of 23 Sub-Projects (Option1)

Project Sites		F.C Portion (million US$)	L.C Portion (million S/.)	Overhead (million S/.)	IGV (million S/.)	Total	
						(million US$)	(million S/.)
1	Puno	1.72	5.46	0.94	2.15	4.75	13.40
2	Juliaca	2.39	8.08	1.44	3.10	6.86	19.36
3	Piura	3.02	10.31	1.87	3.94	8.73	24.64
4	Nuevo Chimbote	1.56	2.92	0.47	1.48	3.29	9.27
5	Tumbes	1.55	3.22	0.52	1.54	3.42	9.65
6	Sullana	1.87	4.57	0.77	2.01	4.48	12.64
7	Abancay	0.93	2.17	0.35	0.98	2.17	6.12
8	Huanuco	1.87	4.90	0.86	2.10	4.66	13.14
9	Paita	0.78	3.04	0.50	1.09	2.42	6.83
10	Puerto Maldonado	1.28	4.84	0.88	1.77	3.95	11.10

Project Sites		F.C Portion (million US$)	L.C Portion (million S/.)	Overhead (million S/.)	IGV (million S/.)	Total	
						(million US$)	(million S/.)
11	Talara	1.71	2.74	0.44	1.52	3.38	9.52
12	Moyobamba	0.90	4.14	0.73	1.41	3.13	8.82
13	Tarapoto	1.84	4.37	0.76	1.96	4.35	12.28
14	Chachapoyas	0.62	2.12	0.36	0.80	1.79	5.03
15	Ilave	0.20	1.79	0.29	0.50	1.11	3.14
16	Azangaro	0.15	1.48	0.24	0.41	0.90	2.55
17	Chincha	0.63	2.93	0.48	0.98	2.19	6.17
18	Sechura	0.78	2.76	0.47	1.03	2.29	6.46
19	Huacho	1.51	4.04	0.70	1.71	3.80	10.71
20	Tarma	0.83	2.22	0.38	0.94	2.09	5.88
21	Ferrenafe	0.72	2.46	0.43	0.93	2.07	5.85
22	Santiago	0.26	1.46	0.24	0.46	1.03	2.89
23	Aymaraes	0.18	1.22	0.20	0.36	0.81	2.29
	Total	27.30	83.24	14.32	33.17	73.67	207.74

Source: JICA survey team

Note : Option1:Initial Investment

Cost includes following items of work.

・construction work , material procurement , overhead for construction works , consulting service of international consultant (excluding fee of local consultant for design work by MINAM)

Table 3.2-4 Cost Estimate of 23 Sub-Projects (Option2)

Project Sites		F.C Portion (million US$)	L.C Portion (million S/.)	Overhead (million S/.)	IGV (million S/.)	Total	
						(million US$)	(million S/.)
1	Puno	1.72	5.46	0.94	2.14	4.75	13.39
2	Juliaca	2.39	8.08	1.44	3.09	6.86	19.35
3	Piura	3.02	10.32	1.87	3.94	8.74	24.64
4	Nuevo Chimbote	1.56	2.92	0.47	1.48	3.29	9.27
5	Tumbes	1.55	3.22	0.52	1.54	3.42	9.66
6	Sullana	1.87	4.57	0.77	2.02	4.48	12.63
7	Abancay	0.93	2.40	0.40	1.03	2.29	6.45
8	Huanuco	1.87	4.90	0.86	2.1	4.65	13.13
9	Paita	0.78	3.04	0.50	1.09	2.42	6.83
10	Puerto Maldonado	1.28	4.84	0.88	1.77	3.94	11.11
11	Talara	1.71	2.74	0.44	1.52	3.38	9.52
12	Moyobamba	0.90	4.14	0.73	1.41	3.13	8.82
13	Tarapoto	1.84	4.37	0.76	1.96	4.35	12.28
14	Chachapoyas	0.62	2.35	0.40	0.86	1.90	5.36
15	Ilave	0.20	2.01	0.33	0.55	1.22	3.45
16	Azangaro	0.15	1.71	0.29	0.46	1.02	2.88
17	Chincha	0.63	3.16	0.53	1.04	2.31	6.51
18	Sechura	0.78	2.76	0.47	1.03	2.29	6.46
19	Huacho	1.51	4.04	0.70	1.71	3.80	10.71
20	Tarma	0.83	2.76	0.49	1.06	2.36	6.65
21	Ferrenafe	0.72	3.00	0.54	1.06	2.35	6.63
22	Santiago	0.26	1.46	0.24	0.46	1.03	2.89
23	Aymaraes	0.18	1.22	0.20	0.36	0.81	2.29
	Total	27.30	85.47	14.77	33.68	74.79	210.91

Source: JICA survey team

Note: Option2:Option1 + reinvestment for composting plant (pelfil project)

Cost includes following items of work.

・construction work, material procurement , overhead for construction works, consulting service of international consultant (excluding fee of local consultant for design work requested by MINAM)

Table 3.2-5 Cost Estimate of 23 Sub-Projects (Option3)

Project Sites		F.C Portion (million US$)	L.C Portion (million S/.)	Overhead (million S/.)	IGV (million S/.)	Total	
						(million US$)	(million S/.)
1	Puno	1.72	8.65	1.58	2.87	6.37	17.95
2	Juliaca	2.39	13.28	2.48	4.27	9.50	26.78
3	Piura	3.02	15.99	3.01	5.23	11.62	32.76
4	Nuevo Chimbote	1.56	4.73	0.83	1.89	4.20	11.85
5	Tumbes	1.55	4.95	0.86	1.93	4.29	12.11
6	Sullana	1.87	7.35	1.32	2.65	5.88	16.59
7	Abancay	0.93	3.55	0.63	1.29	2.87	8.09
8	Huanuco	1.87	6.66	1.21	2.50	5.55	15.64
9	Paita	0.78	3.28	0.55	1.15	2.55	7.18
10	Puerto Maldonado	1.28	7.09	1.33	2.29	5.08	14.32
11	Talara	1.71	4.30	0.76	1.88	4.17	11.76
12	Moyobamba	0.90	6.90	1.28	2.04	4.52	12.76
13	Tarapoto	1.84	7.54	1.39	2.68	5.96	16.80
14	Chachapoyas	0.62	2.35	0.40	0.86	1.90	5.36
15	Ilave	0.20	2.01	0.33	0.55	1.22	3.45
16	Azangaro	0.15	1.71	0.29	0.46	1.02	2.88
17	Chincha	0.63	3.16	0.53	1.04	2.31	6.51
18	Sechura	0.78	2.76	0.47	1.03	2.29	6.46
19	Huacho	1.51	7.41	1.38	2.48	5.51	15.53
20	Tarma	0.83	2.76	0.49	1.06	2.36	6.65
21	Ferrenafe	0.72	3.00	0.54	1.06	2.35	6.63
22	Santiago	0.26	1.46	0.24	0.46	1.02	2.89
23	Aymaraes	0.18	1.22	0.20	0.36	0.81	2.29
	Total	27.30	122.11	22.10	42.03	93.35	263.24

Source: JICA survey team

Note: Option3:Option2 + reinvestment for expansion of composting (other levels project) and sanitary landfill
Cost includes following items of work.

・construction work , material procurement , overhead for construction works , consulting service of international consultant (excluding fee of local consultant for design work requested by MINAM)

Table 3.2-6 Cost Estimate of Yen Loan Project (Option 1)

No.	Items	Amount		
		F.C. portion (million US$)	L.C portion (million S/.)	Total (million US$)
1	**Construction work**			
1.1	Administration service	－	8.45	3.00
1.2	Access road	－	6.92	2.45
1.3	Sanitary Landfill	－	51.64	18.31
1.4	Composting plant	－	0.21	0.07
1.5	Sorting plant	－	4.39	1.56
	Sub Total		71.61	25.39
2	**Equipment and Materials**			
2.1	Waste Bins, Carts and Small Tools, etc	2.43	4.41	4.00
2.2	Equipment for Collection and Transportation (Dump truck and motor cycle)	0.80	0.54	0.99
2.3	Equipment for Landfill Operation	7.63	－	7.63
2.4	Equipment for Collection and Transportation (Compactor truck)	16.44	－	16.44
	Sub Total	27.30	4.95	29.06
3	Capacity development	－	3.25	1.15
4	Public awareness	－	3.44	1.22
5	**Overhead (construction work)**	－	14.32	5.08
6	**Consulting service**	3.42	24.73	12.19
7	**Tax (IGV)**	5.84	23.24	14.08
	Total	36.56	145.54	88.17

Source: JICA survey team

Note: 1. It is assumed that IGV (19%) will be covered by counterpart fund of Peru side,

2. Exchange rate: USD1= PEN 2.82

3. Physical contingency: 10% (on construction work)

4. Price escalation: FC=1.8%, LC=4.4%

Table 3.2-7 Cost Estimate of Yen Loan Project (Option 2)

No.	Items	Amount		
		F.C. portion (million US$)	L.C portion (million S/.)	Total (million US$)
1	**Construction work**			
1.1	Administration service	−	8.45	3.00
1.2	Access road	−	6.92	2.45
1.3	Sanitary Landfill	−	51.64	18.31
1.4	Composting plant	−	2.43	0.86
1.5	Sorting plant	−	4.39	1.56
	Sub Total		73.83	26.18
2	**Equipment and Materials**			
2.1	Waste Bins, Carts and Small Tools, etc	2.43	4.41	4.00
2.2	Equipment for Collection and Transportation (Dump truck and motor cycle)	0.80	0.54	0.99
2.3	Equipment for Landfill Operation	7.63	−	7.63
2.4	Equipment for Collection and Transportation (Compactor truck)	16.44	−	16.44
	Sub Total	27.30	4.95	29.06
3	Capacity development	−	3.25	1.15
4	Public awareness	−	3.44	1.22
5	**Overhead (construction work)**	−	14.77	5.24
6	**Consulting service**	3.42	24.73	12.19
7	**Tax (IGV)**	5.84	23.74	14.25
	Total	36.56	148.71	89.29

Source: JICA survey team

Note: 1. It is assumed that IGV (19%) will be covered by counterpart fund of Peru side,
2. Exchange rate: USD1= PEN 2.82
3. Physical contingency: 10% (on construction work)
4. Price escalation: FC=1.8%, LC=4.4%

Table 3.2-8 Cost Estimate of Yen Loan Project (Option 3)

No.	Items	Amount		
		F.C. portion (million US$)	L.C portion (million S/.)	Total (million US$)
1	**Construction work**			
1.1	Administration service	－	8.45	3.00
1.2	Access road	－	6.92	2.45
1.3	Sanitary Landfill	－	83.45	29.58
1.4	Composting plant	－	7.27	2.58
1.5	Sorting plant	－	4.39	1.56
	Sub Total		110.48	39.17
2	**Equipment and Materials**			
2.1	Waste Bins, Carts and Small Tools, etc	2.43	4.41	4.00
2.2	Equipment for Collection and Transportation (Dump truck and motor cycle)	0.80	0.54	0.99
2.3	Equipment for Landfill Operation	7.63	－	7.63
2.4	Equipment for Collection and Transportation (Compactor truck)	16.44	－	16.44
	Sub Total	27.30	4.95	29.06
3	Capacity development	－	3.25	1.15
4	Public awareness	－	3.44	1.22
5	**Overhead (construction work)**	－	22.10	7.84
6	**Consulting service**	3.42	24.73	12.19
7	**Tax (IGV)**	5.84	32.10	17.22
	Total	36.56	201.05	107.85

Source: JICA survey team

Note: 1. It is assumed that IGV (19%) will be covered by counterpart fund of Peru side,

2. Exchange rate: USD1= PEN 2.82

3. Physical contingency: 10% (on construction work)

4. Price escalation: FC=1.8%, LC=4.4%

3.3 FINANCING PLAN OF YEN LOAN

3.3.1 Terms and Conditions of Yen loan

JICA defines the upper limit rate of financing to a project in a country in line with the criteria of GNI per capita of the country. For Peru, the limit rate is permissible up to 85%, which is applicable to the overall investment cost. The interest rate and repayment period of loan are to be determined through negotiation between the Peruvian Government and JICA. However, it should be noted that the following items shall be included in the Program cost, but are not eligible for JICA financing: land acquisition, compensation, taxes and duties and administration cost. Besides, 0.1% of commitment charges will be accrued on the non-disbursed amount of the loan from 120 days after the signing of the L/A (loan agreement).

3.3.2 Investment Cost expected to be financed by Yen loan

The investment cost is to be financed with both Yen loan and Peruvian counterpart funds as already mentioned in Chapter 2.8.1 of Part I. On the other hand, the re-investment cost is to be financed with the Peruvian Local Government also as was noted in the same chapter. Nevertheless, it should be noted that he Peruvian Government still withholds the expectation of loan from JICA also for re-investment cost. Taking into account this, 3 options for expectation of Yen loan is studied in Chapter 2.8 of Part I which is summarized in Table 3.3-1.

Table 3.3-1 Cost for Expectation of Yen loan

Option	Range of Cost	Relevant Cost
1	Investment Cost only	US$ 88.2
2	Investment Cost (+) Re-investment Cost for extension[1)] scheduled in the 2nd project year	US$ 89.3
3	Investment Cost (+) Re-investment Cost for extension[2)] scheduled until 4th project year	US$ 107.9

Note: 1) compost facilities, 2) compost facilities and landfill
Source: JICA survey team

3.3.3 Yen loan expected for each of 3 Options

With regard to the borrowing amount from JICA, the Peruvian Government contemplates it US$56 million at the maximum. Taking into account this contemplation, the financing plan for each of 3 options is outlined respectively as shown in Table 3.3-2, Table 3.3-3 and Table 3.3-4. As a consequence, Yen loan would cover 63% of the option 1cost, also 63% of the option 2 cost, and 52% of the option 3 cost.

Table 3.3-2 Outline of Financing Plan - Option 1 (Million US$)

Investment			Financing Plan	
Component		Cost	Yen loan	Peruvian Counterparts
1	Dust Bin & Cleaning	4.0	Component-wise apportion could be negotiated.	
2	Collection & Transport	17.4		
3	Sanitary Landfill	36.1		
4	Compost & Recycling	2.0		
5	Capacity Development & Public Awareness	2.4		
Sub-total		61.9	47.5	14.4
6	Administration (UEP)	3.7	-	3.7

Investment			Financing Plan	
7	Consulting Services	8.5	8.5	-
Sub-total		12.2	8.5	3.7
8	IGV	14.1	-	14.1
Total		88.2	56.0	32.2
		(100%)	(63%)	(37%)

Source: JICA survey team

Table 3.3-3 Outline of Financing Plan - Option 2 (Million US$)

Investment + Re-investment in 2nd Project Year			Financing Plan	
Component		Cost	Yen loan	Peruvian Counterparts
1	Dust Bin & Cleaning	4.0	Component-wise apportion could be negotiated.	
2	Collection & Transport	17.4		
3	Sanitary Landfill	36.1		
4	Compost & Recycling	2.9		
5	Capacity Development & Public Awareness	2.4		
Sub-total		62.8	47.5	15.3
6	Administration (UEP)	3.7	-	3.7
7	Consulting Services	8.5	8.5	-
Sub-total		12.2	8.5	3.7
8	IGV	14.3	-	14.3
Total		89.3	56.0	33.3
		(100%)	(63%)	(37%)

Source: JICA survey team

Table 3.3-4 Outline of Financing Plan - Option 3 (Million US$)

Investment + Re-investment until 4th project Year			Financing Plan	
Component		Cost	Yen loan	Peruvian Counterparts
1	Dust Bin & Cleaning	4.0	Component-wise apportion could be negotiated.	
2	Collection & Transport	17.4		
3	Sanitary Landfill	49.7		
4	Compost & Recycling	5.0		
5	Capacity Development & Public Awareness	2.4		
Sub-total		78.5	47.5	31.0
6	Administration (UEP)	3.7	-	3.7
7	Consulting Services	8.5	8.5	-
Sub-total		12.2	8.5	3.7
8	IGV	17.2	-	17.2
Total		107.9	56.0	51.9
		(100%)	(52%)	(48%)

Source: JICA survey team

3.3.4 Sharing Plan among Peruvian Counterparts

A part of the investment cost is planned to be financed with yen loan as noted above and the rest of amount by the Peruvian counterparts that are 23 municipalities and MINAM. How to share

the amount among these counterparts will be discussed and determined taking into account the criteria previously referred in Chapter 2.9.1.

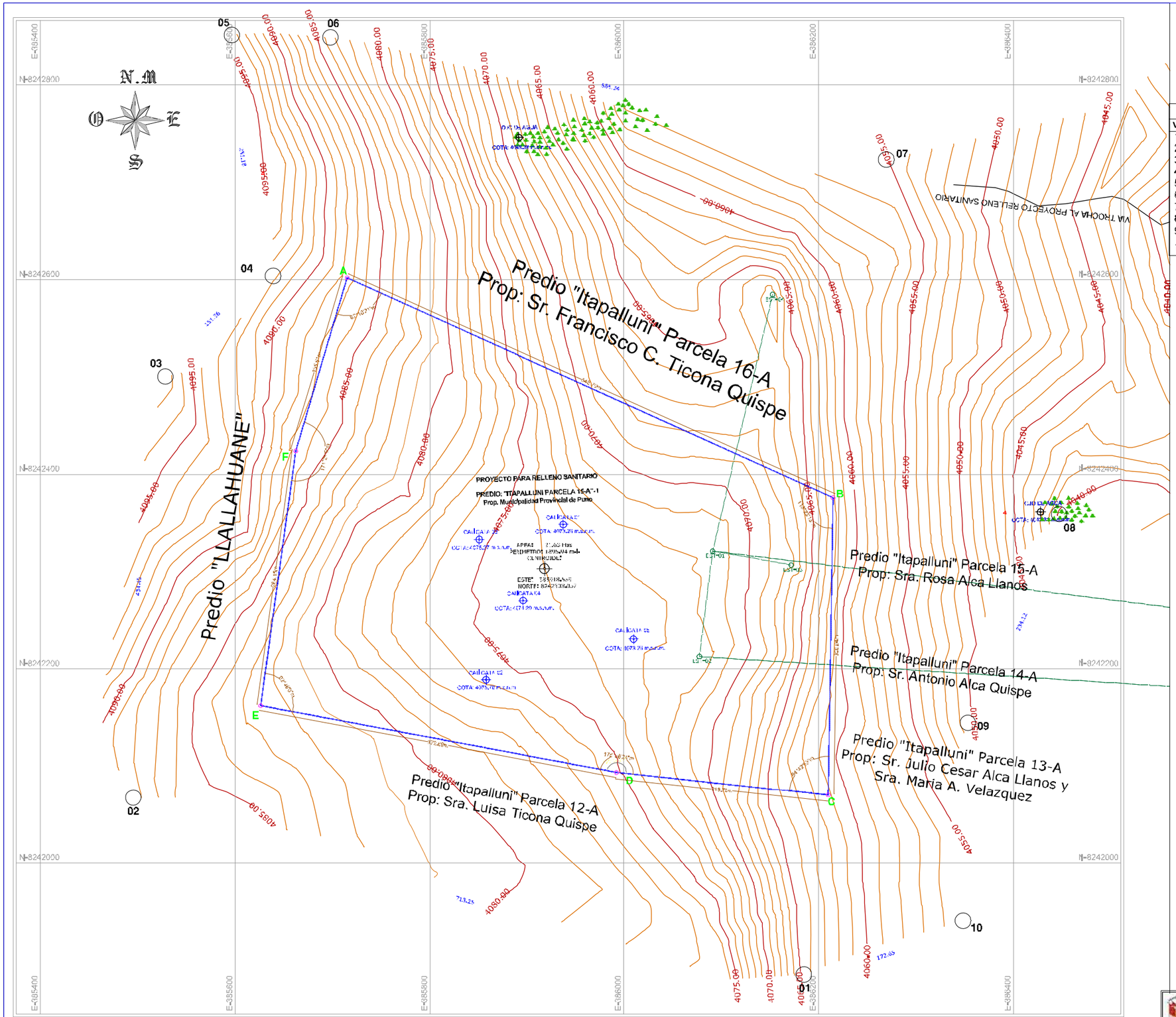
3.3.5 Repayment of Yen loan and Payment of Interest

As referred to in Chapter 2.9.1 (2), the Peruvian Government will repay the amortization and interest on Yen loan. Regarding this, MEF stated the following in the workshop held on February 22, 2011.

- In principle, all municipalities must pay the debts because the projects are their own ones.
- However, not all municipalities have the financial capability to pay the debts.
- Besides, the SWM service charges collected by the municipalities do not cover the cost.
- When considering the financial resources to pay the debts, most of the municipalities would neither finance nor execute the projects. And this situation brings a serious problem to the country.
- To solve this problem, MEF will pay both debts to guarantee the benefits of the Program and the sustainability throughout the project period.

APPENDIXES

Appendix-1: Topographic Survey



CUADRO DE COORDENADAS DEL POLIGONO TERRENO DE LEVANTAMIENTO TOPOGRAFICO

VERT.	COORDENADAS U.T.M. NORTE (m)	ESTE (m)	ANG. INT. S°	PERIMETRICO LADO	LONG (m)
1	8241885.4690	386184.9230	146° 34' 06"	1 - 2	713.25
2	8242067.3660	385495.2580	100° 23' 57"	2 - 3	434.45
3	8242500.5460	385528.4060	137° 26' 56"	3 - 4	151.36
4	8242603.9150	385638.9730	236° 37' 08"	4 - 5	251.18
5	8242851.5060	385596.6880	78° 51' 09"	5 - 6	101.36
6	8242848.9310	385698.0180	169° 04' 25"	6 - 7	585.34
7	8242723.4170	386269.7460	128° 21' 60"	7 - 8	405.03
8	8242359.3290	386447.2030	130° 25' 10"	8 - 9	234.12
9	8242144.7810	386353.4880	202° 11' 44"	9 - 10	204.14
10	8241940.6980	386348.4990	110° 03' 25"	10 - 1	172.65

COORDENADAS DE LOS PUNTOS DE GEOREFERENCIACIÓN Y BMs. (SISTEMA WGS-84)

PUNTO	COORDENADA U.T.M. NORTE	ESTE	Cota absoluta m.s.n.m.
BM-BASE	8248889.001	391211.772	3811.923
PG01	8242830.086	390102.590	4023.711
PG02	8242426.165	390114.960	4023.139
EST-01	8242321.213	386091.354	4071.855
EST-02	8242212.765	386077.557	4072.762
EST-03	8242306.941	386171.948	4068.388
EST-04	8242584.695	386152.862	4067.578
EST-05	8242365.781	387400.690	4024.310
EST-06	8242423.312	387409.600	4025.792
EST-07	8242094.872	387937.320	3986.838

LEYENDA

SIMBOLOGIA	DESCRIPCIÓN
	Trocha carrozable
	Curva maestra
	Curva secundaria
	Cerco de piedra
	Construc. Mat. Adobe
PG03	Puntos de Georeferenciación y BM's.
	Puntos de estación
	Bofedal Ojo de Agua
	Poste
	Centroide
	Perimetro Terreno

P L A N O TOPOGRAFICO
ESCALA 1 : 2000

PERÚ Ministerio del Ambiente | Viceministerio de Gestión Ambiental

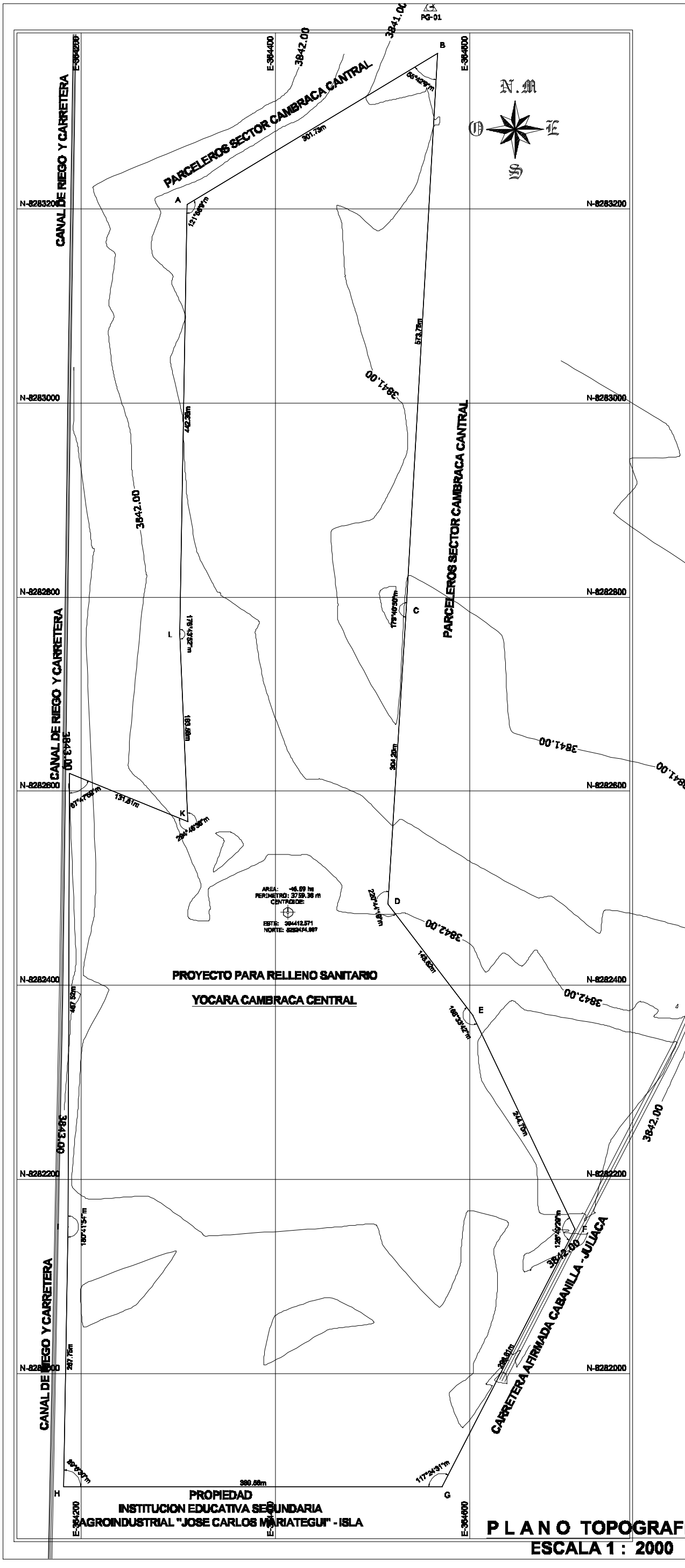
NOMBRE DEL PROYECTO: AMPLIACIÓN Y MEJORAMIENTO DE LA GESTION INTEGRAL DE LOS RESIDUOS SÓLIDOS MUNICIPALES, EN EL DISTRITO DE PUNO, PROVINCIA DE PUNO, DEPARTAMENTO DE PUNO

ESCALA: 1:2000

PLANO: TOPOGRAFICO

DATUM: WGS 84 | FECHA: Junio del 2010

FINANCIA: JICA ESTUDIO PREPARATORIO PARA EL PROYECTO DE DESARROLLO DE GESTION DE RESIDUOS SOLIDOS EN EL PERU



COORDENADAS DE LOS PUNTOS DE GEOREFERENCIACIÓN Y BMs. (SISTEMA WGS-84)

Puntos	Coordenadas geográficas		Coordenada UTM, Zona 19S Sistema de Referencia Geodésico WGS 84		Cota absoluta geoidal m.s.n.m.
	Latitud	Longitud	Este (X)	Norte (Y)	
PG01	15° 31' 23.41556"	70° 15' 46.31852"	364558.715	8283408.113	3840.661
PG02	15° 31' 19.56838"	70° 15' 39.65332"	364756.612	8283527.513	3840.795
PG03	15° 28' 37.04770"	70° 13' 52.57707"	367918.324	8288540499	3834.378
PG04	15° 28' 36.73738"	70° 13' 54.80302"	367851.932	8288549.655	3834.214
BM AYABACAS BASE SUR	15° 25' 35.02712"	70° 04' 16.19324"	385067.371	8294225.979	3836.739

LEYENDA

SIMBOLOGIA	DESCRIPCIÓN
	Trocha carrozable
	Curva maestra
	Curva secundaria
	Cerros de piedra
	Construc. Mat. Adobe
PG01	Puntos de Georeferenciación y BMs.
	Puntos de estación
	Bofedal Ojo de Agua
	Poste
	Centroide
	Perimetro Terreno

CUADRO DE DATOS TECNICOS DEL TERRENO

VERTICE	LADO	DIST.	ANGULO	ESTE	NORTE
A	A - B	301.73	121°58'9"	364308.235	8283204.529
B	B - C	573.76	55°42'9"	364566.645	8283360.310
C	C - D	304.20	179°40'50"	364534.476	8282787.450
D	D - E	143.62	220°44'19"	364515.728	8282483.832
E	E - F	244.70	168°33'42"	364802.571	8282369.442
F	F - G	298.81	126°49'29"	364706.942	8282149.077
G	G - H	389.56	117°24'31"	364571.394	8281883.813
H	H - I	267.75	89°6'30"	364181.830	8281883.812
I	I - J	467.52	180°41'54"	364185.996	8282151.527
J	J - K	131.81	67°47'59"	364187.573	8282619.044
K	K - L	193.56	294°46'36"	364309.444	8282568.829
L	L - A	442.36	176°43'52"	364301.396	8282762.222

Area: 466990.061 m²
Area: 46.69 ha
Perimetro: 3759.38 ml

PERÚ | Ministerio del Ambiente | Viceministerio de Gestión Ambiental

NOMBRE DEL PROYECTO: AMPLIACIÓN Y MEJORAMIENTO DE LA GESTIÓN INTEGRAL DE LOS RESIDUOS SÓLIDOS MUNICIPALES, EN EL DISTRITO DE JULIACA, PROVINCIA DE SAN ROMÁN, DEPARTAMENTO PUNO

ESCALA: 1:2000

PLANO: TOPOGRAFICO - GEORREFERENCIADO

Nº PLANO:

ELABORADO POR: EQUIPO DE ESTUDIO DE JICA | DATUM: UTM WGS 84 | FECHA: Enero del 2011 | UBICACIÓN: LUGAR: YOCARA-CAMBRACA CENTRAL | DISTRITO: JULIACA | PROVINCIA: SAN ROMÁN | DEPARTAMENTO: PUNO

FUENTE: JICA: ESTUDIO PREPARATORIO PARA EL PROYECTO DE DESARROLLO DE GESTION DE RESIDUOS SOLIDOS EN EL PERU

PLANO TOPOGRAFICO

ESCALA 1 : 2000

548000 E
548200 E
548400 E
548600 E
548800 E
549000 E
549200 E
9428800 N
9428600 N
9428400 N
9428200 N
9428000 N
9427800 N
9427600 N

A
B
C
D

1000.00 m
1000.00 m
1000.00 m
1000.00 m

90°0'0"
90°0'0"
90°0'0"
90°0'0"

CELDA CLAUSURADA

CELDA DE OPERACION CON GEOMEMBRANA

ST-01
ST-02
ST-03

BM 1
BM 2

VIA AFIRMADA

TROCHA CARROZABLE
TROCHA CARROZABLE

BOTADERO ANTIGUO

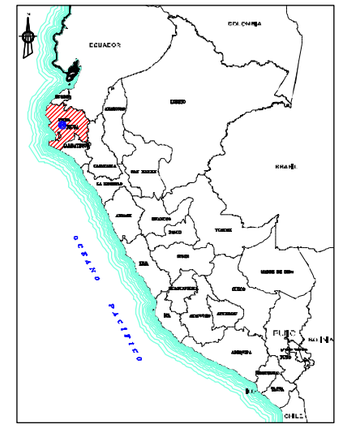
AREA= 100.00 Ha
AREA= 1,000 000.00 m2
PERIMETRO= 4 000.00 ml

CANTERA

VIA EXISTENTE

<------ CARRETERA PIURA - CHULUCANAS

UBICACION DEPARTAMENTAL



UBICACION DE BM
DATUM = WGS 84

BM	COTA	ESTE (X)	NORTE (Y)
BM-1	60.31	548847.00	9427847.86
BM-2	66.36	548746.40	9428624.70

POLIGONAL DEL PROYECTO
DATUM = WGS 84

VERTICE	LADO	DISTANCIA	ANG. INTERNO	ESTE (X)	NORTE (Y)
A	A-B	1000.00	90°0'0"	548151.578	9427633.239
B	B-C	1000.00	90°0'0"	549108.563	9427923.363
C	C-D	1000.00	90°0'0"	548818.443	9428880.352
D	D-A	1000.00	90°0'0"	547861.449	9428590.226
TOTAL		4000.00	360°0'0"		

Suma de ángulos (real) = 360°00'00"
Error acumulado = 00°00'00"

LEYENDA

SIMBOLOGIA	DESCRIPCION
	COTA MAYOR
	COTA MENOR
	POLIGONAL AREA DEL PROYECTO
	BOTADERO ANTIGUO
	VIA AFIRMADA
	TROCHA CARROZABLE
	CANTERA

PERÚ Ministerio del Ambiente — Viceministerio de Gestión Ambiental

NOMBRE DEL PROYECTO: ESTUDIO DE PRE FACTIBILIDAD DEL PROYECTO DE INVERSION PUBLICA "MEJORAMIENTO Y AMPLIACION DE LA GESTION INTEGRAL DE RESIDUOS SOLIDOS MUNICIPALES PROVINCIA DE PIURA, DEPARTAMENTO DE PIURA"

ESCALA: 1/2000

PLANO: PLANO TOPOGRAFICO

PLANO Nº: 01

COORDENADAS UTM: DATUM: WGS 84 | PROY.: JULIO/2011 | UBICACION: LUGAR: PIURA | PROVINCIA: PIURA | DEPARTAMENTO: PIURA

FUENTE: "ESTUDIO PREPARATORIO PARA EL PROYECTO DE FORTALECIMIENTO DE GESTION DE RESIDUOS SOLIDOS EN EL PERU

AREA 20.47 HA

PERIMETRO
1850.674

385.658m

553.865m

560.40m

348.011m

87°0'2"

91°35'21"

92°16'3"

Botadero en Uso

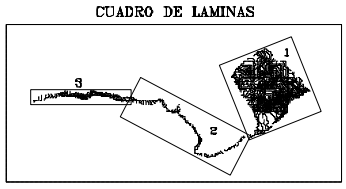
Linea de Trasmision Electrica

N 9602200

N 9602000

N 9601800

CUADRO DE LAMINAS



LEYENDA

- Curvas de Nivel a 5m
- Curvas de Nivel a 1m
- Accesos Existentes
- Linea de trasmision electrica
- Punto topografico

CUADRO TECNICO

VERTICE	LADO	DISTANCIA	ANG. INTER	ESTE	NORTE
V-A	VA-VB	348.011	91°35'21"	564918.013	9601760.053
V-B	VB-VC	553.865	92°16'03"	563230.123	9601913.984

PERÚ | Ministerio del Ambiente | Viceministerio de Gestión Ambiental

"Mejoramiento y ampliación de la gestión integral de los residuos sólidos municipales en la Ciudad de Tumbes de la Provincia de Tumbes - Departamento de Tumbes "

ESCALA: 1/1000

PLANO: DISTRIBUCIÓN GENERAL

N° PLANO:

ELABORADO POR: PERU WASTE PROYECTOS S.A.C.

DATUM: UTM WGS 84

FECHA: Julio del 2010

UBICACION

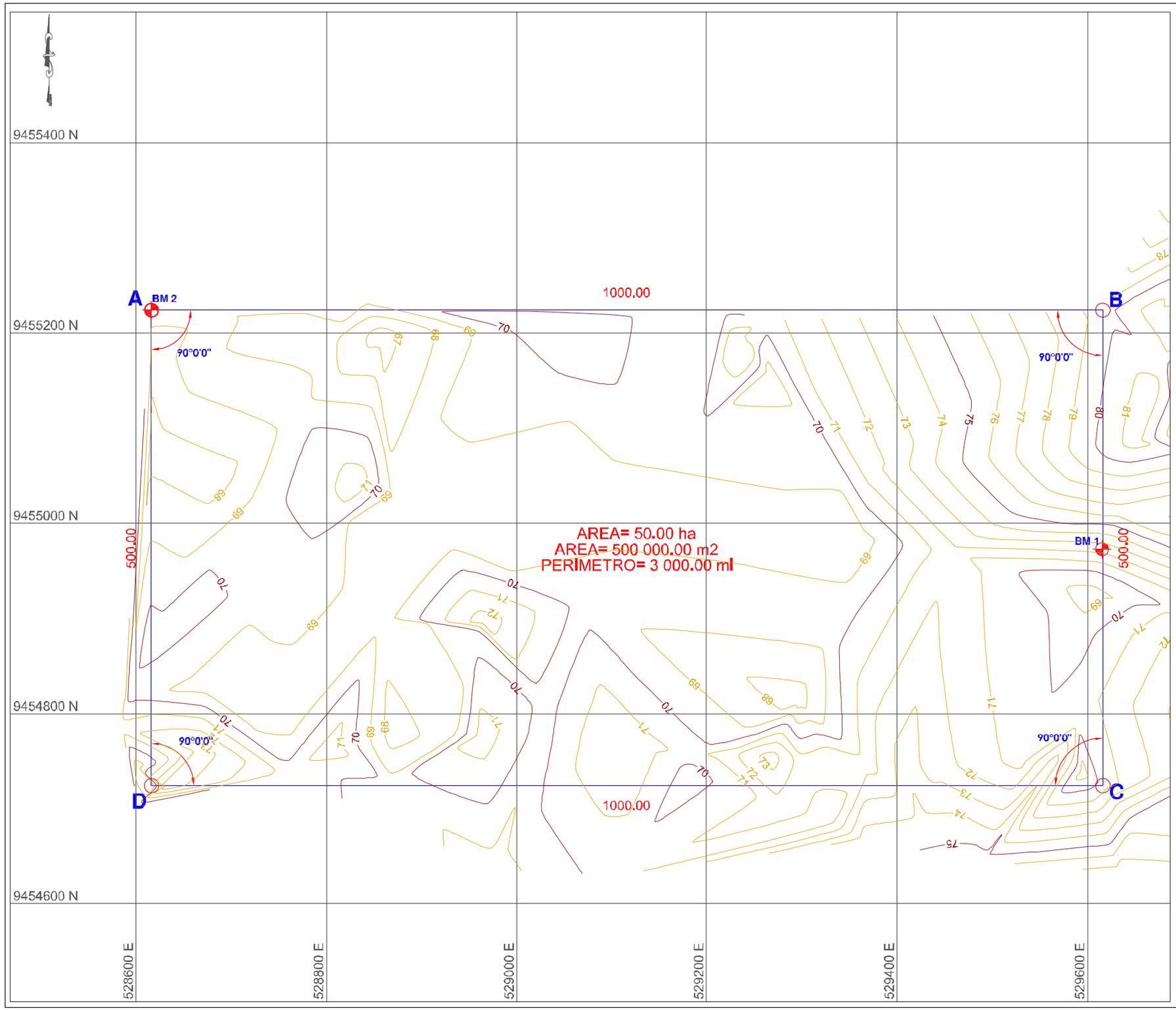
LUGAR: TUMBES

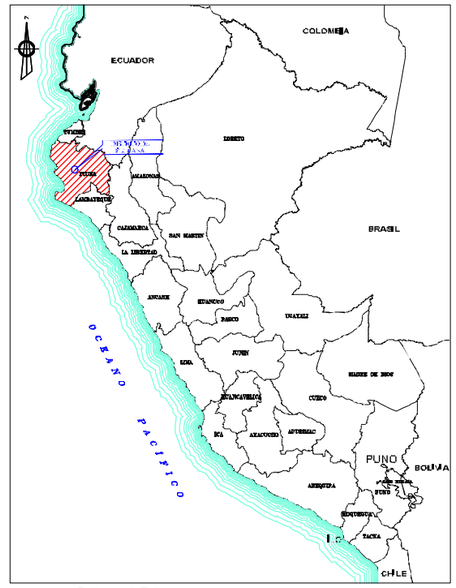
DISTRITO: TUMBES

PROVINCIA: TUMBES

DEPARTAMENTO: TUMBES

FUENTE: JICA : ESTUDIO PREPARATORIO PARA EL PROYECTO DE DESARROLLO DE GESTION DE





UBICACION DEPARTAMENTAL

UBICACION DE BMs
DATUM = WGS 84

BM	COTA	ESTE (X)	NORTE (Y)
BM-1	78.71	529615.295	9454972.985
BM-2	85.52	528616.295	9455223.985

POLIGONAL DEL PROYECTO
DATUM = WGS 84

VERTICE	LADO	DISTANCIA	ANG. INTERNO	ESTE	NORTE
A	A-B	1000.00	90°0'0"	528616.295	9455223.985
B	B-C	500.00	90°0'0"	529616.295	9455223.985
C	C-D	1000.00	90°0'0"	529616.295	9454723.985
D	D-A	500.00	90°0'0"	528616.295	9454723.985
TOTAL		3000.00	360°0'0"		
Suma de ángulos (real) =			360°00'00"		
Error acumulado =			00°00'00"		

LEYENDA	
SIMBOLOGIA	DESCRIPCION
	CURVA DE NIVEL MAYORES
	CURVA DE NIVEL MENORES
	POLIGONAL AREA DEL PROYECTO
	BM

PERÚ | Ministerio del Ambiente | Viceministerio de Gestión Ambiental

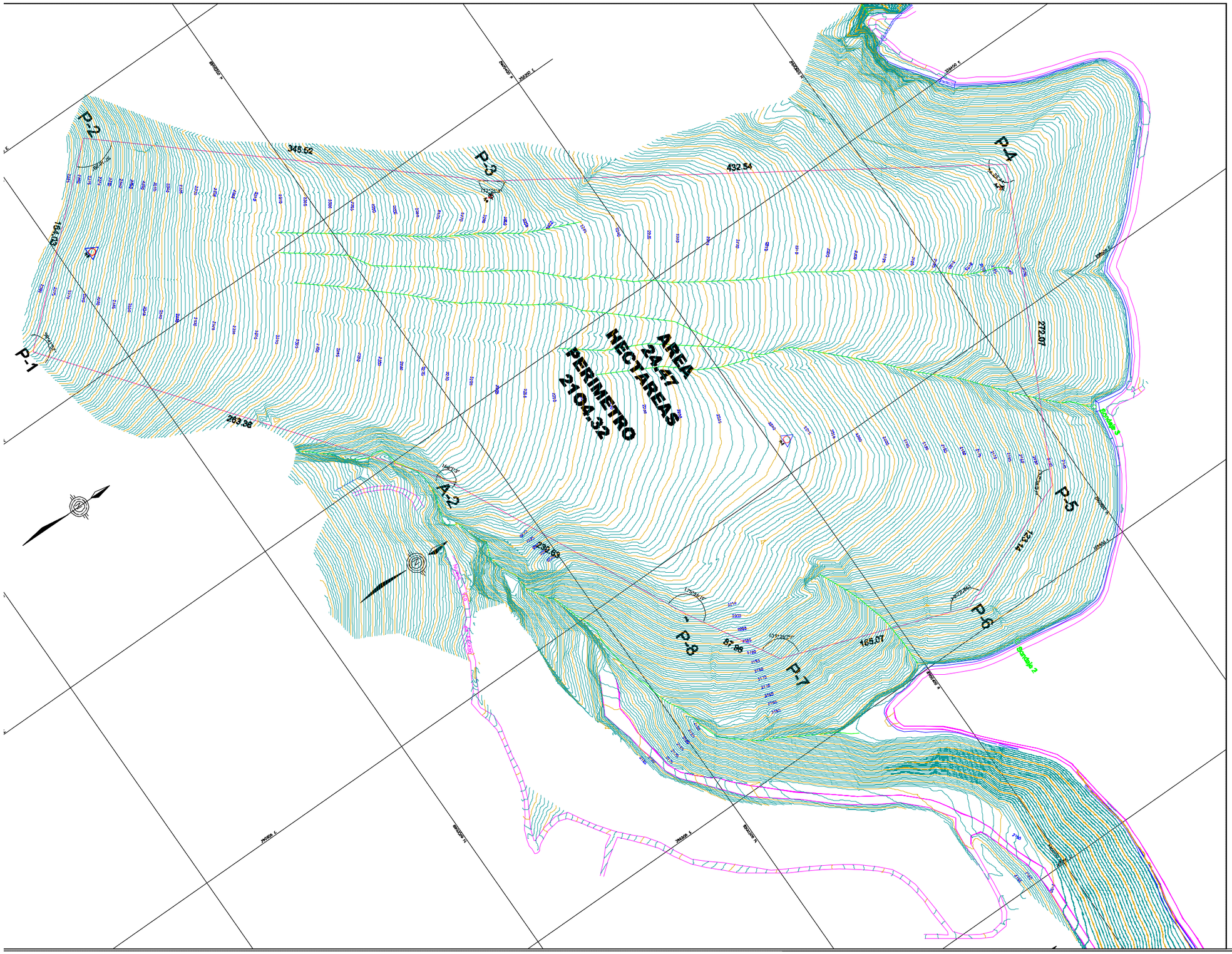
MEJORAMIENTO Y AMPLIACION DE LA GESTION INTEGRAL DE LOS RESIDUOS SOLIDOS MUNICIPALES EN LAS CIUDADES DE SULLANA Y BELLAVISTA DE LA PROVINCIA DE SULLANA DEPARTAMENTO DE PIURA

TOPOGRAFICO DEL PROYECTO

WGS 84

JICA ESTUDIO PREPARATORIO PARA EL PROYECTO DE DESARROLLO DE GESTIÓN DE RESIDUOS SOLIDOS EN EL PERU

1/2000



COORDENADAS UTM WGS 84

PUNTO	COORDENADAS		ELEVACION Geoidal (m.s.n.m.)
	NORTE	ESTE	
PUNTOS GEODESICOS			
H-1	8900413.210	359574.577	2219.564
H-2	8900025.207	359110.388	2366.351
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CUADRO DE DATOS TÉCNICO

VERTICE	LADO	DISTANCIA	ANG. INTER	ESTE	NORTE
P-1	P1-P2	184.03	98°41'52"	359150.590	8899936.520
P-2	P2-P3	345.52	97°18'28"	359027.920	8900075.700
P-3	P3-P4	432.54	172°21'03"	359264.089	8900334.905
P-4	P4-P5	272.07	96°20'44"	359491.180	8900696.660
P-5	P5-P6	123.14	137°38'57"	359734.110	8900573.470
P-6	P6-P7	165.07	139°27'24"	359777.760	8900408.320
P-7	P7-P8	87.96	139°36'27"	359721.870	8900303.000
P-8	P8-A2	230.63	175°56'10"	359645.560	8900259.260
A-2	A2-P1	263.38	168°01'03"	358437.820	8900159.030
PERIMETRO		2104.32	1225°22'08"		

LEYENDA

- Curvas de Nivel a 5m.
- Curvas de Nivel a 1m.
- Accesos Existentes
- Puntos Topograficos
- Perimetro
- Puntos de Control Geodésico
- Quebrada
- Canal
- Sondaje

PERÚ | Ministerio del Ambiente | Viceministerio de Gestión Ambiental

NOMBRE DEL PROYECTO: "AMPLIACIÓN Y MEJORAMIENTO DEL SISTEMA DE LA GESTIÓN INTEGRAL DE RESIDUOS SÓLIDOS MUNICIPALES EN LA CIUDAD DE HUÁNUCO Y ADECUADA DISPOSICIÓN FINAL EN LAS CIUDADES DE AMARILIS, RILLO MARCA, SANTA MARÍA DEL VALLE, PROVINCIA DE HUÁNUCO - HUÁNUCO"

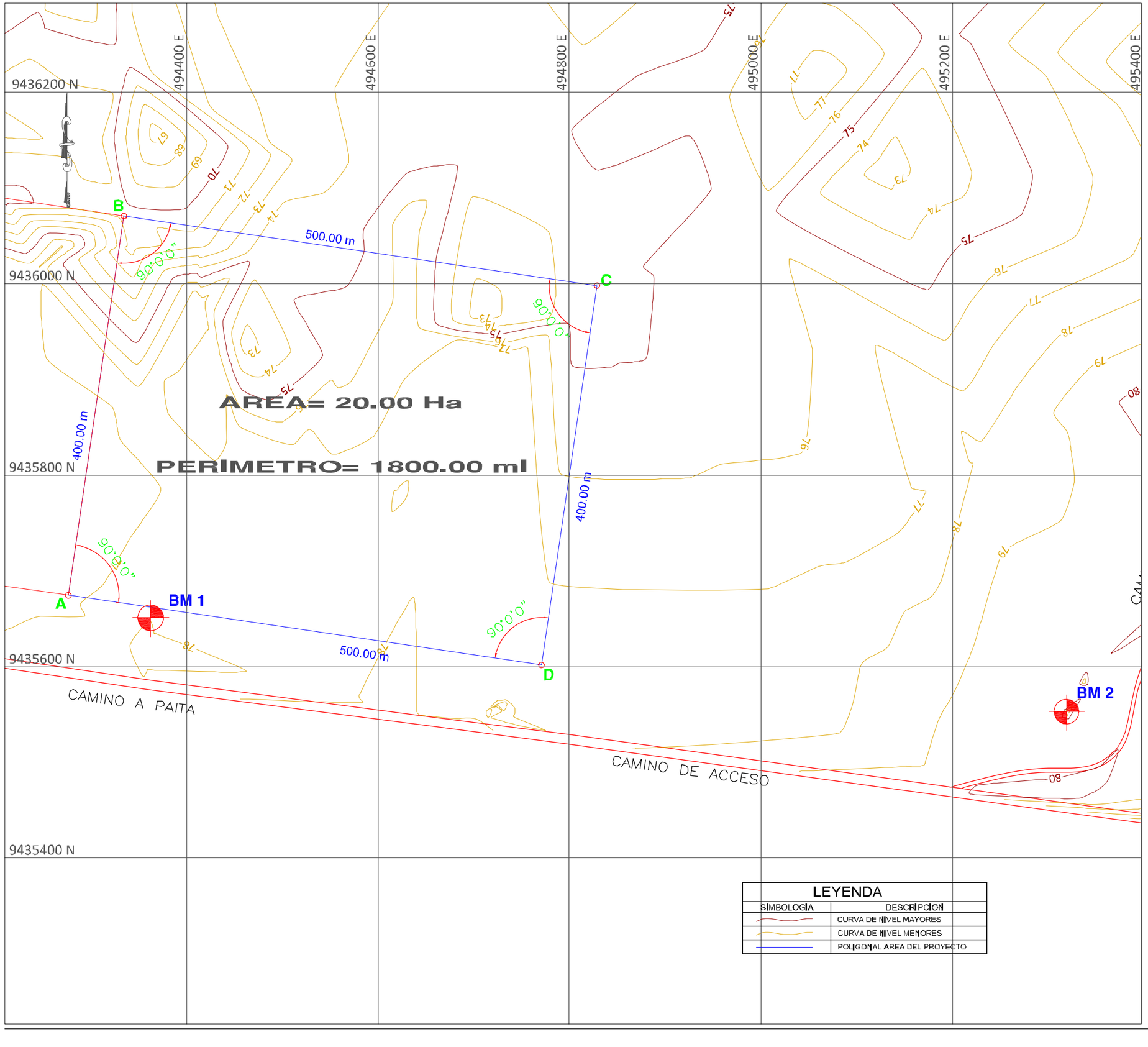
ESCALA: 1/1500

PLANO: PLANO TOPOGRAFICO

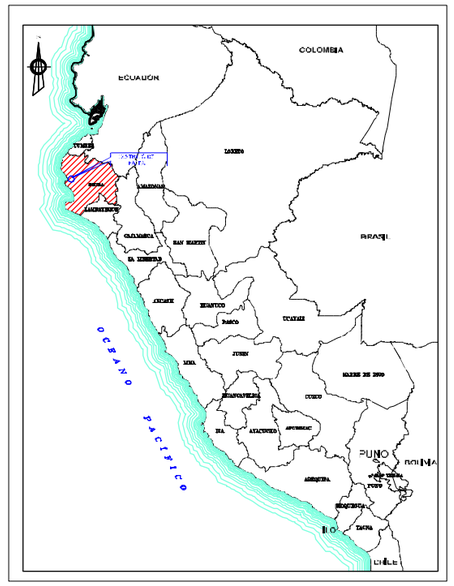
N° PLANO:

ELABORADO POR: PERUMADE INNOVATIONS A.C | DATUM: WGS 84 - 18 S | FECHA: Ene- 2011 | UBICACIÓN: LUGAR: SAN NARCISA | DISTRITO: HUÁNUCO | PROVINCIA: HUÁNUCO | DEPARTAMENTO: HUÁNUCO

FUENTE: JICA ESTUDIO PREPARATORIO PARA EL PROYECTO DE DESARROLLO DE GESTIÓN DE RESIDUOS SOLIDOS EN EL PERU



UBICACION DEPARTAMENTAL



CUADRO DE DATOS TECNICOS
DATUM = WGS 84

VERTICE	LADO	DISTANCIA	ANG. INTERNO	ESTE (X)	NORTE (Y)
A	A–B	500.00	90°0'0"	494276.197	9435674.869
B	B–C	400.00	90°0'0"	494334.347	9436070.619
C	C–D	500.00	90°0'0"	494829.036	9435997.932
D	D–A	400.00	90°0'0"	494770.885	9435602.181
TOTAL		1800 00	360°0'0"		
Suma de ángulos (real) =			360°00'00"		
Error acumulado =			00°00'00"		

CUADRO DE DATOS TECNICOS BMs
DATUM = WGS - 84

BM	COTA	ESTE (X)	NORTE (Y)
BM-1	77.97	494362.120	9435651.423
BM-2	81.79	495319.468	9435553.041

LEYENDA

SIMBOLOGIA	DESCRIPCION
	CURVA DE NIVEL MAYORES
	CURVA DE NIVEL MENORES
	POLIGONAL AREA DEL PROYECTO

PERÚ | Ministerio del Ambiente | Viceministerio de Gestión Ambiental

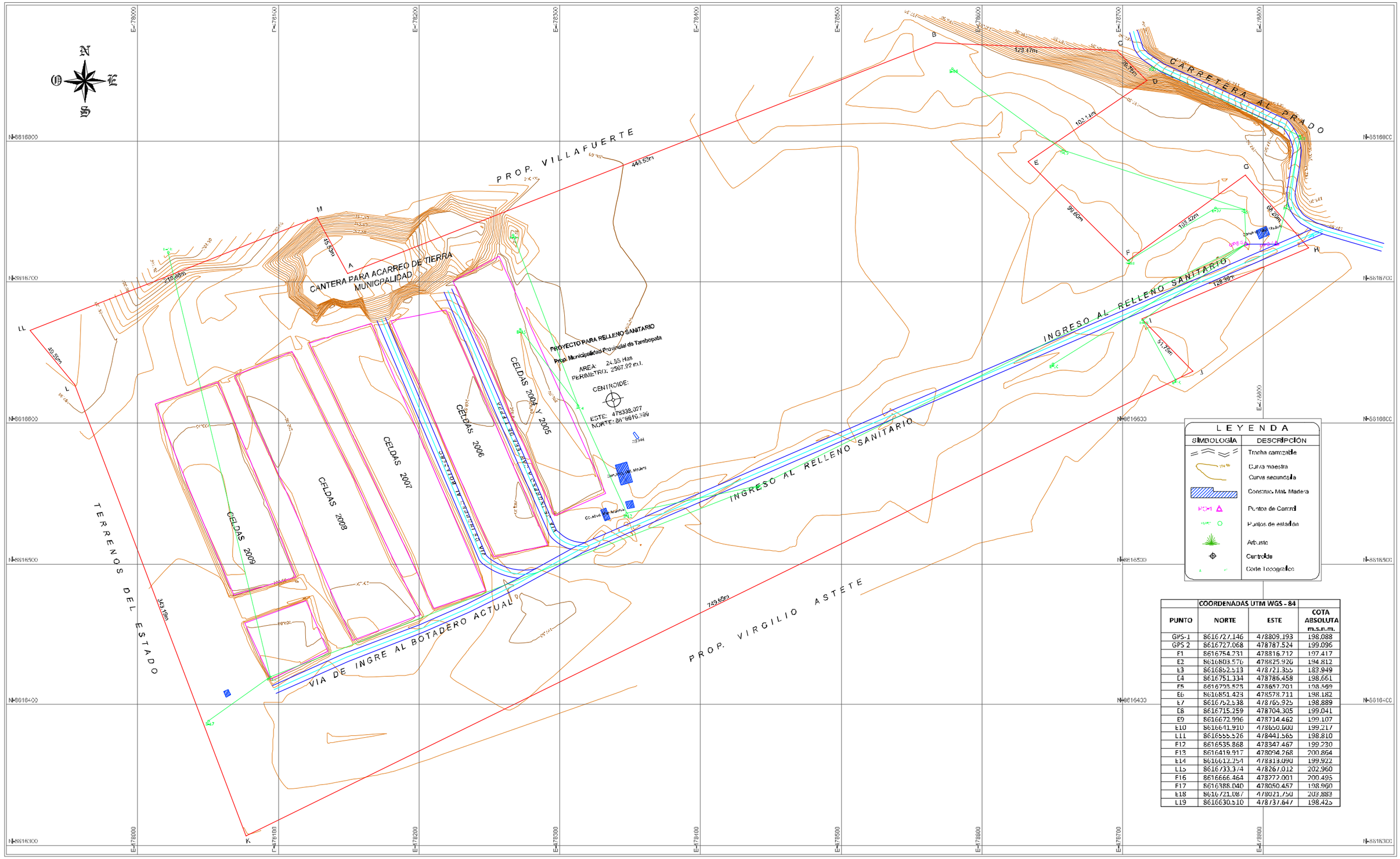
PROYECTO: AMPLIACION Y MEJORAMIENTO DE LA GESTION INTEGRAL DE RESIDUOS SOLIDOS MUNICIPALES EN LA CIUDAD DE PAITA, PROVINCIA DE PAITA, DEPARTAMENTO DE PIURA

PLANO: TOPOGRAFICO DEL AREA DEL PROYECTO

DATUM: WGS - 84

UBICACION: PIURA - PAITA

PROYECTO: JICA ESTUDIO PREPARATORIO PARA EL PROYECTO DE DESARROLLO DE GESTION DE RESIDUOS SOLIDOS EN EL PERU



COORDENADAS UTM WGS - 84			
PUNTO	NORTE	ESTE	COTA ABSOLUTA m.s.n.m.
GPS-1	8616727.146	478809.193	198.088
GPS 2	8616727.068	478787.524	199.096
F1	8616754.231	478816.712	197.417
E2	8616803.576	478825.926	194.812
E3	8616862.513	478721.355	182.949
E4	8616751.334	478786.458	198.661
E5	8616793.525	478657.701	198.569
E6	8616851.423	478578.711	198.182
E7	8616762.538	478765.925	198.889
E8	8616715.259	478704.305	199.041
E9	8616672.996	478714.462	199.107
E10	8616641.910	478650.600	199.217
L11	8616555.526	478441.565	198.810
F12	8616535.868	478347.467	199.230
F13	8616419.917	478094.268	200.864
E14	8616612.254	478318.090	199.922
L15	8616733.374	478267.012	202.960
F16	8616666.464	478272.001	200.495
F17	8616388.040	478050.457	198.960
E18	8616721.087	478021.750	202.883
L19	8616630.510	478737.647	198.425

PLANO TOPOGRAFICO
ESCALA 1 : 1250

PERÚ | Ministerio del Ambiente | Viceministerio de Gestión Ambiental

AMPLIACIÓN Y MEJORAMIENTO DE LA GESTIÓN INTEGRAL DE LOS RESIDUOS SÓLIDOS MUNICIPALES, EN EL DISTRITO DE TAMBOPATA, PROVINCIA DE TAMBOPATA, DEPARTAMENTO DE MADRE DE DIOS

ESCALA: 1:1250

PLANO: TOPOGRÁFICO

DATUM: UTM WGS 84

FECHA: 06/2013

FUENTE: JICA: ESTUDIO PREPARATORIO PARA EL PROYECTO DE DESARROLLO DE GESTIÓN DE RESIDUOS SOLIDOS EN EL PERU

N

<--- a Talara

a Lobitos --->

470800 E

471000 E

471200 E

471400 E

9498000 N

9497800 N

9497600 N

P

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

Q

AREA DE PROYECTO
AREA = 214228.92 m2
PERIMETRO = 2147.03 ml.

Residuos con Cobertura

Descarga de Residuos

Plataforma

Plataforma

Plataforma

Plataforma

Plataforma

Residuos Acumulados

Tubería de agua

LEYENDA	
SIMBOLOGIA	DESCRIPCION
	COTA MAYOR
	COTA MENOR
	PERIMETRICO
	BOTADERO ACTUAL
	VIA AFIRMADA
	TUBERIA DE AGUA
	AREA DEL PROYECTO

PERÚ Ministerio del Ambiente | Viceministerio de Gestión Ambiental

MEJORAMIENTO Y AMPLIACIÓN DE LA GESTIÓN INTEGRAL DE LOS RESIDUOS SÓLIDOS MUNICIPALES DE LA CIUDAD DE PARIÑAS, PROVINCIA DE TALARA, DEPARTAMENTO DE PIURA

ESCALA: 1/1000

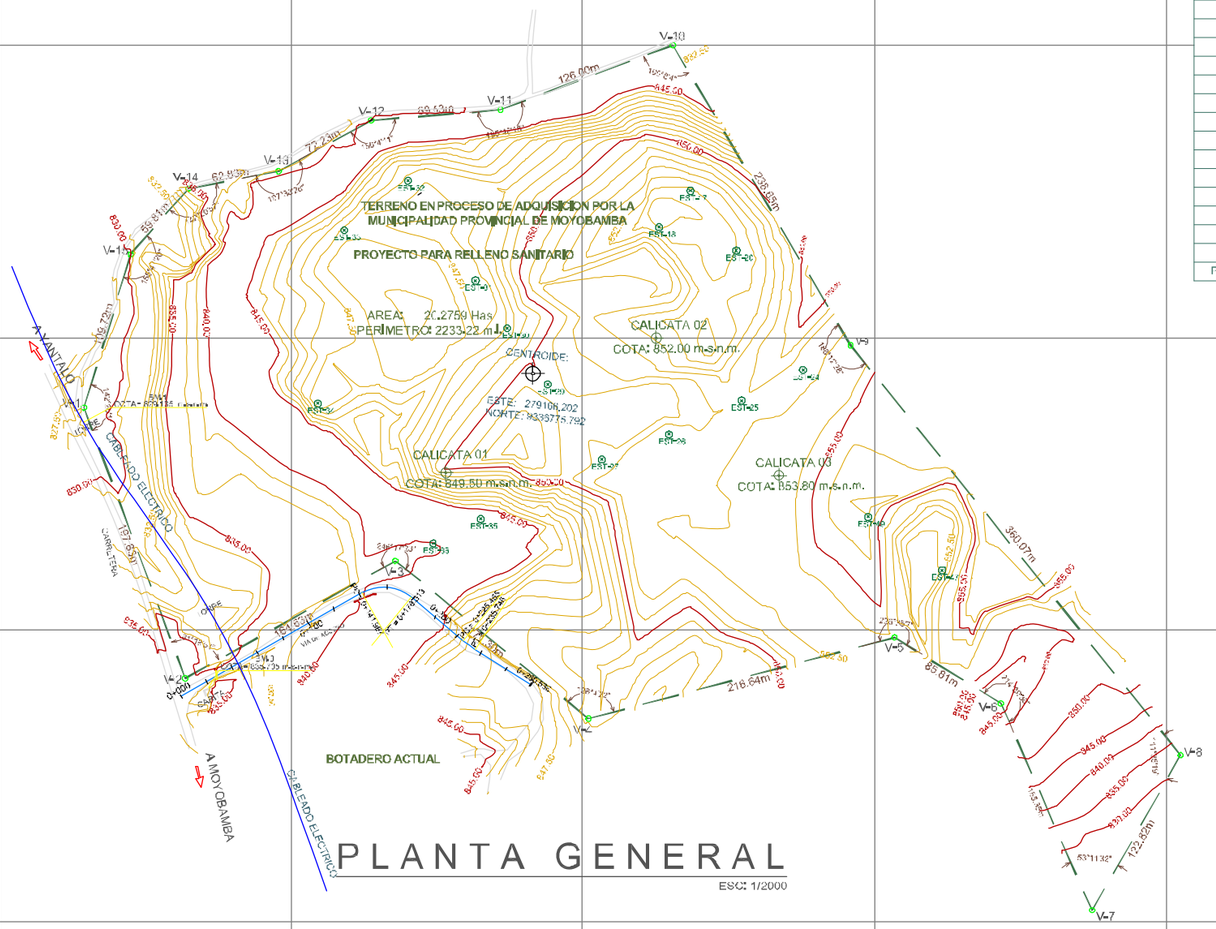
TOPOGRAFICO Y POLIGONAL DE APOYO

Nº PLANO:

PUESTO: JICA: ESTUDIO PREPARATORIO PARA EL PROYECTO DE DESARROLLO DE GESTIÓN DE RESIDUOS SOLIDOS EN EL PERU

Coordenadas UTM, en Sistema WGS 84; zona 18M

VERTICE	LADO	DISTANCIA	ANG. INTERNO	ESTE (X)	NORTE (Y)
1	1-2	197.83	142°26'01"	278858.117	9336752.440
2	2-3	164.63	81°18'54"	278927.546	9336587.194
3	3-4	171.30	248°17'23"	279071.215	9336647.589
4	4-5	216.64	126°04'22"	279204.226	9336539.652
5	5-6	85.81	226°35'07"	279413.611	9336595.241
6	6-7	155.35	214°39'26"	279486.602	9336550.131
7	7-8	122.82	53°11'32"	279548.854	9336407.796
8	8-9	360.07	111°35'19"	279609.485	9336514.624
9	9-10	238.65	188°12'28"	279383.638	9336785.074
10	10-11	126.30	100°08'04"	279262.032	9337000.417
11	11-12	89.53	195°46'18"	279144.012	9336956.291
12	12-13	72.73	156°04'11"	279054.781	9336948.911
13	13-14	62.93	197°38'28"	278991.408	9336914.269
14	14-15	59.31	142°20'57"	278929.731	9336902.261
15	15-1	109.72	155°41'20"	278890.233	9336857.352
PERIMETRO =		2233.22 m	2340°00'00"	AREA TOTAL	202759.56 m²



PLANTA GENERAL

ESC: 1/2000

LEYENDA	
SIMBOLOGIA	DESCRIPCION
	CURVA DE NIVEL MAYORES
	CURVA DE NIVEL MENORES
	POLIGONAL AREA DEL PROYECTO
	CABLEADO ELECTRICO

PERÚ | Ministerio del Ambiente | Viceministerio de Gestión Ambiental

NOMBRE DEL PROYECTO:
MEJORAMIENTO Y AMPLIACIÓN DE LA GESTIÓN INTEGRAL DE RESIDUOS SÓLIDOS MUNICIPALES DE LA CIUDAD DE MOYOBAMBA Y AMPLIACIÓN DEL SERVICIO DE DISPOSICIÓN FINAL DE LOS RESIDUOS SÓLIDOS MUNICIPALES DE LAS CIUDADES DE YANTALO, CALZADA, JEPELACIO, HABANA Y SORITOR, PROVINCIA DE MOYOBAMBA, DEPARTAMENTO DE SAN MARTÍN

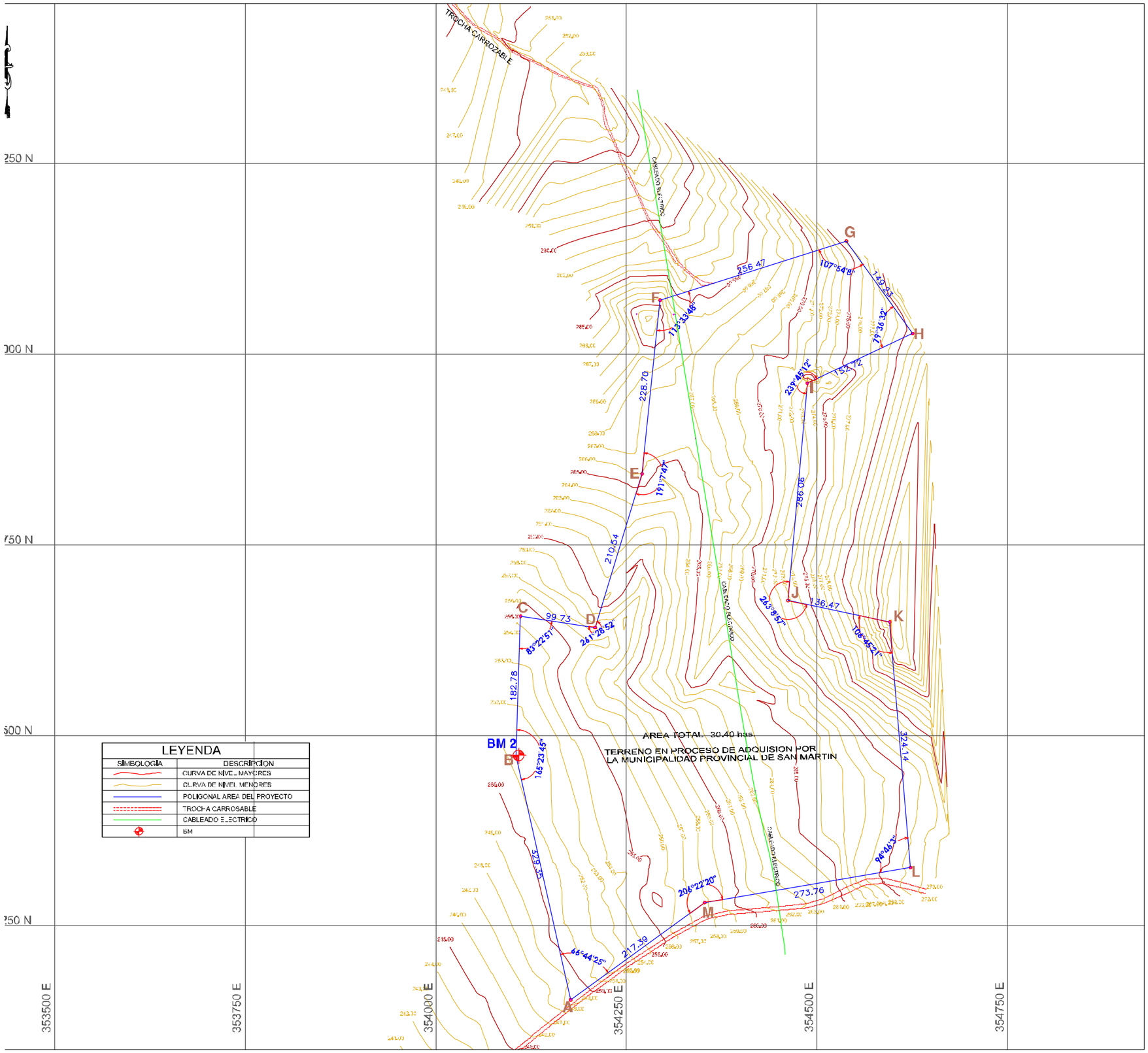
ESCALA: INDICADA

PLANO: TOPOGRAFICO DEL PROYECTO

N° PLANO:

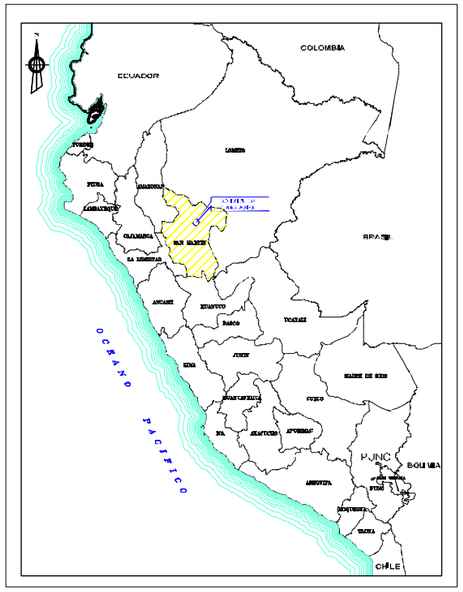
ELABORADO POR: EQUIPO DEL ESTUDIO DE JICA | DATUM: UTM WGS 84 | FECHA: Junio del 2010 | UBICACIÓN: SECTOR EL PACHISO, PROVINCIA MOYOBAMBA | DISTRITO: MOYOBAMBA, DEPARTAMENTO SAN MARTIN

FUENTE: JICA: ESTUDIO PREPARATORIO PARA EL PROYECTO DE DESARROLLO DE GESTIÓN DE RESIDUOS SOLIDOS EN EL PERU



PLANTA GENERAL
ESCALA : 1/2500

UBICACION DEPARTAMENTAL



CUADRO DE DATOS TECNICOS
DATUM = WGS 84

VERTICE	LADO	DISTANCIA	ANG. INTERNO	ESTE (X)	NORTE (Y)
A	A–B	329.36	66°44'25"	354177.0806	9264152.7277
B	B–C	182.78	165°23'45"	354104.6347	9264474.0228
C	C–D	99.73	83°22'51"	354110.6873	9264656.7029
D	D–E	210.54	261°28'52"	354209.3167	9264641.9329
E	E–F	228.70	191°7'47"	354270.9998	9264843.2385
F	F–G	256.47	113°33'48"	354294.5333	9265070.7266
G	G–H	149.23	107°54'8"	354538.9225	9265148.5195
H	H–I	152.72	79°36'32"	354625.7063	9265027.1195
I	I–J	286.06	239°45'12"	354487.4883	9264962.1723
J	J–K	136.47	263°8'57"	354462.1664	9264677.2316
K	K–L	324.14	106°45'21"	354595.6843	9264649.0238
L	L–M	273.76	94°46'3"	354622.9583	9264326.0299
M	M–A	217.39	206°22'20"	354353.0280	9264280.4030
TOTAL		2847.35	1980°0'1"		

Suma de ángulos (real) = 1980°00'00"
Error acumulado = 00°00'01"

CUADRO DE DATOS TECNICOS BMs
DATUM = WGS 84

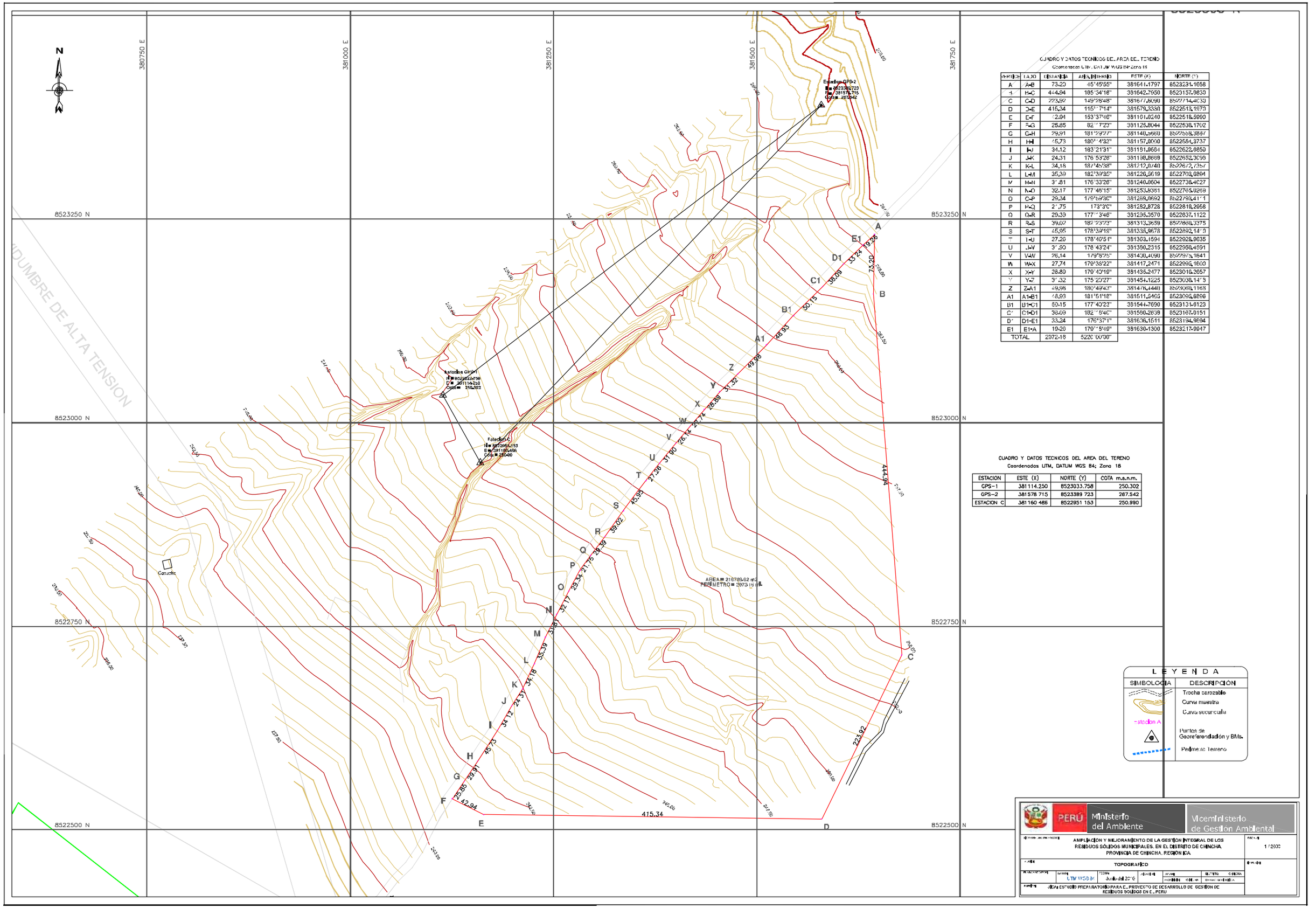
BM	COTA	ESTE (X)	NORTE (Y)
BM-1	231.0	353640.620	9265907.595
BM-2	251.2	354108.036	9264474.071

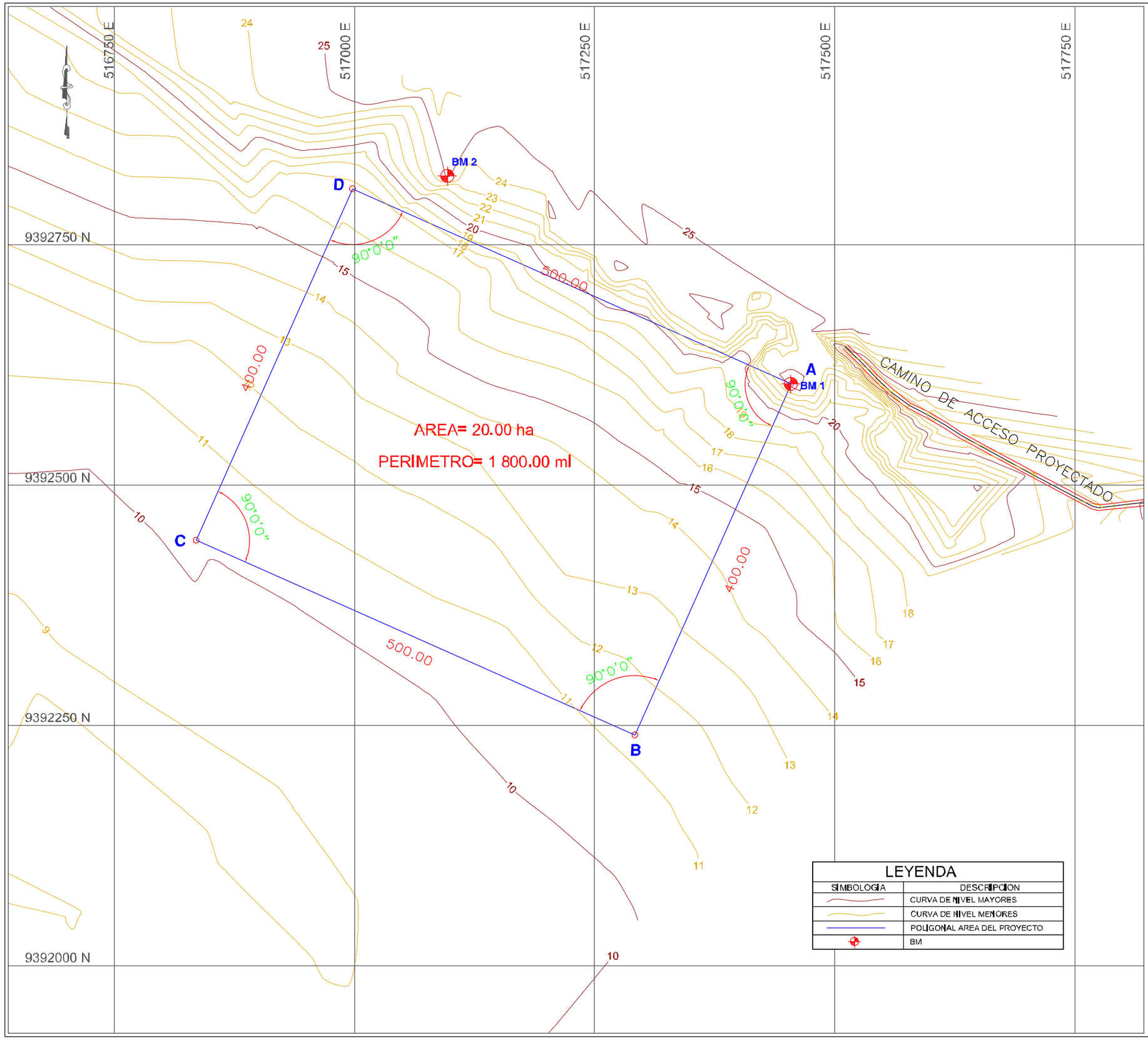
PERU | Ministerio del Ambiente | Viceministerio de Gestión Ambiental

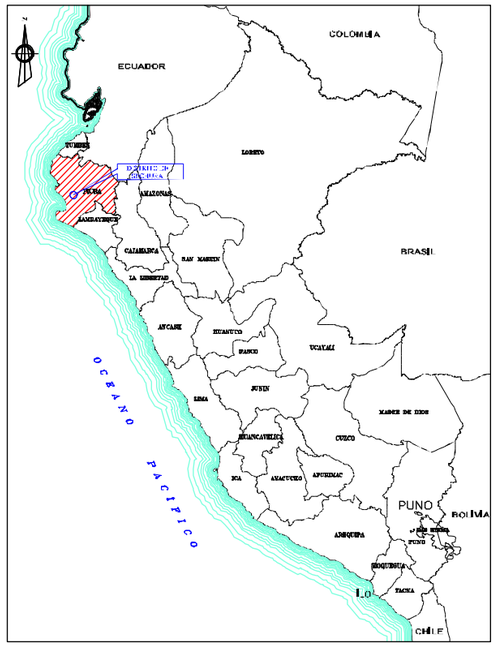
TOPOGRAFICO DEL PROYECTO

WGS 84

ESTUDIO PREPARATORIO PARA EL PROYECTO DEL DESARROLLO DEL RELLENO DE RESIDUOS SOLIDOS EN EL PERU


N
380750 E
381000 E
381250 E
381500 E
381750 E
8523250 N
8523000 N
8522750 N
8522500 N
Estacion GPS-2
N= 8523389.723
E= 381578.715
Cota= 287.542
Estacion A
N= 8523033.758
E= 381114.250
Cota= 250.302
Estacion C
N= 8522951.153
E= 381160.485
Cota= 250.990
Caseta
AREA= 218789.62 m2
PERIMETRO= 2073.18 ml
A
B
C
D
E
E1
D1
C1
B1
A1
Z
Y
X
W
V
U
T
S
R
Q
P
O
N
M
L
K
J
I
H
G
F
73.20
444.94
223.92
415.34
42.94
25.85
29.91
45.73
34.12
24.37
34.18
35.39
31.81
32.17
29.34
21.75
29.39
39.02
45.93
27.28
37.32
26.14
27.74
28.89
49.98
49.93
50.15
38.09
33.24
19.26
CUADRO Y DATOS TECNICOS DEL AREA DEL TERENO
Coordenadas UTM, DATUM WGS 84 Zona 18
VERTICE | LADO | DISTANCIA | ANGULO INTERNO | ESTE (X) | NORTE (Y)
A | A-B | 73.20 | 45°45'55" | 381641.1797 | 8523231.1658
B | B-C | 444.94 | 165°34'18" | 381642.7950 | 8523157.9850
C | C-D | 223.92 | 149°28'48" | 381677.8090 | 8522714.4030
D | D-E | 415.34 | 115°17'14" | 381579.3330 | 8522513.1870
E | E-F | 42.94 | 153°37'46" | 381161.0240 | 8522518.5990
F | F-G | 25.85 | 82°17'22" | 381125.8044 | 8522538.1702
G | G-H | 29.91 | 181°29'27" | 381140.3660 | 8522564.3837
H | H-I | 45.73 | 180°14'32" | 381157.0090 | 8522584.3737
I | I-J | 34.12 | 183°21'31" | 381181.9654 | 8522622.6859
J | J-K | 24.31 | 176°53'28" | 381198.8888 | 8522652.3095
K | K-L | 34.18 | 187°45'58" | 381212.0740 | 8522672.7357
L | L-M | 35.39 | 182°39'36" | 381226.5619 | 8522703.6864
M | M-N | 31.81 | 176°33'26" | 381240.0604 | 8522736.4027
N | N-O | 32.17 | 177°48'15" | 381253.9351 | 8522765.0269
O | O-P | 29.34 | 176°56'36" | 381269.0692 | 8522793.4171
P | P-Q | 21.75 | 173°3'0" | 381282.8728 | 8522818.2858
Q | Q-R | 29.39 | 177°7'346" | 381295.3570 | 8522837.1122
R | R-S | 39.02 | 185°23'22" | 381313.3659 | 8522868.3375
S | S-T | 45.93 | 178°39'16" | 381335.9678 | 8522892.1470
T | T-U | 27.28 | 178°46'51" | 381363.1594 | 8522928.9035
U | U-V | 37.90 | 178°43'24" | 381380.2315 | 8522950.4591
V | V-W | 26.14 | 179°8'25" | 381400.4098 | 8522973.1841
W | W-X | 27.74 | 179°38'22" | 381417.2471 | 8522996.1600
X | X-Y | 28.89 | 179°40'19" | 381435.2477 | 8523016.2657
Y | Y-Z | 37.32 | 175°20'27" | 381454.1225 | 8523038.1479
Z | Z-A1 | 49.98 | 180°49'4" | 381476.4441 | 8523060.1168
A1 | A1-B1 | 49.93 | 181°51'18" | 381511.5465 | 8523096.6806
B1 | B1-C1 | 50.15 | 177°40'23" | 381544.7690 | 8523131.6123
C1 | C1-D1 | 38.09 | 182°1'54" | 381580.2838 | 8523167.0151
D1 | D1-E1 | 33.24 | 176°37'1" | 381616.1511 | 8523194.9694
E1 | E1-A | 19.26 | 179°1'518" | 381630.1300 | 8523217.9847
TOTAL | | 2072.18 | 5220°00'00" | | |
CUADRO Y DATOS TECNICOS DEL AREA DEL TERENO
Coordenadas UTM, DATUM WGS 84; Zona 18
ESTACION | ESTE (X) | NORTE (Y) | COTA m.s.n.m.
GPS-1 | 381114.250 | 8523033.758 | 250.302
GPS-2 | 381578 715 | 8523389 723 | 287.542
ESTACION C | 381160 485 | 8522951 153 | 250.990
LEYENDA
SIMBOLOGIA | DESCRIPCIÓN
Trocha carozable
Curva maestra
Curva secundaria
estación A
Puntos de Georeferendiación y BMs.
Perimetro Terreno
PERÚ
Ministerio del Ambiente
Viceministerio de Gestión Ambiental
AMPLIACIÓN Y MEJORAMIENTO DE LA GESTIÓN INTEGRAL DE LOS RESIDUOS SÓLIDOS MUNICIPALES. EN EL DISTRITO DE CHINCHA. PROVINCIA DE CHINCHA. REGION ICA
1 / 2000
TOPOGRAFICO
UTM WGS 84
Junio del 2016
DISTRITO CHINCHA
JICA ESTUDIO PREPARATORIO PARA EL PROYECTO DE DESARROLLO DE GESTION DE RESIDUOS SOLIDOS EN EL PERU





UBICACION DEPARTAMENTAL

CUADRO DE DATOS TECNICOS
DATUM = WGS 84

VERTICE	LADO	DISTANCIA	ANG. INTERNO	ESTE (X)	NORTE (Y)
A	A–B	400.00	90°0'0"	517454.444	9392605.526
B	B–C	500.00	90°0'0"	517292.020	9392239 987
C	C–D	400.00	90°0'0"	516835.096	9392443 016
D	D–A	500.00	90°0'0"	516997.520	9392808 555
TOTAL		1800.00	360°0'0"		

Suma de ángulos (real) = 360°00'00"
Error acumulado = 00°00'00"

CUADRO DE DATOS TECNICOS BMs
DATUM = WGS - 84

BM	COTA	ESTE (X)	NORTE (Y)
BM-1	25.27	517454.444	9392605.526
BM-2	25.17	517096.547	9392821.563

LEYENDA

SIMBOLOGIA	DESCRIPCION
	CURVA DE NIVEL MAYORES
	CURVA DE NIVEL MENORES
	POLIGONAL AREA DEL PROYECTO
	BM

PERÚ | Ministerio del Ambiente | Viceministerio de Gestión Ambiental

NOMBRE DEL PROYECTO: MEJORAMIENTO Y AMPLIACION DE LA GESTION INTEGRAL DE LOS RESIDUOS SOLIDOS MUNICIPALES EN LA CIUDAD DE SECHURA PROVINCIA DE SECHURA, DEPARTAMENTO DE PIURA

ESCALA: 1/7000

PLANO: TOPOGRAFICO DEL PROYECTO

DATUM: WGS 84

UBICACION: JICA ESTUDIO PREPARATORIO PARA EL PROYECTO DE DESARROLLO DE GESTION DE RESIDUOS SOLIDOS EN EL PERU

N

CERRO SAN LUIS

CERRO SAN LUIS

PAMPA DEL CURA

PAMPA DEL CURA

CUADRO Y DATOS TECNICOS DEL AREA DEL TERENO
Coordenadas UTM, DATUM WGS 84; Zona 18

VERTICE	LADO	DISTANCIA	ANG. INTERNO	ESTE (X)	NORTE (Y)
A	A–B	449.34	85°51'54"	228865.5100	8782437.0670
B	B–C	738.98	178°38'57"	228486.7170	8782678.7710
C	C–D	268.66	95°39'21"	227873.2980	8783090.8550
D	D–E	593.59	91°12'33"	228000.4040	8783327.5430
E	E–F	364.08	203°43'38"	228529.1720	8783057.8040
F	F–G	150.61	212°56'21"	228892.6500	8783036.8450
G	G–H	194.58	101°11'44"	229023.5520	8783111.3260
H	H–A	598.76	110°55'32"	229150.3560	8782963.7360
TOTAL		3358.60	1080°00'00"		

CUADRO Y DATOS TECNICOS DEL AREA DEL TERENO
Coordenadas UTM, DATUM WGS 84; Zona 18

ESTACION	ESTE (X)	NORTE (Y)	COTA m.s.n.m.
EST–A	228964.693	8782833.989	409.661
EST–B	228750.644	8783044.312	414.234
EST–C	228029.891	8783075.830	434.247

AREA = 48.35 Ha
PERIMETRO = 3358.60 ml.

Estacion C
N = 8783075.830
E = 228029.891
Cota = 434.247

Estacion B
N = 8783044.312
E = 228750.644
Cota = 414.234

Estacion A
N = 8782833.989
E = 228964.693
Cota = 409.661

LEYENDA

SIMBOLOGIA	DESCRIPCIÓN
	Trocha carozable
	Curva maestra
	Curva secundaria
Estacion A	Puntos de Georeferenciación y BMs.
	Perimetro Terreno

PERÚ | Ministerio del Ambiente | Viceministerio de Gestión Ambiental

AMPLIACIÓN Y MEJORAMIENTO DE LA GESTIÓN INTEGRAL DE LOS RESIDUOS SOLIDOS MUNICIPALES, EN EL DISTRITO DE HUAURA, PROVINCIA DE HUAURA, DEPARTAMENTO LIMA

TOPOGRAFICO

1 / 2000

UTM WGS 84 | Junio Jul 2013

JICA ESTUDIO PREPARATORIO PARA EL PROYECTO DE DESARROLLO DE GESTIÓN DE RESIDUOS SOLIDOS EN EL PERU

Appendix-2: Result of Geological Survey and Soil Test

Results of soil test at BH-1 Puno

Bore Hole Number	Depth below G.L. in m	Description	SPT N Value	Grain Size Analysis				Density and Moisture Test			Atterberg Limits			Compression Strengh		Consolidation Test		Void Ratio, e_0	Permeability K (m/s)
				Gravel >4.75mm (%)	Sand 0.075-4.75mm (%)	Silt 0.002-0.075mm (%)	Clay <0.002mm (%)	Natural Moisture Contents(%)	BulkDensity (g/cm3)	Dry Density (g/cm3)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Type of Test	qu (kg/cm2)	Cc	$\frac{Cc}{1+e_0}$		
BH-1	0.0	SUELO ARCILLOSO POCO DESARROLLADO																	
	0.5				100.00	34.80	65.20	14.80	1.74	1.51	52.20	37.30	14.80			0.247	0.137	0.807	
		0.75m		75.84	24.16	19.07	56.77	41.32	1.74	1.23	46.80	27.10	19.70	ASTM D-2116	0.430				
	1.0	ROCAS TOBACEAS FRACTURADA EN BOLONES GRANDES OBSCURAS Y																	
	1.5																		
		1.55m																	
	2.0	ROCAS V[illegible]AS DACITA) CON FRACTURAMIENTO EN DOS																	
	2.5	DIRECCIONES CON OXIDACION ENTRE LAS FRACTURAS POR CIRCULACION HIDRICA																	
		2.85m																	
	3.0																		
	3.5																		
	4.0																		
	4.5	ROCA VOLCANICA MASIVA (DACITA) NO FRACTURADA																	
	5.0																		8.5×10^{-5}
	5.5																		
	6.0	6.0m																	
	6.5																		

Results of soil test at BH-2 Puno

Bore Hole Number	Depth below G.L. in m	Description	SPT N Value	Grain Size Analysis				Density and			Atterberg Limits			Compression		Consolidation		Void Ratio, e_0	Permeability K (m/s)
				Gravel >4.75mm (%)	Sand 0.075-4.75mm (%)	Silt 0.002-0.075mm (%)	Clay <0.002mm (%)	Natural Moisture Contents(%)	BulkDensity (g/cm3)	Dry Density (g/cm3)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Type of Test	qu (kg/cm2)	Cc	$\frac{Cc}{1+e_0}$		
BH-2	0.0																		
	0.5	SUELO ARCILLOSO POCO DESARROLLADO		93.14	6.86	15.71	77.43	53.01	1.77	1.16	43.20	28.70	14.50	ASTM D-2116	0.360				
	1.0			99.10	0.90	31.90	68.10	14.80	1.73	1.51	55.30	29.80	25.50			0.240	0.133	0.808	
		1.2m																	
	1.5	ROCAS TOBACEAS FRACTURADA EN BOLONES GRANDES OBSCURAS Y OXIDADAS POR AGENTES HIDRICOS SUBTERRANEOS																	
	2.0																		
		2.3m																	
	2.5	ROCAS VOLCANICAS (DACITA) CON FRACTURAMIENTO EN DOS																	
	3.0																		
	3.5	DIRECCIONES CON OXIDACION ENTRE LAS FRACTURAS POR CIRCULACION HIDRICA																	
	4.0																		
	4.5																		
	5.0	5.0m																	8.0×10^{-5}
	5.5																		
	6.0	ROCA VOLCANICA MASIVA (DACITA) NO FRACTURADA																	
	6.5																		
	7.0	7.0m																	
	7.5																		

Results of soil test at BH-3 Puno

Bore Hole Number	Depth below G.L. in m	Description	SPT N Value	Grain Size Analysis				Density and			Atterberg Limits			Compression		Consolidation		Void Ratio, e_0	Permeability K (m/s)
				Gravel >4.75mm (%)	Sand 0.075~4.75mm (%)	Silt 0.002~0.075mm (%)	Clay <0.002mm (%)	Natural Moisture Contents(%)	BulkDensity (g/cm3)	Dry Density (g/cm3)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Type of Test	qu (kg/cm2)	Cc	$\frac{C_c}{1+e_0}$		
BH-3	0.0	SUELO ARCILLOSO POCO DESARROLLADO		64.14	35.86	2.83	61.31	60.22			56.90	34.10	22.80						
	0.5	0.9m																	
	1.0	ROCAS TOBACEAS FRACTURADA EN BOLONES GRANDES OBSCURAS Y OXIDADAS POR AGENTES HIDRICOS SUBTERRA																	
	1.5	1.6m																	
	2.0																		
	2.5	ROCAS VOLCANICAS (DACITA)																	
	3.0	CON FRACTURAMIENTO EN DOS																	
	3.5	DIRECCIONES CON OXIDACION																	
	4.0	ENTRE LAS FRACTURAS POR CIRCULACION HIDRICA																	
	4.5																		
	5.0	4.8m																	7.7×10^{-5}
	5.5																		
	6.0	ROCA VOLCANICA MASIVA (DACITA) NO FRACTURADA																	
	6.5																		
	7.0	7.3m																	
	7.5																		

Results of soil test at BH-1Juliaca

Bore Hole Number	Depth below G.L. in m	Description	SPT N Value	Grain Size Analysis				Density and Moisture Test			Atterberg Limits			Compression Strengh		Consolidation Test		Colapso	Void Ratio, e_0	Permeability K (m/s)
				Gravel >4.75mm (%)	Sand 0.075-4.75mm (%)	Silt 0.002-0.075mm (%)	Clay <0,002mm (%)	Natural Moisture Contents(%)	BulkDensity (g/cm3)	Dry Density (g/cm3)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Type of Test	qu (kg/cm2)	Cc	$\frac{C_c}{1+e_0}$			
BH-1	0.0	SUELO Y MATERIAL																		
		0.3m																		
	0.5																			
	1.0	LIMO - ARENOSO	9		100	26.30	73.70	5.30	1.73	1.64	32.40	22.50	9.90	ASTM D2166	15.50	0.243	0.15		0.659	
		1.2m						5.41	1.78	1.69										
	1.5																			
	2.0		8																	
	2.5			58.10	41.90	92.80	7.20	4.10	1.64		NP	NP	NP					1.23		
	3.0	GRAVA Y ARENAS	11	85.79	14.21	78.05	7.74	18.68	1.84		NP	NP	NP							
	3.5																			
	4.0		13																	
	4.5																			
	5.0	5.0m	15																	1.76 X 10^{-1}
	5.5																			
	6.0		16																	
	6.5																			
	7.0		19																	
	7.5	GRAVAS, ARENAS Y LIMO																		
	8.0																			
	8.5																			
	9.0																			
	9.5																			
	10.0	10.0m																		0.60 X 10^{-2}
	10.5																			

Results of soil test at BH-2 Juliaca

Bore Hole Number	Depth below G.L. in m	Description	SPT N Value	Grain Size Analysis				Density and Moisture Test			Atterberg Limits			Compression Strengh		Consolidation Test		Colapso	Void Ratio, e_0	Permeability K (m/s)
				Gravel >4.75mm (%)	Sand 0.075-4.75mm (%)	Silt 0.002-0.075mm (%)	Clay <0,002mm (%)	Natural Moisture Contents(%)	BulkDensity (g/cm3)	Dry Density (g/cm3)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Type of Test	qu (kg/cm2)	Cc	$\frac{C_c}{1+e_0}$			
BH-2	0.0	SUELO Y MATERIAL																		
		0.2m																		
	0.5	GRAVAS Y ARENAS																		
		0.7m						1.78	4.71											
	1.0	ARCILLA INORGANICOS DE	9		100	20.30	79.70	4.70	1.74	1.66	30.50	22.00	8.60	ASTM D2166	14.95	0.216	0.132		0.637	8.64 X 10^{-4}
		MEDIA ALTA PLASTICIDAD		99.49	0.51	21.86	77.63	0.77	1.64	1.70	31.90	22.44	9.46							
	1.5	1.45m																		
	2.0		8																	
	2.5			58.80	41.20	93.50	6.50	3.80	1.64		NP	NP	NP					1.21		
	3.0		10																	3.9 X 10^{-1}
	3.5																			
	4.0	GRAVA Y ARENAS	11																	
	4.5																			
	5.0		13																	
	5.5																			
		5.7m																		
	6.0		13																	
	6.5																			
	7.0	GRAVA, ARENA Y LIMO	18																	
	7.5																			
	8.0	8.0m																		
	8.5																			

Results of soil test at BH-1 Tumbes

Bore Hole Number	Depth below G.L. (m)	Description	SPT N Value	Grain Size Analysis				Density and			Atterberg Limits			Compression		Consolidation		Void Ratio, e_0	Colapso	Permeability K (m/s)
				Gravel >4.75mm (%)	Sand 0.075–4.75mm (%)	Silt 0.002–0.075mm	Clay <0.002mm (%)	Natural Moisture Contents(%)	BulkDensity (g/cm3)	Dry Density (g/cm3)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Type of Test	qu (kg/cm2)	Cc	$\frac{C_c}{1+e_0}$			
BH-1	0.0																			
	0.5																			
	1.0	LUTITA CON ARENA	26																	
					100	39.20	60.80				35.40	15.40	20.00							
	1.5																			
	2.0	2.0m	25																	
		ARENA CON ARCILLA																		
	2.5																			
	3.0		22																	
	3.5				100	57.60	42.40	2.97	1.87	1.82	27.75	13.73	14.02	ASTM D-2116	2.62					
	4.0		16		100	67.40	32.60	21.00										1.25		
	4.5																			
	5.0		23																	4.34×10^{-3}
	5.5																			
	6.0		22																	
	6.5																			
	7.0	7.0m																		
	7.5			99.80	0.20	58.50	41.30				29.60	18.99	10.61							
	8.0				100	93.00	7.00	1.10			NP	NP	NP						1.23	
	8.5	ARENA CON ARCILLA																		
	9.0																			1.72×10^{-3}
	9.5																			
	10.0	10.0m																		
	10.5	ARENISCA CON CANTO RODADO																		
	11.0	11.0m																		
	11.5																			
	12.0																			
	12.5																			
	13.0				100	9.30	90.70	7.68	1.68	1.56	62.10	25.75	36.35	ASTM D-2116	2.54					
	13.5																			3.04×10^{-4}
	14.0	LUTITA 80% ARENA 20%																		
	14.5																			
	15.0																			
	15.5																			
	16.0																			
	16.5																			
	17.0	17.0m			100	11.30	88.70	10.40	1.74	1.57	72.10	31.60	40.50			0.255	0.146	0.743		
	17.5																			
	18.0																			
	19.0																			
	20.0																			4.45×10^{-4}
	21.0	BENTONITA																		
	22.0																			
	23.0																			
	24.0																			3.52×10^{-4}
	25.0	25.0m																		

Results of soil test at BH-2 Tumbes

Bore Hole Number	Depth below G.L. (m)	Description	SPT N Value	Grain Size Analysis				Density and			Atterberg Limits			Compression		Consolidation		Void Ratio, e_0	Colapso	Permeability K (m/s)
				Gravel >4.75mm (%)	Sand 0.075–4.75mm (%)	Silt 0.002–0.075mm (%)	Clay <0.002mm (%)	Natural Moisture Contents(%)	BulkDensity (g/cm3)	Dry Density (g/cm3)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Type of Test	qu (kg/cm2)	Cc	$\frac{C_c}{1+e_0}$			
BH-2	0.0	SUELO																		
	0.5																			
	0.9m				100	59.40	40.60				36.00	14.25	21.75							
	1.0		30																	
	1.5																			
	2.0		12																	
	2.5	ARENA																		
	3.0		16																	
	3.5																			
	4.0	4.0m			100	81.90	18.10	20.30			NP	NP	NP						1.23	
	4.5																			
	5.0																			1.35×10^{-3}
	5.5	LUTITA CON ARENA			100	9.80	90.20	10.23	1.86	1.69	69.60	25.04	44.56	ASTM D-211(	2.22					
	6.0																			
	6.5																			
	7.0	7.0m																		
	7.5																			
	8.0																			
	8.5	ARENA																		
	9.0																			2.27×10^{-3}
	9.5																			
	10.0																			
	10.5																			
	11.0																			
	11.5	ARENA																		
	12.0																			
	12.5																			
	13.0	13.0m																		
	13.5																			
	14.0			99.10	0.90	35.30	64.70	3.50	1.74	1.68	42.10	18.80	23.40			0.225	0.138	0.625		
	14.5																			2.95×10^{-3}
	15.0																			
	15.5																			
	16.0																			
	16.5																			
	17.0																			
	17.5	BENTONITA																		
	18.0																			
	19.0																			2.52×10^{-4}
	20.0																			
	21.0																			
	22.0																			
	23.0																			
	24.0																			2.70×10^{-4}
	25.0	25.0m																		

Results of soil test at BH-3 Tumbes

Bore Hole Number	Depth below G.L. (m)	Description	SPT N Value	Grain Size Analysis				Density and			Atterberg Limits			Compression		Consolidation		Void Ratio, e_0	Colapso	Permeability K (m/s)
				Gravel >4.75mm (%)	Sand 0.075–4.75mm (%)	Silt 0.002–0.075mm (%)	Clay <0.002mm (%)	Natural Moisture Contents(%)	BulkDensity (g/cm3)	Dry Density (g/cm3)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Type of Test	qu (kg/cm2)	Cc	$\frac{C_c}{1+e_0}$			
BH-3	0.0																			
	0.5																			
	1.0																			
	1.5	LUTITA CON ARENA																		
	2.0		52																	
	2.5																			
	3.0	3.0m	37																	
	3.5																			
	4.0		26		100	28.50	71.50	8.40	1.43	1.60	46.20	20.57	25.63	ASTM D-2616	3.03					
	4.5																			
	5.0	ARENA CON ARCILLA																		2.49×10^{-4}
	5.5																			
	6.0																			
		6.4m																		
	6.5																			
	7.0																			
	7.5			99.90	0.10	51.80	48.10				36.40	18.76	17.64							
	8.0	ARENA			100	67.40	32.60	21.00			NP	NP	NP						1.25	
	8.5																			
	9.0																			2.69×10^{-3}
		9.3m																		
	9.5																			
	10.0																			
	10.5																			
	11.0																			
	11.5																			
	12.0	LUTITA 80% ARENA 20%			100	74.20	25.80	2.88	1.88	1.83	32.60	18.09	14.51	STMA D-211	1.90					
	12.5																			
	13.0																			
	13.5																			
	14.0																			
	14.5	14.5m																		2.95×10^{-3}
	15.0			92.70	7.30	63.50	36.50	4.20	1.72	1.64	77.30	30.50	46.80			0.234	0.141	0.662		
	15.5																			
	16.0																			
	16.5																			
	17.0																			
	17.5																			
	18.0	BENTONITA	25																	
	19.0																			2.52×10^{-4}
	20.0																			
	21.0																			
	22.0																			
	23.0																			
	24.0																			$2.70X 10^{-4}$
	25.0	25.0m																		

Results of soil test at BH-1Huanuco

Bore Hole Number	Depth below G.L. in m	Description	SPT N Value	Grain Size Analysis				Density and Moisture Test			Atterberg Limits			Compression Strengh		Consolidation Test		Void Ratio, e_0	Colapso	Permeability K (m/s)
				Gravel >4.75mm (%)	Sand 0.075–4.75mm (%)	Silt 0.002–0.075mm (%)	Clay <0.002mm (%)	Natural Moisture Contents(%)	BulkDensity (g/cm3)	Dry Density (g/cm3)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Type of Test	qu (kg/cm2)	Cc	$\frac{C_c}{1+e_0}$			
BH–1	0.0	SUELO CON LIMO, ARENA Y MATERIAL ORGANICO																		
	0.5	0.3m																		
	1.0		12	83.60	16.40	92.60	7.40				NP	NP	NP							
	1.5																			
	2.0		19	57.90	42.10	56.10	1.80	8.70	1.65		NP	NP	NP						1.17	5.56×10^{-4}
	2.5																			
	3.0		23																	
	3.5																			
	4.0	ARENAS Y BRECHAS DE ROCA GRANITICA	28	79.70	20.30	78.90	0.80	4.50	1.65		NP	NP	NP						1.20	
	4.5																			2.66×10^{-4}
	5.0		15																	
	5.5																			
	6.0		27	99.70	0.30	99.10	0.60	6.40	1.63		NP	NP	NP						1.20	2.33×10^{-4}
	6.5																			
	7.0		30																	
	7.5																			
	8.0	8.0m		99.40	0.60	91.10	8.90				NP	NP	NP							
	8.5																			
	9.0		27																	
	9.5																			
	10.0	GRANITO ALTERADO Y ROCAS FRACTURADAS	16	99.40	0.60	90.70	8.70	6.00	1.63		NP	NP	NP						1.20	
	10.5																			
	11.0			98.40	1.60	92.30	7.70				NP	NP	NP							4.35×10^{-5}
	11.5																			
	12.0	12.0m		89.60	10.40	92.30	7.70				NP	NP	NP							
	12.5																			

Results of soil test at BH-2 Huanuco

Bore Hole Number	Depth below G.L. in m	Description	SPT N Value	Grain Size Analysis				Density and Moisture Test			Atterberg Limits			Compression Strengh		Consolidation Test		Void Ratio, e_0	Colapso	Permeability K (m/s)
				Gravel >4.75mm (%)	Sand 0.075–4.75mm (%)	Silt 0.002–0.075mm (%)	Clay <0.002mm (%)	Natural Moisture Contents(%)	BulkDensity (g/cm3)	Dry Density (g/cm3)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Type of Test	qu (kg/cm2)	Cc	$\frac{C_c}{1+e_0}$			
BH-2	0.0	SUELO CON LIMO, ARENA Y METERIAL ORGANICO																		
	0.5	0.3m																		
	1.0		12																	
	1.5																			
	2.0		20	92.80	7.20	86.70	6.10	6.50	1.63		NP	NP	NP						1.21	
	2.5																			5.32×10^{-4}
	3.0		26																	
	3.5																			
	4.0		29	62.00	38.00	57.90	4.10	2.60	1.64		NP	NP	NP						1.18	
	4.5																			
	5.0		41																	
	5.5	ARENA Y BRECHAS DE ROCA GRANITICA																		
	6.0		43	59.90	40.10	95.90	4.10				NP	NP	NP							1.95×10^{-4}
	6.5																			
	7.0																			
	7.5																			
	8.0		39																	
	8.5																			
	9.0		22	61.40	38.60	57.20	4.20	2.20	1.65		NP	NP	NP						1.21	
	9.5																			
	10.0		45																	
	10.5																			
	11.0	11.0m		58.80	41.20	95.30	4.70				NP	NP	NP							
	11.5																			
	12.0		39																	
	12.5																			1.46×10^{-4}
	13.0		46	78.60	21.40	93.00	7.00				NP	NP	NP							
	13.5	GRANITO ALTERADO Y FRACTURADAS																		
	14.0		53	82.30	17.70	91.70	8.30	5.40	1.65		NP	NP	NP						1.20	
	14.5																			
	15.0		59																	1.24×10^{-4}
	15.5																			
	16.0	16.0m		78.60	21.40	93.00	7.00				NP	NP	NP							
	16.5																			

Results of soil test at BH-1 Puerto Mardonado

Bore Hole Number	Depth below G.L. in m	Description	SPT N Value	Grain Size Analysis				Density and Moisture Test			Atterberg Limits			Compression Strengh		Consolidation Test		Void Ratio, e_0	Colapso	Permeability K (m/s)
				Gravel >4.75mm (%)	Sand 0.075~4.75mm (%)	Silt 0.002~0.075mm (%)	Clay <0.002mm (%)	Natural Moisture Contents(%)	BulkDensity (g/cm3)	Dry Density (g/cm3)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Type of Test	qu (kg/cm2)	Cc	$\frac{C_c}{1+e_0}$			
BH-1	0.0																			
	0.5																			
	1.0	SUELO ARCILLOSO CON MATERIAL ORGANICO	18		100	0.71	99.29	26.01	1.94	1.48	46.00	25.88	20.12	ASTM D-2116	0.65					
	1.5																			
	2.0		16							1.55				ASTM D-2116	0.56					
	2.3m																			
	2.5																			
	3.0		17																	2.75 X 10^{-6}
	3.5			98.10	1.90	32.60	67.40	7.20	1.72	1.60	41.50	25.00	16.50			0.242	0.143	0.694		
	4.0		14																	
	4.5	HORIZONTE DE COLOR ROJIZO, COMPUESTO DE MATERIAL ARCILLOSO POCO COMPACTO, LIGERAMENTE HUMEDO.			100	0.44	99.56	28.95	1.91		48.50	26.36	22.14							
	5.0		12																	
	5.5																			
	6.0		15																	
	6.5																			
	7.0		16																	
	7.1m																			
	7.5																			
	8.0		14																	
	8.5	SUELO ARCILLOSO DE COLOR ROJIZO MAS CLARO QUE HORIZONTE SUPERIOR MAYOR CONTENIDO DE ARENISCA POCO COMPACTO.																		
	9.0		11		100.00	0.87	99.13				40.00	22.91	17.09							
	9.5																			
	10.0																			
	10.1m																			
	10.5																			
	11.0	HORIZONTE DE ARENA DE POTENCIA VARIABLE, EN PARTES SE PRESENTAN COMO LENTES		41.00	59.00	93.10	6.90	3.70	1.66		NP	NP	NP						1.24	
	11.5																			
	12.0																			
	12.1m			98.50	1.50	91.80	8.20				NP	NP	NP							
	12.5																			
	13.0	GRAVA SUELTA CON MUY POCO FINO DE CANTO DE TAMAÑO HETEROGENEO.																		
	13.5																			
	14.0																			2.25 X 10^{-5}
	14.0m																			
	14.5																			

Results of soil test at BH-2 Puerto Mardonado

Bore Hole Number	Depth below G.L. (m)	Description	SPT N Value	Grain Size Analysis				Density and			Atterberg Limits			Compression		Consolidation		Void Ratio, e_0	Colapso	Permeability K (m/s)
				Gravel >4.75mm (%)	Sand 0.075~4.75mm (%)	Silt 0.002~0.075mm (%)	Clay <0.002mm (%)	Natural Moisture Contents(%)	BulkDensity (g/cm3)	Dry Density (g/cm3)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Type of Test	qu (kg/cm2)	Cc	$\frac{C_c}{1+e_0}$			
BH-2	0.0																			
	0.5																			
	1.0		26																	
	1.5	SUELO ARCILLOSO CON MATERIAL ORGANICO			100	13.40	86.60	19.40	1.72	1.44	49.60	24.50	25.10			0.267	0.141	0.899		
					100	0.59	99.41	25.02	1.96	1.75	49.40	27.93	21.47	ASTM D-2116	1.78					
	2.0		32																	
	2.5																			
										1.55				ASTM D-2116	0.75					6.12×10^{-6}
	3.0	3.0m	34																	
	3.5	HORIZONTE DE COLOR ROJIZO, COMPUESTO DE MATERIAL			100	0.78	99.22	22.77	1.86		44.80	24.82	19.98							
				99.20	0.80	18.60	81.40	8.40	1.74	1.60	34.70	22.70	11.90			0.241	0.142	0.700		
	4.0	ARCILLOSO POCO COMPACTO,	24																	
	4.5	LIGERA... E HUMEDO. 4.4m			100	1.04	98.96				42.30	22.39	19.91							
	5.0		13																	
	5.5	SUELO ARCILLOSO DE COLOR																		
	6.0	ROJIZO MAS CLARO QUE HORIZONTE SUPERIOR	13																	
	6.5	MAYOR CONTENIDO DE ARENISCA POCO																		
	7.0	COMPACTO.	10																	
	7.5	7.4m																		
	8.0	HORIZONTE DE ARENA DE POTENCIA VARIABLE, EN		99.80	0.02	64.10	35.90				16.45	NP	NP							
	8.5	PARTES SE PRESENTAN COMO																		
		8.75m																		
	9.0	GRAVA SUELTA CON MUY POCO																		1.71×10^{-5}
	9.5	FINO DE CANTO DE TAMAÑ 9.5m																		
	10.0																			

Results of soil test at BH-1 Moyobamba

Bore Hole Number	Depth below G.L. in	Description	SPT N Value	Grain Size Analysis				Density and			Atterberg Limits			Compression		Consolidation		Void Ratio, e_0	Colapso	Permeability K (m/s)
				Gravel >4.75mm (%)	Sand 0.075–4.75mm (%)	Silt 0.002–0.075mm (%)	Clay <0,002mm (%)	Natural Moisture Contents(%)	BulkDensity (g/cm3)	Dry Density (g/cm3)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Type of Test	qu (kg/cm2)	Cc	$\frac{C_c}{1+e_0}$			
BH-1	0.0	ARCILLA LIMOSOS ORGANICOS DE BAJA PLASTICIDAD																		
	0.5	0.8m			100	52.42	47.58				33.30	15.90	17.40							
	1.0		9																	
	1.5																			
	2.0		10																	
	2.5																			1.76×10^{-4}
	3.0	ARCILLAS INORGANICOS DE MEDIA A ALTA PLASTICIDAD.	12	95.10	4.90	58.00	37.10	10.05	2.02	1.63	29.60	14.10	15.50	ASTM D-2116	0.78					
	3.5				100	10.9	89.1	11.8	1.72	1.54	45.6	25.6	20.00			0.253	0.142	0.780		
	4.0		12																	
	4.5																			
	5.0		13																	
	5.5	5.3m																		
	6.0				100	0.15	99.85				61.30	23.10	38.20							
	6.5																			
	7.0																			
	7.5																			
	8.0																			
	8.5	ARENOSOS ARCILLOSOS MEZCLA ARENA – ARCILLA																		1.32×10^{-4}
	9.0			98.10	1.90	88.00	12.00	6.30			NP	NP	NP						1.26	
	9.5				100	0.48	99.52	12.65	2.05	1.82	56.80	22.80	34.00	ASTM D-2116	1.80					
	10.0																			
	10.5																			
	11.0																			
	11.5																			
	12.0	12.0m																		
	12.5																			

Results of soil test at BH-2 Moyobamba

Bore Hole Number	Depth below G.L. in	Description	SPT N Value	Grain Size Analysis				Density and			Atterberg Limits			Compression		Consolidation		Void Ratio, e_0	Colapso	Permeability K (m/s)
				Gravel >4.75mm (%)	Sand 0.075–4.75mm (%)	Silt 0.002–0.075mm (%)	Clay <0.002mm (%)	Natural Moisture Contents(%)	BulkDensity (g/cm3)	Dry Density (g/cm3)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Type of Test	qu (kg/cm2)	Cc	$\frac{C_c}{1+e_0}$			
BH-2	0.0																			
	0.5																			
	1.0	ARCILLA LIMOSOS ORGANICOS DE BAJA PLASTICIDAD	27																	
	1.5				100	27.50	72.50				37.10	19.00	18.10							
	2.0		28																	
	2.5																			
		2.8m																		
	3.0		29																	
	3.5																			
					100	23.60	76.40	21.02	1.96	1.62	44.80	22.10	22.70	ASTM D-2116	1.90					
	4.0		29	99.30	0.70	8.90	91.10	8.20	1.74	1.61	48.9	19.7	29.2			0.235	0.138	0.702		5.23×10^{-5}
	4.5	ARCILLAS INORGANICOS DE MEDIA A ALTA PLASTICIDAD.																		
	5.0		38																	
	5.5																			
	6.0	6.0m	43	96.00	4.00	78.80	17.20				NP	NP	NP							
	6.5																			
	7.0		44																	
	7.5																			
	8.0	ARENOSOS ARCILLOSOS MEZCLA ARENA – ARCILLA																		
	8.5																			
	9.0			99.40	0.60	84.30	15.70	3.50			NP	NP	NP						1.20	
	9.5			98.80	1.20	86.10	12.70	11.35			NP	NP	NP							1.32×10^{-4}
	10.0	10.0m																		
	10.5																			

Results of soil test at BH-1Tarapoto

Bore Hole Number	Depth below G.L. in m	Description	SPT N Value	Grain Size Analysis				Density and Moisture Test			Atterberg Limits			Compression Strengh		Consolidation Test		Void Ratio, e_0	Permeability K (m/s)
				Gravel >4.75mm (%)	Sand 0.075~4.75mm (%)	Silt 0.002~0.075mm (%)	Clay <0.002mm (%)	Natural Moisture Contents(%)	BulkDensity (g/cm3)	Dry Density (g/cm3)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Type of Test	qu (kg/cm2)	Cc	$\frac{C_c}{1+e_0}$		
BH-1	0.0	SUELO																	
	0.5	0.5m																	
	1.0		8																
	1.5	ARCILLAS ORGANICOS DE PLASTICIDAD BAJA		92.50	7.50	8.50	84.00				30.70	16.77	13.93						
				99.80	0.20	12.90	87.10	6.90	1.73	1.62	35.50	21.20	14.30			0.238	0.142	0.680	2.54×10^{-3}
	2.0		9																
	2.5	2.5m																	
	3.0		13																
	3.5	RCILLAS INORGANICOS MED			100	21.90	78.10	6.95	2.14	1.68	31.20	14.25	16.95	ASTM D-2116	1.93				
	4.0		43		100	32.20	66.80	6.00	1.74	1.64	31.50	16.90	14.70			0.233	0.141	0.658	
	4.5																		9.79×10^{-4}
		4.9m																	
	5.0		44																
	5.5																		
	6.0		54		100	24.22	75.78	16.44	2.09	1.79	31.00	15.48	15.52	ASTM D-2116	1.42				
	6.5																		
	7.0		16																
	7.5	ARCILLAS ARENOSAS																	
	8.0		14																
	8.5																		
	9.0		11		100	28.10	71.90				26.90	14.40	12.50						
	9.5																		
	10.0	10.0m																	5.78×10^{-4}
	10.5																		

Results of soil test at BH-2 Tarapoto

Bore Hole Number	Depth below G.L. in	Description	SPT N Value	Grain Size Analysis				Density and			Atterberg Limits			Compression		Consolidation		Void Ratio, e_0	Permeability K (m/s)
				Gravel >4.75mm (%)	Sand 0.075-4.75mm (%)	Silt 0.002-0.075mm (%)	Clay <0.002mm (%)	Natural Moisture Contents(%)	BulkDensity (g/cm3)	Dry Density (g/cm3)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Type of Test	qu (kg/cm2)	Cc	$\frac{C_c}{1+e_0}$		
BH-2	0.0																		
	0.5	SUELO																	
		0.4m																	
	1.0		21																
	1.5	ARCILLAS ORGANICOS DE PLASTICIDAD BAJA			100	0.83	99.17	8.73	2.04	1.63	42.40	20.30	22.10	ASTN D-2116	0.78				
					100	6.90	93.10	9.20	1.74	1.59	46.10	25.90	20.30			0.243	0.142	0.711	
	2.0		20																
		2.45m																	2.97×10^{-3}
	2.5																		
	3.0		24																
	3.5																		
					100	4.35	95.65	5.72	2.19	1.73	39.36	18.26	21.34	ASTM D-2116	1.00				
	4.0	RCILLAS INORGANICOS MEDI	31		100	8.70	91.30	7.40	1.74	1.61	43.30	22.00	21.40			0.237	0.141	0.683	
	4.5																		1.73×10^{-3}
	5.0		13																
		5.2m																	
	5.5																		
	6.0		13																
	6.5	ARCILLAS ARENOSAS			100.00	4.46	95.54				33.80	17.50	16.30						
	7.0		6																
		7.4m																	
	7.5	ZONA SATURADA																	
	8.0	8.0m																	
	8.5																		
	9.0		6		100	16.20	83.80				29.70	15.10	14.60						
	9.5	CILLAS ARENOSAS SATURAD																	
	10.0		7																5.78×10^{-4}
	10.5																		
	11.0	11.0m																	
	11.5																		

Results of soil test at BH-1 Sechura

Bore Hole Number	Depth below G.L. in m	Description	SPT N Value	Grain Size Analysis				Density and Moisture Test			Atterberg Limits			Compression Strengh		Consolidation Test		Void Ratio, e_0	Colapso	Permeability K (m/s)
				Gravel >4.75mm (%)	Sand 0.075-4.75mm (%)	Silt 0.002-0.075mm (%)	Clay <0.002mm (%)	Natural Moisture Contents(%)	BulkDensity (g/cm3)	Dry Density (g/cm3)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Type of Test	qu (kg/cm2)	Cc	$\frac{C_c}{1+e_0}$			
BH-1	0.0																			
	0.5	ARENA SUELTA COSTERA																		
	1.0	1.0m	7																	
	1.5																			
	2.0		17																	
	2.5	ARENA CON LIMO Y CON CANTOS RODADOS		80.80	19.20	74.00	6.80	0.88			NP	NP	NP							
	3.0		27	98.40	1.60	59.90	40.10	2.40	1.73	1.69	38.30	36.20	2.10			0.209	0.131	0.596		1.89×10^{-2}
	3.5																			
	4.0		52	88.80	11.20	53.40	35.40				22.50	19.38	3.12							
	4.5	4.2m																		
	5.0		58																	
	5.5	ARCILLA CON ARENA			100	48.30	51.70	2.23	1.82	1.78	24.70	21.35	3.35	ASTM D-2116	1.51					
	6.0		65																	
	6.5																			4.8×10^{-4}
	7.0	7.0m	31																	
	7.5																			
	8.0		35																	
	8.5																			
	9.0																			
	9.5																			
	10.0	MARGAS MUY COMPETENTES CON CARACTERISTICAS DE ROCA																		5.89×10^{-4}
	10.5																			
	11.0																			
	11.5																			
	12.0																			
	12.5																			
	13.0	13.0m																		
	13.5																			

Results of soil test at BH-2 Sechura

Bore Hole Number	Depth below G.L. in	Description	SPT N Value	Grain Size Analysis				Density and			Atterberg Limits			Compression		Consolidation		Void Ratio, e_0	Colapso	Permeability K (m/s)
				Gravel >4.75mm (%)	Sand 0.075–4.75mm (%)	Silt 0.002–0.075mm (%)	Clay <0.002mm (%)	Natural Moisture Contents(%)	Bulk Density (g/cm3)	Dry Density (g/cm3)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Type of Test	qu (kg/cm2)	Cc	$\frac{C_c}{1+e_0}$			
BH-2	0.0	ARENA SUELTA COSTERA																		
	0.5																			
	1.0		8																	
	1.5	1.5m			100	59.50	40.50	2.50	1.73	1.69	41.80	38.80	3.00			0.218	0.136	0.599		
					100	40.50	59.50	1.28	1.68	1.66	34.30	24.21	10.09	ASTM D-2116	1.54					
	2.0		15																	
	2.5	ARCILLAS CON ARENA			100	39.40	60.60	3.00	1.79	1.74	29.10	21.36	7.74	ASTM D- 211	1.66					1.62×10^{-3}
	3.0		34																	
	3.5																			
		3.6m																		
	4.0		56																	
	4.5																			
	5.0		65																	
	5.5																			
	6.0		36																	
	6.5	MARGAS MUY COMPETENTES CON CARACTERISTICAS DE ROCA																		5.59×10^{-4}
	7.0																			
	7.5																			
	8.0																			
	8.5																			
	9.0																			1.19×10^{-3}
	9.5																			
	10.0	10.0m																		
	10.5																			

Results of soil test at BH-1 HUACHO

Bore Hole Number	Depth below G.L. in m	Description	SPT N Value	Grain Size Analysis				Density and Moisture Test			Atterberg Limits			Compression Strengh		Consolidation Test		Void Ratio, e_0	Colapso	Permeability K (m/s)
				Gravel >4.75mm (%)	Sand 0.075–4.75mm (%)	Silt 0.002–0.075mm (%)	Clay <0.002mm (%)	Natural Moisture Contents(%)	BulkDensity (g/cm3)	Dry Density (g/cm3)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Type of Test	qu (kg/cm2)	Cc	$\frac{C_c}{1+e_0}$			
BH–1	0.0																			
	0.5	BRECHAS CON ARENA FINOS																		
	1.0		18																	
	1.5	1.5m		44.50	55.50	40.10	4.40	1.30	1.67		NP	NP	NP						1.23	
		BRECHAS																		
	1.75m																			
	2.0		23																	
	2.5																			
	3.0		23																	1.06 X 10^{-3}
	3.5	ARENA																		
	4.0		28	98.10	1.90	94.80	3.30				NP	NP	NP							
	4.5																			
	5.0	5.0m	22																	
	5.5																			

Results of soil test at BH-2 HUACHO

Bore Hole Number	Depth below G.L. in m	Description	SPT N Value	Grain Size Analysis				Density and Moisture Test			Atterberg Limits			Compression Strengh		Consolidation Test		Void Ratio, e_0	Colapso	Permeability K (m/s)
				Gravel >4.75mm (%)	Sand 0.075–4.75mm (%)	Silt 0.002–0.075mm (%)	Clay <0.002mm (%)	Natural Moisture Contents(%)	BulkDensity (g/cm3)	Dry Density (g/cm3)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Type of Test	qu (kg/cm2)	Cc	$\frac{C_c}{1+e_0}$			
BH–2	0.0																			
	0.5	BRECHAS CON ARENA FINOS																		
		0.5m																		
	1.0		14																	
	1.5																			
	2.0		17	94.60	5.40	88.10	6.50	2.50	1.63		NP	NP	NP						1.23	3.82 X 10^{-3}
	2.5	ARENA																		
	3.0		23																	
	3.5																			
	4.0	4.0m	23																	2.22 X 10^{-3}
	4.5																			
	5.0		29	19.00	81.00	12.00	7.00				NP	NP	NP							
	5.5	BRECHAS																		
	6.0		32																	
	6.5																			
	7.0	7.0m	35																	
	7.5																			
	8.0		41																	
	8.5	ARENA																		
	9.0		45																	
	9.5																			
	9.9m																			
	10.0	BRECHAS	47	29.50	70.50	28.80	0.70				NP	NP	NP							4.94 X 10^{-3}
	10.3m																			
	10.5																			

Results of soil test at BH-3 HUACHO

Bore Hole Number	Depth below G.L. in m	Description	SPT N Value	Grain Size Analysis				Density and Moisture Test			Atterberg Limits			Compression Strengh		Consolidation Test		Void Ratio, e_0	Colapso	Permeability K (m/s)
				Gravel >4.75mm (%)	Sand 0.075~4.75mm (%)	Silt 0.002~0.075mm (%)	Clay <0.002mm (%)	Natural Moisture Contents(%)	Bulk Density (g/cm3)	Dry Density (g/cm3)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Type of Test	qu (kg/cm2)	Cc	$\frac{C_c}{1+e_0}$			
BH-3	0.0	BRECHAS CON ARENA FINOS	17																	
	1.0																			
	1.5																			
	2.0		22	49.80	50.20	44.50	5.30	1.40	1.65		NP	NP	NP						1.22	
	2.5																			
	3.0	3.0m	23																	
	3.5	BRECHAS 3.5m		97.50	2.50	95.00	2.50				NP	NP	NP							
	4.0		28																	
	4.5	ARENA																		5.08×10^{-3}
	5.0		43																	
	5.5																			
	6.0	6.0m	45																	
	6.5																			

Appendix-3: Result of Waste Characterization for Domestic Waste

Appendix-3: Result of Waste Characterization for Non Domestic Waste

Characteristics	Unit	NONDOMESTIC WASTES (RESTAURANTS, COMMERCIALS, MARKETS, INSTITUTIONS, HOTELS, HOSPITALS)																					
		Puno(2)	Juliaca (2)	Piura (2)	Nuevo Chimbote	Tumbes (3)	Sullana (2)	Abancay (2)	Huánuco (2)	Paita(2)	Puerto Maldonado (2)	Talara (2)	Moyobamba(2)	Tarapoto (2)	Chachapoyas (5)	Ilave (5)	Azángaro (2)	Chincha (2)	Sechura (4)	Huacho (2)	Tarma (2)	Ferreñafe (5)	Santiago (2)	Aymaraes (2)
I).- Commercial Wastes																								
Total Generation	t/d	**1.360**	**34.900**	**13.070**			**3.153**	**1.087**	**4.520**	**0.242**	**3.317**	**3.215**	**0.915**	**13.426**	**1.430**	**0.760**	**0.599**	**1.790**		**10.082**	**1.490**	**1.000**	**0.390**	**0.031**
Normal density	kg/m^3	**141.27**	**130.13**	**138.97**			**194.47**	**228.18**	**109.34**	**124,20**	**134.74**	**166.80**	**176.61**	**137.51**			**186.77**	**94.56**		**104.57**	**73.88**		**61.58**	**102.26**
Qualitative characteristics (A+B+C)	%	100.00	100.00	100.00				100.00		100.00			100.00				100.00				100.00			100.00
A. Reusable Wastes (A1 + A2)	%	**73.99**	**66.37**	**61.66**				**83.80**		**77.76**			**78.86**				**63.32**				**72.90**			**83.55**
A1. Compostable Wastes	%	**42.86**	**41.93**	**12.73**				**56.90**		**48.97**			**40.50**				**38.26**				**24.81**			**58.02**
Organics (bonds, woods, etc)	%	0.88	2.65	0.44						0.88			0.35				0.67				5.50			0.14
Organics (foods)	%	41.17	30.48	10.08				16.50		48.09			35.54				37.14				19.31			57.89
Organics (green areas)	%	0.00	8.54	2.21				38.60					4.61											
Rest	%	0.81	0.26					1.80					0.00				0.45							
A2. Recyclable Wastes	%	**31.13**	**24.44**	**48.93**				**26.90**		**28.79**			**38.36**				**25.06**				**48.10**			**25.53**
Papers	%	11.61	5.30	8.16				2.30		6.54			6.44				4.81				15.71			2.62
Cardboards	%	6.30	5.31	29.38				4.10		7.65			15.25				3.80				10.91			4.99
Glass	%	1.75	2.07	2.21				1.30		5.71			8.25				4.14				9.06			2.28
Plastics	%	8.94	7.93	7.64				12.70		5.53			8.42				6.04				11.43			8.22
Others	%	2.53	3.83	1.54				6.50		3.36			0.00				6.27				1.00			7.42
B. Nonreusable Wastes	%	**10.59**	**21.18**	**32.70**				**12.90**		**17.60**			**17.41**				**34.00**				**16.00**			**13.94**
Plastic bags, bateries textil, etc	%	9.07	13.51	11.56				5.20		6.91			11.77				16.10				8.90			8.53
Earth, sand, stones, etc	%	1.52	7.67	21.14				7.70		10.69			5.64				17.90				7.10			5.41
C. Hazardous Wastes	%	**15.42**	**12.45**	**5.64**				**3.30**		**4.64**			**3.73**				**2.68**				**11.10**			**2.51**
Chemicals, paints, tissues, etc	%	5.98	7.21	1.37				1.10		0.92			0.26								0.70			0.03
Pathogens, sanitary towells, etc	%	9.44	5.24	4.27				2.20		3.72			3.47				2.68				10.40			2.48
II).- Restaurants Wastes (Total Generation)	t/d	**2.890**	**0.927**	**2.510**		**2.490**	**3.273**	**1.611**	**1.710**	**0.404**	**1.045**	**0.837**	**0.462**	**3.339**	**0.332**	**0.650**	**0.000**	**0.750**	**0.093**	**5.333**	**2.680**	**1.000**	**0.021**	**0.026**
III).- Hotels wastes (Total Generation)	t/d	**1.110**	**1.027**	**0.528**		**0.050**	**0.374**	**0.446**	**0.210**	**0.082**	**0.301**	**0.397**	**0.070**	**0.339**	**0.045**	**0.250**	**0.000**	**0.140**	**0.012**	**0.275**	**0.220**	**1.000**	**0.000**	**0.003**
IV).- Markets wastes (Total Generation)	t/d	**3.820**	**3.178**	**45.357**		**6.000**	**2.372**	**1.254**	**9.070**	**1.559**	**3.714**	**1.884**	**2.390**	**11.554**	**1.303**	**0.860**	**0.352**	**1.670**	**0.244**	**2.189**	**2.480**	**2.000**	**0.022**	**0.116**
V).- Institutions wastes (all) (Total Generation	t/d	**3.120**	**5.008**	**2.387**		**0.910**	**1.710**	**7.862**	**1.810**	**1.201**	**0.762**	**1.229**	**0.403**	**0.934**	**0.427**	**0.700**	**0.495**	**1.710**	**0.075**	**0.706**	**0.370**	**2.000**	**0.230**	**0.073**
VI).- Sweeping wastes (Total Generation)	t/d	**2.020**	**4.809**	**7.021**		**0.000**	**3.172**	**7.279**	**6.420**	**1.036**	**1.769**	**3.686**	**0.404**	**2.206**	**0.811**		**0.000**	**6.000**	**0.000**	**3.032**	**2.940**	**4.500**	**0.182**	**0.036**
VII).- Informal activities (Total Generation)	t/d																							
Total Generation (I+ . . .VII)	t/d	**14.320**	**49.849**	**70.873**		**9.450**	**14.054**	**19.539**	**23.740**	**4.523**	**10.908**	**11.248**	**4.644**	**31.798**	**4.348**	**3.220**	**1.446**	**12.060**	**0.424**	**21.617**	**10.180**	**11.500**	**0.845**	**0.285**

(1) ODS Survey (2009)
(2) PWI
(3) MEDA(2008)
(4) Contravalor Peru-Germany Fund (2007)
(5) Municipal report

Solid waste Caracterization Study Complete PWI

Solid Waste Caracterization Study Non domestic

Appendix-4: Result of Waste Characterization for Non Domestic Waste

COMPARATIVE CHART FOR SOLID WASTES CARACTERIZATION

Characteristics	Unit	DOMESTIC WASTES																						
		Puno (2)	Juliaca (2)	Piura (2)	Nuevo Chimbote (1)	Tumbes (1)	Sullana (1)	Abancay (2)	Huánuco (1)	Paita (2)	Puerto Maldonado (1)	Talara (1)	Moyobamba (2)	Tarapoto (1)	Chachapoyas (1)	Ilave(1)	Azángaro(1)	Chincha(1)	Sechura (1)	Huacho (1)	Tarma (2)	Ferreñafe (1)	Santiago (2)	Aymaraes (2)
Per cápita generation (average)	kg/hab./d	0.510	0.500	0.628	0.459	0.312	0.509	0.556	0.347	0.400	0.393	0.535	0.620	0.539	0.459	0.316	0.282	0.502	0.309	0.401	0.403	0.548	0.304	0.468
Normal density	kg/m^3	195.89	171.49	190.65	176.55	77.50	142.72	249.85	137.76	205.01	149.57	78.49	240.76	195.57	135.47	202.65	82.84	132.81	91.98	108.93	144.10	200.28	71.06	128.12
Qualitative characteristics (A+B+C)	%	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
A. Reusable Wastes (A1 + A2)	%	78.34	64.52	77.70	60.11	79.36	64.49	58.60	81.51	63.66	76.00	72.97	87.19	78.98	64.06	76.22	75.52	63.91	60.11	76.89	76.77	46.88	54.52	58.05
A1. Compostable Wastes	%	62.82	45.70	48.90	41.59	53.85	38.79	52.00	63.64	44.42	54.80	47.02	76.99	63.50	47.50	42.69	47.12	48.93	32.61	59.35	59.13	33.17	23.18	52.44
Organics (bonds, woods, etc)	%	0.49	6.91	0.00	0.46	0.50	0.93	1.20	0.01	0.71	0.44	0.38	0.22	0.10	0.07	2.78	0.00	0.04	0.20	0.39	6.91	0.00	2.15	0.11
Organics (foods)	%	59.46	35.66	44.10	41.13	53.35	37.86	37.40	63.63	43.10	54.36	46.64	57.10	63.40	47.43	39.91	47.12	48.89	32.41	58.96	41.99	33.17	18.99	52.33
Organics (green areas)	%	1.99	2.22	3.80	0.00	0.00	0.00	13.00	0.00	0.61	0.00	0.00	19.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.22	0.00	2.04	0.00
Rest	%	0.88	0.91	1.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.01	0.00	0.00	0.00
A2. Recyclable Wastes	%	15.52	18.82	28.80	18.52	25.51	25.70	6.60	17.87	19.24	21.20	25.95	10.20	15.48	16.56	33.53	28.40	14.98	27.50	17.54	17.64	13.71	31.34	5.61
Papers	%	3.99	3.55	8.50	4.93	5.40	5.62	0.60	5.61	4.74	2.83	6.83	2.21	3.23	2.29	3.10	3.71	4.50	7.01	4.27	4.79	2.16	5.09	0.68
Cardboards	%	2.59	3.24	3.80	2.22	4.67	3.77	1.00	1.73	3.09	2.45	5.04	2.60	2.06	2.99	4.96	3.41	2.16	4.26	2.11	2.12	1.93	6.29	0.93
Glass	%	0.81	2.21	2.80	2.37	2.21	4.29	0.10	0.69	1.63	1.39	2.37	0.78	1.99	1.61	6.18	2.98	0.59	3.09	2.22	2.02	2.57	10.65	0.11
Plastics	%	5.42	6.51	10.00	6.76	9.39	8.52	3.50	6.39	5.46	10.68	7.39	2.73	5.20	7.14	14.72	11.82	5.02	10.25	6.33	6.14	5.77	6.22	2.38
Others	%	2.71	3.31	3.70	2.24	3.84	3.50	1.40	3.45	4.32	3.85	4.32	1.88	3.00	2.53	4.57	6.48	2.71	2.89	2.61	2.57	1.28	3.09	1.51
B. Nonreusable Wastes	%	9.33	23.62	14.60	31.54	13.19	28.52	40.10	9.35	27.69	11.26	16.74	7.45	14.76	26.33	17.24	18.36	26.65	32.92	9.20	16.36	48.11	32.61	41.04
Plastic bags, textil, etc	%	8.50	13.49	4.70	1.41	1.73	1.69	1.70	0.89	7.37	2.05	1.42	7.13	1.13	1.66	2.68	0.69	1.67	3.04	1.23	11.34	1.82	26.74	2.31
Earth, sand, stones, etc	%	0.83	10.13	9.90	30.13	11.46	26.83	38.40	8.46	20.32	9.21	15.32	0.32	13.63	24.67	14.56	17.67	24.98	29.88	7.97	5.02	46.29	5.87	38.73
C. Hazardous Wastes	%	12.33	11.86	7.70	8.35	7.45	6.99	1.30	9.14	8.65	12.74	10.29	5.36	6.26	9.61	6.54	6.12	9.44	6.97	13.91	6.87	5.01	12.87	0.91
Chemicals, paints, bateries, tissues, etc	%	0.46	2.54	1.60	0.42	0.24	0.34	0.30	1.12	1.45	0.19	1.20	0.50	0.10	0.63	1.29	0.72	0.15	0.25	0.91	1.71	0.10	4.30	0.00
Pathogens, san. towells, etc	%	11.87	9.32	6.10	7.93	7.21	6.65	1.00	8.02	7.20	12.55	9.09	4.86	6.16	8.98	5.25	5.40	9.29	6.72	13.00	5.16	4.91	8.57	0.91

(1) ODS Survey (2009)
(2) PWI

Appendix-5: Result of Environmental Survey (Water Quality)

Appendix-5: Result of Environmental Survey (Water Quality)

Parameter	Units	CATEGORY 3	2005 APHA STANDARD METHODS	Puno					Tarapoto					Piura					Sullana					Juliaca					Huanuco				
				Date of analysis: 08/05/10					Date of analysis: 08/05/2010					Date of analysis: 06/05/2010					Date of analysis: ----------					Date of analysis: 1/12/2010					Date of analysis: 30/10/2010				
				Surface water			Ground water*1		Surface water			Ground water*1		Surface water*1			Ground water		Surface water*1			Ground water*1		Surface water			Ground water		Surface water			Ground water	
				Result		Meet ECA	Result	Meet ECA	Result		Meet ECA	Result	Meet ECA	Result		Meet ECA	Result	Meet ECA	Result		Meet ECA	Result	Meet ECA	Result		Meet ECA	Result	Meet ECA	Result		Meet ECA	Result	Meet ECA
				AS-01	AS-02				W1	W2				-	-				-	-				AS-01	AS-02				-	-			
Temperature	℃	-	2550 B	16.1	16.2	-			27,8	25,7	-						31	-						15.8	15.6	-			-		-		
pH	Unid.pH	6.5-8.5	4500 H+ B	6.79	6.61	YES			7,18	7,7	YES						7,56	YES						6.96	6.98	YES			-		-		
Dissolved Oxygen	mg/L	<5	4500 C	4.41	4.36	YES			1,10	5,68	NO						2,5	YES						5.11	5.09	NO			(1) 7.7		NO		
Electrical Conductivity	uS/cm	<=5,000	2510 B	40	54	YES			1096	202	YES						11650	NO						-	-	-			40		NO		
Total solids	mg/L	-	2540 B	230	742	-			8,48	252	-						5412	-						-	-	-			-		-		
Total Suspended Solids (TSS)	mg/L	-	2540 D	<4	18	-			299	150	-						<4	-						12	10	-			29		-		
Total Dissolved Solids(TDS)	mg/L	-	2540 C	54	284	-			536	88	-						5400	-						-	-	-			-		-		
Hardness	mg/L	-	2340 c	60,5	52	-			334,2	117	-						4527	-						-	-	-			-		-		
Total Nitrogen	mg/L	-	4500- B	2,5	<1.0	-			19	3,1	-						1	-						-	-	-			-		-		
Nitrates	mg/L	10	4500 NO_3 E	1.78	3.49	YES			3,63	4,19	YES						11,8	NO						0.6	1.96	YES			0.3		YES		
BOD	mg/L	<=15	5210 B	<2.0	<2.0	YES			<2.0	<2.0	YES						<2.0	YES						<2.	<2.	YES			4		YES		
COD	mg/L	40	5220 D	<4.0	<4.0	YES			<4.0	<4.0	YES						<4.0	YES						-	-	-			-		-		
Fecal Coliforms	NMP/100 mL	-	9221 E	2	2.5	-			5.4x10	4.9x10	-						5	-						<1.8	2	-			490		-		
Total Coliforms	NMP/100 mL	5,000	9221 B	11	14	YES			1.6x10	5.4x10	YES						10	YES						7.8	11	YES			1300		-		
Heterotrophic Bacteria	UFC/mL	-	9215 D	250	270	-			4.5x10	2.5x10	-						90	-						-	-	-			-		-		
Total Alkalinity	mg/L	-	SM 2320-B	55	63	-			72	76	-						*1	-						117	109	-			92.8		-		
Total Arsenic	mg/L	0.050	EPA 200.7	0.008	0.009	YES			0.003	<0.003	YES						*1	-						0.019	0.015	YES			ND		YES		
Total Copper	mg/L	0.200	EPA 200.7	<0.01	<0.01	YES			<0.01	<0.01	YES						*1	-						<0.01	<0.01	YES			ND		YES		
Total Iron	mg/L	1.000	EPA 200.7	1.45	1.3	NO			2.10	3.11	NO						*1	-						0.97	0.3	NO			0.781		YES		
Total Manganese	mg/L	150.0	EPA 200.7	0.02	0.33	YES			0.07	0.12	YES						*1	-						0.08	0.03	YES			0.026		YES		
Total Lead	mg/L	0.050	EPA 200.7	0.05	<0.02	YES			0.27	<0.02	YES						*1	-						<0.02	<0.02	YES			ND		YES		
Total Zinc	mg/L	2.000	EPA 200.7	<0.01	<0.01	YES			0.1	<0.01	YES						*1	-						0.03	0.01	YES			0.009		YES		
Total Cadmium	mg/L	0.005	EPA 200.7	<0.004	<0.004	YES			<0.004	<0.004	YES						*1	-						<0.004	<0.004	YES			ND		YES		
Total Mercury	mg/L	0.001	EPA 1631	<0.001	0.003	NO			<0.001	<0.001	YES						*1	-						0.002	0.001	YES			ND		YES		
Sulfate	mg/L	300	EPA 375.4	87.9	93.9	YES			38.5	42.2	YES						*1	-						93	92.3	YES			26		YES		
Turbidity	N.T.U	-	EPA 180.1	2.4	3.9	-			37.2	129	-						*1	-						1.9	0.8	-			17		-		

*1 There is no water for sample.
*2 Field survey is not implemented yet.
Note: Additional survey which is required in the draft Directive of DIGESA will be implemented later in these six (6) cities.

Appendix-6: Result of Environmental Survey (Air Quality)

Appendix-6: Result of Environmental Survey (Air Quality)

Parameter	Environmental Quality Standards Forms					Puno				Tarapoto				Piura				Sullana				Juliaca				Huanuco			
						Start date: 06-05-2010				Start date: 05-05-2010				Start date:13-05-2010				Start date : 06-05-2010				Start date: 1/12/2010				Star date: 30/10/2010			
						Results		Meet ECA		Results		Meet ECA		Results		Meet ECA		Results		Meet ECA		Results		Meet ECA		Results		Meet ECA	
	Period	Value	Unit	Format	Method of Analysis[1]	Windward	Leeward	Windward	Leeward	Windward	Leeward	Windward	Leeward	Windward	Leeward	Windward	Leeward	Windward	Leeward	Windward	Leeward	Windward	Leeward	Windward	Leeward	Windward	Leeward	Windward	Leeward
PM_{10}	Yearly	50	µg/m³	Annual arithmetic average	Inertial/Filtration Separation Gravimetry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	24 hours	150	µg/m³	Not Exceed more than 3 times per year		8,59	10,47	YES	YES	14,21	15,65	YES	YES	62,8	211,94	YES	NO	3,08	32,62	YES	YES	18.4	15.9	YES	YES	30	468	YES	NO
Sulfur Dioxide SO_2	Yearly	80	µg/m³	Annual arithmetic average	UV Fluorescence (automated method)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	24 hours	20	µg/m³	Not Exceed more than once per year		<0.2	<0.2	YES	YES	<0.2	<0.2	YES	YES	<0.2	<0.2	YES	YES	<0.2	<0.2	YES	YES	<0.2	<0.2	YES	YES	ND	ND	YES	YES
PM2.5	24 hours	25	µg/m³	Not Exceed more than 3 times per year	Inertial/Filtration Separation Gravimetry	11.92	13.21	YES	YES	10.4	7.0	YES	YES	7.5	1.68	YES	YES	8.34	15.52	YES	YES	2.47	4.52	YES	YES	26	346	NO	NO
Hidrogen sulfide (H_2S)	24 hours	150	µg/m³	Annual arithmetic average	Inertial/Filtration Separation Gravimetry	<0.04	<0.04	YES	YES	<0.02	<0.02	YES	YES	<0.04	<0.04	YES	YES	<0.04	<0.04	YES	YES	<0.04	<0.04	YES	YES	ND	ND	YES	YES
Nitrogen oxide (NO_2)	Yearly	100	µg/m³	Annual arithmetic average	Chemiluminescence (automated method)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1 hour	200	µg/m³	Not Exceed more than 24 times per year		<0.5	<0.5	YES	YES	<0.5	<0.5	YES	YES	<0.5	<0.5	YES	YES	<0.5	<0.5	YES	YES	<0.05	<0.05	YES	YES	ND	3	YES	YES

Note: Additional survey which is required in the draft Directive of DIGESA will be implemented later in these six (6) cities.

Appendix-7: Result of Environmental Survey (Noise)

Appendix-7: Result of Environmental Survey (Noise)

Norm	Methodology	Sample No.	Contents	Puno		Tarapoto		Piura		Sullana		Juliaca		Huanuco			
														day-time		night-time	
				Result	Meet ECA	Result	Meet ECA	Result	Meet ECA	Result	Meet ECA	Result	Meet ECA	Result	Meet ECA	Result	Meet ECA
National Standards for Noise Environmental Quality. Supreme Decree N° 085-2003 PCM Zona industrial (day time) 80.0 dB (night time) 70 dB	Sound level meter	1	Location	385 875E 8 242 313N	YES	353893E 9266284N	YES	385 875E 8 242 313N	YES	-	YES	0365058E 8283722N	YES	18L 03559123 / UTM 8900325	YES	18L 03559123 / UTM 8900325	YES
			Maximum value (dB)	48.6		82		68.9		70.9		46.5		49.0		56.1	
			Equivalent value (dB)	46.4		59.5		54.4		56.1		45.5		44.2		53.4	
			Minimum value (dB)	40.9		41		42.8		41.6		44.5		40.0		48.9	
		2	Location	386 169E; 8 242 374N	YES	354222E 9265932N	YES	386 169E 8 242 374N	YES	-	YES	0365002E 8283403N	YES	18L 0359833 / UTM 8900366	YES	18L 0359833 / UTM 8900366	YES
			Maximum value (dB)	48.9		57		83.2		70.5		43.9		54.3		54.2	
			Equivalent value (dB)	45.8		43.3		72.4		55.8		43		51.6		52.6	
			Minimum value (dB)	41.5		36		62.9		42.3		42.1		48.5		49.6	
		3	Location			354596E 9265472N	YES	386 121E 8 242 231N	YES	-	YES	0365129E 8283314N	YES	18L 0359993 / UTM 8900284	YES	18L 0359993 / UTM 8900284	YES
			Maximum value (dB)			49		72.5		68.8		46.7		58.4		59	
			Equivalent value (dB)			44.8		57.2		55.2		45.5		53.0		55.8	
			Minimum value (dB)			43		45.3		44.2		44.2		43.8		50.9	
		4	Location			354664E 9265474N	YES	386 345E 8 242 459N	YES	-	YES	0365346E 8283626N	YES	18L 0359903 / UTM 8900348	YES	18L 0359903 / UTM 8900348	YES
			Maximum value (dB)			43		70		72.7		45.6		58.5		58.8	
			Equivalent value (dB)			42		55.7		62		44.4		53.6		56.8	
			Minimum value (dB)			41		42.4		54.5		43.2		48.1		53.2	
		5	Location			354694E 9265094N	YES	386 592E 8 242 625N	YES	-	YES	0365174E 8283546N	YES	18M 0360149 / UTM 8899995	YES	18M 0360149 / UTM 8899995	YES
			Maximum value (dB)			44		79.1		71.4		46.3		60.1		59.6	
			Equivalent value (dB)			43.5		62.1		55.4		45.5		55.7		56.7	
			Minimum value (dB)			42		48.1		41.5		44.6		47.9		50.1	

Appendix-8: Study of Landfill Leachate Amount and Treatment Methods

Appendix -8: Study of Landfill Leachate Amount and Method of Treatment Method

(1) Calculation of Leachate Volume

Leachate volume can be calculated in consideration of the following two generation sources:

- Generated by precipitation percolating through waste deposited in a landfill.
- Generated by the decomposition of organic matter and humidity content of waste.

i) Calculation Formula for Leachate Volume

Leachate volume is calculated using the formula below. Generation volume is the sum of leachate generated by precipitation percolating through waste and leachate generated by the decomposition of organic matter, after subtracting the volume of treated leachate.

$$Q = 1 / 1{,}000 \times (C1 \times A1 + C2 \times A2) \times I + Q1 - Q2 \quad \cdots \text{Rational formula}$$

Where

Q : Leachate volume (m^3/day)
Q1: Generated by decomposition of organic matter and humidity content of waste (m^3/day)
Q2: Leachate treatment capacity or evaporation (m^3/day)
C1 : Coefficient for seepage into disposal area
C2 : Coefficient for seepage into soil covered area (C2 = C1 x 20%)
A1 : Waste disposal area (m^2)
A2 : Soil covered area (m^2)
I : Daily rainfall (mm) : in the past 10 years

$$C = (I - E_{PT}) / I$$

Where

C : Coefficient for monthly seepage
I : Monthly rainfall
E_{PT} : Monthly Evaporation

$$E_{PT} = 25.4 \times K \times C \times t \quad \cdots\cdots \text{Blaney and Criddle}$$

Where

E_{PT} : Monthly Evaporation
K : Empirical crop and meteorological coefficient (Landfill : 0.7)
C : Monthly percent of annual sunshine hours
t : Monthly average temperature (°F)

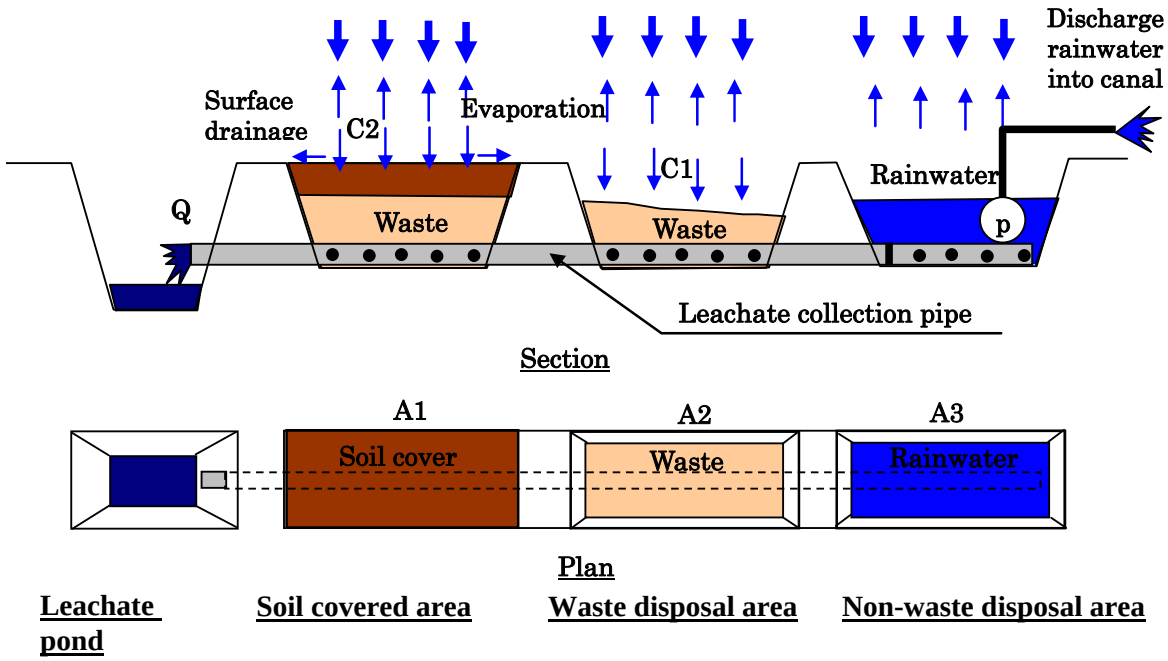


Figure 1 Schematic view of leachate generation

ii) Calculation of Seepage Coefficient

Seepage coefficient is calculated by Blaney and Criddle formula as mentioned above. Table 1 shows the calculated seepage coefficient at each project site.

The calculation result revealed the monthly seepage coefficient is about 0 all through the year, indicating that leachate generation is not caused by rainwater. In the project site marked with yellow in Table 1, it can be considered that there is no leachate generation caused by the "precipitation percolating through waste deposited in a landfill."

Calculation for the seepage coefficient of the Piura project site is shown in Table 2 to Table 5, as examples.

The project whose seepage coefficient is zero all through the year does not move on to the next step. Thus, the volume of a), leachate generated by precipitation percolating is determined through the waste deposited in a landfill.

Table 1 Calculation Result of Monthly Seepage Coefficient of the Projects

Name of municipality		Jan.	Feb.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1 Puno	Rainfall	188.0	173.0	133.9	43.7	6.4	5.5	8.4	9.8	15.9	32.2	33.4	91.3	741.2
	Evaporation	56.8	54.6	63.0	69.9	75.3	69.8	71.5	73.9	73.9	77.8	75.9	69.7	832.0
	Seepage	0.69	0.68	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	-
2 Juliaca	Rainfall	188.0	173.0	133.9	43.7	6.4	5.5	8.4	9.8	15.9	32.2	33.4	91.3	741.2
	Evaporation	56.8	54.6	63.0	69.9	75.3	69.8	71.5	73.9	73.9	77.8	75.9	69.7	832.0
	Seepage	0.69	0.68	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	-
3 Piura	Rainfall	5.0	26.0	31.1	15.7	0.4	0.2	0.2	0.0	0.0	0.3	1.1	2.8	82.9
	Evaporation	127.2	98.0	124.9	127.8	123.3	92.2	96.4	104.3	116.2	122.0	119.1	121.7	1,373.0
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
4 Nuevo Chimbote	Rainfall	0.8	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	1.5
	Evaporation	118.1	109.2	123.9	119.8	107.1	66.4	65.8	75.4	78.0	100.2	107.1	117.6	1,188.7
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
5 Tumbes	Rainfall	34.9	94.4	98.4	46.8	17.4	0.5	1.1	0.4	0.7	0.6	1.5	3.7	300.5
	Evaporation	131.7	104.1	154.3	154.2	144.7	97.0	94.2	79.8	74.0	88.0	113.6	117.0	1,352.6
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
6 Sullana	Rainfall	47.5	68.7	90.9	25.5	5.1	0.6	0.1	0.0	0.1	1.4	1.9	18.9	260.5
	Evaporation	117.8	101.2	125.3	127.5	124.3	92.0	101.8	109.8	119.1	130.2	119.1	117.1	1,385.2
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
7 Abancay	Rainfall	182.0	186.1	138.4	52.7	15.1	7.6	14.8	17.7	22.3	60.8	65.2	125.2	887.7
	Evaporation	60.0	59.8	67.8	81.8	102.4	103.0	95.4	96.7	101.8	106.9	120.3	81.9	1,077.7
	Seepage	0.67	0.67	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	-
8 Huanuco	Rainfall	52.6	62.0	75.6	34.9	12.3	6.2	4.0	7.1	13.6	38.3	50.5	55.8	412.9
	Evaporation	78.6	68.2	75.4	99.1	122.7	123.4	128.4	123.1	103.8	102.9	95.4	86.4	1,207.5
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
9 Paita	Rainfall	1.1	4.8	4.3	1.6	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.5	12.8
	Evaporation	118.3	107.4	125.0	124.3	118.3	94.7	99.1	104.0	106.6	109.0	110.4	116.6	1,333.7
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
10 Puerto Maldonado	Rainfall	588.3	530.8	562.1	371.2	231.2	226.7	179.9	141.8	174.0	467.7	421.5	552.7	4,448.0
	Evaporation	123.2	72.5	115.9	107.5	100.4	101.0	114.9	165.8	147.3	137.7	98.7	95.1	1,379.8
	Seepage	0.79	0.86	0.79	0.71	0.56	0.55	0.36	0.00	0.15	0.70	0.76	0.82	-
11 Talara	Rainfall	9.9	23.8	27.5	16.2	1.1	0.5	0.3	0.0	0.3	0.0	0.7	0.3	80.7
	Evaporation	171.0	136.9	172.3	173.1	175.6	166.7	181.3	174.3	177.4	179.3	181.7	182.9	2,072.4
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
12 Moyobamba	Rainfall	102.8	183.0	178.3	164.9	105.9	83.2	70.2	61.4	114.8	176.7	171.0	141.7	1,553.7
	Evaporation	82.0	63.0	71.6	102.0	117.4	124.2	132.4	158.2	125.8	132.6	119.4	91.0	1,319.6
	Seepage	0.20	0.65	0.59	0.38	0.00	0.00	0.00	0.00	0.00	0.24	0.30	0.35	-
13 Tarapoto	Rainfall	44.6	56.3	68.9	90.8	57.2	41.3	48.6	38.8	60.3	59.3	50.5	43.7	660.2
	Evaporation	116.8	89.7	94.1	99.1	115.6	126.9	131.7	140.7	128.2	134.6	126.7	127.6	1,431.8
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
14 Chachapoyas	Rainfall	35.0	64.3	92.3	103.3	73.5	70.4	55.4	41.4	65.1	96.4	61.9	62.4	821.3
	Evaporation	91.3	70.7	71.0	89.3	102.7	112.4	111.6	119.2	109.6	113.6	124.2	111.2	1,226.7
	Seepage	0.00	0.00	0.23	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
15 Ilave	Rainfall	188.0	173.0	133.9	43.7	6.4	5.5	8.4	9.8	15.9	32.2	33.4	91.3	741.2
	Evaporation	56.8	54.6	63.0	69.9	75.3	69.8	71.5	73.9	73.9	77.8	75.9	69.7	832.0
	Seepage	0.69	0.68	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	-
16 Azangaro	Rainfall	147.7	135.4	121.8	51.6	8.4	1.9	3.3	7.0	16.8	50.8	58.7	127.5	731.1
	Evaporation	42.3	45.8	55.7	68.4	73.5	66.7	68.8	72.4	73.2	73.9	70.7	56.3	767.7
	Seepage	0.71	0.66	0.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	-
17 Chincha	Rainfall	1.4	2.8	1.0	0.9	1.8	3.1	2.4	3.3	2.9	0.8	1.6	0.3	22.1
	Evaporation	153.5	153.3	183.7	175.6	118.5	43.5	35.5	30.8	45.4	83.7	101.9	127.7	1,253.1
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
18 Sechura	Rainfall	39.1	27.4	21.8	8.7	0.6	0.2	0.1	0.0	0.1	0.3	0.8	4.6	103.8
	Evaporation	138.2	118.4	130.6	131.4	120.4	82.6	78.5	89.4	101.5	107.1	115.7	129.6	1,343.3
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
19 Huacho	Rainfall	0.5	1.0	0.5	0.2	0.2	0.9	0.7	1.0	0.5	0.2	0.3	0.2	6.2
	Evaporation	132.6	137.1	161.2	161.2	116.7	51.7	45.1	46.9	63.7	96.9	105.7	118.9	1,237.6
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
20 Tarma	Rainfall	102.9	108.9	116.0	45.8	13.8	4.1	3.7	5.4	25.0	59.6	64.1	94.7	643.9
	Evaporation	59.2	49.9	54.4	72.6	96.8	96.2	97.3	99.7	80.9	78.6	80.9	62.4	928.9
	Seepage	0.42	0.54	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	-
21 Ferrenafe	Rainfall	1.3	5.9	13.9	3.0	0.2	1.1	0.1	0.0	0.6	0.5	2.3	1.6	30.3
	Evaporation	124.3	98.7	125.7	115.9	110.6	76.5	79.1	85.2	101.1	115.7	110.6	115.9	1,259.3
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
22 Santiago	Rainfall	3.8	3.9	0.3	0.2	0.0	0.4	0.5	0.4	0.1	0.0	0.1	0.3	9.9
	Evaporation	96.2	90.1	116.7	124.3	121.2	89.0	84.4	92.0	105.5	119.5	115.2	102.9	1,257.0
	Seepage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
23 Aymaraes	Rainfall	188.0	173.0	133.9	43.7	6.4	5.5	8.4	9.8	15.9	32.2	33.4	91.3	741.2
	Evaporation	56.8	54.6	63.0	69.9	75.3	69.8	71.5	73.9	73.9	77.8	75.9	69.7	832.0
	Seepage	0.69	0.68	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	-

Table 2 Coefficient for Monthly Seepage (Piura)

Date		(1) Annual sunshine hours	(2) Monthly sunshine hours	(3) C (2) / (1)	(4) K	(5) t(℃)	(6) t(°F) = (5) x 5/9 +32	(7) E_{PT}	(8) Monthly Rainfall	(9) Coefficient for monthly seepage = ((8)-(7)) / (7)
Average	Jan.	2,464.0	216.2	0.088	0.7	27.53	81.5	127.2	5.0	0.00
	Feb	2,464.0	162.2	0.066	0.7	28.74	83.7	98.0	26.0	0.00
	Mar	2,464.0	207.4	0.084	0.7	28.60	83.5	124.9	31.1	0.00
	Apr	2,464.0	220.0	0.089	0.7	26.95	80.5	127.8	15.7	0.00
	May	2,464.0	223.4	0.091	0.7	24.71	76.5	123.3	0.4	0.00
	Jun	2,464.0	173.9	0.071	0.7	23.04	73.5	92.2	0.2	0.00
	Jul	2,464.0	184.0	0.075	0.7	22.55	72.6	96.4	0.2	0.00
	Aug	2,464.0	198.7	0.081	0.7	22.64	72.7	104.3	0.0	0.00
	Sep	2,464.0	218.9	0.089	0.7	23.09	73.6	116.2	0.0	0.00
	Oct	2,464.0	226.8	0.092	0.7	23.64	74.5	122.0	0.3	0.00
	Nov	2,464.0	218.2	0.089	0.7	24.25	75.6	119.1	1.1	0.00
	Dec	2,464.0	214.4	0.087	0.7	25.91	78.6	121.7	2.8	0.00

Table 3 Monthly Sunshine Hours (Piura)

Year	Jan.	Feb.	March	April	May	June	July	August	Sep.	Oct.	Nov.	Dec.	Total
1996	232.5	221.4	204.0	242.5	272.2	221.9	219.2	230.3	235.4	256.6	239.6	241.9	2,817.5
1997	211.2	202.2	246.9	219.3	239.1	140.5	181.8	163.2	163.2	225.2	138.7	101.2	2,232.5
1998	145.2	128.5	190.0	191.3	102.8	163.2	210.8	186.4	217.7	220.3	260.2	224.5	2,240.9
1999	227.5	121.3	243.5	222.2	213.1	182.5	184.0	209.7	200.4	232.2	207.9	142.4	2,386.7
2000	230.8	138.8	184.5	211.9	207.6	110.6	139.2	179.7	208.0	272.6	229.9	230.5	2,344.1
2001	217.9	193.7	201.1	203.1	187.4	105.4	163.3	202.9	221.0	230.4	227.5	231.2	2,384.9
2002	288.0	156.1	174.3	173.2	246.0	219.6	187.9	202.6	247.4	170.1	223.2	204.7	2,493.1
2003	191.3	136.4	226.9	240.2	253.9	220.5	235.9	232.1	208.4	234.2	179.6	222.0	2,581.4
2004	258.3	196.1	267.0	242.9	229.2	214.9	179.0	224.0	243.5	231.5	242.4	246.4	2,775.2
2005	262.3	169.3	185.5	249.9	245.7	214.2	210.1	224.9	230.3	219.0	207.8	237.5	2,656.5
2006	235.2	152.9	197.0	248.9	258.1	170.2	161.8	199.6	233.4	223.5	233.8	229.5	2,543.9
2007	191.7	197.1	216.4	226.9	233.8	209.5	213.1	221.3	230.5	201.2	244.3	213.8	2,599.6
2008	152.5	152.4	211.0	216.1	178.1	89.8	121.6	109.7	205.9	227.0	220.6	287.4	2,172.1
2009	182.6	136.6	198.6		260.5	171.5	168.5	195.5		231.2	199.3	188.5	1,932.8
2010		130.7	164.2	191.1									486.0
Average	**216.2**	**162.2**	**207.4**	**220.0**	**223.4**	**173.9**	**184.0**	**198.7**	**218.9**	**226.8**	**218.2**	**214.4**	**2,464.0**

Table 4 Monthly Rainfall (Piura)

Year	Jan.	Feb.	March	April	May	June	July	August	Sep.	Oct.	Nov.	Dec.	Total
1996	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998		151.5		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	151.5
1999	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.9	19.9
2001	11.3	5.9	161.2	19.7	0.0	0.0	0.0	0.0	0.0	0.7	0.0	7.3	206.1
2002	0.0	4.1	132.0	136.7	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.4	275.5
2003	4.1	22.2	3.7	1.0	0.0	1.3	0.0	0.0	0.5	0.0	6.2	2.1	41.1
2004	4.6	0.7	0.0	4.7	1.1	0.0	0.0	0.0	0.0	0.8	0.8	6.7	19.4
2005	2.2	0.7	17.7	0.6	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0	23.7
2006	0.0	26.1	31.5	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.6	0.6	59.4
2007	6.5	0.0	3.7	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	14.3
2008	7.2	92.3	54.1	35.4	1.5	0.3	2.3	0.0	0.0	0.2	0.2	0.0	193.5
2009	29.7	21.9	18.0		3.6	0.3	0.2	0.0		0.0	5.0	1.6	80.3
2010		64.2	13.9	18.6									96.7
Average	5.0	26.0	31.1	15.7	0.4	0.2	0.2	0.0	0.0	0.3	1.1	2.8	82.9

Table 5 Monthly Average Temperature (Piura)

Year	Jan.	Feb.	March	April	May	June	July	August	Sep.	Oct.	Nov.	Dec.
1996	27.18	28.58	28.18	25.51	23.87	21.81	20.94	21.76	22.46	23.26	23.28	25.20
1997	26.51	28.33	28.86	27.55	28.05	26.82	26.24	26.29	27.34	26.55	27.74	28.86
1998	28.84	29.27	29.17	28.45	26.52	24.80	23.44	22.18	22.85	23.38	23.59	24.51
1999	26.43	28.01	28.16	26.28	23.44	22.35	21.29	21.77	22.19	23.35	24.08	25.36
2000	27.02	28.51	28.26	27.20	24.65	22.59	21.51	22.72	23.10	23.61	22.91	25.66
2001	27.42	28.94	28.02	26.84	23.53	21.50	22.13	21.98	22.17	22.50	23.48	25.48
2002	26.79	28.86	29.50	27.46	25.73	22.73	22.09	22.47	22.77	24.15	24.85	26.56
2003	27.83	28.77	28.52	26.51	24.66	23.09	22.37	22.44	22.63	23.67	24.41	26.31
2004	27.57	29.23	29.24	27.06	24.14	22.42	22.49	22.15	23.39	24.25	24.79	26.32
2005	27.84	28.82	27.81	27.13	24.11	23.07	22.35	22.50	22.31	22.97	23.18	25.57
2006	28.01	29.09	28.64	26.43	24.05	22.99	22.75	23.27	23.44	24.07	25.37	26.48
2007	28.70	29.20	28.81	26.96	23.99	22.11	22.17	21.77	21.97	22.02	23.52	24.77
2008	27.49	28.22	28.46	26.63	24.16	22.88	22.75	22.85	23.58	23.43	23.98	25.40
2009	27.76	28.45	28.63		25.09	23.48	23.19	22.78		23.75	24.31	26.32
2010		28.82	28.82	27.29								
Average	27.53	28.74	28.60	26.95	24.71	23.04	22.55	22.64	23.09	23.64	24.25	25.91

Source : Piura Miraflores meteorological station (1996-2010)

: Deficit data

iii) Target Seepage Area

Target seepage area in each project site is as described in the Table below;

Table 6 Target Seepage Area

Name of Municipality	Landfill area (ha)	Number of Construction phase	Phase-1 Area (ha)	Phase-2 Area (ha)	Phase-3 Area (ha)	Target Seepage Area (ha)				
						Target Seepage Area	Block		A1 Disposal Area	A2 Soil Cover Area
							No.	Area of 1 block		
1. Puno	6.51	3	2.17	2.17	2.17	2.17	4	0.54	0.54	1.63
2. Juliaca	12.93	3	4.31	4.31	4.31	4.31	6	0.71	0.71	3.60
7. Abancay	3.36	3	1.08	1.08	1.08	1.08	3	0.36	0.36	0.72
10.P. Maldonado	4.50	3	1.50	1.50	1.50	1.50	4	0.375	0.375	1.125
12.Moyobamba	4.69	3	1.57	1.56	1.56	1.57	4	0.40	0.40	1.17
14.Chachapoyas	1.56	2	1.04	0.52	-	1.56	2	-	0.52	1.04
15.Ilave	1.43	2	0.99	0.44	-	1.43	2	-	0.44	0.99
16.Azangaro	0.83	2	0.55	0.28	-	0.83	2	-	0.28	0.55
20.Tarma	2.03	2	1.35	0.68	-	2.03	2	-	0.68	1.35
23.Aymaraes	0.46	2	0.31	0.15	-	0.46	2	-	0.15	0.31

iv) Daily Rainfall

Daily rainfall data can be obtained through the nearest meteorological weather station to the project site. Table 7 shows the name of the nearest weather station to each project site, mean annual rainfall and measurement period.

Table 7 Average Annual rainfall at Each Project

Project Name	Average annual rainfall (mm/year)	Measurement period	Name of Whether Station
1. Puno	775.0	1996-2010 year	Puno
2. Juliaca	627.7	2003-2010 year	Juliaca
7. Abancay	887.7	1996-2010 year	Abancay
10.P. Maldonado	2,157.7	1998-2009 year	Puerto Maldonado
12.Moyobamba	1,341.0	2000-2010 year	Moyobamba
14.Chachapoyas	870.8	1996-2009 year	Chachapoyas
15.Ilave	753.3	1996-2009 year	Ilave
16.Azangaro	630.0	2000-2010 year	Azangaro
20.Tarma	382.2	2000-2010 year	Tarma
23.Aymaraes	787.9	1999-2010 year	Chalhuaca

v) Leachate generated from decomposition of organic matter and humidity content of waste.

The volume of leachate generated from organic matter and humidity of waste can be calculated in the same manner as the Ica SW project. The calculation results are as shown in Table 8, and the calculation of the leachate volume in Piura is described below as a calculation example.

Table 8 Calculation Result of the Leachate Generation by Organic Waste

Project Name	Organic waste amount (m^3/year)		Leachate generation (m^3/day)	
	2015	2024	2015	2024
1. Puno	20,682	26,177	0.9	1.2
2. Juliaca	32,033	41,600	1.7	2.2
3. Piura	72,643	92,047	6.1	7.8
4. Nuevo Chimbote	13,146	16,142	6.5	7.2
5. Tumbes	12,573	15,664	0.9	1.1
6. Sullana	18,296	22,539	2.2	2.7
7. Abancay	10,402	11,705	0.6	0.6
8. Huanuco	19,272	21,918	1.0	1.1
9. Paita	6,825	9,164	3.4	4.5
10.Puerto Maldonado	8,511	11,815	0.7	0.9
11.Talara	10,884	12,308	5.4	6.1
12.Moyobamba	16,847	24,967	2.3	3.3
13.Tarapoto	35,978	44,063	1.8	2.2
14.Chachapoyas	3,499	4,888	0.2	0.3
15.Ilave	1,779	2,100	0.2	0.2
16.Azangaro	1,246	1,597	0.1	0.1
17.Chincha	8,548	10,193	4.3	5.1
18.Sechura	2,843	3,827	1.4	1.8
19.Huacho	52,002	59,721	8.5	9.7
20.Tarma	6,272	6,889	0.7	0.6
21.Ferrenafe	4,810	5,721	2.3	2.8
22.Santiago	633	837	0.3	0.4
23.Aymaraes	722	845	0.1	0.1

【Calculation Example: Piura】

The percentage of organic waste in the total amount of solid waste in Piura is 48.90%, and the humidity content of organic waste is 69.3%(reference value in Ica project). Consequently, the humidity of solid waste is estimated to be 33.89%.

Table 9 Capacity of Reception, Content of Organic Material and Humidity of Municipal Solid Waste

Year	Total amount of disposed wastes (t/year)	Organic matter disposed wastes (m3/year)	Moisture content in Organic matter (m3/year)
		48.90%	69.30%
2015	148,555.87	72,643	50,341
2016	152,459.72	74,552	51,664
2017	156,480.79	76,519	53,027
2018	160,622.76	78,544	54,430
2019	164,889.47	80,630	55,876
2020	169,284.85	82,780	57,366
2021	173,812.96	84,994	58,900
2022	178,478.01	87,275	60,481
2023	183,284.33	89,626	62,110
2024	188,236.38	92,047	63,788
Total	**1,676,105.15**	**819,610**	**567,983**

Based on the ratio of total organic material and its moisture content, which is 69.3% (assuming that there is no recovery of organic wastes practice), the total volume of water generated from the organic waste over a 10-year period of landfill lifetime is estimated to be 567,983m3, which are “potential leachate”.

Estimation of leachate volume from organic waste requires consideration of leachate reduction (absorption) by daily cover soil. The survey result of the Ica project revealed that clay-based cover soil absorbs 55% of moisture from organic waste, mud-based cover soil absorbs 18.7% and sand-based cover soil absorbs the smallest amount, 2.7%.

Equivalent humidity (% weight) = 55.5% (clay) + 18.7% (mud) + 2.7% (sand)

A geological survey indicates that superficially the sanitary landfill is located in a sand ground. Sand-based daily cover soil generates a lot of leachate from organic waste. Therefore, material for daily cover soil should contain a combination of clay (70%) and sand (30%), in order to reduce the generation of leachate from organic waste.

The water absorption coefficient of the clay and sand-based cover material is calculated to be 39.66% using the formula above. The ratio of cover material to disposed waste is 1 to 5 (20%),

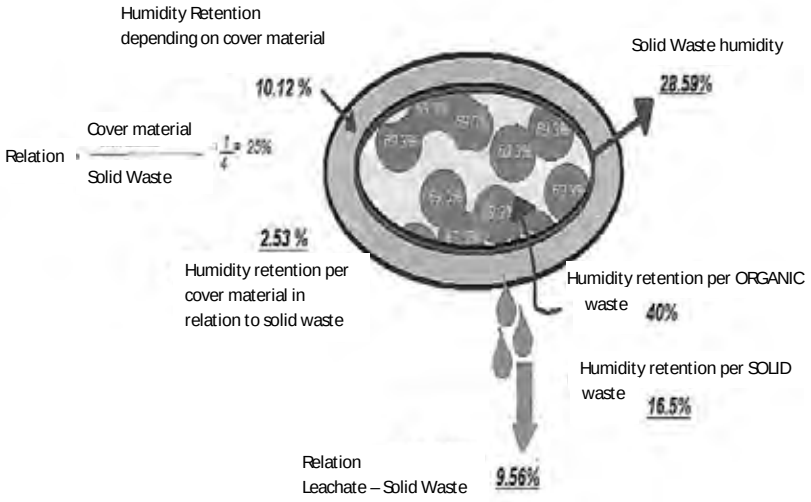
therefore the maximum humidity percentage of maximum humidity that the land can absorb in relation to solid waste will be of 7.93%.

The concept of field capacity is a parameter which does not depend on the weather, but is an own characteristic of the study material, in this case solid waste, which can retain a certain amount of liquid based on its porosity and put under certain conditions of compaction. We

assume a field capacity of 50% organic waste, that are translated in a retention of the 24.45% for confined wastes.

Balance	Trench and Platform
Moisture content of received solid waste	33.89%
Humidity retained by the material of cover in relation to received solid waste	-7.93%
Humidity retained by action of the capacity of field of confined solid waste	-24.45%
Liquid leached in relation to received solid waste	**1.51%**

The diagram below illustrates the flow of moisture from disposed waste in landfill area.



Hereby, leachate generated from organic waste in the sanitary landfill is calculated as shown in the table below;

Table 10 Calculation of Leachate Generated from Organic Waste

Year	Total amount of disposed wastes (t/year)	Volume Leached (m3/year)	Monthly volume Leachate (m3/month)	Daily volume Leachate (m3/day)
		1.51%	12 month	365 day
2015	148,555.87	2,236.0	186.3	6.1
2016	152,459.72	2,295.0	191.3	6.3
2017	156,480.79	2,356.0	196.3	6.5
2018	160,622.76	2,418.0	201.5	6.6
2019	164,889.47	2,482.0	206.8	6.8
2020	169,284.85	2,548.0	212.3	7.0
2021	173,812.96	2,617.0	218.1	7.2
2022	178,478.01	2,687.0	223.9	7.4
2023	183,284.33	2,759.0	229.9	7.6
2024	188,236.38	2,834.0	236.2	7.8
Total	**1,676,105.15**	**25,232.0**	**2,102.6**	**69.3**

(2) Study of Treatment Method

1) Evaporation Treatment

As a leachate treatment method, evaporation treatment method was studied first because it is the most economical method. This method is to collect leachate from a landfill area into a leachate pond, and to re-inject collected leachate into the landfill area. It is planned that 100m3 of leachate will be re-injected daily, expecting 10m3/day of leachate vaporization. It is also planned to spray the collected leachate to composting waste in a composting plant in summer.

Table 11 shows the calculation result. As for the projects marked with yellow in Table 11, its volume of leachate generation by the rainfall percolating through the disposed waste is expected to be 0, and volume of leachate generation from organic waste and water content of waste is expected to be smaller than evaporation volume ($10m^3$/day). Therefore, these projects can apply evaporation treatment system with a small leachate pond, in which leachate generated is collected in a small pond and then re-injected into landfill for evaporation. It is expected that the evaporation treatment is effective for the project marked with greenish yellow, too, but a large-sized pond is needed for these projects. Table 3 shows the calculation results for these projects which evaporation treatment is applicable. On the other hand, the projects marked with blue have a large amount of leachate generation, and thus evaporation treatment is not applicable. The calculation results for these projects are as shown in

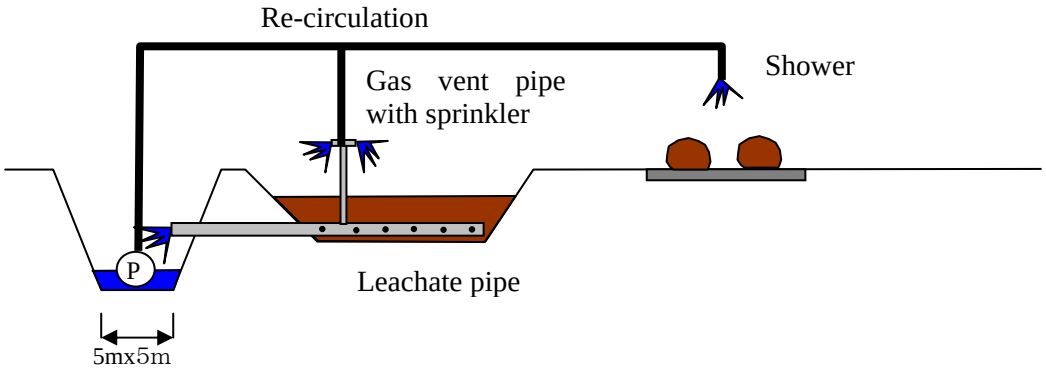


Figure 2 Schematic View of Evaporation Treatment

Table 11 Calculated Leachate Volume Requirement for Evaporation Treatment

Name of Municipality	Leachate volume requirement*1 (m3)	Remark
1. Puno	2,900	
2. Juliaca	x	Evaporation treatment is not applicable.
3. Piura	30	
4. Nuevo Chimbote	30	
5. Tumbes	30	
6. Sullana	30	
7. Abancay	1,260	
8. Huanuco	30	
9. Paita	30	
10.Puerto Maldonado	x	Evaporation treatment is not applicable.
11.Talara	30	
12.Moyobamba	1,200	
13.Tarapoto	30	
14.Chachapoyas	140	
15.Ilave	1,530	
16.Azangaro	320	
17.Chincha	30	
18.Sechura	30	
19.Huacho	30	
20.Tarma	400	
21.Ferrenafe	30	
22.Santiago	30	
23.Aymaraes	280	

*1: As for the projects with the leachate volume requirements of $30m^3$, the figure given in the above table represents a minimum volume needed because these projects has only small leachate generation. Leachate volume requirements were calculated on the assumption that the size of leachate pond is minimum size which can be constructed using heavy machines.

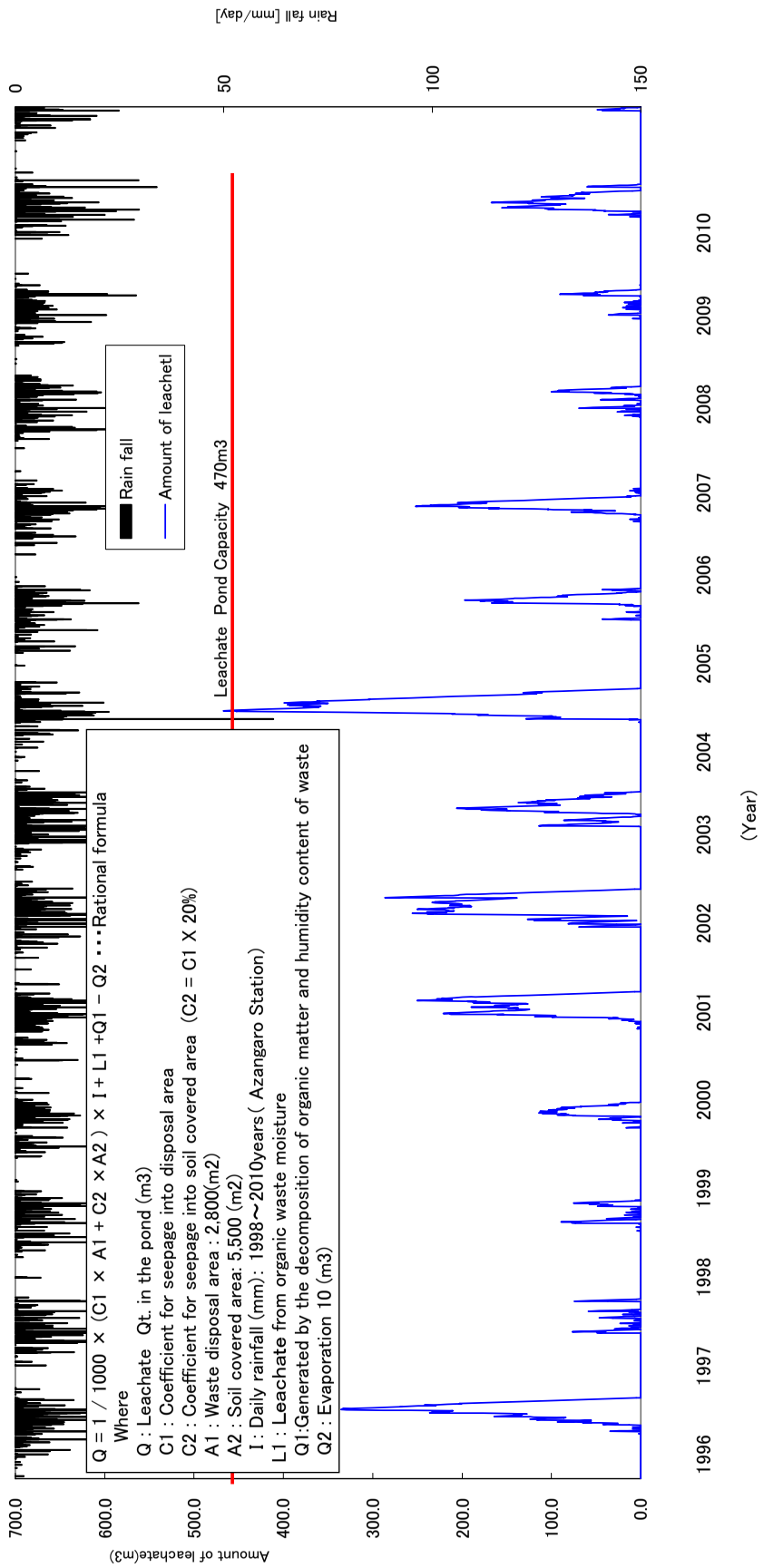


Figure 3 Example: Results of Calculation for Leachate Volume Requirement for the Project that Can Apply Evaporation Treatment (Azangaro)

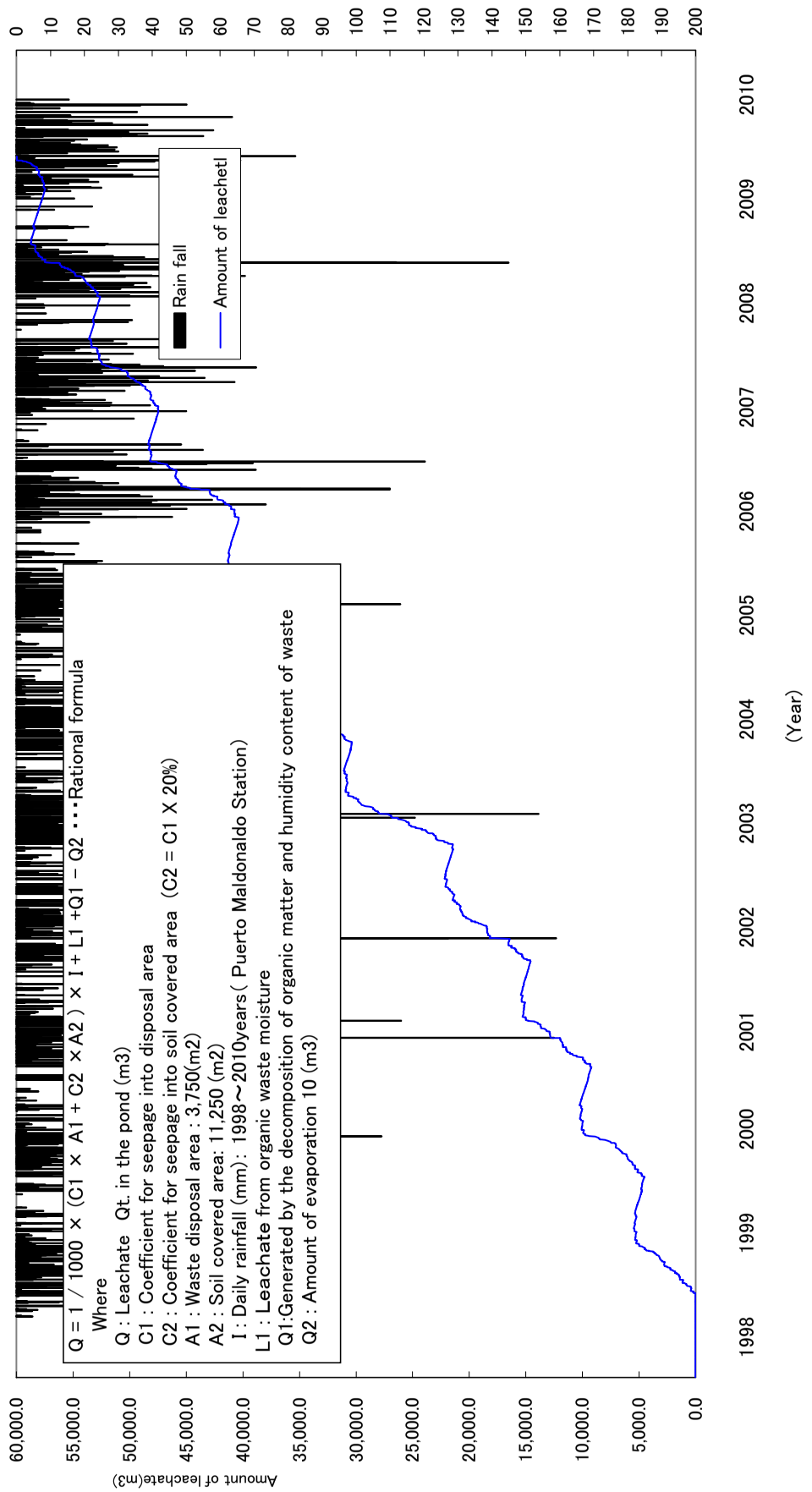


Figure 4 Example: Results of Calculation of Leachate Volume for the Project that Cannot Apply Evaporation Treatment (Puerto Maldonado)

2) Leachate Treatment System

As shown in Table 11, Puerto Maldonado needs to install leachate treatment facilities.

i) Applied effluent standard

Since there are currently no effluent standard for leachate treatment in Peru, the project will comply with DEGESA's Draft Effluent Standard shown in Table 12. As for BOD, however, it will comply with the Draft Effluent Standard that MINAM has under discussion, which defines the standard value of BOD as 100mg/l.

ii) Influent quality

Comparing the quality of leachate of landfill in Lima City to the above-mentioned Draft Effluent Standard, parameters exceeding the Effluent Standard were determined as parameters of influent quality, which are BOD and SS. Based on the quality of leachate from LIMA landfill, the concentration of BOD and SS are set to 3,500 mg/l and 1,000mg/l, respectively,.

iii) Calculation of the capacity of leachate treatment facility

Capacity of leachate treatment facility is calculated using the aforementioned rational formula. Leachate treatment facility should have a capacity enough to cover the daily rainfall calculated from the monthly maximum rainfall. Calculation of the capacity for Puerto Maldonado is described below as an example.

$Q = 1 / 1{,}000 \times (C1 \times A1 + C2 \times A2) \times I + Q1$ ・・・Rational formula

Where

Q : Capacity of Leachate treatment (= 60 m^3/day)
Q1: Generated by decomposition of organic matter and humidity content of waste (0.9m^3/day, Refer to table 8)
C1 : Coefficient for seepage into disposal area (= 0.86)
C2 : Coefficient for seepage into soil covered area (C2 = C1 X 20%)
A1 : Waste disposal area (3,750 m^2)
A2 : Soil covered area (11,250 m^2)
I : Daily rainfall calculated from monthly maximum rainfall (=11.3mm/day)

Using the equation above, the capacity of leachate treatment facility was calculated to be 60m3/day.

iv) Calculation of leachate pond capacity

In order to set necessary pond volume (capacity of leachate pond), daily water amount shall be calculated from daily rainfall in the past 10 years and each assumed capability of leachate treatment. Capacity of leachate pond is calculated using the rational formula shown below;

$V = 1 / 1000 \times (C1 \times A1 + C2 \times A2) \times I + Q1 - Q$ ・・・Rational formula

Where

V : Capacity of leachate pond (m^3)
Q : Capability of leachate treatment (60m^3/day)
Q1: Generated by decomposition of organic matter and humidity content of waste (0.9m^3/day, Refer to table 8)
C1 : Coefficient for seepage into disposal area: (See table 6)
C2 : Coefficient for seepage into soil covered area : (C2 = C1 X 20%)

A1 : Waste disposal area (m^2) :3,750m^2
A2 : Soil covered area (m^2) :11,250m^2
I : Daily rainfall (mm) : average in the past 12 years (1998 – 2009year)

Figure 5 shows the capacity of leachate pond in Puerto Maldonado calculated using the above formula, which is 1,850m^3/day.

Table 12 DIGESA's Draft Effluents Standards,
"Maximum Limits Allowed of Effluents in Solid Waste Infrastructure"

	PARAMETERS	UNIT	MLA	ESSAY METHOD
	Generals			
1	pH		6.5 - 8.5	APHA 4500H+B P.4-90 to 4-94 21st Edition
2	Total suspended solid	Mg/L	30	APHA 2540-D p. 2-58 to 2-59 21st Edition
II	**Organic**			
3	COD	Mg/L	120	EPA method 410.1 600/4-79-020 revised March
4	BOD	Mg/L	20	APHA-AWWA-WEF 5210B. 21st Edition
5	Total Petroleum Hydrocarbon		10	DIN EN ISO 9377-July 2, 2001
III	**Inorganic**			
6	Ammonium (as N)	Mg/L	10	
7	Total Arsenic	Mg/L	0.1	APHA 3114-CP. 3-37 TO 3-38 21st Edition
8	Total Cadmium	Mg/L	0.1	APHA 3111-B P. 3-17 to 3-19, 21st Edition
9	Total Copper	Mg/L	0.5	APHA 3111-B P. 3-17 to 3-19, 21st Edition
10	Chromium VI (*)	Mg/L	0.1	Standard Methods for the examination of water and wasterwater APHA-AWWA-WEF. 3500 Cr-B 21st Edition
11	Total Iron	Mg/L	2	APHA 3111-B P. 3-17 to 3-19 21st Edition
12	Total Mercury	Mg/L	0.01	APHA 3111-B P. 3-23 to 3-24 21st Edition
13	Total Lead	Mg/L	0.5	APHA 3111-B P. 3-17 to 3-19 21st Edition
14	Total Zinc	Mg/L	0.5	APHA 3111-B P. 3-17 to 3-19 21st Edition
IV	**Biological**			
15	Total Coliforms	Most Probable Number/100mL	1000	APHA 9221 B Standard Methods for the Examination of Water and Wastewater 21st Edition

Source: DIGESA
(*) Non filtered simple
Note: Direct discharge to surface water courses

Table 13(1) Results of Leachate quality survey at Lima Existing Landfill site

Inspectorate Services Perú S.A.C.
Av. Elmer Faucett N° 444
Callao - Perú
Central : (511) 613-8080
Fax : (511) 628-9016
www.inspectorate.com

LABORATORIO DE ENSAYO
ACREDITADO POR EL ORGANISMO PERUANO
DE ACREDITACIÓN INDECOPI-SNA
CON REGISTRO No LE-031

Registro N° LE-031

INSPECTORATE

Nº 138658

INFORME DE ENSAYO CON VALOR OFICIAL No. 52123L/10-MA-MB

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Cliente	:	RELIMA AMBIENTAL S.A.
Dirección	:	Av. Tomas Marsano No. 432 Surquillo
Producto	:	Agua
Cantidad de muestra	:	07
Presentación	:	Frascos de plástico y vidrio proporcionados por Inspectorate Services Perú S.A.C.
Instrucciones de ensayo	:	Enviadas por el cliente
Procedencia de la muestra	:	Muestras enviadas por el cliente indicando fecha de muestreo: 2010-04-30 Hora: 12:50 O/S 592-10-LAMA
Referencia del Cliente	:	Relleno Sanitario Portillo Grande (Leachate pond)
Fecha Ingreso de Muestra(s)	:	2010-04-30
Fecha de inicio de análisis	:	2010-04-30; Hora: 17:50 (Microbiológico)
Fecha de término de análisis	:	2010-05-11
Solicitud de Análisis	:	21075/10

Código de Laboratorio	Descripción de Muestra Declarado por el Cliente	Sólidos Totales Suspendidos mg/L	Demanda Bioquímica de Oxigeno mg/L O_2	Aceites y Grasas mg/L
21075-116843	Poza de lixiviado N° 02	669,5	3550,0	30,7
Límite de Cuantificación		5,0	2,0	5,0

Código de Laboratorio	Descripción de Muestra Declarado por el Cliente	Demanda Química de Oxigeno mg/L O_2	pH unidades	Nitrógeno Nitrato mg/L N-NO_3^-
21075-116843	Poza de lixiviado N° 02	16525,6	8,5	<0,06
Límite de Cuantificación		20,0	--	0,06

Código de Laboratorio	Descripción de Muestra Declarado por el Cliente	Zn (tot) mg/L	Pb (tot) mg/L	As (tot) mg/L
21075-116843	Poza de lixiviado N° 02	0,791	<0,010	0,9556
Límite de Cuantificación		0,003	0,010	0,0004

Código de Laboratorio	Descripción de Muestra Declarado por el Cliente	Cd (tot) mg/L	Cr (tot) mg/L	Hg (tot) mg/L
21075-116843	Poza de lixiviado N° 02	<0,003	2,36	<0,0006
Límite de Cuantificación		0,003	0,02	0,0006

Código de Laboratorio	Descripción de Muestra Declarado por el Cliente	Coliformes Totales NMP/100ml	Fósforo total mg/L
21075-116843	Poza de lixiviado N° 02	35×10^7	19,75
Límite de Cuantificación		1,8	0,01

Métodos:

Demanda Bioquímica de Oxigeno	EPA 405.1 Biochemical Oxygen Demand, 5 Days, 20oC; "Methods for Chemical Analysis of Water and Waste; Document 20460; EPA 621-C-99-004, June 1999"
Aceites y Grasas	EPA 1664 N-Hexane Extractable Material(HEM; Oil and Grease) and Silica Gel Treated by N-Hexane Extractable Material (SGT-HEM, Non-polar Materia) by Extraction and Gravimetry; "Methods for Chemical Analysis of Water and Waste; Document 20460; EPA 621-C-99-004, June 1999"
Demanda Química de Oxigeno	EPA 410.1 Chemical Oxygen Demand, Titrimetric, Mid-Level; "Methods for Chemical Analysis of Water and Waste; Document 20460; EPA 621-C-99-004, June 1999"
Sólidos Totales Suspendidos	APHA AWWA WEF 21th Edition, 2005. Pag 2-56 a 2-59. 2540-D Solids,Total Suspended Solids Dried at 103-105oC.
pH	EPA 150.1: pH Electrometric; "Methods for Chemical Analysis of Water and Waste; Document 20460; EPA 621-C-99-004, June 1999"
Nitrógeno Nitrato	EPA 352.1: Nitrate, Colorimetric, Brucine; "Methods for Chemical Analysis of Water and Waste; Document 20460; EPA 621-C-99-004, June 1999"
Fósforo Total	EPA 365.3 Phosphorus, All Forms, Colorimetric, Ascorbic Acid, Two Reagent, "Methods for Chemical Analysis of Water and Waste; Document 20460; EPA 621-C-99-004, June 1999"

Los resultados presentados corresponden sólo a la muestra indicada
< "valor" significa no cuantificable debajo del límite de cuantificación indicado
A excepción de los productos perecibles los tiempos de custodia dependerán del laboratorio que realice el análisis.
Este tiempo variará desde 7 días hasta 3 meses como máximo

Table-13 (2) Results of Leachate Quality Survey at Lima Existing Landfill Site1

LABORATORIO DE ENSAYO ACREDITADO POR EL SERVICIO NACIONAL DE ACREDITACION

Inspectorate Services Perú S.A.C.
Av. Elmer Faucett N° 444
Callao - Perú
Central : (511) 613-8080
Fax : (511) 628-9016
www.inspectorate.com

INSPECTORATE

Nº 119702

SUPLEMENTO DEL INFORME DE ENSAYO CON VALOR OFICIAL
No. 77934L/09-MA-MB
Original 2 de 2

Pag. 01/2

Cliente	:	VEGA UPACA S.A. – RELIMA
Dirección	:	Av. Pastor Sevilla s/n San Juan de Miraflores
Producto	:	Agua
Cantidad de muestra	:	12
Presentación	:	Frascos de plástico y vidrio proporcionados por Inspectorate Services Perú S.A.C.
Instrucciones de Ensayo	:	Enviadas por el cliente
Procedencia de la Muestra	:	Muestras enviadas por el cliente indicando fecha de muestreo: 2009-07-07 Hora: No indica O/S 743-09-LAMA
Referencia del Cliente	:	Poza Lixiviado 01 – R.S. Patillo Grande (Lurín) (Leachate pond) Poza Lixiviado 01 – R.S. El Zapallal (Carabayllo)
Fecha Ingreso de Muestra(s)	:	2009-07-07
Fecha de Inicio de Análisis	:	2009-07-07; Hora: 15:38 (Microbiológico)
Fecha de Término de Análisis	:	2009-07-13
Solicitud de Análisis	:	17433/09

Código de Laboratorio	Descripción de Muestra Declarado por el cliente	DBO (old) mg/L	pH unidades	Fósforo total mg/L	Aceites y Grasas (mg/L)
17433-93176	Poza Lix. 01 R.S. Portillo Grande (Lurín)	1880,0	8,4	31,98	21,2
17433-93177	Poza Lix. 01 R.S. El Zapallal (Carabayllo)	48,0	8,3	18,57	14,3
	Límite de Cuantificación	2,0	--	0,01	5,0

Código de Laboratorio	Descripción de Muestra Declarado por el Cliente	Zn (tot) mg/L	Pb (tot) mg/L	Cd (tot) mg/L	Cr (tot) mg/L	Hg (tot) mg/L
17433-93176	Poza Lix. 01 R.S. Portillo Grande (Lurín)	0,565	0,181	<0,003	1,60	<0,0006
17433-93177	Poza Lix. 01 R.S. El Zapallal (Carabayllo)	0,205	0,150	0,007	1,38	<0,0006
	Límite Cuantificación	0,003	0,025	0,003	0,02	0,0006

Código de Laboratorio	Descripción de Muestra Declarado por el Cliente	Coliformes Totales NMP/100ml	Sólidos Totales Suspendidos (mg/L)	Demanda Química de Oxígeno (mg/L) (COD)
17433-93176	Poza Lix. 01 R.S. Portillo Grande (Lurín)	23×10^2	964,0	9180,3
17433-93177	Poza Lix. 01 R.S. El Zapallal (Carabayllo)	11 x 10	62,9	3719,3
	Límite de Cuantificación	1,8	5,0	20,0

Nota: El presente documento deja sin efecto el informe original

Métodos:

DBO_5	EPA 405.1 Biochemical Oxygen Demand, 5 Days, 20°C; "Methods for Chemical Analysis of Water and Waste; Document 20460; EPA 621-C-99-004; June 1999"
pH	EPA 150.1 pH Electrometric; "Methods for Chemical Analysis of Water and Waste: Document 20460; EPA 621-C-99-004, June 1999"
Sólidos Totales Suspendidos	APHA AWWA WEF 21th Edition, 2005. Pag 2-58 a 2-59. 2540-D Solids,Total Suspended Solids Dried at 103-105oC.
Demanda Química de Oxígeno	EPA 410.1 Chemical Oxygen Demand, Titrimetric, Mid-Level; "Methods for Chemical Analysis of Water and Waste; Document 20460; EPA 621-C-99-004, June 1999"
Fósforo Total	EPA 365.3 Phosphorus, All Forms, Colorimetric, Ascorbic Acid, Two Reagent; "Methods for Chemical Analysis of Water and Waste; Document 20460; EPA 621-C-99-004, June 1999"
Aceites y Grasas	EPA 1664 N-Hexane Extractable Material(HEM; Oil and Grease) and Silica Gel Treated by N-Hexane Extractable Material (SGT-HEM; Non-polar Material) by Extraction and Gravimetry; "Methods for Chemical Analysis of Water and Waste; Document 20460; EPA 621-C-99-004, June 1999"
Plomo	EPA 239.1 Lead, Atomic Absorption, Direct Aspiration; Sample Preparation Procedure for Spectrochemical Determination of Total Recoverable Elements; "Methods for Chemical Analysis of Water and Waste; Document 20460; EPA 621-C-99-004, June 1999"
Zinc	EPA 289.1 Zinc, Atomic Absorption, Direct Aspiration; Sample Preparation Procedure for Spectrochemical Determination of Total Recoverable Elements; "Methods for Chemical Analysis of Water and Waste; "Methods for Chemical Analysis of Water and Waste; Document 20460; EPA 621-C-99-004, June 1999"
Cadmio	EPA 213.1 Cadmium, Atomic Absorption, Direct Aspiration; Sample Preparation Procedure for Spectrochemical Determination of Total Recoverable Elements; "Methods for Chemical Analysis of Water and Waste; Document 20460; EPA 621-C-99-004, June 1999"
Cromo	APHA AWWA WEF, 21st Edición 2005. 3030-G Preliminary Treatment of Samples, Nitric Acid-Sulfuric Acid Digestion; Metals by Flame Atomic Absorption, Direct Air - Acetylene Flame Method ; Pag 3-10; APHA-AWWA-WEF 3111-B, Pag 3-17 a 3-19.

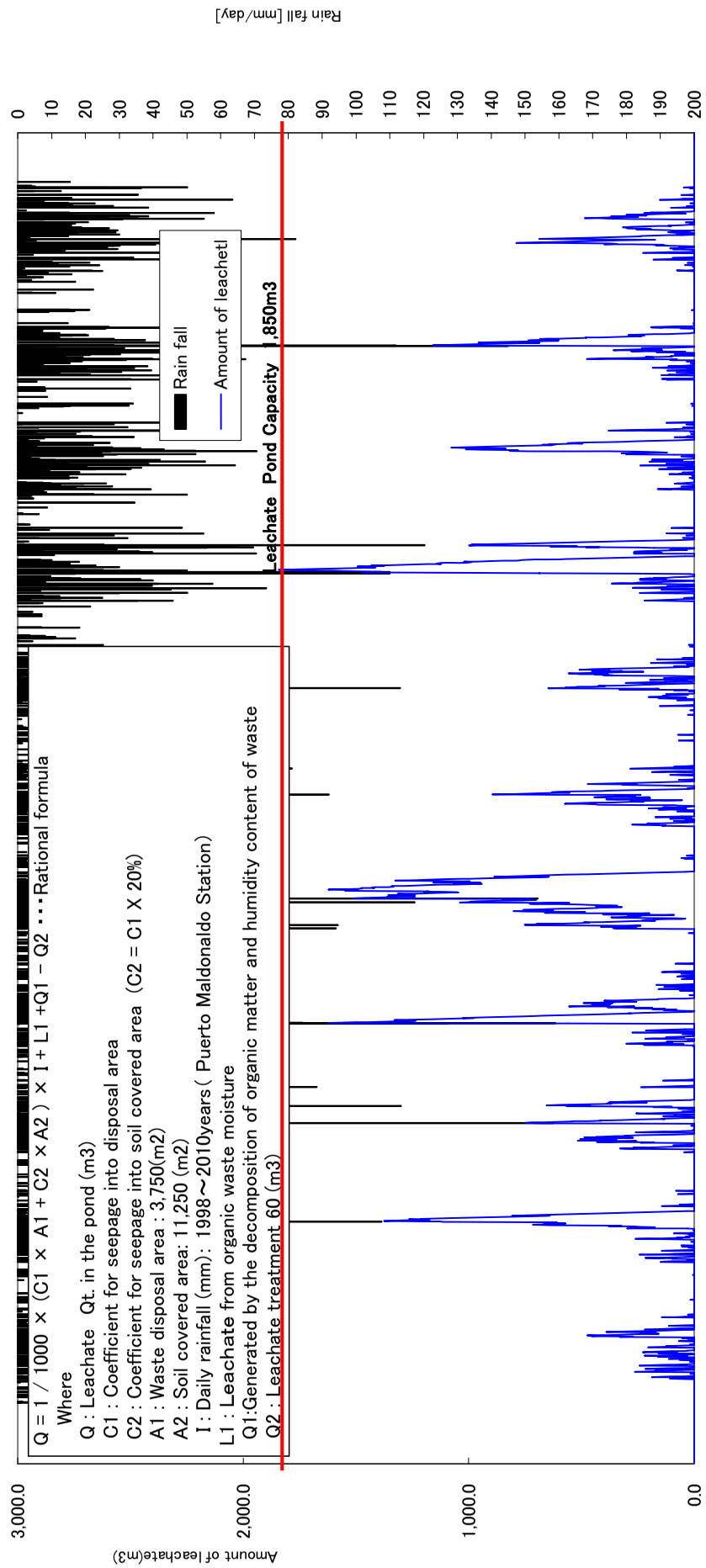


Figure 5 Result of Calculation for Leachate Volume Requirement in Puerto Maldonado
(With the assumption that leachate treatment capacity is 60m^3/day)

v) Examination of leachate treatment method

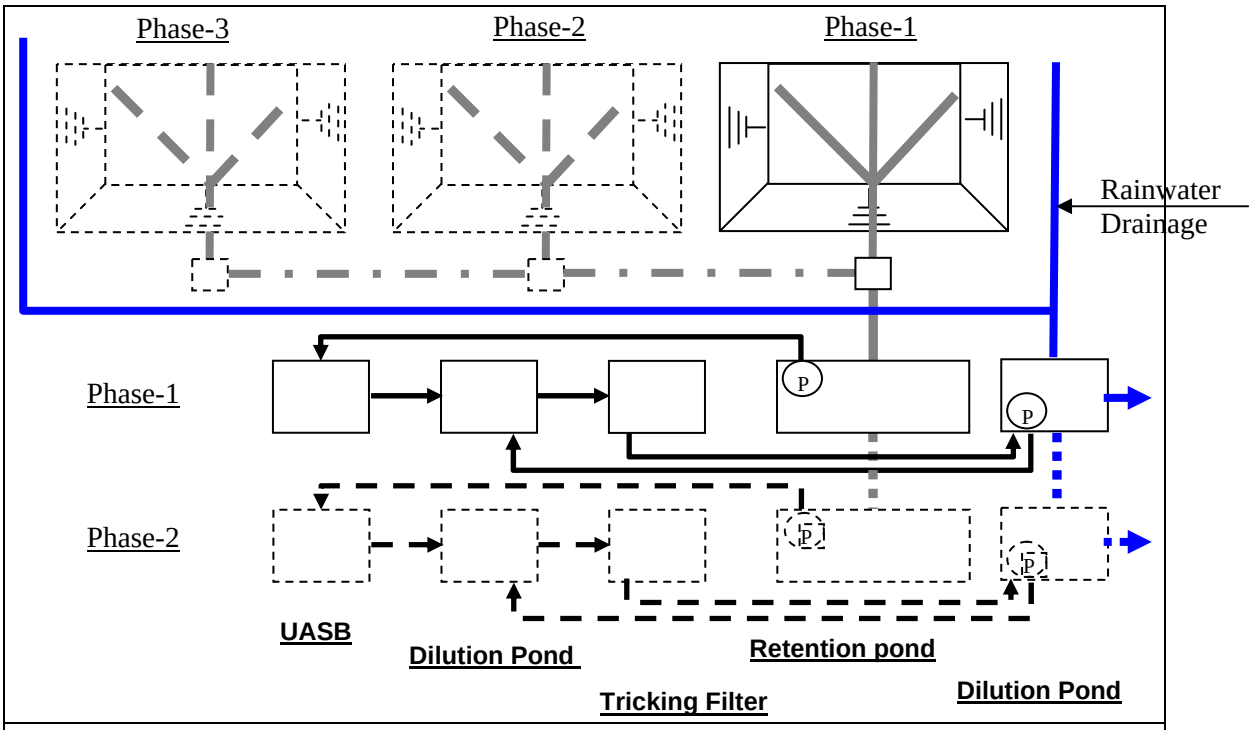
As previously mentioned, substances to be removed are BOD and SS. Since most SS settle out in the leachate pond, a major treatment process would be removal of BOD. Although aeration treatment is considered to be the most excellent method to remove BOD, it requires quite high cost of operation and maintenance. Therefore MINAM requested to combine aerobic and anaerobic treatment system. Thus, we examined the treatment method with a combination of aerobic and anaerobic treatment system.

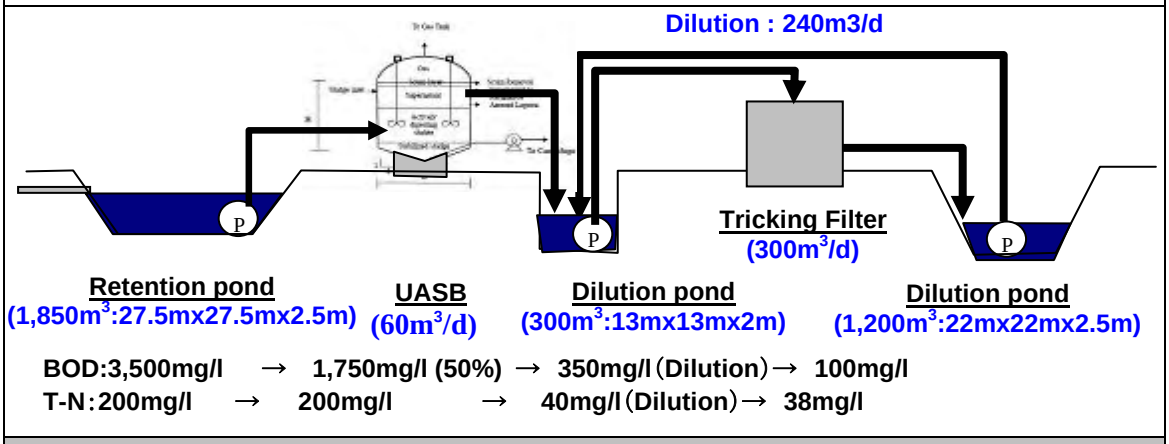
There are two types in anaerobic treatment system, i.e., normal type and UASB (Upflow Anaerobic Sludge Blanket). UASB is a proven system in Peru, while there is no precedent for the normal type in Peru. In addition, UNI (UNIVERSIDAD NACIONAL DE INGENIERIA) is promoting research on UASB and the project can receive support from UNI for facility design through MINAM. Therefore, UASB was selected for this project.

Major types of aerobic treatment system include activated sludge process, trickling filter process and rotating disc process. Among these, rotating disc process was eliminated from the examination because there is no precedent in Peru. Compared to activated sludge process, trickling filter process requires lower construction cost and O&M cost, but is inferior in removal performance. Still, trickling filter process is applicable to the target area because Puerto Maldonado has high rainfall and it would be possible to dilute leachate by adding rainwater before treatment. Hence, trickling filter process was selected as aerobic treatment system for the project. Table 3 shows the outlines of the treatment methods.

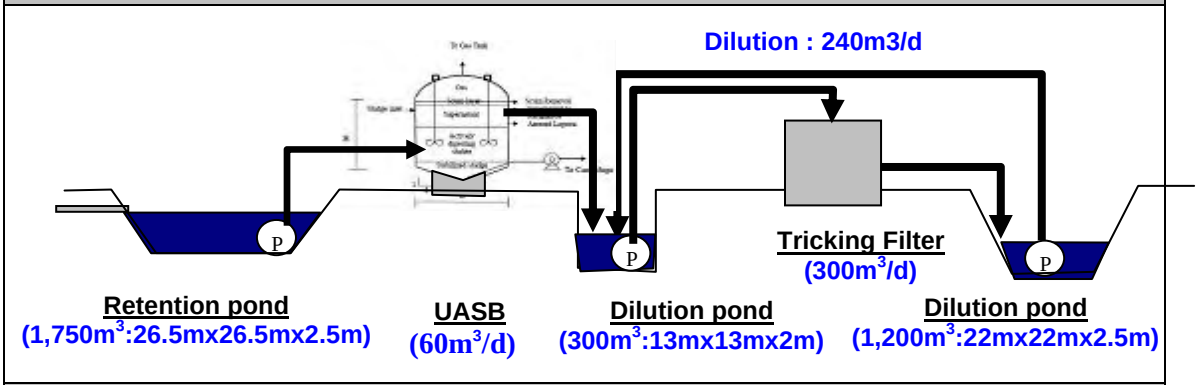
Table 14 Outlines of the Treatment Methods

Treatment System	Anaerobic Treatment System		Aerobic Treatment System		
	Normal	UASB	Activated sludge	Trickling filter	Rotating disc
Precedent	No	1 case under construction, 1 case in trial operation by UNI	Many	Few	No
Operation management	Easy	Easy	Difficult	Easy	Easy
Construction cost	Low	Low	High	Middle	Middle
O&M cost	Low	Low	High	Middle	Middle
Manufacturer	No	No	Yes	Yes	No





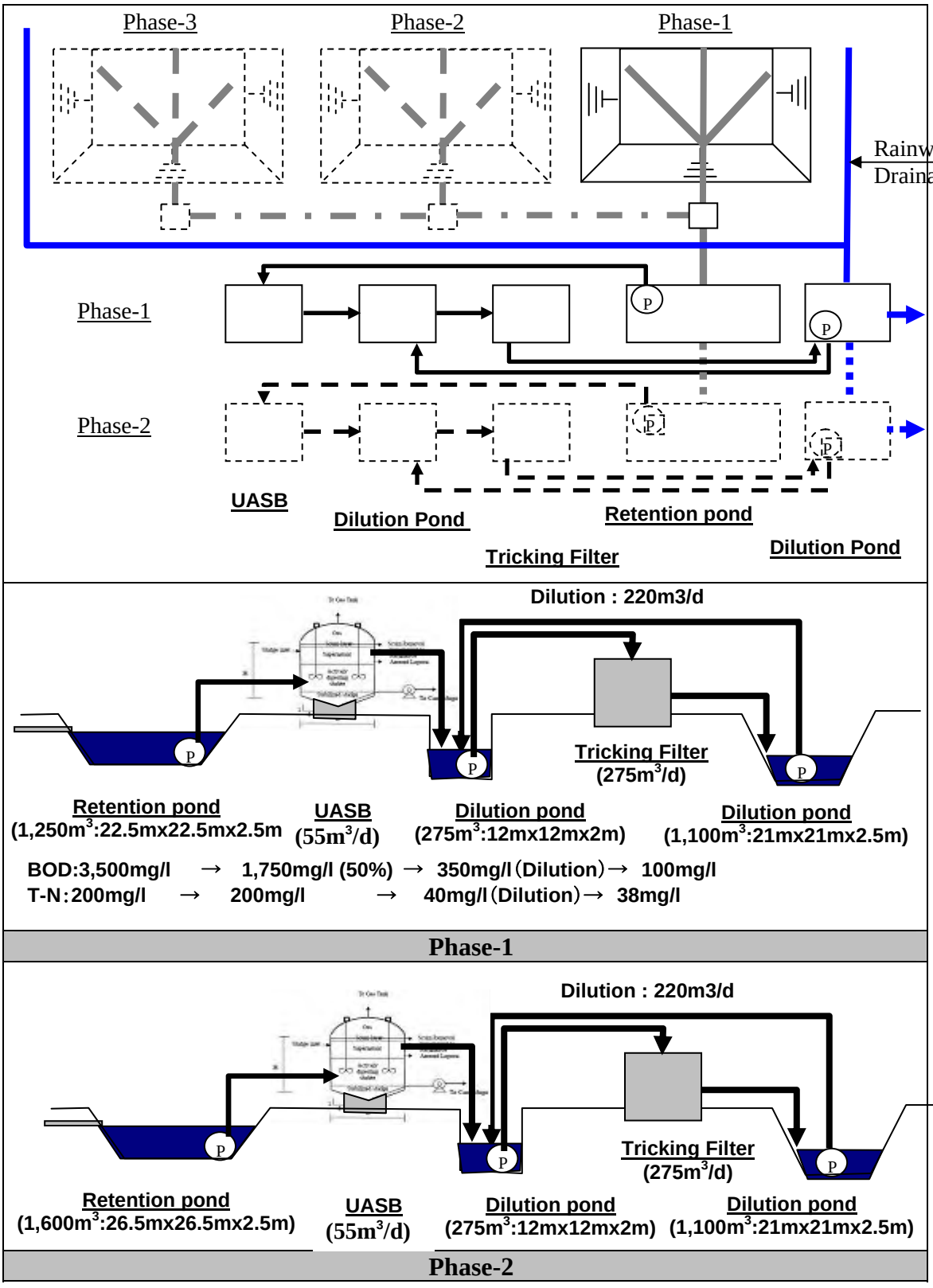
Phase-1



Phase-2

Anaerobic (UASB) + Aerobic (Tricking Filter) proceeding

Figure 6 Proposed leachate treatment system in Puerto Maldonado



Anaerobic (UASB) + Aerobic (Tricking Filter) proceeding

Figure 7 Proposed leachate treatment system in Juliaca

Appendix-9: Environmental Checklist for Pre-FS and *Perfil* projects

Appendix-9: Environmental Checklist for Perfil and PreFS projects

Environmental Checklist 21. Waste Management and Disposal complemented with Checklist 24. Forestry Projects for *Perfils* and PreFS Level Projects

<table>
<tr><th>Category</th><th>Environmental Item</th><th>Main Check Items</th><th>Confirmation of Environmental Considerations</th></tr>
<tr><td rowspan="3">1 Permits and Explanation</td><td rowspan="3">(1) EIA and Environmental Permits</td><td>1) Have EIA reports been officially completed?</td><td>Conduction of public investment projects in Peru is regulated by the National System of Public Investment (SNIP). The system establishes a requirement of EIA approval previous to SNIP procedure completion for projects with investment amount larger than S/.10 million.
For the project with investment amount below S/. 10 million (at “profile (perfil in Spanish)” and “pre-feasibility (PreFS)” levels), SNIP procedure does not requires EIA in the SNIP approval process.
Individual Projects of the Program in this situation are as follows:
<table>
<tr><th>Project site</th><th>SNIP level</th></tr>
<tr><td>Nuevo Chimbote</td><td>PreFS</td></tr>
<tr><td>Tumbes</td><td>PreFS</td></tr>
<tr><td>Abancay</td><td>Perfil</td></tr>
<tr><td>Paita</td><td>PreFS</td></tr>
<tr><td>Puerto Maldonado</td><td>PreFS</td></tr>
<tr><td>Talara</td><td>PreFS</td></tr>
<tr><td>Moyabamba</td><td>PreFS</td></tr>
<tr><td>Chachapoyas</td><td>Perfil</td></tr>
<tr><td>Ilave</td><td>Perfil</td></tr>
<tr><td>Azángaro</td><td>Perfil</td></tr>
<tr><td>Chincha</td><td>Perfil</td></tr>
<tr><td>Sechura</td><td>PreFS</td></tr>
<tr><td>Huacho</td><td>PreFS</td></tr>
<tr><td>Tarma</td><td>Perfil</td></tr>
<tr><td>Ferreñafe</td><td>Perfil</td></tr>
<tr><td>Santiago</td><td>Perfil</td></tr>
<tr><td>Aymaraes</td><td>Perfil</td></tr>
</table>
Abovementioned Projects include conduction of EIA in only the stage after the SNIP approval stage.</td></tr>
<tr><td>2) Have EIA reports been approved by authorities of the Peruvian government?</td><td>Authority for the approval of EIA regarding SWM infrastructures is the Directorate of Environmental Sanitation (DIGESA) under the Ministry of Health (MINSA).
Currently, DIGESA is processing an Administrative Directive for enactment of the Guidelines for the Formulation of Environmental Studies of Municipality Managed Solid Wastes Infrastructures. According to the Directive bill, environmental studies for project constituted by sanitary landfill require detail assessment.
Therefore, abovementioned Projects must follow DIGESA’s EIA procedure.</td></tr>
<tr><td>3) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the</td><td>EIA procedures for SWM facilities are not officially established. MINSA-DIGESA is formulating an Administrative Directive for this purpose.
Under this scenario, understanding of EIA procedure concerned to projects on SWM infrastructures was recorded</td></tr>
</table>

<table>
<tr><th>Category</th><th>Environmental Item</th><th>Main Check Items</th><th>Confirmation of Environmental Considerations</th></tr>
<tr><td rowspan="4"></td><td rowspan="2"></td><td>conditions satisfied?</td><td>among DIGESA/MINAM and JST/Local Consultant.
In fact, EIA reports were made on the guidelines of above-mentioned draft Administrative Directive of DIGESA.</td></tr>
<tr><td>4) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the Peruvian government?</td><td>As pre-requisites of EIA approval, following requirements will be requested by the respective institutions:
- Certification of land use compatibility by the respective Provincial Municipality;
- Certification of non-encompassing protected areas by the National Natural Protected Areas Agency (SERNANP, former INRENA). In case of the target area is totally or partially contained in protected areas or buffer zones, technical opinion from SERNANP is necessary;
- Report on non-encompassing natural disaster vulnerable area by the National Civil Defense Institute (INDECI);
- Certification of non-encompassing archeological valuable area by the Ministry of Culture (MINC); and,
- Favorable opinion by the correspondent Regional Directorate of Health (DIRESA) on the site selection report.</td></tr>
<tr><td rowspan="2">(2) Explanation to the Public</td><td>1) Are contents of the project and the potential impacts adequately explained to the public based on appropriate procedures, including information disclosure? Is understanding obtained from the public?</td><td>Public Participation Plan (PPP) should be prepared for all stages of the Project as part of EIA process.
Public consultation is part of EIA approval process which is conducted by the local governments.
In addition, records of observations claimed by the participants and the correspondent replies should be submitted.</td></tr>
<tr><td>2) Are proper responses made to comments from the public and regulatory authorities?</td><td>As part of Environmental Management Strategy, a Compensation Plan and a Community Relations Plan should be prepared. These plans will formulate considering the results of actions for the formulation stage of abovementioned PPP.</td></tr>
<tr><td>2 Mitigation Measures</td><td>(1) Air Quality</td><td>1) Do air pollutants, such as sulfur oxides (SO_X), nitrogen oxides (NO_X), and soot and dust, and dioxins emitted from various sources, such as incinerators, and vehicles used for waste collection and transportation comply with the Peruvian emission standards and ambient air quality standards?</td><td>Emission standards (Maximum Permitted Limits) for solid waste management facilities are not established.
Vehicles for solid waste transportation should follow emission standards formulated by the Ministry of Transportation and Communication. However these standards are still under revision.
Air Quality Standards (ECA-air) are established by the Cabinet Decree (D. S. No. 074-2001-PCM) and its amendments (D. D. No. 069-2003-PCM and R. M. No. 138-2008-MINCETUR/DM) as follows:
<table>
<tr><th>Parameter</th><th>Period</th><th>Value ($\mu g/m^3$)</th></tr>
<tr><td rowspan="2">SO_2</td><td>Annual</td><td>80</td></tr>
<tr><td>24 hours</td><td>20</td></tr>
<tr><td rowspan="2">NO_2</td><td>Annual</td><td>100</td></tr>
<tr><td>1 hour</td><td>200</td></tr>
<tr><td rowspan="2">CO</td><td>8 hours</td><td>10,000</td></tr>
<tr><td>1 hour</td><td>30,000</td></tr>
<tr><td>O_3</td><td>8 hours</td><td>120</td></tr>
<tr><td>H_2S</td><td>24 hours</td><td>150</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Category</th><th>Environmental Item</th><th>Main Check Items</th><th>Confirmation of Environmental Considerations</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><td rowspan="2">Pb</td><td>Annual</td><td>0.5</td></tr>
<tr><td>Monthly</td><td>1.5</td></tr>
<tr><td rowspan="2">PM-10</td><td>Annual</td><td>50</td></tr>
<tr><td>24 hours</td><td>150</td></tr>
<tr><td>PM-2.5</td><td>24 hours</td><td>25</td></tr>
<tr><td>hydrocarbons</td><td>24 hours</td><td>100</td></tr>
<tr><td>Benzene</td><td>Annual</td><td>2</td></tr>
</table>
The following mitigation measure will be conducted to satisfy the standards:
- Transportation vehicles: preventive maintenance program, recovering aids for mitigation of waste scattering and water sparkling of routes for dust scattering mitigation.
- Machinery in landfill site: preventive maintenance program and water sparkling of routes for dust scattering mitigation.
- Operating cells of landfill area: installation of gas collection system for exhausting generated gases by decomposition of accumulated waste.
- Closed cells of landfill area: coverage by low permeability soil with vegetation.
- Segregation plant and composting plant: covered by open roof
</td></tr>
<tr><td></td><td>(2) Water Quality</td><td>1) Do effluents from various facilities comply with the Peruvian effluent standards and ambient water quality standards?</td><td>
Effluent standards for solid waste management facilities are not established. Ministry of Health (MINSA) had proposed for their enactment by the Ministry of Environment (MINAM).
Proposed effluent standards for direct drainage to water bodies are as follows:
<table>
<tr><th>Parameter</th><th>Unit</th><th>Maximum Permitted Limit</th></tr>
<tr><td>pH</td><td>-</td><td>[6.5 , 8.5]</td></tr>
<tr><td>TSS</td><td>mg/L</td><td>30</td></tr>
<tr><td>COD</td><td>mg/L</td><td>120</td></tr>
<tr><td>BOD</td><td>mg/L</td><td>20</td></tr>
<tr><td>Hydrocarbons</td><td>-</td><td>10</td></tr>
<tr><td>NH_3-N</td><td>mg/L</td><td>10</td></tr>
<tr><td>As</td><td>mg/L</td><td>0.1</td></tr>
<tr><td>Cd</td><td>mg/L</td><td>0.1</td></tr>
<tr><td>Cu</td><td>mg/L</td><td>0.5</td></tr>
<tr><td>Cr (VI)</td><td>mg/L</td><td>0.1</td></tr>
<tr><td>Fe</td><td>mg/L</td><td>2</td></tr>
<tr><td>Hg</td><td>mg/L</td><td>0.01</td></tr>
<tr><td>Pb</td><td>mg/L</td><td>0.5</td></tr>
<tr><td>Zn</td><td>mg/L</td><td>0.5</td></tr>
<tr><td>T-coliforms</td><td>MPN/100 mL</td><td>1,000</td></tr>
</table>
Pollution prevention measures are taken in all of the components of the facility as follows:
- Sanitary landfill: installation of leachate treatment system including re-circulation system and/or aerobic and anaerobic system to fulfill standards.
</td></tr>
</table>

<table>
<tr><th>Category</th><th>Environmental Item</th><th>Main Check Items</th><th>Confirmation of Environmental Considerations</th></tr>
<tr><td></td><td></td><td></td><td>- Composting plant: collection of wastewater and treatment at the leachate treatment system.
Water quality standards are established by MINAM Decree (D. S. No. 002-2008-MINAM) depending of water usage preventing risk for human health and preserving environmental resilience. Water quality standards are established for the following categories:
- Category 1: Surface water for public and recreational use
- Category 2: Seawater for marine coastal activities
- Category 3: Water for vegetable irrigation and animal beverage
- Category 4: Water for conservation of aquatic environment
Administrative Directive bill stipulates parameters for water quality monitoring for surface waters as follows. ECA-water for groundwater is inexistent.
<table><tr><th>Parameter</th></tr><tr><td>Cd</td></tr><tr><td>Hg</td></tr><tr><td>Pb</td></tr><tr><td>As</td></tr><tr><td>Cu</td></tr><tr><td>Fe</td></tr><tr><td>Mn</td></tr><tr><td>Zn</td></tr><tr><td>NO_3</td></tr><tr><td>SO_4</td></tr><tr><td>T-coliforms</td></tr><tr><td>Thermo-tolerant coliforms</td></tr><tr><td>BOD</td></tr></table></td></tr>
<tr><td></td><td></td><td>2) Does the water quality of leachates from the waste disposal sites comply with the Peruvian effluent standards and ambient water quality standards?</td><td>Based on data from the nearest meteorological station was estimated the water balance for the landfill site.
Process selection for leachate treatment is considering the estimated water balance and fulfillment of effluent standards for waste management infrastructures proposed by DIGESA.
With the consideration of the estimation of the investment amount and operation and maintenance costs, the leachate treatment system was determined. In the area of small annual rainfall, leachate recirculation system with regulation pond is adopted for the system to evaporate leachate and keep the leachate in the landfilling area. In the area of much annual rainfall, adopt aerobic and un-aerobic treatment system of leachate to satisfy the Perubian effluent standard.</td></tr>
<tr><td></td><td></td><td>3) Are adequate measures taken to prevent contamination of surface water and groundwater by</td><td>Design of leachate treatment facility will consider prevention of surrounding surface waters and groundwater contamination.
Regulation of Law on Solid Waste (D. S. No.</td></tr>
</table>

<table>
<tr><th>Category</th><th>Environmental Item</th><th>Main Check Items</th><th>Confirmation of Environmental Considerations</th></tr>
<tr><td rowspan="5"></td><td></td><td>these effluents and leachates?</td><td>057-2004-PCM) stipulates following design parameters to prevent contamination by leachate generated in solid waste final disposal facility:
- Permeability coefficient of the basement and slopes lower than 10^{-6} cm/s
- Leachate collection, close circuit or treatment and discharge systems
- Storm-water and runoff deviation channels and discharge methods
In addition, it is planned to install following devices to monitor and control leachate drainage and leaks:
- Observation wells for groundwater monitoring
- Monitoring and control systems for leachate</td></tr>
<tr><td rowspan="2">(3) Wastes</td><td>1) Are wastes, such as treatment residues, cinder, and fly ash generated from crushing and segregation processes, and diverted wastes from composting process properly treated and disposed of in accordance with the Peruvian standards?</td><td>Peruvian standards regarding these issues are lacking. However, any wastes generated from composting plant for recoverable organics and segregation plant for recoverable inorganics in the Projects are planned to treat properly and finally disposed in the sanitary landfill following technical criteria established in Regulation of Law on Solid Waste (D. S. No. 057-2004-PCM).</td></tr>
<tr><td>2) Are hazardous and dangerous wastes properly segregated from other wastes, stabilized, treated, and disposed of in accordance with the Peruvian standards?</td><td>The Program will manage municipal waste generated from households, commercial shops and similar solids wastes from other activities.
Hazardous and dangerous wastes are defined as non municipal waste and are excluded from the Projects.</td></tr>
<tr><td>(4) Soil Contamination</td><td>1) Are adequate measures taken to prevent contamination of soil and groundwater by leachates from the waste disposal sites?</td><td>As mentioned above in section (2) Water Quality 3), leachate treatment facility together with the monitoring systems will prevent contamination of surrounding soil and groundwater.
Furthermore, The liner system the landfill area utilizes utilizing geo-membrane and geotextile with the protection layer of clay soil.</td></tr>
<tr><td>(5) Noise and Vibration</td><td>1) Do noise and vibrations generated by the facility operations (especially incinerators, waste segregation and crushing facilities), and vehicle traffic for waste collection and transportation comply with the Peruvian standards?</td><td>Cabinet Decree for environmental noise standards (D. S. No. 085-2003-PCM) establishes national standards for residential, commercial, industrial and special protection zones fixing permitted limits for continuous sound pressure level in terms of “Equivalent A-weighted Level” (L_{Aeq}). The values are:
<table>
<tr><th rowspan="2">Zone</th><th colspan="2">Values in L_{Aeq}</th></tr>
<tr><th>Daytime</th><th>nighttime</th></tr>
<tr><td>Residential</td><td>60</td><td>50</td></tr>
<tr><td>Commercial</td><td>70</td><td>60</td></tr>
<tr><td>Industrial</td><td>80</td><td>70</td></tr>
<tr><td>Special protection</td><td>50</td><td>40</td></tr>
</table>
The Projects is not considering installation of incinerators; furthermore, segregation plants are planned to be located jointly to the landfill site, except case of Piura Project.</td></tr>
</table>

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
			Thus, in former cases locations are outside of residential, commercial or industrial zones. In the latter, Piura case because of plant location inside industrial area must follow respective standards. Vibration standards are not regulated in Peru.
	(6) Odor	1) Are there any odor sources? Are adequate odor control measures taken?	Odor sources are latent in full process of solid waste management. The Projects will take following measures in each step of waste handling. - Collection and transportation: improvement of waste collection with establishment of more stringent time schedules for waste disposal and timely collection is one of the principal components of the Projects. In fact, lesser time between primary disposal and collection compared to the current situation can drive in lower exposure of the population to odors generated. - Transfer station: the Projects are not considering establishment of transfer station. - Treatment plants: Treatment plants of the Projects are planned to be located in the same area selected for the final disposal. Treatment plants are consisted on composting of recoverable organic waste and segregation of recoverable inorganic wastes. In particular, composting plant is one of the main sources of odor generation. Location of this plant adjoined to sanitary landfill -far from population- results on lower exposure to odors. - Final disposal: the Project is considering construction of a sanitary landfill following prevailing Peruvian regulations and norms concerning design, operation and maintenance of sanitary landfills for municipal wastes. Operation in the sanitary landfill must follow stipulations of Art. 87 of the Regulation of Law on Solid Wastes (D. S. No. 057-2004-PCM); stipulation regarding mitigation of odor exposure consist on the requirement of diary coverage of at least 0.2 m thick and 0.5 m for cell closure.
3 Natural Environment	(1) Protected Areas	1) Is the project site located in protected areas designated by the Peruvian laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	Site selection study must be conducted for the locations of waste management facilities. One of the pre-requisites for the site selection consisted on submission of certification of non-encompassing protected areas issued by the National Natural Protected Areas Agency (SERNANP). In case of target area is totally or partially contained in protected areas or buffer zones, technical opinion from SERNANP will be necessary.
	(2) Ecosystem	1) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)?	Based on the land classification and vegetation type of the project sites, it can verify the inexistency of primeval forests, tropical rain forests or ecologically valuable habitats.
		2) Does the project site encompass the protected habitats of endangered species designated by the	Certification of non-encompassing protected areas issued by SERNANP mentioned in (1) “Protected Areas”, considers protected habitats of endangered species. In fact, issuance of SERNANP certification will assure that Projects

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
		Peruvian laws or international treaties and conventions?	activities do not impact directly endangered species.
		3) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem?	Significant ecological impacts, such as irreversible negative effects, wide extension of influence area or long time impacts are not expected in the Projects.
		4) Is there a possibility that the project will adversely affect aquatic organisms? If impacts are anticipated, are adequate measures taken to reduce the impacts on aquatic organisms?	Leachate generated at sanitary landfill is the main factor of surface water and groundwater pollution. Design of sanitary landfills will fulfill technical conditions required in Regulation of Law on Solid Waste (D. S. No. 057-PCM). Principal concerned facilities for leachate control are: - Leachate collection, close circuit or treatment and discharge systems - Storm-water and runoff deviation channels and discharge methods - Permeability coefficient of the basement and slopes lower than 10^{-6} cm/s - Monitoring and control systems for leachate - Observation wells for groundwater monitoring
		5) Is there a possibility that the project will adversely affect vegetation and wildlife? If impacts are anticipated, are adequate measures taken to reduce the impacts on vegetation and wildlife?	Rehabilitation of disturbed areas will be made by soil coverage and natural vegetation on top with native species.
		6) Is there a possibility that changes in localized micro-meteorological conditions, such as solar radiation, temperature, and humidity due to a large-scale timber harvesting will affect the surrounding vegetation?	It is not expected in the Projects large-scale harvesting.
		7) Is there a possibility that a large-scale timber harvesting will result in loss of breeding and feeding grounds for wildlife?	Idem
		8) In the case of reforestation projects, is there a possibility that mono-species plantations will adversely affect wildlife habitats? Is there a possibility that mono-species plantations will cause outbreaks of	Reforestation is not a component of the Projects.

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
		pests?	
	(3) Management of Abandoned Sites	1) Are environmental protection and restoration plans (such as landfill gas and leachate collection and treatment systems, prevention of illegal dumping, and reforestation) after facility closure considered?	Closure plan for the infrastructures of solid waste management must be formulated and submitted as part of EIA procedures. Art. 89 of Regulation of Law on Wastes (D. S. No. 057-2004-PCM) stipulates technical requirement for the closure activities as follows: - Environmental assessment - Design of final coverage - Gas control facility - Control and treatment of leachate - Program of environmental monitoring - Contingency measures - Project of use for closed site - Other relevant issues established by the authority (DIGESA) In addition, post-closure plan is formulated with a sanitary and environmental monitoring plan covering 10-year program for the closed landfill and 5-year program for the rest of closed facilities.
		2) Is a sustainable management framework for the abandoned sites established?	Abovementioned project of use for closed site of sanitary landfill must formulate considering framework to assure sustainability of the proposal. Revision of the closure plan will be conducted at least four years before the definitive closure of the sanitary landfill. Art. 90 of Regulation of Law on Wastes (D. S. No. 057-2004-PCM) prohibits use of closed sanitary landfill area for urbanization or construction of infrastructure.
		3) Are adequate financial provisions secured to manage the abandoned sites?	Suitable closure of abandoned landfill sites will be implemented after the operation with some financial provisions.
		4) Are adequate restoration and re-vegetation plans considered for the harvested areas? In particular, are adequate measures taken to prevent soil runoff from the harvested areas?	It is not expected in the Projects large-scale harvesting.
		5) Is a sustainable management system for the harvested areas established?	Idem
		6) Are adequate financial provisions secured to manage the harvested areas?	Due to large-scale of harvesting is not expected in the Project, allocation of financial provision for this purpose is not considered.
	(4) Hydrology	1) Is there a possibility that alteration of rainwater runoff and runoff characteristics due to a large-scale timber harvesting and access road construction will cause	Large-scales of timber harvesting or construction of access road are not expected in the Project.

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
		impacts on the hydrology of the surrounding areas?	
		2) Is there a possibility that decreased water retention capacity due to deforestation will affect the existing drainage patterns of the forest?	Deforestation of existing forest is not considered in the Projects.
	(5) Topography and Geology	1) Is there a possibility that loss of forest stability due to timber harvesting will cause slope failures or landslides?	Loss of forest stability is not expected in the Projects.
4 Social Environment	(1) Resettlement	1) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?	Site selection studies were conducted for each Project site. In the studies, it was not identified requirement of resettlement for the construction of sanitary landfills. Ineludible requirement for site selection is consisted on opposition from population is inexistent.
		2) Is adequate explanation on relocation and compensation given to affected persons prior to resettlement?	Idem
		3) Is the resettlement plan, including proper compensation, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?	Idem
		4) Does the resettlement plan pay particular attention to vulnerable groups or persons, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?	Idem
		5) Are agreements with the affected persons obtained prior to resettlement?	Idem
		6) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?	Idem
		7) Is a plan developed to	Idem

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
		monitor the impacts of resettlement?	
	(2) Living and Livelihood	1) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary?	The Projects had been formulated with the purpose to improve the current situations related to the management of solid wastes. Thus, mainly positive social and environmental impacts are expected comparing with the current situations. In order to enhance living conditions with proper management of solid wastes, population should charge additional cost allocation concerned to the improved services. With the purpose to mitigate impact for the new cost allocation, the Projects will introduce service tariffs according to the results of willingness/capacity to pay.
		2) Are considerations given to the existing recovery systems, including waste pickers?	Peruvian government had enacted laws and regulations for the formalization of waste recyclers. Recently, it was promulgated the rules of the Law of Recyclers Activity by Decree of Ministry of Environment (D.S. No. 005-2010-MINAM). Segregation and composting plants will be installed, adjoined to the sanitary landfill site, to manage partially the recoverable organic and inorganic materials. The coordination with existing recovery system is under consideration through the discussion with MINAM. The Project has components for introducing progressively selective collection and improvement of current pilot activities approach.
		3) Is there a possibility that waste transportation will adversely affect the regional traffic?	Projects have a component for the improvement of waste collection system by purchasing and replacing collection vehicles. Waste collection service should be targeted to conduct mainly in low-traffic hours; in fact, affection to the district traffic is negligible.
		4) Is there a possibility that effluents from the project and leachates from the waste disposal sites will adversely affect fisheries and other water uses by local inhabitants (especially drinking water)?	Direct influence area of the Project consists of 1 km radius circumference as instructed by DIGESA. Water consumption by human or commercial interest animals is rare inside the direct influence areas of the Projects. As mentioned in (2) Water Quality 2) a leachete treatment system is planned to install in order to prevent pollution of surrounding waters.
		5) Is there a possibility that pathologic insects or other disease vectors will breed as a result of the project?	Breeding of pathogenic insects and disease vectors is a latent constrain in all process of SWM. In order to mitigate the negative impacts, following actions are considered: - Collection and transportation: improvement of waste collection with establishment of more stringent time schedules for waste disposal and timely collection is one of the principal components of the Projects. In fact, lesser time between primary disposal and collection compared to the current situation can drive in lower exposure of the waste to generate pathogenic insects and disease vectors. - Transfer station: the Project is not considering establishment of transfe station. - Treatment plants: Treatment plants of the Projects are

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
			planned to be located in the same area selected for the final disposal. Treatment plants are consisted on composting of recoverable organic waste and segregation of recoverable inorganic wastes. Specially, at composting plant will conduct a sanitary safety operation practice to mitigate generation of pathogenic insects and disease vectors. - Final disposal: the Projects are considering construction of sanitary landfills following prevailing Peruvian regulations and norms concerning design, operation and maintenance of sanitary landfills for municipal wastes. Operation in sanitary landfills must follow stipulations of Art. 87 of the Regulation of Law on Solid Wastes (D. S. No. 057-2004-PCM); stipulation regarding mitigation of pathogenic insects and disease vectors consist on the requirement of diary coverage of at least 0.2 m thick and 0.5 m for cell closure.
	(3) Heritage	1) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage sites? Are adequate measures considered to protect these sites in accordance with the Peruvian laws?	As a pre-requisite of EIA approval, certification of non-encompassing archeological valuable area by the Ministry of Culture (MINC) is required. This certification issued by INC assures that in the projects areas valuable heritage are inexistent.
	(4) Landscape	1) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	The solid waste management facilities is constructed in out skirt of urban center and not located in protection areas. During the construction stage, they affect adversely. However, at the operation stage, buffer zone including some planting and fence for landfill site will be prepared to mitigate the impact on the local landscape. At closure stage, sanitary landfills will rise 10 to 20 m above the cell bottom and covered by 0.5 m soil layer and vegetation on top. Post-closure usage of the landfill sites must be decided through public consultation until four years before their definitive closures.
	(5) Ethnic Minorities and Indigenous Peoples	1) Does the project comply with the Peruvian laws for rights of ethnic minorities and indigenous peoples? 2) Are considerations given to reduce the impacts on culture and lifestyle of ethnic minorities and indigenous peoples?	The Projects activities do not affect lifestyle or discriminate ethnic minorities neither indigenous people living in their influence areas.
5 Others	(1) Impacts during Construction	1) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, ex-	Environmental Management Strategy of the Projects will compose by following plans described by Projects stages, including construction stage: - Environmental Management Plan (Only for EIA-d, EIA-sd)

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
		haust gases, and wastes)?	- Sanitary and Environmental Monitoring Plan (Only for EIA-d, EIA-sd) - Community Relations Plan (Only for EIA-d) - Contingency Plan
		2) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts?	Because EIA study will be implemented later stage there is no detail description of mitigation measure in the Perfil and Pre-FS study., and there is no significant impact on natural environment.
		3) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?	There is no significant impact on social environment because there is no resettlement and there is no residential area near the site. There are some positive impacts on employment of workers social environment.
		4) If necessary, is health and safety education (e.g., traffic safety, public health) provided for project personnel, including workers?	Because EIA study will be implemented later stage, there is no detail description of health and safety education in the Perfil study and Pre-FS study. However, the health and safety education should be provided by the contractor with supervision of the construction supervision consultants.
	(2) Monitoring	1) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?	Abovementioned Sanitary and Environmental Monitoring Plan will be considered as monitoring program for environmental risk factors during the EIA study for the individual project. Main monitored parameters will be as follows: - Air quality parameters: 10-μm particulate matter, 2.5-μm particulate matter, hydrogen sulfide, sulfur dioxide, methane and nitrogen oxides. - Effluent quality parameters: pH, total suspended solids, chemical oxygen demand, biochemical oxygen demand, hydrocarbons, ammonia, arsenic, cadmium, copper, hexavalent chrome, iron, mercury, lead, zinc and total coliforms. - Surface water quality parameters: turbidity, alkalinity, sulfates, total suspended solids, cadmium, mercury, lead, arsenic, copper, iron, manganese, zinc, nitrate, total coliforms, thermo-tolerant coliforms, biochemical oxygen demand and dissolved oxygen. - Groundwater quality parameters: cadmium, mercury, lead, arsenic, copper, iron, manganese, zinc, nitrate, sulfate, total coliforms, thermo-tolerant coliforms and biochemical oxygen demand. - Noise: measurement of noise levels at site on sanitary landfill area and treatment plants.
		2) Are the items, methods and frequencies included in the monitoring program judged to be appropriate?	Methods for monitoring and analysis and frequencies for the monitoring program will formulate as follows: - Air quality parameters: Monitoring points will establish at borderline of sanitary landfill. Data on wind velocity and direction collected from the nearest meteorological station of National Service of Meteorology and Hydrol-

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations

ogy (SENAMHI) in order to recognize influence degree and direction. Frequency of measurement will determine using criteria of wind behavior. Analysis methods are as follows:

Parameter	Method
PM-10	Gravimetry EPA-40 CFR Pt 50
PM-2.5	Gravimetry
H_2S	UV fluorescence EPA 11
SO_2	UV fluorescence EPA-40 CFR Pt. 11
CH_4	-
NO_X	EPA 40 CFR Pt 50 ISO 6767/90

Note: The method of CH_4 is not stipulated.

- Effluent quality parameters: Effluent sampling device will be installed at end-of-pipe of leachate treatment system. Design criteria of leachate treatment system will base on water balance resulted by meteorological and hydrological features of Projects area obtained from statistical data of SENAMHI's nearest station. Frequency of monitoring program resulted from the recognized seasonality of water balance. Methods of analysis are as follows:

Parameter	Method
pH	APHA 4500 H+ B
TSS	APHA 2540 D
COD	APHA 5220 D
BOD	APHA 5210 B
Hydrocarbons	DIN EN ISO 9377-2
NO_3-N	APHA 4500 NO_3 E
As	APHA 3114-C
Cd	APHA 3111-B
Cu	APHA 3111-B
Cr (VI)	APHA 3111-B
Fe	APHA 3111-B
Hg	APHA 3112-B
Pb	APHA 3111-B
Zn	APHA 3111-B
T-coliforms	APHA 9221 B

Note: The method of NH_3-N is not stipulated

- Surface water quality parameters: Monitoring of surface waters during rainy season and dry season will establish for the streams flowing in the direct influence area of the Projects. Methods of analysis are as follows:

Parameter	Method
Turbidity	APHA 2130-B
Alkalinity	APHA 2320-B
SO_4	APHA 4500 SO42- E

<table>
<tr><th>Category</th><th>Environmental Item</th><th>Main Check Items</th><th>Confirmation of Environmental Considerations</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><td>TSS</td><td>APHA 2540 D</td></tr>
<tr><td>Cd</td><td>APHA 3111-B</td></tr>
<tr><td>Hg</td><td>APHA 3112-B</td></tr>
<tr><td>Pb</td><td>APHA 3111-B</td></tr>
<tr><td>As</td><td>APHA 3114-C</td></tr>
<tr><td>Cu</td><td>APHA 3111-B</td></tr>
<tr><td>Fe</td><td>APHA 3111-B</td></tr>
<tr><td>Mn</td><td>APHA 3111-B</td></tr>
<tr><td>Zn</td><td>APHA 3111-B</td></tr>
<tr><td>NO_3-N</td><td>APHA 4500 NO3 E</td></tr>
<tr><td>T-coliforms</td><td>APHA 9221 B</td></tr>
<tr><td>Thermo-tolerant coliforms</td><td>APHA 9222 D</td></tr>
<tr><td>BOD</td><td>APHA 5210 B</td></tr>
<tr><td>DO</td><td>APHA 4500-O G</td></tr>
</table>
- Groundwater quality parameters: Observation wells will be installed in the direct influence area of the Projects. Locations and depths will determine by the results of hydrogeological study. Frequency of monitoring depends on flow-path of groundwater. Methods of analysis are as follows:
<table>
<tr><th>Parameter</th><th>Method</th></tr>
<tr><td>Cd</td><td>APHA 3111-B</td></tr>
<tr><td>Hg</td><td>APHA 3112-B</td></tr>
<tr><td>Pb</td><td>APHA 3111-B</td></tr>
<tr><td>As</td><td>APHA 3114-C</td></tr>
<tr><td>Cu</td><td>APHA 3111-B</td></tr>
<tr><td>Fe</td><td>APHA 3111-B</td></tr>
<tr><td>Mn</td><td>APHA 3111-B</td></tr>
<tr><td>Zn</td><td>APHA 3111-B</td></tr>
<tr><td>NO_3</td><td>APHA 4500 NO_3 E</td></tr>
<tr><td>SO_4</td><td>APHA 4500 SO_4^{2-} E</td></tr>
<tr><td>T-coliforms</td><td>APHA 9221 B</td></tr>
<tr><td>Thermo-tolerant coliforms</td><td>APHA 9222 D</td></tr>
<tr><td>BOD</td><td>APHA 5210 B</td></tr>
</table>
Note :
- Noise: using a sound level meter referring standard DIN IEC-651.
</td></tr>
<tr><td></td><td></td><td>3) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?</td><td>There is no clear description regarding monitoring framework in Perfil level. However, in the EIA for landfill site and composting facility to be implemented in pre-investment stage after SNIP approval, adequate monitoring framework should be prepared.</td></tr>
<tr><td></td><td></td><td>4) Are any regulatory requirements pertaining to the monitoring report</td><td>There is no clear description regarding monitoring report system in Perfil level. However, in the EIA for landfill site and composting facility to be implemented in</td></tr>
</table>

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
		system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	pre-investment stage after SNIP approval, adecuate monitoring framework should be prepared.
6 Note	Note on Using Environmental Checklist	1) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	Transboundary impacts from the Projects activities are not expected.

1) Regarding the term “Peruvian Standards” mentioned in the above table, in the event that environmental standards in Peru diverge significantly from international standards, appropriate environmental considerations must made, if necessary.

2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.

Appendix-10: Environmental Checklist for FS projects

Appendix-10: Environmental Checklist for FS projects

Environmental Checklist 21. Waste Management and Disposal complemented with Checklist 24. Forestry Projects for Feasibility projects

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
1 Permits and Explanation	(1) EIA and Environmental Permits	1) Have EIA reports been officially completed?	Conduction of public investment projects in Peru is regulated by the National System of Public Investment (SNIP). The system establishes a requirement of EIA approval previous to SNIP procedure completion for projects with investment amount larger than S/.10 million. The SWM Projects in Puno, Juliaca, Piura, Sullana, Huanco and Tarapoto are estimated more than S/.10 million for each project. Thus, its EIA approval is a pre-requisite for its viability.
		2) Have EIA reports been approved by authorities of the Peruvian government?	Authority for the approval of EIA regarding SWM infrastructures is the Directorate of Environmental Sanitation (DIGESA) under the Ministry of Health (MINSA). The prepared EIA reports are under the approval process.
		3) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied?	In this moment, DIGESA still review the EIAs for final approval.
		4) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the Peruvian government?	As pre-requisites of EIA approval, following requirements will be requested by the respective institutions: - Certification of land use compatibility by the respective Provincial Municipality; - Certification of non-encompassing protected areas by the National Natural Protected Areas Agency (SERNANP, former INRENA). In case of the target area is totally or partially contained in protected areas or buffer zones, technical opinion from SERNANP is necessary; - Report on non-encompassing natural disaster vulnerable area by the National Civil Defense Institute (INDECI); - Certification of non-encompassing archeological valuable area by the Ministry of Culture (MINC); - Favorable opinion by the correspondent Regional Directorate of Health (DIRESA) on the site selection report;
	(2) Explanation to the Public	1) Are contents of the project and the potential impacts adequately explained to the public based on appropriate procedures, including information dis-	Public Participation Plan (PPP) has been prepared as part of EIA process. Public consultation is part of EIA approval process which is conducted by the local governments. Conduction of Public Audience is a requisite of EIA process for detail EIA classified project as is this. And

<table>
<tr><th>Category</th><th>Environmental Item</th><th>Main Check Items</th><th>Confirmation of Environmental Considerations</th></tr>
<tr><td></td><td></td><td>closure? Is understanding obtained from the public?</td><td>Records of observations claimed by the participants and the correspondent replies should be submitted.
As result of conduction of PPP in the formulation stage of the Project, were conducted Public Audience and meetings.</td></tr>
<tr><td></td><td></td><td>2) Are proper responses made to comments from the public and regulatory authorities?</td><td>As part of Environmental Management Strategy, a Compensation Plan and a Community Relations Plan has been prepared through the discussion with public and regulatory authorities.</td></tr>
<tr><td>2 Mitigation Measures</td><td>(1) Air Quality</td><td>1) Do air pollutants, such as sulfur oxides (SO_X), nitrogen oxides (NO_X), and soot and dust, and dioxins emitted from various sources, such as incinerators, and vehicles used for waste collection and transportation comply with the Peruvian emission standards and ambient air quality standards?</td><td>Emission standards (Maximum Permitted Limits) for solid waste management facilities are not established.
Vehicles for solid waste transportation should follow emission stands formulated by the Ministry of Transportation and Communication. However these standards are still under revision.
Air Quality Standards (ECA-air) are established by the Cabinet Decree (D. S. No. 074-2001-PCM) and its amendments (D. D. No. 069-2003-PCM and R. M. No. 138-2008-MINCETUR/DM) as follows:
<table>
<tr><th>Parameter</th><th>Period</th><th>Value ($\mu g/m^3$)</th></tr>
<tr><td rowspan="2">SO_2</td><td>Annual</td><td>80</td></tr>
<tr><td>24 hours</td><td>20</td></tr>
<tr><td rowspan="2">NO_2</td><td>Annual</td><td>100</td></tr>
<tr><td>1 hour</td><td>200</td></tr>
<tr><td rowspan="2">CO</td><td>8 hours</td><td>10,000</td></tr>
<tr><td>1 hour</td><td>30,000</td></tr>
<tr><td>O_3</td><td>8 hours</td><td>120</td></tr>
<tr><td>H_2S</td><td>24 hours</td><td>150</td></tr>
<tr><td rowspan="2">Pb</td><td>Annual</td><td>0.5</td></tr>
<tr><td>Monthly</td><td>1.5</td></tr>
<tr><td rowspan="2">PM-10</td><td>Annual</td><td>50</td></tr>
<tr><td>24 hours</td><td>150</td></tr>
<tr><td>PM-2.5</td><td>24 hours</td><td>25</td></tr>
<tr><td>hydrocarbons</td><td>24 hours</td><td>100</td></tr>
<tr><td>Benzene</td><td>Annual</td><td>2</td></tr>
</table>
The following mitigation measure will be conducted to satisfy the standards:
- Transportation vehicles: preventive maintenance program, recovering aids for mitigation of waste scattering and water sparkling of routes for dust scattering mitigation.
- Machinery in landfill site: preventive maintenance program and water sparkling of routes for dust scattering mitigation.
- Operating cells of landfill area: installation of gas collection system for exhausting generated gases by decomposition of accumulated waste.
- Closed cells of landfill area: coverage by low permeability soil with vegetation.
- Segregation plant and composting plant: covered by</td></tr>
</table>

<table>
<tr><th>Category</th><th>Environmental Item</th><th>Main Check Items</th><th>Confirmation of Environmental Considerations</th></tr>
<tr><td></td><td></td><td></td><td>open roof</td></tr>
<tr><td></td><td>(2) Water Quality</td><td>1) Do effluents from various facilities comply with the Peruvian effluent standards and ambient water quality standards?</td><td>Effluent standards for solid waste management facilities are not established. Ministry of Health (MINSA) had proposed for their enactment by the Ministry of Environment (MINAM).
Proposed effluent standards for direct drainage to water bodies are as follows:
<table>
<tr><th>Parameter</th><th>Unit</th><th>Maximum Permitted Limit</th></tr>
<tr><td>pH</td><td>-</td><td>[6.5 , 8.5]</td></tr>
<tr><td>TSS</td><td>mg/L</td><td>30</td></tr>
<tr><td>COD</td><td>mg/L</td><td>120</td></tr>
<tr><td>BOD</td><td>mg/L</td><td>20</td></tr>
<tr><td>Hydrocarbons</td><td>-</td><td>10</td></tr>
<tr><td>NH_3-N</td><td>mg/L</td><td>10</td></tr>
<tr><td>As</td><td>mg/L</td><td>0.1</td></tr>
<tr><td>Cd</td><td>mg/L</td><td>0.1</td></tr>
<tr><td>Cu</td><td>mg/L</td><td>0.5</td></tr>
<tr><td>Cr (VI)</td><td>mg/L</td><td>0.1</td></tr>
<tr><td>Fe</td><td>mg/L</td><td>2</td></tr>
<tr><td>Hg</td><td>mg/L</td><td>0.01</td></tr>
<tr><td>Pb</td><td>mg/L</td><td>0.5</td></tr>
<tr><td>Zn</td><td>mg/L</td><td>0.5</td></tr>
<tr><td>T-coliforms</td><td>MPN/100 mL</td><td>1,000</td></tr>
</table>
Pollution prevention measures are taken in all of the components of the facility as follows:
- Sanitary landfill: installation of leachate treatment system including re-circulation system and/or aerobic and anaerobic system to fulfill standards.
- Composting plant: collection of wastewater and treatment at the leachate treatment system.
Water quality standards are established by MINAM Decree (D. S. No. 002-2008-MINAM) depending of water usage preventing risk for human health and preserving environmental resilience. Water quality standards are established for the following categories:
- Category 1: Surface water for public and recreational use
- Category 2: Seawater for marine coastal activities
- Category 3: Water for vegetable irrigation and animal beverage
- Category 4: Water for conservation of aquatic environment
Administrative Directive bill stipulates parameters for water quality monitoring for surface waters as follows. Monitoring data on surface waters taken and measured and analyzed in this moment. ECA-water for groundwater is inexistent.
<table>
<tr><th>Parameter</th></tr>
<tr><td>Cd</td></tr>
</table></td></tr>
</table>

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
			Hg Pb As Cu Fe Mn Zn NO_3 SO_4 T-coliforms Thermo-tolerant coliforms BOD The groundwater sampling and analysis had been conducted in the preparation of EIA reports. According to the EIA reports (though not approved), the significant environmental impacts are not expected during construction and operation stages by suitable mitigation measures.
		2) Does the water quality of leachates from the waste disposal sites comply with the Peruvian effluent standards and ambient water quality standards?	Based on data from the nearest meteorological station was estimated the water balance for the landfill site. Process selection for leachate treatment is considering the estimated water balance and fulfillment of effluent standards for waste management infrastructures proposed by DIGESA. With the consideration of the estimation of the investment amount and operation and maintenance costs, the leachate treatment system was determined. In the area of small annual rainfall, leachate recirculation system with regulation pond is adopted for the system to evaporate leachate and keep the leachate in the landfilling area. In the area of much annual rainfall, adopt aerobic and un-aerobic treatment system of leachate to satisfy the Perubian effluent standard.
		3) Are adequate measures taken to prevent contamination of surface water and groundwater by these effluents and leachates?	Design of leachate treatment facility is considered to prevent surrounding surface waters and groundwater contamination. Regulation of Law on Solid Waste (D. S. No. 057-2004-PCM) stipulates following design parameters to prevent contamination by leachate generated in solid waste final disposal facility: - Permeability coefficient of the basement and slopes lower than 10^{-6} cm/s - Leachate collection, close circuit or treatment and discharge systems - Storm-water and runoff deviation channels and discharge methods In addition, it is planned to install following devices to monitor and control leachate drainage and leaks: - Observation wells for groundwater monitoring - Monitoring and control systems for leachate
	(3) Wastes	1) Are wastes, such as treatment residues, cinder, and fly ash generated from	Peruvian standards regarding these issues are lacking. However, any wastes generated from composting plant for recoverable organics and segregation plant for reco-

<table>
<tr><th>Category</th><th>Environmental Item</th><th>Main Check Items</th><th>Confirmation of Environmental Considerations</th></tr>
<tr><td rowspan="5"></td><td rowspan="2"></td><td>crushing and segregation processes, and diverted wastes from composting process properly treated and disposed of in accordance with the Peruvian standards?</td><td>verable inorganics in the Project are planned to treat properly and finally disposed in the sanitary landfill following technical criteria established in Regulation of Law on Solid Waste (D. S. No. 057-2004-PCM).</td></tr>
<tr><td>2) Are hazardous and dangerous wastes properly segregated from other wastes, stabilized, treated, and disposed of in accordance with the Peruvian standards?</td><td>The projects will manage municipal waste generated from households, commercial shops and similar solids wastes from other activities.
Hazardous and dangerous wastes are defined as non municipal waste and are excluded from the projects.</td></tr>
<tr><td>(4) Soil Contamination</td><td>1) Are adequate measures taken to prevent contamination of soil and groundwater by leachates from the waste disposal sites?</td><td>As mentioned above in section (2) Water Quality 3), leachate treatment facility together with the monitoring systems will prevent contamination of surrounding soil and groundwater.
Furthermore, The liner system the landfill area utilizes utilizing geo-membrane and geotextile with the protection layer of clay soil.</td></tr>
<tr><td>(5) Noise and Vibration</td><td>1) Do noise and vibrations generated by the facility operations (especially incinerators, waste segregation and crushing facilities), and vehicle traffic for waste collection and transportation comply with the Peruvian standards?</td><td>Cabinet Decree for environmental noise standards (D. S. No. 085-2003-PCM) establishes national standards for residential, commercial, industrial and special protection zones fixing permitted limits for continuous sound pressure level in terms of “Equivalent A-weighted Level” (L_{Aeq}). The values are:
<table>
<tr><th rowspan="2">Zone</th><th colspan="2">Values in L_{Aeq}</th></tr>
<tr><th>daytime</th><th>nighttime</th></tr>
<tr><td>Residential</td><td>60</td><td>50</td></tr>
<tr><td>Commercial</td><td>70</td><td>60</td></tr>
<tr><td>Industrial</td><td>80</td><td>70</td></tr>
<tr><td>Special protection</td><td>50</td><td>40</td></tr>
</table>
The Projects is not considering installation of incinerators; furthermore, segregation plants are planned to be located jointly to the landfill site. Thus, in all cases locations are outside of special protection, residential, commercial or industrial zones.
According to stipulation of Administrative Directive bill of DIGESA, noise was measured for baseline data at Project site, which indicate lower than the standard of the industrial zones.
Vibration standards are not regulated in Peru.</td></tr>
<tr><td>(6) Odor</td><td>1) Are there any odor sources? Are adequate odor control measures taken?</td><td>Odor sources are latent in full process of solid waste management. The Project is taking following measures in each step of waste handling.
- Collection and transportation: improvement of waste collection with establishment of more stringent time schedules for waste disposal and timely collection is one of the principal components of the Project. In fact, lesser time between primary disposal and collection compared to the current situation can drive in lower exposure of the population to odors generated.</td></tr>
</table>

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
			- Transfer station: the Project is not considering establishment of transfer station. - Treatment plants: Treatment plants of the Project are planned to be located in the same area selected for the final disposal. Treatment plants are consisted on composting of recoverable organic waste and segregation of recoverable inorganic wastes. In particular, composting plant is one of the main sources of odor generation. Location of this plant adjoined to sanitary landfill -far from population- results on lower exposure to odors. - Final disposal: the project is considering construction of a sanitary landfill following prevailing Peruvian regulations and norms concerning design, operation and maintenance of sanitary landfills for municipal wastes. Operation in the sanitary landfill must follow stipulations of Art. 87 of the Regulation of Law on Solid Wastes (D. S. No. 057-2004-PCM); stipulation regarding mitigation of odor exposure consist on the requirement of diary coverage of at least 0.2 m thick and 0.5 m for cell closure.
3 Natural Environment	(1) Protected Areas	1) Is the project site located in protected areas designated by the Peruvian laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	The site selection study for all the target project has been conducted for the locations of waste management facilities. One of the pre-requisites for the site selection consisted on submission of certification of non-encompassing protected areas issued by the National Natural Protected Areas Agency (SERNANP). In case of target area is totally or partially contained in protected areas or buffer zones, technical opinion from SERNANP will be necessary. According to the SERNANP certification, the Project site is not affecting any protected areas or their buffer zones.
	(2) Ecosystem	1) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)?	Basically, the project sites do not include primeval forests, tropical forest or ecological valuable habitats are inexistent in the Project influence areas.
		2) Does the project site encompass the protected habitats of endangered species designated by the Peruvian laws or international treaties and conventions?	Certification of non-encompassing protected areas issued by SERNANP mentioned in (1) “Protected Areas”, considers protected habitats of endangered species. In fact, issuance of SERNANP certification will assure that the project activities do not impact directly endangered species.
		3) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem?	Significant ecological impacts, such as irreversible negative effects, wide extension of influence area or long time impacts are not expected in the project.
		4) Is there a possibility that	Leachate generated at sanitary landfill is the main factor

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
		the project will adversely affect aquatic organisms? If impacts are anticipated, are adequate measures taken to reduce the impacts on aquatic organisms?	of surface water and groundwater pollution. Design of sanitary landfill fulfills technical conditions required in Regulation of Law on Solid Waste (D. S. No. 057-PCM). Principal concerned facilities for leachate control are: - Leachate collection, close circuit or treatment and discharge systems - Storm-water and runoff deviation channels and discharge methods - Permeability coefficient of the basement and slopes lower than 10^{-6} cm/s - Monitoring and control systems for leachate - Observation wells for groundwater monitoring
		5) Is there a possibility that the project will adversely affect vegetation and wildlife? If impacts are anticipated, are adequate measures taken to reduce the impacts on vegetation and wildlife?	Rehabilitation of disturbed areas will be made by soil coverage and natural vegetation on top with native species.
		6) Is there a possibility that changes in localized micro-meteorological conditions, such as solar radiation, temperature, and humidity due to a large-scale timber harvesting will affect the surrounding vegetation?	It is not expected in the project large-scale harvesting.
		7) Is there a possibility that a large-scale timber harvesting will result in loss of breeding and feeding grounds for wildlife?	Idem
		8) In the case of reforestation projects, is there a possibility that mono-species plantations will adversely affect wildlife habitats? Is there a possibility that mono-species plantations will cause outbreaks of pests?	Reforestation is not a component of the Project.
	(3) Management of Abandoned Sites	1) Are environmental protection and restoration plans (such as landfill gas and leachate collection and treatment systems, prevention of illegal dumping, and reforestation) after facility closure considered?	Closure plan for the infrastructures of solid waste management must be formulated and submitted as part of EIA procedures. Art. 89 of Regulation of Law on Wastes (D. S. No. 057-2004-PCM) stipulates technical requirement for the closure activities as follows: - Environmental assessment - Design of final coverage - Gas control facility - Control and treatment of leachate

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
			- Program of environmental monitoring - Contingency measures - Project of use for closed site - Other relevant issues established by the authority (DIGESA) In addition, post-closure plan is formulated with a sanitary and environmental monitoring plan covering 10-year program for the closed landfill and 5-year program for the rest of closed facilities.
		2) Is a sustainable management framework for the abandoned sites established?	Abovementioned project of use for closed site of sanitary landfill must formulate considering framework to assure sustainability of the proposal. Revision of the closure plan will be conducted at least four years before the definitive closure of the sanitary landfill. Art. 90 of Regulation of Law on Wastes (D. S. No. 057-2004-PCM) prohibits use of closed sanitary landfill area for urbanization or construction of infrastructure.
		3) Are adequate financial provisions secured to manage the abandoned sites?	Suitable closure of abandoned landfill sites will be implemented after the operation with some financial provisions.
		4) Are adequate restoration and revegetation plans considered for the harvested areas? In particular, are adequate measures taken to prevent soil runoff from the harvested areas?	It is not expected in the Project large-scale harvesting.
		5) Is a sustainable management system for the harvested areas established?	Idem
		6) Are adequate financial provisions secured to manage the harvested areas?	Due to large-scale of harvesting is not expected in the Project, allocation of financial provision for this purpose is not considered.
	(4) Hydrology	1) Is there a possibility that alteration of rainwater runoff and runoff characteristics due to a large-scale timber harvesting and access road construction will cause impacts on the hydrology of the surrounding areas?	Large-scales of timber harvesting or construction of access road are not expected in the Project.
		2) Is there a possibility that decreased water retention capacity due to deforestation will affect the existing drainage patterns of the forest?	Deforestation of existing forest is not considered in the Project.
	(5) Topography	1) Is there a possibility that	Loss of forest stability is not expected in the Project.

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
	and Geology	loss of forest stability due to timber harvesting will cause slope failures or landslides?	
4 Social Environment	(1) Resettlement	1) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?	Site selection studies were conducted for each Project site. It was not identified requirement of resettlement for the construction of sanitary landfills in the studies. Ineludible requirement for the site selection is consisted on opposition from population is inexistent. Although EIA reports are being reviewed by DIGESA, there is a comment on EIA of Piura that distance between project site and populated area is too close. Countermeasures are considered in Peru side.
		2) Is adequate explanation on relocation and compensation given to affected persons prior to resettlement?	Idem
		3) Is the resettlement plan, including proper compensation, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?	Idem
		4) Does the resettlement plan pay particular attention to vulnerable groups or persons, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?	Idem
		5) Are agreements with the affected persons obtained prior to resettlement?	Idem
		6) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?	Idem
		7) Is a plan developed to monitor the impacts of resettlement?	Idem
	(2) Living and Livelihood	1) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary?	The Project has been formulated with the purpose to improve the current situation related to the management of solid waste. Thus, mainly positive social and environmental impacts are expected comparing with the current situation. In order to enhance living conditions with proper management of solid waste, population should charge additional cost allocation concerned to the improved service.

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
			With the purpose to mitigate impact for the new cost allocation, the Project will introduce service tariffs according to the results of willingness/capacity to pay.
		2) Are considerations given to the existing recovery systems, including waste pickers?	Peruvian government had enacted laws and regulations for the formalization of waste recyclers. Recently, it was promulgated the rules of the Law of Recyclers Activity by Decree of Ministry of Environment (D.S. No. 005-2010-MINAM). Formalization of waste recycling activity is one of the objectives jointly with improvement of selective collection and treatments. Projects have components for introducing progressively selective collection and improvement of current pilot activities approach. Furthermore, segregation and composting plants will be installed, adjoined to the sanitary landfill site, to manage partially the recoverable organic and inorganic materials.
		3) Is there a possibility that waste transportation will adversely affect the regional traffic?	Projects have a component for the improvement of waste collection system by purchasing and replacing collection vehicles. Waste collection service should be targeted to conduct mainly in low-traffic hours; in fact, affection to the district traffic is negligible.
		4) Is there a possibility that effluents from the project and leachates from the waste disposal sites will adversely affect fisheries and other water uses by local inhabitants (especially drinking water)?	Direct influence area of the projects are defined by 1 km radius circumference as instructed by DIGESA. As mentioned in (2) Water Quality 2) a leachete treatment system is planned to install in order to prevent pollution of surrounding waters.
		5) Is there a possibility that pathologic insects or other disease vectors will breed as a result of the project?	Breeding of pathogenic insects and disease vectors is a latent constrain in all process of SWM. In order to mitigate the negative impacts, following actions are considered: - Collection and transportation: improvement of waste collection with establishment of more stringent time schedules for waste disposal and timely collection is one of the principal components of the Projects. In fact, lesser time between primary disposal and collection compared to the current situation can drive in lower exposure of the waste to generate pathogenic insects and disease vectors. - Transfer station: the Projects are not considering establishment of transfer station. - Treatment plants: Treatment plants of the Projects are planned to be located in the same area selected for the final disposal plants are consisted on composting of recoverable organic waste and segregation of recoverable inorganic wastes. Specially, at composting plant will conduct a sanitary safety operation practice to mitigate generation of pathogenic insects and disease vectors. - Final disposal: the Project is considering construction

<table>
<tr><th>Category</th><th>Environmental Item</th><th>Main Check Items</th><th>Confirmation of Environmental Considerations</th></tr>
<tr><td></td><td></td><td></td><td>of a sanitary landfill following prevailing Peruvian regulations and norms concerning design, operation and maintenance of sanitary landfills for municipal wastes. Operation in the sanitary landfill must follow stipulations of Art. 87 of the Regulation of Law on Solid Wastes (D. S. No. 057-2004-PCM); stipulation regarding mitigation of pathogenic insects and disease vectors consist on the requirement of diary coverage of at least 0.2 m thick and 0.5 m for cell closure.</td></tr>
<tr><td></td><td>(3) Heritage</td><td>1) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage sites? Are adequate measures considered to protect these sites in accordance with the Peruvian laws?</td><td>As a pre-requisite of EIA approval, certification of non-encompassing archeological valuable area by the Ministry of Culture (MINC) is required.
This certification issued by MINC assures that in the project area valuable heritage are inexistent.</td></tr>
<tr><td></td><td>(4) Landscape</td><td>1) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?</td><td>The Project requires land areas as follows:
<table>
<tr><th rowspan="2">Project site</th><th colspan="2">Required area (ha)</th></tr>
<tr><th>Sanitary Landfill</th><th>Other Facilities</th></tr>
<tr><td>Puno</td><td>6.5</td><td>0.64</td></tr>
<tr><td>Juliaca</td><td>12.9</td><td>0.57</td></tr>
<tr><td>Piura</td><td>16.2</td><td>1.29</td></tr>
<tr><td>Sullana</td><td>6.3</td><td>0.69</td></tr>
<tr><td>Huanuco</td><td>6.0</td><td>0.60</td></tr>
<tr><td>Tranapoto</td><td>6.8</td><td>0.71</td></tr>
</table>
The solid waste management facilities is constructed in out skirt of urban center and not located in protection areas. During the construction stage, they affect adversely. However, at the operation stage, buffer zone including some planting and fence for landfill site will be prepared to mitigate the impact on the local landscape.
At closure stage, sanitary landfills may rise 10 to 20 m above the cell bottom and covered by 0.5 m soil layer and vegetation on top. Post-closure usage of the landfill sites must be decided through public consultation until four years before their definitive closures.
Leachete treatment and gas exhaust facilities, segregation plants and composting plants will be dismantled and soil remediation works will conduct on their basements.</td></tr>
<tr><td></td><td>(5) Ethnic Minorities and Indigenous Peoples</td><td>1) Does the project comply with the Peruvian laws for rights of ethnic minorities and indigenous peoples?
2) Are considerations given to reduce the impacts on culture and lifestyle of ethnic minorities and indigenous peoples?</td><td>The Project activities do not affect lifestyle or discriminate ethnic minorities neither indigenous people living in its influence areas.</td></tr>
</table>

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
5 Others	(1) Impacts during Construction	1) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?	Environmental Management Strategy of the Project is composed by following plans described by project stages, including construction stage: - Environmental Management Plan: - Sanitary and Environmental Monitoring Plan: - Community Relations Plan: - Contingency Plan: In that plans, mitigation measures are described.
		2) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts?	In the abovementioned Contingency Plan considers pollution mitigation measures to reduce ordinary and accidental impacts.
		3) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?	Although EIA reports are being reviewed by DIGESA, there is a comment on EIA of Piura that distance between project site and populated area is too close. Countermeasures are considered in Peru side. On the other hand, there are some positive impacts on employment of workers social environment.
		4) If necessary, is health and safety education (e.g., traffic safety, public health) provided for project personnel, including workers?	The health and safety education plan are briefly provided in the Contingency Plan. However, the health and safety education should be provided by the contractor with supervision of the construction supervision consultants.
	(2) Monitoring	1) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?	Abovementioned Sanitary and Environmental Monitoring Plan considers monitoring program for environmental risk factors. Main monitored parameters are as follows: - Air quality parameters: 10-μm particulate matter, 2.5-μm particulate matter, hydrogen sulfide, sulfur dioxide, methane and nitrogen oxides. - Effluent quality parameters: pH, total suspended solids, chemical oxygen demand, biochemical oxygen demand, hydrocarbons, ammonia, arsenic, cadmium, copper, hexavalent chrome, iron, mercury, lead, zinc and total coliforms. - Surface water quality parameters: turbidity, alkalinity, sulfates, total suspended solids, cadmium, mercury, lead, arsenic, copper, iron, manganese, zinc, nitrate, total coliforms, thermo-tolerant coliforms, biochemical oxygen demand and dissolved oxygen. - Groundwater quality parameters: cadmium, mercury, lead, arsenic, copper, iron, manganese, zinc, nitrate, sulfate, total coliforms, thermo-tolerant coliforms and biochemical oxygen demand. - Noise: measurement of noise levels at site on sanitary landfill area and treatment plants.
		2) Are the items, methods and frequencies included in the monitoring program judged to be appropriate?	Methods for monitoring and analysis and frequencies for the monitoring program were formulated as follows: - Air quality parameters: Monitoring points will establish at borderline of sanitary landfill. Data on wind velocity and direction was collected from the nearest

<table>
<tr><th>Category</th><th>Environmental Item</th><th>Main Check Items</th><th>Confirmation of Environmental Considerations</th></tr>
<tr><td></td><td></td><td></td><td>
meteorological station of National Service of Meteorology and Hydrology (SENAMHI) in order to recognize influence degree and direction. Frequency of measurement was determined using criteria of wind behavior. Analysis methods are as follows:
<table>
<tr><th>Parameter</th><th>Method</th></tr>
<tr><td>PM-10</td><td>Gravimetry
EPA-40 CFR Pt 50</td></tr>
<tr><td>PM-2.5</td><td>Gravimetry</td></tr>
<tr><td>H_2S</td><td>UV fluorescence
EPA 11</td></tr>
<tr><td>SO_2</td><td>UV fluorescence
EPA-40 CFR Pt. 11</td></tr>
<tr><td>CH_4</td><td>-</td></tr>
<tr><td>NO_X</td><td>EPA 40 CFR Pt 50
ISO 6767/90</td></tr>
</table>
However, there is no description of frequency. The monitoring program should be updated at later stage.

- Effluent quality parameters: Effluent sampling device will be installed at end-of-pipe of leachate treatment system. Design criteria of leachate treatment system is based on water balance resulted by meteorological and hydrological features of Project area obtained from statistical data of SENAMHI's nearest station. Frequency of monitoring program resulted from the recognized seasonality of water balance. Methods of analysis of measurement are as follows:
<table>
<tr><th>Parameter</th><th>Method</th></tr>
<tr><td>pH</td><td>APHA 4500 H+ B</td></tr>
<tr><td>TSS</td><td>APHA 2540 D</td></tr>
<tr><td>COD</td><td>APHA 5220 D</td></tr>
<tr><td>BOD</td><td>APHA 5210 B</td></tr>
<tr><td>Hydrocarbons</td><td>DIN EN ISO 9377-2</td></tr>
<tr><td>NO_3-N</td><td>APHA 4500 NO_3 E</td></tr>
<tr><td>As</td><td>APHA 3114-C</td></tr>
<tr><td>Cd</td><td>APHA 3111-B</td></tr>
<tr><td>Cu</td><td>APHA 3111-B</td></tr>
<tr><td>Cr (VI)</td><td>APHA 3111-B</td></tr>
<tr><td>Fe</td><td>APHA 31 1-B</td></tr>
<tr><td>Hg</td><td>APHA 3112-B</td></tr>
<tr><td>Pb</td><td>APHA 3111-B</td></tr>
<tr><td>Zn</td><td>APHA 3111-B</td></tr>
<tr><td>T-coliforms</td><td>APHA 9221 B</td></tr>
</table>
Surface water quality parameters: Monitoring of surface waters during rainy season and dry season was established for the streams flowing in the direct influence area of the Project. Methods of analysis of measurement are as follows:
</td></tr>
</table>

<table>
<tr><th>Category</th><th>Environmental Item</th><th>Main Check Items</th><th>Confirmation of Environmental Considerations</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Parameter</th><th>Method</th></tr>
<tr><td>Turbidity</td><td>APHA 2130-B</td></tr>
<tr><td>Alkalinity</td><td>APHA 2320-B</td></tr>
<tr><td>SO_4</td><td>APHA 4500 SO_4^{2-} E</td></tr>
<tr><td>TSS</td><td>APHA 2540 D</td></tr>
<tr><td>Cd</td><td>APHA 3111-B</td></tr>
<tr><td>Hg</td><td>APHA 3112-B</td></tr>
<tr><td>Pb</td><td>APHA 3111-B</td></tr>
<tr><td>As</td><td>APHA 3114-C</td></tr>
<tr><td>Cu</td><td>APHA 3111-B</td></tr>
<tr><td>Fe</td><td>APHA 3111-B</td></tr>
<tr><td>Mn</td><td>APHA 3111-B</td></tr>
<tr><td>Zn</td><td>APHA 3111-B</td></tr>
<tr><td>NO_3-N</td><td>APHA 4500 NO_3 E</td></tr>
<tr><td>T-coliforms</td><td>APHA 9221 B</td></tr>
<tr><td>Thermo-tolerant coliforms</td><td>APHA 9222 D</td></tr>
<tr><td>BOD</td><td>APHA 5210 B</td></tr>
<tr><td>DO</td><td>APHA 4500-O G</td></tr>
</table>

- Groundwater quality parameters: Observation wells will be installed in the direct influence area of the Project. Locations and depths were determined by the results of hydrogeological study. Frequency of monitoring depends on flow-path of groundwater. Methods of analysis of measurement are as follows:
<table>
<tr><th>Parameter</th><th>Method</th></tr>
<tr><td>Cd</td><td>APHA 3111-B</td></tr>
<tr><td>Hg</td><td>APHA 3112-B</td></tr>
<tr><td>Pb</td><td>APHA 3111-B</td></tr>
<tr><td>As</td><td>APHA 3114-C</td></tr>
<tr><td>Cu</td><td>APHA 3111-B</td></tr>
<tr><td>Fe</td><td>APHA 3111-B</td></tr>
<tr><td>Mn</td><td>APHA 3111-B</td></tr>
<tr><td>Zn</td><td>APHA 3111-B</td></tr>
<tr><td>NO_3</td><td>APHA 4500 NO_3 E</td></tr>
<tr><td>SO_4</td><td>APHA 4500 SO_4^{2-} E</td></tr>
<tr><td>T-coliforms</td><td>APHA 9221 B</td></tr>
<tr><td>Thermo-tolerant coliforms</td><td>APHA 9222 D</td></tr>
<tr><td>BOD</td><td>APHA 5210 B</td></tr>
</table>

- Noise: using a sound level meter referring standard DIN IEC-651.
</td></tr>
<tr><td></td><td></td><td>3) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?</td><td>In EIA report, an organization structure including monitoring function is proposed. The necessary budget is described in the report as a environmental management plan.</td></tr>
</table>

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
		4) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	There is no clear description regarding monitoring report system in Peru. The consultation with the regulatory authorities will be needed for the preparation of detail monitoring plan.
6 Note	Note on Using Environmental Checklist	1) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	Transboundary impacts from the Project activities are not expected.

1) Regarding the term “Peruvian Standards” mentioned in the above table, in the event that environmental standards in Peru diverge significantly from international standards, appropriate environmental considerations must made, if necessary.

2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.

Appendix-11: Expenditures and Financial Recourses of Solid Waste Management

Appendix-11 Expenditures and Financial Resources (S/. 000)

	Municipalities	SWM Expenditures (2009)				SWM Financial Resourses (2009)				Municipality Total (2009)				Projection (2015)			Projection (2024)			SWM Exp. Dependency on FONCOMUN		
		Manpower	Fuel	Others	Total (a)	SWM Service Charges	FONCOMUN (b)	Others	Total	Municipal Total FONCOMUN (c)	SWM / Mun. Ratio =b/c	Municipal Total Expenditures (d)	SWM / Mun. Ratio =a/d	SWM Expenditures (e1)	FONCOMUN for SWM (f1)	SWM / Mun. Ratio =f1/ c	SWM Expenditures (e2)	FONCOMUN for SWM (f2)	SWM / Mun. Ratio =f2/ c	2009 =b/a	1015 =f1/e1	2024 =f2/e2
1	PUNO	1,796	203	380	2,379	887	1,487	5	2,379	26,308	6%	51,638	5%	3,567	2,157	8%	4,046	580	2%	63%	60%	14%
2	JULIACA	312	520	1,685	2,517	218	885	1,414	2,517	35,848	2%	70,557	4%	4,652	3,409	10%	5,497	2,736	8%	35%	73%	50%
3	PIURA	6,278	1,011	1,493	8,782	2,952	4,109	1,721	8,782	61,928	7%	114,941	8%	7,378	3,633	6%	8,993	2,172	4%	47%	49%	24%
4	NUEVO CHIMBOTE	30	810	484	1,324	758	87	479	1,324	4,836	2%	47,695	3%	1,982	1,031	21%	2,369	898	19%	7%	52%	38%
5	TUMBES	1,080	451	152	1,683	311	996	376	1,683	12,447	8%	35,713	5%	2,986	1,784	14%	3,434	1,058	9%	59%	60%	31%
6	SULLANA	2,763	257	569	3,589	696	2,725	168	3,589	20,433	13%	66,129	5%	4,389	3,317	16%	5,072	1,105	5%	76%	76%	22%
7	ABANCAY	561	150	241	952	302	512	138	952	7,339	7%	15,866	6%	1,289	983	13%	1,419	784	11%	54%	76%	55%
8	HUANUCO	1,530	279	456	2,265	844	961	460	2,265	17,036	6%	59,823	4%	1,780	119	1%	2,059	0	0%	42%	7%	0%
9	PAITA	816		779	1,595	663	770	162	1,595	14,550	5%	45,978	3%	1,412	610	4%	1,769	414	3%	48%	43%	23%
10	P. MALDONADO	380	293	388	1,061	573	454	34	1,061	7,676	6%	17,762	6%	1,691	780	10%	2,466	1,179	15%	43%	46%	48%
11	TALARA	2,932		29	2,961	553	1,213	1,195	2,961	6,997	17%	70,191	4%	1,946	920	13%	2,182	290	4%	41%	47%	13%
12	MOYOBAMBA	214	179	361	754	503	160	91	754	11,778	1%	11,180	7%	989	460	4%	1,356	450	4%	21%	47%	33%
13	TARAPOTO	324	442	722	1,488	786	696	6	1,488	9,259	8%	23,709	6%	2,215	131	1%	2,733	0	0%	47%	6%	0%
14	CHACHAPOYAS	160	48	106	314	313	1	0	314	5,472	0%	11,183	3%	804	359	7%	944	233	4%	0%	45%	25%
15	ILAVE	150	44	356	550	57	383	110	550	16,364	2%	26,104	2%	720	617	4%	818	271	2%	70%	86%	33%
16	AZANGARO	242	26	146	414	46	342	26	414	14,668	2%	19,190	2%	520	434	3%	571	336	2%	83%	83%	59%
17	CHINCHA	2,108	539	1,234	3,881	1,099	1,935	847	3,881	8,372	23%	38,732	10%	2,232	1,523	18%	2,668	1,482	18%	50%	68%	56%
18	SECHURA	606	69	120	795	132	473	190	795	7,541	6%	37,541	2%	1,000	699	9%	1,333	516	7%	59%	70%	39%
19	HUACHO	1,972	184	794	2,950	1,078	1,067	805	2,950	7,041	15%	25,279	12%	2,647	1,166	17%	3,236	1,252	18%	36%	44%	39%
20	TARMA	744	151	383	1,278	323	793	162	1,278	11,637	7%	37,229	3%	1,159	1,243	11%	1,278	1,034	9%	62%	107%	81%
21	FERRENAFE	603	80	120	803	495	195	113	803	6,665	3%	14,434	6%	873	287	4%	1,044	176	3%	24%	33%	17%
22	SANTIAGO	56	26	21	103	0	69	34	103	1,602	4%	8,629	1%	320	296	18%	395	224	14%	67%	92%	57%
23	AYMARAES	1	15	61	77	0	77	0	77	2,907	3%	4,452	2%	319	299	10%	337	300	10%	100%	94%	89%
	Total	25,658	5,777	11,080	42,515	13,589	20,390	8,536	42,515	318,704	6%	853,955	5%	46,868	26,257	8%	56,019	17,490	5%	48%	56%	31%
						32%									44%			69%				

Note: Same amount of 2009 Municipality Total FONCOMN are utilized for ratio calculation.

Appendix-12: Economic Evaluation of Program

Appendix-12 Economic Evaluation of Program

Discount rate	11%

EIRR	33%
B/C	1.4

Year	Project Cost						Benefits						Net Flow
	Investment	Re-investment			O & M	Total	Ability-to-Pay			Sale of Recycable	Reduction of CO2	Total	
		L/F Site & Composting	Equipment	Total			Main Dist	Other Dist	Total				
0	178,098			0	0	178,098	0	0	0	0	0	0	-178,098
1				0	35,102	35,102	81,395	11,052	92,447	1,357	9,353	103,157	68,054
2		7,303	105	7,408	35,102	42,511	83,144	10,761	93,905	1,357	9,598	104,860	62,349
3		24,064	813	24,877	35,911	60,788	84,890	10,961	95,851	2,694	10,213	108,758	47,969
4				0	36,984	36,984	86,636	11,165	97,801	2,694	10,471	110,966	73,982
5		6,910	44,957	51,868	37,158	89,026	88,383	11,374	99,757	5,158	10,879	115,794	26,768
6		24,848	871	25,719	40,646	66,364	90,122	11,587	101,709	5,158	11,408	118,275	51,911
7				0	41,270	41,270	91,873	11,806	103,679	7,733	11,840	123,252	81,982
8			48	48	41,270	41,318	93,618	12,030	105,648	7,733	12,135	125,516	84,198
9			904	904	41,270	42,174	95,364	12,258	107,622	12,895	12,733	133,250	91,076
10				0	41,856	41,856	97,075	12,486	109,561	12,895	13,041	135,497	93,640
Total	178,098	63,125	47,699	110,825	386,569	675,492	892,500	115,479	1,007,979	59,674	111,671	1,179,324	503,832
NPV						470,384						676,253	**205,870**

THE PREPARATORY SURVEY ON SOLID WASTE MANAGEMENT PROGRAM IN THE REPUBLIC OF PERU

DRAFT FINALREPORT
VOLUME I: MAIN REPORT

PART II: THE PROGRAM FS

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PART II THE PROGRAM FS

CHAPTER 1 INTRODUCTION

1.1 BACKGROUND OF PREPARATION OF PROGRAM FS

The program consists 31 projects (23 subprojects of JICA loan and 8 subprojects of IDB laon). 23 JICA subprojects are formulated by JICA survey team in a parallel with to IDB subprojects which are formulated by other consultants.

It has been agreed among the concened organization for the program, such as MEF, OPI-MINSA and MINAM, it is necessary to acquire viabilities of subprojects which count for more than 50% of total investment amount of the program in order to acquire viability of program.

In normal SNIP procedure, it is required to get approval of program perfil, program Pre-FS and program FS in order. In this survey to skip the process of program Pre-FS is considered to reduce time for the process of program Pre-FS.

As of the end of March 2010, the program perfil has been evaluated and not approved yet by OPI-MINSA. Nevertheless, JICA survey team have prepared the draft final of program FS which will be necessary for further step of SNIP procedure and submitted MINAM.

1.2 PRESENT CONDITION

While the program perfil was submitted to OPI-MINSA at the beginning of November, as mentioned above, the program perfil is still under process of evaluation required by SNIP. Similarly, PIPs of other individual projects, which are mostly still perfil, are under evaluation of OPI-MINSA.

JICA survey team prepared drafts of all necessary PIPs for 22 projects, in addition to the program, excluding Nuevo Chimbote since the project had difficulty to decide the project site duaring all priod of the preparatory survey.

CHAPTER 2 GENERAL ASPECTS

2.1 NAME OF THE PROGRAM

Program of Development of Solid Waste Management Systems in the Priority Areas[1]of Puno, Piura, Ancash, Tumbes, Apurimac, Ica, Huánuco, Puerto Maldonado, San Martin, Junin, Lambayeque, Loreto, Ayacucho, Amazonas,Lima And Pasco.

2.2 FORMULATING AND EXECUTING UNIT

2.2.1 Formulating Unit

The Ministry of the Environment assumes the responsibility of the formulation of the Program, according to the Public Investment Projects (PIPs) formulated by 31 selected municipalities.Each PIP was formulated based on the methodological guideline approved by the Ministry of Economy and Finances, MEF.Most of the municipalities where the projects will be executed have formulating units, whose duties and responsibilities are stated in the corresponding PIPs. In the cases of municipalities without a formulating unit, said task will be carried out by the regional governments.

Table 2.2-1 Formuladora Unit

VICE MINISTRY OF ENVIRONMENTAL MANAGEMENT	
Sector	Environment
Area	Ministry of Environment
Person in charge of the organization	**Ruth Loayza Floers**
Address	Av. Javier Prado 1440 - San Isidro
No. Telephone/Fax	611-6000 – 1247
Electronic mail	rloayza@minam.gob.pe

Source: own elaboration

2.2.2 Executing Unit

The Ministry of the Environment, as the national environmental sector governing entity, whichcoordinates the local, regional and national government , will be the executing unit of the Project, and based on the agreements between the Peruvian Government and the Japan International Cooperation Agency(JICA) and the Inter-American Development Bank (IDB) will be responsible toexecute the “Program of Development of Solid waste Management Systems in Priority Sites”. Then, the municipalities will become coexecuting units of the program.

[1]Based on the name stated in the loan agreement between the Government of Peru and the Government of Japan

Table 2.2-2 Proposed Executing Unit

Ministry of Environment - MINAM	Holder MINAM:Antonio Jose Brack Egg
Sector	Environment
Area	Ministry of the Environment
Responsible unit	MINAM- General Administration Office
Person in charge of the Executing Unit	Ing. Montalva de Falla, Jose Ernesto. Manager of the General Administration Office
Address	Av. Javier Prado 1440 - San Isidro
No. Telephone/Fax	(+511) 611 - 6000
Electronic mail	

Source: own elaboration

2.2.3 Reasons for theExecuting Unit

(1) From the Ministry of Environment level

The mission of the Ministry of Environment (MINAM) is to maintain the quality of the environment and to assure to the present and future generations the right to enjoy a balanced and fair environment to ensure life development.Bearing this in mind, it promotes and ensures the sustainable, responsible, rational and ethical use of the natural resources and the environment that supports them, and contributes to the social, economic and cultural integral development of the human being, in permanent harmony with the environment.

The Ministry of the Environment is the governing sector for environment and the competent authority to formulate, plan, direct, coordinate, execute, supervise and evaluate the National Policy of the environment applicable to the three levels of government; it practice technical-normative functions, among others; formulates and approves plans, programs and projects in the scope of his sector, according to the Legislative Decree No. 1013 that approves the Law of creation, organization and functions of this organism. The Ministry of the Environment is a legal party with public rights and constitutes a budgetary component.

The Ministry of the Environment, among others specific functions, must (1) formulate, approve, coordinate, supervise, execute and evaluate the National Plan of Environmental Action and the National Agenda of Environmental Action; (2) to direct the National System of Environmental Management; (3) **to promote and to coordinate the proper solid waste management**; (4) to promote the citizen participation in the processes of makings decisionsfor the sustainable development and to promote national environmental culture; (5) to exert the sanctioning power in the scope of its competitions.

The Minister, as head of the sector and of its respective budget, has as functions: (a) to direct the process of sector planning strategy and to determine the sector, functional, nationals objectives applicable to all the levels of government, within the framework of the National System of Strategic Planning, as well as to approve the action plans and to assign the necessary resources for its execution, within the limits of the corresponding budgetary allocations; (2) Maintain the relations with the regional and local governments and to call for sector meetings related to his sector´s competence|

(2) From the MunicipalityLevel

The Organic Law of Municipalities establishes that the local governments aims to represent the neighborhood, promotes the proper local service renderingand an integrated, sustainable and harmonious development of the jurisdiction.

According to the Solid waste General Law, the provincial municipalities are responsible for solid waste management for domiciliary and commercial waste and of those activities that generate similar wastes, all in the scope of their jurisdiction; the district municipalities are responsible for the collection and transport of solid waste service provision and the cleaning of streets, public areas and monuments in their jurisdiction. Total Solid waste will have to be transported directly to the treatment plant, transference or to the final disposal place authorized by the Provincial Municipality, where the district municipalities must paythe corresponding fee. Likewise, this Law establishes that the municipal solid waste management in the country must be coordinated and be agreed, especially in conurban areas, in harmony with the actions of the sector authorities and the policies of regional development.

2.2.4 Administrative Capacity of the Executing Unit

(1) Administrative capacity of the Ministry of Environment

The Ministry of Environment (MINAM), within the framework of the Organic Law of the Executive Branch and within the scope of its powers, can create a Program in order to cover a problem or implement a specific public policy. In that sense, the Ministry plans the creation of an **Executing Unit of the Program (UEP)** with financial, administrative and economic autonomy that facilitates the achievement of the objectives and targets planned in this Program. See the chapter of technical, sustainability, organization and management approach of the Program to see detailed building capacity actions to execute the project by creating this unit.

(2) Administrative Capacity of the Local Government

The municipalities, as institutions with legal function and public rights, economic and administrative autonomy in the subjects of their competition and conducted by local governments conformed by representatives of their locality; maintain a close relationship with their population. As they have economic, financial, administrative and technological resources, among others; they are able to fulfill with the mandate of law (to offer public cleaning services and solid waste management), and the objectives of the program.

For the execution effects of the “Program each of the involved Municipalities will constitute and strengthena municipal unit of solid waste management, with technical and administrative capability, which will coordinate with the UEP of the Program and will facilitate the implementation of the Project in the corresponding Municipality. More details on this municipal unit will be shown in the sustainability, organization and management analysis of said study.

2.3 IDENTIFICATION OF THE CONCERNED ENTITIES AND BENEFICIARIES

2.3.1 General Information of the Stakeholders

For the implementation of the Program, the participation of the diverse stakeholdersof the civil society, public or private, with natural or legal status, is vital to guarantee the sustainability of said program.

For each of the PIP´s of the Program, the consultation process (Citizen Agreement) is being taken into account for their formulation, the elaboration of the complementary studies, the implementation and operation.

Part of the consultation process includes: surveys or interviews that allow to know the opinion, approval or will of the beneficiaries regarding the PIPs proposal, such as capacity of payment of the services; adoption of new habits and uses related to the service provided.

Thestakeholders' analysis section, in the identification stage, interests, problems, conflicts and strategies of stakeholders' participation are shown in relation to the program, based on the information gathered. The primary source is included in the appendix of the corresponding stakeholders.

The beneficiaries of the project (Municipalities included in the program) have interest in participating in the management, since each municipality has sent letters addressed to MINAM asking to be considered in the program. We will describe the participation method of the involved organizations and the beneficiaries:

Table 2.3-1 Stakeholdersby Participation Level

Involved organizations	Participation Method
Ministry of Environment (MINAM)	The goal is to ensure a suiTable environmental quality for the health and the integrated development the people, preventing theecosystems pollution, recovering damaged areas and promoting an integrated management of the environmental risks, as well as a clean and coefficient production. In coordination with the regional and local governments, sharing a clear vision of the sustainable development, MINAM is building capacities and the necessary investment programs, so that the ecoefficient municipalities become true in the shortest period of time in our country. Promotes financing initiatives, that allows to develop systems of integral management of wastes in the local governments. The Environmental Quality Directorate at MINAM will coordinate and set up the executing unit of the program.
Regional governments of the districts included in the program	Promote the suiTable management and handling of solid waste in the scope of its jurisdiction;to prioritize programs of public or mixed investment, for the construction, environmental and sanitary adjustment of the infrastructure of solid waste in the scope of its jurisdiction, coordinating with the corresponding provincial municipalities. In coordination with the health authority of health of its jurisdiction and the Ministry of Environment, or under the request of any of said authorities, as the case may be, providesthe services of solid waste to complement or to replace those provincial or district municipalities that cannot provide said service in a suiTable way, or when the areas are declaredin a state of sanitary or environmental emergency.The cost of services provided will be borne by the corresponding municipality.
Regional Health Directorates	Regulate anitary and technical aspectsof solid waste management, including the those activities related to recycling, reuse and recovery. Issue a Favorable Technical Opinion to build solid waste facility.Approve the Environmental Impact Assessment and to express favorable technical opinion, before approving the projects of solid waste facility. Sanitary surveillance of handling of solid waste having to adopt, according to corresponds, the following measures, among others:(1) eliminate or control the sanitary risks generated by the inadequate handling of solid waste;(2) require the compliance of the present law to the municipal authority, under its own responsibility.
Ministry of Economy	Feasibility Declaratory of the public investment projects and approval of exoneration of public preinvestmetn studies, as well as the procedures to register the loan agreement between the Government of Peru and the Government of Japan.

Involved organizations	Participation Method
Regional Education Directorate	Design efficient strategies to obtain an education of quality with fairness, relevance and transparency. To promote the "Social Mobilization Safe, Clean Schools and Healthy" as theNational Strategy of Environmental Education. This proposalarticulates the diverse national experiences,using new approaches regarding education and curricula management, environmental education, risk management and health promotion.
Local governments, formed by all districts and provinces included in the program	They are committed in the integral management of household, commercial solid waste and waste originated by those activities that generate wastes similar to the above mentioned in all the scope of their jurisdiction.Also, they regulate and control the process of final disposal of solid waste, liquidsindustrial dumping in the provincial scope and can take part in the system of public cleaning and treatment of solid waste, when it is worthwile to centralize the service, due to the economy of scale. Implement programs of segregation at source, which can include compensation to the contributors, through the reduction of the payment of ratesor the delivery of goods and services to less cost or free,as part of programs of environmental certification of companies or institutions generally. They promote solid waste reuse.
Japan International Cooperation Agency–JICA, and Inter American Bank-IDB.	To support in the financing of environmental projects and provide technical assisstance, related to the integral management of solid waste.
Beneficiaries	Adoption of habits and customs, besides conforming groups that control that local government and citizens manage solid waste properly(dumping of clearance to the public areas, for instance).
Waste pickers	Keen on forming associations of waste pickers and small EC-RS, specialized in the collection of solid waste for the recycling and the commercialization .

Source: own elaboration

The following chart shows the stakeholders and beneficiaries of the 31 projects included in the program, considering their concern and commitment towards the project.

Table 2.3-2 Identification of Stakeholders and Beneficiaries of the Program

City	Provincial Municipality	District Municipality	Ministry of Environment	Ministry of Economy	Ministry of Health	Japan International Cooperation Agency - JICA	Inter American Development Bank/ IDB	Waste Pickers	Municipal Environmental Commission	Población en general
TUMBES	X	X	X	X	X	X		X engaged according to Law 29419 and its regulations	OM Nº 002-2006-MPT-SG	X
PIURA	X	X				X			OM N° 021-2008-C/CPP	
SULLANA	X	X				X			OM Nº 10-2008-MPS	
TALARA	X					X			AC Nº 119-12-2009-MPT	
SECHURA	X	X				X			OM Nº 030-2005-MPS	
PAITA	X					X				
FERREÑAFE	X	X				X			OM Nº 026-2010-MPF	
TARAPOTO	X	X				X			OM Nº014-2005-A-MPSM	

City	Provincial Municipality	District Municipality	Ministry of Environment	Ministry of Economy	Ministry of Health	Japan International Cooperation Agency - JICA	Inter American Development Bank/ IDB	Waste Pickers	Municipal Environmental Commission	Población en general
MOYOBAMBA	X	X				X			OM Nº 183-2009-MPM	
CHACHAPOYAS	X	X				X			OM Nº 082-2010-MPCH	
NUEVO CHIMBOTE		X				X			OM N° 028-2008-MDNCH	
HUACHO	X	X				X			OM Nº 056-2007-MPH	
SANTIAGO		X				X			OM N° 025-2008/MDS-A-R-ICA	
CHINCHA	X					X				
HUANUCO	X	X				X			OM Nº 010-2010-MPHCO	
TARMA	X					X			OM N° 026-2008-CMT.	
ABANCAY	X					X			OM Nº 28-2005-MPA	
PUNO	X					X			OM Nº 157-2006-CMPP	
JULIACA	X					X				
AYMARAES	X	X				X			OM Nº 021-2008-MPA-CH	
AZANGARO	X					X				
ILAVE	X					X				
PUERT0 MALDONADO	X					X			Decreto 003-2009-MPT	
BAGUA	X	X					X		OM Nº 011-2008-MPB	
ANDAHUAYLAS	X	X					X		OM N° 006-2007-MPA-AL	
SAN JUAN BAUTISTA		X					X			
HUAMANGA	X	X					X		OM Nº 30-2006-MPH	
OXAPAMPA	X						X		OM N° 104-2006-MPO	
POZUZO		X					X		AC Nº93-2004 MDP	
CHANCAY	X						X		OM Nº 002-2005-MDCH	
YAUYOS		X					X			

2.3.2 Priorization of Beneficiaries

(1) Priorization criteria

The public investment projects for solid waste in prioritized cities are 31 (thirty one), and for the year 0, the projected population totals 2 938 948 inhabitants. In order to select each municipality, a selection process took place, based on thefollowing:

1) Availability of Investment Projects

The Ministry of Economy has the Bank of SNIP Projects (to the date of the evaluation) with 236 investment registered projects of solid waste management, (registered under different criteria such as viable, in evaluation and execution).

Table 2.3-3 Projects of Solid Waste 2003 - 2009

Years	*Number of Viable Projects, in Evaluation and Execution*	*Amount of Investment of the Projects*
2007	*55*	*S.89.381.364, 00*
2008	*154*	*S.540.232.693, 00*
2009	*27*	*S.86.657.754, 00*
Totals	***236***	***S.716.271.811, 00***

Source: Base of Bank of projects of the MEF/SNIP, March 2009

2) Approach of Integrality of the Investment Project

According to the objectives of the program and to the approach for the solid waste management, the projects must accomplish to provide treatment to all the stages or components of the solid waste management process, so based on different information, an analysis was done as follows:

- The supply of final disposal services for solid waste nationwide is very limited, there are only eight (8) sanitary landfills and four are located in the Region Lima and the remaining are in the Regions Ancash, Junín and Cusco. There is a serious deficiency in the other Regions[2].
- According to the above mentioned, from 1833 district municipalities, only 48 use 8 sanitary landfills.This means that 1786 municipalities dump their solid waste to open-airdumping sites, water bodies, wastelands, lagoons, among others. This shows that 97.4% of cities dispose their solid waste in improper places.

  The protection of the environment and the controlled and proper use of natural resources affects everyone, so it is necessary to have final disposal facilities for solid waste, as well as facilities waste reuse of the organic fraction for compostic (soil enhancer), and recover and reuse of waste such as paper, cardboard, plastic, glass and metals for the recycling market.
- According to the above mentioned criteria and further revision of the PIPs from the Bank of Projects, only 73 projects fulfill these exigencies.

[3] Censo de Población y Vivienda – INEI; 2007

Table 2.3-4 Demand of Infrastructure of Final Disposal Nationwide

Region	No. of Provinces	No. of districts	Districts with potential demand of sanitary landfills manuals	Districts with potential demand of semi-mechanized sanitary landfills	Districts with potential demand of mechanized sanitary landfills	Districts with micro potential demand of - sanitary landfills or other systems
Amazon	7	83	11	3	0	69
Ancash	20	166	21	2	6	141
Apurímac	8	80	13	2	2	67
Arequipa	8	109	31	4	11	67
Ayacucho	11	110	25	2	3	84
Cajamarca	12	127	23	1	4	103
Callao	1	6	3	1	4	2
Cuzco	13	108	28	4	6	74
Huancavelica	7	94	13	1	2	82
Huánuco	11	76	15	1	5	59
Ica	5	43	22	7	5	13
Junín	9	124	39	6	5	78
La Libertad	12	83	22	13	6	46
Lambayeque	3	38	24	7	4	7
Lima (Districts of Lima and Callao)	2	49	0	0	0	0
Lima (Provinces)	8	122	29	13	14	94
Loreto	7	51	22	2	6	25
Madre de Dios	3	11	7	0	1	7
Moquegua	3	20	7	0	2	15
Pasco	3	28	17	4	0	11
Piura	8	64	26	8	8	26
Puno	13	109	33	2	4	74
San Martin	10	77	30	6	3	42
Tacna	4	27	6	3	2	20
Tumbes	3	13	12	1	1	3
Ucayali	4	15	9	0	3	7
PERU	**195**	**1833**	**488**	**93**	**107**	**1216**

Source: Report of the present situation of the management of municipal solid waste - October 2008 - MINAM

3) Risk Criteria defined by the DIGESA

The General Direction of Environmental Health from the Ministry of Health (DIGESA) in coordination with its regional counterparts has developed a program of sanitary monitoring of the management and the monitoring of the environmental conditions and risks to the health, related to waste management. It shows a risk map:

Figure 2.3-1 Risk Map DIGESA/MINSA (2008)

4) Criteria of municipalities that are part of the Priority Tourist Destinations

The Ministry of Foreign Trade and Tourism (MINCETUR) and the Ministry of Environment (MINAM) subscribed in August 2008, an Agreement of Interinstitutional Collaboration, with the intention to carrying out tasks of interinstitutional collaboration that help to promote a responsible tourism with the environment nationwide. One of the benefits that the subscription of this agreement has generated is to promote that the prioritized tourist destinations are certificated as Ecoefficient Municipalities, thus these tourist destinations are established within the framework of the National Strategic Plan of Tourism (PENTUR, September 2008).

Figure 2.3-2 Map of Priority Tourist Destinations(PENTUR, 2008)

5) Criteria of the Cities withHighest Generation of Solid Waste

The MINAM has carried out a report on the current situation of municipal solid waste management, in October 2008, where it establishes a list of one hundred cities with biggest generation of wastes of the country:

Figure 2.3-3 Map of the 100 Cities with Greater Generation of Solid Waste

(2) Priority Municipalities

Selected cities

According to the evaluation one based on the mentioned criteria, the following cities were identified and prioritized in this first stage of the Program: Puno, Juliaca, Piura, Nuevo Chimbote, Tumbes, Sullana, Abancay, Aymaraes, Santiago, Huánuco, Puerto Maldonado, Talara, Moyobamba, Tarapoto, Chachapoyas, Ilave, Azángaro, Chincha, Sechura, Huacho, Tarma, Paita, Ferreñafe, Bagua, Andahuaylas, San Juan Bautista, Huamanga, Oxapampa, Pozuzo, Chancay and Yauyos.

Table 2.3-5 Beneficiary Population according to Prioritized Municipalities

Nro	Municipalities	Cities	Population
1	Provincial municipality of Puno - Puno	Puno	124,841
2	Provincial municipality of San Roman	Juliaca	248,006
3	Provincial municipality of Piura	Piura	293,992
4		Castile	138,217
5	Municipality Nuevo Chimbote District	Nuevo Chimbote	135,411

Nro	Municipalities	Cities	Population
6	Provincial municipality of Tumbes	Tumbes	106,603
7		Corrales	21,993
8		De la Cruz	8,650
9		Pampas del Hospital	2,666
10		San Jacinto	4,224
11		San Juan de la Virgin	2,710
12	Provincial municipality of Sullana	Sullana	163,961
13		Bellavista	38,372
14	Provincial municipality of Abancay	Abancay	46,408
15	Provincial municipality of Santiago	Santiago	19,026
16	Provincial municipality of Huánuco	Huánuco	73,713
17		Amaryllis	61,234
18		Santa Maria del Valle	1,253
19		Pilco Marco	20,802
20	Provincial municipality of Paita	Paita	89,707
21	Provincial municipality of Tambopata	Port Maldonado	56,382
22	Provincial municipality of Talara	Pariñas	90,450
23	Provincial municipality of Moyobamba	Moyobamba	53,619
24		Yantaló	1,897
25		Road	2,986
26		Soritor	18,248
27	Provincial municipality of San Martin	Tarapoto	75,496
28		Morals	26,783
29		Banda deShilcayo	31,186
30		Catacachi	2,701
31		Juan Guerra	3,227
32		Sauce	12,056
33	Provincial municipality of Chachapoyas	Chachapoyas	29,517
34	Provincial municipality of El Collao	Ilave	26,979
35	Provincial municipality of Azángaro	Azángaro	18,680
36	Provincial municipality of Chincha Alta	Chincha Alta	65,192
37	Provincial municipality of Sechura	Sechura	42,042
38		Bellavista de la Unión	3,558
39		Vernal	6,672
40		Christ Nos Valga	2,470

Nro	Municipalities	Cities	Population
41		Vice	13,858
42		Rinconada Llicuar	3,165
43	Provincial municipality of Huaura	Huacho	57,193
44		Hualmay	28,977
45		Huaura	33,344
46		Santa Maria	28,777
47		Vegueta	19,547
48		Caleta de Carquín	6,799
49	Provincial municipality of Tarma	Tarma	44,588
50	Provincial municipality of Ferreñafe	Ferreñafe	58,202
51		Pueblo Nuevo	
52		Mesones Muro	
53	Provincial municipality of Aymaraes	Challhuanca	3,854
54		Caraybamba	1,264
55		Cotaruse	828
56		Sañayca	584
57	Provincial municipality of Bagua (1)	Bagua	39,531
58		La Peca	
59		El Parco	
60		Copallin	
61		Aramango	
62	Provincial municipality of Andahuaylas (1)	Andahuaylas	44,980
63		San Jerónimo	
64		Talavera	
65	Municipality District of San Juan Bautista (1)	San Juan Bautista	94,292
66	Provincial municipality of Huamanga (1)	Ayacucho	110,708
67		Carmen Alto	20,213
68		San Juan Bautista	45,231
69		Jesus Nazareno	16,006
70	Provincial municipality of Oxapampa (1)	Oxapampa	9,102
71	District Municipality of Pozuzo (1)	Pozuzo	8758
72	District Municipality of Yauyos (1)	Yauyos	9,718
73	Provincial municipality of Chancay (1)	Chancay	58,028
Total:			**2,938 948**

Source: INEI, Censuses 1993 and 2007
Own elaboration

In each one of the PIPs formulated, the main socioeconomic stakeholders and the beneficiaries of the Program were identified, who will participate under the following forms:

Table 2.3-6 Groups of Beneficiaries according to Priorization

Beneficiaries	Form of participation
Provincial and districtmunicipalities	Provide the service directly and will build capacities onthe public service of solid waste.
Waste pickers	Important actors in the recovery and minimization of solid waste. Formalization of the activities of recovery of solid waste
Population of 74 cities that count on better services of solid waste in the cities of Puno, Juliaca, Piura, Nuevo Chimbote, Tumbes, Sullana, Abancay, Santiago, Huánuco, Port Maldonado, Talara, Moyobamba, Tarapoto, Chachapoyas, Ilave, Azángaro, Chincha, Sechura, Huacho, Tarma, Paita, Ferreñafe, Bagua, Andahuaylas, San Juan Bautista, Huamanga, Oxapampa, Pozuzo, Chancay, Yauyos and Aymaraes. Total population: 2945,010 direct beneficiaries.	Generators of solid waste and receivers of the public service Adoption of practices adapted for the environmental conservation and the reduction of risks to the public health (reduction, reuse, and recycling of solid waste); Sustainability of the service with payment culture and social monitoring of the public service.

2.4 FRAME OF REFERENCE

It consists on the description of legal background that norm the development and execution of the program, formed by the multi-sector legislation (economy, health, environment and foreign relations).

2.4.1 Background

MINAM is promoting ecoefficiency as one of the main strategies to assure that the development of the country is headed, satisfying the needs of current and future generations based on health and productivity of its population, in harmony with the nature. They have the decision to promote Ecoefficient Municipalities to achieve targets in a short term in three priority lines: recycling and safe final disposal of municipal solid waste; treatment and reuse of domestic sewage waters; and land use planning for the sustainable development.

In this direction, MINAM in coordination with the Regional and Local Governments, in a corporative way and with a clear and shared vision of the sustainable development, is developing actions for the reinforcement of capacities and promoting the necessary Investment Programs, so the Ecoefficient Municipalities would be a reality in the shortest term in our country.

2.4.2 Environment

(1) Law Frame of the National System of Environmental Management

The frame law of the National System of Environmental Management, in its Title II: Environmental Management, article 4,1, establishes that the environmental functions in charge of the organizations indicated in their article 2 are executed in a coordinated, decentralized and dispersed form, with the Environmental National Police, the National Agenda and Plan for Environmental Actions and to cross-sector norms, instruments, that are of obligatoryin the different scopes and levels of government. In the same way, its article 5.-

from the Environmental Management Principles, establishes that the environmental management in the country is ruled by the principles of compulsory of fulfilling Environmental National Policies, the national Agenda and Plan for Environmental Actions and the cross-section rules which are settled to reach its objectives, among others.

The National Policy of the environment which was approved in May 23rd, 2009 by Supreme Decree N0 012-2009-MINAM, constitutes one of the main instruments of management for achieving the sustainable development in the country and has as specific objective, to assure a proper environmental quality for health and the integral development of the people, preventing to affect the ecosystems, recovering degraded environments and promoting an integrated management of the environmental risks, as well as a clean and ecoefficient production. In his political axle "integral Management of the environmental quality", it establishes policy guidelines to improve solid waste management:

- To fortify the management of the regional and local governments regarding municipal solid waste, prioritizing its recovery.
- To promote measures to improve tariff collections of cleaning and the financial sustainability of the services of municipal solid waste.
- To promote national campaigns of education and environmental awareness to improve the conducts regarding dump of waste and to foment the reduction, segregation, reuse, and recycling; as well as the recognition of the importance of counting on sanitary landfills for the final disposal of solid waste.
- To promote the public and private investment in projects to improve the systems of collection, operations of recycling, final disposal of solid waste and the development of infrastructure nationwide; assuring the closing of dumping sites or other illegal facilities.
- To develop and to promote the adoption of management models appropriate for solid waste adapted to the conditions of the city.
- To promote the formalization of waste pickers, recyclers and other state holders who participate in solid waste handling.
- To promote a proper management of dangerous solid wastes by the municipalities as per their scope, coordinating actions with the correspondent sector authorities.
- To promote a proper management of non municipal infrastructure, facilities and management practices by their generators.
- To promote the reduction of waste generation and effective handling and segregated final disposal of dangerous solid wastes, through facilities and proper systems to its dangerous characteristics

(2) Guidelines of the environmental management policy established in the Law of solid waste and its Regulation D.L. 1065

- To develop education and training actions for an efficient, effective and sustainablesolid waste management and handling.
- To adopt measures of reduction of solid waste in all the service life time of the goods and services, through the maximum reduction of its volumes of generation and characteristics of danger.
- To establish a system of shared responsibility and integral management of solid waste, from the generation to its final disposal, in order to avoid negative situations of risk and impacts to the human health and the environment, notwithstanding the technically

necessary measures for handling dangerous solid waste. This system will include among others, the extended responsibility of the companies that produce, import or commercialize massive consumer goods and that consequently, contribute to the generation of wastes in an important amount or with characteristics of danger.

- To adopt measures so that the accounting of the organizations that generate or handle to solid waste can include the real cost of the prevention, control, monitoring, recovery and possible compensation that is derived from the handling of these wastes.
- To develop and use technologies, methods, practices and processes of production and commercialization, that promotes decrease or recovery of solid waste and its proper management.
- To foment the recovery of solid waste and the complementary adoption of treatment practices and proper final disposal.
- To establish gradually the selective handling of solid waste being admitting its joint handling by exception, when sanitary or environmental risks are not generated significantly.
- To establish oriented actions to recover the areas degraded by the improper and uncontrolled solid waste discharge.
- To promote the initiative and active participation of the population, the organized civil society and the private sector in the management and the handling of solid waste.
- To foment the formalization of the people, operators and other organizations that intervene in the solid waste management without the corresponding authorizations, considering the measures to prevent the damages derived from its work, the generation of health conditions and job security, as well as the social and economic valuation of its work.
- To harmonize the policies of land-use planning and solid waste management, in order to favoring its proper handling, as well as the identification of appropriate areas for the solid waste infrastructure location, taking into account the current and future needs, in order to avoid the insufficiency of the services.
- To foment the generation, systematization and information diffusion for making decisions and improvement of the solid waste management and handling.
- To define cross-sector plans, programs, strategies and actions for solid waste management conjugating economic, social, cultural, technical, sanitary and environmental variables.
- To prioritize the private provision of solid waste services, under enterpriseand sustainability criteria.
- To assure that the rates or tariffs charged for solid waste service provision are calculated based on its real cost, quality and efficiency, assuring a better efficiency in the collection through any legally allowed mechanism, which can be used directly or through third parties.
- To establish action aimedat preventing the environmental contamination, eliminating bad practices of solid waste handling which could affect the quality of the air, water, soil and ecosystems.
- To promote the public and private investment in infrastructure, facilities and services of waste handling.

(3) Principles and Guidelines of the Policy from the National Plan of Integral Management of Solid Waste.

The integral management of solid waste sustains in the principles and established policies world-wide, according to agreements and programs referred to the sustainable development like Agenda 21 and the Agreement of Brasilia; at national level, in the government Policies, especially in Nineteenth regarding sustainable development and environmental management included in the National Agreement and the guidelines of the General Law of Solid waste.

In that context the governing principles, general and specific policy guidelines which orient the actions of this plan, are:

1) Governing Principles.

Established in the DS 057-2004/PCM, Regulation of law 27314 General Law of Solid waste, and includes:

- Education- The modification ofproduction patterns and unsustainable consumption, require of a maintained education that sustains in strategic alliances and the joint between home, school and community including the economic activities, that are oriented to obtain habits and styles of healthful and sustainable lives.
- Prevention and reduction- The health of the people and the environment is fundamental and for that reason prioritized the measures destined to get a reduction of waste generation as well as its danger, as much of the production as of the consumption.
- Precaution- In order to protect the health of the people and the environment, when necessary, precaution criteria will be applied. In this way, the lack of scientific assurance will not be reason to delay protection measures.
- Integration- The current Plan will promote the integration of plans, programs and actions of the different economic and social, public and private sectors, as well as of the different levels from government, national, regional and local.The concept of integrated management of vital cycle, means to take care of the needs of wastes management from the plans and designs in the production sectors up to the final disposal services in the health, cleaning and environmental sectors. It also contemplates the conciliation of the development with the protection of the health and the environment.
- Control in the source- In general, the actions destined to the waste treatment in the place of the generation or in the closer proper facility should prevail in order to avoid unnecessary transfer of urban wastes which can originate negative risks and impacts on the environment.
- Recycling - It will be done through the valuation of wastes, the direct recovery of wastes, reinforcing the recovery and formal recycling and the markets of recovery products, introducing economy and market approaches in his management.
- Sustainability- The modification of no sustainable rules of production and consumption will orient the establishment of actions and measures of the Plan.The sustainable actions will be prioritized and the private investment in the Sector will be stimulated.
- Self-sufficiency- The action from the Plan will be based on the idea that the possessor or producer of wastes must assume the costs of its proper environmental management.The solid waste management services will be financedthrough taxes or similar instruments managed by the local organizations.The principle of the contaminating payer will be applied at any moment.

- Common but differentiated responsibility- The solid waste management is a common responsibility, despite the generators should assume a differentiated responsibility according to the volume and danger of their wastes.
- Clean production and enterprise responsibility- The plan will promote that the industry and commerce tend to obtain the greater possible efficiency in each one of the stages of the cycle of the product, as well as the creation of a manager responsible for resources use and management, reducing to the maximum the generation of wastes and assuming the responsibilities on them.The principle "from the cradle to the tomb" will be applied, which means that generator is responsible for generation of dangerous waste throughout all their cycle.
- Citizen participation and communication- The citizen participation is fundamental to revert the current situation, the Plan will promote the maximum conjunction of efforts, around a shared vision and through an efficient and permanent communication to manage corporative actions that contributes with the objectives of the Plan.
- Science and Technology- The adoption of decisions and the development of programs will be sustained in the information, the knowledge and the technology. Science and technology are priority and strategic for a better use of the limited resources available.

2) General Policy Guidelines

- Sanitary and environmental education- The generation, systematization and universal and opportune diffusion of the knowledge and information that occurs around the sanitary and environmental education will improve the solid waste management and contributes that the population adopts responsible and environmental consumption methods and socially and more healthful lifestyles.
- Decentralization- The laws promulgated regarding regionalisation and Municipalization show that the Decentralization is the most consistent Policy to take care of the development problems in a more participating and democratic way. The solid waste management is fortified with a greater capacity for making decisionsfor the whole national and according to the different realities.
- Multisector- The Plan will be sustained in multi-sector and multidisciplinary actions with effective participation of the different stakeholders from solid waste management, incorporating its interests, rights and obligations. It contemplates all the processes involved in the solid waste management, all the consumption modalities, cultural realities and global and local economy, associated to the cycle of products and solid waste.
- Information and monitoring- The development of informative systems and efficient sanitary and environmental monitoring will allow a better definition of the conditions, tendencies and priorities related to solid waste management, fortifying the capacity for making decisions and facilitating the investment processes.
- Citizen Participation- The citizen participation is the action of the citizens in the programs guidelines and policies regarding solid waste management in the sector or the municipalities. It can be very useful to canalize information and elements of support for the adoption of effective decisions oriented to a proper solid waste management.
- Technical Cooperation- The technological transference and the processes of fortification of the local capacity will be facilitated with an effective technical cooperation within the framework of coordination forum in the conception of networks, the corporative work and the synergy of the knowledge will allow to fortify the management resources.

3) Specific GuidelinesPolicy

The Program´s perfil declares that the guidelines for specific policies for the execution of projects solid waste management must be according to the following policies:

- To develop education and training actions for an efficient, effective and sustainablesolid waste management and handling.
- To adopt measures of reduction of solid waste through the maximum reduction of its volumes of generation and characteristics of danger.
- To establish a system of shared responsibility and integral management of solid waste, from the generation to its final disposal, in order to avoid negative situations of risk and impacts to the human health and the environment, notwithstanding the technically necessary measures for handling dangerous solid waste.
- To adopt measures so that the accounting of the organizations that generate or handle to solid waste can include the real cost of the prevention, control, monitoring, recovery and possible compensation that is derived from the handling of these wastes.
- To develop and use technologies, methods, practices and processes of production and commercialization, that promotes decrease or recovery of solid waste and its proper management.
- To foment the recovery of solid waste and the complementary adoption of treatment practices and proper final disposal.
- To promote selective management of solid waste and admission of its integral management, when sanitary or environmental risks are not generated significatively.
- To establish oriented actions to recover the areas degraded by the improper and uncontrolled solid waste discharge.
- To promote the initiative and active participation of the population, the organized civil society and the private sector in the management and the handling of solid waste.
- To foment the formalization of the people, operators and other organizations who intervene in the solid waste management.
- To harmonize the policies of land-use planning and solid waste management, in order to favoring its proper handling, as well as the identification of appropriate location of treatment, transfer and final disposal facilities.
- To foment the generation, systematization and information diffusion for making decisions and improvement of the solid waste management and handling.
- To define cross sector plans, programs, strategies and actions for solid waste management conjugating economic, social, cultural, technical, sanitary and environmental variables.
- To prioritize the private provision of solid waste services, under enterpriseand sustainability criteria.
- To assure that the rates or tariffs charged for solid waste service provision are calculated based on its real cost, quality and efficiency.
- To establish action aimed at preventing water body contamination, eliminating discharge of solid waste in water bodies or courses

(4) Strategic Guidelines of National Development 2010-2021

Strategic axis 6: Natural Resources and Environment

It requires a decided action of the government in the regulation of a sustainable exploitation of natural resources and environmental quality, the creation of economic incentives for a good environmental management and the establishment of effective mechanisms of supervision, evaluation and environmental control of the companies. To these, it should be added the support to mechanisms of information and citizen participation, as well as the environmental education in all the educative levels.

Table 2.4-1 Detail of the Strategic Axis

INDICATOR	BASIC LINE 2008	GOAL 2011
Sewage water treatment (% of total 2007)	22%	100%
Solid waste prepared in sanitary landfill (% of the total)	19%	100%
Stock takingand valuation of the natural resources carried out		Complete stock takingand valuation

Source: Strategic Guidelines for National Development 2010-2021
National Center of Strategic Planning-CEPLAN
National Plan of Environmental Action PLANAA-Perú 2010-2021

2.4.3 Legal framework

(1) Organic Law of Municipalities Law No. 27972

The municipalities, regarding cleaning, and health exert the functions of administration and direct regulation or by concession of the services of water, sewage system and drainage, public cleaning and solid waste treatment, when by economy of scale turns out to be efficient to centralize the service provincially, or when it is not in capacity to do it.

(2) The General Law of Solid Waste

The General Law of Solid waste no. 27314 promulgated in the year 2000 marked a landmark in the solid waste management in the country. Before 2000 solid waste management focused as a domestic waste and urban cleanliness subjects. There was a simplified conception of solid waste management, regulating the collection and the disposal of wastes, without taking into account the danger characteristicsthat could have wastes, or the risks that could generate in the health of the people and the environment. These functions were assigned to the municipalities, understanding that they were part of the conservation and maintenance of the cities. Historically, mainly the municipalities have been the direct providers of the public cleaning services, under the modality of “direct administration”.

It should be indicated that DS No. 06-STN, Regulation for waste disposal through the use of sanitary landfill in 1964, was effective during decades and several of their statements are still taken into account as the sanitary landfill continues being the unique alternative for the final disposal of solid waste; later norms were generated DS No. 105/67-DGS, that arranged that land areas destined to sanitary landfill, could only be qualified for parks or forests; supreme Decree No. 013-77-SA, Regulation for the recoverable nonorganic product; supreme Decree N° 033-81-SA, Regulation of Urban Cleanliness that regulated with greater amplitude the incipient solid waste management; the Legislative Decree No. 613, Environment and Natural Resources code, Legislative Decree No. 757, among others legal devices followed in

the process of normative evaluation, every day understanding wastes as valuable productsor that could be valorized.

The Sector Analysis of Solid waste performed by the DIGESA from the Ministry of Health, with the support of the Pan-American Organization of Health (OPS) in 1998 provoked a substantial change in this sector, settling down that there was a "virtual sector" of solid waste. Additionally, one of the recommendations of this diagnosis, was oriented to order and to modernize the legislation of solid waste, that was characterized then by its great dispersion and to have important gapsregarding aspects like dangerous wastes, the evaluation of environmental impact for infrastructure, the prevention in the handling, the informality of the operators, the lack of planning of the services, participation of private, among others.

With the participation of the National Congress, the Ministry of Health, Municipalities, and other social authorities, organizations and diverse estates of the civil society which were involved in citizen participation process; On July 21st, 2000, Law Nº 27314, General Law of Solid waste was published. It was later regulated through Supreme Decree No. 057-2004-PCM.

In the 2008, with DL 1065, General Law for Solid waste no. the 27314 of 2000 was modified; easing the administrative processes for the approval of the infrastructure projects of solid waste and its corresponding Environmental Studies. Currently, there is a new draft of the newRegulation of the modified law (Ministry Resolution N° 136-2009/MINSA), which is estimated to be soon approved by DIGESAand MINSA. For the public investment projects, the current regulation is based on the National System of Public Investment (SNIP).

The General Law of Solid waste and its modifying D.L. 1065; as well as the D.S. 057-2004-PCM Regulation of the General Law, establishes that the regional governments must promote the proper solid waste management and handling in the scope of their jurisdiction; to prioritize programs of public or mixed investment for the construction, putting in value or environmental and sanitary adjustment of the infrastructure of solid waste in the scope of its jurisdiction, in coordination with the corresponding provincial municipalities. The Regional Governments must assume, in coordination with the authority of health of their jurisdiction and the Ministry of the environment, or by order of anyone of these authorities, solid waste service provision to complement or to replace the action of those provincial or district municipalities that cannot take care of them in a proper way or when they are included in the sanitary or environmental emergency declaration. The cost of the provided service should be assumed by the corresponding Municipality.

In addition, in this normative frame, the responsibilities of the municipalities are established, such as: (1) the provincial Municipalities are responsible for solid waste management of domiciliary andcommercial origin and of those activities that generate wastes similar to these, in the scope of their jurisdiction, carrying out the coordination with the regional government to which they correspond, to promote the execution, infrastructure revaluation or adjustment for handling solid waste as well as for the elimination of dumpingsites that put in risk the health of the people and the environment. They are forced to:

1. To plan the integral management of solid waste in the scope of its jurisdiction, making compatible the solid waste management plans of their districts and smaller slums, with the policies of local and regional development and with their respective Plans for Territorial Preparation and Urban Development.
2. To regulate and control the solid waste management service provision of its jurisdiction.

3. To express opinion regarding the district ordinance projects referred to solid waste management, including corresponding tariff collection.
4. To assure a proper cleaning of streets, public spaces and monuments, the collection and transport of solid waste in the capital city´s downtowns.
5. To approve the solid waste infrastructure projects of the scope of municipal management.
6. To authorize the solid waste infrastructure operation of the scope of municipal and non municipal management, except what it is dictated by the law.
7. To assume, in coordination with the authority of health of its jurisdiction and the Ministry of the environment, or by order of anyone of these authorities, the solid waste service provision to complement or replace the action of those districts that have been declared in sanitary emergency or cannot take care in a proper way. The cost of service provided should be assumed by the corresponding district municipality.
8. To adopt measures to promote the constitution of solid waste service provider companies indicated in Article 27 of this Law, as well as to stimulate and to prioritize the private provision of these services.
9. To promote and to guarantee solid waste services administrated under principles, criteria and accounting of costs from an enterprise.
10. To subscribe contracts solid waste service provision with companies which are registered in the Ministry of Health
11. To authorize and control the transport of dangerous wastes in its jurisdiction, in accordance with the established in Law No. 28256, Law that regulates the land Transport of dangerous Materials and Wastes, with exemption of the transported in national and regional roads.
12. To implement progressively programs of segregation in the source and the selective collection of wastes in all the scope of its jurisdiction, facilitating its recovery and assuring its technically and differentiated final disposal.

Finally, the districts and provincial municipalities, regarding downtown districts (capital cities) are responsible for collection and transport service provision for municipal solid waste and the cleaning of streets, public spaces and monuments in their jurisdiction. All the solid waste should be transfer directly to waste infrastructures authorized by the Provincial Municipality.The district municipalities have to pay the corresponding fee. Complementarily, the municipalities must execute programs for the progressive formalization of the people, operators and other organizations that take part in solid waste management without the corresponding authorizations.

(3) The National System of Public Investment and the Solid Waste Projects

In December 2008, through directive 007-2008, MEF approved the “Guideline to formulate public investment projects of solid waste at perfil level”, which defines rules and specific guidelines that the present program of investment is applying in the development from this program of investment.

The present program is framed legally in the Law for National System of Public Investment (SNIP), Organic Law for Municipalities and General Law for Solid waste. In the following guidelines of sector and territorial policy:

Table 2.4-2 Programmatic Functional Classification

FUNCTIONAL CLASSIFIER - SNIP/MEF	
FUNCTION 17:	Environment
PROGRAM 039:	Environment
SUB PROGRAMS 086:	Public cleaning

Source: General directive of the National System of public Investment
01 Annex SNIP - V 01 (10/02/2009)

- Responsible sector: Health, where it includes the actions oriented to the public cleaning: collection, transport, treatment and final disposal of solid waste.

CHAPTER 3 DIAGNOSIS OF THE CURRENT SITUATION

3.1 AREA OF THE PROGRAM

As part of the development of the Public Investment Perfil of the program "Program of development of solid waste management systems in priority sites", in this chapter, it is shown the scope of the situation where the solid waste management activities are developed in the PIP´s which are part of the program.

3.1.1 Identification of the Area of Influence of the Program

The area of influence of the program is formed by the areas of intervention of each of the 31 projects that are part of the Program. The following graph and chart show the information of each of the projects.

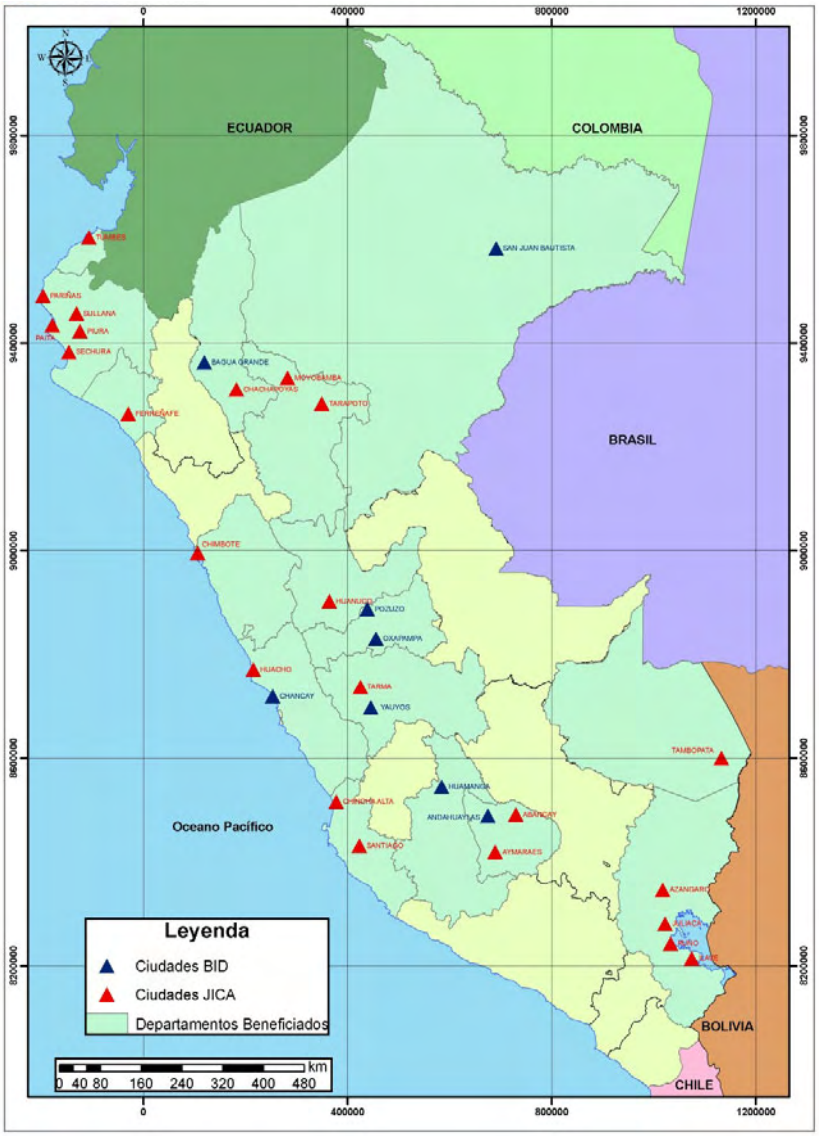


Figure 3.1-1 Scope of study of the PIPRS

Table 3.1-1 Projects's perfil that are part of the PIPRS

LOCALITIES					
No.	**Cod SNIP**	**Name**	**Location**	**Costs**	**Beneficiaries**
1	71948	"Enlargement and improvement of the integral management of municipal solid waste in the city of Puno, province of Puno, department of Puno"	Puno	10,912,170.40	137,534
2	139755	Extension and improvement of the system of the integral management of municipal solid waste in the district of Juliaca, province of San Roman - Puno	Juliaca	13,980,966.46	259,032
3	149181	Improvement and enlargement of the integral management of municipal solid waste in the city of Piura and extension of the service of final disposal for the city of Castillo, province of Piura, department of Piura	Piura	23,326,149.94	439,922
4	78429	Improvement and enlargementof the integrated management of municipal solid wastein the city of Nuevo Chimbote – Santa province - Ancash	Nuevo Chimbote	9,823,143.47	122,828
5	49754	Improvement and extension of the integral management of municipal solid waste in the city of Tumbes and extension of the service of final disposal for the cities of Corrales, La Cruz, Pampas de Hospital, San Jacinto, San Juan de la Virgen, Province of Tumbes, Department of Tumbes.	Tumbes	7,716,116	148,788
6	143894	Improvement and extension of the integral management of municipal solid waste in the city of Sullana and extension of the service of final disposal for the city of Bellavista, province of Sullana - department of Piura	Sullana	14,023,368	202,333
7	109963	Improvement and extension of the integral management of municipal solid waste in the city of Abancay, province of Abancay, department of Apurímac.	Abancay	5,342,006.51	46408
8	154579	Extension and improvement of the integral management of municipal solid waste in the city of Santiago, province of Ica, department of Ica	Santiago	3,206,730.82	19,708
9	102867	Extension and improvement of the integral management of municipal solid waste in the city of Huánuco and suiTable final disposal in the cities of Amaryllis, Pillco Marca and Santa Maria del valle, province of Huanuco, Huanuco department	Huánuco	11,047,441.11	157002
10	95944	Improvement of the integral management of municipal solid waste in the district of Paita, province of Paita, Piura	Paita	8,380,583.92	86,612
11	75901	Improvement and extension of the integral management of municipal solid waste in the city of Puerto Maldonado, province of Tambopata, department of Madre de Dios	Port Maldonado	6,691,524.43	71967
12	37163	Improvement and Extension of the integral management of municipal solid waste of the district of Pariñas, Province of Talara, Department of Piura	Talara	10,678,099.32	90,450
13	87398	Improvement and extension of the integral management of municipal solid waste in the City of Moyobamba and extension of the service of final disposal of municipal solid waste of the cities of Yantalo, Calzada and Soritor, Province of Moyobamba, Department of San Martin	Moyobamba	7,903,981	78,520
14	106247	"Improvement and extension of the integral management of municipal solid waste in the city deTarapoto and extension of the service of final disposal of municipal solid waste of the cities of Morales, La Banda, Cacatachi, Juan Guerra y Sauce , Province of San Martin, Department of San Martin"	Tarapoto	11,733,570	151,781
15	146148	Improvement and Extension of the Integral Management of Municipal Solid waste in the City of Chachapoyas and extension of the service of final disposal of municipal solid waste of the city of Huancas, Province of Chachapoyas, Amazonas Region	Chachapoyas	5,789,687.78	28,130
16	140240	"Extension and improvement of the integral management of municipal solid waste in the city of Ilave, province of the Collao, department of Puno"	Ilave	2,862,255.07	23,514
17	145665	Extension and improvement of the integral management of solid waste in the city of Azángaro, province of Azángaro, Puno department.	Azángaro	2,469,816.23	18680
18	90106	Improvement and extension of the integral management of municipal solid waste in the city of Chincha Alta, province of Chincha, department of Ica	Chincha	6,300,886.20	65,192

LOCALITIES					
No.	**Cod SNIP**	**Name**	**Location**	**Costs**	**Beneficiaries**
19	71455	Improvement and extension of the integral management of municipal solid waste in the city of Sechura and extension of the service of final disposal for the cities of Bellavista de la Unión, Bernal, Cristo nos Valga, Vice and Rinconada Llicuar, Province of Sechura, Department of Piura	Sechura	5,874,748	68,863
20	106764	Improvement and extension of the integral management of municipal solid waste in the city of Huacho and extension of the service of final disposal for the cities of Hualmay, Huaura, Santa Maria, Végueta and Caleta de Carquín, Province of Huaura, Department of Lima	Huacho	9,852,503.80	170,783
21	84907	Improvement and extension of the integral management of municipal solid waste in the city of Tarma, Province of Tarma, Department of Junín"	Tarma	5,216,665.07	43,366
22	107077	Improvement and extension of the integral management of municipal solid waste in the city of Ferreñafe and extension of the service of final disposal for the cities of Pueblo Nuevo y Mesones Muro, Province of Ferreñafe, Department of Lambayeque	Ferreñafe	5,011,424	47,372
23	118281	Improvement and extension of the integral management of municipal solid waste in the city of Chalhuanca and extension of the service of final disposal for the cities of Caraybamba, Cotaruse and Sañayca, province of Aymaraes, department of Apurimac	Aymaraes	2,765,792.48	6,565
24	161450	Improvement and extension of the integral management of municipal solid waste, in the districts of Bagua, La Peca, El Parco, Copallin and Aramango, of the province of Bagua	Bagua	5,536,669.35	51692
25	126569	Improvement and Extension of the Integral management of municipal solid waste in the cities of Andahuaylas, San Jerónimo and Talavera, Province of Andahuaylas, Department of Apurímac	Andahuaylas	3,610,478	47479
26		Improvement of the recovery system, treatment and final disposal of solid waste in Villa San Juan, district of San Juan Bautista - Maynas - Loreto	San Juan Baptist	8125158.4	94,292
27	165167	Improvement and extension of the integral management of municipal solid waste the cities of Ayacucho, Carmen Alto, San Juan Bautista and Jesus Nazareno, province of Huamanga, department of Ayacucho	Huamanga	18,197,203.02	163,482
28	84935	Construction and implementation of integral management of solid waste of the city of Oxapampa, province of Oxapampa - Pasco	Oxapampa	4,800,835.16	9102
29	78861	Improvement of the integral management of municipal solid waste of the district of Pozuzo - province of Oxapampa - Pasco Region	Pozuzo	2,529,158.19	8758
30	145441	Improvement and Extension of the Integral Management Of Municipal Solid waste In the District De Yauyos - Province De Jauja	Yauyos	1520476.07	9718
31	145493	Improvement and extension of the integral management of municipal solid waste of the district of Chancay, Huaral Lima	Chancay	6,259,284.47	53,025
	Total			**241,488,892.67**	**2,922,898.00**

Source: Bank of Projects of the MEF-SNIP

3.1.2 Geographic Location of the Localities involved in the Program

The program involved 31 public investment projects and includes 74 cities located in the Coast, Mountain and Forest of Peru, which provide the Program with certain national representativeness. The implementation implies all the range of urbanization processes, cultures and environments, climates and ecological strata in the Country.

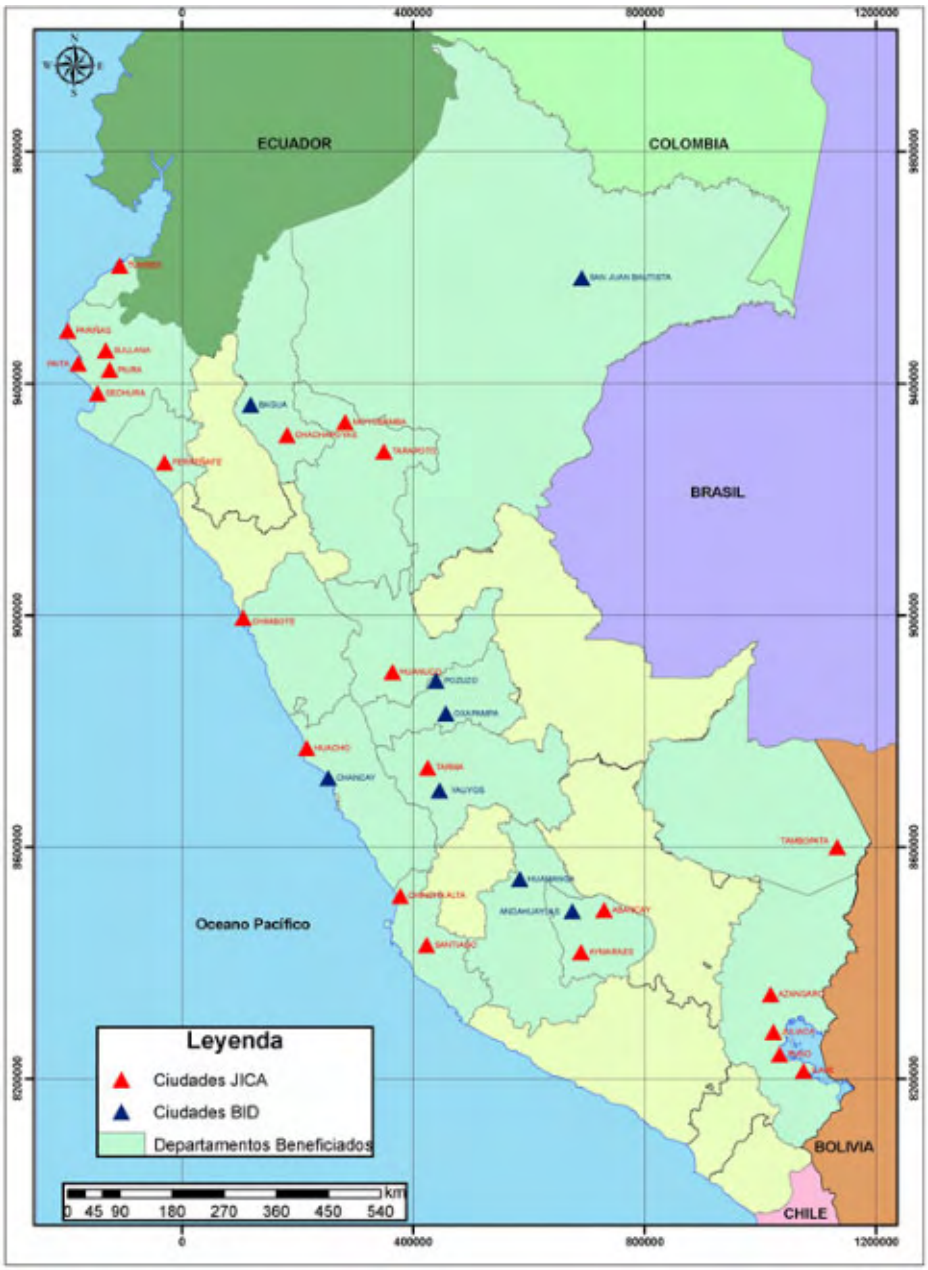


Figure 3.1-2 Map of Location of theScopeof the Program

3.1.3 Information on the Climate of the Localities involved in the Program.

The localities in the scope of the programare located in 7 of the 11 echo regions that exist in our country, which include: desert of the Pacific, equatorial dry forest, tropical forest of the Pacific, steppe mountainous area, puna, high and low forest. Therefore, the diverse climate will play a very important factor in the definition of systems, practical technologies and models of operation of solid waste for each individual integral system.

Figure 3.1-3 Climatic Classification of the Cities involved in the Program

3.1.4 Productive Activities of Cities involved in the Program

Within the scope of the program, it is possible to identify the conditions and main economic activities which determine the socioeconomic conditions of the population of each locality which conform the program, among them we have:

Table 3.1-2 Main Productive Activities in the Scope of Intervention

Nro.	Location	Main economic Activities
1	Tumbes	Agriculture, Commerce and services, transport and communications
2	Piura	Commerce, manufacturing Industry
3	Sullana	Commerce retail and Services
4	Talara	Commerce, transport and Fishing
5	Sechura	Fishing, Commerce and services, manufacturing industry
6	Tarapoto	Tourism, Commerce, Agriculture and services
7	Paita	Manufacturing industry, Fishing, commerce
8	Ferreñafe	Agriculture, Commerce and Services and, Transport
9	Moyobamba	Agriculture, services and Tourism
10	Chachapoyas	Services, Tourism,
11	Santiago	Agriculture, Services, Commerce and tourism
12	Chincha	Manufacturing industries, Retail
13	Huacho	Commerce, education, transport and manufacturing industries
14	Nvo Chimbote	Retail, education, agriculture and cattle ranch
15	Huánuco	Retail, Education, Transport.
16	Tarma	Agriculture, Commerce and Tourism
17	Puno	Commerce, services and agriculture
18	Juliaca	Commerce, services and agriculture
19	Abancay	Commerce, Services
20	Pto Maldonado	Commerce, Services,
21	Azángaro	Commerce and services
22	Ilave	Commerce, services and agriculture
23	Bagua	Commerce, Tourism and Agriculture
24	Andahuaylas	Agriculture, Commerce and services
25	San Juan Bautista	Agriculture and commerce
26	Huamanga	Retail, Education
27	Oxapampa	Agriculture, Tourism, Services and Commerce
28	Pozuzo	Agriculture, Tourism, and Commerce
29	Chancay	Agriculture, cattle ranch, hunt and forestry
30	Yauyos	Agriculture and Commerce
31	Chalhuanca	Agriculture and Commerce

Source: INEI 2007 - own elaboration

3.2 SOCIO ECONOMIC DIAGNOSIS

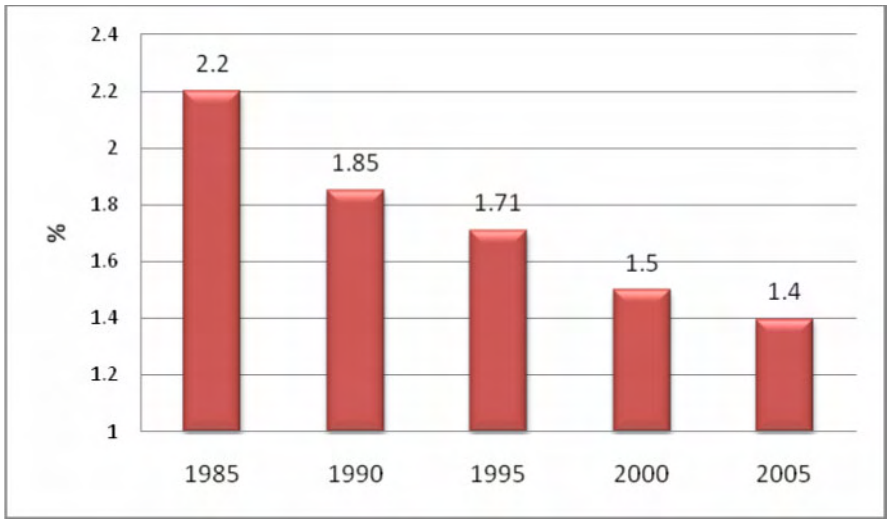
Among the socioeconomic and cultural aspects that are necessary to emphasize, a nationwide analysis of the situation is shown and then explain the aspects related the scope of intervention of the program. Among the main aspects to study, we have:

3.2.1 Demographic Aspects

(1) Population Growth

Currently, total population of Perú is 28 220 7643 inhabitants.If it is compared with the figures of the last census (1993), total population in the country increased in 5 581 321 inhabitants. Regarding the average of the annual growth rate for period 1993-2007 (1.6%), itis

shown and confirmed a tendency observed in the last 46 years, where the national population growth tends to decline[4].



Source: INEI 2007

Figure 3.2-1 Annual Rate of National Population Increase

Likewise, national population is distributed of the following way:

- Urban population: 20 810 288 inhabitants
- Rural population: 6 601 869 inhabitants

Where the population of the urban zone represents 75.9% of national population and the rural population represents 24.1%. These figures indicate that the population concentrates mainly in the urban areas; therefore they are the main generators of solid waste.

On the other hand, it is important to know that the population is distributed according to the natural geographic in the following way:

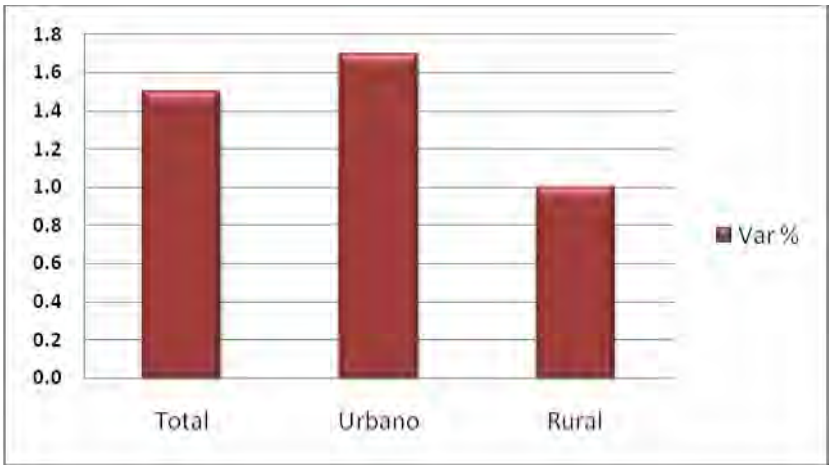
- Population of Coast: 14 973 264 inhabitants
- Population of Mountain: 8 763 601 inhabitants
- Population of Forest: 3 675 292 inhabitants

Likewise; according to the census of Population and Households of year 2007, the five regions with greater population are: Lima with 8 445 211 inhabitants which concentrates nearly third part of the national population that reaches 30.8%, Piura Region with 1 676 315 inhabitants and a participation of 6.1% of population, Region La Libertad with 1 617 050 inhabitants and 5.9%, Cajamarca region with 1 387 809 inhabitants and 5.1% and Puno 1 268 thousand 441 inhabitants (4.6%).

In contrary, the five less populated regions in 2007, are Madre de Dios with 109 555 inhabitants with 0.4% of the population, Region Moquegua with 161 533 inhabitants and a participation of 0.6% of the population, Tumbes Region that have 200 306 inhabitants and 0.7% of the population, Pasco Region with 280 449 inhabitants and participation of the 1.0%

[4] The population growth between years 1981-1993 was 2%, and between 1972-1981 was 2.6%

of the population and finally Tacna region with 288 781 inhabitants and 1.1% of total population of the country.



Source: INEI 2007

Figure 3.2-2 National Population Increase 2005 - 2007

On the other hand, it is important to emphasize that the Program of the United Nations for the development - the PNUD, has elaborated the Report on human development, which locates our country according to the following Table .

Table 3.2-1 Peru: Indicators of Human Development, 2006

Indicators	2006
Life expectancy when being born	71 years
Rate of literacy (%)[5]	88.7
Rate of Registration (%)[6]	88.1
Perceived entrance considered (U.S. $/year)	7088

Source: Report of the PNUD

(2) Economically Active population - PEA

The population in age to work or economically active population, is the population available to carry out an economic activity, is considered PEA to the people of 14 and more years old. In Peru, PEA is 19 646 652 people. In the urban area, PEA reaches 15 379 882 people and in the rural area 4 266 770 people.The economically active population is 10 637 880 people, from where 6 877 166 are men which means 64.6% and 3 760 714 are women (35.4%). From total PEA, 10 163 614 are employed and 474 266 are unemployed. In the urban area, employed PEA is 8 128 649 whereas in rural area 2 034 965 people have a job.

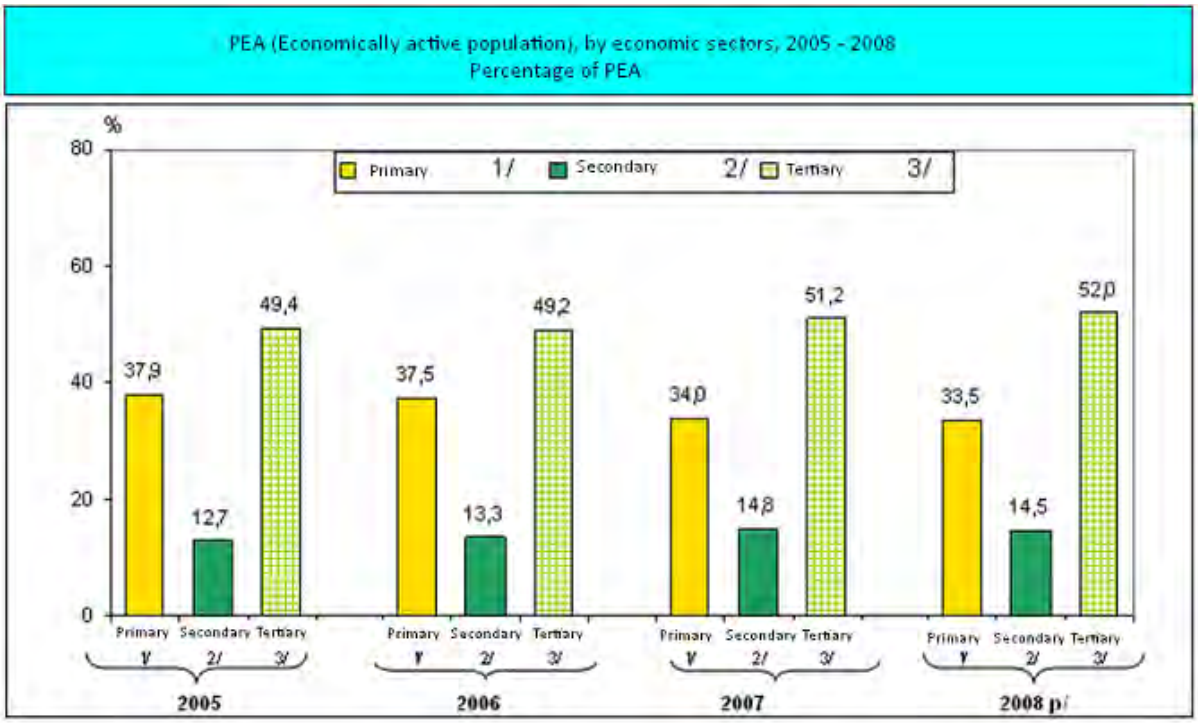
As it can be seen in the following graph, the rate of activity in 11 departments[7] is higher to the national average, for example, Madre de Dios registers a rate of activity of 65.5% and Tacna 62%. In 8 departments[8], a rate of activity is less than 50%.

[5]Literacyrate in adults (15 years or more) 1999-2006

[6]Gross Registration rate, combined between elementary, high school and college education

[7]Madre de Dios, Tacna, Moquegua, Lima, San Martìn, Arequipa, Provincia constitucional del Callao, Ica, Ucayali, Puno and Cuzco

[8] Huanuco, Lambayeque, Ayacucho, Cajamarca, Ancash, Piura, Huancavelica y Apurimac

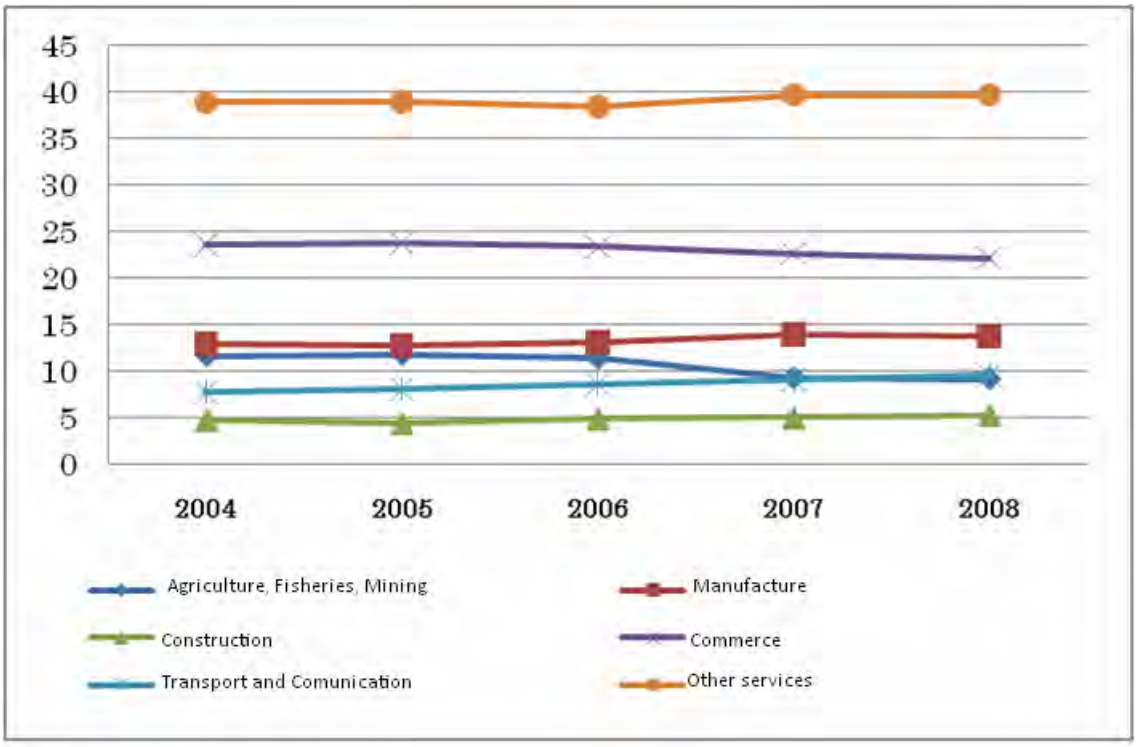


1/ Include Agriculture, Fishery and exploitation of mines and quarries.
2/ Include Manufacture and Construction
3/ Include Services
P/ Preliminar
Source: INEI-ENAHO 2005 - 2008

Figure 3.2-3 Peru: Participation Rateof PEA, 2005 -2008

However, it is interesting to emphasize that the sector which registered a major participation of PEA population in some branch or economic activity is based on the commerce, manufactures and activities like agriculture, fishing and mining, which altogether concentrates more contributions of participation of the population.

Likewise, it is important to emphasize that in the last years, an interesting process of contraction and development of diverse economic activities has been shown. In case of the commerce, agriculture, fishing and mining, reduction has being registered whilein manufacture, construction and others register a substantial increase which infers the fact of the existence of new sources of work and improvements in the quality of life which is reflected in the appearance of new activities that in the long run influence in the change of the type of wastes that we will find in future generation.



Source: INEI 2003

Figure 3.2-4 Urban Peru: Employed PEA according to field of activity 2004 - 2008

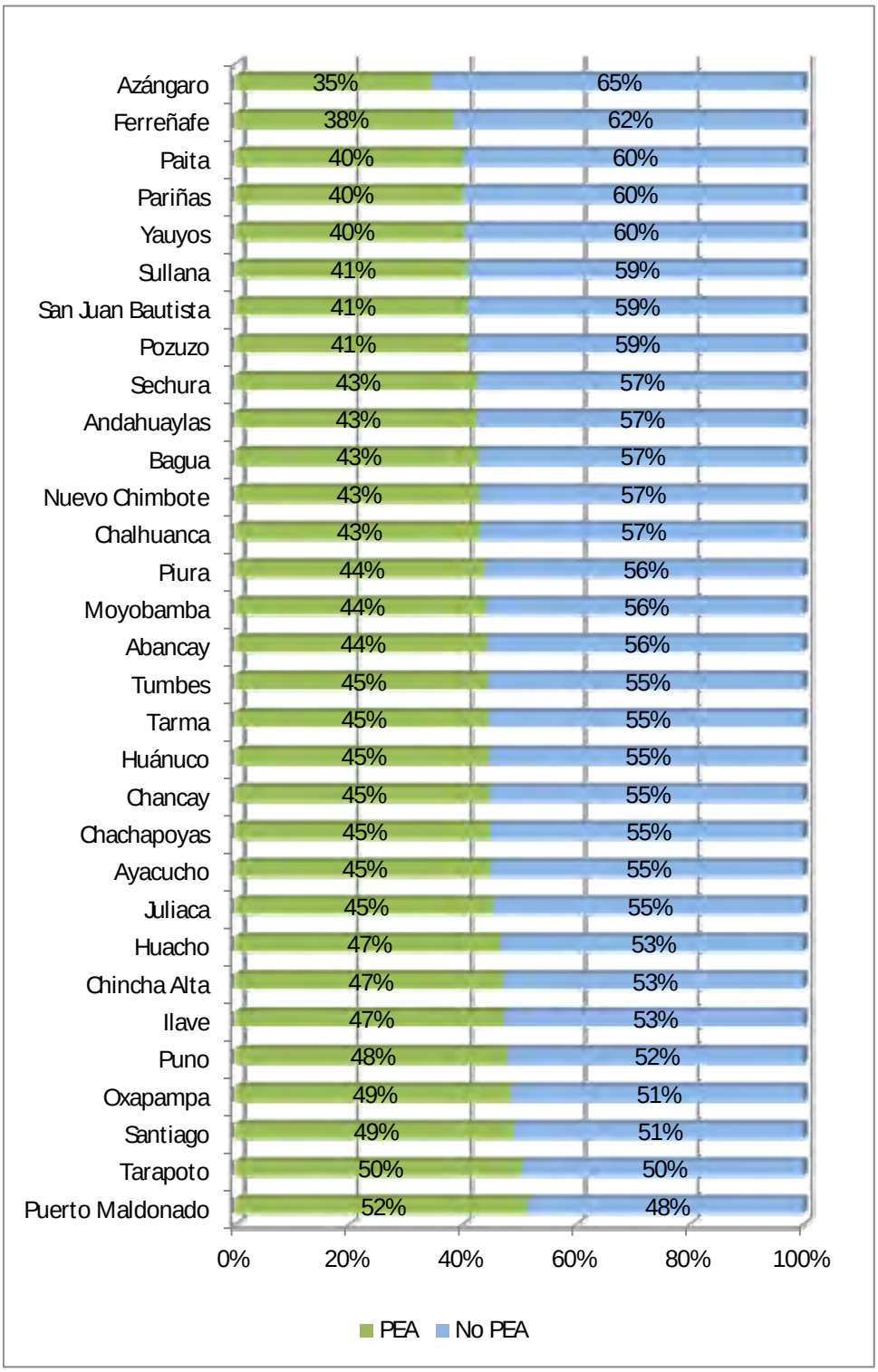
(3) Economically Active Population in the Intervention Area

This population includes the people, with more than 15 years old, in age to work, who in the week of reference were working or looking for a job.

According to the results of CENSUS 2007 elaborated by the INEI, the intervened districts present certain common characteristics with respect to the PEA, since this one mainly would be reaching more than 50% of the population in age to work. Thus, we have minimum 35% and maximum 52% for the districts of Azángaro and Puerto Maldonado respectively.

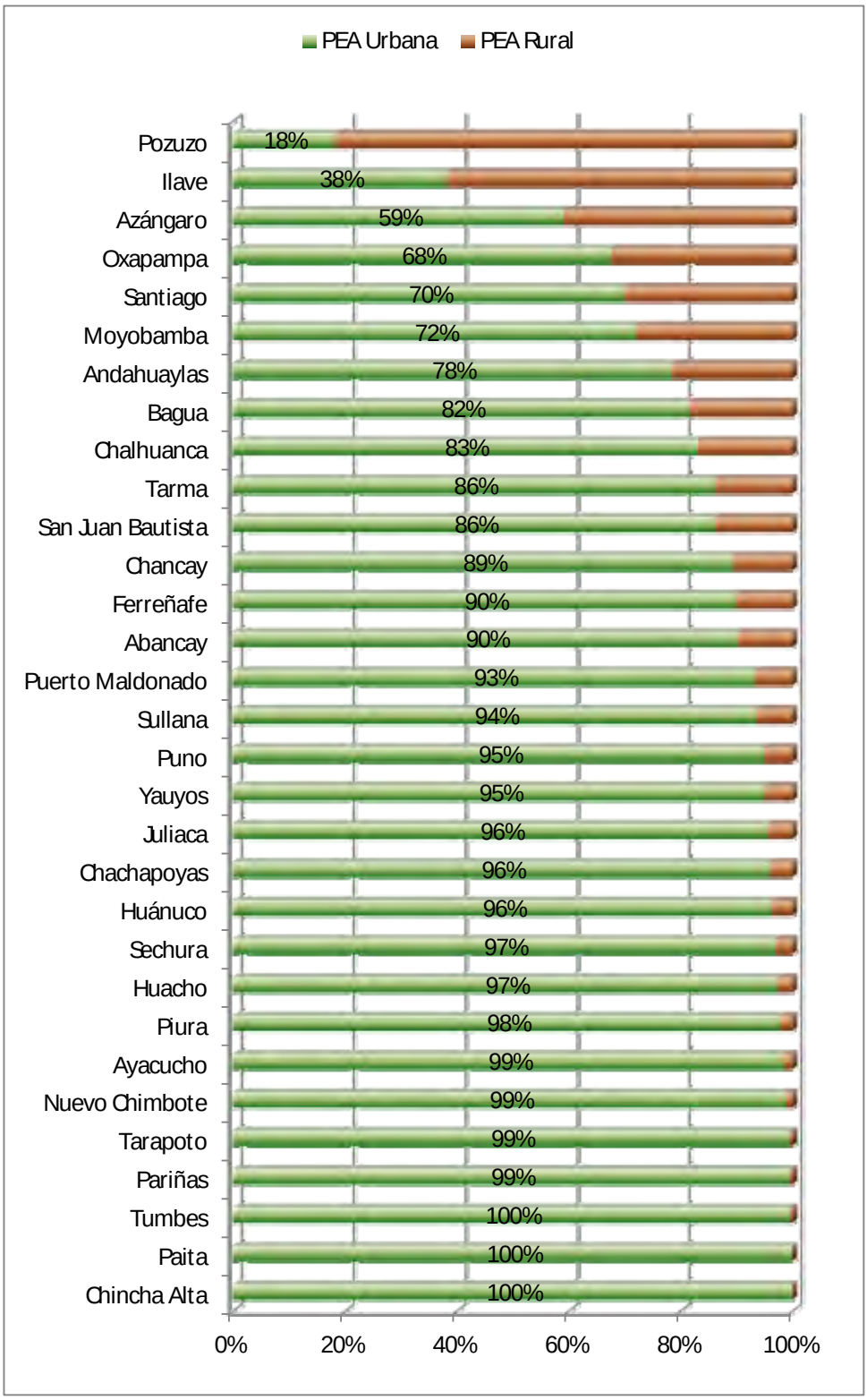
Another feature that presents these districts with respect to the PEA is that it is conformed in its majority by urban population; nevertheless this situation is different in the districts from Ilave and Pozzuoli, where PEA would be conformed mainly by rural population.

In the next graphs, it is possible to appreciatethe different characteristics from the PEA for the intervened cities:



Source: Censuses 2007 - INEI JICA survey team

Figure 3.2-5 PEA in involved Cities (%)



Source: Censuses 2007 - INEI - JICA survey team

Figure 3.2-6 Urban and Rural PEA in involved Cities

In the selected cities, Tumbes, Piura, Sullana, Ferreñafe, Tarapoto, Chachapoyas, Nuevo Chimbote, Huacho, Chincha, Abancay, Puno, Juliaca, Azángaro, Ilave, Bagua, Andahuaylas, San Juan Bautista, Pozuzo, Chancay and Yauyos, the PEA is concentrated in men between 30 and 44 years old. In the rest of cities, the PEA is significant in men between 15 to 29 years old.

In the following Table , it is possible to observe clearly that the PEA of the districts in study is represented mainly by male population. In some cases, it reaches 70% from the PEA, such in Sechura, Talara, and Paita.

Table 3.2-2 Peru: Active PEA according to Gender and Rank of age by Cities of Intervention

Scope	Men					Women				
	Total	15 to 29 years	30 to 44 years	45 to 64 years	65 AMORE years	Total	15 to 29 years	30 to 44 years	45 to 64 years	65 or more years
	%	%	%	%	%	%	%	%	%	%
Tumbes	68.50	22.87	26.08	17.01	2.53	31.50	10.21	13.56	7.05	0.69
Piura	61.19	19.98	22.59	16.48	2.14	38.81	13.35	15.30	9.39	0.77
Sullana	68.28	22.23	25.41	17.41	3.22	31.72	10.18	12.97	7.74	0.83
Talara	72.82	24.81	24.04	21.97	2.01	27.18	9.58	9.96	6.99	0.65
Sechura	71.08	30.71	23.59	14.61	2.17	28.92	13.57	9.76	5.04	0.55
Paita	72.57	28.86	27.17	14.82	1.73	27.43	11.31	10.91	4.80	0.41
Ferreñafe	68.83	20.25	24.23	20.63	3.72	31.17	9.48	12.66	8.04	0.99
Tarapoto	61.09	20.53	22.21	15.87	2.48	38.91	14.04	15.12	8.67	1.09
Moyobamba	69.43	26.14	24.74	15.54	3.02	30.57	11.59	11.98	6.14	0.86
Chachapoyas	58.04	18.06	22.40	14.80	2.78	41.96	13.39	17.63	9.29	1.64
Nvo.Chimbote	63.32	19.68	25.18	16.38	2.09	36.68	11.46	15.54	9.03	0.65
Huacho	60.42	18.26	21.52	17.16	3.48	39.58	11.76	15.36	11.03	1.42
Santiago	65.15	26.77	22.22	13.52	2.64	34.85	14.38	13.87	6.11	0.50
Chincha	62.43	21.31	22.44	15.92	2.76	37.57	12.49	14.80	9.19	1.09
Huanuco	59.41	20.13	20.94	15.24	3.11	40.59	13.44	15.88	9.87	1.40
Tarma	60.41	18.38	21.63	16.11	4.29	39.59	11.63	15.51	10.34	2.11
Abancay	56.15	18.82	21.73	13.17	2.42	43.85	15.20	17.70	9.74	1.21
Puno	55.79	16.84	21.53	15.22	2.19	44.21	13.86	17.75	11.02	1.59
Juliaca	58.50	20.75	22.46	13.43	1.86	41.50	15.55	16.10	8.62	1.23
Azángaro	59.11	15.16	20.89	17.83	5.23	40.89	12.02	15.04	10.90	2.94
Ilave	59.41	17.10	19.26	16.81	6.24	40.59	12.80	13.26	10.56	3.97
Pto.Maldonado	63.30	24.23	22.66	14.38	2.03	36.70	15.38	14.48	6.28	0.55
Bagua	58.02	18.04	20.40	16.80	2.78	41.98	19.39	11.66	9.29	1.64
Andahuaylas	61.40	18.38	22.63	16.11	4.28	39.60	11.64	15.51	10.34	2.11
San Juan Bautista	61.09	20.59	22.20	15.80	2.50	38.91	14.06	15.12	8.65	1.08
Huamanga	59.50	20.75	23.46	13.43	1.86	40.50	15.55	16.10	7.62	1.23
Oxapampa	63.43	25.12	21.74	12.54	4.03	36.57	15.59	11.98	7.14	1.86
Pozuzo	52.04	14.06	20.40	14.80	2.78	47.96	16.39	18.63	10.29	2.65
Chancay	60.38	18.22	21.52	17.16	3.48	39.52	11.70	15.36	11.03	1.43
Yauyos	55.69	16.84	21.44	15.32	2.09	44.31	23.76	17.75	2.22	0.58

Source: Censuses 2007 - INEI - Own elaboration

3.2.2 Health, Hygiene and Basic Cleaning

(1) Coverage of Drinking Water and Drainage

With the National Plan of Sanitation[9] 2006-2015, the targets for coverage of total poTable water and cleaning were settled down in 82% and 77%, respectively. The progress in the urban areas is evident, because in 10 departments already the target was reached and it is about to be accomplished in other 3 departments.

Table 3.2-3 Coverage of Services of Drinking Water and Sanitation by Departments - Urban Area 1993 - 2007

Coverage of services of Drinking water and Sanitation by departments - urban area[10], 1993 – 2007				
Department	1993		2007	
	Drinking water[11]	Sewage system[12]	Drinking water[13]	Sewage system[14]
Total	81,1	60,0	85,3	77,3
Amazonas	77,2	40,3	85,9	74,2
Ancash	83,7	59,0	92,6	84,7
Apurímac	67,5	39,8	87,3	77,7
Arequipa	87,4	60,0	91,2	80,2
Ayacucho	81,5	35,0	85,8	73,3
Cajamarca	83,6	58,6	89,5	84,4
Cusco	88,1	55,8	93,4	86,0
Huancavelica	76,0	24,7	89,7	69,4
Huánuco	73,1	51,5	80,7	75,1
Ica	86,3	51,3	85,3	70,5
Junín	83,5	48,1	86,1	73,3
La Libertad	87,0	65,5	81,8	75,2
Lambayeque	86,2	56,3	84,8	78,3
Lima	82,6	71,7	87,8	84,1
Loreto	61,2	48,2	58,8	53,8
Madre de Dios	61,8	30,1	90,3	47,5
Moquegua	85,3	67,5	97,6	85,0
Pasco	78,4	36,1	64,1	56,0
Piura	80,2	43,1	83,6	63,2
Puno	68,2	38,8	75,0	66,1
San Martin	55,4	31,1	78,2	54,9
Tacna	90,8	71,5	97,8	84,5
Tumbes	76,1	44,7	80,5	62,7
Ucayali	42,7	27,4	55,8	54,2

[9] Report “Towards the Millenium Objectives 2008”
[10] Ditto
[11] INEI, consider access to houses by the public net inside or outside the house.
[12] Ditto
[13] Ditto
[14] Ditto

However, in the rural areas there is still a long way to obtain the proposed target. Although there is more access to the drinking water, it is still less than 50% and in the case of cleaning, the progress barely constitutes 22% of the proposed target.

Table 3.2-4 Coverage of Services of DrinkingWater and Sanitationby Departments - Urban Area 1993 - 2007

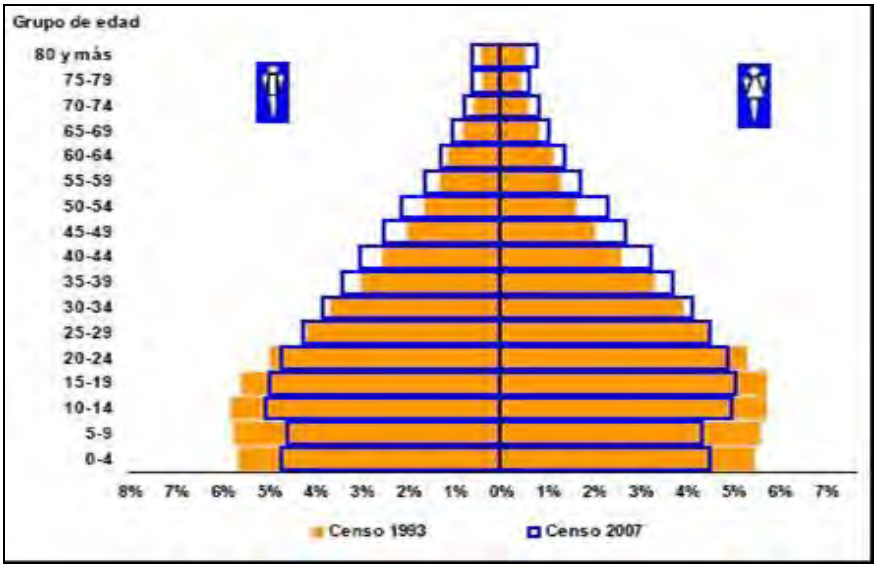
Sustainable access to the drinkingwater and services of cleaning			
Indicators	1993 (a)	2007 (b)	2015 (c)
Drinking water coverage in the urban area	81,1	85,3	87,0
Coverageof sanitation in the urban area	60,0	77,0	84,0
Drinking water coverage in the rural area	6,9	32,0	70,0
Sanitation coverage in the rural area	24,6	13,1	60,0
Total drinking water coverage	58,9	69,2	82,0
Total sanitation coverage	49,4	57,9	77,0

(a) INEI, Census 1993.
(b) INEI, Census 2007. It does not consider septic tank in sanitation in the rural area
(c) Cleaning Plan2006-2015

(2) Infant Mortality

The national average of dead children is 18.7 ‰, which means 19 children dead by each 1000 women. On the other hand, it is observed that the average of children who died in the urban area is 13.2 ‰ and in the rural area reaches levels up to 39.1 ‰.

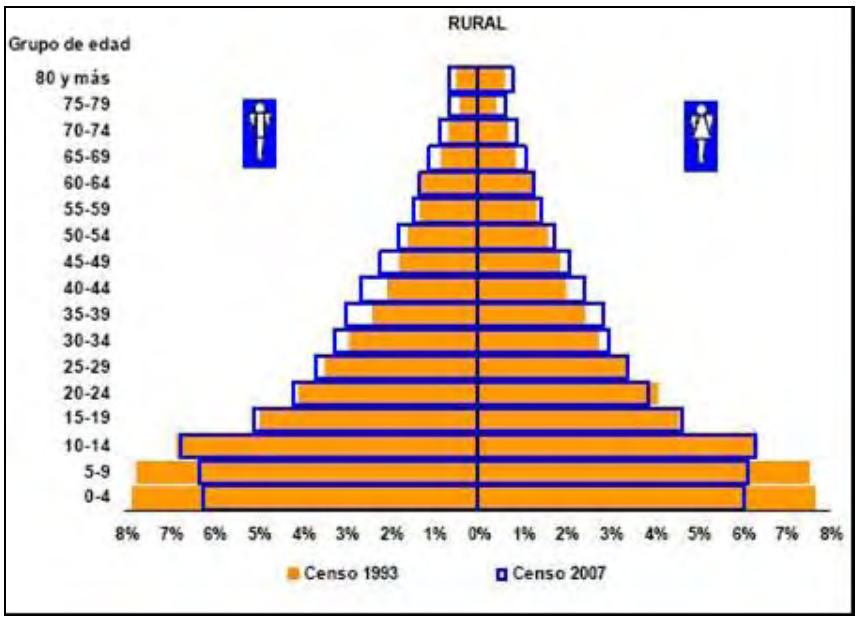
If it is analyzed by region, 16 regions are over the national average, as it is the case of Huancavelica (43.1 ‰), Ayacucho (38 ‰), Apurímac (36.9 ‰) etc. The regions that are below the national average are: Arequipa (13.5 ‰), Tacna (11.5 ‰), and Lima with (9.1 ‰).



Source: INEI 2007

Figure 3.2-7 Urban Peru: Pyramid of Population 1993 - 2007

Also, it is important to emphasize the impact on the current population, in the urban zones as well as in rural areas, which are shown as follows:



Source: INEI 2007

Figure 3.2-8 Rural Peru: Pyramid of Population 1993 - 2007

(3) Morbidity

The morbidity ratio in Peru is related mainly to infections, the 10 first causes of morbidity in Peru (2007)[15] are:

- Severe infections of the superior respiratory tract
- Diseases of the buccal cavity, the salivary glands and maxilares
- Intestinal infectious diseases
- Other severe infections of the inferior respiratory tract
- Helminthiasis
- Other diseases of the urinary system
- Chronic diseases of the inferior respiratory tract
- Undernourishment
- Diseases of the esophagus, the stomach and the duodenum.
- Dermatitis and eczema.

In the following Table , it can be seen the mobility ratio in the scope of the study of Development Program for the development of solid waste management systems in priority areas:

[15] Ministry of Health, General Office of Statistics and information

Table 3.2-5 Main Causes of Morbidity Registered in External Consultation - Year 2008

Nº	Causas de morbilidad	Tumbes	Piura	Sullana	Talara	Sechura	Paita	Ferreñafe	Tarapoto	Moyobamba	Chachapoyas	Nvo Chimbote
1	Infecciones agudas de las vías respiratorias superiores (J00-J06)	15,70%	26,63%	21,19%	29,44%	45,11%	34,07%	23,04%	11,97%	20,88%	20,27%	13,29%
2	Enfermedades infecciosas intestinales (A00-A09)	4,73%	6,64%	6,38%	9,27%	8,01%	7,14%	6,55%	4,50%	5,35%	4,64%	2,19%
3	Enfermedades de la cavidad bucal, de las glándulas salivales y de los maxilares (K00-K14)	11,13%	7,88%	5,98%	12,59%	6,43%	3,61%	6,83%	8,19%	3,85%	10,00%	5,70%
4	Helmintiasis (B65-B83)	1,26%	2,94%	2,53%	2,40%	1,87%	4,83%	1,44%	3,69%	10,39%	4,32%	0,66%
5	Otras infecciones agudas de las vías respiratorias inferiores (J20-J22)	4,38%	3,08%	3,13%	6,79%	3,78%	4,00%	3,51%	1,95%	1,76%	3,04%	2,77%
6	Otras enfermedades del sistema urinario (N30-N39)	5,33%	5,54%	5,47%	5,09%	5,05%	7,06%	5,94%	3,09%	5,74%	4,13%	2,09%
7	Anemia nutricionales (D50-D53)	0,54%	1,03%	1,57%	0,38%	0,16%	3,08%	0,96%	1,68%	2,92%	0,35%	0,73%
8	Anemias aplásticas y otras anemias (D60-D64)	0,38%	0,10%	0,19%	0,52%	0,15%	0,00%	-	0,88%	0,70%	0,30%	0,02%
9	Desnutrición (E40-E46)	0,52%	0,88%	0,87%	0,48%	0,40%	0,80%	0,14%	1,24%	0,79%	0,08%	1,28%
10	Trastornos de otras glandulas endocrinas (E20-E35)	0,79%	0,47%	0,06%	0,00%	0,28%	0,01%	0,37%	1,10%	0,87%	0,24%	0,60%
11	Infecciones de la piel y del tejido subcutáneo (L00-L08)	1,89%	1,89%	1,06%	0,94%	1,76%	1,67%	1,21%	1,80%	2,38%	0,92%	1,09%
12	Enfermedades debidas a protozoos (B50-B64)	0,71%	0,02%	2,17%	0,01%	0,01%	0,02%	0,25%	0,47%	0,28%	0,21%	0,02%
13	Trastornos de la conjuntiva (H10-H13)	0,28%	0,59%	0,51%	0,44%	0,16%	0,58%	0,97%	0,85%	1,36%	1,75%	1,59%
14	Otros trastornos maternos relacionados principalmente con el embarazo (O20-O29)	3,83%	2,44%	3,47%	0,00%	1,40%	1,26%	2,04%	3,20%	1,70%	1,17%	1,36%
15	Micosis (B35-B49)	0,97%	1,58%	1,46%	0,92%	1,43%	2,98%	1,41%	1,83%	2,65%	1,53%	1,18%
16	Enfermedades del esófago, del estómago y del duodeno (K20-K31)	1,59%	2,91%	1,19%	1,01%	1,74%	2,33%	2,46%	1,38%	2,71%	2,72%	2,81%
17	Traumatismos de parte no especificada del tronco, miembro o región del cuerpo (T08-T14)	0,33%	0,48%	0,31%	0,04%	0,31%	0,45%	0,05%	0,37%	0,85%	0,52%	1,20%
18	Parto (O80-O84)	0,82%	1,38%	0,49%	1,23%	0,58%	0,21%	0,39%	0,07%	0,22%	1,62%	0,29%
19	Enfermedades crónicas de las vías respiratorias inferiores (J40-J47)	1,57%	1,94%	2,12%	1,45%	1,58%	1,41%	4,92%	3,28%	1,22%	1,74%	1,47%
20	Dermatitis y eczema (L20-L30)	0,53%	0,92%	1,28%	1,47%	0,86%	0,95%	1,39%	1,20%	1,77%	2,06%	1,79%
21	Traumatismos de la cabeza (S00-S09)	0,08%	0,61%	0,66%	0,81%	1,13%	0,52%	2,05%	0,87%	0,53%	0,98%	0,76%
22	Infecciones con modo de transmisión predominantemente sexual (A50-A64)	1,02%	1,30%	1,79%	1,38%	0,20%	1,60%	1,03%	1,85%	0,60%	0,35%	0,62%
23	Obesidad y otros tipos de hiperalimentación (E65-E68)	1,38%	0,53%	0,21%	0,07%	0,09%	0,03%	1,49%	0,31%	0,19%	0,19%	5,28%
24	Enfermedades inflamatorias de los órganos pélvicos femeninos (N70-N77)	2,10%	0,62%	1,51%	1,76%	1,08%	1,43%	1,39%	3,33%	1,83%	2,54%	3,81%
25	Trastornos no inflamatorios de los órganos genitales femeninos (N80-N98)	2,16%	0,79%	0,79%	0,30%	0,81%	0,52%	0,95%	2,58%	1,08%	1,50%	1,45%
26	Pediculosis, acariasis y otras infestaciones (B85-B89)	0,17%	0,29%	0,28%	0,40%	0,51%	0,59%	0,50%	0,17%	0,41%	0,33%	0,31%
27	Otras dorsopatías (M50-M54)	1,96%	2,51%	1,74%	1,11%	2,66%	3,35%	3,33%	1,66%	1,97%	2,93%	2,04%
28	Enfermedades del oído medio y de la mastoides (H65-H75)	0,35%	0,72%	0,57%	0,56%	2,31%	0,43%	0,59%	0,74%	0,82%	0,85%	0,85%
29	Enfermedades hipertensivas (I10-I15)	1,33%	1,08%	0,90%	0,38%	0,50%	0,55%	0,76%	1,21%	0,48%	1,41%	1,47%
30	Trastornos episódicos y paroxísticos (G40-G47)	0,70%	0,68%	0,77%	0,69%	0,21%	0,78%	0,73%	1,55%	0,78%	1,42%	1,47%
31	Entre otras causas	31,50%	21,51%	29,37%	18,08%	9,43%	13,75%	23,32%	32,96%	22,92%	25,91%	39,82%

Source:Ministry of Health - MINSA.Office of Statistic and Computer science.Year 2008
Own elaboration

Table 3.2-6 Main Causes of Morbidity Registered in External Consultation - Year 2008

Nº	Causas de morbilidad	Huacho	Ica	Chincha	Huánuco	Tarma	Abancay	Puno	Juliaca	Azangaro	Ilave	Pto Maldonado
1	Infecciones agudas de las vías respiratorias superiores (J00-J06)	11,98%	19,65%	13,70%	26,82%	18,74%	24,45%	19,41%	34,03%	19,94%	27,58%	17,33%
2	Enfermedades infecciosas intestinales (A00-A09)	2,18%	4,15%	3,47%	6,85%	4,39%	5,45%	4,08%	3,33%	4,21%	2,66%	6,24%
3	Enfermedades de la cavidad bucal, de las glándulas salivales y de los maxilares (K00-K14)	6,40%	13,83%	5,22%	6,96%	15,85%	13,47%	19,19%	9,14%	6,82%	14,94%	15,27%
4	Helmintiasis (B65-B83)	1.02%	1,58%	1,62%	2,35%	2,11%	2,13%	0,50%	0,78%	0,54%	0,41%	3,57%
5	Otras infecciones agudas de las vías respiratorias inferiores (J20-J22)	1,59%	3,06%	3,97%	2,14%	4,27%	1,30%	3,25%	6,87%	9,06%	3,53%	1,85%
6	Otras enfermedades del sistema urinario (N30-N39)	3,14%	2,72%	4,01%	4,84%	1,32%	4,19%	2,24%	2,26%	4,00%	2,11%	3,38%
7	Anemia nutricionales (D50-D53)	0,62%	0,41%	0,08%	0,95%	0,24%	0,33%	0,21%	0,11%	0,12%	0,07%	0,67%
8	Anemias aplásticas y otras anemias (D60-D64)	0,94%	0,25%	0,76%	0,01%	0,14%	0,06%	0,06%	0,05%	0,06%	0,01%	0,45%
9	Desnutrición (E40-E46)	0,33%	0,66%	0,80%	0,21%	1,27%	0,72%	1,23%	0,68%	1,93%	0,55%	0,72%
10	Trastornos de otras glandulas endocrinas (E20-E35)	0,39%	0,13%	0,46%	0,64%	1,62%	2,60%	1,14%	1,59%	4,03%	2,27%	0,55%
11	Infecciones de la piel y del tejido subcutáneo (L00-L08)	0,68%	1,03%	0,80%	0,90%	0,85%	0,88%	0,65%	1,15%	0,68%	1,55%	3,21%
12	Enfermedades debidas a protozoos (B50-B64)	0,04%	0,01%	0,01%	0,10%	0,07%	0,07%	0,03%	0,11%	0,12%	-	0,76%
13	Trastornos de la conjuntiva (H10-H13)	0,84%	0,66%	0,39%	1,61%	1,77%	1,19%	2,20%	2,81%	1,57%	2,94%	1,00%
14	Otros trastornos maternos relacionados principalmente con el embarazo (O20-O29)	0,68%	1,97%	2,31%	0,73%	0,66%	0,63%	2,69%	1,79%	0,69%	0,20%	2,49%
15	Micosis (B35-B49)	0,76%	1,03%	0,96%	2,75%	0,78%	2,25%	0,68%	0,95%	0,94%	0,87%	3,81%
16	Enfermedades del esófago, del estómago y del duodeno (K20-K31)	3,14%	1,66%	3,97%	4,84%	3,17%	3,92%	2,90%	2,82%	2,90%	3,67%	1,71%
17	Traumatismos de parte no especificada del tronco, miembro o región del cuerpo (T08-T14)	0,48%	0,61%	0,10%	0,27%	0,75%	0,31%	0,22%	0,29%	1,19%	1,61%	0,39%
18	Parto (O80-O84)	0,05%	0,85%	-	0,61%	0,01%	0,08%	0,10%	0,19%	4,25%	1,78%	0,06%
19	Enfermedades crónicas de las vías respiratorias inferiores (J40-J47)	4,14%	2,06%	3,46%	1,10%	1,75%	2,54%	1,65%	2,36%	2,68%	4,98%	1,51%
20	Dermatitis y eczema (L20-L30)	1,94%	3,09%	1,38%	1,55%	1,05%	1,62%	1,45%	2,11%	1,18%	1,91%	1,53%
21	Traumatismos de la cabeza (S00-S09)	0,55%	1,17%	1,13%	1,04%	1,31%	1,18%	1,40%	1,12%	0,62%	1,65%	1,09%
22	Infecciones con modo de transmisión predominantemente sexual (A50-A64)	0,95%	0,38%	2,79%	1,37%	1,39%	1,32%	0,51%	1,23%	1,33%	0,75%	1,68%
23	Obesidad y otros tipos de hiperalimentación (E65-E68)	1,81%	1,65%	2,04%	0,02%	0,49%	0,40%	1,10%	0,72%	11,33%	1,11%	2,12%
24	Enfermedades inflamatorias de los órganos pélvicos femeninos (N70-N77)	2,52%	3,47%	3,20%	1,88%	1,02%	2,51%	1,08%	1,30%	0,53%	0,25%	1,31%
25	Trastornos no inflamatorios de los órganos genitales femeninos (N80-N98)	2,23%	1,83%	2,65%	0,71%	0,56%	0,94%	0,79%	0,66%	0,79%	0,48%	0,83%
26	Pediculosis, acariasis y otras infestaciones (B85-B89)	0,17%	0,12%	0,16%	0,51%	0,26%	0,51%	0,12%	0,71%	0,27%	0,50%	0,80%
27	Otras dorsopatías (M50-M54)	2,99%	1,63%	2,43%	3,92%	1,65%	3,56%	0,98%	1,37%	1,03%	1,18%	1,66%
28	Enfermedades del oído medio y de la mastoides (H65-H75)	0,71%	0,48%	0,36%	0,55%	0,64%	0,66%	0,49%	0,48%	0,38%	0,41%	0,72%
29	Enfermedades hipertensivas (I10-I15)	1,74%	1,07%	1,19%	0,62%	0,49%	0,33%	0,63%	0,16%	0,43%	0,15%	1,00%
30	Trastornos episódicos y paroxísticos (G40-G47)	0,48%	0,64%	0,95%	1,20%	0,53%	1,67%	1,14%	0,65%	0,80%	0,56%	0,85%
31	Entre otras causas	45,54%	28,14%	35,62%	21,94%	30,84%	18,72%	27,88%	18,16%	15,60%	19,33%	21,44%

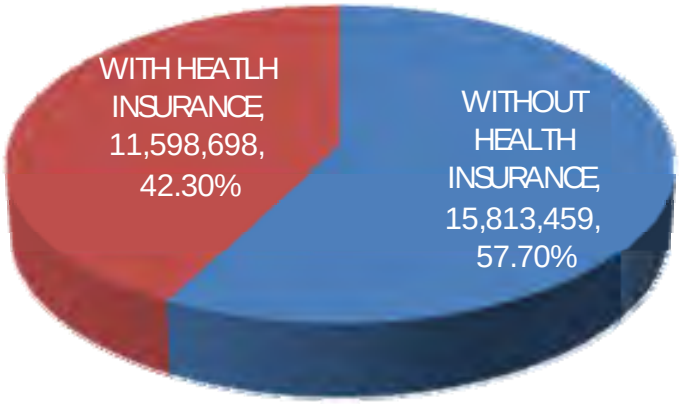
Source:Ministry of Health - MINSA.Office of Statistic and Computer science.Year 2008
own elaboration

It is necessary to point out that the diseases of the superior respiratory tract and the intestinal infectious diseases are the main causes of morbidity in children of less than 1 year and also in the pre-school category (1 to 4 years old). The scholastic category (5 to 17 years) besides undergoing of superior respiratory tract diseases, also suffers diseases of the buccal cavity of the salivaryglands and maxilares, and other diseases of the respiratory apparatus.

The adults between 20 and 64 years old mainly suffer diseases of the feminine genital organs, and the elderly peoples (more than 65 years old) suffer diseases of the osteomusclesystem and the conjunctive weave, diseases of the digestive apparatus and other diseases of the respiratory apparatus.

(4) Health Insurance

In the country only 42.3% of the population count health insurance, which means 11,598,698 people, while 57.7% of the population are unprotected.



Source:INEI Census 2007.

Figure 3.2-9 Population that Counts on Health Insurance

On the other hand,there are noticeable differences between the areas (urban or rural) regarding social insurance cover of the population. Of the total insured, 8 748 433 people reside in an urban area (75,43%), while in rural area only 2 850 265 have some type of insurance (24,57%).

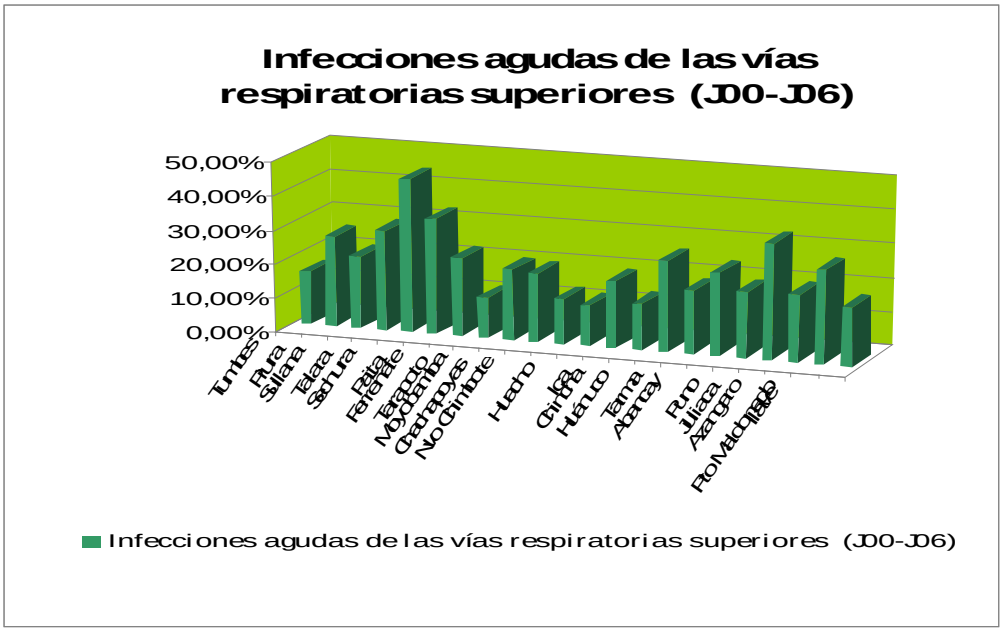
The results of census 2007 show that men as well as women accede almost in the same proportion to a health insurance, 42.1% and 42.5% respectively even though there are different types of insurances. 18.4% of the insured population are protected by the Integral Insurance of Health (SIS), 17.4% counts with social insurance (ESSALUD), 5.9% counts on private insurance of health, insurance of the Armed Forces and police officers and university insurance. On the other hand, only 0.5% has ESSALUD insurance besides a private insurance.

(5) Diseases related to Solid Waste Management

Solid waste and their inadequate management present evident environmental effects (soil degradation, water contamination (surface and underground) and influences in the quality of the air). It also show close relation with the incidence of diseases especially those related to skin infections and respiratory affections, which brings an increase in the morbidity ratios because of risk factors which precipitate conditions for the proliferation of diseases.

1) AcuteInfections of the Upper Respiratory Tract

The severe acute respiratory infections known as SARS, are considered one of the affections that present high morbidity and the low mortality in the underdeveloped countries. Between the factors that determine the acute infections of the superior respiratory tract are the increase of the atmospheric pollution, since in the air there are mainly injurious agents, organic particles, gases, humus, microorganisms, virus, fungi, humidity, among others factors. The lack of awareness of the population and the inadequate solid waste management is one of the factors that directly affect the respiratory tract as it is established in the Report No. 125 of the Ombudsman[16].



Source: MINSA 2008.

Figure 3.2-10 Acute infections of the Superior Respiratory Tract in Some Parts of the Program

The highest incidences of acute infections of the respiratory tract appear in the districts of Sechura (45.11% of total cases), while Paita and Juliaca show 34% of total cases.

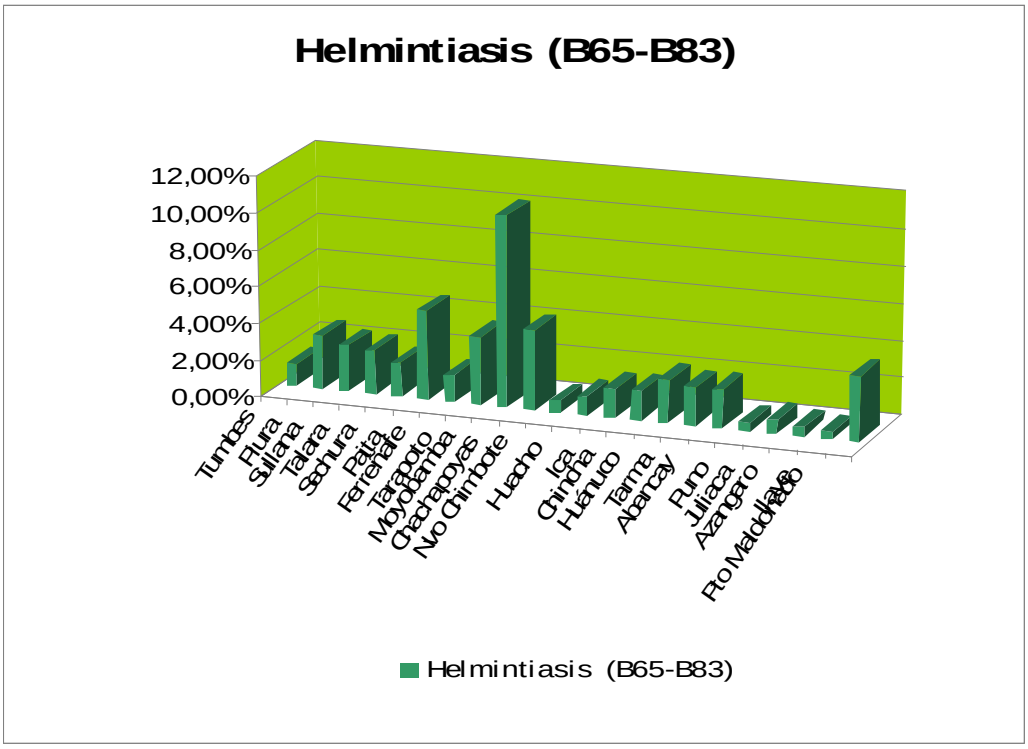
The cities of Talara, Ilave, Huánuco, Piura, Abancay, Ferreñafe, Sullana, Moyobamba, Chachapoyas, oscillate between 20 to 29% of cases from total population. The lowest value within the scope of influence of the program is 11.97% of the population.

[16] People Defensory – Defensory Report "Let`s putt he waste in its place". Proposal for municipal solid waste management. Year 2007.

2) The Helminthiasis

The intestinal Helminthiasis is one of the diseases related to basic cleaning issues. The impact of the helmints in the population varies according to the climatic and epidemiologists conditions. This present in cities where cleaning deficiencies exist, therefore the inadequate solid waste management is one of the mostimportant causes. These parasites are present where a high degree of "fecal environment" exists.

The district with greater incidence in helminthiasis is Moyobamba with 10.39% of registered cases. The cities of Paita, Chachapoyas,Tarapoto are districts that show more cases in external consultation by helminthiasis and in the case of Ilave has the lowest affectation.

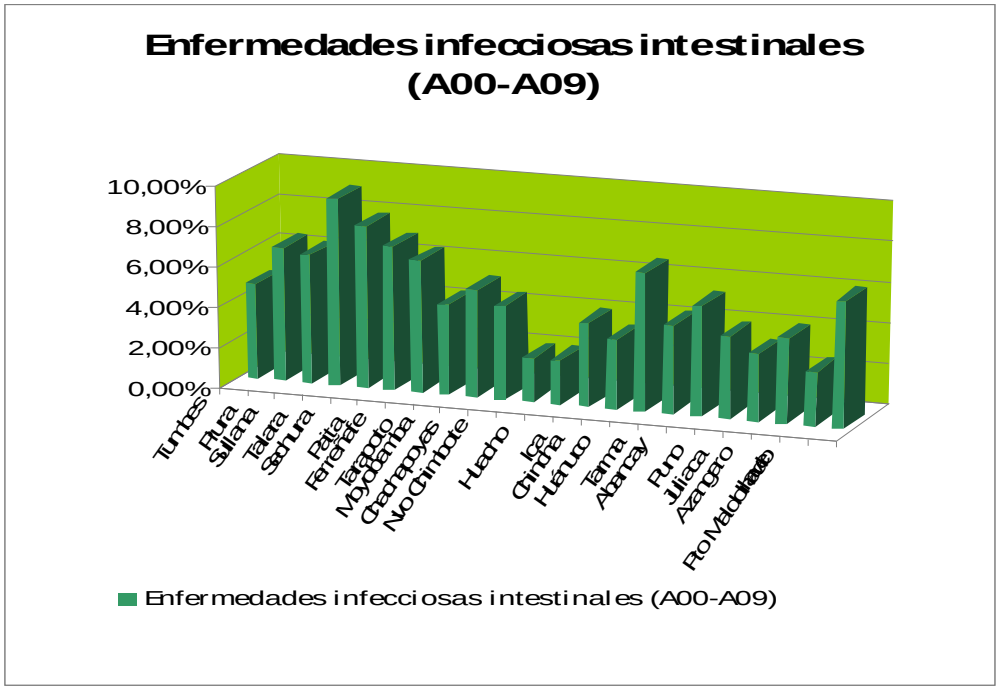


Source:MINSA 2008
Own elaboration

Figure 3.2-11 The Helminthiasisin Some Localities Leaves from the Program

3) Intestinal Infectious Diseases

The intestinal infectious diseases are directly related to the inadequate solid waste management. Next, the number of cases expressed in % of the total population by regional governments:



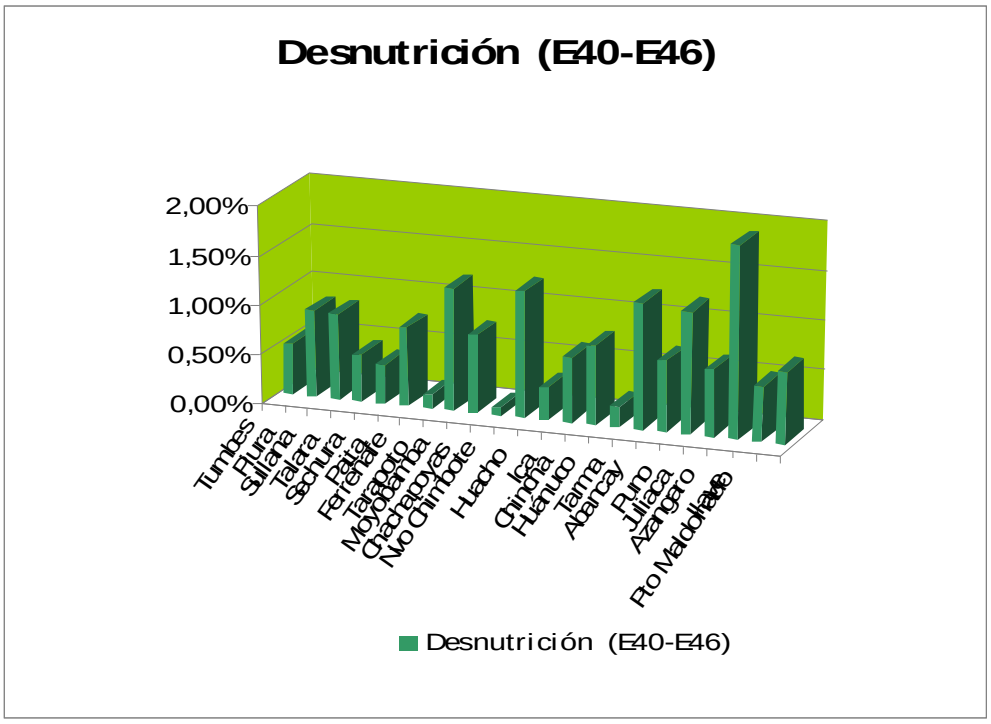
Source: MINSA 2008
Own elaboration

Figure 3.2-12 Intestinal Infectious Diseases in partly of the Scope of the Program

It is possible to be observed that the cities of Talara (9.27% of cases), Sechura (8.01% of cases) and Paita (7.14% of cases) present the incidence of cases in intestinal infectious diseases. The cities of Huánuco, Piura, Ferreñafe, Puerto Maldonado are around 6% of the total of cases in comparison with the cities of Moyobamba and Abancay that present around 5% of the total of cases. The city of Huacho presents the smaller incidence of cases of intestinal diseases infected of all the scope of the program.

4) Malnutrition

Solid waste by the inadequate management that receives, contributes to the appearance of gastrointestinal infectious diseases and which can come up with undernourishment cases by the diarrheal processes and parasitism. The incidence of cases of undernourishment can be observed as follows:



Source:MINSA 2008
own elaboration

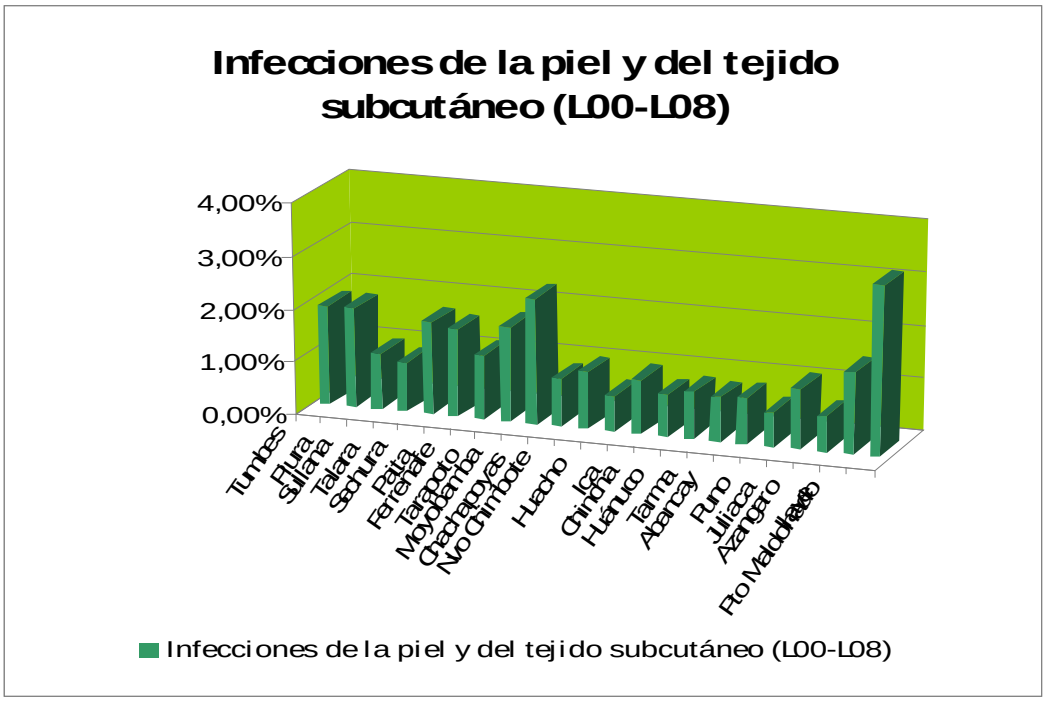
Figure 3.2-13 Levels of Malnourishment in some areas of the Program

Of the previous graph it is possible to be observed that the incidence of cases in Azángaro in 2008 is bigger than the rest of cities that belong to the program, with a 1.93% of the total cases.

The cities Nuevo Chimbote, Tarma, Tarapoto, Puno, register around 1% of the total cases. The district of Chachapoyas has the lowest incidence of undernourishment within the scope of the program represented by a 0.41% of the total cases.

5) Skin and Subcutaneous Weave Diseases

The diseases to the skin and of the subcutaneous weave also are caused by the inadequate solid waste management, either by the direct bonding with the wastes or indirect way through the presence of vectors (flies, birds, cats, dogs, mice). Next, the incidence of the diseases the skin and the subcutaneous weave within the regional governments of intervention of the program:



Source: MINSA 2008
Own elaboration

Figure 3.2-14 Infections of the Skin and the Subcutaneous Tissue in parts of the Scope of the Program

It is possible to be observed from the previous graph that the city with greater incidence of cases within the scope of the program is Puerto Maldonado, represented by 3.21% of the total cases. Also, the lowest incidence registered in infections of the skin and the weave represents the city of Puno with a 0.65% of the total cases. On the other hand the city of Moyobamba has 2.38% of the total of registered cases. The cities of Tumbes, Piura, Tarapoto, Sechura, Paita, Ilave, Ferreñafe, Juliaca, Nuevo Chimbote, Sullana, Ica present incidences around 1% of the total cases.

3.2.3 Characteristics of the Houses and Urban Surroundings

The housesare associated to the conditions of life of the homes and the population in general. Census 2007 reveals that there are 7 583 140 houses in Peru. From this total, 7 566 142 are particular houses and 16 998 are collective houses.

In the urban area a total of 5 343 331 particular houses exists, figures higher than 1 909 457 houses with respect to year 1993, which represents an increase of 55.6%. The collective houses in the urban area are 15 657, while in year 1993 there were 6 155 which represents a growth of 154.4% for the same intercensus period.

In the rural area, the Census of the 2007, demonstrates that the particular houses were 2 222 811 houses, having increased in 557 093 houses in relation to the Census of year 1993, which means, a growth of 33.4%.

At Regional level, it is important to emphasize that the departments with the greater number of particular houses are Lima (2.123,751 units), Puno (498.658 units), La Libertad (416.064 units), Cajamarca (412.375 units), Piura (408.419 units), Cusco (358.498 units), Junín

(348,571 units), Arequipa (343,631 units) and Ancash (314,221 units). In relation to the collective houses, the greater number of these is in Lima (3,859 Units), Arequipa (1,176 units), Cusco (1,094 units), Piura (886 units), Ancash (864 units),La Libertad(848 units), Junín (776 units), Loreto (759 units) and Puno (750 units).

Table 3.2-7 Number of Particular, Collective Houses and of Another Type Registered, according to Department, 2007

Department	Total	House		
		Individual	Collective	Another type
Amazonas	112,916	112,680	205	31
Ancash	315,085	314,221	762	102
Apurimac	148,280	148,069	183	28
Arequipa	344,807	343,631	948	228
Ayacucho	223,301	222,831	384	86
Cajamarca	413,115	412,375	685	55
Prov.Const.Of Callao	212,856	212,608	236	12
Cusco	359,592	358,498	968	126
Huancavelica	157,070	156,819	199	52
Huánuco	226,776	226,367	368	41
Ica	198,003	197,493	466	44
Junín	349,347	348,571	645	131
La Libertad	416,912	416,064	726	122
Lambayeque	268,716	268,235	407	74
Lima	2,127,610	2,123,751	3,625	234
Loreto	184,393	183,634	707	52
Madre de Dios	30,472	30,201	231	40
Moquegua	57,753	57,549	187	17
Pasco	78,121	77,677	395	49
Piura	409,305	408,419	823	63
Puno	499,408	498,658	632	118
San Martin	191,485	191,032	397	56
Tacna	99,981	99,665	296	20
Tumbes	55,502	55,348	147	7
Ucayali	102,334	101,746	559	29
TOTAL	**7,583,140**	**7,566,142**	**15,181**	**1,817**

Source: INEI, Census 2007

The information of the type of house helpsto define the conditions in which it will be selected the mechanisms of collection and transport of solid waste since they are possible to be decided on conventional systems.

(1) Construction Material of the Houses

According to the analysis of census 2007, from the 6 400 131 particular houses with present occupants, 2 991 627 have like main material in the outer walls bricks or blocks of cement, which represents 46.7% of the total, while 2 229 715 houses have as predominant construction material the adobe or mud wall, which represents 34.8% of the total. On the other hand, houses constructed with wood also exist, that represent 9.7%, constructed with

quincha 2.9%, constructed with mats 2.3%, and finally the houses constructed with stone and mud (the 1.7% of the total). Therefore, under an approach of incidence of the diseases related to the wastes management, it is important to emphasize that the construction material of the houses, like solid waste, has an important contribution in the incidence of diseases related to infections to the acute respiratory tract and diseases to the skin and of the subcutaneous weave.

According to the study, the predominant material in the walls of the houses of the urban area is the cement brick or block, that represents 61.1%; followed of the adobe or mud wall that represents 23.5%; while in the rural area the predominant materials in the outer walls of the houses are the adobe or mud wall (68.5%) and the wood (14.0%).

At regional level, the region Lima, has the greater percentage (78.3%) of houses with outer walls of bricks or cement block, followed by the departments of Tacna and Arequipa with 73.4% and 70.0%, respectively. The second more used material nationwide in the walls of the houses is adobe or mud wall and the departments with greater percentage of houses with this material are: Apurímac (87.5%), Huancavelica (86.5%), Cajamarca (76.7%) and Cusco (76.2%). Of another side, Ucayali with 77.6%, Loreto with 66.6% and Madre de Dios with 62.2%, show a greater percentage of houses with wood walls.

(2) Construction Material in the Scope of the Program

Of the considered cities, in 12 of them, the predominant material used in the construction of walls of the house is cement brick or block is the case of Puno (68.54%), Juliaca (64.93%), Ayacucho (52.6%), Piura (69.17%), Sullana (53.73%), Paita (59.58%), Talara (75.1%), Sechura (65.86%), Tumbes (51%), Nuevo Chimbote (70.76%), Huaura (65.84%), Chancay (62.01%) and Tarapoto (57.15%); in 11 cities, Ilave, Abancay, Aymaraes, Andahuaylas, Ferreñafe, Santiago, Yauyos, Tarma, Huánuco, Chachapoyas and Baugua, the used material is the adobe; and, in 03 cities, Puerto Maldonado, San Juan Bautista and Pozuzo, are used mainly, wood.

It is possible to emphasize, that in cities of Sullana, Paita and Moyobamba, the Quincha is used. See the following Table .

Table 3.2-8 Characteristics of the Houses

Material de construcción predominante en las paredes

Material	Puno	Juliaca	Ilave	Azangaro	Puerto Maldonado	Abancay	Aymaraes	Andahuaylas	Ayacucho	Piura	Sullana	Paita	Talara	Sechura	Tumbes	Ferreñafe	Nuevo Chimbote	Huaura	Chanchay	Chincha Alta	Santiago	Yauyos	Oxapampa	Tarma	Huanuco	Moyobamba	Tarapoto	Chachapoyas	San Juan Bautista	Bagua	Pozuzo
Ladrillo o Bloque de cemento	68.54	64.93	24.94	17.91	46.62	25.95	12.8	29.66	52.6	69.17	53.73	59.58	75.10	65.86	51.00	36.04	70.76	65.84	62.01	38.47	31.09	48.51	31.31	34.32	49.53	39.57	57.15	30.53	35.81	37.83	16.79
Adobe o tapia	29.67	34.45	73.14	79.70	0.62	73.10	84.08	68.51	45.79	6.33	23.17	10.03	0.65	1.69	9.69	57.15	0.46	22.19	22.05	35.5	41.46	51.14	1.28	63.7	49.42	5.41	36.59	66.41	0.47	52.71	13.2
Madera	0.10	0.08	0.07	0.05	49.56	0.34	0.23	0.92	0.13	6.43	2.10	3.49	19.79	4.47	4.04	0.14	4.10	1.51	1.89	1.15	0.80	0.2	64.7	0.12	0.24	27.27	1.71	0.46	59.6	2.44	66.73
Quincha	0.06	0.07	0.01	0.03	0.15	0.12	0.15	0.16	0.06	2.07	17.37	17.00	0.32	8.04	30.17	1.42	0.13	4.15	0.89	0.92	16.36		0.62	0.27	0.18	25.81	1.12	1.87	0.1	5.9	0.62
Estera	0.03	0.02	0.01	0.08	0.20	0.04	0.08	0.06	0.06	13.01	1.45	4.51	0.51	17.75	0.41	4.04	22.73	5.61	12.22	18.88	8.24		0.14	0.02	0.01	0.23	0.23	0.08	2.91	0.08	0.37
Piedra con barro	0.68	0.20	1.56	2.07	0.02	0.22	2.59	0.2	0.97	0.10	0.29	0.22	0.11	0.12	0.84	0.2	0.04	0.06	0.1	0.01	0.09	0.05	0.08	0.81	0.27	0.17	0.4	0.31	0.03	0.29	0.87
Piedra o Sillar con cal o cemento	0.10	0.06	0.13	0.08	0.28	0.05		0.1	0.22	0.08	0.22	0.22	0.12	0.18	0.30	0.04	0.13	0.04	0.08	0.02			0.46	0.13	0.08	0.25	0.12	0.14	0.04	0.39	0.37
Otro	0.82	0.18	0.15	0.09	2.55	0.19	0.08	0.39	0.17	2.81	1.67	4.96	3.39	1.9	3.55	0.97	1.64	0.59	0.77	5.04	1.96	0.1	1.41	0.63	0.28	1.29	2.7	0.2	1.04	0.36	1.05

Material de construcción predominante en los pisos

Material	Puno	Juliaca	Ilave	Azangaro	Pto Maldonado	Abancay	Aymaraes	Andahuaylas	Ayacucho	Piura	Sullana	Paita	Talara	Sechura	Tumbes	Ferreñafe	Nuevo Chimbote	Huaura	Chanchay	Chincha Alta	Santiago	Yauyos	Oxapampa	Tarma	Huanuco	Moyobamba	Tarapoto	Chachapoyas	San Juan Bautista	Bagua	Pozuzo
Tierra	24.99	48.24	79.59	74.14	24.33	38.53	60.47	63.48	39.88	37.34	42.56	42.39	20.25	46.2	34.64	42.95	27.23	15.84	29.45	37.11	52.88	42.33	6.63	37.52	29.25	52.15	18.67	30.6	53.06	40.16	28.31
Cemento	55.72	45.62	18.77	20.61	64.74	52.03	33.28	30.16	46.71	42.75	49.02	49.48	62.49	46.96	54.50	49.12	54.51	54.57	59.82	47.56	44.02	48.71	42.66	43.02	56.21	42.98	69.72	58.45	35.1	56.47	22.12
Losetas, terrazos	4.88	1.95	0.49	0.18	4.60	4.39	1.83	2.69	11.7	18.77	7.75	6.36	14.20	6.38	9.44	6.74	14.16	23.09	9.23	12.45	2.48	1.67	3.56	4.08	11.66	3.6	10.59	5.59	2.46	2.91	1.73
Parquet o madera pulida	7.20	2.13	0.42	1.12	0.43	1.25	2.06	1.18	0.62	0.24	0.13	0.12	0.52	0.03	0.41	0.16	1.39	3.71	0.51	1.89	0.02	1.01	3.01	3.56	1.36	0.13	0.1	1.05	0.19	0.06	1.67
Madera, entablados	5.08	1.53	0.57	3.87	5.68	3.42	2.36	2.31	0.46	0.10	0.03	0.67	1.05	0.09	0.41	0.21	0.16	0.79	0.24	0.24	0.14	6.13	43.5	11.33	1.07	0.66	0.05	4.05	9	0.19	45.72
Laminas asfálticas	1.32	0.29	0.05	0.01	0.07	0.24		0.09	0.32	0.22	0.09	0.59	0.99		0.08	0.07	0.63	1.54	0.26	0.16		0.05	0.19	0.17	0.27	0.07	0.18	0.08	0.02		0.31
Otro	0.81	0.25	0.1	0.05	0.16	0.15		0.09	0.3	0.59	0.42	0.39	0.49	0.35	0.52	0.76	1.94	0.46	0.49	0.57	0.46	0.1	0.46	0.32	0.17	0.41	0.69	0.19	0.17	0.21	0.12

Source: INEI 2007

(3) Predominant Material in the Floors

According to census 2007, 43.4% of total houses have as predominant floor the soil, that means 2 779 676 houses, 38.2% of houses have as main material concrete meaning 2 441 884 houses. 9.3% (597 534) use floor tile, ceramic, 4.5% uses parquet or polished wood, 3.4% uses wood.

The concrete predominates as material of the floors in the houses of the urban area (48.4%); the houses that use soil represent 29.2% and 12.4% have as material in their floors floor tile, ceramic. In the rural area, the predominant material in the floors of the houses is soil that represents 85.8%, 7.8% of the houses have concrete and 5.8% wood.

At national level, the materials of better quality (parquet, floor tile, and ceramic) are used mainly in the departments of Lima (29.7%),Constitutional Province of Callao (25.7%) and Arequipa (12.2%). On the contrary the departments of Huancavelica (87.5%), Apurímac (81.9%), Ayacucho (77.9%), Cajamarca (74.2%) and Puno (73.1%) have dirt floor.

The concrete is the most used material in the floors of the houses of the departments of Arequipa (55.1%), Constitutional Province of Callao (53.7%), Lima (50.9%) and Tumbes (50.1%).

Similarly to the above mentioned, the predominant material of the floors of the houses is related to the amount of wastes generated in the sweeping of the houses, which increases the generation of inert wastes as well as the global density of it.

Main material of the floor in the scope of the program

Of the 31 cities, in 21 of them, the material used in the floors of the houses, mainly is the concrete, for example, in Puno (55.72%), Puerto Maldonado (64.74%), Abancay (52.03%), Ayacucho (46.71%), Piura (42.75%), Sullana (49.02%), Paita (49.48%), Talara (62.49%), Sechura (46.96%), Tumbes (54.5%), Ferreñafe (49.12%), Nuevo Chimbote (54.51%), Huaura (54.57%), Chancy (59.82%), Chincha Alta (47.56%), Yauyos (48.71%), Oxapampa (42.66%), among others; in Juliaca (48.24%), Ilave (79.59%), Aymaraes (60.47%), Andahuaylas (63.48%), Santiago (52.88%), Moyobamba (52.15%), San Juan Bautista (53.06%) and Pozuzo (28.31%), the floors is of soil.

(4) Houses Implemented with Water Service

According to census 2007, 3 504 658 houses have access to the poTable water by public network within the house, which represents nationwide 54.8%, 568 800 houses count on access to the poTable water by public network outside the house but inside the construction (8.9%) and 243 241 accede to the poTable water through public pylon. On the other hand 1 024 654 houses use the water of river through dikes which represents 16% and 515 589 houses accede to the water through a well, meaning 8.1%.

In the urban area 68.8% are supplied water through the public network within the house, while the houses located in countryside that are supplied poTable water by public network within the house represent 13.1%, 210 494 houses.

Also should be emphasize that six departments show the most number of houses with the service connected to public network water supply (inside and outside the house) are Lima, Arequipa, Ica, Constitutional Province of Callao, Tacna and Moquegua, with percentage that exceed 70% of availability of this service. The less favored departments with the access to

this quality of service are Huánuco, Pasco, Puno and Ucayali (percentage inferiors to 38%). The water availability of river, dikes or similar appears in bigger proportions to 40% in the departments of Pasco (51.2%), Huánuco (49.4%) and Amazonas (42.5%).

Service of water in the scope of the program

According to information of Census 2007, in the city of Puno 65.46% of the houses has access to poTable water, in Abancay 62.03%. In the cities of Ayacucho, Piura, Andahuaylas, Talara, Tumbes, Nuevo Chimbote, Huaura, Chincha Alta, Yoyos, Huánuco, Tarapoto and Chachapoyas more than 70% of the houses are connected directly to the public network. However, in the cities of Juliaca (29.48%), Ilave (59.32%), Azángaro (30.16%), Santiago (44.34%) and San Juan Bautista (52.27% are supplied by wells; likewise, in Oxapampa (92.37%) are supplied by the river.

(5) Houses with Electric Lighting

The census 2007 show that total particular houses, 4 741 750 have connected electric lighting to the public network and 1 658 401 houses have not this service yet

In urban area 9 of each 10 houses has electric lighting by public network, while in the countryside, 3 of each 10 houses count on this service.

Departmental level it is possible to find that more than 50% of the houses do not count on electric lighting by public network in the departments of Cajamarca, Huánuco and Amazonas, while in the capital only 7% do not count on this service.

Electrical service in the scope of the program

In 03 selected cities, Tarma, Tarapoto and Chachapoyas, more of 90% of the houses have electric lighting and 13 cities have more than 80%.

Table 3.2-9 Basic services in the Houses

Abastecimiento de agua en la vivienda

Categorias	Puno	Juliaca	Ilave	Azangaro	Pto Maldonado	Abancay	Aymaraes	Andahuaylas	Ayacucho	Piura	Sullana	Paita	Talara	Sechura	Tumbes	Ferreñafe	Nuevo Chimbote	Huaura	Chanchay	Chincha Alta	Santiago	Yauyos	Oxapampa	Tarma	Huanuco	Moyobamba	Tarapoto	Chachapoyas	San Juan Bautista	Bagua	Pozuzo
Red pública Dentro de la viv. (Agua potable)	65.46	49.90	21.37	21.71	59.40	62.03	60.32	73.76	76.09	74.16	66.35	53.95	76.59	62.94	73.61	65.63	78.9	76.41	63.53	76.06	36.29	77.87	4.62	67.86	74.69	56.25	85.46	70.99	15.97	62.54	2.48
Red Pública Fuera de la vivienda	14.93	17.92	3.44	28.75	22.39	26.93	21.78	10.16	10.47	6.16	3.47	3.03	5.89	4.01	6.50	2.86	3.68	7.22	7.61	7.59	12.20	16.20	0.65	11.28	12.28	8.76	9.22	20.2	2.43	14.42	0.93
Pilón de uso público	1.45	1.06	2.11	1.94	5.77	0.82	1.45	1.53	4.97	6.50	2.81	19.14	1.81	10.69	3.23	8.61	8.75	4.38	3.6	2.29	2.16	1.62	0.19	1.09	3.70	1.18	1.28	0.83	6.74	0.78	0.37
Camión-cisterna u otro similar	0.07	0.06	0.1	0.04	1.10	0.04		0.05	0.64	2.84	6.53	12.21	2.19	1.11	0.88	6.44	2.54	5.6	1.24	2.54	1.03			0.05	2.52	0.05	0.64	0.05	8.26	0.04	
Pozo	12.36	29.48	59.32	30.16	6.04	0.31	0.15	2.42	0.54	0.70	3.90	3.16	0.70	8.49	0.51	4.86	0.5	2.15	15.04	0.66	44.34	0.1	1.03	1.34	1.38	8.36	0.53	2.12	52.27	1.14	1.55
Rio, acequia.manantial o similar	2.86	0.31	6.11	13.81	3.11	8.31	13.86	6.54	2.57	2.59	9.27	0.03	0.08	0.13	0.45	0.47	0.97	0.89	3.73	0.05	0.44	0.25	92.37	15.62	2.86	23.45	0.4	3.74	5.45	17.93	93.68
Vecino	2.22	0.89	5.67	2.92	1.43	1.28	2.06	4.59	3.63	4.49	5.43	4.28	10.05	10.69	12.28	9.59	3.58	2.8	4.49	8.87	2.69	2.84	0.98	1.92	2.09	1.43	1.92	1.59	5.49	2.45	0.68
Otro	0.64	0.38	1.87	0.67	0.77	0.28	0.38	0.94	1.09	2.56	2.26	4.19	2.69	1.93	2.54	1.54	1.08	0.54	0.76	1.93	0.85	1.11	0.16	0.83	0.47	0.52	0.55	0.49	3.39	0.70	0.31

Alumbrado electrico

Categorias	Puno	Juliaca	Ilave	Azangaro	Pto Maldonado	Abancay	Aymaraes	Andahuaylas	Ayacucho	Piura	Sullana	Paita	Talara	Sechura	Tumbes	Ferreñafe	Nuevo Chimbote	Huaura	Chanchay	Chincha Alta	Santiago	Yauyos	Oxapampa	Tarma	Huanuco	Moyobamba	Tarapoto	Chachapoyas	San Juan Bautista	Bagua	Pozuzo
Si tiene alumbrado eléctrtrico	87.97	85.24	63.45	48.78	83.36	90.34	86.06	79.11	84.27	83.96	86.75	80.98	87.27	64.45	86.95	78.64	81.48	74.31	86.75	80.99	75.4	93.57	83.52	92.52	87.94	59.36	96.03	90.89	69.95	78.76	35.07
No tiene alumbrado eléctrico	12.03	14.76	36.55	51.22	16.64	9.66	13.94	20.89	15.73	16.04	13.25	19.02	12.73	35.55	13.05	21.36	18.52	25.69	13.25	19.01	24.6	6.43	16.48	7.48	12.06	40.64	3.97	9.11	30.05	21.24	64.93

Source: INEI 2007

3.2.4 Characteristics of the Education

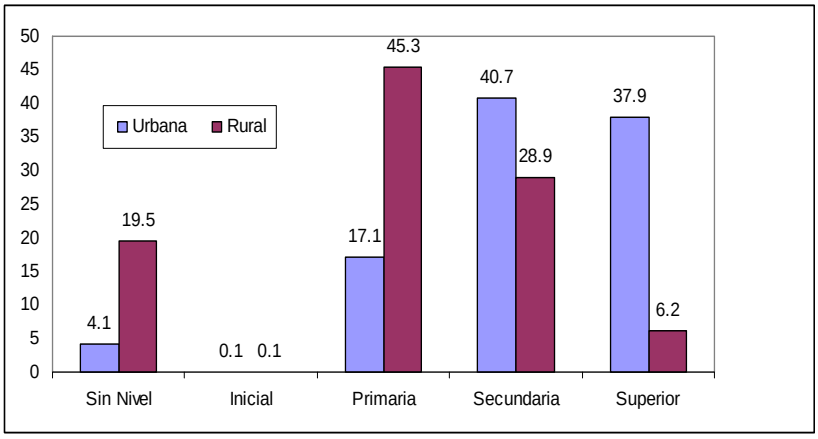
According to the figures from 2007[17], the educative level of the population from 15 years old and more has improved with respect to the level registered in 1993. If it is compared with the census of year 1993, the population with college education has increased of 112% (3 129 339 people).

Between1993 and 2007, the population with high school education registered an increase of 2419600 people. In 1993 the population with this level of education represented 35.5%, in 2007 population that has this educative level reaches 38.2% of the total population, which means 7 274 897 people.

Regarding the population without educative level or that only counts on pre-school level, it reduces to 15,8% and 56,9% respectively.

According to diagram 3.24, it is shown that the populations of the urban area obtain better educative levels, since 37.9% of the population of this geographic scope reached college education. While in the rural area, only 6.2% reached this educative level. 40.7% of the urban population has high school education; in the rural area, 28.9% reached this level.

As for the population without educative level, the percentage is higher in the rural area since it reaches 19.5%; in the urban area this category represents 4.1%.



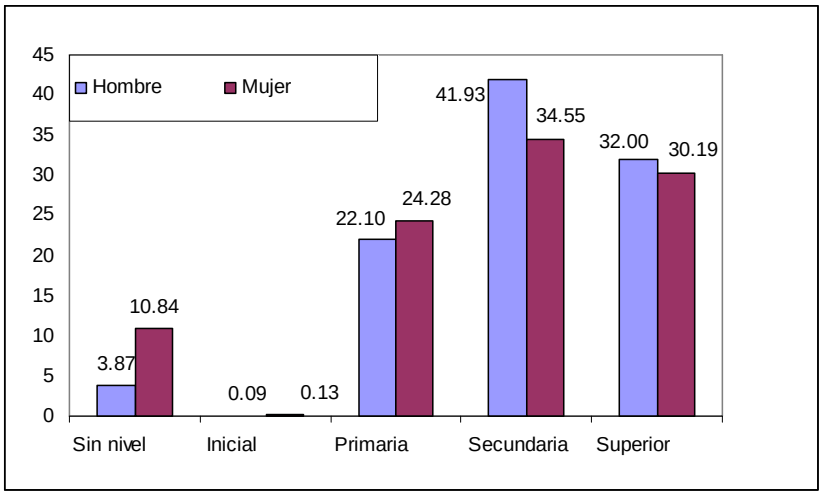
Source: National INEI-Census 2007

Figure 3.2-15 Registered Population of 15 years and above, by Education Level reached, according to Area of Residence, 2007 (in %)

According to the sex, in the 2007, 32% men and 30.2% women of15 years old or more obtained college education, if it is compared with the figures from 1993, where 21.6% of men and 19.3% women reached this level of college education, an improvement for women as for men is observed.

In the graph, it is shown that 10.3% women do not have any educative level; if it is compared with the percentage of the men that is of 3.9%, we can see that the percentage of the women is three times superior that the observed thing in the men.

[17] INEI, National Census 2007: XI of Population and VI of houses, Sociodemographic perfil of Perú, Second Edition 2008



Source: INEI 2007

Figure 3.2-16 More registered Year and Population of Age, by Education Level reached, according to Sex, 2007 (in %)

As it can be seen, the level of education improves for men as for women, but there is still latent inequality between men and women regarding education levels.

Table 3.2-10 Censed Population from 15 years old or more, according to Sex and reached Level of Education, 1993 and 2007

Sex/Level of education	Census 1993	Census 2007	Variaciónintercensal	
			absolute	%
Man	6714600	9363046	2648446	39.4
Without level	452891	362509	-90382	-20
Initial	22366	8630	-13736	-61.4
Primary	2141422	2069330	-72092	-3.4
Secondary	2649526	3926159	1276633	48.2
Superior	1448395	2996418	1548023	106.9
Woman	6964082	9691518	2727496	39.2
Without level	1224815	1050828	-173987	-14.2
Initial	26048	12238	-13810	-53
Primary	2162508	2353518	191010	8.8
Secondary	2205771	3348738	1142967	51.8
Superior	1344940	2926256	1581316	117.6

Source: INEI 2007

(1) Educative Level in Provinces

As it is shown in Table 3.13, the regions with bigger percentage of population with college education are: Arequipa (45.9%), Constitutional Province of Callao (43.1%), Moquegua (43.1%), Lima (41.4%), Tacna (39.6%) and Ica (34.6%).

Table 3.2-11 Level of Education reached, according to Department, 2007

Department	Total	Level of Education in %				
		Without level	Initial	Primary	Secondary	Superior
Total	**19054624**	**7.4**	**0.1**	**23.2**	**38.2**	**31.1**
Amazon	233763	10.8	0.1	47.2	29.3	12.5
Ancash	728419	13.8	0.2	26.1	33	27
Apurimac	252506	20.5	0.1	29.9	31.1	16.3
Arequipa	847534	5.4	0.1	14.4	34.2	45.9
Ayacucho	390645	16.8	0.2	30.8	32.9	19.4
Cajamarca	902905	16.2	0.1	44.7	25.6	13.5
Prov.Const.Of the Callao	641596	2.3	0.1	11.6	42.9	43.1
Cusco	768708	12.8	0.1	27.7	35.6	23.8
Huancavelica	274219	18.9	0.1	35.4	33.4	12.2
Huánuco	476754	15.4	0.1	37.1	31	16.3
Ica	507022	2.7	0.1	17.4	45.3	34.6
Junín	821111	7.7	0.1	25.3	40.2	26.7
La Libertad	1114712	10.1	0.1	27.4	31.6	30.7
Lambayeque	772573	7.2	0.1	25.4	37.8	29.4
Lima	6299389	2.5	0.1	12.9	43.1	41.4
Loreto	547385	5	0.1	34	43.1	17.8
Madre de Dios	75132	4.6	0.2	18.5	44.2	32.6
Moquegua	120636	5.9	0.1	16.3	34.6	43.1
Pasco	187853	8	0.1	26.5	41.3	24.1
Piura	1123449	10.8	0.1	31.3	32.6	25.1
Puno	864383	11.6	0.1	29.5	38.9	19.9
San Martin	476927	6.9	0.1	43.6	34.4	15
Tacna	211900	4.5	0.1	15.7	40.1	39.6
Tumbes	139530	3	0.1	27	43.8	26.1
Ucayali	275573	4.5	0.2	28	46.2	21.1

Source: National INEI-Census 2007.

The departments of Ucayali (46.2%), Ica (45.3%), Madre de Dios (44.2%), Tumbes (43.8%), Lima (43.1%), Loreto (43.1%), Constitutional Province of Callao (42.9%), Pasco (41.3%), Junín (40.2%) and Tacna (40.1%), show the highest percentage of population who has attended some years of high school education. In the regions of Apurímac (20.5%), Huancavelica (18.9%), Ayacucho (16.8%), Cajamarca (16.2%) and Huánuco (15.4%) is the biggest proportion of population without any education level.

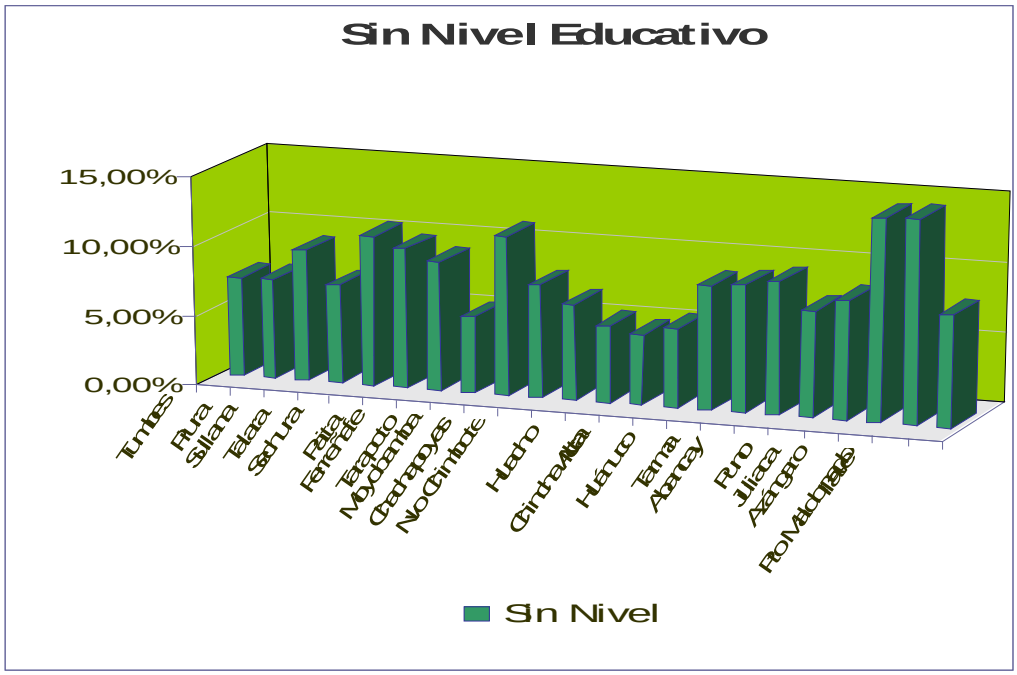
According to the analysis of census 2007, in the departments of Apurímac, Huancavelica and Huánuco reside the biggest proportion of the male population that does not have any level of education. On the contrary, the department of Lima and the constitutional province of Callao present the lowest percentage of male population without educative level. As far as the female population without educative level, the proportion Is higher in the departments of Apurímac (30.4%), Huancavelica (28.1%), Ayacucho (25.4%), Cajamarca (24.2%), Huánuco (22.1%) and Ancash (20.1%). However, in the department of Tumbes and the Constitutional Province of Callao 3.6% and 3.4% respectively of the female population do not have any educative level.

(2) Level of Education of the Scope of the Program

Next, the level of education of CENSUS INEI - 2007 by districts of intervention in the scope of the Program has been compiled.

1) Without Education Level

This chart shows the cities that count with a biggest population with lack of education are Azángaro and Ilave with 14,46% and 14,55% from the total population respectively. The cities of Ica (5,06%), and Tarapoto (5,48%) have the lowest number of people without educative level.

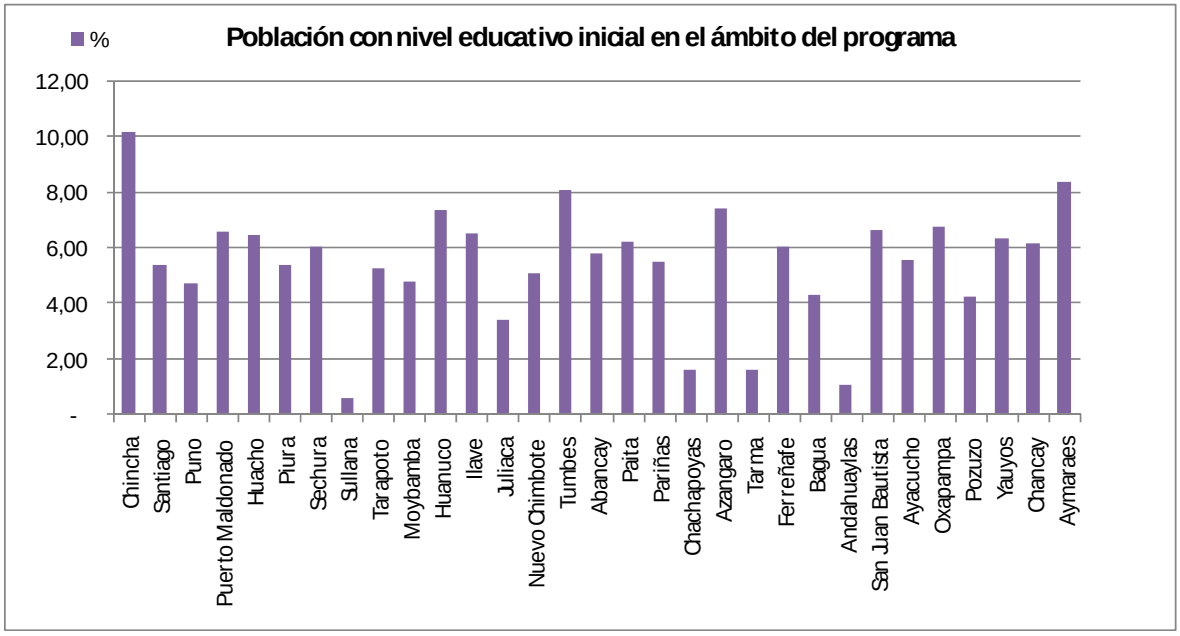


Source: CENSUS INEI 2007
Own elaboration

Figure 3.2-17 Population Without educative Level in the Scope of the Program

2) Pre-School Education

This chart shows that Chincha, Aymaraes, followed by Piura are the cities with biggest percentage of population that received a level of pre-school education with 10.13; 8.38 and 8,06 respectively of the total of its population. Also, the localities that count on smaller population with this level are Sullana (0,58%) and Andahuaylas (1,07%).

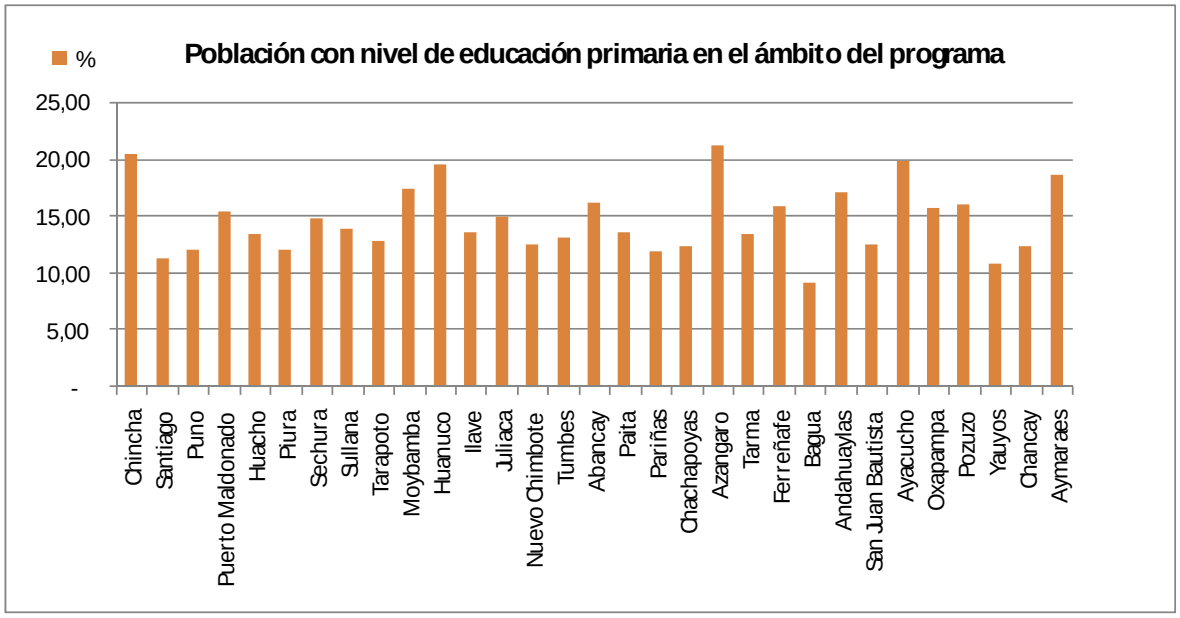


Source: ESCALE (Education Quality Statistics), 2009
Own elaboration

Figure 3.2-18 Population with Initial Educative Level the Scope of the Program

3) ElementaryEducation

The following chart show that the cities of Azángaro and Chincha are the localities that count with a biggest percentage of the population that received an elementary education (21,13% and 20,39% of the total of its population respectively). The city of Bagua presents the smaller percentage of population with this level, reaching only 9.13% of total.

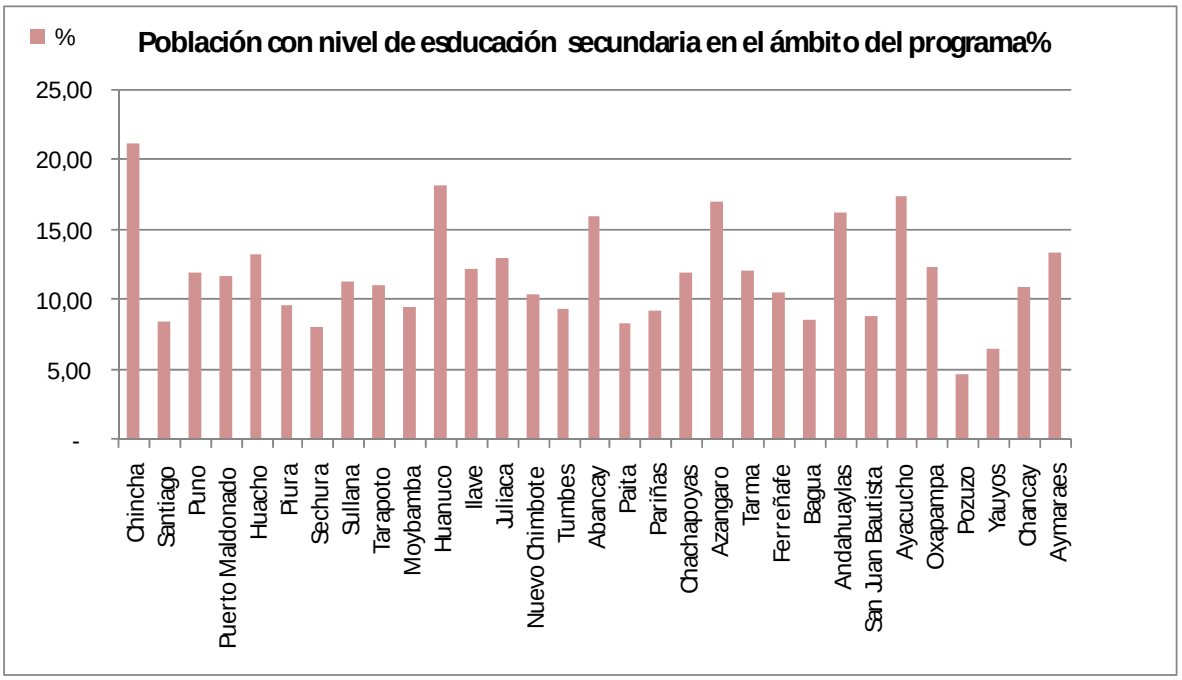


Source: ESCALE, 2009
Own elaboration

Figure 3.2-19 Population with Elementary Educative Level the Scope of the Program

4) High School Education

The following chart shows that the cities of Chincha Alta and Huánuco have thebiggest population who receivedhigh school education with 21.12% and 18.07% respectively. On the contrary, the cities of Pozuzo and Santiago (4.60% and 6.49% respectively) are those that have minor population with this level of education.

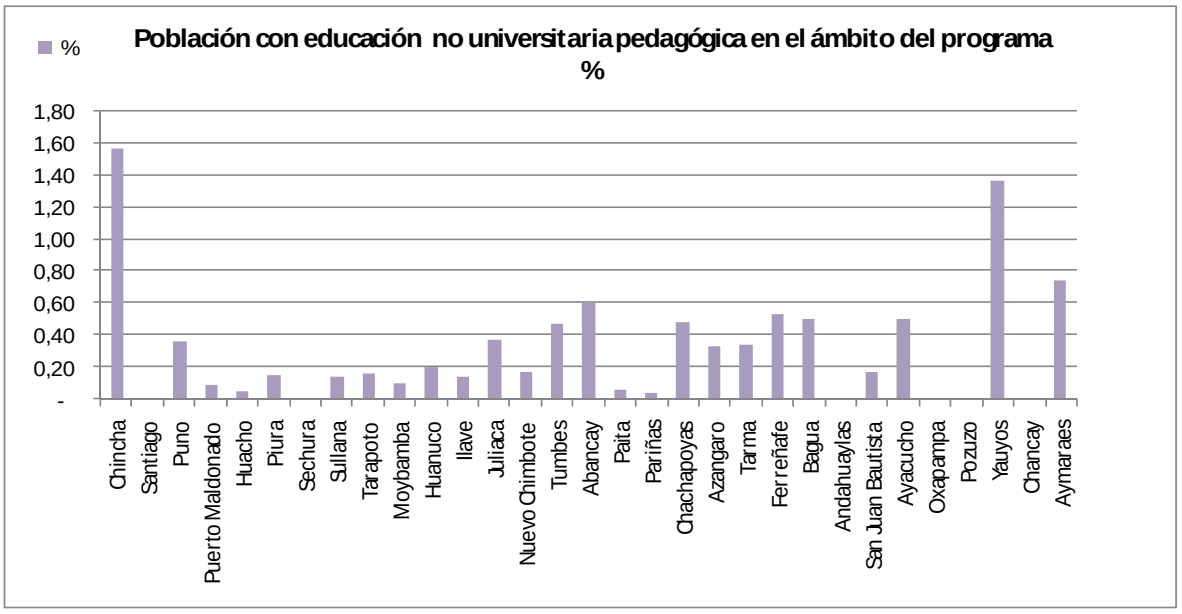


Source: ESCALE, 2009
Own elaboration

Figure 3.2-20 Population with High School Educative Level the Scope of the Program

5) Pedagogical Non University – College Education

The chart mentioned below shows that Chincha (1.57% of its total population) and Yauyos (6.72% of its total population) are the localities that count with a biggest percentage of population that received pedagogical nonuniversity college education. Cities like Huacho and Pariñas, represented with 0.04% and 0.05% of their total population respectively are cities that have very little population with this level of education. But cities like Santiago, Sechura, Andahuaylas, Oxapampa, Pozuzo and Chancay did not receive this type of formation and it is probably because these cities do not count on this type of education centers.

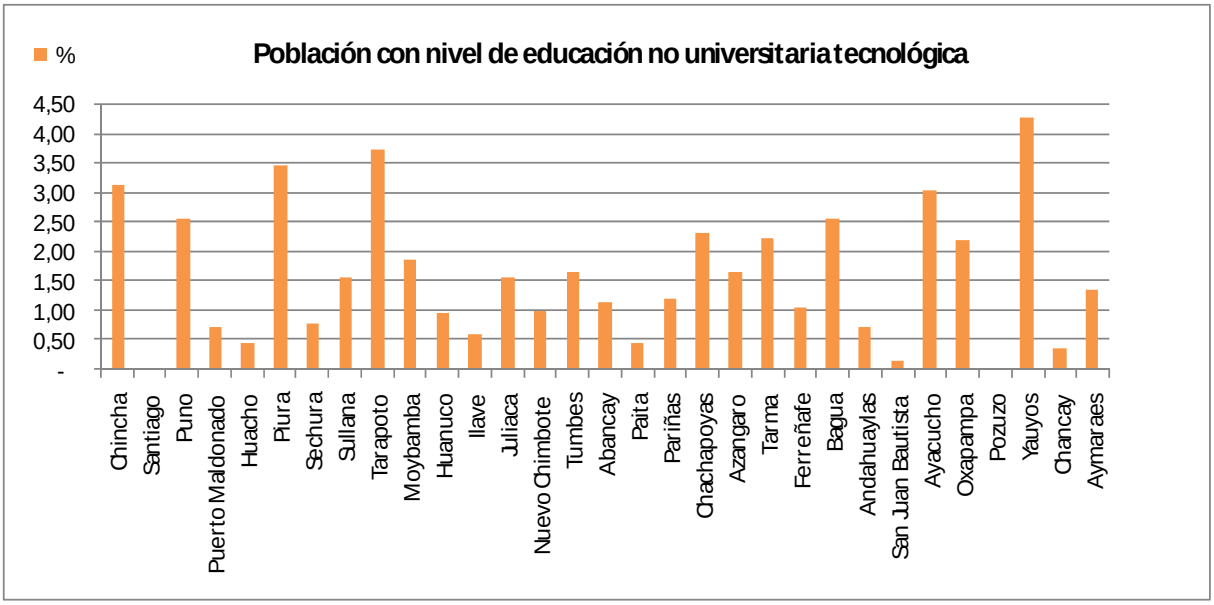


Source: ESCALE, 2009
Own elaboration

Figure 3.2-21 Population with Pedagogical Nonuniversity Educative Level in the Scope of the Program

6) Technological nonUniversity College Education

It is possible to be observed of the following graph that the cities of Yauyos (4.26) and Tarapoto (3.72%) counts with a greater percentage of population than received technological nonuniversity college education. But there are cities like Santiago and Pozuzo which did not receive this type of educationand it is probably becausethis type of education centers are not available in these places. On the other hand cities like San Juan Bautista and Huacho, to mention some, have population that received this type of education but in smaller proportion (0.15 and 0.44% respectively)

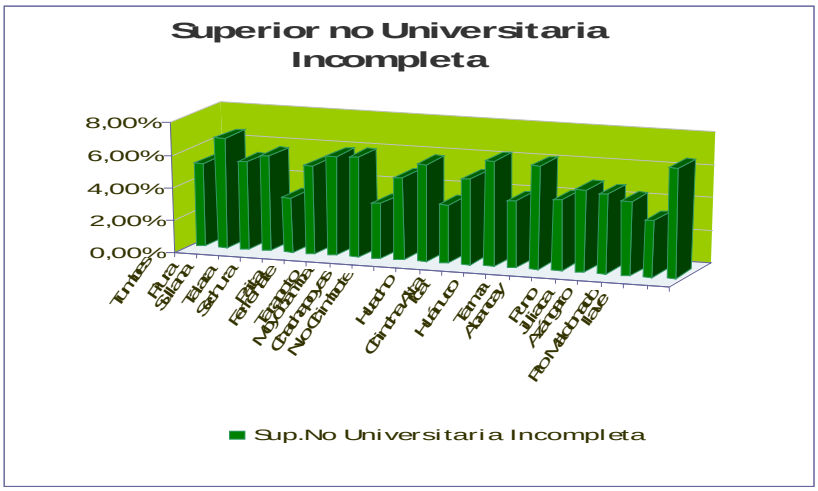


Source: 2009 CLIMB

Figure 3.2-22 Population with Technological Nonuniversity Educative Level in the Scope of the Program

7) Incomplete nonUniversity College Education

The following chart showsthat Piura (6.81% of its total population) and Puerto Maldonado (6.72%) are the localities that count with a greater percentage of population who received nonuniversity education but incomplete. On the contrary, the cities of Sechura and Moyobamba, represented with 3.38% and 3.41% of their total population respectively, are the cities that have minor population with this level of education.

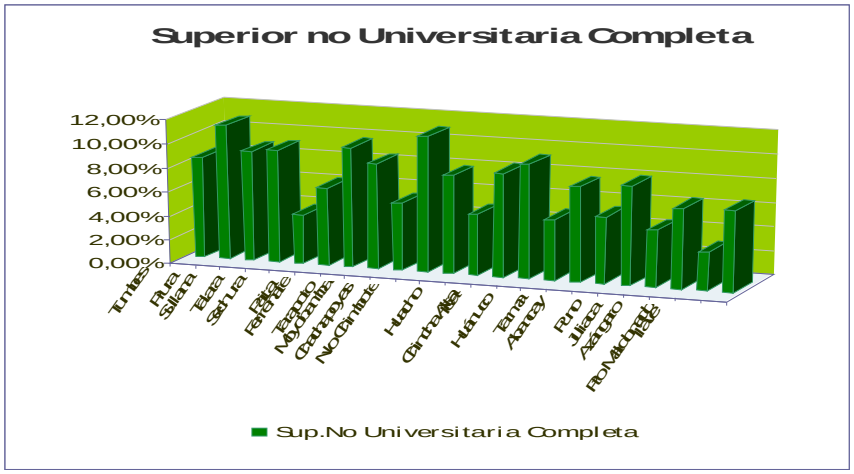


Source: CENSUS INEI 2007
Own elaboration

Figure 3.2-23 Population with Incomplete Nonuniversity Educative Level in the Scope of the Program

8) Complete nonUniversity College Education

It is possible to be observed of the following graph that the cities of Piura (with 11.16%) and Chachapoyas (11.27%) counts with a greater percentage of population who received nonuniversity college education and completed their studies; on the contrary, the cities of Sechura (4,09%) and Ilave (3,21%) are those who have less population with this level of education.

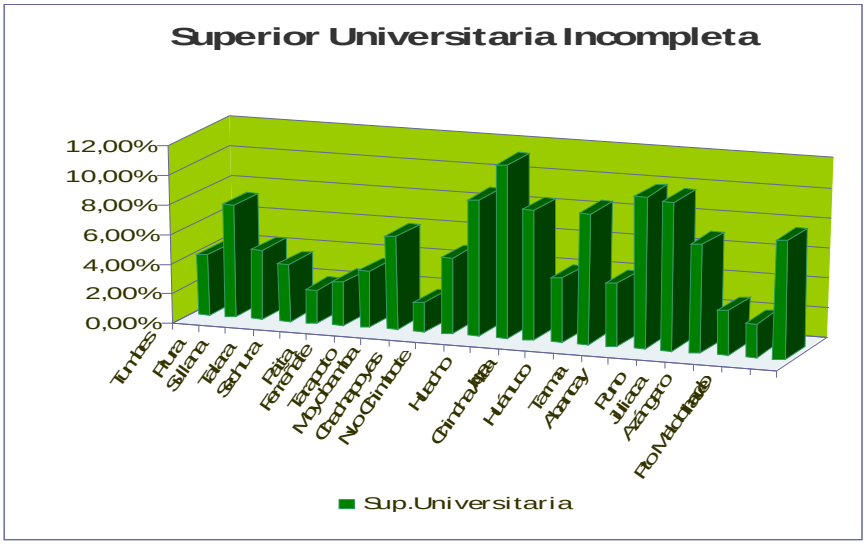


Source: CENSUS INEI 2007

Figure 3.2-24 Population with Complete Nonuniversity Educative Level in the Scope of the Program

9) Incomplete University Education

It is possible to appreciate of the following graph that the cities of Huacho and Abancay have 11.57% and 10.11% of their total population respectively, with greater percentage of population who received university education but they did not complete their studies. The cities of Moyobamba (with 1.97%) and Sechura (with 2.25%) are those who have less population with incomplete university level.

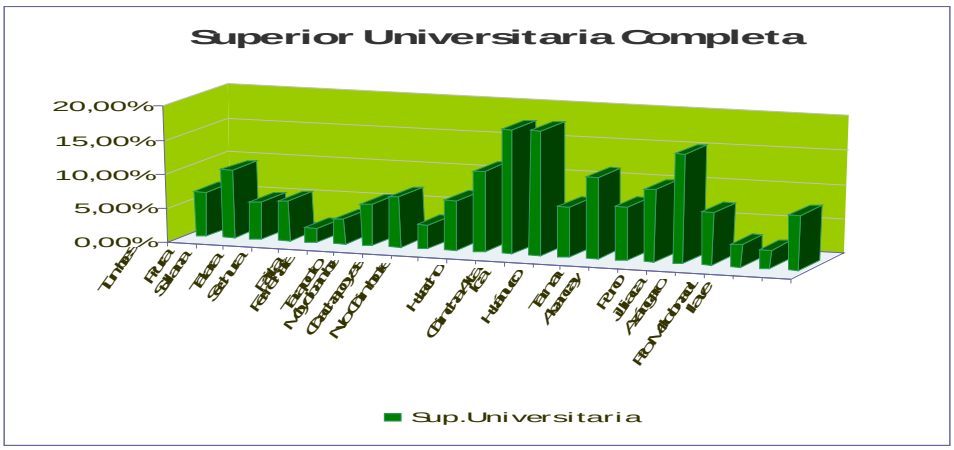


Source: CENSUS INEI 2007
Own elaboration

Figure 3.2-25 Population with Incomplete University Educative Level the Scope of the Program

10) Complete University Education

From the following graph, it is possible to observe that the cities of Huacho represented by 18.06% of their total population and Ica with 18.12% of the total, count with a greater percentage of population who received university education and completed their studies; however, the cities of Sechura and Ilave (with 2.09% and 2.67% of its total population) have less population with this level of education.



Source: CENSUS INEI 2007
Own elaboration

Figure 3.2-26 Population with University Educative Level completes the Scope of the Program

(3) Illiteracy in Peru

Nationwide, it is shown that in 2007, 1 359 558 people from 15 years old or more do not know to read nor to write. If it is compared with the results of census 1993, the illiteracy is reduced to 424 723 people. According to the analysis conducted by INEI, the illiteracy affects more to women than to the men, there is a great disparity. However, between 1993 and 2007 the rate of feminine illiteracy is the one that decrease more, since it goes from 18.3% to 10.6%. There is also a disparity between the residence areas (rural and urban), the illiteracy affects 19.7% of the population of 15 years old or more of rural area and 3.7% of the urban area. The illiteracy is higher in rural and mountain area. A high incidence affects the departments of Apurímac (21.7%), Huancavelica (20.1%), Ayacucho (17.9%), Cajamarca (17.1%), Huánuco (16.6%), Cusco (13.9%), Ancash (12.4%), Puno (12.2%) and Amazonas (12.0%), while in the departments of Ucayali (4.8%), Moquegua (4.7%), Arequipa (4.1%), Tacna (3.7%), Tumbes (3.4%), Madre de Dios (3.2%), Ica (2.8%), Lima (2.1%) and Constitutional Province of Callao (1.6%), the lowest rates of illiteracy are observed.

Table 3.2-12 Censed Population of 15 years old or more who are illiterate and Rate of Illiteracy, according to Department, 1993 and 2007

Department	Census 1993		Census 2007		Variation (percentage points
	Population illiterate	%	Population illiterate	%	
Total	**1,784,281.00**	**12.80**	**1,359,558.00**	**7.10**	**-5.70**
Amazonas	36,977.00	19.90	27,965.00	12.00	-7.90
Ancash	123,837.00	21.10	90,482.00	12.40	-8.70
Apurimac	77,776.00	36.90	54,734.00	21.70	-15.20
Arequipa	46,879.00	7.60	35,025.00	4.10	-3.50
Ayacucho	92,887.00	32.70	69,922.00	17.90	-14.80
Cajamarca	193,735.00	27.20	154,800.00	17.10	-10.10
Prov.Const.Of Callao	13,561.00	3.00	10,032.00	1.60	-1.40
Cusco	154,424.00	25.40	107,050.00	13.90	-11.50
Huancavelica	71,162.00	34.10	55,146.00	20.10	-14.00
Huánuco	89,927.00	24.70	79,241.00	16.60	-8.10
Ica	21,156.00	5.80	14,376.00	2.80	-3.00
Junín	82,708.00	13.40	62,217.00	7.60	-5.80
La Libertad	104,539.00	13.00	90,121.00	8.10	-4.90
Lambayeque	63,865.00	11.00	50,397.00	6.50	-4.50
Lima	184,354.00	4.10	132,148.00	2.10	-2.00
Loreto	40,349.00	10.80	29,899.00	5.50	-5.30
Madre de Dios	3,245.00	8.00	2,437.00	3.20	-4.80
Moquegua	7,693.00	8.80	5,721.00	4.70	-4.10
Pasco	20,053.00	15.20	15,581.00	8.30	-6.90
Piura	135,170.00	16.30	103,808.00	9.20	-7.10
Puno	145,101.00	22.20	105,833.00	12.20	-10.00
San Martin	40,603.00	12.50	36,897.00	7.70	-4.80
Tacna	10,836.00	7.40	7,749.00	3.70	-3.70
Tumbes	6,452.00	6.60	4,752.00	3.40	-3.20
Ucayali	16,992.00	9.60	13,225.00	4.80	-4.80

The illiteracy is present mainly in the senior adults, according to the numbers of census 2007, 26.7% of the population of 65 years or more is considered illiterate, while 10.1% of the group of40 to 64 years old are also included within the group of illiterates. The illiteracy affects in

smaller proportion the groups of 30-39 years (4%), to the group of 20-29 years (2.2%) and to the group of 15-19 years old (1.3%).

3.2.5 Characteristics of the Transport Routes

The transport routes of the scope of the program are described in the following Table :

Table 3.2-13 Characteristics of the Communication Channels in the Scope of the Program

Cities	Distance	Access roads	Conditions
Tumbes	Lima to Tumbes:1250 km.	Pan-American highway	Good state
Piura	Lima to Piura 973 km.	Pan-American North	Asphalt paving in good state
Sullana	1090 km.	Pan-American North	Asphalt paving in good state
Talara	1185 km.	Pan-American North	Asphalt paving in good state
Sechura	1300 km	Pan-American North	Asphalt paving in good state
Paita	1107 km.	Pan-American North	Asphalt paving in good state
Ferreñafe	Lima-Chiclayo-Ferreñafe 721 Km.	LLima-Chiclayo-Ferreñafe Pan-American North	Asphalt paving in good state
Tarapoto	1037 km.	Lima - Chiclayo-Tarapoto	Without Asphalting
Moyobamba	1363 km	Lima-Chiclayo-Jaen-La Rioja-Pedro Ruiz-Moyobamba	Without Asphalting
Chachapoyas	Lima Chiclayo Olmo, Pedro Ruiz Gallo, Chachapoyas:1224 km.	Via Chiclayo, Olmo, Pedro Ruiz, Chachapoyas Via Pacasmayo, Cajamarca, Celendín, Chachapoyas Via Tarapoto, Pedro Ruiz, Chachapoyas	The highway is in a poor state
Nuevo Chimbote	431 km.	Pan-American North	Asphalt paving in good state
Huacho	81 km.	Lima - Oyón - Churin - Huacho	Asphalt paving in good state
Santiago	Km.	The Pan-American South	Asphalt paving in good state
Chincha	200 km.	The Pan-American South	Asphalt paving in good state
Huanuco	410 Km.	Lima-La oroya - Huanuco	Asphalt paving in good state
Tarma	244 Km.	Lima - La Oroya – Tarma	Asphalt paving in good state
Abancay	907 Km.	Lima- Nazca - Abancay	Asphalt paving in good state
Puno	1402 Km.	Lima-Moquegua-Puno	Asphalt paving in good state
Juliaca	1299 km.	**Lima**- Arequipa - **Juliaca**	Asphalt paving in good state
Azángaro	1447 Km.	Lima - Juliaca - Macusani- Azángaro	Asphalt paving in good state
Ilave	1 389 km	Lima-Puno Ilave	Asphalt paving in good state
PuertoMaldonado	1 637 km	Lima - Nazca-Abancay-Cusco-PuertoMaldonado	Aerial
Aymaraes			

Cities	Distance	Access roads	Conditions
Bagua	Lima Chiclayo Bagua 1,031 Km	Lima Chiclayo Bagua	Asphalt paving in good state
Andahuaylas	Lima- Nazca - Chalhuanca 1,027 Km	Lima nazca Chalhuanca	
San Juan Bautista			Aerial
Huamanga		Lima - Huamanga (Carretera Libertadores)	Asphalt paving in good state
Oxapampa		Lima - La Merced - Oxapampa	Asphalt paving in good state
Pozuzo		Lima - oxapampa - POzuzo	Asphalt paving in good state. Last section of the highway is in poor state
Chancay		Lima - Chancay	Asphalt paving in good state
Yauyos	380 Km	Lima – Jauja - Yauyos	Asphalt paving in good state

Source:Own elaboration

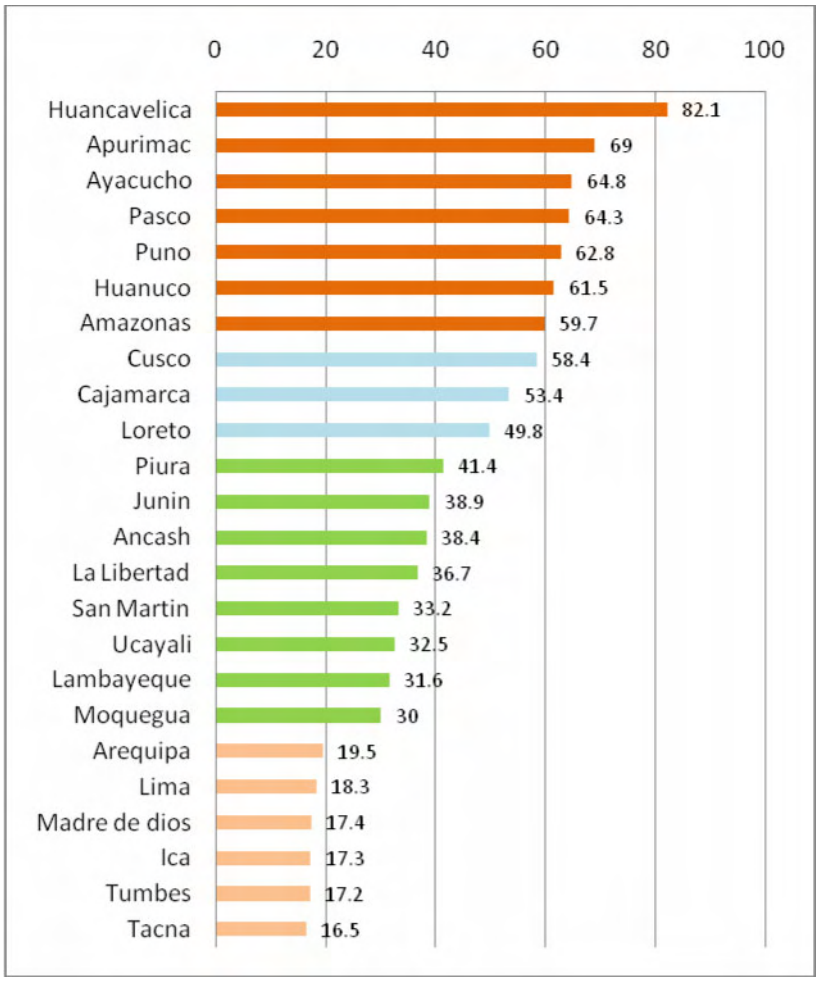
3.2.6 Economic Aspects

(1) Socio Economic Situation of the Population

In 2008, Peruvian GDP grew by 9.8%, which one of the highest rates worldwide. In the same year, exports reached a record level, totaling US$ 31,529 million, which represents a growth of 13% compared with the previous year, and non-traditional exports increased by 20%.

In the financial year 2008, the main sectors in the export market were construction (16.5%), trade (12.8%), manufacture (8.5%), and mining and hydrocarbon (7.6%). The construction sector has undergone a sharp growth in the last years, thus generation an sTable economic situation in the poorest population, since non qualified labor were used.

Furthermore, trade activities grew by 12.8%, mainly in activities related to the sale of manufactured products (dairy products, sugar, bakery products, other food produce, drinks, shoes, furniture, personal hygiene products, medicines, chemical products and refine products (fuel); agro forestry products (olive, coffee, potatoes, mango, avocado, grapes, oranges, tomatoes and poultry), fishing products (mackerel, hake, seafood, seaweed, other fish); mining products (gold, copper, silver, zinc, iron, lead). The manufacturing sector increased by 8.53% was driven specially by the growth of non-primary manufacture, which usually by its value-added and the positive impact on the creation of jobs. Said growth is based on the sustainable increase of the internal demand, the consolidation of the market and the access to new market abroad. The more dynamic sectors were food and metal mechanical sectors.



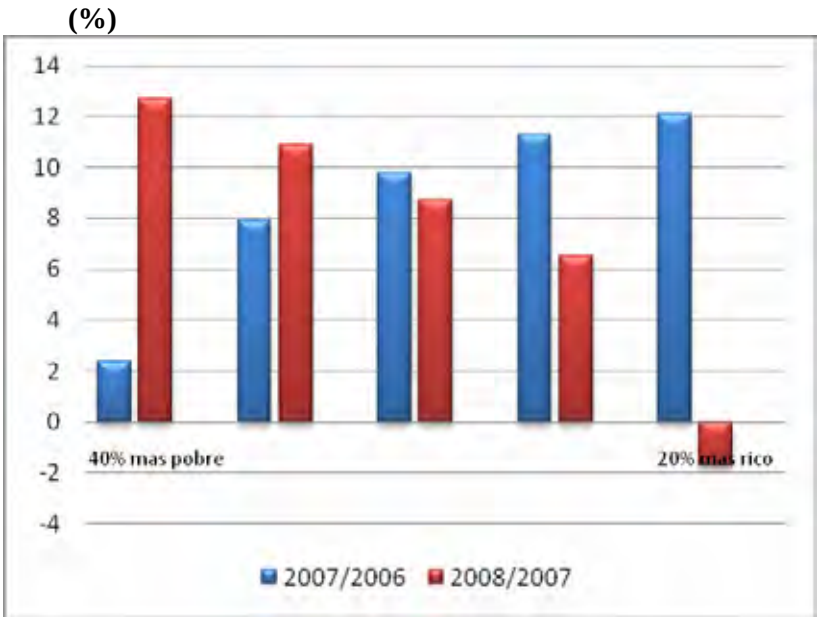
Source: INEI

Figure 3.2-27 Peru: Poverty Index by Regions 2009

Taking into account the current conditions of the population (mainly between the area of influence of the program), it is important to mention that the poverty index is split in 5 quintiles. The poorest region is Huancavelica. Cities from the regions of Ayacucho,

Cusco and Moquegua, will not be included in the program. Their poverty index are;

On the other hand, it is important to mention that since 2006 until now, the average salary has changed, according to quintiles, showing that population has undergone important changes in the population, especially among the poorest, as this chart shows:



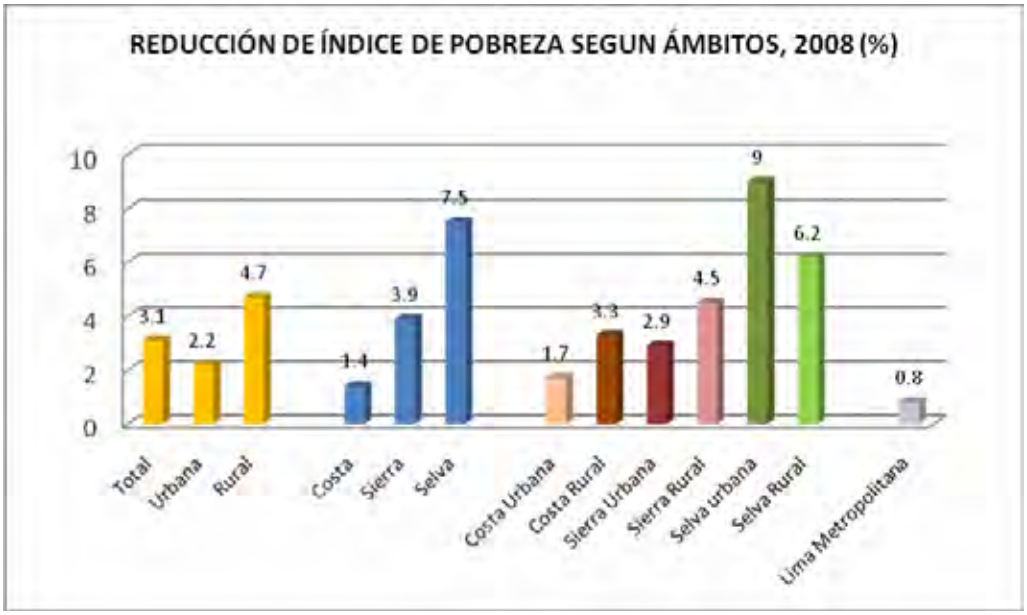
Source: INEI 2008

Figure 3.2-28 Variation of the Average Income per Household

Taking into account the information above mentioned, it seems clear the poverty reduction is a clear consequence. Within the study periods mentioned, there are reduction in the absolute poverty rates, as the following chart shows:

Figure 3.2-29 Peru: Poverty Level (95% of accuracy)

According to the previous chart, it is clear that in the last three years, poverty incidence in Peru has been reduced. According to the scope, it can be explained as follows:



Source: INEI 2008

Figure 3.2-30 Peru: Results of Poverty Reduction, 2008

(2) Main Economic Activities

The main economic activities produce different kind of waste, that represents the specific composition features of the solid waste in each place. The following chart shows the main activities of the areas included in the Program.

Table 3.2-14 Main economic Activities of PEA by districts (%) of Some Cities of the Program

Location	Agriculture, livestock, hunting and forestry	Fishing	Manufacturing Industries	Construction	Trade	Teaching	Others	Unemployed
Tumbes	5.52	5.06	6.40	6.54	19.91	8.43	43.03	5.10
Piura	3.80	0.47	6.69	5.92	24.09	8.80	45.09	5.15
Sullana	14.20	0.34	7.14	4.82	25.28	8.16	34.91	5.15
Talara	0.90	10.03	6.51	6.92	17.89	4.14	44.58	9.02
Sechura	6.75	27.72	11.70	3.40	17.61	2.66	25.78	4.40
Paita	0.75	19.70	20.13	3.61	13.46	2.93	32.19	7.23
Ferreñafe	21.17	0.03	5.26	5.98	16.93	9.73	32.78	8.11
Tarapoto	7.90	0.09	7.13	6.77	24.41	7.25	43.43	3.02
Moyobamba	37.11	0.06	3.93	4.53	14.35	7.73	29.91	2.38
Chachapoyas	9.48	0.00	5.20	8.72	18.76	12.32	40.55	4.98
Nvo. Chimbote	3.14	4.02	11.04	7.73	20.58	8.67	40.33	4.48
Huacho	4.53	3.05	5.93	5.46	22.23	11.17	42.68	4.95
Santiago	61.5	0.1	8.2	2.7	6.6	2.8	1	4.06
Chincha	7.03	0.39	19.34	7.11	20.99	8.39	32.49	4.27
Huanuco	5.62	0.01	5.77	6.17	26.10	10.51	40.03	5.79
Tarma	19.12	0.01	5.75	4.84	24.34	8.15	32.19	5.59
Abancay	10.36	0.03	4.35	7.56	20.62	13.45	38.52	5.10
Puno	4.69	0.34	8.48	6.02	18.52	13.96	41.75	6.25
Juliaca	4.52	0.02	13.10	6.07	28.53	7.76	32.78	7.22

Location	Agriculture, livestock, hunting and forestry	Fishing	Manufacturing Industries	Construction	Trade	Teaching	Others	Unemployed
Azángaro	41.64	0.02	2.06	6.23	11.18	13.16	17.07	8.63
Ilave	61.41	0.21	2.49	2.06	13.07	3.86	12.16	4.75
Pto. Maldonado	11.23	0.38	7.41	6.58	18.82	5.51	47.40	2.67
Bagua	12.48	0.00	2.20	5.72	18.76	10.32	43.55	6.98
Andahuaylas	10.62	0.00	2.78	6.17	24.10	8.51	41.03	6.79
S. J. Bautista	5.62	0.00	5.78	5.16	26.10	12.51	43.04	5.79
Huamanga	6.52	0.00	11.12	6.07	28.53	7.76	30.78	9.22
Oxapampa	36.11	0.06	4.93	5.53	14.35	8.73	29.91	2.38
Pozuzo	39.31	0.00	2.93	4.50	15.88	7.79	27.50	2.09
Chancay	4.53	3.08	5.90	5.40	21.28	11.23	43.73	4.95
Yauyos	25.16	0.01	6.75	3.80	20.34	8.15	32.19	5.59

Source: Census 2007- INEI
Own elaboration

After seeing the charts and Table s regarding the economic activities of PEA, it seems clear that one of the main activities is trade, followed by agricultural, cattle and forestry.

According to 2007 INEI Census, in the "Other" field, activities such as hotels, restaurants, communications, social services and health, and unspecified economic activities are included there.

Thus, solid waste composition in cities such as Azángaro and Ilave are different from Northern cities, such as Piura. Furthermore, the composition of solid waste in the department of Piura varies in relation to districts from this region, such as Sechura, Talara and Sullana.

In the case of Sechura, fishing is the main economic activity, which influence on the fact that the organic composition of the solid waste shows traces of hydrobiological products, due to this activity. Besides, companies that produce said products scatter them around in the middle of the dessert, as we saw during a field trip.

The previous Table shows that the cities of Piura, Talara, Tarapoto and Puerto Maldonado show high rate of activities such as hotels and restaurants, communications and other services.

The main activities carried out in Ilave and Azángaro are agriculture and cattle farming, which influence on the composition of the solid waste of the areas. For example, plastic percentages increase due to the packaging of materials using in the main economic activities is plastic.

Previous Table shows that trade is the most important economic activity in Huánuco and Juliaca, those cities export many products influenced by the emerging agriculture and the fact these cities are located strategically to sell their products, and influence on the generation of solid waste.

(3) Other Existing Services

Solid waste management has been influenced by the consumption services. The increase of the construction activities and the need of comforTable , safe, modern market places, with a large number of products, has originated a large construction of new homes and shopping centers in Lima and in the provinces, and this growth is larger in Peru than in other countries of the region. Regarding the program, large cities such as Ica and Piura shopping centers have been

built, which changes consumption habits of certain segment of the population who have access to these services. Therefore, it is one of the factors related to the change in the consumption habits originated by the economic growth the country is undergoing.

3.2.7 Organization of the Civil Society

Article 12 of General Law on Solid Waste states that the municipal solid waste management must be coordinated with the actions of the political authorities of the region. Likewise, the Law mentions that provincial municipalities must contribute towards the implementation of the regulations, thus adopting joint management, interinstitutional cooperation agreements, subscription of concession agreements and any other legal instrument that enables the efficient rendering of solid waste services, thus fostering larger and improved coverage of solid waste.

Article 4, Policy Guidelines of the said Law mentions the following:

"Establish a system with co shared responsibility and a comprehensive solid waste management system, from generation to final disposal, in order to avoid risky situations and negative consequences for the human health and the environment, without prejudice to the measures technically necessaries for the proper management of hazardous solid waste. This system will include, among others, the extended responsibility of the companies that produce, import and sell consumer goods, and that could be hazardous."

The shared responsibility and the approach of comprehensive solid waste management system require to involve social actors in the management of solid waste, thus assuming each of them their corresponding role.

From this point of view, civil society organizations represent the different groups of population, and must share information and take part in a responsible and shared way with the municipality, throughout the whole process in order to complete the comprehensive system of solid waste management and implement it.

So, the participation of the civil society within the solid waste management will bring, among other benefits, to spread and multiply educational actions to all beneficiaries. The development of an information system and the shared surveillance, as well as the implementation of the selective collection program and reuse of solid waste, will definite contribute to control environmental and health risks for the population, and to improve environmental quality and quality of life.

The participatory diagnosis carried out recently showed that there are multisector organizations such as RoundTable s of Fight Against Poverty, Committees of Community Development (CODECO), and even some Environmental Municipal Commissions, which are developing joint projects to improve social and environmental conditions of the population, working closely with local governments.

However, most of the municipalities do not take advantage of this valuable human resources and only call Health and Education sectors, Comités de Vaso de Leche (Committes of the Glass of Milk) and Mothers' Clubs or Community Kitchen, that only represent specific groups of the population. This generates mistrust in the organizations representing the population and limits the communication.

An important element is the Environmental Municipal Commission promoted by the former Environmental National Council (CONAM) in order to transform them into coordination agencies to deal with environmental issues. The following chart shows participating agencies,

and most of them are not implemented in most of the municipalities involved in the Program. In that sense, the strategy used should be changed taking into account that there are other social actors (representatives of the sectors and social organizations) in order to avoid proliferation of organizations, duplicate activities and strengthening existing capabilities.

.The following chart shows social organizations called by municipalities to develop educational and social communication programs regarding solid waste management.

Table 3.2-15 Social Organizations and Sectors that coordinate with the Municipalities involved in the Program

MUNICIPALITY	SOCIAL ORGANIZATION			PRIVATE SECTOR	PUBLIC SECTOR
	Interinstitutional	Functional	Territorial		
TUMBES	CONCERTATION TABLE , Comission of solid waste, CAM	Glass of Milk, community kitchen		AECID, NGOs	Health, education
PIURA	CAM was formed but is not running	Waste Pickers Association, Vaso de Leche (Glass of Milk), community kitchen,youth institutions		PRISMA NGO	Health and Education
SULLANA	CAM was formed but is not running	Glass of Milke and Community Kitchen		NGOs	There is no articulated work with Health or Education
TALARA	CAM was formed. I operates from time to time	Glass of Milk,, Community Kitchen,youth organization		PETROTECH, EEPSA (electricity company provides support)	Poor coordination with Health (DESA) and Regional Government
SECHURA	CAM was formed. It operates from time to time	Glass of Milk,Committee and CCommunity Kitchen		NGOs	There is no coordination with Health or Education
PAITA		Glass of Milk,, community kitchen,youth organization		Small companies	Poor coordination with Health
SAN MARTIN (Tarapoto)	CAM formed solid waste committee but it is not active	Mother´s Club, Glass of Milk and Community Kitchen		DEVIDA ONGs	Health, local government, Education EMAPA
FERREÑAFE		Vaso de leche committee and community kitchen	Neighbor committee		Health, Education
MOYOBAMBA	CODECO (Committee of Comunal Development)	Waste pickers Association, Glass of Milk committee community kitchen	Neighbor committe	Ciudad Saludable NGO	Health, Education

MUNICIPALITY	SOCIAL ORGANIZATION			PRIVATE SECTOR	PUBLIC SECTOR
	Interinstitutional	Functional	Territorial		
CHACHAPOYAS	CAM	Glass of Milk committee,community kitchen and youth organization	Neighbor committee	IIAP, Eco Verde	Health Education
SANTIAGO	CAM	Mother´s Club, Glass of Milk and Community Kitchen	Neighbor committee		Very little coordination with Health and Education sectors
CHINCHA	CAM	Mother´s Club, Glass of Milk,Community Kitchenand youth organization			Government. Local
HUACHO	CAM	Aldermen Committee, Mother´s Club and community kitchen	Neighbor committee	OTAM Sánchez Carrión University, EMAPA	Education and Health DIRESA
NUEVO CHIMBOTE	CAM was formed but does not work	Asociation ofWaste Pickers of Nuevo Chimbote, Glass of Milk and Mother´s Club		PNUMA, La comunidad.	Education, Health and Local Government
HUANUCO		Vaso de leche committee and community kitchen		SEMBRANDO VIDAS NGO	Education, Health and Local Government.
TARMA	CAM	Glass of MilkCommittee and Community Kitchen			MINED (Project 3R)
PUNO	CAM was formed.	Mother´s club, Glass of milk andcommunity kitchen			ALT (Titicaca;s Lake Authority, after its name in Spanish)
JULIACA	CAM was formed but it is not operating	Mother´s club, Glass of Milk,Community Kitchenand youth organization			Defense of the people MINAM MINSA
PUERTO MALDONADO	CAMwas installed, But does not work	Mother´s Club and Glass of Milk	Federation of AAHH Agrarian Federation	- Pro Naturaleza NGO - Neighbor committee	Limited coordination with Education and Health.
AZANGARO	Commiteeof local coordination (CCL)environmental network of azángaro, (It is just starting).	Mother´s Club and Glass of Milk		NGOs and community	Health and Reagional Government Education

MUNICIPALITY	SOCIAL ORGANIZATION			PRIVATE SECTOR	PUBLIC SECTOR
	Interinstitutional	Functional	Territorial		
ILAVE		Mother´s Club, Glass of Milk,Community Kitchenand Youth organization			Health and Regional Government, Education
ABANCAY	Multisectorial RoundTable of , CAM	Mother´s club, Vaso de leche andcommunity kitchenand market association.	Peasant federation		National University. Micaela Bastidas, Health, Education, INRENA
BAGUA		Vaso de Leche – community kitchenyouth organization		Merchants Association	Health, Education and Agriculture
ANDAHUAYLAS	Multisectorial Round Table	Mother´s Club, Glass of MilkCommunity and youth organization		Chamber of Commerce, Peasant federation and NGO´s	Health, Education and Agriculture
SAN JUAN BAUTISTA	CAM	Glass of Milk and community kitchen		ONG´s	Health and Education
HUAMANGA	CAM	Vaso de leche, community kitchenand youth organization	Federation of AA.HH.	Peasant Federation NGO´s	Health, Education, Agriculture and Nacional University
OXAPAMPA	MultisectorialRound Table	Glass of Milk and community kitchen			Health, Education, Local Government and Agriculture
POZUZO		Mother´s Club and Glass of Milk			Health, Local Government and Education
CHANCAY	CAM	Mother´s club, Glass of Milk, Community Kitchenand youth organization	Neighbor Committee	Chamber of commerce and Peasants Federation NGOs	Local Government, Health and Education
YAUYOS	MultisectorialRound Table	Glass of Milk and Community kitchen		Peasants Federation NGOs	Health, Local Government and Education

Therefore, the initiative to promote active participation of organized civil society, as well as public and private sector in the comprehensive solid waste management must be included in the actions that may require more strengthen for the program to be sustainable.

3.3 DIAGNOSE OF THE SOLID WASTE MANAGEMENT SERVICE

3.3.1 Nationwide

Population is growing in Peru; besides,consumption habits, unplanned migration processes and trade routes increase the amount of solid waste, which is higher than the finance for the services. This situation puts people’s health at risk and increases poverty.

The current report of the country, which has been prepared by the Ministry of Environment, describes a sanitary and environmental situation rather critical. The quality and cover of the services provided shows there are not enough investments in this field and a persistent resilience to change on behalf of the municipal authorities.

For the year 2009, cities made up 78% of the population, where the average household waste generated was 0.602 kg per person per day. In the jungle area, the average varies between 0.42 and 1.042 kg/person/day, which shows clearly consumption habits in the area (based on the use of natural products) rather than poverty levels. The total amount of urban solid waste nationwide is 17.201 daily tons of waste. The cover of the solid waste collection services is 69.86%. However, regarding the final disposal of waste in authorized sanitary landfills (10), the cover for the whole country is 25.09%, so the situation at this point of the process becomes critical. Then, there is a large amount of solid waste that are disposed in the environment, such as dump sites, rivers and beaches the main places where waste is disposed. This causes pollution, because waste is accumulated and stays in the environment, thus putting people's health and ecosystems at risk.

Regarding the comprehensive plans of solid waste environmental management (PIGARS, after its name in Spanish) established in the legal framework for provincial municipalities, 58% of provincial municipalities do not have PIGARS, only 42% (82) of the provincial municipalities have a PIGAR approved.

The number of PIGARS approved at national level has in steadily increasing, but not in all cases. Those plans are executed since provincial municipalities do not allocate resources or an annual budget for the activities prioritized in the document.

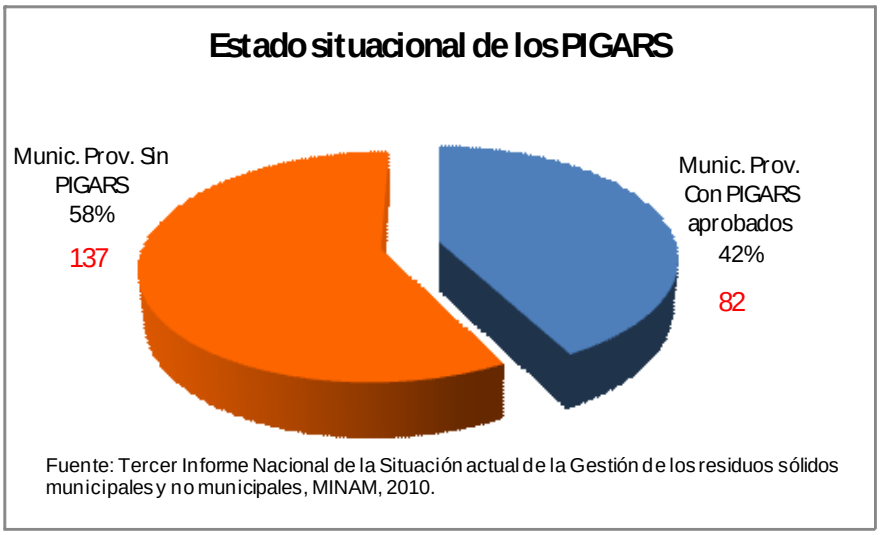
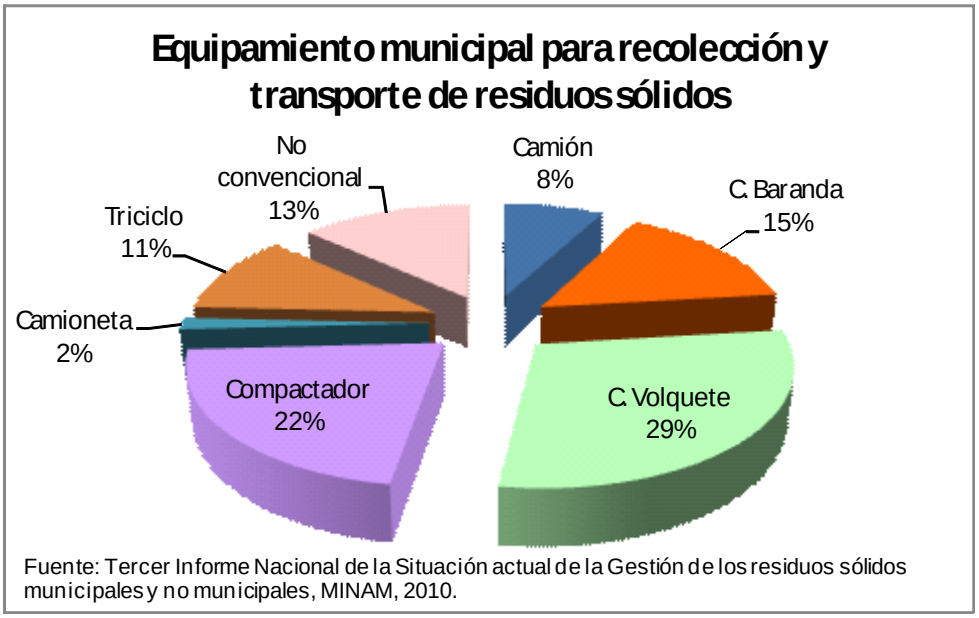


Figure 3.3-1 Status of PIGARS

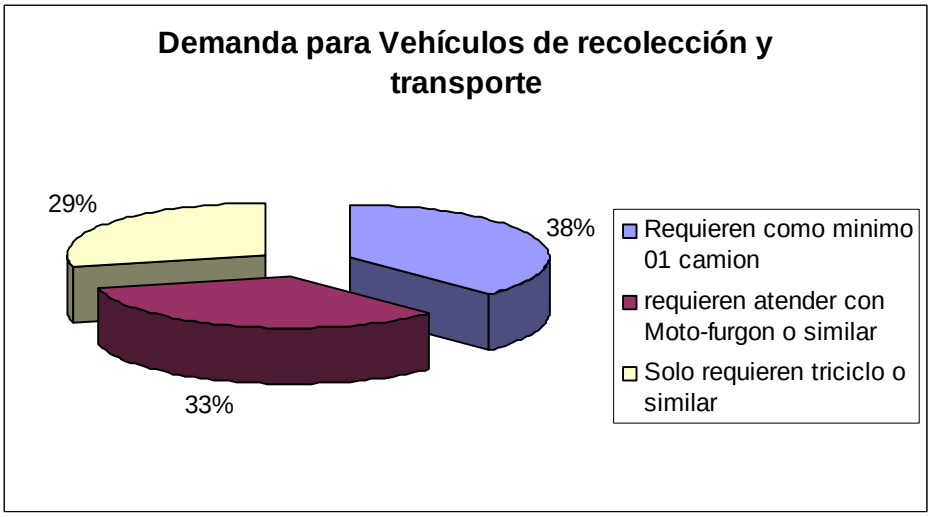
Regarding the type of collection vehicles used nationwide, 22% are compactor trucks, 15% Hopper trucks, 29% dump truck and 34% other (tricycles, vans, among others).



Fuente: Tercer Informe Nacional de la Situación actual de la Gestión de los residuos sólidos municipales y no municipales, MINAM, 2010.

Figure 3.3-2 Collection vehicles used

Following is the demand for vehicles nationwide. 38% of cities need at least 1 collector truck (compactor or dump truck); 33% need motor van for segregation of solid waste, and 29% need non conventional vehicles, such as tricycles, due to the geographic features.



Source: Report on the current situation of municipal solid waste management

Figure 3.3-3 Demand for Collection and Transportation Vehicles

The cities included in this Program, regarding the infrastructure demand for solid waste, it was identified that 58% of the cities nationwide require mechanized sanitary landfills; 19& need semi mechanized sanitary landfills and 23% need manual sanitary landfills.Reuse of solid wasteaccounts for 14.7% of the solid waste generated in the municipalities. Reuse is done in the households, during collection and at final disposal. From the social, health and environmental point of view, this activity is performed under very poor conditions, jeopardizing the health of the recyclers.

The problem lies in the cost of the service and collection rate at the municipalities. Due to several factors, such as lack of credibility of municipalities, weak sanitary management, arrears from population, create the need for establishing strategies to charge for the service.

Below is the analysis for each of the cities included in the program.

3.3.2 Characterization of Solid Wastein the cities of the Program

(1) Results of Household Waste Characterization

In 2009 and 2010, characterization studies of solid waste in the 31 cities of the Program were carried out. The results showed that in Piura and Moyobamba, per capita generation is over 600 gr/person/day; in Abancay, Ayacucho, Ferreñafe, Sullana, Talara, Juliaca, Puno, Oxapampa, Tarapoto, Chincha and San Juan Bautista, is more than half kilogram per person per day; in Azángaro, is hardly 282 gr./person/day. Regarding solid waste density, the heaviest solid waste are produced in Ayacucho, Andahuaylas and Abancay.

Table 3.3-1 Household per capita Generation and Average Density

DEPARTMENT	TOWN	GPC	DENSITY
		Kg/day.hab	Kg/m^3
AMAZONAS	Chachapoyas	0,459	135,47
	Bagua	0,493	51,51
ANCASH	Nuevo Chimbote	0,459	110,35
APURIMAC	Abancay	0,556	250,00
	Aymaraes	0,468	128,12
	Andahuaylas	0,493	266,282
AYACUCHO	Huamanga	0,683	192,13
HUANUCO	Huánuco	0,347	137,76
LAMBAYEQUE	Ferreñafe	0,548	200,28
LIMA	Huacho	0,401	108,93
	Chancay	0,400	162,40
MADRE DE DIOS	Puerto Maldonado	0,393	150,00
PIURA	Piura y Castilla	0,628	190,65
	Sechura	0,309	226,70
	Sullana	0,509	142,72
	Paita	0,400	205,01
	Talara	0,535	78,49
PUNO	Azángaro	0,282	83,00
	Ilave	0,316	202,65
	Juliaca	0,500	171,49
	Puno	0,510	195,89
PASCO	Oxapampa	0,560	150,24
	Pozuzo	0,410	200,00

DEPARTMENT	TOWN	GPC	DENSITY
		Kg/day.hab	Kg/m^3
SAN MARTIN	Tarapoto	0,539	195,57
	Moyobamba	0,620	240,76
TUMBES	Tumbes	0,312	77,50
ICA	Chincha	0,502	133,00
	Santiago	0,304	71,06
JUNIN	Tarma	0,403	144,10
	Yauyos	0,490	234,10
LORETO	San Juan Bautista	0,548	283,66

Source: Solid Waste Characterization Study, 2009 and 2010.

(2) Household Solid Waste Composition

The cities have undergone a urbanization process, consumption and life habits of the population, as well the economic activities have a direct impact on solid waste composition. In those cities where agriculture is the main activity, there is more organic matter. On the contrary, in the cities with high trade activities, there are more reusable waste, such as paper, cardboard, plastic, glass and metals, among others.

Compost can be obtained from organic matter, so in cities such as Puno, Huánuco, Moyobamba, Tarapoto, Bagua, Oxapampa and San Juan Bautista, there are between 30% and 60% of organic matter; in Santiago, the levels of organic matter are below 30%.

Regarding solid waste that can be recyclable into paper, cardboard, plastic, glass and metal, cities like Tumbes, Sullana, Talara, Ilave, Azángaro, Sechura, Santiago, Andahuaylas and Yauyos produce 25% of reciclable solid waste; Abancay and Aymaraes have a low percentage of reciclable waste; and in 22 of the cities, recyclable waste varies between 7% and less than 25%.

Besides, some solid waste can not be reusable and must be disposed in a sanitary landfill. For example, in Abancay, Ferreñafe, Santiago and Aymaraes the percentage of solid waste disposed in a sanitary landfill are 41,4%, 53,1%, 45,4% and 41,9%, respectively.

Below is a summary of the 31 cities evaluated during 2009 and 2010.

Table 3.3-2 Solid Waste Composition in the Area of Intervention

Características	Unidades	Puno	Juliaca	Piura	Nuevo Chimbote	Tumbes	Sullana	Abancay	Huánuco
Generación per cápita (promedio)	kg/hab./d	0,510	0,500	0,628	0,459	0,312	0,509	0,556	0,347
Densidad	kg/m³	185,89	171,49	190,65	110,35	77,50	142,72	250,00	137,76
Caracteristicas cualitativas	%	100,00	100,00	100,00	100,00	99,99	100,00	100,00	100,00
A. Residuos reaprovechables (A1 + A2)	%	**78,34**	**64,52**	**78,40**	**60,11**	**79,36**	**64,49**	**58,60**	**81,51**
A1. Residuos compostificables	%	**62,82**	**45,70**	**49,60**	**41,59**	**53,85**	**38,79**	**52,00**	**63,64**
Residuos orgánicos (maderas, etc)	%	0,49	6,93	0,00	0,46	0,50	0,93	1,20	0,01
Restos de comida	%	59,46	35,66	44,10	41,13	53,35	37,86	37,40	63,63
Residuos de jardines	%	1,99	2,22	3,80	0,00	0,00	0,00	13,00	0,00
Otros	%	0,88	0,89	1,70	0,00	0,00	0,00	0,40	0,00
A2. Residuos reciclables	%	**15,52**	**18,82**	**28,80**	**18,52**	**25,51**	**25,70**	**6,60**	**17,87**
Papel	%	3,99	3,55	8,50	4,93	5,40	5,62	0,60	5,61
Cartón	%	2,59	3,24	3,80	2,22	4,67	3,77	1,00	1,73
Vidrio	%	0,81	2,21	2,80	2,37	2,21	4,29	0,10	0,69
Plásticos	%	5,42	6,51	10,00	6,76	9,39	8,52	3,50	6,39
Metales	%	2,26	2,98	3,30	1,93	2,65	3,50	1,20	3,45
Otros	%	0,43	0,33	0,40	0,31	1,19		0,20	
B. Residuos no aprovechables / inservibles	%	**21,66**	**35,48**	**21,60**	**39,89**	**20,63**	**35,51**	**41,40**	**18,49**
Bolsas plásticas, baterías, textiles,etc	%	8,50	13,36	4,00	1,41	1,73	1,69	1,70	0,89
Tierra, arena, piedra, etc	%	0,83	10,16	9,90	30,13	11,46	26,83	38,40	8,46
Otros	%	12,33	11,96	7,70	8,35	7,44	6,99	1,30	9,14
B. Total (A + B)	%	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00

Source: Characterization Study of Solid Waste ONG ODS-GEA-JICA- PWI SAC – CIUDAD SALUDABLE.

Caracteristicas	Unidades	Paita	Puerto Maldonado	Tatara	Moyobamba	Tarapoto	Chachapoyas	Ilave
Generación per cápita (promedio)	kg/hab./d	0,400	0,393	0,535	0,620	0,539	0,459	0,316
Densidad	kg/m³	205,01	150,00	78,49	240,76	195,57	135,47	202,65
Caracteristicas cualitativas	%	100,01	100,00	100,00	100,00	100,00	100,00	100,00
A. Residuos reaprovechables (A1 + A2)	%	**63,67**	**76,00**	**72,97**	**87,19**	**78,98**	**64,06**	**76,22**
A1. Residuos compostificables	%	**44,43**	**54,80**	**47,02**	**76,99**	**63,50**	**47,50**	**42,69**
Residuos orgánicos (maderas, etc)	%	0,71	0,44	0,38	0,22	0,10	0,07	2,78
Restos de comida	%	43,10	54,36	46,64	57,10	63,40	47,43	39,91
Residuos de jardines	%	0,62	0,00	0,00	19,48	0,00	0,00	0,00
Otros	%	0,00	0,00	0,00	0,19	0,00	0,00	0,00
A2. Residuos reciclables	%	**19,24**	**21,20**	**25,95**	**10,20**	**15,48**	**16,56**	**33,53**
Papel	%	4,74	2,83	8,83	2,21	3,23	2,29	3,10
Cartón	%	3,09	2,45	5,04	2,60	2,06	2,99	4,96
Vidrio	%	1,83	1,39	2,37	0,78	1,99	1,81	8,18
Plásticos	%	5,46	10,66	7,39	2,73	5,20	7,14	14,72
Metales	%	3,70	3,85	3,80	1,81	2,51	2,08	4,23
Otros	%	0,62		0,52	0,27	0,49	0,45	0,34
B. Residuos no aprovechables / inservible	%	**36,34**	**24,00**	**27,03**	**12,81**	**21,02**	**35,94**	**23,78**
Bolsas plásticas, baterías, textiles,etc	%	7,37	2,05	1,42	7,13	1,13	1,66	2,68
Tierra, arena, piedra, etc	%	20,32	9,21	15,32	0,32	13,63	24,67	14,56
Otros	%	8,65	12,74	10,29	5,36	6,26	9,61	6,54
B. Total (A + B)	%	100,00	100,00	100,00	100,00	100,00	100,00	100,00

Source: Characterization Study of Solid Waste ONG ODS-GEA-JICA- PWI SAC – CIUDAD SALUDABLE.

Características	Unidades	Azángaro	Chincha	Sechura	Huacho	Tarma	Ferreñafe	Santiago	Aymaraes
Generación per cápita (promedio)	kg/hab./d	0,282	0,502	0,309	0,401	0,403	0,548	0,304	0,468
Densidad	kg/m³	83,00	133,00	226,70	108,93	144,10	200,28	71,06	128,12
Características cualitativas	%	100,00	100,00	100,00	99,99	99,99	100,00	100,00	100,00
A. Residuos reaprovechables (A1 + A2)	%	**75,52**	**63,91**	**60,11**	**76,89**	**76,77**	**46,88**	**54,52**	**58,05**
A1. Residuos compostificables	%	**47,12**	**48,93**	**32,61**	**59,35**	**59,13**	**33,17**	**23,18**	**52,44**
Residuos orgánicos (maderas, etc)	%	0,00	0,04	0,20	0,39	6,91	0,00	2,15	0,11
Restos de comida	%	47,12	48,89	32,41	58,96	41,99	33,17	18,99	52,33
Residuos de jardines	%	0,00	0,00	0,00	0,00	8,22	0,00	2,04	0,00
Otros	%	0,00	0,00	0,00	0,00	2,01	0,00	0,00	0,00
A2. Residuos reciclables	%	**28,40**	**14,98**	**27,50**	**17,54**	**17,64**	**13,71**	**31,34**	**5,61**
Papel	%	3,71	4,50	7,01	4,27	4,79	2,16	5,09	0,66
Cartón	%	3,41	2,16	4,26	2,11	2,12	1,83	6,29	0,93
Vidrio	%	2,98	0,59	3,09	2,22	2,02	2,57	10,65	0,11
Plásticos	%	11,82	5,02	10,25	6,33	6,14	5,77	6,22	2,38
Metales	%	5,76	2,30	1,58	2,20	2,19	1,03	2,02	1,34
Otros	%	0,72	0,41	1,31	0,41	0,38	0,25	1,07	0,17
B. Residuos no aprovechables / inservible	%	**24,48**	**36,09**	**39,89**	**23,10**	**23,22**	**53,12**	**45,48**	**41,95**
Bolsas plásticas, baterías, textiles,etc	%	0,69	1,67	3,04	1,23	11,34	1,82	26,74	2,31
Tierra, arena, piedra, etc	%	17,67	24,98	29,88	7,97	5,02	46,29	5,87	38,73
Otros	%	6,12	9,44	6,97	13,90	6,86	5,01	12,87	0,91
B. Total (A + B)	%	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00

Source: Solid Waste Characterization Study ONG ODS-GEA-JICA- PWI SAC – CIUDAD SALUDABLE.

Características	Unidades	Andahuaylas	Chancay	Bagua	Huamanga	Oxapampa	Pozuzo	San Juan Bautista	Yauyos
Generación per cápita (promedio)	kg/hab./d	0,493	0,400	0,493	0,683	0,560	0,410	0,548	0,490
Densidad	kg/m^3	266,28	162,40	51,51	192,13	150,24	200,00	263,66	234,10
Características cualitativas	%	100,01	100,01	99,99	99,99	100,00	100,00	100,00	100,00
A. Residuos reaprovechables (A1 + A2)	%	**77,55**	**75,92**	**82,49**	**81,96**	**87,27**	**71,51**	**75,52**	**76,72**
A1. Residuos compostificables	%	**47,68**	**58,70**	**63,44**	**55,09**	**66,91**	**51,36**	**64,07**	**38,13**
Residuos orgánicos (maderas, etc)	%	0,23	0,00	0,44	1,39	0,00	0,52		
Restos de comida	%	47,45	58,70	63,00	37,62	66,91	50,84	64,07	38,13
Residuos de jardines	%	0,00	0,00	0,00	14,27	0,00	0,00	0,00	0,00
Otros	%	0,00	0,00	0,00	1,81	0,00	0,00	0,00	0,00
A2. Residuos reciclables	%	**29,87**	**17,22**	**19,05**	**26,87**	**20,36**	**20,15**	**11,45**	**38,59**
Papel	%	5,25	2,49	2,57	5,64	5,01	6,97	0,75	4,48
Cartón	%	5,94	3,68	2,49	5,73	2,06	2,76	0,00	4,41
Vidrio	%	2,15	1,64	8,85	3,14	2,03	1,46	1,14	4,83
Plásticos	%	12,82	8,09	3,27	8,06	8,19	4,27	5,57	16,85
Metales	%	0,00	0,00	0,00	3,74	0,00	0,00	2,12	0,00
Otros	%	3,71	1,42	1,87	0,56	3,13	4,70	1,87	8,02
B. Residuos no aprovechables / inservible	%	**22,46**	**24,09**	**17,50**	**18,03**	**12,73**	**28,49**	**24,48**	**23,28**
Bolsas plásticas, baterías, textiles,etc	%	3,09	1,96	9,40	6,76	5,74	11,47		17,27
Tierra, arena, piedra, etc	%	10,66	10,16	3,48		0,00	1,68		6,01
Otros	%	8,71	11,95	4,62	11,27	6,98	15,34	24,48	0,00
B. Total (A + B)	%	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00

Source: Characterization Study of Solid Waste ONG ODS-GEA-JICA- PWI SAC – CIUDAD SALUDABLE.

Characterization of non-household solid waste

The results of the complementary characterization of non-household solid waste, such as that coming from restaurants, markets, institutions, hotels, etc carried out by PWI S.A.C in 2010 in the cities of Puno, Juliaca, Piura, Abancay, Paita, Moyobamba, Azángaro, Tarma,Aymaraes,Huánuco, Tarapoto, Huamanga and San Juan Bautista shows that most of it is formed by reusable waste (recyclable and composting), representing between 60% and 84% of all waste generated. Therefore, non-household solid waste is a potential source for the segregation in the city, thus increasing the possibilities to sell such waste, which in turn would be a relief for both the population and the environment.

Table 3.3-3 Characterization of non-Household Solid Waste

Características	Unida	Puno	Juliaca	Piura	Nuevo Chimbote	Tumbes	Sullana	Abancay	Huánuco
I).- Residuos comerciales									
Generación total	t/d	1,360	34,900	13,069	S.D.		3,153	1,087	4,520
II).- Residuos de restaurantes									
Generación total	t/d	2,890	0,927	2,512	S.D.	2,490	3,273	1,611	1,710
III).- Residuos de hoteles									
Generación total	t/d	1,110	1,027	0,528	S.D.	0,050	0,374	0,446	0,210
IV).- Residuos de mercados									
Generación total	t/d	3,820	3,178	45,357	S.D.	6,000	2,372	1,254	9,070
V).- Residuos de instituciones									
Generación total	t/d	3,120	5,008	2,386	S.D.	0,910	1,710	7,862	1,810
VI).- Residuos de barrido									
Generación total	t/d	2,020	4,809	7,021	S.D.	0,000	3,172	7,279	6,420
Total Generation (I+...VI)	t/d	14,320	49,849	70,873	S.D.	9,450	14,054	19,539	23,740

Source:Solid Waste Characterization Study ONG ODS-GEA-JICA- PWI SAC – CIUDAD SALUDABLE.

Características	Unida	Paita	Puerto Maldonado	Talara	Moyobamba	Tarapoto	Chachapoyas	Ilave
I).- Residuos comerciales								
Generación total	t/d	0,242	3,317	3,215	0,915	13,426	1,430	0,760
II).- Residuos de restaurantes								
Generación total	t/d	0,404	1,045	0,837	0,462	3,339	0,332	0,650
III).- Residuos de hoteles								
Generación total	t/d	0,082	0,301	0,397	0,070	0,339	0,045	0,250
IV).- Residuos de mercados								
Generación total	t/d	1,559	3,714	1,884	2,390	11,554	1,303	0,860
V).- Residuos de instituciones								
Generación total	t/d	1,201	0,762	1,229	0,403	0,934	0,427	0,700
VI).- Residuos de barrido								
Generación total	t/d	1,036	1,769	3,686	0,404	2,206	0,811	
Total Generation (I+...VI)	t/d	4,523	10,908	11,248	4,644	31,798	4,348	3,220

Características	Unida	Azángaro	Chincha	Sechura	Huacho	Tarma	Ferreñafe	Santiago	Aymaraes
I).- Residuos comerciales									
Generación total	t/d	0,599	1,790		10,516	1,490	1,000	0,390	0,031
II).- Residuos de restaurantes									
Generación total	t/d	0,000	0,750	0,093	5,333	2,680	1,000	0,021	0,026
III).- Residuos de hoteles									
Generación total	t/d	0,000	0,140	0,012	0,275	0,220	1,000	0,000	0,003
IV).- Residuos de mercados									
Generación total	t/d	0,352	1,670	0,244	2,189	2,480	2,000	0,022	0,116
V).- Residuos de instituciones									
Generación total	t/d	0,495	1,710	0,075	0,706	0,370	2,000	0,233	0,073
VI).- Residuos de barrido									
Generación total	t/d	0,000	6,000	0,000	3,032	2,940	4,500	0,182	0,036
Total Generation (I+...VI)	t/d	1,446	12,060	0,424	22,051	10,180	11,500	0,848	0,285

Source: Solid Waste Characterization Study ONG ODS-GEA-JICA- PWI SAC – CIUDAD SALUDABLE.

Características	Unida	Andahuaylas	Chancay	Bagua	Huamanga	Oxapampa	Pozuzo	San Juan Bautista	Yauyos
I).- Residuos comerciales									
Generación total	t/d	0,590	0,470	0,670	3,619		0,340		1,200
II).- Residuos de restaurantes									
Generación total	t/d	0,520	0,350	0,210	3,417				
III).- Residuos de hoteles									
Generación total	t/d	0,000		0,290	0,177				
IV).- Residuos de mercados									
Generación total	t/d	0,680	2,500	1,440	28,920				
V).- Residuos de instituciones									
Generación total	t/d	1,340	1,380	6,200	2,662				0,350
VI).- Residuos de barrido									
Generación total	t/d	2,880	3,890	0,350	8,425	0,310			0,450
Total Generation (I+...VI)	t/d	6,010	8,590	9,160	47,220	0,310	0,340	0,000	2,000

Source: Solid Waste Characterization Study NGO ODS-GEA-JICA- PWI SAC – CIUDAD SALUDABLE.

(3) Municipal Solid Waste Generation

The total amount of waste generated by the 31 cities included in the program is 637,370 t/year. Piura generates the largest amount of waste: 106 thousand tons/year, followed by Juliaca, with 68 thousand tons/year; Ayacucho, 49 thousand tons/year and Sullana, 45 thousand tons/year of solid waste. The detailed information of the waste generated in each city is below.

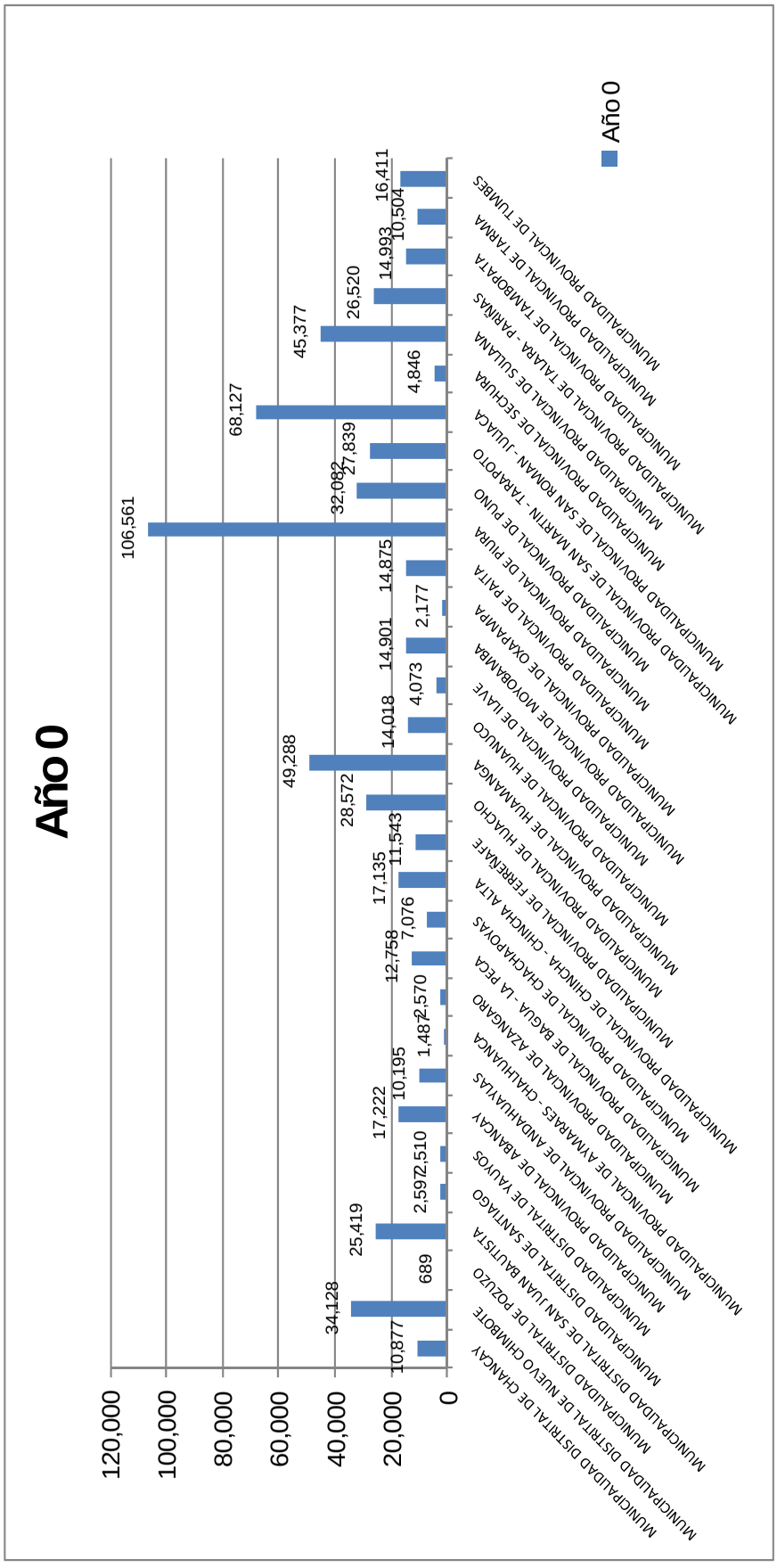


Figure 3.3-4 Waste Generation Year 0

(4) Public Storage of Municipal Solid Waste

The following chart describes the type of storage existing in the public spaces and roads of the cities included in the Program.

Table 3.3-4 Current public storage capacity of solid waste

Cities	Actual capacity of storage (t)	Storage type / Condition
TUMBES	0.12	17 waste bins of 90 Lt / bad conditions
PIURA	0.44	46 waste bins of 50 Lt. / bad conditions
SULLANA	0.85	119 waste bins of 50 Lt. / bad conditions
TALARA	0.151	48 waste bins of 40 Lt. / bad conditions
SECHURA	0.125	11 waste bins of 50 Lt. / bad conditions
PAITA	0.21	13 waste bins of 80 Lt / bad conditions
FERREÑAFE	0.10	10 waste bins of 50 Lt./ bad conditions
TARAPOTO	3.44	220 waste bins of 80 Lt. / regular conditions
MOYOBAMBA	0.28	26 waste bins of 40 and 50 Lt./ bad conditions
CHACHAPOYAS	0.413	29 waste binsof 50 Lt. / regular conditions
NUEVO CHIMBOTE	0.28	50 waste bins of 50 Lt./ bad conditions
HUACHO	0.16	30 waste binsof 50 Lt. / bad conditions
SANTIAGO	0.000	0 waste bins
CHINCHA	0.53	50 waste bins 80 Lt. / bad conditions
HUANUCO	0.22	32 waste bins 50 Lt. / regular conditions
TARMA	0.83	72 waste bins of 80 Lt. / regular conditions
ABANCAY	0.13	10 waste bins of 50 Lt. / regular condition
PUNO	0.47	30 waste bins 80 Lt. / regular conditions
JULIACA	0.55	61 waste bins 60 Lt./ regular conditions
AYMARAES	0.10	15 waste bins 50 Lt. / bad conditions
AZANGARO	0.02	8 waste bins of 30 Lt. / bad condition
ILAVE	0.5	27 waste bins of 42 and50 Lt./ Bad conditions
PUERT0 MALDONADO	0.23	30 waste bins 50 Lt / bad conditions
BAGUA	0,53	8 waste bins of 50 Lt and 4 containers of2,50 m3/ bad conditions
ANDAHUAYLAS	0,639	12 cylinders of 200 Lt / bad conditions
SAN JUAN BAUTISTA	1.89	57 waste bins of different sizes / regular conditions
HUAMANGA	1,403	88 waste bins of different sizes (100 y 50 Lt)/ regular condition
OXAPAMPA	0,05	8 waste bins/ bad conditions
POZUZO	0,31	52 waste bins/ bad conditions
CHANCAY	1.13	0 waste bins
YAUYOS	0,25	22 waste bins of 50 Lt. / bad conditions

As the chart shows, 20 cities have damaged waste bins, that is to say, they have a limited capacity to provide storage service, whereas 10 cities have fairly damaged waste bins. Santiago does not have containers to provide storage service.

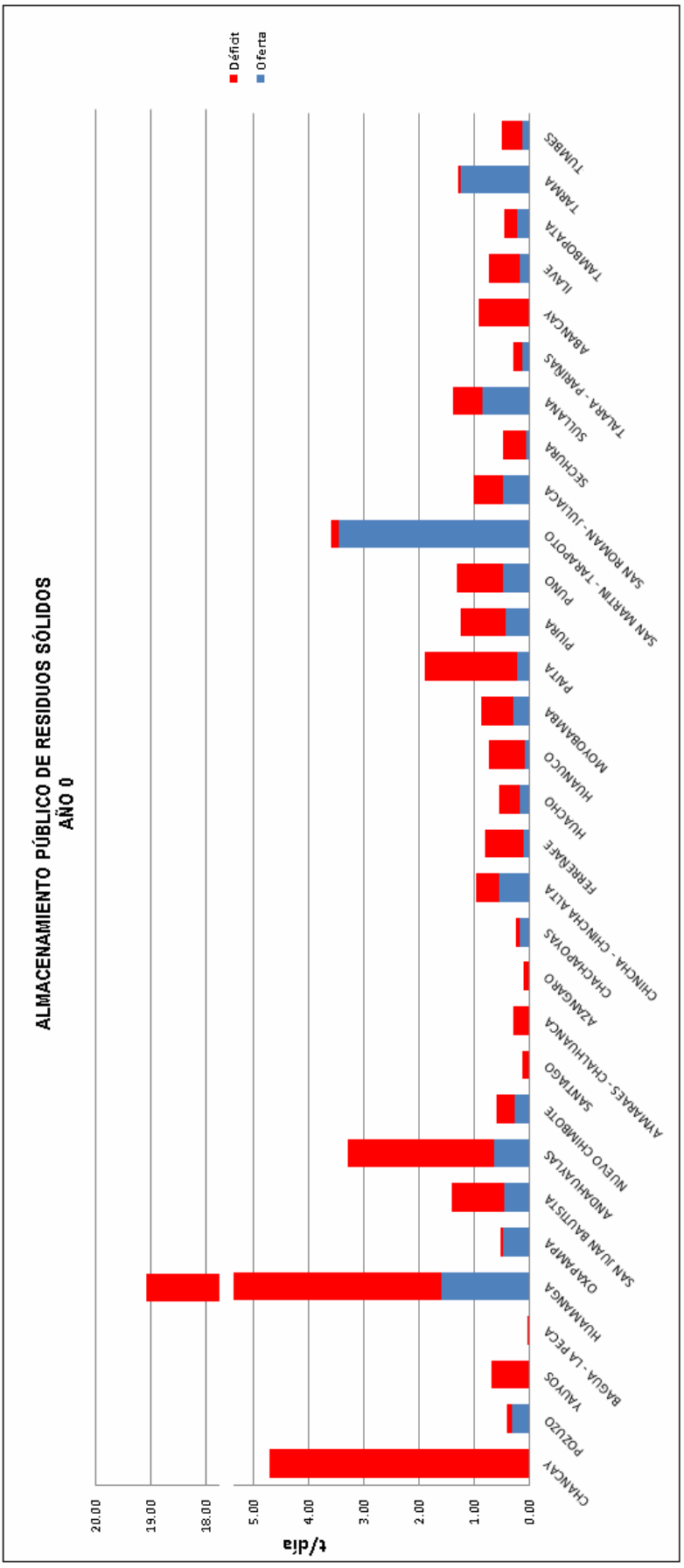


Figure 3.3-5 Storage of Municipal Solid WasteYear 0

(5) Street Sweeping

In the cities involved in the program, street sweeping is done manually and is provided directly by the municipalities, except for the district of San Juan Bautista (Maynas) that provides service to small companies. In some cities, there are too many personnel hired to carry out street sweeping activities, as it happens in Chincha, whereas in most of the cities, operational performance is low. Below, it is a summary of the current situation of the service.

Working conditions of streetsweepers are poor, since they do not wear personal protection garments (EPPs, tools and work material), lack of sweeping plans (there are not defined routes), lack of evaluation, tracking and monitoring plans of the service, and lack of training programs for the workers.

Table 3.3-5 Information on Street Sweeping

City	Coverage of sweeping	Name of attended areas	Frequency and schedule	Amount of collected waste	Sweeper performance Km/day	Equipment and tools	Amount of tools
TUMBES	100%	Main squareCentral area of Tumbes city	Daily	ND	0.85	Broom, waste pickers, bags and wheelbarrows	(24 wheelbarrows, 34 containers)
		Atahualpa, Inca Yupanqui, Huáscar, Hilario Carrasco, Bolognesi, José Lishner Tudela, Centenario, Bolívar, Serafín Bodero, José Olaya, Pasaje Jenquel, Sinchi Roca, Periferia de mercado modelo, Av. Perú.	Daily	ND		brooms, waste pickers, wheelbarrows	(23 brooms and 23 waste pickers, 08 wheelbarrows)
		Main square and central area (paved streets); las Calles Piura, San Pedro, Alfonso Ugarte, Miramar, Bolívar, Francisco Pizarro, Paseo Av. Independencia, Mercado, Túpac Amaru, San Martín, 28 de Julio y cementerio.	Daily	ND		brooms, waste pickers, wheelbarrows	(08 brooms and waste pickers)
		Plaza Principal, zona céntrica y Calle Alipio Rosales, las plazas y plazuelas del distrito	Daily	ND		brooms, waste pickers, wheelbarrows	(08 brooms and waste pickers)
		Horacio Patiño street and main square	Every other day	ND		brooms, waste pickers, wheelbarrows	(03 brooms and waste pickers))
		Main square and streets	daily and every other day	ND		brooms, waste pickers, wheelbarrows	(06 brooms and waste pickers))
PIURA	100%	Paved main streets of Piura city: Sánchez Cerro, Huancavelica, Miguel Grau, Bolognesi, Ayacucho, Libertad, Loreto, Tacna, Apurímac, Junín, Cuzco, Sullana, Callao, Ica, Moquegua, Circunvalación. Espacios públicos: ovalo Grau, ovalo Bolognesi, Plaza de armas, plaza Pizarro, Plaza marino, Plaza cruz del norte Vías de la ciudad de Castilla	Daily- PIURA Shift 1: 5:00 a.m. to 1:00 p.m. Shift 2:14.00 p.m to 10.00 p.m Daily CASTILLA 5.00 a.m to 1.00 p.m	ND	0.52	brooms, waste pickerscarts, tricycles	(120 brooms and waste pickers) (276 wheelbarrowand28 tricycles)

City	Coverage of sweeping	Name of attended areas	Frequency and schedule	Amount of collected waste	Sweeper performance Km/day	Equipment and tools	Amount of tools
SULLANA	92%	Urban area of Sullana city	Daily 5.00 a.m to 1.00 p.m	ND	1.52	brooms, waste pickers and wheelbarrows (buguis) tricycles	500 brooms (every 03 months) 60 waste pickers (every 03 months), 20 buguis, 45 tricycles.
TALARA	90%	Main streets of Talara city	Daily	ND	1.318	brooms, waste pickers, tricycles and carts	70 tricycles
SECHURA	**100%**	Paved main streets of Sechura city : Ca.Atahualpa, Ca. Bolognesi, Ca. Constitucion, Ca. Dos de mayo, Ca. Huascar, Ca. Jose Galvez, Ca. Leoncio Prado, Av. Los Eucaliptos, Ca. Los Faiques, Prolog. Sucre, Ca. Restauracion, Ca. San Miguel.	Daily	ND	2.14	brooms, waste pickers, carts and shovels	ND
PAITA	68%	Paved main streets of the city of Paita: Av. 9 de Octubre, Jir Alfonso Ugarte, Jir Elias Aguirre, Jir Hermanos Carcamo, Jir Jose de San Martin, Jir Junin, Jir La Merced Jir Melendez, Jir Mercado, Jir Nueva de Pozo, Jir Ramon Castilla, Jir Tacna, Jir Tarata, Jir Zepita, Jorge Chavez.	Daily	ND	1.22	brooms, waste pickers and carts	ND
FERREÑAFE	100%	Urban area of Ferreñafe: Av. Tacna, Calle Santa Rosa, Calle Tres Marías, Prolg. Tres Marias Sur, Av. Cáceres, Prolong. A. A. Caceres, Calle Nicanor Carmona, Calle San Martin, Calle Bolívar, Calle Sucre, Calle Arequipa, Calle Túpac Amaru, Jose Olaya, Av. Augusto B. Leguia, Jr. Castro de Bulnes, Prolong. Castro de Bulnes, Ca. Gonzales Burga, Ca. Unión, Ca. Grau, Ca. Libertad, Prolong. Libertad, Ca. Santa Clara, Av. El Pueblo.	Daily	ND	1.27	brooms, waste pickers, wheelbarrows, rakes and shovels	(13 brooms, 13 waste pickers, 06 wheel barrows, 06 rakes, 06 palanas)

City	Coverage of sweeping	Name of attended areas	Frequency and schedule	Amount of collected waste	Sweeper performance Km/day	Equipment and tools	Amount of tools
TARAPOTO	52%	Main paved streets of Tarapoto city: JR. Alegria A. Morey, JR. Antonio Raymondi, JR. Augusto B Leguia, JR. Ramirez Hurtado, JR. San Martin, JR. Gregorio Delgado, Jr. Jimenez Pimentel, Jr. Moyobamba, Jr. Manco Capac, Jr. Martinez De Compagñon, JR. Maynas, Jr. Ramon Castilla, Jr. Rioja, Jr. San Pablo De La Cruz.	Daily 11.00 p.m to 6.00 a.m	ND	2.26	brooms, waste pickers, wheelbarrows and shovels	(20 wheelbarrows, 30 shovels, 360 brooms, 240 waste pickers)
MOYOBAMBA	82%	Paved streets of Moyobamba city: Jr. 2 de Mayo, Jr. 20 de Abril, Jr. 25 de Mayo, Jr. Alonso de Alvarado, Jr. Cajamarca, Jr. Callao, Jr. Damian Najar, Jr. Emilio Acosta, Jr. Manuel del Aguila, Jr. Oscar Benavides, Jr. Pedro Canga, Jr. Reyes Guerra, Jr. San Martin, Jr. Serafin Filomeno, Jr. Varacadillo.	Daily	ND	1.12	Brooms and waste pickers	ND
CHACHAPOYAS	78%	paved streets of Chachapoya city.	Daily	0.1 tn/día	2.62	brooms and waste pickers	ND
NUEVO CHIMBOTE	37%	Av Country, Av. Pacífico, Av. Casuarina, Av. Bruces, Av., Argentina, and markets exteriors	Daily	ND	1.06	waste bins, brooms and waste pickers	ND
		Av. La Marina, Av. Brazil, Av. Universitaria, Av. Central, Av. Calle urbanas, Av. Buenos Aires, Av. Anchoveta	Daily			waste bins, brooms and waste pickers	
HUACHO	100%	Urban area of Huacho city: Av. 9 de Octubre, Av. 2 de Mayo, Av. Grau, Av. Espinar, Av. Túpac Amaru, Av. 28 de Julio, Calle Colón, Av. Leoncio Prado, Av. Mercedes Indacochea, Av. San Martin, Av. Echenique, Jr. Atahualpa, Ca. Tupac Amaru, Domingo Mandamiento, Jr. Marsical castilla, Jr. Moore, Av. Francisco Vidal, Coronel Portillo, Av. Salaverry.	Monday to Saturday 3.00 a.m to 10.00 a.m 1.00 p.m to 11.00 p.m	ND	1.91	Brooms, waste pickers, carts and tricycle	ND
SANTIAGO	79%	Calles principales de la ciudad de Santiago: Av. Santiago, Av. Principal de Casa Blanca (Av. Camino Real)	daily 3.00 a.m to 6.00 a.m	1.5 Tn/day	1.90	brooms, waste pickers and carts	ND

City	Coverage of sweeping	Name of attended areas	Frequency and schedule	Amount of collected waste	Sweeper performance Km/day	Equipment and tools	Amount of tools
CHINCHA	100%	urban areas and paved streets of Chincha city: Luis Galvez Chipoco, Av. Fatima, Mariscal Oscar Benavides, Av. San Martin, Av. 28 de Julio, Grau, Calle Mariscal Castilla, Los Angeles, Abelardo Alva Maurtua, Italia, Av. Grau, Calle Lima, Santo Domingo, Av. Idelfonso, Colon, Calle Maurtua, Pasaje Los Pinos, Calle San Carlos.	Daily 4.00 a.m to 10.00 a.m	7.95 tn/day	0.46	Escobas, recogedor, carritos, triciclos y palas	(35 unidades de escobas y recogedor) (20 carritos, 03 triciclos, 10 palas)
		main square and other streets	Daily 1.00 a.m to 7.00 p.m				
HUANUCO	69%	main streets of Huánuco city	Daily 1.00 a.m to 8.00 a.m	ND	2.48	brooms wheelbarrows, shovels and cylinders	ND
TARMA	92%	Main streets and paved ways of Tarma city: Jr. Alegria a. Morey, Jr. Antonio Raymondi, Jr. Augusto B Leguía, Jr. Ramírez Hurtado, Jr. San Martin, Jr. Gregorio Delgado, Jr. Jiménez Pimentel, Jr. Moyobamba, Jr. Manco Capac, Jr. Martínez de Compagñon, Jr. Maynas, Jr. Ramón Castilla, Jr. Rioja Jr. San pablo De la Cruz	Daily	0,75 tn/day	1.93	brooms and wheelbarrows	ND
ABANCAY	100%	Main areas of Abancay city: Jr. Arica, Jr. Chalhuanca, Jr. Puno, Av. Juan Pablo, Castro, Jr. Miguel Grau, Jr. Santa Rosa, Av. Manuel A. Seoane, Av. Abancay, Jr. Independencia, Jr. Apurimac, Av. Daniel A. Carrión, Av. Manuel Prado Sur, Av. Nuñez, Jr. Andahuaylas, Jr. Unión, Psje Tarapaca, Jr. Huancavelica, Av. 28 de Julio, Calle 9 de diciembre, Calle Espinoza Medrano, Av. 28 de abril, Jr. Mariscal Gamarra, Jr. Lima, Jr. Libertad, Jr. Cusco, Jr. 2 de mayo, Jr. Junín, Psje. Enrique Valdivia, Jr. Sousa, Av. Centenario, Av. Enrique Pelach, Calle La Victoria.	Monday to Friday 3.00 a.m to 6.00 a.m 8.00 a.m to 12.00 a.m 3.00 p.m to 6.00 p.m	ND	2.01	brooms, waste pickers,wheelbarrows and carts	(15 wheelbarros and 15 carts)
		Surrounding areaof Abancay city	Monday to Friday 8.00 a.m to 12.00 a.m 3.00 p.m to 6.00 p.m			Brooms, waste pickers, coches and carts	(20 brooms and waste pickers 15 coches carts)
		Main streets and adjacent avenues ofTamburco city	Monday to Friday 3.00 a.m to 6.00 a.m			brooms, waste pickers, andStrawsacking	(04 waste pickers, 04 straw sacking)

City	Coverage of sweeping	Name of attended areas	Frequency and schedule	Amount of collected waste	Sweeper performance Km/day	Equipment and tools	Amount of tools
PUNO	100%	Main streets: Av. Cahuide, Av. Circunvalacion Sur, Av. Costanera Centro, Av. Costanera Norte, Av. El Ejercito, Av. El Sol, Av. Floral, Av. La Torre, Av. Laykakota, Av. Los Incas, Av. Progreso, Av. Titicaca.	Daily 00.00 a.m to 10.00 a.m	9,89 Tn/day	2.34	Brooms and waste pickers	(53 of each)
		Easy Access area	Daily 00.00 a.m to 10.00 a.m	21,75 Tn/day		brooms, waste pickers	(54 of each)
JULIACA	97%	urban areas of Juliaca city: JR TACNA AV LA TORRE Jr Jose Maria Arguedas, Jr Enrique Lopez Albujar, JR Huaraz, Jr 28 de Julio, Jr Francisco Pastor, Jr Inca Catari, Jr Lampa, Av Costanera Norte, Jr Ilo, Jr Talara, Jr Puerto Maldonado, Psje Puerto Maldonado.	Daily 8.00 p.m to 3.00 a.m 6.00 a.m to 1.00 p.m 1.00 p.m to 6.00 p.m	4,73 Tn/day	1.8	Brooms, waste pickers, shovels, wheelbarrows(two wheels) ,picks	(127 brooms and waste pickers)
AZANGARO	100%	Barrio Vilcapaza, Alianza, Lizandro Luna, Revolución, Ezquiel Urviola	Daily	0,854 tn /day	0.91	brooms, waste pickers and wheelbarrows.	ND
ILAVE	100%	urban center of Ilave: JR Alfonso Ugarte 3 Al Final, Jr Sta Barbara 3 Al Final, Jr Zepita, Jr Sucre 3 Al Final, Av El Niño 3 Hasta El Final, Jr Chuchito 3 Al Final, Pasaje Rumiñahui, Jr Tarapaca 1 Al Final, Jr Arica 1 Al Final, Av Ejercito 3 A 5	daily	1,66 tn /day	1.35	wheelbarrows, picks, shovels, rakes	(15 wheelbarrows)
PUERT0 MALDONADO	**99%**	Av. León Velarde, Av. Fitzcarrald, Av. Ernesto Rivero, Jr. Ica, Plaza de Armas y Av. Dos de Mayo, Jr. 28 de Julio, Jr. 26 de diciembre, Jr. Ica, Av. Tacna, Jr. Arequipa, Jr. Puno, Jr. Billinghurst, Jr. Loreto, Jr. Daniel Alcides Carrión, Jr. Moquegua, Jr. San Martin, Jr. Cajamarca, Jr. Junin, Av. Aeropuerto.	daily 4.00 a.m to 12.00 m	ND	2.39	Brooms, waste pickers	ND
BAGUA	48%	Bagua, La Peca, El Parco, Copallin y Arango	Every other day	0,347 tn/day	0,65	brooms, waste pickers, wheelbarrows	ND
ANDAHUAYLAS	100%	Abdahuaylas, Sn Jerónimo y Talavera	Daily	ND	0,5	brooms, waste pickers, wheelbarrows	ND

City	Coverage of sweeping	Name of attended areas	Frequency and schedule	Amount of collected waste	Sweeper performance Km/day	Equipment and tools	Amount of tools
SAN JUAN BAUTISTA	76%	Evitamiento Amazonas, Plaza Jorge Chávez, carretera Iquitos Nauta,vía de Evitamiento Secada Vigneta, pista Sr. De los Milagros, berma Central de la Av. Quiñones.	Daily	ND	1,33	broomswheelbarrow and or Bugí, waste pickers, 2 Motos furgoneta.	ND
HUAMANGA	63%		Daily	ND	1,85	brooms, waste pickers, wheelbarrows	ND
OXAPAMPA	12%	Easy access areas	Daily	ND	1,5	brooms, waste pickers, wheelbarrows.	ND
POZUZO	76,92%	the service is not provided		ND		brooms and waste pickers	ND
CHANCAY	87,19%		Daily: from 4:00am to 12:00pm and from 8:00am to 16:00pm	27 tn/día	S.D.	brooms, tricycles and waste pickers	52 broomstricycleand 6 waste pickers
YAUYOS	73%	streets, avenues passages and squares,.	daily from 5.30 a.m. to 1.15 p.m.	ND	1,32	brooms, waste pickers, wheelbarrows	1 wheelbarrow, 12 brooms and 1 waste picker

Source: own elaboration

Regarding the daily performance per sweeping worker, the cities of Sechura, Tarapoto, Chachapoyas, Huánuco, Abancay, Puno y Puerto Maldonado show a daily performance of 2 km/worker/day. The reason for this is that apart from sweeping the streets, workers must also pick up papers left on the streets, and sometimes sidewalks are very narrow, so that workers can cover larger areas.

(6) Collection and Transportation

In almost every the cities, the service is provided directly by the municipalities, except in the city of Villa San Juan (province of Maynas), that outsources the service.

In many cases, the service provided combines conventional technology (collecting vehicles, compactors and also hopper trucks) and non-conventional technology (tricycles,trimovil) is applied to the service. In six cities of the program (Chancay, Pozuzo, San Juan Bautista, Bagua, Ayacucho and Oxapampa), the service of collection and transportation of solid waste is partially offered; the rest of the cities have collection vehicles older than 5 years, there is a higher deficit in the collection service provided. Therefore, the current supply is minimal.

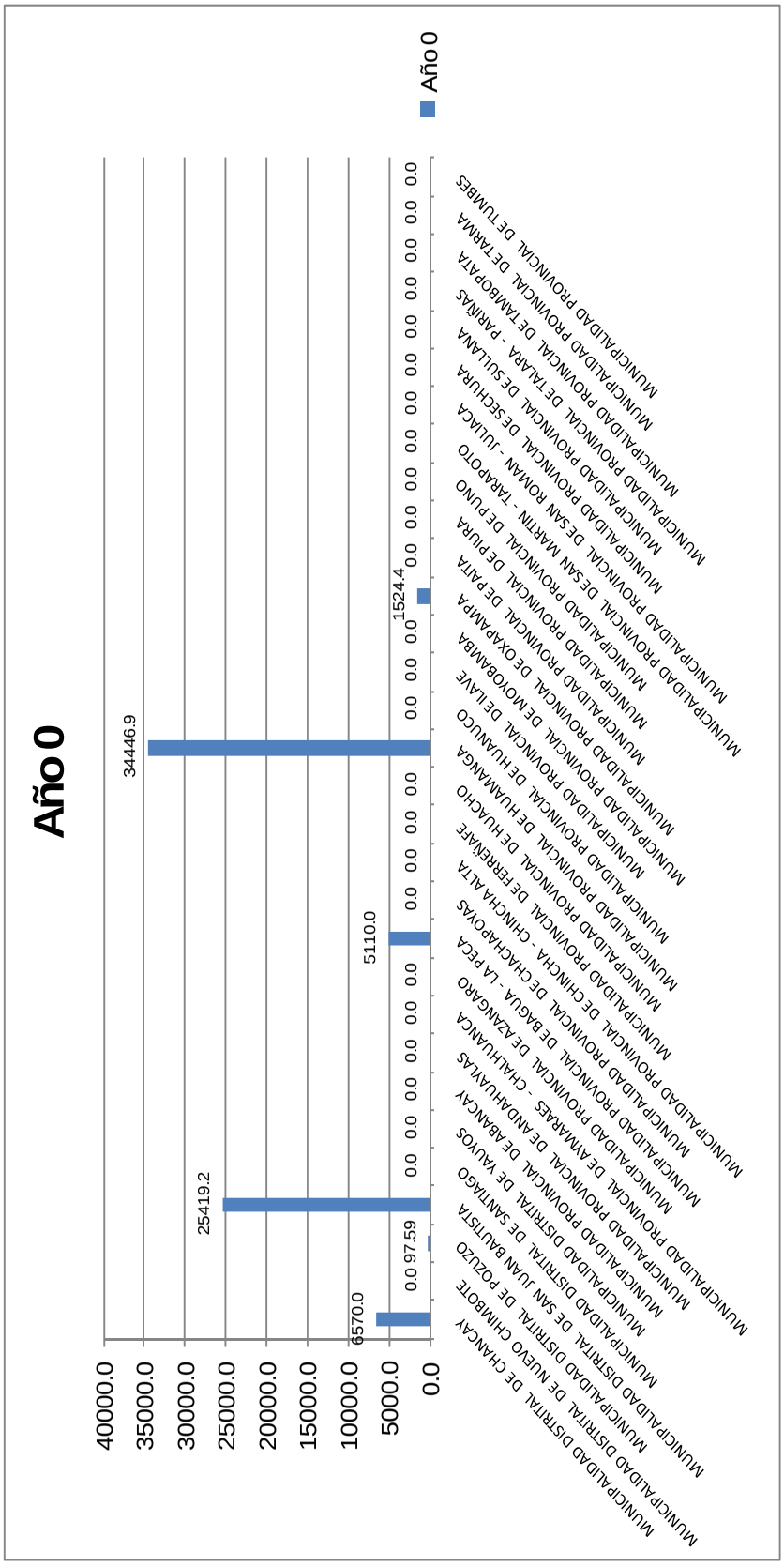


Figure 3.3-6 Collection and Transportation Year 0

Table 3.3-6 Existing Collection Vehicles in Municipalities

CITIES	Coverage	Type of vehicle	Brand	Total carrying capacity (t)	Total carrying capacity (m3)	Year of manufacture	Nº of travels per shift	Nº of travels per day	Amount of waste collected per day (t/día)	Amount of waste collected per day (m3/día)
Tumbes	**52%**	Compactor	Hyundai		9	2007	1	2	6.75	18
		Compactor	Hyundai		9	2007	1	3	10.13	27
		Compactor	Hyundai		9	2007	1	3	10.13	27
		Compactor	Volvo		9	2003	1	2	6.75	18
		Compactor	Volvo		9	2003	1	2	6.75	18
		Compactor	International		3	1990	1	1	3.00	3
Piura	**ND**	Truck	Volvo		10	200	2	3	5.15	30
		Truck	Volvo		12	2009		3	6.18	36
		Truck	Volvo		12	2009	2	3	6.18	36
		Compactor	Mercedes B.		12	2000	2	3	16.20	36
		Compactor	Mercedes B.		12	2000	2	3	16.20	36
		Compactor	Mercedes B.		12	2000	2	3	16.20	36
		Compactor	Mercedes B.		12	2000	2	3	16.20	36
		Compactor	Mercedes B.		12	2000	2	3	16.20	36
		Compactor	Mercedes B.		12	2000	2	3	16.20	36
		Compactor	Iveco		15	2009		3	20.25	45
		Compactor	Iveco		15	2009		3	20.25	45
		Compactor	Iveco		15	2009		3	20.25	45
		Compactor	Iveco		15	2009		3	20.25	45
		Compactor	Iveco		15	2009		3	20.25	45
Sullana	**85.8 %**	Compactor	Mercedes B.	5	10	2003	2	4	18.00	40
		Compactor	Mercedes B.	5	10	2003	2	4	18.00	40
		Compactor	Mercedes B.	5	10	2003	2	4	18.00	40
		Compactor	Mercedes B.	5	10	2003	2	4	18.00	40
		Compactor	Mercedes B.	5	10	2006	2	4	18.00	40
Talara	**88,2 %**	Dump truck	Mercedes B.	7.5	15	2006	1	1	6.0	15
		Dump truck	Mercedes B.	7.5	15	2006	1	1	6.0	15
		Dump truck	Mercedes B.	6.0	12	2000	1	1	4.8	12
		Compactor	Mercedes B.	7.5	15	2005	1	2	12	30
		Compactor	Mercedes B.	7.5	15	2006	1	2	12	30
		Compactor	Mercedes B.	7.5	15	2006	1	2	12	30
Sechura	**70%**	Compactor	Mercedes B.		12	2005	1	1	3.9	12
		Compactor	Mercedes B.		12	2005	1	1	3.9	12
		Compactor	Mercedes B.		12	2002	1	1	3.9	12
Paita	**65%**	Compactor	ND	15	20	2004	1	1	9.00	20
		Compactor	ND		20	2006	1	1	9.00	20
		Compactor	ND	15	20	2004	1	1	9.00	20
		Compactor	ND	15	14	2005	1	1	6.30	14
Ferreñafe	**90%**	Compactor	International	3.75	10	1994	2	2	7.5	20
		Dump truck	International	1.50	10	1994	2	2	3.0	20
Tarapoto	**90%**	Compactor	Volvo	7.5	15	2005	1	2	13.50	30
		Compactor	Volvo	7.5	15	2005	1	2	13.50	30
		Compactor	Volvo	7.5	15	2005	1	2	13.50	30
		Compactor	Volvo	7.5	15	2001	1	2	11.25	30
Moyobamba		Compactor	Volvo	6.75	15	2008	2	2	13.50	30
		Compactor	Volvo	5.40	12	2005	2	3	16.20	36
		Hopper truck	Volvo	3.61	20	1984	1	1	3.61	20
Chachapoyas	**70 a 80%**	Compactador	Volvo	12		1985	1	1	12	
		Hopper truck	Peggaso	6		ND	1	1	6	
Nuevo Chimbote	**90%**	Compactor	Nissan	5	10	ND	2	2	18.00	40
		Compactor	Mercedes B.	5	10	ND	2	2	18.00	40
		Compactor	Volswagen	5	10	ND	2	2	18.00	40
Huacho	**70%**	Compactor	Volvo	6.75	15	1997	2	2	27.00	60
		Compactor	Volvo	5.63	15	2009	2	2	22.50	60
Santiago	**98%**	Dump truck	Volvo	0.91	15	2003	2	4	3.62	60
Chincha		Compactor	Ford	8.55	19	2006	2	2	17.10	38
		Dump truck	JVC	0.60	6	2010	2	4	2.39	24
		Dump truck	JVC	0.60	6	2010	2	4	2.39	24
		Dump truck	JVC	0.60	6	2010	2	4	2.39	24
Huánuco	**ND**	Compactor	Ford	9.00	20	2004	1	1	9.00	20

CITIES	Coverage	Type of vehicle	Brand	Total carrying capacity (t)	Total carrying capacity (m3)	Year of manufacture	Nº of travels per shift	Nº of travels per day	Amount of waste collected per day (t/día)	Amount of waste collected per day (m3/día)
		Compactor	Volvo	9.00	20	2006	1	1	9.00	20
		Compactor		9.00	20	2004	1	1	9.00	20
		Compactor		6.30	14	2005	1	1	6.30	14
Tarma		Compactor	Volvo	7,5	15	2005	1	2	13.50	30
		Compactor	Volvo	7.5	15	2005	1	2	13.50	30
		Compactor	Volvo	7.5	15	2005	1	2	13.50	30
		Compactor	Volvo	7.5	15	2001	1	2	11.25	30
Abancay	**61,85 %**	Compactor	Volvo	10	20	1990	1	2	18.00	40
		Compactor	Volvo	10	20	1990	1	2	18.00	40
		Compactor	Volvo	10	20	1990	1	1	9.00	20
		Compactor	Chevrolet	10	20	1980	1	1	9.00	20
		Compactor	Toyota Dyna	4	8	1985	1	1	3.60	8
		Dump truck	Pegaso	2	8	1990	1	1	1.80	8
		Truck	Mitsubishi	2.5	10	1975	1	1	2.25	10
Puno	**70,00 %**	Compactor	Volvo	6.38	15	2003		4	25.50	60
		Compactor	Volvo	6.38	15	2003		4	25.50	60
		Compactor	Volvo	6.38	15	2003		0	0.00	
Juliaca	**50,31 %**	Compactor	Volvo	6.38	15	2003	2	4	25.50	60
		Compactor	Volvo	6.38	15	2003	2	4	25.50	60
		Compactor	Volvo	6.38	15	2003		0	0.00	
Azángaro	**70,17 %**	Compactor	volvo	7.5	15	2010	1	1	7.5	15
Ilave	**ND**	Compactor	International	1.25	2,5	2009	1	2	2,5	
		Compactor	Volvo	1.25	2,5	1999	1	2	2,5	
Pto Maldonado		Compactor	Mercedes B.	8.55	19	2010	2	4	34.20	76
		Compactor	Volkswagen	7.60	19	2008	2	4	30.40	76
		Dumper	Hino	1.56	13	1994	2	2	3.12	26
		Dumper	Dodge	1.56	13	1976	2	2	3.12	26
		Dumper	International	1.92	16	1990	2	2	3.84	32
		Dump truck	International	1.92	16	1990	2	2	3.84	32
		Cart+tractor		1.68	14	1988	2	2	3.36	28
		Compactor	Mitsubishi	2.00	5	1990	2	2	4.00	10
Bagua	**52%**	Compactor	Volvo FL 14	8.00		1980				
		Truck	Dodge Diesel	6.00						
Andahuaylas	**60,7 %**	Compactor	Volvo	10		1985	1	1	4	
		Truck	Nissan	7		1999	1	2	6	
San Juan Bautista		Compactor	Volvo	8.50	17	2005	3		21.86	
		Dump truck	Volvo	3.37	12	1975	3		8.67	
		Dump truck	Ford	2.81	10	1990	3		7.23	
		Truck		2.81	10	1996	3		7.23	
		Moto, van		0.72	2.56	2007	2		7.40	
		Moto, van		0.72	2.56	2007	2		8.63	
		Moto, van		0.72	2.56	2007	2		3.70	
Huamanga	**75%**	Compactor	Iveco		15.00	2009	1		7.50	
		Compactor	Iveco		15.00	2009	1		7.50	
		Compactor	Volvo		9.00	1994	1		4.05	
		Compactor	Volvo		9.00	1994	1		4.05	
		Compactor	Wolkwagen		12.50	2003	1		5.63	
		Compactor	Wolkwagen		12.50	2003	1		5.63	
		Truck	Nissan		4.00	1992	1		1.40	
		Truck	Nissan		4.00	1992	1		1.40	
		Truck	Nissan		8.50	1995	1		2.98	
		Dump truck	Nissan		10.00	1989	1		3.50	
		Dump truck	Volvo		7.00	1993	1		2.45	
		Dump truck	Pegaso		8.00	1993	1		2.80	
Oxapampa		Compactor			3,8			2		7,6
Pozuzo	**61,95 %**	Dump truck		7				2		
		Compactor	Volvo	5	10	1982	2	2	20	40
		Compactor	Wolkwagen	4.5	9	2003	2	2	18	36
		Compactor	Wolkwagen	5	10	2007	2	2	20	40
Yauyos		Hopper truck	Hyundai		6			2	5.9	

Source: own elaboration

(7) Reuse and/or Treatment

Nowadays, the reuse in the area of intervention is done informally. In most of the cities, reuse is inadequate and done under risky conditions. It is important to mention that informal personnel do not wear the necessary personal protection clothing.

The amount of organic and inorganic solid waste to be reused in the cities of the Program depends on the market analysis, reference value of the product and the main reused materials in each of the cities. In that sense, around 30% of organic and inorganic waste can be treated and sold.

Figure 3.3-7 Informal Segregation at Huacho Dump Sites

The following chart shows consolidated information of the selling price of waste, according to the markets of each city.

Table 3.3-7 Price per kg of recyclable waste

City	Price per Kg of waste					
	Paper (S/.)	PET (S/.)	Cardboard (S/.)	Plastic (S/.)	Metals (S/.)	Glass (S/.)
TUMBES	0.50	0.50	0.10	0.50	2.76	0.10
PIURA	0.43	0.48	-	0.28	0.41	0.10
SULLANA	0.40	0.56	0.10	0.25	0.28	
TALARA	0.50	0.60	0.10	0.40	2.52	0.30
SECHURA	0.50	0.50	0.10	0.60	2.76	0.10
PAITA	0.45	0.60	0.15	-	0.60	-
FERREÑAFE	0.50	0.80	-	-	0.50	-
TARAPOTO	0.50	0.90	-	0.30	0.40	-
MOYOBAMBA	0.50	0.90	-	0.30	0.40	
CHACHAPOYAS	0.50	0.90	-	0.30	0.40	-
NUEVO CHIMBOTE	0.32	0.76	0.48	-	0.96	-
HUACHO	0.43	0.48	0.50	0.60	0.41	0.10
SANTIAGO	0.50	0.90	-	0.30	0.40	-
CHINCHA	0.50	1.00	0.10		0.60	0.50
HUANUCO	0.50	1.00	0.11	0.30	0.40	-
TARMA	0.50	0.50	0.11	-	0.50	-
ABANCAY	0.64	0.72	0.48	-	0.80	-
PUNO	0.43	0.48	0.50	0.40	0.41	-
JULIACA	0.43	-	-	0.40	0.50	-
AYMARAES	0.50	0.50	-	-	0.50	-
AZANGARO	0.24	0.40	-	-	-	-
ILAVE	0.70	0.25	0.10	-	0.50	-
PUERT0 MALDONADO	0.32	0.76	0.48	-	0.96	-
BAGUA	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
ANDAHUAYLAS	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
SAN JUAN BAUTISTA	0.30	0.80	-	0.30	0.50	-
HUAMANGA	0.40	0.80	-	-	0.40	0.10
OXAPAMPA	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
POZUZO	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
CHANCAY	0.60	1.10	0.10	0.60	0.50	0.10
YAUYOS	N.D.	N.D.	N.D.	N.D.	N.D..	N.D.

Source: work field, 2010

The previous table show that in almost every city, there is market for paper, plastic, PET and metal.Chincha and Huánuco show the highest selling prices for PET.

It can also be appreciated that few cities sell cardboard, because is cheap and is bulky.Only Tumbes, Piura, Talara, Sechura, Huacho, Chincha and Huamanga sell glass.

(8) Final Disposal

None of the cities included in the program have a sanitary landfill. They all have open air dump sites, and only of the cities of Piura and Tarma have a controlled dump site. Some of the cities included in the Program burn solid waste in order to decrease the volume of the waste and then carry on using the space available of the dump sites. Likewise, informal segregation is performed and sometimes this is permitted by the municipality. The staff does not wear the proper personal protection clothing.

Figure 3.3-8 Yacucatina Dump Site in the city of Tarapoto

Figure 3.3-9 DumpSite in the city of Puerto Maldonado

The following chart explains the characteristics of final disposal of the cities included in the Program.

Table 3.3-8 Characteristics of Final Disposal (Year 2009)

City	Final disposal place	Location of the final disposition area	Solid waste treatment		Burial of solid waste	Burning of solid waste
			Recycling	Composting		
TUMBES	Puerto del Cura	4.0 Km. From the city of Tumbes –San Juan de la Virgen District	YES	NO	YES	YES
PIURA	ND	km 8 from the road toChulucanas - Distrito de Castilla	YES	NO	YES	YES
SULLANA	Valle de Cieneguillo	18 km from the city	YES	NO	YES	YES
TALARA	ND	3 Kms from the urban center	YES	NO	NO	YES
SECHURA	Yapato	7 Km. Out of the city	YES	NO	NO	YES
PAITA	ND	7.00 Km. From the center of Paita Baja	YES	NO	NO	YES
FERREÑAFE	Cantera Mesones Muro	11 Km from the city of Ferreñafe	YES	NO	YES	NO
TARAPOTO	Yacucatina	District of Cabo Alberto de Leveau	YES	NO	YES	NO
MOYOBAMBA	Yantalo	Waste dump Road Moyobamba-Yantaló	YES	NO	YES	NO
CHACHAPOYAS	Quebrada el Atajo o Rondón	6º13'45.74" S y 77º52'21" W; a 15 minuts by car	NO	NO	NO	YES
NVO CHIMBOTE	Pampa la Carbonera	5 Km from the city of Nuevo Chimbote	YES	YES	NO	YES
HUACHO	ND	200 metres from the Panamericana Norte road Km. 143	YES	NO	NO	YES
SANTIAGO	La Huega	4 Km. From Ica	YES	NO	YES	YES
CHINCHA	Pampa de la Chanchería	2 km of the city	YES	NO	NO	YES
HUANUCO	Marabamba	5 Km, south west of Huanuco	YES	NO	NO	YES
TARMA	Pampaya	7 Km of the city	NO	NO	YES	NO
ABANCAY	Quitasol	7 Km. from the city of Abancay and 10 Km. fromTamburco	YES	NO	YES	NO
PUNO	Sur Oeste de la comunidad de Cancharani	8 Km. From the city of Puno	YES	NO	YES	NO
JULIACA	Chingora	13.5km. from the city of Juliaca	YES	NO	YES	NO
AZANGARO	ND	4 Km. Away from Azángaro, UTM 0373484 8350582	NO	NO	YES	NO
ILAVE	ND	5 kilómetres from hte urban radio	YES	NO	YES	NO
PTO MALDONADO	El Prado	Km. 11 from the road to the Comunidad de la Cachuela-Prado.	NO	NO	YES	NO
BAGUA	San Luis La Curva	3.21 km. From the main square (17 M 0771556, 9377658); 5 - 8 minuts away	NO	NO	NO	NO
ANDAHUAYLAS	San José	Andahuaylas – Río Chumbao	NO	NO	NO	NO

City	Final disposal place	Location of the final disposition area	Solid waste treatment		Burial of solid waste	Burning of solid waste
			Recycling	Composting		
SAN JUAN BAUTISTA	Dump site of Construcciones MP company	km. 30 of the Road Iquitos - Nauta	YES	NO	YES	NO
HUAMANGA	Uchuycruz-Mollepampa	ND	NO	NO	NO	NO
OXAPAMPA	Gramazú-Carolina III	Sector of Gramazú-Carolina III Distrito de Huancabamba and Waste dump San Jorge Gramazú	NO	NO	NO	NO
POZUZO	Delfín Prusia + 40 micro rellenos	Locality of Prusia, Sector Delfín Prusia Centro 838 I Etapa, Pozuzo district	YES	YES	YES	NO
CHANCAY	Dump siteTres Tetas	kilómetre 93.5 of the Carretera Panamericana Norte, 3 km away from the city of Chancay	NO	NO	YES	NO
AYMARAES	Orillas del Río Challhuanca	Carretera Panamérciana Sur, direction Santa rosa - Lima	YES	NO	YES	YES
YAUYOS	Macón	1.8 Km. From the 20 de Enero Square	YES	YES	YES	NO

Source: information provided by municipalities
Own elaboration

Figure 3.3-10 Type of sanitary Landfill to be built

3.3.3 Service Management Analysis

Solid waste service in the cities included in the program is, in most cases, managed directly. So, municipalities are responsible for the service, except for in the city of San Juan Bautista,

which has hired a company provider of solid waste services to render the public cleaning services.

Source: Population perception survey regarding public cleaning service
Own elaboration

Figure 3.3-11 Responsible for SW Collection

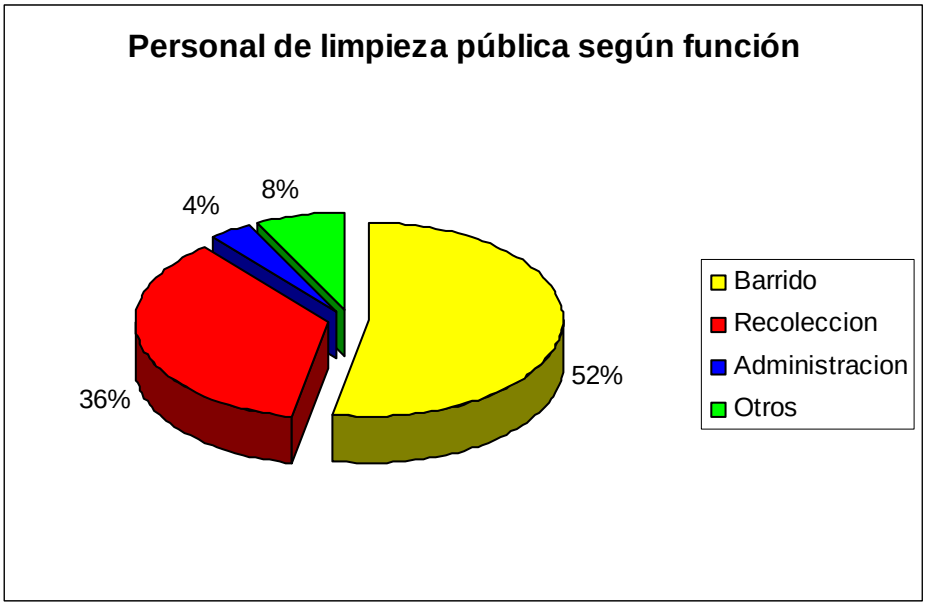
According to the previous chart, 97.8% of surveyed population believes that the cleaning service is provided by the municipality; only 1.8% says that the service is done by informal workers and only 0.3% believes that a company provides the service.

(1) Administrative Management and Human Resources

The municipalities have Environmental Administration Offices in charge of solid waste management within its jurisdiction. Likewise, sub administration offices must coordinate with areas such as community participation, among others. The current coordination is poor, and so is the interinstitutional articulation, which does not enable to optimize local resources to improve management.

It is clear that no training has been done regarding public cleaning. None of the municipalities visited has a consolidated claim system

The following figure shows that 52% of personnel cleans public spaces, 36% do collection activities, 4% works in administrative activities and 8% in other services.



Source: Information provided by municipalities
JICA survey team

Figure 3.3-12 Personnel Working in the Public Cleaning

(2) Finance

The budget for public cleaning service in the Program area come from two main sources: resources directly collected and determined resources. The results for each of the cities are shown inthe following Table .

Table 3.3-9 Financing

Cities	Public cleaning 2007 S/.			Public cleaning 2008 S/.		
	Directly collected resources	Allocated resources	Total	Directly collected resources	Allocated resources	Total
Tumbes	336.962	865.526	1.202.488	384.769	1.140.427	1.525.196
Piura	2.589.341	3.643.585	6.232.926	2.824.606	9.117.002	11.941.608
Sullana	422.426	3.702.381	4.124.807	501.126	4.256.185	4.757.311
Talara	1.511.610	1.537.685	3.049.295	1.329.729	2.134.166	3.463.895
Sechura	92.845	677.800	770.645	164.316	552.165	716.481
Paita	556.280	766.613	1.322.893	634.299	843.272	1.477.571
Ferreñafe	38.259	192.985	231.244	437.784	225.835	663.619
Tarapoto	549.712	585.698	1.135.410	947.854	279.839	1.342.193
Moyobamba	420.114	60.538	480.652	646.103	419.363	1.065.466
Chachapoyas	229.247	0	229.247	191.237	27.590	218.827
Nvo Chimbote	495.819	1.709.138	2.204.957	649.341	1.412.321	2.061.662
Huacho	779.832	1.042.367	1.822.199	544.268	1.481.050	2.025.318
Ica	1.034.170	2.866.923	3.901.093	1.739.159	2.854.007	4.593.166
Chincha	810.642	1.852.156	2.662.798	1.176.807	2.444.985	3.621.792

Cities	Public cleaning 2007 S/.			Public cleaning 2008 S/.		
	Directly collected resources	Allocated resources	Total	Directly collected resources	Allocated resources	Total
Huanuco	983.901	604.197	1.591.523	716.915	1.184.020	.1.900.935
Tarma	336.962	865.526	1.202.488	384.769	1.140.427	1.525.196
Abancay	85.632	625.183	710.815	154.555	663.135	817.690
Puno	513.292	992.295	1.505.587	619.051	1.571.342	2.190.393
Juliaca	302.527	2.800.829	3.103.356	68.958	342.304	411.262
Azángaro	30.879	164.563	195.442	68.958	342.304	411.262
Ilave	62.303	244.549	306.852	54.867	306.356	361.223
Pto Maldonado	764.485	960.167	1.724.652	949.429	936.977	1.886.406
Yauyos	25.420	0	25.420	23.631	0	23.631
Chancay	770,142.99		770,142.99	931,274.58		931,274.58
Pozuzo	46.176	75.000	121.176	46.176	75000	121.176
Oxapampa						
Huamanga	1.700.000	2.300.000	4.000.000	1.700.000	2.500.00	4.200.000
S.J. Bautista	188.623	872.161	1.060.784	188.623	872.161	1.060.784
Andahuaylas	172.618	647.882	820.500	172.618	647.882	820.500
Bagua	21.109	232.203	253.312	21.109	232.203	253.312

Source: MEF – Economic Transparency. JICA survey team

Table 3.3-10 Service management

CITIES	LATE PAYMENTS %	SYSTEM OF PAYMENT COLLECTION	BILLING	ROF	MOF	ORDINANCE	MANAGEMENT MODEL	PIGARS	COST STRUCTURE
Tumbes	70%	The charge of the service is included in the appraisal of the monetary value of each property	Monthly/Weekly/ Annual	YES	YES	Does not have ordinance of waste management	Does not have management model	-	YES
Piura	60%	Payment of service (taxes, landfill, serenazgo)	Quarterly	YES	YES	Has ordinance of Solid Waste Mnagement	Does not have management model	Approved by council resolution	YES
Sullana	87%	Payment of the service is included in the appraisal of the monetary value of each property	Annual	YES	YES	Has ordinance of Solid Waste Mnagement	Does not have management model	-	YES
Talara	65%	Payment of the service is included with the autovalúo	Annual (quarterlypayment)	YES	YES	Does not have ordinance of waste management	Does not have management model	Approved by council resolution	YES
Sechura	80%	Payment of the service is included in the appraisal of the monetary value of each property	Annual	YES	YES	Preparing	Does not have management model	Approved by council resolution	YES
Paita	60%	Payment of the service is included in the appraisal of the monetary value of each property	Annual (quarterlypayment)	YES	YES	Does not have ordinance of waste management	Does not have management model	-	YES
Ferreñafe	45%	Independent	Quarterly	YES	YES	Does not have ordinance of waste management	Does not have management model	Approved by council resolution	YES
Tarapoto	65%	Independent	Monthly	YES	YES	Has ordinance of Solid Waste Mnagement	Does not have management model	Approved by council resolution	YES
Moyobamba	ND	Independent	Monthly	YES	YES	Does not have ordinance of waste management	Does not have management model	Approved by council resolution	YES

CITIES	LATE PAYMENTS %	SYSTEM OF PAYMENT COLLECTION	BILLING	ROF	MOF	ORDINANCE	MANAGEMENT MODEL	PIGARS	COST STRUCTURE
Chachapoyas	66%	Independent	Monthly	YES	YES	Does not have ordinance of waste management	Does not have management model	Approved by council resolution	YES
Nvo Chimbote	70%	Payment of taxes	Quarterly	YES	YES	Has an ordinance related to the collection	Does not have management model	-	YES
Huacho	ND	Payment of the service is included in the appraisal of the monetary value of each property	Annual	YES	YES	Does not have ordinance of waste management	Does not have management model	-	YES
Ica	86%	Independent	Annual	YES	YES	Has an ordinance related to the cost	Does not have management model	Approved by council resolution	YES
Chincha	ND	Payment of the service is included in the appraisal of the monetary value of each property	Monthly	YES	YES	ND	Does not have management model	-	YES
Huanuco	69%	Independent	Annual	YES	YES	Does not have ordinance of waste management	Does not have management model	Approved by council resolution	YES
Tarma	ND	Independent	ND	YES	YES	Does not have ordinance of waste management	Does not have management model	Approved by council resolution	YES
Abancay	80%	Payment of the service does not exist	Annual	YES	YES	Does not have ordinance of waste management	Does not have management model	Approved by council resolution	YES
Puno	60%	Payment of the service is included in the appraisal of the monetary value of each property	Annual	YES	YES	Does not have ordinance	Does not have management model	Approved by council resolution	YES
Juliaca	70%	Payment of the service is included in the appraisal of the monetary value of each property	Annual	YES	YES	Does not have ordinance	Does not have management model	-	YES

CITIES	LATE PAYMENTS %	SYSTEM OF PAYMENT COLLECTION	BILLING	ROF	MOF	ORDINANCE	MANAGEMENT MODEL	PIGARS	COST STRUCTURE
Azángaro	80%	Payment of the service does not exist	Annual	YES	YES	Does not have ordinance	Does not have management model	-	YES
Ilave	88%	Payment of the service does not exist	Annual	YES	YES	Does not have ordinance	Does not have management model	-	YES
Pto Maldonado	ND	ND	ND	YES	YES	Has an ordinance related to the collection	Does not have management model	-	YES
Yauyos	45%	Independent	Annual	YES	YES	Does not have ordinance	Does not have management model	-	YES
Chancay	65%	Independent	Monthly	YES	YES	Does not have ordinance	Does not have management model	-	YES
Pozuzo	30%	Independent	Monthly	YES	YES	-	Does have	-	YES
Oxapampa				YES	YES				YES
Huamanga	70%	Payment of the service is included in the appraisal of the monetary value of each property	Quarterly	YES	YES	Has an ordinance	-	Approved by council resolution	YES
S.J. Bautista	65%	Payment of the service is included in the appraisal of the monetary value of each property	Quarterly	YES	YES	Has an ordinance	Does not have management model	-	YES
Andahuaylas	75%	Payment of the service is included in the appraisal of the monetary value of each property	Quarterly	YES	YES	Has an ordinance	Does not have management model	-	YES
Bagua	50%	Payment of the service is included in theappraisal of the monetary value of each property	Quarterly	YES	YES	-	Does not have management model	Approved by council resolution	YES

Source: Information provided by municipalities
JICA survey team
ND: Undetermined

(3) Service payment

Practically all population living in the intervention area of the Program has a collection system. However, the levels of rate arrears are high. Population does not pay for the service, since there is a culture of non-payment, and collection systems are not effective.

The finance of the public cleaning service is subsidized by the municipality.

(4) Rates in the Intervention Area

The municipalities have resources from the transfers made by the central government, directly collected income (property tax, services, etc), income from the rendering of services such as sweeping, collection and final disposal of municipal solid waste. Therefore, the municipalities should finance the operation and maintenance costs of the public cleaning service with the payments done for rendering the service. However, there is a deficit between profit and loss relation for the public cleaning service, as the following Table shows.

. In large cities, , several factors must be taken into account, such as built area for collection, frequency of collection, frequency of sweeping, type of zoning, length of property façade, basic amount of public cleaning per each property, among others.[18] The same situation happens in the other cities, regarding factors such as length of property, frequency of sweeping and collection.[19]

It is important to mention that in none of the cities of the intervention area, the collection system is related to basic services such as water and/or electricity.

Table 3.3-11 Rates in the Intervention Areas

CITIES	Actual rate of Municipalities (S/.household/month)
Tumbes	5.04
Piura	11.76
Sullana	7.86
Talara	11.6
Aymaraes	3.90
Sechura	6.80
Paita	7.21
Ferreñafe	6.63
Tarapoto	6.20
Moyobamba	4.86
Chachapoyas	3.08
Nuevo Chimbote	3.79
Huacho	12.33
Ica	1.65
Chincha	7.00
Huanuco	8.34
Tarma	9.39
Abancay	4.74
Puno	4.05

[18] Tax Administrative System– SAT Piura.
[19] Information from municipalities supplied by personnel in charge of the area

CITIES	Actual rate of Municipalities (S/.household/month)
Juliaca	2.56
Azángaro	5.58
Ilave	4.16
Pto Maldonado	5.31
Yauyos	0,34
Chancay	2,01
Pozuzo	3,01
Oxapampa	5.04
Huamanga	13,60
S. J. Bautista	5.32
Andahuaylas	6,46
Bagua	10,41

Source: Own elaboration

3.3.4 Social Aspects

Social aspects were decided by competent personnel during the site visits. Besides, perceptions surveys carried out in the cities included in the program were analyzed. In the surveys took part professionals involved in the area of expertise, municipal workers and general public.

(1) Institutional Perception

After reviewing the interviews done to the key players in the solid waste management field in each of the cities, the following information can be stated.

- There is a poor articulation and coordination between the different areas of the municipality, thus delaying all issues related to management.
- Poor administrative management due to burocracy, which make the whole process less dynamic and originate an inadequate management.
- Staff is not motivated to do their jobs due to lack of support and acknowledgement. This affect negatively on the overall personnel performance.
- Negative and pessimistic perception regarding population and solid waste management. There is not a dialogue established with the population.
- Inadequate coordination and articulation from the organization standpoint, that does not allow to optimize local resources to improve management.
- Lack of programs on environmental education and specialized personnel to develop and implement educational and social communication action.

(2) Analysis of Habits and Population Perception

The results correspond to a study carried out regarding knowledge, attitudes and practices of population regarding solid waste.

Regarding knowledge of population:

- People confuse sanitary landfill, and most of them think it is the same as dump site.

- Inhabitants are not aware of legal provisions regarding environment and their rights and obligations to ensure an efficient service.
- Lack of clear knowledge regarding economic value of waste and the need to reuse and segregate.

Regarding attitudes

- Low commitment of population regarding participation. This implies lack of social responsibility in the solid waste management.
- Population is not aware of issues such as indiscriminate use of products that generate a large amount of solid waste.
- Lack of commitment regarding the obligation of citizens to pay for this service. They argue they are not satisfied with the service provided to them, as an excuse for not paying for said service. On the other hand, payment is delayed until the end of each year. Besides, there is no specific ticket or bill to charge for solid waste services, as in the case of the telephone or electricity bill.
- The general feeling of most of the population is the lack of trust in the municipal management. Citizens ask themselves questions such as: If we pay more, how can I be sure the service will improve? Or "Who can guarantee that the sanitary landfill will not become in the short term in a dump site?" These are some of the assumptions of citizens regarding local government management.
- Lack of credibility regarding use of municipal funds.

Regarding social practices

- Lack of respect regarding provisions established by municipalities in the case of frequency of collection. For example, in the places where solid waste is collected more than one day, people take the waste out of their homes, place them in collection points, burn the waste of just throw them in the nearby rivers.
- Segregation of solid waste is done only in those places where there is a promoter or when an NGO works in the organization and formalization of informal waste pickers.
- In some cases, informal waste pickers are contributing to solve the inadequate service offered, especially in the areas where is difficult to Access. However, in other case the problem worsens since waste pickers break plastic bags with waste and scatter waste in the streets.
- Another problem is the presence of informal waste pickers in the dump sites. Sometimes, there are pregnant women working in the dump site with their children, thus putting their health at risk.

3.3.5 Seriousness of the Matter to be Solved

The program will reduce environmental pollution levels generated by solid waste of the cities included in the program. The current situation of the cities included in the program originate an inadequate quality of life. Issues related are the following:

Disease. The presence of solid waste causes respiratory infections and skin diseases, affecting mainly to those people living near (less than 1 km distance) of the final disposal sites (dump sites). Therefore, the implementation of a sanitary landfill eliminates the exposure to solid waste in the environment and therefore, problems related to public health.

- City landscaping. The problems are obvious; there are some critical points of waste accumulation, dirty streets, personnel who does not do their job properly, lack of protection gear and equipment. Therefore, the implementation of a comprehensive solid waste management would improve environmental conditions of the cities included in the program, such as proper storage systems in the collection points or critical points. All this favors trade, tourism, participation of citizens and
- Environmental pollution. Dump sites used as final destination of solid waste causes emissions that affect the environment (water, soil and air); this causes leachate, that may affect water and soil, methane, CO_2, H_2S, smoke and bad smell that may affect the quality of the air, and also have a negative impact on the soil, due to increasing number of dump sites. However, proper disposal of solid waste in sanitary landfills will prevent solid waste from having negative effects on the environment.
- Low environmental awareness. Population do not identify themselves with the city. In many cases, people are not aware of the negative impact on health and environment of the. Furthermore, there are participation spaces to empower people and to value citizen´s participation in the environmental management system. Therefore, a program will be developed in each of the cities included in the program so that spaces will be created to integrate population opinion regarding improvements to the environmental conditions of each of the cities (related to solid waste management).
- Inadequate local management. Currently, all cities involved need to improve the planning of services from the human, technical and resource standpoint. In that sense, it has been considered to build capacities in each city, so that there is a proper management of services in each of the cities involved in the program, and services are properly planned, personnel is trained and at the same time, a proper cost structure is ensured to enable the solid waste management system.
- Wrong environmental practices. In the intervention areas, there are wrong practices, both from the workers and from the population, mainly due to the fact that there are not adequate conditions to recover solid waste with safety and efficient measures and without harming other components of the system. Thus, the implementation of the program will enable to each of the cities to develop reuse systems of organic and inorganic solid waste. Then, management systems of solid waste could offer the possibility to reuse solid waste that would be disposed in the environment otherwise, or perhaps end up in a sanitary landfill.
- Illegal activities. Informal management of solid waste originates informal markets of solid waste, where people are outsourced and tax evasion caused by informal activities. The implementation of the program will eliminate inadequate practices of solid waste management, such as those generated by informal waste pickers, who recover waste under poor health conditions. In that sense, the program foresees social inclusion of said workers in collection activities and in the operation of solid waste reuse facilities.
- Increase of environmental liabilities. The lack of action of local authorities and inexistence of mechanisms of environmental control, as well as lack of final disposal facilities prompt the existence and increase of dump sites, thus occupying larger plots of land, and in some cases, damages land of agricultural
- Increase of environmental liabilities. The inadequate action of local authorities and the lack of environmental control mechanisms, as well as the lack of final disposal facilities, favor the operation of dump sites and the proliferation of said dump sites. So, more unproductive areas are occupied by dump sites and in some cases, it damages sites that could be used for agricultural purposes. In that sense, the program aims at having a sanitary landfill in each of the cities.

(1) Temporality

The inadequate solid waste management is a typical situation of all cities. None of them has had a comprehensive solid waste management system or sanitary landfill. In fact, most of them opt for partial solutions, such as purchase of collection trucks, construction of controlled dump sites, and even local campaigns of solid waste management. However, none of the cities has implemented a comprehensive, sustainable and environmental friendly management system.

(2) Relevance

The implementation of said program will offer a context for the conditions for the proper management of solid waste. Under this scheme, pollution levels of environment in the cities and prevalence of diseases caused by solid waste will decrease.

Another important factor is the real possibility to raise awareness among population, in order to ensure the economic sustainability of the system

(3) Level of Progress

The difficult economic situation of the cities included in the program increase every day since there is not a solid waste management system, thus originating the increase of dump sites and poor quality of services. The operation of all municipal

solid waste management is inadequate.

Another important factor that worsens the situation is the inadequate formulation of cost structures in order to obtain a proper collection for the services offered. Consequently, the service is subsidized with money to be used for disbursements that were going to be used for other services. Equipment is not properly replaced, and there is not enough staff for the operations, therefore an independent and self-sufficient system is not sustainable.

3.3.6 Attempts of Previous Solutions

Actions that have originated changes in the solid waste sector are listed below:

Sector Analysis of Solid Waste. DIGESA, OPS. 1998. It concluded it was necessary to improve the institutional and legal framework of the solid waste sector. An important contribution was the enactment of Law N 27314, General Law on Solid Waste in 2000.

General Law on Solid Waste 27314. It was an important achievement in the solid waste sector, establishing different legal frameworks for municipal and non municipal solid waste. It organized the sector with modern approaches (minimization, prevention of pollution, etc.) and private participation.

Regulation on the General Law on Solid Waste 27314. DS 057-2004-PCM. It facilitated the implementation of Law 27314 and enabled the beginning of a formalization process of private operators, such as EPS-RS and EC-RS.

National Plan of Solid Waste (CONAM, 2005). It establishes the guidelines and specific activities in three topics: building capacities, institution development and investment feasibility. It represents a fresh attempt to calculate the investment required in the solid waste sector, estimating an amount above US$100 million.

Amendment of the General Law of Solid Waste. DL 1065, 2008. It fosters participation of private sector in the infrastructure, and it notes the responsibility of the producer, thus establishing the fundamentals of selective collection and environmental studies by type and importance of project of solid waste.

Plan of Technological Options (FONAM, 2008). It analyzes different technological options for the country, noting the best options available for collection, composting, recycling and sanitary landfill.

Strategic Sector Plan of Solid Waste (IDB, 2008). It establishes a strategy of legal and institutional changes to ease and foster participation of private sector to operate the services of public cleaning.

National Policy of Environment, aimed at improving quality of life of people, then guaranteeing healthy, feasible and viable ecosystems in the long-term; sustainable development of the country through prevention, protection and recovery of environment and its components; conservation and sustainable use of natural resources, while respecting basic rights of people. This is done around four main ideas, and the second is the Comprehensive Management of Environmental Quality, where policy alignments (09) are included for the solid waste component.

3.4 RISKS IDENTIFICATION

In the site area of the Puno´s project, some dangerous situations have been idenfied, such as earthquakes, landslides and volcanic activities have been found.

Regarding vulnerability degree the project faces, as far as floods are concerned, the vulnerability level is medium, regarding quakes is low, because the project will be located far away from the urban area. Furthermore, during the construction stage, the construction rules in force will be complied with, and the vulnerability level regarding landslides is medim because in the project site there are volcanicrocks from the Pichurasi volcano. However, the volcano is not active, according to the volcano map by INDECI.

In the project site in the city of Huánuco, there are faults in the hill, which represents a high risk. Other medium risk situations are caused by percolation, quakes, landslides, and the poor drainage of soil represents a law risk. Then, the problems identified so far represent a medium risk with high vulnerability level.

In the case of Juliaca, dangers are posed by erosion caused by run-off which is a medium risk; percolation, erosion, poor soil drainage, landslides and collapse cause law distress. Thus, the risks identified in the area are low and the vulnerability level is medium.

Regarding the city of Sulllana, floods, erosion caused by run-off were identified as medium risks, and poor soil drainage, landslides and collapse represent a low danger. So, the dangers identified in the project site are medium and vulnerability medium as well.

In the case of Tarapoto, the main risks are linked to quakes and environmental pollution. So, the level of vulnerability and risk level is medium.

The following chart shows that the vulnerability is medium, and quakes activities in the area are related to faults in Sisa, Huallaga, Angaiza and Pucatambo, and the tectonic plate of Paracas, which causes the quakes in all the region. The project will be located far from the

city center, and the contruction stage will comply with the quake construction rules in force and effect.

Table 3.4-1 Danger identification for the infrastructure

City	Existence of previous dangers in the Project site	Existence of surveys predicting likelihood of danger	Level of vulnerability	
PIURA	Landslides, erosion caused by run-off, percolation	Landslides, erosion caused by run-off, percolation	Regarding floods	Medium vulnerability
SULLANA	Floods, landslides, erosion caused b y run-off, percolation,	Floods, landslides, erosion caused b y run-off, percolation,	Regarding floods:	Medium vulnerability
TARAPOTO	Quake, environmental pollution	Quake, environmental pollution	Regarding quakes	Medium vulnerability
			Regarding floods	Medium vulnerability
HUANUCO	Quakes, landslides, environmental pollution,	Quakes, landslides, environmental pollution	Regarding floods	Medium vulnerability
			Regarding quakes	Medium vulnerability
PUNO	Quakes, landslides, volcanic activity ,	Floods, heavy rains and quakes	Regarding floods	Medium vulnerability
			Regarding quakes	Low vulnerability
			Regarding volcanic activity	Medium vulnerability
JULIACA	Landslikdes, volcanic activity, environmental pollution	Landslikdes, volcanic activity, environmental pollution	Regarding landslides	Medium vulnerability
			Regarding quakes:	Low vulnerability

3.5 ANALYSIS OF STAKEHOLDERS

Based on the information gathered through surveys, questionnaires, interviews, the following matrix has been drafted.

Table 3.5-1 Stakeholders Matrix

GROUPS	INTERESTS	PROBLEMS SENSED	CONFLICTS	STRATEGIES
Population nationwide	Clean cities, timely collection of solid waste generated	Accumulation of municipal solid waste in the cities. Dumping of municipal solid waste in dump sites	Municipalities Ministry of Health Ombudsman	Population monitors the service
Municipalities	El Perú País Limpio (Peru, a clean country) Proper management of solid waste in Peru	Poor quality of service and collection coverage. Inadequate final disposal. High level of default.	Population. Ministry of Health Ministry of Education NGOs	Improve solid waste service. Awareness of improvement of service rendering.
Reginal governments	Coordinate and solve alongside majors the problema of solid waste	Little coordination between regional and local authorities	Regional government Local government	Hold periodic coordinating meetings among institutions
Ministry of Health	Improve health conditions of population	Increase of disease caused by environmental pollution	Municipalities Urgan and periurban population	Training of municipal employees

GROUPS	INTERESTS	PROBLEMS SENSED	CONFLICTS	STRATEGIES
Ministry of Education	Integrated development of teachers	Little environmental attitude Limited environmental education	Municipalities Ministry of Health NGOs that misinform the population	Environmental Awareness Program focused on population, mainly children at school
Ministry of Environment	Promote proper solid waste management	Environmental pollution caused by a por solid waste management in the final stage	Citizens . Ministry of Health Ministry of Education NGOs	Awareness and training of municipal officials
Ministry of Econoy	Ensure good use of government's resources	Risk tht the management system of municipal solid easate is unsustainable and therefore, the debt is not repaid.	Regional government Local government	Coordinated work with the formulators Revision of formulation tools
International Cooperation Agencies (IDB-JICA)	Meet the environmental goals with the lenders so that the projects are in force and effect	Damage of environmental quality caused by poor solid waste management Lack of credibility due to inexistence of environmental improvement	People and municipalities nationawide P Ministry of Health Ministry of Education	Engage in the monitoring of quality of the service provided to the community Esngage in the classification process of inorganic waste
EPS and EC-RS	Develop a business	Informal sector Unfair competition	Operators of informal solid waste	Formalize informal sector, including them in the system
Informal waste pickers	Working conditions	High level of diseases and Price understimation	Municipalities and DESA's Population	Formalization of sector
Companies requiring reusable inputs	Obtain materials	Lack of quality standards and lack of program to assess waste	Good quality of materials used as inputs in the productive process	Inclusion of chains of waste reuse

Source: own elaboration

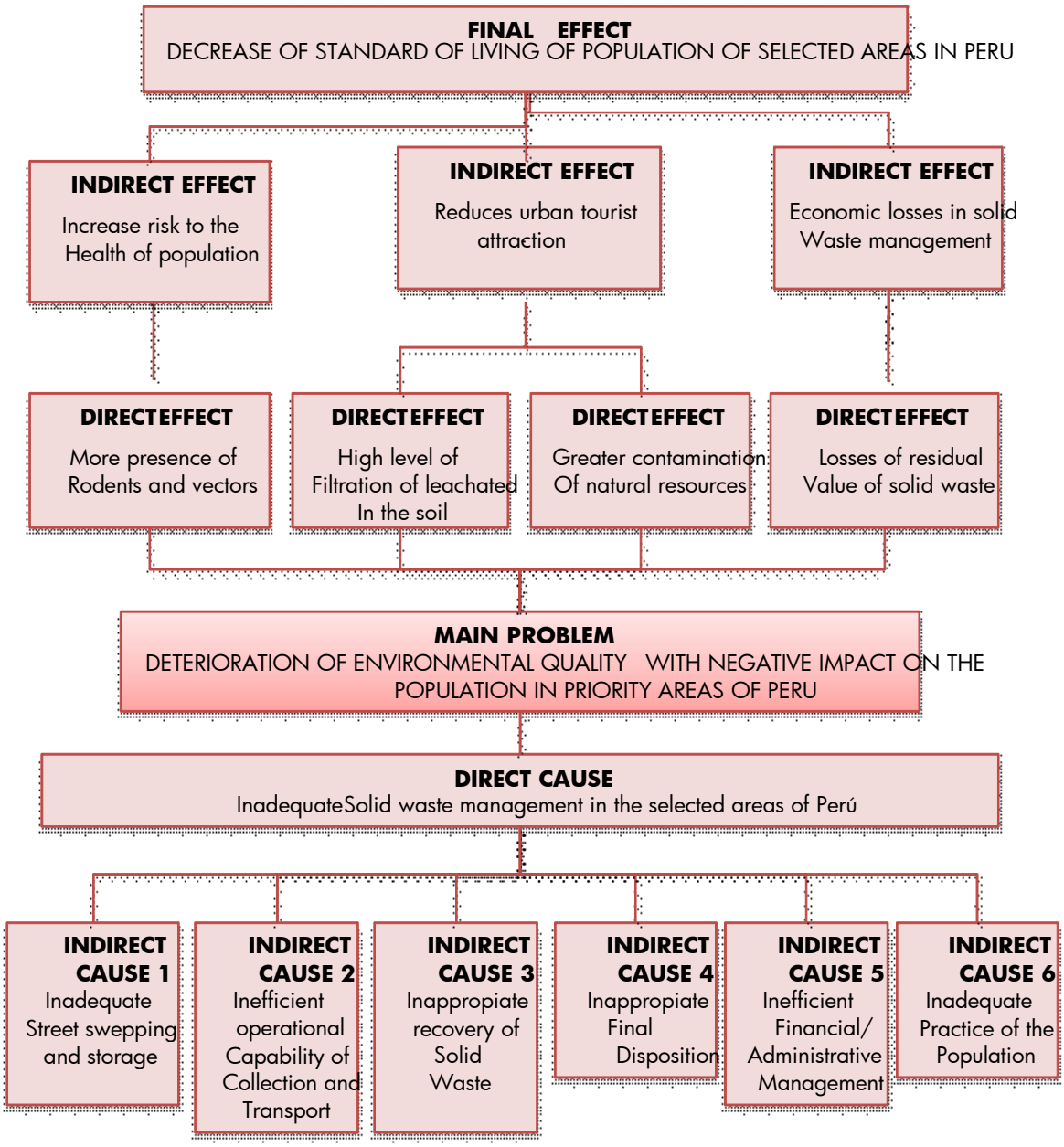


Figure 3.5-1 Problem Tree of the Program

3.6 OBJECTIVE OF THE PROGRAM

3.6.1 General Objectives

- Improve the environmental and health conditions with ecoefficiency measures in the priority areas of Peru.

3.6.2 Specific Objectives

- Achieve a proper storage and street sweeping in the areas included in the program.
- Reachthe operational capacity of collection and transportation of the selected municipalities.
- Proper the reuse of solid waste in the areas included in the program
- Proper final disposal so that it is safe for the health and the environment in the areas included in the program
- Proper administrative and financial management of solid waste
- Proper population practices and habits, so that they properly handle solid waste

3.6.3 Main Goals

Program Goals

- Install all waste bins planned in the program at year 1
- Cover totally the service of street sweeping at year 1
- Increase service rate for the collection of solid waste up to 100% in the priority areas during the first year of the program execution

- Formally reuse of inorganic solid waste by 30% of reusable waste and steadily increase organicsolid waste until 30% of reusable waste in the horizon of the program
- Dispose all solid waste in sanitary landfills
- Rise awareness at year 01 of all population in the main cities of the program
- Increase collection rate by 60% at year 10 of the program execution.

CHAPTER 4 FORMULATION AND EVALUATION

4.1 EVALUATION PERIOD

The evaluation period of said program covers a 10 year period, where costs and benefits of the projects are analyzed. The horizon is defined depending on the life cycle of facilities and machinery requested by each of the PIPs of the areas included in the program.

In the case of street sweeping, the life cycle of the investment covers a period of 3 years. The containers are made of high density polyethylene, heat resistant (UV radiation), cold, humidity, pressure, crash and cleaning agents.

In the case of collection, and transportation, compactor trucks have a life cycle no less than five years, according to technical specifications of chassis and compactor hopper.

In the case of heavy machinery, the average life cycle is 10 years, including frontal loader, caterpillartractor, etc.

To establish the life cycle, the regulation of Law of Income Tax has been considered, approved by legislative decree 774, chapter IV, art. 22 provisions to calculate amortization is governed by the following Table .).

Table 4.1-1 Amortization of Production Goods

GOODS	Annual percentage of amortization up to máximum of
1. Cattle for work and reproduction; fishing nets	25%
2. Land vehicles (except for trains); ovens in general.	20%
3. Machinery and equipment used in mining, fuel and construction activities, except furnitures, fittings and office equipment.	20%
4. Data processing equipment	25%
5. Machinery and equipment bought from 01.01.91.	10%
6. Other asset goods	10%

Final disposal facility has a life cycle of 10 years old (horizon of the program), taking into account that the law requires that sanitary landfills have a life cycle no less than a five-year period.. There are also geology, geotechnical and hydrological studies sustaining this information, and life cycle value will increase when ecoefficiency actions are implemented to reduce and reuse solid waste generated.

4.2 DEMAND ANALYSIS

4.2.1 Estimation of Current Population

The estimation of target population of the current perfil is included in the following work schedule.

Current population

It includes the total beneficiaries of the cities where this investment program shall be executed, which includes 2,922,898 people for the base year.

Table 4.2-1 Population at Year 0

Nº	PROJECT	Base year
		0
1	IDB –DISTRICT MUNICIPALITY OF CHANCAY	58,028
2	IDB - DISTRICT MUNICIPALITY OF POZUZO	8,758
3	DISTRICT MUNICIPALITY OF YAUYOS	9,718
4	IDB–PROVINCIAL MUNICIPALITY OF BAGUA - LA PECA	51,692
5	IDB- PROVINCIAL MUNICIPALITY OF HUAMANGA	192,159
6	IDB - PROVINCIAL MUNICIPALITY OF OXAPAMPA	9,102
7	IDB DISTRICT MUNICIPALITY OF SAN JUAN BAUTISTA	101.101
8	IDB- PROVINCIAL MUNICIPALITY OF ANDAHUAYLAS	47,479
TOTAL IDB		478.036
9	JICA - DISTRICT MUNICIPALITY OF NUEVO CHIMBOTE	135,411
10	JICA - DISTRICT MUNICIPALITY OF SANTIAGO	19,026
11	JICA - PROVINCIAL MUNICIPALITY OF AYMARAES - CHALHUANCA	6,531
12	JICA - PROVINCIAL MUNICIPALITY OF AZANGARO	18,680
13	JICA - PROVINCIAL MUNICIPALITY OF CHACHAPOYAS	29,517
14	JICA - PROVINCIAL MUNICIPALITY OF CHINCHA - CHINCHA ALTA	65,192
15	JICA - PROVINCIAL MUNICIPALITY OF FERREÑAFE	47.626
16	JICA - PROVINCIAL MUNICIPALITY OF HUACHO	174,638
17	JICA - PROVINCIAL MUNICIPALITY OF HUANUCO	157,002
18	JICA - PROVINCIAL MUNICIPALITY OF MOYOBAMBA	76,749
19	JICA - PROVINCIAL MUNICIPALITY OF PAITA	89,707
20	JICA - PROVINCIAL MUNICIPALITY OF PIURA	432,209
21	JICA - PROVINCIAL MUNICIPALITY OF PUNO	137.534
22	JICA - PROVINCIAL MUNICIPALITY OF SAN MARTIN - TARAPOTO	151,449
23	JICA - PROVINCIAL MUNICIPALITY OF SAN ROMAN - JULIACA	248,006
24	JICA - PROVINCIAL MUNICIPALITY OF SECHURA	71,765
25	JICA - PROVINCIAL MUNICIPALITY OF SULLANA	202,334
26	JICA - PROVINCIAL MUNICIPALITY OF TALARA - PARIÑAS	90,450
27	JICA- PROVINCIAL MUNICIPALITY OF ABANCAY	46,408
28	JICA- PROVINCIAL MUNICIPALITY OF ILAVE	26,979
29	JICA- PROVINCIAL MUNICIPALITY OF TAMBOPATA	84.234
30	JICA- PROVINCIAL MUNICIPALITY OF TARMA	44,588
31	JICA-PROVINCIAL MUNICIPALITY OF TUMBES	146,845
TOTAL JICA		**2,502.881**
TOTAL		**2 980.918**

Source: own elaboration

Table 4.2-2 Population Growth Rate

CITIES	POPULATION GROWTH RATE
CHANCAY	3,05%
POZUZO	1,75%
YAUYOS	1,20%
BAGUA	1,70%
AYACUCHO	2,26%
OXAPAMPA	1,75%
SAN JUAN BAUTISTA	2,25%
ANDAHUAYLAS	2,63%
NUEVO CHIMBOTE	2,72%
SANTIAGO	1.94%

CITIES	POPULATION GROWTH RATE
CHALLHUANCA	0,70%
AZÁNGARO	2,21%
CHACHAPOYAS	2,79%
CHINCHA ALTA	1,30%
FERREÑAFE	2,10%
HUACHO	0,82%
HUÁNUCO	0,39%
MOYOBAMBA	3,31%
PAITA	3,09%
PIURA	2,06%
PUNO	1,90%
TARAPOTO	1,54%
JULIACA	1,95%
SECHURA	3,91%
SULLANA	1,68%
PARIÑAS	0,45%
ABANCAY	0,17%
ILAVE	2,86%
PUERTO MALDONADO	4,90%
TARMA	0.46%
TUMBES	1,70%

Source: Own survey

4.2.2 Estimation of Projected Population

The following chart shows the projection of beneficiary population of the program. It is necessary to mention that the level of intervention for each of the projects will be perfomed in two ways: the first one will be the comprehensive management of the services in the main city (from storage to final disposal); and the second represents the first one and some cities of the outskirst, so that population will benefit only from final disposal. The first modality will benefit 2 335.526people, whereas the second will benefit 2 980 918including the first option at year 0.

Table 4.2-3 Projection of Population of Main City

Nº	PROJECT	YEAR										
		0	1	2	3	4	5	6	7	8	9	10
1	IDB - DISTRICT MUNICIPALITY OF CHANCAY	58,028	59,798	61,622	63,502	65,439	67,436	69,493	71,613	73,798	76,049	78,370
2	IDB - DISTRICT MUNICIPALITY OF POZUZO	8,758	9,084	9,424	9,775	10,140	10,518	10,910	11,317	11,739	12,177	12,632
3	IDB - DISTRICT MUNICIPALITY OF YAUYOS	9,718	9,835	9,953	10,072	10,193	10,315	10,439	10,565	10,691	10,820	10,949
4	IDB - PROVINCIAL MUNICIPALITY OF BAGUA - LA PECA	51,692	52,378	53,075	53,783	54,501	55,230	55,970	56,722	57,485	58,259	59,045
5	IDB - PROVINCIAL MUNICIPALITY OF HUAMANGA	110,708	113,207	115,762	118,374	121,046	123,778	126,572	129,428	132,350	135,337	138,391
6	IDB - PROVINCIAL MUNICIPALITY OF OXAPAMPA	9,102	9,294	9,489	9,688	9,891	10,099	10,311	10,528	10,749	10,975	11,205
7	IDB- DISTRICT MUNICIPALITY OF SAN JUAN BAUTISTA	51,692	52,378	53,075	53,783	54,501	55,230	55,970	56,722	57,485	58,259	59,045
8	IDB- PROVINCIAL MUNICIPALITY OF ANDAHUAYLAS	47,479	48,433	49,407	50,400	51,413	52,446	53,501	54,576	55,673	56,792	57,933
TOTAL IDB		396,586	405,929	415,509	425,329	435,396	445,718	456,301	467,153	478,278	489,686	501,382
9	JICA - DISTRICT MUNICIPALITY OF NUEVO CHIMBOTE	135,411	139,089	142,866	146,745	150,730	154,823	159,028	163,346	167,782	172,338	177,018
10	JICA - DISTRICT MUNICIPALITY OF SANTIAGO	19,026	19,394	19,770	20,153	20,543	20,941	21,346	21,759	22,181	22,610	23,048
11	JICA - PROVINCIAL MUNICIPALITY OF AYMARAES - CHALHUANCA	3,854	3,878	3,903	3,927	3,952	3,976	4,001	4,025	4,049	4,074	4,098
12	JICA - PROVINCIAL MUNICIPALITY OF AZANGARO	18,680	19,092	19,513	19,944	20,384	20,833	21,293	21,762	22,242	22,733	23,234
13	JICA - PROVINCIAL MUNICIPALITY OF CHACHAPOYAS	28,130	28,914	29,721	30,550	31,402	32,278	33,179	34,104	35,055	36,033	37,038
14	JICA - PROVINCIAL MUNICIPALITY OF CHINCHA - CHINCHA ALTA	65,192	66,037	66,893	67,760	68,638	69,527	70,428	71,341	72,265	73,202	74,150
15	JICA - PROVINCIAL MUNICIPALITY OF FERREÑAFE	34,121	34,446	34,772	35,097	35,423	35,748	36,074	36,399	36,725	37,050	73,252
16	JICA - PROVINCIAL MUNICIPALITY OF HUACHO	57,193	57,664	58,139	58,619	59,102	59,589	60,081	60,576	61,075	61,579	62,087
17	JICA - PROVINCIAL MUNICIPALITY OF HUANUCO	73,713	74,004	74,296	74,589	74,884	75,179	75,476	75,774	76,074	76,374	76,675
18	JICA - PROVINCIAL MUNICIPALITY OF MOYOBAMBA	53,619	55,393	57,227	59,121	61,078	63,099	65,188	67,345	69,574	71,877	74,256
19	JICA - PROVINCIAL MUNICIPALITY OF PAITA	89,707	92,476	95,331	98,274	101,308	104,435	107,659	110,983	114,409	117,941	121,581
20	JICA - PROVINCIAL MUNICIPALITY OF PIURA	293,992	300,050	306,233	312,544	318,984	325,557	332,265	339,112	346,100	353,232	360,510
21	JICA - PROVINCIAL MUNICIPALITY OF PUNO	137,534	140,202	142,921	145,693	148,519	151,400	154,336	157,330	160,382	163,492	150,695
22	JICA - PROVINCIAL MUNICIPALITY OF SAN MARTIN - TARAPOTO	75,496	76,660	77,841	79,041	80,259	81,496	82,752	84,028	85,323	86,638	87,973
23	JICA - PROVINCIAL MUNICIPALITY OF SAN ROMAN - JULIACA	248,006	252,830	257,749	262,763	267,874	273,085	278,398	283,813	289,335	294,963	300,701
24	JICA - PROVINCIAL MUNICIPALITY OF SECHURA	42,042	43,685	45,393	47,168	49,012	50,928	52,918	54,987	57,137	59,370	61,691
25	JICA - PROVINCIAL MUNICIPALITY OF SULLANA	163,961	166,721	169,527	172,380	175,281	178,232	181,231	184,281	187,383	190,537	193,744
26	JICA - PROVINCIAL MUNICIPALITY OF TALARA - PARIÑAS	90,450	90,862	91,275	91,690	92,107	92,526	92,947	93,370	93,795	94,221	94,650
27	JICA- PROVINCIAL MUNICIPALITY OF ABANCAY	46,408	46,486	46,565	46,643	46,722	46,801	46,879	46,959	47,038	47,117	47,196
28	JICA- PROVINCIAL MUNICIPALITY OF ILAVE	26,979	27,749	28,542	29,357	30,195	31,057	31,944	32,856	33,794	34,759	35,752
29	JICA- PROVINCIAL MUNICIPALITY OF TAMBOPATA	84,234	89,206	94,472	100,048	105,953	112,207	118,831	125,845	133,273	141,140	100,145
30	JICA- PROVINCIAL MUNICIPALITY OF TARMA	44,588	44,795	45,003	45,211	45,420	45,631	45,842	46,055	46,268	46,482	46,698
31	JICA -PROVINCIAL MUNICIPALITY OF TUMBES	106,603	108,413	110,254	112,126	114,030	115,966	117,935	119,937	121,974	124,045	126,151
TOTAL JICA		**1,938,940**	**1,978,049**	**2,018,205**	**2,059,443**	**2,101,800**	**2,145,316**	**2,190,031**	**2,235,989**	**2,283,231**	**2,331,807**	**2,352,344**
TOTAL		**2,335,526**	**2,383,978**	**2,433,714**	**2,484,772**	**2,537,196**	**2,591,034**	**2,646,332**	**2,703,142**	**2,761,509**	**2,821,493**	**2,808,943**

Table 4.2-4 Projection of Total Population in the Cities

Nº	PROJECT	YEAR										
		0	1	2	3	4	5	6	7	8	9	10
1	IDB - DISTRICT MUNICIPALITY OF CHANCAY	58,028	59,798	61,622	63,502	65,439	67,436	69,493	71,613	73,798	76,049	78,370
2	IDB- DISTRICT MUNICIPALITY OF POZUZO	8,758	9,084	9,424	9,775	10,140	10,518	10,910	11,317	11,739	12,177	12,632
3	IDB- DISTRICT MUNICIPALITY OF YAUYOS	9,718	9,835	9,953	10,072	10,193	10,315	10,439	10,565	10,691	10,820	10,949
4	IDB - PROVINCIAL MUNICIPALITY OF BAGUA - LA PECA	51,692	52,378	53,075	53,783	54,501	55,230	55,970	51,692	52,378	53,075	53,783
5	IDB - PROVINCIAL MUNICIPALITY OF HUAMANGA	192,159	197,175	202,286	207,495	212,803	218,211	223,720	229,333	235,050	240,874	246,807
6	IDB - PROVINCIAL MUNICIPALITY OF OXAPAMPA	9,102	9,294	9,489	9,688	9,891	10,099	10,311	10,528	10,749	10,975	11,205
7	IDB- DISTRICT MUNICIPALITY OF SAN JUAN BAUTISTA	101,101	103,900	106,778	109,735	112,773	115,896	119,106	101,101	103,900	106,778	109,735
8	IDB- PROVINCIAL MUNICIPALITY OF ANDAHUAYLAS	47,479	48,433	49,407	50,400	51,413	52,446	53,501	54,576	55,673	56,792	57,933
TOTAL BID		478,036	489,897	502,034	514,450	527,153	540,151	553,450	567,058	580,979	540,151	580,885
9	JICA - DISTRICT MUNICIPALITY OF NUEVO CHIMBOTE	135,411	139,089	142,866	146,745	150,730	154,823	159,028	163,346	167,782	172,338	177,018
10	JICA - DISTRICT MUNICIPALITY OF SANTIAGO	19,026	19,394	19,770	20,153	20,543	20,941	21,346	21,759	22,181	22,610	23,048
11	JICA - PROVINCIAL MUNICIPALITY OF AYMARAES - CHALHUANCA	6,531	6,581	6,630	6,680	6,730	6,780	6,830	6,880	6,930	6,980	7,030
12	JICA - PROVINCIAL MUNICIPALITY OF AZANGARO	18,680	19,092	19,513	19,944	20,384	20,833	21,293	21,762	22,242	22,733	23,234
13	JICA - PROVINCIAL MUNICIPALITY OF CHACHAPOYAS	29,517	30,414	31,343	32,304	33,298	34,328	35,395	36,501	37,647	38,835	40,068
14	JICA - PROVINCIAL MUNICIPALITY OF CHINCHA - CHINCHA ALTA	65,192	66,037	66,893	67,760	68,638	69,527	70,428	71,341	72,265	73,202	74,150
15	JICA - PROVINCIAL MUNICIPALITY OF FERREÑAFE	47,626	48,165	48,707	49,252	49,801	50,354	50,910	51,469	52,033	47,626	73,252
16	JICA - PROVINCIAL MUNICIPALITY OF HUACHO	174,638	178,234	181,921	185,702	189,582	193,564	197,652	201,852	206,167	210,603	215,164
17	JICA - PROVINCIAL MUNICIPALITY OF HUANUCO	157,002	157,964	158,934	159,910	160,893	161,882	162,879	163,883	164,893	165,911	166,936
18	JICA - PROVINCIAL MUNICIPALITY OF MOYOBAMBA	76,749	79,418	82,183	85,047	88,014	91,089	94,274	97,574	100,993	104,535	108,206
19	JICA - PROVINCIAL MUNICIPALITY OF PAITA	89,707	92,476	95,331	98,274	101,308	104,435	107,659	110,983	114,409	117,941	121,581
20	JICA - PROVINCIAL MUNICIPALITY OF PIURA	432,209	440,652	449,260	458,038	466,989	476,115	485,421	494,910	504,585	514,451	524,511
21	JICA - PROVINCIAL MUNICIPALITY OF PUNO	137,534	140,202	142,921	145,693	148,519	151,400	154,336	157,330	160,382	137,534	140,202
22	JICA - PROVINCIAL MUNICIPALITY OF SAN MARTIN - TARAPOTO	151,449	154,653	157,940	161,312	164,772	168,323	171,968	175,711	179,553	183,500	187,554
23	JICA - PROVINCIAL MUNICIPALITY OF SAN ROMAN - JULIACA	248,006	252,830	257,749	262,763	267,874	273,085	278,398	283,813	289,335	294,963	300,701
24	JICA - PROVINCIAL MUNICIPALITY OF SECHURA	71,765	73,927	76,164	78,478	80,871	83,347	85,909	88,559	91,301	94,138	97,074
25	JICA - PROVINCIAL MUNICIPALITY OF SULLANA	202,334	205,434	208,583	211,783	215,033	218,336	221,691	225,101	228,564	232,083	235,658
26	JICA - PROVINCIAL MUNICIPALITY OF TALARA - PARIÑAS	90,450	90,862	91,275	91,690	92,107	92,526	92,947	93,370	93,795	94,221	94,650
27	JICA- PROVINCIAL MUNICIPALITY OF ABANCAY	46,408	46,486	46,565	46,643	46,722	46,801	46,879	46,959	47,038	47,117	47,196
28	JICA- PROVINCIAL MUNICIPALITY OF ILAVE	26,979	27,749	28,542	29,357	30,195	31,057	31,944	32,856	33,794	34,759	35,752
29	JICA- PROVINCIAL MUNICIPALITY OF TAMBOPATA	84,234	89,206	94,472	100,048	105,953	112,207	118,831	125,845	133,273	84,234	89,206
30	JICA- PROVINCIAL MUNICIPALITY OF TARMA	44,588	44,795	45,003	45,211	45,420	45,631	45,842	46,055	46,268	46,482	46,698
31	JICA -PROVINCIAL MUNICIPALITY OF TUMBES	146,845	149,244	151,682	154,161	156,680	159,241	161,844	164,490	167,180	169,914	172,692
TOTAL JICA		**2,502,881**	**2,552,905**	**2,604,246**	**2,656,947**	**2,711,058**	**2,766,626**	**2,823,704**	**2,882,346**	**2,942,608**	**2,502,881**	**2,552,905**
TOTAL		**2,980,918**	**3,042,803**	**3,106,280**	**3,171,397**	**3,238,211**	**3,306,777**	**3,377,154**	**3,449,404**	**3,523,587**	**2,980,918**	**3,042,803**

4.2.3 Determination of Service Demand

Service refers to the comprehensive management of solid waste in the priority areas through a system that includes the following operations:

- Storage of solid waste (t/year)
- Sweeping of public spaces (km)
- Recollection and transport of solid waste (t/year)
- Reuse of waste (t/year)
- Final disposal of solid waste (m3/year)

The analysis of service demand of the program varies depending on cultural factors related to income level/rate, consumption habits, technological development, standards of life quality of population and the behavior of economy on each city.

It is important to mention that municipalities must manage and handle domestic and commercial waste, cleaning of public spaces and those activities that originate similar waste.

4.2.4 Analysis of Services

(1) Demand of Public Storage of Solid Waste

The demand of public storage of solid waste covers waste of public spaces and parks, thus using waste bins located in the most busy areas, where solid waste accumulate, or critical areas, and containers in markets.

The total demand for the year 0 is 13,019.18.1 t/year, and the demand for the year 10 is 16 176.58 t/year, which is the result of the demands of the projects funded by IDB and JICA. Then, for the projects financed by IDB the demand for the year 0 is 5418.93 t/year, and a projected demand at year 10 is 6 896.97 t/year. In the case of JICA projects, the demand at year 0 is 7 600.26 t/year, and the projected demand for the year 10 is 9 279.61t/year.

Table 4.2-5 Demand of Storage per Project (t/year)

PROJECT	YEAR										
	0	1	2	3	4	5	6	7	8	9	10
BID - DISTRICT MUNICIPALITY OF CHANCAY	865.03	891.42	918.61	946.64	975.52	1,005.28	1,035.95	1,067.55	1,100.12	1,133.68	1,168.27
BID - DISTRICT MUNICIPALITY OF POZUZO	148.23	156.44	165.13	174.28	183.95	194.15	204.91	216.27	228.26	240.93	254.30
BID - DISTRICT MUNICIPALITY OF YAUYOS	248.06	250.54	253.04	255.57	258.13	260.71	263.32	265.95	268.61	271.30	274.01
BID - PROVINCIAL MUNICIPALITY OF BAGUA - LA PECA	1,277.50	1,308.67	1,345.51	1,381.84	1,418.32	1,455.76	1,495.02	1,536.14	1,579.92	1,622.89	1,665.74
BID - PROVINCIAL MUNICIPALITY OF HUAMANGA	535.30	547.38	559.74	572.37	585.29	598.50	612.00	625.82	639.94	654.38	669.15
BID - PROVINCIAL MUNICIPALITY OF OXAPAMPA	187.52	195.29	203.38	211.80	220.58	229.71	239.23	249.14	259.45	270.20	281.39
BID- DISTRICT MUNICIPALITY OF SAN JUAN BAUTISTA	960.09	986.67	1,014.00	1,042.08	1,070.93	1,100.59	1,131.07	1,162.39	1,194.58	1,227.66	1,261.66
BID- PROVINCIAL MUNICIPALITY OF ANDAHUAYLAS	1,197.20	1,209.17	1,221.26	1,233.48	1,245.81	1,258.27	1,270.85	1,283.56	1,296.40	1,309.36	1,322.45
TOTAL BID	960.09	986.67	1,014.00	1,042.08	1,070.93	1,100.59	1,131.07	1,162.39	1,194.58	1,227.66	1,261.66
JICA - DISTRICT MUNICIPALITY OF NUEVO CHIMBOTE	179.34	184.21	189.21	194.35	199.63	205.05	210.62	216.34	222.21	228.25	234.45
JICA - DISTRICT MUNICIPALITY OF SANTIAGO	47.61	48.53	49.47	50.43	51.40	52.40	53.41	54.45	55.50	56.58	57.67
JICA - PROVINCIAL MUNICIPALITY OF AYMARAES – CHALHUANCA	93.76	94.42	95.08	95.74	96.41	97.08	97.76	98.44	99.13	99.82	100.52
JICA - PROVINCIAL MUNICIPALITY OF AZANGARO	41.32	42.23	43.16	44.12	45.09	46.08	47.10	48.14	49.20	50.29	51.39
JICA - PROVINCIAL MUNICIPALITY OF CHACHAPOYAS	168.35	173.05	177.88	182.84	187.94	193.18	198.57	204.11	209.80	215.65	221.67
JICA - PROVINCIAL MUNICIPALITY OF CHINCHA - CHINCHA ALTA	339.89	344.29	348.75	353.27	357.85	362.48	367.18	371.94	376.76	381.64	386.59
JICA - PROVINCIAL MUNICIPALITY OF FERREÑAFE	292.40	295.20	298.03	300.89	303.78	306.69	309.63	312.60	315.60	318.63	321.68
JICA - PROVINCIAL MUNICIPALITY OF HUACHO	182.84	184.35	185.87	187.40	188.95	190.51	192.08	193.66	195.26	196.87	198.49
JICA - PROVINCIAL MUNICIPALITY OF HUANUCO	355.02	356.42	357.83	359.24	360.66	362.08	363.51	364.95	366.39	367.83	369.29
JICA - PROVINCIAL MUNICIPALITY OF MOYOBAMBA	335.34	346.43	357.90	369.75	381.98	394.63	407.69	421.18	435.12	449.52	464.40
JICA - PROVINCIAL MUNICIPALITY OF PAITA	572.95	590.63	608.87	627.66	647.04	667.01	687.60	708.83	730.71	753.27	776.52
JICA - PROVINCIAL MUNICIPALITY OF PIURA	453.02	462.35	471.88	481.60	491.53	501.65	511.99	522.54	533.31	544.30	555.51
JICA - PROVINCIAL MUNICIPALITY OF PUNO	474.85	484.06	493.44	503.02	512.77	522.72	532.86	543.19	553.73	564.47	575.42
JICA - PROVINCIAL MUNICIPALITY OF SAN MARTIN - TARAPOTO	1,335.63	1,356.22	1,377.12	1,398.34	1,419.89	1,441.78	1,464.00	1,486.56	1,509.47	1,532.74	1,556.36
JICA - PROVINCIAL MUNICIPALITY OF SAN ROMAN - JULIACA	294.10	299.82	305.65	311.60	317.66	323.84	330.14	336.56	343.11	349.78	356.58
JICA - PROVINCIAL MUNICIPALITY OF SECHURA	477.49	496.16	515.56	535.71	556.65	578.41	601.03	624.52	648.94	674.31	700.67
JICA - PROVINCIAL MUNICIPALITY OF SULLANA	498.43	506.82	515.35	524.03	532.85	541.81	550.93	560.21	569.63	579.22	588.97
JICA - PROVINCIAL MUNICIPALITY OF TALARA - PARIÑAS	115.82	116.34	116.87	117.40	117.94	118.47	119.01	119.55	120.10	120.64	121.19
JICA- PROVINCIAL MUNICIPALITY OF ABANCAY	321.53	322.08	322.62	323.16	323.71	324.25	324.80	325.35	325.90	326.45	327.00
JICA- PROVINCIAL MUNICIPALITY OF ILAVE	273.19	280.99	289.02	297.27	305.76	314.49	323.47	332.70	342.20	351.98	362.03
JICA- PROVINCIAL MUNICIPALITY OF TAMBOPATA	199.71	211.50	223.99	237.21	251.21	266.04	281.74	298.37	315.98	334.63	354.39
JICA- PROVINCIAL MUNICIPALITY OF TARMA	362.19	363.86	365.55	367.24	368.94	370.65	372.37	374.10	375.83	377.57	379.32
JICA -PROVINCIAL MUNICIPALITY OF TUMBES	185.49	188.63	191.84	195.10	198.41	201.78	205.20	208.69	212.23	215.83	219.50
TOTAL JICA	199.71	211.50	223.99	237.21	251.21	266.04	281.74	298.37	315.98	334.63	354.39
TOTAL	199.71	211.50	223.99	237.21	251.21	266.04	281.74	298.37	315.98	334.63	354.39

Source: own elaboration

(2) Demand of the Street Sweeping Services (km/year).

The demand for the sweeping service depends on the number of streets, roads, parks and other public spaces of the city that need sweeping. The total distance to be swept in the program for the year 0 is 640 411km, and the projected demand for the year 10 of 767 317 km, which is the sum of the demand for the year 0 and year 10 of projects funded by IDB and JICA. Therefore, the projects financed by IDB the demand for the year 0 is 82 737.69 km of streets, and a projected demand for the year 10 of 107 219.83 km of swept streets. In the case of JICA, the demand is 557 667.41kms of streets at year 0 and a projected demand at year 10 of 673 050km of streets swept.

The following chart shows the growth projection of the demand for sweeping during the evaluation period.

Table 4.2-6 Sweeping Demand per Project

PROJECT	YEAR										
	0	1	2	3	4	5	6	7	8	9	10
IDB DISTRICT MUNICIPALITY OF CHANCAY	15,659.46	16,137.19	16,629.50	17,136.82	17,659.63	18,198.38	18,753.57	19,325.70	19,915.28	20,522.85	21,148.95
IDB - DISTRICT MUNICIPALITY OF POZUZO	474.50	839.50	1,204.50	1,569.50	1,825.00	1,825.00	1,825.00	1,825.00	1,825.00	1,825.00	1,825.00
IDB - DISTRICT MUNICIPALITY OF YAUYOS	1,814.05	2,179.05	2,544.05	2,909.05	3,274.05	3,639.05	4,004.05	4,369.05	4,734.05	5,099.05	5,464.05
IDB - PROVINCIAL MUNICIPALITY OF BAGUA - LA PECA	7,541.41	7,669.51	7,799.89	7,932.49	8,067.34	8,204.48	8,343.97	8,485.82	8,630.07	8,776.79	8,925.99
IDB - PROVINCIAL MUNICIPALITY OF HUAMANGA	26,518.63	27,117.15	27,729.17	28,355.01	28,994.98	29,649.39	30,318.57	31,002.85	31,702.58	32,418.10	33,149.77
IDB - PROVINCIAL MUNICIPALITY OF OXAPAMPA	8,595.75	8,774.60	8,960.75	9,150.55	9,340.35	9,537.45	9,738.20	9,942.60	10,150.65	10,362.35	10,581.35
IDB- DISTRICT MUNICIPALITY OF SAN JUAN BAUTISTA	21,081.87	21,665.67	22,265.65	22,882.23	23,515.89	24,167.10	24,836.34	25,524.11	26,230.93	26,957.32	27,703.83
IDB- PROVINCIAL MUNICIPALITY OF ANDAHUAYLAS	1,052.02	1,073.17	1,094.74	1,116.74	1,139.19	1,162.09	1,185.44	1,209.27	1,233.58	1,258.37	1,283.67
TOTAL BID	82,737.69	85,455.84	88,228.24	91,052.39	93,816.42	96,382.94	99,005.13	101,684.40	104,422.14	107,219.83	110,082.60
JICA - DISTRICT MUNICIPALITY OF NUEVO CHIMBOTE	16,251.66	16,692.98	17,146.29	17,611.91	18,090.17	18,581.42	19,086.01	19,604.30	20,136.66	20,683.49	21,245.16
JICA - DISTRICT MUNICIPALITY OF SANTIAGO	2,666.74	2,718.37	2,771.01	2,824.66	2,879.35	2,935.10	2,991.93	3,049.86	3,108.91	3,169.10	3,230.46
JICA - PROVINCIAL MUNICIPALITY OFAYMARAES - CHALHUANCA	6,128.83	6,171.62	6,214.71	6,258.10	6,301.79	6,345.78	6,390.08	6,434.70	6,479.62	6,524.86	6,570.41
JICA - PROVINCIAL MUNICIPALITY OFAZANGARO	9,869.57	10,087.24	10,309.70	10,537.07	10,769.46	11,006.97	11,249.72	11,497.83	11,751.40	12,010.57	12,275.46
JICA - PROVINCIAL MUNICIPALITY OF CHACHAPOYAS	10,386.68	10,676.41	10,974.23	11,280.35	11,595.01	11,918.45	12,250.91	12,592.65	12,943.92	13,304.98	13,676.12
JICA - PROVINCIAL MUNICIPALITY OFCHINCHA - CHINCHA ALTA	24,768.59	25,089.55	25,414.66	25,743.99	26,077.58	26,415.50	26,757.80	27,104.53	27,455.75	27,811.53	28,171.92
JICA - PROVINCIAL MUNICIPALITY OF FERREÑAFE	12,299.17	12,417.14	12,536.23	12,656.47	12,777.87	12,900.43	13,024.16	13,149.08	13,275.20	13,402.53	13,531.08
JICA - PROVINCIAL MUNICIPALITY OFHUACHO	30,286.30	30,536.00	30,787.75	31,041.59	31,297.52	31,555.56	31,815.72	32,078.03	32,342.50	32,609.16	32,878.01
JICA PROVINCIAL MUNICIPALITY OF HUANUCO	21,770.36	21,856.32	21,942.62	22,029.27	22,116.25	22,203.58	22,291.25	22,379.27	22,467.63	22,556.35	22,645.41
JICA - MUNICIPALIDAD PROVINCIAL DE MOYOBAMBA	10,529.13	10,877.62	11,237.65	11,609.60	11,993.85	12,390.83	12,800.94	13,224.63	13,662.34	14,114.53	14,581.70
JICA - PROVINCIAL MUNICIPALITY OF PAITA	13,072.64	13,476.20	13,892.22	14,321.07	14,763.17	15,218.92	15,688.73	16,173.05	16,672.32	17,187.00	17,717.57
JICA - PROVINCIAL MUNICIPALITY OF PIURA	77,080.98	78,669.31	80,290.38	81,944.85	83,633.42	85,356.78	87,115.65	88,910.76	90,742.87	92,612.73	94,521.11
JICA - PROVINCIAL MUNICIPALITY OFPUNO	37,645.71	38,375.90	39,120.25	39,879.03	40,652.54	41,441.04	42,244.84	43,064.24	43,899.52	44,751.01	45,619.01
JICA - PROVINCIAL MUNICIPALITY OF SAN MARTIN - TARAPOTO	20,443.62	20,758.70	21,078.64	21,403.51	21,733.39	22,068.35	22,408.47	22,753.84	23,104.52	23,460.62	23,822.20
JICA - PROVINCIAL MUNICIPALITY OFSAN ROMAN - JULIACA	66,561.76	67,856.59	69,176.62	70,522.33	71,894.21	73,292.78	74,718.56	76,172.07	77,653.86	79,164.47	80,704.47
JICA - PROVINCIAL MUNICIPALITY OF SECHURA	11,024.12	11,455.09	11,902.90	12,368.22	12,851.73	13,354.14	13,876.20	14,418.66	14,982.33	15,568.03	16,176.63
JICA - PROVINCIAL MUNICIPALITY OF SULLANA	41,867.20	42,571.85	43,288.36	44,016.92	44,757.75	45,511.04	46,277.02	47,055.88	47,847.86	48,653.16	49,472.02
JICA - PROVINCIAL MUNICIPALITY OFTALARA - PARIÑAS	25,016.24	25,130.03	25,244.34	25,359.16	25,474.51	25,590.39	25,706.79	25,823.72	25,941.18	26,059.18	26,177.71
JICA- PROVINCIAL MUNICIPALITY OFABANCAY	23,319.82	23,359.14	23,398.52	23,437.97	23,477.48	23,517.07	23,556.72	23,596.43	23,636.22	23,676.07	23,715.98
JICA- PROVINCIAL MUNICIPALITY OF ILAVE	14,242.01	14,648.69	15,066.97	15,497.20	15,939.72	16,394.87	16,863.02	17,344.53	17,839.80	18,349.20	18,873.16
JICA- PROVINCIAL MUNICIPALITY OFTAMBOPATA	21,681.30	22,961.07	24,316.38	25,751.69	27,271.72	28,881.47	30,586.24	32,391.63	34,303.59	36,328.41	38,472.74
JICA- PROVINCIAL MUNICIPALITY OFTARMA	21,482.89	21,582.41	21,682.40	21,782.84	21,883.75	21,985.13	22,086.98	22,189.30	22,292.09	22,395.36	22,499.11
JICA -PROVINCIAL MUNICIPALITY OFTUMBES	39,278.84	39,945.78	40,624.04	41,313.82	42,015.31	42,728.71	43,454.22	44,192.06	44,942.42	45,705.52	46,481.58
TOTAL JICA	**557,674.16**	**567,914.01**	**578,416.86**	**589,191.62**	**600,247.54**	**611,594.29**	**623,241.95**	**635,201.03**	**647,482.51**	**660,097.85**	**673,059.02**
TOTAL	**640,411.85**	**653,369.84**	**666,645.11**	**680,244.01**	**694,063.96**	**707,977.23**	**722,247.08**	**736,885.42**	**751,904.64**	**767,317.67**	**783,141.62**

Source: own elaboration

(3) Demand for Collection and Transportation of Solid Waste (t/year)

The demand for the collection and transportation depends on the amount of municipal solid waste originated. Therefore, we relate production values per capita with the population, and we will obtain the amount of the existing household solid waste. Besides, it should be taking into account the amount of non-household solid waste (such as commercial, institutional, market, etc). Once this calculation is done, we will obtain the amount of municipal solid waste.

In our case, the estimation of the total demand for collection and transportation of solid wastefor the year 0 is 611 003.60 t/year and the demand for the year 10 is 804 877.47 t/year, which is the result of adding the demands for both the year 0 and year 10 of the projects funded by IDB and JICA. Therefore, for the projects funded by IDB, the demand for the year 0 is 112 880.06 t/year, and the demand projected for the year 10 is 148 473.82 t/year. In the case of projects financed by JICA, the demand is 498 123.54 t/year for the year 0, and the projected demand for the year 10 is 651.775.51 t/year.

The following chart shows the projection for growth of the demand for collection and transportation during evaluation period.

Table 4.2-7 Demand for Collection, Transportation and Transfer per Project

Nº	PROJECT	AÑO										
		0	1	2	3	4	5	6	7	8	9	10
1	IDB–DISTRICT MUNICIPALITY OF CHANCAY	11,347.74	11,784.10	12,237.45	12,708.52	13,197.89	13,706.49	14,234.77	14,783.71	15,354.13	15,946.72	16,562.67
2	IDB – DISTRICT MUNICIPALITY OF POZUZO	157.61	170.81	184.61	198.84	212.06	222.53	233.49	245.14	257.33	270.26	283.96
3	IDB – DISTRICT MUNICIPALITY OF YAUYOS	2,510.29	2,565.91	2,622.67	2,680.56	2,739.89	2,800.42	2,862.42	2,925.94	2,990.44	3,056.79	3,124.17
4	IDB–PROVINCIAL MUNICIPALITY OF BAGUA - LA PECA	12,756.75	13,030.50	13,337.10	13,651.00	13,968.55	14,297.05	14,636.50	14,979.60	15,333.65	15,695.00	16,067.30
5	IDB - PROVINCIAL MUNICIPALITY OF HUAMANGA	46,729.55	48,077.78	49,466.07	50,895.63	52,367.73	53,883.66	55,444.75	57,052.40	58,708.01	60,413.05	62,169.04
6	IDB - PROVINCIAL MUNICIPALITY OF OXAPAMPA	2,177.33	2,265.16	2,356.62	2,451.81	2,550.84	2,653.97	2,761.31	2,873.03	2,989.31	3,110.35	3,236.38
7	IDB – DISTRICT MUNICIPALITY OF SAN JUAN BAUTISTA	26,407.96	27,351.09	28,328.38	29,341.09	30,390.50	31,477.97	32,604.89	33,772.71	34,982.93	36,237.10	37,536.83
8	IDB- PROVINCIAL MUNICIPALITY OF ANDAHUAYLAS	10,792.83	11,084.83	11,385.21	11,694.24	12,012.15	12,339.22	12,675.71	13,021.91	13,378.09	13,744.56	14,121.61
TOTAL BID		112,880.06	116,330.18	119,918.10	123,621.69	127,439.62	131,381.30	135,453.84	139,654.44	143,993.88	148,473.82	153,101.96
9	JICA - MUNICIPALIDAD DISTRITAL DE NUEVO CHIMBOTE	34,061.97	35,231.85	36,442.67	37,695.87	38,992.97	40,335.53	41,725.17	43,163.55	44,652.43	46,193.59	47,788.90
10	JICA –DISTRICT MUNICIPALITY OF SANTIAGO	2,531.04	2,602.44	2,675.89	2,751.43	2,829.15	2,909.08	2,991.31	3,075.90	3,162.92	3,252.43	3,344.51
11	JICA - PROVINCIAL MUNICIPALITY OFAYMARAES - CHALHUANCA	792.05	804.03	816.17	828.47	840.94	853.58	866.38	879.36	892.51	905.84	919.35
12	JICA - PROVINCIAL MUNICIPALITY OFAZANGARO	2,596.77	2,674.69	2,755.00	2,837.77	2,923.08	3,010.99	3,101.61	3,195.00	3,291.26	3,390.48	3,492.74
13	JICA PROVINCIAL MUNICIPALITY OF CHACHAPOYAS	6,724.76	6,963.26	7,210.35	7,466.36	7,731.60	8,006.41	8,291.15	8,586.17	8,891.86	9,208.60	9,536.80
14	JICA - PROVINCIAL MUNICIPALITY OFCHINCHA - CHINCHA ALTA	17,189.07	17,538.99	17,896.37	18,261.38	18,634.20	19,015.00	19,403.94	19,801.22	20,207.01	20,621.51	21,044.90
15	JICA - PROVINCIAL MUNICIPALITY OF FERREÑAFE	11,533.85	11,716.52	11,901.68	12,089.38	12,279.65	12,472.51	12,668.00	12,866.15	13,067.00	13,270.59	13,476.94
16	JICA PROVINCIAL MUNICIPALITY OFHUACHO	17,115.34	17,345.15	17,578.49	17,815.40	18,055.96	18,300.21	18,548.23	18,800.07	19,055.80	19,315.49	19,579.19
17	JICA - PROVINCIAL MUNICIPALITY OF HUANUCO	18,615.08	18,787.09	18,961.16	19,137.32	19,315.58	19,495.99	19,678.57	19,863.34	20,050.34	20,239.60	20,431.15
18	JICA - PROVINCIAL MUNICIPALITY OF MOYOBAMBA	14,551.37	15,163.38	15,801.30	16,466.25	17,159.37	17,881.86	18,634.98	19,420.03	20,238.37	21,091.42	21,980.66
19	JICA - PROVINCIAL MUNICIPALITY OF PAITA	15,493.24	16,112.02	16,755.69	17,425.25	18,121.76	18,846.29	19,599.99	20,384.04	21,199.66	22,048.14	22,930.79
20	JICA PROVINCIAL MUNICIPALITY OF PIURA	98,192.86	100,931.94	103,749.51	106,647.87	109,629.38	112,696.49	115,851.70	119,097.59	122,436.82	125,872.13	129,406.34
21	JICA - PROVINCIAL MUNICIPALITY OFPUNO	32,285.79	33,183.60	34,106.85	35,056.29	36,032.66	37,036.74	38,069.33	39,131.24	40,223.33	41,346.45	42,501.50
22	JICA PROVINCIAL MUNICIPALITY OF SAN MARTIN - TARAPOTO	27,948.88	28,538.14	29,140.54	29,756.38	30,385.98	31,029.65	31,687.72	32,360.53	33,048.43	33,751.76	34,470.90
23	JICA PROVINCIAL MUNICIPALITY OFSAN ROMAN - JULIACA	66,751.38	68,530.06	70,357.57	72,235.29	74,164.63	76,147.05	78,184.02	80,277.10	82,427.86	84,637.92	86,908.96
24	JICA - PROVINCIAL MUNICIPALITY OF SECHURA	5,163.97	5,417.63	5,683.77	5,963.00	6,255.97	6,563.35	6,885.86	7,224.24	7,579.27	7,951.78	8,335.20
25	JICA PROVINCIAL MUNICIPALITY OF SULLANA	37,499.29	38,455.96	39,437.53	40,444.64	41,477.97	42,538.21	43,626.08	44,742.30	45,887.61	47,062.80	48,268.64
26	JICA - PROVINCIAL MUNICIPALITY OFTALARA - PARIÑAS	22,744.38	23,034.32	23,328.29	23,626.37	23,928.60	24,235.05	24,545.78	24,860.84	25,180.31	25,504.25	25,832.71
27	JICA- PROVINCIAL MUNICIPALITY OFABANCAY	16,980.41	17,107.21	17,235.37	17,364.91	17,495.84	17,628.19	17,761.96	17,897.17	18,033.85	18,172.00	18,311.64
28	JICA- PROVINCIAL MUNICIPALITY OF ILAVE	4,585.87	4,750.46	4,921.05	5,097.87	5,281.15	5,471.13	5,668.06	5,872.18	6,083.78	6,303.13	6,530.51
29	JICA- PROVINCIAL MUNICIPALITY OFTAMBOPATA	17,707.32	18,887.01	20,145.69	21,488.69	22,921.66	24,450.68	26,082.21	27,823.14	29,680.86	31,663.23	33,778.65
30	JICA- PROVINCIAL MUNICIPALITY OFTARMA	10,610.09	10,727.81	10,847.08	10,967.92	11,090.36	11,214.42	11,340.12	11,467.49	11,596.54	11,727.31	11,859.81
31	JICA - PROVINCIAL MUNICIPALITY OFTUMBES	16,448.76	16,857.81	17,277.33	17,707.59	18,148.87	18,601.47	19,065.67	19,541.78	20,030.11	20,530.98	21,044.72
TOTAL JICA		**498,123.54**	**511,361.35**	**525,025.35**	**539,131.71**	**553,697.33**	**568,739.89**	**584,277.83**	**600,330.46**	**616,917.94**	**634,061.40**	**651,775.51**
TOTAL		**611,003.60**	**627,691.53**	**644,943.45**	**662,753.39**	**681,136.95**	**700,121.19**	**719,731.68**	**739,984.89**	**760,911.83**	**782,535.22**	**804,877.47**

Source: own elaboration

(4) Demand of Solid Waste Reuse (t/year)

In order to estimate the reuse demand of recyclable solid waste such as paper, glass, plastic, cardboard, metals, etc, the projects foresee to include selective collection in order to promote segregation at source, and facilitate the reuse of part of recyclable solid waste. Approximately 5 % of the population will be covered. During the execution of the Program, the recovery goal (depending on the size of the cities and generation of solid waste) is 20-40-60%, based on a two-year pilot program. The pilot program will cover an estimated amount of solid waste and a target population already aware of the subject.

In order to estimate the demand of organic solid waste reuse, it has been considered the market waste from each city, and some cities will also include waste from restaurants.

- During the first two years, a pilot program will be implemented,considering a demand of 200 kg , and reusing market waste.
- For the years 3,4 and 5 of the projects, all market waste will be used, up to a maximum of 4 tons/day.
- For the years 6-10 of the projects, all solid waste generated at markets will be reused, up to a maximum of 7 tons/day. Some cities will include waste from restaurants, and to a lesser extent, from households included in the pilot area.

PROGRAMThe demand for the reuse of organic solid waste for the year 0 is 27 013.05 t/year and a projected demand for the year 10 is 68 064.91t/year.

The demand for the reuse of inorganic solid waste for the year 0 is 13 839.16 t/year and a projected demand for the year 10 is 53 224.33 t/year.

- IDB

The demand for the organic solid waste for the year 0 is 25 427.85t/year and a projected demand for the year 10 is 34 302.41 t/year.

The demand for the reuse of inorganic solid waste at year 0 is9 914.53 t/year and a projected demand at year 14 123.75t/year.

- JICA

The demand for the reuse of organic solid waste for the year 0 is 1 585.21t/year, and the projected demand for the year 10 is 33 762.50 t/year.

The demand for the reuse of inorganic solid waste for the year 0 is 3 924.63 t/year and a projected demand for the year 10of 39 100.58 t/year.

The following charts show the growth projections for the reuse demand both for organic and inorganic waste.

Table 4.2-8 Demand for Organic Reusefor each Project

Nº	PROJECT	YEAR										
		0	1	2	3	4	5	6	7	8	9	10
1	BID - DISTRICT MUNICIPALITY OF CHANCAY	0.00	73.00	73.00	94.54	117.33	141.42	166.87	193.74	222.10	252.01	283.53
2	BID - DISTRICT MUNICIPALITY OF POZUZO	79.18	83.54	88.21	93.12	98.25	103.73	109.47	115.57	121.94	128.71	135.88
3	BID - DISTRICT MUNICIPALITY OF YAUYOS	717.88	733.79	750.02	766.57	783.54	800.85	818.58	836.75	855.19	874.17	893.43
4	BID - PROVINCIAL MUNICIPALITY OF BAGUA - LA PECA	8,037.45	8,209.51	8,401.97	8,599.13	8,801.13	9,008.08	9,220.10	9,437.33	9,659.89	9,887.92	10,121.56
5	BID - PROVINCIAL MUNICIPALITY OF HUAMANGA	5,147.73	5,296.25	5,449.18	5,606.66	5,768.83	5,935.82	6,107.79	6,284.89	6,467.27	6,655.10	6,848.54
6	BID - PROVINCIAL MUNICIPALITY OF OXAPAMPA	1,244.59	1,296.14	1,349.83	1,405.74	1,463.96	1,524.60	1,587.75	1,653.51	1,722.00	1,793.33	1,867.61
7	BID- DISTRICT MUNICIPALITY OF SAN JUAN BAUTISTA	6,767.83	7,009.54	7,260.00	7,519.53	7,788.48	8,067.17	8,355.98	8,655.27	8,965.42	9,286.84	9,619.94
8	BID- PROVINCIAL MUNICIPALITY OF ANDAHUAYLAS	3,433.20	3,529.25	3,628.14	3,729.94	3,834.75	3,942.65	4,053.74	4,168.10	4,285.85	4,407.09	4,531.91
TOTAL IDB		25,427.85	26,231.02	27,000.34	27,815.24	28,656.27	29,524.33	30,420.29	31,345.16	32,299.68	33,285.17	34,302.41
9	JICA - DISTRICT MUNICIPALITY OF NUEVO CHIMBOTE	73.00	73.00	73.00	1,460.00	1,460.00	1,460.00	2,555.00	2,555.00	2,555.00	2,555.00	2,555.00
10	JICA - DISTRICT MUNICIPALITY OF SANTIAGO	8.67	8.84	9.01	9.18	9.18	9.18	401.50	401.50	401.50	401.50	401.50
11	JICA - PROVINCIAL MUNICIPALITY OF AYMARAES - CHALHUANCA	43.53	43.84	44.14	44.45	44.45	44.45	401.50	401.50	401.50	401.50	401.50
12	JICA - PROVINCIAL MUNICIPALITY OF AZANGARO	73.00	73.00	73.00	149.68	149.68	149.68	401.50	401.50	401.50	401.50	401.50
13	JICA - PROVINCIAL MUNICIPALITY OF CHACHAPOYAS	73.00	73.00	73.00	576.60	576.60	576.60	1,460.00	1,460.00	1,460.00	1,460.00	1,460.00
14	JICA - PROVINCIAL MUNICIPALITY OF CHINCHA - CHINCHA ALTA	73.00	73.00	73.00	641.76	641.76	641.76	1,460.00	1,460.00	1,460.00	1,460.00	1,460.00
15	JICA - PROVINCIAL MUNICIPALITY OF FERREÑAFE	73.00	73.00	73.00	758.41	758.41	758.41	1,460.00	1,460.00	1,460.00	9,108.02	9,371.63
16	JICA - PROVINCIAL MUNICIPALITY OF HUACHO	73.00	73.00	73.00	846.25	846.25	846.25	1,460.00	1,460.00	1,460.00	1,460.00	1,460.00
17	JICA - PROVINCIAL MUNICIPALITY OF HUANUCO	73.00	73.00	73.00	1,460.00	1,460.00	1,460.00	2,555.00	2,555.00	2,555.00	2,555.00	2,555.00
18	JICA - PROVINCIAL MUNICIPALITY OF MOYOBAMBA	73.00	73.00	73.00	1,060.57	1,060.57	1,060.57	1,460.00	1,460.00	1,460.00	1,460.00	1,460.00
19	JICA - PROVINCIAL MUNICIPALITY OF PAITA	73.00	73.00	73.00	704.10	704.10	704.10	1,460.00	1,460.00	1,460.00	1,460.00	1,460.00
20	JICA - PROVINCIAL MUNICIPALITY OF PIURA	73.00	73.00	73.00	1,460.00	1,460.00	1,460.00	2,555.00	2,555.00	2,555.00	12,486.52	12,837.11
21	JICA - PROVINCIAL MUNICIPALITY OF PUNO	73.00	73.00	73.00	1,275.99	1,275.99	1,275.99	1,460.00	1,460.00	1,460.00	1,460.00	28,978.01
22	JICA - PROVINCIAL MUNICIPALITY OF SAN MARTIN - TARAPOTO	73.00	73.00	73.00	1,460.00	1,460.00	1,460.00	2,555.00	2,555.00	2,555.00	2,555.00	4,377.80
23	JICA - PROVINCIAL MUNICIPALITY OF SAN ROMAN - JULIACA	73.00	73.00	73.00	1,327.45	1,327.45	1,327.45	1,460.00	1,460.00	1,460.00	1,460.00	7,943.48
24	JICA - PROVINCIAL MUNICIPALITY OF SECHURA	73.00	73.00	73.00	103.95	103.95	103.95	401.50	401.50	401.50	401.50	401.50
25	JICA - PROVINCIAL MUNICIPALITY OF SULLANA	73.00	73.00	73.00	973.08	973.08	973.08	1,460.00	1,460.00	1,460.00	1,460.00	3,698.96
26	JICA - PROVINCIAL MUNICIPALITY OF TALARA - PARIÑAS	73.00	73.00	73.00	709.86	709.86	709.86	1,460.00	1,460.00	1,460.00	1,460.00	4,858.62
27	JICA- PROVINCIAL MUNICIPALITY OF ABANCAY	73.00	73.00	73.00	463.14	463.14	463.14	1,460.00	1,460.00	1,460.00	1,460.00	1,460.00
28	JICA- PROVINCIAL MUNICIPALITY OF ILAVE	73.00	73.00	73.00	1,275.99	1,275.99	1,275.99	1,460.00	1,460.00	1,460.00	401.50	401.50
29	JICA- PROVINCIAL MUNICIPALITY OF TAMBOPATA	73.00	73.00	73.00	1,417.69	1,417.69	1,417.69	1,460.00	1,460.00	1,460.00	7,245.77	7,598.91
30	JICA- PROVINCIAL MUNICIPALITY OF TARMA	73.00	73.00	73.00	934.96	939.30	943.65	1,460.00	1,460.00	1,460.00	2,773.74	2,805.08
31	JICA -PROVINCIAL MUNICIPALITY OF TUMBES	73.00	73.00	73.00	1,460.00	1,460.00	1,460.00	2,555.00	2,555.00	2,555.00	4,422.37	4,533.03
TOTAL JICA			**1,585.21**	**1,585.68**	**1,586.15**	**19,648.45**	**19,652.78**	**19,657.13**	**33,762.50**	**33,762.50**	**33,762.50**	**102,880.13**
TOTAL			**27,013.05**	**27,816.69**	**28,586.50**	**47,463.69**	**48,309.06**	**49,181.46**	**64,182.79**	**65,107.66**	**66,062.18**	**152,301.95**

Source: own elaboration

Table 4.2-9 Demand for the Inorganic Reuse for each project

Nº	PROJECT	YEAR										
		0	1	2	3	4	5	6	7	8	9	10
1	IDB - DISTRICT MUNICIPALITY OF CHANCAY	0.00	304.74	307.78	383.50	464.59	551.37	644.16	743.30	849.14	962.05	1,082.44
2	IDB - DISTRICT MUNICIPALITY OF POZUZO	27.38	28.89	30.51	32.20	33.98	35.87	37.86	39.97	42.17	44.51	46.99
3	IDB - DISTRICT MUNICIPALITY OF YAUYOS	616.40	630.06	644.00	658.21	672.78	687.64	702.87	718.46	734.30	750.60	767.14
4	IDB - PROVINCIAL MUNICIPALITY OF BAGUA - LA PECA	2,586.02	2,641.38	2,703.30	2,766.74	2,831.73	2,898.31	2,966.53	3,036.42	3,108.03	3,181.40	3,256.57
5	IDB - PROVINCIAL MUNICIPALITY OF HUAMANGA	2,511.25	2,583.70	2,658.31	2,735.13	2,814.24	2,895.71	2,979.60	3,066.00	3,154.97	3,246.60	3,340.96
6	IDB - PROVINCIAL MUNICIPALITY OF OXAPAMPA	361.73	376.71	392.32	408.57	425.49	443.11	461.47	480.58	500.49	521.22	542.81
7	IDB- DISTRICT MUNICIPALITY OF SAN JUAN BAUTISTA	1,209.48	1,252.68	1,297.44	1,343.82	1,391.88	1,441.69	1,493.30	1,546.79	1,602.22	1,659.66	1,719.19
8	IDB- PROVINCIAL MUNICIPALITY OF ANDAHUAYLAS	2,602.27	2,669.45	2,738.55	2,809.63	2,882.74	2,957.95	3,035.31	3,114.89	3,196.77	3,280.99	3,367.65
TOTAL IDB		9,914.53	10,487.61	10,772.20	11,137.80	11,517.44	11,911.67	12,321.10	12,746.41	13,188.09	13,647.02	17,352.44
9	228.27	230.55	230.55	708.10	708.10	1,416.20	1,416.20	2,124.30	2,124.30	3,540.50	3,540.50	3,540.50
10	JICA - DISTRICT MUNICIPALITY OF SANTIAGO	72.37	72.37	72.37	124.10	124.10	248.20	248.20	372.30	372.30	620.50	620.50
11	JICA - PROVINCIAL MUNICIPALITY OF AYMARAES - CHALHUANCA	19.94	19.94	19.94	19.94	19.94	19.94	19.94	21.90	21.90	36.50	36.50
12	JICA - PROVINCIAL MUNICIPALITY OF AZANGARO	61.45	61.45	61.45	116.80	116.80	233.60	233.60	350.40	350.40	584.00	584.00
13	JICA - PROVINCIAL MUNICIPALITY OF CHACHAPOYAS	58.90	58.90	58.90	189.80	189.80	379.60	379.60	569.40	569.40	949.00	949.00
14	JICA - PROVINCIAL MUNICIPALITY OF CHINCHA - CHINCHA ALTA	86.54	88.28	88.28	255.50	255.50	511.00	511.00	766.50	766.50	1,277.50	1,277.50
15	JICA - PROVINCIAL MUNICIPALITY OF FERREÑAFE	57.64	57.64	57.64	147.82	147.82	295.63	295.63	443.45	443.45	1,364.09	1,389.19
16	JICA - PROVINCIAL MUNICIPALITY OF HUACHO	80.95	81.76	82.57	277.40	277.40	554.80	554.80	832.20	832.20	1,387.00	1,387.00
17	JICA - PROVINCIAL MUNICIPALITY OF HUANUCO	95.15	95.15	95.15	292.00	292.00	584.00	584.00	876.00	876.00	1,460.00	1,460.00
18	JICA - PROVINCIAL MUNICIPALITY OF MOYOBAMBA	72.02	72.74	72.74	182.50	182.50	365.00	365.00	547.50	547.50	912.50	896.81
19	JICA - PROVINCIAL MUNICIPALITY OF PAITA	116.92	147.62	147.62	350.40	350.40	700.80	700.80	1,051.20	1,051.20	1,752.00	1,752.00
20	JICA - PROVINCIAL MUNICIPALITY OF PIURA	1,030.44	1,040.74	1,040.74	1,040.74	1,040.74	1,460.00	1,460.00	2,190.00	2,190.00	7,250.23	7,453.81
21	JICA - PROVINCIAL MUNICIPALITY OF PUNO	210.44	212.55	212.55	525.60	525.60	1,051.20	1,051.20	1,576.80	1,576.80	31,388.67	32,108.61
22	JICA - PROVINCIAL MUNICIPALITY OF SAN MARTIN - TARAPOTO	128.03	129.31	129.31	423.40	423.40	846.80	846.80	1,270.20	1,270.20	1,044.95	1,067.22
23	JICA - PROVINCIAL MUNICIPALITY OF SAN ROMAN - JULIACA	428.89	469.28	469.28	657.00	657.00	1,314.00	1,314.00	1,971.00	1,971.00	3,185.77	3,271.25
24	JICA - PROVINCIAL MUNICIPALITY OF SECHURA	65.20	65.20	65.20	277.40	277.40	554.80	554.80	832.20	832.20	1,387.00	1,387.00
25	JICA - PROVINCIAL MUNICIPALITY OF SULLANA	401.46	405.47	405.47	496.40	496.40	992.80	992.80	1,489.20	1,489.20	2,391.25	2,450.71
26	JICA - PROVINCIAL MUNICIPALITY OF TALARA - PARIÑAS	266.29	268.96	268.96	532.90	532.90	1,065.80	1,065.80	1,598.70	1,598.70	2,647.34	2,681.44
27	JICA- PROVINCIAL MUNICIPALITY OF ABANCAY	27.90	28.15	28.15	94.90	94.90	189.80	189.80	284.70	284.70	474.50	474.50
28	JICA- PROVINCIAL MUNICIPALITY OF ILAVE	81.29	81.29	81.29	262.80	262.80	525.60	525.60	788.40	788.40	1,314.00	1,314.00
29	JICA- PROVINCIAL MUNICIPALITY OF TAMBOPATA	127.85	129.12	129.12	569.40	569.40	1,138.80	1,138.80	1,708.20	1,708.20	3,553.36	3,726.54
30	JICA- PROVINCIAL MUNICIPALITY OF TARMA	54.00	54.54	54.54	167.90	167.90	335.80	335.80	503.70	503.70	827.48	836.83
31	JICA -PROVINCIAL MUNICIPALITY OF TUMBES	152.66	154.19	154.19	430.70	430.70	861.40	861.40	1,292.10	1,292.10	2,094.98	2,147.40
TOTAL JICA			**3,924.63**	**4,025.23**	**4,026.05**	**8,143.50**	**8,143.50**	**15,645.57**	**15,645.57**	**23,460.35**	**23,460.35**	**72,812.31**
TOTAL			**13,839.16**	**14,512.84**	**14,798.25**	**19,281.30**	**19,660.94**	**27,557.24**	**27,966.67**	**36,206.75**	**36,648.43**	**90,164.75**

Source: own elaboration

(5) Demand for Final Disposal of Solid Waste (m^3/year)

Total demand for final disposal of solid waste of the program at year 1 totals 1 291.722.56m^3, and for the year 10 the demand is 13 919.030.30 m^3. This figure represents the demand at year 1 and year 10 for the projects funded by IDB and JICA.

Then, for projects financed by IDB, the demand for the first year is 262 925.09 m^3 of solid waste and for the year 10, the projection is 2 283.286.24 m^3. In the case of project financed by JICA, the demand is 1 028.797.47 m^3 for the first year, and the volume projected at year 10 is 11 635.743.97 m^3.

The following chart shows the projection for the demand growth of final disposal during the evaluation horizon.

Table 4.2-10 Demand for Final Disposal for each of the Project(m3/year)

PROJECT	YEAR									
	1	2	3	4	5	6	7	8	9	10
BID - DISTRICT MUNICIPALITY OF CHANCAY	30,842.44	47,159.04	64,103.73	81,700.91	99,976.23	118,955.93	138,667.54	159,139.72	191,033.16	224,158.51
BID - DISTRICT MUNICIPALITY OF POZUZO	1,455.33	1,536.17	1,621.23	1,711.26	1,806.05	1,906.18	2,011.83	2,123.43	2,241.20	2,365.58
BID - DISTRICT MUNICIPALITY OF YAUYOS	6,158.19	6,294.40	6,433.35	6,575.75	6,721.00	6,869.81	7,022.26	7,177.07	7,336.30	7,498.01
BID - PROVINCIAL MUNICIPALITY OF BAGUA - LA PECA	51,574.50	78,248.70	105,550.70	133,487.80	162,081.90	191,354.90	221,314.10	251,981.40	283,371.40	315,506.00
BID - PROVINCIAL MUNICIPALITY OF HUAMANGA	105,168.02	213,706.01	325,714.52	441,296.95	560,559.55	683,611.56	810,565.26	941,536.08	1,076,642.69	1,216,007.04
BID - PROVINCIAL MUNICIPALITY OF OXAPAMPA	4,530.32	4,713.24	4,903.62	5,101.69	5,307.94	5,522.61	5,746.06	5,978.63	6,220.69	6,472.75
BID- DISTRICT MUNICIPALITY OF SAN JUAN BAUTISTA	41,026.63	83,519.20	127,530.83	173,116.58	220,333.53	269,240.87	319,899.93	41,026.63	83,519.20	127,530.83
BID- PROVINCIAL MUNICIPALITY OF ANDAHUAYLAS	22,169.65	22,770.43	23,388.47	24,024.30	24,678.44	25,351.42	26,043.81	26,756.18	27,489.11	28,243.23
TOTAL BID	262,925.09	457,947.18	659,246.46	867,015.23	1,081,464.64	1,302,813.27	1,531,270.79	1,767,066.83	262,925.09	457,947.18
JICA - DISTRICT MUNICIPALITY OF NUEVO CHIMBOTE	52,847.77	107,511.77	164,055.58	222,545.04	283,048.33	345,636.08	410,381.41	477,360.05	546,650.43	618,333.78
JICA - DISTRICT MUNICIPALITY OF SANTIAGO	5,204.89	10,556.66	16,059.53	21,717.82	27,535.99	33,518.62	39,670.43	45,996.26	52,501.11	59,190.12
JICA - PROVINCIAL MUNICIPALITY OF AYMARAES - CHALHUANCA	3,024.21	6,094.41	9,211.26	12,375.42	15,587.57	18,848.38	22,158.54	25,518.75	28,929.71	32,392.16
JICA - PROVINCIAL MUNICIPALITY OF AZANGARO	5,349.39	10,859.39	16,534.93	22,381.08	28,403.07	34,606.29	40,996.30	47,578.82	54,359.79	61,345.27
JICA - PROVINCIAL MUNICIPALITY OF CHACHAPOYAS	10,986.72	22,392.42	34,234.80	46,532.42	59,304.78	72,572.36	86,356.70	100,680.42	115,567.36	131,042.60
JICA - PROVINCIAL MUNICIPALITY OF CHINCHA - CHINCHA ALTA	26,308.48	53,153.03	80,545.11	108,496.41	137,018.91	166,124.82	195,826.65	226,137.17	257,069.44	288,636.79
JICA - PROVINCIAL MUNICIPALITY OF FERREÑAFE	35,879.80	36,886.26	37,923.01	38,990.96	40,091.09	41,224.38	42,391.87	43,594.60	44,833.67	46,110.19
JICA - PROVINCIAL MUNICIPALITY OF HUACHO	32,765.44	66,107.67	100,036.53	134,562.08	169,694.52	205,444.27	241,821.93	278,838.29	32,765.44	66,107.67
JICA - PROVINCIAL MUNICIPALITY OF HUANUCO	60,083.18	120,855.44	182,326.50	244,506.26	307,404.75	371,032.18	435,398.89	500,515.42	566,392.44	633,040.81
JICA - PROVINCIAL MUNICIPALITY OF MOYOBAMBA	32,609.84	66,647.99	102,178.73	139,269.29	177,990.00	218,414.43	260,619.55	304,685.87	350,697.63	398,742.97
JICA - PROVINCIAL MUNICIPALITY OF PAITA	24,168.04	49,301.57	75,439.45	102,622.09	130,891.53	160,291.52	190,867.58	222,667.08	255,739.29	290,135.48
JICA - PROVINCIAL MUNICIPALITY OF PIURA	222,341.85	450,650.83	685,092.34	925,836.46	1,173,058.13	1,426,937.24	1,687,658.82	1,955,413.16	2,230,395.97	2,512,808.53
JICA - PROVINCIAL MUNICIPALITY OF PUNO	49,775.40	100,935.68	153,520.12	207,569.11	263,124.23	320,228.23	378,925.09	439,260.08	49,775.40	100,935.68
JICA - PROVINCIAL MUNICIPALITY OF SAN MARTIN – TARAPOTO	86,359.13	175,048.38	266,141.53	359,715.13	455,848.66	554,624.57	656,128.51	760,449.40	867,679.64	977,915.20
JICA - PROVINCIAL MUNICIPALITY OF SAN ROMAN – JULIACA	102,795.09	208,331.44	316,684.38	427,931.34	542,151.91	659,427.94	779,843.60	903,485.38	1,030,442.26	1,160,805.70
JICA - PROVINCIAL MUNICIPALITY OF SECHURA	13,752.13	28,057.14	42,939.04	58,422.95	74,535.11	91,302.97	108,755.23	126,921.91	145,834.38	165,514.36
JICA - PROVINCIAL MUNICIPALITY OF SULLANA	71,078.13	143,862.96	218,397.06	294,724.11	372,888.93	452,937.44	534,916.77	618,875.26	71,078.13	143,862.96
JICA - PROVINCIAL MUNICIPALITY OF TALARA – PARIÑAS	34,551.47	69,543.91	104,983.47	140,876.37	177,228.94	214,047.61	251,338.88	289,109.34	327,365.72	366,114.78
JICA- PROVINCIAL MUNICIPALITY OF ABANCAY	25,660.81	51,513.86	77,561.23	103,804.99	130,247.27	156,890.20	183,735.96	210,786.73	238,044.73	265,512.19
JICA- PROVINCIAL MUNICIPALITY OF ILAVE	9,500.92	19,343.03	29,538.77	40,101.08	51,043.34	62,379.45	74,123.82	86,291.39	98,897.65	111,958.67
JICA- PROVINCIAL MUNICIPALITY OF TAMBOPATA	28,330.51	58,549.05	90,782.08	125,164.58	161,840.60	200,963.91	242,698.62	287,219.92	28,330.51	58,549.05
JICA- PROVINCIAL MUNICIPALITY OF TARMA	16,091.71	32,362.33	48,814.21	65,449.76	82,271.39	99,281.58	116,482.81	133,877.62	151,468.59	169,258.31
JICA -PROVINCIAL MUNICIPALITY OF TUMBES	34,810.26	70,464.33	106,983.35	144,389.00	182,703.54	221,949.78	262,151.12	303,331.58	34,810.26	70,464.33
TOTAL JICA	**1,028,797.47**	**2,085,021.71**	**3,169,556.50**	**4,283,319.54**	**5,427,263.93**	**6,602,379.82**	**7,809,696.09**	**9,050,282.13**	**1,028,797.47**	**2,085,021.71**
TOTAL	**1,291,722.56**	**2,542,968.88**	**3,828,802.96**	**5,150,334.77**	**6,508,728.57**	**7,905,193.09**	**9,340,966.88**	**10,817,348.96**	**1,291,722.56**	**2,542,968.88**

Source: own elaboration

The following chart shows the summary of projected demands during the evaluation horizon of the 31 cities included in the program.

Table 4.2-11 Summary of Demand

SUMMARY OF SERVICES DEMAND								
Population	Population	Population t/Year	Population t / year Demand	Population Km / year Demand	Population t / year Demand	Population t / year Demand	Population t / year Demand	Population m3/ year Demand
0	2,335,526	610,437.95	13,019.18	640,411.85	611,003.60	13,839.16	27,013.05	206,110.95
1	2,383,978	627,107.32	13,294.19	653,369.84	627,691.53	14,512.84	27,816.69	1,291,722.56
2	2,433,714	644,340.09	13,581.60	666,645.11	644,943.45	14,798.25	28,586.50	2,542,968.88
3	2,484,772	662,130.24	13,875.42	680,244.01	662,753.39	19,281.30	47,463.69	3,828,802.96
4	2,537,196	680,493.36	14,176.57	694,063.96	681,136.95	19,660.94	48,309.06	5,150,334.77
5	2,591,034	699,456.50	14,486.07	707,977.23	700,121.19	27,557.24	49,181.46	6,508,728.57
6	2,646,332	719,045.18	14,805.05	722,247.08	719,731.68	27,966.67	64,182.79	7,905,193.09
7	2,703,142	739,275.89	15,133.80	736,885.42	739,984.89	36,206.75	65,107.66	9,340,966.88
8	2,761,509	760,179.57	15,473.41	751,904.64	760,911.83	36,648.43	66,062.18	10,817,348.96
9	2,821,493	781,778.95	15,820.67	767,317.67	782,535.22	52,747.59	67,047.67	12,346,314.26
10	2,883,145	804,096.39	16,176.58	783,141.62	804,877.47	53,224.33	68,064.91	13,919,030.30

Source: own elaboration

4.3 SUPPLY ANALYSIS

Following, there is the analysis of the offer provided depending on the services and current operation capacities of the cities included in the program.

(1) Supply of the solid waste storage

The supply depends on the capacity of the municipality to provide the necessary containers for the proper storage of the municipal solid waste generated in public spaces.

The optimized supply of the storage for the program at year 0 is de 4 759.29 t/year, which will be maintained during the 10 years. This amount includes the projects financed by IDB and JICA. In the case of IDB we have an optimized supply of 1 330.69 t/year, whereas for projects financed by JICA reach 3 428.60 t/year.

Table 4.3-1 Storage Supply for each of the Projects

PROJECT	YEAR										
	0	1	2	3	4	5	6	7	8	9	10
IDB - DISTRICT MUNICIPALITY OF CHANCAY	206.28	206.28	206.28	206.28	206.28	206.28	206.28	206.28	206.28	206.28	206.28
IDB - DISTRICT MUNICIPALITY OF POZUZO	113.88	113.88	113.88	113.88	113.88	113.88	113.88	113.88	113.88	113.88	113.88
IDB - DISTRICT MUNICIPALITY OF YAUYOS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IDB - PROVINCIAL MUNICIPALITY OF BAGUA - LA PECA	200.75	200.75	200.75	200.75	200.75	200.75	200.75	200.75	200.75	200.75	200.75
IDB - PROVINCIAL MUNICIPALITY OF HUAMANGA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IDB - PROVINCIAL MUNICIPALITY OF OXAPAMPA	175.92	175.92	175.92	175.92	175.92	175.92	175.92	175.92	175.92	175.92	175.92
IDB- DISTRICT MUNICIPALITY OF SAN JUAN BAUTISTA	458.66	458.66	458.66	458.66	458.66	458.66	458.66	458.66	458.66	458.66	458.66
IDB- PROVINCIAL MUNICIPALITY OF ANDAHUAYLAS	175.20	175.20	175.20	175.20	175.20	175.20	175.20	175.20	175.20	175.20	175.20
TOTAL IDB	1,330.69	1,330.69	1,330.69	1,330.69	1,330.69	1,330.69	1,330.69	1,330.69	1,330.69	1,330.69	1,330.69
JICA - DISTRICT MUNICIPALITY OF NUEVO CHIMBOTE	112.09	115.13	118.26	121.47	124.77	128.16	131.64	135.21	138.88	142.66	146.53
JICA - DISTRICT MUNICIPALITY OF SANTIAGO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA - PROVINCIAL MUNICIPALITY OF AYMARAES - CHALHUANCA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA - PROVINCIAL MUNICIPALITY OF AZANGARO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA - PROVINCIAL MUNICIPALITY OF CHACHAPOYAS	71.70	71.70	71.70	71.70	71.70	71.70	71.70	71.70	71.70	71.70	71.70
JICA - PROVINCIAL MUNICIPALITY OF CHINCHA - CHINCHA ALTA	194.18	194.18	194.18	194.18	194.18	194.18	194.18	194.18	194.18	194.18	194.18
JICA - PROVINCIAL MUNICIPALITY OF FERREÑAFE	36.55	36.55	36.55	36.55	36.55	36.55	36.55	36.55	36.55	36.55	36.55
JICA - PROVINCIAL MUNICIPALITY OF HUACHO	59.64	59.64	59.64	59.64	59.64	59.64	59.64	59.64	59.64	59.64	59.64
JICA - PROVINCIAL MUNICIPALITY OF HUANUCO	80.45	80.45	80.45	80.45	80.45	80.45	80.45	80.45	80.45	80.45	80.45
JICA - PROVINCIAL MUNICIPALITY OF MOYOBAMBA	103.69	103.69	103.69	103.69	103.69	103.69	103.69	103.69	103.69	103.69	103.69
JICA - PROVINCIAL MUNICIPALITY OF PAITA	77.82	77.82	77.82	77.82	77.82	77.82	77.82	77.82	77.82	77.82	77.82
JICA - PROVINCIAL MUNICIPALITY OF PIURA	160.05	160.05	160.05	160.05	160.05	160.05	160.05	160.05	160.05	160.05	160.05
JICA - PROVINCIAL MUNICIPALITY OF PUNO	171.60	171.60	171.60	171.60	171.60	171.60	171.60	171.60	171.60	171.60	171.60
JICA - PROVINCIAL MUNICIPALITY OF SAN MARTIN – TARAPOTO	1,256.37	1,256.37	1,256.37	1,256.37	1,256.37	1,256.37	1,256.37	1,256.37	1,256.37	1,256.37	1,256.37
JICA - PROVINCIAL MUNICIPALITY OF SAN ROMAN – JULIACA	199.05	199.05	199.05	199.05	199.05	199.05	199.05	199.05	199.05	199.05	199.05
JICA - PROVINCIAL MUNICIPALITY OF SECHURA	45.51	45.51	45.51	45.51	45.51	45.51	45.51	45.51	45.51	45.51	45.51
JICA - PROVINCIAL MUNICIPALITY OF SULLANA	309.96	309.96	309.96	309.96	309.96	309.96	309.96	309.96	309.96	309.96	309.96
JICA - PROVINCIAL MUNICIPALITY OF TALARA – PARIÑAS	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00
JICA- PROVINCIAL MUNICIPALITY OF ABANCAY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA- PROVINCIAL MUNICIPALITY OF ILAVE	66.57	66.57	66.57	66.57	66.57	66.57	66.57	66.57	66.57	66.57	66.57
JICA- PROVINCIAL MUNICIPALITY OF TAMBOPATA	82.13	82.13	82.13	82.13	82.13	82.13	82.13	82.13	82.13	82.13	82.13
JICA- PROVINCIAL MUNICIPALITY OF TARMA	302.96	302.96	302.96	302.96	302.96	302.96	302.96	302.96	302.96	302.96	302.96
JICA -PROVINCIAL MUNICIPALITY OF TUMBES	43.28	43.28	43.28	43.28	43.28	43.28	43.28	43.28	43.28	43.28	43.28
TOTAL JICA	**3,428.60**	**3,431.64**	**3,434.77**	**3,437.98**	**3,441.28**	**3,444.67**	**3,448.15**	**3,451.72**	**3,455.39**	**3,459.16**	**3,463.04**
TOTAL	**4,759.29**	**4,762.33**	**4,765.46**	**4,768.67**	**4,771.97**	**4,775.36**	**4,778.84**	**4,782.41**	**4,786.08**	**4,789.86**	**4,793.73**

Source: own elaboration

(2) Sweeping Supply of Solid Waste

The supply for solid waste sweeping for the program equals 90.1% of the sweeping service.

The optimized sweeping supply of the program for the year 0 is 500 158.94. km/year, which includes both the optimized supply of de 71 426.45km/year for the projects financed by IDB and 428 732.46 km/year for the projects financed by JICA. This is due to the lack of improvement of this component.

Table 4.3-2 Sweeping Supply for each of the Projects

PROYECTO	YEAR										
	0	1	2	3	4	5	6	7	8	9	10
IDB - DISTRICT MUNICIPALITY OF CHANCAY	22,684.75	22,684.75	22,684.75	22,684.75	22,684.75	22,684.75	22,684.75	22,684.75	22,684.75	22,684.75	22,684.75
IDB - DISTRICT MUNICIPALITY OF POZUZO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IDB - DISTRICT MUNICIPALITY OF YAUYOS	1,587.75	1,587.75	1,587.75	1,587.75	1,587.75	1,587.75	1,587.75	1,587.75	1,587.75	1,587.75	1,587.75
IDB - PROVINCIAL MUNICIPALITY OF BAGUA - LA PECA	3,222.95	3,222.95	3,222.95	3,222.95	3,222.95	3,222.95	3,222.95	3,222.95	3,222.95	3,222.95	3,222.95
IDB - PROVINCIAL MUNICIPALITY OF HUAMANGA	24,257.90	24,257.90	24,257.90	24,257.90	24,257.90	24,257.90	24,257.90	24,257.90	24,257.90	24,257.90	24,257.90
IDB - PROVINCIAL MUNICIPALITY OF OXAPAMPA	1,080.00	1,080.00	1,080.00	1,080.00	1,080.00	1,080.00	1,080.00	1,080.00	1,080.00	1,080.00	1,080.00
IDB- DISTRICT MUNICIPALITY OF SAN JUAN BAUTISTA	17,520.00	17,520.00	17,520.00	17,520.00	17,520.00	17,520.00	17,520.00	17,520.00	17,520.00	17,520.00	17,520.00
IDB- PROVINCIAL MUNICIPALITY OF ANDAHUAYLAS	1,073.10	1,073.10	1,073.10	1,073.10	1,073.10	1,073.10	1,073.10	1,073.10	1,073.10	1,073.10	1,073.10
TOTAL BID	**71,426.45**	**71,426.45**	**71,426.45**	**71,426.45**	**71,426.45**	**71,426.45**	**71,426.45**	**71,426.45**	**71,426.45**	**71,426.45**	**71,426.45**
JICA - DISTRICT MUNICIPALITY OF NUEVO CHIMBOTE	14,600.00	14,600.00	14,600.00	14,600.00	14,600.00	14,600.00	14,600.00	14,600.00	14,600.00	14,600.00	14,600.00
JICA - DISTRICT MUNICIPALITY OF SANTIAGO	1,460.00	1,460.00	1,460.00	1,460.00	1,460.00	1,460.00	1,460.00	1,460.00	1,460.00	1,460.00	1,460.00
JICA - PROVINCIAL MUNICIPALITY OF AYMARAES - CHALHUANCA	6,022.50	6,022.50	6,022.50	6,022.50	6,022.50	6,022.50	6,022.50	6,022.50	6,022.50	6,022.50	6,022.50
JICA - PROVINCIAL MUNICIPALITY OF AZANGARO	10,220.00	10,220.00	10,220.00	10,220.00	10,220.00	10,220.00	10,220.00	10,220.00	10,220.00	10,220.00	10,220.00
JICA - PROVINCIAL MUNICIPALITY OF CHACHAPOYAS	8,606.58	8,606.58	8,606.58	8,606.58	8,606.58	8,606.58	8,606.58	8,606.58	8,606.58	8,606.58	8,606.58
JICA - PROVINCIAL MUNICIPALITY OF CHINCHA - CHINCHA ALTA	11,680.00	11,680.00	11,680.00	11,680.00	11,680.00	11,680.00	11,680.00	11,680.00	11,680.00	11,680.00	11,680.00
JICA - PROVINCIAL MUNICIPALITY OF FERREÑAFE	8,030.00	8,030.00	8,030.00	8,030.00	8,030.00	8,030.00	8,030.00	8,030.00	8,030.00	8,030.00	8,030.00
JICA - PROVINCIAL MUNICIPALITY OF HUACHO	27,010.00	27,010.00	27,010.00	27,010.00	27,010.00	27,010.00	27,010.00	27,010.00	27,010.00	27,010.00	27,010.00
JICA - PROVINCIAL MUNICIPALITY OF HUANUCO	18,977.81	18,977.81	18,977.81	18,977.81	18,977.81	18,977.81	18,977.81	18,977.81	18,977.81	18,977.81	18,977.81
JICA - PROVINCIAL MUNICIPALITY OF MOYOBAMBA	4,927.50	4,927.50	4,927.50	4,927.50	4,927.50	4,927.50	4,927.50	4,927.50	4,927.50	4,927.50	4,927.50
JICA - PROVINCIAL MUNICIPALITY OF PAITA	6,570.00	6,570.00	6,570.00	6,570.00	6,570.00	6,570.00	6,570.00	6,570.00	6,570.00	6,570.00	6,570.00
JICA - PROVINCIAL MUNICIPALITY OF PIURA	21,900.00	21,900.00	21,900.00	21,900.00	21,900.00	21,900.00	21,900.00	21,900.00	21,900.00	21,900.00	21,900.00
JICA - PROVINCIAL MUNICIPALITY OF PUNO	38,378.19	38,378.19	38,378.19	38,378.19	38,378.19	38,378.19	38,378.19	38,378.19	38,378.19	38,378.19	38,378.19
JICA - PROVINCIAL MUNICIPALITY OF SAN MARTIN - TARAPOTO	11,572.22	11,572.22	11,572.22	11,572.22	11,572.22	11,572.22	11,572.22	11,572.22	11,572.22	11,572.22	11,572.22
JICA - PROVINCIAL MUNICIPALITY OF SAN ROMAN - JULIACA	61,320.00	61,320.00	61,320.00	61,320.00	61,320.00	61,320.00	61,320.00	61,320.00	61,320.00	61,320.00	61,320.00
JICA - PROVINCIAL MUNICIPALITY OF SECHURA	10,952.73	10,952.73	10,952.73	10,952.73	10,952.73	10,952.73	10,952.73	10,952.73	10,952.73	10,952.73	10,952.73
JICA - PROVINCIAL MUNICIPALITY OF SULLANA	33,580.00	33,580.00	33,580.00	33,580.00	33,580.00	33,580.00	33,580.00	33,580.00	33,580.00	33,580.00	33,580.00
JICA - PROVINCIAL MUNICIPALITY OF TALARA - PARIÑAS	25,550.00	25,550.00	25,550.00	25,550.00	25,550.00	25,550.00	25,550.00	25,550.00	25,550.00	25,550.00	25,550.00
JICA- PROVINCIAL MUNICIPALITY OF ABANCAY	21,318.58	21,318.58	21,318.58	21,318.58	21,318.58	21,318.58	21,318.58	21,318.58	21,318.58	21,318.58	21,318.58
JICA- PROVINCIAL MUNICIPALITY OF ILAVE	13,870.00	13,870.00	13,870.00	13,870.00	13,870.00	13,870.00	13,870.00	13,870.00	13,870.00	13,870.00	13,870.00
JICA- PROVINCIAL MUNICIPALITY OF TAMBOPATA	21,816.35	21,816.35	21,816.35	21,816.35	21,816.35	21,816.35	21,816.35	21,816.35	21,816.35	21,816.35	21,816.35
JICA- PROVINCIAL MUNICIPALITY OF TARMA	14,600.00	14,600.00	14,600.00	14,600.00	14,600.00	14,600.00	14,600.00	14,600.00	14,600.00	14,600.00	14,600.00
JICA -PROVINCIAL MUNICIPALITY OF TUMBES	35,770.00	35,770.00	35,770.00	35,770.00	35,770.00	35,770.00	35,770.00	35,770.00	35,770.00	35,770.00	35,770.00
TOTAL JICA	**428,732.46**	**428,732.46**	**428,732.46**	**428,732.46**	**428,732.46**	**428,732.46**	**428,732.46**	**428,732.46**	**428,732.46**	**428,732.46**	**428,732.46**
TOTAL	**500,158.9**	**500,158.9**	**500,158.9**	**500,158.9**	**500,158.9**	**500,158.9**	**500,158.9**	**500,158.9**	**500,158.9**	**500,158.9**	**500,158.9**

Source: JICA survey team

(3) Supply of Collection and Transportation of Solid Waste

The supply of collection and transportation of solid waste in the program includes the use of compactor truck, dump trucks, hopper truck, tricycles and motor vans. Most of the times, the fleet is formed by old vehicles.

The overall optimized supply for the year 0 is 25 273.94 t/year and for the year 10 the offer is 14 924.61 which includes the projects financed by IDB and JICA. Therefore, for the projects financed by IDB, the supply is 25 273.94 tons for the year 0 and 14 924.61 t/year for the year 10, whereas in the case of JICA projects, the optimized supply for collection is 0 t/year and at year10 is 0 t/year.

Table 4.3-3 Supply for Collection, Transportation and Transfer for each of the Projects

PROJECT	YEAR										
	0	1	2	3	4	5	6	7	8	9	10
BID - DISTRICT MUNICIPALITY OF CHANCAY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BID - DISTRICT MUNICIPALITY OF POZUZO	97.59	105.77	114.31	123.12	131.31	137.79	144.58	151.79	159.34	167.34	175.83
BID - DISTRICT MUNICIPALITY OF YAUYOS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BID - PROVINCIAL MUNICIPALITY OF BAGUA - LA PECA	5,110.00	5,110.00	5,110.00	5,110.00	5,110.00	5,110.00	0.00	0.00	0.00	0.00	0.00
BID - PROVINCIAL MUNICIPALITY OF HUAMANGA	12,483.00	12,483.00	12,483.00	12,483.00	12,483.00	12,483.00	12,483.00	12,483.00	12,483.00	12,483.00	12,483.00
BID - PROVINCIAL MUNICIPALITY OF OXAPAMPA	1,524.35	1,585.84	1,649.87	1,716.51	1,785.85	1,858.04	1,933.19	2,011.41	2,092.82	2,177.55	2,265.79
BID- DISTRICT MUNICIPALITY OF SAN JUAN BAUTISTA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BID- PROVINCIAL MUNICIPALITY OF ANDAHUAYLAS	6,059.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL IDB	**25,273.94**	**19,284.61**	**19,357.18**	**19,432.63**	**19,510.16**	**19,588.83**	**14,560.77**	**14,646.20**	**14,735.15**	**14,827.90**	**14,924.61**
JICA - DISTRICT MUNICIPALITY OF NUEVO CHIMBOTE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA - DISTRICT MUNICIPALITY OF SANTIAGO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA - PROVINCIAL MUNICIPALITY OF AYMARAES - CHALHUANCA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA - PROVINCIAL MUNICIPALITY OF AZANGARO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA - PROVINCIAL MUNICIPALITY OF CHACHAPOYAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA - PROVINCIAL MUNICIPALITY OF CHINCHA - CHINCHA ALTA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA - PROVINCIAL MUNICIPALITY OF FERREÑAFE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA - PROVINCIAL MUNICIPALITY OF HUACHO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA - PROVINCIAL MUNICIPALITY OF HUANUCO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA - PROVINCIAL MUNICIPALITY OF MOYOBAMBA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA - PROVINCIAL MUNICIPALITY OF PAITA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA - PROVINCIAL MUNICIPALITY OF PIURA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA - PROVINCIAL MUNICIPALITY OF PUNO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA - PROVINCIAL MUNICIPALITY OF SAN MARTIN – TARAPOTO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA - PROVINCIAL MUNICIPALITY OF SAN ROMAN – JULIACA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA - PROVINCIAL MUNICIPALITY OF SECHURA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA - PROVINCIAL MUNICIPALITY OF SULLANA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA - PROVINCIAL MUNICIPALITY OF TALARA – PARIÑAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA- PROVINCIAL MUNICIPALITY OF ABANCAY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA- PROVINCIAL MUNICIPALITY OF ILAVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA- PROVINCIAL MUNICIPALITY OF TAMBOPATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA- PROVINCIAL MUNICIPALITY OF TARMA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JICA -PROVINCIAL MUNICIPALITY OF TUMBES	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL JICA	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
TOTAL	**25,273.94**	**19,284.61**	**19,357.18**	**19,432.63**	**19,510.16**	**19,588.83**	**14,560.77**	**14,646.20**	**14,735.15**	**14,827.90**	**14,924.61**

Source: own elaboration

(4) Supply of Waste Reuse (t/year)

The overall supply of reuse of organic and inorganic solid waste of the program is not very high. There are some plans to reuse waste, but it is not done properly. In that sense, and for the purpose of this study, the supply will be nil.

(5) Supply of Final Disposal of Solid Waste (m^3/year)

It depends on the existing capacity to properly dispose the municipal solid waste, and therefore a sanitary landfill is necessary. After reviewing the current situation of the cities included in the program, it seems clear that the main problem affecting all cities included in the program is the inadequate final disposal of solid waste, since none of the cities has a sanitary landfill. In that sense, the supply for the final disposal of solid waste is 0 t/year.

The following chart shows the summary of the current projected supply during the evaluation period of the 31 cities included in the program.

Table 4.3-4 Summary of the Supply

RESUMEN DE OFERTA DE LOS SERVICIOS								
Nº	Population	Generation	Public Storage	Street Sweeping	Collection of Solid Wastes	Reuse of Inorganic Solid Wastes	Reuse of Organic Solid Wastes	Final Disposal
		t/Year	t / Year	Km / Year	t / Year	t / Year	t / Year	m / Year
			Offer	Offer	Offer	Offer	Offer	Offer
0	2,335,526	610,437.95	4,759.29	500,158.91	25,273.94	36.43	125.48	0.00
1	2,383,978	627,107.32	4,762.33	500,158.91	19,284.61	37.92	131.74	0.00
2	2,433,714	644,340.09	4,765.46	500,158.91	19,357.18	38.22	131.74	0.00
3	2,484,772	662,130.24	4,768.67	500,158.91	19,432.63	38.52	131.74	0.00
4	2,537,196	680,493.36	4,771.97	500,158.91	19,510.16	38.83	131.75	0.00
5	2,591,034	699,456.50	4,775.36	500,158.91	19,588.83	39.15	131.75	0.00
6	2,646,332	719,045.18	4,778.84	500,158.91	14,560.77	39.48	131.75	0.00
7	2,703,142	739,275.89	4,782.41	500,158.91	14,646.20	39.82	131.76	0.00
8	2,761,509	760,179.57	4,786.08	500,158.91	14,735.15	40.16	131.76	0.00
9	2,821,493	781,778.95	4,789.86	500,158.91	14,827.90	40.52	131.76	0.00
10	2,883,145	804,096.39	4,793.73	500,158.91	14,924.61	40.89	131.77	0.00

Summary: own elaboration

4.4 SUPPLY-DEMAND BALANCE

The balance for the supply and demand enables to obtain the gap to be reviewed, as part of the development program of management systems of solid waste in priority areas.

Table 4.4-1 Summary of Deficit of System of Solid Waste Management

SUMMARY OF SERVICE DEFICIT																					
N°	Year	Population	Generation	Public Storage			Sweeping of streets			Collection of Solid Waste			Reuse of inorganic solid waste			Reuse of Organic solid waste			Final Disposition		
			t/year	t / year			Km / year			t / year			t / year			t / year			M3 / year		
				Demand	Optimized supply	Deficit	Demand	Optimized supply	Deficit	Demand	Optimized supply	Deficit	Demand	Optimized supply	Deficit	Demanda	Optimized supply	Deficit	Demand	Optimized supply	Deficit
0	2010	2,335,526	610,437.95	13,019.18	4,759.29	8,259.89	640,411.85	500,158.91	140,252.94	611,003.60	25,273.94	585,729.66	13,839.16	36.43	2,335,526	610,437.95	13,019.18	4,759.29	8,259.89	640,411.85	500,158.91
1	2011	2,383,978	627,107.32	13,294.19	4,762.33	8,531.85	653,369.84	500,158.91	153,210.93	627,691.53	19,284.61	608,406.92	14,512.84	37.92	2,383,978	627,107.32	13,294.19	4,762.33	8,531.85	653,369.84	500,158.91
2	2012	2,433,714	644,340.09	13,581.60	4,765.46	8,816.14	666,645.11	500,158.91	166,486.19	644,943.45	19,357.18	625,586.27	14,798.25	38.22	2,433,714	644,340.09	13,581.60	4,765.46	8,816.14	666,645.11	500,158.91
3	2013	2,484,772	662,130.24	13,875.42	4,768.67	9,106.75	680,244.01	500,158.91	180,085.10	662,753.39	19,432.63	643,320.76	19,281.30	38.52	2,484,772	662,130.24	13,875.42	4,768.67	9,106.75	680,244.01	500,158.91
4	2014	2,537,196	680,493.36	14,176.57	4,771.97	9,404.60	694,063.96	500,158.91	193,905.05	681,136.95	19,510.16	661,626.80	19,660.94	38.83	2,537,196	680,493.36	14,176.57	4,771.97	9,404.60	694,063.96	500,158.91
5	2015	2,591,034	699,456.50	14,486.07	4,775.36	9,710.71	707,977.23	500,158.91	207,818.31	700,121.19	19,588.83	680,532.36	27,557.24	39.15	2,591,034	699,456.50	14,486.07	4,775.36	9,710.71	707,977.23	500,158.91
6	2016	2,646,332	719,045.18	14,805.05	4,778.84	10,026.21	722,247.08	500,158.91	222,088.16	719,731.68	14,560.77	705,170.91	27,966.67	39.48	2,646,332	719,045.18	14,805.05	4,778.84	10,026.21	722,247.08	500,158.91
7	2017	2,703,142	739,275.89	15,133.80	4,782.41	10,351.39	736,885.42	500,158.91	236,726.51	739,984.89	14,646.20	725,338.70	36,206.75	39.82	2,703,142	739,275.89	15,133.80	4,782.41	10,351.39	736,885.42	500,158.91
8	2018	2,761,509	760,179.57	15,473.41	4,786.08	10,687.32	751,904.64	500,158.91	251,745.73	760,911.83	14,735.15	746,176.67	36,648.43	40.16	2,761,509	760,179.57	15,473.41	4,786.08	10,687.32	751,904.64	500,158.91
9	2019	2,821,493	781,778.95	15,820.67	4,789.86	11,030.82	767,317.67	500,158.91	267,158.76	782,535.22	14,827.90	767,707.32	52,747.59	40.52	2,821,493	781,778.95	15,820.67	4,789.86	11,030.82	767,317.67	500,158.91
10	2020	2,883,145	804,096.39	16,176.58	4,793.73	11,382.85	783,141.62	500,158.91	282,982.70	804,877.47	14,924.61	789,952.86	53,224.33	40.89	2,883,145	804,096.39	16,176.58	4,793.73	11,382.85	783,141.62	500,158.91

% Service Coverage Deficit :	Public Storage	Sweeping of streets	Collection of Solid Waste	Reuse of inorganic solid waste	Reuse of Organic solid waste	Final Disposition
Year 0	63.4%	21.9%	95.9%	99.7%	63.4%	100.0%
Year 10	70.4%	36.1%	98.1%	99.9%	70.4%	100.0%
Project Goals (Tn/Year)	44.32	2,145.59	2,205.14	145.82	44.32	32,988.02

4.5 TECHNICAL DESCRIPTIONS OF THE PROGRAM

Each PIP has formulated and assessed in order to develop the technical activities feasible, that try to solve the main problem, caused by the following reasons: 1) inadequate storage and street sweeping, 2) poor operating capacity of collection and transportation, 3) inadequate reuse of solid waste, 4) inadequate final disposal, 5) inadequate administrative and financial management, 6) inadequate population practices. The alternatives will be selected based on technical, economic, social and environmental sustainability, and the critical issue in all cities is final disposal.

Thus, each city has different solution alternatives but a common goal.

Each proposal is integrated and is aimed at increase quality and cover of services to increase, enlarge public cleaning, street cleaning, collectionand transportation, reuse and final disposal. Besides, it is important to reduce solid waste generation and control environmental and sanitary risks. This will include implementation of permanent programs of environmental education for schools and general public, implementation of a 2-year pilot program of selective collection and organic and inorganic reuse. Besides, actions are foreseen to strengthen the technical area of waste and the department responsible of public cleaning tax collection.

It is important to precise that the program will include the selected alternative, formed by integrated proposal of each public investment project. The following Table shows the different technical proposals of each of the projects included in the program. The main difference is the type of sanitary landfills for final disposal, being those manual, semi mechanized and mechanized.

Table 4.5-1 Technical Proposal of the Project

Nº	PROJECT	TECHNICAL PROPOSAL OF THE PROJECT										
		PUBLIC STORAGE	MANUAL SWEEPING OF STREETS	COLLECTION AND TRANSPORTATION	REUSE		FINAL DISPOSAL				MANAGEMENT STRENGTHENING	ENVIRONMENTAL EDUCATION
					ORGANIC WASTE FOR COMPOST	RECYCLABLE WASTE	CAPITAL CITY			ADDITIONAL CITIES		
				CONVENCIONAL	MANUAL (PILOT PLAN)	MANUAL (PLAN PILOTO)	MANUAL	SEMI MECHANIZED	MECHANIZED			
1	BID - M.D. DE CHANCAY	X	X	X	X	X	X				X	X
2	BID - M.D. DE POZUZO	X	X	X	X	X	X				X	X
3	BID - M.D. DE YAUYOS	X	X	X	X	X	X				X	X
4	BID - M.P. DE BAGUA - LA PECA	X	X	X	X	X	X			X	X	X
5	BID - M.P. DE HUAMANGA	X	X	X	X	X			X	X	X	X
6	BID - M.P. DE OXAPAMPA	X	X	X	X	X	X				X	X
7	BID- M.D. DE SAN JUAN BAUTISTA	X	X	X	X	X			X		X	X
8	BID- M.P. DE ANDAHUAYLAS	X	X	X	X	X	X			X	X	X
9	JICA - M.D. DE NUEVO CHIMBOTE	X	X	X	X	X			X		X	X
10	JICA - M.D. DE SANTIAGO	X	X	X	X	X	X				X	X
11	JICA - M.P. DE AYMARAES – CHALHUANCA	X	X	X	X	X	X			X	X	X
12	JICA - M.P. DE AZANGARO	X	X	X	X	X	X				X	X
13	JICA - M.P. DE CHACHAPOYAS	X	X	X	X	X		X		X	X	X
14	JICA - M.P. DE CHINCHA - CHINCHA ALTA	X	X	X	X	X		X			X	X
15	JICA - M.P. DE FERREÑAFE	X	X	X	X	X		X			X	X
16	JICA - M.P. DE HUACHO	X	X	X	X	X			X	X	X	X
17	JICA - M.P. DE HUANUCO	X	X	X	X	X			X	X	X	X
18	JICA - M.P. DE MOYOBAMBA	X	X	X	X	X		X		X	X	X
19	JICA - M.P. DE PAITA	X	X	X	X	X		X			X	X
20	JICA - M.P. DE PIURA	X	X	X	X	X			X	X	X	X
21	JICA - M.P. DE PUNO	X	X	X	X	X			X		X	X
22	JICA - M.P. DE SAN MARTIN – TARAPOTO	X	X	X	X	X			X	X	X	X
23	JICA - M.P. DE SAN ROMAN – JULIACA	X	X	X	X	X			X		X	X
24	JICA - M.P. DE SECHURA	X	X	X	X	X		X		X	X	X
25	JICA - M.P. DE SULLANA	X	X	X	X	X			X	X	X	X
26	JICA - M.P. DE TALARA – PARIÑAS	X	X	X	X	X			X		X	X
27	JICA- M.P. DE ABANCAY	X	X	X	X	X		X			X	X
28	JICA- M.P. DE ILAVE	X	X	X	X	X	X				X	X
29	JICA- M.P. DE TAMBOPATA	X	X	X	X	X		X			X	X
30	JICA- M.P. DE TARMA	X	X	X	X	X		X			X	X
31	JICA -M.P. DE TUMBES	X	X	X	X	X			X	X	X	X

(1) Component 1: PublicStorage and Street Sweeping

1) Public storage

The storage in all 31 cities is aimed at guaranteeing, under technical conditions, the temporary accumulation of solid waste generated in the public areas as part of the management system, until the final disposal of solid waste. Solid waste disposal depends on amount, composition and transport (type of collection and frequency). Generally, the containers must be resistant and compatible with the service to be provided. Therefore, the following items will be installed:

2) Waste bins

This storage system will be used to store solid waste generated by pedestrians in places with medium to high pedestrian traffic. Waste bins are specially recommended in public places, such as parks, squares, boulevards, streets and main or commercial avenues. Waste bins have a capacity of 50 liters, made of metal, with a pivoting system to empty waste, and will be placed in strategic places with high pedestrian and vehicle traffic of the cities. The design will be adapted to weather conditions for better solid waste handling.

3) Containers

These are used to store large amounts of waste, with a capacity of 2.50m^3

Said containers have a wide opening and reinforced walls. They will be used exclusively in areas with a high generation of waste and/or high population density, as well as places that tend to generate critical points (markets, block of apartments, poor housing areas difficult to access for the garbage vehicle.. It is important to mention that in the case of the cities that implement this system, the municipality must keep a standard health conditions and citizenship safety, so that containers are properly used. This containers shall be lift easily by the garbage vehicle to empty the waste.

4) Street sweeping

a) Equipment

Sweeping guarantees the manual cleaning of waste that is located on paved roads. Furthermore, it is considered the procurement of the following equipment and tools:

- Load trimovils to back in the waste collected by this equipment
- Collection vehicles of high density polyethylene of 120 liters.
- Procurement of metal lockers of 3 doors and 12 pigeonholes (one pigeon hole for each of the street sweepers, so that workers can put their personal belongings and personal hygiene inside).
- Tools for manual sweeping, formed by straw broom, metal brooms, dustpan, safety cones or crossarms, etc.

b) Personnel

Personnel in charge shall be trained in accordance to the information included in the environmental component, and shall wear the following personal protection equipment:

- 100% drilled, Three quarter length shirt drill 100%, orange color, mercerized and sanforized, lower discoloration, perfect fit, high performance (2 items for each street sweeper per year)
- 100% drilled cotton trousers, orange color (2 items for each street sweeper per year)
- Taslan hats, waterproof, with cotton inner lining, orange and black color and the municipality emblem embroidered (2 items for each street sweeper per year)
- Taslan ponchos, with rubber, orange color, 100% waterproof.
- KPG breathable gloves
- Drill maks
- Pair of trainers
- Pair of rubber boots with lining
- Pair of leather ankle boots
- Rucksacks

c) Consultancy Works

It is necessary to have a plan of sweeping routes implemented, so thatthe collection service will be optimized and better scheduled. Consultancies are not implemented in small cities, where itis not necessary to develop route plan.

Besides, it will be a supervision system implemented, so that the cleaning of public spaces will be verified, so that this job is done quickly and timely during the process. Personnel will use 125 cc linear motorcycles.

Table 4.5-2 Summary of equipments,tools and personal protection equipment for storage and street cleaning (JICA)

City	N° of waste bins	Movable trash container	Lockers	Trimovils	Safety cons	Straw broom	Metal broom	Metal dustbins	Safety cross arms	EPP's
TUMBES	103	55	5	6	174	348	348	116	0	58
PIURA	87	108	9	11	348	696	696	232	0	116
SULLANA	76	59	5	6	189	378	378	126	0	63
TALARA	43	37	4	4	111	222	222	74	0	37
SECHURA	109	17	2	2	51	102	102	34	0	17
PAITA	137	19	2	2	63	126	126	42	0	22
FERREÑAFE	71	20	2	1	40	120	120	40	0	20
TARAPOTO	28	27	3	2	54	162	162	54	0	27
MOYOBAMBA	56	22	2	4	44	132	132	44	0	22
CHACHAPOYAS	41	13	2	1	26	78	78	26	0	13
NUEVO CHIMBOTE	35	25	3	3	75	150	150	50	0	27
HUACHO	63	42	4	5	135	270	270	90	0	45
SANTIAGO	38	5	1	1	10	30	30	10	0	5
CHINCHA	62	35	3	4	114	228	228	76	0	38
HUANUCO	110	26	3	3	52	156	156	52	52	27
TARMA	24	30	3	3	96	192	192	64	0	32
ABANCAY	71	36	3	4	108	216	216	72	0	36
PUNO	88	45	4	5	144	288	288	96	0	48
JULIACA	33	92	8	10	291	582	582	194	0	97
AYMARAES	41	13	2	1	26	78	78	26	0	13
AZANGARO	28	15	2	2	30	90	90	30	30	15
ILAVE	58	21	2	3	63	168	126	63	0	24
PUERT0 MALDONADO	48	30	3	3	90	180	180	60	0	32

Table 4.5-3 Summary of equipments,tools and personal protection equipment for storage and street cleaning (IDB)

City	N° of waste bins	Movable trash container	Lockers	Trimovils	Safety cons	Straw broom	Metal broom	Metal dustbins	Safety cross arms	City	N° of waste bins	Movable trash container	Lockers
BAGUA	142	100	13	0	10	0	0	0	18	0	9	0	9
ANDAHUAYLAS	186	0	2	0	48	0	0	48	48	48	48	0	48
SAN JUAN BAUTISTA	98	0	0	0	0	0	0	0	0	0	0	0	0
HUAMANGA	156	0	0	0	41	4	5	123	246	246	82	123	42
OXAPAMPA	30	36	3	13	0	0	0	0	0	0	0	0	0
POZUZO	50	0	0	0	0	0	0	0	12	0	6	0	1
CHANCAY	243	0	0	0	25	1	2	25	25	25	25	0	26
YAUYOS	22	4	1	0	4	0	0	2	4	2	4	0	4

(2) **Component 2**: Collection and Transportation

Collection and transportation of solid waste to the treatment and/or final disposalwill consider, procurement of vehicles, as well as trained personnel with the corresponding protection clothing and tools.

1) **Equipment.**Conventional and non-conventional vehicles will be procured to collect and transport municipal solid waste until final disposal. For the procurement of above mentioned vehicles, the following technical criteria are considered: width of roads,slope, distance of the route,volume, uncompacted density and features of generated waste and location of final disposal site. The vehicles to be procured for the program are listed below:

- Compactor vehicles of solid waste with a capacity of 15 m^3, with 2:1 compact hydraulic system, and drainage to collect leachate to transit roads with a slope of 10% up to 12%.
- Compactor vehicles of solid waste with a capacity of 12 $m^3$with 1.5:1 compact hydraulic system, and drainage to collect leachate to transit roads with a slope of 10% up to 12%.
- Compactor vehicles of solid waste with a capacity of 10 $m^3$with 1.5:1 compact hydraulic system, and drainage to collect leachate to transit roads with a slope of 10% up to 12%.
- Compactor vehicles of solid waste with a capacity of 7 $m^3$with 1.5:1 compact hydraulic system, and drainage to collect leachate to transit roads with a slope of 10% up to 12%.
- Compactor vehicles of solid waste with a capacity of 6 $m^3$with 1.5:1 compact hydraulic system, and drainage to collect leachate to transit roads with a slope of 10% up to 12%.
- Hopper truck with just one axis and 19.80 m^3 of volume capacity for the selection collection of reusable waste, with steel edge; height not less than 1.60 m and completely closed.
- Hopper truck with just one axis and 10 m^3 of volume capacity for the selection collection of reusable waste, with steel edge; height not less than 1.60 m and completely closed.
- Load trimovils for places difficult to access to back sweeping of streets and avenues, with a loading capacity up to 0.50 tones.
- Vans to supervise and monitor collection system, transport, mechanical and emergency support during operations.
- 125 cc linear motorcycles to supervise public cleaning service.
- Safety and tracking systems with GPS to monitor and communicate with each of the collecting vehicles.

2) **Personnel**

Personnel in charge shall be trained in accordance to the information included in the environmental component, and shall wear the following personal protection equipment.

- 100% drilled, Three quarter length shirt drill 100%, color, mercerized and sanforized, lower discoloration, perfect fit, high performance (2 items for each street sweeper per year)
- 100% drilled cotton trousers, color
- 100% cotton orange t-shirts, municipality emblem embroidered at the back
- Taslan hats, waterproof, with cotton inner lining, black color and the municipality emblem embroidered

- Taslan ponchos, with rubber, color, 100% waterproof.
- Regulating glasses with polycarbonate transparent mica
- breathable gloves
- Drill maks
- Pair of rubber boots with lining
- Pair of black leather ankle boots with polyurethane sole, steel tipped, vulcanized
- Rucksacks

3) **Consultancy Works**

It is necessary to have a plan of sweeping routes implemented, so that the collection service will be optimized and better scheduled.

Table 4.5-4 Summary of Vehicles for Collection and Transportation

City	Compactor trucks				Dump truck	Truck	Hopper Truck			
	07 m^3	10 m^3	12 m^3	15 m^3	10 m^3	40 t	18.9 m^3	6 m^3	2 T	Motocarga 2.25 m^3
PUNO	0	0	0	5	0	0	1	0	0	0
JULIACA	0	0	0	9	0	0	1	0	0	0
PIURA	0	0	10	3	0	0	1	0	0	0
NUEVO CHIMBOTE	0	0	5	0	0	0	1	0	0	0
TUMBES	0	0	2	2	0	0	1	0	0	0
SULLANA	0	0	6	0	0	0	0	0	1	0
ABANCAY	0	0	3	1	0	0	1	0	0	0
HUANUCO	0	0	6	0	0	0	1	0	0	0
PAITA	0	0	3	0	0	0	1	0	0	0
PUERTO MALDONADO	0	0	6	0	0	0	1	0	0	0
TALARA	0	0	5	0	0	0	1	0	0	0
MOYOBAMBA	0	0	4	0	0	0	1	0	0	0
TARAPOTO	0	0	0	6	0	0	1	0	0	0
CHACHAPOYAS	1	0	2	0	0	0	1	0	0	0
ILAVE	2	0	0	0	0	0	0	0	0	0
AZANGARO	1	0	0	0	0	0	0	0	0	0
CHINCHA	0	0	0	2	0	0	1	0	0	0
SECHURA	0	0	3	0	0	0	0	0	0	0
HUACHO	0	0	0	4	0	0	1	0	0	0
TARMA	1	0	3	0	0	0	1	0	0	0
FERRENAFE	0	0	3	0	0	0	0	0	1	0
SANTIAGO	0	0	1	0	0	0	0	0	0	0
AYMARAES	1	0	0	0	0	0	0	0	0	0
BAGUA	0	1	0	0	0	0	2	0	0	0
ANDAHUAYLAS	0	2	0	0	1	0	0	0	0	0
SAN JUAN BAUTISTA	0	0	4	0	0	0	0	0	1	0
HUAMANGA	2	0	5	0	0	0	1	0	0	0
OXAPAMPA	0	1	0	1	0	1	0	0	0	0
POZUZO	0	1	0	0	0	0	0	0	0	0
CHANCAY	0	0	2	1	0	0	0	0	1	0
YAUYOS	0	1	0	0	0	0	0	1	0	1

Table 4.5-5 Sumamry of Tools and personal Protection Equipment for Collection and Transportation

City	Straw broom	Metal dustbin	Bucket loader	Pick	Nylon blanket	Rake	Safety Cones	PPE
TUMBES	96	32	32	32	52	32	48	29
PIURA	234	78	78	78	134	78	117	113
SULLANA	120	40	40	40	68	40	60	56
TALARA	18	18	12	12	24	12	12	33
SECHURA	9	9	6	6	12	6	6	13
PAITA	18	18	12	12	24	12	12	21
FERREÑAFE	12	12	10	8	16	10	8	16
TARAPOTO	21	21	18	14	28	18	14	48
MOYOBAMBA	15	15	18	10	20	18	10	21
CHACHAPOYAS	12	12	10	8	16	10	8	16
NUEVO CHIMBOTE	18	18	12	12	24	12	12	39
HUACHO	90	30	30	30	30	30	45	38
SANTIAGO	3	3	4	2	4	4	2	5
CHINCHA	60	20	20	20	32	20	30	24
HUANUCO	21	21	20	14	28	20	14	30
TARMA	78	26	26	16	26	26	52	20
ABANCAY	15	15	10	10	20	10	10	23
PUNO	136	51	34	34	68	68	51	50
JULIACA	240	90	60	60	120	120	90	78
AYMARAES	3	3	4	2	4	4	2	4
AZANGARO	3	3	2	2	4	2	2	5
ILAVE	16	6	4	4	8	8	6	11
PUERT0 MALDONADO	21	21	14	14	28	14	14	28

(3) **Component 3**: Recovery of Organic and Inorganic Waste

Solid waste reuse will be provided in 31 cities of the program. Thus, proper facilities will be implemented (composting and recycling plants) in order to manage solid waste properly. Each city will have a pilot program, and then move to other sectors with citizen participation. Then, the following parameters must exist to project the demand and calculate the infrastructure design.

Table 4.5-6 Scheme of Recovery of Organic and Inorganic Materials

Criterias for the recovery of recyclable waste	Value parameters
Population for the pilot test	5% of the total of directly benefited population
Percentage of recyclable solid waste	0.1754
Generation of Municipalities solid waste	at the 1st. Year
Percentage of maximum receiving capacity of the Recycle Plant	20%(if generation at 1st. Year is more than 100t/day) 40%(If generation at 1st. Year is more than 20 t/day) 60%(if generation at 1st. Year is less than 20 t/day)
Progressive increase of Recyclable waste	20% (year 3 and 4) 40%(year 5 and 6) 60%(year 7 and 8) 100%(year 9 and 10)

Criterias for the recovery of waste for compost	Value parameters
Quantity of organic solid waste for pilot test (markets)	200Kg (if generation of markets is more than 0.2 t/day) Same (if generation in markets is less than 0.2 t/day)
Progresive increase of reception of reusable waste (years 3,4, and 5)	100%(if gerenration of markets is less than 4 t day) 4 t/day (if generation of markets is more >= 4 t/day)
Progresive increase of reusable waste (years 6 to 10)	1.1 t/day(if generation in markets is less than 1.1 t/day) 4t/day(if generation in markets is >=1.1 and < 4 t/day) 7 t/day (if generation in markets is >= 4 t/day)

1) Infrastructure

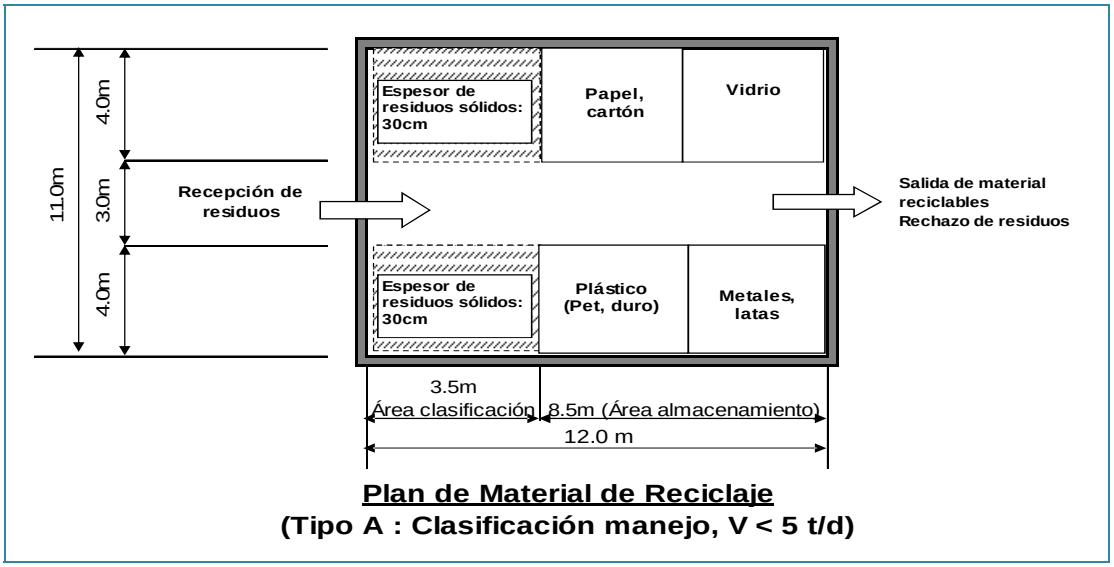
a) Inorganic Waste

The program includes the construction of areas to reuse recyclable solid waste to be obtained from segregationat source. The recycling plant is designed depending on the maximum receiving capacity (20, 40 and 60%) of recyclable waste and it will be built as of year 0.

The recycling plant of solid waste will have two areas: sorting area and storage area, with a place for waste such as paper, glass, plastic, metal and those with trading value. Other access area, transit area and exit area of recyclable material and waste.

The recycling plant will have the following basic structure:

- Concrete columns, polished concrete floor with face bricks
- Area of the plant will have a metal structure to withstand the roof: 3´´galvanized black steel tubing, using 12 wavesopaque fibraforte sheets for roofing. Besides, chute draining will be installed.
- 27 m^2 sliding door with 2” x 2” mesh and electric installations.
- Barbwire fence and planting of trees as life fence around the perimeter
- Al projects will be manual in the beginning and it will remain like that until year 10, except for the city of Piura, which will conduct manual reuse during the pilot program and at the end of the design, the recycling plant will be semimechanized.
- As it was indicated, during the first 2 years there will be a pilot reuse program, so within the recycling plant there will be a composting area. Additionally, the plant will have two sizes, depending on the generation, as the following charts show:



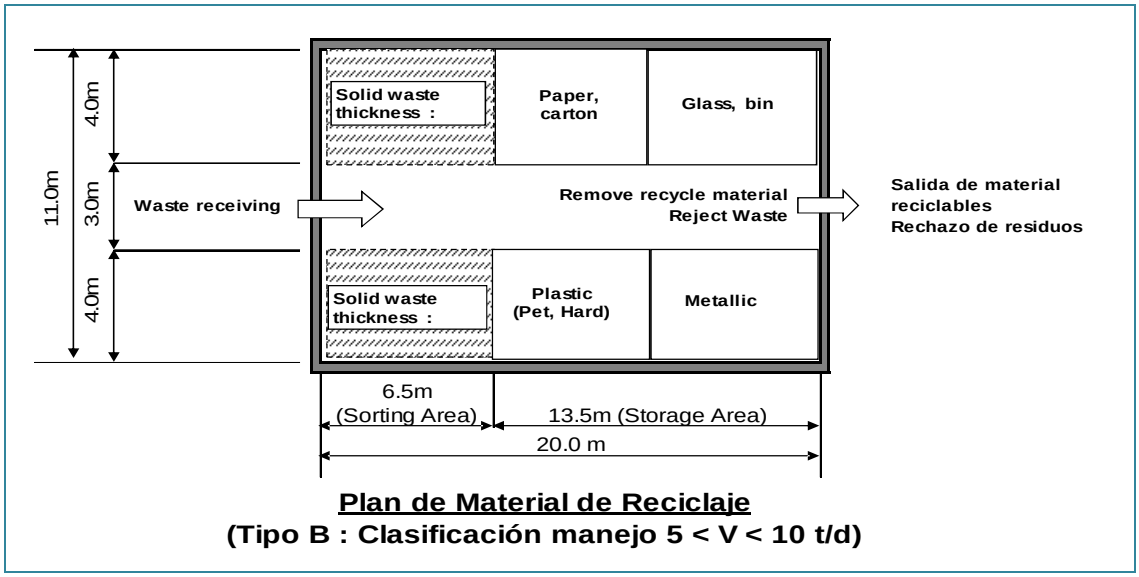


Figure 4.5-1 Size of recycling plant

b) Organic Waste

The program includes the construction of a composting area using the organic waste collected. Bearing this in mind, it is considered to implement 31 facilities to reuse organic waste.

The first two years, the recycling plant will operate.The composting plant will be built at a later stage, depending on the ongoing growth of organic waste, as it is explained later on.

Table 4.5-7 Processing Capacity of Composting Plant

Cities	Reception at plant	Beginning of 1ststage	Beginning of 2nd stage
Chancay, Andahuaylas, Santiago, Aymaraes, Sechura.	1.10 t/day	Year 5	---
Puno, Juliaca, Sullana, Abancay, Paita, Tambopata, Talara, Moyobamba, Chachapoyas, Chincha Alta, Huacho, Tarma , Ferreñafe, Azángaro, IlavePozuzo, Yauyos, Bagua – La Peca, Oxapampa,	4.0 t/day	Year 2	---
Piura, Nuevo Chimbote, Tumbes, Huánuco, Tarapoto, Huamanga, San Juan Bautista.	7.0 t/day	Year 2	Year 5

There are different areas in the composting plant:

- Receiving area and piling, where organic matter will be selected before forming the pile. In order to expedite and improve treatment conditions of solid waste, it is better if waste is medium sized,so cut them in 5-10 cm pieces. Once organic matter is obtained, it is then moved to the piling area for fermentation. The area where the pile will be formed must be cleared of stones, sticks, so that no elements damage fresh organic matter. Piles will be 1.5 m height, 3 m width and length will depend on the amount of waste received. Minimal distance between piles is 1-5 m.During this stage, there is an increase of temperature, due to microbial activity caused by high amount of organic matter existing in the pile, with temperatures of almost 80° C.

  It is necessary that all piles are identified, to control sieving and turning. Piles are turned during the 2^{nd}, 5^{th} and 8^{th} week. The turning allows air to enter. So, it is important that the center of the pile is outside the new pile. During the turning process, humidity is rectified through irrigation. Besides, a stick or tube is installed to facilitate pile ventilation.

- Curing area. After 4 or 5 weeks, compost piles are transported to the aging area. Once there, piles “rest”, by turning them periodically in order to oxygenate the mass until the product is aged.

- Storing area.Once cured, materials are sieved and thicker materials are rejected. through a ½´´ diameter mesh. The material going through is the compost.

The compost facility will have the following items:

- Concrete floor of 0.20 thickness,occupying the same area as the piles. Besides, there will be a splitting wall between piles of 1.5m height made of face brick.

- The curing and storage area will be covered with opaque corrugated iron sheets of 12 waves, with wooden beams and concrete columns of 3 m, as well as installation of draining chutes.

- Installation of leachate pond, with 2´´SAP PVC tubings.

At the same time, water can be supplied to the compost plant through water tanks of 110 l each. The tank will have the corresponding pump and provided by the tanker.

There will also be a small frontal loader of 0.45 m3 to turn the piles, procured as reinvestment in the year 2 of the project.

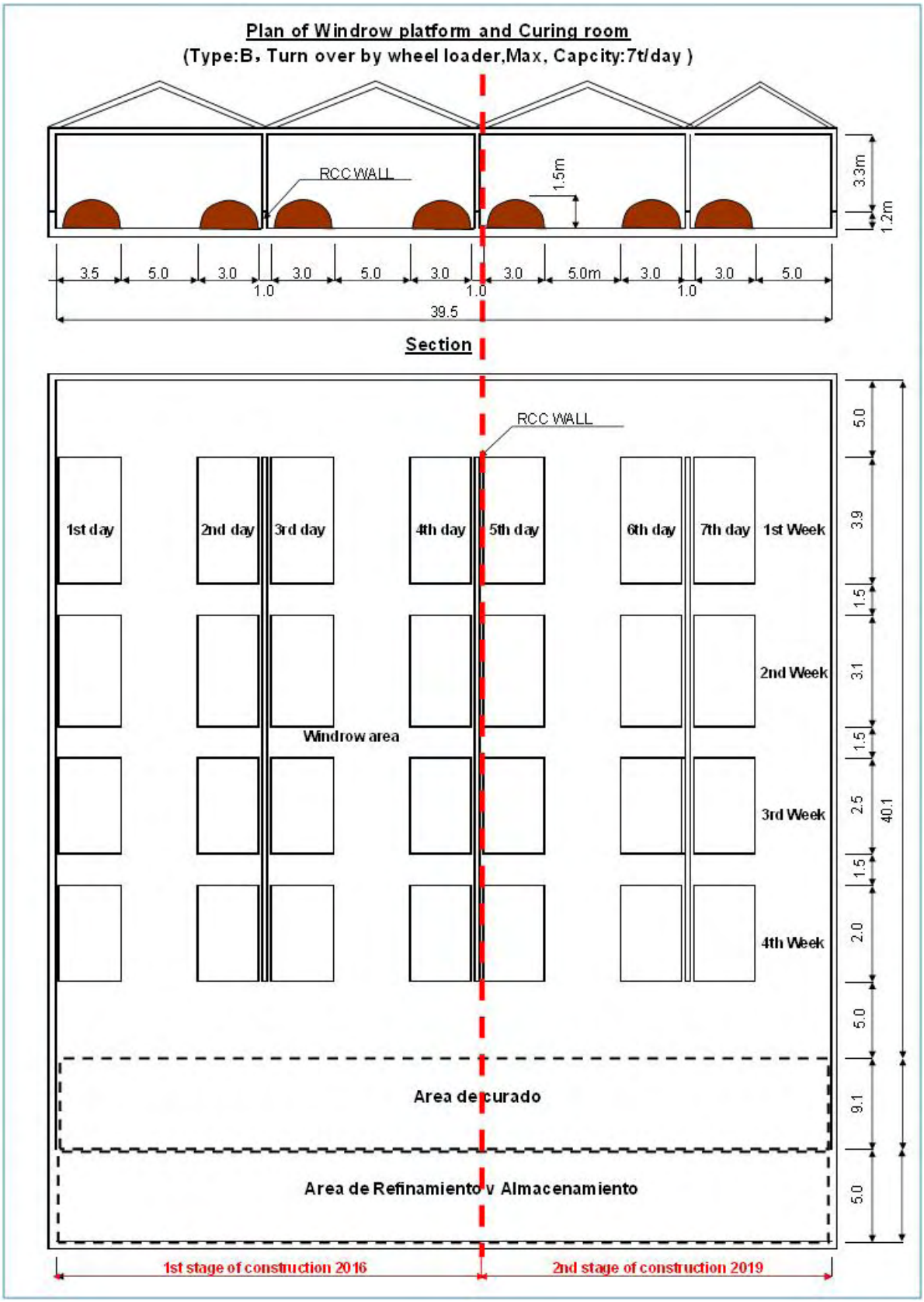


Figure 4.5-2 Composting Plant (Type B, Capacity: 7t/day)

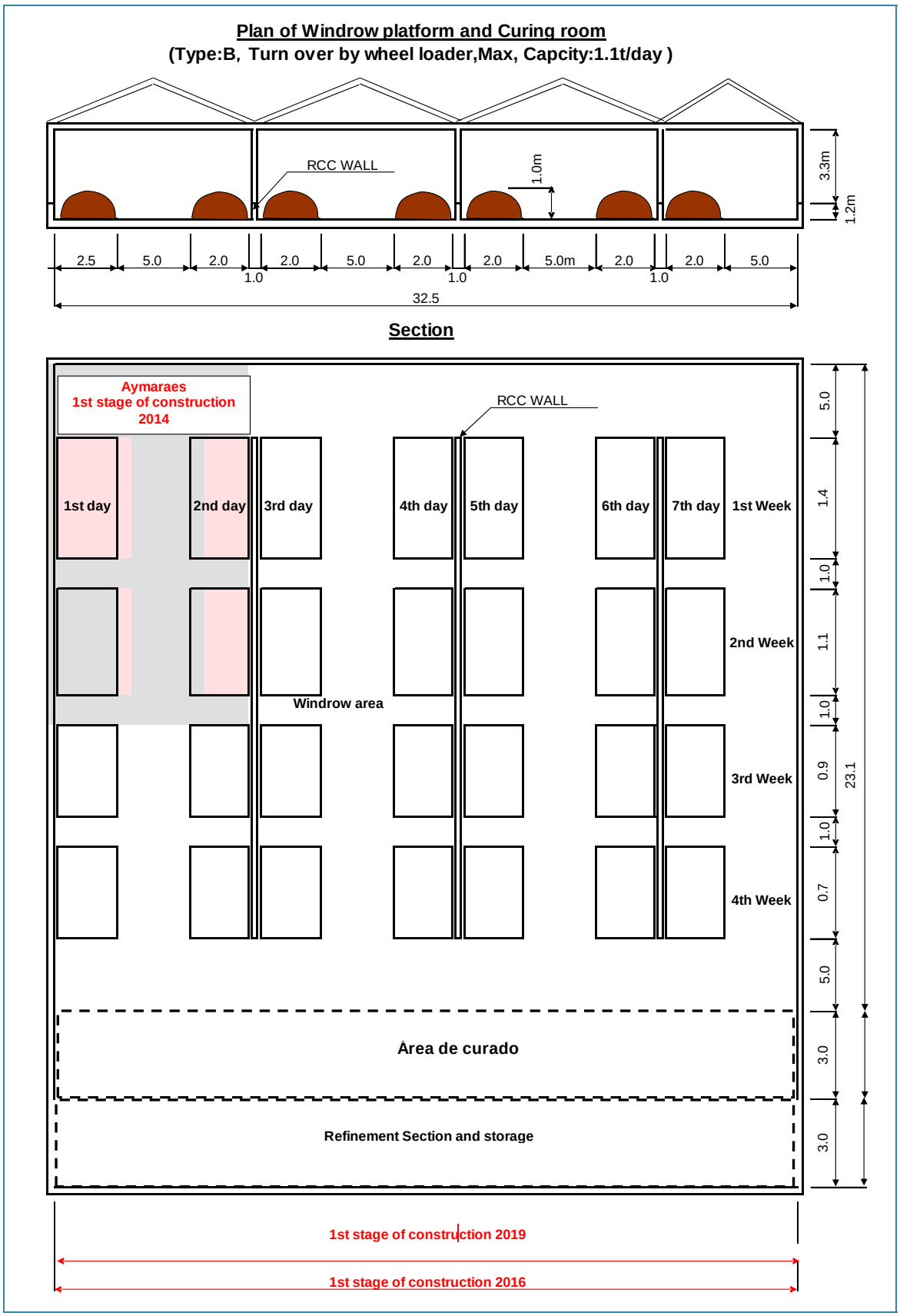


Figure 4.5-3 Composting Plant (Type B, Capacity: 1.1t/day)

2) Equipment

a) Equipment for Inorganic Waste Treatment

Operations will be manual in 31 cities, classifying and sorting reusable waste segregated at source, such as plastic, cans, cardboard, using a sieve Table to facilitate segregation and a scaleto weight materials.Only in the case of Piura, for year 9 it will be necessary to install a belt conveyor, press and plastic crusher, because the recyclable generation is above 10 t/day.

b) Equipment for Organic Waste Treatment

Manual operations will be done with basic equipment, such as shovel, rake, wheelbarrow and sieve.

3) Personnel

It is important to have personnel to segregate, treat and/or compact and pack solid waste for commercial purposes. Therefore, personnel must wear personal protection garments, including:

- Drill three quarter length 100% cotton shirt, color, mercerized and sanforized, low dying, perfect fit, high performance.
- Drill 100% trousers, color.
- 100% cotton shirts, embroidered logo at the front and printed at the back.
- Taslan hats, glued, waterproofed with inner cotton lining, black color, and embroidered logo of the municipality.
- Taslan poncho, rubbered, color, 100% waterproofed.
- Glasses with transparent polycarbonate plastic, with regulator
- Breathable gloves
- Masks with filters
- Leather ankle boots, with polyurethane soil, steel tips, vulcanized.
- Rubber boots with lining (for organic waste recovery).

Table 4.5-8 Summary of Equipment, Tools and PPEs for reuse (JICA)

City	Weighing scale with platform	Table with Sieve	Rakes	Picks	Wheelbarrow	Shovel	Sieve	PPEs
TUMBES	1	1	3	2	2	4	2	2
PIURA	1	1	6	4	0	4	4	6
SULLANA	1	1	3	2	2	4	2	4
TALARA	1	1	3	1	1	3	1	2
SECHURA	1	1	3	1	1	4	1	2
PAITA	1	1	4	4	1	2	4	1
FERREÑAFE	1	1	3	1	1	3	1	1
TARAPOTO	1	1	3	2	2	4	2	2
MOYOBAMBA	1	1	3	1	1	3	1	1
CHACHAPOYAS	1	1	3	1	1	3	1	1

City	Weighing scale with platform	Table with Sieve	Rakes	Picks	Wheelbarrow	Shovel	Sieve	PPEs
NUEVO CHIMBOTE	1	1	3	1	1	4	1	2
HUACHO	1	1	3	2	2	4	2	1
SANTIAGO	1	1	3	1	1	3	1	1
CHINCHA	1	1	3	2	2	4	2	1
HUANUCO	1	1	3	1	1	3	1	1
TARMA	1	1	3	2	2	4	2	1
ABANCAY	1	1	3	1	1	4	1	1
PUNO	1	1	3	2	2	4	2	2
JULIACA	1	1	3	2	0	2	2	3
AYMARAES	1	1	3	1	1	3	1	1
AZANGARO	1	1	2	1	1	2	1	2
ILAVE	1	1	4	2	1	3	1	2
PUERT0 MALDONADO	1	1	3	1	1	4	1	1

Table 4.5-9 Summary of Equipment, Tools and PPEs for reuse (IDB)

City	Scale	Table with sieve	Conveyor belt	Wheelbarrow	Press	Mill	Windrow equipment	Bugis	Shovel	Trinches	Picks	Brooms	Dustbin	Sieve	EPP's
BAGUA	1	0	1	5	1	1	1	2	5	5	5	0	0	0	11
ANDAHUAYLAS	0	0	1	10	1	1	1	0	15	0	15	15	0	0	15
SAN JUAN BAUTISTA	1	1	0	0	0	0	0	2	4	3	2	0	0	2	1
HUAMANGA	1	1	0	0	0	0	0	1	4	3	1	0	0	1	3
OXAPAMPA	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0
POZUZO	0	0	0	0	0	1	0	3	3	0	0	2	2	0	2
CHANCAY	1	0	1	0	1	0	0	1	1	1	1	0	0	1	1
YAUYOS	0	0	0	5	1	1	0	0	12	0	12	12	0	0	8

(4) **Component 4**: Final Disposal

This is the componentthat differentiates PIPs.The program includes the construction of 31 facilities for the proper final disposal of solid waste in the municipalities. The design will depend on the tons generated daily to be disposed. According to this, 10 manual sanitary landfills will be built, with a daily capacity of 20 mt/day; 9 semimechanized, with a capacity of 20-50 mt/day and/or 12 mechanized , witha capacity over 50 mt/day. Please, find below details of cities breakdown depending on type of sanitary landfill.

Table 4.5-10 Type of Landfill

Quantity	Cities	Type of Sanitary Landfill
10	Chancay, Pozuzo, Yauyos, Bagua – La Peca, Oxapampa, Andahuaylas, Santiago, Aymaraes – Chalhuanca, Azángaro, Ilave.	Manual
09	Chachapoyas, Chincha Alta, Ferreñafe, Moyobamba, Paita, Sechura, Abancay, Tambopata, Tarma.	Semi mechanized
12	Huamanga, San Juan Bautista, Nuevo Chimbote, Huacho, Huánuco, Piura, Puno, Tarapoto, Juliaca, Sullana, Talara, Tumbes.	Mechanized

1) Location criteria and Design of Solid Waste Final Disposal Facility

a) Location Criteria

For all final disposal facilities of solid waste to be implemented, it has been taken into account the guidelines and requirements for location issued by MINAM in the Guidelines for Design, Construction, Operation, Maintenance and Closing of mechanized and manual sanitary landfill. The criteria are detailed bellow

- Lower limit distance between final disposal facility and population: 1 km.
- Existence of cover material in the same area or in a nearby area, if the transportation and use of said material is cost effective.
- Trafficable access roads at all times and the lower existing distance to the urban area to be covered.
- If possible, the facility should be built in sites that allow the maximum use of waste.
- Facilities must be located in an area where the soil can be used for its main purpose.
- Positive environmental conditions must be sought, regarding rain, direction and speed of winds, geological, hydrogeological features and less vulnerability to natural events (such as earthquakes, landslides, etc).
- It is important to mention also that apart from the above mentioned criteria, none of the proposed areas to build a sanitary landfill will be located on a solid waste dump site, according to the site selection study. Said study has the technical approval of the regional directorate of health of the jurisdiction and the SERNANP certificate,

b) Design Criteria

Sanitary landfill have been designed under engineering criteria, the details of which are included in the corresponding projects. However, an outline of the main criteria are presented here:

- A mix process will be considered for the final disposal of waste at sanitary landfills.
- Laying out of trenches and platforms projected for the sanitary landfill in accordance with solid waste projection to be generated, taking into account growth population and per capita generation of beneficiaries.
- Daily cover of solid waste, considering between 10% and 25% of solid waste volume.
- Consider design system of rain drainage

- Design of facility for drainage, reception and recirculation of leachate. In two of the cities (i.e. Puerto Maldonado and Juliaca), facilities for leachate treatment shall be implemented through use of upflow anaerobic reactors, within the pretreatment stage. Other alternatives treatment plants using activated mud or percolating filter.
- Design of infrastructure to eliminate decomposing gas.

The cell design is based on the weather conditions and topography of the area. The height varies from 10 m in the mountain, jungle and 20 m for the coast. Depending on the area to be used in the sanitary landfill during the 10 year project, it could be built in 2-3 stages,asthefollowing chart shows:

Table 4.5-11 Staging of Landfill

Area of Sanitary Landfill	Construction Stages	Construction year
< 3.00 ha	2	0 (investment) and 5
> 3.00 ha	3	0 (investment), 3 and 6

2) Minimal Infrastructure

The minimal structure for the sanitary landfill is described below:

a) Administrative and Service Stand

This facility will be used for the administration activities related to the sanitary landfill. This will be the place where vehicles transporting solid waste will be registered. Therefore, it should located as near as possible to the main access road.

This building will have the following areas:

Surveillance and control stand, made of durable materials, must be located as close as possible to the main access door.

Administrative office, where the technical office, reception and meeting room will be.

Warehouse for materials and tools. There will be a room for materials, tools and everyday material to be used to operate the facility.

Dining area and kitchen, with a small kitchen, Table and chairs.

Registration and weighing stand, to register and weight the vehicles that transport solid waste, and to register also the entrance and exit of personnel working in the facility.

Weighing box includes entrance and exit platform. There will be a reinforced concrete box, and over this the metalmechanic structure of the weighing scale will be built, in accordance with details of the corresponding map, which should be horizontal along the surface. At the entrance and exit of the weighing platform, horizontal platforms will be built of reinforced concrete, to ease entrance and exit of vehicles.

Power generator stand. Walls are covered with isolating material fire proof, windows will be protected by mesh and theywill be located in such a place as to allow ventilation. The power generator shall have a minimum start off power of 200 KW, so that electric installations of

registration and weighing, administrative office, canteen, toilets and external lighting work normally.

Changing rooms and toilets. Toilets and changing rooms for men and women will be built. To supply water two prefabricated tanks of 1.100 liters each will be built, and they will be supplied by tankers, that will be located at 5 m height. Then, a base and concrete columns will be built, from water will be channeled by a 1hp pump.

b) Machinery Parking Space

This will be the place to park heavy machinery operating daily in the sanitary landfill in order to protect them from weather conditions.

c) Construction of Slope

While constructing sanitary landfill, the machinery used store waste, fuel should be necessary for everyday activities.

Taking into account the distance from the sanitary landfill to the cities, the fuel must be supplied at work place, and for that purpose, a temporary tank shall be installed. Therefore, it is necessary to have a slope (ramp formed by natural soil) that allows to supply fuel to the machinery using hoses.

d) Sanitary Structure

To supply water to W.C, a reservoir will be built, and will be withstood on reinforced concrete, and a ½" diameter transmission network.

Sewage waters will treated using the following equipment:

Septic tank built on V type reinforced concrete, special for ground structures (wall). The sewage water will get in and out through a 4´´PVC tube. Furthermore, two covers of 0.36 m2 will be design and will be used for inspection and maintenance purposes.

Percolation well, built with reinforced concrete structure, granular material base of 0.30 m thickness and 0.60 m height between the liquid and the cover base.

Drying mud bed, with reinforced concrete. Material such as brick, sand and gravel will be used in the base layers, then acting as natural filter of the water.

e) Internal and External Access Road

During this stage, internal and external roads will be built, and will have 6 m width. For that matter, different works will be done, such as earthworks, leveling and compacting to the subgrade, and then the road surface will be improved with a 20 cm thickness weighted, using material from selected quarry.

f) Platforms

Earthworks will be performed in the foundation area, executing cuts in the bulk material, until the specific level of the maps is reached. Once the base of the platform is excavated, the ground and walls of the area are leveled, to finally waterproof with clay and/or geomembrane or geotextile, as appropriate.

In case of the geomembrane and geotextil is used, they will be built-in in the foundation land through dados of 50x 50 cm, either in the base of the area of in the higher part of the slope.

g) Trenches

Earth works will be done from the grade, cutting bulk material. The excavation works of bulk material will be executed using a 190 – 240 HP caterpillar tractor; regarding slopes formation, a 190-190 HP caterpillar tractor will be used, a 125 HO grader and a 70-100 HP self-propelled vibratory roller

Then the bottom ground and slopes will be leveled and compacted in order to waterproof the area, using clay and/or geomembranes and geotextiles, as appropriate. The membranes will be covered with a fine soil layer to prevent breakage from using sharp tools.

In order to access the trenches, ramps will be built with slopes made of local material. The road surface will be improved by ballast.

h) Drains to Collect Leachate

Drains will be installed to collect leachate in the lower base of the platforms. There will be a primary longitudinal drain and transversal secondary drains, with 30 meters.The leachate will be taken to the storage pond, which will be waterproofed with geomembrane and geotextile. In the cities of Puerto Maldonado and Juliaca a full leachate treatment will be installed. Leachate will be captured by a drainage system from the bottom of the cell until leachate pond. From there, the leachate will be pumpedto anUpflow Anaerobic reactor. Then, the leachate with less organic load will go to a pond to be diluted with rain drainage. From here, the leachate is pumped to a gravel percolating filter.. Once percolated, the leached will go to a pond with rain drainage. The sewage water will be poured into the river by means of tubes. A previous authorization to pour industrial , household and municipal treated sewage waters is needed. This document is granted by the Water National Authority (ANA), through the Management of Water Resources Quality.

i) Chimneys

Vertical drains with burners will be built to control and eliminate gas caused by decomposing of organic waste, which will be linked with the drains for leachate collection. The chimneys will be built considering a 30 meters space between each. This structure is made of wood, metal mesh, stone with a space in the center to place a PVC tube with lateral holes of 150 mm. The chimney will be 0.60 m width, and height may vary depending on the platform used according to topography of the area. The size will increase by stages.

j) Ponds to Storage Leachate

Reinformed and waterproofed concrete ponds will be built with additives to storage leachate, while evaporation and recirculation will be done through pumping. In the areas with heavy rains, roofs will be place over the pond in order to prevent rain filtration.

k) Construction of Monitoring Well

Monitoring Wells shoud be built to control leachate filtration and monitor underground water, as appropriate.

l) Construction of Safety Fences and Life Fences

A fence will be built with eucalyptus wood sticks or similar wood, protected with barbwire along the perimeter. There will be an entry door, measuring 6 m width x 2.40m height to delimit the area of the sanitary landfill. The fence will avoid free passing , so that the entrance and exit of vehicles and authorized personnel will be controlled and done in an orderly manner.

A life fence with native trees will be built throughout the perimeter of the area, in order to improve the landscaping and mitigate the effect of winds.

Each of the structures will need materials, qualified labor, non-qualified labor and outsourcing.

DISTRIBUTION OF SANITARY LANDFILL

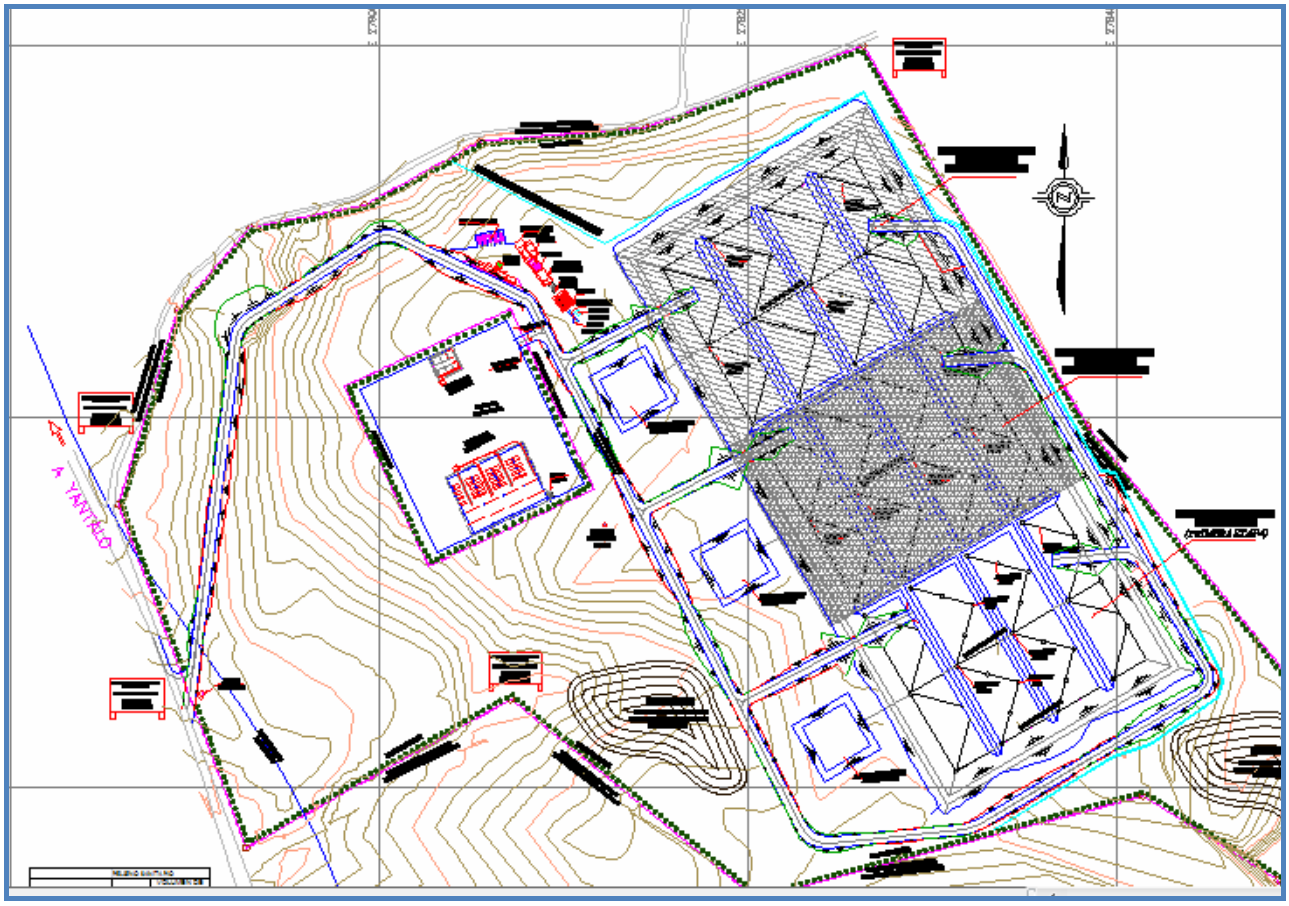


Figure 4.5-4 Sanitary Landfill Layout

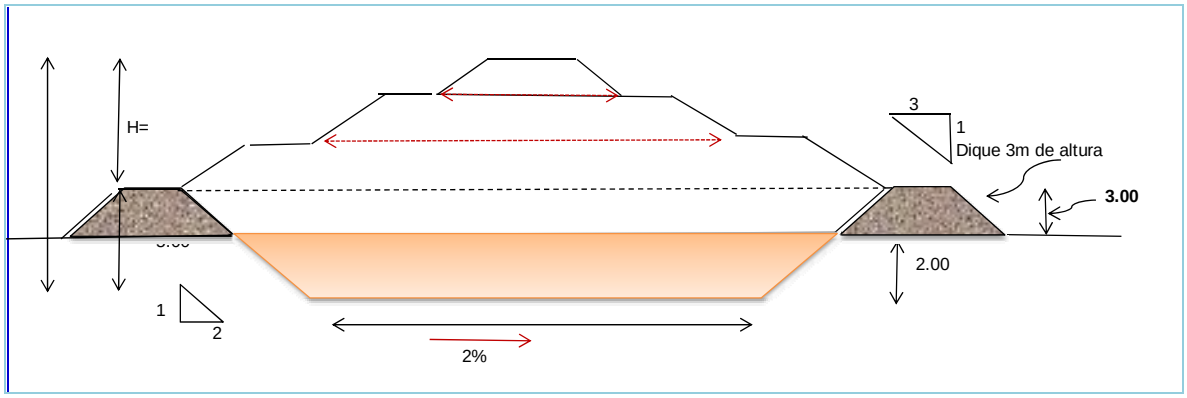


Figure 4.5-5 Cross Section of Sanitary Landfill

Sanitary landfill considered for the 31 cities included in the program follow the same facility design criteria, both for manual, semi mechanized and mechanized sanitary landfill, different measures of the sanitary landfill height, detail as follow:

Table 4.5-12 Height of Landill

Type of Sanitary Landfill	Height of Landfill
Manual	Coast (10 a 15 m) Sierra (10 m) Jungle (10 m)
Semi Mechanized	Coast (15 a 20) Sierra (10 m) Jungle (10 m)
Mechanized	Coast (20 m) Sierra (20 m) Jungle(10 a 20)

3) **Equipment**

According to the sanitary landfill facility, the following basic equipment is considered:

Table 4.5-13 Equipment for Final Disposal

City	Type of Sanitary Landfill	Equipment
Chancay, Pozuzo, Yauyos, Bagua, Oxapampa, Andahuaylas, Santiago, Aymaraes, Azángaro, Ilave.	Manual	Mini Caterpillar loader o257B2 de 1.1 t (0.44 m^3). 40 t weighing scale
Chachapoyas, Chincha Alta, Ferreñafe, Moyobamba, Paita, Sechura, Abancay, Tambopata, Tarma.	Semi mechanized	Caterpillar tractor D4 de 10 - 15 t. 40 t weighing
Huamanga, San Juan Bautista, Nuevo Chimbote, Huacho, Huánuco, Piura, Puno, Tarapoto, Juliaca, Sullana, Talara, Tumbes.	Mechanized	Caterpillar tractorD6 de 21 t. Frontal loader 1.9 – 2.7 m^3 15 t dump truck 40 t weighing

Regarding the set of engine+water pump, an electrical pump should be procured to recirculate leachate.

All infrastructures must have electrical installation to operate the equipments, lightening and services that may require electricity.

4) **Personnel**

Qualified and non qualified labor will be required to operate the sanitary landfill. During the implementation stage, there will be also outsourced labor.

The personal hired to operate the sanitary landfill will wear the following personal protection garments:

- 100% drilled cotton three quarter length shirt, mercerized and sanforized.
- 100 % cotton drilled trousers, with orange color
- 100% cotton shirt, orange color, with the emblem embroidered in the chest and printed at the back.
- Taslan hats, with rubber, waterproofed with interior lining of cotton, orange and black color, municipality emblem embroidered.
- Taslan ponchos, orange color, 100% waterproof.
- Reinforced leather gloves
- Glasses with transparent polycarbonate plastic, with regulator
- Double filtered masks to protect from dust and gas
- Leather ankle boots, black color with polyurethane soil and steel tips, vulcanized.

Table 4.5-14 Summary of Tools and PPE for final disposal

City	Pick	Bucket loader	Wheelbarrow	Rake	Carving Fork	Manual roller	PPE
TUMBES	8	16	8	12	12	0	11
PIURA	12	24	12	18	18	0	14
SULLANA	12	24	12	18	18	0	14
TALARA	88	24	8	24	24	0	16
SECHURA	6	6	2	6	6	0	4
PAITA	4	16	4	12	12	0	8
FERREÑAFE	2	6	2	6	6	0	4
TARAPOTO	8	16	8	12	12	0	12
MOYOBAMBA	2	6	2	6	6	0	4
CHACHAPOYAS	2	6	2	6	6	0	4
NUEVO CHIMBOTE	4	4	4	12	12	0	12
HUACHO	12	24	12	18	18	0	14
SANTIAGO	1	3	1	3	3	0	3
CHINCHA	8	16	8	12	12	0	8
HUANUCO	4	12	4	12	12	0	9
TARMA	4	8	4	6	6	0	4
ABANCAY	2	8	2	6	6	0	4
PUNO	12	24	12	18	18	0	14
JULIACA	12	24	12	18	18	0	14
AYMARAES	1	3	1	3	3	0	2
AZANGARO	1	2	1	2	2	2	3
ILAVE	2	3	1	4	4	2	3
PUERT0 MALDONADO	2	8	2	6	6	0	4

City	Pick	Bucket loader	Wheelbarrow	Rake	Carving Fork	Manual roller	PPE
BAGUA	8	8	6	0	0	0	5
ANDAHUAYLAS	0	6	4		6	4	6
SAN JUAN BAUTISTA	16	32	16	24	24	0	16
HUAMANGA	6	6	2	6	6	0	10
OXAPAMPA	0	0	0	0	0	0	0
POZUZO	0	0	0	0	0	1	5
CHANCAY	2	2	2	0	0	0	2
YAUYOS	0	0	0	0	0	0	5

(5) **Component 5**: Administrative and Financial Management from the Municipality and People

The ongoing improvement of integrated solid waste management requires a management team formed by expert professionals on technical and operating issues, and administrative and financial management of public service.

In that sense, it is necessary to strengthen the following issues so that the service is more efficient.

a) Specialized management of the service

Write terms of reference to hire a public service manager. Furthermore, an Annual Operating Plan (AOP) shall be designed for the Sub Management of Municipal Services.

b) Service Monitoring

B1. Training on solid waste management of technical personnel.
Selection of participants
Registration in the Program

The training program must include at least the following contents

UNIT 1 Integrated Vision of the Management System of the Solid Waste
1.1 Solid Waste Management in Peru
1.2 Problem of Solid Waste

UNIT 2. National and local regulations on solid waste management

UNIT 3. Municipal Solid Waste
3.1 Solid Waste
3.2 Solid Waste Classification
3.3 Hazardous Waste

UNIT 4. Municipal System and Environmental Management of Solid Waste
4.1 Challenges and objectives of municipal solid waste management
4.2 Concept of public cleaning service
4.3 Environmental Management Plan of solid waste: previous steps

UNIT 5. Integrated Environmental Plan of Solid Waste: PIGARS
5.1 What PIGARS is
5.2 Scope of PIGARS
5.3 Purpose of PIGARS
5.4 Steps to follow to elaborate a PIGAR

UNIT 6. Generation of household solid waste
6.1 Household solid waste
6.2 Amount of household waste generated and practical measures

UNIT 7 Collection and transportation of solid waste
7.1 Collection at source
7.2 Type of garbage vehicles
7.3 Collection Routes of solid waste
7.4 Street Sweeping service and public spaces

UNIT 8 Decrease, reuse, recycling and composting of waste
8.1 Reduction of solid waste generation
8.2 Alternatives of solid waste reuse
8.3 Previous treatment and transfer of solid waste
8.4 Reuse
8.5 Recycling
8.6 Composting: organic compost
8.7 Other alternatives for MSW reuse

UNIT 9 Costs and public cleaning rate, collection rate system
9.1 What a public service is
9.2 What is a tax
9.3 Why is important to pay taxes
9.4 Who benefits from paying taxes
9.5 Simplified costing estimation
9.6 Financing mechanisms

UNIT 10. Human Resources in solid waste management
10.1 Workers health and safety
10.2 Prevention of accidents and occupational diseases

UNIT 11. Participation of population
11.1 Environmental Education and participation of population
11.2 Definition and importance of citizen participation
11.3 Conflict Resolution through non conventional means

B.2 Procurement of a supervisionvehicle (van or lineal motorcycle)
C. Costing services,establishing taxes, collection
C.1 Procurement of computing equipment
C.2 Training for administrative and financial personnel

Workshop on administrative management
Workshop on financial management

C3.Implementation of a costing system
-Direct cost: labor, materials, depreciation, other costs, variable costs
-Indirect costs: indirect labor, materials
-Fixed costs

Implementation of a costing computing service to manage solid waste and collection

Parameters to consider to elaborate a program are the following

-Registration form
Date and time
Registration of expenses
Concept
Field and type of expense
Detail
Amount
Price
Type of expense
-Data entry in format provided by MEF Management
-Set-up and printing options

C4. Elaboration of database of taxpayers to establish taxes

Revision and updating of taxpayers´ database

From the existing information, technical field revisions will take place for each property identified in the land registry in order to identify the following variables:

-Address
-Name of owner
-Property use: household, trade, household and trade, public institution, plot of land with no buildings, non defined use and others.
-Length of façade
-Extension variation compared to map
-Total area and built area

Systematization and process of information

Program of taxpayers management

This is a database computing program to administer the information of each taxpayer, so thatidentifies, counts and classifies them according to identified properties in the stage of gathering information.

An Access or SQL database and a database program must be created to set up the system to administer taxpayers. Said program must be able to show thefollowing information in printing cards:

-Administration and user password
-Identification card per property

Property code (self generated)
Taxpayer name
Address
Total area and built area
Length of façade
Use of property
Debt from property
Registration of payments (date and amount)
Current status of debt
Observations from claims
Status of claim
-Quantification of use, area, default and façade length
-Classification of use, area, default and façade length
-Registration and storage of new data

Payments done: date, amount and definition
Changes in registration card
-Creation of new registration cards of properties
-Printing options of registration card and results report

Training on program management

Train administration personnel how to manage the taxpayer management program in order to ensure proper operation during implementation and operation.

C5. Desing of a strategic plan to increase tax collection
The strategies to improve collection are two-fold: municipality and beneficiaries

The first one has a quick impact, whereas the second one is related to cultural aspects, and it requires a medium and long term to implement.

A combination of both strategies will offer better results regarding collection and will ensure the results throughout the life cycle of the project, beyond the project design.

In order to achieve this goal, a specialist consultant will be hired to design these strategiesin the investment stage. Among the internal measures, we can mention, without limiting to, the following measures:

- Write a base line of diagnose on tax collection
- Make sure the bills are sent to each household early enough so that citizens can schedule the payment.
- Staple together the public cleaning service invoice, with the invoice of another tax (even if there is no connection among the
- Update taxpayers database
- Set up agreements or extend the existing ones with the different financial organizations so that they collect taxes and payment is made easy to the neighbor.
- Take advantage of the Municipal Modernization Plan (PMM) and Incentives Plan for Municipal Management –IP- to update the land registry, implement tax software, train staff on how to use such software and implement basic equipment.
- Proper legal framework to promote proper solid waste management and sanctions for those who don't.
- Establish minimal criteria and parameters to allocate tax, observing Constitutional Tax judgments.
- Establish efficient procedures to collect taxes, split of taxpayers portfolio, split of current debt and accrued debt, and establishing a clear collection stage.
- Implement collectionsystem door to door, includes the following items.

C6. Design of a follow up tax collection system
The aim is to have a register of taxpayers that pay on due date, and those who are not paying. According to this register, personnel in charge of tax collection will take measures so that people pay.

(6) **Component 6.** Practices aimed at population

A. MUNICIPAL COMMUNICATION STRATEGIES

Six strategies are proposed, description of actions of each activity, which will be included in all perfils of the projects. Then, each project will take into account the socio cultural features, access to media. Every strategy is based on the objectives set and must be included in a communication, education and environmental awareness plan aimed at the population.

Regarding activities and costs incurred by the above mentioned strategies, this will vary depending on the project, importance in connection with activities and availability of media to achieve said objectives.

In order to apply the strategies, media such as radio, television, leaflets, flyers, banners will be used, and also training and awareness workshops for the population.

A.1.1 Draft of Communication Plan to include Project Strategies

This will support the planning of all communication, education and environmental awareness activities of the project. The following activities are suggested:

A.1.1.1. Consultancy to design the Communication Plan of the Project

An individual or team will be hired to draft the communication plan of the project. The plan will include at least an analysis or public study, a CAC study (knowledge, attitudes and habits), and a media consumption survey.

A.1.1.2 Consultancy to implement the communication plan of the project in the pilot area

An individual will be hired to implement the communication plan of the project.

A.1.2 Information and Awareness strategy on the project-pilot area

This will solve any doubts or misconception the population may have regarding the project, aand will help to spread the features and benefits for the health. The following actions are proposed to comply with this strategy.

A.1.2.1 Printing environmental awareness bulleting

This activity will disseminate information, benefits of the project to the target population (authorities, population living nearby the work and the pilot area).

A.1.2.2 Radio Jingle (melody or song for the project)

Compose a catchy song that conveys the features and benefits of the project. This tries to build trust in the relationship project-population.

A.1.2.3 Model and 3D of the sanitary landfill

The purpose is to provide audiovisual and physical material of the civil engineering of the project. This will have an impact on the people regarding importance of the works.

The static model will show features of the project, and the animation will be used for other audiovisual material.

A.1.2.4 Printing of Project Banner

The banner of the project will be used in the meetings or at event when people will attend.

A.1.2.4 Jingle of project

Advertisement on most important local radio stations to inform the project has started.

A.1.2.5 Press Conference to Launch the Project

An event will be organized to gather all authorities and stakeholders; this will enforce trust on population. At the event, future interviews can be arranged with local media to provide more information on the project.

A.1.3 Strategy to Foster Good Practices at Schools

This strategy will increase or improve the knowledge, social and environmental awareness to promote a positive attitude at schools regarding solid waste. Thus, efficiency of collection and transportation of generated waste will be achieved. So, population will be informed and adopt new habits regarding solid waste management. The strategy will be implemented at primary and secondary level,and then to other courses. The implementation of the strategy must be coordinated with the school authorities, Regional Education Directorate (DRE) and the corresponding Local Education Management Unit (UGEL after its name in Spanish) to guarantee the correct execution of the strategy and meets the educational goals and objectives.

Different activities will be implemented, such as workshops, lectures, educational visits in the classroom, coordination with administrative workers, etc.

It is recommended to use the videos from other strategies as training material.

Coordination and monitoring volunteers will be trained through talks, since they are only a few.

A.1.3.1 Design and printing of training material for schools

Strengthen the information delivered during talks and workshops held for the selected members of the school. The information included in the documents will inform participants on procedures and duties to follow so that the school can implement good solid waste management practices.

A.1.3.2 Waistcoats for field coordinators

Waistcoats will identify field workers that will coordinate and supervise the strategy is implemented in public institutions.

A.1.33 T-Shirts and/or aprons for volunteer teams

This will identify the teachers, parents, administrative workers and students that coordinate within the school.

A.1.3.4 Preparation of calendar/planner for the classroom

This element will enforce information and strategy awareness in the classroom, and will also be used as a calendar/planner for the activities performed during the campaign.

A.1.3.5. Awareness and training workshops for all selected teaching community

The training will be held at the school and will include teachers, administrative workers, parents and students that apply the strategy.

The workshop will train on issues such as responsibilities and tasks to implement at work, transferringknowledge to their colleagues.

A.1.3.6 Interschool contest to reward those who obtain best results at solid waste management at the school

This will motivate healthy competitiveness among schools participating in the pilot experience. The pilot program will evaluate the performance and applicationof procedures. A the end of the test period, the winner will be chosen.

A.1.3.8 Monitoring of Strategy

The purpose is to monitor the strategy and identify problems, obstacles to successfully correct such problems. It is important the participation of volunteers,perhaps young students of local institutes or universities. They will teach and monitor in the classroom.

A.1.4 Strategy to implement pilot plan of good practices on solid waste management with population in public spaces and households

This will foster new habits on the population so that the pilot program is successful.

Practices aimed at population are related to solid waste management: meet collection services, segregate at home, not throw waste in public spaces, reduce waste. The activies mentioned below are recommended.

A.1.4.1 Printing of training material, guides for people to be used at home

The graphic material will reinforce the information from talks or workshops done with people at their homes.

The graphic information will guide participants on good practices to be carried out at home.

A.1.4.2 Procurement and Distribution of labeledpolyethylene bags identifying the project

Bags will be handed in to inhabitants of the pilot area where segregation at source will be carried out. Then, plastic bags will be picked up by municipal service.

A.1.4.3 Production of video-guide of good practices for the population

The vide will show, guide and teach population on good practices to be performed by the family at home so that the strategy is successful.

It is recommended to shoot the video in local areas, with local people to have more impact.

A.1.4.4 Awareness spot for the radio

3 spots will be created for the radio stations. The messages will be different and will last for three months.

The first on will explain the importance of participation of people. The second one will foster habits people have to include in their houses and public areas. The third one will inform on the progress of the strategy and will also motivate.

This activity will also include a campaign on the local media and will use leading public figures (actors, sports people, technical, political and social leaders so that they spread benefits and features of the project.

A.1.4.5 Spread of awareness spot

Hire advertisement spots in local radio stations, such as journalism or music program.

A.1.4.6 Shooting and dissemination of car mounted megaphoning spot

The purpose is to use local media to inform on callings for population so that they can attend the project activities..

A.1.4.7 Home calendar/planner

This will reinforce the information and awareness of the strategy at home, and will be used as a calendar/planner of activities to be executed.

A.1.4.7 Panel elaboration and installation,information murals

The purpose is to inform and spread habits of people to be implemented at home and public places. It is better to implement them in places with high transit of people, such as markets, commercial areas, bus stops, etc.

A.1.4.8 Waistcoat for household monitors

Waistcoats will identify volunteers at households of people where the pilot program will be implemented.

A.1.4.9 Information and awareness talks aimed at population in the pilot area

A video will be shot using an engaging technique, which promotes the use of the video to inform and raise awareness. This task will be done at each neighborhood, street or block chosen to implement the pilot project. The video will allow people participate and give their opinions

A.1.4.10 Instruction and monitoring

Monitor activities at participants households.This will allow to properly follow up practices. Volunteers will be provided with an evaluation sheet to verify in situ. Based on the results, the winner will be selected.

A.1.4.11 Contest between neighborhoods or streets called Clean and Ecoefficient Neighborhood

Acknowledge and reward the effort and adoption of new practices among population in the pilot area. The event will allow to exchange ideas and experiences to be followed.

Each neighborhood will be have a committee and will register in the contest. Theneighborhoods will be monitored and evaluated and best practices will be awarded with the municipal certification of Clean and Ecoefficient Neighborhood. If practices are not maintained, the certification will be lost. To motivate people, they can obtain benefits that can be implemented by the municipalities.

A.1.5 Strategy to raise awareness and promote service payment among population

Aim is to promote among users payment culture regarding the service with or without project so that default is decreased.

A.1.5.1 Production and dissemination of radio spot (including journalism campaign)

The message will explain to population how important is to pay municipal service and new mechanism to apply it.

This activity must be reinforced by a public campaign on local journalism programs, so that public leading figures will be used to explain benefits and features of the project.

The project will be broadcasted in the three most important local radio stations and at prime time, such as information or music programs.

A.1.5.2 Informative banners to inform on the routes

Promote the service payment and inform on routes, timeTable s and payment places. Banners should be placed in high traffic areas, such as markets, bus stops and entrance door of municipalities.

A.1.6 Orientation strategy to formalize waste pickers and companies selling solid waste

The strategy wants to promote organization of people that want to segregate household solid waste in public areas and companies receiving or selling waste in the cities. Those people will be informed on benefits and important of formalization.

A.1.6.1 Printing of formalization guide

People attending talks at the municipality or at field work will receive a guide so that they know the procedures to be formalized. This is a procedure manual and supporting material to carry out the field work.

A.1.6.2 Identification and orientation field work

Contact people that can not attend a talk in a fixed place. They will receive a field orientation. This activity wants to reach the largest possible number of people involved in segregation in public places. It is important that regional and local governments build capacity and promote communication, education and environmental awareness components.

B. STRATEGY OF MINISTRY COMMUNICATION

The program is the executing unit and will use complementary communication strategies. In that sense, there is an additional cost of S/. 435 000. The proposal is attached as an annex to be reviewed.

4.5.1 Action Program

The actions included in the program have been planned and scheduled for the timeframe of the execution, implementation. Each of the items of the program is included here with its corresponding estimated time in months.

Table 4.5-15 Program of Investment Actions

Ítem	ACTIVITY-INVESTMENT	TIME IN MONTHS
1	**PROPER STORAGE AND SWEEPING**	**4**
1,1	Storage equipment	4
1,2	Sweeping equipment	4
2	**EFFICIENT OPERATIONAL CAPACITY OF COLLECTION AND TRANSPORTATION**	**24**
2,1	Equipment for collection and transportation	8
2,2	Safety tools for collection and transportation	4
3	**PROPER REUSE**	**18**
3,1	Reuse Infrastructure for Inorganic Waste Treatment	18
3,2	Reuse Infrastructure for Organic Waste Treatment	18
4	**PROPER FINAL DISPOSAL**	**24**
4,1	Final Disposal Infrastructure	22
4,2	Final Dispotal Equipments	5
4,3	External Access Path	14
5	**EFFICIENT TECHNICAL MANAGEMENT ADMINISTRATIVE, ECONOMICAL, AND FINANTIAL OF THE SERVICE.**	**17**
5.1	Sufficient Management capacity specialized in the service	
5.2	Trained Staff and strengthened supervision and monitoring of the service	
5.3	Appropriate Cost Service System, determination of the Municipalities taxes and monitoring	17
6	**APPROPRIATE PRACTICES FOR THE POPULATION IN THE SOLID WASTE MANAGEMENT**	**17**
6,1	Sufficient enviromental educational plans	17
6,2	Strengthened payment culture per public cleaning service	17
7	GESTIÓN ADMINISTRATIVA Y TÉCNICA DEL PROGRAMA	6
7.1	Implementación de la unidad ejecutora	6

Source: Own elaboration

Table 4.5-16 Program of Post Investment Actions

ITEM	POST-INVESTMENT ACTIVITES	TIME IN YEARS
8	OPERATION OF EXECUTING UNIT	4
9	OPERATION AND MAINTENANCE OF STORAGE AND SWEEPING	10
10	OPERATION AND MAINTENANCE OF COLLECTION AND TRANSPORTATION	10
11	OPERATION AND MAINTENANCE OF REUSE	10
12	OPERATION AND MAINTENANCE OF FINAL DISPOSAL	10
13	BUILDING CAPACITIES	10

4.6 COSTS ANALYSIS

Cost analysis is developed in order to provide a cost summary incurred by throughout the program. It is important to detail the expenses during the investment, reinvestment, operation and maintenance stages.

4.6.1 Investment costs at market prices

Investment costs at market price, with finance from IDB with a counterpart of S/. 53 798.633, whereas investment from JICA is S/. 192 891.234 Said investment will be executed during year 0 or year of investments, and the total amount of the investments is S/. 246 689 867.

The project includes some reinvestment during the horizon of evaluation of the project in order to replace vehicles (such as compactor trucks, hopper truck, trimovils, etc) or equipment whose life cycle is due, to increase composting area of increase number of trenches for final disposal.

Investment costs are shown in the following charts:

Table 4.6-1 Investment Cost at Market Price

Nº	PROJECT	DIRECT COST	GENERAL EXPENSES (% OF THE COST´S WORK)	PROFIT (%OF THE COST´S WORK)	TECHNICAL FILE (% OF THE DIRECT COST)	SUPERVISION AND LIQUIDATION OF THE DIRECT COST)	TOTAL
1	IDB - DISTRICT MUNICIPALITY OF CHANCAY	5,136,183			456,793	560,341	**6,153,317**
2	IDB - DISTRICT MUNICIPALITY OF POZUZO	2,083,553	129,046	129,046	83,339	104,174	**2,529,158**
3	IDB- DISTRICT MUNICIPALITY OF OF YAUYOS	1,239,323	84,807	84,807	49,573	61,966	**1,520,476**
4	IDB - PROVINCIAL MUNICIPALITYOF BAGUA - LA PECA	4,631,496	244,169	244,169	185,260	231,575	**5,536,669**
5	IDB - PROVINCIAL MUNICIPALITY OF HUAMANGA	15,426,719	652,837	652,837	771,336	771,336	**18,275,065**
6	IDB - PROVINCIAL MUNICIPALITY OF OXAPAMPA	4,074,826	179,653	179,653	162,980	203,723	**4,800,835**
7	IDB- DISTRICT MUNICIPALITY OF SAN JUAN BAUTISTA	7,683,408	318,119	318,119	384,170	384,170	**9,087,988**
8	IDB- PROVINCIAL MUNICIPALITY OF ANDAHUAYLAS	4,850,213	304,196	304,196	194,009	242,511	**5,895,125**
	TOTAL IDB	**45,125,721**	**1,912,828**	**1,912,828**	**2,287,460**	**2,559,796**	**53,798,633**
9	JICA - DISTRICT MUNICIPALITY OF NUEVO CHIMBOTE	7,892,562	219,130	219,130	394,628	394,628	9,120,079
10	JICA - DISTRICT MUNICIPALITY OF SANTIAGO	2,320,854	116,325	116,325	116,043	116,043	2,785,590
11	JICA - PROVINCIAL MUNICIPALITYOFAYMARAES - CHALHUANCA	1,808,905	101,803	101,803	90,445	90,445	2,193,401
12	JICA - PROVINCIAL MUNICIPALITYOFAZANGARO	2,007,433	141,798	141,798	100,372	100,372	2,491,772
13	JICA - PROVINCIAL MUNICIPALITY OF CHACHAPOYAS	4,066,952	168,228	168,228	203,348	203,348	4,810,104
14	JICA - PROVINCIAL MUNICIPALITYOFCHINCHA - CHINCHA ALTA	4,789,288	234,036	234,036	239,464	239,464	5,736,289
15	JICA - PROVINCIAL MUNICIPALITY OF FERREÑAFE	4,712,075	205,316	205,316	235,604	235,604	5,593,914
16	JICA - PROVINCIAL MUNICIPALITYOFHUACHO	8,466,268	299,592	315,890	411,000	411,000	9,903,751
17	JICA - PROVINCIAL MUNICIPALITY OF HUANUCO	10,382,110	348,698	398,537	504,354	504,354	12,138,053
18	JICA - PROVINCIAL MUNICIPALITY OF MOYOBAMBA	6,823,845	314,592	341,390	335,909	335,909	8,151,646
19	JICA - PROVINCIAL MUNICIPALITY OF PAITA	5,258,489	222,381	234,747	273,000	273,000	6,261,616
20	JICA - PROVINCIAL MUNICIPALITY OF PIURA	19,022,595	735,708	868,970	934,900	934,900	22,497,073
21	JICA - PROVINCIAL MUNICIPALITYOFPUNO	10,311,951	396,565	428,296	490,000	490,000	12,116,812
22	JICA - PROVINCIAL MUNICIPALITY OF SAN MARTIN - TARAPOTO	9,961,077	307,592	356,248	473,500	473,500	11,571,917
23	JICA - PROVINCIAL MUNICIPALITYOFSAN ROMAN - JULIACA	15,096,424	437,015	665,437	731,400	731,400	17,661,676
24	JICA - PROVINCIAL MUNICIPALITY OF SECHURA	5,046,679	199,275	216,437	306,700	306,700	6,075,791
25	JICA - PROVINCIAL MUNICIPALITY OF SULLANA	10,092,337	314,592	357,848	475,500	475,500	11,715,777
26	JICA - PROVINCIAL MUNICIPALITYOFTALARA - PARIÑAS	7,837,251	182,275	205,551	371,500	371,500	8,968,077
27	JICA- PROVINCIAL MUNICIPALITYOFABANCAY	4,968,067	166,778	166,778	248,403	248,403	5,798,430
28	JICA- PROVINCIAL MUNICIPALITY OF ILAVE	2,510,489	144,711	144,711	125,524	125,524	3,050,959
29	JICA- PROVINCIAL MUNICIPALITYOFTAMBOPATA	8,461,397	226,797	387,480	406,500	406,500	9,888,674
30	JICA- PROVINCIAL MUNICIPALITYOFTARMA	4,586,536	168,873	168,873	229,327	229,327	5,382,935
31	JICA - PROVINCIAL MUNICIPALITYOFTUMBES	7,749,755	222,275	242,062	381,402	381,402	8,976,897
TOTAL JICA		**164,173,340**	**5,874,356**	**6,685,891**	**8,078,823**	**8,078,823**	**192,891,234**
TOTAL		**209,299,062**	**7,787,184**	**8,598,720**	**10,366,283**	**10,638,619**	**246,689,867**

Table 4.6-2 Reinvestment Costs at Market Prices

Nº	PROJECT	DIRECT COST	GENERAL EXPENSES (% OF COST OF WORK)	PROFIT (% OF COST OF WORK)	Technical File (% OF DIRECT COSTS)	SUPERVISION (% OF DIRECT COST)	TOTAL
1	IDB - DISTRICT MUNICIPALITY OF CHANCAY	4,141,541			415,266	509,401	5,066,208
2	IDB - DISTRICT MUNICIPALITY OF POZUZO	1,968,077	86,155	86,155	70,062	87,577	2,298,026
3	IDB- DISTRICT MUNICIPALITY OF OF YAUYOS	1,036,291	71,147	71,147	41,452	51,815	1,271,850
4	IDB - PROVINCIAL MUNICIPALITYOF BAGUA - LA PECA	3,269,291	172,355	172,355	130,772	163,465	3,908,237
5	IDB - PROVINCIAL MUNICIPALITY OF HUAMANGA	12,182,831	548,383	548,383	609,142	609,142	14,497,880
6	IDB - PROVINCIAL MUNICIPALITY OF OXAPAMPA	3,374,401	150,901	150,901	142,635	178,294	3,997,132
7	IDB- DISTRICT MUNICIPALITY OF SAN JUAN BAUTISTA	6,236,181	267,220	267,220	311,809	311,809	7,394,240
8	IDB- PROVINCIAL MUNICIPALITY OF ANDAHUAYLAS	4,746,808	241,063	241,063	160,277	200,347	5,589,558
	TOTAL IDB	**36,955,420**	**1,537,224**	**1,537,224**	**1,881,415**	**2,111,849**	**44,023,131**
9	JICA - DISTRICT MUNICIPALITY OF NUEVO CHIMBOTE	6,412,481	184,070	184,070	320,624	320,624	7,421,868
10	JICA - DISTRICT MUNICIPALITY OF SANTIAGO	1,868,663	97,713	97,713	93,433	93,433	2,250,956
11	JICA - PROVINCIAL MUNICIPALITYOFAYMARAES - CHALHUANCA	1,623,634	85,514	85,514	81,182	81,182	1,957,026
12	JICA - PROVINCIAL MUNICIPALITYOFAZANGARO	1,666,187	99,357	99,357	83,309	83,309	2,031,520
13	JICA - PROVINCIAL MUNICIPALITY OF CHACHAPOYAS	3,307,166	141,312	141,312	165,358	165,358	3,920,507
14	JICA - PROVINCIAL MUNICIPALITYOFCHINCHA - CHINCHA ALTA	3,950,324	196,590	196,590	197,516	197,516	4,738,537
15	JICA - PROVINCIAL MUNICIPALITY OF FERREÑAFE	3,810,646	172,465	172,465	190,532	190,532	4,536,642
16	JICA - PROVINCIAL MUNICIPALITYOFHUACHO	6,881,092	251,657	265,348	345,240	345,240	8,088,577
17	JICA - PROVINCIAL MUNICIPALITY OF HUANUCO	8,359,694	292,906	334,771	423,657	423,657	9,834,686
18	JICA - PROVINCIAL MUNICIPALITY OF MOYOBAMBA	5,501,185	264,257	286,767	282,164	282,164	6,616,538
19	JICA - PROVINCIAL MUNICIPALITY OF PAITA	4,290,866	186,800	197,188	229,320	229,320	5,133,493
20	JICA - PROVINCIAL MUNICIPALITY OF PIURA	15,359,336	617,995	729,935	785,316	785,316	18,277,897
21	JICA - PROVINCIAL MUNICIPALITYOFPUNO	8,257,907	333,115	359,769	411,600	411,600	9,773,990
22	JICA - PROVINCIAL MUNICIPALITY OF SAN MARTIN - TARAPOTO	8,085,321	258,377	299,248	397,740	397,740	9,438,426
23	JICA - PROVINCIAL MUNICIPALITYOFSAN ROMAN - JULIACA	12,382,602	367,093	558,967	614,376	614,376	14,537,413
24	JICA - PROVINCIAL MUNICIPALITY OF SECHURA	4,116,600	167,391	181,807	257,628	257,628	4,981,054
25	JICA - PROVINCIAL MUNICIPALITY OF SULLANA	8,192,010	264,257	300,592	399,420	399,420	9,555,700
26	JICA - PROVINCIAL MUNICIPALITYOFTALARA - PARIÑAS	6,365,044	153,111	172,663	312,060	312,060	7,314,937
27	JICA- PROVINCIAL MUNICIPALITYOFABANCAY	4,024,253	140,094	140,094	201,213	201,213	4,706,866
28	JICA- PROVINCIAL MUNICIPALITY OF ILAVE	2,009,211	121,557	121,557	100,461	100,461	2,453,247
29	JICA- PROVINCIAL MUNICIPALITYOFTAMBOPATA	6,893,404	190,510	325,483	341,460	341,460	8,092,317
30	JICA- PROVINCIAL MUNICIPALITYOFTARMA	3,722,760	141,853	141,853	186,138	186,138	4,378,742
31	JICA - PROVINCIAL MUNICIPALITYOFTUMBES	6,295,869	186,711	203,332	309,829	309,829	7,305,570
	TOTAL JICA	**133,376,256**	**4,914,706**	**5,596,396**	**6,729,576**	**6,729,576**	**157,346,510**
	TOTAL	**170,331,676**	**6,451,930**	**7,133,620**	**8,610,991**	**8,841,425**	**201,369,641**

4.6.2 Costs of the Executing Unit

The following chart shows the operation cost of the UEP during the first stage of the Program, with a duration of 4 years (48 months)

Table 4.6-3 Costs of the Executing Unit

Nº	CONCEPT	AMOUNT (S/.)	AMOUNT (US$) *
1	Individual Consultancy Services: Consultants of the UEP	7,632,000	2,725,714
2	Goods: UEP equipment	209,720	74,900
3	Operating Expenses–basic services, rent, travel tickets, per diem	1,248,640	445,943
4	Consultancy services: administrative , financial audits, evaluation studies (midterm and final studies)	435,000	155,357
5	Consultancy Services: Administrative and financial audits, and evaluation studies (mid term and final)	2,485,000	887,500
TOTAL AMOUNT		**12,010,360**	**4,289,414**

Summary:

1. Cost of local professional fees
2. Procurement of personal computers, desk, chairs, telephone line, file and other inputs (stapler, waste bin and others) for each of the positions, as well as the general equipment of the office (multimedia proyector, printer and photocopying machine, van, meeting Table and chairs, ecran, travel notebooks, etc.
3. Includes service expenses (wáter, electricity, telephone), aswell as premises rent and coordination travels, supervision scheduled to visit the municipality once a year.
4. Includes the costs to implement communication strategies to disseminate activities performed in the project, including environmental education.

4.6.3 International Assistance and Monitoring

In accordance with international standards set by JICA/IDB for abroad operations, every international project financed by the international cooperation, requires assistance during the execution of the project. In this case, an international consultancy company that supports the executing unit in the technical and administrative processes for a better performance of the project. Said company will report directly to local office of JICA/IDB and will inform on progress, problems, compliance of schedules and general performance of the project.

The estimated costs to hire consultancies are S/. 15 952 400, or US$ 5 697.286, and are part of the costs to be financed by the project. JICA will finance U$S 5 223.000and IDB S/. 474.286

Table 4.6-4 Assistance and International Supervision Costs

Attendance and supervision	Total rate ($)	Total rate (S/.)
International Consultancyfinanced by JICA (Consultants and support staff)	5,223,000	14,624,400
International Consultancy financed by BID (Consultants and support staff)	474,286	1,328,000
Total cost of international attendance and supervision	**5,697,286**	**15,952,400**

Generally, the consulting teamwill assist and supervise and will be formed by a head of team, a specialist in technical issues and a specialist in administrative issues. However, it is important to have an expert in different areas for short periods of time, so it is important to have a senior expert (for a period of one year/consultant through the Project, whose executing and closing is scheduled in four years' time), so that the specialized services of a consultant can be hired timely. Usually, consulting team is formed by four experts and administrative supports, who work in the offices of the project .

At the same time, considering that said experts will travel (usually together with the Peruvian team), travel expenses, per diem and local transportation are considered, as well as normal expenses due to office equipment and operation expenses.

4.6.4 Total Investment Costs of the Program

The following chart shows the consolidated expenses needed to implement each Project, the cost to implement and execute the executing unit for 4 years and assistance and international supervision costs that will take place in 4 fours.

Table 4.6-5 Total investment costs of the program

SUMMARY OF PROGRAM COSTS		
FIELD	**AMOUNTS (S/.)**	**AMOUNTS ($)**
1. COST OF PROJECT	**245,635,300**	**87,726,893**
Direct Cost	208,326,372	74,402,276
General Expenses (% of cost of works)	7,934,249	2,833,660
Profit (% of cost of works)	8,501,451	3,036,232
Technical file (% of direct cost)	10,323,283	3,686,887
Supervision (% of direct cost)	10,549,945	3,767,838
2. COST OF THE EU	**12,010,360**	**4,289,414**
Individual consultants: UEP consultants	7,632,000	2,725,714
Goods: UEP equipment	209,720	74,900
Operating Expenses –Basic services, rents,tickets, allowance	1,248,640	445,943
Strategies of social and environmental communication	435,000	155,357
Consultancy services: administrative, financial audits and evaluation studies (midterm and final)	2,485,000	887,500
3. COSTS OF ASSISTANCE AND INTERNATIONAL SUPERVISION -JICA	**14,624,400**	**5,223,000**
4. COSTS OF ASSISTANCE AND INTERNATIONAL SUPERVISION -BID	**1,328,000**	**3,718,400**
TOTAL COSTS OF INTERNATIONAL SUPERVISION	**15,952,400**	**5,697,286**
TOTAL COSTS	**273,598,059**	**97,713,593**

4.6.5 Operation Costs at Market Price

To manage the whole program, so that all tasks planned during the time frame of the program (10 years), it has been decided that the current initial amount is S/. S/. 57 261 435, as the following chart shows:

Table 4.6-6 Operation Costs at Market Prices

Nº	PROJECT	1	2	3	4	5	6	7	8	9	10	TOTAL
1	BID – DISTRICT MUNICIPALITY OF CHANCAY	1,234,960	1,275,843	1,318,173	1,390,580	1,435,962	1,482,941	1,581,300	1,631,674	1,683,828	1,737,847	14,773,108
2	BID - DISTRICT MUNICIPALITY OF POZUZO	619,446	655,487	655,487	655,487	655,487	655,487	655,487	655,487	655,487	655,487	6,518,829
3	BID - DISTRICT MUNICIPALITY OF YAUYOS	772,506	772,506	772,506	772,506	772,506	772,506	772,506	772,506	772,506	772,506	7,725,060
4	BID - DISTRICT MUNICIPALITY OF BAGUA - LA PECA	735,072	735,072	735,072	735,072	735,072	735,072	735,072	735,072	735,072	735,072	7,350,720
5	BID - DISTRICT MUNICIPALITY OF HUAMANGA	3,035,719	3,035,719	3,035,719	3,060,557	3,186,557	3,423,369	3,461,525	3,461,525	3,461,525	3,499,703	32,661,918
6	BID - DISTRICT MUNICIPALITY OF OXAPAMPA	1,112,496	1,112,496	1,112,496	1,112,496	1,112,496	1,112,496	1,112,496	1,112,496	1,112,496	1,181,260	11,193,724
7	BID- DISTRICT MUNICIPALITY OF SAN JUAN BAUTISTA	2,847,289	2,847,289	2,847,289	2,859,789	2,859,789	2,975,299	2,975,299	2,975,299	2,975,299	2,975,299	29,137,939
8	BID- PROVINCIAL MUNICIPALITY OF ANDAHUAYLAS	35,846	35,846	35,846	35,846	35,846	35,846	35,846	35,846	35,846	35,846	358,460
	TOTAL BID	**10,393,334**	**10,470,258**	**10,512,588**	**10,622,332**	**10,793,715**	**11,193,016**	**11,329,531**	**11,379,905**	**11,432,059**	**11,593,020**	**109,719,758**
9	JICA DISTRICT MUNICIPALITY OF NUEVO CHIMBOTE	1,981,960	1,981,960	2,057,259	2,097,488	2,097,488	2,303,221	2,329,575	2,329,575	2,329,575	2,369,106	21,877,207
10	JICA - DISTRICT MUNICIPALITY OF SANTIAGO	320,300	320,300	320,300	329,355	329,355	394,415	394,455	394,455	394,455	394,515	3,591,906
11	JICA – PROVINCIAL MUNICIPALITY OF AYMARAES - CHALHUANCA	318,739	318,739	318,739	318,789	318,789	327,746	327,766	327,766	327,766	337,231	3,242,068
12	JICA - PROVINCIAL MUNICIPALITY OF AZANGARO	519,848	519,848	519,848	519,848	519,848	571,261	571,261	571,261	571,261	571,261	5,455,547
13	JICA - PROVINCIAL MUNICIPALITY OF CHACHAPOYAS	804,201	804,201	848,090	857,945	857,945	914,452	924,241	924,241	924,241	943,721	8,803,278
14	JICA - PROVINCIAL MUNICIPALITY OF CHINCHA - CHINCHA ALTA	2,232,078	2,232,078	2,313,285	2,383,206	2,383,206	2,616,244	2,655,490	2,655,490	2,655,490	2,668,029	24,794,596
15	JICA - PROVINCIAL MUNICIPALITY OF FERREÑAFE	872,506	872,506	954,365	954,471	954,471	1,034,480	1,044,190	1,044,190	1,044,190	1,044,250	9,819,619
16	JICA - PROVINCIAL MUNICIPALITY OF HUACHO	2,646,926	2,646,926	2,724,444	2,915,067	2,915,067	3,178,418	3,192,697	3,192,697	3,192,697	3,235,634	29,840,575
17	JICA - PROVINCIAL MUNICIPALITY OF HUANUCO	1,779,531	1,779,531	1,835,966	1,835,966	1,835,966	2,059,201	2,059,201	2,059,201	2,059,201	2,059,201	19,362,966
18	JICA - PROVINCIAL MUNICIPALITY OF MOYOBAMBA	988,796	988,796	1,055,770	1,106,418	1,106,418	1,301,235	1,319,555	1,319,555	1,319,555	1,356,034	11,862,133
19	JICA - PROVINCIAL MUNICIPALITY OF PAITA	1,411,692	1,411,692	1,472,314	1,484,498	1,585,103	1,719,786	1,744,154	1,744,154	1,744,154	1,768,522	16,086,069
20	JICA - PROVINCIAL MUNICIPALITY OF PIURA	7,377,525	7,377,525	7,450,679	7,928,553	7,928,553	8,668,725	8,851,651	8,851,651	8,851,651	8,992,720	82,279,233

Nº	PROJECT	1	2	3	4	5	6	7	8	9	10	TOTAL
21	JICA - PROVINCIAL MUNICIPALITY OF PUNO	3,567,341	3,567,341	3,619,401	3,692,045	3,692,045	3,882,124	3,991,286	3,991,286	3,991,286	4,045,659	38,039,813
22	JICA - PROVINCIAL MUNICIPALITY OF SAN MARTIN - TARAPOTO	2,214,871	2,214,871	2,277,395	2,287,380	2,287,380	2,703,817	2,723,448	2,723,448	2,723,448	2,733,473	24,889,533
23	JICA - PROVINCIAL MUNICIPALITY OF SAN ROMAN - JULIACA	4,651,645	4,651,645	4,731,718	4,968,713	4,968,713	5,268,647	5,381,068	5,381,068	5,381,068	5,497,355	50,881,642
24	JICA - PROVINCIAL MUNICIPALITY OF SECHURA	1,000,252	1,000,252	1,000,252	1,023,969	1,150,903	1,255,738	1,296,703	1,296,703	1,296,703	1,333,178	11,654,653
25	JICA - PROVINCIAL MUNICIPALITY OF SULLANA	4,389,313	4,389,313	4,453,519	4,562,713	4,562,713	4,882,389	4,934,947	4,934,947	4,934,947	5,072,193	47,116,996
26	JICA - PROVINCIAL MUNICIPALITY OF TALARA - PARIÑAS	1,946,061	1,946,061	2,039,804	2,039,804	2,039,804	2,181,952	2,181,952	2,181,952	2,181,952	2,181,952	20,921,291
27	JICA- PROVINCIAL MUNICIPALITY OF ABANCAY	1,289,018	1,289,018	1,328,388	1,328,388	1,328,388	1,419,422	1,419,422	1,419,422	1,419,422	1,419,422	13,660,311
28	JICA- PROVINCIAL MUNICIPALITY OF ILAVE	719,669	719,669	719,669	731,043	731,043	772,563	795,312	795,312	795,312	818,083	7,597,675
29	JICA- PROVINCIAL MUNICIPALITY OF TAMBOPATA	1,690,616	1,690,616	1,766,415	1,852,931	1,852,931	2,257,673	2,360,353	2,360,353	2,360,353	2,465,770	20,658,013
30	JICA- PROVINCIAL MUNICIPALITY OF TARMA	1,159,413	1,159,413	1,192,793	1,192,793	1,192,793	1,252,225	1,277,827	1,277,827	1,277,827	1,277,827	12,260,739
31	JICA - PROVINCIAL MUNICIPALITY OF TUMBES	2,985,801	2,985,801	3,052,081	3,086,936	3,086,936	3,314,868	3,399,437	3,399,437	3,399,437	3,434,292	32,145,026
	TOTAL JICA	**46,868,102**	**46,868,102**	**48,052,492**	**49,498,321**	**49,725,861**	**54,280,603**	**55,175,992**	**55,175,992**	**55,175,992**	**56,019,431**	**516,840,888**
	TOTAL	**57,261,436**	**57,338,360**	**58,565,080**	**60,120,653**	**60,519,575**	**65,473,619**	**66,505,523**	**66,555,897**	**66,608,051**	**67,612,452**	**626,560,646**

Source: Own elaboration

4.6.6 Operation Costs Of System– without Program

The operation costs of the system under the situation of "without program" include all current expenses incurred by all activities developed in each of the cities included in the program. Therefore, the current costs incurred by municipalities for the public cleaning service are shown in the chart; the costs will be similar until year 10 for analysis purposes.

Table 4.6-7 Cost of operation without Program (Nuevos Soles.)

Nº	PROJECT	1	2	3	4	5	6	7	8	9	10	TOTAL
1	BID –DISTRICT MUNICIPALITYOF CHANCAY	1,043,074	1,043,074	1,043,074	1,043,074	1,043,074	1,043,074	1,043,074	1,043,074	1,043,074	1,043,074	10,430,740
2	BID - DISTRICT MUNICIPALITYOF POZUZO	217,000	217,000	217,000	217,000	217,000	217,000	217,000	217,000	217,000	217,000	2,170,000
3	BID - DISTRICT MUNICIPALITY OF YAUYOS	163,830	163,830	163,830	163,830	163,830	163,830	163,830	163,830	163,830	163,830	1,638,300
4	BID - DISTRICT MUNICIPALITY OF BAGUA - LA PECA	367,536	367,536	367,536	367,536	367,536	367,536	367,536	367,536	367,536	367,536	3,675,360
5	BID - DISTRICT MUNICIPALITY OF HUAMANGA	1,575,634	1,575,634	1,575,634	1,575,634	1,575,634	1,575,634	1,575,634	1,575,634	1,575,634	1,575,634	15,756,340
6	BID - DISTRICT MUNICIPALITY OF OXAPAMPA	295,633	295,633	295,633	295,633	295,633	295,633	295,633	295,633	295,633	295,633	2,956,330
7	BID- DISTRICT MUNICIPALITY OF SAN JUAN BAUTISTA	1,975,309	1,975,309	1,975,309	1,975,309	1,975,309	1,975,309	1,975,309	1,975,309	1,975,309	1,975,309	19,753,090
8	BID- PROVINCIAL MUNICIPALITYOF ANDAHUAYLAS	35,740	35,740	35,740	35,740	35,740	35,740	35,740	35,740	35,740	35,740	357,400
	TOTAL BID	**5,673,756**	**5,673,756**	**5,673,756**	**5,673,756**	**5,673,756**	**5,673,756**	**5,673,756**	**5,673,756**	**5,673,756**	**5,673,756**	**56,737,560**
9	JICA DISTRICT MUNICIPALITY OF NUEVO CHIMBOTE	1,361,552	1,361,552	1,361,552	1,361,552	1,361,552	1,361,552	1,361,552	1,361,552	1,361,552	1,361,552	13,615,520
10	JICA - DISTRICT MUNICIPALITY OF SANTIAGO	103,496	103,496	103,496	103,496	103,496	103,496	103,496	103,496	103,496	103,496	1,034,960
11	JICA –PROVINCIAL MUNICIPALITYOF AYMARAES - CHALHUANCA	77,150	77,150	77,150	77,150	77,150	77,150	77,150	77,150	77,150	77,150	771,500
12	JICA - PROVINCIAL MUNICIPALITY OF AZANGARO	457,484	457,484	457,484	457,484	457,484	457,484	457,484	457,484	457,484	457,484	4,574,836
13	JICA - PROVINCIAL MUNICIPALITY OF CHACHAPOYAS	314,589	314,589	314,589	314,589	314,589	314,589	314,589	314,589	314,589	314,589	3,145,890
14	JICA - PROVINCIAL MUNICIPALITY OF CHINCHA - CHINCHA ALTA	3,209,899	3,209,899	3,209,899	3,209,899	3,209,899	3,209,899	3,209,899	3,209,899	3,209,899	3,209,899	32,098,990
15	JICA - PROVINCIAL MUNICIPALITY OF FERREÑAFE	802,495	802,495	802,495	802,495	802,495	802,495	802,495	802,495	802,495	802,495	8,024,950
16	JICA - PROVINCIAL MUNICIPALITY OF HUACHO	2,470,976	2,470,976	2,470,976	2,470,976	2,470,976	2,470,976	2,470,976	2,470,976	2,470,976	2,470,976	24,709,758
17	JICA - PROVINCIAL MUNICIPALITY OF HUANUCO	2,265,274	2,265,274	2,265,274	2,265,274	2,265,274	2,265,274	2,265,274	2,265,274	2,265,274	2,265,274	22,652,740
18	JICA - PROVINCIAL MUNICIPALITY OF MOYOBAMBA	753,637	753,637	753,637	753,637	753,637	753,637	753,637	753,637	753,637	753,637	7,536,369
19	JICA - PROVINCIAL MUNICIPALITY OF PAITA	1,594,678	1,594,678	1,594,678	1,594,678	1,594,678	1,594,678	1,594,678	1,594,678	1,594,678	1,594,678	15,946,780
20	JICA - PROVINCIAL MUNICIPALITY OF PIURA	6,774,349	6,774,349	6,774,349	6,774,349	6,774,349	6,774,349	6,774,349	6,774,349	6,774,349	6,774,349	67,743,490
21	JICA - PROVINCIAL MUNICIPALITY OF PUNO	2,350,940	2,350,940	2,350,940	2,350,940	2,350,940	2,350,940	2,350,940	2,350,940	2,350,940	2,350,940	23,509,401
22	JICA - PROVINCIAL MUNICIPALITY OF SAN MARTIN - TARAPOTO	1,482,632	1,482,632	1,482,632	1,482,632	1,482,632	1,482,632	1,482,632	1,482,632	1,482,632	1,482,632	14,826,320
23	JICA - PROVINCIAL MUNICIPALITY OF SAN ROMAN - JULIACA	2,465,724	2,465,724	2,465,724	2,465,724	2,465,724	2,465,724	2,465,724	2,465,724	2,465,724	2,465,724	24,657,240
24	JICA - PROVINCIAL MUNICIPALITY OF SECHURA	802,001	802,001	802,001	802,001	802,001	802,001	802,001	802,001	802,001	802,001	8,020,007
25	JICA - PROVINCIAL MUNICIPALITY OF SULLANA	3,588,588	3,588,588	3,588,588	3,588,588	3,588,588	3,588,588	3,588,588	3,588,588	3,588,588	3,588,588	35,885,878
26	JICA - PROVINCIAL MUNICIPALITY OF TALARA - PARIÑAS	2,961,441	2,961,441	2,961,441	2,961,441	2,961,441	2,961,441	2,961,441	2,961,441	2,961,441	2,961,441	29,614,410
27	JICA- PROVINCIAL MUNICIPALITY OF ABANCAY	951,229	951,229	951,229	951,229	951,229	951,229	951,229	951,229	951,229	951,229	9,512,290
28	JICA- PROVINCIAL MUNICIPALITY OF ILAVE	549,972	549,972	549,972	549,972	549,972	549,972	549,972	549,972	549,972	549,972	5,499,720
29	JICA- PROVINCIAL MUNICIPALITY OF TAMBOPATA	1,054,005	1,054,005	1,054,005	1,054,005	1,054,005	1,054,005	1,054,005	1,054,005	1,054,005	1,054,005	10,540,050
30	JICA- PROVINCIAL MUNICIPALITY OF TARMA	1,278,658	1,278,658	1,278,658	1,278,658	1,278,658	1,278,658	1,278,658	1,278,658	1,278,658	1,278,658	12,786,580
31	JICA - PROVINCIAL MUNICIPALITY OF TUMBES	1,639,269	1,639,269	1,639,269	1,639,269	1,639,269	1,639,269	1,639,269	1,639,269	1,639,269	1,639,269	16,392,690
	TOTAL JICA	39,310,037	39,310,037	39,310,037	39,310,037	39,310,037	39,310,037	39,310,037	39,310,037	39,310,037	39,310,037	393,100,369
	TOTAL	**44,983,793**	**44,983,793**	**44,983,793**	**44,983,793**	**44,983,793**	**44,983,793**	**44,983,793**	**44,983,793**	**44,983,793**	**44,983,793**	**449,837,929**

Source: own elaboration

4.6.7 Increasing Costs at Market Price

The increasing costs up to year 10 have been calculated in order to provide values where operation costs could increase during program intervention. That is to say, it shows a summary of the additional cost that should be paid in order to achieve a proper comprehensive management of solid waste at market prices, as the following chart shows.

Table 4.6-8 Increasing Costs at Market Prices

Nº	PROJECT	1	2	3	4	5	6	7	8	9	10	TOTAL
1	BID – DISTRITAL MUNICIPALITY OF CHANCAY	191,886	232,769	275,099	347,506	392,888	439,867	538,226	588,600	640,754	694,773	4,342,368
2	BID - DISTRITAL MUNICIPALITY OF POZUZO	402,446	438,487	438,487	438,487	438,487	438,487	438,487	438,487	438,487	438,487	4,348,829
3	BID - DISTRITAL MUNICIPALITY OF YAUYOS	608,676	608,676	608,676	608,676	608,676	608,676	608,676	608,676	608,676	608,676	6,086,760
4	BID – PROVINCIAL MUNICIPALITY OF BAGUA - LA PECA	367,536	367,536	367,536	367,536	367,536	367,536	367,536	367,536	367,536	367,536	3,675,360
5	BID - PROVINCIAL MUNICIPALITY OF HUAMANGA	1,460,085	1,460,085	1,460,085	1,484,923	1,610,923	1,847,735	1,885,891	1,885,891	1,885,891	1,924,069	16,905,578
6	BID - PROVINCIAL MUNICIPALITY OF OXAPAMPA	816,863	816,863	816,863	816,863	816,863	816,863	816,863	816,863	816,863	885,627	8,237,394
7	BID- DISTRITAL MUNICIPALITY OF SAN JUAN BAUTISTA	871,980	871,980	871,980	884,480	884,480	999,990	999,990	999,990	999,990	999,990	9,384,849
8	BID- PROVINCIAL MUNICIPALITY OF ANDAHUAYLAS	106	106	106	106	106	106	106	106	106	106	1,060
	TOTAL BID	**4,719,578**	**4,796,502**	**4,838,832**	**4,948,576**	**5,119,959**	**5,519,260**	**5,655,775**	**5,706,149**	**5,758,303**	**5,919,264**	**52,982,198**
9	JICA –DISTRITAL MUNICIPALITY OF NUEVO CHIMBOTE	620,408	620,408	695,707	735,936	735,936	941,669	968,023	968,023	968,023	1,007,554	8,261,687
10	JICA – DISTRITAL MUNICIPALITY OF SANTIAGO	216,804	216,804	216,804	225,859	225,859	290,919	290,959	290,959	290,959	291,019	2,556,946
11	JICA - PROVINCIAL MUNICIPALITY OF AYMARAES - CHALHUANCA	241,589	241,589	241,589	241,639	241,639	250,596	250,616	250,616	250,616	260,081	2,470,568
12	JICA - PROVINCIAL MUNICIPALITY OF AZANGARO	62,364	62,364	62,364	62,364	62,364	113,778	113,778	113,778	113,778	113,778	880,711
13	JICA - PROVINCIAL MUNICIPALITY OF CHACHAPOYAS	489,612	489,612	533,501	543,356	543,356	599,863	609,652	609,652	609,652	629,132	5,657,388
14	JICA - PROVINCIAL MUNICIPALITY OF CHINCHA - CHINCHA ALTA	-977,821	-977,821	-896,614	-826,693	-826,693	-593,655	-554,409	-554,409	-554,409	-541,870	-7,304,394
15	JICA - PROVINCIAL MUNICIPALITY OF FERREÑAFE	70,011	70,011	151,870	151,976	151,976	231,985	241,695	241,695	241,695	241,755	1,794,669
16	JICA - PROVINCIAL MUNICIPALITY OF HUACHO	175,950	175,950	253,468	444,091	444,091	707,442	721,722	721,722	721,722	764,659	5,130,817
17	JICA - PROVINCIAL MUNICIPALITY OF HUANUCO	-485,743	-485,743	-429,308	-429,308	-429,308	-206,073	-206,073	-206,073	-206,073	-206,073	-3,289,774
18	JICA - PROVINCIAL MUNICIPALITY OF MOYOBAMBA	235,159	235,159	302,133	352,782	352,782	547,598	565,918	565,918	565,918	602,398	4,325,764
19	JICA - PROVINCIAL MUNICIPALITY OF E PAITA	-183.508,0	-183.508,0	-122.886,0	-110.701,8	-10.097,0	124.585,6	148.954,0	148.954,0	148.954,0	173.322,4	134.069,1
20	JICA - PROVINCIAL MUNICIPALITY OF PIURA	638.921,0	638.921,0	638.921,0	1.116.600,8	1.116.600,8	1.777.446,6	1.960.520,0	1.960.520,0	1.960.520,0	2.101.635,2	13.910.606,2
21	JICA - PROVINCIAL MUNICIPALITY OF PUNO	424.343,0	421.316,0	424.378,0	424.039,0	425.269,0	424.076,0	424.451,0	424.970,0	424.489,0	754.027,0	4.571.358,0
22	JICA - PROVINCIAL MUNICIPALITY OF SAN MARTIN - TARAPOTO	694.609,2	694.609,2	694.609,2	704.594,7	704.594,7	924.994,2	944.625,2	944.625,2	944.625,2	954.650,6	8.206.537,3
23	JICA - PROVINCIAL MUNICIPALITY OF SAN ROMAN - JULIACA	2.870.890,9	2.870.890,9	2.870.890,9	3.149.729,7	3.149.729,7	3.333.731,6	3.470.085,9	3.470.085,9	3.470.085,9	3.624.063,3	32.280.184,9
24	JICA - PROVINCIAL MUNICIPALITY OF SECHURA	182.788,2	182.788,2	182.788,2	206.504,8	333.439,3	441.046,7	465.363,3	465.363,3	465.363,3	506.327,9	3.431.773,0
25	JICA - PROVINCIAL MUNICIPALITY OF SULLANA	465.499,9	477.137,4	489.065,8	501.292,5	513.824,8	708.909,6	726.632,3	744.798,2	763.418,1	782.503,6	6.173.082,2
26	JICA - PROVINCIAL MUNICIPALITY OF TALARA - PARIÑAS	-986.438,0	-986.438,0	-986.438,0	-986.438,0	-986.438,0	-894.332,5	-894.332,5	-894.332,5	-894.332,5	-894.332,5	-9.403.852,2
27	JICA- PROVINCIAL MUNICIPALITY OF ABANCAY	337.789,0	337.789,0	377.159,5	377.159,5	377.159,5	468.193,0	468.193,0	468.193,0	468.193,0	468.193,0	4.148.021,4
28	JICA- PROVINCIAL MUNICIPALITY OF ILAVE	169.473,3	169.473,3	169.473,3	180.847,6	180.847,6	222.368,0	245.116,5	245.116,5	245.116,5	267.887,9	2.095.720,6
29	JICA- PROVINCIAL MUNICIPALITY OF TAMBOPATA	1.201.852,0	1.201.852,0	1.201.852,0	1.201.852,0	1.201.852,0	1.201.852,0	1.201.852,0	1.201.852,0	1.201.852,0	1.201.852,0	12.018.520,0
30	JICA- PROVINCIAL MUNICIPALITY OF TARMA	319.073,8	319.073,8	319.073,8	319.073,8	319.073,8	378.505,8	405.607,4	405.607,4	405.607,4	405.607,4	3.596.304,5
31	JICA - PROVINCIAL MUNICIPALITY OF TUMBES	1.190.551,0	1.190.551,0	1.190.551,0	1.263.163,5	1.263.163,5	1.445.964,5	1.494.121,5	1.494.121,5	1.494.121,5	1.517.400,3	13.543.709,3
	TOTAL JICA	**8.789.495,0**	**8.798.105,5**	**9.260.959,3**	**10.518.171,0**	**10.759.472,6**	**13.988.229,9**	**14.601.327,4**	**14.620.012,2**	**14.638.151,2**	**15.831.516,4**	**121.805.440,4**
	TOTAL	**13.452.580,5**	**13.587.453,0**	**14.142.962,7**	**15.548.750,5**	**16.013.792,5**	**19.614.209,0**	**20.418.985,1**	**20.544.310,9**	**20.671.994,9**	**22.084.861,6**	**176.079.900,5**

Source: Own elaboration

The evaluation component aims at measuring the real contribution of the projects for the social welfare of the population. For that matter, social profitability, benefits must be identified and valued in each of the alternatives.

Later on, the sustainability must be analyzed, identify negative environmental impacts and mitigate them, and plan, organize the investment, operation and maintenance.

4.7 BENEFITS OF THE PROGRAM

The program will improve solid waste managementin the cities and will generate environmental, social and economic benefits.
The benefit is clear, since solid waste management are basic and essential services for the population. The service must be providedby the municipalities, so the Government understands the Program generates some benefits due to the proper solid waste management, and are stated below:

4.7.1 Environmental benefits

- Decrease of environmental pollution in the air, water and soil, due to implementing a solid waste integrated management system, from generation to final disposal.
- More conservation of natural resources, due to the reuse of some inorganic waste (paper, plastic, metals, etc) instead of using raw materials from nature.
- Maximum sustainable use of natural resources, by incorporating a solid waste percentage in the recycling process.
- Expand life cycle of sanitary landfill, by implementing waste reuse plants and dispose less waste.
- Decrease of green house effect gas (GHE), since composting process does not generate methane, and the methane produced at the sanitary landfill produces carbon dioxide, thus reducing the impact twentyfold.
- Environmental improvement due to implicit reduction of vectors and public health risk, avoiding spread of disease.
- Reduction of visual impact and odors from wrong handling and disposal of solid waste
- More chances that organic farmers use compost to improve harvest and then have a sustainable soil management
- Help to support environment for future generations

4.7.2 Social benefits

- Use intensive technologies in labor
- As a consequence of creation of employment, consumption increases and basic needs are satisfied (health, housing, education, etc)
- Reduction of risk infection of the population with diseases linked to bad waste handling, such as diarrhea, respiratory diseases, etc.
- More active tourism, since local and foreign tourists will find a clean and healthy city
- Improve employment and health conditions for public cleaning workers
- Improve formal working conditions of informal waste pickers

- Capacity building of environmental culture of population
- Improvement of public service will increase credibility of municipalities
- Cross-sector integration in solid waste management will strengthen State organizations
- Capacity building of citizens, since participation will be fostered in planning and monitoring of public service

4.7.3 Economic benefits

- Reduction of public cleaning cost since solid waste generation decreases and good management of solid waste by population.
- Reduction of expenses in families, since there will be less diseases caused by inadequate solid waste management.
- When the public cleaning service is improved (storage, sweeping, collection and transport), collection rate also increases.
- Additional income for municipalities, since final disposal service will be provided to district municipalities and/or solid waste generator included in the project
- Income from recyclable waste reuse (perhaps through a public auction), such as paper, plastic, metals, etc. So companies will have raw materials at a cheaper price and will save water and energy.
- Economic saving by using compost, produced in the reuse plant, used in the green areas of beneficiary districts.
- An option could be the creation of small recycling companies aimed at selling recovered material.
- The improvement of the public service will develop competitive cities. So, sanitary risks will decrease and will increase productivity of cities, since less man/hour will be wasted caused by the diseased above mentioned. Economy will improve, such as tourism, since cities will be clean and healthy for local and foreign tourists.

In short, it seems clear the large number of benefits from these projects, aiming at improving the wellbeing of the population.

Municipalities manage solid waste andmust cover the demand of the population by implementing better solid waste management systems An efficient management generates less monthly expenses regarding collection, transportation and sanitary landfill, which generates more money to be allocated in other municipal expenses.

Besides, the public cleaning services, including the final disposal of solid waste, like other services such as electricity, water,etc. is a basic service that really improves the developmentof the users. In that sense, taking into account the benefits granted by this services and the cost of providing such services, the municipality can charge for the service and the population must pay for the services.

4.7.4 Increasing Benefits

The net increasing benefits of theproject are obtained after comparing the indicators at the beginning and at the end of the horizon of the project to show changes, results of environmental, social and economic benefits included in the project.

- ✓ Environmental Indicators
    - Quality and purification of sewage and river waters
    - Air quality and control of greenhouse effect gas emission
    - Control of energy consumption and natural resources exploitation
    - Amount of municipal solid waste sold
    - Amount of organic solid waste treated
    - Reduction of waste generation (decrease) and improve amount of solid waste disposed in the sanitary landfill
    - Increase of green areas after using compost to improve soil
- ✓ Socio economic Indicators
    - Population can access public basic services
    - Number of cases of acute diarrheal disease and acute respiratory disease
    - Number of waste pickers registered in the Municipal Census of Waste Pickers
    - Default level of public cleaning taxes
    - Number of small size companies of solid waste
    - Population participating in programs of solid waste segregation
    - Monthly arrival of tourists to the beneficiary city

CHAPTER 5 EVALUATION

5.1 SOCIAL EVALUATION OF THE PROJECT

In order to assess the social impact of this program, the cost-effectiveness method will be used, which consists of find out the effective cost depending on the impact, although the main benefits are difficult to measure in terms of money.

5.1.1 Cost at Social Prices

In order to show the real cost of the solid waste management and know the price paid by the country, correction factors are applied (calculated by the Ministry of Economy and Finance)to some of the costs so that taxes are not included in the market prices, so that the evaluation is not distorted.

Following, it is the chart of the correction factors for each of the cost items, applied in the 31 projects included in the program. Therefore, the consolidated of the cost flow at social prices is shown in the following chart.

Table 5.1-1 Correction Factors

Corrector Factors for Social Prices (Mthodology of MEF)		
Expenditure on national goods	Value	0.84
Expenditure on imported goods	Value	0.81
Drect taxes on imported inputs 1/		
Ad valorem rate	%	12
VAT rate	%	19
Correction value on the currency		1.08
Fuel costs	Value	0.66
Indirect costs(administrative and financial cost)	Value	0.84
Consulting service (including detailed design and supervision)		
Legal person (company)	Value	0.84
Natural person	Value	0.91
Cost of skilled labor	Value	0.91
Cost of non skilled labor		
Urban metropolitan Lima	Value	0.86
Urban coast region	Value	0.68
Rural coast region	Value	0.57
Urban highland region	Value	0.6
Rural highland region	Value	0.41
Urban jungle region	Value	0.63
Rural jungle region	Value	0.49
Indirect taxes on manpower /2		
Rate of 4th. Cathegory for Non Personalized services (10%)	Value	0.91
1/ correspond to the average tax		
2/ Only include nonskilled labor if pay by recibo por honorarios (fee receipt)		
Source:General Directive of Public Investment National System,, Annex SNIP 09, Parameters of Evaluation		

5.1.2 Cost flow at social prices

Cost flow at social prices are the following:

Table 5.1-2 Flow of Social Costs-JICA IDB Investment and Reinvestments Stages

Nº	PROJECT	0	1	2	3	4	5	6	7	8	9	10	TOTAL
1	BID –DISTRITAL MUNICIPALITY OF CHANCAY	5.066.207,9		122.189,2		2.317.973,3	1.548.818,1						9.055.188,6
2	BID –DISTRITAL MUNICIPALITY OF POZUZO	2.298.026,2	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	2.298.026,2
3	BID –DISTRITAL MUNICIPALITY OF YAUYOS	1.271.849,8	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	1.271.849,8
4	BID –PROVINCIAL MUNICIPALITY OF BAGUA - LA PECA	3.908.237,2	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	3.908.237,2
5	BID –PROVINCIAL MUNICIPALITY OF HUAMANGA	14.497.880,0			3.970.854,4		5.989.543,4	4.911.126,0			47.464,4		29.416.868,1
6	BID - PROVINCIAL MUNICIPALITY OF OXAPAMPA	3.997.132,1	0,0	0,0	0,0	0,0	678.801,1	0,0	0,0	0,0	0,0	0,0	4.675.933,2
7	BID- DISTRITAL MUNICIPALITY OF SAN JUAN BAUTISTA	7,394,240			1,927,635		1,751,365	1,645,584			8,235		12,727,059
8	BID- PROVINCIAL MUNICIPALITY OF ANDAHUAYLAS	5.589.558,3	0,0	0,0	0,0	0,0	338.497,4	0,0	0,0	0,0	0,0	0,0	5.928.055,6
	TOTAL BID	**44,023,131**	**0**	**122,189**	**5,898,490**	**2,317,973**	**10,307,025**	**6,556,710**	**0**	**0**	**55,700**	**0**	**69,281,218**
9	JICA –DISTRITAL MUNICIPALITY OF CHIMBOTE	7,421,868	0	309,172	1,281,828	0	2,389,726	1,282,537	0	0	32,836	0	12,717,967
10	JICA –DISTRITAL MUNICIPALITY OF SANTIAGO	2,250,956	0	0	10,502	0	804,991	10,502	0	0	10,913	0	3,087,864
11	JICA - PROVINCIAL MUNICIPALITY OF AYMARAES - CHALHUANCA	1,894,475	0	0	13,417	0	262,029	13,417	0	0	13,347	0	2,196,686
12	JICA - PROVINCIAL MUNICIPALITY OF AZANGARO	2,031,520	0	133,366	14,530	0	317,397	16,037	0	0	15,625	0	2,528,476
13	JICA - PROVINCIAL MUNICIPALITY OF CHACHAPOYAS	3,920,507	0	307,327	16,230	0	1,627,508	16,160	0	0	17,255	0	5,904,986
14	JICA - PROVINCIAL MUNICIPALITY OF CHINCHA - CHINCHA ALTA	4,738,537	0	310,165	34,674	0	1,779,309	35,996	0	0	36,338	0	6,935,019
15	JICA - PROVINCIAL MUNICIPALITY OF FERREÑAFE	4,536,642	0	378,806	16,633	0	1,953,054	16,563	0	0	16,975	0	6,918,674
16	JICA - PROVINCIAL MUNICIPALITY OF HUACHO	8,088,577	0	437,080	1,666,946	0	1,812,107	1,733,262	0	0	41,579	0	13,779,553
17	JICA - PROVINCIAL MUNICIPALITY OF HUANUCO	9,834,686	0	319,700	1,199,890	0	2,849,115	1,558,030	0	0	25,386	0	15,786,806
18	JICA - PROVINCIAL MUNICIPALITY OF MOYOBAMBA	6,616,538	0	469,565	1,716,645	0	2,186,321	1,704,721	0	0	39,685	0	12,733,474
19	JICA - PROVINCIAL MUNICIPALITY OF PAITA	5,133,493	0	303,502	23,651	0	4,186,884	24,817	0	0	25,923	0	9,698,271
20	JICA - PROVINCIAL MUNICIPALITY OF PIURA	18,277,897	0	323,309	4,401,547	0	5,800,673	4,911,804	0	48,364	113,609	0	33,877,204
21	JICA - PROVINCIAL MUNICIPALITY OF PUNO	9,773,990	0	572,401	2,052,719	0	2,235,869	1,905,361	0	0	52,330	0	16,592,671
22	JICA - PROVINCIAL MUNICIPALITY OF SAN MARTIN - TARAPOTO	9,438,426	0	215,172	2,222,516	0	2,875,046	2,319,195	0	0	30,658	0	17,101,013
23	JICA - PROVINCIAL MUNICIPALITY OF SAN ROMAN - JULIACA	14,537,413	0	573,553	3,773,954	0	3,930,915	3,780,912	0	0	101,157	0	26,697,904
24	JICA - PROVINCIAL MUNICIPALITY OF SECHURA	4,981,054	0	0	396,113	0	1,620,644	28,530	0	0	30,791	0	7,057,132
25	JICA - PROVINCIAL MUNICIPALITY OF SULLANA	9,555,700	0	437,583	1,932,796	0	2,625,032	1,751,713	0	0	63,074	0	16,365,896
26	JICA - PROVINCIAL MUNICIPALITY OF TALARA - PARIÑAS	7,314,937	0	303,675	898,536	0	2,340,774	1,102,360	0	0	34,424	0	11,994,707
27	JICA- PROVINCIAL MUNICIPALITY OF ABANCAY	4,706,866	0	407,991	959,207	0	1,872,717	1,031,315	0	0	33,184	0	9,011,280
28	JICA- PROVINCIAL MUNICIPALITY OF ILAVE	2,453,247	0	183,537	23,785	0	591,913	24,468	0	0	25,549	0	3,302,499
29	JICA- PROVINCIAL MUNICIPALITY OF TAMBOPATA	8,092,317	0	575,644	993,011	0	3,834,936	826,963	0	0	52,049	0	14,374,919
30	JICA- PROVINCIAL MUNICIPALITY OF TARMA	4,378,742	0	384,323	26,481	0	1,976,414	31,318	0	0	31,318	0	6,828,595
31	JICA - PROVINCIAL MUNICIPALITY OF TUMBES	7,305,570	0	322,938	1,201,611	0	1,994,263	1,592,725	0	0	60,471	0	12,477,578
	TOTAL JICA	**157,283,959**	**0**	**7,268,807**	**24,877,220**	**0**	**51,867,638**	**25,718,708**	**0**	**48,364**	**904,477**	**0**	**267,969,173**
	TOTAL	**201,307,090**	**0**	**7,390,996**	**30,775,710**	**2,317,973**	**62,174,663**	**32,275,418**	**0**	**48,364**	**960,177**	**0**	**337,250,391**

Table 5.1-3 Flow of Social Costs- Post Investment Stage

Nº	PROJECT	1	2	3	4	5	6	7	8	9	10	TOTAL
1	BID – DISTRITAL MUNICIPALITY OF CHANCAY	1.037.366,4	1.071.708,1	1.107.265,3	1.168.087,2	1.206.208,1	1.245.670,4	1.328.292,0	1.370.606,2	1.414.415,5	1.459.791,5	12.409.410,7
2	BID – DISTRITAL MUNICIPALITY OF POZUZO	461.259,8	486.615,8	486.615,8	486.615,8	486.615,8	486.615,8	486.615,8	486.615,8	486.615,8	486.615,8	4.840.802,4
3	BID – DISTRITAL MUNICIPALITY OF YAUYOS	648.905,0	648.905,0	648.905,0	648.905,0	648.905,0	648.905,0	648.905,0	648.905,0	648.905,0	648.905,0	6.489.050,4
4	BID – PROVINCIAL MUNICIPALITY OF BAGUA - LA PECA	617.460,5	617.460,5	617.460,5	617.460,5	617.460,5	617.460,5	617.460,5	617.460,5	617.460,5	617.460,5	6.174.604,8
5	BID – PROVINCIAL MUNICIPALITY OF HUAMANGA	2.235.581,0	2.235.581,0	2.235.581,0	2.253.526,9	2.357.889,4	3.665.768,0	2.490.983,8	2.490.983,8	2.490.983,8	2.574.290,6	25.031.169,1
6	BID - PROVINCIAL MUNICIPALITY OF OXAPAMPA	814.893,2	814.893,2	814.893,2	814.893,2	814.893,2	814.893,2	814.893,2	814.893,2	814.893,2	814.893,2	8.148.931,6
7	BID- DISTRITAL MUNICIPALITY OF SAN JUAN BAUTISTA	1,893,877	1,893,877	1,893,877	2,411,616	2,411,616	2,513,064	2,513,064	2,513,064	2,513,064	2,513,064	23,070,182
8	BID- PROVINCIAL MUNICIPALITY OF ANDAHUAYLAS	30.110,6	30.110,6	30.110,6	30.110,6	30.110,6	30.110,6	30.110,6	30.110,6	30.110,6	30.110,6	301.106,4
	TOTAL BID	**7,739,454**	**7,799,152**	**7,834,709**	**8,431,215**	**8,573,698**	**8,875,641**	**8,930,325**	**8,972,639**	**9,016,448**	**9,145,131**	**86.236.054,0**
9	JICA – DISTRITAL MUNICIPALITY OF CHIMBOTE	1,505,509	1,505,509	1,558,104	1,586,860	1,586,860	1,727,981	1,746,760	1,746,760	1,746,760	1,774,929	19.931.316,5
10	JICA – DISTRITAL MUNICIPALITY OF SANTIAGO	250,100	250,100	250,100	256,266	256,266	299,765	299,799	299,799	299,799	299,849	2.766.653,2
11	JICA - PROVINCIAL MUNICIPALITY OF AYMARAES - CHALHUANCA	235,343	235,343	235,343	235,385	235,385	240,759	240,776	240,776	240,776	247,215	2.386.591,8
12	JICA - PROVINCIAL MUNICIPALITY OF AZANGARO	361,814	361,814	361,814	361,814	361,814	394,080	394,080	394,080	394,080	394,080	3.757.999,9
13	JICA - PROVINCIAL MUNICIPALITY OF CHACHAPOYAS	627,428	627,428	657,048	663,814	663,814	698,704	705,415	705,415	705,415	718,755	6.781.776,8
14	JICA - PROVINCIAL MUNICIPALITY OF CHINCHA - CHINCHA ALTA	1,677,626	1,677,626	1,733,957	1,785,864	1,785,864	1,959,266	1,986,906	1,986,906	1,986,906	1,995,855	18.576.776,9
15	JICA - PROVINCIAL MUNICIPALITY OF FERREÑAFE	682,228	682,228	727,167	727,254	727,254	775,293	782,297	782,297	782,297	782,348	25.287.192,0
16	JICA - PROVINCIAL MUNICIPALITY OF HUACHO	1,973,878	1,973,878	2,027,728	2,179,037	2,179,037	2,411,169	2,421,244	2,421,244	2,421,244	2,451,552	22.465.478,9
17	JICA - PROVINCIAL MUNICIPALITY OF HUANUCO	1,310,869	1,310,869	1,346,432	1,346,432	1,346,432	1,483,805	1,483,805	1,483,805	1,483,805	1,483,805	13.998.555,2
18	JICA - PROVINCIAL MUNICIPALITY OF MOYOBAMBA	758,371	758,371	804,001	841,884	841,884	973,957	986,575	986,575	986,575	1,011,675	10.641.545,1
19	JICA - PROVINCIAL MUNICIPALITY OF PAITA	1,078,940	1,078,940	1,120,997	1,129,653	1,203,434	1,298,549	1,315,852	1,315,852	1,315,852	1,333,155	12.186.998,2
20	JICA - PROVINCIAL MUNICIPALITY OF PIURA	5,513,191	5,513,191	5,564,812	5,933,444	5,933,444	6,580,278	6,710,383	6,710,383	6,710,383	6,809,684	61.773.426,7
21	JICA - PROVINCIAL MUNICIPALITY OF PUNO	2,605,783	2,605,783	2,642,116	2,688,730	2,688,730	2,805,302	2,879,232	2,879,232	2,879,232	2,914,106	15.396.949,8
22	JICA - PROVINCIAL MUNICIPALITY OF SAN MARTIN - TARAPOTO	1,750,072	1,750,072	1,792,668	1,799,544	1,799,544	2,093,037	2,106,504	2,106,504	2,106,504	2,113,414	17.897.096,0
23	JICA - PROVINCIAL MUNICIPALITY OF SAN ROMAN - JULIACA	3,412,310	3,412,310	3,464,890	3,643,638	3,643,638	3,904,149	3,981,761	3,981,761	3,981,761	4,061,174	40.848.915,2
24	JICA - PROVINCIAL MUNICIPALITY OF SECHURA	773,162	773,162	773,162	790,205	890,431	972,158	1,001,040	1,001,040	1,001,040	1,027,362	8.877.963,6
25	JICA - PROVINCIAL MUNICIPALITY OF SULLANA	3,305,638	3,305,638	3,353,821	3,428,979	3,428,979	3,696,588	3,733,538	3,733,538	3,733,538	3,833,145	42.433.080,0
26	JICA - PROVINCIAL MUNICIPALITY OF TALARA - PARIÑAS	1,491,749	1,491,749	1,557,362	1,557,362	1,557,362	1,673,220	1,673,220	1,673,220	1,673,220	1,673,220	16.068.017,6
27	JICA- PROVINCIAL MUNICIPALITY OF ABANCAY	916,558	916,558	945,383	945,383	945,383	1,017,532	1,017,532	1,017,532	1,017,532	1,017,532	9.756.926,0
28	JICA- PROVINCIAL MUNICIPALITY OF ILAVE	509,007	509,007	509,007	516,373	516,373	549,899	564,630	564,630	564,630	579,380	5.381.126,8
29	JICA- PROVINCIAL MUNICIPALITY OF TAMBOPATA	1,254,351	1,254,351	1,306,650	1,362,718	1,362,718	1,659,571	1,729,217	1,729,217	1,729,217	1,800,135	25.941.367,2
30	JICA- PROVINCIAL MUNICIPALITY OF TARMA	841,753	841,753	866,106	866,106	866,106	916,408	933,100	933,100	933,100	933,100	11.751.001,0
31	JICA - PROVINCIAL MUNICIPALITY OF TUMBES	2,266,716	2,266,716	2,312,456	2,337,416	2,337,416	2,514,303	2,575,941	2,575,941	2,575,941	2,600,902	22.639.915,4
	TOTAL JICA	**35,102,396**	**35,102,396**	**35,911,123**	**36,984,161**	**37,158,169**	**40,645,775**	**41,269,609**	**41,269,609**	**41,269,609**	**41,856,375**	**417.546.669,6**
	TOTAL	**42,841,850**	**42,901,548**	**43,745,831**	**45,415,376**	**45,731,867**	**49,521,416**	**50,199,934**	**50,242,248**	**50,286,058**	**51,001,506**	**503.782.723,6**

Below is the current value of social costs of the program. The social discount rate is used, being the current one valued at 11%[20]:

Table 5.1-4 Actual Value of Social Costs

VACS (Cost of Investment)
S/. 285 885.379
CHAPTER 6
VACS (Cost of O&M)
S/. 68 351.700
CHAPTER 7

Source: Own elaboration

5.1.3 Effectiveness Indicator and Cost-Effectiveness Ratio

In order to find the cost-effectiveness ratio of the Project, the effectiveness indicator is used.

In that case, the effectiveness indicator used is the current value of the tons of solid waste effectively treated, totaling 5 381 133.10

Below, it is the current value of tons of solid waste demand of the program

Table 5.1-5 Total Waste of Tons of Solid Waste Effectively Treated

TOTAL OF SOLID WASTE	
YEAR	**TONS**
1	824,734.57
2	847,254.53
3	870,493.64
4	894,477.13
5	919,230.96
6	944,787.17
7	971,176.32
8	998,429.18
9	1,026,579.49
10	1,055,653.74
VA solid waste	5 381 133.10

Source: own elaboration

The bases for the analysis is treated waste for final disposal per ton, and the current value formula was applied, because the cost-effectiveness ratio allows to estimate an average growth in the long term for treated ton.

Following is the cost-effectiveness ratio for the proposed alternative.

[20]Snip Annex 09 “Evaluation Parameters”

Table 5.1-6 Cost effectiveness ratio

Nº	PROJECT	0	1	2	3	4	5	6	7	8	9	10	TOTAL
1	Investments flow	201,307,090	0	7,390,996	30,775,710	2,317,973	62,174,663	32,275,418	0	48,364	960,177	0	337,250,391
2	O&M flow		8,171,118	8,230,816	9,075,099	10,744,644	11,061,135	14,850,684	15,529,202	15,571,516	15,615,325	16,330,774	471,887,635
TOTAL		205.125.001,45	201,307,090	8,171,118	15,621,812	39,850,809	13,062,617	73,235,798	47,126,102	15,529,202	15,619,880	16,575,502	16,330,774
VA IINVESTMENTS		S/. 285,885,379											
VA O&M		S/. 68,351,700											

Source: own elaboration

After finding the current value of the social costs of the investment and the post investment stage, the following results are obtained, which will allow to obtain the cost-effectiveness ratio, as the following chart shows:

Table 5.1-7 Cost-Effectiveness Indicator

DESCRIPTION	VACS	INDICATOR OF EFFECTIVENESS (t)	CE
Alternative 1	S/. 354 237.079,11	5 381.133	S/. 65.83

5.2 PRIVATE INVESTMENT PARTICIPATION IN THE PROGRAM

5.2.1 Law fosters private participation to provide services

The government prioritizes public investment and promotes also the participation of the prívate sector within the research, technological development, procurement of equipments, as well as the construction and operation of solid waste facilities. However, the competent authorities must take all measures to foster the investment in the activities. The following criteria and mechanisms will be considered:

1) Include infrastructure and equipment projects to manage municipal solid waste regarding the Plans of Land of Refurbishment, Plans of Urban Development and Participative Budget of the corresponding municipalities.

2) Design of Projects for Cofinanced Concessions, coordinated for that purpose with the Ministry of Economy and PROINVERSIÓN.

3) Suscribe agreements of legal stability with the concessionaires in order to grant them certain guarantees regarding the investment done in infrastructure works or the solid waste services provided.

4) In the concession agreement to build and operate solid waste facilities, include the design of the projects in different stages in order to implement the Regime of Anticipated Recovery of the Value Added Tax established in the Legislative Decree 973, which will come from operations in independent account for each stage.

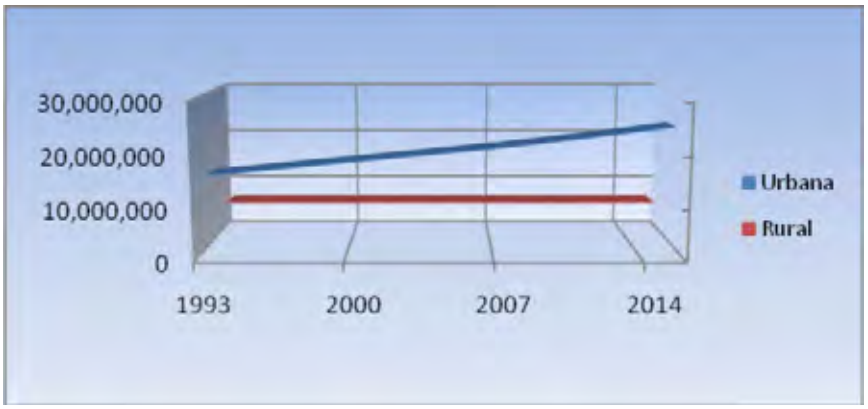
5) Prioritize the construction of solid waste facility, using the canon resources and other complementary sources of the budget.

6) Foster the construction of solid waste facilities of solid waste as part of the projects of social responsibility executed by the private sector.

7) In emergency situation, prioritize the construction and operation of solid waste facilities. In those cases, the authority shall draft a list of priority projects, within a reseonable period of time, considering the emergency situation and shall not exceed 180 days from the date the rule declaring the emergency situation is passed, in order to expedite the declaration of viability, design and execution.

5.2.2 The Market for Private Investment

Population in Peru is 29´260.439 [21], 77% live in urban areas and 23% in rural areas.

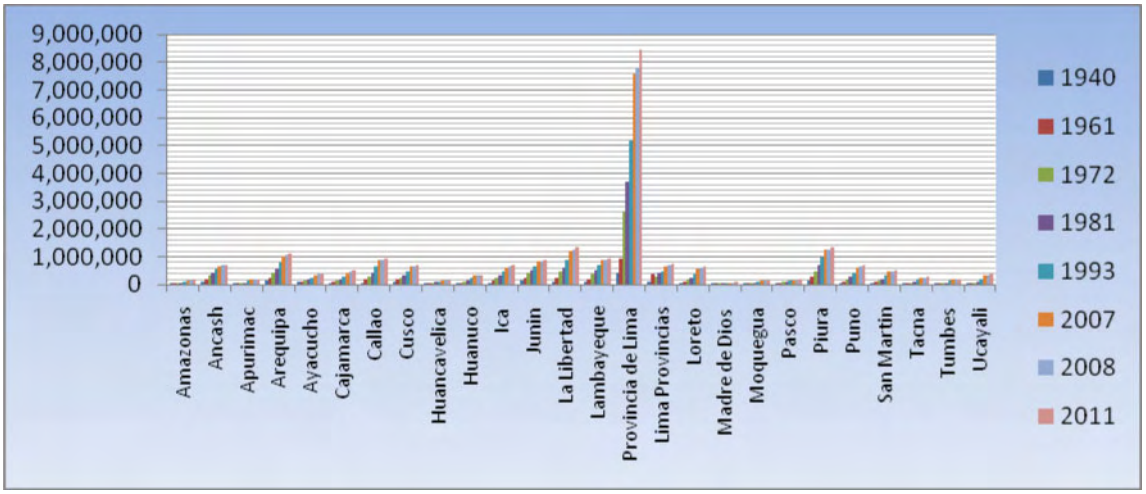


Source:INEI, 1993 and 1997 census

Figure 5.2-1 Urban and rural population

Growth rate in the cities is 2.15% annual. It is estimated there are

22´889.344 inhabitants in 1834 cities, and people are rerquesting more and better public services, specially regarding solid waste. The department of Lima concentrates 40% of urban population, with an important growth.



Source:INEI, 1993 and 1997 census

Figure 5.2-2 Urban growth in the cities

Based on the economic growth, nowadays there are departments with more than one million inhabitants in urban areas, such in the case of Piura, La Libertad and Arequipa. Lambayeque and the Constitutional province of Callao are reaching similar levels. However, 5% of the cities of Peru, that is to say, 93 municipalities generate 50 tons/day, which represents 76% of solid waste generated in the country; 61 cities generate between 20 and 50 tons/day, which is 10% of total waste, whereas 1 680 municipalities

[21] Elaboración propia. Proyección considerando los resultados del INEI. Censos Nacionales de Población 1993 y 2007.

generate at least 20 tons/day, which represents 14% of total solid waste generated. See the following chart.

Table 5.2-1 Generation of solid waste based on social stratum

Municipal solid waste generation	N° of districts	%	Percentage share of solid waste generation (%)
Less than0.5 ton/day	784	43%	1%
More than0.5 and 2 ton/day	601	33%	3%
More than 2 and less tan 5 ton/day	138	8%	2%
More than 5 and less than 20 ton/day	157	9%	8%
More than 20 and less than 50 ton/day	61	3%	10%
More than 50 ton/day	93	5%	76%
TOTAL	1,834	100%	100%

Own elaboration
So far, private investment are interested in the markets (cities) that generate more than 50 t/day. In the districts of
Lima, Huancayo, Maynas (Loreto) the services are provided by private companies. In the small cities with little generation of solid waste, a possible option would be small companies. However, there is no such regulation to implement the process.

5.2.3 Private Investment in Peru

There are 363 companies providing solid waste services (EPS-RS) nationally. Thus, 17 inArequipa, 1 in Cusco. However, there are no EPS-RS in Puno. See the following chart.

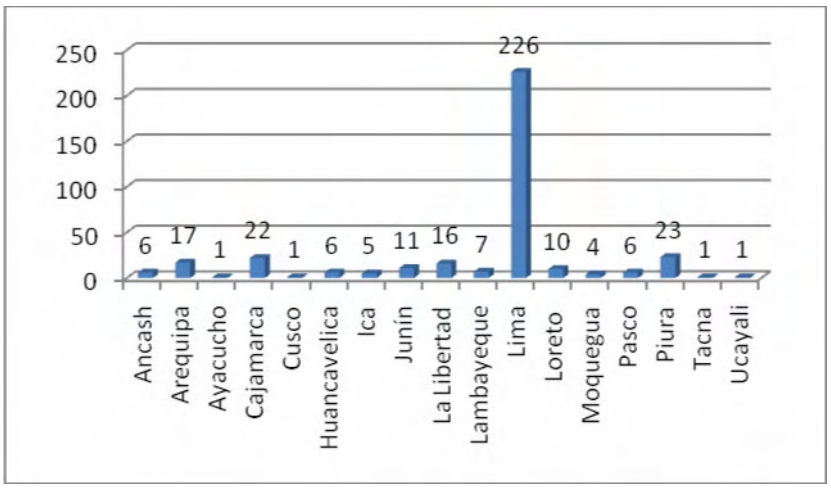


Figure 5.2-3 EPS/RS per department

On the other hand, there are , 662 companies selling solid waste (EC-RS) nationally. However, there are only 3 legal companies in Puno.

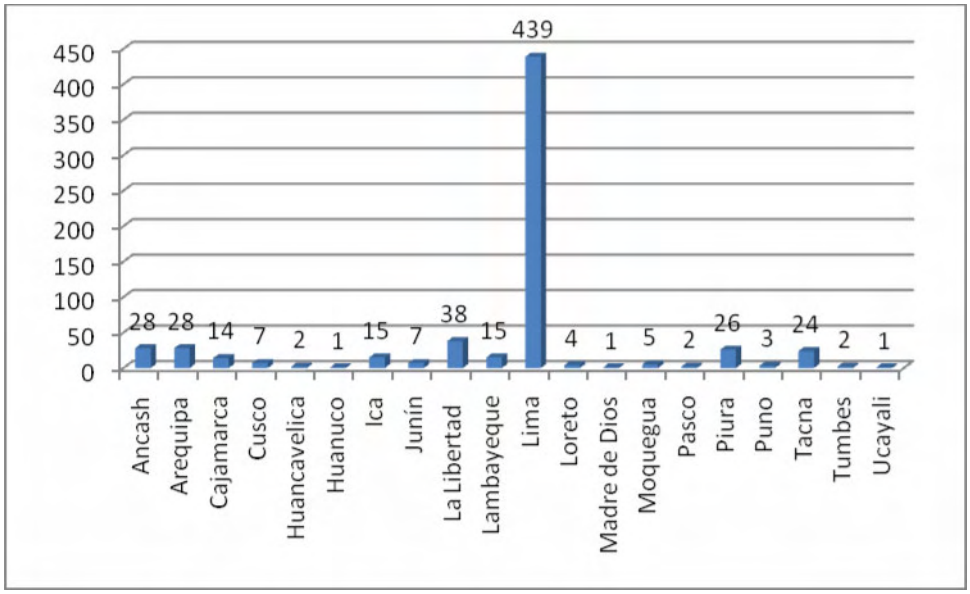


Figure 5.2-4 Companies Selling Solid Waste per Department

The decentralization process in Peru is rather slow. One of the reasons is the municipal financial déficit to provide the service (renevue does not cover expenditure) and therefore, private investment is discouraged. In 2010, public cleaning expenditure was S/. 715.074.517, being the financing the following: 51.41% were established resources, 47,63% were resources directly allocated. The rest were ordinary resources, donations, credit operations and transfers

[22].That is to say, public cleaning services are financed mainly with FONCOMUN resources, municipal tax, canon and others. See the following chart.

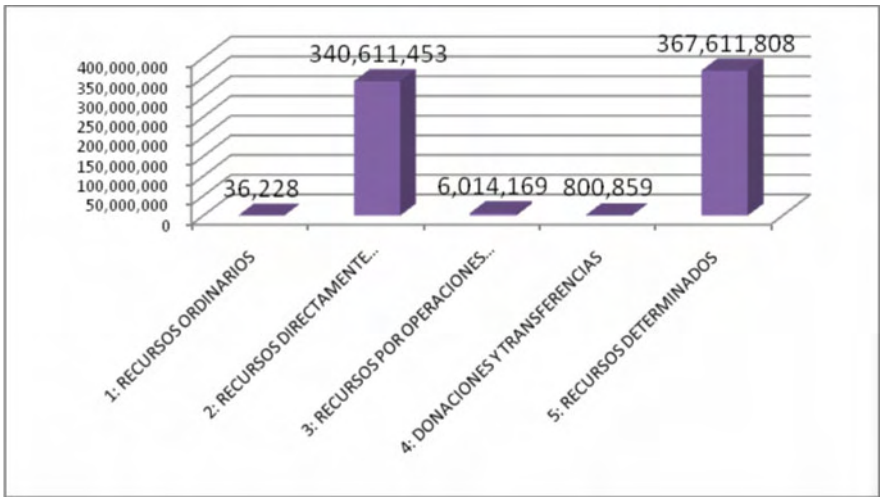


Figure 5.2-5 Service financing nationally-2010

[22]Consulta Amigable. MEF.

This situation worsens due to a weak tax management service and por service of municipal departments of tax collection.

On the other hand, market costs of the services provided by the private sector are rather high for cities in the provinces with a limited budget. In the case of Lima, the collection cost alone is 168 soles/ton and San Juan Bautista (Maynas) 149.95 soles/ton. If we applied those costs to the municipality of Puno in the year 1 of the project (90.91 t/day) the cost would increase threefold, which would worsen the financial situation of the municipality.

In this sense, the program foresees to set the ground for an ongoing decentralization of the public service, establish a basic management system with the participation of the citizens and an improved and strengthened municipal collection system.

5.3 SENSITIVITY ANALYSIS

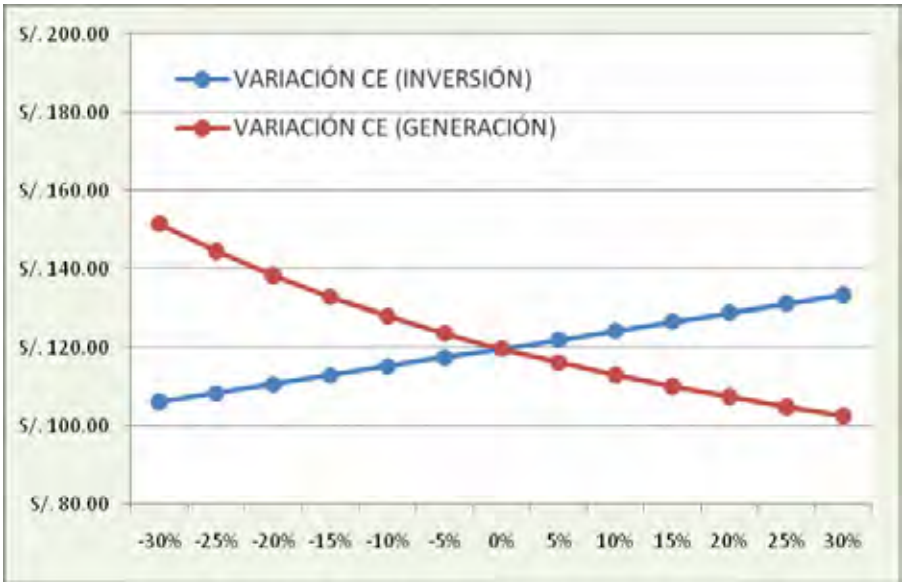
Then, the impact of changing a variable in the proposed alternative is analyzed, in order to evaluate the PIP profitability.

An important factor is the investment cost. Changes in the variable are analyzed to see the impact on the ratio cost-effectiveness, due to the fact that an increase of decrease of the market prices will influence the investment cost. The following chart explains this:

Table 5.3-1 Behavior of Sensitivity-Investment Cost Variable

VARIATIÓN	INVESTMENT COST (S/.)	VA GENERACION T/AÑO	VACS (S/)	EFFECTIVENESS COST	
				VARIATIÓN CE (INVESTMENT) (S/)	VARIATIÓN CE (GENERATION) (S/)
-30%	140,914,963	3,766,793	293,844,952	S/. 54.61	S/. 78.01
-25%	150,980,318	4,035,850	303,910,307	S/. 56.48	S/. 75.30
-20%	161,045,672	4,304,906	313,975,661	S/. 58.35	S/. 72.93
-15%	171,111,027	4,573,963	324,041,016	S/. 60.22	S/. 70.84
-10%	181,176,381	4,843,020	334,106,370	S/. 62.09	S/. 68.99
-5%	191,241,736	5,112,076	344,171,725	S/. 63.96	S/. 67.33
0%	**201,307,090**	**5,381,133**	**354,237,079**	**S/. 65.83**	**S/. 65.83**
5%	211,372,445	5,650,190	364,302,434	S/. 67.70	S/. 64.48
10%	221,437,799	5,919,246	374,367,788	S/. 69.57	S/. 63.25
15%	231,503,154	6,188,303	384,433,143	S/. 71.44	S/. 62.12
20%	241,568,508	6,457,360	394,498,497	S/. 73.31	S/. 61.09
25%	251,633,863	6,726,416	404,563,852	S/. 75.18	S/. 60.15
30%	261,699,217	6,995,473	414,629,206	S/. 77.05	S/. 59.27

Source: own elaboration



Source: own elaboration

Figure 5.3-1 Sensitivity Analysis

As the chart shows, the ratio cost-effectiveness, when the investment changes, the cost-effectiveness ratio varies between 54.61 and77.05 Soles/t, whereas when the current value of solid waste changes, the cost –effectiveness ratio varies from 59.27 to78.01, according to variations of -30% to 30%.

5.4 RISK ANALYSIS

The variables identified are more likely to change, either in a positive or negative way. The variables are related to exogenous variables of the project.

These variables are analyzed through in the begining, sine the horizon of evaluation will last for 10 years. The variables selected for the probability analysis of cost effectiveness are:

- Generation of municipal solid waste
- Investment cost at year 0.

Detailed analysis is shown in the Annex of the Program FS which is one of annex of this report

5.5 SUSTAINABILITY ANALYSIS

5.5.1 Institutional Arrangements forseen for the operation and maintenance stage

Municipalities are responsible for the operation, maintenance and reinvestment. Therefore, a fund trust contract (see attachment) must be established between the Ministry of Environment and each of the municipalities included in the Program.

The trust fund contract is a financial instrument to guarantee the sustainability of the Program. The trust fund is the best way to guarantee the operation and maintenance costs.operation and maintenance of the 31 PIPs, and must also ensure the financing of reinvestments originated by the Program execution.

Operation of Trust Fund Agreement

- The municipalities are the trustors, beneficiariesand Banco de la Nación will be the trustee.
- In accordance with the trust fund contract, the trustors will transfer under beneficial ownership the resources included in the trusted equity to Banco de la Nación, in order to ensure the finance of operation and maintenance costs, through a trustor.
- The trustee shall open a bank account where all resources of the trust will be deposited.
- Each month, part of the amount due to each municipality shall be discounted and shall be debited into an operational account. This amount shall be used to finance the operation and maintenance costs.
- The beneficiary will teach the trustee on the payments to be done in relation to the operation and maintenance costs.

What the Fund Trust Contract Implies

The main objective of the trust fund contract is to have something like "own Program's resources" to finance the operation and maintenance costs.

Furthermore, the municipality shall establish the criteria so that Banco de la Nación will pay the corresponding maintenance and operation costs.

By so doing, the programs shall have sufficient resources and when needed to finance the above mentioned costs; the program will be sustainable, so the expected benefits of the Program shall be achieved.

5.5.2 Legal Framework Required to Execute and Operate the Project

The Executing Unit will manage the Plan of Procurement and Contracting, which will detail or tender procedures and direct awards to be executed during the financial year of the Project. Find below som of the laws.

- Bill of the Law of Public Sector Budget for the financial year 2011.
- Law of Government Contract passed by D.L. N° 1017)
- Regulation of the Law of Government Contract, approved by DS D.S. N° 184-2008-EF)Supreme Decree 154 2010 EF Amendment to the regulation of the Law of Government Contract

The different process will be defined according to the rules and criteria established by JICA in the loan agreements. Otherwise, the tender methods will be established by local regulations.

The different methologies of godos and works are the following:

- International Public Tender
- Limited International Tender
- National Public Tender
- Price Comparison
- Direct Award

Rol of the Municipalities in the tender and contracting

a) Definition of the Annual Operating Plan and the Contracting Plan

The municipality must provide the necessary information with the UEP, so that the information regarding the AOP and the CP are correct, regarding the activities included during the life cycle of the Project.

B Definition of the terms of reference and technical specifications

The municipality is responsable to draft this documents, which are basic element of any contracting process. The tender or contracting process must clearly include the scope, time, cost and quality.

b) Participation to select the suppliers

The municipality, through the representatives, will participate in the evaluation committees, who are responsable to manage the process satisfactorily through a correct evaluation of the proposals and contract awarding.

The technical issues are key in every evaluation.

c) Participation of the Contract execution

The municipality is responsable to monitor the execution of the contracts, and will be in charge of the technical supervisions so that suppliers/contractors/consultants comply with the stipulations of the contract.

The institutions are responsable to issue the compliance with the godos,works and services delivered within the framework of the contract.

5.5.3 Capacity Building of the Organization in charge of the project during the operation stage

The Program considers the execution of activities aimed at building technical, administrative, economic and financial management of the public cleaning service and improve management capacities of the project organization during the operating stage.

If necessary, the municipal council must change the chartflow of the municipality so that it meets the mission and duties, that could be summarized as follow:

- Plan and operate public cleaning service
- Plan and execute best practices to segregate at source generated waste
- Draft technical specifications purchase requirements for equipment and inputs (tools, maintenance service, spare parts, fuels, clothing, furniture, computing equipment replacement, etc)
- Quality control of equipment, inputs and services hired by the municipality regarding the project in compliance with standards agreed.
- Execution of personnel training programs
- Execution of awareness campaign aimed at population programs
- Execution of social communication programs
- Execution of ongoing collection improvement programs

- Administration of human resources of the service
- Set up of operating cost of the service
- Relation to other SubManagement Offices
- Link to the execution unit of the program of the Ministry of Environment

Bearing this in mind, the public cleaning service will be formed by at least a technical and administrative team to perform the activities before mentioned. The team must be formed by:

- Service Assistant Manager
- Service Supervisor
- Responsible of environmental promotion
- Administrative assistant

Long term proposal for solid waste management

The municipal management of public service could evolve in the long term as follow:

1. First administration stage for all areas. It will consist on implementing a municipal management unit of solid waste in each involved municipality.

2. A second stage will consist on the analysis and intermediate evaluation of the operation of solid waste management services. This evaluation must enhance the level of economic efficiency achieved and new economic conditions to decide to move a step forward. This could imply to implement new organization ways, such as a company. This second stage is simultaneous to the second stage and both must end at the same time.

3. A third stage implies that with proper legislation, in some cases private investment or municipal business activities should be considered. It will depend on the development level of municipal units of solid waste management. Additionally, municipal units could become monitoring units of the service.

Figure 5.5-1 Municipal Management Units

Then, the program proposes municipal management units of solid waste as the starting administrative mechanism to guarantee efficiency of services.

(1) Capacity Building to improve municipal management: Plan of Municipal Management and Incentives Plan

The program's goal is for the 31 municipalities to use public resources to improve municipal management, after implementing the Program, in each of the municipalities.

In that sense, the Law N° 29465, Law of Public Sector Budget for the financial year

201023 created the Program of Municipal Modernization (PMM after its name in Spanish) for the period 2010-2013. Besides, it was set up the Incentive Plan for the Municipal Management (PI).

a) Six hundred million 00/100 NUEVOS SOLES (S/. 600 000 000,00) to financethe Program of Municipal Modernization established by this provision for theperiod 2010-2013 in order to provide proper condition for sustainable growthof local economy and reduction of child chronic malnutrition nationwide.

The resources of the program mentioned are allocated depending on criteriasuch as i) municipalities classification taking into account features, needsand potentitalities, and ii) compliance with requirements related tocollection results of municipal tax, establishment of businessopportunities, and quality of social expenditure, specially in connectionwith Nutritional Articulated Strategic Program (PAN). The above mentionedresources are transferred in two stages: the first one until March 31, 2010,and the second until September 30, 2010.

By means of Supreme Decree backed by the Ministry of Economy, severalcriteria are developed. It will be approved until December 31, 2009.Furthermore, the methodology, goals, use, indicators and procedures will beestablished to allocated said resources, as well as requirements localgovernments shall comply with for said allocation. The present paragraphwill entry into force the next day after issuing said law.

b) Seven hundred million 00/100 NUEVOS SOLES (S/. 700 000 000,00) to financethe Incentive Plan to Improve Municipal Management according to paragraph1.2 of article 1 of Law Nº 29332. Said law creates Incentive Plan forMunicipal Management Improvement. Said resources are included in the budgetof local governments, in accordance with criteria, goals and opportunitiesestablished in the above mentioned law and its regulations. Said resourcesare transferred in two stages: the first one until March 31, 2010 and thesecond one until September 30, 2010.

Through DS 002-2010, the procedures to comply with the goals and the allocation of resources to the Program of Municipal Modernization were approved. In that sense, the PMM wants to foster conditions that contribute towards the sustainable growth and development of local economy, with incentives to municipalities, such as

- Increase municipal tax collection through a better financial management.
- Create positive conditions for the business environment by improving public service, basic infrastructure and reducing paper work during the procedures, among others.

In order to distribute and allocate the resources, as well as to establish the corresponding goals for the year ending 2010, the municipalities classify depending on its features and capabilities, according to the following information:

- Municipalities of main cities type "A".
- Municipalities of main cities type tipo "B".
- Municipalities that do not belong to the main cities, with 500 or more urban households
- Municipalities that do not belong to the main cities, with less than 500 urban households

The following chart shows the resources allocated for the year 2010:

Table 5.5-1 Amount that can be allocated to municipalities

PMM Municipal Classification	Data				
	Total PMM 2010	Total Max. allocated up to March 1st. 2010	Total Max. allocated up to Sept. 1st. 2010	Total Population	Number of District
Main Cities A	188,122,157	94,061,078	94,061,078	8,592,461	40
Main Cities B	212,918,860	106,459,430	106,459,430	9,725,048	209
Less than 500 urban housing	79,563,784	39,781,892	39,781,892	3,634,068	1,030
More than 500 urban housing	119,395,200	59,697,600	59,697,600	5,453,364	555
Overall Total	600,000,000	300,000,000	300,000,000	27,404,941	1,834

Source: MEF

The General Directorate of Public Budget (DNPP) evaluates the goals, and calculates the amount corresponding to each municipality, depending on the goals and ranks established. Those municipalities complying with all assigned goals shall receive the maximum amount to be approved. Otherwise, the amount will proportionally depend on the goals achieved. In order to implement the PMM, the Ministry of Economy offers technical assistance to the Municipalities in the following cases:

A) Improvements to the financial management, prioritizing tax management tools.

b) Improvements to the procedures reduction

c) Improvements to the public services provided and to the infrastructure

Besides, in order to ensure monitoring and follow-up of the PMM, each municipality (by means of a Major Resolution) has appointed an official responsible for coordinating the compliance of the goals established in the supreme decree, with the different areas.

On the other hand, the supreme Decree 003-2010-EF has approved the procedures to comply with the goals and allocation of resources to the Incentive Plan for the improvement of the Municipal Management (PI). The main goal of the PI is to Foster conditions to promote sustainable growth and development of the local economy. For that purpose, the municipalities shall:

- Increase collection rates of municipal taxes, strengthening the estability and efficiency regarding tax perception.
- Improve the execution of investment projects, considering the guidelines of improvement policy.
- Reduce chronic child malnutrition in the country

The PI is financed with Public Treasury resources, for a total amount that equals the deduction of FONCOMUN, to which article 76 of the Sole Unified Text of Law on Municipal Tax refers to, approved by Supreme Decree Nº 156-2004-EF and ammendments. The General

Directorate of Economic and Social Affairs of MEF estimates the total amount per year to finance the Plan for the following financial year, depending on the projected deduction of FONCOMUN originated by the return of the Tax on Municipal Promotion.

For the year 2010, the goals of the PMM are the following:

Program Area	Goals Scope
Improvement of Financial Management	Declaration and Payment Collection Information on Collection Awareness and Transparency
Business Environment: Procedures Simplification	Operating License (LF) Construction License (LE) Information on LF and LE Awareness and Transparency
Business Environment: Public Services and Facility	Citizen Safety Information Basic Facility

For 2010, the goals of the PI are the following:

Program Area	Goals Scope
Financial Self Suficiency	Effectiveness in Property Tax Collection
Chronic Malnutrition	Expenditure in Health and Sanitation Focus

For that matter, in the case of the National Program of solid waste in priority areas, 84% of the selected cities are considered “Main cities B”and the rest of the cities are considered small cities. Overall, the 31 cities will receive from PMM and PI S/. 47.555,007 and S/. 61.958.565, totalling S/. 109.513.572. As it can bee seen, for the financial year 2010, Chachapoyas could receive up to S/. 1.255.946; and Juliaca, S/. 10.962.737.

The expense of the PMM and PI resources is clearly defined in the following five items:

First:Ensures the operation and maintenance of the investments under execution. In the case of municipalities prone to frequent natural disasters, resources shall be allocated to prevent such disasters. Only in the cases when resources are guaranteed for this purpose, it should be investments in new infrastructure, if the corresponding resources are used for the maintenance.

Second: Ensure that the goods and services of health and basic education work. Once the resources have been guaranteed for this purpose, it must be improved the Access and cover to the basic health services (preventive health/pregnant mothers and children aged 0-3), and education (kindergarten and primary).

Third:Offer a continuous service regarding public cleaning service including final disposal of solid waste, as well as the citizen safety services. Those services shall comply with the minimum standards, which implies the ongoing service (without interruptions); and the cost shall not exceed the real cost of providing the service, with specialized personnel and efficient machinery.

Four: The Sole Text of Administrative Procedure (TUPA) shall be updated to reduce the procedures and systematized them. TUPA should contain all municipal procedures, especially those with more municipal demand. Furthermore, a methodology shall be developed and implemented to calculate cost of the services offered, bearing in mind the the cost shall not exceed the cost of providing said service.

Five: Update the information regarding the land property in order to increase property tax collection. Implement orientation campaigns to pay taxes, control and monitoring actions to pay taxes, as well as information campaigns regarding how tax collected are utilized. Besides, systems must be developed to pay online or with credit and/or debit cards, continuously train personnel in charge of tax collection procedures, as well as systemize payment procedures.

the bill of the Law on Public Sector Budget for the financial year 2011, out of the ordinary resources, S./ 500 millions will be used to increase the Fund for the Promotion of local and regional investment (FONIPREL), in order to cover the demand of local and regional governments to finance different studies and Project.

S/. 1 277 million will be allocated to local governments through the Incentive Plan to improve municipal management (S/.777 millions), and Municipal Modernization (S./500 millions) in order to contribute to the sustainable growth and development of local governement, by strengthening their financial sustainability, reducing provision of basic services, such as citizen safety and solid waste management.

The Supreme Decree 190-2010-MEF set forth the goals and resources of the PMM for the financial year ending 2011.

Table 5.5-2 Goals for Financial year ending 2011

Description of the Municipality	Collection of Municipal taxes	Creating a climate of favorable business conditions: simplifying procedures	Creating a climate of favorable business conditions: Public servies and infrastructure
Main cities Municipalities Type: ''B''	**Objective: Transparent Information** **Goal 1**: Submit to MEF the complete information specified in the Form Nº 01 of the current standard. **Objective: eficacia en la gestión** **Goal 2**: Print out bills to pay the property taxes and send them to the taxpayer houses.	**Objective: Transparent Information** **Goal 1**: Submit to MEF the complete information specified in the Form Nº 02of the current standard **Goal 2**: Implement the provisions of Supreme Decree Nº 063-2010-PCM referring to the standard Transparency portal of the Public Administration entities. **Objective: Increased the coverage and guidance quality** **Goal 3**: Have a service module for attention and guidance to give information about municipal procedures.	**Objective: Prevention of disaster risks** **Goal 1**: Identify vulnerable zones and disaster risks at the locality. **Objective: Eficiencia gestión residuos sólidos** **Goal 2**: Implement a segregation program in the origin as part of a collection process of domestic solid wastes.

Description of the Municipality	Collection of Municipal taxes	Creating a climate of favorable business conditions: simplifying procedures	Creating a climate of favorable business conditions: Public servies and infrastructure
Municipalities that are not considered main cities, with 500 or more urban houses	**Objective: Transparent Information** **Goal 1**: Submit to MEF the complete information specified in the Form Nº 01 of the current standard. **Goal 2**: Have an electronic portal. **Goal 3**: Incorporate hyperlink "Municipal Taxes" on the Web site of the municipality. **Goal 4**: Post on the hyperlink "Municipal Taxes" of the Municipality web site the information specified in Annex 2-A of this standard. **Objective: Management Effectiveness** **Goal 5**: Have a systematic record of the tax information according to the format specified by the MEF.	**Objective: Transparent Information** **Goal 1**: Submit to MEF the complete information specified in the Form Nº 02of the current standard. **Goal 2**: Incorporate hyperlink"Operating Licenses"on the Web site of the municipality. **Goal 3**: Post on the hyperlink "Operating Licenses"of the Municipality web site the information specified in Annex 2-B of this standard..	**Objective: Prevention of disaster risks** **Goal 1**: Identify vulnerable zones and disaster risks at the locality.
Municipalities that are not considered main cities, with less than 500 urban houses	**Objective: Transparent Information** **Goal 1**: Submit to MEF the complete information specified in the Form Nº 01 of the current standard..	**Does not apply.**	**Objective: Prevention of disaster risks** **Goal 1**: Identify vulnerable zones and disaster risks at the locality. **Objective: access and coverage of the basic infrastructure** **Goal 2**: Program the budget resources of the year 2012 at least in one of the next Budget Strategic Progams: 0005 Access to basic social services and Market oportunities , 0006 Access to porTable water and Sanitary disposal of excreta for rural population of 2,000 inhabitants or less, 0007 Access and use to Telecommunication essential public service in rural population of less than 3,000 inhabitants and 0008 Access to energy at rural localities..

To grant the resources of the Modernization Program corresponding to years 2011, 2012 and 2013, the Ministry of Economy and Finance will establish, by means of a Supreme Decree with a issuance deadline being June 30th of each year, the criteria, procedure and goals for the allocation and distribution of resources of the Modernization Program corresponding to the following year.

The expense of the PMM and PI resources is clearly defined in the following five items:

First:Ensures the operation and maintenance of the investments under execution. In the case of municipalities prone to frequent natural disasters, resources shall be allocated to prevent such disasters. Only in the cases when resources are guaranteed for this purpose, it should be investments in new infrastructure, if the corresponding resources are used for the maintenance.

Second: Ensure that the goods and services of health and basic education work. Once the resources have been guaranteed for this purpose, it must be improved the Access and cover to the basic health services (preventive health/pregnant mothers and children aged 0-3), and education (kindergarten and primary).

Third:Offer a continuous service regarding public cleaning service including final disposal of solid waste, as well as the citizen safety services. Those services shall comply with the minimum standards, which implies the ongoing service (without interruptions); and the cost shall not exceed the real cost of providing the service, with specialized personnel and efficient machinery.

Four: The Sole Text of Administrative Procedure (TUPA) shall be updated to reduce the procedures and systematized them. TUPA should contain all municipal procedures, especially those with more municipal demand. Furthermore, a methodology shall be developed and implemented to calculate cost of the services offered, bearing in mind the the cost shall not exceed the cost of providing said service.

Five: Update the information regarding the land property in order to increase property tax collection. Implement orientation campaigns to pay taxes, control and monitoring actions to pay taxes, as well as information campaigns regarding how tax collected are utilized. Besides, systems must be developed to pay online or with credit and/or debit cards, continuously train personnel in charge of tax collection procedures, as well as systemize payment procedures.

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S/. 1 277 million will be allocated to local governments through the Incentive Plan to improve municipal management (S/.777 millions), and Municipal Modernization (S./500 millions) in order to contribute to the sustainable growth and development of local governement, by strengthening their financial sustainability, reducing provision of basic services, such as citizen safety and solid waste management.

The Supreme Decree 190-2010-MEF set forth the goals and resources of the PMM for the financial year ending 2011.

Table 5.5-3 Goals for Financial year ending 2011

Description of the Municipality	Collection of Municipal taxes	Creating a climate of favorable business conditions: simplifying procedures	Creating a climate of favorable business conditions: Public servies and infrastructure
Main cities Municipalities Type: ''B''	**Objective: Transparent Information** **Goal 1**: Submit to MEF the complete information specified in the Form Nº 01 of the current standard. **Objective: eficacia en la gestión** **Goal 2**: Print out bills to pay the property taxes and send them to the taxpayer houses.	**Objective: Transparent Information** **Goal 1**: Submit to MEF the complete information specified in the Form Nº 02of the current standard **Goal 2**: Implement the provisions of Supreme Decree Nº 063-2010-PCM referring to the standard Transparency portal of the Public Administration entities. **Objective: Increased the coverage and guidance quality** **Goal 3**: Have a service module for attention and guidance to give information about municipal procedures.	**Objective: Prevention of disaster risks** **Goal 1**: Identify vulnerable zones and disaster risks at the locality. **Objective: Eficiencia gestión residuos sólidos** **Goal 2**: Implement a segregation program in the origin as part of a collection process of domestic solid wastes.
Municipalities that are not considered main cities, with 500 or more urban houses	**Objective: Transparent Information** **Goal 1**: Submit to MEF the complete information specified in the Form Nº 01 of the current standard. **Goal 2**: Have an electronic portal. **Goal 3**: Incorporate hyperlink "Municipal Taxes" on the Web site of the municipality. **Goal 4**: Post on the hyperlink "Municipal Taxes" of the Municipality web site the information specified in Annex 2-A of this standard. **Objective: Management Effectiveness** **Goal 5**: Have a systematic record of the tax information according to the format specified by the MEF.	**Objective: Transparent Information** **Goal 1**: Submit to MEF the complete information specified in the Form Nº 02of the current standard. **Goal 2**: Incorporate hyperlink"Operating Licenses"on the Web site of the municipality. **Goal 3**: Post on the hyperlink "Operating Licenses"of the Municipality web site the information specified in Annex 2-B of this standard..	**Objective: Prevention of disaster risks** **Goal 1**: Identify vulnerable zones and disaster risks at the locality.

Description of the Municipality	Collection of Municipal taxes	Creating a climate of favorable business conditions: simplifying procedures	Creating a climate of favorable business conditions: Public servies and infrastructure
Municipalities that are not considered main cities, with less than 500 urban houses	**Objective: Transparent Information** **Goal 1**: Submit to MEF the complete information specified in the Form Nº 01 of the current standard..	**Does not apply.**	**Objective: Prevention of disaster risks** **Goal 1**: Identify vulnerable zones and disaster risks at the locality. **Objective: access and coverage of the basic infrastructure** **Goal 2**: Program the budget resources of the year 2012 at least in one of the next Budget Strategic Progams: 0005 Access to basic social services and Market oportunities , 0006 Access to porTable water and Sanitary disposal of excreta for rural population of 2,000 inhabitants or less, 0007 Access and use to Telecommunication essential public service in rural population of less than 3,000 inhabitants and 0008 Access to energy at rural localities..

To grant the resources of the Modernization Program corresponding to years 2011, 2012 and 2013, the Ministry of Economy and Finance will establish, by means of a Supreme Decree with a issuance deadline being June 30th of each year, the criteria, procedure and goals for the allocation and distribution of resources of the Modernization Program corresponding to the following year.

In that sense, before the project execution, it is important that MEF allocates resources available from the PMM and the IP to the 31 municipalities involved in the National Program of Solid Waste in Priority Areas so that said municipalities have management tools to build capacities of the Tax Administration Directorates (GAT in Spanish).Some of the examples are: 1) Implementation or updating of the land registry, 2) update and/or change of the sole text of administrative procedures (TUPA), 3) officials training to improve GAT, 4) basic equipment of GAT, 5) implementation and operation of the Tax Collection Desk.

(2) Improvement of rate calculation and increase of tax collection

In order to ensure ongoing rendering of solid waste service,the municipalities will have to ensure FONCOMUN resources, and work hard to improve public service management. That is to say, they shall improve the tax administrative management or other areas in charge of collection.

On one hand, there is the need to establish fair rates and on the other hand, it is important to set up collection mechanisms to reduce default.

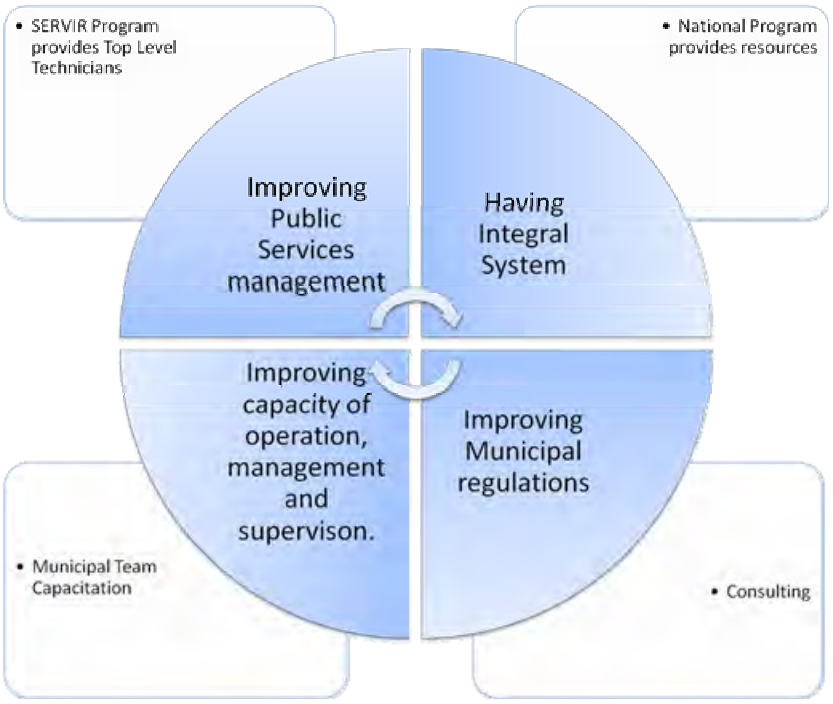
The following chart shows the proposal for collection increase. The percentage proposed depends on the rate calculation with project and the survey of willingness to pay conducted on

the population as part of this study. The survey established different payment ranges: S/.0 to S/.4, S/4 to S/.8 and S/.8 to S/.12. The collection goal will depend on the number of people willing to pay for the calculated rate.

It is necessary to mention that 3% will be added on the initial collection rate, since it is requirement from the PMM and the PI, until the Project is implemented. On the other hand, in other cities more conservative percentages will adopted based on the current collection rate.

STRENGTHENING BUILDING CAPACITY OF MUNICIPAL MANAGEMENT

The program focuses on building capacities of the municipalities involved, mainly in four areas: 1) improve the magement of public services, 2) have an integrated system of solid waste management, 3) improve capacity of the technical team to operate, control and monitor the service provided, and 4) develop municipal regulations withing national and regional laws to establish clearly the rights, obligations and responsibilities of the operators and generators of solid waste. The following chart shows the actions above mentioned:



Source: own elaboration

Figure 5.5-2 Proposal of Management Improvement

Strenghtening Capacities to Manage the Municipalities

Each municipality has a different organization, and in order to implement the program and the corresponding PIPs, each of them will implement specialized management units to guarantee an efficient public service management. This unit will report directly to the municipal management area.

Besides, the municipalities involved in the program have committed to improve management capacities taking advantage of SERVIR program to have qualified managers on solid waste,

tax management and others. In that sense, legislative decree 1024 establishes the Public Managers Agency, taking into account the following issues:

- Call professionals for high and medium positions, through competitive and clear tender processes
- Develop public management capacity and ensure continuity
- Professionalize the highest levels of public administration
- Foster a change in the civil service

On the other hand, legislative decree 1026 establishes a special regime for local and regional governments wishing to implement modernization process. This decree establishes the rules so that human resources are transferred from central government to local and regional governments, within the decentralization process. The following actions should be undertaken by the municipalities:

- Elaborate a modernization file, which is the technical background of the measures to be adopted. It must include: 1) objectives modernization will achieve, 2) description of concrete changes to implement regarding organization, process and human resources, properly sustained, and 3) process and schedule of municipal modernization.
- Approve its inclusion in the special regime by means of an agreement of regional or municipal council that should also approve the file
- Have a budget for the term (no more than 3 years).

The scope of the regime is as follows:

- Improves economic salary of key positions
- Modifies the budget to carry out the proposed changes
- Eliminate job positions that are not necessary, reorganize or eliminate areas, change management tools, apply new management technology tools

This is a clear opportunity to guarantee that the 31 municipalities of the National Program of Solid Waste in Priority Areas would be able to hire highly specialized personnel to ensure a proper public service .

Taking this into account, the managers hired could have work stability to implement the necessary changes and guarantee an effective solid waste management.

Solid Waste Management Unit

The supply of solid waste of the program will cover the public service demand, regarding quality, quantity, costs and fair taxes.

The program will provide municipalities with the resources (human, materials, equipment and infrastructure) for a proper service rendering, optimized process and sustainability of the service. The program will provide programs to raise awareness among population on solid waste management and strengthen environmental institutions.

To ensure the municipality will strengthen the improvement of solid waste service, it can change the municipal structure so that the municipality can plan and manage the solid waste service.

This organic unit will be responsible for all processes necessary to provide solid waste services: 1) technical, operating, administrative, economic and financial aspects, 2) management of environmental education program, 3) management of environmental building capacities.

Along with the municipal management, the solid waste management unit will held meetings with the Administration, Planning and Budget, and Tax Management Units to monitor how the public service is evolving. An important issue will be to evaluate the income and financing of the public service.

Capacity to Manage, Operate and Supervise the Services

Regarding the components of the program and the projects, decisions will be made to organize the unit as the following chart shows:

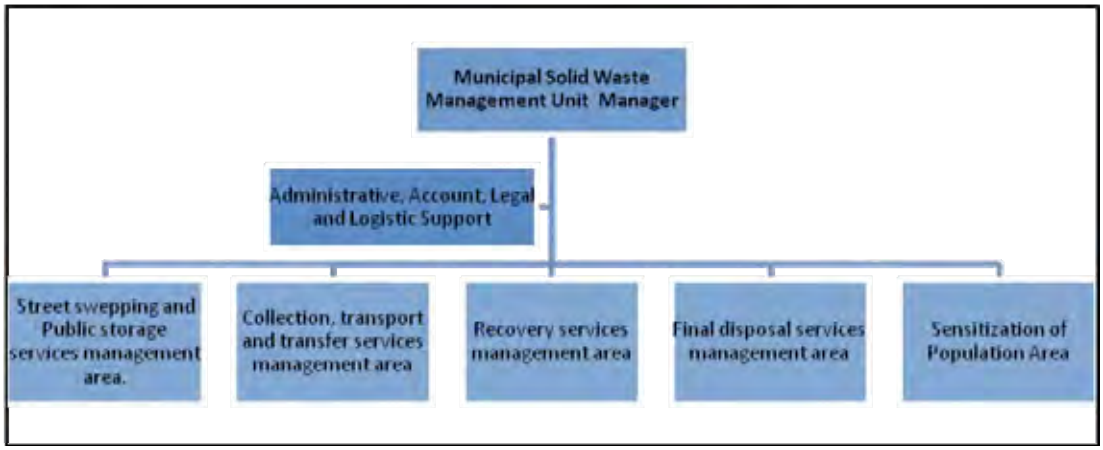


Figure 5.5-3 Organization to Supervise Services

The requirement of personnel for each of the units should not imply to hire more people in the municipality (except to hire specialists). That is to say, depending on the project size, estimate the operating capacity of the management unit.

However, in order to highlight the above information, it is very important that the management capacity can guarantee the quality of the services, efficiency of the budget and social profitability of the services, without further contracting, apart from what is included in the scope of each project.

Municipal Regulations for Solid Waste Management

The program includes that 31 municipalities formulate and/or update municipal ordinances to apply the General Law of Solid Waste in their jurisdiction.

Said ordinance will propose good practices of solid waste management among citizens and companies, sanctioning those who pollute the environment. Thus, the ordinances focus on obligations from citizens but also on incentives for proper solid waste management.

5.5.4 Financing of operation, maintenance and reinvestment costs

The financing of operation, maintenance and reinvestment costs of the PIPs included in the program depend on each municipality. The financing of this activities will take form through a fund trust contract between MINAM, municipalities and Banco de la Nación funded by FONCOMUN. The idea is described below.

Resources from Fondo Municipal de Compensación (FONCOMUN) have been considered for different for the reasons mentioned here:

- Funds available and can be used to finance current expenses such as operation and maintenance costs, capital costs (investment and reinvestments planned in each project of the program)
- Funds can be included in a fund trust to guarantee the payments to be covered by the funds, related to operation, maintenance and reinvestment costs.
- It will allow implement a strategy to guarantee the participation of municipalities. It implies that municipalities can finance the expenses of the projects of program only financed by net balance of FONCOMUN that are transferredregularly. Other income, such as resources directly collected will not be committed, and they could be used in other expenses that are a priority for the municipalities.

(1) FONCOMUN net balance

It is the financial surplus between FONCOMUN revenue less expenses financed by these resources. Financial surplus could be used to finance the expenses of the project of the Program.

The projection of FONCOMUN net balance will be estimated based on the historic information of 2005-2010 for each municipality. Thus, more real information will be available on the possibility to finance operation and maintenance expenses of the projects, reinvestments and if possible, financial expenses incurred by using part of the loan of the Government of Japan and IDB to finance each of the projects of the 31 municipalities.

It is clear that throughout the years, the balance will vary due to the increase or decrease of FONCOMUN income and execution level of the resources. However, the most important is to estimate the resource allocation to complete the finance of at least operation and maintenance expenses of reinvestment to guarantee the sustainability of the projects and then, the overall Program.

There is a direct relation between the economic activity of the country and the revenue from value added tax (from where FONCOMUN resources are obtained to be transferredto the municipalities). Therefore, the resources will increase, since they are based on the economic growth of the country, 5.5% during the last 10 years. In the medium and long term, the growth rate will be sTable , around 5% in the next three years, according to the Multiannual Macroeconomic Framework for the year 2011-2013. Within this scenario, municipalities are expected to have more resources from FONCOMUN and therefore, more margins to cover operation, maintenance costs and reinvestment.

Therefore, based on minimal FONCOMUN net balance and considering a possible increase of FONCOMUN revenue, the municipalities will have enough resources to guarantee at least the operation and maintenance expenses of the projects.

The following chart shows the FONCOMUN balance . Said balance is obtained from the revenue average of the last three years and the expenditure of each project. For further information, see the financing structure of each city in the attached document.

Table 5.5-4 Analysis of FONCOMUN Balance

CITY	FONCOMUN BALANCE	% EXECUTION
AZÁNGARO	2,696.799	82%
ILAVE	1,122.707	76%
TARMA	816.376	81%
SECHURA	569.385	87%
ABANCAY	464.692	94%
PUERTO MALDONADO	624.330	92%
HUÁNUCO	1,820.055	89%
CHINCHA	713.773	90%
NUEVO CHIMBOTE	46.256	96%
PAITA	2,562.501	79%
TARAPOTO	563.296	91%
MOYOBAMBA	4,445.026	66%
CHACHAPOYAS	262.650	91%
PUNO	1,839.466	89%
AYMARAES	244.267	91%
JULIACA	4,199.538	90%
SANTIAGO	97.695	95%
HUACHO	957.312	86%
TALARA	99.665	98%
TUMBES	2,632.537	75%
PIURA	13,115.207	76%
SULLANA	349.578	82%
FERREÑAFE	184.201	96%
HUAMANGA	818.229	93%
SAN JUAN BAUTISTA	2,597.397	81%
POZUZO	320.856	71%
CHANCAY	520.891	65%
YAUYOS	83.836	84%
BAGUA	1,102.828	81%
OXAPAMPA	724.162	75%
ANDAHUAYLAS	780.680	92%

To finance the 31 projets included in the program, the following actions are planned:

5.5.5 Participation of Beneficiaries

The beneficiares will participate by paying the rates. Furthermore, each project includes different activities in the investment stage to raise awareness among beneficiaries and promote the payment and increase of tax collection of public cleaning.

See below the rates that the beneficiaries are willing to pay:

Table 5.5-5 Calcualation of Amount of Service Fee

PROJECTS	How much are you willing to pay for a complete and improved public cleaning service in order to have a clean city?						Maximum collection percentage			Collection analysis		PIP collection proposal		
	S. 4 per month	S/ 5-8	S./9 -12	Nothing	S./15	Unknown	% rate accumulated <=4	% accumulated 4<rate<=12	% accumulated 8<rate<=12	Household rate with project	Willingness to pay (%)	Recaudación según gasto corriente (%)	Collection proposal (% cost s of O&M with project)	Proposal of collection increase (goal to year 10 according to survey)
CHANCAY	47.60%	29.80%	8.10%	8.90%		5.60%	85.50%	37.90%	8.10%	2.01	85.50%	35.40%	38%	86%
POZUZO	28.00%	34.00%	34.00%	2.00%		2.00%	96.00%	68.00%	34.00%	3.01	96.00%	59.30%	62%	80%
YAUYOS	50.00%	7.00%	1.60%	41.40%			58.60%	8.60%	1.60%	0.34	58.60%	0.76%	4%	59%
BAGUA - LA PECA	57.40%	31.10%	8.20%			3.30%	96.70%	39.30%	8.20%	10.41	8.20%	82.70%	86%	97%
HUAMANGA	20.69%	8.62%	49.13%	20.69%		2.59%	31.03%	10.34%	1.72%	4.92	10.34%	52.60%	53%	60%
OXAPAMPA	28.00%	34.00%	34.00%	2.00%		2.00%	96.00%	68.00%	34.00%	5.04	68.00%	59.30%	62%	68%
SAN JUAN BAUTISTA	53.95%	7.89%	1.32%	35.53%		1.32%	63.16%	9.21%	1.32%	6.17	9.21%	7.13%	10%	50%
ANDAHUAYLAS	61.10%	10.30%	6.30%	22.20%			77.70%	16.60%	6.30%	6.46	16.60%	27.28%	28%	50%
AZANGARO	42.50%	0.80%	1.70%	55.00%			45.00%	2.50%	1.70%	2.69	45.00%	14.30%	17%	44%
SULLANA	19.00%	56.30%	16.70%	7.90%			92.00%	73.00%	16.70%	6.08	73.00%	16.50%	20%	73%
SECHURA	35.80%	51.20%	3.30%	8.90%		0.80%	35.80%	54.50%	3.30%	5.10	54.50%	17.10%	20%	55%
ABANCAY	46.60%	32.10%	3.80%	17.60%			46.60%	35.90%	3.80%	2.86	46.60%	21.90%	25%	47%
AYMARAES	50.00%	7.00%	1.60%	41.40%			58.60%	8.60%	1.60%	7.63	8.60%	0.50%	4%	9%
CHACHAPOYAS	38.30%	44.90%	15.00%	1.90%			98.20%	59.90%	15.00%	4.70	59.90%	93.00%	60%	80%
CHINCHA ALTA	30.20%	24.80%	22.50%	21.70%		0.80%	77.50%	47.30%	22.50%	6.54	47.30%	30.40%	33%	47%
FERREÑAFE	67.70%	11.10%	2.00%	19.20%			80.80%	13.10%	2.00%	4.10	13.10%	64.70%	68%	80%
HUACHO	47.60%	29.80%	8.10%	8.90%		5.60%	85.50%	37.90%	8.10%	5.55	37.90%	35.40%	35%	38%
HUANUCO	47.90%	22.70%	9.20%	20.20%			79.80%	31.90%	9.20%	3.56	79.80%	44.13%	58%	80%
ILAVE	48.60%	19.30%	8.30%	22.00%	0.90%	0.90%	76.20%	27.60%	8.30%	2.49	76.20%	14.30%	15%	70%
JULIACA	30.40%	8.70%	11.60%	49.30%			50.70%	20.30%	11.60%	2.60	50.70%	23.70%	27%	51%
MOYOBAMBA	57.40%	31.10%	8.20%			3.30%	96.70%	39.30%	8.20%	3.95	96.70%	82.70%	86%	97%
NUEVO CHIMBOTE	38.40%	20.00%	5.60%	28.00%		8.00%	64.00%	25.60%	5.60%	2.99	64.00%	42.20%	45%	64%
PAITA	35.40%	39.40%	4.70%	17.30%		3.10%	79.50%	44.10%	4.70%	3.72	79.50%	41.60%	60%	80%
PARIÑAS	24.00%	47.20%	19.20%	6.40%		3.20%	90.40%	66.40%	19.20%	4.58	66.40%	31.20%	55%	90%
PIURA	29.80%	39.50%	14.50%	16.10%			83.80%	54.00%	14.50%	4.54	54.00%	33.70%	48%	60%
PUERTO MALDONADO	50.40%	20.00%	8.80%	18.40%	1.60%	0.80%	79.20%	28.80%	8.80%	3.81	79.20%	54.40%	57%	79%
PUNO	28.00%	49.60%	7.20%	14.40%		0.80%	84.80%	56.80%	7.20%	3.65	84.80%	33.50%	37%	85%
SAN MARTIN	28.00%	34.00%	34.00%	2.00%		2.00%	96.00%	68.00%	34.00%	4.66	68.00%	59.30%	62%	68%
SANTIAGO	45.20%	1.60%	1.60%	51.60%			48.40%	3.20%	1.60%	3.03	48.40%	6.00%	9%	48%
TARMA	61.10%	10.30%	6.30%	22.20%			77.70%	16.60%	6.30%	3.97	77.70%	27.28%	34%	50%
TUMBES	24.60%	34.90%	19.80%	15.90%	4.00%	0.80%	79.30%	54.70%	19.80%	4.78	54.70%	25.70%	29%	55%

Source: own elaboration

In those cities where the funding comes from the Inter American Development Bank, no payment perception survey has been carried out, except for Huamanga and San Juan Bautista.

5.5.6 Measures Adopted to Reduce Vulnerability of the Project caused by Natural or Social Danger or Social Conflicts that Cound Affect Peole Benefitted by the Project

Once the possible vulnerabilities are identified, the following measures are proposed:

1. The Project must comply with the technical construction regulations to properly storage the waste. It is important to scatter, compact waste, cover the soil, gas control, leachate and vectors, in order to avoid environmental pollution and protect the population health. In order to avoid any impact from El Niño, it is recommended to build drainage systems to avoid floods in the sanitary landfill area and then pollute the city with the leachate or waste material.
2. The municipality must include a monitoring plan to control the quality of the air, elimination of biogas through the system estipulated in the project and the EIA.
3. The municipality must train the population on recycling and reuse of waste, raise awareness through talks and educational campaigns in order to recover the material.
4. The municipality shall raise awareness, edúcate and organize the population regarding solid waste treatment.
5. The municipality shall promote a sustainable consumption and reduce the generation of solid waste to the mínimum and increase as much as possible the reuse and recycling of solid waste. By so doing, it will be source of financing to sustain the sanitary landfill and will create jobs.
6. The municipality shall establish deratting and fumigation programs in the area to minimize possible plagues and epidemic.

Measures to cope with risks in the investment stage

- -Slope. It is the slope of the trench, with a thicker upper part to withstand the pressure of the compacted solid waste.-Precipitation drainage. It is used as a conduit so that rainfall flows, thus avoiding any flood in the facility.
- **Geotextile**. It is used to reinforced the soil and increase the bearing capacity and then reduce any deformation of the soil when compacting soil, due to the high traction strength.
- Leachate pond. It is used in such a way that the leachate capture drainages drain in a recessed area in the wall. In order to avoid saturation, an additional pond could be built.
- Chimney installation. On top of the chimneys, a metal cylinder is installed (approximately a capacity of 55 gal), cut in half. Chimneys must be well maintained and protected at 0.40 meters above the finished profile level. Under no circumstance a chimney shall be closed before the treatment. Combustion will take place after installing a burner at least 1.5 m above the final surface of the landfill, then avoiding fire risks.

Measures to cope with any risk may happen during the operation stage

- Environmental monitoring. It includes the periodic evaluation of the environmental components to establish whether the activities carried out change the environment, specially to assess the soil stability and prevent slopes from falling down.
- Final coverageSupply of cover material to seal. The cover of solid waste will prevent odor from anaerobic decomposing, the contact of rainfall with solid waste and a possible

filtration to non polluted ground, proliferation of vectors and rodents, the unpleasant sight of uncovered solid waste and the scattering of waste caused by wind.

- **Upper cover will take place in two stages.** The first layer will be 0.30m of compacted thickness until proper density is obtained in order to avoid water filtration. The thickness of the second layer will depend on the type of vegeTable chosen or projected forestation. As for the project, the thickenss will be 0.30 m.

Final compacting. For the final seal of the platforms, an additional soil cover is placed until the cover thickness reaches approximately 0.60 m. It takes place 60 days onwards the platform is finished and/or at the same time as the cover of the last layer of waste.

Replanting.Once the platform is finished, it will have green areas. Said green areas will have trees and local plants. In the near future, the green area will include walking paths, so that people may use them to go for a walk.

The whole process described will prevent any risk, such as landslides.

The following chart shows measures and costs to reduce vulnerability

Table 5.5-6 Measures to Reduce Vulnerability

Processes	Cost in S/. of the Processes of CitizenParticipation and Environmental Management Strategy											
	Projects at a Feasibility level											
	Puno		Juliaca		Tarapoto		Huánuco		Piura		Sullana	
	Investment	O&M	Investment	O&M	Investment	O&M	Investment	O&M	Investment	O&M	Investment	O&M
Environmental Management Strategy												
1.1. Environmental Management Plan: EIA document that identifies the measurements that will allow to prevent, ease or correct the environmental impacts identified in each stage of the Project.It will develope between years 1 and 10.	**15500**	**34,565**	**13000**	**48,000**	**15000**	**34,865**	**13,500**	**34,865**	**15,000**	**36,065**	**1300**	**34,865**
a. Air impact (supervision of chimneys and burnersand maintenance)		5,000		5,000		5,000		5,000		6,000		5,000
b. Soil impact(supervision and maintenance of leachate teatment system and periodic irrigation)		22,065		35,000		22,065		22,065		22,065		22,065
c. Landscape impact(maintenance of the sanitary barrier)		1,000		1,000		1,000		1,000		1,000		1,000
d. Fauna Impact(control of species of the Project area)		1,000		1,000		800		800		1,000		800
e, Flora impact(maintenance of replanting)		1,000		1,000		1,000		1,000		1,000		1,000
f. Impact in healt status of the population(Implementation of capacitation plan for preventing health problems)		1,000		1,000		1,000		1,000		1,000		1,000
g. Territory impact due to territorial customs and vial flow(Applicaction of health and security regulationsin work, fulfillment of speed y de prácticas de transporte seguras y sanitarias)		2,000		2,000		2,000		2,000		2,000		2,000
h. Safety impact(Coordination Management between the Municipality, the pólice and the managerto improve the traffic flow avoidingaccidents. Also capacitation to drivers)		1,500		2,000		2,000		2,000		2,000		2,000
1.2. Environmental Surveillance Plan: EIA document that must look out for the fulfillment of the regulations during the operation and maintenance of the Project, ensuring public health and environmental protection)	**12000**	**13,000**	**10000**	**13,000**	**12000**	**13,000**	**10,000**	**13,000**	**12,000**	**13,000**	**12,500**	**13,000**
1.2.1 Responsible for ensuring the fulfillment of the Environmental Monitoring Plan		2,000		2,000		2,000		2,000		2,000		2,000
1.2.2. Environmental Monitoring of air quality (two points upwind and leeward), Superficial and groundwáter quality, noise levels andleachate. Semestral periodicity is expected		8,000		8,000		8,000		8,000		8,000		8,000
1.2.3 Occupational Monitoring (consists in monitoring worker´s health and the posible damage they could suffer. Periodicity is anual)		3,000		3,000		3,000		3,000		3,000		3,000
1.3. Compensation Plan: Document applied according to General Law of Environment – Law N°28611.	**No aplica**	**No aplica**	**11000**	**4,000**	**No aplica**	**No aplica**		**No aplica**		**No aplica**		**No aplica**
1.4 Communitary Relations Plan: Considers the measurements and actions that will develope what needed to ensure a harmonious relationship with communities near to the area of the Project, during the construction, operation and maintenance and closure of infrastructure stages	**13000**	**12,200**	**11000**	**12,200**	**13000**	**12,200**	**11,500**	**12,200**	**13,000**	**13,200**	**13,000**	**13,200**
a. training in road safety, industrial and higiene safety and environmental protection		1,200		1,200		1,200		1,200		1,200		1,200
b. Regulations of Communitary Relations		1,000		1,000		1,000		1,000		1,000		1,000
c. Realizationof social projection work (a tree per house)		4,000		4,000		4,000		4,000		5,000		5,000
d. Visit facilitator to student population(conferences during parcial closure stage)		3,000		3,000		3,000		3,000		3,000		3,000

Processes	Cost in S/. of the Processes of CitizenParticipation and Environmental Management Strategy											
	Projects at a Feasibility level											
	Puno		Juliaca		Tarapoto		Huánuco		Piura		Sullana	
	Investment	O&M	Investment	O&M	Investment	O&M	Investment	O&M	Investment	O&M	Investment	O&M
e. Employment(will be needed for dismantling of facilities and tree planting)		3,000		3,000		3,000		3,000		3,000		3,000
1.5 Contingency Plan: Indicates the measurements that need to be developed before, during and after an eventual emergency that could imply a threat to public health, the environment or to the facilities, in any stage of the Project.. It will be conducted between the years 1 and 10.	**15000**	**7,000**	**12000**	**7,000**	**15000**	**7,000**	**13,000**	**7,000**	**15,000**	**7,000**	**11,000**	**7,000**
a. Capacitation of 6 brigades (2 meetings a year for each one)		2,000		2,000		2,000		2,000		2,000		2,000
b. Driels (2 a year)		1,000		1,000		1,000		1,000		1,000		1,000
c. Purchase of equipment		3,000		3,000		3,000		3,000		3,000		3,000
d.Maintenance of equipment		1,000		1,000		1,000		1,000		1,000		1,000
1.6. Closure Plan: to prevent contamination of solid, liquid or gaseous elementsin a short, médium or long term; generated because fo the termination of activities related to solid waste management and the infrastructure	**18500**	**713,332.79**	**18500**	1259802.40	**18000**	**1'101,997.86**	**17,000**	**787.472,42**	**19,000**	**2.784.754,98**	**15,000**	**916.832,26**
1.6.1 final Coverage		713,332.79		1259802.40		1'101,997.86		**787.472,42**		**2.784.754,98**		**916.832,26**
1.6.1.1 Coverage with materials from the area e= 0.40 m with expanssion of 20% (considered for the years 6,7,8, 9 and 10)		611,309.19		1154654.80		993,774.66		**679.249,22**		**2.533.657,38**		**817.021,46**
a. Cut of the enabled area		116,961.63		240,286.78		202,428.45		131.039,45		520.151,37		164.136,35
b. Load		164,424.31		337,794.46		284,573.32		184.214,88		731.227,28		230.742,41
c. Transport		233,923.25		480,573.56		404,856.89		262.078,90		1.040.302,73		328.272,70
D Spread and conformation		96,000.00		96,000.00		101,916		101.916,00		241.976,00		93.870,00
1.6.2 Burners installation		**4,373.60**		**7,497.60**		5,623.20		**5.623,20**		**7.497,60**		**5.310,80**
a. Installation of gas burners		4,373.60		7,497.60		5,623.20		5.623,20		7.497,60		5.310,80
1.6.3 Vegetation		**97,650**		**97,650**		102,600		**102.600,00**		**243.600,00**		**94.500,00**
a. Vegetation (planting of bushes)		97,650		97,650		102,600		102.600,00		243.600,00		94.500,00
1.6.4 Permanent drainage												

5.6 ENVIRONMENTAL IMPACT ANALYSIS

The Program was established to cater to the environmental problem of solid waste, being the main goal the continuous improvement of long- term environmental sustainability.

Bearing this in mind and considering that the environmental evaluation of the Program wants to solve the problems, thus proposing management measures under a prevention scope, so that environmental impact evaluated can be controlled and minimized.

The measures proposed complied with the technical, economic and social feasibility through engineering designs, and the implementation of standards and/or procedures to guarantee the goals included in the program. Among the goals, one could mention solid waste management, setting up of activities to perform the goals of the program, thus contributing to solve the problems and sustainably develop the activities carried out in each prioritized city.

The Program is aimed at promote the proper management of solid waste generated, and include environmental issues in the development of the activities implemented in each project.

5.6.1 Identification of Environmental Impacts

It has been considered the enlargement and improvement of services rendered by municipalities included in the Program, that's why the negative impacts to the natural environment will be minimal and/or be controlled. However, there are several activities linked to the execution of works (i.e. final disposal and solid waste facilities) that could cause social and environmental risk. Therefore, it is important to identify them in order to propose actions or measures aimed at preventing, mitigating and/or compensate the potential negative impacts.

It is important to mention that the environmental impacts will appear in the pre operational stage (investment: construction of final disposal and use facility), and the operational stage (post investment: including program implementation in each of the cities; improvement of services, building capacities of institutions and participation of citizens).

5.6.2 Identification of Impacts caused by facilities of Final Disposal and Solid Waste Reuse

The main impacts generated are:

- Air. Air can be affected by emission of particles, gas, noise and odor. The evaluation of all these elements decides the quality of the air. In the case of particles, gas and noise the are environmental quality standards and permissible limits regulated. On the other hand, odor could have a potential impact due to the solid waste decomposition, mainly of hydrogen sulphure.
- Soil. It is important to evaluate subcomponents such as permeability, stability, degree of compacting and soil quality. The election of the soil was based taking into account that some mechanical actions should impact the soil. However, the ideal soil has been selected since the site selection stage so that potential impacts were kept to a minimum or easily solved.
- Water. Two subcomponents have been described: superficial water quality and groundwater quality, in order to find any possible impact, such as water pollution. Forthe case of the project, there are no nearby water sources in the area of influence.

- Landscaping. Ecosystems have been evaluated as a subcomponent that may receive environmental impacts, affecting the life in the site, therefore changing the landscape. On the other hand, landscape change has been included to highlight the direct impact that anthropogenic works have on the original landscape.
- Fauna. The subcomponents to evaluate are native habitats and species, since some fauna species could be moved to another area due to the activities performed in the habitat where species live.
- Flora. The subcomponents are vegetal cover and native species. Generally, there will an impact on vegetal cover, and therefore existing native species will be disappeared. However, a proper management of the infrastructure will enabled recover the species.
- Population. The subcomponents are public health, health at work and commitment of beneficiaries. Health issues will have positive and negative impacts. By implementing such Project, the health of beneficiaries will improve. Regarding health at work, it could be jeopardized since some of the safety work procedures may not be complied with. Regarding population involvement, positive impacts are expected.
- Land. The use and customs regarding land and vehicle traffic have been evaluated in order to highlight the potential environmental impact due to changes in the use of land, signaling of vehicle traffic non existing before.
- Economy. Creation of jobs and economic activities that may have a potential positive impact.
- Safety. Evaluation of risk factor of accidents that could occur while performing the activities included in the Project.

5.6.3 Results of Interaction of Program Activities with Environmental Factors

Table 5.6-1 Matrix of Environmental Impact

		Environmental Factors																	
		Physical							Biological				Socio-cultural and economic						
		Soil			Water		Air		Flora		Fauna								
Nro.	Actitivies of the Program	Permeability	Degree of compactation	Quality of Soil	Quantity of Surface water	Quality of groundwater	Emission of gases and particles	Odors	Vegetation	Native species	Habitats	Native species	Public health	Involvement of beneficiary population	Occupational health	Uses and costums of the region	Traffic flow	Employment generation
1	Pre-Operational Stage (Preparation and Construction																	
1.1	Construction of Sanitary landfill infraestructure	-1	-1	-1	0	0	-1	0	-1	-1	-1	-1	0	3	1	1	0	3
1.2	Fitting Out of Organis waste treatment Plant and Plant of separation of Inorganic recyclable waste	0	0	-1	0	0	0	-1	-1	-1	-1	-1	0	3	1	1	0	3
1.3	Implementation of swepping, collection and transporting system (acquisitions)	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	3
1.4	Implementation of Process of citizen participation in the integral management of solid waste	0	0	0	1	1	1	1	1	1	1	1	2	2	2	2	2	1
1.5	Social inclusion of vulnerable sectors of the population in the integral management of solid waste	0	0	0	0	0	0	0	0	0	0	0	2	2	3	3	3	3
2	Operational Stage (Post Investment)																	
2.1	Vigilance, monitoring and supervision of Program Implementation	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1
2.2	Complying with the regulations	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2.3	Application of system of collection tax for providing services	0	0	0	0	0	1	1	0	0	0	0	3	3	3	3	0	3
2.4	Operation and Maintenance of final disposal service of Solid Waste	1	1	1	1	1	3	3	1	1	1	1	3	3	3	1	1	3
2.5	Operation and Maintenance of Selective collection service of Solid Waste	0	0	0	0	0	0	0	0	0	0	3	3	3	3	3	0	3
2.6	Operation and Maintenance of Street and public spaces swepping service	0	0	0	0	0	1	0	0		0	0	2	2	2	2	0	2
2.7	Operation and maintemance of transporting and collection service	0	0	1	1	1	1	1	0	0	0	0	2	2	2	2	0	2
2.8	Operation of citizen participation programs	0	0	0	0	0	0	0	0	0	0	0	2	3	1	3	0	3

																		220		
Negative Impacts																		**14**		
Low=	-1	1	1	2	0	0	1	1	2	2	2	2	0	0	0	0	0	0	12%	**6.36%**
Moderate=	-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	
High=	-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	
Subtotal		**1**	**1**	**2**	**0**	**0**	**1**	**1**	**2**	**2**	**2**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**12%**	
Positive Impacts																		**119**	**54.09%**	
Low=	1	3	3	4	5	5	5	4	4	4	4	4	3	3	6	6	4	3	59%	
Moderate=	2	0	0	0	0	0	1	1	0	0	0	0	5	4	3	3	1	1	16%	
High=	3	0	0	0	0	0	1	1	0	0	0	1	3	6	4	4	1	9	25%	
Subtotal		**3**	**3**	**4**	**5**	**5**	**7**	**6**	**4**	**4**	**4**	**5**	**11**	**13**	**13**	**13**	**6**	**13**	100%	
No significants																		**87**	**39.55%**	
No sifgnificants=	0	9	9	7	8	8	5	6	7	6	7	6	2	0	0	0	7	0	55%	
Total interations		13	13	13	13	13	13	13	13	12	13	13	13	13	13	13	13	13	**100%**	

Wighting of impacts (magnitude)																				
Negative Impacts		**Positive Impacts (+)**										**Depreciable Impacts**								
Low	-1	Low									1	No significant								0
Moderate	-2	Moderate									2									
High	-3	High									3									

The reviewed program, including the two main stages, will generate 6.36% negative impacts. It is important to mention a process of change and transformation due to the construction of the sanitary landfill, and to a lesser extent, the treatment plant of organic waste and segregation plant of inorganic recyclable waste. This is due mainly to the earth works to be performed and local flora and fauna intervention, mainly in the jungle area.

54.09% de of the actions will originate positive impact at all levels. In the pre operation stage, the program will not affect the environment, will improve the conditions of the environment and will involve the population and vulnerable sectors. Finally, 39.55% of the interactions are not important.

Taking all this into account, the program will benefit the cities involved in the program since it will improve basic sanitation, will prevent proliferation of diseases related to the inadequate use of solid waste, and ensures that the air, water and soil do not degradate for the improper disposal of solid waste. Additionally, involvement of beneficiaries regarding transmission of good practices, source of job opportunities are key to ensure the program is sustainable and develops an ongoing improved relationship.

Identified impacts, depending on the objectives are:

Impacts to mitigate
o Contamination of the enviromental factors: air, water, soil, with the eminent risk on public health and enviromental degradation because of the mismanagement of solid wastes .
o Public services of solid waste managements with a limited offer and without a future demand projection.
o Insufficient or limited raise of municipal taxes.
o Increased risk of inadequate population practices, legal gap.
o Active participation of the population while the operation and manteinance of the Project.

Mitigation of identified impact is:

Mitigation Impact (guidelines)
o To improve the services quality and solid waste management.
o Implement an efficent system for the collection of municipal taxes for the public cleaning, according to goals and tangible objectives.
o Generate mechanisms that guarantee in an internal level the participation of all the involved actors.
o Minimize the pressure on natural resources.
o Decrease the pressure on natural resources.
o Increase the reuse of wastes generated in the origin source.
o Implement recycling systems with social inclusión to guarantee a smooth cycle of solid waste generated
o Implement recycle systems with social inclusion, that guarantee a correct cicle of the generated solid waste.

Table 5.6-2 Identification of Environmental Impacts in the Feasibility Projects of the Program

IMPACTS			CITIES											
			Juliaca						Tarapoto					
			Highly significant(<-7)	Significant (>=-7 y <-4.5)	Moderate (>=-4.5 y <-2.5)	Negligible (>=-2.5 y <0)	Beneficial (>0)	No impact	Highly significant(<-7)	Significant (>=-7 y <-4.5)	Moderate (>=-4.5 y <-2.5)	Negligible(>= -2.5 y <0)	Benéfico (>0)	Siin impacto
FACTORES AMBIENTALES	Air	Particles in suspension	0	3	11	16	2	12	0	3	11	16	2	12
		Gas	0	4	8	18	2	12	0	4	8	18	2	12
		Level of noise	0	4	16	15	1	8	0	4	16	15	1	8
		Odor	0	2	4	1	3	34	0	2	5	1	3	34
	Soil	Permeability	0	0	0	0	17	27	0	0	0	0	17	27
		Stability	0	0	3	0	17	24	0	0	3	0	17	24
		Compacting level	0	0	0	0	18	26	0	0	0	0	18	26
		Quality of soil	0	1	1	1	5	36	0	2	1	0	5	36
	Water	Calidad de agua superficial	0	0	0	0	0	44	0	0	0	0	0	44
		Calidad de agua subterránea	0	0	0	0	0	44	0	0	0	0	0	44
	Landscape	Ecosystems	0	15	15	0	4	10	0	15	15	0	4	10
		Landscape change	0	15	15	1	6	7	0	15	15	1	6	7
	Fauna	Habitats	0	1	27	1	4	11	0	15	14	0	4	11
		Native spices	0	1	27	1	2	13	0	15	14	0	2	13
	Flora	Cobertura vegetal	0	1	16	4	4	19	0	11	7	3	4	19
		Especies nativas	0	1	16	3	3	21	0	11	7	2	3	21
	Population	Public Health	0	0	0	0	14	30	0	0	0	0	14	30
		Engagement of beneficiaries	0	0	0	0	7	37	0	0	0	0	7	37
		Occupational Health	0	0	35	2	0	7	0	0	35	2	0	7
	Land	Use of land	0	2	18	1	6	17	0	2	18	1	6	17
		Flujo vial	0	1	2	16	2	23	0	1	2	16	2	23
	Economy	Job creation	0	0	0	0	44	0	0	0	0	0	44	0
		Economic activities	0	0	0	0	44	0	0	0	0	0	44	0
	Safety	Accidents	0	21	21	1	0	462	0	21	21	1	0	462
Total impacts			0	72	235	81	205	924	0	121	192	76	205	924
Percentage (%)			0.00%	4.74%	15.48%	5.34%	13.50%	60.87%	0.00%	7.97%	12.65%	5.01%	13.50%	60.87%

5.6.4 Identification of Measures of the Environmental Management Plan

The strategies to prevent, control and reduce the enviromental impacts caused by the Program are detailed in the chart below, which represents the Enviromental Management Plan, actions to be taken depending on each particular case.

Identification of measures of the Environmental Management Plan in the investment stage
Soil
The responsible contractor of the construction should be required that his working personal is accordingly qualified for the work to do, in order to accomplish working procedures affecting as little as possible to the salary..
A possible contamination to the soil of the location is controled by the instalation of a geomembrane/geotextil of high polyethylene density.
During the construction stage, soil quality can be altered by theClearing and Debris Deposit, the correct handling and final disposal must be guarantee (Solid Waste provider, registered and licensed to provide service by the Department of Environmental Health).
Air
The program will require that every project guarantee protection actions for the air quality, during the enabling and construction stage.
Apply the risk to sediment the dust particles during the construction stage.
Water
The program will require that every Project design guarantee the ground water and the superficial courses near each city protection, therefore the Ministry of Environment and the Department of Environmental Health will require a strict procedure of the existing rules during the construction stage.
Flora
To insure the availability of the vegetal coverage (8 m^2per capita on site). During the operation in the available green area, must ensure the adequate conservation providing shelter to native species. The correction will be made with revegetation and monitoring.
Fauna
The correction to this involvement will be made with revegetation and monitoring. (As for the cleaning and clearing will move to habitats and species housed at the site and the progress of ongoing work in the area tends to degrade habitats and native species).
Sociocultural and economic
At the construction stage, it must be demanded to the contractor to establish mitigation measures: Transmit to all the neighbor environment information that highlights the importance of the work/project and their commitment to the environment care; the signposting and posters must include dissuasive messages in order to gain the public's acceptance; take actions that avoid strong changes in the atmosphere because of the dust, gases.
It should provide, for the prevention of the occupational health case, the correct use of the personal protection equipments. This must have quality certificates, and the workers must be qualified in its use and conservation.
Build and manage all the Project,meeting the according standards in order to mitigate the use that will be assigned to the landfill sites. In regard to traffic flow, coordinate with the local authorities to signpost the transport routes on the way to infrastructures, in order to guarantee road safety. Therefore coordinate with the clients, the attention schedules to mitigate an increase of the road traffic.
On the construction stage it will be required the hiring of a company whose contract has clauses which establish the obligation of comply legal and regulation norms according to the risk prevention and work security. For the landfill infrastructure, organic waste treatment plant and inorganic recyclable wastes separation plant; the work security must be under the control and monitor of an Hygiene Engineer and Industrial Safety with experience in similar projects, responsible of exercise and ensure the compliance of a Security Working Plan. The Security Working Plan will include:Inspection development for the detection of conditions and sub-standard acts (elements condition, risky

Identification of measures of the Environmental Management Plan in the investment stage
equipment, non-compliance norms, etc.), Training at security related themes, the correct use of the personal protection equipment and security devices, signaling of risky zones, traffic precautions, guarantee that every transportation of materials/wastes is developed meeting the existing rules.

Source: PWI S.A.C., 2010.

Identification of Measures of the Environmental Management Plan on the Post Investment Stage
Soil
To guarantee the sustainability of the correct management of solid wastes and not affect the soil; a training plan must be developed targeted to workers, contractors and the involved population in classification issues, management and waste minimization
The program considers that every Project must have a supervision and monitoring mechanism, e.g.: the public storage must be efficient in order to avoid proliferation of critical points
Air
In the case of landfill, should enforce the compliance activities of maintenance and installation of the chimneys with their respective burners ensuring the operation of themselves. Leachate treatment odor, requires that there is a complete supervision of the operation and maintenanceof the leachate treatment system. On the organic wastes treatment plant, should enforce the reception of the fresh organic matter and process it to prevent the odor emission. On the same way the compliance of the proper compost elaboration must be monitored accomplishing the established schedule. Control the transport and machinery speed, to ensure their good technical condition. Road training where the carrier is educated in the use of HORNS and arrange a supportive culture with nearby neighbors. Personal protection equipments use. Develop enviromental monitoring meeting the current legislation.
Water
Provide the correct maintenance to the septic tank and the landfill percolating well.
Perform a permanent supervision to the leachate monitoring pond and the applied treatment system
Flora
Ensure the revegetation of the platforms
Promote the public participation on the friendly practices with environment, such as plant trees.
Fauna
Keep in health conditions the future facilities with the application of DERRATING and DESINFECTION, in order to avoid and control vector pests.
Sociocultural and economic
The population must be informed about the possible health risks and be trained to control those sanitary risks (Influence in health and safety issues related to solid waste)
Ensure the provision of necessary safety equipment (gloves, security shoes, masks, glasses, etc.), to the workers from the service provision of solid waste management in each project

Source: PWI S.A.C., 2010.

5.6.5 Identification of Environmental Awareness Measures

Stages	Objective	Indicator
Purpose		
Component 1	The population knows and supports the implementation of the projects for a better management of solid wastes in their cities	A percentage of the population knows the projects for the improvement of the solid waste management in their cities A percentage of the population supports the implementation of the initiative.
Component2	Population from educational institutions and families assume practices for the correct management of solid wastes	Number of educational institutions that implement practices for the waste separation Properties percentage that separate wastes at their residence. Percentage of land holders that are willing to pay for the public cleaning.

Appendix ofEnvironmental Impact Assessment of the National Program will include further details.

Measures of Management Plan and Environmental Mitigation

Final disposal is the activity that may cause more significant impact on the influence area, due to related activities that will affect the landscape and environment as a whole. In that sense, in accordance with the legal framework and National Program scope, the Environmental Impact Assessment category III for the seven projects at perfil level has been drafted. This document reflects the environmental strategy with the budget, so that investment, operation and maintenance are guaranteed.

However, the National Program does not include the financing of environmental impact assessments for the eight pre F/S and 16 perfils. Thus, the EIA, with the corresponding environmental strategy must be financed by the municipalities according to law in force and effect.

Table 5.6-3 Measures of Environmental Management

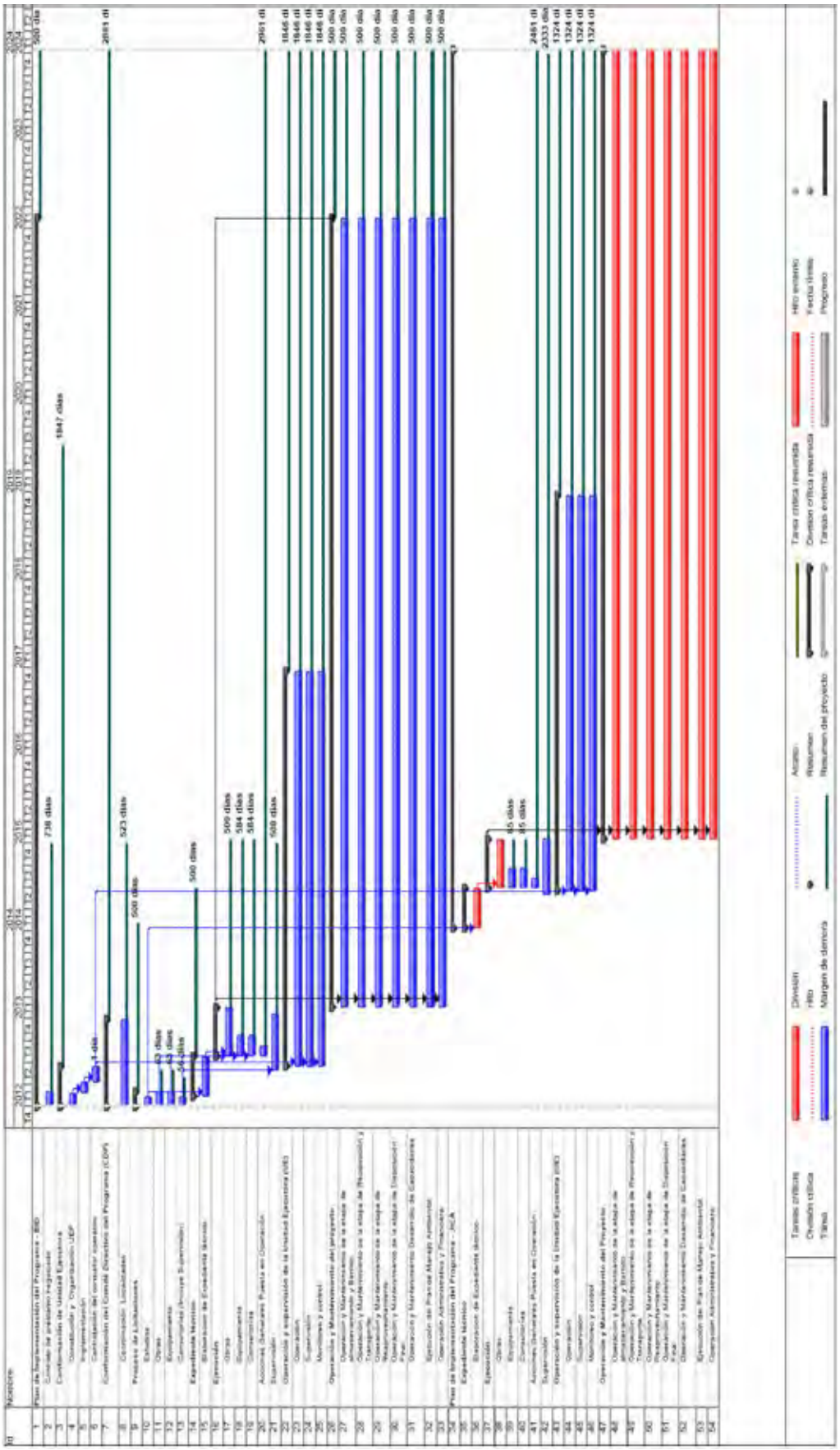
Processes	Cost in S/. of the Processes of CitizenParticipation and Environmental Management Strategy											
	Projects at a Feasibility level											
	Puno		Juliaca		Tarapoto		Huánuco		Piura		Sullana	
	Investment	O&M	Investment	O&M	Investment	O&M	Investment	O&M	Investment	O&M	Investment	O&M
Environmental Management Strategy												
1.1. Environmental Management Plan: EIA document that identifies the measurements that will allow to prevent, ease or correct the environmental impacts identified in each stage of the Project.It will develope between years 1 and 10.	**15500**	**34,565**	**13000**	**48,000**	**15000**	**34,865**	**13,500**	**34,865**	**15,000**	**36,065**	**1300**	**34,865**
a. Air impact (supervision of chimneys and burnersand maintenance)		5,000		5,000		5,000		5,000		6,000		5,000
b. Soil impact(supervision and maintenance of leachate teatment system and periodic irrigation)		22,065		35,000		22,065		22,065		22,065		22,065
c. Landscape impact(maintenance of the sanitary barrier)		1,000		1,000		1,000		1,000		1,000		1,000
d. Fauna Impact(control of species of the Project area)		1,000		1,000		800		800		1,000		800
e, Flora impact(maintenance of replanting)		1,000		1,000		1,000		1,000		1,000		1,000
f. Impact in healt status of the population(Implementation of capacitation plan for preventing health problems)		1,000		1,000		1,000		1,000		1,000		1,000
g. Territory impact due to territorial customs and vial flow(Applicaction of health and security regulationsin work, fulfillment of speed y de prácticas de transporte seguras y sanitarias)		2,000		2,000		2,000		2,000		2,000		2,000
h. Safety impact(Coordination Management between the Municipality, the pólice and the managerto improve the traffic flow avoidingaccidents. Also capacitation to drivers)		1,500		2,000		2,000		2,000		2,000		2,000
1.2. Environmental Surveillance Plan: EIA document that must look out for the fulfillment of the regulations during the operation and maintenance of the Project, ensuring public health and environmental protection)	**12000**	**13,000**	**10000**	**13,000**	**12000**	**13,000**	**10,000**	**13,000**	**12,000**	**13,000**	**12,500**	**13,000**
1.2.1 Responsible for ensuring the fulfillment of the Environmental Monitoring Plan		2,000		2,000		2,000		2,000		2,000		2,000
1.2.2. Environmental Monitoring of air quality (two points upwind and leeward), Superficial and groundwáter quality, noise levels andleachate. Semestral periodicity is expected		8,000		8,000		8,000		8,000		8,000		8,000
1.2.3 Occupational Monitoring (consists in monitoring worker´s health and the posible damage they could suffer. Periodicity is anual)		3,000		3,000		3,000		3,000		3,000		3,000
1.3. Compensation Plan: Document applied according to General Law of Environment – Law N°28611.	**No aplica**	**No aplica**	**11000**	**4,000**	**No aplica**	**No aplica**		**No aplica**		**No aplica**		**No aplica**
1.4 Communitary Relations Plan: Considers the measurements and actions that will develope what needed to ensure a harmonious relationship with communities near to the area of the Project, during the construction, operation and maintenance and closure of infrastructure stages	**13000**	**12,200**	**11000**	**12,200**	**13000**	**12,200**	**11,500**	**12,200**	**13,000**	**13,200**	**13,000**	**13,200**
a. training in road safety, industrial and higiene safety and environmental protection		1,200		1,200		1,200		1,200		1,200		1,200
b. Regulations of Communitary Relations		1,000		1,000		1,000		1,000		1,000		1,000
c. Realizationof social projection work (a tree per house)		4,000		4,000		4,000		4,000		5,000		5,000
d. Visit facilitator to student population(conferences during parcial closure stage)		3,000		3,000		3,000		3,000		3,000		3,000
e. Employment(will be needed for dismantling of facilities and tree planting)		3,000		3,000		3,000		3,000		3,000		3,000

Processes	Cost in S/. of the Processes of CitizenParticipation and Environmental Management Strategy											
	Projects at a Feasibility level											
	Puno		Juliaca		Tarapoto		Huánuco		Piura		Sullana	
	Investment	O&M	Investment	O&M	Investment	O&M	Investment	O&M	Investment	O&M	Investment	O&M
1.5 Contingency Plan: Indicates the measurements that need to be developed before, during and after an eventual emergency that could imply a threat to public health, the environment or to the facilities, in any stage of the Project.. It will be conducted between the years 1 and 10.	**15000**	**7,000**	**12000**	**7,000**	**15000**	**7,000**	**13,000**	**7,000**	**15,000**	**7,000**	**11,000**	**7,000**
a. Capacitation of 6 brigades (2 meetings a year for each one)		2,000		2,000		2,000		2,000		2,000		2,000
b. Driels (2 a year)		1,000		1,000		1,000		1,000		1,000		1,000
c. Purchase of equipment		3,000		3,000		3,000		3,000		3,000		3,000
d.Maintenance of equipment		1,000		1,000		1,000		1,000		1,000		1,000
1.6. Closure Plan: to prevent contamination of solid, liquid or gaseous elementsin a short, médium or long term; generated because fo the termination of activities related to solid waste management and the infrastructure	**18500**	**713,332.79**	**18500**	1259802.40	**18000**	**1'101,997.86**	**17,000**	**787.472,42**	**19,000**	**2.784.754,98**	**15,000**	**916.832,26**
1.6.1 final Coverage		713,332.79		1259802.40		1'101,997.86		**787.472,42**		**2.784.754,98**		**916.832,26**
1.6.1.1 Coverage with materials from the area e= 0.40 m with expanssion of 20% (considered for the years 6,7,8, 9 and 10)		611,309.19		1154654.80		993,774.66		**679.249,22**		**2.533.657,38**		**817.021,46**
a. Cut of the enabled area		116,961.63		240,286.78		202,428.45		131.039,45		520.151,37		164.136,35
b. Load		164,424.31		337,794.46		284,573.32		184.214,88		731.227,28		230.742,41
c. Transport		233,923.25		480,573.56		404,856.89		262.078,90		1.040.302,73		328.272,70
D Spread and conformation		96,000.00		96,000.00		101,916		101.916,00		241.976,00		93.870,00
1.6.2 Burners installation		**4,373.60**		**7,497.60**		5,623.20		**5.623,20**		**7.497,60**		**5.310,80**
a. Installation of gas burners		4,373.60		7,497.60		5,623.20		5.623,20		7.497,60		5.310,80
1.6.3 Vegetation		**97,650**		**97,650**		102,600		**102.600,00**		**243.600,00**		**94.500,00**
a. Vegetation (planting of bushes)		97,650		97,650		102,600		102.600,00		243.600,00		94.500,00
1.6.4 Permanent drainage												

5.7 IMPLEMENTATION PLAN

Once the Project is declared viable by the DGPM, then MEF approves external indebtedness by Supreme Decree, with the approval of the Council of Ministers. After issuing the supreme Decree, MEF will sign the negotiated loan agreement with the lenders. Later on, disbursement takes place financed by the loan, requested by the Project Executing Unit.

The schedule appendix include the physical and financial implementation of the program, which enables a better programming of the expenditure, above all if the program includes to implement strategic actions in all cities simultaneously.



5.8 ORGANIZATION AND MANAGEMENT

5.8.1 Organization and execution outline of the Program

The investment will be done through the Executing Unit of the Program (UEP) regarding administrative,financial, accountancy and coordination tasks. Besides, the UEP will be helped by the Coexecuting Units, formed by the municipalities, to develop certain activities related to the Program.

It is important to mention that each Coexecuting Unit of the Program, formed by the municipalities, will appoint a coordinator who will undertake all necessary actions to develop the Program activities. The coordinator will represent the municipalities for a certain period of time.

At the same time, subexecuting units will be implemented in each municipality to execute some of the investments planned in the program. The USEPs will comply with law and report to the UEP.

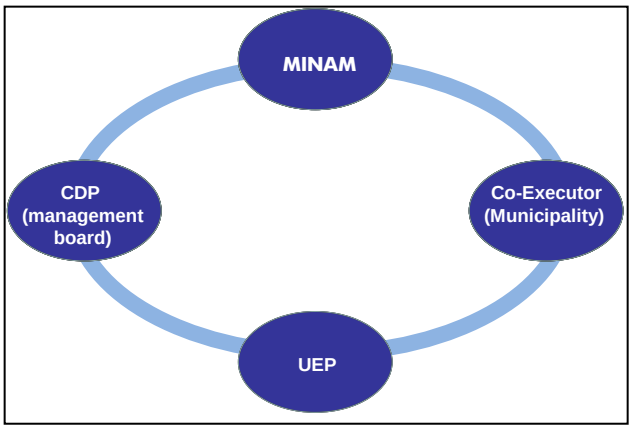


Figure 5.8-1 Organizations of the Program

5.8.2 Responsibilities of Actors involved in the Program

(1) PROGRAM MANAGEMENT BOARD (CDP in Spanish)

The management board is the maximum authority ruling the program. It will guide the program execution and will be formed by the following members with the right to vote:

- Vice Ministry of Environmental Management, the chairperson
- Representative of Ministry of Economy MEF
- Four representatives of the municipalities involved where the program will be executed, organized in four areas of work: north, center, south and east. Said representatives, that can be mayor, general manager or deputy mayor will be chosen by the municipalities of the areas they represent.

At the same time, it will be formed by the following members, with no voting rights>

- JICA representative
- IDB representative

- General coordinator of the executing unit of the program, who will act as a secretary.

The management board will gather quarterly, and the callings and quorum comply with the law in force and effect.

The management board will in charge of the following activities:

- Approve the Annual Operating Plan (AOP) and the Procurement Plan of the program. It is important to mention that the Procurement Plan is flexible and the borrower must update annually whenever appropriate. The borrower must execute the procurement plan as agreed by JICA and IDB.
- Establish guidelines to select the general coordinator of the Program through a fair process according to the regulations of the cooperating organizations.
- Approve the Operating Manual of the Program and modifications, if necessary.
- Approve the annual report of the program
- Be informed on the quarterly and biannual reports on execution of components and activities of the program, thus contributing if necessary.
- Ensure the program and other institutional agreements signed by the program are complied with.
- If appropriate, identify the bottle necks that affect the running of the program and facilitate the adequate corrective measures.
- Meet frequently with civil society in order to inform on the program actions and obtain feedback on the results reached, when appropriate.
- Issue agreements in areas within its competence
- Review and evaluate the global performance of the UEP
- Others that may be assigned

(2) MINISTRY OF ENVIRONMENT

The Ministry of Environment is responsible for conserving the environment and the sustainable use of natural resources. The main duties are:

1. Articulate with those in charge of executing the Program, such as the Program Executing Unit and the Subexecuting units.

2. MINAM must coordinate all budget issues regarding the Program

(3) Municipalities participating as subexcuting units of the Projects (UCE)

Each of the municipalities included in the Program will become subexecuting units and will be responsible to implement specific projects of each of the cities,being responsible to operate the solid waste management.

Each municipality participating in the project will appoint a network coordinator that will act on behalf of the municipalities for a period of time, performing all actions necessary to develop the program. The networks coordinator will be responsible to execute the solid waste management program, coordinating with the UEP all actions to achieve this. It is important to mention that although the executing unit will manage the program, the activities related to the solid waste project will depend on the offices responsible of each local government.

At the same time, each network coordinator has several duties:

i) Promote and disseminate the program, schedule investments always in coordination with the municipalities

ii) Organize all callings for the tender procedures, with the support of the executing unit of the program

iii) Approve the terms of reference or technical specifications

iv) Support the evaluating committees regarding hiring

v) Review and approve the products submitted by the suppliers of goods or services for the program, and send reports to these no later than 15 working days. After this term, and under the network coordinator, it should be understood that the municipality accepts the good or service and the UEP shall pay the supplier.

vi) Administer the contracts and agreements with the municipalities

vii) Monitor and submit reports on the executing of components of the Program.

On the other hand, the subexecuting units (that is, the municipalities) will execute the investments of such places within the framework of the program and according to the provisions and reporting to the UEP.

The USEPs will be responsible for the following actions:

- Coordinate the execution of the investments of each municipality involved in the Program
- Submit the reports to the UEP regarding the physical and financial progress of the investments they are responsible for.
- Submit to the UEP the annual operating plan and procurement plan, in accordance with the operating manual of the program.

(4) Executing Unit of the Program (UEP)

The executing unit of the program, has been approved by law within the framework of the loan agreements signed by JICA and IDB to implement the Program of solid Waste Management Systems in Priority Areas. The executing unit has been developed by the Ministry of Environment, has its own budget in order to develop technical, administrative, economic and financial activities,as well as to plan, execute, monitor and evaluate the Program. At the same time, it is responsible to transfer resources to the municipalities included in the Program, thus providing technical support and monitoring them so that they can show they are capable of executing studies and works..

The UEP is responsible to manage financial resources from JICA and IDB, and depend on the viceministry of Environmental Management.

The UEP will implement its actions and will coordinate with the municipalities included in the Program. For that matter, the unit will sign management agreements with local governments in order to establish the execution method of resources that will be allocated to the Program. The UEP will mention mutual obligations regarding technical assistance, supervision of the program so that execution and results obtained are transparent. Thus, the program will channel the funds to the fund trust accounts opened with the municipalities. Furthermore, network coordinators will manage the programs at the subexecuting units.

Read below the responsibilities of the UEP:

- Execute the program according to the loan agreements
- Execute tender procedures of works, procurement of goods and hiring of services, as required by the Program
- Coordinate and execute the program investments, coordinating with the subexecuting units.

The executing unit will be formed by:

- Program coordinator, formed by:
  - General coordinator of the executing unit
  - Management Assistant
  - Administrative support
  - Driver
- Administration area, formed by:
  - Administrative manager, responsible for:
    - Budget specialist
    - Treasury specialist
    - Accountancy and Equity specialist
    - Procurement specialist
    - Procurement analyst
- Advisory area, formed by:
  - Legal specialist
  - Monitoring and Evaluation specialist
- Technical area, formed by:
  - Technical manager, responsible for:
    - Sweeping and collection specialist
    - Specialist on organic and inorganic waste reuse
    - Specialist on solid waste final disposal
    - Municipal management specialist
    - Communications specialist

(5) Procurement and Contracting Methods

Both the procurement and contracting will be executed jointly by the executing unit of the program and the municipalities.

- The UE of the program transfers part of the resources to execute the activities assigned to the executing unit of the municipality
- The UE of the municipality executes the assigned activities

- The executing unit of the program monitors the execution of the financial resources transfered
- The executing unit executes the rest of the activities that have not been assigned

Advantages

- Economies of scale and scope in the procurement is achieved
- Less procurement procedures, therefore saving time and costs
- The executing unit of the program advises the municipalities and the executing unit of the program by dispatching technical especialists in Works, machinery, etc.
- Works supervisión and delivery of godos and services is done jointly with the executing unit of the program and the executing unit of the municipality.

Disadvantages

- A high level of coordination between both the executing unit of the program and that of the municipalit. The executing units share execution, responsibility and accountability.

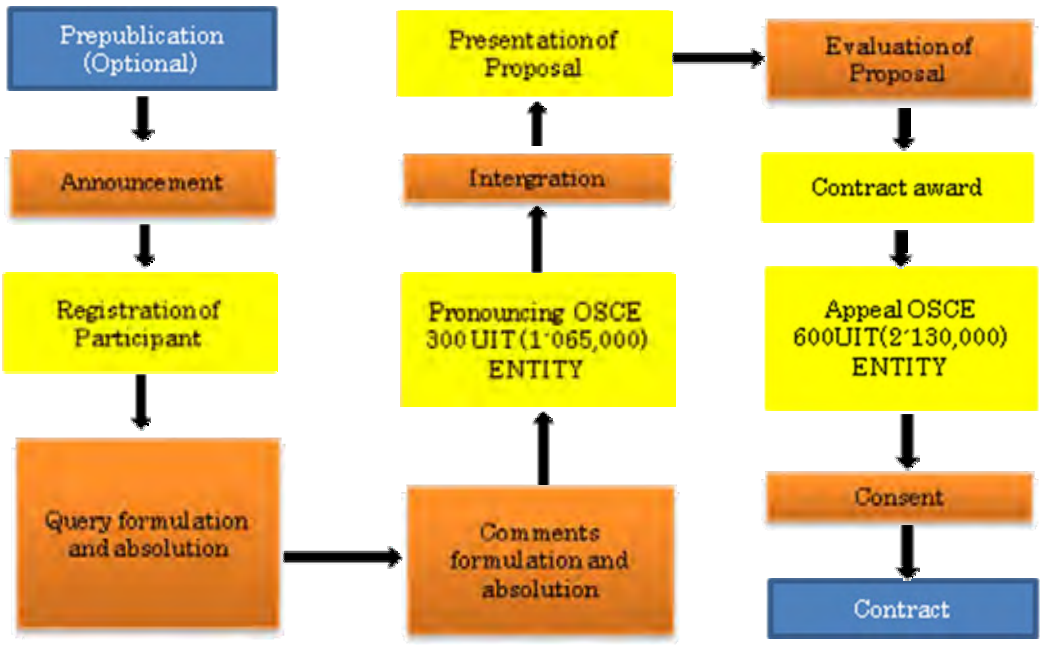
In order to optimize the execution of the program, procurement could be done using JICA/IDB methods and nationala regulations for local procurement. (número de compras, entre otros.)

Therefore, in the case of costly procurement and depending on the type of good (Works, heavy machinery, vehicles and equipment) there is the possibility to split procurement by group of work or geographical area (North, Center, West and South). The purpose is to obtain economies of scale, that is to say, reduce costs and time.

CENTER	NORTH	EAST	SOUTH
Chincha Alta Nuevo Chimbote Santiago Huacho Chancay Yauyos	Sechura Paita Talara Tumbes Piura Sullana Ferreñafe	Tarma Huanuco Tarapoto Moyobamba Chachapoyas Juliaca Sanjuan Bautista Pozuzo Bagua Oxapampa	Azangaro Ilave Abancay Puerto Maldonado Puno Aymaraes Huamanga Andahuaylas

Once the regulations for procurement and group of work have been defined, the international procedures to be used by the executing unit of the program will be explained. Otherwise, local tender procedures will be adopted.

In the case of minor purchases and depending on the type of good (tools, personal protection equipment, among others), local purchases will apply. In this case, the Law of Government Contracting DL 1017 and regulations will be applied.



JICA procedure. In the case of contracting lower than the amount estipulated in the loan agreement, JICA does not mind applying contracting procedures established in the local regulations. In that case, JICA will grant no objection to the contracting process, or to any modification within the framework of said contract.

IDB procedure. It must be applied IDB procurement policies. However, unles otherwise estated, local regulations can apply if they dont contradict their policies.

5.8.3 Organization and Structure of the Executing Unit of the Program (UEP)

The executing unit of the program (UEP) manages the activities to reduce the administrative activities. The organization of the UEP is shown on the following chart.

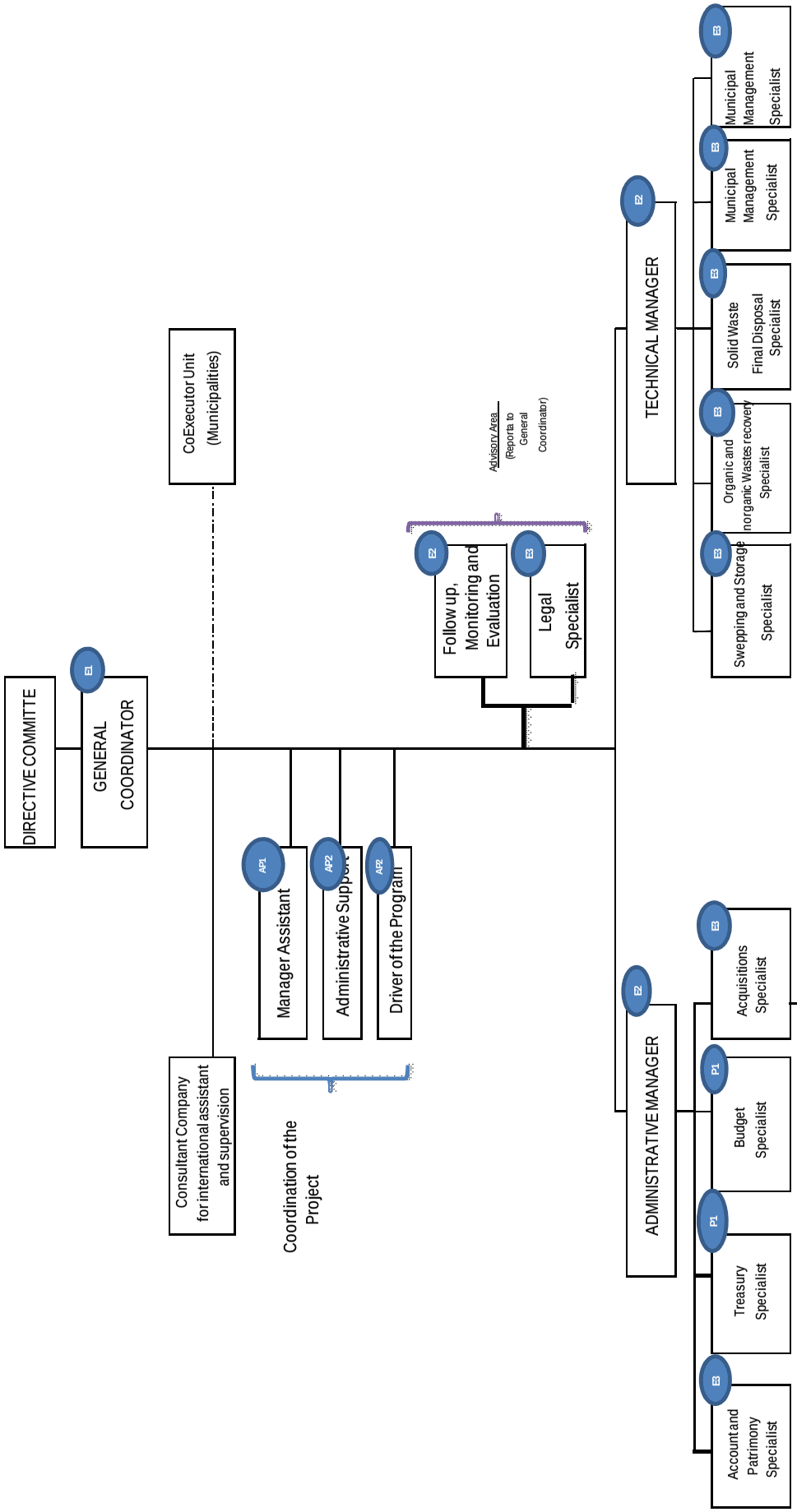


Figure 5.8-2 Organization Structure

(1) Duties and profile of the UEP personnel

1) Program Coordination

a. General coordinator of the Executing Unit of the Program (E1)

The general coordinator manages and monitors the proper running of administrative, technical, monitoring and evaluation of the tasks of the Program. He/she is responsible to execute the program in accordance with the loan agreement, general conditions and policies of it. Besides, the general coordinator shall keep the management board informed on progress of activities and budget execution of the program.

Duties and responsibilities:

- Plan, organize, coordinate and monitors the execution of the program in accordance to the loan agreement.
- Coordinate, supervise and ensure the loan agreement is complied with
- Coordinate, complied with and ensure compliance with the agreements of the program management board, doing the jobs assigned by said board.
- Coordinate and approve the budgets to use funds of national counterpart.
- Appoint personnel with authorized signature before JICA and IDB, and banking organizations for all administrative procedures.
- Submit for each financial year, the operating plan to the management board to approve it and then send it to JICA and IDB.
- Coordinate execution activities of the Program with the municipalities, the Ministry of Economy and other Peruvian organizations, JICA and IDB to ensure the program is successful.
- Manage actions to schedule, manage, negotiate and obtain financial resources for the Program.
- Propose the management board the internal organization of the program, establishing guidelines and manuals to detail duties and responsibilities of the members.
- Sign agreements and other binding document for third parties.
- Represent the program before any private or public authority and international cooperating organization.
- Manage the executing unit of the program before government agencies and international cooperating agencies
- Manage the corporate image of the program
- Solve any controversy, problem regarding registries, administrative, procurement, personnel, suppliers and other procedures they are responsible for.
- Authorize and sign disbursement request from JICA and IDB
- Coordinate callings for meeting of the management board
- Sign interinstitutional cooperation agreements as appropriate
- Issue administrative resolutions and directives when necessary
- Other duties assigned by the Program Management Board

Qualifications required

- Degree on Economics, Administration, Industrial Engineering or related studies.
- Master´s Degree in Administration, Public Management or related studies.
- Minimal professional experience of 10 years.
- No less than 05 years of experience in management positions in the State or programs financed by international cooperation. Proven experience to implement large scale programs, especially regarding management and coordination of different components, human resources to execute operations locally and internationally.
- Proven experience to draft, execute,supervise, evaluate and write reports of programs financed with resources from multilateral financial organizations, especially financial, accounting, administrative and procurement issues locally and internationally.
- Knowledge of procedures applicable to programs financed with JICA and IDB resources.
- Sound knowledge of public sector
- Excellent interpersonal skills of different specialties, team leadership and communication.
- Knowledge of English

Reports:

Reporting to the Chairmanship of the Program Management Board and JICA.

b. Management Assistant (AP1)

Supports the general coordinator and the functioning of the Program activities.

Roles and responsibilities:

- Coordinate and update the diary of the general coordinator of the Program
- Organize and update the reception and registration of all documents in the Program
- Classify the documents and files them in magnetic media.
- Organize and update the documentary proceeding and the general archive of the Program.
- Coordinate over the telephone, couriers, conferences, as Program requires.
- Organize the distribution of documents to be sent locally or to other countries.
- Support in the events organized by the Program
- Write communications, under the general coordinator request, to support the development of the activities
- Inform members of the Program on procedure, follow up and monitoring of documents of the Program.

Required qualifications

- Advanced or technical studies on Administration.
- No less than 03 years experience on similar positions
- Proven experience on computing programs
- Knowledge of public sector

- Desirable knowledge of procedures applicable to programs financed with international cooperation resources.
- Good interpersonal skills of different specialties, team leadership and communication
- Knowledge of English

Reporting to:

Reports to the general coordinator of the Program.

c. Administrative Support (AP2)

Responsible to help in the administrative actions of the Program for a normal performance of the activities.

Roles and responsibilities:

- Distribute mail from Program' s coordinator and other areas of UEP, properly and using the required safety measures.
- Support to photocopy of the Program's coordination
- Help to organize files and bindingsfor meeting held by the executing unit of the Program
- Other duties assigned by the Coordination of the Program.

Required studies

- Administration technical studies or similar studies
- No less than 02 years of experience in administrative duties.
- Sound experience using computing programs
- Knowledge of English

Reporting to:

Reports directly to the general coordinator of the Program and works closely with the administrator.

d. Program's driver (AP2)

It is responsible to drive the vehicle allocated to the Program.

Roles and responsibilities:

- Drive safely the authorized personnel of the Executing Unit of the Program when required so that they can perform duties related to the Program.
- Form work commissions assigned and inform timely on such commission.
- Keep the vehicle in optimal working and cleaning conditions, coordinating the maintenance with the corresponding area and the timely fuel supply.
- Report directly to the Program administrative area every time the vehicle is used during every shift.
- Perform other activities assigned by the general coordinator of the Program

Qualifications required

- Professional driver license A1.
- Minimum of 5 years proven experience in similar positions
- Pleasant appearance and well-mannered

Reporting to:

Reports directly to the general coordinator of the Program, especially with the administrator.

2) Administrative area

a. Administrative Manager of the Program (E2)

He/She plans, organizes, manages, coordinates and monitors administrative duties of Program. The Program Administrator also reports periodically to General Coordinator regarding duties of the departments of Treasury, Accountancy, Procurement, and Budget. He/she is also responsible to properly execute the financial and economic resources, tender procedure and register and control the Program's assets.

Roles and responsibilities:

- Manage, supervise, evaluate and control the following positions: accountancy specialist, Treasury specialist, Equity Specialist, Procurement specialist, Procurement analyst and Budget specialist.
- Participate in Annual Operating Plan to be submitted to Program Management Committee, JICA and IDB for approval.
- Process general information regarding financial and physical Program Process and send reports to the Program General Coordinator
- Revise and approve agreements signed by the Program.
- Revise disbursement request, complying with all procedures established by JICA and IDB regarding this matter.
- Prepare Program Annual Budget, in accordance with information supplied regarding financial execution of Program.
- Supervise evaluation reports of Evaluation Committees regarding contracting processes.
- Supervise and sign jointly with the procurement specialist purchase orders of the Program
- Coordinate and supervise location and condition of goods under Program responsibility.
- Coordinate with technical department of Program to submit on time products or deliverables stated in the agreements signed with the Program or delivery of purchased goods.
- Coordinate and supervise follow-up and verification agreements of contracts signed by the Program.
- Other activities assigned by the Program General Coordinator.

Qualifications required:

- Degree in Business Administration, Accountancy, Economics, Industrial Engineering, or related degrees.
- Master's Degree in Administration or Public Management or related studies.

- If possible, specialization or postgraduate studies related to the position.
- No less than 5 years experience managing international cooperation Programs.
- No less than 10 years of general professional experience.
- Knowledge of procurement regulation and procedure and disbursement of international cooperation agencies, especially JICA and IDB.
- Good team worker and able to work under pressure
- Computing user knowledge
- Knowledge of English

Reporting to:

Reports directly to General Coordinator of Program

b. Accounting and Equity Specialist(E3)

Responsible for planning, organizing, managing, coordination and monitoring activities related to accountancy management of Program.

Roles and responsibilities:

- Plan, organize, develop and implement internal control systems to guarantee reliability of payment processes and program execution.
- Process accounting information at SIAF.
- Prepare by-annual and annual program financial reports in accordance with JICA and IDB guidelines.
- Prepare financial reports to consolidate accountancy entries, following government regulations.
- Data entry of accrued stage of SIAF.
- Register disbursement from JICA and IDB.
- Prepare acknowledge of receipt from disbursement
- Conciliate expenditure flow with the Ministry of Economy
- Coordinate with JICA and IDB disbursement execution
- Supervise and control execution of financial resources of the Program
- Create accounting entries from operations carried out
- Perform account analysis and keep balances duly checked
- Supervise and control tax payment.
- Coordinate and facilitate auditors work (either in-house or external auditors).
- Present and explain financial statements of Program.
- Keep accountancy updated and in an orderly fashion
- Process general accounting information of Program and submit periodical reports to the Program General Coordinate and to the Administrator
- Perform bank reconciliation of Program bank accounts

- Perform periodic stocktaking of fixed assets according to law in force and effect and directives issued for that purpose
- Propose and maintain acquisition and disposal of goods writing the necessary documentation, in accordance with law in force and effect.
- Catalog goods and services of the program, register and control properties when they are in and out of organizations beneficiaries of the Program
- Identify and code all heritage bought through any procurement method
- Distribute the goods according to the procurement and/or administration schedule, with acknowledge of receipt and issuing the corresponding documentation, complying with the corresponding control procedure
- Keep safety stock and request timely replacement
- Coordinate the appraisal of assets, when necessary
- Propose the necessary procedure for a proper control of equity
- Other activities assigned by the administrator

Qualifications required:

- Registered Public Accountant
- Master's Degree in Administration, Public Management and related studies.
- No less than 08 years of experience in the public sector, and no less than 5 years related to equity control in the public sector
- No less than 03 years of experience within accountancy of International Cooperation Programs.
- Experience with SIAF of MEF, its administrative, budget, accountancy modules, payroll and Investment Programs.
- Experience on warehouse areas in public or private companies
- Knowledge of financial regulations
- Knowledge of law regulating fixed asset and State equity
- Knowledge and experience in government logistics
- Knowledge of English

Reporting to:

Reports directly to the Administrative Manager of the Program

c. Treasury Specialist (P1)

Responsible for planning, managing, coordinating and monitoring activities related to handling of current accounts and obligations payment of the Program.

Roles and responsibilities:

- Revision of payment requirements with supporting documents
- Opening of Program bank accounts

- Perform bank conciliations with Banco de la Nación regarding counterpart funds received from Public Treasury.
- Verify disbursement category before doing any payment
- Monitors Program bank accounts balance and reports Accountant and administrator .
- Oversees and control of bond letters.
- Coordinate and prepare financial reports requested by JICA and IDB
- Monitor timely payment of Program obligations
- Data entry of fase de giro del SIAF.
- Draft and keep bank book updated
- Process general information of current account and payment obligations of Program and submit periodical reports to the Administrator and Program General Coordinator
- Other activities allocated by the Program Administrator

Qualifications required:

- Registered Public Accountant, Administrator or Economist
- Master's Degree in Administration, Public Management or related studies
- No less than 8 years of experience in public sector treasury and no less than 3 years of experience of international cooperation programs treasury
- Experience using SIAF at MEF
- Knowledge of expenditure regulations of multilateral organizations
- Knowledge of English

Reporting to:

Reports directly to the Administrative Manager of the Program

d. Procurement Specialist (E3)

Responsible for planning, managing, organizing, coordination and monitoring procurement processes with JICA, IDB standards and other that may also be applicable.

Roles and responsibilities:

Responsible for planning, managing, organizing, coordination and monitoring procurement processes with JICA standards and other applicable standards.

Duties

- Elaborate Annual Plan of Program Contracts for consultancy works, goods and services as part of the Annual Operating Plan.
- Prepare administrative requirements and coordinate terms of reference, technical specifications and technical dossiers of studies, goods and works to be contracted and purchased by the Program, with the corresponding people in charge of said activities.
  Publish authorized notification
- Write and publish the authorized tender procedures

- Coordinate and organize meetings prior to consultation period with bidders and consultants, and coordinate opening of proposals.
- Ensure reports prepared by Evaluation committees are submitted on time.
- Participate in contract negotiation with winner bidders.
- Coordinate and monitor proper contract execution that may include goods procurement, as well inform administrator.
- Coordinate formal acceptance of goods received with beneficiaries.
- Write procurement reports to be submitted to JICA and IDB
- Keep an archive update and in an orderly fashion regarding all procurement processes done by the Program
- Prepare reports requested by General Controller of the Republic regarding procurements, in coordination with legal specialist.
- Issue purchase orders and sign them jointly with the administrative manager
- Data entry of commitment stage of SIAF
- Process general information of Program activities related to contract handling and to submit periodic reports to the Program Administration.
- Other duties administrator may assign

Qualifications required:

- Degree in Economics, Administration, Accountancy and Engineering or related studies.
- Specialty master´s degree in Administration, Public Management or related studies.
- Minimum working experience of 10 years.
- No less than 05 years experience regarding rules and procurement procedures of multilateral organizations.
- Experience using SIAF
- Proven knowledge of rules and procurement procedures of JICA and/or IDB.
- Experience implementing, using, supervising and evaluating logistics systems and procedures.
- Experience implementing, using, supervising and evaluating procedure systems of procurement of works, goods and services through tender procedures, direct invitations, if possible, related to Programs financed with resources from multilateral organizations.
- Experience writing technical files, terms of reference, tender requirements, evaluation charts and other related to procurement of works, goods and services related to Programs financed with resources from multilateral organizations, preferably from JICA and/or IDB.
- Proven working experience with programs financed by multilateral organizations.
- Able to work in management teams, to take critical decisions to guarantee the proper implementation of the Program.
- Knowledge of English

Reporting to:

Reports directly to the Program's administrative manager.

e. Procurement Analyst (P2)

Supports logistic activities of the Program and those required by the procurement specialist.

Roles and responsibilities:

- Do market research according to the program requirement before procurement procedures from the UEP.
- Coordinate with the Program supplier regarding technical details or technical files of the goods to procure or works to hire.
- Help to prepare the administrative requirements.
- Support to issue the purchase orders, contracts that sustain the Program procurements.
- Tracking the purchase orders and/or contracts signed.
- Coordinate the advertisement of the notice of the call of the procedures.
- Coordinate with suppliers visiting the UEP in order to gather additional information on the procurement procedures of goods, works and consultancies.
- Participate in meetings held in the participating institutions and JICA and IDB on procurement to be financed with Program resources.
- Coordinate permanently with the beneficiaries of the Program, making sure the acknowledgement of receipt and functioning of the goods procured are signed.
- Keep updated the Annual Plan of Procurement of goods, Works and services of the program.
- Coordinate and support the tracking and execution of the contracts related to goods or services procurement, and inform the procurement specialist and the program administrator.
- Maintain updated and orderly files of the UEP procurement procedures
- Other activities allocated by the procurement specialist.

Qualifications needed:

- Degree in Economics, Administration, Accountancy, Industrial Engineering, etc.
- Specialization and post graduate course on similar areas
- No less than five years in the logistic department of the public sector and no less than three years in the logistic department of international cooperation programs.
- Experience using SIAF from Ministry of Economy
- Basic knowledge of Windows
- Knowledge of procurement procedures and standards by JICA and/or IDB
- Knowledge of English

Reporting to:

Reports directly to the procurement specialist of the Program

f. Budget Specialist (P1)

Responsible for handling the Program Budget, complying with regulations in force and effect. Likewise, coordinates and monitors information regarding profit and loss of expenditure authorized in the annual budget.

Roles and responsibilities:

- Responsible for the budget, through the different stages such as formulation, Schedule, execution and evaluation, expenditure control, complying with Law of Public Sector Budget and provisions issued by the National Directorate of Public Budget at the Ministry of Economy.
- Prepare and submit budget schedules for expenditure quarterly.
- Prepare and submit timely any extension of deadline according to budget regulations.
- Monitor quarter and monthly allowance regarding schedule and execution.
- Entry profit and loss budget information in the budget module SIAF-SP.
- Reconcile Operating Plan (OP) and Program General Budget to meet goals; also, goals must show activities of each component.
- Prepare monthly reports on budget performance for profit and loss regarding allocated resources to make decisions.
- Prepare budget reports requested by Program General Coordinator and by monitoring agencies.
- Keep updated files with information required for budget management.
- Other activities Program General Coordinator may assign.

Qualifications required:

Degree in Economics, Accountancy, Administration, Industrial Engineering and related areas.

- Master's Degree in Administration, Public Management or related studies.
- Five years working experience in international cooperation agencies and/or government agencies regarding financial management in general and budget management in particular.
- Knowledge of regulations regarding formulation, Schedule, execution and budget evaluation.
- Knowledge of Excel, Word, Power Point and Windows.
- Knowledge of English and database management would be advisable.
- Use of budget module of SIAF-SP.

Reporting to:

Reports directly to the Administrative Manager of the Program

3) Consulting Area

a. Specialist in Following, Monitoring and Evaluation(E3)

Responsible for planning, organizing, managing, coordination and controlling tasks such as Program follow-up, monitoring and evaluation.

Duties:

- Follow and control monitoring indicators and prepare quarterly report regarding progress of such indicators. Reports shall be approved by Program General Coordinator and sent to JICA and IDB.
- Participate in the writing of General Plan (GP)
- Manage preparation of Operating Plans of Program, coordinating with Program Specialists and Administrator.
- Revise and evaluate periodically indicators of framework are complied with.
- Organize and carry out follow up to program activities, supervise goals are met, coordinating with coordinators and administrator.
- Supervise all products are available electronically and in the portal web of Program.
- Measure result indicators, methodology, and keep record on verification sources.
- Write terms of reference of Program evaluations for third parties.
- Revise writing of base line of Program.
- Perform periodic inspection visits to verify Program activities are executed in participating municipalities.
- Keep MOP updated regarding monitoring and evaluation.
- Process and submit general information regarding progress of operating plan, goals, results indicators and program impact, and submit periodic reports to Program General Coordinator.
- Other activities assigned by Program General Coordinator

Qualifications required:

Degree in Economics, Administration, Industrial Engineering and related studies.

- Master's Degree in Administration, Public Management or related studies.
- Related specialized courses or postgraduate.
- No less than 10 years of experience monitoring and evaluation social programs and no less than 5 years working at monitoring departments of international cooperation programs.
- Knowledge and experience with public administration and civil society organizations.
- Good interpersonal skills, leadership skills
- Basic computing skills
- Knowledge of English

Reporting to:

Reports directly to Program General Coordinator and works closely with Program Administrative Manager

b. Legal Specialist (E3)

Responsible for planning, organizing, managing, coordinating and controlling activities related to contract drafting, and ensure contractual conditions established in the Loan Agreement are complied with.

Roles and responsibilities:

- Ensure contractual conditions established in the Loan Agreement are complied with, thus issuing reports to Program General Coordinator.
- Register contractual conditions of loan agreement and coordinate with Program personnel in order to met scheduled dates.
- Draft contracts to contract works, goods and service procurement.
- Write personnel contracts for Program administration
- Approve requirements, proposal requests and contracts signed by general coordinator.
- Assess and keep program personnel informed on issued legal provisions.
- Ensure provisions issued by General Controller of the Republic are complied with, coordinating with corresponding area.
- Write guidelines needed to operate Program, requested by General Coordinator and Program Administrator.
- Coordinate, follow and verify execution of contracts signed by Program.
- Assess evaluation committees of contracts notified by Program
- Assess legally General Coordinator and Administrative Manager

Qualifications required:

- Registered lawyer
- Master´s Degree in Administration, Public Management or related studies.
- No less than 10 years of professional experience and no less than 5 years writing contracts and documents related to procurement.
- Knowledge of international organization procurement regulations, mainly that of JICA and IDB.
- Good knowledge of administrative regulations and control entities.
- Computing knowledge
- Knowledge of English

Reporting to:

Reporting directly to the Program General Coordinator and coordinates closely with Program General Administrator.

4) Technical Area

a. Technical Manager of the Program (E2)

Technical Manager of the Program plans, organizes, manages, coordinates and controls all the technical activities performed by the field specialists of the Program. He/she informs periodically the general coordinator of the Program on actions performed by the specialists, according to their expertise.

Roles and responsibilities:

- Manage, monitor, evaluate and control field specialists that are part of the Program

- Prepare the Annual Operating Plan to be submitted to the management board of the program, JICA and IDB for approval.
- Organize and control the operating development of the technical tasks of the Program
- Propose actions and activities to improve technical aspects that may have an impact on the program
- Coordinate the activities of the consulting companies and individual consultants hired to develop the different components of the program
- Propose the general coordination of the goals of the program
- Manages the technical evaluation of the projects included in the program
- Coordinate with the field specialists the technical and administrative requirements to select and execute contractors and suppliers, then proposing features, conditions and benefits.
- Other activities assigned by the general coordinator of the program

Qualifications required:

- Degree in Economics, Administration, Industrial Engineering, Environmental Engineering of related studies.
- Master's degree in the major area or in areas related inpublic management or related studies
- General working experience no less than 10 years
- No less than 05 years of professional experience in management positions, especially in the environment sector
- Proven experience on management procedures of financial projects with resources of external indebtedness
- Wide knowledge of public sector, specially the environmental sector
- Good interpersonal skills and team leader
- Able to work in a team under pressure
- Knowledge of English

Reporting to:

Reports directly to the general coordinator of the program

b. Storage and Sweeping specialist(E3)

Responsible for planning, organizing, coordinating and controlling program activities related to storage and sweeping in order to guarantee the temporary storage of solid waste in public areas as part of the management system until the final disposal, and to guarantee as well the manual or mechanical solid waste collection.

Roles and responsibilities:

- Support participating municipalities when writing terms of reference for storage and sweeping related to the Program.
- Participate in evaluation committees of activities related to storage and sweeping.

- Coordinate and supervise the execution of activities related to processes of temporal piling of solid waste, and manual and mechanical collection of solid waste.
- Write reports on physical progress of activities related to component
- Coordinate and monitor proper execution of contracts of consulting works, goods and services related to storage and sweeping, and inform administrator and legal specialist.
- Ensure quality of hired surveys, workshops and others with approval of deliverables.
- Keep updated indicators related to storage and sweeping, alongside with monitoring and evaluation specialist.
- Coordinate all important issues with other specialist of Technical Department.
- Process and submit general information of activities related to storage and sweeping; submit periodic reports to program general coordinator and administrator.
- Other activities assigned by the Program General Coordinator

Qualifications required:

- Degree in environmental engineering, sanitary engineering, civil engineering or related studies.
- Master's degree in the major area or in areas related in environmental management and/or solid waste.
- Knowledge of environmental sanitary law of solid waste.
- General working experience no less than 10 years
- No less than 05 years of professional experience with solid waste management
- Good interpersonal skills and team leader
- Good team leader
- Knowledge of English

Reporting to:

Reports directly to the general coordinator of the Program.

c. Specialist in Recovery of Organic and Inorganic Waste reuse (E3)

Responsible for planning, organizing, coordinating and monitoring of activities Program related to organic and inorganic waste use, especially to build reuse facilities.

Duties:

- Help participating municipalities to write terms of reference regarding organic and inorganic waste reuse related to the Program.
- Participate in the evaluation committees of activities related to reuse of Organic and Inorganic Waste.
- Coordinate and monitor execution of activities related to reuse of Organic and Inorganic Waste.
- Write progress reports of activities related to reuse of Organic and Inorganic Waste.
- Coordinate and monitor proper execution of consultancy contracts related to reuse of Organic and Inorganic Waste, and to inform to the Administrator and the Legal Specialist.

- Ensure quality the contracted studies, workshops or others through compliance with deliverables.
- Jointly with the specialist in Monitoring and Evaluation, maintain updated the indicators related to reuse of organic and inorganic waste reuse
- Coordinate with the other technical specialists any necessary issue.
- Write approval requests within the framework of the processes performed by "Reuse of Organic and Inorganic Waste" component.
- Process and submit general information of program activities related to the reuse of Organic and Inorganic Waste; submit periodic reports to the Program General Coordinator and the Administrative Manager
- Other activities assigned by the Program General Coordinator

Qualifications required:

- Degree in Environmental Engineering, Sanitary Engineering, Civil Engineering or related studies.
- Master's degree in the specialization area, related to environmental management and/or solid waste.
- Knowledge of sanitary-environmental legislation on solid waste
- No less than 10 years of general professional experience
- No less than 5 years of professional experience in solid waste management
- Good interpersonal skills and team leadership
- Availability to work to provinces when required
- Knowledge of English

Reporting to:

Reports directly to the general coordinator of the Program

d. Specialist in solid waste final disposal (E3)

Responsible to plan, organize, coordinate and control program activities of solid waste final disposalrelated to building facilities necessary for municipal solid waste final disposal.

Roles and responsibilities:

- Support participating municipalities to write terms of reference with the Program on solid waste final disposal.
- Participate in evaluation committee committees of activities related to solid waste Final disposal.
- Coordinate and supervise the execution of activities related to Solid waste Final disposal
- Write progress reports of activities related to Solid waste Final disposal
- Coordinate and monitor proper execution of consultancy contracts regarding Solid waste Final Disposal, and to inform to the Administrator and the Legal Specialist.

- Ensure the quality of contracted studies, workshops or others through the approval of deliverables.
- Jointly with the specialist in Monitoring and Evaluation, maintain updated the indicators related to solid waste Final Disposal.
- Coordinate with other technical specialists, issues related to that matter
- Elaborate approval requests within the framework of the processes included in solid waste Final Disposal.
- Process and submit general information of Program activities related to solid waste Final Disposal; submitting periodic reports to Program General Coordinator and to the Administrator.
- Other activities assigned by the Program General Coordinator

Qualifications required

- Degree in Environmental Engineering, Sanitary Engineering, Civil Engineering or similar studies.
- Master's Degree on environmental management and/or solid waste
- Knowledge of sanitary environmental legislation of solid waste
- No less than 10 years of general experience
- No less than 5 years of professional experience in solid waste management, especially in design and implementation of sanitary landfill.
- Good interpersonal skills and team leadership.
- Availability to travel to provinces when required.
- Knowledge of English

Reporting to

Reports directly to the general coordinator of the Program

e. Specialist in Municipal Management (E3)

Responsible to plan, organize, coordinate and control program activities related to the administrative and financial management of the municipality (hereinafter, municipal management) regarding implementation of program building capacities to improve and develop management and solid waste tools. All this taking into account environmental legislation, tax law and other legislations that may allow the future sustainability of the Program.

Roles and responsibilities:

- Support participating municipalities to write terms of reference of municipal management issues related to the Program.
- Participate in evaluation committees of the activities related to Municipal management.
- Coordinate and supervise the execution of the activities related toMunicipal management.
- Elaborate progress reports of activities related to Municipal management.
- Coordinate and monitor proper execution of consultancy contracts regarding Municipal Management, and to inform to the Administrator and the Legal Specialist.

- Ensure quality of contracted studies, workshops or others through approval of deliverables.
- Jointly with Monitoring and Evaluation specialist, maintain updated the indicators related to Municipal Management.
- Coordinate with other technical specialists all necessary issues.
- Elaborate approval requests within the framework of the processes included in "Municipal Management".
- Process and submit general information of program activities related to the Municipal Management; submitting periodic reports to the Program General Coordinator and Administrator.
- Other activities that are assigned by the General Coordinator of Program

Qualifications required;

- Degree in Environmental Engineering, Sanitary Engineering or related degrees
- Master' s Degree in related areas of environmental management and/or solid waste.
- Knowledge of sanitary environmental legislation of solid waste
- General experience no less than 10 years
- No less than 5 years of professional experience managing solid waste
- Good interpersonal skills and team leadership
- Available to work to provinces when required
- Knowledge of English

Reporting to:

Reports directly to the technical manager of the Program.

f. Communications Expert (E3)

Responsible to plan,organize, coordinate and monitor activities related to awareness and position of corporate image of the Program. The expert will also coordinate training and awareness campaigns organized by the Program in order to strengthen social actors regarding minimization and reuse of solid waste; also important will be to promote payment for the service of public cleaning, and organized and responsible participation of population as a key element for a sustainable environmental management of solid waste.

Roles and responsibilities:

- Design and propose strategies of corporate image, media, public relations, communication and information of the Program.
- Coordinate with external communication media regarding information on progress and achievements of the Program development, and also practices focused on population.
- Coordinate external and internal information of the Program that try to improve corporate image.
- Monitor graphic design and keep updated the content of the Program's web.
- Process the general information of the Program activities related to position of corporate image and submit periodical reports to the general coordinator of the Program.

- Keep a coded file with all the Program's publication.
- Support participating institutions of the Program to write the terms of reference on training issues related to the Program.
- Coordinate and review execution of training activities
- Coordinate and monitor proper execution of consultancy contracts related to practices focused on population, and inform administrator and legal specialist.
- Ensure the studies, workshops hired meet quality standards, through compliance of deliverables
- Update indicators related to monitoring and evaluation, alongside the expert on monitoring and evaluation.
- Process and submit general information of activities related to the Program related to practices focused on population, submit periodically reports to the general coordinator of the program and the administrative manager
- Other activities assigned by the general coordinator of the Program.

Qualifications required:

- Degree in Communications Science, Public Relations or related studies.
- Master's degree in Administration, Public Management or related areas.
- No less than 10 years of working experience in the public or private sector.
- Computing knowledge
- Knowledge of English

Reporting to:

Reports directly to the general coordinator of the Program.

5.8.4 Program Fees

DENOMINATION	CAT	Quantity	Amount (S/.)	Minimum	Maximum	Total cost (S/.)
EJECUTIVE1	**E1**	1	14,000	13,000	15,600	672,000
EJECUTIVE2	**E2**	3	12,000	11,000	13,000	1,728,000
EJECUTIVE3	**E3**	8	10,000	9,000	11,000	3,840,000
PROFESSIONAL1	**P1**	2	8,000	7,000	9,000	768,000
PROFESSIONAL2	**P2**	1	5,500	4,000	7,000	264,000
SUPPORTSTAFF1	**AP1**	1	3,500	3,000	4,000	168,000
SUPPORTSTAFF2	**AP2**	2	2,000	1,000	3,000	192,000
TOTAL						7,632,000

According to law in force and effect and provisions on the matter issued by the Minister´s Office, for international cooperation projects no CAS (Administrative Hiring services), employees could be hired.

Therefore, consultants of the Executing Unit of the Program will be hired under the rendering of services method to provide individual consultancies under JICA/IDB procedure, and in accordance with the amounts stated in the previous chart as a lump sum. Within this project, the fees will be paid monthly, after approval of general coordinator. A different case will be the individual consultancies the program requires, whose fees will be paid once the deliverable for such consultancy has been agreed with and approved.

Operating cost of the executing unit of the program

The following chart will show the operating cost of the UEP during the first stage of the program, that will last for four years.

Table 5.8-1 Cost of the UEP

*Exchange rate. S/.2.80

1	**Individual consultants**							
	Locall consultants		48	month			7,632,000	4 years
		Executive E1	1	48	14,000	672,000		
		Executive E2	3	144	12,000	1,728,000		
		Executive E3	8	384	10,000	3,840,000		
		Profesional P1	2	96	8,000	768,000		
		Professiona P2	1	48	5,500	264,000		
		Assistant AP1	1	48	3,500	168,000		
		Assistant AP2	2	96	2,000	192,000		
	International Consultants			- - -				See separate sheet
2	**Goods**							
	Main office						209,720	4 years
		Office fittings	1	Gl	88,760	88,760		
		Computing equipment	1	Gl	50,960	50,960		
		Vehicle for the office	1	Gl	70,000	70,000		
3	**Operating expenses**							
	Local expenses						1,248,640	4 years
		Basic services (rent, electricity, etc)	1	Gl	484,800	484,800		
		Tickets	1	Gl	208,320	208,320		
		Allowance	1	Gl	555,520	555,520		
	Expenses of international consultants			- - -				See separate sheet
4	**Consultancy Companies**							
	Audits and evaluations						2,485,000	On time
		Financial-administrative audits	1	Gl	2,485,000	2,485,000		
		Evaluation. (midterm/final)	1	Gl	included			
	Communication and Awareness						435,000	
		Plan of Communication and awareness	1	Gl	46,500	46,500		For t he 31 municip..
		Scripts for audio and video	1	Gl	151,500	151,500		For t he 31 municip..
		Practices of segregation at source	1	Gl	139,000	139,000		For t he 31 municip..
		Strategy for prompt payment	1	Gl	51,500	51,500		For t he 31 municip..
		Strategy to formalize waste pickers	1	Gl	46,500	46,500		For t he 31 municip..
	Outsourced services (*)						- - -	
		Topographic survey	1	Gl				See note (*)
		Geological surveys	1	Gl				See note (*)
		Lab(soil, wáter, air,)	1	Gl				See note (*)
		Others	1	Gl				
Total Operation amount of the UEP					**(Soles)**		**12,010,360**	No international Consultant

Exchange Rate= **2.80**

(*) These costs are included in the technical file of each Project included in each PIP

Program Closure

The program closure will begin during the second semester of the fourth and last year of the execution of the program. During said period, the financial and administrative program closure will take place, termination of contracts under execution by accepting the corresponding deliverables, and goods will be transferred to the Ministry of Environment.

The closure activities will include writing reports for each area, included actions carried out during the execution of the program, transfer of goods to each municipality, documents that will be delivered to the Ministry of Environment. At the same time, technical reports will be written for each component included in the Program. These documents will be included in the final evaluation of the program management.

International assistance and supervision

In accordance with international standards established by JICA/IDB while operating abroad, every project financed by an international cooperating agency requires a consulting company to support the executing unit regarding administrative and technical processes. The consultancy firm will report directly to JICA/IDB (local office) and will inform on progress, problems, schedules and general performance of the project.

The costs from hiring such consultancy firm are part of the expenses to be financed and totals US$5.6 million. Normally, the consultancy team assisting and supervising will be formed by a technical specialist, administrative specialist. However, it is also important to have specialist in other areas for shorter period of times. Normally, the consulting team is formed by 4 experts and administrative support, that work in the project offices (that's why these are not considered local costs).

At the same time, considering that said experts will require to travel (with other members of the Peruvian team),
travel expenses, allowances, local transportation will be estimated for office equipment and operating expenses.
Please, take into account that the international assistance and supervision team are part of the executing unit and costs
(salaries, allowances) will be financed by the program investment.

The management and supervision of the Project is as follows:

Table 5.8-2 Cost of the International Consultant

	Monitoring Specialist	48	month	8,000	384,000			
	Procurement Specialist	24	month	8,000	192,000			
	Accountant Specialist	48	month	8,000	384,000			
	Administrative Assistant	48	month	4,000	192,000			
JICA International Consultants					0		2,765,597	3 years
	Professional 1	34	month	29,385	999,096			
	Professional 2	34	month	28,255	960,669			
	Professional 3	31	month	25,995	805,832			
	Works supervisors	1	Gl					See note (*)
Goods								
Main office						0		
	Office fittings		Gl	88,760	0			
	Computing equipment		Gl	50,960	0			
	Vehicle for the office		Gl	70,000	0			
Regional offices						0		
	Office fittings		Gl	8,000	0			
	Computing equipment		Gl	6,000	0			
	Miscellanea		24	100	0			
Operating Expenses								
Local Expenses						0		
	Basic services (rent, electricity, etc)		Gl	484,800	0			
	Travel tickets		Gl	208,320	0			
	Allowance		Gl	555,520	0			
	Other		48	500	0			
Operating expenses of the consultants							1,623,479	3 years
	Transportation (global)	1	Gl	959,272	959,272			
	Tickets, allowance, etc		Gl	included				
	Communications, reports, etc	1	Gl	664,207	664,207			
	Other							
Consultancy Companies								
IDB audits and evaluations						176,000		
	Administrative/financial audits	1	Gl	80,000	80,000			
	Enviromental and social management of the program	1	Gl	96,000	96,000			
Outsourced services (*)						- - -		
	Topograhic survey	1	Gl					See note (*)
	Geological survey	1	Gl					See note (*)
	Lab (soil, wáter, air)	1	Gl					See note (*)
VAT		19%					833,924	
Amount IDB consultancy				**(Soles)**		**1,328,000**		
Amount JICA consultancy				**(U$S)**			**5,223,000**	
2.80								

(*)These costs are included in the technical file of each Project included in the PIP

COSTS OF ATTENDING AND INTERNATIONAL SUPERVISION -JICA	14,624,400	5,223,000
COSTS OF ATTENDING AND INTERNATIONAL SUPERVISION -BID	1,328,000	474,286
TOTAL COST	15,952,400	5,697,286

(1) Institutional Committment: Adhesion Agreement

The program covers 31 local governments, all of them orgnized differently and have different public policies to allocate their resources.

Therefore, it is important to have a standard pattern to align public policies priorities in each of the above mentioned municipalities. Therefore, the program includes adhesion agreement signed by the 31 municipalities.

The adhesion agreement will make sure that the 31 municipalities included in the program commit, comply with the actions planned to obtain the results expected in the Program.

(2) The agreements will have the following principles and requirements:

1) Principles of the Program

- Adhesion by the municipalities. Since the design and the objective of the program is aimed at 31 municipalities, all of them must sign said agreement in order to remain in the program and must complied with different requirements that will be mentioned below.
- The Ministry of Environment will execute the program through the UEP, in coordination with the subexecutiong units of the program. (USEP).
- Joint financial efforts. The total cost o the program will be shared. Taking into account the financial possibilities, the local governments will finance the counterpart, whereas the national government will allocate JICA and IDB resources through the Ministry of Environment.
- Sustainability of the program. The local governments must sign fund trust agreements by which the funds from the FONCOMUN will be deducted. Said funds will be used to finance the operation and maintenance costs as well as the reinvestments planned in each of the projects executed within the framework of the program.

2) Requirements that local governments must complied with to participate in the program

The local governments must accept the ítems already mentioned, which are included in the Adhesion Agreement to be signed between the executing unit of the program and each local government.

- Accept the fund trust to finance the reinvestment costs and the operation and maintenance costs planned in each of the Public Investment Projects. The fund trust will be managed by the Ministry of Environment.
- Commitment to allocate resosurces to finance the counterpart, according to the public investment projects of each municipality, based on the corresponding financial sustainability that will be explained later.
- Signed the adhesion agreement between each UEP and each local government, explaining the rights and obligations regarding the principles and requirements established to guarantee the overall sustainability of the program.
- Commitment to accept and implement the recommendations from the executing unit (UEP) to ensure and facilitate the implementation of the corresponding PIPs in the municipalities.

5.8.5 Financing

The resources to implement the program come from external indebtedness through the Japanese International Cooperation Agency and the Inter American Development Bank. In that sense, JICA will finance 23 projects and IDB, 8.

The investment amount for the 23 projects to be financed with JICA resources is S/. 192 891.234, and up to 80% of this amount can be financed with loan resources, S/. 154 312.987, and the remaining amount with national counterpart (S/. 38 578.247.

JICA will grant a loan for up to US$ 56 million to be paid in approximately 20 years, with 5 years of grace, at an annual interest rate of 1%.

IDB will grant a loan of US$15 million to be paid in 20 years, with a 5 years of grace at the LIBOR interest rate.

MEF will be responsible to pay both loans in order to guarantee the country obtains the benefits expected from the Program.

The disbursement period starts when the loan has come into effect, taking into account the grace periods. The loan conditions will be agreed with the National Directorate of Public Indebtedness (DNEP) of the Ministry of Economy and Finance.

In order to establish the general financing plan of the program, it is important to implement a global analysis of the budget of the municipalities to see if they have balances to finance the investments of the projects. On the other hand, it is necessary to perform a specific analysis to know mainly if municipalities have available funds from FONCOMUN to finance operation, maintenance costs and reinvestment.

If the global analysis showed the municipalities don’t have enough resources to finance the investments, then the investments will be complemented with loan resources and Ministry of Environment.

In order to analyze the budget execution of revenue and expenses, the status of source and use of funds of the general account of the Republic of Peru. Likewise, regarding FONCOMUN net balance, the status of budget execution of revenue and expenses of the general account of the Republic of Peru and the web page of the Ministry of Economy-Transpariencia Económica-have been reviewed.

The status of source and use of funds provides information on the budget,which is indeed the difference between the revenue and expenses annually. Revenue is formed by current expenses, capital income and transfers from FONCOMUN resources, plus canon income, etc and loan disbursements, if any.

Expenses are current expenses, investment expenses and financial expenses for the loan debt.

After reviewing the status of sources and use of funds of the 31 municipalities included in the program, most of them have financial resources at the end of the financial year, basically surplus from the remaining balance. Remaining balance can be defined as those financial resources different from ordinary resources unused at the end of the financial year, and which have to be included in the following financial years as supplementary credit.

The main result of this analysis shows if municipalities are able to commit resources of remaining balance to finance investments of program projects. The following situations will appear depending on the amounts of the remaining balance, specially for the financial year 2010:

- The amounts are substantially higher than investment costs (twice or more). Then, the municipalities will finance up to 50% of the total costs of the project, and the rest with loans.
- The remaining balance is higher than the investment cost (between 1.3 and twice higher). Then, the municipalities will finance up to 30% of the investment costs of the projects and the rest will be paid with loans.
- Similar to investment costs (between 0.7 and 1.3 times). In this case, the municipalities will not pay counterpart, which will be paid by the Ministry of Environment, and the financing will be complemented by the loan.
- Less than 0.7 the investment costs. In those cases, the municipalities will not pay the counterpart. MINAM will pay it and the financing will be complemented with the resources from the loan.

Additionally, the following criteria will be applied regarding the use of municipal canon (bonus) collected in 2010.

- If the canon collected varies between S/.7 and S/20 million, the municipality would pay 20% of the investment cost.
- If the canon collected varies between S/.20 and S/40 million, the municipality would pay 30% of the investment cost.
- If the canon collected totals more than S/40 million, the municipality would pay 50% of the investment cost.

The following Table shows that:

- Five municipalities can pay 50% of investment and the rest with the loan
- Six municipalities could pay 30% of the investment and the remaining 70% with the loan
- Eight municipalities that could pay 80% of the loan and the 20% with contributions from the municipality
- One municipality would pay 10% of financing, 80% from the loan and MINAM could pay the other 10%.
- 11 municipalities could not pay counterpart amounts of the investments. Therefore, 80% will be covered with loan resources and the 20% would be paid by MINAM.

The municipalities of Santiago and Andahuaylas are special for the following reasons.

In the case of Santiago, the canon totals almost S/. 7 million. Additionally, there are remaining balance low and this municipality occupies the third fifth of the poverty map by FONCODES. Therefore, this municipality shall not be include counterpart.

As for Andahuaylas, the municipality has important remaining balance. However, the canon collected is very low, and this municipality occupies the second fifith of the poverty map by FONCODES. Then, this municipality will pay 10% of the counterpart.

It is necessary to mention that the percentages have to be agreed by MINAM and the municipalities.

Municipality	Remaining Balance (results of the budget execution) (S/.)				Canon	Investment	Ratio SB10/1	Financing					
								Municipality		Loan		MINAM	
	2007 1/	2008 1/	2009 1/	2010 2/	2010 3/	(S/.)		S/.	%	S/.	%	S/.	%
ABANCAY	1,092,111	1,171,516	1,120,611	4,984,930	6,914,653	5,798,430	0.86	1,159,686	20%	4,638,744	80%	-	0%
AYMARAES	690,835	1,431,354	1,796,944	-485,600	970,933	2,193,401	-0.22	0	0%	1,754,721	80%	438,680	20%
AZÁNGARO	3,736,150	7,223,340	6,119,350	1,812,617	5,306,268	2,491,772	0.73	498,354	20%	1,993,418	80%	-	0%
CHACHAPOYAS	2,280,593	2,874,826	3,786,662	1,853,512	4,427,742	4,810,104	0.39	0	0%	3,848,083	80%	962,021	20%
CHINCHA ALTA	2,836,299	3,782,074	5,680,534	6,249,804	25,725,674	5,736,289	1.09	1,720,887	30%	4,015,402	70%	-	0%
FERREÑAFE	1,804,856	1,426,529	101,243	439,654	2,079,202	5,593,914	0.08	0	0%	4,475,132	80%	1,118,783	20%
HUACHO	7,249,582	7,974,565	489,776	2,071,843	7,122,644	9,903,751	0.21	1,980,750	20%	7,923,000	80%	-	0%
HUÁNUCO	7,449,684	8,293,441	6,450,931	5,805,043	5,196,341	12,138,053	0.48	0	0%	9,710,442	80%	2,427,611	20%
ILAVE	8,223,795	6,753,386	6,266,029	2,458,607	14,057,303	3,050,959	0.81	610,192	20%	2,440,767	80%	-	0%
JULIACA	15,417,419	14,215,732	13,119,433	-2,444,886	24,463,449	17,661,676	-0.14	5,298,503	30%	12,363,173	70%	-	0%
MOYOBAMBA	5,197,988	6,564,873	10,390,515	14,177,491	6,553,631	8,151,646	1.74	2,445,494	30%	5,706,152	70%	-	0%
NUEVO CHIMBOTE	11,825,302	4,417,180	6,932,563	7,214,883	29,315,214	9,120,079	0.79	2,736,024	30%	6,384,055	70%	-	0%
PAITA	16,623,590	26,262,471	18,505,207	18,883,743	33,880,740	6,236,616	3.03	3,118,308	50%	3,118,308	50%	-	0%
PIURA	28,712,509	39,319,270	39,788,939	56,467,295	44,424,579	22,497,073	2.51	11,248,536	50%	11,248,536	50%	-	0%
PUNO	6,307,055	11,921,110	11,019,560	1,637,744	18,232,130	12,116,812	0.14	2,423,362	20%	9,693,450	80%	-	0%
SANTIAGO	1,191,613	981,988	1,266,081	255,851	7,410,400	2,785,590	0.09	0	0%	2,228,472	80%	557,118	20%
SECHURA	6,601,723	7,939,144	2,643,615	8,765,692	14,692,299	6,075,791	1.44	1,822,737	30%	4,253,053	70%	-	0%
SULLANA	16,090,189	16,096,866	15,066,764	-3,523,647	33,538,708	11,715,777	-0.30	3,514,733	30%	8,201,044	70%	-	0%
TALARA	13,745,581	29,053,650	10,621,470	11,562,138	51,779,703	8,968,077	1.29	4,484,038	50%	4,484,038	50%	-	0%
TAMBOPATA	2,306,539	1,859,067	1,378,362	2,581,883	3,060,908	9,888,674	0.26	0	0%	7,910,940	80%	1,977,735	20%
TARAPOTO	2,691,608	3,918,300	6,514,121	3,940,730	3,085,569	11,571,917	0.34	0	0%	9,257,534	80%	2,314,383	20%
TARMA	3,252,606	6,283,214	3,313,934	1,634,922	6,900,910	5,382,935	0.30	0	0%	4,306,348	80%	1,076,587	20%
TUMBES	11,542,997	10,215,078	9,984,093	19,953,651	22,445,016	8,976,897	2.22	4,488,448	50%	4,488,448	50%	-	0%
TOTAL JICA (PIPs)	**176,870,624.72**	**219,978,974.60**	**182,356,738.37**	**166,297,900.00**	**371,584,016.00**	**192,866,234**		**47,550,053**	**25%**	**134,443,263**	**70%**	**10,872,918**	**6%**
ANDAHUAYLAS	9,173,261	13,195,334	1,364,257	14,572,129	1,946,306	5,895,125	2.47	589,512	10%	4,716,100	80%	589,512	10%
BAGUA	892,694	1,958,364	1,876,707	2,598,865	1,547,266	5,536,669	0.47	0	0%	4,429,335	80%	1,107,334	20%
CHANCAY	9,605,346	6,754,588	4,679,621	1,813,691	11,183,009	6,153,317	0.29	1,230,663	20%	4,922,654	80%	-	0%
HUAMANGA	4,049,240	5,628,944	2,804,544	1,224,840	15,266,762	18,275,065	0.07	3,655,013	20%	14,620,052	80%	-	0%
OXAPAMPA	14,505,137	20,796,294	20,146,684	12,720,256	25,538,502	4,800,835	2.65	2,400,418	50%	2,400,418	50%	-	0%
POZUZO	3,940,800	601,648	4,130,016	112,365	3,631,952	2,529,158	0.04	0	0%	2,023,327	80%	505,832	20%
SAN JUAN BAUTISTA	7,511,467	12,206,446	11,781,688	-5,187,094	15,480,109	9,087,988	-0.57	1,817,598	20%	7,270,390	80%	-	0%
YAUYOS	834,614	314,742	-230,069	-66,730	444,791	1,520,476	-0.04	0	0%	1,216,381	80%	304,095	20%
TOTAL BID (PIPs)	**50,512,558.81**	**61,456,360.01**	**46,553,447.53**	**27,788,321.82**	**75,038,697.00**	**53,798,633**		**9,693,204**	**18%**	**41,598,656**	**77%**	**2,506,773**	**5%**
TOTAL PIPs	**227,383,183.53**	**281,435,334.61**	**228,910,185.90**	**194,086,221.82**	**446,622,713.00**	**246,664,867**		**57,243,257**	**23%**	**176,041,919**	**71%**	**13,379,691**	**5%**
National UEP						12,010,360		-		-		12,010,360	
JICA internat.consultancy						14,624,400		-		14,624,400		-	
IDB international consultancy						1,328,000		-		401,344		926,656	
UEP						**27,962,760**		-	**0%**	**15,025,744**	**54%**	**12,937,016**	**46%**
TOTAL PROGRAM						**274,627,627**		**57,243,257**	**21%**	**191,067,663**	**70%**	**26,316,707**	**10%**

5.9 MATRIX OF LOGICAL FRAMEWORK

DEVELOPMENT GOAL	VERIFIABLE INDICATORS OBJECTIVELY													MEDIOS DE VERIFICACION	SUPUESTOS IMPORTANTES
IMPROVEMENT OF QUALITY OF LIFE OF PEOPLE LIVING IN THE SELECTED AREAS OF PERU	-	Reduction of morbility cases related to unhealthy environments	%	**Current value 100%**				Reduce by 60% at year 4						Reporte de morbilidad de la red de salud	La población y las autoridades participan activamente en los programas orientados al manejo adecuado de residuos sólidos.
	-	Decreas e of environmental pollution	%	Current Value 100%					Reduce the methane emisisons by 70% by year 5					Informe de la oficina de medio ambiente de las Municipalidades	

PURPOSE	INDICADORES OBJETIVAMENTE VERIFICABLES													MEDIOS DE VERIFICACION	SUPUESTOS IMPORTANTES
		Indicators	Meaurement Unit	Year 0	Year 1	Year 2	Year 3	Year 4	Año 5	Año 6	Año 7	Año 8	Año 9	Año 10 Meta final	
IMPROVEMENT OF SANITARY AND ENVIRONMENTAL CONDITIONS OF THE PRIORITY AREAS OF PERU	-	Coverage of solid waste management	%	**32**			Increase coverage by 100% by year 3							**Coberturar al 100% en el año 10**	Informe de la Gerencia u órganos encargados del servicio de limpieza pública de las municipalidades seleccionadas	Las autoridades garantizan la continuidad de las medidas propuestas por el programa
	-	Reduction of critical points of household solid waste	%	**100**	Decrease by 83% the accumulation critical points by year 1		Reduce by 50% the acumulation critical points by year 3		Reducir al 100% los puntos críticos de acumulación al año 5					**0% de puntos críticos de acumulación en el año 10**	Encuestas a la población	Población apoya los planes de mejora de la gestión de residuos sólidos

PRODUCTS		INDICATORS VERIFIABLE OBJECTIVELY												MEDIOS DE VERIFICACION	SUPUESTOS IMPORTANTES
			Indicators	Measurement units	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Año 6	Año 7	Año 8	Año 9	Año 10 Meta final		
1.-	**Proper storage and street sweeping**	1.1	Storage capacity	t / year	**14,640.57**	Storage capacity 52398.1 t/ year at year 1									**Capacidad de almacenar 60702.3 t/año en el año 10**	Informe de la Gerencia u órganos encargados del servicio de limpieza pública de las municipalidades seleccionadas	
		1.2	Sweeping coverage	%	**90.11%**	Coverage by 100% the sweeping demand by year 1	100%	100%	100%	100%	100%	100%	100%	100%	**Barrer el total de vías de 804351.3 km/año al año 10**	Informe de la Gerencia u órganos encargados del servicio de limpieza pública de las municipalidades seleccionadas	

DEVELOPMENT GOAL		VERIFIABLE INDICATORS OBJECTIVELY														MEDIOS DE VERIFICACION	SUPUESTOS IMPORTANTES
2.-	**Efficient operating capacity of collection and transportation**	**2.1**	Diseño de rutas de recolección	sistema	**0**	Diseñar 31 rutas de recolección al año 1									**Diseñar 31 rutas de recolección al año 10**	Plan de rutas de las gerencias u órganos encargados del servicio de limpieza pública de las municipalidades seleccionadas	
		2.2	Collection coverage	%	**11.52%**	Cover by 100% collection demand by year 1	100%	100%	100%	100%	100%	100%	100%	100%	**Cubrir al 100% la demanda de recolección al año 10**	Contratos de compra venta,	
3.-	**Adequate reuse of solid waste**	**3.1**	Cobertura de aprovechamiento de residuos sólidos reciclable	%	**0.00%**	Recuperar el 30% de los residuos reciclables al año 1	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%	**Recuperar el 30% de los residuos reciclables al año 10**	Encuestas a los recicladores formalizados	
		3.2	Cobertura de aprovechamiento de materia orgánica	%	**0.00%**	Aprovechar el 5.7% de los residuos orgánicos al año 1	8.40%	11.10%	13.80%	Aprovechar el 16.5% de los residuos orgánicos al año 5	19.20%	21.90%	24.60%	27.30%	**Aprovechar el 30% de los residuos orgánicos al año 10**		
		3.3	Facility to reuse reciclable solid waste	Units	**0**	Build 31 reuse plants for reciclable solid waste by year 1									**Construir 31 plantas para el reaprovechamiento de residuos reciclables al año 10**	Visita in situ a las instalaciones	
		3.4	Facility to reuse organic waste	units	**0**	Build 31 reuse plants for organic waste by year 1									**Construir 31 plantas para el reaprovechamiento de residuos orgánicos al año 10**	Visita in situ a las instalaciones	
4.-	**Adequate final disposal**	**4.1**	Volume of solid waste properly disposed in the sanitary landfill	m3	**0**	Dispo 1350702.8 m3 of solid waste in the sanitary landfills by year 1	2414911	3507335.196	4628822.452	Dispose 5780227.04 m3 of solid waste in the sanitary landfills by year 5	6962490	8176532.805	9423318	10714460	**Disponer 12040626.4 m3 los rellenos sanitarios al año 10**	Visita de campo	
		4.2	Final disposal facility for solid waste	units	**0.00**	Build 31 sanitary landfills by year 1									**Construir 31 rellenos sanitarios al año 10**		

DEVELOPMENT GOAL		VERIFIABLE INDICATORS OBJECTIVELY													MEDIOS DE VERIFICACION	SUPUESTOS IMPORTANTES
5.-	**Efficient administrative and financial management**	**5.1**	Funcionarios municipales capacitados	%	**0**	Capacitar al 100% de funcionarios responsables de la limpieza pública al año 1								**Capacitar al 100% de funcionarios responsables de la limpieza pública al año 10**		
		5.3	Collection rate	%	**31.14%**	Collect 34.14% of taxes for public cleaning by year 1			Collect 46.14% of taxes for public cleaning by year 5					**Recaudar el 61.14% de los impuestos para limpieza pública en el año 10**	Oficina de rentas y tributos de las municipalidades seleccionadas	
6.-	**Proper population practices**	**6.1**	% porcentaje de población sensibilizada	%	**0**	Sensibilizar a un 20% de la población en el año 1			Sensibilizar a un 50% de la población al año 5					**Sensibilizar al 100% de la población al año 10**	Registro de casa sensibilizadas	
		6.2	% porcentaje de número de instituciones educativas sensibilizadas	%	**0**	Sensibilizar en un 20% de las instituciones educativas en el año 1			Sensibilizar en un 50% de las instituciones educativas al año 5					**Sensibilizar en un 100% de las instituciones educativas al año 10**	Informes de las instituciones educativas a la UGEL	

DEVELOPMENT GOAL		VERIFIABLE INDICATORS OBJECTIVELY		MEDIOS DE VERIFICACION	SUPUESTOS IMPORTANTES
1	Proper storage and street sweeping		-La población esta predispuesta a colaborar con el programa. -No se da una variación significativa en los niveles de precios. -Se cumplen oportunamente con todos los horarios y cronogramas dispuestos -Las decisiones políticas no vulneran ni reducen los impactos de la implementación del programa. -Los involucrados directos asimilan y ponen en práctica lo aprendido en los talleres y programas		
1.1	Procurement and installation of 50-liter capacity waste bins	1.1.1	Proccurement and installation of 245 waste bins of 50L	Contratos, facturas e informes	
1.2	Procurement of containers to store solid waste in areas difficult to Access	1.2.1	Procurement and installation of 165 containers of 2.5m3 and 19 containers of 1.5 m3		
1.3	Procurement of sweeping equipment	1.3.1	Procurement of 1003 sweeping vehicles	Contratos, facturas e informes	
1.4	Procurement of tools, personal protection equipment and sweeping materials	1.4.1	Procurement of tools, personal protection equipment and material to sweep streets and others	Contratos, facturas e informes	
1.5	Design of sweeping plans and manuals	1.5.1	Hire consultancies to design a sweeping plan and manual	Contratos, facturas e informes	
2	**Collection and transportation**				

DEVELOPMENT GOAL		VERIFIABLE INDICATORS OBJECTIVELY		MEDIOS DE VERIFICACION	SUPUESTOS IMPORTANTES
2.1	Procurement of compactor vehicles	2.1.1	Procurement of 122 compactor trucks of 6m3, 7 m3, 10m3, 12m3 and 15m3	Contratos, facturas e informes	
2.2	Procurement of a vehicle for selective collection	2.2.1	Procurement of hopper trucks of 19.8 m3 and 5 of 10m3	Contratos, facturas e informes	
2.3	Procurement of loading trimovils	2.3.1	Procurement of trimovils	Contratos, facturas e informes	
2.4	Procurement of tools and personal protection equipment for collection	2.4.1	Procurement of tools and personal protection equipment for selection personnel and others	Contratos, facturas e informes	
2.5	Design of collection routes	2.5.1	Hire consultancies to design collection routes	Contratos, facturas e informes	
2.6	Design of a Plan of selective collection at source	2.6.1	Hire a consultancy to design plans of selective collection at source		
3	**Reuse of inorganic and organic waste**				
3.1	Construction of facilities to reuse reciclable solid waste	3.1.1	Build 31 composting plants	Contracts, invoices and reports	
3.2	Construction of facilities to reuse organic matter organic	3.2.1	Build 31 recycling plants		
3.3	Procurement of equipment, tools and personal protection, materials for solid waste reuse	3.3.1	Procurement of equipment, tools, materials and personal protection equipment for organic solid waste reuse	Contratos, facturas e informes	
		3.3.2	Procure equipments, tools, materials and personal protection equipment to reuse inorganic solid waste and others		
3.4	Design of Promotion Plans to include and formalize waste pickers	3.4.1	Contract consultancies to design plans to formalize waste pickers		
4	Proper final disposal				
4.1	Construction of facilities for final disposal of municipal solid waste	4.1.1	Build 31 sanitary landfills	Contracts, invoices and reports	
4.2	Procurement of equipment	4.2.1	Procurement of 12 dump trucks	Contracts, invoices and reports	

DEVELOPMENT GOAL			VERIFIABLE INDICATORS OBJECTIVELY			MEDIOS DE VERIFICACION	SUPUESTOS IMPORTANTES
		4.2.2	Procurement of 25 caterpillar tractors				
		4.2.3	Procurement of 17 frontal loaders				
		4.2.4	Procurement of 25 weighing scales to weight trucks				
		4.2.5	Procurement of 23 electrical power generator				
		4.2.6	Procurement of electrical pumps				
4.3	Procurement of furniture	4.3.1	Procurement of furniture				
4.4	Procurement of minor equipment, tools, personal protection equipment and materials materials	4.4.1	Procure minor equipment, tools, personal protection equipment and materials for final disposal and others 9				
4.5	Implementation of environmental monitoring	4.5.1	Contract consultancies to conduct environmental monitorings			Contratos, facturas e informes	
5	**Proper administrative and financial management**						
5.1	Management specialized on the service		Contract consultancies			Contratos, facturas e informes	
5.2	Supervision and monitoring of the service		Buy linear motorcycless and vans to supervise and monitor the services			Contracts, invoices and reports	
5.3	Costing systems of the services, establish the taxes collection		Buy minor equipment for a total amount of				
6	**Proper practices for the population**						
6.1	Environmental education for the population		Contract consultancies				
6.2	Pilot plan to design and raise awareness top ay the service		Equipment, furniture and others				
			Direct cost	**Total:**	**S/. 209,299,061.6**		
7	**Write the technical file and environmental impact assessment**		**Contract a consultancy to write the technical file and EIA**	**Total:**	**S/. 10,366,282.8**	Contracts, invoices and reports	
7.1	Draft the terms of reference						
7.2	Tender procedures						

DEVELOPMENT GOAL			VERIFIABLE INDICATORS OBJECTIVELY			MEDIOS DE VERIFICACION	SUPUESTOS IMPORTANTES
7.3	Elaborate the survey						
8	**CONTRACTING OF CONSULTANCY FIRM FOR THE SUPERVISION AND FULFILMENT OF WORK A**		**Contract a consultancy firm to supervise and fulfil the works**	**Total:**	**S/. 10,638,618.9**	Contratos, facturas e informes	
8.1	Drafting of terms of reference						
8.2	Tender procedures						
8.3	Elaboration of surveys						
9.	**General expenses + Profit**			**Total:**	**S/. 16,385,903.7**		
			TOTAL INVESTMENT OF THE PROGRAM		**S/. 246,689,867**		
			COSTS OF THE EXECUTING UNIT		**S/. 12,010,360**		
			COSTOS DE ASISTENCIA Y SUPERVISION INTERNACIONAL-JICA		**S/. 14,624,400**		
			Cost of international assistance and supervisión-IDB		**S/. 1,328,000**		
			TOTAL COST		**S/. 274,652,627**		

5.9.1 Baseline to Evaluate the Impact

(1) Methodology and Indicators

1) Search and review of key information

Usually, the base line uses primary sources of information, such as census, statistics, previous studides, surveys, etc. The present document was not an exeption,Different documents were reviewed, such as existing documents in the district and provincial municipalities, PIGARS, plan of agreed development, plan of solid waste management, municipal ordinances, etc.

2) Description of the studies and components to handle

This item includes the districts that will be part of the Project, as well as the services each district will have. Thus, it is of paramount importance to have the following data:

- Demographic issues
- Physical issues
- Socioeconomic and cultural issues

3) Gathering field information

It refers to primary sources of information to be described below regarding technical, environmental and financial issues. Field visits and trips were carried out.

(2) Technical Issues

➢ Characterization Study of solid waste

The characterization study is drafted in order to establish:

(1) Generation of municipal solid waste

(2) Physical compositionDensity of municipal solid waste

The methodology used was that of the Panamerican Center of Sanitary Engineering and Environmental Sciences (CEPIS), and the method applied is the Simple Method to Analyzed Solid Waste by Kunistoshi Sakuari. by

The results obtained will be used to developed an integrated solid waste management.

➢ Storage and Sweeping in public places

Here, it is important to identify the type, characteristics and size of the container that citizens commonly use to store solid waste in order to project domestic solid waste.

At the time of the field verification, citizens place the containers (bags, bins, boxes, etc) filled with waste in the corners of streets or avenues until a collector vehicle collects the waste. Then, stray dogs break plastic bags, throw the bins and scatter the waste in order to feed themselves. This causes bad odor, increase of insects and problems for the rest of people living in the area. The situation can worsen and become a critical issue: sometimes the collection routs and schedule are incompatible with the habits of the citizens and lack of awareness among people.

During the sweeping stage, first it is important to know the people working in that area and their current working conditions (whether they are permanent or temporary staff). This information can be gathered in the office of public cleaning or the area of Human Resources. Then, photos are taken to describe how the sweeping is performed in the municipality: one person, group of workers, and hten it is important to know how many km each person sweeps to project the generation of solid waste in the streets. Such figure is obtained by multiplying the total length of the streets swept by the average generated in each route analyzed. This would apply in the case of paved streets, and for the unpaved roads, it is important to know the sweeping method, if there is a schedule sweeping time or if it is done from time to time.

- Collection and Transportation

The collection wants to take out the solid waste out of the household in order to control them in a single proper place.

It is important to know which is the current situation of the fleet of the target city (for instance, plate number, year of purchase of the collector vehicle, capacity). This information is verified by the person in charge of the public cleaningarea or, if the case might be, the supervisor working at the workshop. Besides, a visual inspection is conducted to find the current collection coverage..

This will depend on the distribution of households and other production sources of waste which will have an impact on the routes and types of vehicles to be used. In any case, routes can be changed depending on the collection schedule, number of collected blocks and number of trips.

Regarding the transport of waste, it is verified visually that the vehicles in charge of transporting the waste are the same that collect the waste. By means of photos it can be checked the compactors, dump trucks and hopper trucks transporting the solid waste from the generation point to the final disposal.

- Solid Waste Reuse

Information is looked not only in associations of waste pickers of the munipalities, level of organization waste pickers have, working conditions they have. Furthermore, it is important to know in situ the presence of informal waste pickers in the area.

- Final disposal of solid waste

During the verification stage, it is important to know the exact location of final disposal by means of the GPS coordinates, the term of operation, and photos to facilitate the description of the processes or operations of the municipality regarding solid waste (burial, burning of waste, dumping of waste to a nearby watersource, mainly rivers). This information is provided by the area of public cleaning or area of environmental sanitation of the target municipality.

- Municipal organization of the service of solid waste management

In accordance to interviews done to the people responsable of the public cleaning service, they stated that the service is provided by direct administration. In most cases, the service is provided through a unit, division and/or subdirectorate, which is included in the organization structure of each municipality.

The municipalities must ensure the public cleaning service is carried out properly, within the framework of political guidelines established in the article 4 of the General Law of Solid Waste.

1) Indicators

Please, find below the impact indicators related to the technical issues of the base line of the project:

Table 5.9-1 Base line indicators in the 31 cities

Nº	PROJECT	Population	Generation	Storage	Sweeping	Collection	Reuse	Final disposal
		Inhabit	t/day	t/day	Linear km/day	t/day	t/day	t/day
1	IDB – DISTRICT MUNICIPALITY OF CHANCAY	54643	28.83	1.13	33.05	25.11	0.00	25.11
2	IDB – DISTRICT MUNICIPALITY OF POZUZO	989	0.51	0.31	-	0.31	0.00	0.31
3	IDB – DISTRICT MUNICIPALITY OF YAUYOS	9718	6.88	0.00	3.97	0.00	0.00	0.00
4	IDB PROVINCIAL MUNICIPALITY OF DE BAGUA - LA PECA	52378	35.70	3.59	21.01	35.70	0.00	35.70
5	IDB PROVINCIAL MUNICIPALITY OF HUAMANGA	112919	129.85	1.40	66.46	97.14	0.00	97.14
6	IDB PROVINCIAL MUNICIPALITY OF DE OXAPAMPA	9489	6.46	0.05	3.00	5.57	0.00	5.57
7	IDB – DISTRICT MUNICIPALITY OF SAN JUAN BAUTISTA	99489	72.08	1.89	46.69	67.00	0.00	67.00
8	IDB PROVINCIAL MUNICIPALITY OF ANDAHUAYLAS	48433	28.70	0.64	0.63	12.00	0.00	12.00
9	JICA - DISTRICT MUNICIPALITY OF NUEVO CHIMBOTE	121650	83.30	0.28	21.23	74.12	0.00	74.12
10	JICA - DISTRICT MUNICIPALITY OF DE SANTIAGO	17621	6.20	0.00	3.79	3.62	0.00	3.62
11	JICA - PROVINCIAL MUNICIPALITY OF AYMARAES – CHALHUANCA	3756	2.04	0.10	16.02	1.69	0.00	1.69
12	JICA - PROVINCIAL MUNICIPALITY OF AZANGARO	17119	6.32	0.02	25.46	7.50	0.00	7.50
13	JICA - PROVINCIAL MUNICIPALITY OF CHACHAPOYAS	25198	16.54	0.20	23.58	12.11	0.00	12.11
14	JICA - PROVINCIAL MUNICIPALITY OF CHINCHA - CHINCHA ALTA	61920	43.45	0.53	31.77	41.38	0.00	41.38
15	JICA - PROVINCIAL MUNICIPALITY OF FERREÑAFE	32819	30.11	0.77	20.26	10.50	0.00	10.50
16	JICA - PROVINCIAL MUNICIPALITY OF HUACHO	55345	44.31	0.16	72.48	49.50	0.00	49.50
17	JICA - PROVINCIAL MUNICIPALITY OF HUANUCO	72560	49.17	0.22	51.99	50.40	0.00	50.40
18	JICA - PROVINCIAL MUNICIPALITY OF MOYOBAMBA	47071	33.81	0.28	12.32	29.32	0.00	29.32
19	JICA - PROVINCIAL MUNICIPALITY OF PAITA	79435	36.61	0.21	10.95	18.00	0.00	18.00
20	JICA - PROVINCIAL MUNICIPALITY OF PIURA	270959	244.06	0.44	58.79	215.95	0.00	215.95
21	JICA - PROVINCIAL MUNICIPALITY OF PUNO	127362	79.81	0.47	105.15	43.71	0.00	43.71
22	JICA - PROVINCIAL MUNICIPALITY OF SAN MARTIN – TARAPOTO	71016	70.15	3.44	31.70	44.36	0.00	44.36
23	JICA - PROVINCIAL MUNICIPALITY OF SAN ROMAN – JULIACA	229611	164.65	0.55	167.65	87.43	0.00	87.43
24	JICA - PROVINCIAL MUNICIPALITY OF SECHURA	36063	11.68	0.12	30.01	11.70	0.00	11.70
25	JICA - PROVINCIAL MUNICIPALITY OF SULLANA	37040	22.42	0.85	91.25	88.10	0.00	88.10
26	JICA - PROVINCIAL MUNICIPALITY OF TALARA - PARIÑAS	88823	59.40	0.15	52.72	57.38	0.00	57.38
27	JICA- PROVINCIAL MUNICIPALITY OF ABANCAY	46096	45.17	0.13	58.41	61.65	0.00	61.65
28	JICA- PROVINCIAL MUNICIPALITY OF ILAVE	24105	10.91	0.18	37.93	5.00	0.00	5.00

Nº	PROJECT	Population	Generation	Storage	Sweeping	Collection	Reuse	Final disposal
		Inhabit	t/day	t/day	Linear km/day	t/day	t/day	t/day
29	JICA- PROVINCIAL MUNICIPALITY OF TAMBOPATA	66967	39.77	0.23	57.38	82.84	0.00	82.84
30	JICA- PROVINCIAL MUNICIPALITY OF TARMA	43772	28.00	0.83	38.59	19.83	0.00	19.83
31	JICA - PROVINCIAL MUNICIPALITY OF TUMBES	99660	40.85	0.12	97.48	43.50	0.00	43.50

5.10 CONCLUSIONS AND RECOMMENDATIONS

- The analysis done to the following program perfil shows how necessary is to have infrastructure, equipment, training, management and awareness campaigns for Solid Waste Management of the cities selected. The main problem identified is the damage to the environmental quality, with negative consequences on the priority areas of Peru.
- The selected alternative wants to be flexible regarding the application of different strategies and techniques for solid waste management, in accordance with the features of the 31 projects included in the program. The effectiveness coefficient is S/.65.83 per ton effectively treated; this value falls into the rates to be applied to the user in each of the projects.
- The perfil of the Program of the development system for the solid waste management in priority areas includes an initial investment at market prices of S/. 274 652.627
- To implement the program of the Ministry of Environment will set up the corresponding executing unit in order to comply with the goals established in the program.
- Taking into account the features of the service, such as public storage, street sweeping, collection, transportation, reuse and final disposal), it is recommended to evaluate the possibility to involve private sector to provide the service. Furthermore, it is possible for aprogram of CDL/Clean Development Mechanisms,to apply in the near future for the emission reduction and then, access to carbon credits.
- In accordance with the analysis performed and gathering of primary information backing the amounts, the execution is then recommended.

GLOSSARY

- Dump site.UnsuiTable accumulation of solid waste in public spaces or areas, as well as in rural or uncultivated urban areas that generate environmental or health risks. They lack sanitary authorization and are not operated or administered formally.
- Cell.- Set of cells of a sanitary landfill.
- Cell.Storage unit of compacted solid waste that is totally covered.
- Gas drainage.- System by which the gas generated in the landfill are exhausted by chimneys.
- Coverage.- Layer of appropriate material placed to cover the exposed surface of waste in a facility.
- Compacting..- Reduction of waste volume by increasing density either manually or mechanically in the collection units and/or sanitary landfill.

- Pollution. Presence in the atmosphere of any physical, chemical agent, biological or combination of them that harm human beings, animals or plants.
- Density- Relation between the waste weight and its volume.
- Final Disposal. Processes or operations that place solid waste in the last management stage, permanently and environmentally and sanitary safe.
- Scattering. Dispose solid waste on the slope of the corresponding cell, using layers with no more 0.20-0.30 thickness.
- Run-off: Water running on the surface.
- Methane gas. Gas from organic matter decomposing.
- Leachate. Liquid from waste, formed by reaction, dragging or percolation that contains elements dissolved or in suspension found in waste.
- Permeability: Major or minor facility of infiltration of a liquid to traverse
- of porous means. It is measured in units of length/time.
- Waste processing.- Part of the activities aimed to obtain suiTable waste final disposal.
- Burning of solid waste. Process of incomplete and uncontrolled combustion of waste in the open air that pollutes the air due to gas and particles emission.
- Recycling. Process by which segregated material of waste are used as raw material in the productive cycle.
- Sanitary landfill. Place where waste is disposed daily, using engineering to properly dispose it, such as compacting, covering with soil or any other inert material, control of gas and leachate in order to avoid environmental pollution and protect health of population.
- Mechanized sanitary landfill. Landfill with a daily operation of 50 MT.
- Waste.Any material resulting from any process and/or operation to be disposed by the generators.
- Municipal solid waste. Waste collected by local government, such as household, commercial, business waste, among others.
- Non municipal solid waste, All waste different from municipal solid waste, such as hospital waste, pathogens, industrial waste, etc.
- Segregation. Activity consisting of reusable or recyclable waste.
- Trenches. Place where cells are formed.
- Vectors.- Being that transmit diseases (flies, mosquitoes, rodents and other animals).
- Life cycle. Estimated operating period of a sanitary landfill.

PART III RECOMMENDATION

THE PREPARATORY SURVEY ON SOLID WASTE MANAGEMENT PROGRAM IN THE REPUBLIC OF PERU

DRAFT FINAL REPORT
VOLUME I: MAIN REPORT

PART III: RECOMMENDATION

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CHAPTER 1 SUSTAINABILITY OF THE PROGRAM

The sustainability of the Program was analyzed from the institutional, technical, social, financial environmental standpoint in order to ensure that the Program lasts during its life period. In that sense, some measures are recommended in each of the above mentioned fields in order to ensure that each of the sustainability goals is complied with.

1.1 INSTITUTIONAL SUSTAINABILITY

- To implement the program, the ministry of Environment strongly suggests to set up the Executing Unit Program of the Program (UEP), so that the objectives established in the program would be complied throughout the time.
- It is recommended to seek involvement and participation of private companies in future, once the service is consolidated. For that purpose, and according to the local market conditions, each of the individual projects should be going to evaluate the possibilities of private participation.
- Proper management of municipal solid waste must ensure institutional sustainability. For that purpose, it is recommended to implement different training and operating plans described for each of the investment projects under the program.

1.2 FINANCIAL SUSTAINABILITY

Financial sustainability depends on revenue increase and/or cost reduction. However, actual collection rate of SWM service charges are in a low level in most of municipalities. On the other hand, SWM cost of most municipalities seems to be rather in a high level. In this sense, some municipalities have already taken measures to improve this situation. The followings are basic actions, which are recommended to municipalities, especially to these municipalities that have never taken these actions.

(1) To Improve Collection of SWM Service Charges

- Calculate and grasp actual SWM cost regularly
- Project adequate SWM service charges and set it up regularly
- Disclose to the public: outline of SWM cost and necessary service charges
- Publicize necessity of revenue increase with relation to SWM cost aiming to improve SWM services

(2) To Seek for Cost-Effective Services

- Grasp service-wise unit cost regularly: road cleaning (Soles/km), collection/transport (Soles/ton), and disposal (Soles/ton)
- Grasp yearly variation of the said unit cost
- Analyze factor of the variation
- Explain the factor explicitly to each field in charge of SWM services and make the field staff understand
- Improve the services involving all related fields

1.3 TECHNICAL SUSTAINABILITY

The analysis of the program shows that it is necessary to have the proper infrastructure, equipment and technical training to guarantee that it is implemented and operated as planned, and then as it will be sustainable. The following actions are recommended for each project:

- Prioritize reduction, reuse and recycling actions of solid waste
- Consider context of each city so that economic technologies are easy to operate and maintain
- Ongoing update of technical personnel responsible of operation and maintenance of equipment and systems.

1.4 SOCIAL SUSTAINABILITY

This is a key issue to guarantee the sustainability of the program throughout the time, since it is of paramount importance to raise awareness of population on environmental issues. Then, some measures are recommended to ensure the community embraces the project. Therefore, the tasks must be aimed at social communication and population awareness.

1) Social Communication

Strengthening of municipal environmental commissions, where municipal and sector authorities participate related to SWM, as well as local and business leaders. Proper dissemination of actions developed in the investment and operation stages.

2) Environmental awareness campaign

Each of the projects wants to raise awareness of people to improve SWM. However, each municipality must ensure that the actions planned for this purpose will be continued once the projects are finished. The actions will encompass the following areas:

- Formal education: each project aims to execute awareness programs in schools, in coordination with regional directorate of education in order to teach practices to reduce, reuse and recycle solid waste.
- Community education: each PIP includes the promotion to execute environmental awareness programs door to door, in order to teach practices to reduce, reuse and recycle solid waste.
- Campaign in the media to lead people practices to reduce, reuse and recycle solid waste.

1.5 ENVIRONMENTAL SUSTAINABILITY

Each of the projects included in the program must have a proper environmental sustainability throughout the life cycle. Therefore, the design and the operation of the project has been will have a minimum impact on the environment, not only in the beginning but also after 10 years of operation, when the projects will be directly managed by the municipality. The measures recommended for the post closure period will be the following:

- Ensure monitoring of water, soil and air after the life cycle of each sanitary landfill.
- Guarantee maintenance of green areas generated after closing the sanitary landfill.
- Collection and use greenhouse gas of sanitary landfills to apply CDM, to obtain certificates of emission reduction and access to carbon market.

CHAPTER 2 CAPACITY DEVELOPMENT

2.1 CURRENT CAPACITY OF NATIONAL AND LOCAL GOVERNMENTS

(1) National Government

MINAM is the organization in charge of leading SWM at national level. Actually, DIGESA still have strong influence on the technical aspect of SWM as seen the PIPs of the program have been evaluated by DIGESA. The facility designs of sanitary landfill have been developed in the preparatory survey referring the draft guideline of sanitary landfill of DIGESA while MINAM also has guidelines of landfill development. This is because that evaluator of PIPs in SNIP is MINSA which DIGESA belongs to. Also, MINAM does not have many experience of evaluation of SWM facilities such as sanitary landfill, sorting plant and composting plant. There is such duplication of responsibility for SWM at the national level as described above.

Nevertheless, MINAM is initiating the program and has been developing policies and guidelines to lead local government to better SWM in Peru. It is fact the improvement of SWM facility is still quite new sector in Peru. It seems some standard and guidelines would be too strict for the project in Peru to comply with. In order to promote proper SWM which will bring about better environment for the nation, small but many efforts at national level as well as municipality level should be executed one by one. Therefore it is recommended to set standard and guidelines based on the actual situation of SWM in Peru.

(2) Local government

There are 31 projects and 73 municipalities are involved in the program. The size and capacity of municipalities are quite different as observed in the course of the preparatory survey.

Present situation of the municipalities and SWM are described in each PIPs and summery of observation of present operation is shown in Chapter 2.3 of Part1. Due to insufficient capacity and ignorance of the appropriate operation, some problems have been observed as follows. These problems can be recognized s possibility of improvement for the people in the involved municipalities.

- There is not any management activity for final disposal at some of the exiting dumping sites. At the same time, complete soli cover on the dumped waste which can prevent odor, pest and littering has been practiced in some case.
- All municipalities have waste collection and transportation system and their workers. In some cases, uncollected wastes are observed on the streets or critical points of waste collection.
- Most of municipalities do not have experience of material recovery and practice of composting by themselves
- Municipal wastes are normally collected without waste segregation at source that is at households. Formalization of waste pickers has been carried out in some cases.
- Collection rate of SWM service charge is relatively low and not on-time.

2.2 PROPOSED CAPACITY DEVELOPMENT PROGRAM

It is expected that the necessary infrastructure for initial improvement of SWM will be developed for 31 project sites by using loan of JICA and IDB. It is also expected that development of capacity of facility operation is to be covered by the consulting service of loan project to some extent.

At the same time, it is necessary to enhance capacity of national as well as local governments in order to maximize the effectiveness of the infrastructures operation in the projects since appropriate SWM would not be achieved only by facility development and management but by promotion of 3R practices. The following programs are to be considered for promotion of the integrated SWM in Peru.

(1) Training for Operation of the Projects

There are some operation works, which some municipalities have never experienced such as operation of sanitary landfill and practice of composting, are included in the projects.

At first, such municipalities must understand necessity, reason and actual works of these operations before the implementation of the projects. It is proposed for MINAM or the UEP, once established, to develop training course for the municipalities for the bottom-up of the capacities of them. It is recognized that some municipalities with much experience could be trainers for the other municipalities together with MINAM or UEP. Also, training at different level is recommended in accordance with the capacity of municipalities.

(2) Coordination with On-going Activities

There are existing programs related to the issues of SWM sector. It is very recommendable to coordinate such on-going program for preparation of implementation of the program and projects.

In the PIPs prepared the on-going program executed by MEF which are PMM and PI is mentioned and it has been assumed the administrative capacity and collection system of SWM service charge would be improved.

Also, JICA has been conducting SWM training coerces for officials from 31 municipalities. Fifty five trainees in total will be dispatched for this course held in Japan. The trainees dispatched to Japan can be trainers for the said training program for operation of the projects.

(3) Expected Technical Assistants of JICA

It is recommended to conduct technical cooperation project to ensure improvement of SWM in Peru as assistance to soft components while the yen loan project will mainly improve hard components such as constriction of facilities and necessary equipment. The draft project design matrix is shown below.

Project Design Matrix (DRAFT) **The Project for Sustainable Integrated Solid Waste Management of Local Government in the Republic of Peru**

Narrative Summary	Objectively Verifiable Indicators	Means of Verifications	Important Assumptions
Overall Goal Local Governments (LG) execute appropriate Integrated Solid Waste Management (ISWM) to improve and conserve environmental sanitary conditions in the Republic of Peru			
Project Purpose Central Government (CG) strengthens its capacity for ISWM to lead LG in the Republic of Peru, and formulates the strategic promotion plan of ISWM and implements it.			Existence of National SWM policy and regulations
Outputs 1. CG develops sustainable models in some municipality for appropriate ISWM. 2. CG develops ISWM guidelines. 3. The counterpart personnel of CG acquire the knowledge and experiences on ISWM. 4. The counterpart personnel of CG acquire the capabilities to conduct training and raising awareness on ISWM of LG administrators. 5. CG develops a draft strategic promotion plan of ISWM.			
Activities 1.1 Select model LG, and study and analyze present conditions of the LG 1.2 Formulate strategic promotion plan of ISWM for the LG and execute it 1.3 Implement pilot project on ISWM in the LG 1.4 Evaluate the result of execution and elaborate papers on it 2.1 Study the improvement of ISWM based on the result of pilot project 2.2 Elaborate guidelines 3.1 OJT through the pilot project by JICA experts 3.2 Hold workshops and seminars 4.1 Plan and prepare public relations activities materials on ISWM 4.2 Practice through OJT how to plan and implement training on ISWM for LG personnel 5.1 Develop draft strategic promotion plan of ISWM and proceed to get approval of LG			MINAM deploys sufficient number of staff.

CHAPTER 3 OTHER RECOMMENDATIONS

3.1 FURTHER SURVEY BY MINAM

JICA survey team has prepared the draft of pre-investment survey reports necessary for SNIP. It is required for MINAM to follow-up and to continue further works and survey to facilitate the implementation of the program and the yen loan project.

3.1.1 Continuation of SNIP Procedure

The PIPs are being evaluated by OPI-MINSA which is competent authority of solid waste management sector. In the course of the evaluation, OPI-MINSA could comments on the studies. While the executors of sub-projects are municipalities and that for the program is MINAM, MINAM should supports municipalities to correspond to the comments and add necessary revision on the reports. MINAM needs to continue and finish the SNIP procedure to realize the Yen loan project as agreed in the Aide-Momoire signed by JICA and MINAM on March 11, 2011 (see Appendix).

MINAM will be required to correspond to the following issues:

- Soil tests to verify bearing capacity of the project site for perfil level projects
- Obtaining approval of 6 priority projects necessary for evaluation of the Program perfil
- Submission and revision of PIPs for the projects whose investment cost account for more than 50% of the total investment of the program, this is condition of viability declaration of the program
- Submission and revision of the program FS

3.1.2 Preparation for the Investment Stage

(1) The detailed design and EIA

In the course of the preparatory survey, MINAM has agreed to conduct the detailed design and EIA for the projects by Peru side so that the time requirement until commencement of operation of the project could be shorter than the normal one.

MINAM must understand the following conditions and arrange necessary works to ensure the quality of the detailed design and EIA;

- TOR of the consultant of detailed design to be employed by Peru side shall include preparation of the bills of quantity, tender documents which satisfy the level of international bidding and the guidelines of Yen loan. In addition, necessary field works such as environmental monitoring, additional geological survey including boring shall be included in the TOR.
- It is strongly recommended to employ an international consultant to supervise the performance and quality of outputs of the consultant for the said detailed design.
- It is also recommended to employ only one consultant to conduct the said detailed design so that the supervising by MINAM would be easier for ensuring quality of outputs.
- In carrying out EIA, requirements of JICA guidelines for social and environmental consideration must be considered.

(2) Coordination with the Concerned Agencies and Municipalities

There must be various discussion and coordination among MINAM, MEF and municipalities. The following conditions must be decided for the implementation of the projects.

- Agreement to make FIDEICOMISO which is the measure to ensure budget allocation of municipalities for expense of O&M and reinvestment.
- Sharing policy of investment cost for the project between MINAM and municipalities

(3) MINAM's Involvement for Waste Segregation at the Generation Source

Waste segregation at generation source and the segregated collection are basic conditions of the system of sorting plant and composting plant. While segregated waste collection has possibility of waste reduction and utilization of resources, JICA survey team did not assume it for the facilities in the projects at the beginning of the preparatory survey. Because, in Peru, there have not been any successful case, so it was afraid municipalities as well as MINAM do not have sufficient knowledge experience of this measure.

However, MINAM has decided to adopt this collection system respecting their national policy. JICA survey team understands segregated waste collection requires considerable efforts, involvement and commitment of project executor including municipalities. Then, MINAM have to come up with how to make it possible before implementation of the program. Now, MINAM is coordinating with MEF to promote source segregation and segregated waste collection. JICA survey team recommends MINAM to be involved in operation of this measure through the coordination with some municipalities. The facility design and proper operation of sorting plant and composting plant highly depends on the successful operation of the segregated waste collection.

MINAM must have experience and solution for the difficulties which municipalities may face in the operation of the projects. Otherwise, the facilities of these components can not works as designed.

3.2 OTHER RECOMMENDATIONS

(1) Enhancement of National Policy and Guidelines of SWM

In paralleled with initiation of the program, MINAM should enhance the national policy based on the present conditions of SWM in Peru.

(2) Establishment of Technical Advisory Team in MINAM

While MINAM is going to establish the UEP for the program, the UEP is a temporary organization with 4-year operation period. MINAM must have a responsibility to lead local government to appropriate SWM according to national policy and guidelines. It is proposed to establish permanent technical advisor team in MINAM so that the staff can visit and instruct the municipalities whenever they might face difficulties of SWM or when they need technical supports of MINAM as necessary time.

MINAM does not have cities where they have to manage these solid wastes. So, it tends to be weak to realize actual conditions and problems in the operation. It is expected the technical Advisory Team may share experience with municipalities and their experience and knowledge would d be helpful for other municipalities.

APPENDIX

Appendix: Aide-Memoire between JICA and MINAM dated March 11, 2011

AIDE- MEMOIRE
ON
PROGRAMA DE DESAROLLO DE SISTEMAS DE GESTIÓN DE RESIDUOS SÓLIDOS EN ZONAS PRIORITARIAS
BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY
AND
MINISTERIO DEL AMBIENTE

Place: **Lima, Peru**
Date: **March 11, 2011**

A mission of Japan International Cooperation Agency (hereinafter referred to as "JICA Mission") had detailed discussions with the officials of Ministerio del Ambiente (hereinafter referred to as "MINAM") from March 7 to 11, 2011, in order to confirm the progress of formation of the Programa de Desarollo de Sistemas de Gestión de Residuos Sólidos en Zonas Prioritarias (hereinafter referred to as "the Project").

The officials of MINAM and JICA Mission hereby confirm the main findings of JICA Mission as described in Main Points Discussed (Annex I), subject to approval by the competent higher authorities on both sides.

For
Japan International Cooperation Agency

Mitsuo Yoshida
Senior Advisor
JICA

For
Ministerio del Ambiente

Ana María González del Valle Begazo
Vice Ministra de Gestión Ambiental

Yoshikazu Taniguchi
Global Environment Department
JICA

Copy to:
Ministerio de Economía y Finanzas (Directora General, DNEP y Director General, DGPM), Ministerio de Salud (Director Ejecutivo, OPI)

Annex I

Main Points Discussed

1. Background

The Preparatory Study on the Project (hereinafter referred to as "the Study") started from March 2010 with dispatching a study team from JICA, originally expecting to be completed by October 2010.

However, due to the unexpected factors such as delay of the SNIP process and several changes of the candidate sites, the Study could not be completed by its original completion date.

Under such circumstances, JICA dispatched a Mission on October 2010 and discussed with MINAM with regard to the issue, compiled the subjects of the discussion to Aide Memoire signed between JICA and MINAM on 22nd October, 2010, as per attached in Attachment1.

In the said October's mission, how to solve the cause of the delay of SNIP procedures was discussed, and JICA and MINAM agreed the necessity of the extension of the service period of the Study team to achieve its original objective. Under such circumstances, JICA extended the service period the Study Team until the end of February 2011.

However, due to the continuous unforeseeable changes and modifications of the scope of the Project, it is impossible to finish the Study by the end of February 2011. Therefore, now JICA is again going to extend the service period of the Study Team by the end of March 2011.

2. The Expected output of the Study

The expected output of the Study by the end of March 2011 is as follows.

- PIPs of Program

	Perfil[1]	Pre F/S	F/S[2]
Program	△[3]		△

[1] To approve Program Perfil officially in the SNIP procedure, it is necessary for 6 perfils of sub-projects to be approved by OPI-MINSA.

[2] To get viability of Program F/S officially in the SNIP procedure, it is necessary for sub-projects which consists 50% of the total program cost to be approved by MEF.

[3] Revised according to the comments received from MINAM by 10th March, 2011.

➢ PIPs of each sub-project

	Perfil	Pre F/S	F/S	EIA
Puno[5]			△[4]	○
Juliaca	○		△[4]	△
Piura	○		△[4]	○
Nuevo Chimbote[6]	△	×		×
Tumbes	○	△		×
Sullana	○		△[4]	△
Abancay	△			×
Huánuco	○		△[4]	○
Paita[7]		○		×
Puerto Maldonado[7]		△		×
Talara	○	△		×
Moyobamba	○	△		×
Tarapoto	○		△[4]	○
Chachapoyas	△			×
Ilave	○			×
Azangaro	○			×
Chincha[8]	△			×
Sechura[7]		○		×
Huacho	△	△		×
Tarma	○			×
Ferreñafe	△			×
Santiago	○			×
Aymares	○			×

[4] Revised according to the comments received from MINAM on 4th March, 2011.
[5] Because Perfil and Pre-F/S report have been developed and approved by each local municipality in the past, Perfil study and Pre-F/S are not needed to conduct in the Study.
[6] With regard to Nuevo Chimbote, JICA Study team will not furnish the PIP because the selection of the site has not been determined.
[7] Because Perfil report has been developed and approved by each local municipality in the past, Perfil study is not needed to conduct in the Study.
[8] With regard to Chincha, JICA study team has furnished the major part of the draft, but cannot complete the PIP draft because the study team cannot conduct geological survey due to unsolved issue regarding land ownership of the project site.

○ : Draft is prepared. It has already been submitted to MINSA.

△ : Draft is prepared, but it has not been submitted to MINSA yet.

× : Draft is not prepared.

3. Continuation of the SNIP procedures

MINAM and JICA mission agreed that MINAM will be responsible for proceeding SNIP procedures after the termination of the service period of the Study team.

MINAM will work on it under the following working structures.

1) MINAM will keep on working on the investment program elaboration unit until the Project reaches viability with strengthening its workforce and allocating budget as much as possible.
2) MINAM will evaluate pertinence of the subproject of Nuevo Chimbote and Chincha which have problems in the project site.

4. JICA's involvement

As MINAM needs to take initiative of proceding the procedures of SNIP, if MINAM needs additional support to JICA in this area, JICA requests MINAM to specify the Terms of Reference of the work which needs support. MINAM explained it to the mission as shown in Attachment 2.

5. Recommendation from the mission

To achieve the smooth progress of SNIP procedures, JICA mission made the following recommendations.

(i) To reinforce the consultant team of MINAM for the Project such as the number of personnel and expertise for facility designing, cost estimation and geological survey.

(ii) To communicate closely with MINSA including DIGESA and MEF to avoid frequent changes of the requirements of SNIP procedure.

(iii) To communicate closely with each Municipality under new administration.

Attachment 1: Aid-Memoire signed on 22nd October, 2010

Attachment 2: Terms of Reference of the work

(End)

Annex II

List of Attendance for JICA Mission

1. JICA

Mitsuo YOSHIDA	Senior Advisor, JICA
Yoshikazu TANIGUCHI	Yoshikazu TANIGUCHI Deputy Assistant Director Environment Management Division 2, Global Environment Department, JICA
Fumi NAKAMURA	Senior Sector Specialist, Assistant Resident Representative, JICA Peru Office
Jesus GIBU	Sector Specialist, JICA Peru Office

2. MINAM

Jorge Villena Chavez	Asesor del Viceministerio de Gestion Ambiental
Miriam Arista Alarcon	Coordinadora del Programa de Residuos Solidos

3. Other

Mitsuo SAKAMOTO	JICA Expert assigned MEF

AIDE-MEMOIRE
ON
PROGRAMA DE DESAROLLO DE SISTEMAS DE GESTIÓN DE RESIDUOS SÓLIDOS EN ZONAS PRIORITARIAS
BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY
AND
MINISTERIO DEL AMBIENTE

Place: **Lima, Peru**
Date: **October 22, 2010**

A mission of Japan International Cooperation Agency (hereinafter referred to as "JICA Mission") had detailed discussions with the officials of Ministerio del Ambiente (hereinafter referred to as "MINAM") and Ministerio de Salud (hereinafter referred to as "MINSA") from October 19 to 22, 2010, in order to confirm the progress of formation of the Programa de Desarollo de Sistemas de Gestión de Residuos Sólidos en Zonas Prioritarias (hereinafter referred to as "the Project[1]").

The officials of MINAM and JICA Mission hereby confirm the main findings of JICA Mission as described in Main Points Discussed (Annex I), subject to approval by the competent higher authorities on both sides.

[1] The term "The Project" means in Peruvian context "El Programa".

Both parties acknowledge that this Aide Memoire is originally written in English, with a referential Spanish translation. If any controversy between these two version arise, the English version will prevail.

For
Japan International Cooperation Agency

Kengo AKAMINE
Deputy Assistant Director
South America Division,
Latin America and the Caribbean Department

For
Ministerio del Ambiente

Ana María González del Valle Begazo
Vice Ministra de Gestión Ambiental

Shintaro NAKAYAMA
Deputy Assistant Director
South America Division,
Latin America and the Caribbean Department

Yoshikazu TANIGUCHI
Deputy Assistant Director
Environment Management Division 2,
Global Environment Department

Copy to: Ministerio de Economía y Finanzas (Directora General, DNEP y Director General, DGPM)
Ministerio de Salud (Vice Ministra)

Annex I

Main Points Discussed

1. Sustainability of the Project

Under SNIP (Sistema Nacional de Inversion Publica) process, MINAM is required by Ministerio de Economía y Finanzas (MEF) to demonstrate financially and institutionally the sustainability of the Project, which means how each municipality of the sub-project2, which consist of the Project, would financially and institutionally be sustainable to cover the Operation and Maintenance (O&M) cost of their sub-project. Currently the preparatory study team is preparing a proposal on strategy to achieve the financial sustainability.

JICA Mission expressed that, separately from SNIP process, the feasibility of the Project including sustainability would also be examined by JICA throughout its consideration process, and emphasized that JICA would consider its finance only to those sub-projects whose sustainability is confirmed.

The issues to be noted from viewpoint of JICA with regard to the sustainability of the Project are as follows;

1-1.Improvement of Collection Rate of Public Cleaning Charge

MINAM explained that the O&M cost should be covered by income derived from public cleaning charge (normally billed to each household with property tax) and from each municipality's own resource such as Fondo de Compensación Municipal (FONCOMUN). MINAM stated that throughout the Project period, it will intend to let the municipalities of the Project increase the collection of public cleaning charge meanwhile reducing the amount of FONCOMUN to achieve the financial balance. Some of the measures explained by MINAM to increase the collection are as follows:

- Awareness raising among the residents
- Improvement of collection system which are already established such as SAT (Servicio Administración Tributaria), GAT (Gerencia Administración Tributaria), utilization of billing system of utility companies that charge electricity and water.
- Utilization of financial mechanism such as FIDEICOMISO, FONCOMUN, CANON, etc

However, JICA Mission is not yet convinced how the collection will be

[2] The term "sub-project" means in Peruvian context "proyecto".

improved through the above mentioned measures and requested MINAM to examine them in detail and present them to JICA by January, 2011. MINAM agreed to it.

In addition, JICA Mission requested MINAM to complete the financial sustainability analysis, duly consulted with each municipality. MINAM explained that it will start consultation process with each municipality from around the end of November 2010 due to the recent regional and local general election taken place in October 2010.

1-2.The Possibility of Increasing Public Cleaning Charge

JICA Mission asked MINAM the possibility of increasing public cleaning charge for the purpose of increasing income and improving the financial sustainability.

MINAM responded that for MINAM it is more important to improve the collection rate now. From this point of view, increasing the collection charge does not seem to be an appropriate idea, as it might discourage the residents to pay the charge.

However, MINAM does not deny the possibility of increasing the charge in the future, but it will be after improvement of the collection rate.

1-3. Repayment of the Loan by Municipalities

MINAM stated that it would examine the possibility of the municipalities' responsibility to take part of/whole repayment of the loan where the Regional Governments/municipalities receive enough amount of CANON, and propose the result of its examination to MEF when MINAM submits Feasibility Study to MINSA and MEF, even though the repayment issue is not prerequisite of the SNIP, but the debt management issue. JICA Mission requested MINAM to provide the result of its examination as soon as it is finished. MINAM agreed to it.

1-4.The Financial Appropriation of Each Municipality

MINAM explained that until recently, it was prescribed in "Ley General de Residuos Sólidos" that up to 30% of FONCOMUN shall be distributed to waste management service. Currently, there is no restriction with regard to the percentage of FONCOMUN for the waste management service. In the

financial sustainability analysis, it is considered to utilize certain amount of FONCOMUN to fill the gap of the balance between cost and income. JICA Mission understands that the waste management service cannot be covered only by collection of public cleaning charge and compensation by FONCOMUN is, up to certain extent, necessary. With this regard, JICA Mission stated that the amount of FONCOMUN to cover the deficit shall be kept at a reasonable level, considering the actual distribution amount in the past. Furthermore, JICA Mission mentioned that it would be necessary to obtain commitment from each municipality to secure necessary amount of FONCOMUN for the O&M of the Project. MINAM stated that it is going to subscribe an agreement with each municipality of sub-project in order to set forth the commitment that all the municipalities of the Project will be responsible for paying the O&M cost of each own.

1-5.Recycling and Composting Facilities

MINAM briefly explained that by recycling and composting, there will be various benefits such as reduction of waste volume, increase of lifecycle of sanitary landfill, reduction of cost for sanitary landfill construction, reduction of emission of methane gas and elimination of informal group at sanitary landfill, etc. JICA Mission requested MINAM to conduct detailed analysis of necessity and feasibility of recycling and composting such as (i) comparison of cost and benefit, (ii) necessary measures to achieve segregation of waste, (iii) market analysis of recycling and composting, etc. MINAM agreed to submit the above mentioned analysis by January, 2011. JICA Mission and MINAM confirmed that the finance to such facilities will be subject to the result of the above mentioned analysis.

MINAM also mentioned that according to the domestic regulations, government entities can sell the recycled product and compost through the limited ways such as auction, or by transferring the management of the recycling and composting facilities to the third party such as EC-RS (Empresa Comercializadora de Residuos Sólidos). MINAM thinks it is possible for each municipality to receive benefit through these ways.

2. Management Model of the Project

Although the detailed management model has not yet been designed (according

to MINAM, it will be examined in the F/S), MINAM explained its idea that an Executing Unit will be set up in MINAM and it will take whole responsibility of implementation of the Project including procurement of consultant and contractors, disbursement, coordination with each municipality of sub-project, etc, and each municipality will participate in as co-executor in some sense. MINAM and JICA Mission agreed to continue the discussion to identify the most suitable management model.

JICA Mission expressed that it would strongly expect MINAM as an Executing Agency and as a policymaker of solid waste management, to take initiative in the preparation and implementation of the Project by providing necessary technical assistance to each municipality of sub-projects.

3. Schedule

3-1. Estimated Schedule for Submission of the Studies to OPI-MINSA and MEF.

MINAM, MINSA (including Direccion General de Salud Ambiental (DIGESA)) and JICA Mission discussed the estimated schedule of SNIP approval procedure as follows, subject to the actual progress of the preparatory study;

			Submission to MINAM	Submission to OPI-MINSA	Submission to DIGESA	Approval by OPI-MINSA	Approval by DIGESA	Approval by MEF**
3 sub-projects	Perfil	Azangaro	22, Oct	27, Oct	not necessary	23, Nov	not necessary	20, Dec
		Ilave						
	Pre-F/S	Sechura	3, Nov	3, Nov				
Program Perfil			29, Oct	3, Nov		30, Nov		20, Dec
4 Perfils of sub-projects*(Sullana, Tarapoto, Piura, Huanuco)			5, Nov	10, Nov		17, Nov		14, Jan
			12, Nov	17, Nov		24, Nov		
7 sub-projects	Perfil	4 Perfils	17, Dec	21, Dec		11, Jan		25, Mar
				4, Jan		17, Jan		
	Pre-F/S	Paita	12, Jan	17, Jan		31, Jan		
		Puerto Maldonado						
	F/S	Puno	22, Dec	10, Jan		31, Jan		
4 F/Ss		Sullana	28, Jan	2, Feb		17, Feb		
		Tarapoto						
		Piura	8, Feb	10, Feb		28, Feb		
		Huanuco						
Program F/S			27, Jan	2, Feb		28, Feb		
EIA		Puno	9, Nov	not necessary	10, Nov	not necessary	28, Feb	not necessary
		Sullana	17, Jan		18, Jan		15, Mar	
		Tarapoto						
		Piura						
		Huanuco						

* These prefils are necessary for Salto (skipping to F/S)

**As for the dates of "Approval by MEF" in the last column, they are an assumption of the target dates without confirmation of MEF. MINAM confirmed to do their best to achieve the target dates.

3-2.Implementation Schedule

MINAM has been requesting JICA to shorten the implementation period in order to start operation by 2015 due to some political matter. JICA Mission briefly explained the concept of implementation schedule such as time required for procurement of consultant and contractors, etc, and emphasized that it is of significant importance to secure enough time for each process as MINAM does not have experience in JICA procedures. MINAM took note of it. The implementation schedule will be discussed in the coming JICA missions.

3-3.Delay and Time Limit of the Preparatory Study

The contract of the preparatory study is until the end of October of 2010. However, due to the unexpected factors such as delay of the SNIP process and several changes of the candidate sites, the study has not been finished. Under such circumstances, JICA is considering the extension of contract until the end of March 2011, which would be the maximum limit, under the following conditions;

(i) MINAM gives clear and consistent instructions regarding the direction of the study to the preparatory study team.

(ii) MINAM closely communicates with each municipality of sub-project for the coordination.

(iii) MINAM closely communicates with MINSA including DIGESA for acceleration of SNIP procedure.

(iv) MINAM closely communicates with MEF with regard to all the aspects of the Project.

In such case, the preparatory study team will be engaged, at latest, by the end of February 2011.

As a result, some documents which are originally supposed to be prepared by the preparatory study team will not be finished, even if the contract is extended.

JICA Mission and MINAM agreed that MINAM is going to finish these documents on its own responsibility.

At the moment, it is definitely impossible for the preparatory study team to furnish the following documents due to the delay in site selection;

- F/S and Environmental Impact Assessment (EIA) of Juliaca.
- Pre F/S of Nuevo Chimbote

4. Technical Issues

4-1.Parameter for Leachate Treatment

With regard to the quality of leachate treatment, originally DIGESA insisted on imposing strict parameter, which requires Biochemical Oxygen Demand (BOD) of leachate to be less than 20mg/Liter. This is technically possible, but according to the preparatory study team, this regulation might cause excessive specification of the leachate treatment facilities, which would cause not only the increase of the investment cost but also the increase of

O&M cost.

MINAM and MINSA discussed this issue and MINSA agreed to apply MINAM's parameter which, although still under preparation, would require BOD of leachate to be less than 100mg/ Liter.

4-2.Installation of Heavy Machinery in the Small-Sized Final Disposition Sites

The preparatory study team proposed to install heavy machinery such as bulldozers even in the small-sized final disposition sites, which receive less than 20 tons of solid waste per day. JICA Mission and MINAM agreed that heavy machinery will be installed to the small-sized final disposition sites of the Project if the financial sustainability can be demonstrated.

5. Coordination with MINSA with respect to the Contents of the Aide Memoire

MINSA, MINAM and JICA Mission had discussion on the Project especially with respect to the SNIP approval schedule as stipulated in 3-1, the approval dates by OPI-MINSA of which does not reach an agreement with MINSA. To accelerate the procedure, JICA Mission requested MINAM to coordinate with MINSA to maintain the schedule as much as possible. MINAM agreed to it and will inform JICA the result of said coordination.

(End)

Annex II

List of Attendance for JICA Mission

1. JICA

Kengo AKAMINE	Deputy Assistant Director, Latin America and the Caribbean Department
Shintaro NAKAYAMA	Deputy Assistant Director, Latin America and the Caribbean Department
Yoshikazu TANIGUCHI	Deputy Assistant Director Environment Management Division 2, Global Environment Department
Fumi NAKAMURA	Sectorista Senior, Representante Residente Asistente, JICA Perú Office
Jesús GIBU	Sectorista Senior, JICA Perú Office

2. MINAM

Ana María González del Valle Begazo	Vice Minister of Environmental Management
Jorge Villena Chávez	Asesor del Despacho Viceministerial
Miriam Arista	Coordinadora, Area de Residuos Sólidos

3. MINSA

Juan Ricardo Zuñiga Cardenas	Director Ejecutivo, Oficina de Proyectos de Inversión, Oficina General de Planeamiento y Presupuesto
Roxana Villa Zambrano	Analista de Proyecto
Marco A. Valverde Cribillero	Director Ejectuvo de Saneamiento Básico, DIGESA
Betty Peña	Evaluador, DIGESA

4. Other

Mitsuo SAKAMOTO	Experto JICA, Asesor en Préstamos AOD, adscrito en el MEF

Attachment 2

Terms of Reference of the work

1) Geological survey for projects at the level of Perfil and Pre-F/S.
2) Private sector participation analysis for the F/S of PIPs and F/S of the program.
3) Risk analysis for the F/S of PIPs and the F/S of the program in SWM.
4) Definite design for the facilities for SWM (blue prints, cross sections, detailed budgets, operation and maintenance guides, project description, etc) for the six projects at the level of F/S.
5) EIA study in the 17 sub-projects.
6) Tariff collection improvement plan in the target municipalities.
7) Public awareness plan of waste segregation and willingness to pay in the target municipalities.
8) Complete Pre-F/S, F/S and EIA study.

5 professionals for a 5 months period are expected.

Profession	Number
Project manager	1
Environmental engineer	2
Geologist	1
SNIP specialist	2
Private sector participation analyst	1