JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
UNIDAD ADMINISTRATIVA ESPECIAL DE SERVICIOS PUBLICOS (UAESP)

Project on Master Plan Study for Integrated Solid Waste Management in Bogota, D.C.

FINAL REPORT

Volume III
Main Report (2)

November, 2013

KOKUSAI KOGYO CO., LTD.
EX RESEARCH INSTITUTE LTD.

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Preface

The Project on Master Plan Study for Integrated Solid Waste Management in Bogota D.C. is now officially completed and the Final Report is submitted herewith.

Principal contents of this Final Report Volume III are the Master Plan (Part III) and action plans (Part IV). In addition, Volume II contains the evaluation of the current situation of solid waste management in Bogota D.C. (Part I) and a model project and preliminary design of solid waste treatment facilities (Part II).Volume I is a summary of the volumes.

Colombia has a well-established system in which relevant organizations from the central government level to the local government level cooperate effectively to provide appropriate solid waste services to the citizens. In addition, the private sector has acted as a service provider of waste management services in Bogota D.C. based on a scheme of Public-Private Partnership.

Efforts in waste minimization and recycling have just begun in Bogota D.C., although a high level of conventional solid waste service is provided. The Bogota D.C. government works on these issues in a serious manner. The Zero Waste Policy and the Recycler Inclusion Plan are the main pillars in this field. The Master Plan elaborated in this Project proposes various measures to materialize the policy and the plan targeting a 20% reduction of municipal solid waste by 2027. The minimization mainly consists of three measures, i.e., material recycling, composting, and construction and demolition waste recycling. No high cost waste treatment technology is included. A 20% reduction in waste is not an easy target compared with major cities in other countries. Achievement of the target requires each citizen to thoroughly understand and participate in the waste minimization effort.

As mentioned before, the current solid waste management is appropriately carried out in Bogota D.C. However, two vulnerabilities can be envisaged when looking to the future. First, this immense city, with more than 7 million inhabitants, has only one final disposal site, Doña Juana Landfill. If an accident occurs and the landfill closes, waste will be accumulated in the city and it will have adverse effects on the citizens' health. Second, there is no transfer station in the city which stretches lengthwise far to the north and south. Introduction of a transport system with transfer stations would increase efficiency of collection work and reduce costs. The Master Plan also proposes such new infrastructure to overcome these vulnerabilities.

The Master Plan, together with plans targeting other wastes such as hazardous waste, is to be reflected in updating of the Decree 312 in 2006. We hope that the output of the Project presented here will contribute to the improvement of solid waste management and citizens' welfare in Bogota D.C.

November 2013
Ikuo MORI
Project Leader

List of Volumes

Volume I Summary (English, Spanish, Japanese)

Volume II Main Report (1) (English, Spanish)

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1. Profile of the Project
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3. New Policies and Integrated Solid Waste Management Master Plan
4. Field Studies and Review of Existing Studies
5. Current Solid Waste Management Situation

Part II

1. Alqueria Model Project
2. Preliminary Design of Solid Waste Treatment Facilities

Volume III Main Report (2) (English, Spanish)

Part III

1. Preconditions for Planning
2. Selection of Optimum Scenario
3. The Master Plan
4. Components of the Master Plan
5. Evaluation of the Master Plan
6. Conclusion and Recommendations

Part IV

1. Action Plans

Appendix

1. Seminars and Public Relations
2. Records of Meetings

This is the Volume III, Main Report (2) (English)

In this report, the project cost is estimated by using the June 2013 price and an exchange rate of US$1.00 = COP1,900 = JP¥100.00

Republic of Colombia

Source: maps.google.co.jp

Project on Master Plan Study for Integrated Solid Waste Management in Bogota, D.C.

Project Area

1 Study Area

Overlooking of the City of Bogota D.C. from the top of the mountain Monserrate

Old Town, Bolivar Square

Old Town, Candelaria District

High-class residential area (Estrato 6), Usaquen District

The station of public transportation, Trans Milenio planned by JICA

Street recyclers collecting recyclable materials with carriages

2 Waste Management of the City

Containers for waste separation installed in public spaces

Public service of street sweeping

General collection of waste

Bogota City's attempt for organizing 13,757 recyclers (Inclusion Plan).

Entrance gate of the final disposal site of the city, DoñaJuana

Sanitary landfilling of the DoñaJuana

3 Pilot Project

Separate containers for recyclables installed in the apartment area（Primavera Occidental）

Separate discharge of the recyclables by the residents（Primavera Occidental）

Unloading of recyclable materials in the Alqueria recycling Center

Separation of recyclable materials in the Alqueria

Separation of PET in the Alqueria

Compression of plastic materials in the Alqueria

4 Trainings

UAESP officers in the lecture（Training in Chile）

Site visit to the recycling facilities（Training in Chile）

UAESP officers in the lecture of the Tokyo Metropolitan City（Japan Training, Tokyo）

Lecture of the Setagaya incineration Plant （Japan Training, Tokyo）

Site visit to the Mie Recycling Center（Japan Training, Mie Prefecture）

Site visit to the community recycling of the Komono town （Japan Training, Yokkaichi City）

5 Seminars and Workshops

First JCC Meeting

Project Kick-off Seminar

Workshop on the training in Chile by UAESP officers

3R Seminar

Seminar on the experiences of Japan training and Revision of PMIRS

Final Seminar with more than 200 participants

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Abbreviations

ANDI	National Association of Industries
ASE	Exclusive Service Area
ASE	Exclusive Service Area
B/C	Benefit Cost Ratio
CAR	Regional Autonomous Corporation
CAR	Regional Autonomous Corporation of Cundinamarca
CC	Coordination Committee
CDM	Clean Development Mechanism
CDM	Clean Development Mechanism
CDW	Construction and Demolition Waste
CRA	Drinking Water & Basic Sanitation Regulatory Commission
DANE	National Statistics Bureau
DF/R	Draft Final Report
EAAB	Water and Sewage Company of Bogotá
EIRR	Economic Intenal Rate of Return
EMP	Environmental Management Plan
F/R	Final Report
GDP	Gross Domestic Product
GOC	Government of Colombia
GOJ	Government of Japan
GRP	Gross Regional Product
I/R	Inception Report
IDU	Urban Development Institute
IEE	Initial Environmental Assessment
IT/R	Interim Report
JICA	Japan International Cooperation Agency
JMT	JICA Mission Team
MAVDT	Ministry of Environment, Housing and Regional Development
MRF	Material Recovery Facility
NCG	National Central Government
NPV	Net Present Value
PMIRS	Integrated Solid Waste Management Plan
POS	Public Opinion Survey
POT	Land Use Plan
PRM	Potentially Recyclable Materials
PTL	Leachate Treatment Plan
R/D	Record of Discussions
RBL	Collection, Sweeping and Cleaning
RPF	Refuse Paper & Plastic Fuel
RSDJ	Dona Juana Landfill
SC	Steering Committee
SDA	District Secretariat of Environment
SW	Solid Waste

SWM	Solid Waste Management
UAESP	Special Administrative Unit for Public Services
WACS	Waste Amount and Composition Survey
WEEE	Waste of Electric and Electronic Equipment

PART III

Chapter 1

Preconditions for Planning

1 Preconditions for Planning

1.1 Scope of the Master Plan

1.1.1 Definition of Solid Waste and Competency

There are different types of solid waste, sources and parties involved. The limit of responsibility among different authorities regarding management of waste has not been clearly defined. Consequently, it is important to establish the definition of solid waste and the competency of authorities to clarify their responsibilities and maximize the use of resources in the management of solid waste, thereby avoiding duplication of efforts. The following table shows a proposal for the definition of solid waste and competency for its management.

Table 1-1: Proposal for the Definition of, and Competency for Solid Waste

Classification and Source		Competency*	POT Subsystem
Ordinary Waste • households, • small producers, • large-quantity generators, • market places, • roads and public spaces • hospitals and clinics	Non-hazardous waste • common organic and non-organic • combined cdw	UAESP DS Environment IPES DS Planning	garbage collection service
	Hazardous waste Hospital and other similar (infectious) waste	DS Health DS Environment UAESP (i) DS Planning	garbage collection service
	• WEEE (waste electrical and electronic equipment) • Post-consumer waste	DS Environment SD Health DS Planning UAESP	Integrated waste management
Industrial Waste • factories • construction and demolition works • waste water treatment	Non-hazardous waste • common organic and inorganic • Muds and biomuds	DS Environment DS Planning EAAB UAESP (ii)	Integrated waste management
	• CDW	DS Environment DS Planning	Integrated waste management
	Hazardous waste • heavy metals, chemicals, light fittings, tires, etc.	DS Environment DS Planning	Integrated waste management

Competency*: Senior authority has principal competency.
(i) UAESP continuously guarantees provision of collection, transport, treatment and final disposal service for these wastes.
(ii) UAESP within his competence in ensuring clean areas has to provide collection, transport and final disposal of no hazardous waste (organic and inorganic) generated from factories.

1.1.2 Scope of the Master Plan

This Master Plan basically focuses on solid waste for which the UAESP has competency, that is, **Ordinary Non-hazardous Waste**. In addition, the Plan provides a series of recommendations on managing other waste, such as hazardous solid waste from non-industrial sources and cdw.

1.2 Guidelines for Master Plan Formulation

Local governments in Colombia are required by certain laws to formulate Integrated Solid Waste Management Plans ("PGIRS"). In this study, DECREE 1713 of 2002 "Gestión Integral de Residuos Sólidos" (Integrated Solid Waste Management", and RESOLUTION 1045 0f 2003 "Whereby a methodology for the preparation of the Integrated Solid Waste Management Plans – PGIRS – is adopted and other decisions are made", were taken as guidelines for the formulation of the Master Plan, considering the Master Plan "PMIRS" as the PGIRS for the city of Bogota.

a. Target Years

The laws establish a planning time frame, i.e.: short-term: 3 years as short-term, 3 years as medium-term, 9 years as long-term, for a total time frame of 15 years. Therefore, target years are fixed for the formulation of the Master Plan, as follows:

- Short-term (3 years) 2013 - 2015
- Medium-term: (3 years) 2016 - 2018
- Long-term: (9 years) 2019 – 2027

b. Deadline for Considering Final Disposal

Laws also require a projection of solid waste for a 30-year horizon in order to secure the necessary storing capacity at the possible landfill sites. Hence, it is projected up to year 2042 in this study.

1.3 Generation of Solid Waste Projection

1.3.1 Information destined for Projection

Solid waste generation is projected up to year 2042 by applying the guideline and taking into account the following information:

1. Scale Data from the 'Doña Juana' landfill
2. Results from the following previous studies:
    - UAESP, 2011, Caracterización de los residuos sólidos generados en la Ciudad de Bogotá D.C. ["Characterization of solid waste generated in the City of Bogota D.C."] (Residential Characterization)
    - UAESP, 2011, Caracterización de los residuos sólidos de establecimientos comerciales, pequeños productores[1], generados en la Ciudad de Bogotá D.C. ["Characterization of solid waste in commercial establishments, small

[1] Small-quantity producers generate less than 1.0 m3 of solid waste per month.

producers, generated in the City of Bogotá D.C."] (Commercial Characterization)

- UAESP, 2011, Caracterización de los residuos sólidos institucionales, pequeños productores, generados en la Ciudad de Bogotá D.C. ["Characterization of institutional solid waste, small producers, generated in the City of Bogotá D.C."] (Institutional Characterization)
- UAESP and The Andes University, 2005, Estudio de Caracterización y Cuantificación de los Materiales Potencialmente Reciclables presentes en los Residuos Sólidos Municipales Generados en Bogotá D.C ["Characterization and Quantification Study of Potentially Recyclable Materials present in Municipal Solid Waste Generated in Bogota D.C."]
- UAESP, 2011, Caracterización de la Actividad del Reciclaje en Bogotá ["Characterization of the Recycling Activity in Bogota"]
- UAESP, 2012, Estudio de factibilidad técnica, económica y financiera para la Verificación de Motivos para el Otorgamiento de Áreas de Servicio Exclusivo en el Servicio Público Domiciliario de Aseo Distrito Capital 2013-2020, Documento I - Aspectos Generales y Técnicos ["Technical, economic and financial feasibility study for the Verification of Motives leading to the Granting of Exclusive Service in the Capital District Public Domestic Sanitation Service 2013-2020, Document I– General and Technical Aspects "].

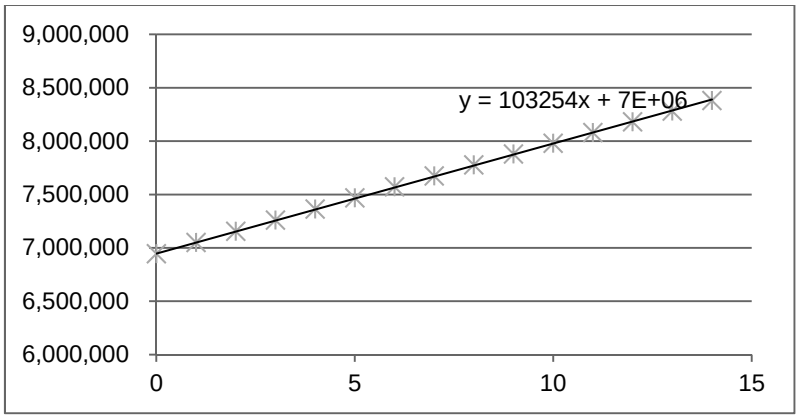
1.3.2 Population Projection

DANE publishes the Bogota Population Projection as seen in the following chart, Table 1-2 and Figure 1-1 shows the increase trend:.

Table 1-2: Population Projection

Year	Population nos.	Increase %
2006	6,945,216	-
2007	7,050,228	1.51%
2008	7,155,052	1.49%
2009	7,259,597	1.46%
2010	7,363,782	1.44%
2011	7,467,804	1.41%
2012	7,571,345	1.39%
2013	7,674,366	1.36%
2014	7,776,845	1.34%
2015	7,878,783	1.31%
2016	7,980,001	1.28%
2017	8,080,734	1.26%
2018	8,181,047	1.24%
2019	8,281,030	1.22%
2020	8,380,801	1.20%

Source: DANE



Source: Own preparation

Figure 1-1: Trend of Population Increase, 2006-2020

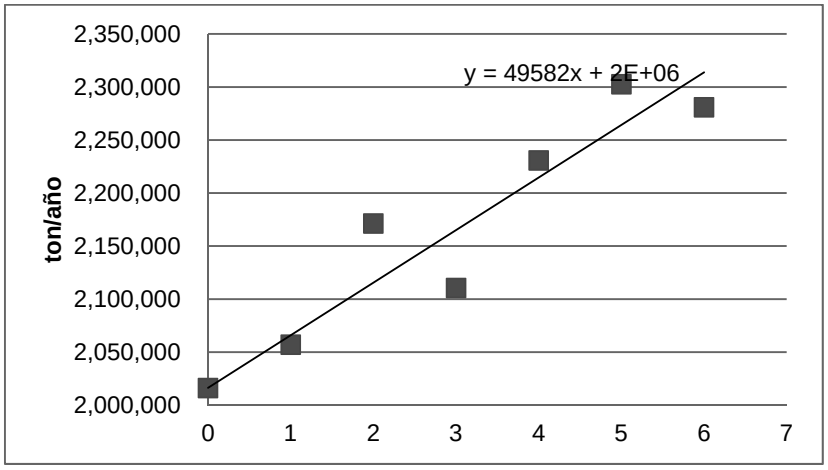
1.3.3 History of the 'Doña Juana' Scale Data and Current Solid Waste Flow

This section shows scale data from the '*Relleno Sanitario Doña Juan*a' (RSDJ) landfill between 2006 and 2012, as well as the total quantity, the upward trend and the amount per service.

Table 1-3: Total Final Disposal at 'Doña Juana', 2006 - 2012

Year	Final Disposal ton/year	Increase %
2006	2,016,300	-
2007	2,057,111	2.46%
2008	2,171,363	2.40%
2009	2,110,596	2.34%
2010	2,230,924	2.29%
2011	2,302,675	2.24%
2012	2,280,930	2.19%

Source: UAESP, RSDJ Scale Data



Source: Own preparation

Figure 1-2: Upward Trend in Final Disposal, 2006-2012

Table 1-4: Quantity of Final Disposal by Service, 2006 - 2012

Unit: ton/year

Year	Res. collection	Large-quantity Generators	Sweeping	Market places	Lawn cutting	Tree pruning	Cdw	Total
2006	1,358,986	214,703	137,751	38,303	23,107	7,093	236,358	2,016,301
2007	1,411,321	180,414	129,740	50,701	27,783	6,647	250,505	2,057,111
2008	1,451,141	217,417	144,052	47,382	33,841	6,300	271,230	2,171,363
2009	1,465,288	175,105	134,324	28,297	27,164	6,103	274,317	2,110,598
2010	1,564,311	172,048	142,539	18,142	44,933	9,827	279,123	2,230,923
2011	1,618,086	167,657	143,228	23,630	39,601	10,117	300,356	2,302,675
2012	1,648,692	163,709	127,004	17,638	22,413	8,525	292,949	2,280,930
Average	1,502,546	184,436	136,948	32,013	31,263	7,802	272,120	2,167,129
%	69.3%	8.5%	6.3%	1.5%	1.4%	0.4%	12.6%	100.0%

Source: UAESP, 'Relleno Sanitario Doña Juana (RSDJ) Scale Data

1.3.4 Generation Projection

This section shows the projection for the generation of solid waste in Bogotá D.C., as based on data exhibited in the previous sections.

Table 1-5: Generation of Solid Waste Projections 2012 - 2042

Year	Population (1)		Waste (2)		Waste per inhabitant	
	nos.	increase	ton/year	increase	kg/day	increase
2012	7,564,740	-	2,446,990	-	0.886	-
2013	7,667,994	1.36%	2,499,426	2.14%	0.893	0.79%
2014	7,771,248	1.35%	2,551,862	2.10%	0.900	0.78%
2015	7,874,502	1.33%	2,604,300	2.05%	0.906	0.67%
2016	7,977,756	1.31%	2,656,735	2.01%	0.912	0.66%
2017	8,081,010	1.29%	2,709,172	1.97%	0.918	0.66%
2018	8,184,264	1.28%	2,761,607	1.94%	0.924	0.65%
2019	8,287,518	1.26%	2,814,044	1.90%	0.930	0.65%
2020	8,390,772	1.25%	2,866,479	1.86%	0.936	0.65%
2021	8,494,026	1.23%	2,918,917	1.83%	0.941	0.53%
2022	8,597,280	1.22%	2,971,353	1.80%	0.947	0.64%
2023	8,700,534	1.20%	3,023,787	1.76%	0.952	0.53%
2024	8,803,788	1.19%	3,076,226	1.73%	0.957	0.53%
2025	8,907,042	1.17%	3,128,661	1.70%	0.962	0.52%
2026	9,010,296	1.16%	3,181,097	1.68%	0.967	0.52%
2027	9,113,550	1.15%	3,233,534	1.65%	0.972	0.52%
2028	9,216,804	1.13%	3,285,972	1.62%	0.977	0.51%
2029	9,320,058	1.12%	3,338,406	1.60%	0.981	0.41%
2030	9,423,312	1.11%	3,390,844	1.57%	0.986	0.51%
2031	9,526,566	1.10%	3,443,279	1.55%	0.990	0.41%
2032	9,629,820	1.08%	3,495,715	1.52%	0.995	0.51%
2033	9,733,074	1.07%	3,548,153	1.50%	0.999	0.40%
2034	9,836,328	1.06%	3,600,588	1.48%	1.003	0.40%
2035	9,939,582	1.05%	3,653,023	1.46%	1.007	0.40%

Year	Population (1)		Waste (2)		Waste per inhabitant	
	nos.	increase	ton/year	increase	kg/day	increase
2036	10,042,836	1.04%	3,705,462	1.44%	1.011	0.40%
2037	10,146,090	1.03%	3,757,898	1.42%	1.015	0.40%
2038	10,249,344	1.02%	3,810,334	1.40%	1.019	0.39%
2039	10,352,598	1.01%	3,862,770	1.38%	1.022	0.29%
2040	10,455,852	1.00%	3,915,205	1.36%	1.026	0.39%
2041	10,559,106	0.99%	3,967,641	1.34%	1.029	0.29%
2042	10,662,360	0.98%	4,020,080	1.32%	1.033	0.39%

Source: Own preparation

(1) Population. It is estimated by applying the line of Figure 1-1: Trend of Population Increase, 2006-2020, because there is no estimation after year 2021.

(2) Amount of solid waste generation. It is estimated by applying the line of Figure 1-2: Upward Trend in Final Disposal, 2006-2012

Table 1-6: Generation Projection by Service, 2012 - 2042

Unit: ton/year

Year	Household	Commerce	Large Generation	Sweeping	Market Places	Lawn cutting	Tree pruning	Cdw	Total
2012	1,200,990	514,710	218,503	144,894	34,707	32,393	9,255	291,538	2,446,990
2013	1,226,726	525,739	223,185	148,000	35,451	33,087	9,453	297,785	2,499,426
2014	1,252,462	536,770	227,867	151,104	36,194	33,781	9,652	304,032	2,551,862
2015	1,278,198	547,799	232,550	154,209	36,938	34,476	9,850	310,280	2,604,300
2016	1,303,933	558,829	237,232	157,314	37,682	35,170	10,048	316,527	2,656,735
2017	1,329,669	569,858	241,915	160,419	38,426	35,864	10,247	322,774	2,709,172
2018	1,355,405	580,888	246,596	163,524	39,169	36,558	10,445	329,022	2,761,607
2019	1,381,141	591,918	251,279	166,629	39,913	37,252	10,643	335,269	2,814,044
2020	1,406,877	602,947	255,961	169,733	40,657	37,946	10,842	341,516	2,866,479
2021	1,432,613	613,977	260,644	172,839	41,400	38,640	11,040	347,764	2,918,917
2022	1,458,349	625,006	265,326	175,944	42,144	39,335	11,238	354,011	2,971,353
2023	1,484,084	636,036	270,007	179,048	42,888	40,029	11,437	360,258	3,023,787
2024	1,509,821	647,066	274,690	182,153	43,632	40,723	11,635	366,506	3,076,226
2025	1,535,556	658,096	279,372	185,259	44,375	41,417	11,833	372,753	3,128,661
2026	1,561,292	669,125	284,055	188,363	45,119	42,111	12,032	379,000	3,181,097
2027	1,587,028	680,155	288,737	191,468	45,863	42,805	12,230	385,248	3,233,534
2028	1,612,764	691,185	293,420	194,574	46,607	43,499	12,428	391,495	3,285,972
2029	1,638,500	702,214	298,101	197,678	47,350	44,194	12,627	397,742	3,338,406
2030	1,664,236	713,244	302,784	200,783	48,094	44,888	12,825	403,990	3,390,844
2031	1,689,972	724,273	307,466	203,888	48,838	45,582	13,023	410,237	3,443,279
2032	1,715,707	735,303	312,149	206,993	49,581	46,276	13,222	416,484	3,495,715
2033	1,741,444	746,333	316,831	210,098	50,325	46,970	13,420	422,732	3,548,153
2034	1,767,179	757,363	321,513	213,203	51,069	47,664	13,618	428,979	3,600,588
2035	1,792,915	768,392	326,195	216,307	51,813	48,358	13,817	435,226	3,653,023
2036	1,818,651	779,422	330,878	219,413	52,556	49,053	14,015	441,474	3,705,462
2037	1,844,387	790,452	335,560	222,518	53,300	49,747	14,213	447,721	3,757,898
2038	1,870,123	801,481	340,243	225,622	54,044	50,441	14,412	453,968	3,810,334
2039	1,895,859	812,511	344,924	228,727	54,788	51,135	14,610	460,216	3,862,770
2040	1,921,595	823,540	349,606	231,833	55,531	51,829	14,808	466,463	3,915,205

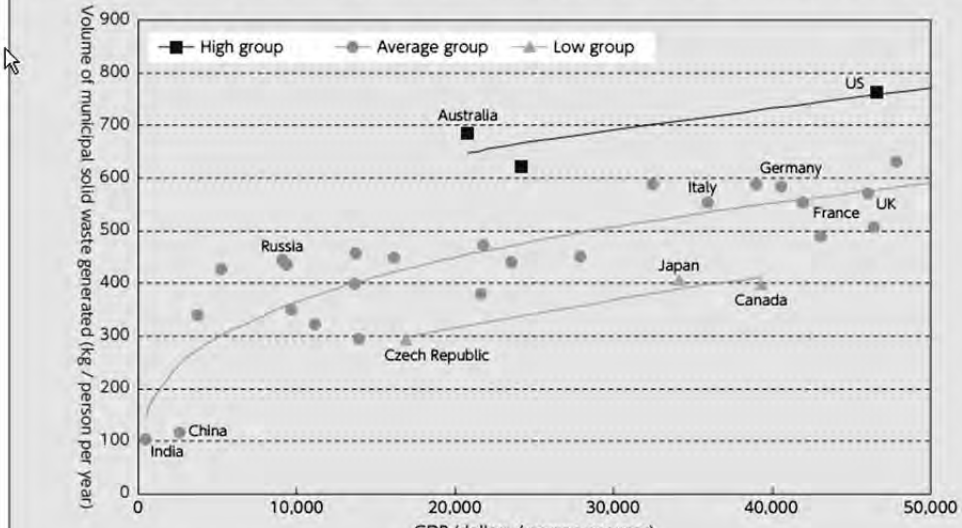
Year	Household	Commerce	Large Generation	Sweeping	Market Places	Lawn cutting	Tree pruning	Cdw	Total
2041	1,947,330	834,570	354,289	234,937	56,275	52,523	15,007	472,710	3,967,641
2042	1,973,067	845,600	358,971	238,042	57,019	53,218	15,205	478,958	4,020,080

Source: Own preparation

COLUMN

Most municipal solid waste generated per person is approximately between 300 and 600 kg/person/year (approx. between 0.8 and 1.6 kg/person/day) in the world, as seen in the figure shown below. The Gross Domestic Product per person in Bogota D.C. in 2011 was 20,239,551 Colombian pesos (Source: Secretaria Distrital del Habitat, 2012). This was equal to about 11,000 USD (1.00 USD = approx. 1,850 pesos in 2011). For up to GDP 20,000 USD dollars per person, generation is approximately between 300 and 500 kg/person/year (approx. between 0.8 and 1.4 kg/person/day). Meanwhile, current generation in Bogotá is approx. 0.9 kg/person/day. Therefore, it is estimated that generation in the future will not stretch beyond this limit in a significant manner.

Figure 4-2-4 Correlative Relationship between Per-capita GDP and Volume of Municipal Solid Waste Generated



Group with high volume of municipal solid waste generation	Australia, Israel, US, Denmark, Ireland
Group with average volume of municipal solid waste generation	China, Brazil, South Africa, Russia, Turkey, Mexico, Poland, New Zealand, Hungary, Slovakia, Estonia, South Korea, Portugal, Slovenia, Greece, Spain, Italy, Austria, Germany, France, Belgium, UK, Finland, the Netherlands, Sweden, Switzerland, Iceland, Norway, Luxembourg
Group with low volume of municipal solid waste generation	Japan, Czech Republic, Canada

Source: Research on Estimation of Global Waste Generation and Future Projections (Masaru Tanaka (Research Institute of Solid Waste Management Engineering, 2011))

Source: Annual Report on the Environment, the Sound Material-Cycle Society and the Biodiversity in Japan 2011

1.4 Projection of Solid Waste Composition

In 2011, UAESP carried out the residential and small-quantity generator solid waste characterization studies. For the formulation of the master plan, results are applied as shown in Table 9.7: Solid Waste Composition. The current composition is used in this master plan formulation.

Table 1-7: Solid Waste Composition

Unit: %

Component		Residential	Small and large generators
Foods	-	60.56	46.48
Gardening	-	0.87	3.23
Paper and Cardboard	MPR	7.10	11.91
Plastic	MPR	10.45	17.83
Rubber and Leather	-	0.42	0.91
Textiles	MPR	1.89	1.93
Wood	-	0.32	2.91
Metal	MPR	0.85	1.57
Glass	MPR	2.08	3.88
Ceramics, etc.	-	1.19	1.15
Hazardous	-	12.94	6.95
Others	-	1.32	1.27
Total		99.99	100.02
MPR		22.37	37.12
Non-recyclable		77.62	62.90
Total		99.99	100.02

Note: MPR: Potentially Recyclable Material
Source:

- UAESP, 2011, Caracterización de los residuos sólidos generados en la Ciudad de Bogotá D.C. (Caracterización Residencial)
- UAESP, 2011, Caracterización de los residuos sólidos de establecimientos comerciales, pequeños productores, generados en la Ciudad de Bogotá D.C. (Caracterización Comercial)
- UAESP, 2011, Caracterización de los residuos sólidos institucionales, pequeños productores, generados en la Ciudad de Bogotá D.C. (Caracterización Institucional)

Chapter 2

Selection of Optimum Scenario

2 Selection of Optimum Scenario

Several scenarios for solid waste management are established in this chapter and the most appropriate scenarios for Bogota D.C. are selected by means of comparative analysis.

2.1 Scenarios

Taking into account the vulnerability of the present Doña Juana Landfill and new Bogota D.C. policies, such as Zero Garbage and the Inclusion Plan, several scenarios have been established from the following viewpoints:

- Final disposal
- Minimization

2.1.1 Final Disposal

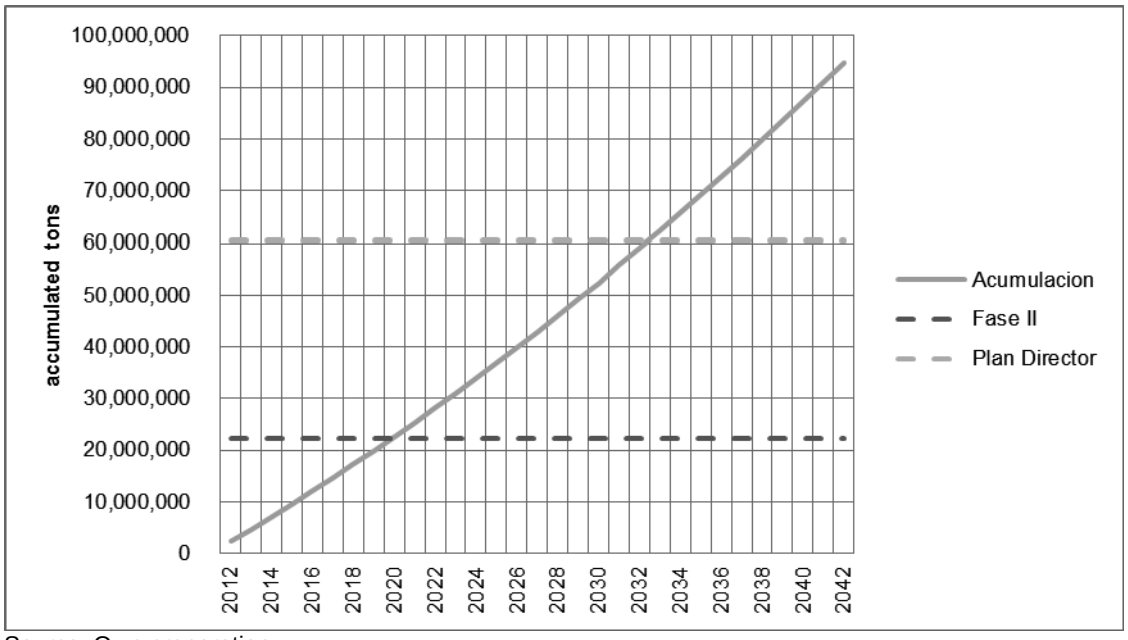
a. Vulnerability of the Doña Juana Landfill

The vulnerabilities of the present Doña Juana landfill can be summarized in the following two aspects:

- There is uncertainty as to the continued use of the RSDJ in the long term
- There is no other landfill that can be used as an alternative in the event of an unexpected event.

Regarding the uncertainty as to the continued use of this landfill in the long term, waste is at present discharged into the Phase I Optimization site, but it is estimated that it will be full by the first half of 2014. At present, the environmental license process for use of the Phase II Optimization site is under way. However, as at July 2013, it had not been possible to obtain the license because of protests by neighboring community. It is estimated that, given the filling capacity of the Phase II site, it will be possible to provide the service until 2020, although the same situation as at present will continue if no minimization method is introduced. Then there is the Director Plan, which aims to discharge waste on top of waste already buried (see Figure 2-1). However, there is uncertainty as to the safety of depositing waste vertically in this way and more studies and technical analyses need to be carried out. On September 26, 2997, the landfill collapsed causing an overflow of waste downstream. This accident has given rise to good deal of controversy and the indemnification process is still continuing.

The landfill is the foundation which sustains the entire garbage collection service. In the event of an accident in the landfill or along the road to it and if transportation of waste to the landfill were to be suspended, the city would be filled with waste, with the consequent negative effect on the health of the citizens. Bogota D.C., which is one of the largest cities in South America with a population of over 7 million inhabitants, has only one landfill. Given this situation, if an accident occurred the health and life of its citizens would suffer immeasurable harm (see column below).

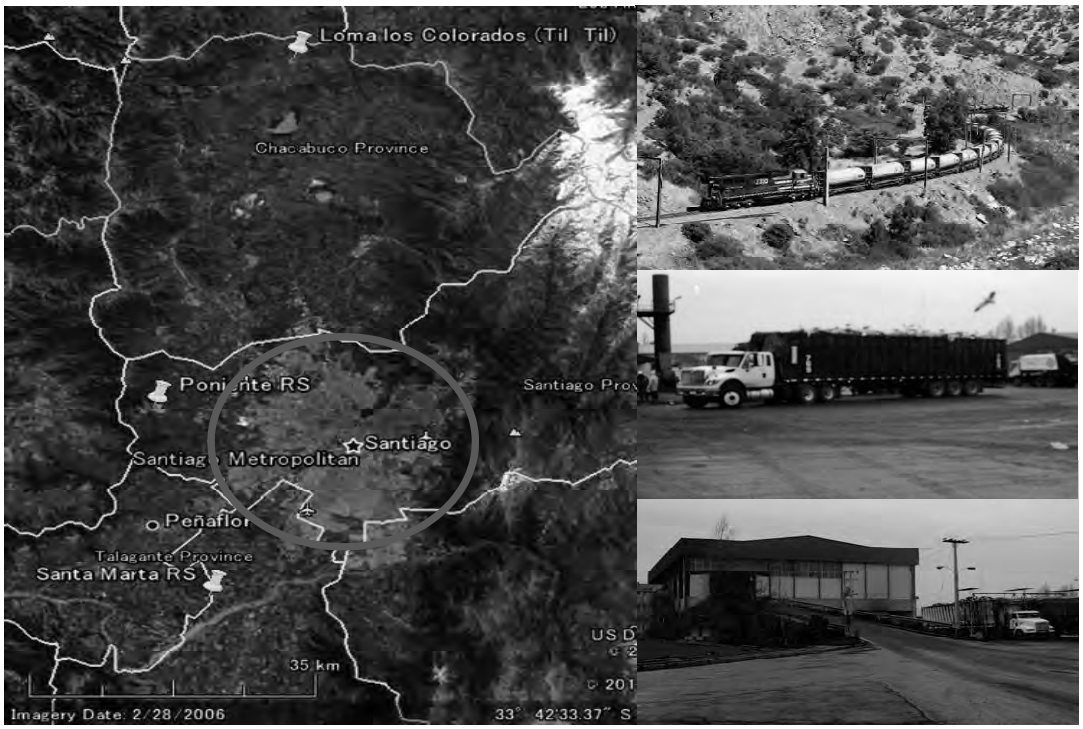


Source: Own preparation

Figure 2-1: Useful Life of the Doña Juana Landfill

COLUMN

The Metropolitan Area of Santiago, Chile has three (3) landfills that are strategically distributed (Loma Los Colorados, Santa Marta and Poniente) with transfer stations. The degree of risk referred to is thus considerably reduced.



Source: Google Earth, http://www.kdm.cl/tratamiento/servicios.html

b. Final disposal scenario

Considering the uncertainty of the use of the RSDJ in the future and the risk referred to above, the following three scenarios for the final disposal system have been established.

Scenario 0 (one landfill)
- Use the Doña Juana Landfill until the year 2030
- Build and operate a landfill as of the year 2031

Scenario I (two landfills)
- Use the Doña Juana Landfill
- Build and operate a landfill outside the city to the west as of the year 2021 together with a transfer station

Scenario II (three landfills)
- Use the Doña Juana Landfill
- Build and operate a landfill outside the city to the west as of the year 2021 together with a transfer station
- Build and operate a landfill outside the city to the north as of the year 2026 together with a transfer station

The following table shows the percentage distribution of the quantity of solid waste to the final disposal site according to the scenario and the figure shows the possible future locations of the landfills and transfer stations.

Table 2-1: Distribution of Solid Waste to the Final Disposal Sites

Scenario	Final Disposal	- 2020	2021 - 2025	2026 - 2030	2031 - 2042
Scenario 0	Doña Juana	100%	100%	100%	0%
	New (1)	0%	0%	0%	100%
Scenario I	Doña Juana	100%	50%	50%	50%
	Western	0%	50%	50%	50%
Scenario II	Doña Juana	100%	50%	30%	30%
	Western	0%	50%	50%	50%
	Northern	0%	0%	20%	20%

Note: (1) It is presumed that they will be located further away from Doña Juana.

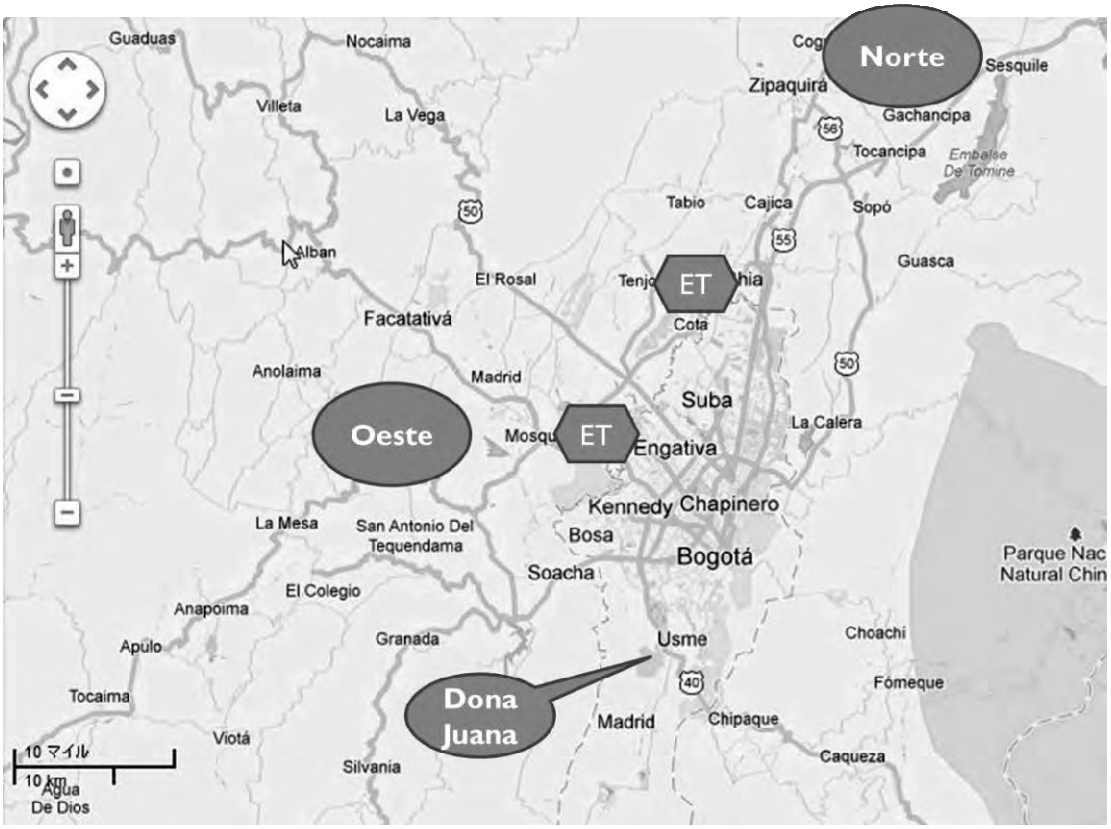


Figure 2-2: Image of Scenario II

2.1.2 Minimization

The present government of Bogota D.C. created the Zero Garbage policy and the Plan for Inclusion of the Recyclers in Public Waste Management. The former is an extensive minimization policy and the latter a plan focused on the recyclers of materials such as paper,

plastic and metals, etc. Taking into account the policy and the plan, the following minimization scenarios are considered.

Scenario a (no official minimization)

- Continued as at present.

Scenario b (progressive minimization)

- Progressive introduction of minimization measures such as recycling materials, composting and recycling cdw

Scenario c (gradual minimization)

- Gradual introduction of minimization measures such as recycling materials, composting and recycling cdw

Scenario d (rapid minimization)

- Rapid introduction of minimization measures such as recycling materials with an ambitious goal, composting and recycling cdw

Scenario e (radical minimization)

- Rapid introduction of minimization measures such as recycling materials with a high goal, composting and recycling cdw with ambitious goals and also includes the application of incineration technologies and Refuse, Paper & Plastic Fuel, RPF

a. Recycling materials

Among the solid waste from households and those of small / large generators, the percentages of Potentially Recyclable Materials are 22% and 37%, respectively. At present, combined waste is dumped and is contaminated by organic waste. Only part of the MPR is recovered informally by the recyclers. Separation at source will increase the quantity of material recovered. However, although separation is appropriately carried out, a considerable proportion will still be contaminated.[1]

b. Composting

At present, there are three services that focus on organic waste from market places, grass cutting and tree pruning. This organic waste is composted on the scenarios mentioned, as grass cutting and tree pruning waste is basically organic. However, in the case of market place waste, the degree of separation varies widely and a great effort is required in order to obtain the required degree of separation in some markets.

[1] In Japan, urban solid waste contains approximately 60% of MPR and separation at sources is carried out appropriately. However, the recycling rate scarcely reaches 20% in large cities.

c. CDW recycling

At present, there is a service focused on combined cdw[2], which is recycled as cdw on the scenarios referred to.

d. Incineration and Refuse, Paper & Plastic Fuel, RPF

"Scenario e" includes the application of technologies such as incineration and Refuse, Paper & Plastics Fuel, RPF. The waste incinerated is non-recyclable and the waste to which RPF is applied is the result of the MPR separation process.

e. Scenarios

The goals of each minimization component are summarized in the following Table.

Table 2-2: Minimization Scenarios

Scenario	Source	2012 (present)	2015 (short)	2018 (medium)	2027 (long)
Scenario a	Recycled material	-	-	-	-
	Households	5.0 %	5.0 %	5.0 %	5.0 %
	Small/Large	10.0 %	10.0 %	10.0 %	10.0 %
	Composting	0.0 %	0.0 %	0.0 %	0.0 %
	Combined cdw	0.0 %	0.0 %	0.0 %	0.0 %
	Incineration	0.0 %	0.0 %	0.0 %	0.0 %
	RDF	0.0 %	0.0 %	0.0 %	0.0 %
Scenario b	Recycled material	-	-	-	-
	Households	5.0 %	5.6 %	6.5 %	11.0 %
	Small/Large	10.0 %	10.6 %	11.5 %	16.0 %
	Composting	0.0 %	10.0 %	20.0 %	100.0 %
	Combined cdw	0.0 %	10.0 %	20.0 %	100.0 %
	Incineration	0.0 %	0.0 %	0.0 %	0.0 %
	RDF	0.0 %	0.0 %	0.0 %	0.0 %
Scenario c	Material recycled	-	-	-	-
	Households	5.0 %	6.5 %	8.0 %	12.5 %
	Small/Large	10.0 %	11.5 %	13.0 %	20.0 %
	Composting	-	-	-	-
	Market place	0.0 %	30.0 %	60.0 %	100.0 %
	Grass and trees	0.0 %	60.0 %	90.0 %	100.0 %
	Combined cdw	0.0 %	100.0 %	100.0 %	100.0 %
	Incineration	0.0 %	0.0 %	0.0 %	0.0 %
	RDF	0.0 %	0.0 %	0.0 %	0.0 %

[2] Combined cdw is the waste from construction and demolition, mainly produced by small-scale works carried out at homes. CDW from large works, such as the construction of buildings and roads, is not included in this category.

Scenario	Source	2012 (present)	2015 (short)	2018 (medium)	2027 (long)
Scenario d	Recycled material	-	-	-	-
	Households	5.0 %	8.0 %	11.0 %	15.0 %
	Small/Large	10.0 %	16.0 %	22.0 %	30.0 %
	Composting	-	-	-	-
	Market Place	0.0 %	30.0 %	60.0 %	100.0 %
	Grass and trees	0.0 %	60.0 %	90.0 %	100.0 %
	Combined cdw	0.0 %	100.0 %	100.0 %	100.0 %
	Incineration	0.0 %	0.0 %	0.0 %	0.0 %
	RDF	0.0 %	0.0 %	0.0 %	0.0 %
Scenario e	Recycled material	-	-	-	-
	Households	5.0 %	8.0 %	11.0 %	15.0 %
	Small/Large	10.0 %	16.0 %	22.0 %	30.0 %
	Composting	-	-	-	-
	Market place	0.0 %	30.0 %	60.0 %	100.0 %
	Grass and trees	0.0 %	60.0 %	90.0 %	100.0 %
	Combined cdw	0.0 %	100.0 %	100.0 %	100.0 %
	Incineration	0.0 %	0.0 %	0.0 %	100.0 %
	RDF	0.0 %	0.0 %	15.0 %	50.0 %

Note: These percentages are the ones that enter the recycling systems and are not those of minimization.

2.2 Analysis of Scenarios and Selection of an Optimum Scenario

2.2.1 Final Disposal Scenarios

a. Useful life of RSDJ

If the space of the landfill is used in accordance with the Director Plan, but if no type of minimization is practiced according to Scenario 0, the useful life of the Doña Juana Landfill will be until 2033; in Scenarios I and II, its useful life will not be exhausted within the coming 30 years, as shown in the figure below.

However, this useful life is not guaranteed and so it is vital to examine the viability of the Director Plan from all points of view and to obtain the required environmental license. In particular, there is uncertainty as to the use of space in the landfill after the Phase II optimization is full, that is, as of the year 2021, because this site is the only open terrain in the final disposal area and, once the Phase II site is full, new solid waste will be discharged onto the existing waste.

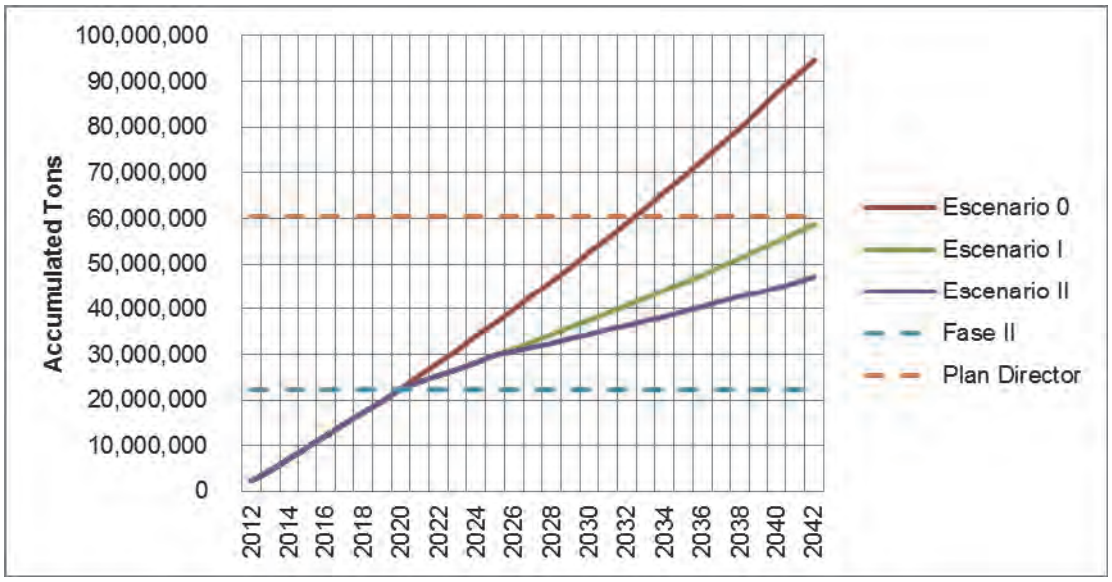


Figure 2-3: Useful Life of the Doña Juana Landfill according to Scenarios

b. Costs

As shown in the following table and the Figure, the costs of Scenarios 0, I and II are calculated by applying the estimated Master Plan unit costs. The amounts of the total costs of the term of 30 years for all the Scenarios are similar. There is also no considerable difference from the costs of the 15 year term.

In the year 2014, the costs of all the Scenarios would increase, because the execution of a new RBL [*collection, sweeping and cleaning*] service contract is programmed for that year and it requires the introduction of Euro IV. The costs of Scenarios I and II would begin to go down as of 2021 as a result of the introduction of the transfer and transport system. The cost of Scenario 0 would increase in the year 2031 because the new landfill instead of the RSDJ will be commissioned.

Table 2-3: Comparison of Total Final Disposal Costs of Scenarios

Scenario	2013 - 2027		2013 - 2042	
	Millions of pesos	Difference	Millions of pesos	Difference
Scenario 0	7,452,221	0.0%	17,338,672	0.0%
Scenario I	7,176,419	-3.7%	15,959,017	-8.0%
Scenario II	7,180,751	-3.6%	16,000,353	-7.7%

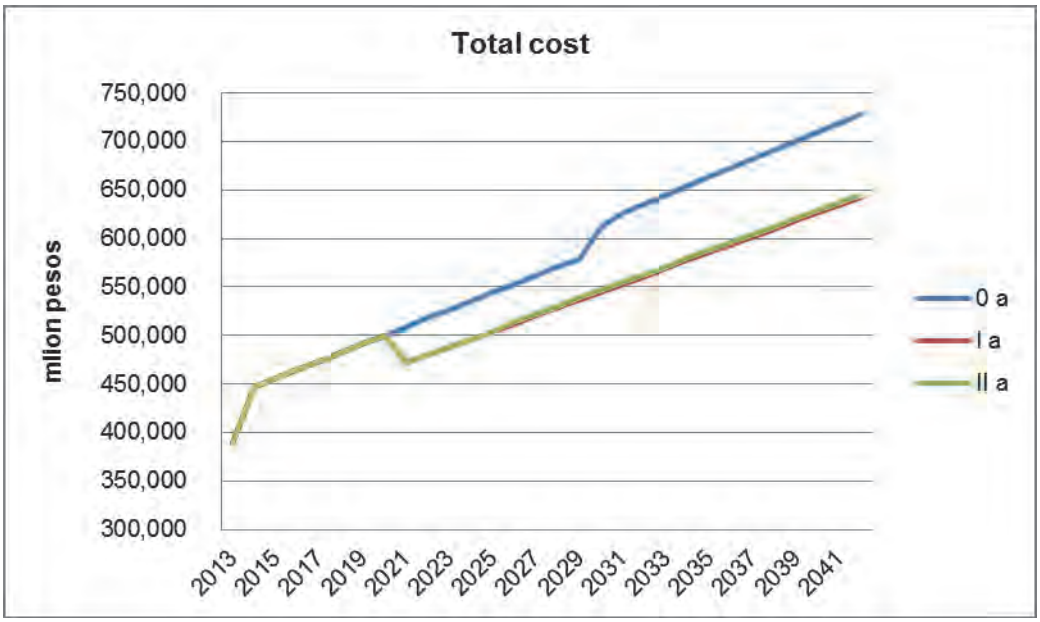


Figure 2-4: Comparison of Final Disposal Costs of Scenarios

c. Assessment of Scenarios and Selection of an Optimum Final Disposal Scenario

Based on the assessment shown in the following table, **selection of Scenario II is recommended.**

Table 2-4: Assessment of Scenarios with Regard to Final Disposal

Scenario	Strength / Timescale	Weakness / Threat
Scenario 0	The present infrastructure of the Doña Juana Landfill can be used until the year 2030.	Once the Optimization area is full the continued use of the RSDJ will be uncertain. It will be difficult to seek and operate a new landfill as of 2031. In 2031 the cost would rise considerably. It would be difficult to seek and operate a new landfill as of 2031. The cost will rise considerably in 2031.
Scenario I	As of 2021, two landfills will be operated. This will be at the risk of shutdown of the entire system of solid waste management due to an accident in the landfill. The total cost is more economic.	If it is impossible to use the RSDJ, the western landfill will be the only one. This system is as vulnerable as the present one. It will be difficult to seek and operate a new landfill as of 2021.
Scenario II	Two landfills will operate as of 2021 and three from 2026 onward. This reduces considerably the degree of risk of shutdown of the entire solid waste management system due to an accident in or on the way to the landfill.	It will be difficult to seek and operate new landfills to the west as of 2026 de 2021 and to the north from 2026 onward.

Scenario	Strength / Timescale	Weakness / Threat
	The new landfills will be beneficial not only for the city of Bogota, but also for the municipalities of Cundinamarca, which do not have a landfill and have to carry their waste over a long distance to the Mondoñedo landfill. Competition will be accelerated and good rates and quality of service are expected.	

2.2.2 Analysis of Scenarios with regard to Minimization

a. Minimization

Table 2-5 and Figure 2-5 show the rate of minimization of the five Scenarios. The rate of "Scenario a" would be maintained at 5.4%. That of "Scenario e" would be over 80% due to the impact of incineration. In "Scenarios b, c and d" the same minimization measures would be applied, but the speed of application would be different. Moreover, in Scenario d, the materials recycling goal is very ambitious.

Table 2-5: Rates of Minimization of Scenarios

Scenarios	2012	2015	2018	2027
Scenario a	5.4%	5.4%	5.4%	5.4%
Scenario b	5.4%	6.3%	7.5%	18.7%
Scenario c	5.4%	10.8%	12.7%	20.3%
Scenario d	5.4%	11.4%	15.1%	23.6%
Scenario e	5.4%	11.4%	15.5%	83.4%

Note: The minimization is obtained by dividing the quantity minimized by the quantity generated.

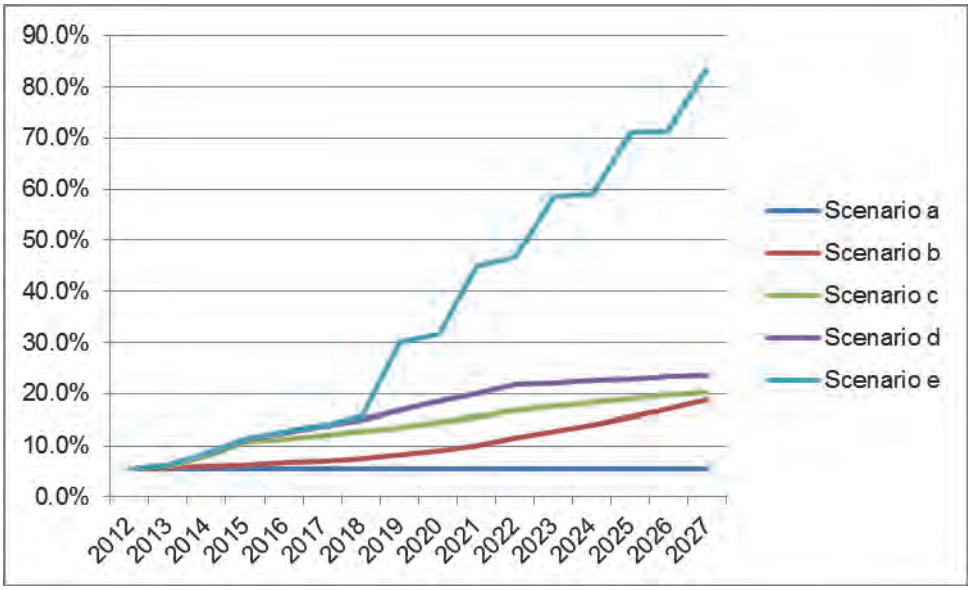


Figure 2-5: Minimization Rates of Scenarios

b. Costs

Scenario II was selected as the scenario for final disposal. Combining Scenario II with the 5 Minimization Scenarios and applying the Master Plan unit costs, the total cost of each combination is calculated as shown on the following Table and Figure.

Between Scenarios a, b, c and d, the difference in the total cost is less than 10%, while the total cost of Scenario e increases significantly. In particular, the annual cost of the final stages of the term of the project is very large in comparison with the other Scenarios. This is mainly due to the introduction of incineration.

Table 2-6: Total Cost of Minimization Scenarios

Unit: millions of pesos

Scenario	Millions of pesos	Difference
Scenario II a	7,180,751	0.0%
Scenario II b	7,500,893	4.5%
Scenario II c	7,683,182	7.0%
Scenario II d	7,761,028	8.1%
Scenario II e	9,291,551	29.4%

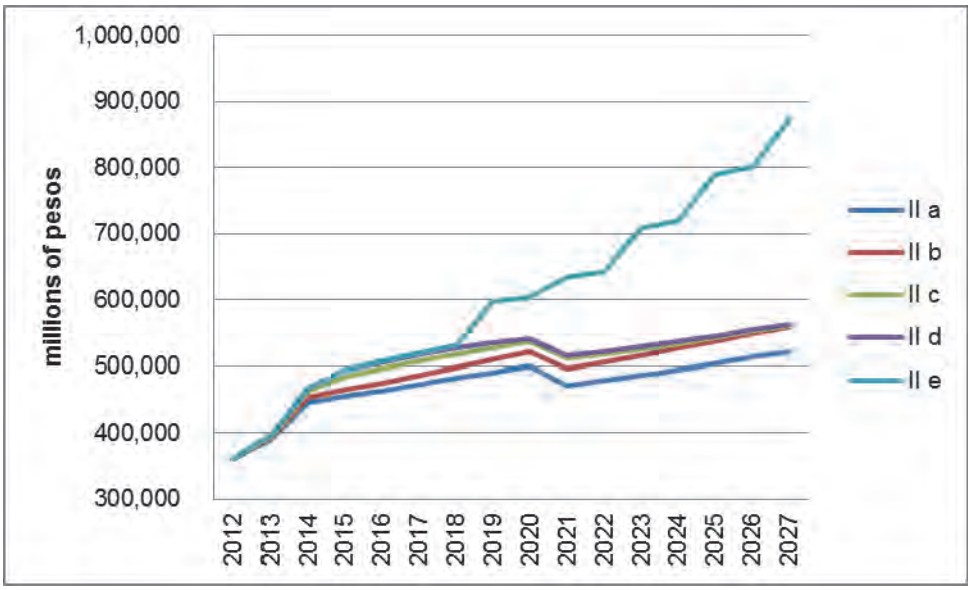


Figure 2-6: Total Cost of Each of the Minimization Scenarios

c. Assessment of Minimization Scenarios

The following Table summarizes the assessment of the Minimization Scenarios.

Table 2-7: Assessment of the Minimization Scenarios

Scenario	Strength / Timescale	Weakness / Threat
Scenario a	No friction with society would occur because there would be no change.	The present situation of the recyclers and the recovery of potentially recyclable materials, MPR would not improve.
Scenario b	No considerable friction would be caused, because changes would be introduced progressively. Taking into account the combination of solid waste in the city, the minimization goals would be achieved technically. The cost would also increase progressively.	The present situation of the recyclers and the recovery of MPR would improve. However, the speed of improvement would be slow. This slow speed would not require a change of attitude on the part of the citizens.
Scenario c	Taking into account the composition of solid waste in the city, the minimization goals would be achieved from the technical point of view. The speed of changes required by this Scenario would have an impact that would change the attitude of the citizens involved.	Friction would be caused even though the changes would be made gradually. The cost would increase in the early years.
Scenario d	This Scenario is in accordance with the new Zero Garbage and Inclusion Plan policies.	Considering the composition of the solid waste in the city, it would be difficult to achieve the materials recycling goal. Friction would be caused, because the changes would be introduced rapidly. The cost would increase quickly in the early years.
Scenario e	This Scenario is in accordance with the new Zero Garbage and Inclusion Plan policies. Moreover, the goals exceed those proposed in the draft POT amendment.	Considering the composition of solid waste in the city, it would be difficult achieve the materials recycling goal. Friction would be caused because the changes would be introduced rapidly. The introduction of incineration would face opposition. Bogota's society could not cover the high cost.

2.2.3 Selection of a Scenario

Regarding final disposal, Scenario II is recommended, because:

- In the event of an accident in the landfill or on the road to it, the degree of risk of suspension of the entire garbage collection service would be very low in comparison with the other Scenarios.

- The total cost is less than that of Scenario 0 and almost the same as Scenario I.
- Competition between operators would be promoted. The price and quality of the service would be maintained as a result of such competition.
- In general the landfill enjoy would benefit from scale economy, that is, a larger landfill would be built and operated at lower cost. Consequently, a lower final disposal rate would be applied to the municipalities of Cundinamarca which would take their waste to the new landfills, instead of paying that applicable to the small landfill.

In the case of minimization, Scenario c is recommended, because:

- The minimization goals are technically viable taking into account the composition of solid waste in the city, although these goals are more prudent than the goals established in Zero Garbage, the Inclusion Plan and the draft amendment of the POT.
- The speed of the changes required on this Scenario would have an impact that would change the attitude of the citizens to the minimization of solid waste.
- This Scenario would bring an increase in cost, but it would nevertheless be sustainable; Scenario 0 = 7,452,221 million pesos, Scenario c = 7,683,321 million pesos, and increase of 3.1%.

Therefore, the combination of Scenario II and Scenario c, that is **Scenario IIc**, is recommended for Bogota D.C.

Table 2-8: Principal Components, Scenario IIc

System	Components
Minimization	• Material recycling • Composting • CDW recycling
Final Disposal	• Doña Juana • Western landfill • Northern landfill

Table 2-9: Distribution of Solid Waste to the Final Disposal Sites, Scenario IIc

Final Disposal	- 2020	2021 - 2025	2026 - 2030	2031 - 2042
Doña Juana	100%	50%	30%	30%
Western	0%	50%	50%	50%
Northern	0%	0%	20%	20%

Table 2-10: Percentage of Solid Waste to the Recycling System, Scenario IIc

Source	2012 (present)	2015 (short)	2018 (medium)	2027 (long)
Material recycled	-	-	-	-
Households	5.0 %	6.5 %	8.0 %	12.5 %
Small/Large	10.0 %	11.5 %	13.0 %	20.0 %
Composting	-	-	-	-
Market Place	0.0 %	30.0 %	60.0 %	100.0 %
Grass and trees	0.0 %	60.0 %	90.0 %	100.0 %
Combined cdw	0.0 %	100.0 %	100.0 %	100.0 %
Incineration	0.0 %	0.0 %	0.0 %	0.0 %
RDF	0.0 %	0.0 %	0.0 %	0.0 %

Table 2-11: Minimization Goals, Scenario IIc

Year	2012	2015	2018	2027
Minimization Rate	5.4%	10.8%	12.7%	20.3%

Chapter 3

The Master Plan

3 The Master Plan

3.1 General Objectives

Solid Waste Management, SWM, has been developed in line with social requirements, which change over the course of time. In general, the first requirement is to improve citizens' quality of life by removing the solid waste produced in the city. The second is to dispose of the solid waste collected appropriately, without environmental deterioration at the site of disposal and its surroundings. The third is to minimize the production of waste by reducing, reusing and recycling materials; these are the 3Rs for the efficient use of natural resources.

Article 3 of Decree 1713 defines certain basic principles for the provision of the garbage collection service, which are considered the general objectives of the plan under Resolution 1045. These principles coincide with the requirements mentioned and are also in accordance with the institutional objectives of UAESP on the MRS: "To achieve a clean City that strengthens its public sector and its inhabitants' quality of life" and " To achieve a City that reduces, separates and uses solid waste and mitigates any negative impacts" through the 2012 - 2016 STRATEGIC INSTITUTIONAL PLAN.

Taking the foregoing into account, this Master Plan has established the following "General Objectives".

General Objectives

1. ***Guarantee the quality and continuity of the garbage collection service to the users***
2. ***Minimize the amount of solid waste***
3. ***Guarantee the proper final disposal of unexploited/unused solid waste***

In general, PMIRS includes hazardous waste. Therefore, consideration of **" Control of hazardous nature of waste"** as another general objective when updating the PMIRS is recommended.

3.2 Objectives and Specific Goals

The specific objectives and goals which form the basis of the general objectives have been defined through a joint effort between the counterpart and the JICA teams, which are explained as follows:

1. To guarantee the quality and continuity of the waste collection service to the users

With regard to the general objective of **"Guaranteeing the quality and continuity of waste collection service to the users"**, the following two specific objectives have been established:

1.1 Maintaining coverage of the urban area

At present, 100% of the urban zones of the city enjoy the RBL [*collection, sweeping and cleaning*] service. However, it is necessary to continue to provide adequate service to all the urban zones in the future, thus maintaining and increasing service quality and guaranteeing its provision for new urban development zones.

1.2 Extending coverage of the rural area

Rural zones require the provision of the garbage collection service in accordance with their present situation, which may be different from the service provided for urban zones. At present, approximately 30% of the rural zones are covered by the garbage collection service. In the future, it will be necessary to increase coverage to 100% and maintain it.

2. Minimizing the amount of solid waste

This Master Plan proposes the minimization of solid waste by recycling materials, composting and recycling construction and demolition waste and numerical goals have been set. However, minimization requires different methods, which relate to different parties. This Master Plan does not reject the implementation of different efforts, but rather recommends these measures, taking into account the need for the formation and maturing of society's recycling culture. Therefore, raising awareness among the community is considered one of the most important measures for success.

2.1 Promoting material recycling

This specific objective seeks to promote the recycling of materials such as plastics and paper and materializing the Inclusion Plan, which is in accordance with

Constitutional Court rulings, which requires affirmative actions to be taken for independent recyclers in the management of solid waste.

At present, the recycling of materials is carried out informally by recyclers. Therefore, the first phase is to set up a register of recyclers, approximately 13,800 of whom are covered by the census, establish weighing centers in some existing warehouses, where the registered recyclers can take potentially recyclable materials, and the organization of the system of payment to the recyclers for the provision of the potentially recyclable materials collection service (87,000 pesos per ton).

The second phase, consisting of structuring a system that consists of separate collection and separation plants, is being undertaken alongside the first phase. This Master Plan includes the establishment of 36 separation plants with a capacity of 30 tons per day, a similar capacity to that of the Alquería Gathering/Collection Center, by the year 2027. However, considering the use of land in Bogota D.C., it is clearly difficult to build this type of new facilities. In addition, there are many warehouses with similar functions and, therefore, using existing warehouses will be a more realistic measure. Consequently, what is important is to succeed in establishing a system of collection and separation of 1,074 tons of potentially recyclable materials per day by the year 2027, implementing separate collection and organizing reception facilities, that is, warehouses or separation plants for these materials.

2.2 Developing and extending the composting system

Development and expansion of the composting system

What is sought is to minimize organic waste from grass cutting, pruning trees and market places, which are already collected selectively, using composting.

In the year 2013, a pilot composting project with this organic waste, for which there is already a well established collection system, must be carried out with the three types of organic waste referred to above. Based on the data and lessons that can be learned from the pilot project, separation at source and expansion of composting coverage must be strengthened.

This Master Plan, includes the organization of three composting plants with a capacity of 100 tons per day by the year 2027. However, the public sector will not necessarily have to build these plants. What is important is to achieve composting the 276 tons of organic waste per day which will be produced by the year 2027 using private plants as well.

2.3 Developing and expanding the combined cdw recycling system

At present, 800 tons of combined cdw from small-scale works carried out at homes and offices is generated; this amount is equivalent to 12% of the total quantity of solid waste generated. The Doña Juana Landfill is a final disposal site for ordinary waste and, therefore, theoretically it should not be used for the disposal of construction and demolition waste. However, there are different materials in combined cdw, such as paper, plastics and paints, which is why it is being deposited there.

In order to promote separation in areas closest to the sources, this Master Plan proposes the establishment of 12 drop-off points with the capacity to receive 60 tons per days and to carry and separate potentially recyclable materials which have been temporarily stored at the drop-off points in 3 plants with a capacity of 200 tons a day by the year 2027. As to the drop-off points, these do not necessarily have to be facilities with the design set out in the Master Plan, as a container can simply be placed at a nearby source or site. The public sector would not have to organize recycling plants, as the private sector could do so. Thus, the aim must be to dispose of 1,055 tons of combined cdw by the year 2027.

2.4 Raising awareness and training users in the reduction, reuse, separation at source and differentiated disposal of solid waste.

Environmental education focused on the reduction, reuse and separation at source of solid waste is being provided at all the schools in Bogota D.C. (2,376), in order to create a culture of waste minimization and to train leaders in the process. At the same time, per the Institutional Environmental Management Plan, PIGA, waste separation will be carried out in the schools.

3. Guaranteeing appropriate final disposal of unexploited/unused solid waste

The following specific objectives have been established in order to achieve this goal of "Guaranteeing proper final disposal of unexploited/unused solid waste":

3.1 Ensuring the operation of RSDJ

It used to be estimated that the Doña Juana landfill could be used until the year 2030 without introducing any minimization measure. However, for it to be possible to do so, the treatment of leachates has to be improved and that of gas continued. It will also be necessary to carry out several technical studies in order to put forward a safe disposal plan.

3.2 Reducing the present vulnerability of the present final disposal system

For Bogota D.C., a large city of over 7 million inhabitants, there is only one landfill, named Doña Juana. Therefore, should any accident happen inside the landfill or on the access roads to it, the entire solid waste management system would come to a standstill and the city would be inundated with waste, which would be harmful to citizens' health. To prevent this type of risks, the construction of two more landfills has been planned with a view to using the three landfills simultaneously.

The following table provides a summary of the specific objectives and goals:

Table 3-1: Master Plan Objectives and Goals

No.	General/Specific Objectives	Short Term 2013-2015	Medium Term 2016-2018	Long Term 2019-2027
1	**Guarantee the quality and continuity of garbage collection service to the users**			
1.1	Maintain coverage of the urban area	100%	100%	100%
1.2	Increase coverage of the rural area	100%	100%	100%
2	**Minimize the amount of solid waste**			
2.1	Promote recycling of materials			
2.1.1	Register and formalize the recyclers	aprox. 13,800 persons	-	-
2.1.2	Establish and extend the separate collection system	3 systems or a number equivalent to 85 tons/day	15 systems or a number equivalent to 427 tons/day	36 systems or a number equivalent to 1,074 tons/day
2.2	Develop and extend the composting system			
2.2.1	Develop a composting system	1 pilot project	-	-
2.2.2	Extend the composting system	25 tons/day to the plant	58 tons/day to the plant	249 tons/day to the plant
2.3	Develop and extend the combined cdw recycling system			
2.3.1	Minimize clandestine disposal of cdw	minus 15,000 m3/month	minus 10,000 m3/month	minus 5,000 m3/month
2.3.2	Reduce the final disposal of combined cdw in the RSDJ	redirect 100% from RSDJ 850 tons/day to the plant	901 tons/day to the plant	1,055 tons/day to the plant
2.4	Raise awareness and train users to succeed in achieving the reduction, reuse, separation at source and differentiated disposal of solid waste			
2.4.1	Raise awareness at source of 100% of Bogota Schools (Total:2,376: 360 official and y 2016 private)	2,376 schools	-	-
2.4.2	Train 100% of Bogota schools to implement the PIGA	2,376 schools	follow-up	-
2.4.3	Train the 360 Bogota schools in the PRAE (School Environmental Project)	-	360 schools	-

3	**Guarantee the proper final disposal of unexploited/unused solid waste**			
3.1	Ensure operation of the RSDJ	Phase II (17 million tons)		Director Plan (38 million tons)
	Reduce vulnerability of the present final disposal system	-	-	2 new RS

3.3 Key indicators and Main Infrastructures

The following table shows the key indicators and main infrastructures included in the Master Plan.

Table 3-2: Key Indicators in the Master Plan

Component		Unit	Present 2012	Short 2015	Medium 2018	Long 2027
1	Population					
	Population	thousand	7,565	7,875	8,184	9,114
2	Flow of solid waste					
	Production	tons/day	6,704	7,135	7,566	8,859
	Collection	tons/day	6,340	6,659	6,973	7,784
	Recycled material, total	tons/day	366	473	592	1,074
	Present	tons/day	366	0	0	0
	Transition	tons/day	0	389	165	0
	Plant	tons/day	0	85	427	1,074
	Composting	tons/day	0	103	180	276
	CDW recycled	tons/day	0	850	901	1,055
	Final disposal	tons/day	6,304	6,368	6,604	7,065
	Minimized quantity	tons/day	364	767	962	1,794
3	RBL service coverage					
	Urban area	%	100	100	100	100
	Rural area	%	30	100	100	100
4	Minimization rate					
	Material recycled	%	5.4	6.2	6.2	9.7
	Composting	%	0.0	1.1	2.0	2.8
	CDW recycled	%	0.0	3.5	4.5	7.7
	Total	%	5.4	10.8	12.7	20.3
5	Infrastructure and equipment					
51	RBL Collection, sweeping and cleaning					
511	Collection truck					
	Compacter 25 yd3	nos.	*217	237	251	-
	Compacter 16 yd3	nos.		35	36	246
	Ampliroll 10 M3	nos.	**219	35	36	46
	Van 4,5 Ton	nos.		14	16	11
	Dump trucks 12 m3	nos.		36	39	-
512	Transfer Station					
	Western station	tons/day	-	-	-	4,500
	Northern station	tons/day	-	-	-	2,000
513	Transport					
	Tractor-truck	nos.	-	-	-	66
	Trailer	nos.	-	-	-	70

Component		Unit	Present 2012	Short 2015	Medium 2018	Long 2027
52	Recycling					
521	Recycled material					
	6 ton Truck	nos.	8	29	143	359
	Gathering center (30tons/day)	nos.	1	3	15	36
522	Composting					
	Plant (100tons/day)	nos.	-	1	2	3
523	CDW recycling					
	Drop-off point (60tons/day)	nos.	-	2	5	12
	Recycling plant (200tons/day)	nos.	-	2	3	3
524	Recycling park					
	Recycling plant	The need for these infrastructures will be analyzed below with the participation of the private sector				
	CATARS					
53	Final disposal					
	Doña Juana	tons/day	6,340	6,368	6,604	2,119
	Western landfill	tons/day	-	-	-	3,532
	Northern landfill	tons/day	-	-	-	1,413
6	Cost (Colombian pesos)					
61	Cost per year					
	FR, commercial	million $	50,454	52,521	54,588	60,789
	BL, sweeping and clean-up	million $	65,035	69,217	73,399	85,945
	RT, recollection	million $	197,188	220,853	227,982	216,210
	Recycling	million $	0	73,852	90,950	116,236
	DT, final disposal	million $	44,668	65,341	67,769	76,031
	PMIRS	million $	3,703	3,940	4,177	4,888
	Total	million $	361,048	485,724	518,865	560,099
62	Unit cost					
	Per generation	$/ton	147,548	186,508	187,885	173,216
	Per population	$/pers.	47,728	61,683	63,398	61,458
63	Cost increase rate (2012 = 100%)					
	Total cost	%	-	35%	44%	55%
	Per generation	%	-	26%	27%	17%
	Per population	%	-	29%	33%	29%

* Number of compacters for RBL service
** Number of other vehicles for the RBL service

3.4 Basic Focus

The following concepts must be understood in order to achieve the objectives and goals referred to above.

Client First

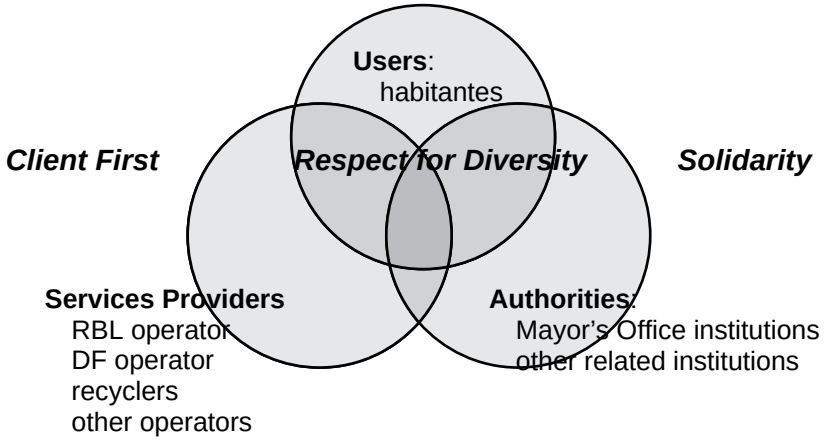
Clients, that is, the citizens of Bogota D.C., are the target of the garbage collection service. Therefore, in the provision of the service, maintenance and improvement in health and the standard of living of the citizens, both present and future, must be the first priority. Work is also required on materialization of a system of solid waste management that is transparent, fair and efficient for the citizens.

Respect for Diversity

Formalization of the recycling of potentially recyclable materials is a great challenge for Bogota D.C. To make it a reality, it is vital for all the parties to fulfill their function as individuals, households and offices that generate waste, as well as the recyclers. Each of these parties is under different conditions and is of a different nature. The appropriate recycling method may also be different according to the type of community. This means that there is no single solution for recycling materials. Personalized measures must be designed and implemented in order to respect the diversity of the actors and the community.

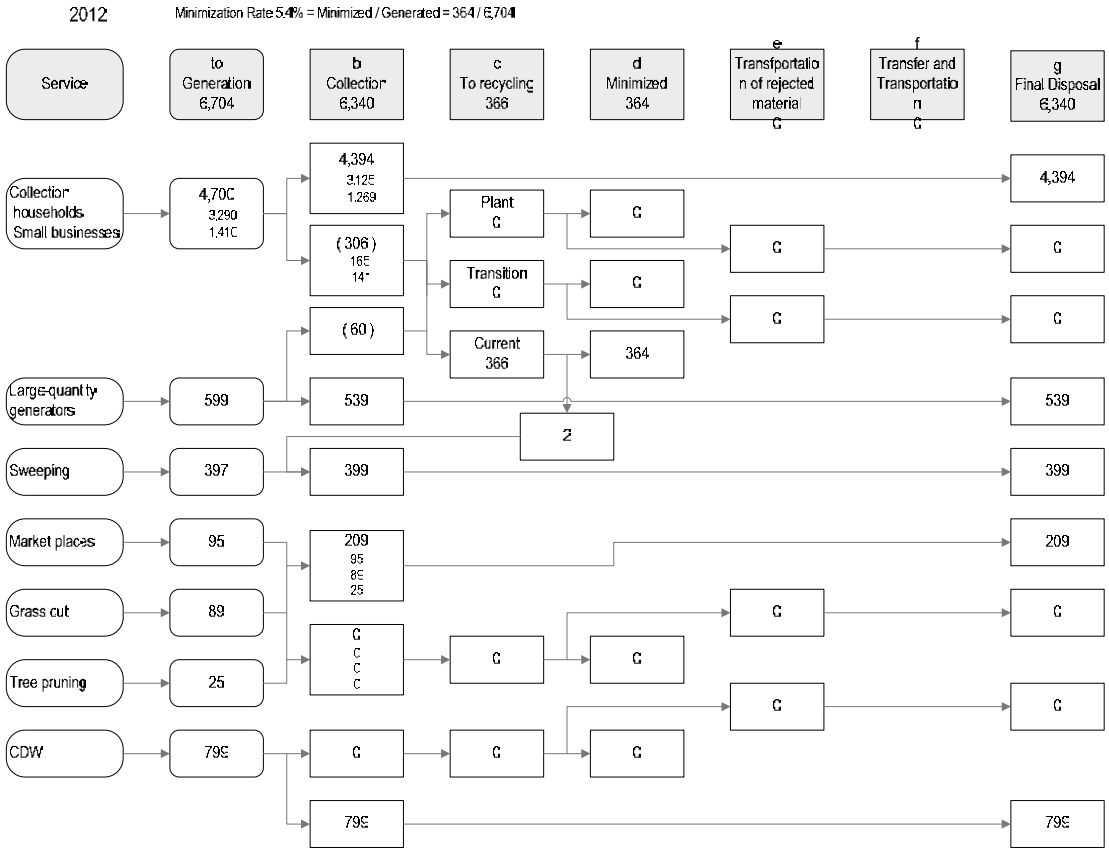
Solidarity

In order to achieve the Solid Waste Flow shown in the following section, it is indispensable for each of the systems, from generation to final disposal, to operate well, but, at the same time, it is necessary for all these systems to function in a balanced manner. For this, it is a necessity for each of the parties, including the waste generators, providers and/or operators of the service and the authorities to recognize their function and share responsibility for solid waste management. For the purpose, it is important to promote a social culture aimed in this direction.



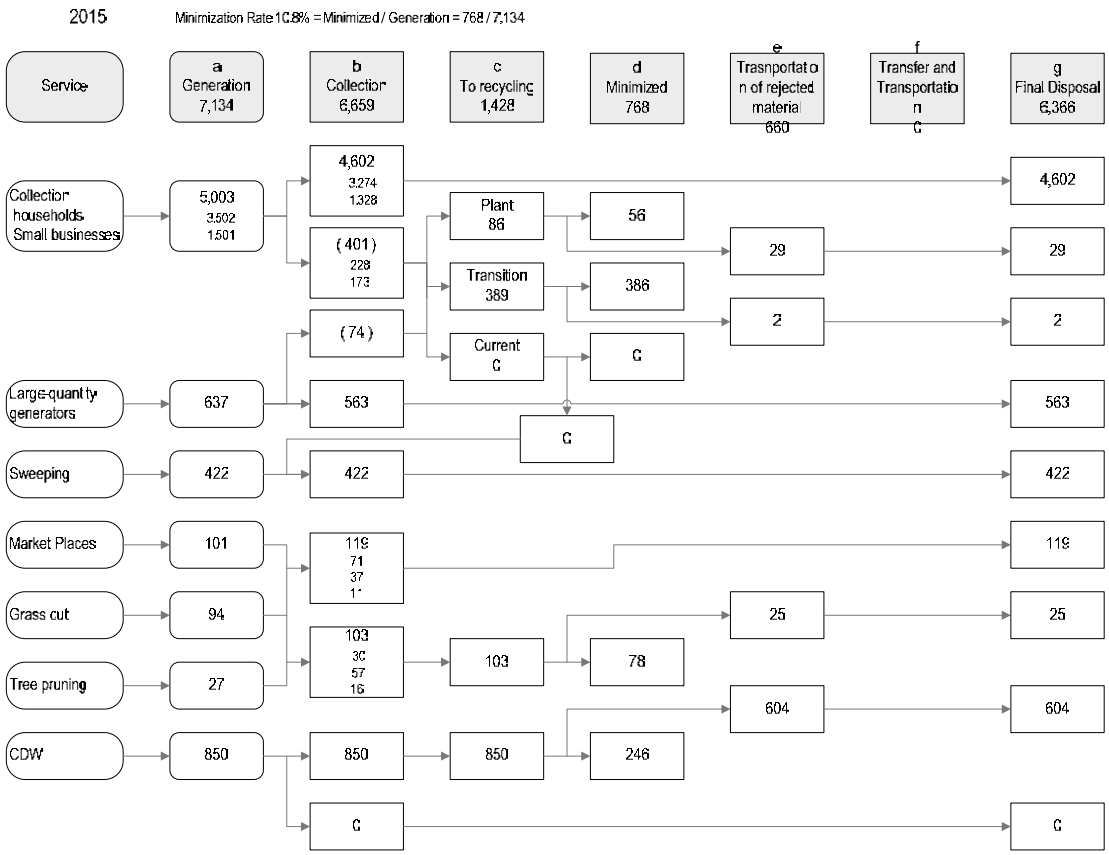
3.5 Solid Waste Flow

This section shows the solid waste flows in 2012 (present), 2015 (short term goal year), 2018 (medium term goal year) and 2027 (long term goal year).



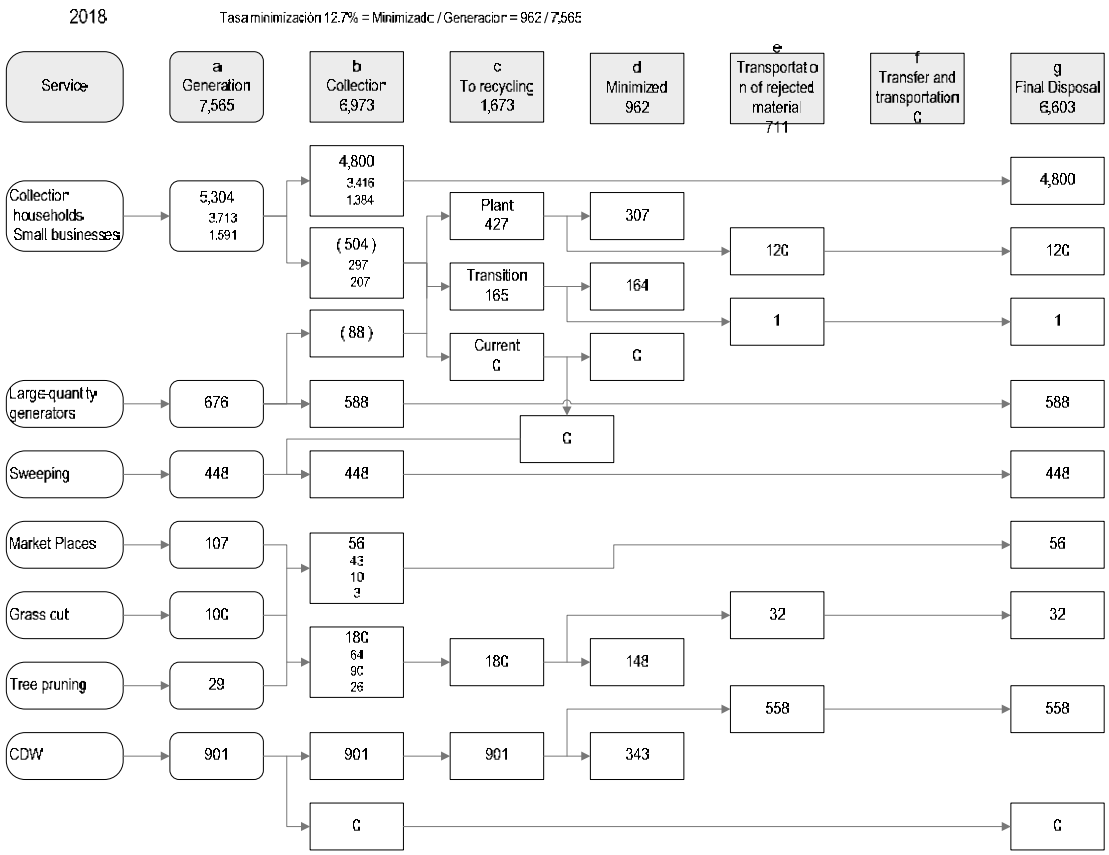
	Item	Tons/day	Note
a	Generation	6,704	The entire quantity of waste produced.
b	Collection	6,340	This does not include the quantity which is to go to material recycling processes.
c	Recycling	366	Includes material recycling, composting and combined cdw recycling.
d	Minimization	364	The quantity minimized in the foregoing recycling processes.
e	Transportation of rejected material	0	Transportation of materials rejected in the recycling processes to the final disposal site or the transfer station.
f	Transfer and Transportation	0	The quantity of waste that reaches the transfer station and is carried by trailer to the final disposal site.
g	Final Disposal	6,340	The quantity of waste that arrives at the final disposal site.
	Minimization rate	5.4%	d / a = 364 / 6,704 = 5.4%

Figure 3-1: Solid Waste Flow, Current in 2012



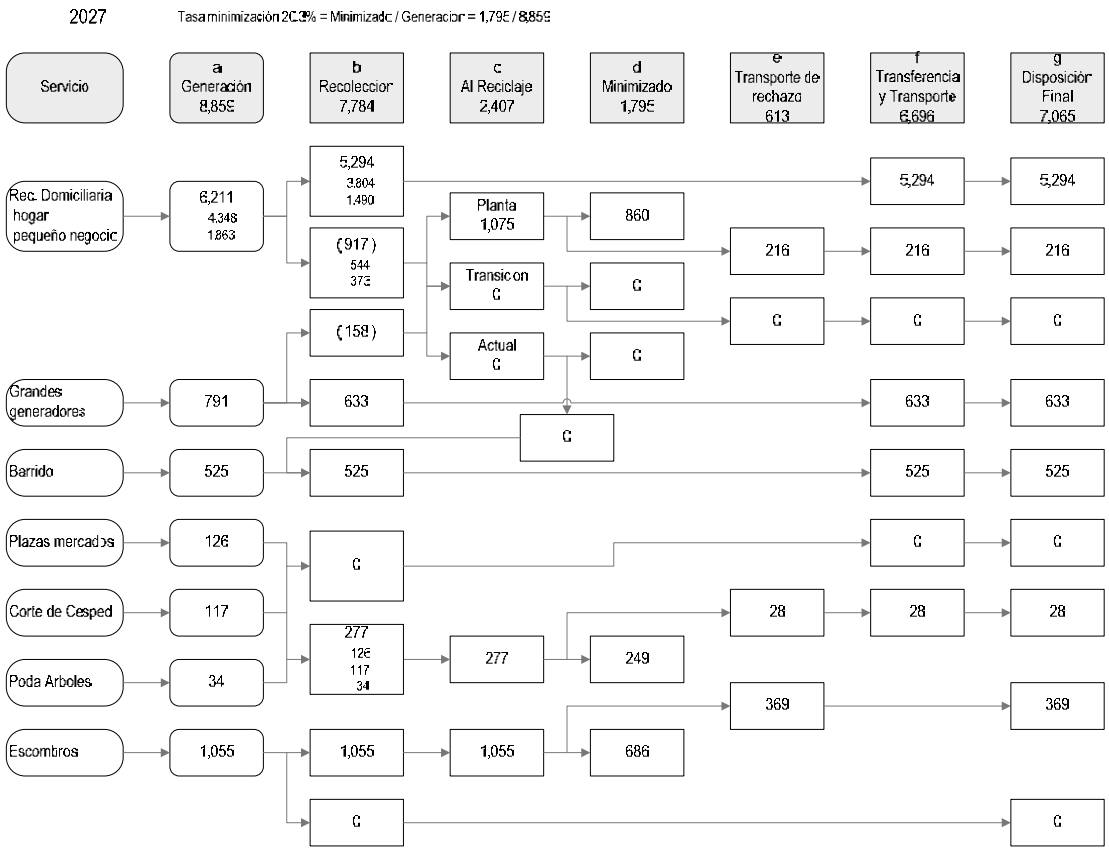
	Item	Tons/day	Note
a	Generation	7,134	The entire quantity of waste produced.
b	Collection	6,659	This does not include the quantity which is to go to material recycling processes.
c	Recycling	1,428	Includes material recycling, composting and combined cdw recycling..
d	Minimization	768	The quantity minimized in the above recycling processes.
e	Transportation of rejected material	660	Transportation of materials rejected in the recycling processes to the final disposal site or the transfer station.
f	Transfer and Transportation	0	The quantity of waste that reaches the transfer station and is carried by trailer to the final disposal site.
g	Final Disposal	6,366	The quantity of waste that arrives at the final disposal site.
	Minimization rate	10.8%	d / a = 768 / 7134 = 10.8%

Figure 3-2: Solid Waste Flow, Short Term in 2015



	Item	Tons/day	Note
a	Generation	7,565	The entire quantity of waste produced.
b	Collection	6,973	This does not include the quantity which is to go to material recycling processes.
c	Recycling	1,673	Includes material recycling, composting and combined cdw recycling.
d	Minimization	962	The quantity minimized in the above recycling processes.
e	Transportation of rejected material	771	Transportation of materials rejected in the recycling processes to the final disposal site or the transfer station.
f	Transfer and Transportation	0	The quantity of waste that reaches the transfer station and is carried by trailer to the final disposal site.
g	Final Disposal	6,603	The quantity of waste that arrives at the final disposal site.
	Minimization rate	12.7%	d / a = 962 / 7,565 = 12.7%

Figure 3-3: Solid Waste Flow, Medium Term in 2018



	Item	Tons/day	Note
a	Generation	8,859	The entire quantity of waste produced.
b	Collection	7,784	This does not include the quantity which is to go to material recycling processes.
c	Recycling	2,407	Includes material recycling, composting and combined cdw recycling.
d	Minimization	1,795	The quantity minimized in the above recycling processes.
e	Transportation of rejected material	613	Transportation of materials rejected in the recycling processes to the final disposal site or the transfer station.
f	Transfer and Transportation	6,696	The quantity of waste that reaches the transfer station and is carried by trailer to the final disposal site.
g	Final Disposal	7,065	The quantity of waste that arrives at the final disposal site.
	Minimization rate	20.3%	d / a = 1,795 / 8,859 = 20.3%

Figure 3-4: Solid Waste Flow, Long Term in 2027

Chapter 4

Components of the Master Plan

4 Components of the Master Plan

4.1 Collection, Sweeping and Cleaning (CSC – RBL in Spanish)

4.1.1 Categorization and Definition of Collection Services

The Table below states the categories and definitions of the service for the collection of solid waste. Within this classification, dangerous waste would be off the jurisdiction of the UAESP; therefore, the practical application requires adequate adjustments.

Table 4-1: Categorization and Definition of Collection Services

Type of Waste	Categorization of the services	Definition of the services
Non Hazardous	Household	The service for household collection includes the collection of waste produced by the residential users and by small generators corresponding to non-residential generators whose production of compacted solid waste is less than one cubic meter per month.
	Commercial and Institutional	The goal of this service is the waste from the large-quantity generators as large shopping malls, supermarkets, hotels, institutions and industries that generate nonhazardous waste. Waste from residential complexes or tall buildings are excluded from this category in the urban area since, in this case, there is concentration of waste at one specific place only.
	Large-quantity Generators	The service to the large-quantity generators must be undertaken with the required frequency, and the collection shall be carried out at the place where they keep the storage warehouse, as long as it meets the provisions of Decree 1713 of 2002, or of the regulation amending or complementing it. The operator shall be responsible for assessing, in each case, the access and the maneuverability of the garbage collection trucks in order to make the adjustments, as much as possible, vis-à-vis the conditions of the large-quantity generator.
	Sweeping	The goal of this service is the waste generated by activities in the street, avenues, in the parks, and in other public areas. This service falls under the responsibility of the District.
	Market	The goal of this service is the waste from municipal markets located in the District where the commercialization of meat, vegetables, fruit, etc. takes place.
	Lawn Mowing	This service includes the collection and transport, up to the treatment or final disposal place, of the waste generated by this activity in all the public green areas of the Capital District located in: i) road dividers including, besides, the other roads for vehicle traffic, pedestrian paths and cyclist paths; ii) traffic circles, roundabouts or similar structures; iii) green areas of sidewalks that are not under the responsibility of the inhabitants, owners or administrators of the neighboring properties, pursuant to the provisions of the Police Code; iv) public parks that are defined in the Zoning Plan of the Capital District that are partially or wholly within the urban perimeter, environmental protection areas and public space areas incorporated by the Capital District. Anyway, the only areas to be taken care of are those within the urban perimeter.
	Tree Pruning	This service includes tree pruning in the public roads and areas.
	Construction and Demolition Waste (CDW)	The goal of this service is the construction and demolition waste and earthworks not surpassing $1m^3$ which falls under the responsibility of the UAESP.

Table 4-2: Collection and Transport System (2013-2020)

Service	Collection	Transfer Station	Transport
1. Household	Compactor Trucks – 25 yd^3	–	Direct Transport
2. Commercial and Institutional	Compactor Trucks – 25 yd^3	–	Direct Transport
3. Large-quantity generators	Ampliroll - 10 M^3	–	Direct Transport
4. Sweeping	Compactors – 16 yd^3	–	Direct Transport
5. Market	Ampliroll 10 M^3	–	Direct Transport
6. Lawn Mowing	Van – 4.5 Tons	–	Direct Transport
7. Tree Pruning	Van – 4.5 Tons	–	Direct Transport
8. Construction and Demolition Waste (CDW)	Truck - 12 m^3	–	Direct Transport

Table 4-3: Collection and Transport System (2021-2027)

Service	Collection	Transfer Station	Transport
1. Household	Compactors – 16 yd^3	New	Trailers (85 yd^3)
2. Commercial and Institutional	Compactors – 16 yd^3	New	Trailers (85 yd^3)
3. Large-quantity Generators	Ampliroll - 10 M^3	New	Trailers (85 yd^3)
4. Sweeping	Compactors – 16 yd^3	New	Trailers (85 yd^3)
5. Market	Ampliroll - 10 M^3	New	Trailers (85 yd^3)
6. Lawn Mowing	Van – 4.5 Tons	New	Trailers (85 yd^3)
7. Tree Pruning	Van – 4.5 Tons	New	Trailers (85 yd^3)
8. Construction and Demolition Waste (CDW)	Ampliroll - 10 M^3, or Dump Truck with containers (5 and 10 m^3)	New	Trailers (85 yd^3)

4.1.2 Contracts/Agreements Management System

a. Selection of Types of Contracts/Agreements

The Table below shows the types of contracts/agreements recommended for each previously described collection service category.

Table 4-4: Selection of Types of Contracts/Agreements

Categorization of the Service	Type of Contract
Household	Contract based on a unitary price with control from the UAESP as per the type of waste and the amount collected per month. Duration of the contract/agreement: 7 years. Preferably, a Concession per Exclusive Service Area.
Commercial and Institutions	Contract based on a unitary price with control from the UAESP as per the type of waste and the amount collected per month. Duration of the contract/agreement: 7 years. Preferably, a Concession per Exclusive Service Area.
Large-quantity Generators	Contract based on a unitary price with control from the UAESP as per the type of waste and the amount collected per month; the waste may be charged depending on the volume collected per month (M^3). Duration of the contract/agreement: 7 years. Preferably, a Concession per Exclusive Service Area.
Sweeping	Contract based on a unitary price with control from the UAESP as per the type of waste and the amount collected per month. Duration of the contract: 7 years. Preferably, a Concession per Exclusive Service Area.

Market	Contract based on a unitary price with control from the UAESP as per the type of waste and the amount collected per month; the waste may be charged depending on the volume collected per month (M^3). Duration of the contract/agreement: 7 years. Preferably, a Concession per Exclusive Service Area.
Lawn Mowing	Contract based on a unitary price with control from the UAESP as per the type of waste and the amount collected per month. Duration of the contract/agreement: 7 years. Preferably, a Concession per Exclusive Service Area.
Tree Pruning	Contract based on a unitary price with control from the UAESP as per the type of waste and the amount collected per month. Duration of the contract/agreement: 7 years. Preferably, a Concession per Exclusive Service Area.
Construction and Demolition Waste	Contract based on a unitary price with control from the UAESP as per the type of waste and the amount collected per month. Duration of the contract/agreement: 7 years. Preferably, a Concession per Exclusive Service Area.

b. Public Tender

The offers may be open or by merit contest. In the case of the open offer, the District, through a public tender, invites the bidders, while in the case of the merit contest the District invites companies that are generally registered in the registries of the Superintendence of Residential Public Services.

b.1 Bidding Process

In most of the cases the contracts/agreements for collection and transport services are the result of a bidding process which stipulates the administrative and technical conditions. The table below shows the most exceptional aspects to be taken into consideration for a bidding process. The whole bidding process must be overseen by the Office of the Assistant Director for Legal Affairs of the UAESP in order to verify the legal validity of the process.

Table 4-5: Bidding Process for Collection and Transport Services

Activity	Specification
Diagnosis	Before preparing the bases for the tender vis-à-vis the collection service, it is necessary to assess the current status of the service concerning the coverage of the service / population served, collection frequency, characteristics of the vehicles and equipment, amounts and volumes of waste collected and transported, characteristics of such waste, etc.
Decision Making	Taking into account the background of the assessment, the decision has to be made concerning the conditions under which the service must be developed and, at the same time, establish its quality. Within the scope of the assessment, it is necessary to analyze if it is necessary or not to transfer the service to the private sector.
Calculation of the costs of the Service	The Costs for the service under the tender must be calculated with the purpose of evaluating the offers and establishing if the District can assume the costs of the service according to the quality set; if not, the conditions are carried out in order to reach a value that complies with the budget of the District and that, at the same time, ensures the sustainability of the service.
Preparation of administrative and technical bases	Once the decision concerning the characteristics of the service is made, the administrative and technical bases for the hiring of the service must be prepared. The preparation of administrative bases that are strict and comply with the law will allow the Mayor's Office to have a mechanism that ensures the hiring of a sound company. In such sense, the administrative bases shall help to define the legal, economic, and technical conditions of the companies that may participate in the

	tender. On the other hand, they define the legal framework and the applicable law, the duration of the contracts/agreements, the fines, the guarantees, the contracting processes, etc. Concerning the technical bases, they must be prepared by requesting the details of the types, models and technical data of the vehicles and equipment, the details of the operations plan, the organization chart of the company, the administrative structure, the maintenance and risk prevention programs, start-up budget, dissemination plan and communication with the community, etc.
Establishing the Oversight System	Pursuant to the characteristics of the service bid for, a program for the oversight of the contract/agreement has to be designed covering both the technical and administrative aspects.
Bidding for the service	Once the bases are ready, the bidding process starts. It includes the following activities: invitation to companies or call for contest, sale of the bases, receipt and opening of offers, evaluation of the offers, award, execution of contracts/agreements, start up and implementation of the services.

b.2 Documents for the Tender

The minimum documents required for the tender are the following:

Administrative Bases

General Aspects

- Purpose of the tender
- Description of the applicable law
- Presumption of the acceptance of the conditions set forth in the bases
- Knowledge about the area or project
- Acquisition of bases and enquiries (in the case of a closed tender)
- Duration of the contract/agreement
- Budget
- Description of the questions and answers process vis-à-vis the Bases
- Jurisdiction and Domicile

Presentation Format of the Bids

- Requirements to be met by the Offerer in order to take part in the process
- Documents evidencing experience, capital and financial status of the Offerer
- Guarantees for the seriousness of the Bid
- Duration of the bid
- Veracity and adequacy of the bid
- How to submit the bids

Award Process

- Process for the opening of the bids
- Procedures for the analysis and evaluation of the Bids to be awarded
- Award process
- Execution of Contract/Agreement
- Guarantees of the Contract/Agreement
- Assignment, Transfer, Association and Subcontracting

Performance of the Contract/Agreement

- Documents that regulate the contract/agreement
- Start-up and Execution of the works
- Increase or decrease of the works
- Penalties and fines

- Procedure for complaints vis-à-vis penalties and fines
- Technical and administrative liability
- Insurance, Indemnities
- Payment for the service, readjustments, increase of contract/agreement
- Taxes, fees and duties

Term of the Contract/Agreement

- Extinction, suspension and assignment of the contract/agreement.

Technical Bases

They include the technical foundations and details of the components of the service bid for:

General Aspects

- Description of the services included in the Tender
- Definitions of terms used in the bases
- Description of the waste that are the subject matter of the contract/agreement
- Minimum amount of waste to be collected per month

Technical Aspects

- Area and sectors to be serviced bid for, including:
  - boundaries of the total area and sectors covered by the service
  - components of garbage
  - calculation of trips and tons collected per month
  - destination of the waste
  - ownership of the collected waste
- Type of service
- Frequency, Schedule and working days
- Daily work program
- How the works that belong to the service have to organized and developed
- Minimum requirements of the operations plan that the Offerer must submit with his bid
- Equipment, definition, requirements to be met, plant and reserve, length of service, etc.
- Description of the facilities needed by the Offerer in order to carry the service out (shops, offices, etc.)
- Personnel and components
  - number of drivers and collectors per truck
  - reserve personnel
  - personnel salaries
  - training plans
  - job security
  - systems for the oversight of the service, etc.
- Procedure for implementation and start up
- Records and reports system

Documents of the Technical Bid

- Details and description of the documents to submit upon the presentation of the bid

Annexes

- Layouts and other relevant information must be submitted for the preparation of the bid.

Once the proposal is awarded, the Bases for the Tender (administrative and technical), the questions and the answers, and the bid of the offerer whose bid was accepted, become part of the contract/agreement.

c. Coverage of the Contracts/Agreements

The Contract/Agreement must include provisions concerning the quality of the service, the auditing of the contract/agreement, the penalties in the event of a breach, and other relevant aspects that are described in the Table below.

Table 4-6: Coverage of Contracts/Agreements for Collection and Transport Services

Administrative Aspects	
Identification:	The parties entering into the contract/agreement must be clearly identified; in other words, UAESP and the Contractor.
Definitions:	The definitions of the terms used in the contract/agreement must be included in order to avoid subsequent interpretations. The terms to be defined, among others, are the following: Contractor or operator; District; Producer or User; cost of the service; contract/agreement; service area; technical liability; legal liability; month; day; guarantee; violation; correction; penalty; fine; and technical terms like type of collection, route, frequency, schedule, container, collector truck, final disposal place, transfer station, etc.
Service hired:	The type of service hired must be clearly stated, as well as the type of waste, assigned territory, etc. (For example, "The service hired corresponds to the collection of ordinary waste at the ASE No. 1 and the transport to the Doña Juana landfill, picking up and washing containers").
Duration of the contract / agreement:	The commencement and duration of the contract/agreement must be stipulated, and if it is renewable or not, the period and under which conditions.
Description of the applicable law:	The legal statutory regulations and other documents the contract/agreement shall be subject to must be set forth.
Obligations of the Contractor and of the UAESP:	The obligations of the Contractor must be explained in general terms: performance and quality of the service, as well as the application of changes, the duties of the UAESP concerning the payment, the transfer of information and the exclusivity of the territory.
Guarantee Documents:	In order to ensure the correct performance of the services, the UAESP must require the Contractor to submit a guarantee slip or a similar document (Pecuniary Criminal Clause) to guarantee the quality of the service hired which will be valid throughout the contract/agreement (regardless of the fact that the payments are made in due time or not) and it shall be made effective in the event of repeated breaches, abandoning the services or the early termination of the contract/agreement due to the contractor. The amount of the guarantee slip must be, at least, the same value of two months' invoicing, so the UAESP has the necessary resources top put into operation a new service in the event of the early termination of abandonment of the contract/agreement. In the event that the contract/agreement included readjustments to the cost of the service, the guarantees must be proportionately adjusted.
Penalties and Fines:	The following must be clearly stated: the causes entitling the UAESP to apply penalties and fines, their amounts, the procedures for their application and for the claim.
Payment of the services:	It must be stated how the services will be paid, whether through a lump sum (value per month) or based on the unitary prices (fixed unitary price). They payment is made one month in arrears, stating the maximum period required for the payment to be made effective, the surcharges that fall under the responsibility of the District in the event that this period is not complied with, the procedures for the discounts of fines, if any, the necessary background in order to make the payment; in this last case, the generally required documents are the following: the invoice with the details of the period during which the services were carried out and the amounts to collect; if the contract/agreement includes unitary prices, the entry

	records to the Doña Juana landfill or to the landfill replacing it, proof of payment of the provisional obligations of all the personnel, and a report to the UAESP on the development of the services during the month being invoiced.
Readjustments and increase of the service:	In the event that the contract/agreement includes readjustments, it will be necessary to indicate them and the procedures for their application (stating the index or parameter upon which the readjustment shall be assessed, the period of the variation, the date of the first readjustment, the initial value of the index or parameter); also, in the event of the lump sum, the procedures to follow in the case of an increase in the service.
Insurance and Indemnity:	It is necessary to state the type of insurance that the Contractor must have (as third party insurance policies, compulsory insurance policies, etc.) for the duration of the contract/agreement, as well as how the Contractor will respond vis-à-vis third parties and indemnities for his personnel.
Taxes, fees and duties:	It is necessary to state the taxes, fees and duties derived from the contract/agreement pursuant to the law or regulations in force.
Provisional obligations:	It is necessary to state the provisional obligations the Contractor has in relation to his personnel and the mechanisms through which it evidences, before the UAESP, their timely payment. The fulfillment of the provisional obligations must be evidenced every month upon submitting the documents for the collection of the payment for the service and, in general, the contractor submits the proof of payment of the immediately previous month.
Termination of the contract/agreement:	It is necessary to state the clauses entitling the UAESP to terminate the contract/agreement, or the extinction, suspension, or assignment of the contract/agreement.
Technical Aspects	
Types of Waste:	State the waste included in the service and the maximum amounts to collect per user, in the event of special collection.
Type of service:	State how the collection service must be performed; for example, “door-to-door” collection, or point-to-point with compactor trucks (25 yd^3) no older than 2013.”
Service Area:	It is necessary to state the boundaries in the District within which the service shall be performed and to inform the sectors and the population serviced. In this cases, it is appropriate to include a map with the boundaries of the area of the contract/agreement, including the rural areas that have a technical possibility of being serviced.
Characteristics of the service:	Regarding the urban household waste, state the characteristics of the services hired including at least: maps of the areas and frequency, working days, proposed schedules, fumigation and sanitization, washing the containers and storage area (large-quantity generators and markets), a layout for each market stating the location of the containers, the gathering area (the place where the large box or container is located), streets to sweep, and zone or areas to wash.
Quality of the service:	The contract/agreement must clearly state the quality that is expected to achieve through the service, including the use of quality indicators.
Characteristics of the vehicles and of the equipment:	It is necessary to state, in a clear manner, the number of vehicles in operation and those of the reserve, their age, capacity, characteristics of the collector trucks, boxes and other equipment, as well as their maintenance plans and the location of the maintenance and parking facilities of the company.
Personnel:	Regarding the personnel, it is necessary to state the profile of the drivers, collectors, supervisors, etc. to be used for the performance of the services, stating also the reserve personnel. In addition, it is necessary to include the training programs, the uniforms and the tools that will be required for the rendering of the service.
Operating Aspects:	The contract/agreement must state, among other things, how the service will be rendered under normal conditions, vis-à-vis breakdowns of the vehicles and emergency situations, the dissemination system and the communication with the community, the cleaning program and the washing of the trucks, containers, and other equipment, how to respond to the claims form the users, etc.
Supervision of the Service:	The contract/agreement must clearly state that the supervision of the service is the sole responsibility of the Mayor’s Office; it must also establish the procedures under which the service will be supervised and controlled by identifying the systems for records and reports the Contractor must keep and submit. The aspects to be supervised must be detailed since penalties and fines shall be imposed based on the non-compliance of the Contractor.

d. Oversight of the Contract/Agreement

The UAESP states in its technical operating regulations several levels of control. For example, the hiring of Supervision; internal and external Audits of those who render services whose reports must be submitted to the Superintendence of Residential Public Services and to the UAESP; the same Superintendence of Residential Public Services; the Center for the Attention of the User and Social Control ("Centro de Atención al Usuario y Control Social") that has a Requests and Complaints system; an information system to be supplied by the Operator, and reports. These controls operate with different levels of effectiveness.

The Supervision

The office of the Assistant Director of the RBL receives the information that the Supervisory Authority considers relevant, not the information required by the UAESP for the supervision and management of the garbage collection service. It is necessary that the UAESP defines, along with the Supervisory Authority, the methodology for supervising the operator and sets forth the instruments for the supervision (measurable indicator, reports and their frequency, the content of the reports, homologation meeting with the Supervisory Authority and with the operators, etc.).

Internal and External Audits of the Providers of the Service

The providers of the service must hire an external audit concerning the management and results from specialized companies. The copies of their reports would have to be submitted to the Superintendence of Residential Public Services and to the UAESP pursuant to Law 142 of 1994 and Law 689 of 2001, on the dates set forth by the surveillance and control entity. Nonetheless, the reports are submitted when the operator deems it convenient and are rarely evaluated in relation to the supervision of the quality of the service.

Superintendence of Residential Public Services

Besides the surveillance undertaken by the UAESP and/or by the Supervisory Authority, the Providers are subject to the inspection, surveillance and control exercised by the Superintendence of Residential Public Services (SSPS) pursuant to the provisions of chapter IV of Law 142/94 and other regulations in force. Nevertheless, the communication and coordination between the Superintendence and the UAESP does not exist for the effective supervision of the operator. In fact, the portal of the Single Information System on Public Utilities does not have its database updated so it could be useful for the supervision of the service by the UAESP.

Center for the Attention of the User and Social Control

The Operators and the provider of the garbage collection service shall have a Center for the Attention of the User and Social Control, along with a PQR system. The clients are the best quality supervisors concerning the garbage collection service. Two management tools that are important for the service are the PQR resolution indicators and the satisfaction surveys; however, they are not thoroughly taken advantage of.

Information System to be supplied by the Operator

The Operator and the providers shall keep an information system enabling them to exercise internal control over their operation, submitting the reports agreed to the Supervisory Authority and to the UAESP and, in general, dealing with any information requirements that, on a regular basis and in a timely manner, are expressed by the users of the garbage collection service. In addition, the UAESP has tried to implement the Garbage Collection Service Integrated Information System (SIISA). Nonetheless, the UAESP does not have resources in order to have measurement parameters for the service in real time yet. Occasionally, the Operators refuse to supply the information under the term "·confidentiality." This is a pending task: an open system allowing the UAESP to manage the service in real time.

Reports

As already mentioned, the reports submitted by the previous Supervision had plenty of data, but the UAESP requires executive information in order to manage the service. In the recent draft of the Technical, Operational, Commercial and Financial Regulations (May 2013), the UAESP includes management indicators based on two parameters:

- Measurable indicators concerning efficiency pursuant to what was identified.
- A significant contribution regarding the use of the indicators when assessing the management and the quality of the garbage collection service.

In addition, it establishes that the indicators defined by the CRA will be adopted as operational performance indicators or as quality indicators. The inclusion of these indicators is important for the adequate management of the service. The CRA disclosed, in 2013, the "Proposal for the quality and discount regime for the garbage collection service" which defines indicators for the supervision of the garbage collection service under two main concepts:

- A noncompliance indicator for commercial complaints due to the invoicing which, in turn, includes: the calculation of commercial complaints due to the invoicing and the calculation of the noncompliance indicator for commercial complaints due to the invoicing.
- A technical quality indicator for the collection of non-usable solid waste, including:

Measurement of the frequency and schedule for the collection of non-usable solid waste: when measuring the frequency and the schedule for the collection of non-usable solid waste, each provider must implement a Global Positioning System (GPS) in the collection and transport vehicles of non-usable solid waste.

Calculation of the quality indicator of the collection frequency of non-usable solid waste: this indicator measures the percentage of shifts not complied with per month by the provider vis-à-vis the previously established collection frequency in the relevant Uniform Conditions Agreement, which is expressed in the number of shifts per week. Its calculation must be made in a detailed manner for each one of the non-usable solid waste collection routes that the providing company has in a particular municipality.

Calculation of the quality indicator for the non-usable solid waste collection schedule: the quality indicator of the non-usable solid waste collection schedule is a monthly indicator. It measures the behavior of the individual provider as per the monthly noncompliance of the non-usable solid waste collection schedule previously established in the relevant Uniform Conditions Agreement for each one of the collection routes in the municipality being analyzed.

Calculation of the technical quality indicator for the collection of non-usable solid waste collection: as previously mentioned, this indicator is calculated based on the quality indicators for the frequency and collection of non-usable solid waste. Since this indicator is used in order to establish the discounts related to the technical dimension and these are set forth every six months, this indicator is calculated per semester.

The indicators proposed by the CRA are more adequate for measuring the quality of the service rendered than the “Clean Area” concept which was subjectively defined.

d.1 Contracts/Agreements Follow Up Program – Administrative Aspects:

Guarantee slip

The validity of the guarantee slip must be verified; it must be changed in the event that it has expired, or due to making readjustments to the value of the contract/agreement. This control must be undertaken by the Accounting, Costs and Systems of the Administration and Development Unit. It has to be paid immediately upon its mere presentation.

Penalties and Fines

Usually, the UAESP solves problems related to noncompliance of the contract/agreement in three ways: a) A request for a corrective action; b) A request for a preventive action, and c) A detailed explanation. This procedure is not clearly defined in the contracts/agreements. It is, however, a general policy of the UAESP. Contracts/Agreements must include the details of the grounds entitling the UAESP for the application of penalties and fines, their amounts, the application and complaint procedures.

Payment of the Service

It is necessary to verify that the invoicing and the collection of the service are carried out pursuant to the provisions of the contract/agreement. The aspects that must be verified are the following:

Upon the presentation of the invoice, the UAESP must check that the amount corresponds to what is set forth in the contract/agreement. As per the case of the lump sum, only the amount must be verified. If the contract/agreement is based on unitary prices, the amounts of waste collected must be verified during the invoicing period; the service provider must submit the entry records to the Doña Juana landfill (or to the landfill that replaces it), or of the Transfer Station. Said information must be checked against the direct control of the Supervisory Authority in the place where waste is discharged. At the same time, the unitary price of the service will be verified against the contract/agreement, and the monthly amount shall be calculated. The procedure for the collection must be checked in both cases as well as the taxes, fees, discounts which should correspond to real amounts.

In the event that the contract/agreement is subject to adjustments, the Office of the Assistant Director of the RBL must calculate, upon the appropriate moment, the new value of the contract/agreement or of the unitary price, and inform about it to the Office of the Assistant Director for Legal Affairs in order to update the contract/agreement. At the same time, it must calculate the new value of the guarantee slip and inform about it to the Office of the Administrative Assistant Director to require the service provider to change it pursuant to the new amounts.

If there are breaches of the contract/agreement during the collection period, the office of the Assistant Director of the RBL shall set the fines pursuant to the provisions of the contract/agreement, and shall inform the office of the Administrative and Financial Assistant Director about it so it undertakes the sanctionary process.

The Office of the Assistant Director of the RBL must verify that, along with the collection document (invoice), the documents set forth in the contract/agreement are attached thereto and that they meet all the requirements stipulated. The documents to be controlled include the entry document to Doña Juana or to the Transfer Station (regardless of the fact that the contract/agreement deals with the unitary price or not), the payment slip of the provisional obligations, etc. The information included in relation to the performance of the service shall be checked against the monthly report concerning the oversight of the service prepared by the Supervisory Authority.

Readjustments and Increase of the Service

The office of the Assistant Director of the RBL shall keep the control over the readjustment of the contracts/agreements, reporting to the office of the Administrative and Financial Assistant Director when they become valid and the percentage to be applied.

Insurance and Indemnities

The office of the Assistant Director for Legal Affairs shall be in charge of verifying that the insurance policies mentioned in the contract/agreement are valid and meet the requirements; likewise, it shall be responsible for enforcing the contract/agreement in all aspects related to indemnities, liability of the company, etc.

Provisional Obligations

On a monthly basis, the Supervisory Authority, as part of the approval for the payment of the services, shall verify that the private company meets all the provisional obligations regarding the employees actually working for it. In order to attain this, it must verify, through the payment slips submitted every month by the operator along with the document for the collection of the service, that they comply with the provisions of the Law including 100% of the personnel set forth in the contract/agreement; the identification number of the employees shall be verified by the Supervisory Authority.

Term of the Contract/Agreement

The oversight of the term of the contract/agreement, extinction, suspension and assignment of the contract/agreement shall be the responsibility of the office of the Assistant Director for Legal Affairs, and the office of the Assistant Director of the RBL shall be in charge of reporting if these events are required.

Social Management Plan

The office of the Assistant Director of the RBL, jointly with the Supervisory Authority, shall be in charge of verifying the fulfillment of the dissemination programs set forth in the contract/agreement, as well as to check their effectiveness.

d.2 Contracts/Agreements Follow Up Program – Technical Aspects:

The follow up concerning the correct performance of the collection service is the responsibility of the office of the Assistant Director of the RBL, with the support of the Supervisory Authority, for in-site supervision, for the verification of the quality of the service, for recording all the background information of the service, for preparing the daily and monthly reports and

sending them to the other offices of the Assistant Directors of the UAESP. On the other hand, it also has the responsibility of assessing the development of the service through the follow up to the quality indicators. The main technical aspects of the contract/agreement that need the follow up procedure are the following:

Characteristics of the waste

Inspections should be carried out at random as per the characteristics of the waste collected to verify that it corresponds to what is set forth in the contract/agreement. Said inspection can be undertaken at the waste discharge places as well as en route. The collection of waste not included in the contract/agreement is, generally speaking, a material breach of the contract/agreement so it should be fined. The "combined waste" will require special monitoring.

Service Area

It must be verified that each operator renders the service within the boundaries assigned in the contract/agreement.

Characteristics of the service

The compliance of 100% of the routes shall be verified on a daily basis. The route shall be inspected pursuant to the diagrams of the routes so they comply with what is set forth in relation to the frequency, schedules, working days and that each truck has its own roadmap. Control points shall be established in the design of the route, which will be clearly indicated in the diagrams of the routes. The inspectors must use said control points to verify that the route takes place within the schedule set forth and, at the same time that the route has been thoroughly complied with. The use of technology, for example the GPS, is particularly useful to confirm the fulfillment of 100% of the routes.

The parking area for the trucks must be controlled on a daily basis, as well as the departure of the garbage collection vehicles within the schedule set forth, the number must be equivalent to the routes, the correct mechanical condition and their cleanliness, that the personnel appointed for each truck corresponds to the number stipulated in the contract/agreement, and that they have their uniforms and the required tools. In the event that one of the permanent vehicles is not operating, then it must be replaced with one of the reserve vehicles, reporting this to the section in charge of controlling said service. Likewise, in the event of not complying with the departure of 100% of the trucks so the necessary measures are taken to ensure the whole service of the routes.

In the event that the contract/agreement includes the operation of the equipment and the installation of containers, their operation must be verified, the physical or mechanical conditions, as well as the fulfillment of the washing, cleaning, and fumigation programs.

If as a result of the inspections previously indicated a breach of the contract/agreement is detected, the inspector(s) shall record said anomalies in the road maps or write a report (‘acta’) which should be signed by the truck driver who is in breach, or by the direct supervisor of the service. Said document shall be subsequently used in the sanctionary process and for the application of fines.

As part of the inspection program, it is necessary to verify that the waste is discharged in the place(s) indicated in the contract/agreement. This information shall be, in turn, verified against the entry controls to the Doña Juan landfill or to the Transfer Station, as the case may be.

Characteristics of the vehicles and of the equipment

The garbage collection trucks, the boxes, the equipment, the containers, etc. must be verified during the startup of the service. These elements for the service must comply with the technical specifications set forth in the contract/agreement, they must have the insurance policies, the permits and technical check-ups set forth by the Law and by the contract/agreement. If the aforementioned is not complied with, the Operator shall be informed in order to replace the units that do not meet the requirements of the contract/agreement, or to incorporate the ones missing, by granting the terms pursuant to the provisions of the contract/agreement. In the event that the operator does not respond to what is requested within the term set forth, the penalties stipulated in the contract/agreement may be applied, or even making the guarantee slip effective. Said measures must be stated in the contract/agreement.

Subsequently, the mechanical condition of the vehicles, boxes, container lifters and of any other equipment must be inspected. Likewise, their cleanliness must be also verified. Said controls may be undertaken en route or when departing from the parking area.

The office of the Assistant Director of the RBL shall have access to the records of the maintenance programs of the vehicles and equipment assigned for the services. The program shall be verified vis-à-vis a previously established frequency along with the updating of the permits, insurance policies, and other documents required by the contract/agreement.

Personnel

As per the personnel, it is necessary to verify that each truck has the equipment set forth in the contract/agreement, that the personnel has the uniform and the security devices, and that they keep the uniform set forth in the contract on a daily basis.

The behavior of the workers shall be verified during the performance of the service: it should be appropriate and they should not ask for gifts or for a payment for the service.

The office of the Assistant Director of the RBL shall keep the records of the personnel (permanent and reserve) assigned to the contracts/agreements that falls under its responsibility. Said records shall be the basis for verifying the payment of the provisional obligations of the operator.

Assessment of the service

Based on the daily information obtained in-site, and of the entry control record at Doña Juana and at the Transfer Station, the UAESP must evaluate the quality indicators and verify if these meet the stipulations of the service and of the contract/agreement. If not, the same Unit shall request the necessary background information to the offices of the Assistant Director for Legal Affairs and of the Administrative and Financial Assistant Director in order to determine the cause and apply the corrective measures to the design, if required, and to identify the breach of the terms of the contract/agreement by the operator.

e. New Tender

The new tender shall strive to widen the spaces of the public sector vis-à-vis the previous concession by taking into consideration that the current administration adopted the Development Plan for Bogotá D.C. through Municipal Agreement 489 of 2012 that sets forth "A Bogotá that Defends and Strengthens what is Public" in the Third Axis.

A better participation of the public sector would result in a greater knowledge about the operating costs of garbage collection which, in turn, would be the input for new tenders. It is suggested that this participation of the public is undertaken under the Free Competition scheme which would enable obtaining fair prices for a quality service.

In the previous scheme, the city was divided into 6 Exclusive Service Areas (ASE) but now a new tender for 12 ASEs is planned (Figure 4-1). It is noted that a greater number of ASEs does not necessarily represent a greater participation of smaller operators, and their control would complicate the supervisory work of the office of the Assistant Director of the RBL. Consequently, a mixed collection system (public-private) under the Free Competition scheme is advisable.

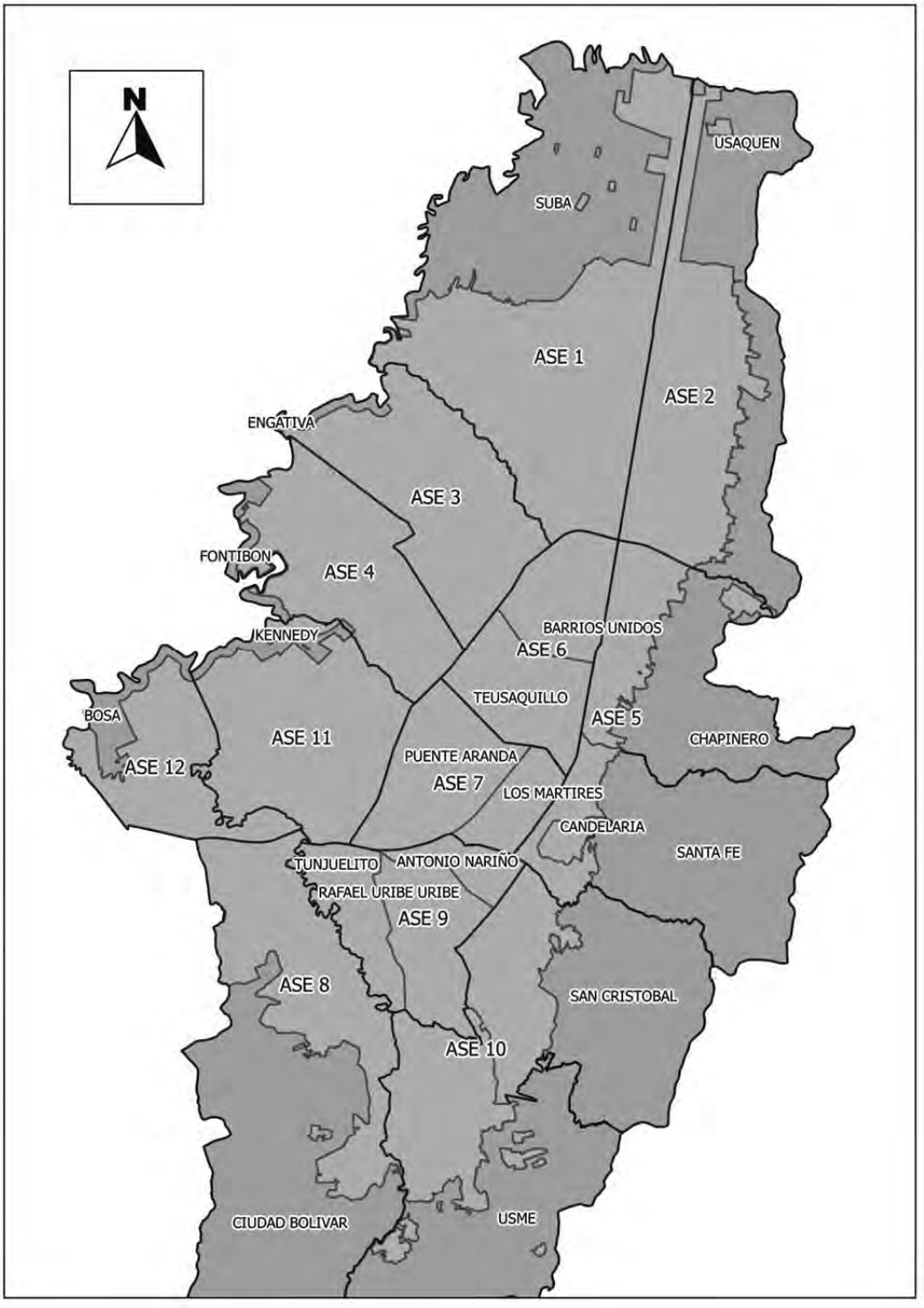


Figure 4-1: New ASEs Proposed for a Future Tender

4.1.3 Collection and Transport

4.1.3.1 Collection and Transport

Within what is considered the new concession period, it was defined that the only landfill to be used will be Doña Juana, up to year 2021. From then onwards, two (2) additional Transfer Stations, and two (2) Landfills, to the north and to the west, respectively, would be operating. Figure 4-2 shows the distribution of the waste per area serviced by Doña Juan and by the two Transfer Stations.

Table 4-7: Localities Grouped by Facilities Servicing them by 2021

Group	Locality	Facilities Used
G1	Usaquén	Transfer Station to the North
	Suba	
G2	Fontibón	Transfer Station to the West
	Engativá	
	Chapinero	
	Santa Fe	
	Barrios Unidos	
	Teusaquillo	
	Los Mártires	
	Candelaria	
	Bosa	
	Kennedy	
G3	Tunjuelito	Doña Juana Landfill
	Puente Aranda	
	Ciudad Bolívar	
	San Cristóbal	
	Usme	
	Antonio Nariño	
	Rafael Uribe	

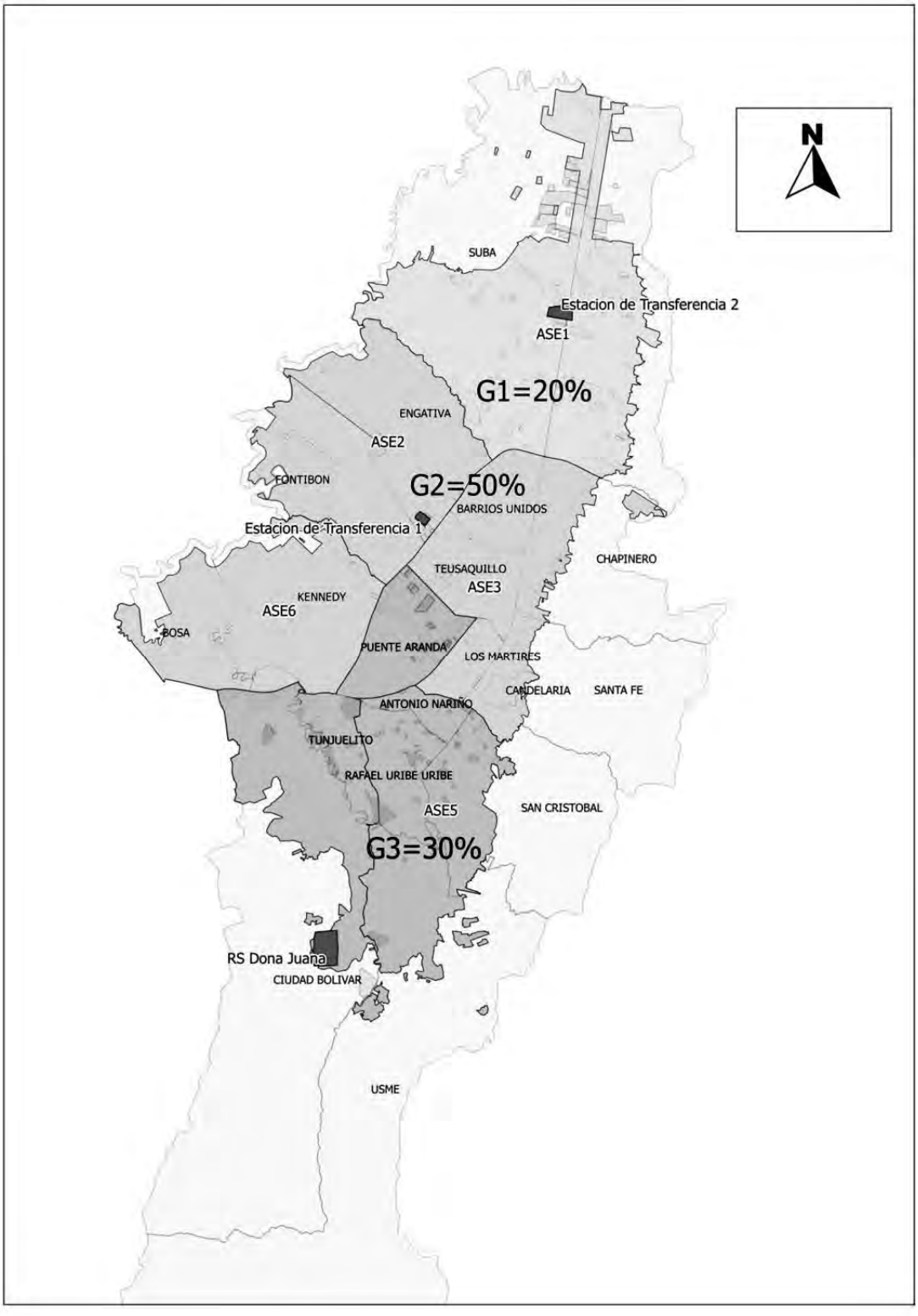


Figure 4-2: Group of Localities Serviced by Doña Juana and by the Two Transfer Stations

4.1.3.2 Collection

The District has 100% coverage in the urban area; nevertheless, the coverage in the rural area is about 30%, whether by the UAESP or through the own resources of the locality. The third tender that was being prepared (2010-2018) was aimed at servicing 40% of the area with "the technical possibility for waste collection" representing the attention to populated rural centers, and 100 meters on both sides of the axis of main access roads to the district.

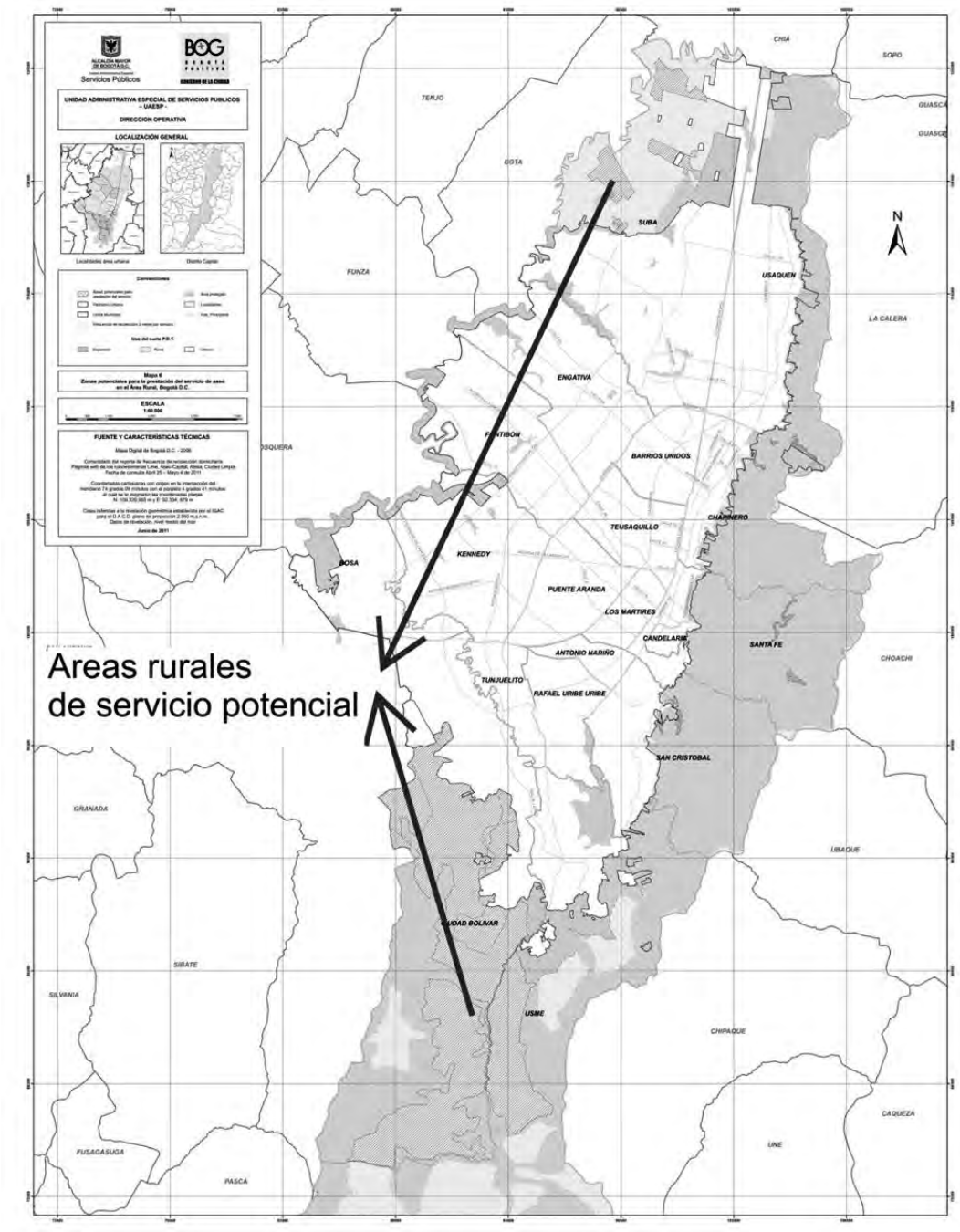


Figure 4-3: Rural Areas with Potential Service (by UAESP)

Table 4-8: Rural Area Coverage

No	Locality	Rurality 2008	% Coverage	Total
1	Usaquén	5.453	50%	2.727
2	Chapinero	2.442	40%	977
3	Santa Fe	677	50%	339
4	San Cristóbal	254	67%	170
5	Usme	11.692	23%	2.699
6	Suba	3.145	38%	1.195
19	Ciudad Bolívar	3.966	22%	873
20	Sumapaz	2.785	27%	752
	Total	30.414	32%	9.730

Table 4-9: Amount of Waste to be Collected (tons)

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Household Collection														
Household	1.182.048	1.202.017	1.225.489	1.248.133	1.269.907	1.290.759	1.310.647	1.326.457	1.341.681	1.359.421	1.376.957	1.394.285	1.411.408	1.428.325
Commercial	479.850	487.925	499.191	509.943	520.149	527.589	534.211	537.353	540.005	544.447	548.712	552.801	562.065	571.330
Sweeping	151.438	154.209	157.314	160.419	163.524	166.629	169.733	172.839	175.944	179.048	182.153	185.259	188.363	191.468
Large-quantity Generators	203.703	207.133	211.914	216.480	220.811	223.970	226.782	228.116	229.242	231.126	232.937	234.673	238.606	242.539
Markets	36.194	36.938	37.682	38.426	39.169	39.913	40.657	41.400	42.144	42.888	43.632	44.375	45.119	45.863
Lawn Mowing	33.781	34.476	35.170	35.864	36.558	37.252	37.946	38.640	39.335	40.029	40.723	41.417	42.111	42.805
Tree Pruning	9.652	9.850	10.048	10.247	10.445	10.643	10.842	11.040	11.238	11.437	11.635	11.833	12.032	12.230
Construction and Demolition Waste	304.032	310.280	316.527	322.774	329.022	335.269	341.516	347.764	354.011	360.258	366.506	372.753	379.000	385.248
Total	2.400.698	2.442.828	2.493.335	2.542.286	2.589.585	2.632.024	2.672.334	2.703.609	2.733.600	2.768.654	2.803.255	2.837.396	2.878.704	2.919.808

a. Type of Collection Service

The types of collection service appear below; in other words, urban sector, rural sector, large-quantity generators, markets, lawn mowing and tree pruning, as well as street sweeping.

a.1 Urban sector collection

The characteristics of the urban sector collection service appear below.

Table 4-10: Summary of the Urban Sector Collection Service

Items	Description
Characteristics of the Waste	Household waste generated in the urban sector corresponding to residential waste (including single-family homes and buildings), small and large businesses, schools, institutions, and industries.
Characteristics of generation area	Urban Area or one or more stories, road network that has wide avenues and secondary streets that, in most of the cases, allows the transit of compactor trucks of up to 25 yd^3 without major inconveniences. There are some sectors with narrow streets allowing the transit of 16 yd^3 compactor vehicles.
Characteristics of collection service	The collection service must be undertaken pursuant to the diagram of optimal collection routes with compactor trucks of up to 25 yd^3, and 16 yd^3 compactor trucks for narrow streets. The attention must be door-to-door. In the particularly residential sectors, with constructions of up to four stories, the frequency must be on an every-other-day basis in two shifts (morning and afternoon). In the areas with constructions of more than five (5) stories, with a high percentage of commercial and institutional areas, the frequency must be daily. The schedules for the residential area must be set during the daytime in two sessions (morning, afternoon). As per the sectors that are mainly commercial and with large avenues, the schedule must be set during the night hours (from 20:00 onwards). The morning shifts should start at 07:00 to avoid driving the truck to the collection starting point during the rush hour. The waste transport is headed directly to the final disposal site or to the transfer station. Regarding residential areas with constructions of up to four stories, the storage of the waste must be carried out in 120 L plastic bags, duly closed and arranged in plastic containers of up to 200 L. The garbage must be arranged in 120 -150 L plastic containers in the other garbage areas. The characteristics of the service, frequency, schedule and working days must be widely disseminated within the community by the service operator.
Operator	Service transferred to public or private operators through a bidding process and subsequent execution of the contract/agreement for a time period of no more than 7 years (the useful life of the trucks operating two shifts). Two operators must be considered in order to avoid monopolistic practices. Each operator must service one exclusive area in order to avoid overlapping operators. The territory may be assigned pursuant to the Exclusive Service Areas (ASEs).

a.2 Rural area collection

The characteristics of the rural area collection service appear below.

Table 4-11: Summary of the Rural Sector Collection Service

Items	Description
Characteristics of the Waste	Household waste generated in the rural sector, corresponding to single-family homes and institutions, mainly schools.
Characteristics of generation area	The rural area, not densely populated, generates, mainly, organic waste that may be used in situ. The effort of the UAESP must be focused on activities for in situ use and treatment. Nonetheless, there will always be a negative attitude that must be dealt with.
Characteristics of collection service	As a result of a technical-economic feasibility study, the zones with "technical possibilities for the waste collection service" will be defined and their area must be revised and updated from time to time. The attention in the rural centers must be door-to-door, although mainly at gathering centers due to the spread of the population that will receive the service. The frequency will be defined according to characteristics of community and location of containers at storage. The office of the Assistant Director of the RBL would be in charge of the rejected material. The waste may be stored in containers to be gathered. The characteristics of the service as its frequency, schedule and working days, collection method, location of the containers at a gathering center, must be widely disseminated to the community in order to prevent the gathering centers from becoming unhealthy disposal sites.
Operator	The operators of the RBL scheme shall provide the service in the areas defined with the "technical possibilities for the waste collection service" for the Collection, Transport and Disposal components. In the event of not having said technical possibility, it would be necessary to create local community enterprises that take their rejected waste to the gathering centers during the hours and frequencies defined for the areas included in the service within the RBL scheme. In order to attain that goal, the office of the Assistant Director of the RBL would provide technical support for the creation of said community enterprises within the scope of an inter-institutional agreement between the Office of the Local Mayor and the UAESP.

a.3 Large-quantity Generators

The characteristics of the large-quantity generators collection service appear below.

Table 4-12: Summary of the Large-quantity Generators Collection Service

Items	Description
Characteristics of the Waste	Great volume of household waste generated from shopping malls, hotels, institutions, and industries. It corresponds to the collection of waste generated by industrial and institutional users, markets, and large commercial areas whose MPR production is more than one cubic meter (1 m^3) per month.
Characteristics of generation area	Waste is generated within the urban area where there are no problems for the movement of garbage collection vehicles.
Characteristics of collection service	The collection service for large producers shall be carried out under the required frequency due to the type and volume of the waste generated. The collection shall be undertaken at the place where they keep the storage area, provide that it meets the requirements set forth by Decree 1713 of 2002, or by the regulation that amends or complements it. It is necessary to evaluate, in each case, the access and maneuverability of the garbage collector vehicles to meet the conditions of the large-quantity generator. The collection of potentially usable solid waste in these places must be performed at times when the vehicular and pedestrian flow is not affected in the area and the operation of the normal activities of these facilities is not affected, either.
Operator	Service transferred to public or private operators through a bidding process and subsequent execution of the contract/agreement for a time period of no more than 7 years (the useful life of the trucks operating two shifts). Two operators must be considered in order to avoid monopolistic practices. Each operator must service one exclusive area in order to avoid overlapping operators. The territory may be assigned pursuant to the Exclusive Service Areas (ASEs).

a.4 Markets

The characteristics of the markets collection service appear below

Table 4-13: Summary of the Markets Waste Collection Service

Items	Description
Characteristics of the Waste	Waste generated at the markets located in the District.
Characteristics of generation area	Markets where meat, vegetables, fruits, etc. are commercialized.
Characteristics of collection service	The collection service includes: - Installation of containers at the area of attention of the market. - Transfer and discharge of the containers into the collection trucks adapted for receiving and containing liquid materials or boxes that may be subsequently lifted by a truck and transferred to the final disposal site for their being discharged. - Sweeping inside the market and the surrounding streets. - Washing streets, washing and fumigating containers, boxes and the installation areas. - Fumigation and sanitization of the area pursuant to the program approved by the Mayor's Office. - Transport and discharge of waste at the final disposal site. Frequency of the service: daily; schedules pursuant to the operation and generation of waste in the market. 100% of the waste must have been collected and discharged at the landfill by the end of the day; the sweeping must have taken place, as previously defined.
Operator	Service transferred to public or private operators through a bidding process and subsequent execution of the contract/agreement for a time period of no more than 7 years (the useful life of the trucks operating two shifts). Two operators must be considered in order to avoid monopolistic practices. Each operator must service one exclusive area in order to avoid overlapping operators. The territory may be assigned pursuant to the Exclusive Service Areas (ASEs).

a.5 Lawn Mowing and Tree Pruning

The following table shows the characteristics of the collection special service.

Table 4-14: Summary of the Lawn Mowing and Tree Pruning Collection Service

Items	Description
Characteristics of the Waste	Waste generated from lawn mowing and tree pruning activities.
Characteristics of generation area	It includes the whole urban sector of the District.
Characteristics of collection service	Regarding the pruning, the trees located in the main hydric network of the city, located between the edge and the top of the slope delimiting the area of the wetlands, which are under the responsibility of the EAAB; likewise, the trees located in the public space that have physical contact with the electricity distribution networks shall be dealt with by CODENSA, parks licensed by the IDRD and, in general public space works in the city, in which the pruning activities shall be the responsibility of the executing entities. On the other hand, lawn mowing is defined as cutting the grass at an adequate level, with a defined regular frequency, in order to keep its health and effectively controlling weeds.
Operator	Service transferred to public or private operators through a bidding process and subsequent execution of the contract/agreement for a time period of no more than 7 years (the useful life of the trucks operating two shifts). Two operators must be considered in order to avoid monopolistic practices. Each operator must service one exclusive area in order to avoid overlapping operators. The territory may be assigned pursuant to the Exclusive Service Areas (ASEs).

a.6 Street Sweeping

The table below shows a summary of street sweeping, particularly the collection of solid waste resulting from street sweeping.

Table 4-15: Summary of the Street Sweeping Waste Collection

Items	Description
Characteristics of the Waste	Waste generated from streets and avenues sweeping activities undertaken by the District.
Characteristics of generation area	It includes all the urban sectors of the District.
Characteristics of collection service	Manual Sweeping is the activity done by the use of human strength and manual elements, including sweeping, so public areas are free of paper, leaves, accumulated grit on the edges of the curbs, and of any other object or material that may be manually removed. The collection service should be undertaken according to the route maps. The vehicles used for the service are the 16 yd^3 compactor trucks. The waste should be arranged in bags by each sweeper and collected at the points set forth in the sweeping program. The frequency and the service program should be based on the sweeping program.
Operator	Service transferred to public or private operators through a bidding process and subsequent execution of the contract/agreement for a time period of no more than 7 years (the useful life of the trucks operating two shifts). Two operators must be considered in order to avoid monopolistic practices. Each operator must service one exclusive area in order to avoid overlapping operators. The territory may be assigned pursuant to the Exclusive Service Areas (ASEs).

b. Necessary Equipment

The numbers of necessary vehicles for each service appear in the tables below. There is a comparison between the scenario with and without transfer stations. If transfer stations are not built, the collection and transport system shall be similar to the current one in which 25 yd^3 large-capacity trucks predominate, while for the event of introducing the Transfer Stations, it is suggested to introduce lower-capacity trucks. For example, 16 yd^3 trucks that could make more trips to the transfer station representing a lower-impact vehicular problem for the District.

b.1 Without Transfer Station

Table 4-16: Total Number of Vehicles Required without Transfer Station (2014-2020)

	2014	2015	2016	2017	2018	2019	2020
Compactor Truck - 25 yd^3	233	237	241	247	251	255	259
Compactor Truck - 16 yd^3	35	35	35	36	36	36	38
Ampliroll - 10 m^3	35	36	36	36	38	39	39
Trucks - 12 m^3	36	38	39	39	40	40	41
Van – 4.5 Tons	14	15	16	16	17	17	17
Grand Total	353	361	367	374	382	387	394

Reserve 5%
Lifetime 7 years

Table 4-17: Total Number of Vehicles Required without Transfer Station (2021-2041)

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Compactor Truck - 25 yd^3	293	297	300	303	306	311	315	319	325	330	335	339	345	350	356	360	366	371	375	381	386
Compactor Truck - 16 yd^3	43	44	45	45	46	47	47	49	49	49	51	51	52	53	53	55	55	56	56	58	59
Ampliroll - 10 m^3	44	44	45	45	45	46	47	47	49	49	49	51	51	52	52	53	55	55	55	56	56
Trucks - 12 m^3	47	47	49	49	51	51	52	52	53	55	55	56	56	58	59	59	60	60	61	63	64
Van – 4.5 Ton	19	19	19	19	19	21	21	21	21	21	22	23	23	23	23	23	23	24	24	24	25
Grand Total	446	451	458	461	467	476	482	488	497	504	512	520	527	536	543	550	559	566	571	582	590

Reserve 5%
Lifetime 7 years

Table 4-18: Annual Acquisition of Vehicles (2014-2020)

	2014	2015	2016	2017	2018	2019	2020
Compactor Truck - 25 yd^3	233	4	4	6	4	4	4
Compactor Truck - 16 yd^3	35	0	0	1	0	0	2
Ampliroll - 10 m^3	35	1	0	0	2	1	0
Trucks - 12 m^3	36	2	1	0	1	0	1
Van – 4.5 Ton	14	1	1	0	1	0	0
Total	353	8	6	7	8	5	7

Reserve 5%
Lifetime 7 years

Table 4-19: Annual Acquisition of Vehicles (2021-2041)

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Compactor Truck - 25 yd^3	267	8	7	9	7	9	8	271	14	12	14	11	15	13	277	18	18	19	15	21	18
Compactor Truck - 16 yd^3	40	1	1	1	1	1	2	42	1	1	3	1	2	3	42	3	1	4	1	4	4
Ampliroll - 10 m^3	40	1	1	0	2	2	1	40	3	1	0	4	2	2	40	4	3	0	4	3	2
Trucks - 12 m^3	42	2	3	0	3	0	2	42	3	5	0	4	0	4	43	3	6	0	5	2	5
Van – 4.5 Tons	16	1	1	0	1	2	0	16	1	1	1	2	2	0	16	1	1	2	2	2	1
Total	405	13	13	10	14	14	13	411	22	20	18	22	21	22	418	29	29	25	27	32	30

Reserve 5%
Lifetime 7 years

b.2 With Transfer Station

Table 4-20: Total Number of Vehicles Required with Transfer Station (2021-2041)

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Compactor Truck - 16 yd^3	229	230	233	236	239	241	246	250	253	257	261	265	269	273	278	282	284	289	293	297	301
Ampliroll - 10 m^3	42	43	43	43	43	46	46	46	47	48	48	49	50	51	52	52	52	54	54	54	56
Van – 4.5 Tons	9	9	9	9	9	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	13
Trailer-truck	62	62	63	63	65	66	66	68	69	70	70	72	73	74	75	76	77	79	79	80	81
Trailer	65	65	66	67	68	69	70	70	72	73	74	76	76	77	79	80	81	82	83	84	86
Total	407	409	414	418	424	433	439	445	452	459	464	473	479	486	495	501	505	515	520	526	537

Reserve 5%
Lifetime 7 years

Table 4-21: Annual Acquisition of Vehicles

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Compactor Truck - 16 yd^3	229	1	3	3	3	2	5	233	4	7	7	7	6	9	238	8	9	12	11	10	13
Ampliroll - 10 m^3	42	1	0	0	0	3	0	42	2	1	0	1	4	1	43	2	1	2	1	4	3
Van – 4.5 Tons	9	0	0	0	0	2	0	9	0	0	0	0	2	0	9	0	0	0	0	2	2
Trailer-truck	62	0	1	0	2	1	0	2	1	1	70	2	2	1	3	2	1	4	1	2	71
Trailer	65	0	1	1	1	1	1	0	2	1	74	2	1	2	3	2	2	1	3	2	76
Total	407	2	5	4	6	9	6	286	9	10	151	12	15	13	296	14	13	19	16	20	165

Reserve 5%
Lifetime 7 years

4.1.3.3 Transfer Stations

a. Location

Bogotá is one of the largest cities in Latin America which grows to the north and to the south. The current site for final disposal, Doña Juana, is located to the south so the trucks collecting in the north and in the center of the District have to make long trips in order to discharge the waste at Doña Juana.

Therefore, there has been an assessment carried out concerning the break-even point, at the pre-feasibility level, in order to determine the distance up to which it is profitable to use a regular 85 yd^3 compactor truck vs. using an 85 yd^3 trailer-truck and a transfer station for the transport of the waste. There was no assessment with the 25 yd^3 Euro IV-type compactor truck since the regular truck supposes a cheaper transport proposal without using the transfer station. If it is not feasible for this case, it will not be so for the Euro IV-type truck. The proposed transfer scheme is as the one proposed in Figure 4-2.

Table 4-22: Amount of Waste Produced by G1 and by G2

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
TS G1	1.532	1.557	1.587	1.616	1.644	1.668	1.691	1.708	1.724	1.746	1.768	1.789	1.815	1.841
TS G2	3.831	3.891	3.967	4.040	4.109	4.170	4.228	4.270	4.310	4.365	4.419	4.473	4.538	4.603

a.1 Transfer Station for the North (G1)

It was defined that the Transfer Station (TS) to the north should handle 20% of the waste produced by 2027 with a security margin added. As a consequence, it should handle 2,000 tons/day.

Doña Juana is around 32 kilometers from the center of the area of influence; on the other hand, the break-even point distance where a transfer station is required equals 21 kilometers, which clearly indicates that a Transfer Station is feasible for the attention of Group 1 (See Table 4-7).

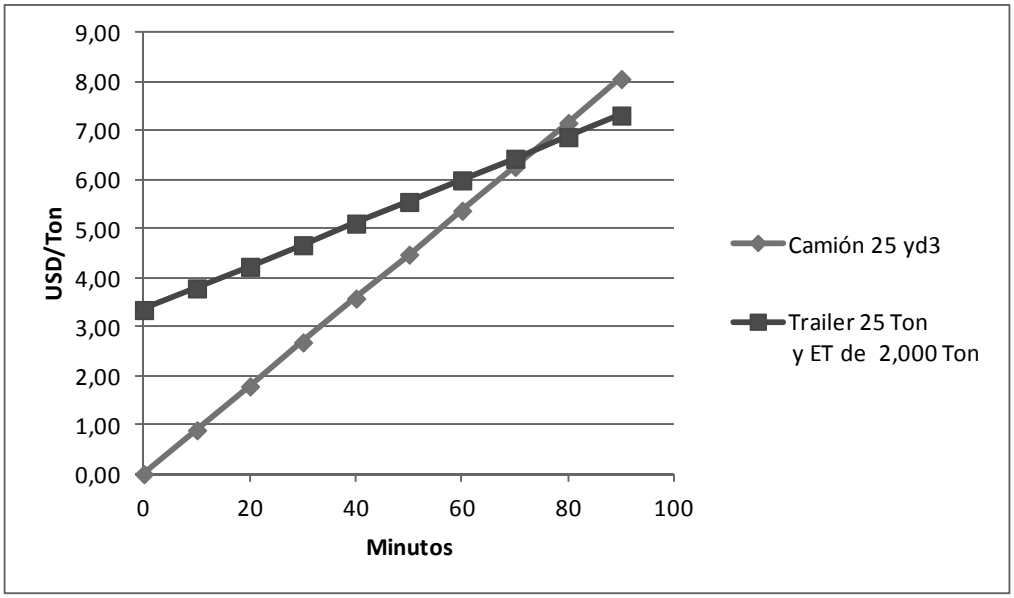


Figure 4-4: Break-even Point Graph for a Transfer Station in the north

a.2 TS for the West (G2)

On the other hand, the TS to the west should handle 50% of the waste by 2027 with a security margin added. Consequently, its capacity was stated at 4,500 tons/day.

Doña Juana is about 21 kilometers from the center of the area of influence, while the Mondoñedo landfill is located at a distance of 28 kilometers. Nonetheless, the distance from the break-even point equals 17 kilometers, which clearly indicates that a Transfer Station is feasible for the attention of Group 2.

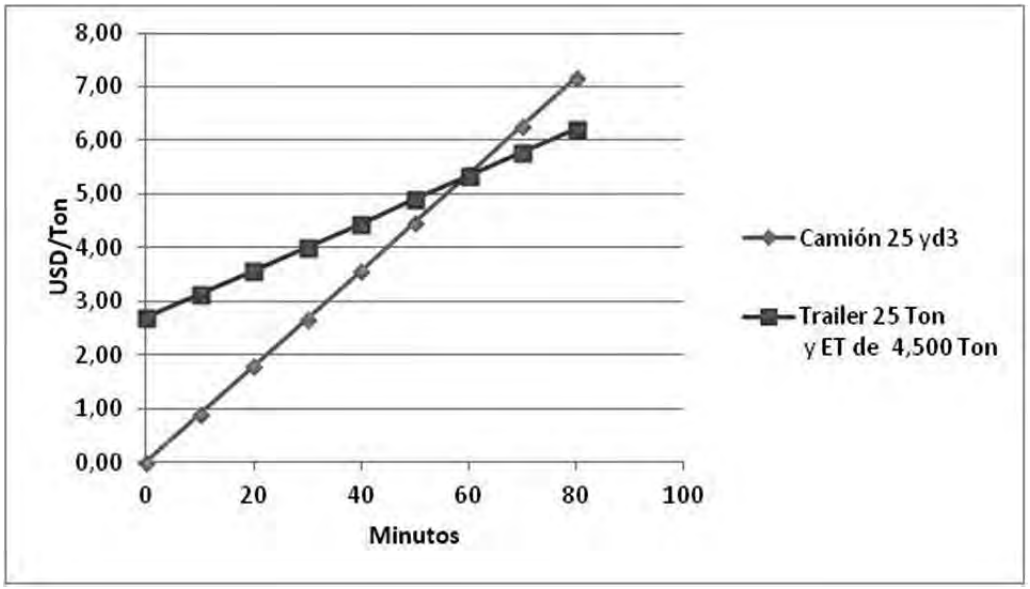


Figure 4-5: Break-even Point Graph for a Transfer Station in the west

The table below summarizes the Break-even Point Assessment for the Transfer Stations.

Table 4-23: Summary of the Assessment of the Break-even Point for the Transfer Stations

Service TS	Intersection Time (minutes)	Intersection Distance – round trip (Km)	Intersection Distance – one way only (Km)	Distance to Doña Juana (Km)	Distance to Mondoñedo (Km)
Group 1	73,7	41,7	20,9	32,2	
Group 2	59,3	33,6	17	21	28

b. Transfer System

There are different types of transfer stations that may be taken into consideration:

- Direct discharge station
- Pit or platform station where waste is not compacted
- Station with a feeding and compacting tank
- Pit station with a "push pit" system and compacting

Their advantages and disadvantages are included in the table below. Taking into consideration that the District has little experience handling these facilities and that their construction is relatively cheaper than the other options, the implementation of a direct-load station is recommended.

Table 4-24: Advantages and Disadvantages of the Different Types of Transfer Stations

Type	Operation	Advantages	Disadvantages
Direct Discharge Station	Waste is directly discharged from the collection vehicles towards the waiting trailer-trucks.	• Little hydraulic balance is used. A closing of operations due to damages is not probable. • In general, it reduces the handling of waste. • Relatively cheap construction. • Facilities for the transfer truck to enter and leave are easily arranged.	• It requires a bigger trailer than the one used at a compacting station. • The discharge of large-sized and heavy waste may affect the trailers. • It reduces the chance of recovering materials. • The number and availability of discharge points may not be adequate to enable direct discharge during highly-trafficked periods.
Pit or platform station where waste is not compacted	The waste is discharged into the pit or on a platform from which the waste is loaded into the trailers by using equipment for waste handling.	• A convenient and efficient area is provided for storing the waste. • Non compacted waste may be so through a bulldozer or the platform. • Trailers that can be loaded from above are less expensive than compacting trailers. • Peak-hour moments can be easily assimilated. • The arrival and the exit area for the vehicles may be easily provided. • The simplicity of the operation and the equipment reduce the chances of a closing of the station. • It allows the recovery of materials.	• Greater capital costs, in terms of other alternatives, concerning the structure and the equipment. • Greater floor area for maintenance purposes. • It requires larger trailers than the compacting station.
Station with a feeding and	The waste is loaded from the collection garbage to a closed trailer through a	• The trailers used are smaller than the ones used at stations where no compacting is done. • Some compactors may be installed so	• If the compactor fails, there is no way of loading the waste into the trailer. • The system for pushing the waste and reinforcing the trailer reduces the useful load.

Type	Operation	Advantages	Disadvantages
compacting tank	compactor.	that a separate level, at a lower level, may be eliminated.	• Capital costs are higher due to the compacting trailers. • The capacity of the compactor may not be adequate for peak periods. • The costs for operating and maintaining the compactors could be high.
Pit station with a "push pit" system and compacting	The waste is discharged from the collection truck into a push pit and then loaded into a closed trailer through a compactor.	• The pit allows storing waste during peak periods. • It increases the opportunity for the recovery of materials. • All the advantages of a feed-type and compacting station.	• Capital costs for the pit equipment could are significant. • All the advantages of the Stations with a feeding and compacting tank.

Source : Decision-Makers' Guide To Solid Waste Management, Volume II, 1995, US EPA

c. Criteria for the Location of the Transfer Stations

Resolution 1096 of November 17, 2000, "Through which the Technical Regulations for the Fresh Water and Basic Sanitation Sectors – (RAS) are adopted," states in its point F.3.4.3, Evaluation and Control, that "The entity rendering the garbage collection service must handle and make an inventory of the detailed information of the garbage collection system, including capital, operating, and maintenance costs." In addition, it states that "if as a result of a periodic evaluation of the collection cost it is determined that it is too high then the use of transfer stations may be considered (F.3.7), provided that after comparing costs and benefits the latter are cheaper."

Farther ahead, in section F.3.7, Transfer Stations, it establishes the following with additional details:

"Regarding the populations included at the high level of complexity of the system, the entities rendering the service must define the need to establish transfer stations based on the following criteria:

1. Increasing the global effectiveness of the garbage collection service.
2. Reaching lower costs in the transport system.
3. Decreasing dead time periods of the workforce used for collection purposes.
4. Decreasing collection costs.
5. Transfer stations may be implemented jointly with the sorting centers to guarantee the recovery of materials."

The location and the need for a Transfer Station are linked to the location of the landfill(s). The RS Cundinamarca Consortium, 2001, in its Study on the Integral Management of Solid Waste through regional schemes, mentions two potential places for locating regional landfills. One option would be located to the North, between the Capital District and the department of Boyacá, while the second would be located to the West in the Mondoñedo area. The location of the northern landfill could mean implementing a transfer station servicing the municipalities of Chía, Cajicá, or Sopó, as well as the northern industrial area of

Bogotá. On the other hand, the landfill to the west could service both the northern sectors of Bogotá as well as Engativá and Fontibón.

In addition, Decree 1713 of 2002 establishes in its Article 64 the following concerning the Transfer Stations:

Article 64 - *Conditions for the location and operation.* The location and operation of the transfer stations for solid waste shall be subject, as a minimum, to the following conditions:

1 Location, pursuant to the uses of the land set forth by the municipal authorities and included in the Zoning Plant ("Plan de Ordenamiento Territorial" – "POT"), Basic Plan, or Zoning Scheme ("Esquema de Ordenamiento Territorial" – "EOT").
2. They should not be located in areas of influence of educational, hospital, military and other facilities that are incompatible vis-à-vis their activities.
3. There should be access roads for the vehicles.
4. They should neither interfere with vehicular or pedestrian traffic nor cause aesthetic problems.
5. They should have a defined loading and unloading system.
6. They should have an alternative system for their operation in the event of failures or emergencies.
7. They should have a weighing system according to the needs of the station.
8. They should have a water supply system enabling washing and cleaning activities.
9. The negative impacts on their area of influence must be minimized.
10. They should comply with the provisions of Law 99 of 1993 and its regulatory decrees concerning environmental pollution control and other regulations in force.
11. They should not generate risks to human health.
12. They should have the public utilities of water service, sewage system, electricity, and basic commuted public telephone service ("telefonía pública básica conmutada" – "TPBC").
13. Processing and obtaining the corresponding permits.
14. The other conditions set forth in the regulations in force.

As per the Zoning Plan (POT), the following activity areas have been defined:

Central activity area: it is the area which land is suitable for locating activities in the traditional central area of the city and in the foundational nuclei of the annex municipalities.

Commercial and services activities area: it is the area which land is suitable for locating establishments offering goods and services to companies and people.

Institutional activity area: it is the land that is suitable for locating the necessary services for urban life to guarantee entertainment and recreation to the population.

Industrial activity area: it is suitable for locating establishments devoted to producing, manufacturing, preparing, recovering, reproducing, assembling, building, repairing, transforming, treating, and manipulating raw materials for the production of goods.

Geomorphological/mining recovery area: its quarry area has undergone considerable deterioration processes. It deserves a special handling aimed at restoring the geomorphological conditions of the land to incorporate it into the urban development.

Residential activity area: it is defined as the land destined for the permanent lodge and residence of the people.

Integral urban area: it is the urban land and/or land for expansion purposes, destined for urban projects combining housing, commercial and services, industry and non-residential areas pursuant to the zoning model set forth for the different units. It requires a Partial Plan for its development pursuant to the provisions for its management. There are two categories: Multiple Integral Urban Area and Residential Integral Urban Area.

Protected Land

According to the description for transfer activities, it could be considered an "institutional activity area," an "industrial activity area," and an "integral urban area." Said uses of the land are found both in the northern and in the eastern sectors of the city; they should be verified through a field visit. In addition, said uses must be confirmed by the other party and defined along with the updating of the Zoning Plan (POT) which is underway.

In this sense, Decree 261 of 2010 (July 7th): "Through which Municipal Decree 620 of 2007, which complemented the Solid Waste Master Plan, is amended and other regulations are issued" establishes:

Article 12 – Transfer stations, temporary gathering centers.

Urban and architectural conditions:

- Use: Institutional, Industrial, Commercial and Basic Urban Services.
- Scale: Urban.
- Location: The transfer stations will be allowed in Institutional Activity Areas and in Industrial Activity Areas.

In other words, several layers of information must be included in order to define the place for a transfer station. In the figure below, the map to the left shows the growth areas to the north, to the west, and to the south, where the waste facilities are proposed (two -2- transfer stations and Doña Juana). On the other hand, the map to the right highlights the two areas that could be destined for Transfer Stations within the POT: Institutional and Industrial Activity.

Growth

Zoning Plan Land Use
Institutional Activity Area – Industrial Activity Area

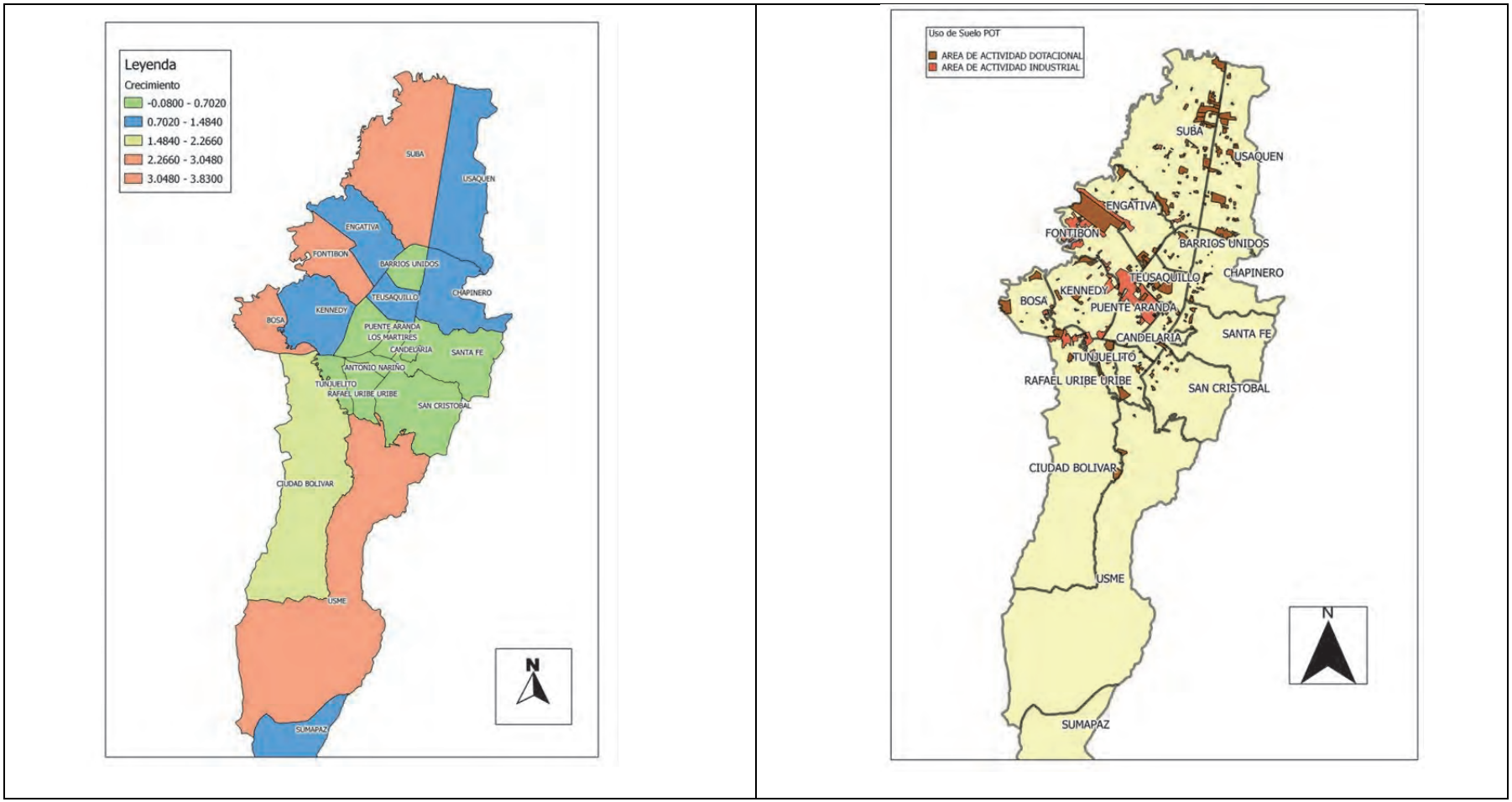


Figure 4-6: Information on the Selection of the Place for the Transfer Stations

d. Conceptual design of the transfer stations

The new transfer and transport system will have two transfer stations: one for 2,000 tons/day and another one for 4,500 tons/day. The waste would arrive by 16 yd^3 compactor trucks which would have a lesser impact on the feasibility vis-à-vis greater capacity trucks (25 yd^3) that predominate in the current system. Besides the transfer station there would be 85 yd^3 trailer-trucks.

Each transfer station is equipped with two scales. The transfer station to the north will have six (6) chutes that can receive three trucks each. The transfer station to the west will have ten (10) chutes with the already mentioned capacity. The conceptual layout and the design are indicated below.

Table 4-25: New Transfer and Transport System

Component	Characteristics
Transfer stations	TS capacity for G1: 2,000 tons/day TS capacity for G2: 4,500 tons/day Direct discharge
Transfer transport	Trailer-truck and trailer - 85yd^3
Collection service	Compactor truck - 16 yd^3

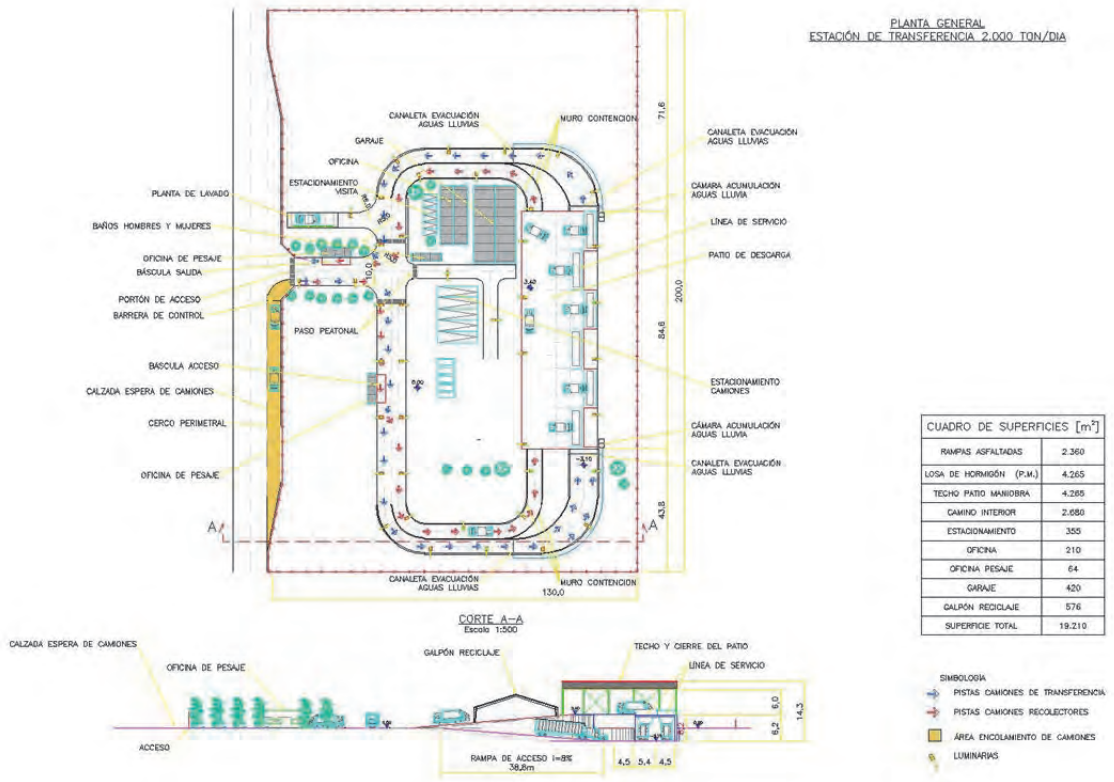


Figure 4-7: Transfer Station Layout – 2,000 Tons/day - North of the District

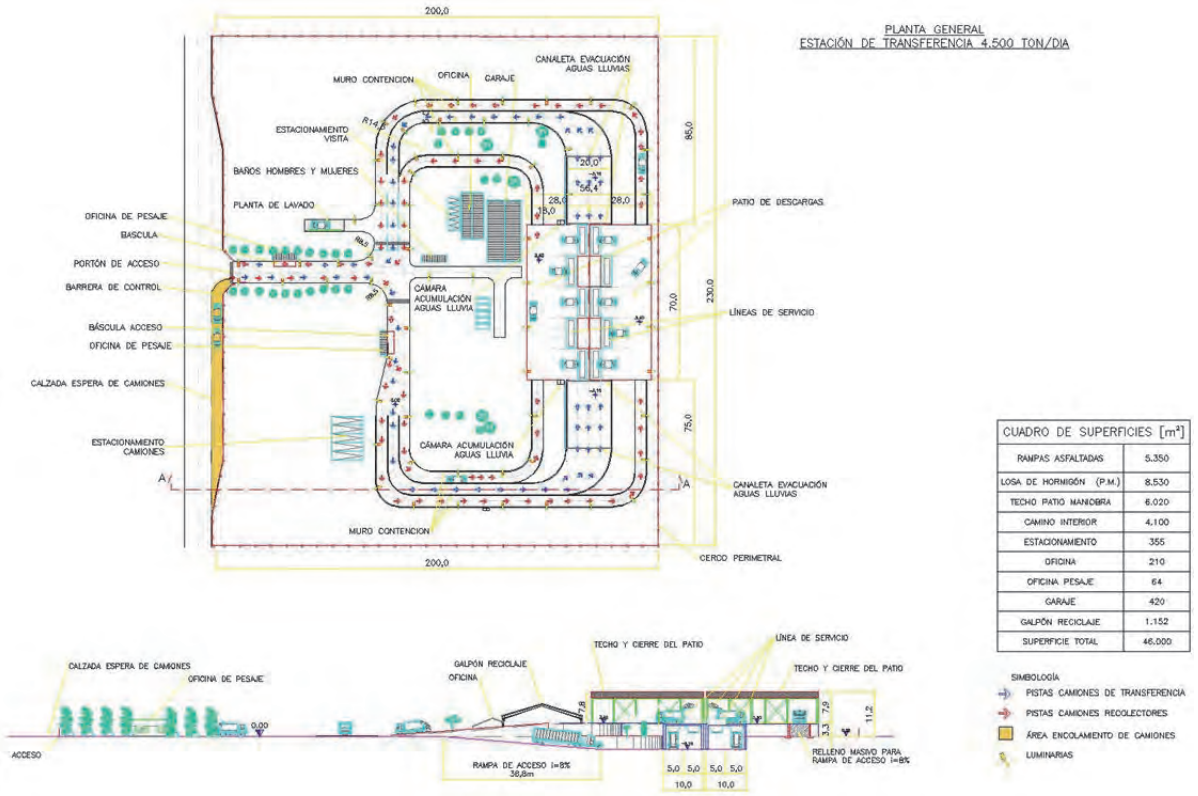


Figure 4-8: Transfer Station Layout – 4,500 Tons/day – West of the District

Table 4-26: Summary – Conceptual Design of Transfer Stations

Concept	Unit	Number
Transfer Station - North		
Total area for the project*	m2	No less than 20.000
Construction Area		
Roof – Maneuvering Area	m2	4.265
Office	m2	210
Office – Weighing	m2	64
Garage	m2	420
Subtotal	m2	4.959
Paved area		
Paved Ramps	m2	2.360
Parking Area	m2	355
Inner path	m2	2.680
Subtotal	m2	5.395
Concrete		
Concrete Slab	m2	4.265
Subtotal	m2	4.265
Transfer Station – West		
Total area for the project*	m2	No less than 50.000
Construction Area		
Roof – Maneuvering Area	m2	6.020
Office	m2	210
Office – Weighing	m2	64
Garage	m2	420
Subtotal	m2	6.714
Paved area		
Paved Ramps	m2	5.350
Parking Area	m2	355
Inner path	m2	4.100
Subtotal	m2	9.805
Concrete		
Concrete Slab	m2	8.530
Subtotal	m2	8.530

*The environmental requirements would have to be verified, particularly the “buffer zone.”

4.1.4 Cost Estimation

The investments to be made have been calculated under two circumstances: with and without the transfer stations. The scenario without the transfer station supposes a scheme that is similar to the current one: the city is served by large-capacity trucks.

In addition, the cost per ton was calculated by estimating the net current value ("valor neto actual" – "VNA") for the 2014-2021 period, without transfer stations, and for the 2021-2041 cases with and without transfer stations. The calculation was made for all the scenarios for regular compactor trucks in relation to Euro IV-type trucks. The summary appears in the table below:

Table 4-27: Cost per Collection and Transport Ton at the VNA for the Different Scenarios

	2014-2021	2021-2041	
Types of vehicles	Without TS	Without TS	With TS
Euro IV Trucks	106.000	113.600	91.800
Regular Trucks	89.900	97.200	84.500

The conclusion that can be drawn from the results is that the case with the Transfer Station is cheaper with Euro IV and with regular trucks. These numbers confirm the assessment of the break-even point concerning the need to build transfer stations to the north and to the west of the District. The main premise derived from the assessment defines two trips per shift for the trailer-trucks and two shifts; in other words, four (4) trips per day. This supposes an approximate distance of 40 kilometers to the new landfills. Nevertheless, it is necessary to define their location and conduct a feasibility study before the execution of the Project.

Table 4-28: Investments Table without Transfer Station 2014-2020 (thousands of pesos)

	2014	2015	2016	2017	2018	2019	2020
Investments (COP/year)							
Compactor truck - 25 yd^3	66.405.000	1.140.000	1.140.000	1.710.000	1.140.000	1.140.000	1.140.000
Compactor truck - 16 yd^3	7.245.000	0	0	207.000	0	0	414.000
Ampliroll - 10 m^3	8.225.000	235.000	0	0	470.000	235.000	0
Trucks - 12 m^3	8.460.000	470.000	235.000	0	235.000	0	235.000
Van – 4.5 Tons	2.380.000	170.000	170.000	0	170.000	0	0
Total Investment	92.715.000	2.015.000	1.545.000	1.917.000	2.015.000	1.375.000	1.789.000
Personnel Cost (COP/year)							
Personnel Cost (2)	28.351.782	28.994.315	29.476.215	30.038.432	30.680.965	31.082.549	31.644.765
Operating Cost (COP/year)							
Operating Cost (3)	77.427.042	79.181.763	80.497.803	82.033.183	83.787.904	84.884.604	86.419.985
Administrative Costs							
12.8% of the fixed costs (4)	13.539.690	13.846.538	14.076.674	14.345.167	14.652.015	14.843.796	15.112.288
Contingency							
10% of the fixed costs (5)	10.577.882	10.817.608	10.997.402	11.207.162	11.446.887	11.596.715	11.806.475
Grand Total (1+2+3+4+5)	222.611.396	134.855.224	136.593.095	139.540.944	142.582.771	143.782.664	146.772.513

Table 4-29: Investments Table without Transfer Station 2021-2031 (thousands of pesos)

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Investments (COP/year)											
Compactor Truck - 25 yd^3	76.095.000	2.280.000	1.995.000	2.565.000	1.995.000	2.565.000	2.280.000	77.235.000	3.990.000	3.420.000	3.990.000
Compactor Truck - 16 yd^3	8.280.000	207.000	207.000	207.000	207.000	207.000	414.000	8.694.000	207.000	207.000	621.000
Ampliroll - 10 m^3	9.400.000	235.000	235.000	0	470.000	470.000	235.000	9.400.000	705.000	235.000	0
Trucks - 12 m^3	9.870.000	470.000	705.000	0	705.000	0	470.000	9.870.000	705.000	1.175.000	0
Van - 4,5 Tons	2.720.000	170.000	170.000	0	170.000	340.000	0	2.720.000	170.000	170.000	170.000
Total Investment	106.365.000	3.362.000	3.312.000	2.772.000	3.547.000	3.582.000	3.399.000	107.919.000	5.777.000	5.207.000	4.781.000
Personnel Cost (COP/year)											
Personnel Cost (2)	35.821.232	36.222.815	36.785.032	37.025.982	37.507.882	38.230.732	38.712.632	39.194.532	39.917.382	40.479.598	41.122.132
Operating Cost (COP/year)											
Operating Cost (3)	97.825.668	98.922.368	100.457.749	101.115.769	102.431.809	104.405.870	105.721.910	107.037.951	109.012.011	110.547.392	112.302.112
Administrative Costs											
12.8% of the fixed costs (4)	17.106.803	17.298.583	17.567.076	17.682.144	17.912.280	18.257.485	18.487.621	18.717.758	19.062.962	19.331.455	19.638.303
Contingency											
10% of the fixed costs (5)	13.364.690	13.514.518	13.724.278	13.814.175	13.993.969	14.263.660	14.443.454	14.623.248	14.892.939	15.102.699	15.342.424
Grand Total (1+2+3+4+5)	270.483.393	169.320.285	171.846.134	172.410.070	175.392.941	178.739.747	180.764.617	287.492.488	188.662.294	190.668.144	193.185.971

Table 4-30: Investments Table without Transfer Station 2032-2041 (thousands of pesos)

	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Investments (COP/year)										
Compactor Truck - 25 yd^3	3.135.000	4.275.000	3.705.000	78.945.000	5.130.000	5.130.000	5.415.000	4.275.000	5.985.000	5.130.000
Compactor Truck - 16 yd^3	207.000	414.000	621.000	8.694.000	621.000	207.000	828.000	207.000	828.000	828.000
Ampliroll - 10 m^3	940.000	470.000	470.000	9.400.000	940.000	705.000	0	940.000	705.000	470.000
Trucks - 12 m^3	940.000	0	940.000	10.105.000	705.000	1.410.000	0	1.175.000	470.000	1.175.000
Van – 4.5 Tons	340.000	340.000	0	2.720.000	170.000	170.000	340.000	340.000	340.000	170.000
Total Investment	5.562.000	5.499.000	5.736.000	109.864.000	7.566.000	7.622.000	6.583.000	6.937.000	8.328.000	7.773.000
Personnel Cost (COP/year)										
Personnel Cost (2)	41.764.665	42.326.881	43.049.731	43.611.948	44.174.165	44.897.015	45.459.231	45.860.815	46.744.298	47.386.831
Operating Cost (COP/year)										
Operating Cost (3)	114.056.833	115.592.213	117.566.274	119.101.654	120.637.034	122.611.095	124.146.475	125.243.176	127.655.917	129.410.637
Administrative Costs										
12.8% of the fixed costs (4)	19.945.152	20.213.644	20.558.849	20.827.341	21.095.833	21.441.038	21.709.530	21.901.311	22.323.227	22.630.076
Contingency										
10% of the fixed costs (5)	15.582.150	15.791.909	16.061.601	16.271.360	16.481.120	16.750.811	16.960.571	17.110.399	17.440.021	17.679.747
Grand Total (1+2+3+4+5)	196.910.799	199.423.648	202.972.454	309.676.303	209.954.153	213.321.959	214.858.808	217.052.700	222.491.463	224.880.291

Table 4-31: Investments Table with Transfer Stations 2021-2031 (thousands of pesos)

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Capital Cost (COP)											
Compactor Truck - 16 yd^3	47.403.000	207.000	621.000	621.000	621.000	414.000	1.035.000	48.231.000	828.000	1.449.000	1.449.000
Ampliroll - 10 m^3	9.870.000	235.000	0	0	0	705.000	0	9.870.000	470.000	235.000	0
Van – 4.5 Tons	1.530.000	0	0	0	0	340.000	0	1.530.000	0	0	0
Trailer-truck		0	225.000	0	450.000	225.000	0	450.000	225.000	225.000	15.750.000
Trailer	5.557.500	0	85.500	85.500	85.500	85.500	85.500	0	171.000	85.500	6.327.000
North Station	6.946.567	0	0	0	0	0	0	0	0	0	0
West Station	10.718.300	0	0	0	0	0	0	0	0	0	0
Total Investment (1)	95.975.367	442.000	931.500	706.500	1.156.500	1.769.500	1.120.500	60.081.000	1.694.000	1.994.500	23.526.000
Personnel Cost (COP/year)*											
Personnel Cost (2)	28.012.119	28.172.752	28.488.261	28.729.211	29.119.279	29.756.054	30.157.637	30.628.022	31.023.847	31.499.989	31.821.256
Operating Cost (COP/year)											
Operating Cost (3)	85.518.625	85.957.305	87.004.090	87.662.110	89.097.659	91.021.805	92.118.505	93.773.394	95.039.519	96.524.984	97.402.344
Administrative Costs (COP/year)											
12.8% of the fixed costs (4)	14.531.935	14.608.647	14.783.021	14.898.089	15.131.768	15.459.566	15.651.346	15.923.381	16.136.111	16.387.197	16.540.621
Contingency (COP/year)											
10% of the fixed costs (5)	11.353.074	11.413.006	11.549.235	11.639.132	11.821.694	12.077.786	12.227.614	12.440.142	12.606.337	12.802.497	12.922.360
Grand Total (1+2+3+4+5)	235.391.121	140.593.710	142.756.107	143.635.042	146.326.900	150.084.710	151.275.603	212.845.939	156.499.814	159.209.167	182.212.581

Table 4-32: Investments Table with Transfer Station 2032-2041 (thousands of pesos)

	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Capital cost (COP)										
Compactor truck - 16 yd^3	1.449.000	1.242.000	1.863.000	49.266.000	1.656.000	1.863.000	2.484.000	2.277.000	2.070.000	2.691.000
Ampliroll - 10 m^3	235.000	940.000	235.000	10.105.000	470.000	235.000	470.000	235.000	940.000	705.000
Van – 4.5 Tons	0	340.000	0	1.530.000	0	0	0	0	340.000	340.000
Trailer-truck	450.000	450.000	225.000	675.000	450.000	225.000	900.000	225.000	450.000	15.975.000
Trailer	171.000	85.500	171.000	256.500	171.000	171.000	85.500	256.500	171.000	6.498.000
North Station	0	0	0	0	0	0	0	0	0	0
West Station	0	0	0	0	0	0	0	0	0	0
Total Investment (1)	2.305.000	3.057.500	2.494.000	61.832.500	2.747.000	2.494.000	3.939.500	2.993.500	3.971.000	26.209.000
Personnel Cost (COP/year)*										
Personnel Cost (2)	32.371.957	32.848.099	33.324.241	33.880.700	34.276.525	34.511.717	35.223.052	35.544.318	35.940.144	36.657.236
Operating Cost (COP/year)										
Operating Cost (3)	99.276.574	100.762.039	102.247.504	103.952.309	105.218.434	106.045.879	108.358.788	109.236.149	110.502.273	112.645.759
Administrative Costs (COP/year)										
12.8% of the fixed costs (4)	16.851.012	17.102.098	17.353.183	17.642.625	17.855.355	17.991.372	18.378.475	18.531.900	18.744.629	19.110.783
Contingency (COP/year)										
10% of the fixed costs (5)	13.164.853	13.361.014	13.557.174	13.783.301	13.949.496	14.055.760	14.358.184	14.478.047	14.644.242	14.930.299
Grand Total (1+2+3+4+5)	163.969.396	167.130.749	168.976.103	231.091.435	174.046.810	175.098.728	180.257.999	180.783.913	183.802.288	209.553.077

4.2 Recycling

4.2.1 Recycling goal

To promote the recycling of waste left over after reducing generation and making good use of such waste.

In Bogota D.C. recycling will be promoted through the following measures:

- Selective collection of waste
  - Collection of potentially recyclable materials (PRM) by registered recyclers.
  - Provision of selective waste collection services by duly registered and authorized **Recyclers' Organizations Authorized for the Provision of Services** (ORA, acronym in Spanish), after receiving training in administrative and technical matters.
- Composting of organic waste from marketplaces, lawn mowing and yard waste.
- Recycling of cdw
- Other recycling activities

Table 4-33 shows the recycling target rate and Figure 4-9 shows the evolution of the recycling rate goal for each one of the above mentioned measures.

- Short term goal (for the year 2015): 10.8%
- Medium-term goal (for 2018): 12.8%
- Long-term goal (for 2027): 20.2%

Table 4-33: Recycling Rate Goal (%)

Recycling Activity	2012 Current	2015 Short term	2018 Medium term	2027 Long term
Selective collection of potentially recyclable materials	5.4	6.2	6.3	9.7
PRM recovery by recyclers (current)	5.4	0.0	0.0	0.0
PRM recovery by registered recyclers and ORAs	0.0	5.4	2.2	0.0
Selective PRM collection service	0	0.8	4.1	9.7
Organic waste composting	0.0	1.1	2.0	2.8
Cdw recycling	0.0	3.5	4.5	7.7
Total target rate	5.4	10.8	12.8	20.2

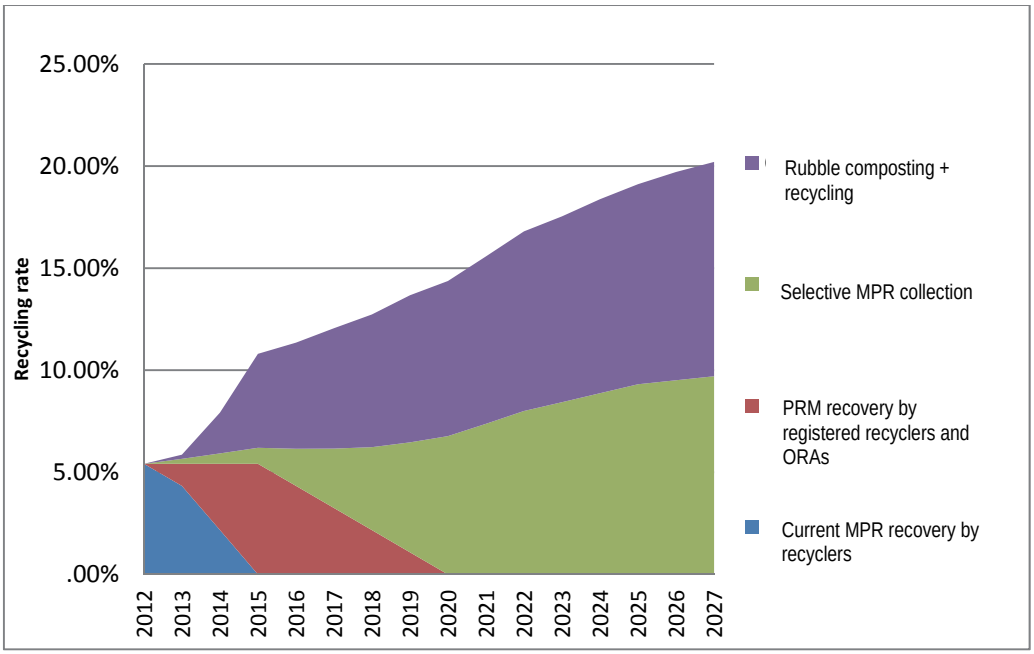


Figure 4-9: Evolution of Recycling Rate Goal by Measure

4.2.2 Selective PRM collection

4.2.2.1 Expansion strategy

a. Short term (2013-2015)

- Structure the PRM recovery system through registration of recyclers included in the census and creation of ORAs.

After the registration and formalization of recyclers their activities should be structured as a PRM recovery system. At the same time, organizations of recyclers will be created and registered, trained in administrative and technical matters, and then authorized as ORAs to provide the service. Each recycler providing the PRM collection and transport service will be paid 87,000 pesos per ton by the Capital District. In addition, different awareness raising activities will be offered to the community promoting PRM separation, such as general communication through the media, community meetings, recyclathons and school education.

- Strengthen the understanding of and collaboration of users regarding waste separation as well as review and structure the operation and administration model for the gathering center by the ORAs through the Alqueria Model Project (AMP).

After determining AMP target area (the Kennedy district and the area currently covered by existing collections routes) the PRM storage and delivery system should be verified by the community and the gathering center operation and management model by the ORAs, in order to structure a utilization service model through feedback processes. Different awareness raising activities will be offered to the community in the target area promoting waste separation, such as recyclathons, school education, community meetings and home visits.

- As part of the expansion strategy for the selective collection service, for the area covered by the existing 73 routes, awareness raising for the community will be strengthened through the activities proposed under the AMP, in order to expand the collection coverage currently being provided in a linear format.

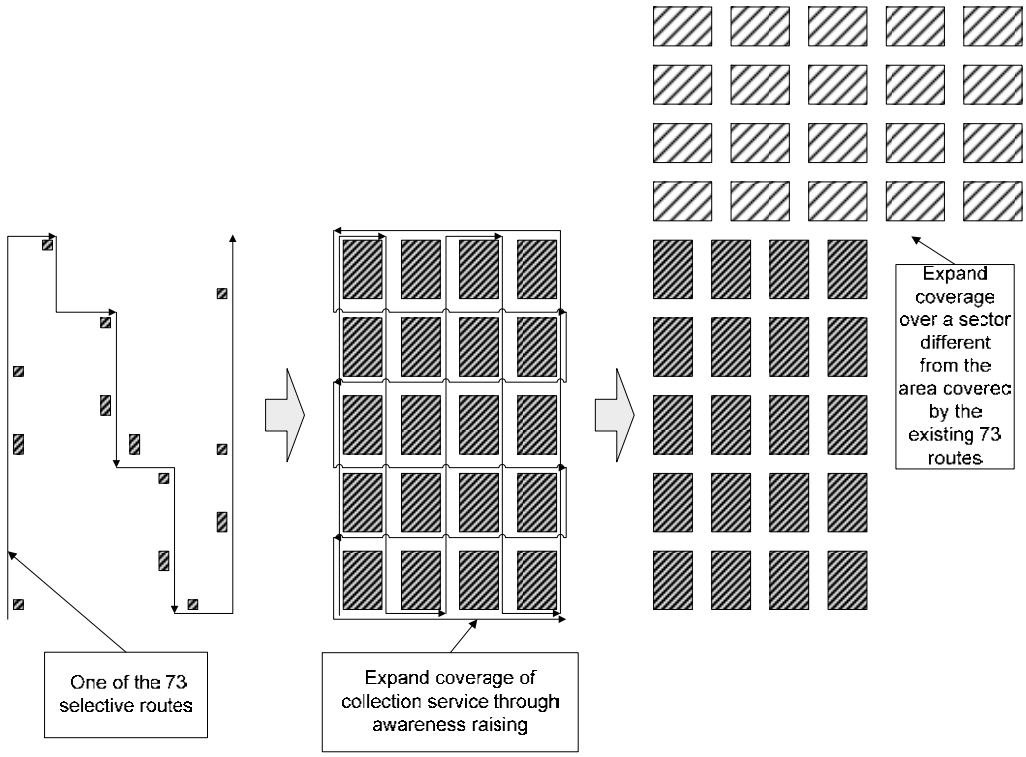


Figure 4-10: Illustration showing the expanded selective collection service coverage

b. Medium term (2016-2018)

- Transition from PRM collection on recyclers' individual routes to selective PRM collection service by ORAs

PRM collection should be gradually changed from the recyclers' individual routes to the selective PRM collection by ORAs provided as a public service. At the same time, different awareness raising activities should be offered to the community, such as general communication through the media, community meetings, recyclathons and school education in order to disseminate the waste separation culture.

- Expansion of the Alqueria model

Based on the coverage expansion strategy proposed for the Alqueria model, the coverage expansion of the target area of the 73 selective routes will be implemented. For the target expansion sector, awareness raising activities will be conducted on PRM separation such as community meetings on home visits.

c. Long term (2019-2027)

- Provision of public service for waste integrated use incorporating from the PRM selective collection and classification to the operation and management of the collection/packing by the ORAs.

The Capital District will determine the area and collection routes both for the sector covered by the existing 73 routes and other sectors to be expanded and will contract with an ORA for each area to provide the integrated use service to include collection and classification activities.

For the sectors targeted for selective collection, awareness raising activities on PRM separation such as community meetings and home visits will be conducted.

4.2.2.2 Development of PRM separation system and mechanism

a. Basic guideline

- Register and formalize recyclers and authorize the succession of individual routes in conformance with the Inclusion Plan. The PRM collected by registered recyclers will be weighed at the warehouses registered as private weighing centers and will be paid at 87,000 pesos per ton. Recyclers will be required to comply with the rules and show the proper attitude.

In order to increase the efficiency of PRM collection, recycler organizations will be created and registered, trained in administrative and technical matters, and authorized as ORAs to provide the service. Once an ORA has been authorized, a registered warehouse should be defined where the PRM collected by such ORA will be taken. In the event that such ORA has a warehouse, such warehouse should also be registered as a weighing center.

- Promote the creation of ORAs and incorporation of existing individual recyclers and private warehouses.
- Gradually consolidate registered warehouses and structure them as gathering centers operated and managed by ORAs.

b. Procedure to develop the system and mechanism

b.1 Registration of recyclers（formalization of recyclers）

The registration of recyclers is accomplished through facilitating their access to banking in order to allow them to receive payment for the services provided. Recyclers included in the census to be provided access to banking are approximately 13,800 persons as shown below.

Table 4-34: Number of recyclers included in the census by district

District		Number of recyclers (individuals) included in the census
1	USAQUÉN	658
2	CHAPINERO	111
3	SANTA FE	799
4	SAN CRISTÓBAL	705
5	USME	700
6	TUNJUELITO	288
7	BOSA	1,167
8	KENNEDY	2,065
9	FONTIBÓN	443
10	ENGATIVÁ	921
11	SUBA	1,385
12	BARRIOS UNIDOS	232
13	TEUSAQUILLO	37
14	LOS MÁRTIRES	463
15	ANTONIO NARIÑO	51
16	PUENTE ARANDA	173
17	CANDELARIA	50
18	RAFAEL URIBE U	704
19	CIUDAD BOLIVAR	2,131
20	SUMAPAZ	7
Other		686
Total		13,776

Source： 2005 Census data

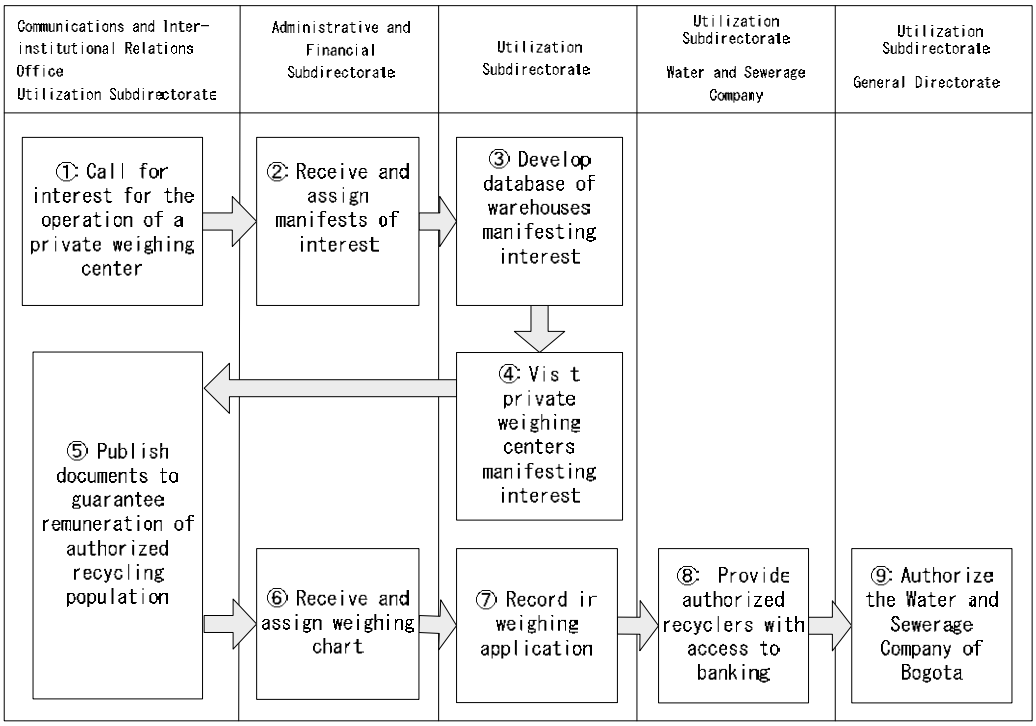
The process for access to banking takes place as follows:

- A call is made to recyclers included in the census through the warehouses by managers in each district (personal visits and phone calls).
- Recyclers are summoned to the corresponding sites to verify their personal data and their inclusion in the census.
- A banking account is assigned.
- The assistance list for access to banking is processed (by weighing the potentially recyclable materials at the registered warehouse, they may receive the payment for the collected PRM volume.

b.2 Warehouse registration

The Figure below indicates the process for the registration of warehouses as weighing centers:

This register allows the payment to recyclers for the provision of the collection and transport service, and to proceed with the formalization and control of the warehouses located in the Capital District.



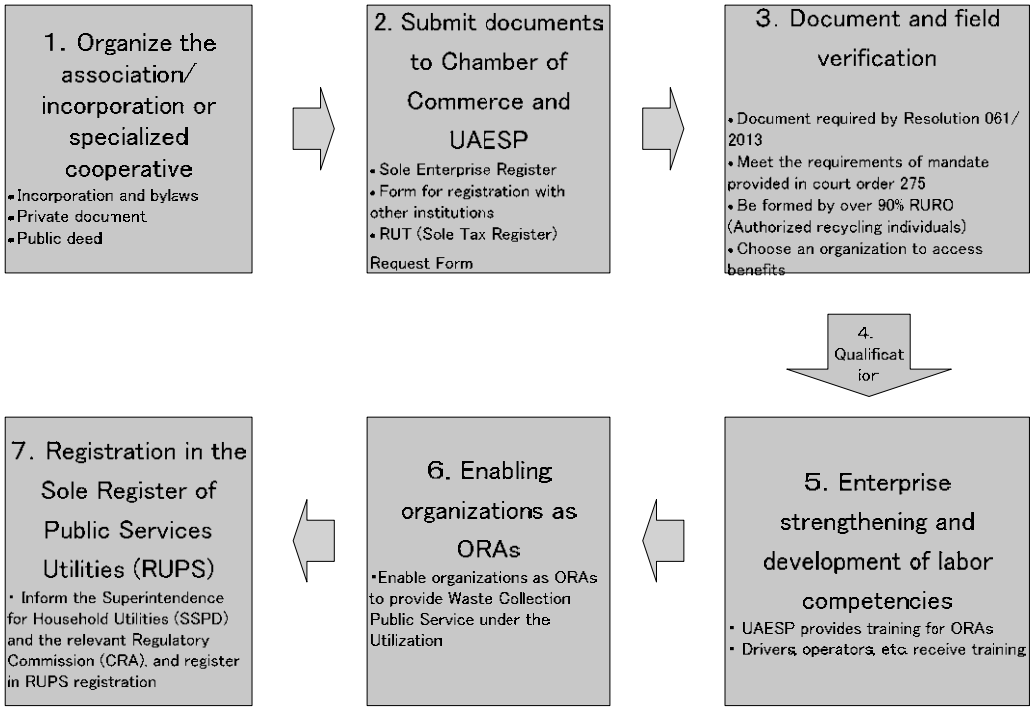
Data source：MANUAL OF PROCESSES AND PROCEDURES (UAESP)

Figure 4-11: Process for the registration of warehouses as weighing centers

b.3 Creation and registration of ORAs

Figure 4-12 shows the trusses for the creation and registration of ORAs.

This process seeks the creation of enterprises to provide the service of collection and transport of potentially recyclable materials in the future; therefore it includes the technical training on the operation and collection activities to facilitate its management and proper operation.



Source: STEPS TO ENABLE ORGANIZATIONS (UAESP)

Figure 4-12: Process for the creation and registration of ORAs

4.2.2.3 AMP review and model building

It is recommended that the Alqueria Model Project (AMP) be implemented with the participation of an established ORA and the support of the Capital District in the area covered by the existing selective collection routes in Alqueria and Kennedy Central, which was chosen as a priority sector. This model project is very important to review the viability and continuity of the following aspects:

- Testing the continuity of an adequate collection and transport service on the existing routes by an ORA composed primarily by local recyclers.
- Analyzing the system of awareness raising in the community, the storage and delivery system, and the collection and transport system in the priority sector where selective collection is to be started.
- Evaluate the Alqueria collection center operation/management status, and the impact of improved facilities and efficient operation.

Table 4-35: Basic AMP sector data

Item	
Sector population（Users）	670,000
Number of existing collection micro-routes	73
Number of neighborhoods	302
Number of districts	16

※Sum of existing selective routes and Kennedy Central

The AMP implementation and evaluation results should be reflected in the expansion plan for the selective collection of potentially recyclable materials as a medium-term plan. The contents of the AMP basic system is explained in chapter 6 “Alqueria Model Project”.

4.2.2.4 Structuring the storage and delivery system

In the short term and until the waste selective collection service has been extended, all registered recyclers and ORAs collect the potentially recyclable materials on their own routes, therefore the community should be made aware of using general mass means primarily so that the potentially recyclable materials are delivered in white bags and the rest in black bags.

The “delivery and storage system” for the collection service will be determined according to the result of the AMP evaluation. Thus, this Master Plan shows the basic AMP system.

a. Classification of waste for delivery

When the selective collection of potentially recyclable materials is carried out, waste should be classified in 2 types: potentially recyclable materials and other waste.

- 2 types of waste (potentially recyclable materials and others)

b. Classification categories of potentially recyclable materials

The Table below shows the classification categories of potentially recyclable materials:

Table 4-36: Classification categories of potentially recyclable materials

Classification categories	
Plastics	(1) PET
	(2) Soft plastics
	(3) Hard plastics
	(4) Polypropylene
	(5) Polystyrene foam
Papers	(6) Office paper
	(7) Newspaper stock
	(8) Corrugated cardboard
	(9) Cartons
	(10) Tetrapack
Metals	(11) Ferrous metals
	(12) Non-ferrous metals (Aluminum)
(13) Glass	

c. Delivery frequency

Delivery frequency of potentially recyclable materials will be once a week and will have to be coordinated for a different day than delivery of other waste.

Table 4-37: Delivery frequency by type of waste

Type of waste	Delivery frequency
Potentially recyclable materials	Once a week
Other waste	3 times a week

d. Delivery schedule

A daytime collection schedule is advisable in order to avoid mixing with other waste. The delivery schedule should be determined by sector and this information should be disseminated to the community.

For example, if 2 trips are run per day（4 hours/trip×2 trips), the collection schedule would be 8 hours（7:00am～16:00pm）, considering the following delivery schedule.

Table 4-38: Delivery and collection schedule

Category	Community delivery time	Collection time
Morning collection	Delivery until 7:00 am	7:00 - 11:00
Afternoon collection	Delivery until 12:00 m	12:00 - 16:00

e. Container and delivery method

Delivery containers should be determined in order to avoid mixing with other waste.

For the household waste collection sector, no delivery container needs to be determined, since the delivery day for potentially recyclable materials is different than the delivery day for other waste. However, an adequate guidance is necessary regarding the form of delivery for pamphlets and other printed media. For example, bulky waste such as cardboard and polystyrene foam should be delivered in tied bundles.

For residential complexes, a container for potentially recyclable materials should be established and building administrators (administrative companies) should be oriented with regard to delivery methods and enforcement measures to be followed by residential complex users.

For commercial sectors collection takes place every day, therefore indications should be provided to establish dedicated containers exclusively for potentially recyclable materials.

f. Delivery site

Delivery site for households and grocery stores as well as for the delivery of other waste is at curbside（side corner).

For residential complexes there is an established delivery site, however in many instances such site is not exclusive for the potentially recyclable materials and is used for other combined waste. Consequently, administrators (administration companies) in residential complexes should be oriented in the separation of the container for potentially recyclable materials from other waste.

As regards large-quantity generators delivery sites should be individually agreed upon. The potentially recyclable materials generated by large-quantity generators are basically collected by contracting private companies at the expense of such generators.

4.2.2.5 Structuring the collection and transport system

a. Guideline for the planning the collection and transport system

Table 4-39 shows a summary of the collection and transport system for each planning term.

For the short-term, the collection of potentially recyclable materials will continue to use the existing method on the individual routes of registered recyclers, and for the sectors covered by the existing 73 routes the selective collection service will be provided by an ORA.

For the medium and long term, with the expanded selective collection service for potentially recyclable materials, the system will move to the structured collection and transport system based on the AMP evaluation results. Consequently, this Master Plan shows the basic AMP collection and transport system.

Table 4-39: Summary of collection and transport system for each planning term

Term	Collection agent	Collection routes	Collection equipment	Collection fee	Dissemination of information to users
Short (2013-2015)	Registered recyclers	Individual routes	Carts, horse-drawn carts	87,000 pesos/ton	Communication through general mass media
	ORA	Sectors covered by the 73 selective routes	Container dump truck (6 t)	Contract with Capital District	Awareness raising on waste separation by community meetings and individual home visits
Medium (2016-2018)	ORA	Sectors covered by the 73 selective routes and other expanded areas	Container dump truck (6 t)	Contract with Capital District	Awareness raising on waste separation by community meetings and individual home visits
Long (2019-2027)	ORA	Sectors covered by the 73 selective routes and other expanded areas	Container dump truck (6 t)	Contract with Capital District	Awareness raising on waste separation by community meetings and individual home visits

b. Collection method for the selective collection service of potentially recyclable materials

b.1 Collection system

The basic collection and transport system operates as follows:

- Collection service is provided on specified routes.
- Collectors load waste delivered by generators directly onto the collection vehicle.

- Collection is basically carried out by one driver and 2 collectors.
- Collection is performed at a specific time and informed to users.
- A special tune is played to warn users about arrival of collection vehicle.

b.2 Selection and required number of collection vehicles

b.2.1 Vehicle selection

Even though loading capacity is an issue to be considered, an open loading truck is recommended for collection purposes in order to ensure efficiency in both the classification and quality of classified waste at the gathering centers. The vehicle should also have the adequate structure to operate in rainy conditions and avoid the scattering of collected waste along the route. In order to facilitate loading and unloading operations at the gathering centers, it should be a dump-truck type.

b.2.2 Required number of vehicles

The required number of vehicles for the collection of potentially recyclable materials has been calculated.

The table below indicates the calculation parameters.

The results of the calculation indicate that the number required will be 29, 143 and 359 units for 2015, the short-term target year, 2018, the medium term target year and 2027, the long-term target year, respectively.

Table 4-40: Basic conditions for the vehicle to be used in selective collection of potentially recyclable materials

Item	Amount	Note
Type of vehicle	Container dump truck	
Vehicle loading capacity (weight)	$27m^3$ (6 ton rating)	
Apparent density	0.056 tons/m^3	Value measured at Alqueria
Maximum load when loading waste	1.5t/trip	27×0.056
Collection trips per day per vehicle	2 trips/day	
Sum of load amount per vehicle	3.0 tons/day	1.5×2
Required number of vehicles		(Amount of potentially recyclable materials)／3.0 ton

Table 4-41: Evolution of the amount of potentially recyclable materials collected and required number of vehicles

Year	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Amount of PRM (t/day)	27	55	85	194	308	427	561	700	756	814	874	935	997	1,036	1,074
Number of vehicles	9	19	29	65	103	143	187	234	253	272	292	312	333	346	359

Table 4-42: Required number of vehicles for target years

Year	2015 Short term	2018 Medium term	2027 Long term
Amount of collection of potentially recyclable materials for the selective collection service (tons/day)	85	427	1,074
Required number of vehicles	29	143	359

b.2.3 Designation of collection routes

Collection routes in the target sectors should be designated considering the following:

- Establishing the load amount (capacity) per collection vehicle：1.5 tons/trip/vehicle (see Table 4-10).
- Establishing the number of households that can be covered by a vehicle and a trip：1.5 tons ÷ 4.284 kg＝350 households

The calculation considered that 100% of the households are participating in the selective collection; however, the participation rate should be actually calculated based on the AMP results.

If the target sector includes a commercial sector and/or large quantity generators, this should be taken into account for the calculation.

- Average collection amount per person：0.71kg/person/day
- Amount of potentially recyclable materials per person (20% of collected waste amount)：0.71×20%＝0.142kg
- Amount of potentially recyclable materials collected (including 20% rejects)＝0.142kg×120%＝0.17kg/person/day
- Average number of persons per family＝3.6 persons/family
- Collection frequency ＝once/week (7 days)
- Amount of potentially recyclable materials collected per household (including rejects)＝0.17×7×3.6＝4284 kg/household/week

- The target sector is divided into 350 households and the required number of vehicles is then established.

Required number of vehicles ＝ (total number of households) ÷ (350 × (number of trips per vehicle) × 6 days)

- Collection days：6 days/week

- Establishing collection sector

- The target sector is divided by 6 blocks (6 collection days) ：Number of households in a block＝350 households×number of trips/day/vehicle×number of collection vehicles

- One block is divided by the number of collection vehicles：Number of households served by one vehicle＝350 households×number of trips

b.2.4 Collection Operation Management System

Table 4-43 shows a summary of the Collection Operation Management System

Table 4-43: Collection Operation Management System

Item	Content
Number of persons for collection	• Administrative section：5 • Driver：1 person×number of vehicles＋supplies • Collector：2 persons×number of vehicles＋supplies
Vehicle management system	Structuring the vehicle management system as indicated below to avoid difficulties in the provision of the service, including the following aspects: • Obtaining the required parking space. • Promoting vehicle neatness after the operation • Developing and disseminating the daily and periodic inspection manual • Having the adequate equipment for daily inspection • Conducting the management of vehicles and structuring the management system
System for the management of collection workers	In order to guarantee security for workers and offer reliable service to users, a system for the management of workers should be structured, including the following aspects: • Implementing training for the operation of a safe, efficient and polite collection service. • Health control • Mandatory use of uniform and safety protection gear

4.2.2.6 Organization of gathering centers

a. Organization guideline

For the extended collection of potentially recyclable materials the organization of registered warehouses and new gathering centers should be developed.

a.1 Short term (2013-2015)

The warehouses registered should be converted in the gathering centers of potentially recyclable materials to be recovered by registered recyclers and ORAs. In this fashion the amount of recovered materials can be properly identified. The existing warehouses have limited areas, therefore they operate as space used for the selection of recyclable materials that arrive with a certain degree of separation, to be stored and shipped to other larger gathering centers or recycling companies. With the extended selective collection service registered warehouses should be merged and converted in gathering centers.

a.2 Medium and long term (2016-2027)

The land surface of existing warehouses is very limited and quite often less than 200m^2, which makes it difficult to be utilized as gathering centers where, according to the Alqueria model, other activities from classification to transformation or pre-transformation of materials will be carried out. In addition, it is difficult to obtain land for gathering centers with a capacity of 30 tons/day in the city (a land plot of over 5,000m^2 is required).

In the future, with the expanded selective collection service, gathering centers with a capacity of 30 tons a day should be organized in each one of the 6 ASEs by integrating registered warehouses or as new developments, based on the Alqueria collection/packing model.

The required number of gathering centers is calculated based on the amount of potentially recyclable materials collected per ASE in 2027. According to the results 36 gathering centers will be required for 2027.

Table 4-44: Calculation of the required number of gathering centers (with a 30 tons/day capacity)

ASE	District	Population		Collected amount of potentially recyclable materials ※3		Required number of gathering centers (corresponding to facilities with a scale of 30 tons/day)
		Year 2015※1	Year 2027※2	By district	By ASE	
		(Persons)	(Persons)	(tons/day)	(tons/day)	
1	USAQUÉN	494,066	626,595	72	243	8
	SUBA	1,174,736	1,489,849	171		
2	FONTIBÓN	380,453	428,704	49	162	5
	ENGATIVÁ	874,755	985,696	113		
3	CHAPINERO	137,870	155,355	18	99	5
	SANTA FE	110,053	124,010	14		
	BARRIOS UNIDOS	240,960	271,520	31		
	TEUSAQUILLO	151,092	170,254	20		
	LOS MÁRTINES	98,758	111,283	13		
	CANDELARIA	24,096	27,152	3		
4	TUNJUELITO	200,048	225,419	26	148	5
	PUENTE ARANDA	258,414	291,187	33		
	CIUDAD BOLIVAR	687,923	775,169	89		
5	SAN CRISTÓBAL	406,025	457,519	53	172	5
	USME	432,724	487,604	56		
	ANTONIO NARIÑO	108,941	122,757	14		
	RAFAEL URIBE U	375,107	422,680	49		
6	BOSA	646,833	820,341	94	250	8
	KENNEDY	1,069,469	1,356,345	156		
	SUMAPAZ	6,460	6,656	1	1	0
Total		7,878,783	9,356,097	1,074	1,074	36

※1：Predicted population based on DEMOGRAPHICS

※2：The population growth index between 2005 and 2015 is 2% per year in ASE1 and 6.1% in ASE2 to 5. This growth rate for each ASE is used to predict the 2027population.

※3：The amount of waste collected in each district in the year 2027, is divided into the total amount collected in the population

b. Organization schedule for gathering centers

The following schedule for the organization of gathering centers is established in accordance with the expanded selective collection of potentially recyclable materials:

3 gathering centers for the short term, 15 for the medium term and 36 for the long term will be required.

Table 4-45: Evolution of the amount of potentially recyclable materials (PRM) collected and schedule for the organization of gathering centers

Year		Short-term			Medium-term			Long-term								
		13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Amount of PRM collected (tons/day)		27	55	85	194	308	427	561	700	756	814	874	935	997	1036	1074
Amount of PRM recovered (tons/day)		17	35	56	132	216	307	415	532	590	651	699	748	798	828	860
Gathering centers developed	Per year	1	1	1	4	4	4	4	5	2	2	2	2	2	1	1
	Cumulative total	1	2	3	7	11	15	19	24	26	28	30	32	34	35	36

c. Summary of organization of gathering centers

c.1 Summary of facility

The table below shows a summary of the facility.

Table 4-46: Summary of the facility (30 tons/day)

Item		Content	
1. Raw materials			
	Waste to be treated	Potentially recyclable materials, separated and collected in the city	
	Amount received	30 tons/day	
	Water content	～10%	
	Apparent density	40 kg/m^3	
2. Summary of the facility			
	MRF method	Manual separation + Magnetic separator	
	Treatment line	1 line	
	Capacity	30 tons/day (1.54 tons/hour)	
	Operational period	312 days/year	
		19.5 hours/day (2 shifts)	
3. Recovery categories (breakdown of established weight)			
		tons/day	Wt %
	(1) PET bottles	3.4	11.4
	(2) Soft plastics	3.5	11.7
	(3) Hard plastics	2.8	9.3
	(4) Polypropylene	0.1	0.3
	(5) Bond papers (office paper)	3.3	11.0
	(6) Newspaper stock	2.6	8.7
	(7) Cardboard	3.4	11.3
	(8) Ferrous metals	1.4	4.7
	(9) Non- ferrous metals	0.1	0.3
	(10) Glass	3.3	11.0
	(11) Rejects	6.1	20.3
	Total	30.0	100.0
4. Primary equipment			
	Feeding equipment	Conveyor belt and hopper	
	Bag-tearing machine	With pressure air cylinder	
	Conveyor belt for manual separation	Flatbed conveyor	
	Magnetic separator	Suspended electromagnet	
	PET sorting	Tabletop	
	PET baling press	Hydraulic with string bundling	
	Cardboard baling press	Hydraulic with string bundling	
	Metal baling press	Press (ferrous metals and aluminum)	

c.2 Classification flow

The following Figure shows the classification flow.

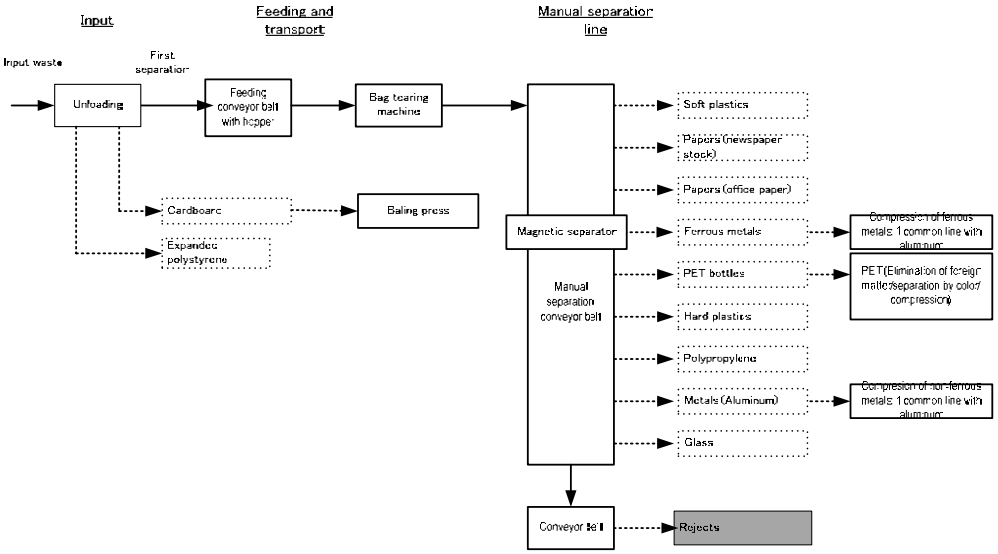


Figure 4-13: Classification flow diagram (30 tons/day)

c.3 Facility layout plan

The Figure below shows the facility layout plan.

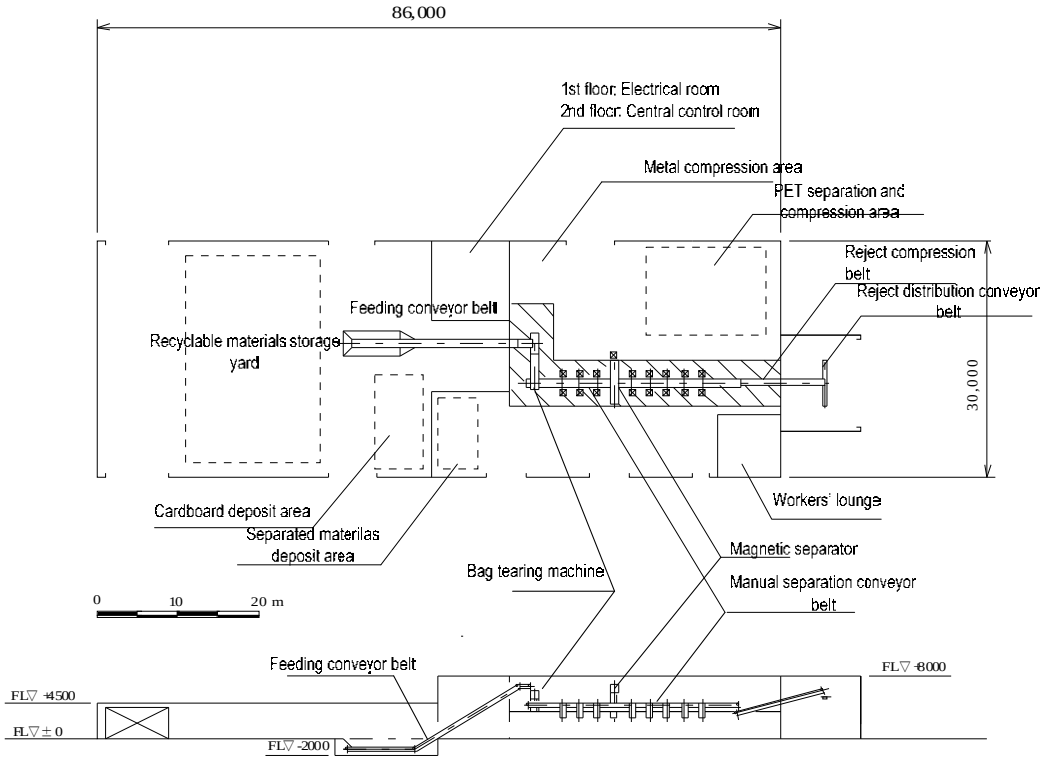


Figure 4-14: Layout plan (30 tons/day)

c.4 Operational plan

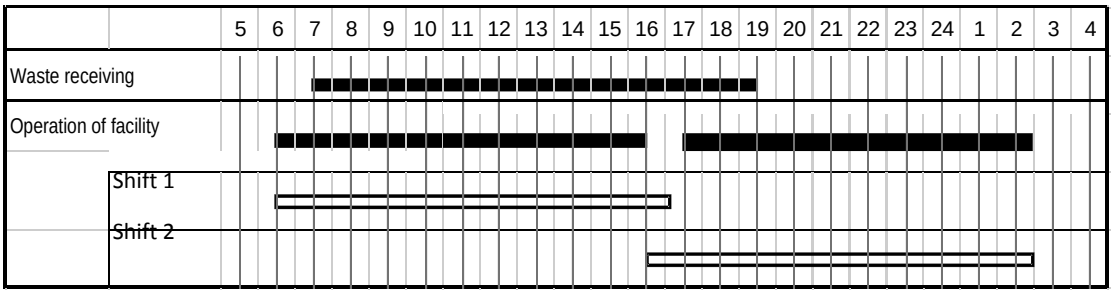
Following is an operational plan from the input waste receiving end to the shipping of recovered materials.

c.4.1 Operating hours

The following operating hours are established:

- Monday through Saturday: 05:30 - 03:00 of the following day (21 hours 30 minutes)
- Sunday Off
- Waste receiving 7:00 - 19:00 (12 hours)
- Operating hours 19.5 hours/day
- Line 1 line
- Shifts 2 shifts

Table 4-47: Operating hours



c.4.2 Heavy machinery equipping plan

The table below shows the heavy machinery equipping plan:

Table 4-48: Heavy machinery equipping plan

	Machinery	Specifications	Quantity	Unit
1	Wheel load truck	1.2 m^3	1	Each

c.4.3 Work by section

The table below shows the workload by section:

Table 4-49: Workload by section (30 tons/day)

Section	Workload
Management	・Manages the facility. ・Measures and registers weight of infed waste to the truck scale,

Section	Workload
	voucher issuing, etc. ・Manages electrical systems such as the substation equipment.
Receiving (infed waste)	・Separated waste collected throughout the city is received. ・Measures weight of waste fed into truck scale. ・Bulky waste such as cardboard and polystyrene foam which are difficult to handle on the manual separation line manual is separated in the storage yard of potentially recyclable materials. ・After the separation of bulky waste, potentially recyclable materials are fed to the in-feed conveyor hopper with the wheel loader. ・Separated cardboard is compressed with the exclusive baling press.
Manual separation	・Responsible for the operation and administration of facility main equipment and the management of the central control panel and onsite control panels. ・The manual separation section is located on the second floor and the separated materials are deposited in the recovery bins placed on the first floor through a duct (chute). Whole glass bottles are deposited in a box placed in the manual separation section. ・Waste transported from receiving are fed onto the manual separation conveyor belt, and manually separated by categories as defined above. Ferrous metals are mechanically separated by the magnetic separator. ・Given that potentially recyclable materials are generally delivered in plastic bags or cardboard containers, a bag-tearing machine needs to be installed. [Definition of order of articles to be separated] ・In order to increase the efficiency of separation soft plastics and papers of an apparently high density should be separated first. ・Second, ferrous metals are separated by the magnetic separator. ・Third, PET bottles and hard plastics are separated. ・As far as glass bottles, to avoid breakage, they are recovered in an exclusive recovery basket placed on the side of the corresponding worker. ・Potentially recyclable materials separated by workers are run through the ducts (chutes), separated by article and deposited in an exclusive recovery bin under the duct.
Recovery of separated materials	・Transports and stores potentially recyclable materials separated to a designed site. ・Separated PET bottles are first transported to the separation table where foreign matter such as labels and caps are eliminated, and then classified by color. Metals separated in ferrous and non-ferrous go through compression treatment.
Shipment of separated materials	・Rejects that are generated in the manual separation line are deposited in an exclusive container. ・Once a container is completely filled, the conveyor belt is operated in the reverse direction, to transport rejects to the other container. The filled container is taken outside for reject disposal.

c.4.4 Worker assignment plan

The table below shows personnel assignments:

Table 4-50: Worker assignment plan (30 tons/day)

Section			Shift 1	Shift 2	Total
Management					
	Manager		1 (08:00-17:30)		1
	Accounting		1 (08:00-17:30)		1
	Office clerk		2 (08:00-19:30)		2
	Total		4		4
Operation					
	Receiving				
		Equipment operation			
		Equipment operator	1	1	2
		Waste receiving			
		Wheel load truck's driver	1	1	2
		Workers	4	4	8
	Manual separation				
		Supervisor	1	1	2
		Workers	24	24	48
		PET bottle separation	5	5	10
	Recovery of separated materials				
		Workers	3	3	6
		Cardboard baling press	1 (07:00-16:30)		1
		PET baling press	1 (07:00-16:30)		1
		Metal compactor	1 (07:00-16:30)		1
	Shipping of recovered materials				
		Workers	1	1	2
	Total		43	40	83
Total			47	40	87

The number of workers to be assigned to the manual separation conveyor belt has been calculated according to the infed volume of potentially recyclable materials and the efficiency of the separation. Whenever there is an odd number of workers, one more person is added to make it an even number, considering the arrangement of workers on both sides of the conveyor belt.

The table below shows the values established for the weight of potentially recyclable materials recovered on the conveyor belt by type. These values are obtained when the rate of potentially recyclable materials in the infed waste is 20% to 30%. As far as the waste fed into the MRF in Bogota, the potentially recyclable materials rate is estimated to be 70% to 80%; therefore the weight of each material recovered will have a higher value. This value of the recovered weight

should be checked in accordance with the operational results of the Alqueria collection/packing pilot project.

Table 4-51: Weight recovered by type of potentially recyclable materials in the manual separation conveyor belt (after initial separation and bag opening)

Name of recovered material	Condition and form of recovered material	Weight recovered per hour per person (kg)
Papers	Magazines in original form Other in sheets	240
Plastic film	Sheets	180
Textiles	Cutout	180
Non-ferrous metals	Flattened form	50
Hard plastics	Pieces	60
Glass cullet	Pieces	120
Soft plastics (containers)	Original form	240

Note) This table shows the weight recovered by type of material when the manual separation is performed after the initial separation and bag opening. This will be used to calculate the number of workers to be assigned to the manual separation such as the manual separation with the conveyor belt. These values can change depending on the quality of waste.

4.2.3 Recycling organic waste

4.2.3.1 Organic waste to be recycled

Of all the organic waste generated in Bogota D.C. and collected by the sanitation utility company marketplace waste, lawn mowing waste and yard waste can be recycled as compost. The table below shows the amount of organic waste generated to be recycled and the recycling rate.

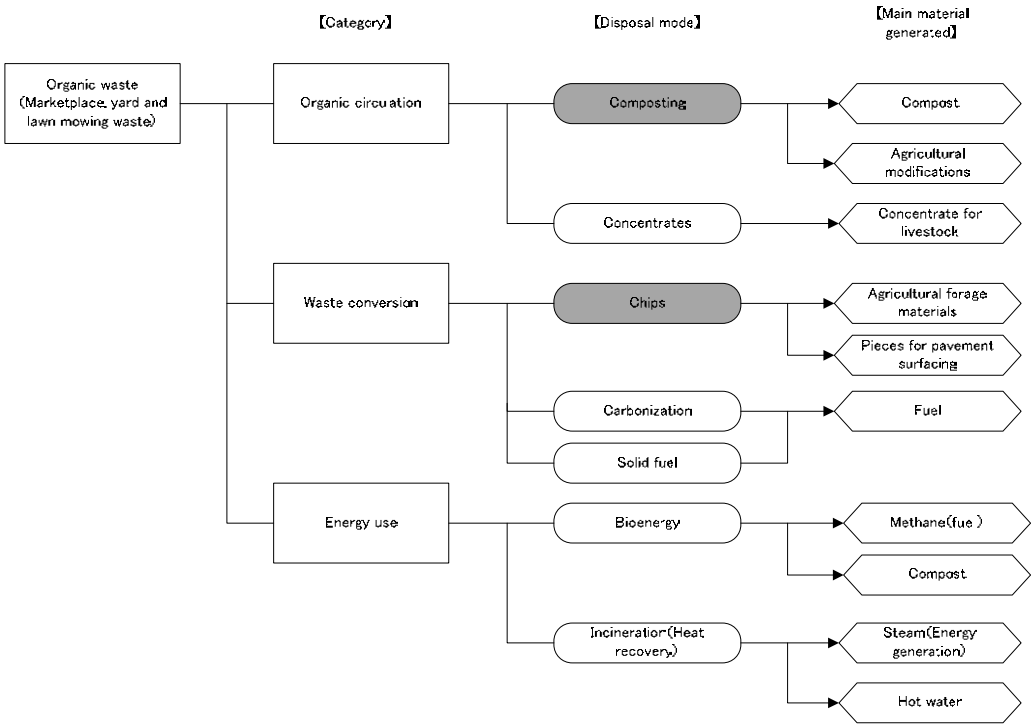
The recycled amount and rate over the amount of organic waste to be recycled are: 79 tons/day (76%) in the short term, 148 tons/day (82%) in the medium term, and 249 tons/day (90%) in the long term.

Table 4-52: Generated and recycled amounts and recycling rate for target organic waste to be recycled

Year	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
	Short term			Medium term			Long term								
Amount of generated target organic waste to be recycled (tons/day)	11	51	103	127	154	180	208	223	238	254	259	264	267	272	277
Marketplace	5	15	30	41	53	64	77	89	102	115	118	120	122	124	126
Lawn mowing	5	28	57	67	79	90	102	104	106	108	110	112	113	115	117
Yard waste	1	8	16	19	22	26	29	30	30	31	31	32	32	33	34
Amount of target organic waste recycled (tons/day)	8	37	79	100	123	148	175	192	210	229	233	237	241	245	249
Marketplace	4	11	23	32	42	53	64	77	90	104	106	108	109	111	113
Lawn mowing	3	21	43	53	63	74	86	89	93	97	99	100	102	104	106
Yard waste	1	6	12	15	18	21	25	26	27	28	28	29	29	30	30
Recycling rate (%)	70	73	76	79	80	82	84	86	88	90	90	90	90	90	90

4.2.3.2 Technique for the recycling of biowaste and yard waste

Generally, the recycling of biowaste and yard waste is classified in organic circulation as composting and concentrates, the conversion of yard waste in chips (pieces) of wood and carbonization, the generation of biogas or the use of energy for incineration. The figure below shows the recycling techniques for biowaste and yard waste that are currently used. In this Master Plan, the recycling of target organic waste as compost is recommended. The yard waste needs the chip pre-treatment for recycling purposes.



Data: Commission made up of the 7 target departments to research the solid waste issue (2000)

Figure 4-15: Biowaste and yard waste recycling technique

4.2.3.3 Composting

Composting is a process to produce fertilizers with organic waste as biowaste and yard waste through the decomposition generated by microbes existing in nature, without affecting the environment, to a soil-reducible condition. This composting method has been used to recycle biowaste and yard waste for some time.

Composting brings about benefits, in addition to recycling and waste minimization, such as the decomposition of unstable organic matter, the supply of soil fertilizers, the elimination of dirty appearance, the inertization of microbes, plagues, weed seeds, etc. On the other hand, in order to produce good quality fertilizers there is a need to reduce the content of foreign matter in biowaste and yard waste and it is also required that the fertilizers produced is ensured for users and countermeasures are taken to remove the emitted bad odors near the surrounding areas.

The Figure below shows the flow diagram for the disposal by fermentation and composting.

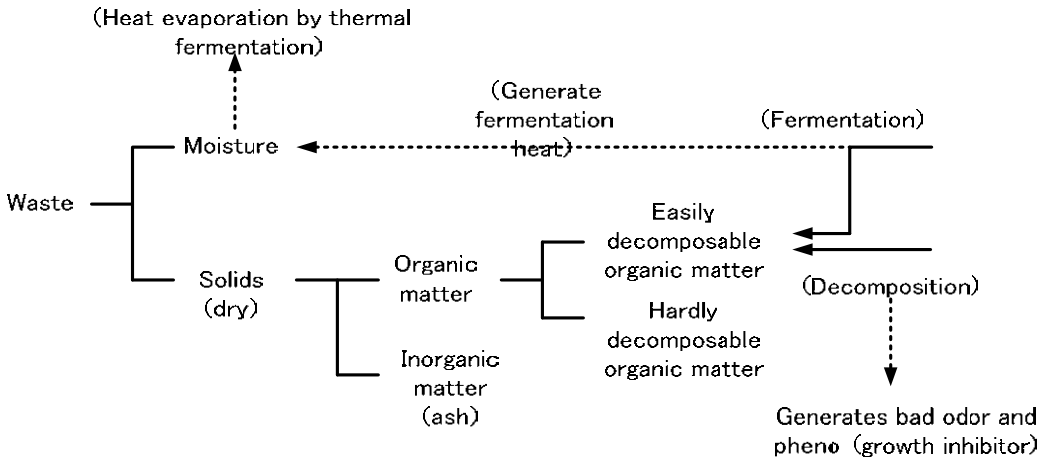


Figure 4-16: Flow chart showing disposal by fermentation (Composting)

In order to stimulate decomposition of organic waste it is important to create an environment favorable to microorganisms. The major environmental factors are the following 5: oxygen, temperature, pH of raw materials, water and C/N ratio. If one of them is insufficient, proper decomposition fails to occur. These 5 factors also influence each other.

a. Oxygen

The decomposition of organic waste occurs by aerobic microorganisms consuming a high amount of oxygen. Given the high amount of oxygen consumed in the raw material it is important to supply oxygen to the raw material in the composting process. Therefore, straw needs to be mixed into the raw material to ensure airing, force ventilation (if too strong, temperature drops) or the supply of oxygen and ensure airing by mixing the raw material, for example by turning. If the raw material contains a lot of water and/or the granulometry of the raw material is high, neither airing nor a sufficient oxygen supply will be ensured, and therefore decomposition will not be sufficient.

b. Water

Microbes live and proliferate in water. Therefore the water content in the raw material has to be essentially high. Water content of 50 - 60% w.b. is generally considered suitable to keep the appropriate water content level, otherwise if it is low water should be added and if it is high it should be regulated by mixing ancillary matter such as straw or by heating it up.

c. Temperature

There are 2 temperature bands where the composting process develops more actively which are associated with two types of microbes. One of them is a group of mesophile bacteria

which are activated at medium temperatures (30℃ - 50℃) and the other is a group of hyperthermophilic bacteria activated at high temperatures (50℃ - 65℃). The decomposition rate is higher on the high temperature band, and increasing the temperature to the high band is also better for hygienic reasons in order to inertize pathogens, pathogen eggs, viruses and weed seeds. The US Environmental Protection Agency requires to keep it for more than 3 days at a temperature above 55℃.

d. pH of raw material

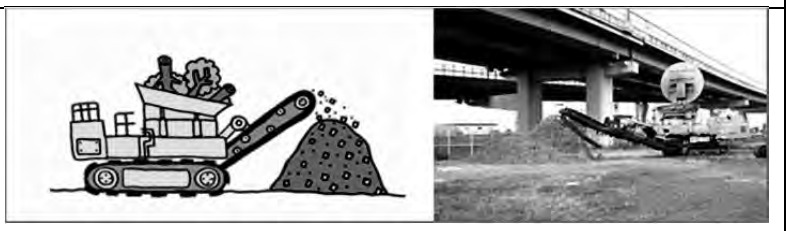
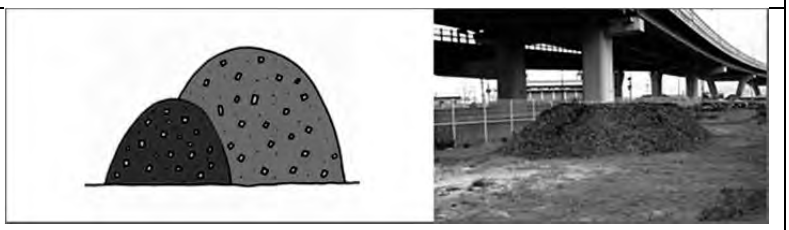
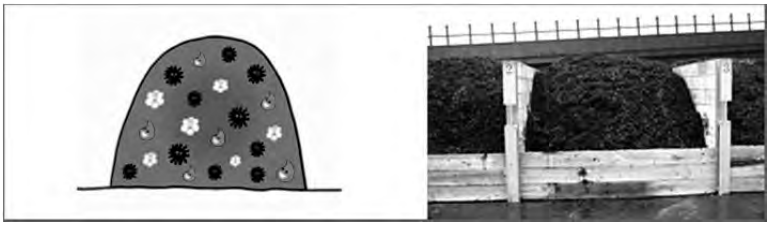
When the pH descends below 5 approximately, decomposition ceases, and with an increase in pH, the composition is accelerated and reaches a maximum pH of 9. If it tends to be alkaline, this means that the composting process is advancing very positively. The lactic acid and the acetic acid decompose and proteins decompose in ammonia, therefore the fertilizer will be alkaline. In a large-scale composting facility the raw material is mixed with calcium hydroxide or with the fertilizer that is completely decompose and alkalinized, in order for the fertilizer to be forcefully alkaline.

e. C/N ratio

The C/N ratio is obtained by dividing the amount of carbon (C) contained in the raw material by the amount of nitrogen (N). Microbial activation depends on what nutritious elements require substances constituting such microbe. Among the nutritious elements the carbon to nitrogen ratios add to the activation of microbes. Generally, when the C/N ratio is 10 to 30, decomposition advances at a faster rate. Urban waste tends to have a high C/N ratio, consequently, ammonium chloride or ancillary materials with high nitrogen content are sometimes added to increase the amount of nitrogen and obtain an adequate C/N ratio. If the fertilizer having a high C/N ratio is directly applied to the field, it may cause a lack of nitrogen, whereas if the fertilizer containing a low C/N ratio is applied to the crop, it may cause an excessive amount of nitrogen.

f. Yard waste chipping

It is a technique to chip yard waste, grass and fallen leaves with a crusher. The chips produced argues as materials for conditioning land (land conditioners), stratum, paving material, padding material, cattle bedding, carbonization material, material for paper manufacturing and boiler fuel. At the composting plant, it is mixed with biowaste as a pretreatment to produce composting.

Urban green area	
Yard waste	
Gathered yard waste	
Yard waste chipping	
Obtaining raw material chips	
Recycling (1) Stratum	
Recycling (2) Composting (1) (preparation and maturing)	

Recycling (2) Composting (2) (Turning)	
Recycling (2) Composting(3) (Finished)	
Chip transformation	 A few weeks after gathering Quasi-finished Most advanced state of decomposition

Data: Web page of the Kishiwada Tree-Planting Association Foundation at the city park


Mobile chipper

Data: Machinery donated by JICA for the solid waste minimization and recycling promotion project in Fiji

4.2.3.4 Aspects to consider when applying composting techniques

a. Quality

- The primary chemical compounds for composting are: water, pH, ammonium nitrogen, nitric nitrogen, fertilizer compound ratio (NPK) and concentration of heavy metals (oligoelement: copper, zinc) and the differences in waste generated in each sector should be considered.

- Organic waste has a high fertilizing effect, but while the organic waste with a high meat or fish content has a high fertilizing effect, the fertilizing effect is low in organic waste having a high vegetable content. Thus the product effect may vary. Therefore, some measures need to be taken to increase the fertilizing effect and reduce the fluctuation in product quality, by mixing various types of organic waste or cattle manure.
- The fertilizer is required to contain a stable compound in a high concentration. Therefore, food waste is not used as raw material for regular fertilizers but for special fertilizers and soil conditioners.
- Cooperation from grocery stores for the separation of materials is needed.
- Yard waste chipping is required.

b. Marketability

- Conditions needed by farmers to utilize compost as a fertilizer:
  - ✓ It should be less costly than other existing composts.
  - ✓ It should have a stable compound or the compound has to facilitate use.
- Given that the price of compost is low, if the cost to produce it is not below the cost of food waste disposal, the business cannot be established as viable. Consequently, in order to have a viable business, local distribution would need to be established without generating any collection and transport cost.
- Food related enterprises should try to structure a composting system as a successful operation, from the perspective of disposal and effective use of food waste. To this end they should avoid any combination with foreign matter, furnish the information regarding the food waste component and organize a purchasing system for the agricultural products cultivated along with the compost.

c. Other recycling techniques

The table below shows a summary of the major biowaste and yard waste recycling techniques, including composting and chipping.

Table 4-53: Summary of different biowaste and yard waste recycling techniques

Treatment method	Summary of technique
Composting	A technique used to decompose organic waste such as biowaste and yard waste with the microbial function existing in nature to a soil-reducible condition, without affecting the environment. It is known as composting and has been used as a waste disposal method for quite some time. There are cases where composting is made only with biowaste from households and yard waste, or combined with the slurry from human waste treatment plant and cattle manure.
Concentrates	A technique to make powder concentrates through a biowaste thermal processing and drying and the adjustment of fat content. Concentrates made of fresh biowaste and of certain types are called “eco-foods (eco-concentrates). To make concentrates, it is very important that organic waste, which are raw materials, have not deteriorated; therefore the processing should be performed on a site close to the waste source.
Wood chipping	It is a yard waste chipping technique for lawn mowing and fallen leaves with a crusher. The chips produced are used as earth conditioners, stratum materials, paving materials, padding materials, cattle bedding, carbonization material, material for paper manufacturing, boiler fuel and raw materials for biogas. At the composting plant, compost is sometimes mixed with biowaste as a pretreatment to produce composting.
Carbonization	Waste carbonization technique (with only carbon as residue), heating it with little oxygen or no oxygen. Carbides produced are used as auxiliary fuel (carbon alternative) in thermal carbon plants and cement factories and as an auxiliary reducing agent (coke alternative) in steel mills. In order to perform carbonization, a limited amount of clients should be secured to purchase the produced carbides.
Solid fuel	Obtained through thermal compression of fuel waste, including biowaste and yard waste. Solid fuel also produces RDF (Refuse Derived Fuel) and is used to generate energy and as boiler fuel. To produce solid fuel, as with carbonization, clients should be ensured sale destination and types of clients should be limited.
Biogas	Technique for fermenting biowaste without oxygen and generating biogas containing mainly methane and monoxide, with the effect of anaerobic microbes such as methanogenic bacteria, a process also called methanization or methane fermentation. Biogas produced is used for energy generation in gas engines, gas microturbines and fuel cells and also uses the residual heat. It is likewise used as alternative energy for vehicle petrol, after refining the biogas methane. Fermentation waste is separated into solid and liquid fuel and each can be used as solid fertilizer and liquid fertilizer (the use of liquid fertilizers is rare).
Incineration (heat recovery)	A form of disposing fuel waste delivered including biowaste and yard waste through high temperature incineration at an incineration plant to reduce quantity and volume, also good to avoid decomposition and establish soil condition. Heat generated by incineration is recovered at the boiler and its residual heat is used for energy generation. In the gasification and melting method fuel waste is divided into fuel and carbon, gas and carbides generated in the melting furnace are introduced in and incinerated at a temperature above 1,300 degrees Celsius to generate molten slag. The heat generated is recovered and used in the same fashion as in an incineration plant. Establishing the effective use of the slag generated is required.

Data: Recycling Research Board in the Ashigarashimo district, city of Odawara

4.2.3.5 Summary of composting facility

The composting plant operates to apply an aerobic treatment to organic waste collected in the city, such as marketplace, yard waste and lawn mowing waste to convert it in compost.

The table below shows the composting plant configuration:

Table 4-54: Composting plant configuration

Item	Content
1. Raw materials	
Target waste	Urban organic waste from marketplaces, yard waste and lawn mowing
Receiving quantity	100 tons/day
Water content	60-70%
Apparent density	~500 kg / m3
2. Composting	
Composting method	In windrows
Treatment line	1 line
Capacity	100 tons/day
Operation	312 day/year
	8 hours/day
Composting time	28 days
Temperature inside the windrow	>55 degrees Celsius
3. Maturing	
Operation	312 days/year
	8 hours/day
Capacity	35 tons/day
Water content	~40 %
Apparent density	~500 kg/m^3
Maturing time	60 days
4. Product	
Classification	Trommel (rotary screen)
Operation	312 days/year
	8 hours/day
Quantity of compost products	18 tons/day
Water content	~40%
Apparent density	~500 kg / m^3

4.2.3.6 Composting flow

The Figure below shows the composting flow.

The waste generated at marketplace and lawn mowing activities, after weighing, are unloaded on the windrow area. Meanwhile, yard waste products are crushed in small chips, after weighed. This crushed yard waste is stored in a temporary depot to be used as an agent to

increase volume. Subsequently, it is combined with input waste whose apparent density should be adjusted and sent to the composting process.

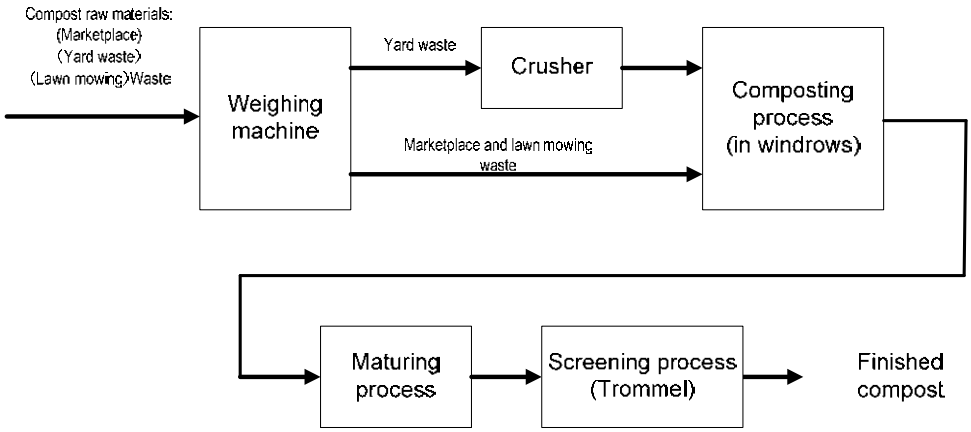


Figure 4-17: Process flow in a composting plant

4.2.3.7 Materials balance in a composting plant

The materials balance was calculated, establishing the following composition of compost raw materials:

Apparent specific weight		250	kg/l
Flammable materials	Kitchen waste	90.0	(%)
	Paper	2.3	(%)
	Textile	1.1	(%)
	Plant and tree	0.2	(%)
	Plastic	5.2	(%)
	Leather and rubber	0.1	(%)
	Total	98.9	(%)
Non-flammable materials	Metal	0.2	(%)
	Glass	0.3	(%)
	Ceramic and stone	0.1	(%)
	Other	0.5	(%)
	Total	1.1	(%)
Total		100.0	(%)

The Figure below shows the materials balance in a composting plant:

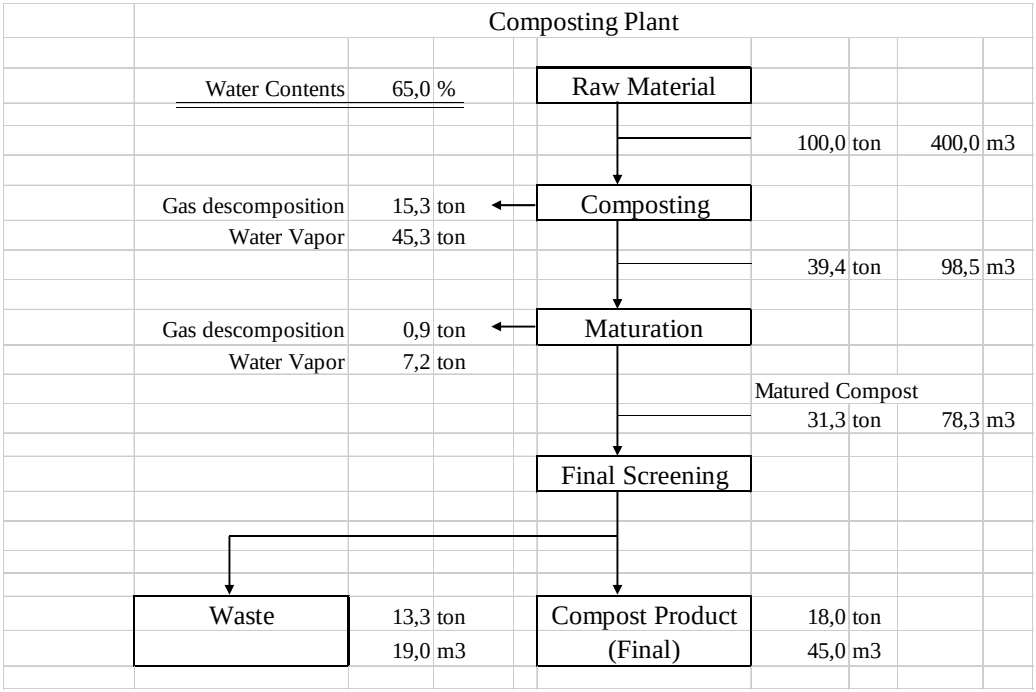


Figure 4-18: Materials balance in a composting plant

4.2.3.8 Plant layout

The Figure below shows the composting facilities layout

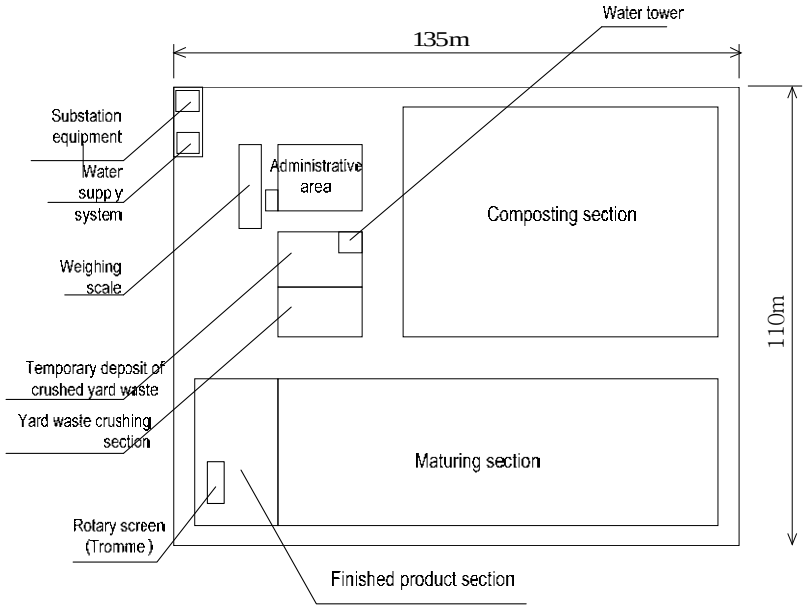


Figure 4-19: Composting plant layout

4.2.3.9 Composting plant operational plan

Following is an operational plan from receiving the raw materials (marketplace, yard waste and lawn mowing waste) to the final shipping of compost products.

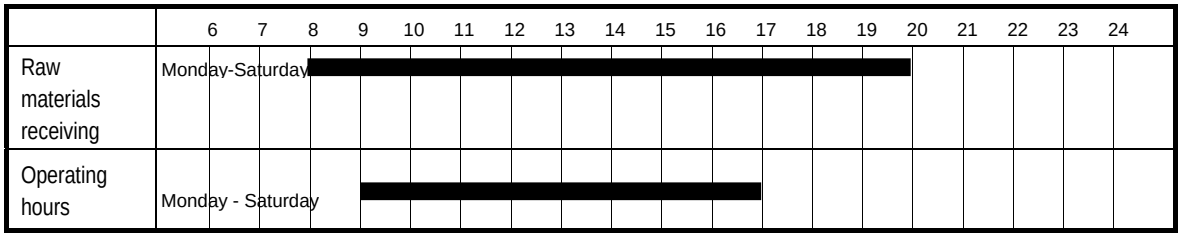
a. Operating hours

The following operational hours for the composting plant are established.

Monday through Saturday: 8:00 - 18:00 (actual operation of facilities: 8 hours/day)

- Sunday Off
- Waste receiving 8:00 - 20:00
- Lines 1 Line

Table 4-55: Operating hours



b. Heavy machinery equipping plan

The table below shows the machinery equipping plan for the composting plant:

Table 4-56: Machinery equipping plan for the composting plant

	Machinery	Specifications	Quantity	Unit
1	Dump truck	11 tons	1	Unit
2	Wheel loader	1.2 m^3	2	Unit
3	Wheel loader with windrow turner	Turning capacity: equal to or above 40m^3/hour	1	Unit

c. Workload by section at the composting plant

The table below shows the workload by section at the composting plant:

Table 4-57: Workload by section at the composting plant

Section	Workload
Receiving	This section covers the work related to the receiving of raw materials for composting (waste collected coming from marketplaces, yard waste and lawn mowing). ・The input raw materials are weighed on the scale according to information such as type and origin. ・Marketplace and lawn mowing waste is taken directly to the windrow arrangement area with no required prior treatment. ・Yard waste is treated with prior crushing in small chips and classified with a screen. Waste going through the screen is taken to the windrow arrangement area. Waste retained at the screen is taken back to the crusher. ・Waste not suitable for composting is taken to the final disposal site and buried there.
Composting	The composting work takes place in this section. This section is divided into various areas where windrows are arranged. ・Marketplace and lawn mowing waste, in addition to yard waste after prior treatment, are taken to the previously defined windrows. ・It is better than mixing pre-treated yard waste with marketplace and lawn mowing waste, since they can be used as a swelling agent and to adjust water content. ・Depending on the condition of the compost windrows, the finished compost is mixed with raw materials forming the windrow to obtain the appropriate density and water content. ・The composting period is 28 days.
Maturing	Raw compost leaving the composting section is matured in this section. This area is not as neatly divided as the compost matching, but when arranging the maturing windrow the site, date and time should be recorded to better allow it to be managed. ・The maturing period is 60 days.
Finishing (final products)	The matured compost is classified in this section with the rotary soil screen (trommel) to obtain the finished product. ・The screen should have a structure that is easy to remove and place and its size may change according to client requirements. ・The fragments remaining on the rotary soil screen are taken to the final disposal site. ・The screened material is taken to the finished product depot. ・As to the form of shipping, the following two are proposed: taking the wholesale compost to the client by truck or carrying the compost packed in plastic bags. The size of the plastic bag should be defined by a market study.

d. Personnel assignment plan

The table below shows the personnel assignment at the composting plant:

Table 4-58: Personnel assignment at the composting plant

Section		No.
Administration		
	Manager	1
	Accounting	1
	Office clerk	2 (08:00-20:00)
	Total	4
Operation		
	Receiving	
	Supervisor	1
	Equipment operator	
	Screen operator	1
	Workers	2
	Waste receiving	
	Wheel load truck's driver	1
	Workers	3
	Composting and Maturing	
	Dump truck's driver	2
	Wheel load truck's driver	1
	Workers	3
	Classification	
	Supervisor	1
	Trommel operator	1
	Workers	2
	Finished product	
	Packing operator	1
	Workers	2
	Total	21
Total		25

4.2.4 Recycling of Mixed Construction and Demolition Waste

4.2.4.1 Outline

a. Target Waste

a.1 Quantity of Mixed Construction and Demolition Waste

Target waste is Mixed Construction and Demolition Waste (MCDW) which is generated from construction and demolition in houses and small businesses. Waste that is generated in large scale construction works of buildings and/or roads and sludge that is from wastewater treatment plant are not considered in this section. The following table shows quantity of the MCDW.

Table 4-59: Quantity of MCDW

Unit: ton/year

Year	Total Generation	Generation of MCDW	To plant	Recovered /escombrera	Refuse to SL	Minimize. rate
2013	2,499,426	297,785	14,889	3,424	11,465	0.1%
2014	2,551,862	304,032	152,016	39,524	112,492	1.5%
2015	2,604,300	310,280	310,280	89,981	220,299	3.5%
2016	2,656,735	316,527	316,527	101,289	215,238	3.8%
2017	2,709,172	322,774	322,774	112,971	209,803	4.2%
2018	2,761,607	329,022	329,022	125,028	203,994	4.5%
2019	2,814,044	335,269	335,269	137,460	197,809	4.9%
2020	2,866,479	341,516	341,516	150,267	191,249	5.2%
2021	2,918,917	347,764	347,764	163,449	184,315	5.6%
2022	2,971,353	354,011	354,011	177,006	177,005	6.0%
2023	3,023,787	360,258	360,258	190,937	169,321	6.3%
2024	3,076,226	366,506	366,506	205,243	161,263	6.7%
2025	3,128,661	372,753	372,753	219,924	152,829	7.0%
2026	3,181,097	379,000	379,000	234,980	144,020	7.4%
2027	3,233,534	385,248	385,248	250,411	134,837	7.7%

To plant: quantity that goes in the recycling plant
Recovered/escombrera: quantity of materials that is recovered or goes to licensed disposal site of CDW.
Refuse to SL: refuse that goes to Sanitary Landfill.
Minimization rate: percentage of minimization, quantity of recovered/escombrera divided by quantity of total generation

a.2 Classification and Quantity of the MDCW in 2027

Weight and volume of the MDCW in 2027 is shown by type in the following table. Facilities described in this section are designed based on the figures in the table.

Table 4-60: Classification of Construction Waste at Construction and Demolition Sites

No.	Main Separation Categories	Sub-categories		Amount of Construction Waste Created	
				Total Amount (tons/day)	Total Volume (m^3/day)
1	Waste for recycling (Creation of products through recycling.)	Concrete		287.1	261.0
2		Brick (pieces of solid brick, blocks and tiles)		194.8	177.1
3		Hardwood (pine, oak, cedar, tabebuia rosea, etc.)		23.0	38.3
4	Waste for temporary storage (When a certain volume of storage has been reached, the materials will be given away or sold. Separation is not done at the storage site.)	Earth	Dust	199.0	153.1
			Sand	13.7	12.5
			Additions (stones and gravel)	0.8	0.7
5		Plastic	Thermoformable plastic (PET, PVC, PP, PS, HDPE, LDPE, etc.)	9.8	19.6
6		Metals	Copper (wire, certain kinds of hinges, etc.)	1.5	1.1
			Steel (screws, plates, pieces of steel rods, etc.)	1.2	0.2
			Iron	0.1	0.1
			Aluminum	0.0	0.0
			Brass (certain kinds of hinges, doorknobs, etc.)	0.0	0.0
Total waste stored in the temporary storage facility				731.0	663.7
7	Waste that is not recycled (Transported from the demolition site to the final disposal site.)	Ceramics (floor tiles, wall tiles, pieces of bathroom fixtures, etc.)		96.4	96.4
		Stoneware (pipes, tiles, etc.)		45.2	45.2
		Granite (countertops, flooring, walls, etc.)		26.0	26.0
		Glass		21.3	35.5
		Asphalt		12.6	18.0
		Drywall		11.2	11.2
		Textiles (Canvas, rugs, carpeting, etc.)		9.7	32.3
		Marble (countertops, flooring, walls, etc.)		7.0	8.8
		Rubber		6.1	10.2
		Polystyrene foam		4.3	4.8
		Particle board (plywood, MDF, laminates, etc.)		3.0	10.0
		Bamboo (coffee grounds)		2.2	1.8
		Thermoformable plastic (PF, PU, NBR, SBR, etc.)		2.1	10.5
		Paper (Bags from cement, plaster, etc.)		0.8	1.0
		Cardboard		0.2	2.0
		Organic waste (food, grass cuttings, tree prunings, etc.)		0.1	0.1
		Light bulbs (dangerous waste)		0.0	0.0
		Other waste		31.7	26.4
Total non-recycled waste				279.9	340.2
8	Non-suitable waste (Highly dangerous asbestos waste will be separated and transported to the final disposal site and buried in a location to be determined.)	Asbestos-Cement (roof tiles, gutters downspouts, etc.)		44.1	44.1
Total non-recycled waste + waste not suitable for recycling				324.0	384.3
Total Construction Waste				1,055.0	1,048.0

Source: Own preparation based on "UAESP, Diagnosis of Integrated Management of Construction and Demolition Waste in Bogota City – 2009"

b. Construction Waste Disposal System in Bogotá D.C.

(1) Classification at source

In small scale construction and demolition sites, waste is classified in eight types as shown in the previous table.

(2) Temporary Storage Facility

Twelve temporary storage facilities shall be built in the city to store waste for recycling at the construction waste recycling facility, and the waste to be sent to the temporary storage facility where recovered materials are stored temporarily until a certain amount has accumulated at which point these are sold or given away for free.

Construction waste to be recycled shall be placed in a container set up for that purpose and when a certain amount has accumulated it shall be transported to the construction waste recycling facility.

(3) Construction Waste Recycling Facility

The city will build three construction waste recycling facilities.

4.2.4.2 Construction Waste Temporary Storage Facility

a. Target Waste

The main waste objects for recycling are materials produced and separated at small scale building demolition sites, which are divided into two categories; materials for recycling (concrete, brick and wood) and temporary storage materials (earth, plastics and metals).

Table 4-61: Amount of Recycling per Day at the Temporary Storage Facility[1]

			Amount of recycling per day	
No	Category	Material	Total amount (tons/day)	Amount per facility (tons/day)
1	Waste for recycling	Concrete	287.1	23.9
2		Brick (Pieces of solid brick, blocks and tiles)	194.8	16.2
3		Hardwood (pine, oak, cedar, tabebuia rosea, etc.)	23.0	1.9
4	Waste for temporary storage	Earth	213.5	17.9
5		Plastic	9.8	0.8
6		Metal	2.8	0.2
Total			731.0	60.9

[1] Based on the study that describes the waste collected by the UAESP.

b. Capacity of the Temporary Storage Facility

Each facility must have the capacity to allow the different materials to be stored for seven days.

The amount of material received by each facility per week is 426.3 tons (= 60.9 tons/day X 7 days). If this amount of material in temporary storage is converted into volume, that is 108 m^3. To store this volume requires an area of 10 m X 11 m at a height of 1 m.

Table 4-62: Capacity of the Temporary Storage Facility

No	Category	Material	Amount handled per facility		Amount of storage needed (design capacity) (m3/day)
			Amount (tons/day)	Volume (m3/day)	
1	Waste for recycling	Concrete	23.9	21.8	These materials are taken to the recycling facility when the container is full.
2		Brick (Pieces of solid brick, blocks and tiles)	16.2	14.8	
3		Hardwood (pine, oak, cedar, tabebuia rosea, etc.)	1.9	3.2	
4	Waste for temporary storage	Earth	17.9	13.7	96
5		Plastic	0.8	1.6	11
6		Metal	0.2	0.2	1
		Total	60.9	55.3	108

c. Operating Plan of the Temporary Storage Facility

c.1 Operating Hours

The following operating hours shall in effect for the construction waste temporary storage facility:

- Monday to Saturday 8:00 - 18:00
- Sunday Closed

c.2 Heavy Machinery Plan

The following table shows the heavy machinery plan for the construction waste temporary storage facility:

Table 4-63: Heavy Machinery Plan for the Construction Waste Temporary Storage Facility

Machinery		Specifications	Amount	Unit
1	Wheel loader	1.2 m3	3	Unit

c.3 Staffing Plan

The following table shows the staffing plan at the construction waste temporary storage facility:

Table 4-64: Staffing Plan at the Construction Waste Temporary Storage Facility

Section		Number of people
Temporary Storage Facility		
	Supervisor	1
	Workers	2
	Wheel loader driver	1
Total		4

d. Cost of the Temporary Storage Facility

One Temporary Storage Facility manages 60.9 ton per day. Considering it as 60 ton per day, a unit cost of 11,500 COP per ton is estimated.

Table 4-65: Unit Cost of Temporary Storage Facility

Item	Unit	Quantity
Capacity	tons/day	60
Total investment	1 million COP	3,784
Days of operation	days/year	365
Years of operation	Year	15
Total amount treated	Tons	328,500
Unit price	1000 COP	11.5

4.2.4.3 Construction Waste Recycling Facility

a. Waste To Be Recycled

The waste to be processed at the construction waste recycling facility is concrete, brick and wood waste that are stored in a temporary storage facility.

b. Calculation of the Capacity of the Construction Waste Recycling Facility

The capacity of the construction waste recycling facility was calculated in the following way:

b.1 Amount of waste produced at small scale demolition sites

The following table shows the proportion and quantity of waste to be recycled and other waste that would be produced in 2027. In terms of asphalt waste, this could be included in the waste

for recycling, however, seeing as only a very small amount is produced it was not included as a material for recycling.

With this capacity, 47.8% of the construction waste for recycling can be handled in this system.

Table 4-66: Proportion of Waste for Recycling and Other Waste and Amount Produced Produced (2027)

No	Category	Proportion	Amount (tons/year)
1	Concrete	27.2%	104,826
2	Brick (Pieces of solid brick, blocks and tiles)	18.5%	71,117
3	Hardwood (pine, oak, cedar, tabebuia rosea, etc.)	2.2%	8,398
4	Waste for temporary storage	52.2%	200,907
Total		100.0%	385,248

b.2 Operating Conditions at the Facility and Number of Facilities To Be Built

It has been decided that the facility will be open for operation 312 days per year. Building a single large-scale facility in one location is not the best plan, considering the cost of transportation and the environmental impact that this could cause, therefore the proposal is to build three facilities of equal size. The plan for a facility establishes:

The facility must have the capacity to handle 197 tons of waste per day, as shown in the following table:

Table 4-67: Capacity of the Construction Waste Recycling Facility

No	Category	Amount produced (tons/day)	Capacity of the Facility (tons/day)
1	Concrete	336.0	112
2	Brick (Pieces of solid brick, blocks and tiles)	227.9	76
3	Hardwood (pine, oak, cedar, tabebuia rosea, etc.)	26.9	9
Total		590.8	197

c. Technology for Recycling Construction Waste and Resulting Final Products

The following table shows the technological process that is applied to each of the four categories of construction waste and the resulting final products:

Table 4-68: Technology for Recycling Construction Waste and Resulting Final Products

No	Category	Recycling Technology	Resulting Final Products and their Use
1	Concrete	Crushing and sorting by size	Two final products are produced with the following size: ・Size: 80-40 mm (material for concrete pavement, etc.) ・Size: less than 40 mm (base material for roads)
2	Brick (Pieces of sold brick, blocks and tiles)	Crushing and sorting by size	Final products are produced of the following size: ・Size: less than 40 mm (base material for roads)
3	Hardwoods (pine, oak, cedar, tabebuia rosea, etc.)	Crushing and sorting by size	Final products (pieces of wood) are produced of the following size: ・Size: less than 40 mm (fuel; wooden base material for roads)

d. Flow at the Construction Waste Recycling Facility

The following figure shows the flow at the construction waste recycling facility. The recycling processes are separated by the four categories of materials to be recycled. The basic process is the same for all, which consists of crushing, sorting through a vibrating screen or trommel, and making the products. The material that remains in the screen (which is larger than the given particle size) is returned to the front yard to pass through the crushing process again.

Materials visually identified as unsuitable for recycling are removed by the workers.

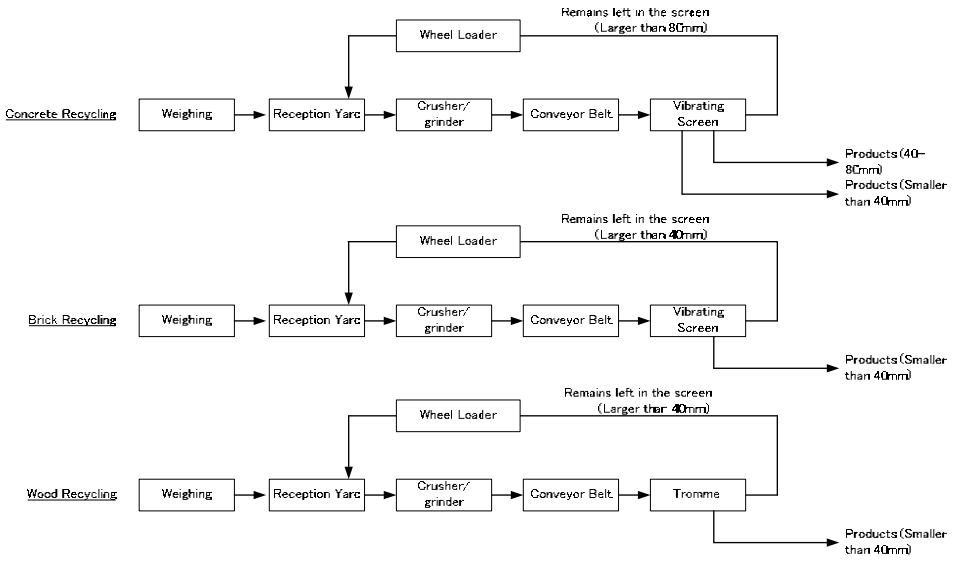


Figure 4-20: Flow at the Construction Waste Recycling Facility

e. Layout at the Construction Waste Recycling Facility

The following figure shows the layout at the construction waste recycling facility:

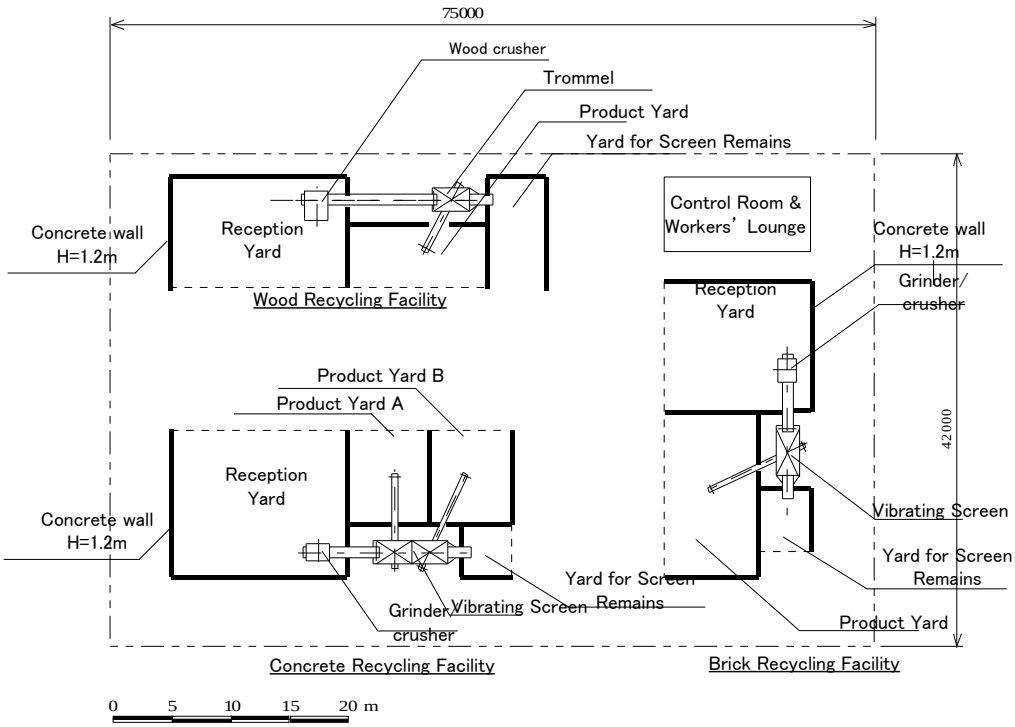


Figure 4-21: Layout at the Construction Waste Recycling Facility

[Area Needed for the Facility]

It has not been decided whether only the Construction Waste Recycling Facility will be built or whether the other related facilities will also be built. The layout does not show the plan of the outside structure. In the case that it is built alone, it should include a strip 15m wide around the lot, where the buffer zone (green zone) will be built, buildings for measuring equipment and measurement control, the temporary waste storage area and parking.

Calculation of the area needed: (75+15 x 2) x (42+15 x 2) = 7,560 m^2 →7,500 m^2

f. Features of the Construction Waste Recycling Facility

The Construction Waste Recycling Facility has the purpose of crushing, sorting by size and recycling concrete, brick and wood waste that is produced and delivered, having been separated at small scale construction and demolition sites in the city.

The following table shows the features of the Construction Waste Recycling Facility:

Table 4-69: Features of the Construction Waste Recycling Facility

Section		Handles
1. Concrete Recycling Section		
Waste treated		Concrete waste
Reception capacity		112 tons/day
Estimated density		~1,100 kg / m^3
Facility Summary	Method	Jaw crusher + sorting by size (two-level vibrating screen)
	Treatment lines	1 line
	Treatment capacity	20 tons/hour
	Operations	312 days/year
		8 hours/day
2. Brick Recycling Section		
Waste treated		Brick waste
Reception capacity		76 tons/day
Estimated density		~1,100 kg / m^3
Facility Summary	Method	Jaw crusher + sorting by size (vibrating screen)
	Treatment lines	1 line
	Treatment capacity	15 tons/hour
	Operations	312 days/year
		8 hours/day
3. Wood Recycling Section		
Waste treated		Wood waste
Reception capacity		9 tons/day
Estimated density		~600 kg / m^3
Facility Summary	Method	Crusher (wood) + sorting by size (trommel)
	Treatment lines	1 line
	Treatment capacity	2 tons/hour
	Operations	312 days/year
		8 hours/day

g. Operating Plan for the Construction Waste Recycling Facility

Below is the operating plan, from reception of primary materials (concrete, brick and wood waste) to the resulting construction waste recycling products:

g.1 Hours of Operation

The following are the hours of operation for the Construction Waste Recycling Facility:

- From Monday to Saturday — 8:00-18:00 (real working hours: 8 hours/day)
- Sunday — Closed
- Reception of waste — 8:00-17:00
- Lines — 1 line
- Shifts — 1 shift

Table 4-70: Hours of Operation

	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Reception of primary materials	Monday-Saturday																		
Hours of operation of the CWR facility	Monday-Saturday																		

g.2 Heavy Machinery Plan

The following table shows the heavy machinery plan for the Construction Waste Recycling Facility:

Table 4-71: Heavy Machinery Plan for the Construction Waste Recycling Facility

	Machinery	Specifications	Quantity	Unit
1	Wheel loader	1.2 m3	3	unit

g.3 Work Processes by Section at the Construction Waste Recycling Facility

The following table shows the work processes by section at the Construction Waste Recycling Facility:

Table 4-72: Work Processes by Section at the Construction Waste Recycling Facility

Section	Work Processes
Concrete Waste Recycling	Crushed and sorted waste concrete is transformed into concrete paving materials or base material for roads. ・As it enters, the concrete waste is weighed on the scale and unloaded into the reception yard. During this process if materials unsuitable for recycling are found, these are removed manually. ・The wheel loader is used to place the concrete waste in the reception yard into the hopper of the crusher. ・The crushed concrete pieces are sent along the conveyor belt to the vibrating screen. ・The vibrating screen consists of two grades of mesh of 40 mm and 80 mm; and the mesh can be changed easily, as needed. ・Concrete is transformed into chunks sized 40 mm to 80 mm and less than 40 mm. Those that remain on the top screen (particle size of more than 80 mm) are returned to the reception yard and crushed again. During this process materials unsuitable for recycling are removed manually.
Brick Waste Recycling	Brick waste is crushed and sorted to use as base material for roads. ・As it enters, the brick waste is weighed on the scale and unloaded into the reception yard. During this process if materials unsuitable for recycling are found, these are removed manually. ・The wheel loader is used to place the brick waste in the reception yard into the hopper of the crusher. ・The crushed brick pieces are sent along the conveyor belt to the vibrating screen. ・The vibrating screen consists of two grades of mesh of 40 mm and 80 mm; and

	the mesh can be changed easily, as needed. ・Brick is transformed into chunks sized 40 mm to 80 mm and less than 40 mm. Those that remain on the top screen (particle size of more than 80 mm) are returned to the reception yard and crushed again. During this process materials unsuitable for recycling are removed manually.
Wood Waste Recycling	Wood waste is crushed and sorted to use fuel and chunks of wood as base material for roads. ・As it enters, the wood waste is weighed on the scale and unloaded into the reception yard. During this process if materials unsuitable for recycling are found, these are removed manually. ・The wood waste in the reception yard is loaded into the hopper of the crusher either manually or using the wheel loader. ・The crushed wood pieces are sent along the conveyor belt to the vibrating screen. ・The vibrating screen consists of 40 mm mesh, and the mesh can be changed easily, as needed. ・The wood is transformed into chunks less than 40 mm. Those that remain on the top screen (particle size of more than 40 mm) are returned to the reception yard in the wheel loader and crushed again. During this process materials unsuitable for recycling are removed manually.

g.4 Staffing Plan

The following table shows the staffing plan for the Construction Waste Recycling Facility:

Table 4-73: Staffing Plan for the Construction Waste Recycling Facility

Section		Number of people
Administration		
	Administrator	1
	Accounting	1
	Office assistant	2
	Total	4
Operations		
	Concrete Recycling Section	
	Supervisor	1
	Equipment operators	1
	Workers	2
	Wheel loader driver	1
	Brick Recycling Section	
	Supervisor	1
	Equipment operators	1
	Workers	2
	Wheel loader driver	1
	Wood Recycling Section	
	Supervisor	1
	Equipment operators	1
	Workers	2
	Wheel loader driver	1
	Total	15
Total		19

h. Cost of the Construction Waste Recycling Facility

One plant manages 197 ton per day. Considering it as 200 ton per day, a unit cost of 34,600 COP per ton is estimated.

Table 4-74: Unit Cost of Construction Waste Recycling Plant

Item	Unit	Quantity
Capacity	tons/day	200
Total investment	1 million COP	32,431
Days of operation	days/year	312
Years of operations	Year	15
Total amount treated	Tons	936,000
Unit price	1000 COP	34.6

4.2.5 Recycling park

The main objective of the Recycling Park is originally to apply the primary treatment to the potentially recyclable materials classified at the gathering center and to increase their added value.

After conducting research on the recycling condition of the potentially recyclable materials in Bogota and its surrounding areas as potentially recyclable materials plastics are suitable for meeting the Recycling Park objective. If plastics are classified in PET, polypropylene and polyethylene plastics, etc. and pelletized or converted in flakes to reduce their volume, transport efficiency can be improved. As most of plastic processing plants are microenterprises and cause damage to the environment in terms of bad odors, wastewater discharge and noise, integrating these plants to a Recycling Park will make great sense as far as improving the environment quality.

As regards other potentially recyclable materials such as papers, metals and glass, given the lack of enterprises that use these recycled materials it is difficult to add any value to them. However, it would be possible to think about developing a facility for the collection and storing of these materials at the Recycling Park to obtain a certain quantity that can be sold in better terms.

The table below shows possible treatment processes for each of the potentially recyclable materials at the Recycling Park, based on the study on the recycling condition of potentially recyclable materials in Bogota and its surroundings.

Table 4-75: Possible treatment processes for each of the potentially recyclable materials at the Recycling Park

Type of resources	Facility required to carry out treatment process suggested at the Recycling Park	Points to consider
Plastics	Pelletization, etc. (Treatment process to satisfy the demands of plastic product manufacturers)	There are many small-scale processors of used plastic materials throughout the city who sell their processed products to plastic product manufacturers. Molten polyethylene or polypropylene film and crushed hard polyethylene are delivered to plastic product manufacturers as raw materials for recycling or pelletization to provide some added value. Given that most of them are microenterprises, there is a concern about any damaged to the environment in terms of bad odors, wastewater discharge and noise.
Papers	Collection and storage facility	The recycling flow of papers in Bogota and its surroundings is as follows: Recyclers → Warehouses → Intermediary agents → Classifiers (20) → Paper manufacturers (3) In Bogota and its surroundings there are only 3 paper manufacturers using recycled materials, and lately used papers are being imported from abroad at very low prices. Therefore, these manufacturers establish sales quota for small- and medium-sized classifiers..

Type of resources		Facility required to carry out treatment process suggested at the Recycling Park	Points to consider
			Purchase prices for large-scale classifiers are somewhat lower but maintain a stable purchasing volume. Receiving conditions such as the need for compressed baling, cost of transport, etc. should be reviewed. A determined amount for sale should be established in order to improve sales terms.
Metals	Aluminum	Collection and storage facility	In Bogota there are around 40 non-ferrous metal intermediaries. Non-ferrous metals collected by those intermediaries are purchased by James, an exporter. Ensure a fixed sales amount in order to improve sales terms.
	Ferrous metals	Collection and storage facility	Ferrous metals collected in Bogota and its surroundings are taken to Aceros Diaco. Ferrous metals piled in scrap warehouses are collected by a small-scale intermediary. A fixed sales amount should be ensured in order to improve sales terms.
Glass		Collection and storage facility	Manufacturing of glass bottles and containers is monopolized by Peldar. The Peldar plant located in Zipaquira has a prior treatment plant called Feral, charged with eliminating foreign matter from cullets. Feral buys cullets separated by color (clear, green and amber) at 150 a 200 pesos per kg. Moreover, whole bottles are distributed among over 200 small- and medium-sized intermediaries who reuse them. These enterprises classify bottles by type, wash them, clean them and sell them to enterprises where they are used to be filled with different materials such as glue, paint, detergents, honey, etc. The Recycling Park could be used partly to collect bottles and cullets. The distance between Bogota and Peldar is 57 km. If a considerable amount of cullets can be collected along such route, assuming the transport cost, it could be feasible to sell cullets to Peldar. In order to do so, the following aspects should be examined. • Glass bottle classification process by color • Method and space to store bottles classified by color, and method of transportation • Calculation of transport costs

4.2.6 Cost Estimation

a. Separate Collection

As shown below, estimated unit cost of separate collection is 144,000 COP/ton.

1) Cost per vehicle (6ton)

Salary				
	driver	19,440,000	COP/year	
	worker	9,884,000	COP/year	
	driver	2	pers./shift	
	worker	4	pers./shift	
	driver	38,880,000	COP/year	
	worker	39,536,000	COP/year	
	sub-total	78,416,000	COP/year	
Fuel and Oil				
	millage	30	km/trip	
	nos. trip	2	trip/day	
	diesel	5	km/litter	
	diesel	2,300	COP/litter	
	diesel	27,600	COP/day	
	oil	10	% of diesel	
	oil	2,760	COP/day	
	sub-total	30,360	COP/day	
	sub-total	9,498,000	COP/year	
Vehicle				
	invest.	120,000,000	COP	7 years life time
	invest.	17,142,857	COP/year	
	mainte. etc.	10	%	insurance, etc.
	mainte. etc.	1,714,000	COP/year	
	sub-total	18,856,857		
Total Cost				
1)	mainte. etc.	1,714,000	COP/year	
2)	fuel	9,498,000	COP/year	
3)	personnel	78,416,000	COP/year	
4)	vehicle	17,142,857	COP/year	
	sub-total	106,770,857	COP/year	
5)	indirect	16,015,629	COP/year	15%
	sub-total	122,786,486	COP/year	
6)	physical contingency	12,278,649	COP/year	10%
	Total Cost	135,065,135	COP/year	

2) Cost per waste ton

	collection amount	3.00	ton/day	
	collection amount	939	ton/year	365 x 6 / 7
1)	maintenance	1,825	COP/ton	
2)	fuel	10,115	COP/ton	
3)	personnel	83,510	COP/ton	
4)	vehicle	18,257	COP/ton	
5)	indirect	17,056	COP/ton	
6)	physical contingency	13,076	COP/ton	
	Total	143,839	COP/ton	
	Total	144,000	COP/ton	

b. Composting

As described in the part of "Main Report (1), Part II, 2. Preliminary Design of Solid Waste Treatment Facilities, 2.3 Composting Plant", unit cost of composting with 100 ton/day is 39,300 COP/ton.

c. Recycling of Mixed Construction and Demolition Waste

As described in the part of "Main Report (1), Part II, 2. Preliminary Design of Solid Waste Treatment Facilities, 2.6 Temporary Storage Facility and Construction Waste Recycling Facility", unit cost of temporal storage facility with 60 ton/day capacity is 11,500 COP/ton. In like wise, unit cost of construction waste recycling facility with 200 ton/day capacity is 34,600 COP/ton.

4.3 Final Disposal

The final disposal component under the Master Plan seeks to *"Guarantee correct final disposal of solid waste"*, which means that, throughout the Master Plan, on the one hand, operation of the Doña Juana Landfill (RSDJ) must be ensured and, on the other, the vulnerability of the present final disposal system, which requires a single final disposal site, must be reduced.

Two strategies have been formulated to ensure operation of the Doña Juana Landfill under the Master Plan: the first is to maximize the useful life of the RSDJ, including new project areas, thus increasing the volume available for waste disposal; the second is to implement safe operation in accordance with current regulations, quality indicators and the requirements established in the concession contracts. Regarding the purpose of reducing present vulnerability of the final disposal system, the Master Plan includes the introduction of a strategy whose purpose is to ensure, in the long term, the commissioning of two regional landfills in the western and the northern sectors, respectively. There is a possibility that waste exploitation plants will be included in the process of both landfills, an aspect which will be evaluated during the project planning process.

Quantifiable goals have been fixed for each of these two strategies to permit follow-up and evaluation of fulfillment of their objectives. Likewise, in order to achieve each of the goals, plans of action have been drawn up, which include the most important activities to be carried out as part of the Master Plan. The following figure shows the structure of the Final Disposal component of the Master Plan.

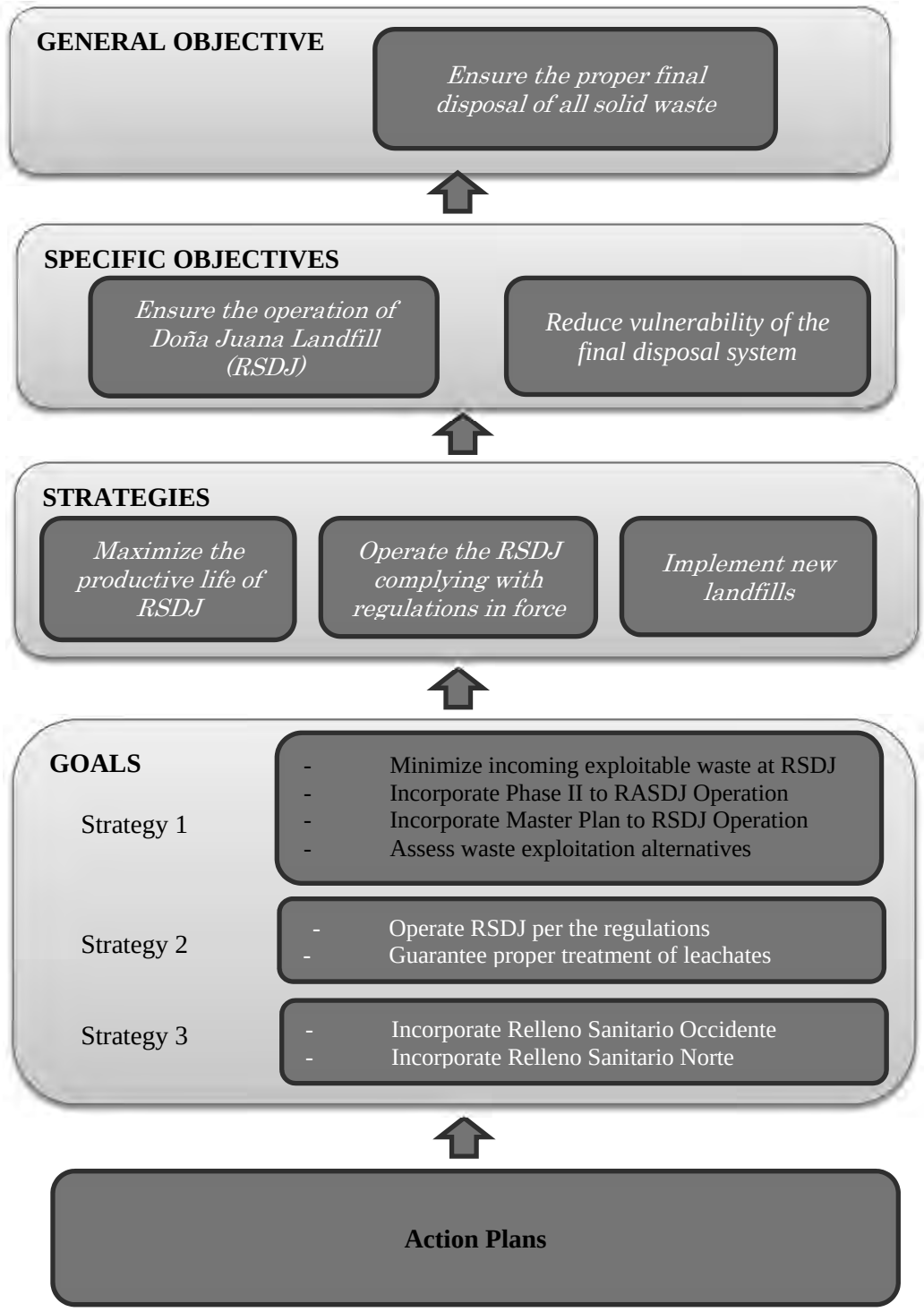


Figure 4-22: Master Plan Structure in its Final Disposal Component

While the Master Plan covers a series of goals and actions aimed at minimizing the quantity of waste that requires final disposal, this will not exclude the need to operate landfills, which is necessary, regardless of the processes of management and treatment applied to the waste because they also generate waste or rejected material which require elimination.

In addition, given the population and urban development and road structure of the city of Bogota, it not strategically advisable to have one single facility, because any problem that arises in both the landfill and the access to it would leave the city without any service whatsoever, which would result in serious health problems.

The foregoing aspects are included in the Master Plan and establish actions aimed at ensuring continuous operation of the Doña Juana landfill and implementing two regional solutions for the disposal and possible exploitation of the waste.

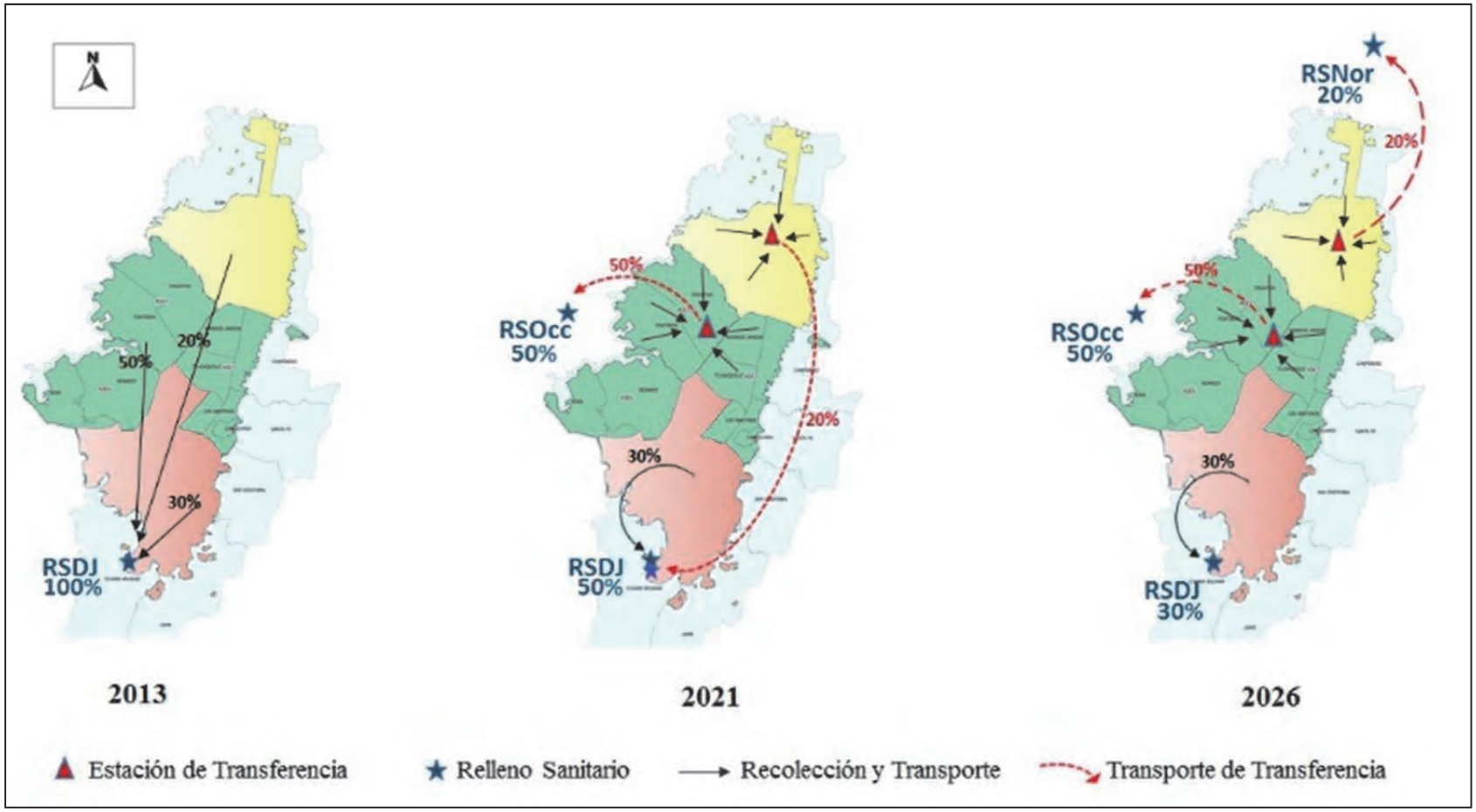
Specifically, from the point of view of infrastructure, the Master Plan includes the following for final disposal:

- Extend the useful life of the RSDJ beyond the target year (2027),
- Inclusion of a landfill in the system in 2021 and possible exploitation of waste in the western sector by way of a regional solution.
- Inclusion in the system of a landfill in the year 2026 and possible exploitation of waste in the western sector by way of a regional solution.

In addition, and as part of the transfer and transportation component, there are plans for the commissioning of two transfer stations, one to the west and the other to the north, in 2021, which will operate in an initial phase with the RS Western and the RSDJ, respectively. As of 2026the Northern landfill will operate with the Northern landfill.

The following figure shows the operating scheme established in the Master Plan for the transfer, transportation and final disposal component.

The following is a description of the most important aspects that form part of the Master Plan final disposal component.



Transfer Station Landfill ---→ Collection and Transportation Transfer Transportation

Figure 4-23: Operating Scheme Included in the Master Plan

4.3.1 Doña Juana Landfill (RSDJ)

At present, the RSDJ is operating in the Phase I Optimization Zone (see the following Figure) and the remaining capacity at December 31, 2012, is 2,585,293 m^3, equivalent to 2,892,263 tons taking into account a density of 1.07 ton/m^3. In addition, and according to the projected waste for the years 2013 y 2014, the entry of 2,351,656 and 2,347,515 tons of waste, respectively, per year and, therefore, Phase I will allow for operation until approximately March 2014.

Figure 4-24: Phase I Optimization Zone

The Master Plan includes the following two strategies aimed at ensuring operation of the RSDJ:

- Increase in the useful life of the RSDJ for a term beyond 2017, the year fixed as the goal of the Master Plan , and
- Adaptation of the RSDJ to current regulations so that it remains operative throughout the duration of the MP.

a. Increase in he Useful Life of the RSDJ

Through the strategy to increase the useful life of the RSDJ, Master Plan includes the achievement of four goals. These are:

- Minimization discharge of exploitable waste into the RSDJ;
- Inclusion of the Phase II Optimization Zone in the operation of the RSDJ
- Inclusion of the Director Plan in the RSDJ operation, and
- Assessment of waste exploitation alternatives for possible implementation.

a.1 Minimization of discharge of exploitable waste into the RSDJ

At present waste from the following are tipped into the RSDJ:

- Tree pruning, cut grass, markets and
- Mixed waste

The goal the Master Plan has established for this minimization is 100%.

Waste from tree pruning, cut grass and markets mainly consist of organic matter, which can be stabilized through an aerobic process to generate compost. The MP includes the segregated collection of this waste and its transfer to composting plants in order to reduce it by 60% by the end of the short term (2015) and by 90% by the end of the medium term (2018). These percentages are measured with respect to the total generated in those years. By the year 2019 (beginning of the long term) the plan is to reduce the quantity of this type of waste entering the RSDJ by 100%. In addition, the composting processes will generate rejected material which will be deposited in the landfill and the quantity of material rejected is expected to be gradually reduced by some 24% in the short term, 18% in the medium term and 10% in the long term; these percentages are measured in relation to the total amount of waste composted.

In the case of cdw, waste referred to as mixed, it should not be discharged into the RSDJ, because it is not included in the waste authorized by the Environmental License. The MP establishes the management of waste by transfer to construction and demolition waste landfills and the recovery of sterile material, establishing as a short term goal a reduction of 100%.

Fulfilling the foregoing goals will make possible, in the short term, a reduction in the quantity of waste discharged into the RSDJ of the order of 118,000 tons/year and 179,000 tons/year in the medium and long terms respectively.

Based on the above goals for the entry of waste into the DHL, as well as those established for the exploitation of waste with a commercial value, the MP has determined the following projection of waste for final disposal.

Table 4-76: Projected Quantity of Waste for Final Disposal

Year	Generation Tons/year	Reduction in Entry of Waste in			For Final Disposal Tons/year	% Reduction in Entry of Compost and cdw
		Recycled Tons/year	Compost Tons/year	Construction/ demolition waste landfill Tons/year		
2013	2.499.426	141.537	2.809	3.424	2.351.656	0,2%
2014	2.551.862	151.164	13.659	39.524	2.347.515	2,1%
2015	2.604.300	161.472	28.635	89.981	2.324.212	4,6%
2016	2.656.735	163.400	36.447	101.289	2.355.599	5,2%
2017	2.709.172	166.886	44.881	112.971	2.384.434	5,8%
2018	2.761.607	172.022	53.960	125.028	2.410.597	6,5%
2019	2.814.044	182.020	63.701	137.460	2.430.863	7,1%
2020	2.866.479	194.145	69.930	150.267	2.452.137	7,7%
2021	2.918.917	215.308	76.507	163.449	2.463.653	8,2%
2022	2.971.353	237.753	83.446	177.006	2.473.148	8,8%
2023	3.023.787	255.133	84.918	190.937	2.492.799	9,1%
2024	3.076.226	272.971	86.392	205.243	2.511.620	9,5%
2025	3.128.661	291.265	87.863	219.924	2.529.609	9,8%
2026	3.181.097	302.393	89.336	234.980	2.554.388	10,2%
2027	3.233.534	313.726	90.809	250.411	2.578.588	10,6%

Source: Own preparation

In addition, and as we shall see below, the MP, in order to reduce the vulnerability of the final disposal system, covers the introduction of two landfills in the operation with potential for RSU exploitation, one located in the western sector to receive 50% of the waste sent for final disposal, while the second, which will be located in the northern sector, will go into operation in the year 2026 and receive 20% of waste for final disposal (see Figure 4-2). Based on the foregoing scheme and the reduction in the entry of into the RSDJ waste, the following is a projection of the discharge of waste according to final destination.

Table 4-77: Projection of Entry of Waste according to Final Disposal

Year	Final Disposal			Accumulated Tons F.D.		
	Doña Juana	Western	Northern	Doña Juana	Western	Northern
	Tons/year	Tons/year	Tons/year	Tons	Tons	Tons
2013	2.351.656	0	0	2.351.656	0	0
2014	2.347.515	0	0	4.699.171	0	0
2015	2.324.212	0	0	7.023.383	0	0
2016	2.355.599	0	0	9.378.982	0	0
2017	2.384.434	0	0	11.763.416	0	0
2018	2.410.597	0	0	14.174.013	0	0
2019	2.430.863	0	0	16.604.876	0	0
2020	2.452.137	0	0	19.057.013	0	0
2021	1.231.827	1.231.827	0	20.288.840	1.231.827	0
2022	1.236.574	1.236.574	0	21.525.414	2.468.401	0

Year	Final Disposal			Accumulated Tons F.D.		
	Doña Juana	Western	Northern	Doña Juana	Western	Northern
	Tons/year	Tons/year	Tons/year	Tons	Tons	Tons
2023	1.246.400	1.246.400	0	22.771.814	3.714.801	0
2024	1.255.810	1.255.810	0	24.027.624	4.970.611	0
2025	1.264.805	1.264.805	0	25.292.429	6.235.416	0
2026	766.316	1.277.194	510.878	26.058.745	7.512.610	510.878
2027	773.576	1.289.294	515.718	26.832.321	8.801.904	1.026.596
2028	786.122	1.310.203	524.081	27.618.443	10.112.107	1.550.677
2029	798.666	1.331.110	532.444	28.417.109	11.443.217	2.083.121
2030	811.210	1.352.017	540.807	29.228.319	12.795.234	2.623.928
2031	823.755	1.372.925	549.170	30.052.074	14.168.159	3.173.098
2032	836.300	1.393.833	557.533	30.888.374	15.561.992	3.730.631
2033	848.844	1.414.741	565.896	31.737.218	16.976.733	4.296.527
2034	861.389	1.435.649	574.260	32.598.607	18.412.382	4.870.787
2035	873.934	1.456.557	582.623	33.472.541	19.868.939	5.453.410
2036	886.479	1.477.465	590.986	34.359.020	21.346.404	6.044.396
2037	899.024	1.498.373	599.349	35.258.044	22.844.777	6.643.745
2038	911.568	1.519.280	607.712	36.169.612	24.364.057	7.251.457
2039	924.112	1.540.187	616.075	37.093.724	25.904.244	7.867.532
2040	936.657	1.561.096	624.438	38.030.381	27.465.340	8.491.970
2041	949.201	1.582.002	632.801	38.979.582	29.047.342	9.124.771
2042	961.747	1.602.911	641.164	39.941.329	30.650.253	9.765.935

Source: Own Preparation

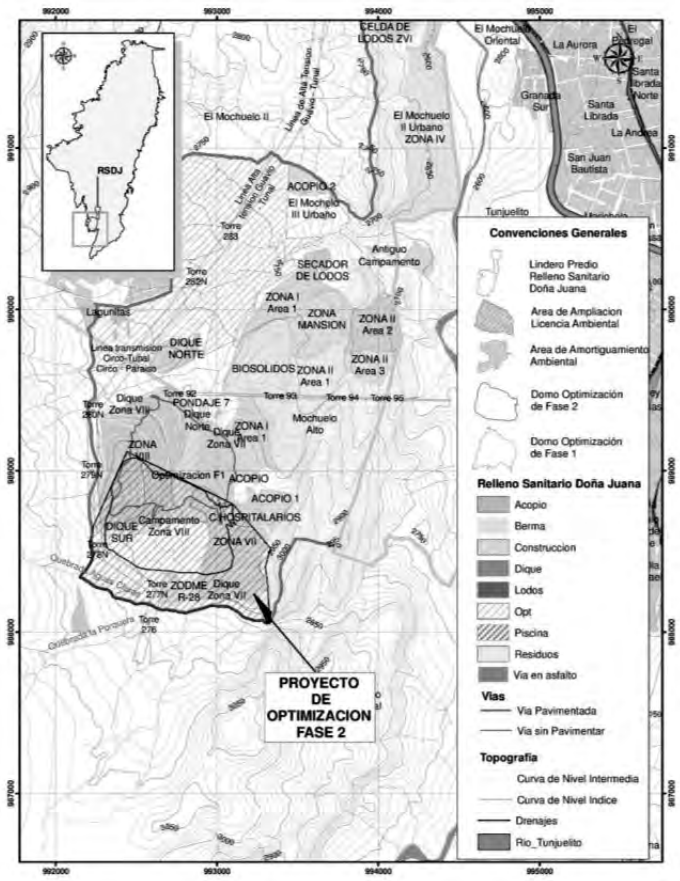
The inclusion of the two landfills and the reduction in the entry of waste make it possible to increase the useful life of the landfill. However, this is not sufficient to meet the MP goals and, therefore, the incorporation of new areas of the RSDJ operation is necessarily a requirement. This will be explained in the following points.

a.2 Inclusion of the Phase II Optimization Zone in the RSDJ operation

To guarantee proper disposal of waste, the MP establishes the expansion of RSDJ exploitation zones, increasing the surface required for waste disposal. The UAESP has already carried out studies in this respect and to date has two projects, one for the Phase II Optimization Zone, the study of which is in the final stage, that is, in the process of obtaining the Environmental License, and the second, named the Director Plan, which has only reached the pre-feasibility level.

With regard to the first study within the property where the RSDJ is located, the area referred to as optimization zone of zones VII and VIII Phase II (hereinafter Phase II). It is adjacent to the Phase I optimization zone, which covers an area of 79.8 hectares, of which 41.5 hectares will be used for final waste disposal. Of the total area, approximately 50% has been intervened with

the disposal of waste between zones VII and VIII. The following Figure shows the site of the Phase II zone.



Source: Study of the Complementary Environmental Impact for Phase 2 of Optimization Zones VII and VIII, GENVAR - UAESP 2013.

Figure 4-25: Location of the Phase II Optimization Zone

The main characteristics of the design of Phase II are summarized below:

The area where Phase II is projected is located within the borders of the present property of the RSDJ and, therefore, it is not necessary to increase it. It is specifically located in the sector furthest to the south of the property between the right of way of the Guavio-Tunal High Tension line and the old zones of the landfill. The polygon coordinates limiting this surface area are:

Table 4-78: Coordinates Polygon Phase II

	MAGNA SIRGAS- PLANAS DE GAUSS KRÜGER			MAGNA SIRGAS- PLANAS DE GAUSS KRÜGER			BOGOTA- PLANAS CARTESIANAS			BOGOTA- PLANAS CARTESIANAS	
Vértice	NORTE	ESTE	Vértice	NORTE	ESTE	Vértice	NORTE	ESTE	Vértice	NORTE	ESTE
1	989121,19	992439,77	41	988159,04	992609,63	1	89120,90	92439,79	41	88163,74	93045,79
2	988794,44	993101,04	42	988162,42	992603,85	2	88794,15	93101,06	42	88157,16	93074,80
3	988522,36	993330,33	43	988169,02	992590,92	3	88522,08	93330,36	43	88151,29	93086,76
4	988406,70	993298,68	44	988172,57	992578,14	4	88406,41	93298,71	44	88144,87	93095,55
5	988315,41	993310,41	45	988178,52	992551,28	5	88315,12	93310,43	45	88141,16	93106,05
6	988062,36	993325,79	46	988180,22	992537,78	6	88062,07	93325,82	46	88126,23	93128,71
7	988056,69	993307,86	47	988175,98	992498,93	7	88056,40	93307,88	47	88115,47	93143,31
8	988060,12	993299,31	48	988177,09	992491,63	8	88059,83	93299,34	48	88100,50	93156,06
9	988076,21	993280,84	49	988195,83	992458,24	9	88075,92	93280,86	49	88091,88	93170,45
10	988074,74	993276,23	50	988197,84	992435,11	10	88074,45	93276,25	50	88085,74	93185,62
11	988074,78	993237,19	51	988207,63	992405,76	11	88074,49	93237,21	51	88085,10	93200,13
12	988077,75	993217,11	52	988213,29	992368,20	12	88077,46	93217,13	52	88082,77	93207,84
13	988083,06	993207,82	53	988221,16	992354,61	13	88082,77	93207,84	53	88077,46	93217,13
14	988085,39	993200,11	54	988243,69	9923243,33	14	88085,10	93200,13	54	88074,49	93237,21
15	988086,03	993185,60	55	988256,93	992334,36	15	88085,74	93185,62	55	88074,45	93276,25
16	988092,17	993170,43	56	988262,85	992325,96	16	88091,88	93170,45	56	88075,92	93280,86
17	988100,79	993156,03	57	988269,09	992297,71	17	88100,50	93156,06	57	88059,83	93299,34
18	988115,76	993143,28	58	988269,71	992283,28	18	88175,70	92498,95	58	88056,40	93307,88
19	988126,52	993128,68	59	988273,76	992272,88	19	88179,93	92537,81	59	88062,07	93325,82
20	988141,44	993106,02	60	988281,86	992244,30	20	88178,23	92551,31	60	88315,12	93310,43
21	988145,16	993095,53	61	988318,99	992193,25	21	88172,28	92578,17	61	88406,41	93298,71
22	988151,57	993086,73	62	988336,55	992166,32	22	88168,74	92590,94	62	88522,08	93330,36

	MAGNA SIRGAS- PLANAS DE GAUSS KRÜGER			MAGNA SIRGAS- PLANAS DE GAUSS KRÜGER			BOGOTA- PLANAS CARTESIANAS			BOGOTA- PLANAS CARTESIANAS	
Vértice	NORTE	ESTE	Vértice	NORTE	ESTE	Vértice	NORTE	ESTE	Vértice	NORTE	ESTE
23	988157,45	993074,77	63	988341,25	992150,41	23	88162,13	92603,88	63	88794,15	93101,06
24	988164,02	993045,77	64	988363,16	992163,14	24	88158,75	92609,65	64	88362,87	92163,16
25	988161,77	993003,50	65	988378,74	992178,74	25	88150,42	92619,14	65	88378,45	92178,77
26	988166,92	992993,49	66	988402,20	992196,05	26	88144,28	92634,01	66	88401,91	92196,07
27	988166,25	992957,14	67	988419,30	992208,65	27	88136,47	92655,18	67	88419,01	92208,68
28	988149,07	992911,91	68	988459,03	992224,55	28	88140,82	92672,83	68	88458,74	92224,58
29	988144,05	992889,44	69	988485,54	992228,28	29	88139,38	92688,10	69	88485,25	92228,30
30	988133,45	992844,23	70	988500,92	992228,92	30	88134,57	92715,05	70	88500,63	92228,94
31	988120,54	992803,93	71	988508,45	992226,37	31	88132,68	92740,89	71	88508,17	92226,39
32	988123,84	992785,75	72	988512,16	992222,19	32	88124,32	92762,76	72	88511,87	92222,21
33	988124,61	992762,73	73	988519,19	992218,65	33	88123,55	92785,77	73	88518,90	92218,67
34	988132,97	992740,86	74	988525,92	992215,26	34	88120,25	92803,96	74	88525,63	92215,29
35	988134,86	992715,02	75	988528,87	992214,90	35	88133,16	92844,25	75	88528,58	92214,93
36	988139,67	992688,08	76	988548,99	992212,47	36	88143,76	92889,46	76	88548,70	92212,50
37	988141,11	992672,81	77	988564,56	992215,95	37	88148,79	92911,93	77	88564,27	92215,97
38	988136,76	992655,16	78	988604,29	992222,77	38	88165,97	92957,16	78	88604,00	92222,79
39	988144,57	992633,98	79	988624,99	992224,06	39	88166,64	92993,51	79	88624,70	92224,08
40	988150,71	992619,11	80	988641,57	992223,61	40	88161,48	93003,52	80	88641,28	92223,63

Source: Study of the Complementary Impact Study for Phase II: Optimization of Zones VII and VIII. GENVAR 2013.

Phase II was designed for disposal of solid waste from the city of Bogota and the municipalities which at present have an agreement with the UAESP, not including the disposal of special waste, muds, liquids and cdw.

According to the description of the project included in the EIA, the far end of the project will consist of 4 terraces, cemented in natural clayey terrain, the excavations for the formation of these terraces will allow the material necessary for the work of operation with waste to be obtained and for the complementary activities required, such as closure and the environmental dike, among others. A total of approximately 2,298,078 m^3 of natural soil is expected to be removed, which, added to the closure clay of the zones operated, that has been estimated to be 1 m thick, generates a total of 2,529,546 m^3 clayey material.

According to the preparation of the terraces and the formation of the cells of waste, a reception capacity of approximately 16,072, 533 m^3 is expected, which would allow disposal of a total of 17,197,610 tons of waste of a density of 1.07 ton/m^3.

The disposal of waste in Phase II will be effected supporting the waste against Zone VIII and Phase I of optimization to the north and in Zone VII - Phase II to the east and so the useful area for disposal has been calculated at 415,327 m2 with a height of 38.7 m. The maximum slope of Phase II will be 2,999.3, for an optimum exploitation of the area or discharge basin.

The design of the landfill includes the construction of the structures necessary for sufficient control and evacuation of gases and leachates; the following are included among them: installation of gravel filters and pipes, at the bottom under a gravel drainage layer to take up and remove the leachates. Likewise, a network of gabion chimneys with an average space of 40 m between them, which will permit passive release of the biogas generated by waste decomposition. As the landfill reaches the definitive elevations of the external slopes, the final closing stage will begin, which includes the installation of clay of a thickness of 80 cm and a layer of organic soil in the slopes for revegetalization and ordinary or gravel surfacing on roads and shoulders to allow circulation and access for maintenance.

In addition and following closure, the project includes the construction of a definitive rainwater management system. After closure is complete, the finalization phase will start, which includes activities such as the final management of gases, continuation of stability monitoring, maintenance of elevations, roads and rainwater. In short, the project includes the following main activities:

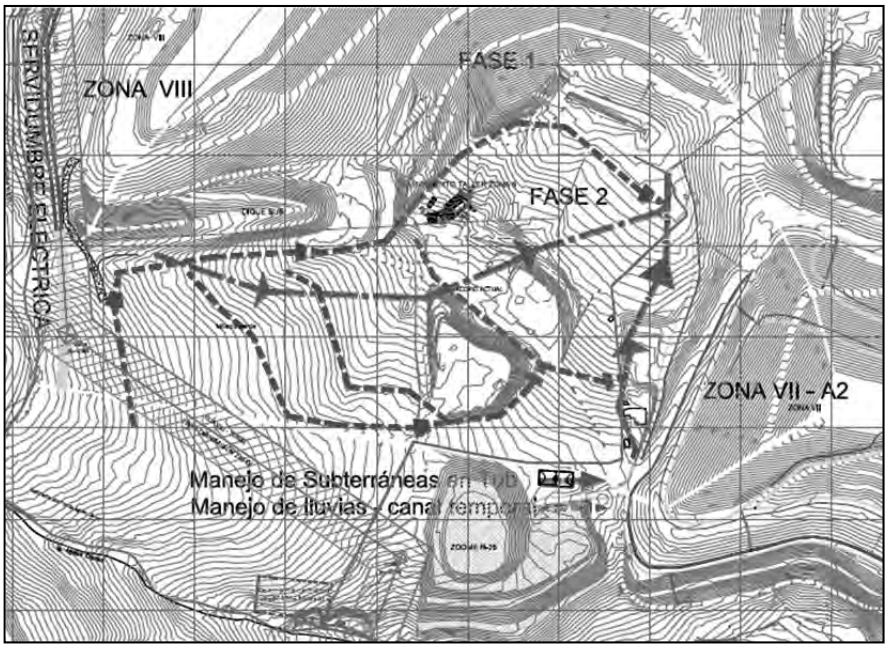
- Preliminary works
- Adaptation and construction
- Operation and closing
- Closure and post-closure

Among the preliminary works will be the construction of an environmental dike which will fulfill a commitment previously made to the community and which will terminate before the operation of Phase II, construction of a temporary rainwater management system, access ways, transfer of the operative camp and preliminary studies.

For their part, adaptation and construction include the following works: adaptation of the base; internal collection; management of underground water; waterproofing of the bottom of the terraces; draining the base of leachates; excavations, biogas drainage; rainwater drainage during the construction; adaptation of roadways.

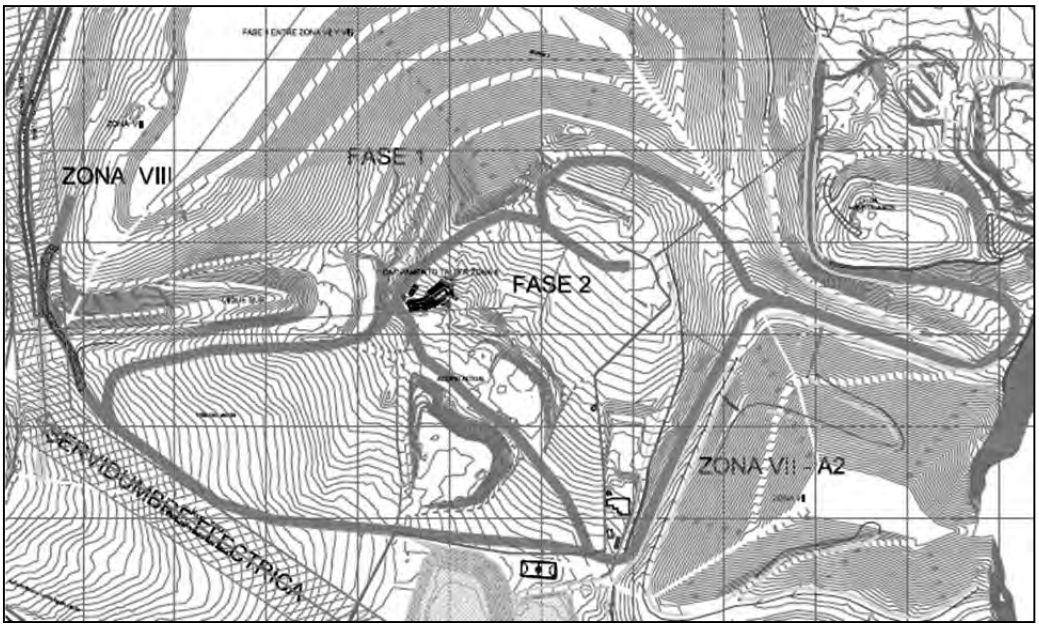
The operation will continue to develop following the present procedure. Final closing of the landfill includes the closing of elevations and closing for roads or shoulders.

The following Figures show some details of the Phase II design.



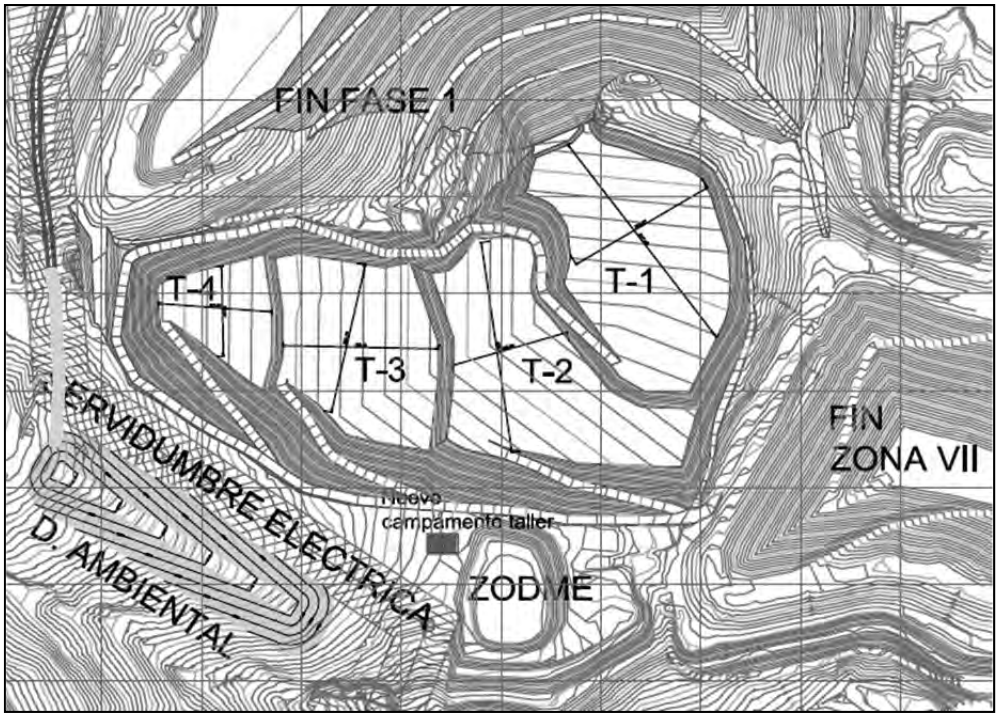
Source: EIA Complementary Phase II of the Optimization of Zones VII and VIII. GENIVAR 2013

Figure 4-26: Temporary Canals for Rainwater Management During Construction.



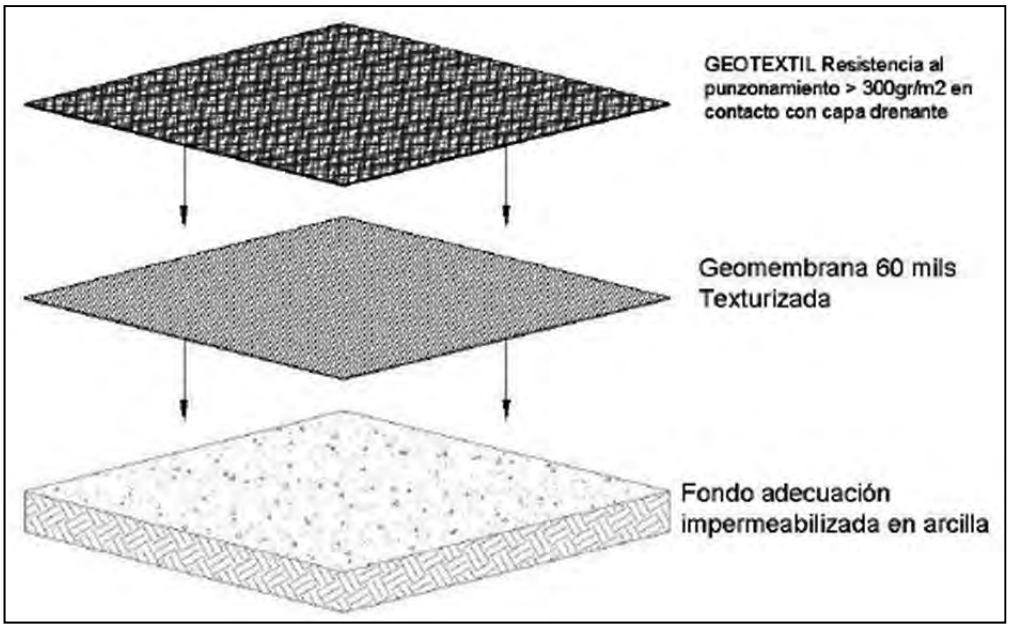
Source: EIA Complementary Phase II of the Optimization of Zones VII and VIII. GENIVAR 2013

Figure 4-27: Adaptation of Roads to Commence Works



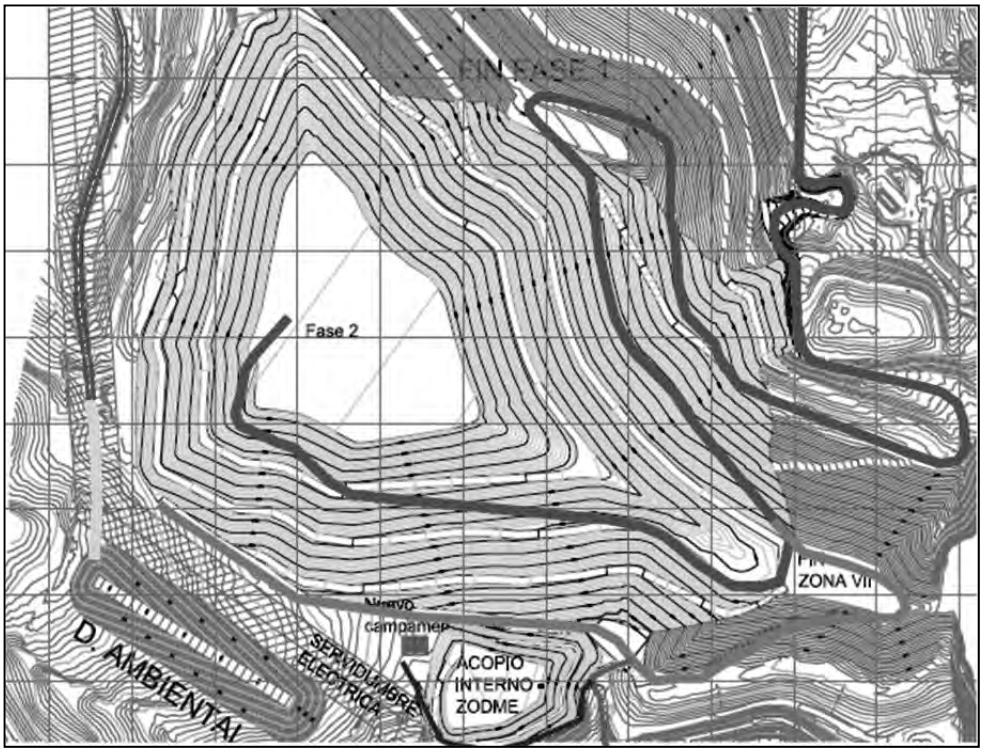
Source: EIA Complementary Phase II of the Optimization of Zones VII and VIII. GENIVAR 2013

Figure 4-28: Phase II General Adaptation and Optimization Plan.



Fuente: EIA Complementary to Phase II of Zones VII y VIII Optimization. GENVAR 2013

Figure 4-29: Base Waterproofing



Source: EIA Complementary Phase II of the Optimization of Zones VII and VIII. GENIVAR 2013

Figure 4-30: Final Appearance of Phase II Filling Dome

The direct costs of the adaptation of Phase II are approximately 120.8MMUS$ and the indirect costs are 22.5 MMUS$, for a total cost of 143.3 MMUS$, representing a unit value of 8.33 US$/ton[2].

As mentioned above, included among the goals of the Master Plan for the final disposal component, incorporating the operation of the RSDJ in the Phase II short term, which means increasing the present capacity of the landfill by approximately 17,197,610 tons, which would increase its useful life by approximately 9 years, taking into account the projection of waste entering the RSDJ determined by the MP (see Table 4-2)..

a.3 Inclusion of the Director Plan in the RSDJ operation

The Director Plan study of the Doña Juana Landfill was prepared by UAESP in the year 2011 and its general Purpose is

"To prepare a document that compiles information that will serve later to fix policies for its operation and future use and as a base on which to plan the provision of the final disposal services of solid waste and implementation of research in the Doña Juana landfill of the city of Bogota D.C."

The particular objectives relate to:

- Calculation of the possible useful life of the RSDJ
- Calculation of the capacity in the RSDJ to receive waste
- Calculation of the quantities of gases and leachates which will be produced in the RSDJ from 1988 to the end of its useful life.
- Calculation of the approximate form of the RSDJ at the end of its useful life.
- Recommendation of the general elevations required in order to maintain stability of the RSDJ.
- Recommendation in general terms of the design of the future RSDJ park.

As a result of this study, a final pre-design of the landfill, in which the old areas are used again for the disposal of solid waste has been proposed. This could increase the capacity of the RSDJ by 53.911.870 m^3, a volume that includes the Bio-solids Zone, Phase I Optimization, Phase II Optimization and 9 Pre-Designs. To date, the Bio-Solids Zone is complete, Phase I is about to be completed and Phase II is in the process of obtaining a license and its operation is included

[2] Exchange rate 1US$=1,900 Colombian$ at June 30, 2013.

in the previous goal of the MP and, therefore the goal of including the Director Plan in the RSDJ operation means licensing pre-designs 1 to 9 exclusively.

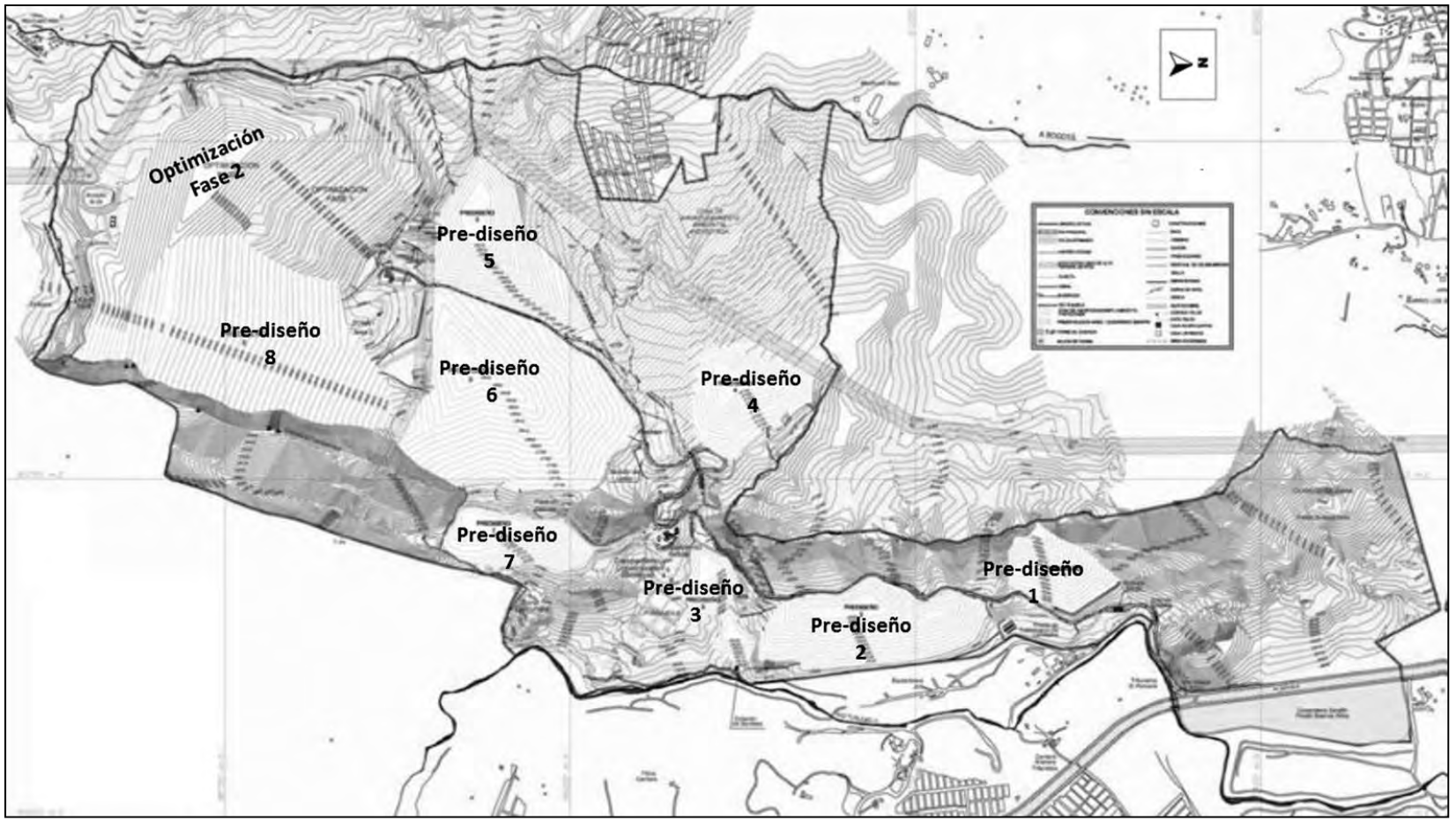
According to the Director Plan, pre-designs 1 to 9 signify an increase in the RSDJ capacity of 35,502,121 m3, representing 37,987,270 tons, taking into account a density of 1.07 ton/m3, as in the previous cases.

The following Table and Figures show the areas to be intervened with the pre-designs and the capacities of each of them, respectively.

Table 4-79: Pre-design of the Director Plan

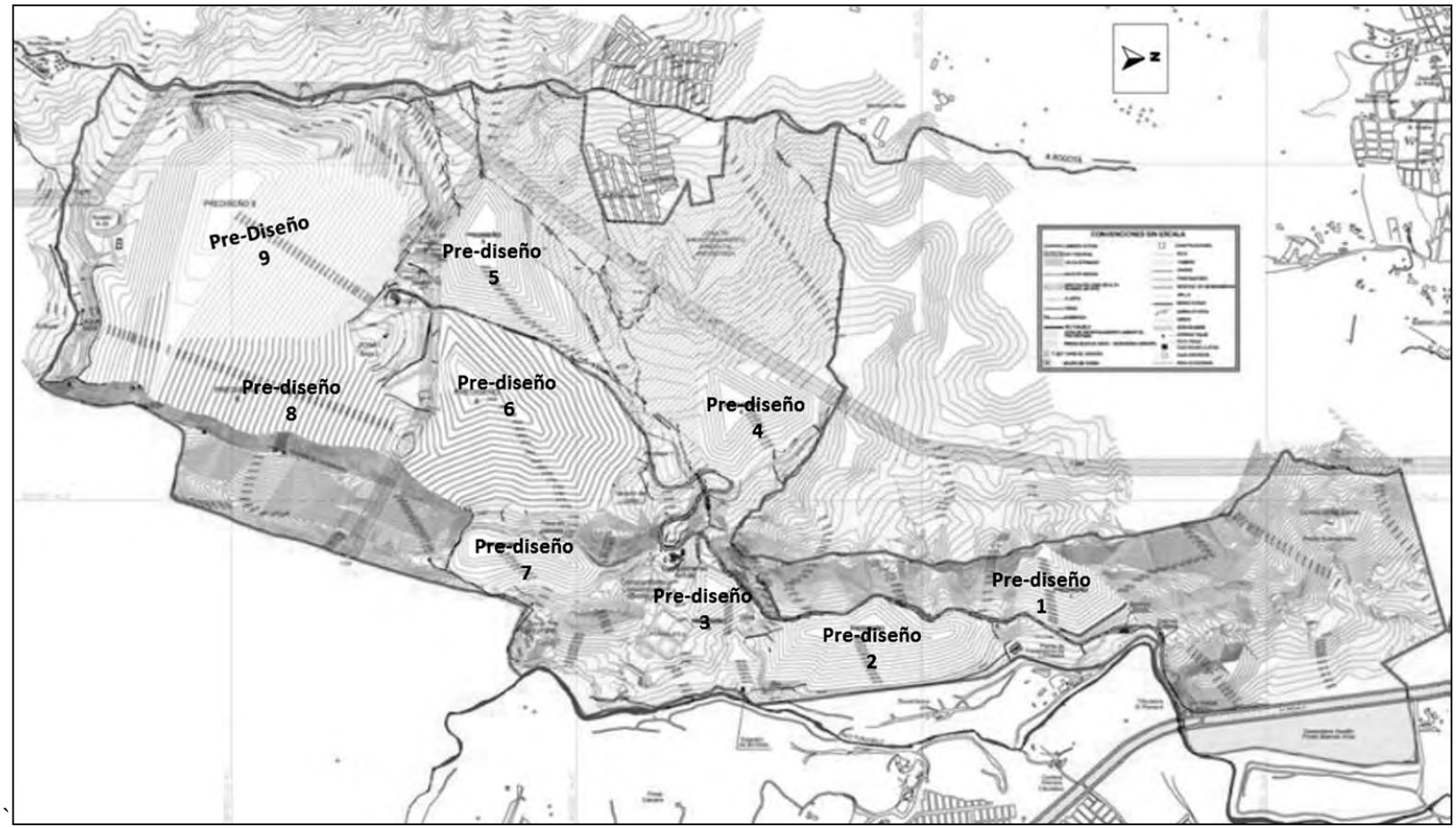
Zones	Area	Capacity	
	m^2	m^3	Tons
Pre-design 1	80.216	1.181.772	1.264.496
Pre-design 2	197.255	2.417.506	2.586.731
Pre-design 3	59.201	985.692	1.054.690
Pre-design 4	119.546	1.980.827	2.119.485
Pre-design 5	185.220	3.490.177	3.734.489
Pre-design 6	431.365	3.065.713	3.280.313
Pre-design 7	88.017	837.671	896.308
Pre-design 8	478.120	14.024.564	15.006.283
Pre-design 9	504.500	7.518.199	8.044.473
TOTAL		35.502.121	37.987.269

Source: Own preparation



Source: Director Plan UASP 2011

Figure 4-31: Director Plan Pre-designs 1 to 8



Source: Director Plan UASP 2011

Figure 4-32: Director Plan Pre-designs 1 to 9

It is important to point out that this study is at pre-feasibility level and, therefore, each pre-design must be technically evaluated, in particular as regards its stability, so that there will be a requirement for specific geotechnical and other studies. Based on the results, the detailed engineering and that(those) of the environmental impact must be developed in order to obtain the environmental license(s).

In addition, the technical viability of the Director Plan project will have to be globally evaluated, regardless of whether the licenses are obtained for each of the pre-designs separately, because the said pre-designs will define the final RSDJ morphology, a variable that will affect the final coverage, management of gases and surface run-off waters.

The MP covers the inclusion of the Director Plan in the operation of the RSDJ in the long term, specifically in the year 2023 and that, according to the distribution of the waste discharge in each final disposal site (see Table 4-2: Waste Drop-off Projection according to each Final Destination), would make it possible to keep the RSDJ operative for several years beyond the MP goal (2027). The Director Plan has not yet been economically evaluated, but it is thought that the cost per ton is similar to the one calculated for Phase II and the costs associated with the specific studies must also be included.

Assuming that the remaining capacity of the RSDJ at January 01, 2013 and the inclusion of Phase II and the Director Plan (Pre-designs 1 to 9) in the same, the RSDJ capacity may reach 58.077,143 tons as shown in the details on the following Table:

Table 4-80: RSDJ Capacity according to MP Goals

Stage or Phase	Capacity (m^3)	Capacity (Tons)	Accumulation (Tons)
Phase I al 01/01/2013	2.703.050	2.892.263	2.892.263
Phase II	16.072.533	17.197.610	20.089.873
Director Plan	35.502.121	37.897.270	58.077.143
Total Remaining Capacity projected in the MP	54.277.704	58.077.143	-

Source: Own preparation

In addition, and taking into account the entry of waste entry in the RSDJ, the useful life which can be expected of each of these phases:

Table 4-81: Useful life of RSDJ according to MP goals

Stage or Phase	Useful life in years	Date of Useful Life
Phase I al 0170172013	1,23	March 2014
Phase II	7,6	October-2021
Director Plan		> Dec-2027

Source: Own preparation

The following graph shows the useful life of the Doña Juana landfill as a function of compliance with the MP goals.

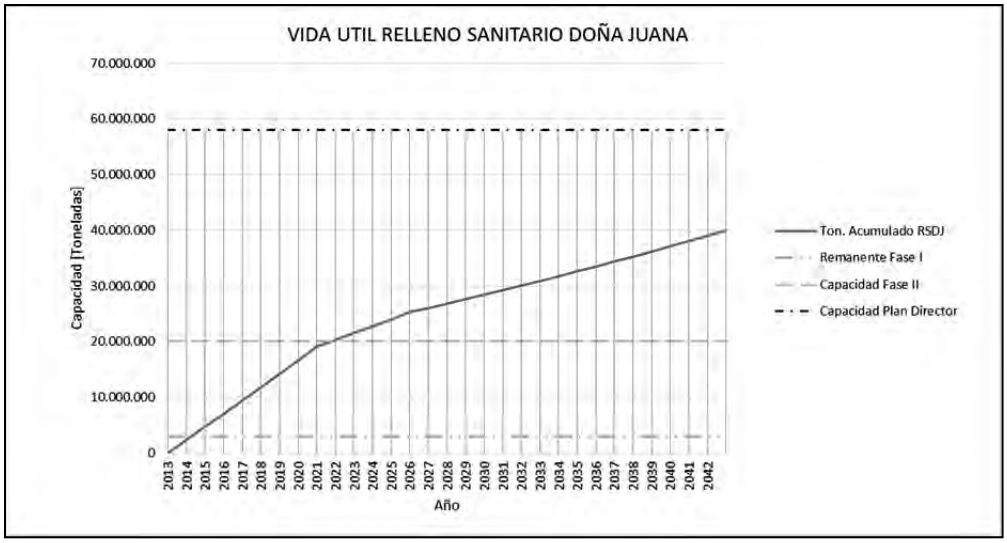


Figure 4-33: Useful life of RSDJ according to Master Plan goals

a.4 Assessment of waste exploitation alternatives for possible implementation

The Zero Garbage policy presented in the Development Plan includes the implementation of a waste exploitation plant in the Doña Juana landfill and also in future landfills.

At present, there are various technologies for the exploitation of organic waste that allow, among other things, for the production of synthetic diesel, solid fuel, biogas, etc. These technologies were evaluated during this study, indicating the advantages and disadvantages of each of them.

As a way to increase the capacity of the RSDJ, the exploitation of solid waste is a good alternative. However, the selection of the technology to be implemented constitutes a critical activity, bearing in mind that an unadvisable selection would have a considerable impact not only on the technical aspects of waste management, but also on finances.

The MP includes an assessment of the technologies available for exploitation of waste as a measure to increase RSDJ capacity. This assessment must necessarily be in response to the real

needs for treatment and taking into consideration, among other variables, the characteristics and volumes of the waste to be treated; the ease of operation; complexity and cost of the facilities; efficiency of the treatment, products to be obtained and market prices, economic viability, impact on tariffs, etc.

b. b. Operation of the RSDJ in Compliance with Current Regulations

The purpose of the second strategy to succeed in guaranteeing correct final disposal of solid waste referred to in the MP is to operate the RSDJ in accordance with current regulations and the conditions under which the respective operation concessions are established.

It should be pointed out that the first strategy set out in the MP is achieved by increasing RSDJ capacity and thus its useful life. However, this does not ensure that it will be maintained operative. It is only through correct operation that satisfactory disposal of waste can be guaranteed.

Two goals have been established for this strategy, which are:

- To operate the RSDJ in accordance with the regulations and the concession contract in force and
- To ensure adequate treatment of leachates.

b.1 b.1 Operation of the RSDJ in Accordance with the Regulations and the Concession Contract in force

The environmental license imposes a series of conditions under which the RSDJ must be operated. These conditions are directly related to the project in question, with the current regulations and obligations to the community bordering on the landfill.

The MP establishes that revision of the environmental license and adjustment of the operation to comply with its requirements must be a main continuous activity in the short, medium and long terms and it must be undertaken by the UAESP as a supervisory entity (or the person designated) and the concessionaire as operator.

The foregoing implies that the operation must be adjusted and updated according to, among others, the following:

- The complementary environmental measures stated on the License;
- Compliance with social measures;
- Compliance with the monitoring programs, contingency plans, operating manuals, mitigation measures and compensation for the impacts caused, etc.;

- Compliance and implementation of other obligations considered pertinent by the CAR in its work of Environmental Control and Follow-up;
- Others.

To fulfill the foregoing, the UAESP must have personnel trained and instructed in both the scopes of the project and the current regulations and who must be responsible for supervising and controlling the project and evaluating the efficiency of its operation and request the correction measures required by the project. This activity may be carried out by an external entity if the UAESP considers it advisable. For the purpose, the latter must draw up the terms of reference for the tender process for the service, which must clearly establish the obligations, responsibilities and rights of the supervisor. Management of the information (operator-supervisor UAESP) is an aspect of great importance in this service, as is obtaining information. Likewise, the results of the supervision must be given to UAESP in real time, favoring a prompt and timely response to particular situations or conflict.

Regarding efficiency of the operation, UAESP has defined quality control indicators in the Concession for the operation of the RSDJ and three specific indicators which affect invoicing for:

- Damming: this is the indicator of waiting times or lines caused on the work front due to operational problems, accepting a maximum waiting time of 15 minutes.
- Densities: this is the indicator associated with the density of the waste when discharged into the Landfill, establishing an optimum value of 1.07 ton/m^3. The density is determined on the basis of three daily measuring, two manual densities and one mechanical.
- Open areas: this is an indicator associated with the amount of surface with waste that is left uncovered every day, accepting as a maximum 6,000 m^2 in a maximum period of 3days.

There are also indicators of the quality of:

Disposal: Included in these are Daily Management Coverage; Maintenance of Gabion Chimneys; Minimum Machinery on the Discharge Front; General Maintenance of RSDJ and Damming on the Discharge Front.

Environmental: The following are included, among others: Vegetal Replacement; Laying Grass; Management and Final Disposal of Excess; Erosion Control and Runoff Water Management; Protection of Wild Fauna; Landscape Restoration and Vegetal Restoration using Ecological

	Restoration Models; Management of Construction Materials, Air Quality Control; Leachates Management; Camp Management; Stability of the slope of the Landfill; Control of Vectors and Updating the Environmental Management Plan.
Social	Include Population Projection: Community Information Program; Job Creation and Health and the Environment Program.
PTL	Lime dosing; Sulfuric Acid Dosing; Polyelectrolyte Dosing; Excess Flow Volume in Biological Reactors; Excess Organic Load Treated in the Biological Reactors; Use of Power; Muds Production; Increased Dryness of Muds,; DBO Removal.

These indicators must be evaluated during the RSDJ useful life in order to verify their effectiveness and at the same time update or change them or include any others required. This activity must be carried out at least twice a year.

In addition, verification of the quantities of the variables of waste received and of volume remaining for disposal must be regularly controlled and through which it is possible to understand in advance the need to include new areas in the operation phase and to prepare the projects sufficiently in advance to obtain the respective environmental license. The densities indicator makes it possible to determine whether the waste disposal is being carried out optimally in order to maximize the use of space.

Another aspect to be followed up in order to ensure operation of the RSDJ is that of fulfillment of the contractual obligations imposed on the operator and concessionaire by the contract, in the operational, administrative, financial, legal, judicial, etc. aspects. Revision of the scopes of the contract and fulfillment of obligations allows faults to be detected in advance and the corrective measures to be implemented.

Regarding the management of biogas, at present there is an MDL project in the RSDJ. However, and due to reduction in the values of the CERs, this project is non-viable and therefore the MP includes revision of the project in the short term and analysis of different biogas exploitation alternatives that bring income and make the project viable. Later, when the project to be implemented has been defined, the current concession contract must be revised in order to effect the necessary corrections and amendments to adapt it to the new project.

Lastly, and no less importantly, the preparation of the terms of reference for new RSDJ operation concessions is an indispensable activity to ensure the respective operation. This activity must be carried out sufficiently in advance to ensure operational continuity and the suitability of the operator. The MP establishes that a new tender must be issued for RSDJ

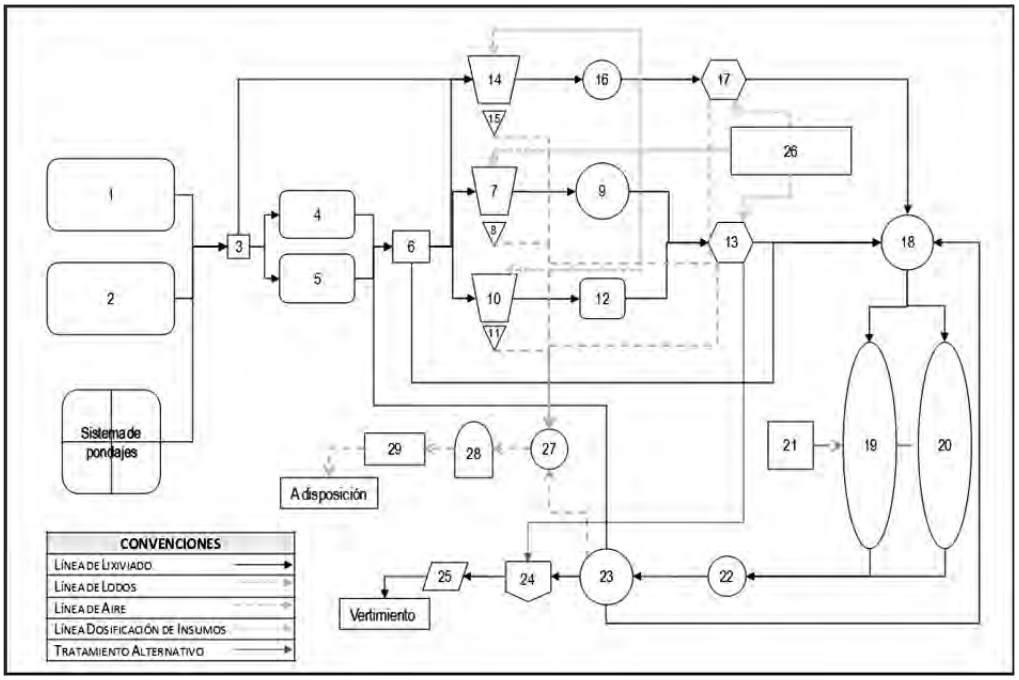
operation and maintenance in the long term, when the different pre-designs of the Director Plan have been introduced.

b.2 b.2 Ensure Correct Treatment of Leachates

As stated in the RSDJ diagnosis, one of the problems which arise at present in the operation of the landfill is the treatment of leachates, because the treatment plant effluent (TPE) does not comply with the regulations in force to discharge into a surface water course.

The production of percolated liquid is continuous throughout the useful life of the landfill and beyond. The larger area occupied for waste disposal and the increased volume of waste disposed of will have an impact on the production of leachates, increasing their production throughout the project. For Phase II and according to its design, an average production of 9.0L/s to 10 L/s is expected.

It is important to stress that the treatment of leachates constitutes one of the most important measures to guarantee the project's environmental viability and, therefore, they must be purged adequately in the Leachates Treatment Plant. The following shows the scheme of the present leachates treatment system in the RSDJ.



Source: Technical Team of the Final Disposal Department UAESP 2013

Figure 4-34: Plan of the Leachates Treatment Plant

Table 4-82: Leachates Treatment System Units

LEGEND		
1 Sequential biological Reactor - SBR North	11. Muds purge	21. Blowers building
2. Sequential biological Reactor - SBR South	12.Laminated clarifier	22. Post-de-nitrifier
3. Entry Box	13. Neutralization	23. Secondary settler
4. Eastern Reservoir	14. Physical-chemical 3	24. Rings filter
5. Western Reservoir	15. Muds purge	25. Chlorination
6. Pump well	16. Settler 3	26. Outlet cannel
7. Physical-chemical 1	17. Neutralization 3	27. Reagents zone
8. Sludge/ Muds purge	18. Pre-nitrifier	28. Muds thickener
9. Primary settler	19. Western oxidation biological reactor ditch	29. Dehydrator
10. Physical-chemical 2	20. Eastern oxidation biological reactor ditch	30. Temporary muds cell

Source: Technical Team of the Final Disposal Department UAESP 2013

The flow volume of the treatment plant design is 23 L/s. During 2012, approximately 418.208 m^3 of leachates were treated and an average annual flow volume 13,3 L/s was reached, while the maximum monthly figure was 17,6 L/s. It should be clarified that the flow volume of treated leachates does not necessarily coincide with the volume produced, because units of

storage in the catchment and conduction system allow regulation of the volume entering the plant.

According to the calculations made in the EIA, the inclusion of Phase II will produce the flows and volumes of leachates shown in the following Table:

Table 4-83: Estimated Flow Volumes of Leachates in Phase II

Year	Leachates Produced		
	Average Flow Volume L/s	Daily Flow Volume m3/day	Annual Volume m3/year
2015	2,5	211,9	77.359,6
2016	4,4	379,9	138.646,6
2017	6,6	569,8	207.973,6
2018	9,2	796,7	290.813,4
2019	9,7	841,9	307.298,1
2020	10,1	874,9	319.344,8
2021	10,9	944,8	344.852,6
2022	9,0	704,0	256.965,3
2023	7,2	622,9	227.376,3
2024	5,0	434,7	158.652,6

Source: EIA Complementary Phase II Optimization of Zones VII and VIII. GENVAR 2013

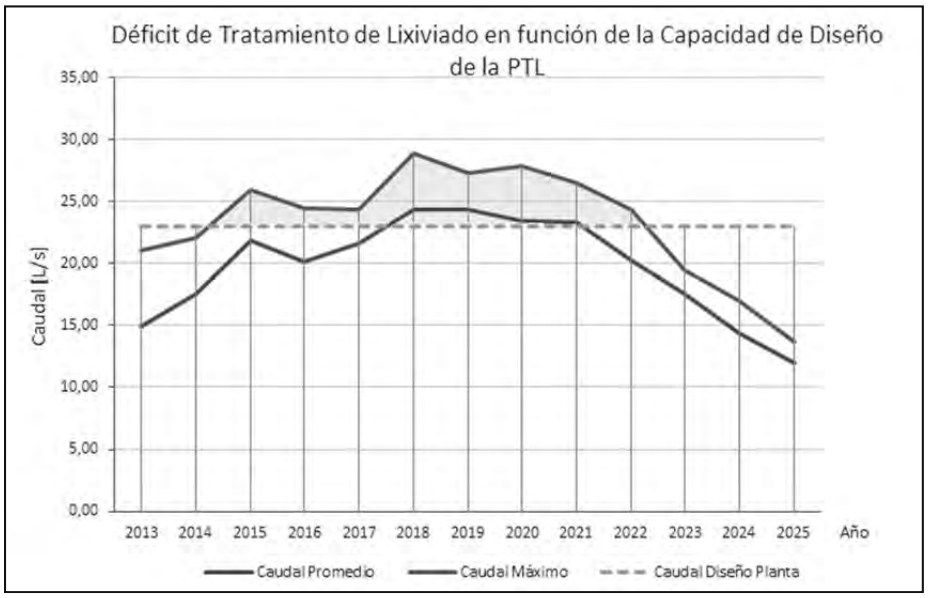
Taking into account the production of leachates projected for Phase II and those generated in other areas of the landfill, the total production of leachates in the landfill has been projected with the values shown in the following Table.

Table 4-84: Projection of Leachates Produced in RSDJ in L/s

Year / Month	PROJECTED PRODUCTION OF LEACHATES IN RSDJ L/s												
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
January	15,32	17,16	21,01	17,51	17,59	16,33	26,05	21,20	21,89	21,66	18,83	11,80	13,48
February	13,65	18,81	24,99	19,40	19,51	19,82	21,25	20,28	20,98	21,18	17,97	12,96	13,64
March	11,00	14,32	18,10	19,04	20,38	23,39	27,01	21,70	22,49	19,92	16,74	15,57	12,49
April	11,52	15,79	18,33	18,16	22,81	24,60	27,04	27,90	25,61	24,31	19,52	17,02	12,89
May	12,94	18,05	25,88	22,16	24,35	26,87	24,17	25,47	25,33	21,19	18,00	16,26	12,56
June	16,14	22,02	25,57	24,41	24,10	26,01	23,07	21,54	21,49	18,53	17,08	14,85	11,44
July	15,10	19,94	23,59	22,05	23,11	25,36	22,15	22,71	23,25	17,11	17,85	14,99	11,35
August	19,29	19,45	24,17	20,26	20,87	22,83	22,01	23,09	22,10	18,20	17,80	14,17	11,14
September	13,71	12,74	17,90	18,16	18,31	25,34	21,81	22,82	20,47	18,49	16,54	13,22	11,33
October	13,26	15,83	18,57	19,18	23,55	24,51	25,19	25,28	23,80	19,62	17,14	13,64	11,47
November	16,58	15,94	21,37	20,97	23,96	28,16	27,26	27,32	26,52	22,78	18,33	14,00	11,58
December	21,05	19,98	22,98	20,88	20,33	28,86	24,69	22,28	25,30	20,64	15,00	14,00	10,29
Average	14,96	17,50	21,87	20,18	21,57	24,34	24,31	23,47	23,27	20,30	17,57	14,37	11,97
Maximum	21,05	22,02	25,88	24,41	24,35	28,86	27,26	27,90	26,52	24,31	19,52	17,02	13,64

Source: EIA Complementary Phase II of Optimization of Zones VII and VIII. GENVAR 2013

The following Figure shows graphically the maximum and average flow volumes of leachates for each year and the deficit in treatment as a function of the design volume.



Source: Own preparation

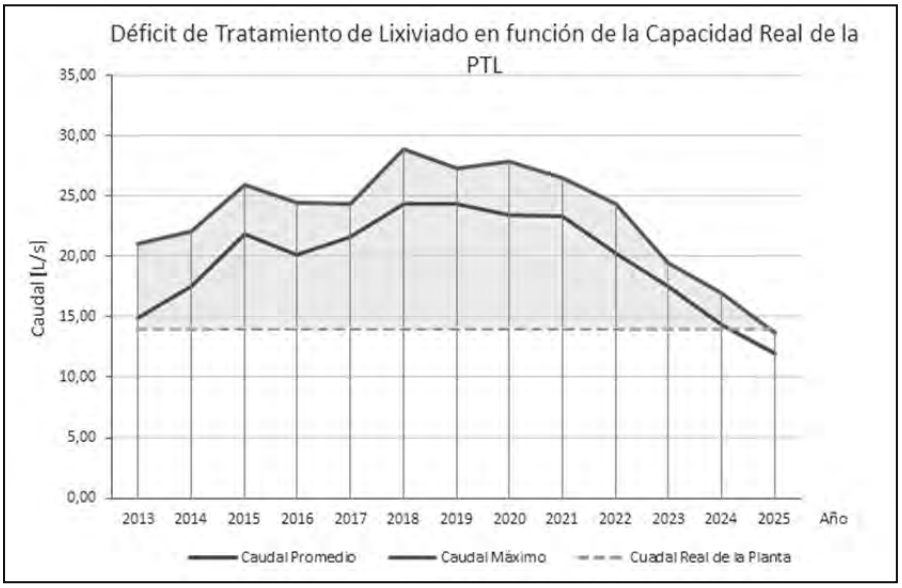
Figure 4-35: Deficit in Treatment of Leachates as a Function of the Design Flow Volume of the TPE.

The yellow shaded area on the graph shows the deficit in the treatment generated in the RSDJ. According to this graph, during the years 2014 to 2022, the maximum flow volume will exceed

the design capacity of the plant and the most critical situation will be in the period from 2017 to 2021, when the average volume will do so.

While the graph shows a reduction in the production of leachates as of 2021, in fact this will not happen because, as of 2021, new zones in the RSDJ will be activated for the disposal of solid waste as a result of the commissioning of the projects included in the Director Plan and, therefore, the production of liquid in the new areas of operation will be added to the projected production, so that the treatment deficit is expected to be maintained over time.

Regarding the design volume, the Supervisor has analyzed the behavior of the plant and concluded that it has a real treatment capacity of 14.3 L/s and 13.7 L/s according to the reports dated December 21, 2011 and February 23, 2012. Both reports state that there is a treatment deficit of approximately 40% and that the TPE requires expansion, which would require new civil works, equipment and even the incorporation of new processes. A graph of this scenario showing the real treatment capacity of the plant (average 14 L/s) has again been prepared and the maximums and averages of leachates expected as a result of the Phase II operation and, as in the previous case, the treatment deficit is again shaded in yellow. The following figure shows the treatment deficit as a function of the real capacity of the treatment plant for both flow volumes.



Source: Own preparation

Figure 4-36: Leachates Treatment Deficit as a Function of the real Flow Volume of the TPE

A comparison of the two graphs shows clearly that the present condition is critical because, given the average flow volume and that of the TPE design, the untreated leachates storage volume during the period when the average volume exceeds that of the design, is

approximately 107,000 m^3, while in the second case, that is, taking into account the actual treatment capacity of the plant, it is as high as 2,400,000 m^3.

The above situation is proof of the need to evaluate the plant and make the changes required to meet the treatment requirements of the RSDJ, also taking into consideration the construction of storage works to allow absorption of peak production.

As to the purifying efficiency and, as mentioned above, effluent from the TPE does not comply with Decree 3930 of 2010 governing discharge into surface water courses, as its densities exceed the standard in the of DBO5 parameters: grease and oils, cadmium, copper, manganese, molybdenum, nickel, lead and phenols.

Given the foregoing situation and the goals of the Master Plan, the urgent need to adjust the design and operation of the leachates treatment plant is clear and, for the purpose, the implementation of a series of actions through which it is expected to achieve expansion or modification of the TPE to effect treatment of 100% of the leachates generated in the short term, has been included in the MP, thus complying with discharge standards. Inclusion of an assessment of the treatment and its compliance with effluent quality has been included in both the medium and the long terms. In addition, in the medium term and once the definitive design of the Director Plan projects is ready, the treatment needs of this phase must be determined and the expansion needs of the TPE must be evaluated; if necessary, the designs must be prepared and the respective discharge permit obtained. If expansion of the TPE is necessary, the purpose of the long term actions contemplated will be the construction of the civil works and acquisition of the equipment necessary in the TPE in order for the required expansion to go into operation in the year 2021.

4.3.2 Occidente (Western) Landfill (RSOcc)

As mentioned above, one of the specific objectives of the MP for the final disposal component is to create new landfills, which could ultimately be included in waste exploitation processes, thereby reducing the vulnerability of the final disposal system. Specifically, the MP includes the commissioning of one landfill in the western sector and another in the northern sector in the years 2021 and 2026, respectively.

Because there are no zones for the implementation of landfills in Bogota, they will necessarily have to be located in Cundinamarca Department, thus becoming a project of a regional nature for the final disposal of solid waste.

a. Sizing the Western Landfill

a.1 Useful Life and Capacity

Article 5 of Decree 838/2005, issued by the Ministry of the Environment, Housing and Territorial Development (now the Ministry of the Environment and Sustainable Development) establishes that the area where the landfill is to be located must be sufficient to allow its useful life to be compatible with the projected production of solid waste to be discharged into it, taking into account both the receiver municipality and those located within a radius of 60 kilometers of it. It also fixes the minimum useful life for landfills at 30 years.

In the specific case of the landfill projected for the western sector, the municipalities in that zone already have the Nuevo Mondoñedo landfill. However, in the long term it is possible that it will be included in the solution put forward under the Master Plan owing to the end of its useful life.

According to the projected final waste disposal determined for the Master Plan, the quantity of waste from Bogota, which will be discharged into the western landfill are:

Table 4-85: Projected Discharge of Waste Produced by Bogota into the RSOcc

Year	Year of Operation	Discharge	Accumulated Discharge	Annual Increase
		Tons/year	Ton	%
2021	1	1.231.827	1.231.827	
2022	2	1.236.574	2.468.401	0,4%
2023	3	1.246.400	3.714.801	0,8%
2024	4	1.255.810	4.970.611	0,8%
2025	5	1.264.805	6.235.416	0,7%
2026	6	1.277.194	7.512.610	1,0%
2027	7	1.289.294	8.801.904	0,9%
2028	8	1.310.203	10.112.107	1,6%
2029	9	1.331.110	11.443.217	1,6%
2030	10	1.352.017	12.795.234	1,6%
2031	11	1.372.925	14.168.159	1,5%
2032	12	1.393.833	15.561.992	1,5%
2033	13	1.414.741	16.976.733	1,5%
2034	14	1.435.649	18.412.382	1,5%
2035	15	1.456.557	19.868.939	1,5%
2036	16	1.477.465	21.346.404	1,4%
2037	17	1.498.373	22.844.777	1,4%
2038	18	1.519.280	24.364.057	1,4%
2039	19	1.540.187	25.904.244	1,4%
2040	20	1.561.096	27.465.340	1,4%
2041	21	1.582.002	29.047.342	1,3%
2042	22	1.602.911	30.650.253	1,3%
2043	23	1.623.749	32.274.002	1,3%
2044	24	1.644.858	33.918.859	1,3%
2045	25	1.666.241	35.585.100	1,3%
2046	26	1.686.236	37.271.336	1,2%
2047	27	1.706.470	38.977.806	1,2%
2048	28	1.726.948	40.704.754	1,2%
2049	29	1.747.671	42.452.426	1,2%
2050	30	1.768.644	44.221.069	1,2%

Source: Master Plan Projection

In addition, and in compliance with Decree 838/2005, the municipalities whose waste is at present deposited in the Nuevo Mondoñedo landfill are also considered included as users of the Western landfill and it is estimated that they will contribute a tonnage of 1,104 by the year 2021, which will increase annually by some 1.2%. Based on these figures, the amount of waste from other municipalities has been determined and the total quantity of waste which will be discharged into the RSOcc during its useful life has been calculated (see following Table).

Table 4-86: Total Projected Waste Discharged into the RSOcc

Year of Operation	Year	Bogota	Other Municipalities	Annual Total	Accumulation	Annual Total	Accumulation
		Tons/year	Tons/year	Tons/year	Ton	m3	m3
1	2021	1.231.827	403.109	1.634.936	1.634.936	1.527.978	1.527.978
2	2022	1.236.574	407.946	1.644.520	3.279.456	1.536.935	3.064.912
3	2023	1.246.400	412.842	1.659.242	4.938.698	1.550.693	4.615.606
4	2024	1.255.810	417.796	1.673.606	6.612.304	1.564.118	6.179.723
5	2025	1.264.805	422.809	1.687.614	8.299.918	1.577.210	7.756.933
6	2026	1.277.194	427.883	1.705.077	10.004.995	1.593.530	9.350.463
7	2027	1.289.294	433.018	1.722.312	11.727.307	1.609.637	10.960.100
8	2028	1.310.203	438.214	1.748.417	13.475.724	1.634.034	12.594.134
9	2029	1.331.110	443.472	1.774.582	15.250.306	1.658.488	14.252.622
10	2030	1.352.017	448.794	1.800.811	17.051.117	1.683.001	15.935.623
11	2031	1.372.925	454.180	1.827.105	18.878.222	1.707.574	17.643.198
12	2032	1.393.833	459.630	1.853.463	20.731.684	1.732.208	19.375.406
13	2033	1.414.741	465.145	1.879.886	22.611.571	1.756.903	21.132.309
14	2034	1.435.649	470.727	1.906.376	24.517.947	1.781.660	22.913.969
15	2035	1.456.557	476.376	1.932.933	26.450.879	1.806.479	24.720.448
16	2036	1.477.465	482.092	1.959.557	28.410.437	1.831.362	26.551.810
17	2037	1.498.373	487.877	1.986.250	30.396.687	1.856.309	28.408.119
18	2038	1.519.280	493.732	2.013.012	32.409.699	1.881.320	30.289.438
19	2039	1.540.187	499.657	2.039.844	34.449.543	1.906.396	32.195.834
20	2040	1.561.096	505.653	2.066.749	36.516.291	1.931.541	34.127.375
21	2041	1.582.002	511.720	2.093.722	38.610.014	1.956.750	36.084.125
22	2042	1.602.911	517.861	2.120.772	40.730.786	1.982.030	38.066.155
23	2043	1.623.749	524.075	2.147.824	42.878.610	2.007.312	40.073.467
24	2044	1.644.858	530.364	2.175.222	45.053.832	2.032.918	42.106.385
25	2045	1.666.241	536.729	2.202.969	47.256.801	2.058.850	44.165.235
26	2046	1.686.236	543.169	2.229.405	49.486.206	2.083.556	46.248.791
27	2047	1.706.470	549.687	2.256.158	51.742.364	2.108.559	48.357.350
28	2048	1.726.948	556.284	2.283.232	54.025.596	2.133.861	50.491.211
29	2049	1.747.671	562.959	2.310.631	56.336.227	2.159.468	52.650.679
30	2050	1.768.644	569.715	2.338.358	58.674.585	2.185.381	54.836.061

Source: Own preparation

As shown in the above Table, the total amount of waste to be disposed of in the RSOcc in a period of 30 years is 58,674,585 tons, the equivalent, with a density of 1.07 ton/$m^{3,\ of}$ 54,836,061 m^3.

a.2 Surface

The following have been taken into consideration to determine the surface area necessary for the RSOcc to operate:

- The surface area necessary for solid waste disposal is calculated as a function of an area occupation factor per ton disposed of (m^2/ton) based on the quantity of waste discharged into the RSDJ and the surface area used for its final disposal. This is supported by the supposition that the Western landfill will be developed with the same design considerations as those of the RSDJ.

- Surface areas for the facilities for: recording truck entry and weight; facilities for personnel, parking and machinery maintenance; internal trucks, leachates treatment plant and leachates storage areas and the biogas management plant.

- An environmental buffer zone equivalent to 50% of the disposal area is included.

The surface area occupation factor per ton of waste is calculated on the basis of the data of the quantity of waste discharged into each prepared area in the RSDJ, although without taking into consideration the areas where bio-solids and hospital waste are disposed of. The following table summarizes this information:

Table 4-87: RSDJ surface area occupation factor

Disposal Area	Year of Operation	Surface Area		Waste Disposed Of	Occupation Factor
	Year	Ha	m^2	Ton	m^2/ton
Antigua-Zone I Zone	1988-1993	80,0	800.000	7.000.000	0,11
Mansion	1995	10,0	100.000	1.000.000	0,10
Zone II - Area I	1995-1997	25,0	250.000	3.000.000	0,08
Zone IV	1997-1999	19,0	190.000	2.100.000	0,09
Zone VII	1999-2002	40,0	400.000	6.000.000	0,07
Zone VIII	2002-2010	41,0	410.000	13.040.240	0,03
Zone II -Area 3	2008-2009	3,3	33.000	515.000	0,06
Phase I Optimization	2011 to the present	35,0	350.000	9.300.000	0,04

Source: EIA Complementary Phase II Optimization de Zones VII and VIII. GENVAR 2013

As shown in Table 4-12, the oldest zones have a larger occupation factor in comparison with the newer zones. This situation is a result of the changes made in both the design and the operation of the RSDJ following the landslide of 1997 and, therefore, the figures from 1999 onward will be used to determine the occupation factor.

In view of the foregoing, an occupation factor of 0.041 m^2/ton is obtained and, therefore, the area required for a useful life span of 30 years is 242.6 hectares, which will allow the disposal of 58,670,585 tons in that period.

The facilities include a porter's lodge, 2 weighing machines (entrance and exit), offices, personnel facilities (bathrooms, changing rooms, canteens), stores and mechanical, workshop, warehouse, soils laboratory and machine washing area. A surface area of 2.8 hectares is calculated.

Surface areas of 3.5 hectares for liquids treatment and of 3 hectares for a biogas plant have been calculated, as well as an estimated buffer zone in 50% of the disposal area, that is 121.3 hectares.

In short, the total surface area required for the RSOcc (Western) is 387 hectares, as shown in the following table:

Table 4-88: Detailed Distribution of RSOcc surface areas

Item	Surface Area
	Hectares
Waste disposal	242,6
Facilities	2,8
Leachates treatment plant	3,5
Leachates storage	4,4
Biogas management plant	3,0
Roadways,	9,0
Buffer zone	121,3
Total	386,6

Source: Own preparation

b. Selection of Western Landfill Site

Selection of the site for the construction of a landfill is one of the most important activities in the implementation of this type of project, as it has a direct environmental impact on the size and characteristics of the civil works, mitigation measures, investment and project operation costs, among others.

Chapter II of Decree 838/2005, issued by the Ministry of the Environment, Housing and Territorial Development, establishes the procedures, criteria, methodology, prohibitions and restrictions required in order to locate areas for solid waste final disposal. Specifically, Article 6 of the Decree fixes the areas where the location, construction and operation of landfills are prohibited. These are:

- **Surface sources**: Within the strip parallel to the maximum volume line or that of the permanent beds of rivers and lakes, of a minimum of thirty (30) meters in width or those defined in the respective Zoning plan (POT), Land Use Scheme (EOT) and Basic Zoning plans (PBOT), as the case may be; within the strip parallel to the site of drinking water sources, both operating and abandoned, springs and upstream of any site of catchment of a surface source of hydric supply for human consumption of at least five hundred (500) meters, as well as in marshlands, wetlands and similar areas.

- **Underground sources:** in aquifer supply zones.

- **Critical natural habitats:** Zones of habitats of endemic endangered species.
- **Geological fault areas:** At a distance of less than sixty (60) meters from geological fault zones.
- **Areas belonging to** the National Natural Parks System and other special management and special ecosystems, such as wetlands, high plateaux and mangrove swamps.

In addition, and in the same article, it establishes areas with restrictions, where, even though landfills can be located, built and operated, certain specifications and particular requirements must be complied with and without which their location, construction and operation are not possible. These requirements are:

- **Distance from urban land.** Within one thousand (1,000) meters of horizontal distance from urban or suburban area limits, including expansion and urban growth zones. This distance can be changed in accordance with the results of specific environmental studies.
- **Proximity to airports.** The regulations issued by the Special Civil Aeronautics Administrative Unit, or the entity acting in its stead, in the case of airports.
- **Underground sources.** The installed infrastructure must be located at a minimum height of five (5) meters above the phreatic level.
- **Unstable areas:** Efforts must be made for areas for the final disposal of solid waste not to be located in zones which could give rise to subsidence that destabilizes the integrity of the infrastructure installed there, such as highly compressible soils, sites liable to landslides and those where karstification phenomena might be caused.
- **High seismic risk zones.** The level of the seismic risk of the site where the landfill is to be located and its vulnerability must be taken into account when locating areas where the landfill is to be placed for the final disposal of solid waste.

In addition, Article 5 fixes the evaluation criteria and methodology for the location of landfills.

Based on the provisions of Decree 838, the following procedure is recommended for the selection of sites for landfills, the scheme for which is shown in the following figure:

Source: Own preparation

Figure 4-37: Procedure for Selection of a Site for a Landfill

The criteria for exclusion of a 1st category exclusion area involves the areas where the installation of a landfill is prohibited and the exclusion criteria of a 2nd category exclusion area refer to areas with restrictions, both of which are defined in Decree 838. Other restrictions which the UAESP may establish directly, such as the maximum distance to the transfer station, minimum available surface area, etc., are included in the 2nd Category exclusion criteria.

The exclusion of the 1st and 2nd Category zones is based on a cartographic analysis using the territorial information systems analysis tool (e.g. ArcGis 9.3 software) and, as a base, official cartography (scale 1: 50,000, with level curves every 50 meters), which served to develop a Digital Terrain Model (DTM).

As a result of phase 1, cartography in which 1st and 2nd Category exclusion areas are identified is to be obtained.

In the second phase and based on the foregoing cartography, the sites which may potentially be used for a landfill will be identified and an assessment, which must be based on the provisions of article 5 of Decree 838, will be made. To evaluate potential sites, information must be compiled and the terrain surveyed in order to establish the facts required for its assessment. Among those which must be established are:

- Surface (defined according to useful life and landfill capacity);
- Present occupation of the area (rural, urban, protected, etc., land);
- Accessibility by road (paved, unpaved, gradients, distance to access way, number of roads, etc.);

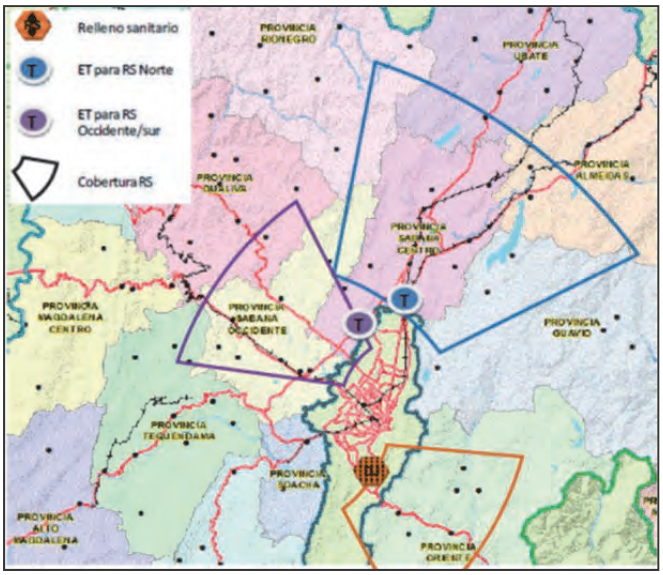
- Soil and topography conditions (gradients, hardness of soil);
- Distances (urban perimeter, transfer station, CG of municipalities);
- Availability of surface layer material (existence on the site, distance to the location where it can be obtained and quality of the material);
- Density of population of the area;
- Effect on vehicular congestion;
- Wind direction;
- Geoforms of the area with respect to surroundings (landscape impact);

After acquiring the survey information, phase 3, which is mainly office work, in which each site will be evaluated and ranked, will begin.

The most suitable sites can be selected on the basis of site ranking. If necessary, and if points are equal, certain assays and specific studies of the terrain or a re-definition of the 2nd Category exclusion criteria are recommended in order to settle the situation and re-evaluate.

A study entitled “Feasibility Study for the Structuring and Implementation of the Integral Management of Solid Waste Using Regional Exploitation, Transformation and Final Disposal Systems in Cundinamarca Department”. Among its objectives, this Study includes the identification of sites for future landfills in Cundinamarca Department, sectors to the north and west of Bogota, respectively.

So far, one proposal of sites considered appropriate for landfills has been presented, which are shown on the following figure.



Source: Feasibility study for the Structuring and Implementation of Integral Management of Solid Waste Using Regional Exploitation, Transformation and Final Disposal Systems in Cundinamarca Department 2013.

Figure 4-38: Areas in which to Search for Landfill Sites in the Northern and Western Sectors

Specifically, 14 sectors were identified in the western area: 9 in Bojaca, 1 in Mosquera, 1 in Madrid, 1 in Facatativa, 1 in Funza and 1 in Soacha (see the following figure).

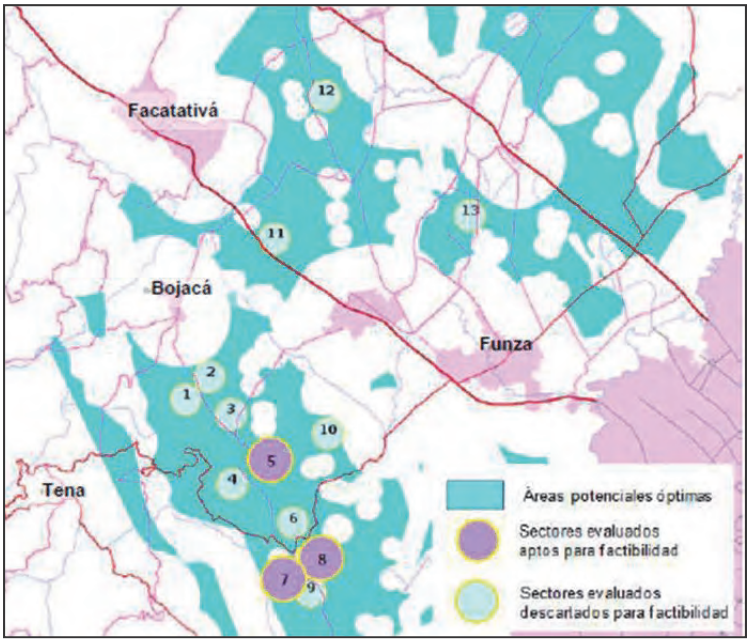


Figure 4-39: Areas Potentially Optimum in the Western Sector.

The following is an assessment of the drop-off points included in the following Table.

Table 4-89: Results of the Assessment of the Western Region Sectors

Sector	Location	Coordinates	Area (ha)	Points Dec. 838	Place in the Assessment	Conclusion
O-1	Bojacá, Barroblanco Hamlet	4°42,535´ N 74°20,118´ O	50	504	13°	This sector was excluded because of its type of productivity (grasses for livestock) and the settlements present in the areas of influence, such as cattle farms
O-2	Bojacá, Barroblanco Hamlet	4°42,535´ N 74°20,118´ O	50	502	14°	This sector was excluded because of its type of productivity (grasses for livestock) and the settlements present in the areas of influence, such as cattle farms
O-3	Bojacá, Barroblanco Hamlet	4°42,028´ N 74°20,146´ O	100	560	8°	This sector was excluded because of its type of productivity, which is agriculture and livestock farming
O-4	Bojacá, Barroblanco Hamlet	4°40,238´ N 74°19,029´ O	50	522	11°	This sector was excluded because of its topographical conditions (high hills) and because it is considered to be difficult to excavate.
O-5	Bojacá, Barroblanco Hamlet	4°39,563´ N 74°17,585´ O	200	788	1°	This sector was chosen for feasibility. There is erosion in gullies with little landscape value and the topographical conditions are favorable for excavation and the formation of infill cells.
O-6	Bojacá, Barroblanco Hamlet	4°38,673´ N 74°18,176´ O	50	566	6°	This sector was excluded because it was considered difficult to excavate and it has a thick layer of native vegetation.
O-7	Bojacá, Fute Hamlet	4°37,591´ N 74°17,337´ O	100	698	3°	This sector was chosen for feasibility. It is non-productive, has been subject to previous environmental interference and its topographical and location conditions make it suitable.
O-8	Bojacá, Fute Hamlet	4°37,723´ N 74°17,464´ O	100	724	2°	This sector was chosen for feasibility. It is non-productive, has been subjected to previous environmental interference; its topographical and location conditions make it suitable.

Sector	Location	Coordinates	Area (ha)	Points Dec. 838	Place in the Assessment	Conclusion
O-9	Bojacá, Fute Hamlet	4°37,107´ N 74°16,995´ O	50	522	12°	This sector was excluded because it was considered to have potential for livestock and the vegetal layer is mostly grass.
O-10	Mosquera, Balsillas hamlet	4°41,252´ N 74°16,535´ O	2	542	9°	This sector is excluded because its area is insufficient and it is suitable for livestock; the vegetal layer is mostly grass.
O-11	Madrid, Balsillas hamlet	4°46,25´ N 74°18,50´ O	90	594	4°	This sector was excluded due to the possible social effect as the adjacent flower farm brings in a large number of workers every day. It was also excluded because the surrounding area is suitable for both agriculture and livestock.
O-12	Facatativá, Paso Ancho hamlet	4°49,31´ N 74°16,01´ O	90	486	15°	This sector was excluded because of the social impact on the flower growers as creators of jobs and the surrounding area is suitable for agriculture and livestock.
O-13	Funza, Ceuta Hamlet	4°46,01´ NW 74°13,75´ O	13	566	7°	This sector was excluded because of the social impact on the flower farms as creators of jobs and the surrounding area is suitable for agriculture and livestock. It also has hydric potential for local irrigation.
O-14	Soacha, Canoas Hamlet	4°35,369´ N 74°16,335´ O	70	594	5°	Not viable because the area is insufficient for the Project.
O-15	Bogotá D.C. Quiba Neighborhood, Ciudad Bolívar	4°31,920´ N 74°10,980´ O	100	530	10°	Not viable because of complicated access by road through Ciudad Bolívar and Casuca.

Source: Feasibility Study for the Structuring and Implementation of Integral Management of Solid Waste through Regional Exploitation, Transformation and Final Disposal Systems in Cundinamarca Department 2013.

The evaluation carried out in the study referred to showed that sectors O-5, O-8 and O-7 are in first, second and third place in points favoring the location of a landfill.

So far no cartography maps of the study have been presented to permit verification of the first and second category exclusion areas and it will also define the pre-selected and evaluated sectors according to Decree 388.

In the short term, the Master Plan includes a revision of this study and verification of the procedures used to select the sectors and new restrictions in addition to those of the 2nd Category could be included. The preparation of maps is indispensable for the selection of the sector, as they will identify the 1st and 2nd Category excluded areas and permit a rapid overview of the possible sectors to be considered for selection.

Moreover, it must be borne in mind that selection of the site must be in line with clearly defined criteria and as far as possible quantifiable, in order to avoid subjective assessments. Among these aspects it is important to note that, among the conclusions reached as a result of the assessment of the sectors in the Cundinamarca study (see previous Table), most of them are excluded because they have land suitable for agriculture or livestock, neither of which appears in articles 5 and 6 of Decree 838 which establish *"Criteria and methodology for the identification of areas for the final disposal of solid waste using landfill technology"* and *"Prohibitions and restrictions on the identification of areas for final disposal of solid waste"*, respectively. and, therefore, do not constitute valid arguments for their elimination.

Once the study has been reviewed and adjusted to the procedure of selection of the proposed site, it is expected that there will be two or three sites in the case of which legal studies must be made of the possible properties and costs associated with their acquisition. The definitive site will be selected on the basis of these results and it will then be purchased. Lastly, and once the site has been selected, this information must be included in the Zoning Plan (POT).

c. Management Model

As the Western landfill will be of a regional nature, because it will provide the solution for the final disposal from Bogota and several municipalities in Cundinamarca Department, it cannot be administered in the same way as the RSDJ and, therefore, the management model for its administration and operation, which will govern the said project and ensure its viability in time, must be defined.

Chapter IX of Law 136 of 1994, which establishes the general principles of municipal organization and functioning, refers to the formation of associations among municipalities,

specifically in article 148, which states: *"Two or more municipalities in one or more Departments may associate for the purposes of jointly organizing the provision of public services, the execution of works or the performance of administrative functions, seeking their efficiency and efficacy, as well as the integral development of their territories and collaborating with each other in the implementation of public works"*. Subsequently, article 149 provides a definition of the association of municipalities, stating *"Associations of municipalities are public law administrative entities, with legal status and with their own capital, which is independent of the entities which form them; they are governed by their own by-laws and shall enjoy, for the fulfillment of their purpose, the same rights, privileges, exceptions and prerogatives granted by the law and the municipalities. The acts of the associations may be reviewed and annulled by Contentious Administrative Jurisdiction"*. Article 150 establishes their formation and functioning.

Under Law 1551 of 2012, which establishes regulations for modernizing the organization and functioning of the municipalities, points g) to i) were included in article 5 of Law 136/1994, in which points h) and i) are for the purposes of promoting associative schemes and they state specifically:

> *h) Association. The municipal authorities, in order to achieve the objectives of economic and territorial development, shall promote the formation of associations between territorial entities and territorial integration agencies in order to produce scale economies and to generate synergies and competitive alliances. Likewise, they shall promote the execution of public-private contracts, plan and alliances for rural development:*
>
> *i) Economy and Good Governance. The municipality shall seek to guarantee its economic and fiscal self-sustainability and shall foster the professionalization of its administration, for which it shall promote associative schemes which prioritize reduction in spending and good governance in its formation and functioning.*

Based on current legislation, the administrative model proposed will be the formation of an Association of Municipalities which includes Bogota and Municipalities of Cundinamarca , whose purpose shall be to administer the western landfill for the purpose of providing its partner municipalities with the service of final disposal.

> The respective agreement shall be drawn up for the formation of this association and, following the prior approval of their respective councils, signed by the mayors of the partner municipalities.

In addition, an organizational structure to facilitate efficient administration and operation (either directly or through third parties) of all the components of the project, maximizing the results and responding rapidly and opportunely to its requirements.

The following organizational structure is proposed for the association.

Source: Own preparation

Figure 4-40: Association Organization Chart

The organization proposed will have the following structure: The Executive Secretary will report directly to the Association Directors, implementing the provisions and outlines established by them. Such Executive Secretary will also be the Legal Representative and have executive responsibility for the management and administration of the different components of the project.

The Executive Secretary will be in charge of three units: Technical Planning, Administration and Finance and the Executive Unit, each with Management level activities.

The Administration and Finance Unit will be responsible for efficiently administering economic-financial and human resources, using an adequate accounting system and for budgetary and costs control. It must also implement the process of invoicing and collection.

For its part, the Technical Planning Unit will be responsible for permanent evaluation of the project and must have the information necessary for decision taking by the Executive Secretary and the Directors of the Association. For the purpose, implementation of management and operational indicators will be indispensable for follow-up and evaluation of the project while, at the same time, recommending actions to achieve continuous improvement. This Unit will be responsible for carrying out tender processes in coordination with the other Units, the implementation of pilot projects, study and assessment of new or alternate technologies that

can be incorporated into the process of waste exploitation, final disposal, treatment of leachates, etc., in order to achieve greater efficiencies and reduce costs. Its work must be supported by the activities of Supervisor by providing the background information necessary for assessment of the project. Moreover, it must assist the concessionaire(s) responsible for the operation of the project in obtaining permits and/or licenses.

As to the Executive Unit, it will function as a control and coordination entity for the different contracts that operate in the landfill in order to achieve continuous and efficient operation of the entire system according to the established quality standards and in compliance with the established goals and current legislation. This Unit will be responsible for ensuring good, correct performance of the concession or other contracts relating to the enabling, operation and maintenance of the different project components.

The association shall review and verify the existence of national level resources which it can opt for because the project is regional and, at the same time, comply with the provisions of Law 1450 of 2011 governing the regional incentives for the location of landfills.

d. Project, Licenses and Permits

The Master Plan covers the development of the Western Landfill in the medium term in order to have the time necessary to prepare the specific studies of terrain, the design and detailed engineering of the landfill, the percolated liquids treatment plant, biogas and facilities, to present and obtain environmental licenses and permits according to current regulations and thus ensure that, at the beginning of the long term (year 2019) it will be possible to carry out the concession process for the operation and maintenance of the landfill, beginning the year after it is commissioned.

The following are identified as the Authorizations, Licenses and Permits required for the project:

Environmental License: Under Law 99 of 1993, an Environmental License is defined as an administration and planning instrument to prevent, mitigate, correct, compensate for and manage environmental effects during the performance of any work or activity. Article 49 of Law 99 establishes the obligatory nature of an Environmental License for the implementation of works, the establishment of industries or the performance of any activity which, according to the law and regulations, might cause serious deterioration of natural renewable resources or of the environment or introduce considerable or notable changes in the landscape. For its part, Decree 2820/2010, under which Heading VIII of Law 99 of 1993 on Environmental Licenses is regulated, establishes in article 9 that Regional Autonomous Entities are responsible for issuing or denying environmental licenses for the projects, works or activities described in the said

article implemented in the area of their jurisdiction. Among the projects cited in the article, numeral 13 refers to: *"The construction and operation of landfills"* and numeral 12 to: *"The construction and operation of plants whose purpose is the exploitation and revaluation of 20,000 tons per year or more of biodegradable organic waste"*.

Article 3 of the same Decree 2820/2010 states: "All permits, authorizations and/or concessions for the use, exploitation and/or regarding effects on renewable natural resources necessary during the useful life of the project, work or activity are implicit in an environmental license. As stated in this paragraph, it is understood that obtaining permits for: the concession of surface waters, for the occupation of river beds, for discharges and for atmospheric emissions, form part of the environmental licensing process and, therefore, all the background information on the project must be presented during this instance.

The surface waters concession permit, regulated under Decree Law 2811 of 1974 and Decree 1541 of 1978, which was amended under Decree 2858 of 1981, establishes the procedures required for the granting of hydric resources concessions. This permit is necessary in the event that the landfill project includes any hydric resource close to the facilities as a source of water supply.

The permit for the occupation of river beds is required in the event that the project requires occupation of a river bed or deposit of water either temporarily or permanently, according to the conditions established by the competent environmental authority, as regulated under Chapter 2 of Heading III of Decree Law 2811 of 1974.

A discharge permit, which is regulated under Decree 3930 of 2010, is applicable in the event that the effluent from the leachates treatment plant is discharged into a hydric resource or sewage system.

Under Decree 3930, Chapter VI regulates discharges and Chapter VII the obtaining of discharge permits and compliance plans. Regarding permits, article 41establishes that: *"All natural or legal persons whose activity or service produces discharges into surface waters, marinas or onto soil must request and process the respective discharge permit with the competent environmental authority."* For its part, article 42 establishes the requirements of the discharge permit.

In addition to the foregoing permits, a landfill requires a Town Planning Permit or License, which, according to the respective requirements, may be for urban development, partitioning, sub-division and/or Construction. This License is granted by the competent urban planning or municipal authority. Such licenses must be obtained in accordance with the provisions of Decree 1469 of 2010.

Lastly, Heading F of Resolution 1096 of 2000 (RAS 2000) establishes the basic criteria and minimum requirements which must be met in the different processes involved in the concept, design, construction, technical supervision, commissioning, operation and maintenance of the **urban garbage systems** used in the Republic of Colombia in order to guarantee their safety, durability, functioning, quality, efficiency, sustainability and redundancy within a specific level of complexity. Numeral F.6 of this instrument defines the minimum requirements necessary for landfill final disposal systems to be designed, operated and monitored in order to avoid and mitigate the environmental impacts caused by using this system. These requirements must be complied with by the Western Landfill project.

e. Exploitation Project

The Master Plan includes revision and evaluation of technologies for the exploitation of organic waste in the Western Landfill and the viability of its implementation. Commissioning a project of this nature may reduce the volume of waste for final disposal, which could increase the useful life of the landfill or reduce the surface area required for the project.

Analysis of the technologies must be made in the medium term once the project site is defined and before designing the final disposal site because it will be affected by the implementation of a waste exploitation project.

In the viability study for the waste exploitation project the ways in which it will, among other parameters, affect the other service user municipalities, in particular by its impact on costs and its effect on their capacity to absorb such costs in the tariff for final disposal and exploitation, must be taken into consideration.

When a waste exploitation project is to be implemented, the permits required by it must be included in the environmental licensing process.

f. Western Landfill Concession Process

Once the environmental license and permits have been obtained as established in the current regulations, it will be necessary to draw up terms of reference for the tender process for the concession of the commissioning, operation and maintenance of the Western Landfill. The Master Plan includes this process at the beginning of the long term (2019), so that the work of landfill commissioning can commence in the year 2020.

It will also be necessary, in accordance with the management system defined, to draw up the terms of reference for the Supervisor contract tender, the main objective of which will be to ensure compliance with the landfill concession contractual terms.

Both tender processes can take place in parallel.

In addition, the MP includes the process of one or more prior tenders for fulfillment of the following necessities:

- Selection of the site for the RSOcc;
- Studies of title deeds of the lot(s) of land selected and the documentation required for their acquisition;
- Specific studies of the terrain for the preparation of the design and detailed engineering of the project;
- Processing and obtaining the respective environmental license and the permits.

The above requirements can be included in the preparation of the terms of reference for the tender for the concession of the commissioning, operation and maintenance of the landfill and the Supervisor contract, also including follow-up of the process, assessment of bids and bidder ranking preparation. All of the foregoing is covered by the MP for the short and medium term.

In addition, the MP states that, once the RSOcc goes into operation, its operation must be followed up in order to ensure compliance with current regulations governing the operation to verify fulfillment of the contractual obligations under the existing contracts and evaluate the effectiveness of the RSOcc operation and maintenance management indicators.

4.3.3 Northern Landfill (RSNor)

In addition to a landfill going into operation in the western sector, the MP includes, for the long term, specifically the year 2026, the commissioning of a landfill in the north. It will be a regional project that includes part of the population of Bogota and municipalities in the northern sector of Cundinamarca Department.

a. Sizing the Northern Landfill

a.1 Useful Life and Capacity

As stated previously, the northern landfill will receive approximately 20% of Bogota waste for final disposal, while a quantity equal to that of the capital has been calculated for the municipalities of the northern sector of Cundinamarca Department. The following Table shows the quantity of waste that will be discharged into the RSNor over a period of 30 years.

Table 4-90: Projection of Income from Waste to RSNor

Year of Project	Year	Bogota	Other Municipalities	Annual Total	Accumulation
		Tons/year	Tons/year	Tons/year	Tons
1	2026	510.878	510.878	1.021.756	1.021.756
2	2027	515.718	515.718	1.031.436	2.053.192
3	2028	524.081	524.081	1.048.162	3.101.354
4	2029	532.444	532.444	1.064.888	4.166.242
5	2030	540.807	540.807	1.081.614	5.247.856
6	2031	549.170	549.170	1.098.340	6.346.196
7	2032	557.533	557.533	1.115.066	7.461.262
8	2033	565.896	565.896	1.131.792	8.593.054
9	2034	574.260	574.260	1.148.520	9.741.574
10	2035	582.623	582.623	1.165.246	10.906.820
11	2036	590.986	590.986	1.181.972	12.088.792
12	2037	599.349	599.349	1.198.698	13.287.490
13	2038	607.712	607.712	1.215.424	14.502.914
14	2039	616.075	616.075	1.232.150	15.735.064
15	2040	624.438	624.438	1.248.876	16.983.940
16	2041	632.801	632.801	1.265.602	18.249.542
17	2042	641.164	641.164	1.282.328	19.531.870
18	2043	648.858	648.858	1.297.716	20.829.586
19	2044	656.644	656.644	1.313.289	22.142.874
20	2045	664.524	664.524	1.329.048	23.471.922
21	2046	672.498	672.498	1.344.997	24.816.919
22	2047	680.568	680.568	1.361.137	26.178.056
23	2048	688.735	688.735	1.377.470	27.555.526
24	2049	697.000	697.000	1.394.000	28.949.526
25	2050	705.364	705.364	1.410.728	30.360.253
26	2051	713.828	713.828	1.427.657	31.787.910
27	2052	722.394	722.394	1.444.788	33.232.698
28	2053	731.063	731.063	1.462.126	34.694.824
29	2054	739.836	739.836	1.479.671	36.174.496
30	2055	748.714	748.714	1.497.427	37.671.923

Source: Own preparation

Surface Area

To determine the surface area necessary for the implementation of the RSNor, the same criteria as those for the RSOcc have been used to obtain a surface area equal to: approximately 253 hectares, as detailed in the following Table.

Table 4-91: Details of Distribution of Surface Areas for RSNor.

Item	Surface Area
	Hectares
Waste disposal	154,5
Facilities	2,8
Leachates treatment plant	3,5
Storage of leachates	4,4
Biogas management plant	3,0
Pathways	7,0
Area of buffer zone	77,2
Total	252,4

Source: Own preparation

b. Selection of Northern Landfill Site

The proposal for the selection of the del RSNor is to apply the same procedure as the one described for the RSOcc, allowing for the inclusion of new restrictions under the 2nd Category exclusion criteria if it is considered relevant. Likewise, the exclusion criteria must be updated if the present regulations are amended.

In the "Feasibility Study for the Structuring and Implementation of Integral Solid Waste Management Using Regional Exploitation, Transformation and Final Disposal Systems in Cundinamarca Department". Also included are the study and selection of sites for the installation of a landfill in the northern sector of Cundinamarca, where a total of 12 sectors have been identified: 2 in Nemocón, 2 in Cogua, 2 in Suesca, 3 in Cucunubá, 1 in Sutatausa, 1 in Tausa y 1 in Ubaté, the locations of which are shown in the following Figure:

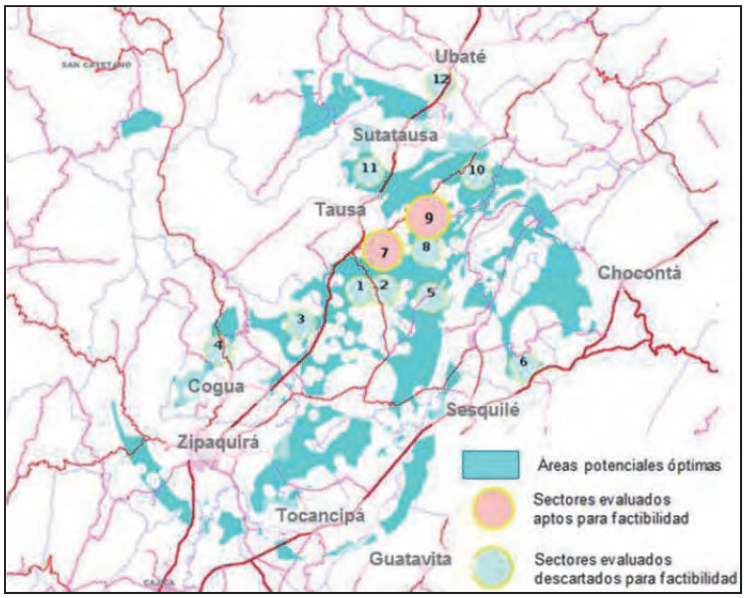


Figure 4-41: Areas Potentially Suitable for a Northern Sector Landfill

An assessment of the sites included in the study under reference is set out in the following Table.

Table 4-92: Results of the Evaluation of Sites in the Northern Sector of Cundinamarca Department

Sector	Location	Coordinates	Area (ha)	Points Dec. 838	Place in the Assessment	Conclusion
N-1	Nemocón, hamlet Cerro Verde	5°07,998´ N 73°52,706´ O	100	738	1°	This place is technically and environmentally suitable. However, opposition on the part of the community reduces the possibilities of implementing a landfill in this area and it was therefore excluded.
N-2	Nemocón, hamlet Cerro Verde	5°08,003´ N 73°51,147´ O	50	638	4°	This sector was excluded because it was considered difficult to excavate and because of opposition to this type of project on the part of the community.
N-3	Cogua, hamlet Casablanca	5°06,803´ N 73°54,793´ O	5	588	6°	This sector was excluded because the size of the terrain is insufficient and the effect on the population would be considerable.
N-4	Cogua, Rodamental hamlet	5°04,768´ N 73°58,676 O	500	560	7°	This sector was excluded because it is close to densely populated centers and productivity of the land.
N-5	Suesca, Susatá hamlet	5°07,999´ N 73°50,302´ O	50	468	11°	This sector was excluded because it would be difficult to excavate, it is a long way away from the main road and access to the location is difficult.
N-6	Suesca, Tenería hamlet	5°05,493´ N 73°45,911´ O	200	538	8°	This sector was excluded because of difficult access and population density.
N-7	Tausa, Ladera Grande hamlet	5°09,839´ N 73°51,010´ O	40	694	2°	This sector has been chosen for a feasibility study. Soils are degraded and non-productive, easy land movement and few houses in the area of influence.
N-8	Cucunubá, Alto Aire hamlet	5°10,719´ N 73°49,874´ O	50	638	5°	This sector was excluded because of the presence of bodies of water, productivity of the land and difficult Access.

Source: Feasibility Study for the Structuring and Implementation of Integral Management of Solid Waste through Regional Exploitation, Transformation and Final Disposal Systems in Cundinamarca Department 2013.

According to the assessment in the study referred to, sectors N-1 and N-7are in first and second place in points favoring the localization of a landfill.

So far no maps of the study have been presented to allow verification of the 1st and 2nd category exclusion areas and which also define the pre-selected and evaluated sectors according to Decree 388.

The Master Plan includes revision of this study and verification of the procedures followed to select the sectors and new restrictions in addition to those of the 2nd Category could be included or updated in the event of an amendment to the regulations.

For the selection of the RSNor site, the same procedure as the one proposed for the RSOcc is recommended and a re-assessment of the land considered in the Cundinamarca study.

c. Management Model

A management model must be established for the administration of the Northern landfill. Therefore, implementation of a model similar to that of the RSOcc, once it has been evaluated, optimized and also adapted to the peculiarities of the RSNor, is proposed.

d. Project, Licenses and Permits

The Master Plan includes the development of the Northern Landfill project as of the beginning of the long term, with a schedule of activities that will permit the respective environmental license and permits to be obtained by the year 2023.

When the time comes to prepare the projects, the current regulations must be reviewed to check for any amendments have been introduced which might affect the process of obtaining the environmental license and permits and which must be included introduced into the process.

e. Exploitation Project

The MP also anticipates the possibility of implementing a waste exploitation project as part of the RSNor. This project will be able to benefit from experience gained in projects of this nature already implemented in the other landfills (if any), as well as an assessment of any new technologies that may be available at the time for this project.

f. Northern Landfill Concession Process

For correct implementation of the different projects, the MP has taken into account the different tender processes detailed above for the RSOcc.

4.3.4 Costs of Final Disposal

4.3.4.1 General Aspects

The MP covers operation of the Doña Juana landfill and the implementation of two new landfills, one in the western sector in 2021and the other in the northern sector in 2026. Based on the conditions established in the MP, the number of tons to be discharged into each landfill has been determined and the conditions under which they should operate in compliance with the current regulations.

Taking the foregoing scenario into account, each of the projects has been economically evaluated in order to fix an average tariff for each landfill. All costs have been included in these assessments, regardless of who undertakes the construction, operation and maintenance of the landfill.

Moreover, the requirements and restrictions applied to these projects under the regulations, such as, for example, the requirement for a useful life of a minimum of 30 years for regional landfills (Western and Northern landfills), the required quality of effluent from the treatment plant in order to grant the discharge permit, among others.

The quantities of waste destined for each landfill are those determined in the MP. For landfills where an evaluation horizon in excess of the term of the MP was calculated, the amount of waste for later years was assessed according to recent years' growth rates.

The following is a description of the criteria or suppositions applied to calculate the costs.

4.3.4.2 Costs of Preliminary Activities

As their name suggests, these costs involve all those which have to be paid prior to the construction or commissioning of the landfill or any component of it. The following are included:

1.1 Preliminary Site Selection Studies
1.2 Purchase of land (studies of titles)
1.3 Specific Studies, Landfill Design, EIA
1.4 Presentation and Obtaining Licenses and Permits
1.5 Tender Processes

a. RSDJ Costs

In the case of the Doña Juana landfill, the costs of obtaining an environmental license for the Director Plan and the expenses associated with the tender process for the concession of the construction, operation and maintenance of this phase of the landfill were considered preliminary costs. The land is not included in them, because it is presumed that these expenses have already been amortized. The costs represent real present values.

b. Costs for the Western and Northern Landfills

For the Western and Northern landfills, the preliminary activities are all those relating to the selection of sites, purchase of properties, preparation of studies and project, obtaining permits and environmental licenses and the tender process for the Concession of the Final Disposal service. The cost of land is included for these landfills, because it forms part of the commissioning and it is distributed throughout the useful life of the landfill. The annual cost is calculated as a unit amount for the tons discharged into them in the year. To determine the unit cost, that of land for both landfills has been included at 30,000,000 $CO/hectare, thereby obtaining the following unit costs.

Table 4-93: Unit Cost of Land for Western and Northern Landfills

Item	Unit	RS0cc Landfill	RSNo
Cost of land	$Co/ha	30.000.000	30.000.000
Surface Area	ha	400	260
Total Cost		12.000.000.000	7.800.000.000
Total tons in useful life	Tons	58.674.585	37.671.923
Unit Cost	$Co/Tons	204,51	207,05

Source: Own preparation

4.3.4.3 Costs of Infrastructure - Facilities - Machinery

The costs of infrastructure and facilities include all those associated with the construction of:

- Perimeter fencing
- Buildings such as offices, storehouses, workshops, personnel facilities, soil laboratory, etc.;
- Access ways and internal roadways;
- Entry and weighing controls, including a weighing machine;
- Services such as drinking water, sewage system, electricity and communications;
- Other minor infrastructure.

These costs were determined on the basis of present data provided by UAESP.

For their part, the costs of machinery include those of initial investment and replacement of machinery, equipment and tools.

a. RSDJ Infrastructure Costs

The RSDJ already has the necessary infrastructure and facilities and therefore only a maintenance cost is included for them, which is equivalent to 180 $Co/Ton. The same applies to the machinery, so that the purchase of machinery as an initial investment has not been taken into account, so that only the respective replacement and maintenance cost per ton of 230 $Co/Ton has been determined.

b. Costs of Western and Northern Landfills Infrastructure and Facilities

Because they are new, these two landfills must include the construction of all the infrastructure and facilities, as well as the initial investment in machinery, equipment and tools. The investments associated with these items were distributed throughout the useful life per landfill, following the same procedure as the one explained above for investment in land. The following table shows the costs of the initial investments and the respective unit cost.

Table 4-94: Unit Cost of Land for Western and Northern Landfills

Item	Unit	Western Landfill	Northern Landfill
Cost of Infrastructure and facilities	$Co	98.588.790.275	59.153.274.165
Total tons in useful life	Ton	58.674.585	37.671.923
Unit Cost	$Co/Ton	1680,26	1570,22

Source: Own preparation

In addition, a cost for maintenance and repairs of the facilities throughout the project equivalent to 180 $Co/Ton has been included.

Table 4-95: Unit Cost of Land for Western and Northern Landfills

Item	Unit	Western Landfill	Northern Landfill
Cost of machinery, equipment and tools	$Co	9.500.000.000	5.700.000.000
Total tons in useful life	Ton	58.674.585	37.671.923
Unit Cost	$Co/Ton	161,91	151,31

Source: Own preparation

In addition, a cost for maintenance and replacement of machinery, equipment and tools of 230 $Co/Ton has been included.

4.3.4.4 Costs per Landfill

A landfill presupposes dynamic activity which, year after year, requires investments in land adaptation, internal roadways, leachates management and biogas, machinery, etc., and the activities of operation, sealing and maintenance also have to be carried out. For this reason, and in order to facilitate calculations, a unit cost for the items described above has been determined. They are classified in:

3.1	Preliminary works:	These include the activities of re-designing works, laboratory assays, adaptation of adjacent areas to the deposit zone, etc. Management of water, dikes, etc. along the perimeter.
3.2	Adaptation	This includes all the activities involved in the preparation of the surface area for later reception of waste, which implies land movements (excavation, landfill collections, etc.), management of surface waters, waterproofing, leachates bed drainages, roadways, etc.
3.3	Operation	This involves all the activities of operation or waste disposal, instrumentation, monitoring, assays, rainwater management, machinery, etc.
3.4	Sealing	These are the activities of final coverage, catchment and disposal of leachates, biogas management, etc.

The calculation of costs is based on budgets drawn up by the RSDJ concessionaire company for Phase II of optimization. On the understanding that, as mentioned previously, the activity is cyclic, a unit value per ton disposed of ($/ton) has been calculated for each of these activities, which was obtained by dividing the total cost of the activity for Phase II of optimization by the total tons to be disposed of.

The unit costs calculated for each activity are:

Preliminary works:	560 $Co/ton
Adaptation/ Preparation:	3,040 $ Co/ton
Operation:	5,840$ Co/ton
Sealing:	150$ Co/ton
Total:	9,590 $Co/ton

a. Costs of Final Disposal for RSDJ

The costs of final disposal for this landfill are determined on the basis of the unit costs and the amount of waste discharged in the year in which the cost is incurred because it is already in operation.

b. Costs of Final Disposal in Western and Northern Landfills

The costs of final disposal for these landfills are calculated as they are for the RSDJ. However, it has been presumed that both the costs of the preliminary works and those of adaptation are reflected in the year prior to operation of same.

4.3.4.5 Costs of Leachates Treatment (PTL)

The costs of leachates treatment were determined on the basis of the draft "New Framework Garbage Collection Tariff Draft Resolution" of the CRA. A ceiling tariff has been included in this proposal for the treatment of leachates according to the expected effluent quality. These ceiling tariffs, which include investment and operation, are:

Table 4-96: Unit Cost of Leachates Treatment

Type of Treatment	Cost of Treatment $Co/m3
1	5.192
2	6.350
3	14.599
4	15.758

Source: Own preparation

In addition, it has been estimated that, according to the requirements to obtain a discharge permit, the level of leachates treatment must comply with the one identified as type 4. Moreover, and, based on the RSDJ leachates generation per ton of waste, which is approximately 0.28 m^3, the unit cost of leachates treatment has been calculated at 4,412.24 $Co/ton, which is the unit value to be applied to the treatment of leachates in the three landfills.

The annual cost of leachates treatment was calculated as a function of the unit price of treatment and the number of tons discharged into the landfill in that year.

4.3.4.6 Costs associated with the Biogas Plant

Up to the beginning of 2013, management of the biogas plant in the RSDJ was under a contract that permitted exploitation of the biogas generated in the landfill as part of an MDL project. However, due to the sharp drop in carbon bonds this project is not economically viable.

For the purpose of economic assessment, it has been taken into consideration that, regardless of the type of project undertaken to exploit biogas power value, the expenses involved in its management must always be covered, since, at the least, it will have to be incinerated in order to avoid atmospheric contamination and, at the same time, the risks in the landfill. On the most negative scenario, the UAESP must assume these costs and, therefore, they have been included in the economic assessment. In the event that an exploitation project is implemented, the

income it produces must be included in the economic assessment and the average cost per ton re-calculated.

For the purposes of the economic assessment, a unit cost has been assumed for the management of the biogas plant at 0.6 US$/ton, that is 1,140 $Co/ton at an exchange rate of 1,900 Co/US. This unit cost is used for the three landfills.

4.3.4.7 Environmental Management Plan

a. Doña Juana landfill

The costs of the Environmental Management Plan are calculated on the basis of present values of the Plan implemented in the RSDJ. On the supposition that there will be no increase in the surface area in Doña Juana and the population impacted will be the same, it is considered that there will be no changes in the cost of this Plan and that it will remain at an annual value of 1,594,039 $Co/year.

b. Western and Northern Landfills

Because these two landfills are new, it is presumed that the cost of the Environmental Management Plan will gradually increase over time, because the area impacted will also increase and, therefore, an annual sum was calculated on the basis of a percentage of the present cost of the RSDJ Management Plan and an annual rate of reduction because of the larger surface area occupied by the solid waste. The costs for these landfills are:

Western Landfill: initial value 1.195.530 $Co/year, final value (year 30): 1.611.393 $Co/year.

Northern Landfill: initial value 956.424 $Co/year, final value (year 30): 1.289.115 $Co/year.

The annual cost increase rate has been set at 1%.

4.3.4.8 Closing and Post Closing Provision

An item associated with the landfill closing and post-closing has been included in the costs as an established provision so that these activities can be carried out when the useful life of the landfill comes to an end.

The provision was determined as a function of the content of the proposed “New Framework Garbage Collection Draft Tariff Resolution”, which establishes that the provision for landfills of this capacity accounts for 14% of the total costs of the landfill.

Therefore, the provision for Closing and Post Closing is calculated at 14% of the sum of the costs of infrastructure and buildings, landfill, leachates treatment plant and biogas plant, as these items have to be maintained throughout the said period.

4.3.4.9 Supervisor

The landfills are expected to require Supervisor contracts in order to supervise and control correct implementation of the concession agreements.

The cost of these contracts may be expected to gradually increase as larger quantities of waste are discharged into the landfill and a larger area will be covered by the project.

An annual cost has been established by the Supervisor for each landfill as detailed below:

a. RSDJ Supervisor

At present there is a contract which will be maintained until the year 2022 and these costs will therefore be included in the economic assessment. According to this contract, the Supervisor costs will increase annually by 3%..

In addition, according to the MP, as of 2021, the quantity of waste going into the landfill will be reduced by some 50% and, therefore, it is considered that there should be a reduction in costs in that year, which is estimated at 40%. Up to 2022, the cost of Supervisor will maintain its growth rate of 3%.

b. Western and Northern Landfills Supervisor

The costs associated with the Supervisor are determined as a function of the cost of this service in the RSDJ, the amount of waste discharged into each landfill and the area of the project. An annual increase of 1% in this cost has also been included.

An initial cost of 3,644,515 $Co/year has been included for the Western landfill and, for the Northern landfill, of 2,803,473 $Co/ton, equivalent to 65% and 50% of the present value of the RSDJ Supervisor.

4.3.4.10 Indirect Costs

The following indirect costs are included: general expenses, contingency and profit. The costs associated with general expenses and profit were determined as a percentage of all the landfill costs, which are shown by the CRA in the document “New Framework Garbage Collection Draft Tariff Resolution” 2013, and represent 12.8% for general expenses and 12.6% for profit. In the case of contingencies, the percentage has been estimated at 10% based on the consultant’s experience.

4.3.4.11 Other Indicators or Suppositions

- A discount rate 12.6%, equal to that applied by the CRA to establish the ceiling tariffs in the “New Framework Garbage Collection Draft Tariff Resolution” 2013 has been taken for the purposes of the assessment.

- The exchange rate has been fixed at 1,900 ($Co) per United States dollar (US$).
- The amounts are before tax.
- The term for assessment for the RSDJ is the same as that of the MP, while for the western and northern landfills the term is 30 years, as required under current regulations.
- The average tariff has been calculated as the quotient between the present value of total costs and the present value of the tons discharged in the same period.

The following are the results of the economic assessments.

4.3.4.12 Results of Economic Evaluation of Final Disposal

The following tables show the annual cost flow for final disposal and the average cost per ton for the three landfills.

Table 4-97: Cost Flow, Doña Juana Sanitary Landfill

		Unit Cost	Año															Total
		$/ton	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	
	Total waste amount		2,351,656	2,347,515	2,324,212	2,355,599	2,384,434	2,410,597	2,430,863	2,452,137	1,231,827	1,236,574	1,246,400	1,255,810	1,264,805	766,316	773,576	**26,832,321**
Item	**Description**		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	
1.-	**Preliminary Activities**																	
1.1	Preliminary Site Selection Study																	0
1.2	Land Acquisition																	0
1.3	Design, EIA Study					570,000												570,000
1.4	Obtaining Environmental License		10,000				15,000											25,000
1.5	Bidding								80,000									80,000
	Sub-total, preliminary activities		**10,000**	**0**	**0**	**570,000**	**15,000**	**0**	**80,000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**675,000**
2.-	**Infrastructure and Equipment**																	
2.1	Access road, site preparation, etc.	0.18	423,298	422,553	418,358	424,008	429,198	433,907	437,555	441,385	221,729	222,583	224,352	226,046	227,665	137,937	139,244	4,829,818
2.2	Equipment	0.23	540,881	539,928	534,569	541,788	548,420	554,437	559,098	563,992	283,320	284,412	286,672	288,836	290,905	176,253	177,922	6,171,434
	Sub-total, infrastructure and equipment		**964,179**	**962,481**	**952,927**	**965,796**	**977,618**	**988,345**	**996,654**	**1,005,376**	**505,049**	**506,995**	**511,024**	**514,882**	**518,570**	**314,190**	**317,166**	**11,001,252**
3.-	**Sanitary Landfill**																	
3.1	Preliminary works	0.56	1,314,783	1,312,468	1,299,440	1,316,988	1,333,109	1,347,737	1,359,067	1,370,961	688,700	691,354	696,848	702,109	707,138	428,438	432,497	15,001,638
3.2	Preparation	3.04	7,148,077	7,135,490	7,064,658	7,160,062	7,247,709	7,327,234	7,388,834	7,453,498	3,744,253	3,758,682	3,788,549	3,817,151	3,844,492	2,329,289	2,351,356	81,559,333
3.3	Operation	5.84	13,722,305	13,698,142	13,562,165	13,745,313	13,913,570	14,066,236	14,184,491	14,308,629	7,187,916	7,215,616	7,272,952	7,327,861	7,380,348	4,471,582	4,513,945	156,571,070
3.4	Closure	0.15	361,610	360,973	357,390	362,216	366,650	370,673	373,789	377,060	189,416	190,146	191,656	193,103	194,487	117,835	118,951	4,125,954
	Sub-total, sanitary landfill	**9.59**	**22,546,775**	**22,507,073**	**22,283,653**	**22,584,579**	**22,861,038**	**23,111,879**	**23,306,181**	**23,510,148**	**11,810,284**	**11,855,797**	**11,950,005**	**12,040,224**	**12,126,465**	**7,347,144**	**7,416,750**	**257,257,994**
4.-	**Leachate Treatment Plant**																	
4.1	Investment, operation and monitoring	4.41	10,376,071	10,357,800	10,254,981	10,393,468	10,520,695	10,636,133	10,725,551	10,819,417	5,435,116	5,456,061	5,499,416	5,540,935	5,580,623	3,381,170	3,413,203	118,390,640
	Sub-total, LTP	**4.41**	**10,376,071**	**10,357,800**	**10,254,981**	**10,393,468**	**10,520,695**	**10,636,133**	**10,725,551**	**10,819,417**	**5,435,116**	**5,456,061**	**5,499,416**	**5,540,935**	**5,580,623**	**3,381,170**	**3,413,203**	**118,390,640**
5.-	**Biogas Plant**																	
5.1	Investment, operation and monitoring	1.14	2,680,888	2,676,167	2,649,602	2,685,383	2,718,255	2,748,081	2,771,184	2,795,436	1,404,283	1,409,694	1,420,896	1,431,623	1,441,878	873,600	881,877	30,588,846
	Sub-total, biogas plant	**1.14**	**2,680,888**	**2,676,167**	**2,649,602**	**2,685,383**	**2,718,255**	**2,748,081**	**2,771,184**	**2,795,436**	**1,404,283**	**1,409,694**	**1,420,896**	**1,431,623**	**1,441,878**	**873,600**	**881,877**	**30,588,846**
6.-	**Environment Management Plant**																	
6.1	EMP	1,594,039.43	1,594,039	1,594,039	1,594,039	1,594,039	1,594,039	1,594,039	1,594,039	1,594,039	1,594,039	1,594,039	1,594,039	1,594,039	1,594,039	1,594,039	1,594,039	23,910,591
	Sub-total EMP		**1,594,039**	**1,594,039**	**1,594,039**	**1,594,039**	**1,594,039**	**1,594,039**	**1,594,039**	**1,594,039**	**1,594,039**	**1,594,039**	**1,594,039**	**1,594,039**	**1,594,039**	**1,594,039**	**1,594,039**	**23,910,591**
7	**Closure and Post-closure**																	
7.1	Closure and Post-closure	2.14	5,043,784	5,034,903	4,984,923	5,052,241	5,114,086	5,170,200	5,213,666	5,259,294	2,641,998	2,652,179	2,673,254	2,693,436	2,712,728	1,643,579	1,659,150	57,549,422
	Sub-total, closure and post closure	**2.14**	**5,043,784**	**5,034,903**	**4,984,923**	**5,052,241**	**5,114,086**	**5,170,200**	**5,213,666**	**5,259,294**	**2,641,998**	**2,652,179**	**2,673,254**	**2,693,436**	**2,712,728**	**1,643,579**	**1,659,150**	**57,549,422**
8	**Supervision**																	
8.1	Supervision		4,558,960	4,695,729	4,836,601	4,981,699	5,131,150	5,285,084	5,443,637	5,606,946	3,465,093	3,569,045	3,676,117	3,786,400	3,899,992	4,016,992	4,137,502	67,090,947
	Sub-total, supervision		**4,558,960**	**4,695,729**	**4,836,601**	**4,981,699**	**5,131,150**	**5,285,084**	**5,443,637**	**5,606,946**	**3,465,093**	**3,569,045**	**3,676,117**	**3,786,400**	**3,899,992**	**4,016,992**	**4,137,502**	**67,090,947**
9	**Indirect Cost**																	
9.1	Administration	12.8%	6,113,881	6,122,009	6,087,261	6,176,922	6,261,361	6,340,321	6,406,517	6,475,604	3,437,550	3,461,608	3,497,568	3,532,997	3,567,910	2,453,851	2,485,720	72,421,081
9.2	Contingency	10.0%	4,776,470	4,782,819	4,755,673	4,825,721	4,891,688	4,953,376	5,005,091	5,059,066	2,685,586	2,704,381	2,732,475	2,760,154	2,787,430	1,917,071	1,941,969	56,578,969
9.3	Profit	12.6%	6,018,352	6,026,352	5,992,147	6,080,408	6,163,527	6,241,254	6,306,415	6,374,423	3,383,839	3,407,520	3,442,919	3,477,794	3,512,161	2,415,510	2,446,881	71,289,501
	Sub-total, indirect cost	**0**	**16,908,703**	**16,931,180**	**16,835,081**	**17,083,051**	**17,316,576**	**17,534,951**	**17,718,023**	**17,909,093**	**9,506,975**	**9,573,509**	**9,672,962**	**9,770,945**	**9,867,501**	**6,786,433**	**6,874,569**	**200,289,551**
	TOTAL	**17**	**64,683,399**	**64,759,372**	**64,391,807**	**65,910,256**	**66,248,457**	**67,068,711**	**67,848,935**	**68,499,750**	**36,362,838**	**36,617,321**	**36,997,712**	**37,372,486**	**37,741,797**	**25,957,147**	**26,294,256**	**766,754,243**

Table 4-98: Cost Flow, West Sanitary Landfill (1/2)

		$/ton	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
	Waste amount from Bogota			1,231,827	1,236,574	1,246,400	1,255,810	1,264,805	1,277,194	1,289,294	1,310,203	1,331,110	1,352,017	1,372,925
	Waste amount from other municipalities			403,109	407,946	412,842	417,796	422,809	427,883	433,018	438,214	443,472	448,794	454,180
	Total waste amount			1,634,936	1,644,520	1,659,242	1,673,606	1,687,614	1,705,077	1,722,312	1,748,417	1,774,582	1,800,811	1,827,105
Item	**Description**		**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1.-	**Preliminary Activities**													
1.1	Preliminary site selection study		380,000											
1.2	Land acquisition		0.2045	334,374	336,334	339,345	342,282	345,147	348,719	352,243	357,582	362,934	368,298	373,676
1.3	Design, EIA, etc.		760,000											
1.4	Environmental license		15,000											
1.5	Bidding		80,000											
	Sub-total, preliminary activities		**1,235,000**	**334,374**	**336,334**	**339,345**	**342,282**	**345,147**	**348,719**	**352,243**	**357,582**	**362,934**	**368,298**	**373,676**
2.-	**Infrastructure and Equipment**													
2.1	Access road, site preparation, etc.	1.86		3,041,413	3,059,242	3,086,627	3,113,348	3,139,408	3,171,893	3,203,954	3,252,517	3,301,192	3,349,984	3,398,897
2.2	Equipment	0.39		640,748	644,504	650,273	655,903	661,393	668,237	674,991	685,222	695,477	705,756	716,060
	Sub-total, infrastructure and equipment		**0**	**3,682,160**	**3,703,746**	**3,736,901**	**3,769,251**	**3,800,801**	**3,840,130**	**3,878,945**	**3,937,739**	**3,996,668**	**4,055,740**	**4,114,957**
3.-	**Sanitary Landfill**													
3.1	Preliminary works	0.56	9,614,983	914,074	927,663	935,693	943,525	953,289	962,924	977,519	992,148	1,006,812	1,021,513	1,036,249
3.2	Preparation	3.04	4,969,540	4,969,540	5,043,419	5,087,080	5,129,661	5,182,740	5,235,126	5,314,475	5,394,008	5,473,733	5,553,654	5,633,772
3.3	Operation	5.84		9,540,124	9,596,050	9,681,952	9,765,769	9,847,511	9,949,409	10,049,976	10,202,304	10,354,984	10,508,033	10,661,460
3.4	Closure	0.15		251,401	252,875	255,138	257,347	259,501	262,186	264,836	268,851	272,874	276,907	280,950
	Sub-total, sanitary landfill	**9.59**	**14,584,523**	**15,675,139**	**15,820,007**	**15,959,864**	**16,096,302**	**16,243,041**	**16,409,646**	**16,606,807**	**16,857,311**	**17,108,403**	**17,360,107**	**17,612,432**
4.-	**Leachate Treatment Plant**													
4.2	Investment, operation and monitoring	4.41		7,213,730	7,256,018	7,320,972	7,384,350	7,446,159	7,523,209	7,599,252	7,714,435	7,829,883	7,945,611	8,061,624
	Sub-total, LTP	**4.41**	**0**	**7,213,730**	**7,256,018**	**7,320,972**	**7,384,350**	**7,446,159**	**7,523,209**	**7,599,252**	**7,714,435**	**7,829,883**	**7,945,611**	**8,061,624**
5.-	**Biogas plant**													
5.2	Investment, operation and monitoring	1.14	0	1,863,827	1,874,753	1,891,535	1,907,911	1,923,880	1,943,788	1,963,435	1,993,195	2,023,024	2,052,925	2,082,899
	Sub-total, biogas plant	**1.14**	**0**	**1,863,827**	**1,874,753**	**1,891,535**	**1,907,911**	**1,923,880**	**1,943,788**	**1,963,435**	**1,993,195**	**2,023,024**	**2,052,925**	**2,082,899**
6.-	**Environmental Management Plan**													
6.1	EMP	1,195,530	1,195,530	1,207,485	1,219,560	1,231,755	1,244,073	1,256,514	1,269,079	1,281,770	1,294,587	1,307,533	1,320,608	1,333,815
	Sub-total, EMP		**1,195,530**	**1,207,485**	**1,219,560**	**1,231,755**	**1,244,073**	**1,256,514**	**1,269,079**	**1,281,770**	**1,294,587**	**1,307,533**	**1,320,608**	**1,333,815**
7	**Closure and Post-closure**													
7.1	Closure and Post-closure	2.38		3,891,175	3,913,986	3,949,023	3,983,210	4,016,550	4,058,112	4,099,131	4,161,261	4,223,536	4,285,961	4,348,540
	Subtotal, closure and post-closure	**2.38**	**0**	**3,891,175**	**3,913,986**	**3,949,023**	**3,983,210**	**4,016,550**	**4,058,112**	**4,099,131**	**4,161,261**	**4,223,536**	**4,285,961**	**4,348,540**
8	**Supervision**													
8.1	Supervision		3,644,515	3,680,960	3,717,770	3,754,947	3,792,497	3,830,422	3,868,726	3,907,413	3,946,487	3,985,952	4,025,812	4,066,070
	Sub-total, supervision	**0**	**3,644,515**	**3,680,960**	**3,717,770**	**3,754,947**	**3,792,497**	**3,830,422**	**3,868,726**	**3,907,413**	**3,946,487**	**3,985,952**	**4,025,812**	**4,066,070**
9	**Indirect cost**													
9.1	Administration	12.8%	2,644,425	4,806,253	4,843,798	4,887,596	4,930,544	4,974,402	5,025,460	5,080,192	5,153,613	5,227,256	5,301,128	5,375,234
9.2	Contingency	10.0%	2,065,957	3,754,885	3,784,217	3,818,434	3,851,988	3,886,251	3,926,141	3,968,900	4,026,260	4,083,793	4,141,506	4,199,401
9.3	Profit	12.6%	2,603,106	4,731,155	4,768,114	4,811,227	4,853,504	4,896,677	4,946,937	5,000,814	5,073,087	5,145,580	5,218,298	5,291,246
	Sub-total, indirect cost		**7,313,487**	**13,292,293**	**13,396,129**	**13,517,257**	**13,636,036**	**13,757,330**	**13,898,538**	**14,049,905**	**14,252,960**	**14,456,629**	**14,660,932**	**14,865,880**
	TOTAL		**27,973,055**	**50,841,143**	**51,238,303**	**51,701,600**	**52,155,912**	**52,619,845**	**53,159,947**	**53,738,902**	**54,515,558**	**55,294,563**	**56,075,993**	**56,859,893**

Table 4-99: Cost Flow, West Sanitary Landfill (2/2)

2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	Total
1,393,833	1,414,741	1,435,649	1,456,557	1,477,465	1,498,373	1,519,280	1,540,187	1,561,096	1,582,002	1,602,911	1,623,749	1,644,858	1,666,241	1,686,236	1,706,470	1,726,948	1,747,671	1,768,644	**44,221,069**
459,630	465,145	470,727	476,376	482,092	487,877	493,732	499,657	505,653	511,720	517,861	524,075	530,364	536,729	543,169	549,687	556,284	562,959	569,715	**14,453,515**
1,853,463	1,879,886	1,906,376	1,932,933	1,959,557	1,986,250	2,013,012	2,039,844	2,066,749	2,093,722	2,120,772	2,147,824	2,175,222	2,202,969	2,229,405	2,256,158	2,283,232	2,310,631	2,338,358	**58,674,585**
12	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	
																			380,000
379,066	384,470	389,888	395,319	400,764	406,224	411,697	417,184	422,687	428,204	433,736	439,268	444,872	450,547	455,953	461,425	466,962	472,565	478,236	12,000,000
																			760,000
																			15,000
																			80,000
379,066	**384,470**	**389,888**	**395,319**	**400,764**	**406,224**	**411,697**	**417,184**	**422,687**	**428,204**	**433,736**	**439,268**	**444,872**	**450,547**	**455,953**	**461,425**	**466,962**	**472,565**	**478,236**	**13,235,000**
3,447,930	3,497,085	3,546,363	3,595,765	3,645,294	3,694,950	3,744,734	3,794,648	3,844,698	3,894,876	3,945,196	3,995,520	4,046,487	4,098,105	4,147,282	4,197,049	4,247,414	4,298,383	4,349,963	109,150,216
726,391	736,746	747,128	757,536	767,970	778,431	788,919	799,435	809,979	820,551	831,152	841,754	852,491	863,366	873,726	884,211	894,821	905,559	916,426	22,995,154
4,174,320	**4,233,831**	**4,293,490**	**4,353,301**	**4,413,264**	**4,473,381**	**4,533,653**	**4,594,083**	**4,654,677**	**4,715,427**	**4,776,348**	**4,837,274**	**4,898,978**	**4,961,470**	**5,021,008**	**5,081,260**	**5,142,235**	**5,203,942**	**5,266,389**	**132,145,370**
1,051,022	1,065,833	1,080,680	1,095,566	1,110,489	1,125,451	1,140,453	1,155,495	1,170,576	1,185,699	1,200,823	1,216,141	1,231,654	1,246,434	1,261,392	1,276,528	1,291,847	1,307,349		41,499,827
5,714,089	5,794,607	5,875,329	5,956,256	6,037,393	6,118,737	6,200,295	6,282,074	6,364,064	6,446,284	6,528,511	6,611,789	6,696,130	6,776,484	6,857,802	6,940,095	7,023,376	7,107,657		178,317,721
10,815,264	10,969,450	11,124,022	11,278,985	11,434,344	11,590,102	11,746,260	11,902,828	12,059,823	12,217,220	12,375,059	12,532,913	12,692,783	12,854,694	13,008,950	13,165,058	13,323,038	13,482,915	13,644,710	342,375,991
285,003	289,066	293,140	297,223	301,317	305,422	309,537	313,663	317,800	321,948	326,107	330,267	334,480	338,746	342,811	346,925	351,088	355,301	359,565	9,022,276
17,865,379	**18,118,956**	**18,373,171**	**18,628,031**	**18,883,543**	**19,139,713**	**19,396,545**	**19,654,061**	**19,912,262**	**20,171,150**	**20,430,501**	**20,691,110**	**20,955,047**	**21,216,358**	**21,470,955**	**21,728,606**	**21,989,349**	**22,253,222**	**14,004,275**	**571,215,815**
8,177,922	8,294,510	8,411,389	8,528,563	8,646,037	8,763,813	8,881,892	9,000,280	9,118,991	9,238,006	9,357,355	9,476,716	9,597,601	9,720,030	9,836,670	9,954,710	10,074,167	10,195,057	10,317,397	258,886,350
8,177,922	**8,294,510**	**8,411,389**	**8,528,563**	**8,646,037**	**8,763,813**	**8,881,892**	**9,000,280**	**9,118,991**	**9,238,006**	**9,357,355**	**9,476,716**	**9,597,601**	**9,720,030**	**9,836,670**	**9,954,710**	**10,074,167**	**10,195,057**	**10,317,397**	**258,886,350**
2,112,948	2,143,070	2,173,269	2,203,543	2,233,895	2,264,325	2,294,834	2,325,422	2,356,093	2,386,844	2,417,680	2,448,520	2,479,753	2,511,385	2,541,522	2,572,020	2,602,884	2,634,119	2,665,728	66,889,027
2,112,948	**2,143,070**	**2,173,269**	**2,203,543**	**2,233,895**	**2,264,325**	**2,294,834**	**2,325,422**	**2,356,093**	**2,386,844**	**2,417,680**	**2,448,520**	**2,479,753**	**2,511,385**	**2,541,522**	**2,572,020**	**2,602,884**	**2,634,119**	**2,665,728**	**66,889,027**
1,347,153	1,360,624	1,374,230	1,387,973	1,401,852	1,415,871	1,430,030	1,444,330	1,458,773	1,473,361	1,488,095	1,502,976	1,518,005	1,533,185	1,548,517	1,564,002	1,579,642	1,595,439	1,611,393	43,197,760
1,347,153	**1,360,624**	**1,374,230**	**1,387,973**	**1,401,852**	**1,415,871**	**1,430,030**	**1,444,330**	**1,458,773**	**1,473,361**	**1,488,095**	**1,502,976**	**1,518,005**	**1,533,185**	**1,548,517**	**1,564,002**	**1,579,642**	**1,595,439**	**1,611,393**	**43,197,760**
4,411,273	4,474,161	4,537,207	4,600,413	4,663,779	4,727,309	4,791,002	4,854,862	4,918,896	4,983,095	5,047,473	5,111,858	5,177,065	5,243,104	5,306,021	5,369,694	5,434,130	5,499,340	5,565,332	139,646,498
4,411,273	**4,474,161**	**4,537,207**	**4,600,413**	**4,663,779**	**4,727,309**	**4,791,002**	**4,854,862**	**4,918,896**	**4,983,095**	**5,047,473**	**5,111,858**	**5,177,065**	**5,243,104**	**5,306,021**	**5,369,694**	**5,434,130**	**5,499,340**	**5,565,332**	**139,646,498**
4,106,731	4,147,798	4,189,276	4,231,169	4,273,480	4,316,215	4,359,377	4,402,971	4,447,001	4,491,471	4,536,385	4,581,749	4,627,567	4,673,842	4,720,581	4,767,787	4,815,465	4,863,619	4,912,255	131,686,310
4,106,731	**4,147,798**	**4,189,276**	**4,231,169**	**4,273,480**	**4,316,215**	**4,359,377**	**4,402,971**	**4,447,001**	**4,491,471**	**4,536,385**	**4,581,749**	**4,627,567**	**4,673,842**	**4,720,581**	**4,767,787**	**4,815,465**	**4,863,619**	**4,912,255**	**131,686,310**
5,449,573	5,524,150	5,598,966	5,674,024	5,749,327	5,824,877	5,900,676	5,976,729	6,053,041	6,129,607	6,206,409	6,283,452	6,361,458	6,439,670	6,515,357	6,591,936	6,669,419	6,747,815	5,737,089	173,683,473
4,257,479	4,315,742	4,374,192	4,432,831	4,491,662	4,550,685	4,609,903	4,669,319	4,728,938	4,788,756	4,848,757	4,908,947	4,969,889	5,030,992	5,090,123	5,149,950	5,210,483	5,271,730	4,482,101	135,690,213
5,364,424	5,437,835	5,511,482	5,585,367	5,659,494	5,733,863	5,808,478	5,883,342	5,958,462	6,033,832	6,109,434	6,185,273	6,262,060	6,339,050	6,413,555	6,488,937	6,565,209	6,642,380	5,647,447	170,969,668
15,071,476	**15,277,727**	**15,484,640**	**15,692,222**	**15,900,482**	**16,109,426**	**16,319,056**	**16,529,390**	**16,740,441**	**16,952,195**	**17,164,601**	**17,377,672**	**17,593,406**	**17,809,712**	**18,019,034**	**18,230,824**	**18,445,111**	**18,661,925**	**15,866,636**	**480,343,354**
57,646,268	**58,435,148**	**59,226,560**	**60,020,533**	**60,817,098**	**61,616,277**	**62,418,085**	**63,222,583**	**64,029,822**	**64,839,751**	**65,652,173**	**66,467,143**	**67,292,293**	**68,119,634**	**68,920,261**	**69,730,328**	**70,549,945**	**71,379,227**	**60,687,642**	**1,837,245,484**

Table 4-100: Cost Flow, North Sanitary Landfill (1/2)

		$/ton	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
	Waste amount from Bogota			510,878	515,718	524,081	532,444	540,807	549,170	557,533	565,896	574,260	582,623	590,986	599,349
	Waste amount from other municipalities			510,878	515,718	524,081	532,444	540,807	549,170	557,533	565,896	574,260	582,623	590,986	599,349
	Total waste amount			1,021,756	1,031,436	1,048,162	1,064,888	1,081,614	1,098,340	1,115,066	1,131,792	1,148,520	1,165,246	1,181,972	1,198,698
Item	**Description**		**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1.-	**Preliminary Activities**														
1.1	Preliminary site selection study		380,000												
1.2	Land acquisition		0.20705	211,555	213,560	217,023	220,486	223,949	227,412	230,875	234,338	237,802	241,265	244,728	248,191
1.3	Design, EIA, etc.		608,000												
1.4	Environmental license		15,000												
1.5	Bidding		80,000												
	Sub-total, preliminary activities		**1,083,000**	**211,555**	**213,560**	**217,023**	**220,486**	**223,949**	**227,412**	**230,875**	**234,338**	**237,802**	**241,265**	**244,728**	**248,191**
2.-	**Infrastructure and Equipment**														
2.1	Access road, site preparation, etc.	1.75		1,788,300	1,805,242	1,834,516	1,863,790	1,893,064	1,922,339	1,951,613	1,980,887	2,010,165	2,039,439	2,068,713	2,097,987
2.2	Equipment	1.57		1,604,384	1,619,583	1,645,847	1,672,110	1,698,374	1,724,637	1,750,901	1,777,164	1,803,431	1,829,695	1,855,958	1,882,222
	Sub-total, infrastructure and equipment		**0**	**3,392,683**	**3,424,825**	**3,480,363**	**3,535,901**	**3,591,438**	**3,646,976**	**3,702,514**	**3,758,051**	**3,813,596**	**3,869,134**	**3,924,671**	**3,980,209**
3.-	**Sanitary Landfill**														
3.1	Preliminary works	0.56	6,730,488	576,664	586,015	595,366	604,718	614,069	623,420	632,772	642,124	651,475	660,827	670,178	679,529
3.2	Preparation	3.04	3,105,722	3,135,146	3,185,986	3,236,826	3,287,666	3,338,507	3,389,347	3,440,187	3,491,033	3,541,874	3,592,714	3,643,554	3,694,394
3.3	Operation	5.84		5,962,117	6,018,601	6,116,200	6,213,799	6,311,398	6,408,997	6,506,596	6,604,195	6,701,806	6,799,405	6,897,004	6,994,603
3.4	Closure	0.15		157,113	158,602	161,174	163,746	166,318	168,890	171,462	174,033	176,606	179,178	181,750	184,321
	Sub-total, sanitary landfill	**9.59**	**9,836,210**	**9,831,040**	**9,949,204**	**10,109,566**	**10,269,929**	**10,430,291**	**10,590,654**	**10,751,016**	**10,911,386**	**11,071,760**	**11,232,123**	**11,392,485**	**11,552,848**
4.-	**Leachate Treatment Plant**														
4.2	Investment, operation and monitoring	4.41		4,508,233	4,550,943	4,624,742	4,698,541	4,772,341	4,846,140	4,919,939	4,993,738	5,067,546	5,141,345	5,215,144	5,288,943
	Sub-total, LTP	**4.41**	**0**	**4,508,233**	**4,550,943**	**4,624,742**	**4,698,541**	**4,772,341**	**4,846,140**	**4,919,939**	**4,993,738**	**5,067,546**	**5,141,345**	**5,215,144**	**5,288,943**
5.-	**Biogas plant**														
5.2	Investment, operation and monitoring	1.14	0	1,164,802	1,175,837	1,194,905	1,213,972	1,233,040	1,252,108	1,271,175	1,290,243	1,309,313	1,328,380	1,347,448	1,366,516
	Sub-total, biogas plant	**1.14**	**0**	**1,164,802**	**1,175,837**	**1,194,905**	**1,213,972**	**1,233,040**	**1,252,108**	**1,271,175**	**1,290,243**	**1,309,313**	**1,328,380**	**1,347,448**	**1,366,516**
6.-	**Environmental Management Plan**														
6.1	EMP	956,424	956,424	965,988	975,648	985,404	995,258	1,005,211	1,015,263	1,025,416	1,035,670	1,046,026	1,056,487	1,067,052	1,077,722
	Sub-total, EMP		**956,424**	**965,988**	**975,648**	**985,404**	**995,258**	**1,005,211**	**1,015,263**	**1,025,416**	**1,035,670**	**1,046,026**	**1,056,487**	**1,067,052**	**1,077,722**
7	**Closure and Post-closure**														
7.1	Closure and Post-closure	2.36		2,416,055	2,438,945	2,478,495	2,518,046	2,557,596	2,597,147	2,636,697	2,676,248	2,715,803	2,755,353	2,794,904	2,834,454
	Subtotal, closure and post-closure	**2.36**	**0**	**2,416,055**	**2,438,945**	**2,478,495**	**2,518,046**	**2,557,596**	**2,597,147**	**2,636,697**	**2,676,248**	**2,715,803**	**2,755,353**	**2,794,904**	**2,834,454**
8	**Supervision**														
8.1	Supervision		2,803,473	2,831,508	2,859,823	2,888,421	2,917,305	2,946,478	2,975,943	3,005,703	3,035,760	3,066,117	3,096,778	3,127,746	3,159,024
	Sub-total, supervision	**0**	**2,803,473**	**2,831,508**	**2,859,823**	**2,888,421**	**2,917,305**	**2,946,478**	**2,975,943**	**3,005,703**	**3,035,760**	**3,066,117**	**3,096,778**	**3,127,746**	**3,159,024**
9	**Indirect cost**														
9.1	Administration	12.8%	1,878,926	3,241,199	3,275,364	3,325,302	3,375,288	3,425,324	3,475,410	3,525,547	3,575,736	3,625,979	3,676,271	3,726,615	3,777,012
9.2	Contingency	10.0%	1,467,911	2,532,186	2,558,878	2,597,892	2,636,944	2,676,034	2,715,164	2,754,333	2,793,543	2,832,796	2,872,087	2,911,418	2,950,791
9.3	Profit	12.6%	1,849,568	3,190,555	3,224,187	3,273,344	3,322,549	3,371,803	3,421,107	3,470,460	3,519,865	3,569,323	3,618,829	3,668,387	3,717,996
	Sub-total, indirect cost		**5,196,404**	**8,963,940**	**9,058,430**	**9,196,538**	**9,334,781**	**9,473,162**	**9,611,681**	**9,750,340**	**9,889,144**	**10,028,099**	**10,167,186**	**10,306,419**	**10,445,799**
	TOTAL	**18**	**19,875,511**	**34,285,803**	**34,647,214**	**35,175,457**	**35,704,220**	**36,233,507**	**36,763,323**	**37,293,675**	**37,824,577**	**38,356,062**	**38,888,052**	**39,420,598**	**39,953,706**

Table 4-101: Cost Flow, North Sanitary Landfill (2/2)

2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	Total
607,712	616,075	624,438	632,801	641,164	648,858	656,644	664,524	672,498	680,568	688,735	697,000	705,364	713,828	722,394	731,063	739,836	748,714	**18,835,961**
607,712	616,075	624,438	632,801	641,164	648,858	656,644	664,524	672,498	680,568	688,735	697,000	705,364	713,828	722,394	731,063	739,836	748,714	**18,835,961**
1,215,424	1,232,150	1,248,876	1,265,602	1,282,328	1,297,716	1,313,289	1,329,048	1,344,997	1,361,137	1,377,470	1,394,000	1,410,728	1,427,657	1,444,788	1,462,126	1,479,671	1,497,427	**37,671,923**
13	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	
																		380,000
251,654	255,118	258,581	262,044	265,507	268,693	271,917	275,180	278,483	281,824	285,206	288,629	292,092	295,597	299,145	302,734	306,367	310,043	7,800,000
																		608,000
																		15,000
																		80,000
251,654	**255,118**	**258,581**	**262,044**	**265,507**	**268,693**	**271,917**	**275,180**	**278,483**	**281,824**	**285,206**	**288,629**	**292,092**	**295,597**	**299,145**	**302,734**	**306,367**	**310,043**	**8,883,000**
2,127,262	2,156,536	2,185,810	2,215,084	2,244,358	2,271,291	2,298,546	2,326,129	2,354,042	2,382,291	2,410,878	2,439,809	2,469,087	2,498,716	2,528,700	2,559,045	2,589,753	2,620,830	65,934,220
1,908,485	1,934,749	1,961,012	1,987,276	2,013,539	2,037,702	2,062,154	2,086,900	2,111,943	2,137,286	2,162,934	2,188,889	2,215,156	2,241,737	2,268,638	2,295,862	2,323,412	2,351,293	59,153,274
4,035,747	**4,091,285**	**4,146,822**	**4,202,360**	**4,257,898**	**4,308,993**	**4,360,700**	**4,413,029**	**4,465,985**	**4,519,577**	**4,573,812**	**4,628,698**	**4,684,242**	**4,740,453**	**4,797,338**	**4,854,906**	**4,913,165**	**4,972,123**	**125,087,494**
688,881	698,232	707,583	716,935	725,538	734,244	743,055	751,972	760,996	770,127	779,369	788,721	798,186	807,764	817,458	827,267	837,194		27,221,169
3,745,234	3,796,075	3,846,915	3,897,755	3,944,528	3,991,863	4,039,765	4,088,242	4,137,301	4,186,949	4,237,192	4,288,038	4,339,495	4,391,569	4,444,267	4,497,599	4,551,570		114,507,311
7,092,202	7,189,801	7,287,400	7,384,999	7,482,598	7,572,389	7,663,258	7,755,217	7,848,279	7,942,459	8,037,768	8,134,221	8,231,832	8,330,614	8,430,581	8,531,748	8,634,129	8,737,739	219,821,956
186,893	189,465	192,037	194,609	197,181	199,547	201,942	204,365	206,817	209,299	211,811	214,353	216,925	219,528	222,162	224,828	227,526	230,256	5,792,738
11,713,210	**11,873,573**	**12,033,935**	**12,194,298**	**12,349,845**	**12,498,043**	**12,648,020**	**12,799,796**	**12,953,393**	**13,108,834**	**13,266,140**	**13,425,334**	**13,586,438**	**13,749,475**	**13,914,469**	**14,081,442**	**14,250,420**	**8,967,995**	**367,343,173**
5,362,742	5,436,542	5,510,341	5,584,140	5,657,939	5,725,834	5,794,544	5,864,079	5,934,448	6,005,661	6,077,729	6,150,662	6,224,470	6,299,163	6,374,753	6,451,250	6,528,665	6,607,009	166,217,565
5,362,742	**5,436,542**	**5,510,341**	**5,584,140**	**5,657,939**	**5,725,834**	**5,794,544**	**5,864,079**	**5,934,448**	**6,005,661**	**6,077,729**	**6,150,662**	**6,224,470**	**6,299,163**	**6,374,753**	**6,451,250**	**6,528,665**	**6,607,009**	**166,217,565**
1,385,583	1,404,651	1,423,719	1,442,786	1,461,854	1,479,396	1,497,149	1,515,115	1,533,296	1,551,696	1,570,316	1,589,160	1,608,230	1,627,528	1,647,059	1,666,823	1,686,825	1,707,067	42,945,992
1,385,583	**1,404,651**	**1,423,719**	**1,442,786**	**1,461,854**	**1,479,396**	**1,497,149**	**1,515,115**	**1,533,296**	**1,551,696**	**1,570,316**	**1,589,160**	**1,608,230**	**1,627,528**	**1,647,059**	**1,666,823**	**1,686,825**	**1,707,067**	**42,945,992**
1,088,499	1,099,384	1,110,378	1,121,482	1,132,697	1,144,024	1,155,464	1,167,019	1,178,689	1,190,476	1,202,380	1,214,404	1,226,548	1,238,814	1,251,202	1,263,714	1,276,351	1,289,115	34,558,208
1,088,499	**1,099,384**	**1,110,378**	**1,121,482**	**1,132,697**	**1,144,024**	**1,155,464**	**1,167,019**	**1,178,689**	**1,190,476**	**1,202,380**	**1,214,404**	**1,226,548**	**1,238,814**	**1,251,202**	**1,263,714**	**1,276,351**	**1,289,115**	**34,558,208**
2,874,005	2,913,555	2,953,106	2,992,656	3,032,207	3,068,593	3,105,416	3,142,681	3,180,394	3,218,558	3,257,181	3,296,267	3,335,822	3,375,852	3,416,362	3,457,359	3,498,847	3,540,833	89,079,440
2,874,005	**2,913,555**	**2,953,106**	**2,992,656**	**3,032,207**	**3,068,593**	**3,105,416**	**3,142,681**	**3,180,394**	**3,218,558**	**3,257,181**	**3,296,267**	**3,335,822**	**3,375,852**	**3,416,362**	**3,457,359**	**3,498,847**	**3,540,833**	**89,079,440**
3,190,614	3,222,520	3,254,745	3,287,293	3,320,165	3,353,367	3,386,901	3,420,770	3,454,978	3,489,527	3,524,423	3,559,667	3,595,263	3,631,216	3,667,528	3,704,204	3,741,246	3,778,658	101,297,162
3,190,614	**3,222,520**	**3,254,745**	**3,287,293**	**3,320,165**	**3,353,367**	**3,386,901**	**3,420,770**	**3,454,978**	**3,489,527**	**3,524,423**	**3,559,667**	**3,595,263**	**3,631,216**	**3,667,528**	**3,704,204**	**3,741,246**	**3,778,658**	**101,297,162**
3,827,463	3,877,968	3,928,528	3,979,143	4,029,198	4,076,409	4,124,174	4,172,502	4,221,397	4,270,868	4,320,920	4,371,561	4,422,798	4,474,637	4,527,086	4,580,151	4,633,841	3,990,124	119,732,741
2,990,206	3,029,663	3,069,163	3,108,706	3,147,811	3,184,694	3,222,011	3,259,767	3,297,966	3,336,615	3,375,719	3,415,282	3,455,311	3,495,810	3,536,786	3,578,243	3,620,189	3,117,284	93,541,204
3,767,659	3,817,375	3,867,145	3,916,969	3,966,242	4,012,715	4,059,734	4,107,306	4,155,438	4,204,135	4,253,406	4,303,255	4,353,691	4,404,720	4,456,350	4,508,587	4,561,438	3,927,778	117,861,916
10,585,328	**10,725,006**	**10,864,836**	**11,004,819**	**11,143,251**	**11,273,818**	**11,405,920**	**11,539,575**	**11,674,801**	**11,811,618**	**11,950,044**	**12,090,098**	**12,231,799**	**12,375,167**	**12,520,221**	**12,666,981**	**12,815,468**	**11,035,187**	**331,135,860**
40,487,383	**41,021,633**	**41,556,462**	**42,091,877**	**42,621,363**	**43,120,761**	**43,626,031**	**44,137,243**	**44,654,466**	**45,177,772**	**45,707,231**	**46,242,918**	**46,784,905**	**47,333,266**	**47,888,077**	**48,449,414**	**49,017,354**	**42,208,032**	**1,266,547,896**

De acuerdo a la evaluación económica los costos por tonelada para cada relleno son:

Table 4-102: Average Cost of Doña Juana Landfill

VAC	$Co	428.261.841.698
DISPOSAL OF VAC TONS	$Co	15.233.657
COSTO PER TON	$Co/ton	**28.113**

Source: Own preparation

Table 4-103: Average Cost of Western Landfill

VAC	$Co	452.873.354.144
DISPOSAL OF VAC TONS	$Co	15.388.047
COSTO PER TON	$Co/ton	**29.430**

Source: Own preparation

Table 4-104: Average Cost of Northern Landfill

VAC	$Co	311.715.401.474
DISPOSAL OF VAC TONS	$Co	9.838.689
COST PER TON	$Co/ton	**31.683**

Source: Own preparation

4.4 Relations with the Community

4.4.1 Basic Policy for Raising Public Awareness

To implement the separate collection service in Bogota D.C. activities to raise public awareness must be carried out according to the following basic policies:

a. Spreading knowledge of 3Rs

In Bogota D.C., the separation of waste is considered a means of recycling and, in general, it is recognized as a good practice. However, recycling alone does not result in elimination of the consumption of resources or any reduction in the environmental load. It is therefore important to spread knowledge of the priority of the 3Rs (Reduction, Reuse and Recycling). That is, firstly, the production of waste must be reduced at source, secondly, waste produced must be reused to the greatest extent possible and, lastly, the remaining waste must be recycled. It is vital to raise awareness of the priority of 3R among the community.

b. Different Focus According to the Characteristics of the Sector.

In Colombia, socio-economic strata are classified at 6 levels and, therefore, the types of waste vary considerably and the problems that arise also vary according to the sector and the respective stratum. To raise awareness among the community, the problems involving waste faced by each sector must be identified, as well as the main conditions, such as the area, the population, the number of homes, lifestyles, the existence or otherwise of garbage chutes, density of offices, the existing location for placing waste for collection and the scheme and frequency of refuse collection in order to be have a flexible focus according to its specificity.

c. Guidance for Good Practices

People can be influenced by the actions and experiences of others. In Bogota D.C. there are sectors where trial separate collection by recyclers has been implemented on the initiative of the local Mayor (of the locality of Usaquen) and of an NGO (in Bosa). By identifying this type of positive examples and sharing the respective information it will be possible to bring about positive actions among others. If possible, visiting these successful cases is recommended.

d. Establishing the Partnership

Carrying out activities in the whole of Bogota to raise awareness among the community and to spread the waste separation culture it is indispensable to mobilize human resources effectively on a large scale. For this purpose, it is not sufficient to deal exclusively with UAESP officials, but rather there is the need to articulate with the different entities (local mayors' offices, garbage collection operator companies, entrepreneurial sectors, such as ANDI and CEMPRE, recycling organizations, health and education sectors, environmental NGOs, etc.) The important role of UAESP is to define the design of the activities program, strategies and outline and to strengthen associativity as the coordinator among different entities.

e. Spreading the Slogan

A slogan is used to unify people's attention and to target activities in one direction. The slogan that has been widely used in Japan to promote the separation of waste is "When it's mixed it's garbage, but when it's separated it's resources". In Bogota D.C. the slogan is "Zero Waste", together with the character named "Super Zero", but they have not been widely disseminated among the inhabitants of the city. To raise community awareness it is effective to use a slogan which is easily understood and attractive together with the logo and the image of the character (image).

4.4.2 Purposes of Community Awareness Activities

The purposes of community waste management awareness activities in Bogota are the following:

- To reduce the amount of waste produced in Bogota.
- To promote community participation in the separation of waste.
- To increase and maintain community awareness of the subject of waste.
- To promote community knowledge of the 3R priority (Reduction, Reuse and Recycling).
- To strengthen the actors' capacity to solve problems involving waste.
- To increase the community's capacity for communication and to raise the awareness of public officials involved in waste management.

4.4.3 Function of the Actors

To promote the minimization and separation of waste, it is indispensable for the different actors to collaborate and work together in this effort at local level. For the purpose, actors such as UAESP, the localities, the private sector, NGOs, the community and recyclers, must understand their function well and fulfill their responsibilities. The following is an ideal articulated list with the function of each party.

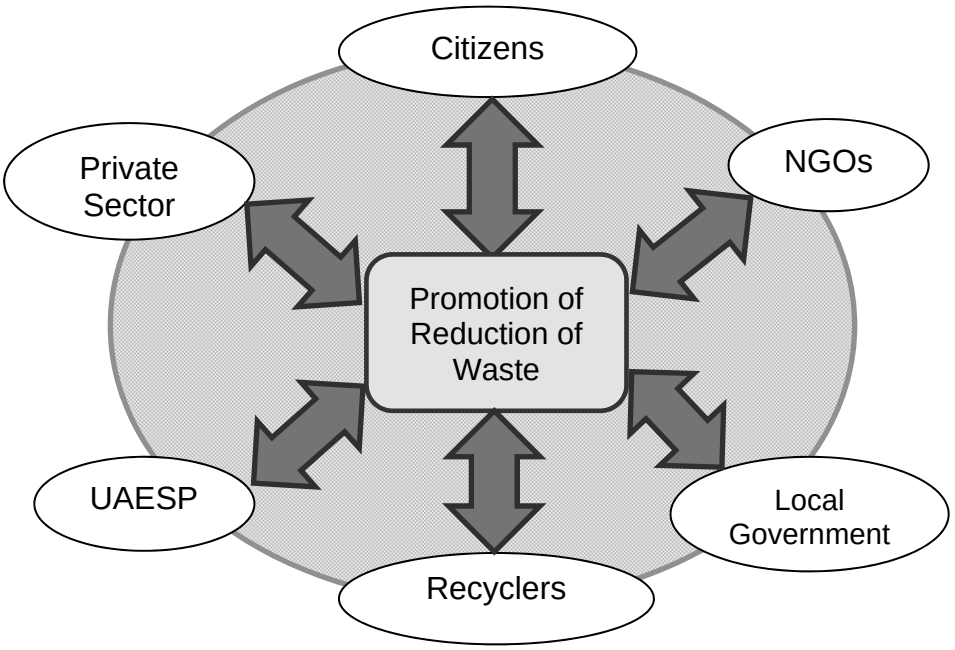


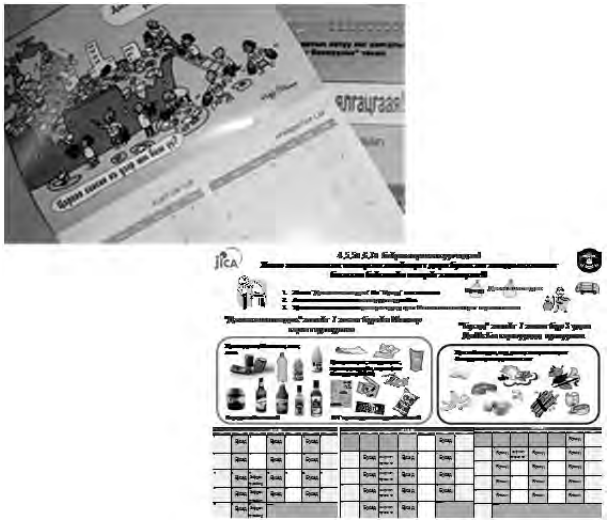
Figure 4-42: Articulation of the Actors Involved in Waste Reduction

Table 4-105: Function and Responsibility of Each of the Actors

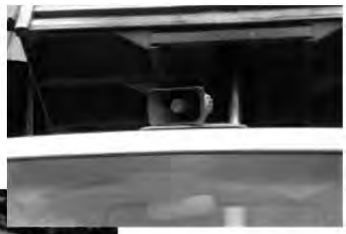
Actor	Function and Responsibility
Citizens	・ Compliance with regulations on when, where and how to put waste out for collection ・ Correct separation of potentially recyclable materials (PRM) ・ Understanding and collaboration on separate collection by recyclers. ・ It must be recognized that it is the inhabitants themselves who produce waste and are causing the environmental load. ・ Active participation in the activities of promoting the 3R, such as waste separation and recycling. ・ Revision of their own lifestyle. ・ Selection of products with low environmental load (eco products).
UAESP	・ Design of strategies, plans and programs involving waste. ・ Promotion of community participation in separation and the 3R promotion activities. ・ Preparation of tools to raise community awareness. ・ Compliance with the role of coordinator among the actors. ・ Orientation and support for localities in solving waste related problems ・ Regular communication activities on 3R efforts on the website and bulletins
Private Sector	・ Supply of environmentally friendly products ・ Correct waste disposal. ・ Supply of information for consumers (environmental labels, eco-mark, etc.) ・ Simplification of packaging and promotion of use of eco-bags.
Recyclers	・ Participation in the provision of the separate collection service. ・ Compliance with separate collection regulations (time and place for garbage collection, good manners such as not leaving waste scattered around). ・ Participation in the activities of raising community awareness of waste separation. ・ Participation and collaboration in environmental events.
Local government	・ Strict implementation of laws and regulations on waste. ・ Definition of the concrete Plan of Action on waste. ・ Raising community awareness and publishing information. ・ Bases for the recycling business. ・ Contribution of space for recycling events, meetings with the community and workshops. ・ Fulfill the role of coordinator among actors at locality level.
NGOs	・ Implementation of environmental education and training. ・ Supervision of activities carried out by the private sector and the administration. ・ Promotion of 3R activities. ・ Policy outlining ・ Promotion of community awareness activities.

4.4.4 Specific Community Awareness Activities Plan

The following are suggested activities to raise public awareness, including those carried out in Bogota D.C.:

Raising Awareness Activities	Content	Entities that Collaborate
Poster on the rule on where to put out waste for collection	Prepare a poster for the community of the target sector that explains the way in which waste has to be separated and the date and time for putting waste out in a visible place, such as the reception of a residential complex. 	UAESP, Health Department, collection operator companies, recyclers' organizations and administrators of residential complexes.
Collection timetable	Spreading the culture of separation, preparing a waste collection schedule for each target sector, timetable showing how it must be separated and the collection days for the target sector and deliver it to every home. 	UAESP, Health Department, collection operator companies and recyclers' organizations.
Leaflet promoting the 3R	To spread the 3R concept among the citizens of Bogota in general, produce a leaflet providing basic knowledge of the 3R and distribute it at environmental events and at schools.	UAESP, local mayors' offices and education and health departments.

	 	
Mobile dustbins for waste separation	Prepare a set of mobile dustbins to show how to separate waste and use them at environmental events, meetings with the community and at schools. 	UAESP, local mayors' offices, sector entities such as ANDI and CEMPRE, private companies, recyclers' organizations and NGOs.
Meeting with the community to explain waste separation	With the collaborationn of the administrator company, explain to inhabitants why waste reduction and recycling are necessary, relating it to the subject of resources, and invite them to practice waste separation 	UAESP, administrator companies of residential complexes and health department.
Home visits	Through officials of the Health Department, promoters and volunteers, visit each home to distribute the leaflet and other materials and to explain waste separation and the 3R. 	UAESP, health department, recyclers' organizations and volunteers.

Tune for separate collection (for collector trucks)	Use of the tune to announce the arrival of the waste collection trucks to help the community to put their MPR out at the time and on the date established.  	UAESP, operator companies.
"My Bag" Campaign	Promote avoidance of the use of plastic bags and waste reduction by handing out a fabric bag (My Bag) with the collaboration of private companies and supermarkets. 	UAESP, sectoral organizations such as ANDI and CEMPRE, private companies, NGOs, etc.
Waste related environmental events	Promote re-use of waste, taking advantage of events held in the city, participative free markets and mini-workshops to encourage waste separation. 	UAESP, sectoral organizations such as ANDI and CEMPRE, private companies, NGOs and ORA.
Preparation of publicity to promote waste separation	Create publicity with the slogan to promote waste separation (e.g. "When it's mixed it's garbage, but when it's separated it's resources") and broadcast it. 	UAESP, sectorial organizations such as ANDI and CEMPRE, operators and private companies.
DVD on waste separation	Film a scene showing waste separation in a home and how it should be put out for collection according to the rule and show it at meetings with communities and at schools.	UAESP, education sector, local mayors' offices and environmental NGOs.

		
3R activities and waste separation at schools	Spread knowledge of the 3R and repairing at the 2,376 schools in Bogota D.C. (of which 360 are public and 2,016 private) through drawing competitions, workshops, newspapers, radio, theaters, art, videos, teacher training and home visits by students; also to promote articulation with the efforts of PIGA (Institutional Environmental Management Plan), leaders of PRAE (School Environmental Project) and groups of environmental social service students and school children.   	UAESP, education sector, local mayors' offices and environmental NGOs.

4.4.5 Cases in Japan

In Japan, according to the 3R priority, the following efforts are being made jointly by the community, companies and the administration, taking into account the importance of creating information, providing environmental education and creating incentives.

Table 4-106: 3R Promotion Activities in Japan

Measures		Responsibility for Activities		
		Community	Companies	Government
Promotion of Reduction	Put into practice actions to avoid producing waste, such as buying only what is necessary, rejecting what is unnecessary and using items for a long time	√	√	
	Present the plan for reduction of general waste from business activities		√	
	Reduce production of waste in the manufacturing and distribution process (develop products with a longer useful life and increase in repair services)		√	
	Raising community awareness using “My Bag”		√	
	Promote reduction at celebrations and local events	√	√	√
	Introduce a charge for the disposal of large volume waste			√
	Studies and research into charging for waste			√
	Issue of information to the community and business people			√
	Reduction of packaging and containers			
	Use of own bags and reduction in use of disposable bags	√	√	
	Promote the use of refillable products, reduce excessive packaging and promote of simplified packaging	√	√	
	Reduction of organic waste			
	Reduction of uneaten food waste	√	√	
	Introduction of eco-cooking	√	√	
	Composting organic waste	√	√	
	Promote of drying organic waste	√	√	
Promotion of R-use	Promotion of re-use, such as returnable bottles	√	√	
	Use of free markets, bazaars and re-use shops	√		
	Distribute information to the community and business people			√
Promotion of Recycling	Spread knowledge of separation and correct placement of waste	√	√	
	Fulfillment of responsibility of businesses to reduce waste from their activities		√	
	Promotion of collection at strategic points (collection of milk cartons, PET bottles and plastic or polystyrene foam trays)	√	√	
	Collaboration with autonomous collection routes for products such as cell phones used by business people.	√	√	
	Active participation in collective collection (collection of recyclable materials by local civic organizations	√		
	Raise awareness of the separation rule			√
	Provide information on entrepreneurial efforts, such as recovery at strategic points			√
	Study and research into recycling of small electrical appliances for recovery of rare metals			√
	Acquisition of recyclable products and products with lower environmental load	√	√	√
	Development and expansion of supply of products with recycled materials		√	

	Provision of information on products and services based on the Green Buying Law			√
Environmental Education	Hold workshops on waste reduction and children's waste days			√
	Encourage reading of complementary book for fourth grade primary "Libro de Trabajo sobre la Reducción de Residuos" (Practical Waste Reduction Manual)			√
	Organize a Children's Eco Club			√
	Strengthen articulation with schools and crèches	√	√	√
	Visits to landfills and waste treatment plants			√
Issue and Spread Information	Issue information using media and methods, such as bulletins, websites, notice boards and events			
	Visualization of result and impacts, such as publication of the amount of waste produced and the cost of waste disposal			√
	Presentation of concrete methods, such as the simple reduction method			√
	Spread knowledge of municipal waste reduction policies and the subsidies mechanism			√
	Provide information on efforts made by the community, civil organizations and entrepreneurs			√
	Provide entrepreneurs with information on different reduction and recycling methods			√
	Eco-labels (labels showing the environmental load of the product)		√	
	Recycling labels (labels stating materials used in the product)		√	
	Collect of information on efforts made by the community, civil organizations, etc.			√
	Collection of information on efforts made by (sic)			√
	Collection of information on efforts of the State and cases and experiences of other regions			√
Incentives	Social incentives			
	Eco-community projects (to encourage local efforts, create projects that can be transformed into a model for other regions and in which local actors can work, articulating with NGOs, business people and territorial entities. For example, collection of organic waste and composting).	√	√	√
	Eco-Town projects (to promote the construction of environmentally friendly cities by reducing the production of waste and using recycling materials, taking the characteristics of the region into account)		√	√
	Prizes for Green Purchasing (priority buying of products with a lower environmental load)			√
	Economic incentives			
	Charge for waste disposal			√
	Tax incentives			√
	Low interest credits			√
	Subsidies			√
	Debt guarantees			√

4.4.6 Cases in Bogota D.C.

At present, Bogota is formalizing and training of recyclers' organizations, such as ORA, and the registration of warehouses as authorized weighing centers with a view to converting them into collection centers with the function of classifying recyclable materials in the future in order to expand coverage of the separate collection service.

This service is provided by Aguas de Bogota along the existing 73 separate collection routes.

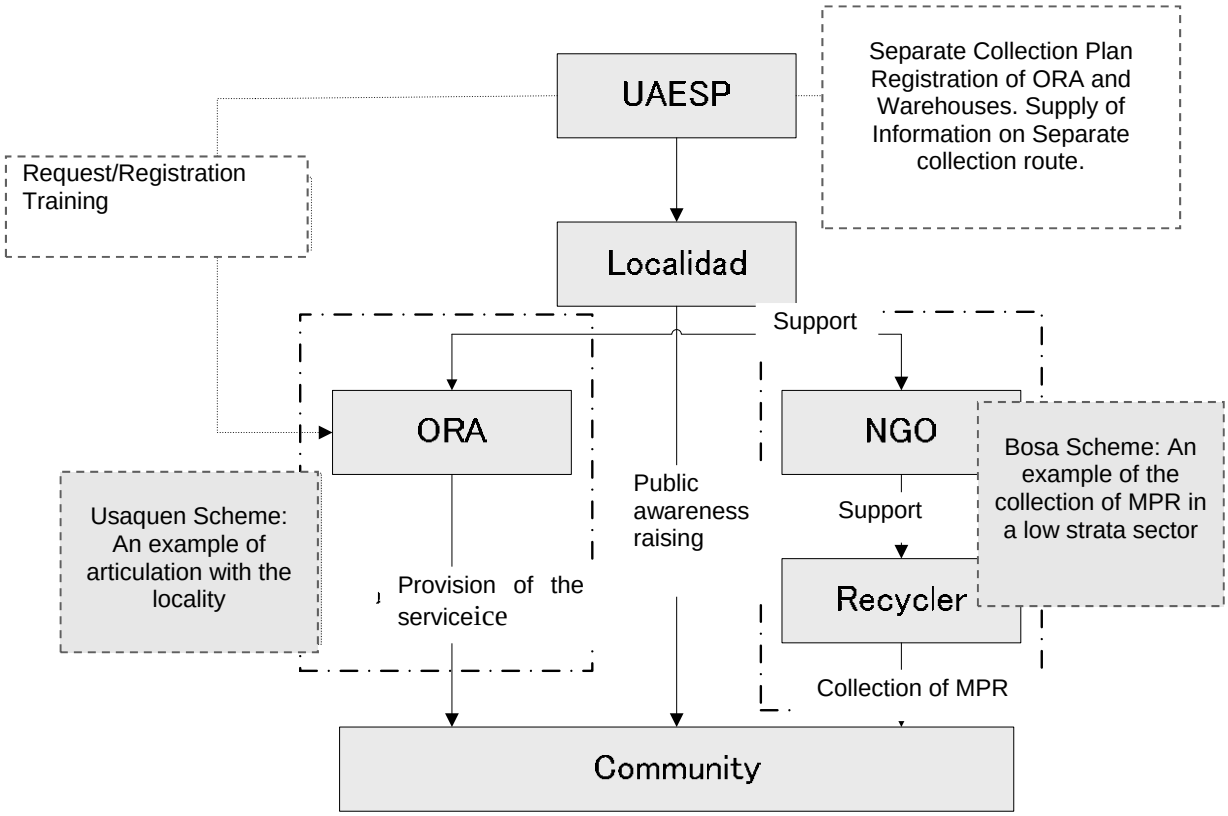
The process of expansion of coverage of the separate collection service is as follows:

1. Continuation of the 73 separate collection routes (service provided by Aguas de Bogota)
2. Increase coverage of the area served by the 73 existing routes
3. Increase coverage to sectors other than those of the area served by the 73 routes.

In order to expand coverage, an analysis of whether this expansion will be led directly by UAESP or by the respective locality must be carried out and the necessary competence for the purpose granted. In some low strata sectors it will not be economically viable to apply the same separate collection scheme as the one being structured at present.

To implement separate MPR collection according to the respective reality, the following are some actual cases in which separate collection is carried out in certain sectors of Bogota.

- Scheme in Usaquen: A recyclers' organization is providing the service with the support of the local Mayor of Usaquen, which is one of the 73 separate routes.
- NGO (Tierra Vida) Scheme: In the Palestina sector of the locality of Bosa separate collection is carried out by a recyclers' organization with the support of an NGO (Tierra Vida) and the collaboration of the community.



4.4.7 Usaquen Scheme

The following table shows the content of separate collection of MPR practiced in Usaquen.

Table 4-107: Summary of Separate Collection of MPR in the locality of Usaquen

Aspect	Content
1. Target sector and number of homes (population)	• A recyclers' organization (M&M Universal) carries out the separate collection of MPR along one of the 73 routes covered by the Alqueria Pilot Project. 6 of the 73 routes referred to are in the locality of Usaquen and the other 5 routes are served by Aguas de Bogota, although they are not covered completely and the degree of collection is inadequate. • In the area covered by the 73 routes, there are 13,000 users in a population of approximately 32,000 inhabitants, of whom 2,000 are served by M&M Universal. 13 tons of MPR have been collected in the two months since this service began. • This sector is stratum 6 and it is an exclusive sector.
2. Separate collection mechanism	
(I) Storage and how to put waste out	
Categories of separation	Categories referred to in the UAESP Bulletin Plastics, paper, cartons, glass, metals, Tetrapak (dry, not contaminated.
Frequency of collection Collection	Twice per week (Tuesday and Saturday)
Timetable for putting garbage out	Timetable for putting garbage out (collection); 8:00 to 14:00 with the collection tune announcing the arrival of the collection truck. Some inhabitants place materials outside before the truck arrives and others only when it arrives.

Containers and placing method	Homes usually use white plastic bags, but waste is collected even when black bags are used. Residential complexes use dustbins of 200 to 300 liters. Therefore, the inhabitants of these complexes put MPR out in these containers at a particular site and other waste is put down a chute.
Location for collection	At the nearest corner.
Others	Previously, the private operator (LIME) collected MPR on Saturdays and, therefore, a larger quantity of materials was collected.
(2) Collection and transportation	
Collection truck	Stake trucks with tarpaulins (2.5 m x 3m x 3m), owned by M&M Universal. There is a sticker on the truck saying “Zero Waste” for ease of identification.
Collection routes	This is one of the 73 routes previously covered by the Alqueria Pilot Project. There are individual recyclers in some parts, but competition is avoided as far as possible.
Collection timetable	
Others	As the truck tarpaulins are high, they collides with trees and it is very difficult to load materials from bins used by residential complexes into the truck.
(3) Sale of materials	
For transportation of MPR	M&M Universal warehouse (5m wide and 20 m deep)
Administration of MPR	
Others	
(4) Raising awareness of the community	• Recycling The UAESP, the local Mayor’s office of Usaquen and recyclers held a recycling event (Recycloton) in the park facing the Mayor’s office on April 27, 2013, the day when separate collection was started by the recyclers’ organization. • Home visit The UAESP, the local Mayor’s office of Usaquen and 10 recyclers are to visit 6,000 users of commercial and residential sectors to provide guidance on waste separation. • Education at schools • The local Mayor’s office of Usaquen and the District Education Department will provide guidance on waste management at the 153 schools in the locality and introduce correct waste management as part of the Schools Environmental Project (PRAE). They will be taught how to separate potentially recyclable materials from other waste and to pass it on to the recyclers. They have a plan for some of the trained school children to carry out activities to raise awareness by visiting homes in the sector.
3. Recyclers’ organization	This was selected according to ORA criteria.
4. Function of the community	• Separate MPR correctly • Keep to the time and date for putting garbage out • Understand and collaborate on separate collection of MPR by recyclers • Active participation in raising awareness activities (Recyclaton and meetings)
5. Function of administrator	• Supply uniforms (UAESP) • Call for participation in recycling at Community Action Committees • Prepare awareness raising tools to help communities to understand the subject • Environmental education in schools • Organization of environmental events, such as Recyclatons • Issue information on recycling and how to separate • Grant subsidies to recyclers’ organizations and support activities

6. Relationship between recyclers and the administration (registration, contract, subsidies, etc.)	M&M Universal is in the process of formalization as ORA, but it has not yet been authorized. No subsidy is being received from the local Mayor's Office.
7. Background to this project	An official of the Usaquen local Mayor's Office responsible for the environment (Ms. Cindy Castillo) is a former UAESP official and, therefore, has sufficient knowledge of the recyclers' organization and separate collection. The Santa Barbara sector of the locality is commercial with large producers and of the upper strata. The locality of Usaquen is the first to have agreed with UAESP on the implementation of separate collection.
8. Projection into the future	The locality of Usaquen is divided into 6 sectors (Santa Barbara, Cedros, San Cristobal Oriental, San Cristobal Occidental, Verbenal Oriental and Verbenal Occidental) and its inhabitants are from three different socio-economic strata. In July coverage of the service of the Cedros sector and the Santa Barbara sector, which is an exclusive area (a budget of 100 million pesos is to be assigned) will be expanded. For the San Cristobal and Verbenal sectors, whose inhabitants are from low strata, it is advisable to introduce the scheme to be implemented in the locality of Bosa where recyclers collect MPR by visiting house by house with a handcart.

M&M collection truck

Collection truck (approx. 20 m3)

Collection (1)

Collection (2)

Collection (3)

MPR put out for collection

Support for collection by the administrator company

Collector's uniform

Condition of MPR

Condition of target collection sector

M&M Warehouse

Meeting with local Mayor of Usaquen

4.4.8 NGO (Tierra Vida) Scheme

The following table describes the content of the separate collection of MPR carried out with the support on an NGO (Tierra Vida).

Table 4-108: Summary of Separate Collection of MPR in the locality of Bosa

Aspect	Content
1. Target sector and number of homes (population)	• Target sector: the Palestina sector of the locality of Bosa (Stratum 2) • Population of the target sector: approximately 10,000 persons
2. Separate collection mechanism	
(1) Storage and placing for collection	
Categories of separation	Categories shown in the leaflet prepared by the NGO: plastics, paper, metals, glass, cartons (not including Tetrapak because of its low value on the market)
Regularity of placing	Twice per week (Monday and Friday)
Placing times	Collection directly from inhabitants (collection times: 19:00 to 20:00
Packaging and placing method	There are no specific containers. Waste is mainly put into plastic bags. No differentiation by color of bags
Placing for collection	Collection directly from inhabitants
Others	Ordinary waste is collected on Monday, Tuesday and Friday
(2) Collection and transportation	
Collection truck	This can vary according to the recycler. A cart pulled by human hand or using bicycles
Collection routes	16 recyclers cover 16 routes, each of which is designed according to the number of homes and distance
Collection Times	From 19:00 to 20:00
Others	
(3) Sale of materials	
MPR transport destination	Each recycler takes materials collected to a warehouse in the Kennedy sector to be sold. Profit from the sale is not shared by the group but individually.
MPR Administration	Monitoring of the quantity of materials collected has begun.
Others	
(4) Raising awareness of the community	Each home has received a leaflet on waste separation from a house visitor requesting understanding and collaboration by the inhabitants, explaining the categories of separation, the method and times for putting garbage out in detail. Before commencing this pilot project, 4 members of the NGO carried out activities to raise awareness for a month. At present, each recycler explains separation to the community when receiving materials.
(5) Articulation with the community	A relationship of trust between the inhabitants and the recyclers is being structured thanks to accompaniment by members of the Community Action Committee.
(6) Recyclers' organization	This recyclers' organization is formed by 12 recyclers who have been working in this sector and another four. If separate collection is practiced by this sector and if financial support is provided by UAESP or the local Mayor's office, they calculate that they will be able to include 17 recyclers who wish to participate in separate collection in this sector.

4. Function of the community	• Separate MPR properly • Keep to the dates and times for collection • Understanding and collaboration on separate collection by recyclers • The practice of putting MPR out for collection has been improved by the inhabitants and, therefore, collection is taking less and less time
5. Function of the adminis-tration	• There is no support at present.
6. Relationship between recyclers and the administration (registration, contract, subsidies, etc.)	• There is no relationship between the NGO (or recyclers) and the administration.
7. Background of this project	• The NGO “Tierra Vida”, which as been in this sector for many years, brought the Community Action Committee and recyclers together to commence separate collection, which started in the month of March 2013.
8. Improved aspects	• Previously, recyclers took recyclable materials out of bags placed in the streets for collection and left garbage scattered around the area. But this situation does not occur any longer and the urban landscape has improved. • The degree of understanding of the recyclers and the collaboration of the inhabitants have increased. • Information on this project has disseminated and officials from other localities and entities visit.
9. Problems	• Recyclers from other sectors wish to participate in the project, but this could affect the unity among the present recyclers. • Motivation of the recyclers has not increased (neither have the amount of recyclable materials or profit from sales) • The NGO does not receive any economic support • Motivation of the community has not increased either (there is no visible impact • The separate collection target sector is a long way from the warehouse (the recyclers take the materials collected as far as Kennedy district)
10. Aspects to be improved	• Consideration must be given to the possibility of distributing profits from sales among the member recyclers (for fair distribution and to strengthen the group) • Becoming independent of the NGO • The quality of the materials that the inhabitants put out for collection should be improved (by better separation)

Flyer that explains the how to separate waste and the date and time it must be delivered (Monday and Friday from 7 to 8pm)

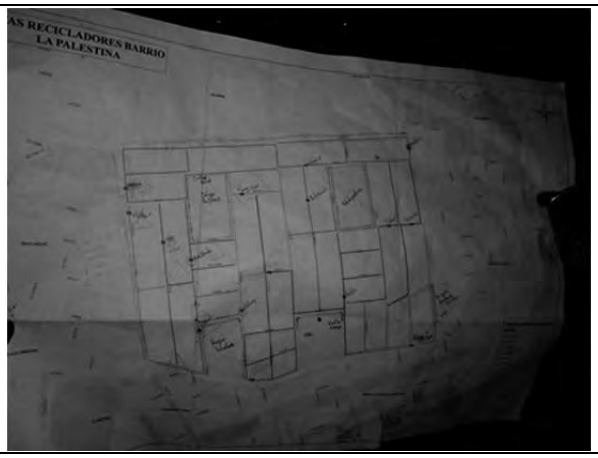
Each registered recycler is given a name-tag and a whistle to alert the community of his arrival

Regular meetings are held one hour before separate collection begins with the participation of Community Action Committees (JAC) and NGOs.

Recyclers listening to a talk by the “Tierra Vida” NGO. A literacy campaign for recyclers has been programmed with the help of retired teachers

Collection of MPR. Recyclers collect materials explaining how to separate using the leaflet.

With the accompaniment of members of Community Action Committees (JAC) is being structured between the inhabitants and recyclers.

	
Collection using a cart pulled by a bicycle.	Cooperation of the Police providing security on the collection routes.
	
Map of the collection routes covered by each recycler.	Previously, it took from 4 to 5 hours to fill a cart, but now takes only one hour.

4.5 Cost Estimation

4.5.1 General Aspects

4.5.1.1 Cost Structure

The costs for the management of the current solid waste, pursuant to Resolutions CRA 351 and 352 of 2005, and to the draft of Resolution 643 of 2013, amending the first ones, appear below:

Cost = CC + SCC + CTC +CU+ FDLCDT

CC: Commercial Cost

SCC: Sweeping and Cleaning Cost

CTC: Collection and Transport Cost

CU: Cost of Use

FDLCT: Final Disposal and Leachate Treatment Cost

The fees are charged and collected based on the estimated costs. The fees cover the already mentioned costs, as well as the different studies, the environmental education, and the activities to promote awareness in the communities regarding the proper management of solid waste. In the case of Bogotá, there is an item for the implementation of the PMIRS which covers the costs of the planned activities according to the PMIRS. Therefore, the cost structure of this Master Plan will be the following:

Total Cost = CC + SCC + CTC +CU+ FDLCT + CPMIRS

CPMIRS: Cost for the implementation of the Master Plan and other necessary costs.

4.5.1.2 Current Costs

a. Service Expenditure

Based on the financial data of the UAESP, the Service Expenditure obtained between 2006 and 2012 is shown in Table 4-109. From 2010, the total expenditure per year has been less than 350 billion pesos. Dividing the total expenditure by the amount of waste disposed of (Table 4-110), using the Consumer Price Index (CPI) (Table 4-111), we obtained the average unit prices between 2006 and 2010, being 2012 the reference year: CSC 135,000 pesos/ton, Final Disposal 20,000 pesos/ton, PMIRS and Others 1,000 pesos/ton. The Total Unit Price is 156,000 pesos/ton (Table 4-112).

Table 4-109: General Funds, 2006 – 2012

Unit: million pesos

General Funds Expenditure							
Item	2006	2007	2008	2009	2010	2011	2012
CSC Payment	201,082	218,046	243,325	275,073	284,981	240,352	280,777
Tree pruning	2,557	3,485	2,637	3,706	7,026	8,629	8,459
Planning, supervision, and control of garbage collection service	4,152	4,232	5,380	7,961	7,764	43,229	8,245
Final disposal: treatment and use	33,980	37,425	37,736	30,939	43,270	49,169	45,009
Education, prevention, and use of the garbage collection service	0	19	17	1,647	1,727	118	0
PMIRS implementation	0	0	90	662	1,906	2,564	246
Other activities of the garbage collection service	0	0	0	0	908	3,027	1,538
Subsidy Surplus - Contribution	0	0	0	0	0	0	333
Total	241,771	263,206	289,185	319,988	347,580	347,087	344,608

Service expenditure							
Item	2006	2007	2008	2009	2010	2011	2012
CSC	207,791	225,763	251,342	286,740	299,771	292,210	297,481
Final disposal	33,980	37,425	37,736	30,939	43,270	49,169	45,009
PMIRS and other	0	19	107	2,309	4,541	5,709	2,117
Total	241,771	263,207	289,185	319,988	347,582	347,088	344,607

Source: Own preparation based on data from the UAESP
Note: there are some differences in the value of the digit due to the rounding-up of the figures.

Table 4-110: Final Disposal Amount, 2006 – 2012

Unit: ton/year

Item	2006	2007	2008	2009	2010	2011	2012
Final Disposal Amount	2,016,300	2,057,111	2,171,363	2,110,596	2,230,924	2,302,675	2,280,930

Source: UAESP

Table 4-111: Consumer Price Index, 2006 - 2012

Item	2006	2007	2008	2009	2010	2011	2012
CPI	4.48%	5.69%	7.67%	2.00%	3.17%	3.73%	2.44%
2012 = 1.0000	1.2725	1.2040	1.1182	1.0963	1.0626	1.0244	1.0000

Source: DANE

Table 4-112: Actual Service Expenditure

Unit: pesos/ton

Item	2006	2007	2008	2009	2010	2011	2012*	Average
CSC	131,138	132,134	129,437	148,939	142,783	129,996	130,421	135,000
Final disposal	21,444	21,904	19,434	16,071	20,610	21,874	19,733	20,000
PMIRS and other	0	11	55	1,199	2,162	2,539	928	1,000
Total	152,582	154,049	148,926	166,209	165,556	154,410	151,082	156,000

Source: Own preparation
Note: * CPI's Basic year

b. Current Unit cost

The Fee for Socioeconomic Status 4, as of December 2012, is the one shown in Table 4-113. Nonetheless, the current expenditure per unit was 156,000 pesos/ton, as shown in the previous section. The current unit cost was estimated by taking both figures into consideration, as evidenced in Table 4-114.

Table 4-113: Fee for Socioeconomic Status 4, December 2012

Item	pesos/month	Percentage
CF	1,792.61	14.1%
SCF	2,312.66	18.2%
CTF	7,005.43	55.2%
FDLTF	1,583.28	12.5%
Total	12,693.98	100.0%

CF: Commercial Fee
SCF: Sweeping and Cleaning Fee
CTF: Collection and Transport Fee
FDLTF: Final Disposal and Leachate Treatment Fee

Table 4-114: Current Unit cost

Item	pesos/ton	Percentage
CC	21,800	14.0%
SCC	28,100	18.0%
CTC	85,200	54.6%
FDLCT	19,300	12.4%
PMIRS, etc.	1,600	1.0%
Total	156,000	100.0%

4.5.2 Component Costs

The costs were estimated as follows:

- The costs were estimated depending on each technical component, such as collection, transfer, transport, and recycling of materials.
- The addition period corresponds basically to the period of the Master Plan, 15 years, from 2013 to 2027. However, items that have a useful life of more than 15 years, such as buildings, were taken into consideration.
- Concerning the new landfills, the 30-year costs, from the start of their construction, were added.
- The costs include indirect costs, such as administrative expenses, in addition to direct costs, such as construction expenses, acquisition of machinery and equipment, personal and maintenance costs.

- The unit cost per ton of waste was obtained after calculating the costs of each technical component.
- The total costs were obtained after applying the unit cost to the future flow of waste until 2027, which is the final year.

4.5.2.1 Commercial Cost

The commercial cost of each year was proportionally estimated vis-à-vis the increase of the population by taking, as reference value, the commercial cost of 21,800 pesos per ton as of 2012.

4.5.2.2 Sweeping and Cleaning Cost

The Sweeping and Cleaning Cost was proportionately estimated vis-à-vis the increase in waste generation by taking, as reference value, the Sweeping and Cleaning Cost of 28,100 pesos per ton as of 2012.

4.5.2.3 Collection and Transport Cost

The unit costs were estimated by assuming that a new contract is entered into with the introduction of the Euro IV in 2014, which complies with the strictest emission criterion, and with the startup of the transfer stations in 2021, as shown in the table below:

Table 4-115: Master Plan Collection and Transport unit cost

Year	Item	pesos/ton	Note
2013	Collection and direct transport	85,200	Normal vehicle
2014 - 2020	Collection and direct transport	106,000	Euro IV vehicle
2021 - 2027	Collection and direct transport	113,600	Euro IV vehicle
	Collection	65,600	Euro IV vehicle
	Transfer Station, TS	6,500	-
	Transport	19,700	Euro IV vehicle

4.5.2.4 Recycling and Intermediate Treatment

a. Materials Recycling

The recycling of materials will be developed in two stages: from the current status to the transitional status, and then to the new system. The unit cost of each stage was estimated by taking into consideration the introduction of the new Euro IV engine and of the transfer stations, as show in the table below:

Table 4-116: Materials Recycling – Unit Cost

Item	pesos/ton	Note
Current	0	-
Transition	-	
Collection and separation	87,000	Current payment to the recycler
Rejected waste - transport, 2013	59,640	Collection and direct transport x 0.7
Rejected waste, 2014 - 2020	74,200	Collection and direct transport x 0.7
New system	-	
Separate collection, 2013	144,000	Per vehicle without compacting
Separation	203,800	Gathering center like Alquería, 30 ton/day
Rejected waste - transport, 2013	59,640	Collection and direct transport x 0.7
Rejected waste - transport, 2014 - 2020	74,200	Collection and direct transport x 0.7
Rejected waste - transport, 2021 - 2027	45,920	Collection to the TS x 0.7
Sale of materials*	280,000	Due to results at Alquería in 2011

Note: * this is not a cost but income.

b. Composting

The table below shows that estimated unit costs, assuming a composting plant with a capacity of 100 tons per day, as well as the introduction of transfer stations and of the Euro IV for the collection and transport system:

Table 4-117: Composting Unit Cost

Item	pesos/ton	Note
Collection, 2013	58,200	Per normal vehicle
Collection, 2014 - 2027	65,600	Per Euro IV vehicle
Composting Plant	39,300	100 ton/day
Rejected waste – transport, 2013	59,640	Collection and direct transport x 0.7
Rejected waste – transport, 2014 - 2020	74,200	Collection and direct transport x 0.7
Rejected waste – transport, 2021 - 2027	45,920	Collection to the TS x 0.7

c. Recycling of Combined CDW

The table below shows the estimated unit costs, assuming a recycling plant with a capacity of 200 tons per day and the introduction of the Euro IV to the collection and transport system:

Table 4-118: Combined Demolition and Construction Waste – Unit Cost

Item	pesos/ton	Note
Collection, 2013	58,200	Per normal vehicle
Collection, 2014 - 2027	65,600	Per Euro IV vehicle
Temporary storage	11,500	Voluntary Drop-off Point, 60 tons/day
CDW Recycling Plant	34,600	200 tons/day
Rejected waste – transport, 2013	59,640	Collection and direct transport x 0.7
Rejected waste – transport, 2014 - 2027	74,200	Collection and direct transport x 0.7

4.5.2.5 Final Disposal Cost

The unit costs shown in the table below were estimated by taking into consideration the continued use of the Doña Juana Landfill, the construction and operation of the Western Landfill from 2012, and of the Northern landfill from 2026:

Table 4-119: Final Disposal Cost

Item	pesos/ton	Note
Doña Juana	28,113	Life 2013 - 30 years or more. Approximate capacity: 58 million tons.
Western Landfill	29,430	Life 2021 - 30 years or more. Approximate capacity: 55 million tons.
Northern Landfill	31,683	Life 2026 - 30 years or more. Approximate capacity: 38 million tons.

4.5.2.6 PMIRS and Other Costs

The cost of the PMIRS and other costs for each year were proportionately estimated vis-à-vis the increase in waste generation by taking as value of reference the PMIRS cost and other costs: 1,600 pesos per ton as of 2012.

4.5.3 Master Plan Costs

4.5.3.1 Total Cost

The total costs, up to year 2027 (final year), were estimated by applying the unit costs obtained through the abovementioned future waste flow. The table below shows the result:

Table 4-120: MP Total Cost

Unit: million COP

Item		2013	2014	2015	2016	2017	2018
1	Commercial	51,143	51,832	52,521	53,210	53,899	54,588
2	Sweeping and Cleaning	66,429	67,823	69,217	70,611	72,005	73,399
3	Collection and Transport	-	-	-	-	-	-
31	Direct Collection	198,958	235,581	220,853	223,308	225,685	227,982
32	Transfer and Transport	0	0	0	0	0	0
4	Recycling	-	-	-	-	-	-
41	Materials Recycling	4,325	11,237	18,224	22,984	27,345	31,280
42	Composting	445	2,292	4,624	5,664	6,718	7,782
43	CDW Recycling	2,237	25,327	51,004	51,327	51,621	51,888
5	Final Disposal	66,112	65,996	65,341	66,223	67,034	67,769
6	PMIRS and Other	3,782	3,861	3,940	4,019	4,098	4,177
7	Total Cost	393,431	463,949	485,724	497,346	508,405	518,865

-	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	55,277	55,966	56,655	57,344	58,033	58,722	59,411	60,100	60,789
2	74,793	76,187	77,581	78,975	80,369	81,763	83,157	84,551	85,945
3	-	-	-	-	-	-	-	-	-
31	229,755	231,949	0	0	0	0	0	0	0
32	0	0	202,710	204,478	206,574	208,617	210,608	213,420	216,210
4	-	-	-	-	-	-	-	-	-
41	35,424	39,036	38,508	39,522	42,411	45,376	48,418	50,267	52,152
42	8,855	9,375	9,599	10,152	10,331	10,510	10,689	10,869	11,047
43	52,127	52,337	52,521	52,677	52,805	52,905	52,977	53,020	53,037
5	68,339	68,937	70,883	71,156	71,722	72,263	72,780	75,317	76,031
6	4,256	4,335	4,414	4,493	4,572	4,651	4,730	4,809	4,888
7	528,826	538,122	512,871	518,797	526,817	534,807	542,770	552,353	560,099

4.5.3.2 Unit Cost

The cost vis-à-vis the amount of waste generated (pesos/ton) and the cost per person (pesos/person) were obtained by dividing the abovementioned Master Plan costs by the amount of waste generated and by the population, as shown in the table below:

Table 4-121: Master Plan Unit Cost

Item		2013	2014	2015	2016	2017	2018
1	Per generation (pesos/ton)	157,409	181,808	186,508	187,202	187,661	187,885
2	per population (pesos/person)	51,308	59,701	61,683	62,342	62,914	63,398

-	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	187,924	187,729	175,706	174,600	174,224	173,852	173,483	173,636	173,216
2	63,810	64,133	60,380	60,344	60,550	60,747	60,937	61,302	61,458

Chapter 5

Evaluation of the Master Plan

5 Evaluation of the Master Plan

5.1 Financial and Economic Analyses

5.1.1 Method of Financial and Economic Analyses

The financial and economic analyses of this study will start up by accepting that the solid waste management is a municipal public service that the City of Bogota has the obligation to supply to its residents, and will try to shed light to the following two points:

1) type of solid waste management scenario that is the most appropriate for Bogota, and

2) whether the scenario selected as appropriate is also reasonable from the financial and economic standpoints.

Concerning 1), a number of scenarios were formulated and evaluated on the basis of strength/weakness, opportunity/threat using quantified data whenever possible, seeking to minimize the threats and/or costs. This resulted in the selection of Scenario IIc as the most appropriate.

Consequently, this Section will examine the selected Scenario IIc, interpreted as the Master Plan, from the financial and economic viewpoints, especially whether the residents of Bogota can afford to provide the cost of the selected scenario. At present, the solid waste management in Bogota is financed by the service charges paid for by the residents of the city, and it is reasonable to think that it will continue to be the same into the future. Hence, the financial analysis will examine whether the Master Plan can be financed by the solid waste service charges paid for by the city residents.

Further, the economic analysis will be based on a comparative study between the cases of “With Master Plan” and “Without Master Plan”, in order to determine whether the Master Plan is reasonable from the economic viewpoint.

5.1.2 Financial Analysis

5.1.2.1 Basic Conditions

The basic conditions of the financial analysis are the following.

Price level：	Price level of 2013（2012 = 2013 will be assumed）
Project period：	2013 to 2027: 15 years
Exchange rate：	USD1.00 = 1,900 COP　¥1.00 = 19.00 COP（June 2013）

5.1.2.2 Analysis of the Master Plan

a. Costs

Before December 2012, the private solid waste collection service providers of the corresponding Service Area calculated the cost of the service on the basis of the quantity of collected solid waste, and the calculated cost was submitted to the Bogota Municipality as payment request. Also, the payment by Bogota residents as solid waste service charges or tariff was calculated on monthly basis taking into consideration the quantity of solid waste estimated to be generated by each resident according to the social strata, and the amount of this service charge was billed to Bogota residents as the monthly tariff. In this way, the solid waste service charges collected from Bogota residents made up the funds from which the private solid waste collection service providers were paid for their services.

Accordingly, as indicated under Cost Estimation, the cost of the Master Plan was calculated by estimating the unit cost per ton by each technical component of the solid waste management service, and then applying the unit cost to the estimated generation of total solid waste tonnage per year. The table below shows the total cost, the unit cost per ton of solid waste, and the cost per capita of Bogota residents.

Table 5-1: Total and Unit Cost of the Master Plan

Year	Total Cost (Million COP)	Unit Cost for Solid Waste (COP/ton)	Unit Cost per Capita (COP/person)
2013	393,431	157,409	51,308
2014	463,949	181,808	59,701
2015	485,724	186,508	61,683
2016	497,346	187,202	62,342
2017	508,405	187,661	62,914
2018	518,865	187,885	63,398
2019	528,826	187,924	63,810
2020	538,122	187,729	64,133
2021	512,871	175,706	60,380
2022	518,797	174,600	60,344
2023	526,817	174,224	60,550
2024	534,807	173,852	60,747
2025	542,770	173,483	60,937
2026	552,353	173,636	61,302
2027	560,099	173,216	61,458
Total	7,683,182	-	-

b. Ability to Pay

The income of the Master Plan is equivalent to the income for solid waste management, and this income is basically made up of the solid waste service charges (tariff) paid for by Bogota residents. The income of the Master Plan is the minimum necessary for the operation and management cost of the Master Plan, whereby it is appropriate to think that income = cost of the Master Plan. This Section will deal with the issue of whether Bogota residents can pay for the solid waste service charges (tariff) that are necessary for the Master Plan.

b.1 Present Tariff

The tariff for solid waste management service in Bogota is set by socioeconomic stratum. Higher tariffs are set for the top highest socioeconomic strata, and the tariff system is designed in such a way that a cross subsidy among the six socioeconomic strata plus tariffs for industrial and commercial service users make it possible the financial management for the whole solid waste management service. The solid waste service users categorized in Stratum 4 do not pay subsidies nor receive subsidies, whereby Stratum 4 simply pays the tariff that is set for Stratum 4. In December 2012, the tariff for Stratum 4 was calculated as follows.

Stratum 4 Tariff (Dec/12) = TFR + TBL + TRT + TDT

= 1,792.61 + 2,312.66 + 7,005.43 + 1,583.28

= 12,693.98 COP/month/household

where, TFR: commercial

TBR: street sweeping

TRT: collection & transport

TDT: final disposal & leachate treatment

On the other hand, according to ”Primera Encuesta Multipropósito para Bogotá 2011”[1] of DANE-SDP, the household size of Stratum 4 was 2.9 persons. By applying this 2011 data on household size to the cost estimation for 2012, the solid waste service cost per person for Stratum 4 in 2012 would be as follows.

12,693.98 / 2.9 = 4,377.23 COP/month/person

4,377.23 x 12 = 52,526.76

= 52,500 COP/year/person

[1] DANE & SDP, 2011, “Primera Encuesta Multipropósito para Bogotá 2011, Principales resultados, Capacidad de pago,” p. 2

b.2 Present Bill Collection

The table below shows the bill collection of the solid waste service in Bogota from 2006 to 2012, except 2011, adjusted to 2012 using the annual CPI, and then calculated the bill collection per capita. This calculation resulted in 46,692COP as the yearly solid waste service bill collection per person.

Table 5-2: Present Bill Collection of the Solid Waste Service (CPI adjusted)

Year	Bill Collection before CPI Adjustment	CPI %	2012 = 100	Bill Collection adjusted with CPI	Population	Bill Collection per capita (COP/person)
2006	249,188,977,735	4.48	1.272	317,091,784,009	6,945,216	45,656
2007	264,519,255,109	5.69	1.204	318,478,085,673	7,050,228	45,173
2008	294,234,906,447	7.67	1.118	329,019,580,123	7,155,052	45,984
2009	331,457,187,466	2.00	1.096	363,374,811,196	7,259,597	50,054
2010	340,843,113,545	3.17	1.063	362,183,341,785	7,363,782	49,184
*2011	(274,808,434,909)	3.73	1.024	(281,513,760,721)	7,467,804	(37,697)
2012	333,919,894,338	2.44	1.000	333,919,894,338	7,571,345	44,103
average				337,344,582,854	-	46,692

Source: UAESP, DANE
Note: * According to UAESP, part of late payment was not included in 2011

b.3 Ability to Pay

The precise value of the Willingness to Pay for solid waste service is difficult to set. As Contingent Valuation Method, the determination of the Willingness to Pay usually depends on the analysis of responses to a questionnaire survey. However, if there is no penalty of an immediate service cut-off as a result of non-payment, like in the drinking water supply service, the responses to the questionnaire survey on the Willingness to Pay in the solid waste service have a tendency to be on the low side. Consequently, rather than the Willingness to Pay, the Ability to Pay is frequently used. The World Bank suggests 2% of the household income as the upper limit of the Ability to Pay for solid waste service[2].

The First Multi-Purpose Survey of Bogota 2011 (”Primera Encuesta Multipropósito para Bogotá 2011”[3]) conducted by DANE-SDP, indicated that the average household income in Bogota in 2011 was 2,849,514 COP/month/household. The corresponding household income adjusted to 2012 using the CPI was 2,919,042 COP/month/household. If the 2% mentioned before is used, the upper limit of the Ability to Pay of Bogota residents for the solid waste service in 2012 would have been 58,381 COP/month/household, or 700,572 COP/year/household.

[2] JICA, 2001, “Guidelines for Economic Evaluation – Solid Waste” (in Japanese)
[3] DANE & SDP, 2011, “Primera Encuesta Multipropósito para Bogotá 2011, Principales resultados, Capacidad de pago,” p. 2

However, the actual payment made by households for the solid waste service depends on the income size of the country where the household is located. These data on solid waste service are summarized as follows: low income countries 0.7 - 2.6%, middle income countries 0.5 - 1.3%, and high income countries 0.2 – 0.5%[4]. Taking into account that the World Bank has classified Colombia as an Upper Middle Income Country, the corresponding values of household income would be 0.5 – 1.3 %, which were applied to the data of DANE-SDP, resulting in 175,200 COP/year/household to 455,520 COP/year/household, equivalent to 51,600 COP/year/person to 134,160 COP/year/person. These values are taken as the Ability to Pay of Bogota residents for the solid waste service.

Table 5-3: Ability to Pay per Household

Stratum	Household %	Average Household Income (Million COP/ month)		Ability to Pay 2012 Household per month (COP/ month)		Ability to Pay 2012 Household per year (COP/ year)	
		2011	2012	0.5 %	1.3 %	0.5 %	1.3 %
1	7.9	1.21	1.24	6,200	16,120	74,400	193,440
2	38.0	1.55	1.59	7,950	20,670	95,400	248,040
3	36.5	2.72	2.79	13,950	36,270	167,400	435,240
4	10.6	5.90	6.04	30,200	78,520	362,400	942,240
5	3.2	7.81	8.00	40,000	104,000	480,000	1,248,000
6	2.5	10.66	10.92	54,600	141,960	655,200	1,703,520
Average		2.85	2.92	14,600	37,960	175,200	455,520

Source: Own calculation based on DANE & SDP, 2011, "Primera Encuesta Multipropósito para Bogotá 2011, Principales resultados, Capacidad de pago," p.2

Table 5-4: Ability to Pay per capita

Stratum	Persons per household*	Average Income (Million COP/month)		Ability to Pay 2012 Per capita per month (COP/ month)		Ability to Pay 2012 Per capita per year (COP/ year)	
		2011	2012	0.5 %	1.3 %	0.5 %	1.3 %
1	3.9	0.31	0.32	1,600	4,160	19,200	49,920
2	3.6	0.43	0.44	2,200	5,720	26,400	68,640
3	3.3	0.82	0.85	4,250	11,050	51,000	132,600
4	2.9	2.03	2.08	10,400	27,040	124,800	324,480
5	2.7	2.89	2.96	14,800	38,480	177,600	461,760
6	2.6	4.10	4.20	21,000	54,600	252,000	655,200
Average	3.4	0.84	0.86	4,300	11,180	51,600	134,160

Source: * DANE & SDP, 2011, "Primera Encuesta Multipropósito para Bogotá 2011, Principales resultados, Calidad de vida," cuadro.4

[4] Sandra Cointreau-Levine & Prasad Gopalan, 2000, "Guidance Pack Private sector participation in municipal solid waste management Part III Tools for preparing for private sector participation," Intermediate Technology Publications, Ltd., UK

b.4 Remarks

The table below summarizes the numbers calculated so far. The tariff of Stratum 4 is 52,500 COP/year/person, but taking into account the bill collection rate in recent years (90%) it becomes 47,250 COP/year/person. This value is quite close to the per capita real bill collection of 46,692 COP. Further, if this per capita real bill collection is compared with the unit cost of the Master Plan, the minimum unit cost of 51,308 COP is equivalent to cost exceeding income by 9.9%, while a comparison with the maximum unit cost of 64,133 COP is equivalent to cost exceeding income by 37.4%. On the other hand, if the comparative analysis is conducted using the maximum per capita bill collection of 50,054 COP, the corresponding percentages become 2.5% and 28.1%, respectively.

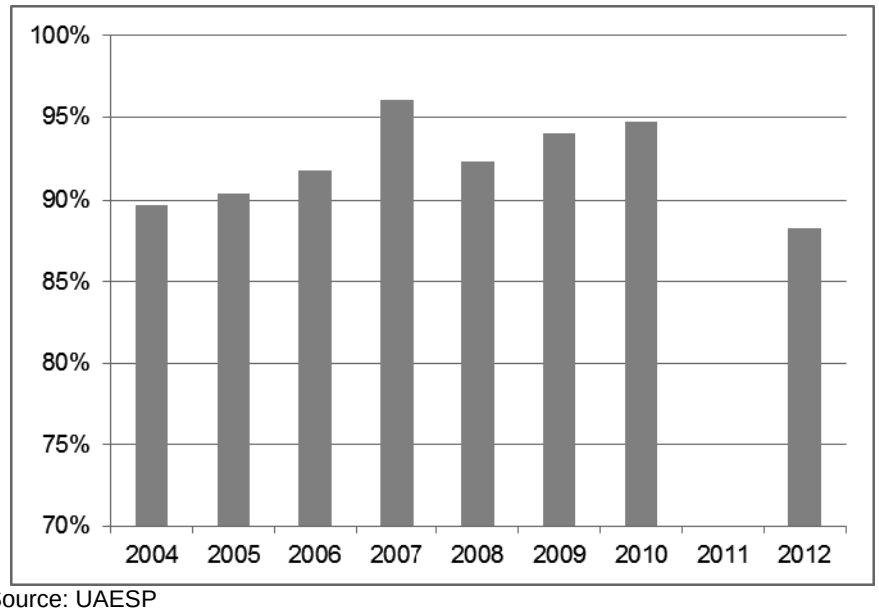
On the other hand, if the comparison is made between the unit cost of the Master Plan and the Ability to Pay, it can be clearly seen that the unit cost falls within the Ability to Pay, and rather closer to the lower value of the Ability to Pay. Hence, it can be said that the cost of the Master Plan is within the Ability to Pay of the users of the solid waste service. The minimum unit cost of 51,308 COP is equivalent to 0.5% of the average per capita income (0.86 x 12 = 10.32 million COP per year), and 0.6% of the maximum unit cost of 64,133 COP.

The above analysis indicates that it would be viable to finance the Master Plan Total System with the bill collection from solid waste service users. However, a strong resistance is feared from the solid waste service users when the time comes for the tariff increase of up to 30% that would be necessary before 2020.

Table 5-5: Numbers on the Ability to Pay to the Master Plan System

Item	COP/year/person
Tariff of Stratum 4	52,500
Tariff of Stratum 4 x bill collection rate (90%)	47,250
Real Bill Collection (2006 – 2012)	44,103 – 50,054 Average 46,692
Ability to Pay	51,600 - 134,160
Unit Cost of the Master Plan	51,308 (2013) - 64,133 (2020)

Item	COP/year/person	%
Real Bill Collection	Average 46,692 Max. (50,054)	100.0
Unit Cost of the Master Plan	Min. 51,308	109.9 (102.5)
	Max. 64,133	137.4 (128.1)



Source: UAESP
Note: * According to UAESP, part of late payment was not included in 2011

Figure 5-1: Solid Waste Bill Collection Rate

b.5 Sensitivity Analysis

An analysis was made by assuming up to 20% increase in the maximum cost, and its effect on the present tariff per capita, as well as on the Ability to Pay. The table below shows that when the maximum cost increases by 20%, the present tariff would increase by 65%, which in terms of income is equivalent to a 0.75% increase. Therefore, a 20% increase in the maximum cost does not exceed the Ability to Pay.

Table 5-6: Sensitivity Analysis

Item	Case	COP/year/person	%
Present Cost	-	46,692	-
Cost	+0%	64,133	137%
	+10%	70,546	151%
	+20%	76,960	165%

Item	Case	cop/year/person	%
Income	-	10,302,504	100.00%
Present Cost	-	46,692	0.45%
Cost of the Master Plan	0%	64,133	0.62%
	+10%	70,546	0.68%
	+20%	76,960	0.75%
Ability to Pay	-	51,600 - 134,160	0.5-1.3%

5.1.2.3 Analysis of the Recycling Components

The analysis so far indicated that the Bogota residents have the Ability to Pay for the cost of the Master Plan Total System. Whether or not the cost can actually be collected as the solid waste tariff is another issue.

According to CRA Resolution 351 and 353 of 2005, and the draft revision Resolution 643 of 2013, the recycling cost would be a summation of the collection and transport cost plus the cost of final disposal. The total recycling cost cannot be collected as tariff even in the case when the recycling cost exceeds this summation.

CAP = CRT + CDT

CAPrt = CAP x 0.71
CAPpc = CAP x 0.25
CAPiu = CAP x 0.04

TAP = (CRT + CDT) x 0.96

CAP = Cost of Recycling
CRT = Cost of Collection & Transport
CDT = Cost of Final Disposal & Leachate Treatment
CAPrt = Cost of Collection & Transport for Recycling
CAPpc = Cost of Weighing & Classification of Recovered Material
CAPiu = Incentive to SW service users for source separation

(Source: CRA Resolution 643 of 2013)

Accordingly, this Section will study whether or not the recycling cost exceeds the summation of the collection and transport cost plus the final disposal cost, and in the affirmative case, how to finance the shortage.

a. Recycling of Materials

As the table below shows, the cost of material recycling largely exceeds the cost of collection and transport plus the final disposal cost. This situation becomes clear when the present system is understood. In Alqueria, at present, the RBL or Collection Service Operator collects the Materials Potentially Recyclable, Bogota City Government pays for the operation and maintenance cost of Alqueria, and the proceeds from the sale of recycled materials are distributed among the recyclers.

The excess cost during the first half of the project is large due to the low separation at the source, whereby the solid waste collected includes a high proportion of Non-recyclable Materials, which as refuse have to be transported to the Doña Juana final disposal site. The excess cost decreases during the second half of the project, due to the dissemination of the separation at the source, which increases the proportion of Recyclable Materials, and less refuse is transported to the nearby transfer station.

A yearly maximum excess cost of 14,000 million COP is estimated, and the first priority is to come up with some measures to decrease this excess cost. Some possible countermeasures are indicated below.

- Insistence on the separation at the source, in order to increase the proportion of Recyclable Materials
- Reduction of investments in Centros de Acopio, by taking advantage of the existing Bodegas
- Reduction of investments in facilities for separate collection, by using existing trucks and other facilities

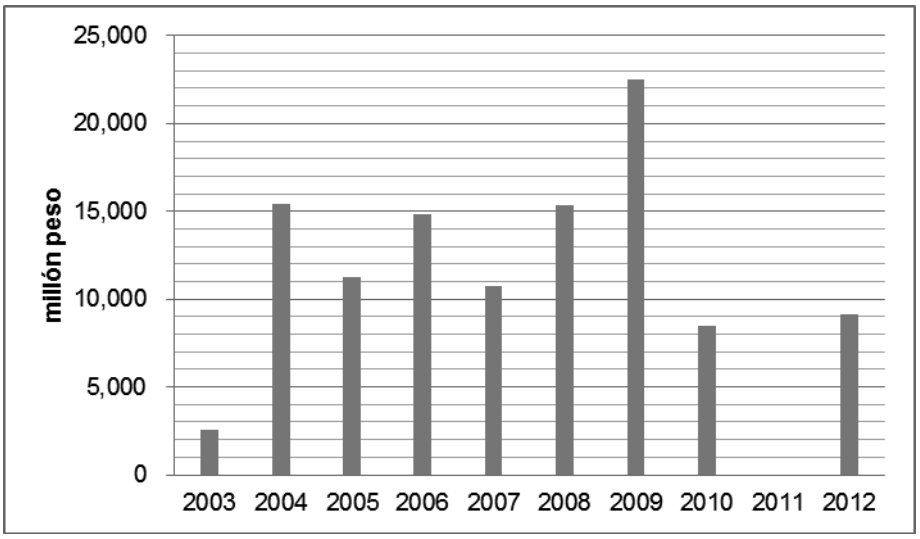
If the financial deficits continue, then the following measures can be considered.

- With the purpose of protecting the weak (recyclers), use the general funds of the Bogota City Government or the Central Government.
- Use the reserves in the Bolsa General, which in the past few years have produced reserves of 10,000 to 15,000 million COP per year.

In order to cover the excess cost, a social agreement would be needed on the basis of some legal measure.

Table 5-7: Balance of Recycling Material – (RT+DT)

Year	Solid Waste	Recycling Material	RT+DT	Balance	
	(ton)	(Million COP)	(Million COP)	(Million COP)	(COP/ton)
2013	9,879	4,325	1,120	-3,205	-324,453
2014	20,172	11,237	2,705	-8,532	-422,958
2015	30,878	18,224	4,141	-14,083	-456,083
2016	70,960	22,984	9,517	-13,467	-189,784
2017	112,600	27,345	15,102	-12,243	-108,734
2018	155,798	31,280	20,895	-10,385	-66,657
2019	204,769	35,424	27,463	-7,961	-38,880
2020	255,455	39,036	34,260	-4,776	-18,698
2021	276,037	38,508	33,282	-5,226	-18,932
2022	297,191	39,522	35,833	-3,689	-12,414
2023	318,916	42,411	38,452	-3,959	-12,414
2024	341,214	45,376	41,140	-4,236	-12,413
2025	364,082	48,418	43,898	-4,520	-12,414
2026	377,991	50,267	45,845	-4,422	-11,698
2027	392,157	52,152	47,563	-4,589	-11,702
Total	3,228,099	506,509	401,216	-105,293	-



Source: UAESP
Note: Part of late payment was not included in 2011.

Figure 5-2: Balance of Bolsa General

b. Composting

Composting costs are estimated to exceed the RT+DT cost of 32 million COP only in the first year. This scale of financial shortage is considered to be viable to be financed with the funds from the Bolsa General or the general funds.

Table 5-8: Balance of Composting – (RT+DT)

Year	Solid Waste	Compost	RT+DT	Balance	
	(ton)	(Million COP)	(Million COP)	(Million COP)	(COP/ton)
2013	3,900	474	442	-32	-8,205
2014	18,459	2,292	2,476	184	9,968
2015	37,677	4,624	5,053	429	11,386
2016	46,726	5,664	6,267	603	12,905
2017	56,102	6,718	7,524	806	14,367
2018	65,804	7,782	8,825	1,043	15,850
2019	75,834	8,855	10,170	1,315	17,341
2020	81,314	9,375	10,905	1,530	18,816
2021	86,940	9,599	10,482	883	10,156
2022	92,717	10,152	11,179	1,027	11,077
2023	94,354	10,331	11,377	1,046	11,086
2024	95,990	10,510	11,574	1,064	11,084
2025	97,625	10,689	11,771	1,082	11,083
2026	99,262	10,869	12,039	1,170	11,787
2027	100,898	11,047	12,237	1,190	11,794
Total	1,053,602	118,981	132,321	13,340	-

c. Recycling of Mixed Debris

The costs of recycling mixed debris are estimated to always exceed the cost of collection and transport plus the cost of final disposal. This excess cost would have to be paid for by the generator of the debris. Except for 2013, the cost of recycling mixed debris was 20,000 to 30,000 COP/ton, which is not an excessive outlay for the generator.

Table 5-9: Balance of Debris – (RT+DT)

Year	Solid Waste	Debris	RT+DT	Balance	
	(ton)	(Million COP)	(Million COP)	(Million COP)	(COP/ton)
2013	14,889	2,347	1,688	-659	-44,261
2014	152,016	25,327	20,388	-4,939	-32,490
2015	310,280	51,004	41,613	-9,391	-30,266
2016	316,527	51,327	42,451	-8,876	-28,042
2017	322,774	51,621	43,288	-8,333	-25,817
2018	329,022	51,888	44,126	-7,762	-23,591
2019	335,269	52,127	44,964	-7,163	-21,365
2020	341,516	52,337	45,802	-6,535	-19,135
2021	347,764	52,521	41,931	-10,590	-30,452
2022	354,011	52,677	42,684	-9,993	-28,228
2023	360,258	52,805	43,437	-9,368	-26,004
2024	366,506	52,905	44,190	-8,715	-23,779
2025	372,753	52,977	44,944	-8,033	-21,550
2026	379,000	53,020	45,967	-7,053	-18,609
2027	385,248	53,037	46,725	-6,312	-16,384
Total	4,687,833	707,920	594,198	-113,722	-

5.1.3 Economic Analysis

5.1.3.1 Basic Conditions

The basic conditions for economic analysis are the following.

Price： Price of 2013（2012 = 2013 is assumed）

Evaluation Period： 2013 to 2042, 30 years

Exchange rate： USD1.00 = 1,900 COP ¥1.00 = 19.00 COP（June 2013）

Discount rate: 8 - 12%

SCF: 0.9155 (Calculated by the JICA Team as the average of 2006-2010 using data on foreign trade plus import duty and export tax)

5.1.3.2 Benefits of the Master Plan

The table below shows a comparative analysis of the cases "Without Master Plan" and "With Master Plan", as well as the identified benefits from the Master Plan. The benefits that could be quantified and monetized included the reduction in the cost of collection and transport that was attributable to the transfer station, the proceeds from the sale of recovered materials from the recycling of materials, and the reduction in the final disposal cost that was attributable to the reduction in the quantity of solid waste for final disposal due to recycling, composting, and recycling of mixed debris. However, these reductions were already reflected in the cost estimation. Other important benefits that could not be quantified and monetized referred to the reduction of the risk of paralyzing the whole solid waste management system caused by some accident in the final disposal site, reduction of the negative impact on the traffic and the environment stemming from the reduction in the number of collection vehicles, and the improvement in the quality of life and income of the recyclers.

Table 5-10: Comparative Analysis between "Without Master Plan" and "With Master Plan"

Components	Without Master Plan	With Master Plan
Collection & Transport	Normal vehicle (2013) Vehícle Euro IV (2014-2027) Direct Transportation (2013-2027)	Normal vehícle (2013) Vehícle Euro IV (2014-2027) Direct Transportation (2013-2020) Trasfer & Transport (2021-2027)
Recycling	The same as at present l	Recycling of materials Composting Recycling of mixed debris
Final Disposal	Doña Juana (2013-2027)	Doña Juana (2013-2027) West (2021-2027) North (2026-2027)

Table 5-11: Benefits of the Master Plan

Components	Benefits
Collection & Transport	• Cost reduction from the introduction of the Transfer & Transport • Reduction in the number of vehicles
Recycling	• Decrease in the quantity of solid waste for final disposal • Recovery of materials • Production of compost • Improvement in the quality of life of recyclers
Final Disposal	• Decrease in the risk of paralyzing the solid waste management

5.1.3.3 Economic Analysis of the Master Plan

The evaluation period for the purpose of economic analysis of the MP is set up as 30 years, between 2013 and 2042, although the project period is 15 years, between 2013 and 2027, because the MP has components of construction of landfills, transfer stations and other recycling plants which are facilities having economic life of 30 year and over. In addition, Law 1713 and Resolution 1045 state that a plan for final disposal should consider at least 30 years.

The balance between the case "Without Master Plan" and the case "With Master Plan" is the incremental cost as well as the benefit of the MP. That is, the negative balance is considered as the incremental cost, and the positive balance is assumed as the benefit of the MP in this economic analysis.

The MP has various components and each of them commences in different point of time. Therefore, the MP as an integrated project applies single Standard Conversion Factor, 0.9155, for the aggregated benefit and cost.

The economic analysis applies discount rates 8%, 10 % and 12%. The results are: NPV is negative in the all cases; B/C Ratio exceeds 1.0 in the case of 8% discount rate; and EIRR is always lower than the discount rates.

Although the results are not so favorable, they do not deny the economic validity of the MP, because of the following reasons.

- B/C Ratio is over 1.0 at least in the case of 8% discount rate
- New landfills and transfer stations have useful lives over the evaluation period, and the MP as a whole will generate benefit continuously. This makes the MP economically more favorable.

Consequently, it can be said that the MP gives the Bogota society benefit for a long time period, although it causes negative balance during the first decade. This means that the MP as a whole may not be an attractive investment opportunity for the private sector, but it is meaningful for the public sector to make decision to invest, after consulting the citizens. Of course, the public sector should make efforts to reduce the negative balance as much as possible.

Table 5-12: Benefit and Cost of the Master Plan

Unit: Million COP

Year	w/o MP	w/ MP	Balance	Balance converted by SCF
2013	267,874	272,077	-4,203	-3,848
2014	323,697	340,433	-16,736	-15,322
2015	330,348	360,046	-29,698	-27,189
2016	336,999	369,506	-32,507	-29,760
2017	343,651	378,403	-34,752	-31,815
2018	350,302	386,701	-36,399	-33,323
2019	356,953	394,500	-37,547	-34,374
2020	363,604	401,634	-38,030	-34,816
2021	370,256	374,221	-3,965	-3,630
2022	376,908	377,985	-1,077	-986
2023	383,559	383,843	-284	-260
2024	390,211	389,671	540	494
2025	396,862	395,472	1,390	1,273
2026	403,513	402,893	620	568
2027	410,164	408,477	1,687	1,544
2028	416,816	415,099	1,717	1,572
2029	423,467	421,725	1,742	1,595
2030	454,493	428,350	26,143	23,934
2031	465,811	434,973	30,838	28,232
2032	472,904	441,597	31,307	28,662
2033	479,998	448,220	31,778	29,093
2034	487,091	454,844	32,247	29,522
2035	494,185	461,468	32,717	29,952
2036	501,279	468,093	33,186	30,382
2037	508,372	474,715	33,657	30,813
2038	515,466	481,342	34,124	31,241
2039	522,559	487,964	34,595	31,672
2040	529,653	494,588	35,065	32,102
2041	536,747	501,213	35,534	32,531
2042	543,840	507,840	36,000	32,958

Table 5-13: Results of Economic Analysis

Discount Rate	NPV million COP	B/C	EIRR
8%	-78,867	1.06	3.4%
10%	-88,453	0.93	3.4%
12%	-91,553	0.83	3.4%

5.2 Initial Environmental Assessment

5.2.1 Summary of the components that could cause socio-environmental impacts

The following is a summary of the components of the plan to which a socio-environmental assessment is applicable.

a. Transfer Stations

The plan is to establish two transfer stations; the Western Transfer Station and the Northern Transfer Station. The following is a summary of the facilities:

a.1 Western Transfer Station

Scale: Quantity of waste handled: 4,500 tons/day

Function: Transfer of waste from collection trucks to large trucks.

Location: This is in the western sector of Bogota D.C. Details of the location have not been defined.

Others: It will go into operation as of the year 2021.

a.2 Northern Transfer Station

Scale: Quantity of waste handled: 2,000 tons day

Function: Transfer of waste from collection trucks to large trucks

Location: This is in the northern sector of Bogota D.C. Details of the location have not been defined.

Others: It will go into operation as of the year 2021.

b. Gathering/Collection Center

Scale Quantity of waste handled: 30 tons/day

Function: Recovery, weighing and collecting recyclable materials from separately collected waste

Location: 36 sites in Bogota D.C. Details of the location have not been defined.

Others: New centers do not necessarily have to be built as the existing warehouses can be used after they have been improved.

c. Composting plant

Scale: Quantity of waste handled: 100 tons/day

Function: Composting of organic waste from market places, cut grass and tree pruning

Location: 3 sites inside or outside Bogota D.C. Details of the location have not been defined.

Others: New composting plants do not necessarily have to be built; private plants can be used or new plants built.

d. CDW Recycling Plant

Quantity: Quantity of waste handled: 200 tons/day

Function: Mixed cdw recycling plant

Location: 3 sites inside or outside Bogota D.C., which are to be established within the disposal site for cdw or zones adjacent to these. Details of the location have not been defined.

Others: These do not necessarily have to be built by the public sector as existing private plants can be used or new plants could be built by the private sector.

e. New Landfills

The plan is to establish two landfills: the Western Landfill and the Northern Landfill. The following is a summary of the facilities:

e.1 Western Landfill

Scale: Quantity of waste handled: 4,700 ton/day in 2027

Total capacity: approximately 55 million tons

Function: Final disposal of ordinary solid waste.

Location: The plan is for the zone to be outside Bogota D.C. to the west. Details of the location have not been defined.

Others: The landfill will go into operation as of the year 2021.

e.2 Northern Landfill

Scale: Quantity of waste handled: 2,800 tons/day in 2027

Total capacity: approximately 38 million tons.

Function: Final disposal of ordinary solid waste.

Location: The plan is for the zone to be outside Bogota D.C. to the north. Details of the location have not been defined.

Others: It will go into operation as of the year 2026.

At this stage of the study, none of the locations for installation has been defined. However, the following figure shows a general image of the location of the landfills and the transfer stations, which are large scale facilities.

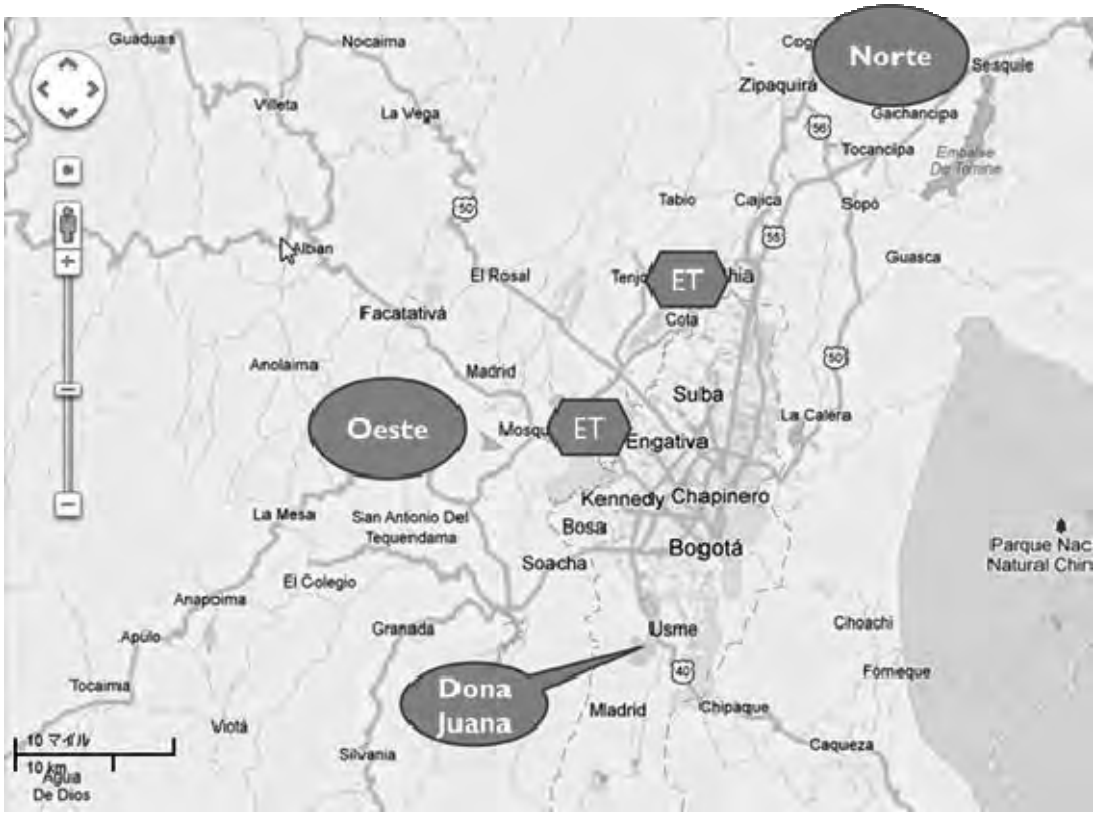


Figure 5-3: Image of the Location of the future Transfer Stations and Landfills

5.2.2 Environmental System and Environmental Authorities in Colombia

a. Colombian legislation associated to the Initial Environmental Evaluation

In the case of a Colombia, the Initial Environmental Evaluation (IEE) is included in the Environmental Licensing Procedure. The procedure to obtain an environmental license is defined by the following regulations:

- Law 99 of December 22, 1993
- Decree 2820 of August 5, 2010

According to Law 99/1993, an environmental license is "… the authorization granted by a competent environmental authority to carry out works or activities, subject to the compliance by the license beneficiary of the requirements established by such authority regarding the prevention, mitigation, correction, compensation and management of any environmental effect of the authorized works or activities (Art. 50)".

Under Colombia's current legislation no other types of social and environmental studies such as the Strategic Environmental Assessment (SEA) or the Initial Environmental Evaluation are required, therefore there are no regulations related to such evaluations.

b. Competence and enforceability of the environmental license

In accordance with the above mentioned Decree, the competent authorities to grant or reject an environmental license, pursuant to the law and the Decree, are the following:

1. Ministry of Environment, Housing and Territorial Development (MAVDT)
2. Regional Environmental Agencies and Sustainable Development Agencies
3. Municipalities, districts and metropolitan areas with a population above one million in their urban perimeter
4. Environmental authorities created by Law 768/2002

Las Regional Environmental Agencies and Sustainable Development Agencies may delegate the exercise of this competence onto the territorial entities.

1) Sectors and Projects over which the MAVDT has competence:

1. Hydrocarbons (including natural gas)
2. Large-scale mining exploitation
3. Construction of dams, reservoirs or weirs
4. Electricity sector
5. Nuclear energy generation projects
6. Maritime sector and ports

7. Construction and operation of international airports
8. Public works execution
   8.1. National road network projects
   8.2. National fluvial network projects
   8.3. Railroad construction
   8.4. Construction of hard maritime works (breakwater, ledges, seawall construction)
9. Construction and operation of large-scale irrigation districts
10. Production and import of pesticides
11. Importation *and/or* production of substances, materials or products subject to control under international environmental treaties, agreements and protocols
12. Projects affecting Natural National Park System Areas
13. Projects, works or activities to be performed in national public protected areas under Decree 2372 of July 1, 2010
14. Projects undertaken by the Regional Environmental Agencies referred to in subparagraph 19, Art. 31 of Law 99/1993
15. Projects requiring inter-basin transfer from a basin to another with water currents not exceeding 2 m /second during the minimum outflow periods
16. Introduction to the country of parentals, species, subspecies, races, hybrids or foreign varieties for the purpose of cultivation, breeding, biological control, reproduction and/or commercialization

2) Sectors and Projects on which authorities other than the MAVDT have powers:

The environmental license for projects different than those mentioned above will be granted by the environmental authority with a jurisdiction over the project site. When the project, works or activity is developed in the jurisdiction of two or more environmental authorities, the Ministry of Environment, Housing and Territorial Development will design the competent environmental authority to decide over the environmental license.
The territorial environmental authorities will grant or reject the environmental license for the following projects, works or activities carried out in their jurisdictional area:

1. Mining exploitation
2. Stationary steel, cement and concrete plants
3. Construction of dams, reservoirs or weirs with a capacity equal to or below 200 million cubic meters of water
4. Electricity sector
5. Maritime sector and ports
6. Construction and operation of domestic airports

7. Projects on secondary and tertiary road networks
8. Execution of private works on the domestic fluvial network
9. Construction of regional railroads
10. Construction and operation of facilities for the storage, treatment, utilization, recuperation and/or final disposition of waste or hazardous waste, and the construction and operation of security landfills for medical waste
11. Construction and operation of facilities for the storage, treatment, use (recovery/recycling) and/or final disposition of waste electrical and electronic devices (WEEE) as well as waste batteries and/or accumulators
12. Construction and operation of plants for the utilization and valuation of biodegradable organic solid waste higher than or equal to 20,000 tons/year
13. Construction and operation of landfills; nevertheless, this operation can only be managed by the persons stipulated in Art. 15 of Law 142/1994
14. Construction and operation of wastewater treatment systems to serve populations equal to or higher than 200,000
15. Manufacturing industry for the production of: a) basic chemical substances of mineral origin; b) alcohols; c) inorganic acid and their oxygenated compounds
16. Projects aimed at storing hazardous substances excepting hydrocarbons
17. Construction and operation of irrigation and/or drainage districts for areas greater than or equal to 5,000 hectares and less than or equal to 20,000 hectares
18. Projects requiring inter-basin transfer from one basin to another of water currents equal to or less than 2 cubic meters/second during the minimum stream periods
19. Commercial hunting and the creation of commercially- intended animal farms
20. Projects, works or activities to be carried out in regional public protected areas included in Decree 2372 of July 1, 2010.

c. Procedures to grant an environmental license

In conformance to Law 99/93, and according to each type of project an Environmental Alternative Diagnosis (DAA) or the Environmental Impact Study (EIA) is required when requesting the environmental license from the corresponding authority.

1) DAA procedure (Art. 56 of Law 99 and Art. 19 of Decree 2820)

For projects requiring an environmental license, the interested party will request the competent environmental authority during the feasibility stage to determine the need to either submit an environmental alternative diagnosis or not. Based on the information provided, the environmental authority will decide whether such diagnoses will be required or not and define the terms of reference within a term no greater than thirty (30) working days.

The DAA should include the following components as a minimum:

1. Objective, scope and description of project, work or activity
2. General description of location alternatives for the project, work or activity, as well as the characteristics of the social and economic environment for each one of the alternatives submitted
3. Information on the compatibility of the project with the uses of soil as established in the Land Zoning Plan or equivalent
4. Identification and comparative analysis of potential risks and effects on the environment, as well as the use and/or utilization of the natural resources required for the different alternatives under study
5. Identification of communities and mechanisms used to inform them about the project, work or activity
6. An environmental cost-benefit analysis of alternatives
7. Selection and justification of the best alternative

Based on the environmental diagnosis of alternatives submitted, the authority will select within a term no greater than sixty (60) days the alternative or alternatives based on which the corresponding Environmental Impact Study will be developed before granting the respective license.

2) EIA procedure (Art. 57 of Law 99 and Art. 21 of Decree 2820)

The EIA contains a set of data that should be submitted by the applicant requesting the environmental license to the competent environmental authority.

The Environmental Impact Study should include the following as a minimum:

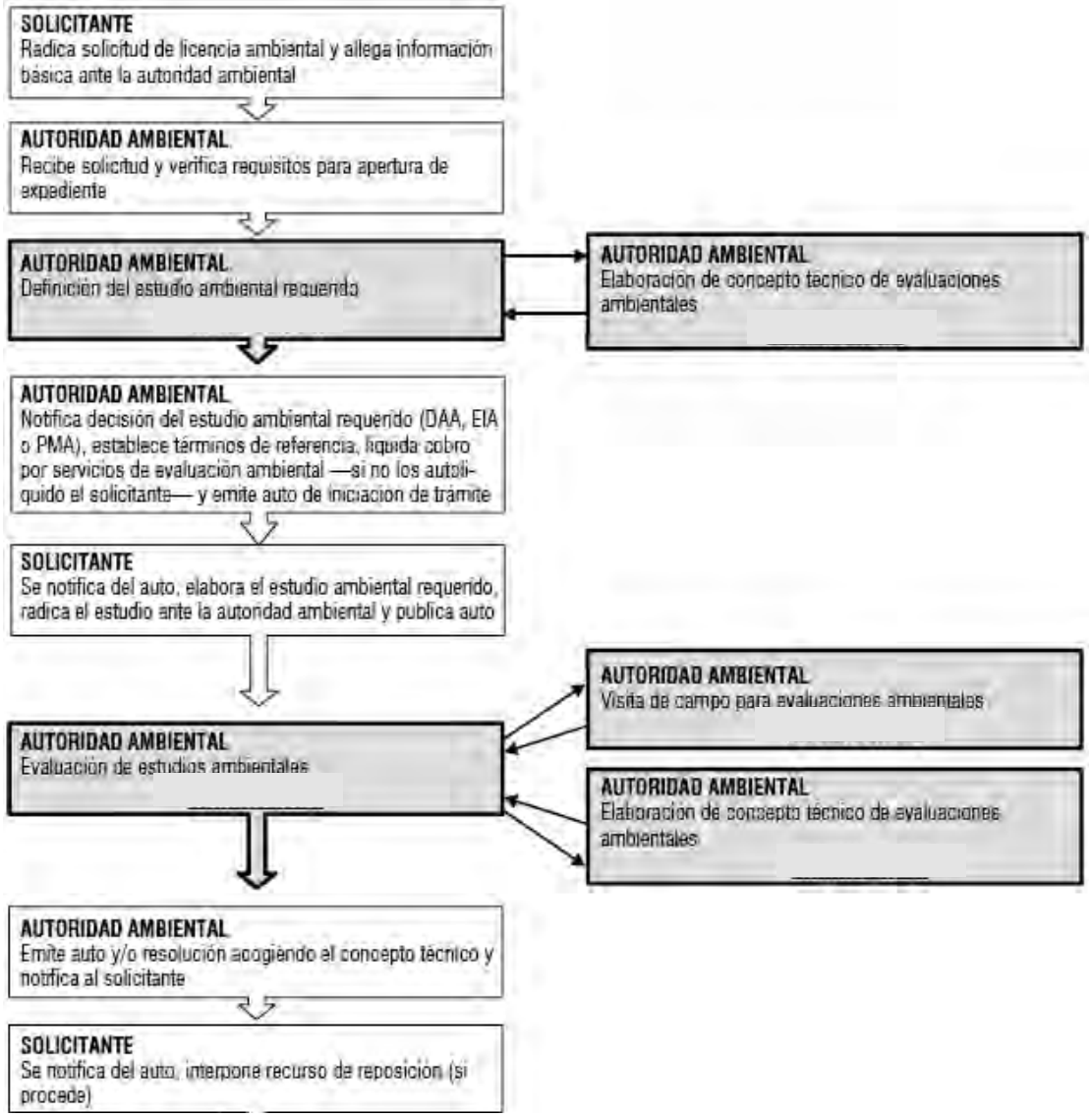
1. Information about the project, including location, infrastructure, project activities and other information considered relevant
2. Characterization of the Project's area of influence for the abiotic, biotic and social-economical media
3. Demand for natural resources by the project; the information required to request permits is submitted including the capture of surface water, outflows, river bed occupation, utilization of construction materials, forest utilization, season opening, atmospheric emissions, solid waste management, exploration and exploitation of underground water
4. Information relating to environmental impact evaluation and risk analysis
5. Environmental management zoning defined for the project, work or activity for which exclusion areas, restricted intervention areas and intervention areas are identified

6. Economic evaluation of the Project positive and negative impacts
7. Project environmental management plan
8. Monitoring and evaluation program, for each medium: abiotic, biotic and social-economic
9. Contingency plan for the construction and operation of the project; it should include activities regarding spills, fire, leaks, emissions and/or discharges outside the permitted limits
10. Dismantling and exit plan, defining the final use of soil, as well as the major management, restoration and morphological renovation measures
11. Plan to invest 1%, including the items and costs considered to estimate the investment and proposal for investment projects, when required by regulations

The competent environmental authority to grant the environmental license will establish the terms of reference for the environmental impact studies within a term not to exceed sixty (60) working days, starting with the request by the interested party.

3) Procedure to grant an environmental license (Art. 58 of Law 99 and Art. 21 of Law 2820)

Those parties interested in the granting of an environmental license will submit before the competent environmental authority the request attaching the Environmental Impact Study for its evaluation. The competent authority will have thirty (30) working days to request from the interested party any additional information that may be required. Once the information has been received, the environmental authority will have an additional fifteen (15) working days to request from other entities or authorities the relevant technical opinions or information, which should be sent within a term no greater than sixty (60) working days. Once the information has been received or the term for the required additional information has expired, the environmental authority will decide by a reasoned resolution on the environmental viability of the project or activity and grant the corresponding environmental license within a term not to exceed sixty (60) working days. The general process is shown below.



APPLICANT Files request for environmental license and provides basic information to the environmental authority	
ENVIRONMENTAL AUTHORITY Receives request and checks requirements for opening file	
ENVIRONMENTAL AUTHORITY Definition of required environmental study	ENVIRONMENTAL AUTHORITY Development of technical opinion on environmental evaluations
ENVIRONMENTAL AUTHORITY Notifies decision of the required environmental study (DAA, EIA or PMA), established terms of reference, calculates charges for environmental evaluation services – if not calculated by the applicant – and issues decision to start process	
APPLICANT Acknowledges notification of decision, develops required environmental study, files the study before the environmental authority and publishes decision	
	ENVIRONMENTAL AUTHORITY Field visit for environmental evaluations
ENVIRONMENTAL AUTHORITY Evaluates environmental studies	ENVIRONMENTAL AUTHORITY Development of technical opinion of environmental evaluations
ENVIRONMENTAL AUTHORITY Issues decision and/or resolution accepting technical opinion and notifies applicant	
APPLICANT Acknowledges notification of decision, files petition for reconsideration (if appropriate)	

Figure 5-4: General process to grant an environmental license

(Extracted from Manual de Evaluación de Estudios Ambientales (*Manual for the Evaluation of Environmental Studies*) – Ministry of the Environment)

d. Method and procedure for community participation

As regards community participation, the following is defined in Art. 15 of Decree 2820:

"Communities should be informed about the scope of the project, with an emphasis on the impacts and proposed management measures to be valued and incorporated in the Environmental Impact Study including, when considered relevant, the contributions received during this process."

In addition, Title X of Law 99/1993 defines different related rights, such as the right to participate in environmental administrative procedures, the process for participation petitions, the procedure for administrative public hearings on environmental decisions under way, the right for the petition for information and all legal procedures for class actions.

5.2.3 Environmental evaluations required for this study and competent authorities

Pursuant to Decree 2820, projects that require an EIA are the following:

- Composting plants with a capacity greater than 20,000 tons per year
- Landfills

As far as the other projects, the competent authority requires that the project executor obtains the corresponding permits and take the required measures according to the activities performed both during the construction stage and the operation stage of facilities (for example, in the case of a transfer station, it should obtain discharge permits and apply noise-avoidance measures).

The competent authority is defined according to the location of each project site. In Bogotá D.C., the subject of this study, if such facility is built in the urban area of Bogotá D.C., the competent authority will be the District Environmental Secretariat (SDA). If facilities such as a landfill or a composting plant are constructed in the rural area, the competent authority will be the Regional Environmental Agency of Cundinamarca (CAR). The table below shows the required studies and competent authorities:

Table 5-14: Required studies and competent authorities

Project	Required study	Competent authority
Transfer stations	—	SDA
Composting plants	EIA	CAR
Construction and demolition waste recycling plants	—	SDA
Recyclable materials gathering centers	—	SDA
Landfills	EIA	CAR

Note) Given that the location of the facility has not yet been determined, the preliminarily assigned competent authority is shown.

5.2.4 Results of Scoping and Environmental and Social Impact Evaluation

Since environmental and social impact evaluation at IEE level is not required by Colombian legislation or law at present and prioritized project for future Feasibility Study has not yet been determined in this study, the scoping and environmental and social impact evaluation at IEE level for each alternative project is conducted according to the JICA's Guidelines for Environmental and Social Considerations.

Table 5-15: Results of Impact Estimation & Evaluation

Project		Impact Estimation & Evaluation											
		1) Transfer Station		2) Compost Plant		3) Recycling facility for Construction Waste		4) Recycling Center		5) Sanitary Landfill		Without-Project	
Environmental Items (Pollution)													
1	Air Quality	Air pollution can be caused by the exhaust gas such as sulfur oxides (SOx), nitrogen oxides (NOx) and dust as the collection vehicle passes through the city.	B	Air pollution can be caused by the exhaust gas such as SOx, NOx and dust as the collection vehicle passes through the city. The dust from operation of the facility can be caused.	B	Air pollution can be caused by the exhaust gas such as SOx, NOx and dust as the collection vehicle passes through the city. The dust from operation of the facility can be caused.	B	Air pollution can be caused by the exhaust gas such as SOx, NOx and dust as the collection vehicle passes through the city.	B	Air pollution can be caused by the exhaust gas such as SOx, NOx and dust as the collection vehicle passes through the city. Landifill gas which contains a large portion of CH4 is to be generated.	B	Without 5), air quality in the vicinity of the existing landfill site can be deteriorated.	B
2	Water Quality	Contaminated water may be generated during cleaning of the facility.	B	Contaminated water may be generated during cleaning and operation of the facility. Leachate from water runoff and condensation at the plant occasionally contains levels of biological oxygen demand (BOD) that may exceed acceptable discharge limits.	B	Contaminated water may be generated during cleaning of the facility.	B	Contaminated water may be generated during cleaning of the facility.	B	Water pollution can be caused by wastewater from the construction site, heavy equipment and vehicle. Leachate can cause contamination of groundwater and surface water in the vicinity of the landfill site.	A	Without 5), water quality in the vicinity of the existing landfill site is deteriorated.	A
3	Waste	Waste may scatter in the operation.	B	Residue that is not suitable for composting is generated.	B	Waste other than C&D waste may come into the plant.	B	Residues can be generated in the process of waste separation.	B	Waste can be generated during construction.	B	Without 1)-4), volume and quantity of residues going to the landfill site can be larger.	A
4	Soil Contamination	Soil can be contaminated by waste water from the facility.	B	Soil can be contaminated by waste water from the facility.	B	Soil can be contaminated by waste water from the facility.	B	Soil can be contaminated by waste water from the facility.	B	Leachate may cause soil contamination in the vicinity of the landfill site.	B	Without 5), soil contamination in the vicinity of the existing landfill site becomes worse.	A
5	Noise & Vibration	Noise and vibration can be caused by unloading/loading waste.	B	Noise and vibration can be caused in the operation of the facility.	B	Noise and vibration can be caused in the dismantling and crushing process of the construction waste.	A	Noise and vibration can be caused in the sorting process of waste.	B	Noise and vibration can be caused by waste transport vehicles and heaby equipment.	B	Without 5), there cannot be any noise and vibration in the existing landfill site.	

6	Offensive Odors	Offensive odors can be slightly generated by decaying wastes.	C	Offensive odors can be slightly generated by decaying organic wastes.	B	Offensive odors cannot be generated.		Offensive odors can be slightly generated by decaying wastes.	C	Offensive odors can be slightly generated by decaying wastes.	B	Without 5), there cannot be offensive odors in the existing landfill site.	
Environmental Items (Natural Environment)													
7	Protected Areas	Although there are some protected areas (National Natural Parks or Forests, Wetlands and the East Hills of Bogota) in the study area, the project site is not yet determined and shall be located outside of these protected areas.	C	Although there are some protected areas (National Natural Parks or Forests, Wetlands and the East Hills of Bogota) in the study area, the project site is not yet determined and shall be located outside of these protected areas.	C	Although there are some protected areas (National Natural Parks or Forests, Wetlands and the East Hills of Bogota) in the study area, the project site is not yet determined and shall be located outside of these protected areas.	C	Although there are some protected areas (National Natural Parks or Forests, Wetlands and the East Hills of Bogota) in the study area, the project site is not yet determined and shall be located outside of these protected areas.	C	Although there are some protected areas (National Natural Parks or Forests, Wetlands and the East Hills of Bogota) in the study area, the project site is not yet determined and shall be located outside of these protected areas.	B	Without 1)-5), protected areas is to be conserved.	
8	Ecosystem & Biota	The project site is not yet determined but shall be located in the area that does not give adverse impact on the rare flora and fauna.	C	The project site is not yet determined but shall be located in the area that does not give adverse impact on the rare flora and fauna.	C	The project site is not yet determined but shall be located in the area that does not give adverse impact on the rare flora and fauna.	C	The project site is not yet determined but shall be located in the area that does not give adverse impact on the rare flora and fauna.	C	The project site is not yet determined but shall be located in the area that does not give adverse impact on the rare flora and fauna.	B	Without 1)-5), significant local ecosystem & biota are to be conserved.	
9	Management of Abandoned Sites									Disposal sites is to adapt the sanitary landfill, the abandoned site can be reused as a public facility such as park and green tract.	C	Without 5), there could be no necessity of management of abandoned sites.	
Environmental Items (Social Environment)													
10	Involuntary Resettlement	The project site is not yet determined but shall be avoiding a large number of resettlement. The land acquisition may be conducted for construction of facility.	C	The project site is not yet determined but shall be avoiding a large number of resettlement. The land acquisition may be conducted for construction of facility.	C	The project site is not yet determined but shall be avoiding a large number of resettlement. The land acquisition may be conducted for construction of facility.	C	The project site is not yet determined but shall be avoiding a large number of resettlement. The land acquisition may be conducted for construction of facility.	C	The project site is not yet determined but shall be avoiding a large number of resettlement. The land acquisition may be conducted for construction of facility.	B	Without 1)-5), involuntary resettlement is to be avoided.	

11	Living & Livelihood	Transportation of waste is expected to be more effective. Job opportunity can be created during constructtion and operation.		Job opportunity can be created during constructtion and operation.		Job opportunity can be created during constructtion and operation.		The livelihood of existing recyclers can be changed due to the inclusion plan. Job opportunity can be created during constructtion and operation.	B	Local trafic condition can be improved as the number of trips of collection vehicles might decrease by the reduction of the amount of waste to be transported to landfill site. Job opportunity can be created. Leachate may cause adverse impact on water use (especially drinking water) of residents near the landfill site.	B	Without 1)-4), the number of trips of collection vehicles does not decrease as the amount of waste to be transported to the disposal site does not decrease so no positive impact on local trafic. Without 1)-5) Opportunity of employment cannot be created during construction and operation.	A
12	Heritage	The project site is not yet determined but shall be located in the area that does not give adverse impact on the heritage.	**C**	The project site is not yet determined but shall be located in the area that does not give adverse impact on the heritage.	C	The project site is not yet determined but shall be located in the area that does not give adverse impact on the heritage.	C	The project site is not yet determined but shall be located in the area that does not give adverse impact on the heritage.	C	The project site is not yet determined but shall be located in the area that does not give adverse impact on the heritage.	C	Without 1)-5), heritages are to be conserved.	
13	Landscape	Appearance of the facility may give some impact on the landscape.	B	Appearance of the facility may give some impact on the landscape.	B	Appearance of the facility may give some impact on the landscape.	B	Appearance of the facility may give some impact on the landscape.	B	Appearance of the landfill site may give impact on the landscape.	B	Without 1)-5), landscape is to be secured.	
14	Ethnic Minorities & Indigenous Peoples	There is little impact on ethnic minorities and indigenous peoples.	C	There is little impact on ethnic minorities and indigenous peoples.	C	There is little impact on ethnic minorities and indigenous peoples.	C	There is little impact on ethnic minorities and indigenous peoples.	C	There is little impact on ethnic minorities and indigenous peoples.	C	Without 1)-5), ethnic minorities & indigenous people's lives are not to be bothered.	B
15	Working Conditions	There might be health and safety issues on workers dealing with waste.	B	There might be health and safety issues on workers dealing with organic waste.	B	There might be health and safety issues on workers dealing with hazardous materials.	B	The working condition of existing recyclers can be improved by the inclusion plan.		There might be health and safety issues on workers dealing with waste.	B	Without 4), working condition of existing recyclers can not be improved.	B

Others													
16	Impacts during Construction	Noise, vibrations, waste water, dust, exhaust gases and wastes, and impact on landscape, health and safety education shall be checked based on preliminary design and basic plan.	B	Noise, vibrations, waste water, dust, exhaust gases and wastes, and impact on landscape, health and safety education shall be checked based on preliminary design and basic plan.	B	Noise, vibrations, waste water, dust, exhaust gases and wastes, and impact on landscape, health and safety education shall be checked based on preliminary design and basic plan.	B	Noise, vibrations, waste water, dust, exhaust gases and wastes, and impact on landscape, living of recyclers, health and safety education shall be checked based on preliminary design and basic plan.	B	Noise, vibrations, waste water, dust, odors, exhaust gases and wastes, impact on ecosystem and protected areas and impact on landscape, living of workers, health and safety education shall be checked based on preliminary design and basic plan.	B		
17	Monitoring	Operators must develop and implement monitoring program for the environmental items that are considered to have potential impacts.	B	Operators must develop and implement monitoring program for the environmental items that are considered to have potential impacts.	B	Operators must develop and implement monitoring program for the environmental items that are considered to have potential impacts.	B	Operators must develop and implement monitoring program for the environmental items that are considered to have potential impacts.	B	Operators must develop and implement monitoring program for the environmental items that are considered to have potential impacts.	B		
	A: Serious impact is anticipated												
	B: Some impact is anticipated												
	C: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses)												
	No Mark: No impact is expected												

5.2.5 Mitigation Measures

The above evaluation results are reflected in developing Environmental Management Plan (EMP) as part of the IEE report. Mitigation and management measures addressed in EMP are shown in the following table.

Table 5-16: Mitigation and Management Measures

Project		Mitigation & Management Measures				
		Transfer Station	Compost Plant	Recycling facility for Construction Waste	Recycling Center	Sanitary Landfill
Environmental Items (Pollution)						
1	Air Quality	▪Low emission trucks and mechanical equipment shall be used. ▪The indoor air quality of the transfer station must comply with the specifications Decree 948 of 1995.	·Low emission trucks and mechanical equipment shall be used. ·Exhaust gases and fungus spores shall be treated within the plant.	▪Low emission trucks and mechanical equipment shall be used. ▪Exhaust gases and dusts shall be treated within the plant.	▪Low emission trucks and mechanical equipment shall be used.	▪Low emission trucks and mechanical equipment shall be used. ▪Draining gas must be comprised of a ventilation system in stone or concrete perforated pipe coated with stone.
2	Water Quality	▪Waste water pretreatment plant is required to install to treat wastewater from the station before being discarded to the sewege treatment.	▪The leachate must be collected, stored and disposed properly so as not to reach the surface and groundwater. ▪Water runoff must be diverted away from the site by building dikes, intercepted, channeled and treated to ensure proper disposal.	▪Sewage treatment facility shall be installed to meet with the acceptable water discharge limits. ▪Water runoff must be diverted away from the site by building dikes, intercepted, channeled and treated to ensure proper disposal.	▪The facility shall install the drainage system to control runoff and infiltration.	▪Stormwater drainage must be intercepted and diverted rainwater runoff out of the landfill by building channels on land or trapezoidal concrete floor. ▪Leachate collection and treatment facility shall be installed to meet with the acceptable water discharge limits. If a site cannot be located on land which naturally contains leachate security, additional lining materials should be brought to the site.
3	Waste	▪Waste shall be treated and disposed of properly during construction of the facility. ▪Windscreens or other facility shall be installed to prevent the flying papers.	▪Waste shall be treated and disposed of properly during construction of the facility. ▪Waste separation at source shall be encouraged to efficiently operate the facility.	▪Waste shall be treated and disposed of properly during construction of the facility. ▪C&D waste shall be properly separated at source in order to avoid other waste entring in the plant.	▪Waste shall be treated and disposed of properly during construction of the facility. ▪Waste separation at source shall be encouraged to facilitate waste separation on site. ▪The storage area of the raw material must be sufficient for a few days.	▪Waste shall be treated and disposed of properly during construction of the facility. ▪Waste separation at source shall be encouraged to reduce the amount of waste transported to the landfill. ▪Soil/alternative material should be placed on waste daily after compactation to avoid dispersal of light elements by wind.
4	Soil Contamination	▪The surface of the facility shall be paved.	▪Runoff shall be diverted so as not to contact compost. ▪Water content of compost shall be properly managed so as not to generate leachate. ▪Leachate if it is generated shall be treated.	▪Organic/hazardous waste if those come into the plant shall be separated and stored properly.	▪The surface of the facility shall be paved. ▪Organic/hazardous waste if those come into the plant shall be separated and stored properly.	▪Leachate collection and treatment facility shall be installed to avoid soil contamination. ▪A landfill liner shall be installed to retard migration of leachate, and its toxic constituents, into the ground.

5	Noise & Vibration	･Less noise trucks and mechanical equipment shall be used.	･Less noise trucks and mechanical equipment shall be used.	･Less noise trucks and mechanical equipment shall be used. ･Air compressors and crusher shall applies a sound absorbing material.	･Less noise trucks and mechanical equipment shall be used.	･Less noise trucks and mechanical equipment shall be used.
6	Offensive Odors	･Waste entring in the plant shall be transported on the day/the following day. ･Ordors control facility shall be installed.	･Adequate operation can control the o.dor ･Generation of odor should be controlled using ventilation on site.		･Organic waste coming into the plant shall be transported on the day/the following day. ･Ordors control facility shall be installed.	･Waste should be compacted and covered with soil/alternative material daily to avoid odors.
Environmental Items (Social Environment)						
7	Living & Livelihood	･The architectural design of the transfer station must be completely closed in order not to generate negative impacts on the surrounding area. .	･It is recommended not place the plant outdoors near residential areas. ･The compost products that come from household waste and sludge treatment plants should be analyzed to assess the content of heavy metals, toxic organic components, glass fragments and pathogens.	･Collection containers and filtration equipments should be made of inert material that does not leach or absorb waste components.	･The architectural design of the center must be completely closed in order not to generate negative impacts on the surrounding area. ･The center should be located in industrial area and need to meet the isolation requirement of the acceptance of the community and to maintain adequate safety zones around the facility.	･Soil should be placed on waste daily to control vectors, birds and to avoid contact with rain water, the visual effect of uncovered waste, and to create a firewall barrier to prevent spread of fire over the filling waste. ･Leachate shall be controlled in order not to give adverse impact on drinking water for the residents near the site.
8	Landscape	･Appearance of the facility shall be harmonized with the surrounding environment.	･Appearance of the facility shall be harmonized with the surrounding environment.	･Appearance of the facility shall be harmonized with the surrounding environment.	･Appearance of the facility shall be harmonized with the surrounding environment.	･The selected site need to meet the requirements of the development of the municipality defined in the POD (Plan de Desarrollo Territorial).
9	Working Conditions	･The area should be washed daily and must be fumigated every a few months. ･Occupation Health and Safety Plan shall be prepared and related training and instructions should be given to staff.	･The vectors should be controlled by enclosing the facility. ･Occupation Health and Safety Plan shall be prepared and related training and instructions should be given to staff.	･Occupation Health and Safety Plan shall be prepared. ･The staff working at the facility must complete a training program for waste management.	･The ventilation system must be designed so that there is no accumulation of substances that interfere with the health and safety of workers. ･Occupation Health and Safety Plan shall be prepared and related training and instructions should be given to staff.	･Occupation Health and Safety Plan shall be prepared and related training and instructions should be given to staff. ･Waste shall be covered with soil/alternative matarial daily to maintain sanitary working conditions for the landfill operators.

5.2.6 Monitoring

The mitigation and management measures addressed in the EMP are applied as monitoring items. Methods and institutional arrangements are discussed below.

a. Institutional Arrangement

Project Environmental Management Committee (PEMC) is to be established to monitor the social and environmental aspects for the Project and to decide compensation conditions. PEMC will be composed of the following members.

- Representative from Secretaria Distrital de Habitat
- Representative from Secretaria Distrital de Planeacion
- Representative from Secretaria Distrital de Ambiente
- Representative from Secretaria Distrital de Salud
- Representative from Secretaria Distrital de Gobierno
- Representative from cooperative of recyclers organized by UAESP
- Representative from Mayors
- Representative from Comites de Desarrollo y Control Social de Servicio Publico de Aseo
- Representative from UAESP
- Representative from MAVDT
- Representative from CAR
- Representative from specialized operators of each project component

Depending on the characteristic of the project component, PEMC may form subcommittees to focus on particular aspects of the Project such as Environmental management, Compensation and Grievance management.

b. Monitoring Plan

The monitoring includes both internal monitoring activities implemented by UAESP or specialized operators and external monitoring carried out by independent third parties. The monitoring plan of each project component is shown in the following table.

Table 5-17: Environmental Monitoring Plan

Project		Environmental Monitoring Plan				
		Transfer Station	Compost Plant	Recycling facility for Construction Waste	Recycling Center	Sanitary Landfill
Environmental Items (Pollution)						
1	Air Quality	·Check parameters of exhaust gas (Nox, Sox, SPM)	·Check parameters of exhaust gas (Nox, Sox, SPM)	·Check parameters of exhaust gas (Nox, Sox, SPM) ·Ensure that air quality mitigation measures being fulfilled.	·Check parameters of exhaust gas (Nox, Sox, SPM)	·Check parameters of exhaust gas (Nox, Sox, SPM) ·Check the biogas parameters; Composition of biogas: CH4, CO2, O2 BI-MONTHLY, explosive BI-MONTHLY, Flow MONTHLY ·Check parameters of Airborne Particle (Total suspended particles, respirable particles) MONTHLY
2	Water Quality	·Check effluent limits for wastewater (Oil and grease, Total petroleum hydrocarbons (TPH) and pH).	·Check effluent limits for wastewater (BOD, pH, organic matter, dissolved oxygen etc.). ·Ensure that water quality mitigation measures being fulfilled.	·Check effluent limits for wastewater (Oil and grease, Total petroleum hydrocarbons (TPH) and pH).	·Check effluent limits for wastewater (Oil and grease, Total petroleum hydrocarbons (TPH) and pH).	·Check the groundwater parameters (pH, Electrical conductivity, Dissolved Oxygen, Heavy Metals, COD, BOD, Organic Matter, Ammonia, Nitrites, Nitrates) BYYEARLY
3	Waste	·Visual observation for waste scattering.	·Visual observation for waste scattering.	·Visual observation for waste scattering. ·Check if hazardous materials such as asbest are mixed in the plant.	·Visual observation for waste scattering. ·Ensure the mitigation measures of the minimum storage capacity for the raw material and processed material being fulfilled.	·Visual observation for waste scattering. ·Ensure the soil/alternative material covering on waste being conducted daily.
4	Noise & Vibration	·Check the noise & vibration level of the facility during operation and during running of collection vehicles. ·Keep track of grievances regarding noise & vibration.	·Check the noise & vibration level of the facility during operation and during running of collection vehicles. ·Keep track of grievances regarding noise & vibration.	·Check the noise & vibration level of the facility during operation and during running of collection vehicles. ·Keep track of grievances regarding noise & vibration. ·Ensure that noise mitigation measures being fulfilled.	·Check the noise & vibration level of the facility during operation and during running of collection vehicles. ·Keep track of grievances regarding noise & vibration.	·Check the noise & vibration level of the facility during operation and during running of collection vehicles. ·Keep track of grievances regarding noise & vibration.
5	Offensive Odors	·Check the odor index on the site. ·Keep track of grievances regarding odors.	·Check the odor index on the site. ·Keep track of grievances regarding odors. ·Ensure that odor mitigation measures being fulfilled.		·Check the odor index on the site. ·Keep track of grievances regarding odors.	·Check the odor index on the site. ·Keep track of grievances regarding odors.

5.2.7 Stakeholder's Consultation

It is essential to work in collaboration with the local residents when introducing waste separation system and making solid waste management plans. Therefore, it is important to conduct consultation with the local stakeholders and public awareness raising activities on solid waste management in order to achieve successful management planning.

Since the details of location, content and scale of each project has not yet been determined, a stakeholder consultation at this stage of the development study has not been conducted. However, it is recommended to have the consultation with local stakeholders as necessary when the details of the project are determined.

Chapter 6

Conclusion and Recommendations

6 Conclusion and Recommendations

6.1 Conclusion

a. Current Situation of Solid Waste Management in the City of Bogotá

a.1 Amount Generated and Composition of Solid Waste

The amount of solid waste generated in Bogotá D.C. during year 2011 was 6,665 tons: 357 tons were recovered through informal recycling activities and the other 6,308 tons were taken to and disposed of at the Doña Juana Landfill.

From the total amount of solid waste generated (6,665 tons), 5,296 tons correspond to residential and institutional waste, 357 tons of which were recycled. The remaining 1,369 tons correspond to waste from street sweeping, tree pruning and lawn mowing/ cut grass, from the markets, as well as from construction and demolition activities.

According to the existing characterization study, organic waste equals 60% and potentially recyclable materials –such as paper and plastic- equal 22% of residential solid waste. Potentially recyclable waste ranges between 25% and 46% of the waste from small-quantity generators such as small commercial establishments and restaurants.

Currently, it is assumed that 1,200 tons of potentially recoverable materials are recovered in Bogotá D.C.; the Inclusion Plan uses this figure. Nevertheless, according to the result of the aforementioned characterization study and of other existing studies, it is calculated that, at present, the amount of potentially recyclable materials equals 357 tons.

a.2 Waste Collection Service

In general, the ordinary waste collection service as well as the sweeping and cleaning service of public areas is being properly rendered. Each inhabitant knows the date for the collection of solid waste of the place where he/she lives and takes out the waste on that date. This seems simple but is hardly ever fulfilled in most of the developing countries.

Up to the month of December 2012, the collection, sweeping and cleaning service (CSC) was rendered by four (4) private companies; nevertheless, due to the termination of the contract, one of the them withdrew and it is currently rendered by three (3) private companies and one (1) public company called Aguas de Bogotá, which is an affiliate company of the Empresa de Acueducto y Alcantarillado de Bogotá (EAAB). This measure is deemed transitional and it is expected that the CSC service will be rendered under a new contract from year 2014.

The waste collected in the city is directly taken to the Doña Juan Landfill, which is located to the south of the city. There are no transfer stations in Bogotá. The northern area of Bogota is more than 30 kilometers away, so it is deemed pertinent to introduce transfer stations.

The density of solid waste at the Doña Juan Landfill is increased by 1.0; the leachate and gas treatment facilities are already built. Although sometimes the quality of the water treated at the leachate plant surpasses the criterion value, or the operation of the gas plant becomes difficult due to the lowering of the Emissions Reduction Certificate ('Certificado de Reducción de Emisiones' – CRE'), in general, they operate properly.

However, it is extremely risky for a big city like Bogotá, with more than 7 million inhabitants, to depend on just one landfill. Should an accident happen at the landfill itself, or en route, and the transport of waste is interrupted, the city will be full of waste and the health of the inhabitants will be seriously affected. Indeed, an accident of this nature happened in 1997.

In general, as already mentioned, the waste collection and disposal services of Bogotá are adequately rendered. The rendering of these services is supported by the administrative and legal framework that makes up the government of the Capital District of Bogotá, the Regulatory Commission for Water and Basic Sanitation ('Comisión de Regulación de Agua Potable y Saneamiento Básico' – 'CRA'), the Superintendence of Residential Public Utilities, etc.

a.3 Special Solid Waste Management

Concerning the management of hazardous solid waste, the responsibility of the generator and the extended responsibility of the producer are relatively well defined and organized, but the set goal tends to be very ambitious.

Efforts are made for the appropriate management of post-consumer products containing hazardous substances such as light bulbs and batteries, expired medicines and used agrochemical products. In the case of Bogotá, the District Environmental Secretariat of Bogotá leads the activities related to this management. Nevertheless, regarding the level of understanding of the inhabitants concerning this type of waste leads them not to identify hazardous waste.

On the other hand, contagious waste generated by health care institutions, such as hospitals, is, in general, adequately dealt with or disposed of by a private entity hired by the UAESP.

a.4 Materials Recycling

The recycling of materials is currently undertaken by informal recyclers in Bogotá. The number of recyclers in Bogotá is over 10,000, and there are more than 1,000 warehouses where these recyclers bring recyclable materials.

The Constitutional Court issued a judgment in 2003, ordering the district government of Bogotá to undertake affirmative actions regarding the recyclers aimed at eliminating discrimination vis-à-vis solid waste management. The UAESP submitted the Inclusion Plan in 2012 as a response to this requirement. This Plan is aimed at organizing and structuring a recovery system for recyclable materials through the separate collection and gathering centers. As of 2013, it is undergoing a transition towards the system defined in the Inclusion Plan; the registry of recyclers and warehouses is being implemented, as well as the payment to recyclers for the collection and transport of potentially recyclable materials.

The recovery of recyclable materials entails complex problems such as the protection of the recyclers who belong to the most vulnerable segment of society, the separation of waste at source undertaken by the inhabitants, the setting-up of separate collection, the adaptation and legalization of existing regulations as the Zoning Plan, as well as the organization of new gathering centers in a city where the use of land is highly advanced.

a.5 Policies and Rules Movement

The current administration that started in 2012 suggested the “Zero Garbage” [*Basura Cero*] policy and it is making different efforts, mainly pursuant to the Inclusion Plan. The “Zero Construction & Demolition Waste” Plan is aimed at recycling large quantities of residual muds generated in large-sized works; the residual water treatment plan is one of said efforts.

As already mentioned, the plan for the rendering of the CSC services is undergoing a transitional stage and it will be under a new contract from 2014. The new contract includes the introduction of collection vehicles, equivalent to or superior than the Euro IV, pursuant to the regulation for the control of emissions that has been established at the national level.

The CRA is reviewing the rates plan, and it wants to include the costs and the rate related to the recovery of recyclable material in the new plan.

So laws and regulations concerning the topic of solid waste management are changing; therefore, it is necessary to be attentive to these changes.

a.6 Fulfillment of the current Integrated Solid Waste Management Plan ('PMIRS')

The PMIRS committee is structured and is made up of the Office of the Mayor of Bogotá, of the Offices of the Local Mayors, and representatives of the recyclers; in addition, the current PMIRS is being monitored and assessed. According to the assessment, the goals related to the CSC services have been fulfilled in general; nonetheless, the ratings of recycling and of the management of solid waste disposal are very low. The assessment by UAESP officers obtained a similar result.

b. Future Challenges

b.1 Overcoming the vulnerability of the current final disposal system

The following two weaknesses (vulnerabilities) are found in the current final disposal system:

- There is only one landfill (Doña Juana) for a city that has over seven (7) million inhabitants; therefore, there are risks that may seriously affect the life and the health of the inhabitants in the event of an accident because the city would be filled with waste.
- According to the Master Plan, the remaining useful life of the Doña Juana landfill goes until 2030. Nevertheless, the Phase II optimization zone, the only remaining free area at the Doña Juana landfill to be used from next year, will be filled by year 2020 if minimization is not accomplished. New waste will then be put over the already buried waste; it is technically unclear if it can be accumulated in this way.

New landfills need to be developed to overcome this type of vulnerability.

b.2 Improving transport efficiency

The northern area of Bogotá is far from the Doña Juana landfill; therefore, the transport of waste takes a long time. The introduction of a transport plan for this area with transfer stations is financially feasible and reasonable.

It is hard to develop a new landfill in the city in the future, and the distance to the landfill will inevitably increase. It will be financially feasible in this case to introduce the transport with transfer stations for the center and for the south of the city.

Due to these reasons, it will be necessary to analyze the possibility of introducing the transport plan with transfer stations, along with the development of new landfills.

b.3 Inclusion of the recycling population in the materials recycling system

Currently, the district government of Bogotá works in the preparation of the Inclusion Plan it submitted before the Constitutional Court. However, there are difficult challenges that prevent the plan from advancing, such as the organization of the recyclers and the interests of the different parties involved. Concerning the Alquería Model Project, it has been planned and prepared, but it has not been implemented due to the foregoing difficulties.

The separate collection mode may be different, depending on whether it involves houses or residential complexes. The approach for the awareness of the inhabitants regarding separation at source may also be different according to the socioeconomic status. Each recycler has different problems; consequently, it is necessary to insist that the administrative authority support each sector and each organization of recyclers so they find and develop an adequate manner instead of insisting on structuring a unique model.

b.4 Minimizing the amount of solid waste taken to the landfill

Pursuant to the environmental license granted to the Doña Juana landfill, the entry of combined construction and demolition waste is not allowed. Nonetheless, as that waste cannot be taken to the existing construction and demolition waste landfills, it is taken to and disposed of at the Doña Juan landfill. Nearly 800 tons of combined construction and demolition waste are generated on a daily basis, and its recycling will contribute not only to the fulfillment of the law but also to increase the useful life of the landfill. To attain this, it is necessary to structure a recycling system starting from the separation at source.

200 tons of waste from lawn mowing/cut grass, tree pruning, and markets are generated per day; this waste is collected separately without combining the residential waste. In other words, it is undertaken both at the separation at source as at the separate collection thus facilitating taking it to intermediate treatment facilities, as the composting plant.

b.5 Hazardous waste

The system for the collection, treatment, and disposal of contagious waste generated in health care facilities, such as hospitals, is already in place; therefore, it must be kept and strengthened from now on.

On the other hand, the management of waste from households and establishments containing hazardous substances, as expired medicines, agrochemical products, as well as electric and electronic devices is at the initial stage, although there are some evident efforts, such as establishing the container for batteries. Consequently, it is necessary to structure a management system for this type of hazardous waste involving the manufacturers and importers of these products.

c. Master Plan

c.1 Selecting the Optimum Scenario

Three final-disposal scenarios and five minimization scenarios were established with the purpose of selecting an adequate system for the future management of solid waste in Bogotá D.C. They were compared in terms of their strengths, weaknesses, opportunities and threats, as well as regarding their costs. As a result, the following Master Plan was selected as the most adequate.

c.2 Objectives and Goals

The following three general objectives were selected for the Master Plan:

1. Guarantee the quality and continuity of the garbage collection service to the users.

2. Minimize the amount of solid waste.

3. Guarantee the proper final disposal for unused/unexploited solid waste.

The following specific objectives were defined pursuant to these general objectives:

No.	General/Specific Objectives	Short Term 2013-2015	Medium Term 2016-2018	Long Term 2019-2027
1	**Guarantee the quality and continuity of the garbage collection service to the users.**			
1.1	Maintain coverage of the urban area	100%	100%	100%
1.2	Increase coverage of the rural area	100%	100%	100%
2	**Minimize the amount of solid waste**			
	(total minimization rate)	(10.8%)	(12.7%)	(20.3%)
2.1	Promote recycling of materials (material recycling minimization rate)	85 tons/day to the system (6.2%)	427 tons/day to the system (6.2%)	1,074 tons/day to the system (9.7%)
2.2	Develop and extend the composting system (composting minimization rate)	25 tons/day to the system (1.1%)	58 tons/day to the system (2.0%)	249 tons/day to the system (2.8%)
2.3	Develop and extend the combined cdw recycling system (cdw minimization)	redirect 100% from Doña Juan landfill 850 tons/day to the system (3.5%)	901 tons/day to the system (4.5%)	1,055 tons/day to the system (7.7%)
2.4	Raise awareness and train users to succeed in achieving the reduction, reuse, separation at source and differentiated disposal of solid waste			
3	**Guarantee the proper final disposal of unused/unexploited solid waste**			
3.1	To ensure the operation of the Doña Juana landfill	Phase II (17 million tons)		Master Plan (38 million tons)
3.2	To reduce the vulnerability of the current final disposal system	-	-	2 new landfills

c.3 Solid Waste Flow

The Master Plan flow of solid waste appears in the table below:

Component		Unit	Present 2012	Short 2015	Medium 2018	Long 2027
1	Population					
	Population	thousand	7,565	7,875	8,184	9,114
2	Solid waste flow					
	Generation	tons/day	6,704	7,135	7,566	8,859
	Collection	tons/day	6,340	6,659	6,973	7,784
	Materials recycling – total	tons/day	366	473	592	1,074
	Composting	tons/day	0	103	180	276
	CDW recycling	tons/day	0	850	901	1,055
	Final disposal	tons/day	6,304	6,368	6,604	7,065
	Minimized amount	tons/day	364	767	962	1,794

c.4 Master Plan Costs

The costs of the Master Plan were calculated as shown in the table below. The cost per capita increases up to 30% in relation to the current situation.

Component		Unit	Current 2012	Short 2015	Medium 2018	Long 2027
1	Cost per year					
	Commercial	Million COP	50,454	52,521	54,588	60,789
	Sweeping and Cleaning	Million COP	65,035	69,217	73,399	85,945
	Collection and Transport	Million COP	197,188	220,853	227,982	216,210
	Recycling	Million COP	0	73,852	90,950	116,236
	Final Disposal	Million COP	44,668	65,341	67,769	76,031
	PMIRS	Million COP	3,703	3,940	4,177	4,888
	Total	Million COP	361,048	485,724	518,865	560,099
2	Cost per unit					
	Per generation	COP/ton	147,548	186,508	187,885	173,216
	Per population	COP/pers.	47,728	61,683	63,398	61,458
3	Cost increase rate (2012 = 100%)					
	Total cost	%	-	35%	44%	55%
	Per generation	%	-	26%	27%	17%
	Per population	%	-	29%	33%	29%

d. Master Plan Assessment

d.1 Technical Aspect

Most of the technical components of this Master Plan are already in Bogotá D.C., or in Colombia, and their application and operation do not generate technical difficulties. However, the following aspects must be taken into consideration:

- Bogotá has no experience in introducing and operating the transport and transfer system; therefore, it must learn from the examples of other countries and cities.
- The separate collection of recyclable material is not technically difficult. Nevertheless, collection shall be undertaken by recyclers in the case of Bogotá. Therefore, recyclers must be technically supported regarding the design of efficient collection routes.
- Pursuant to the UAESP's plan, the collection vehicles shall have an engine equivalent to or superior than the Euro IV from 2014 on. However, it is important to meet the quality of the fuel requirement in order to obtain the expected emission results.

d.2 Institutional Aspect

The legislation and the administrative system related to the garbage collection service in Colombia are well organized. The CSC service can be rendered without any problem under the current system.

On the other hand, although the recycling of materials is partially undertaken by the informal sector, the promotion of the public recycling system, at a large - scale, is a new challenge for Colombia and for Bogotá. The CRA is preparing a new rate system to cover the recycling service. The Office of the Mayor of Bogotá is reviewing the decree that deals with the warehouses. Consequently, each entity related to this issue is preparing a pertinent regulation or administrative system pursuant to the corresponding competence. As these processes are being prepared simultaneously, it is very important to keep the communication and the coordination between the related entities to establish a consistent system.

Colombia has a quite organized legal framework concerning the management of post-consumer products that have hazardous substances. In the case of Bogotá, a restructuring process of a proper collection and disposal plan has been started under the initiative of the District Planning Secretariat, including the participation of generators and the cooperation of the pertinent areas of the Office of the Mayor. However, said process is just starting and needs to be strengthened.

d.3 Environmental Aspect

The Master Plan makes a contribution to the maintenance and improvement of the life and of the health of the citizens due to the collection of solid waste, the reduction of negative environmental impacts due to the proper disposal of waste and the conservation of resources due to the minimization.

As facilities are necessary for this purpose, it is suggested to build different recycling plants, transfer stations and landfills. Since the location of these facilities has not been defined during the design stage of the Master Plan, concrete environmental impacts cannot be projected. Nevertheless, the potential environmental impacts and the decisions to decrease said impacts were analyzed based on the function of each facility.

d.4 Social Aspect

The Master Plan has set a 20% minimization goal for year 2027. It is difficult to attain this goal without a technical component that has a drastic minimization effect. So, in order to attain it, it is essential to rely on the understanding and action of the inhabitants of Bogotá, who are waste generators, concerning the minimization need. The district started actions aimed at raising awareness concerning minimization in schools and communities pursuant to the "Zero Garbage" policy and the "Inclusion Plan." It is expected that the minimization culture will be disseminated in Bogotá D.C.

The recycling of materials shall be undertaken by recyclers. Many recyclers have very low income levels; therefore, they have no educational opportunities or formal jobs so they live very unstable lives. Although they are recyclers, each one of them faces different types of problems. It is necessary to offer them a thorough assistance, besides establishing a legal and institutional framework, so that this vulnerable sector can assume the formal recycling of materials. The Office of the Local Mayor, in the locality of Usaquén, and an NGO, in the locality of Bosa, support the local recyclers. It is important to share these experiences throughout the district in order to build a flexible recycling system pursuant to the local situation and the need of the local recyclers.

d.5 Economic and Financial Aspect

First, a financial analysis was performed to find out if the District can assume the costs of the Master Plan. Currently, the costs for solid waste management in Bogotá are covered through the collection of a rate paid by the users. Therefore, it is assumed here that this plan will be used in the future. The 2006-2012 per capita cost was 46,692 pesos. The minimum per capita cost calculated for this project will be 51,308 pesos while the maximum per capital cost will be 64,133 pesos. When compared against the current situation, these values mean 2.5% and

28.2% increases, respectively. On the other hand, it was calculated that the per capita ability to pay ranges from 51,600 to 134,600 pesos (0.5 to 1.3% of the income). Consequently, the costs of the Master Plan can be covered with the rate. In the event that the Master Plan costs increase 20%, the per capita cost will be 76,960 pesos and it will be within the range of the ability to pay. Therefore, it is possible to say that the Master Plan is financially feasible.

Since the Master Plan includes facilities that have a useful life of more than 30 years, such as the landfills and the transfer stations, the economic analysis compared the costs with and without the Master Plan for 20 years, from 2013 to 2042. If we calculate the economic indicators with an 8, 10, and 12% discount rate, we obtain the 1.06 proportion between costs and benefits with an 8% discount. However, other indicators did not evidence any economic pertinence. The link between costs and benefits is negative during the first 10 years; however, it becomes positive after 20 years. As a consequence, this Master Plan is not so attractive as to encourage direct investment from the private sector, which demands the short-term recovery of the capital. Nevertheless, the economic pertinence of this Master Plan could be increased as it generates benefits in the long term, the risk reduction through the public-private alliance, the investment, and the efficient operation.

e. Action Plans

This report includes Action Plans that were designed by the Offices of the Assistant Directors at UAESP. Based on the content of the Master Plan and of the Inclusion Plan, as well as on the discussion with other offices linked to the Office of the Mayor, they are also, therefore, UAESP's work plans. The structure of the plans is not standardized but, taking their initiative into consideration, they are shown as they were submitted.

6.2 Recommendations

a. Establishment of a Solid Infrastructure

The construction of a new infrastructure brings different interests together; therefore, it is hard for the administration to make decisions. The Master Plan sets out the construction and operation of large-sized infrastructure as transfer stations and landfills: they will solidly support the solid waste management system for 30 years. It is expected to fuel an honest discussion between the district government, the departmental government, and other related parties in order to build the infrastructure for solid waste management supporting the metropolitan city of Bogotá, with over 7 million inhabitants.

b. Use of New Minimization Technology

The minimization technologies evolve on a daily basis. There will be a feasible technology for Bogotá within the framework of those technologies. It is important to promote the participation of the private sector towards minimization and recycling that can introduce and assume, much faster, this type of technological innovation. This Master Plan sets out the idea of composting and recycling construction and demolition waste; this does not necessarily mean that the public sector would have to set up these facilities – the private sector could participate. It is through the rendering of CSC services and managing the landfill that the UAESP has the know-how to make the most of the private sector.

Undertaking minimizing-oriented and recycling activities not included in the Master Plan, has not been excluded either. It is expected that the generation and the maturing of the minimizing-oriented culture will lead to different minimizing-oriented and recycling activities.

c. Building Trust

The fulfillment of the Inclusion Plan is not a technical challenge for Bogotá D.C. in relation to recyclers; it is rather a social challenge concerning all the citizens. Citizens separate waste at source properly; recyclers collect separate recyclable materials. It seems easy to achieve but, as actually observed not only in Bogotá but in other countries and cities, it is quite hard to achieve this coordination. It is important to emphasize the mutual trust between the generators and the collectors from the lessons learned from some successful examples; in other words, between the community and the recyclers. Recyclers tend to be excluded from society, so it is hard for them to have access to it on their own. As seen in the localities of Bosa and Usaquén, it will be important that the authority or an NGO supports the building of trust between both parties, and that the district government sets up a mechanism to promote this type of activities.

d. Ensuring the Financial Feasibility of the Recycling Components

Although the financial pertinence of the Master Plan was proven, the cost of each recycling component surpasses the calculated income level. Pursuant to the formula for the calculation of the rates and the current and ongoing cost for the construction of the CRA, the value for the remuneration of recycling is the result of adding the collection cost and the cost for the disposal of ordinary waste. Nevertheless, this value cannot cover the recycling components included in the Master Plan, particularly the cost for the recycling of materials, which is considerably higher than the value of the remuneration. It is necessary to foster a transparent discussion and to make a fair decision vis-à-vis the citizens as to how to close that gap: either collect the difference from the citizens as an additional rate, or look for another source of income.

e. Updating of the PMIRS

The goal of the JICA Project was to set a Master Plan to meet the challenges faced or to be faced by Bogotá D.C., now and in the future, to facilitate the updating of the PMIRS to the UAESP. Therefore, the next step will be the updating of the PMIRS.

This Master Plan focuses on the ordinary waste which concerns the UAESP, but the PMIRS works with all types of solid waste, including hazardous waste, and construction waste generated from large works which do not fall under the responsibility of the UAESP. Consequently, it is expected that the updating of the PMIRS will take place through an articulate interaction of the different offices, such as the District Environment Secretariat, which has authority over said waste, and the District Planning Secretariat, which coordinates the definition of the regulations.

Once the PMIRS is updated, this Master Plan will have legal support and the budget can be allocated to the activities set in the Action Plans; it will also rely on the cooperation of other organizations. That is where the true structuring of the solid waste management system starts vis-à-vis the next 30 years.

PART IV

Chapter 1

Formulation of the Action Plans

1 Formulation of the Action Plans

This part presents the Action Plans that were designed by the Offices of the Assistant Directors at UAESP. Based on the content of the Master Plan and of the Inclusion Plan, as well as on the discussion with other offices linked to the Office of the Mayor, they are also, therefore, UAESP's work plans. The structure of the plans is not standardized but, taking their initiative into consideration, they are shown as they were submitted.

Chapter 2

Collection, Sweeping and Cleaning (RBL)

2 Collection, Sweeping and Cleaning (RBL)

2.1 Action Plan of RBL

The Action Plan of the office of the Assistant Director for Collection, Sweeping and Cleaning (RBL) is aimed at two main goals:

1. Clearly stating the scope of the UAESP, in particular the office of the Assistant Director of the RBL concerning:
    - The regulations that define the competencies of each national and district entity.
    - The competency of the waste and areas to be serviced, particularly the regulations and the technical and economic analysis assessment for the rural areas.
2. Improving the quality and the effectiveness of the attention.
    - Through the construction of Transfer Stations.
    - Improving the control and supervisory capacity of the service.

The first goal of the Action Plan is basically to define the “rules of the game” under which the office of the Assistant Director of the RBL operates; it cannot define effective instruments related to contracting, controlling, supervising and managing unless it establishes the scope of its competencies.

The second goal is aimed at providing over 100% coverage in the urban area through a service with a higher quality and effectiveness to the whole District.

Table 2-1: Action Plan of Collection, Sweeping and Cleaning (RBL)

GENERAL OBJECTIVE
1. To guarantee to the user the continuity and adequate rendering of the Garbage Collection and Usability Service. 2. To promote the separation at source, the increase of Potentially Recyclable Material, and to decrease the amount of waste to be disposed of at the landfills. 3. To guarantee the adequate final disposal of the ordinary waste. 4. To reduce the negative environmental impacts related to the generation and inadequate disposal of solid waste through the Recovery of Potentially Recoverable Materials that must be part of the productive chains.

Specific Objective
To keep the coverage of the urban area, to widen that of the rural area for ordinary waste, and to keep the coverage of hospital waste.

Strategy 1
To keep the coverage of the urban area according to the growth of the population.

Goal 1	2013 – 2015	2016 – 2018	2019 – 2027
Continuity of the RBL program providing 100% coverage of the urban area with technical possibilities to receive the garbage collection service; measurable "Clean Area."	100%	100%	100%

No.	Actions	Actor	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Preparing the Technical, Operating, Commercial and Financial regulations for the rendering of the cleaning service concerning collection and transport, sweeping of public areas, and other complementary components in the city of Bogotá under the new Solid Waste management model.	UAESP	x														
2	Defining the type, nature and origin of the waste concerning the garbage collection service.	UAESP	x														
2.1	Food or beverage residues (liquid or semi liquid).	SDA SDS															
2.2	Hazardous waste	SDA SDS															
2.3	Special waste	SDA SDS															
3	Gradual setting of parameters of the model for the garbage collection service.	UAESP		X													
3.1.	Sorting at source (Inclusion Plan - Resolution 799 of 2012) - Black Bag - White Bag	UAESP	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
3.2.	Social Management - Integral Handling of Solid	UAESP	x	x	x	x	x	x	x								

No.	Actions	Actor	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
	Waste Operating Support to meet the expectations of the community.	SDA SDE Chamber of Commerce SDEconomico IPES															
4	Corporate Responsibility including Post-consumption. Technical Support to the Principle of Subsidiary Rigour for the issuance of local regulations.	SDA, SDP SDGOB CONCEJO	x	x	x	x	x	x	x								
4.1	Special Tires Furniture Household goods CDW Household Hazardous Waste Waste Electrical and Electronic Equipment (WEEE) Used oils Accumulators and Batteries Automobile spare parts Hospital and Similar Waste (household) Lighting fixtures	MAD and SDA	x	x	x	x	x	x	x								
5	Defining the participation of the agents rendering the garbage collection service, both Public and Private.	UAESP	x						x							x	
6	Monitoring and Overseeing the Service		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
6.1	Defining the Monitoring, Follow-up and Control instrument	UAESP	x						x							x	
5.2	Designing and formulating the Management and Control Indicators	UAESP	x						x							x	
7	Including control, surveillance and sanctionary Contractual Elements.																
7.1.	Including sanctionary and fine-related measures due to the breach of contractual obligations.	UAESP	x						x							x	
7.2	Reviewing and adjusting the operating, commercial and financial Regulations to guarantee the follow-up and control of the rendering of the service.	UAESP		x					x							x	

No.	Actions	Actor	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
8	Defining the areas that are subject to the sweeping service of surfaces and lawn mowing in front of residents.	UAESP COUNCIL OF BOGOTA	x														
9	Definition of responsibilities of the actors involved in the service, users of the service.	COUNCIL UAESP POLICE	x														
10	Requesting and promoting the issuance of ordinances or codes in relation to the management and responsibility of the agents involved in the handling of solid waste.	COUNCIL	x	x													
11	Demanding the fulfillment of interinstitutional regulations at the operating level concerning the attention of public space areas with joint responsibility.	UAESP	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
11.1	Supervising the fulfillment of responsibilities for the maintenance and conservation of the areas under joint responsibility: green areas, railroads, handling and environmental conservation areas, water bodies, etc.	BOTANICAL GARDEN FENOCO SDA EAAB RESIDENTIAL COMPLEXES IDU IDRD	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
12	2 Transfer Stations TS (North and West).	UAESP	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
12.1	Pre-feasibility Plan and Study	UAESP	x														
12.2	Selection of Sites	UAESP		x													
12.3	Feasibility Study	UAESP			x												
12.2	Detailed Design	UAESP			x												
12.4	Obtaining Permits	UAESP				x	x										
12.5	Ensuring budgetary allocation	UAESP					x										
12.6	Construction	UAESP						x	x								
12.7	Operation	UAESP								x	x	x	x	x	x	x	x

No.	Actions	Actor	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Strategy 2																	
To widen the coverage for ordinary waste.																	
Goal 2			2013 – 2015			2016 – 2018			2019 – 2027								
100% of the rural area with technical feasibility to receive the collection service meets the measurable "Clean Area" indicator.			100%			100%			100%								
1	Establishing the rural areas subject to receiving direct attention within the RBL plan.	UAESP	x														
2	Supporting the creation of community organizations for the rendering of the Garbage Collection Service at the inhabited rural centers with the possibility of direct attention.	Offices of the Local Mayors / UAESP	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
3	Establishing inter-institutional agreement UAESP - Local Office of the Mayor, in 100% of the rural area with the technical possibility to receive the collection service within the RBL plan.	Offices of the Local Mayors / UAESP	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Strategy 3																	
To keep the coverage of hospital waste.																	
Goal 3			2013 – 2015			2016 – 2018			2019 – 2027								
Collection and Treatment of 100% of Hospital Waste.			100%			100%			100%								
1																	
2																	
Physical Infrastructure																	
Construction of two (2) TSs: one in the north and one in the west of the city to start operating by year 2020 through the new tender.																	

Chapter 3

Recycling

3 Recycling

3.1 Action Plan of Recycling

The following is the Action Plan of Recycling

Table 3-1: Action Plan of Recycling

GENERAL OBJECTIVE
1. Guarantee the offer and ongoing provision of good service to the users. 2. Promote waste reduction. 3. Guarantee the proper final disposal of unusable solid waste.

Specific Objective
【Short term】: Register recyclers and structure the collection system by creating ORAs - Registration and formalization of recyclers - Structure the basic operation system for selective collection by ORAs - Registration and formalization of warehouses, structure the basic operating system for separating and classifying the waste. 【Medium term】: Establish the selective collection system for recyclable waste. 【Long term】: Expand the selective collection system for recyclable waste.

Goals			13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
①Amount of waste and recycling rate by waste generated																	
	a. Urban waste generated (ton/day)		6,848	6,991	7,135	7,279	7,422	7,566	7,710	7,853	7,997	8,141	8,284	8,428	8,572	8,715	8,859
	b. Finally disposed (ton/day)		6,443	6,593	6,630	6,740	6,841	6,934	6,980	7,010	7,007	6,990	6,981	6,961	6,930	6,998	7,065
	c. Aggregate of exploitable waste (ton/day)		405	452	505	538	580	632	731	843	991	1,150	1,303	1,467	1,642	1,717	1,795
	c-1 Exploitable waste collected by recyclers(current)		297	152	0	0	0	0	0	0	0	0	0	0	0	0	0
	c-2 Exploitable waste collected by registered recyclers		74	227	387	315	241	164	84	0	0	0	0	0	0	0	0
	c-3 Recyclable waste collected selectively		17	35	56	132	216	307	415	532	590	651	699	748	798	828	860
	c-4 Organic waste recycled		8	16	25	35	46	58	81	105	132	160	186	213	241	245	249
	c-5 CDW recycled		9	22	37	56	77	103	151	206	269	339	418	506	603	644	686
	Rate of final disposal (%)	(b/a)	94.1%	94.3%	92.9%	92.6%	92.2%	91.6%	90.5%	89.3%	87.6%	85.9%	84.3%	82.6%	80.8%	80.3%	79.7%
	Collection rate of exploitable waste and exploited selective recollection (%)	((c-1)+(c-2)+(c-3))/a	5.7%	5.9%	6.2%	6.1%	6.2%	6.2%	6.5%	6.8%	7.4%	8.0%	8.4%	8.9%	9.3%	9.5%	9.7%
	Total recycling rate (%)	(c/a)	5.9%	6.5%	7.1%	7.4%	7.8%	8.4%	9.5%	10.7%	12.4%	14.1%	15.7%	17.4%	19.2%	19.7%	20.3%

3 Recycling

②Amount of vehicles necessary to collect recyclable waste	9	19	29	65	103	143	187	234	253	272	292	312	333	346	359
③Amount of collection centers necessary	1	2	3	7	11	15	19	24	26	28	30	32	34	35	36

※Data source： Based on Waste Flow by mutual approval of the UAESP and JICA research team

Actions		13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1. Development of the system for separating waste																
	Organize recyclers, ORAs and warehouses and establish the methodology for organizing recyclers	x	x	x												
	Define recycling operating methodology and administration by ORAs and expansion of the company	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
2.Expand the selective collection area for recyclable waste and raise community awareness																
2.1 Collection routes	Continue with the original routes of the recyclers	x	x	x												
	Continue the expansion in the Kennedy area and in the 73 selective routes	x	x	x	x	x	x									
	Expansion of the 73 selective routes and other areas except for the 73 selective routes				x	x	x	x	x	x	x	x	x	x	x	x
2.2 Raising community awareness	Raise awareness through general mass media, meetings, "reciclatón" and teaching at schools	x	x	x			x									
	Raise awareness in the Kennedy area as well as in the areas of the 73 selective routes through meetings, "reciclatón", teaching at schools and visits to each home	x	x	x	x	x	x									
	Raise awareness in the areas of the 73 selective routes and in the expansion areas, except the 73 selective routes, through meetings, "reciclatón", teaching at schools and visits to each home				x	x	x	x	x	x	x	x	x	x	x	x
3. PMA execution and	construction of the model															
	Prepare the AMP (Works design and construction, purchase and installation of machinery, train the recyclers, design and operation of a selective collection route, raise community awareness, improve and ensure the sale of reused material)	x	x													
	Validate and improve the basic PMA system throughout the operation		x													
	Establish the basic PMA system and structure the Alquería model			x												
4. Structure the storage and delivery system																

Actions		13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
4.1 Existing collection routes of the recyclers	Generators store and deliver the recyclable waste separately（classification of the delivery container）	x	x	x												
4.2 Areas of the 73 selective routes and expansion areas except for the 73 selective routes	Prepare a draft of the basic system（delivery classification, types of recyclable waste, frequency and delivery schedule, delivery container and method, place of delivery）	x														
	Adjust the basic system through development of the PMA		x													
	Establish the basic system			x												
	Implementation of the storage and delivery system based on the basic AMP system (delivery schedule and classification of the delivery container, etc.)				x	x	x	x	x	x	x	x	x	x	x	x

Actions		13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
5.Structure the collection and transportation system																
5.1 Existing collection routes of the recyclers	Recyclers collect the recyclable waste delivered on their original routes	x	x	x												
5.2 Areas of the 73 selective routes and expansion areas except for the 73 selective routes	Prepare the draft of the basic system（collector and collection method, definition of the type and number of collection vehicles, establish the collection routes, and the collection administration system）	x														
	Adjust the basic system through development of the PMA		x													
	Establish the basic system			x												
	Implementation of the collection and transportation system based on the basic PMA system				x	x	x	x	x	x	x	x	x	x	x	x
6. Organize collection centers																
	Register existing warehouses, establish classification system in the target area of the AMP and define the collection center model	x	x	x												
	Integrate the registered warehouses and organize	x	x	x	x	x	x									

Actions		13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
	collection centers in the expansion areas															
	Organize collection centers	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
7. Development of recycling parks																
	Definition of the park development guidelines, the amount required and survey of the facility's premises	x	x	x												
8. Other recycling activities different from the separation of recyclable waste																
8.1 Recycling organic waste																
	Regulating infrastructures, technical equipment and facilities for treatment processes, exploitation and/or appraisal of ordinary organic solid waste generated in the city in both public and private areas	x	x	x	x											
	Create minimization and source separation campaigns and rules for each of the different organic waste generators.		x	x	x	x	x	x	x	x	x	x	x	x	x	x
	-Description/characterization studies (quantity and characteristics) of the organic waste by generator. '-Studies and research with pilot testing on organic solid waste exploitation alternatives '-Design and execution of selective routes for organic solid waste		x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Regulate the exploitation of organic solid waste in large premises and multi-user areas			x	x											
	Agreements with the Cundinamarca Governor's Office, the CARs and national entities.		x	x	x	x	x									
8.2 CDW recycling（Refer to CDW Action Plan）																

Chapter 4

Construction and Demolition Waste (CDW)

4 Construction and Demolition Waste (CDW)

4.1 Action Plan of CDW

Based on the analysis on the current situation, it is possible to propose objectives and goals, as well as recommend strategies and actions that will lead to improving CDW management in Bogotá. These suggestions aim mainly at eliminating cdw disposal at Doña Juana Landfill and unauthorized sites, increasing the availability of proper final disposal sites (cdw landfills), and the implementation of technological solutions to reuse and recycle cdw, goals that are in line with the "Basura Cero" program objectives .

The following general objectives are proposed for the revised Master Plan:

- Guarantee the quality of the services provided to the users and their continuity
- Minimize the amount of solid waste
- Ensure the proper final disposal for unused/unexploited waste

Specific objectives stemming from these general objectives are proposed below relating to cdw management, such as goals, strategies and activities to be carried out, covering the short, medium and long term.

They also propose the physical infrastructure needed for these activities.

Notice that a few of the objectives, goals and activities extend beyond the scope of the UAESP. However, it is impossible to address such a complex issue and only take into consideration one part of it.

The following is the Action Plan of CDW.

Table 4-1: Action Plan of Construction and Demolition Waste

GENERAL OBJECTIVE
Guarantee the quality of the services provided to the users and their continuity

Specific objective
Minimize the illegal disposal of CDW
Strategy
Offer the users an improved and faster collection service along with efficient and low-cost alternatives for voluntarily delivering their cdw and bulky waste

Goals		2013 – 2015	2016 – 2018	2019 – 2027
Achieve gradual reductions in the amount of cdw dumped at illegal sites ** Currently 17.000 m3/month are dumped at illegal sites (2012)*		<15.000 m3/month	<10.000 m3/month	<5.000 m3/month
Achieve gradual reduction in the amount of critical points registered in the city ** There are currently 600 to 700 critical points registered (2012)*		< 450 critical points	< 250 critical points	< 100 critical points

Actions	Party involved	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Review the Technical and Operating Rules, especially the operation of the customer care number (line 110), time and costs to undertake the exceptional collection and cleaning tasks	UAESP	x														
Establish quality standards for the provision of the services	UAESP	x														
Intensify supervision, evaluation and corrective actions to overcome the shortcomings of the public service	UAESP		x	x	x	x	x	x	x	x	x	x	x	x	x	x
Monitor compliance with Resolution 1115/2012, regarding the registration of cdw transporters and the application of the control mechanisms created by this Resolution	SDA		x	x	x	x	x	x	x	x	x	x	x	x	x	x
Create voluntary drop-off points (PEV) for cdw and bulky waste, preferably in the areas where illegal dumping occurs more frequently, starting with 1 (one) or 2 (two) pilot PEVs	UAESP		x	x												
Promote educational campaigns, seeking the support of the civil construction and public cleaning sectors	UAESP and SDA		x	x												

Actions	Party involved	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Promote periodical campaigns for the free collection of unused bulky objects (furniture, appliances, etc.), on scheduled routes and days that have been previously informed	UAESP			x	x	x	x	x	x	x	x	x	x	x	x	x
Evaluate the experience of the pilot PEV and correct their shortcomings	UAESP				x											
Extend the PEV network to other city areas	UAESP				x	x	x									
Physical infrastructure																
Voluntary drop-off points [Puntos de Entrega Voluntaria (PEV)] with an area ranging from 200 to 300m2, on public grounds or grounds that become public, for the free delivery of up to 1m3 of cdw and bulky waste per person. Located in areas showing greater incidence of critical points: - 1 (one) or 2 (two) pilot PEVs, in the short term; - other PEVs quantified and located according to the evaluation of the pilot experience																

GENERAL OBJECTIVE
Minimize the amount of solid waste

Specific Objective (I)
Reduce the final disposal of cdw at Doña Juana Landfill
Strategy
Promote the selection of cdw, making recycling processes feasible

Goals		2013 – 2015	2016 – 2018	2019 – 2027
Achieve minimum treatment rates of combined cdw from small and medium-size generators		15% to selection plant	30% to selection plant	75% to selection plant

Actions	Party involved	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Select proper locations for the placement of cdw selection and transfer areas [*areas para la selección y el trasbordo de escombros* (AST)]; they must be preferably decentralized and near the generators	SDA and UAESP	x														
Make the modifications necessary to the Zoning Plan - POT, taking into account the technical, urban and environmental criteria to make feasible the new structures needed	SDP, SDA, UAESP	x														
Prepare technical instructions for AST licensing, operation and control, guaranteeing swift project analysis to the investors	SDA and UAESP	x	x													

Actions	Party involved	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Set up a classification system (technical standard) for cdw according to their composition and recycling potential	Incontec, IDU, others	x	x													
Create an AST model, with possible cooperation of public and private initiatives associated to a social inclusion project for employment and training in the basic operating labor that will be needed	UAESP			x												
Foster the creation, on the part of private initiatives, of other ASTs located in different areas of the city	SDA and UAESP					x		x								

Physical Infrastructure
Selection and transfer areas [*Áreas de Selección y Transbordo* (AST)], at locations measuring from 5 to 10 thousand m2 and capacity for approximately 100 thousand m3/year/each one, located in different areas of the city: - 1 (one) AST model, installed in a public area and operated by a private initiative through a concession (granted in a bid), associated to a social inclusion project - At least another 2 (two) additional ASTs, preferably privately operated and installed in different areas of the city

GENERAL OBJECTIVE
Minimize the amount of solid waste

Specific Objective (II)
Reduce the final disposal amount in CDW disposal sites.

Strategy
Promote the implementation of technological solutions to expand cdw reuse and recycling

Goals		2013 – 2015	2016 – 2018	2019 – 2027
Achieve minimum rates of reuse and recycling for cdw produced by large generators ** Take into account that currently 80% of the cdw mainly consists of excavation soils*		3%	10%	15%

Actions	Party Involved	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Support the construction sector in the technical and technological contributions necessary, promoting workshops and other forums to exchange information and success stories regarding minimization, reuse and recycling	SDA		x	x												

Actions	Party Involved	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Update the document "Guía Ambiental para el Manejo de Escombros en la Ciudad de Bogotá" [*Environmental Guidelines for CDW Management in Bogota*] and ensure its extensive dissemination. The document must include: separation, reuse, recycling concepts; Information on the responsibilities defined in Resolution 1115/ 2012; and a practical handbook for the preparation of the "Plan de Gestión de RCD en Obra" [Works CDW Management Plan] as required by the Resolution	SDA	x	x													
Select proper locations for the cdw recycling plants [*plantas de reciclaje de escombros (PRE*)], mainly in cdw landfill areas	SDA and UAESP	x														
Make the modifications necessary to the Zoning Plan - POT, taking into account the technical, urban and environmental criteria to make feasible the new structures needed	SDP, SDA, UAESP	x														
Prepare the technical instructions for mobile or fixed PRE licensing, operation and control, guaranteeing swift project analysis to the investors	SDA and UAESP	x														
Open financing lines for the execution of projects and equipment purchases with the possible cooperation of public and private initiatives	SDDE				x											
Ensure compliance with Resolution 1115/2012, regarding the registration and inventory of large generators and the exploitation of recyclable materials by public entities and construction companies	SDA		x	x	x	x	x	x	x	x	x	x	x	x	x	x
Guarantee the preferential purchase of recycled products for the execution of large public works, especially paving (this action is associated to compliance with Resolution 1115/2012)	IDU and others		x	x	x	x	x	x	x	x	x	x	x	x	x	x
Prepare technical standards that will define quality standards for recycled aggregates	Incontec, Camacol		x													
Set up an online database ("excavation waste offer" – bolsa de residuos de excavación) to facilitate reusing excavation soils by bringing together the offerors and those interested in purchasing materials	SDA				x											
Physical Infrastructure																
CDW Recycling Plants [*Plantas de Reciclaje de Escombros* (PRE)], at locations measuring approximately 10 thousand m2, preferably located next to cdw landfills: - 5 (five) or 6 (six) plants with a lathe capacity of 100 tons/hour/each plant																

GENERAL OBJECTIVE
Guarantee the proper final disposal of unused/unexploited waste

Specific Objective
Meet the need for sites in Bogota to dispose of non-exploitable cdw (cdw landfills)
Strategy
Expand the availability of locations for new cdw landfills in Bogotá, reducing the city's reliance on neighboring cities

Goals		2013 – 2015	2016 – 2018	2019 – 2027
Expand cdw disposal capacity in Bogotá ** The current capacity is 4,5 million m3 in two (2) sites, with total potential for 32 million m3 including other seven (7) sites under evaluation*		6.000.000 m3	10.000.000 m3	20.000.000 m3

Actions	Party Involved	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Select proper sites for the creation of new cdw landfills with recycling plants (grinding, crushing) associated to this endeavor	SDA	x														
Make the modifications necessary to the Zoning Plan - POT, taking into account the technical, urban and environmental criteria to make feasible the new structures needed	SDP, SDA, UAESP	x														
Prepare technical instructions for cdw landfill licensing, operation and control, guaranteeing swift project analysis to the investors	SDA	x	x													

Physical Infrastructure
Temporary disposal site for selected non-exploitable cdw (cdw landfill)

4.2 Comments on Certain Activities to be Undertaken

A few of the actions suggested to achieve the proposed goals are detailed below.

a. Creation of a CDW Classification System

Considering that the term "CDW" covers multiple materials of different origin, composition and with different exploitation potential, the creation of a classification system would be extremely useful to guide CDW management actions.

A useful classification system must take into account the origin and composition of the different CDW and the potential for reusing and recycling them.

For instance, a classification system can regroup recyclable waste to obtain construction aggregates subdivided into material composed of cement, lime, sand and gravel (concrete, mortar, concrete blocks) and of ceramic (roof tiles, pipes, bricks). Asphalt paving waste must be classified separately, since their recycling route is different from that used for cement and ceramic. Reusable or recyclable waste for other purposes, such as metal, paper, plastic and glass may be classified in another group. Another group may include hazardous waste, such as asbestos, paint, solvents and oils, as well as those resulting from the demolition of industrial plants with potential for contamination. And finally, there is the group of excavation soils that are unsuitable for recycling but have potential for reuse, and represent the largest volume of waste generically called CDW.

The creation of this classification system would be under their supervision of the Colombian technical and standards organizations, with the support and participation of government organizations and representatives of construction companies.

b. Creation of Physical Facilities and Equipment Necessary for Improved CDW Management, Emphasizing Recycling

The “Basura Cero” program has defined that the solid waste generated in the city must be managed with modern exploitation (reuse and recycling), treatment and final disposal techniques. However, Bogotá lacks the physical facilities to undertake these tasks, especially when it comes to cdw, as observed in the analysis. There is only one cdw recycling pilot plant owned by CEMEX, whose capacity is limited.

Despite the lack of more reliable data on the composition of the CDW produced in Bogotá, the part of the CDW that may be processed for stone aggregates, namely, waste from concrete and ceramic (excluding excavation soils, asphalt waste, organic, hazardous or other non-compatibles), may be estimated at approximately 10% of the total generation, or approximately 0.7 million m3 per year.

To fully meet the demand, five CDW recycling plants with a 100 tons / hour capacity each are required, representing a quite significant investment.

However, the need for pre-processing sites or selection and transfer areas (AST) must be taken into account, since a significant part of the recyclable waste requires a prior selection phase to separate the materials to be part of the recycling process.

There are several models possible for this type of undertaking, but it is preferable that the initiatives come from the private sector and that free competition is encouraged. The State's responsibility is to encourage these undertakings by creating a suitable and attractive environment for the investors, approving proper areas to set up these facilities, facilitate the funding for equipment purchases, guarantee the continuity of the "Basura Cero" and "Escombro Cero" Programs and compliance with the Resolution 1115 in 2012, which establishes the mandatory use of recycled material.

The State, in this case the Government of the District of Bogotá, is also responsible for opening and managing reception areas for small volumes of waste and voluntary drop-off points as alternatives to the improper disposal of the waste.

The following are the characteristics of the facilities deemed necessary for the proper management of CDW.

CDW Recycling Plants [Plantas de Reciclaje de Escombros – PRE]

Physical Aspects

The recycling plant is the physical area endowed with the equipment necessary to process pre-selected stony waste by grinding and sieving, resulting in recycled aggregates that are classified according to the size of the grain, for their extensive use in construction.

In general, the equipment used in CDW recycling is similar to those used in mining operations, with the proper adjustments. The main equipment part of a recycling plant includes: vibrating feeder, jaw or impact crushers, conveyor belts, magnetic separators, screens and loading vehicles.

In addition to the above, a recycling plant must have yards to receive and store the waste and process the materials produced, areas for the vehicles to maneuver, scales for trucks and an administration area.

As a reference, a recycling plant with a capacity of 50 tons / hour may extend throughout 10.000 m2. If the plant also has a CDW selection area, an additional 5 to 10 thousand m2 will be required.

Environmental & Occupational Aspects

To set up a recycling plant, the dust emission, the protection of workers, and the noise and visual impact on the environment must also be taken into account.

Procedures such as using waster to control dust emissions, the distance and isolation of the noise sources, and planting shrubs and vegetation around the site are effective when trying to minimize environmental impacts and labor-related risks.

Location

In the specific case of Bogotá, the location of the recycling plants must comply with the Zoning Plan [Plan de Ordenación del Territorio – POT], since they entail industrial activity with significant environmental impact.

In this sense, the sites located in less populated areas that have already been assigned to house CDW landfills can easily include recycling plants, thus representing major advantages, since the material that is not suitable for recycling may be disposed of right there and at minimum cost. Likewise, the entire physical facilities would be in use, as well as the surveillance system, dust elimination system, vehicle scale, administrative structure, etc.

Operating and Financing Aspects

Ceramics, concrete blocks and brick are waste that may be processed and transformed into recycled aggregates for multiple uses.

While coarser material may be used as pavement base or sub-base and to contain erosion, the finer elements may be used to produce practically any element not used for structural purposes, such as blocks, floors, gutters and masonry furniture.

The use of recycled materials is extremely advantageous, since it may represent savings compared to virgin material, considering overhead expenses and the technology used at recycling plants.

In order for the processing to be viable and yield guaranteed-quality materials, it is essential that the waste is previously selected and purged of unwanted contaminants such as metal, plastic, paper, plaster, wood, etc., as well as hazardous components. This selection usually consists of a manual separation of the contaminants, along with the aid of additional equipment such as a magnetic separator.

The operation of a 50 tons/hour – capacity recycling plant may need up to 15 employees, including machine operators and administrative staff. However, the prior separation of contaminant materials takes longer and requires more labor, since the process is predominantly manual. Because of this, but also due to logistics, the selection and transfer activities may be carried out in separate units – the selection and transfer areas (ASTs) - thus increasing the productivity of the recycling plant's operation.

Selection & Transfer Areas [Áreas de Selección e Transferencia – AST]

Selection & Transfer Areas (ASTs) receive all types of CDW to select and separate the materials in it and assess their recycling potential. These facilities provide selection services to small and medium-sized generators who either lack the space in which to carry out these activities or choose to subcontract them.

The main function of the ASTs is to separate the materials with a negative influence in the process, which compromise the quality of the recycled aggregates and their part is essential, as the waste received will then be transferred to the waste recycling plant. These materials, such as metal, wood, plastic, paper, plaster, etc., also have great potential for recycling and generating resources, as long as they are properly selected, segregated and stockpiled in cheap lots that will facilitate their sale to companies part of the recycling chain, or, whenever possible, directly to the industries that will consume or transform these materials.

Likewise, the great constructions or demolitions that generate significant volumes of waste, must have management plans that entail the selection, separation and conditioning of the waste at the worksite and the direct transfer to the waste recycling plants, intermediate recyclers or transformation industries, in the case of materials such as steel, wood and plaster, for instance, if the volume so justifies it.

ASTs may eventually be placed at CDW recycling plants as an addition to their activities. However, logistically speaking, it is preferable that ASTs are located in decentralized areas that are closer to the generators.

Furthermore, the operation of an AST contrasts with that of a CDW recycling plant, since the former presents more manual labor and less use of technology, the purpose of which is to obtain resources from the materials the recycling plant does not need, whereas the latter presents a mechanized operation, minimum labor and mainly focuses on the sale of aggregates to the industry construction.

An AST requires a physical area that ranges from 5 to 10 thousand m2, with a covered area for unloading, distributing and selecting CDW, containers for the temporary storage of the recyclable material and a loading vehicle to transfer the clean waste to the recycling plant.

From a financial perspective, an AST sustains its operation by charging a fee for receiving the CDW, which may vary according to their degree of contamination, and with the income generated by the sale of recyclable material. Its main expenses result from hiring labor, and maintaining the premises and the loading vehicles.

Ideally, an AST should be a private undertaking with the technical and financial support of public entities and even the entity representing the construction companies.

During the initial phase, the city may encourage the involvement of private agents by granting concessions – through bids - in public areas for setting up ASTs with the purpose of prioritizing the reception of waste from extraordinary and corrective public collections, with the possibility of receiving waste from private sources.

Voluntary Drop-Off Points [Puntos de Entrega Voluntaria – PEV]

Without excluding the legal obligation of the city to cover the collection of small waste volumes not exceeding 1m3 generated by household renovations that do not need construction licenses, the collection of which has been requested by the user by way of the extraordinary collection services rendered by the concessionaires, the creation of alternative voluntary drop-off points (PEVs), where anyone can leave small volumes of CDW and bulky waste for free (furniture, tree trimming remains, etc.), tends to be a positive contribution towards the elimination of illegal depots.

The PEVs should be located in areas that present greater illegal dumping sites, in premises with 200 to 500 m2 equipped with a signalization board to identify the service and the purpose, as well as the type of waste that can be deposited. They must also have different containers allowing for the isolated storage of each type of material (bulky waste, tree trimming remains, etc.), enough space for the loading vehicles to remove the stockpiled waste, a surveillance booth and bathroom to enable the permanent presence of an employee to guard the facilities and supervise the correct use of the public equipment.

Unlike the ASTs, the PEVs must be public facilities and should be built and managed either by the city or by garbage collection concessionaires who must be accountable for the transfer of waste from the PEVs to the authorized ASTs in the corresponding assigned areas.

From a financial perspective, the transport of pre-selected and packed waste from the PEVs should be cheaper for the garbage collection concessionaires than the corrective hauling from irregular dumping sites or collection at request, which leads to decreasing operation costs.

Considering that many of the initiatives to achieve the goals of the “Basura Cero” program must be integrated, these PEVs may be used to deliver other waste, such as construction waste, as well as hazardous products, such as e-waste, contaminated containers and expired medications, as a complement to the reverse collection programs defined by the industries, who in turn may contribute with technical and financial support for the constitution and operation of these facilities.

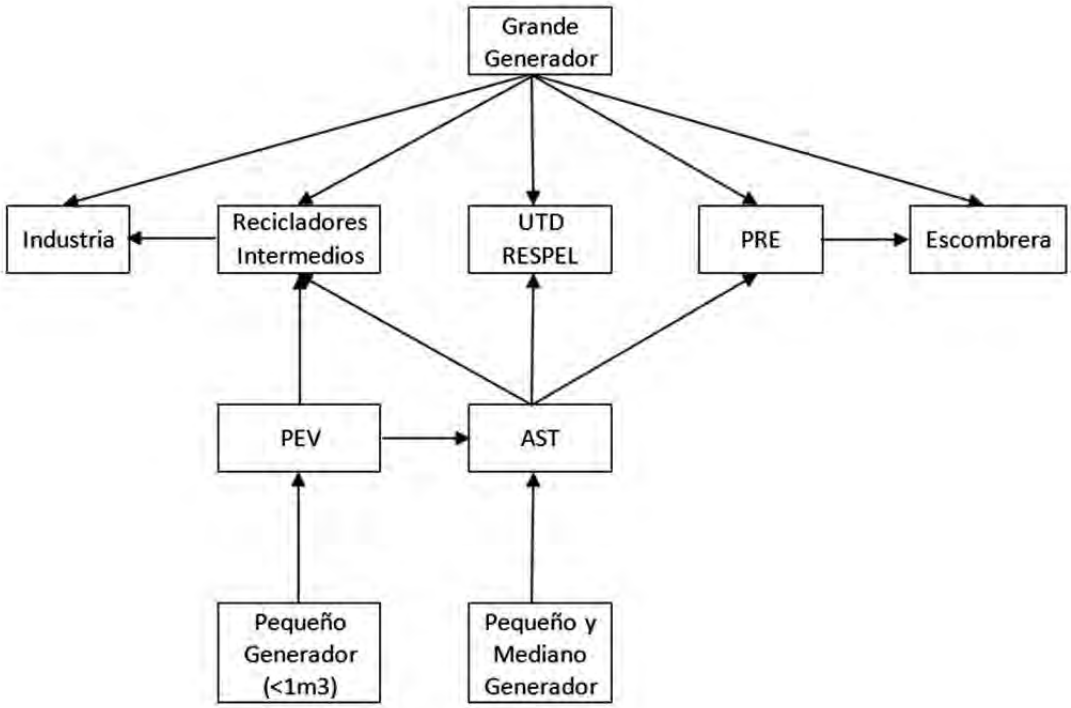


Figure 4-1: Proposed CDW Flow

PRE = CDW recycling plant; AST = selection & transfer area; PEV = voluntary delivery point; UTD RESPEL = hazardous waste treatment & disposal unit

c. Follow up to Resolution 1115 / 2012

New Resolution 1115 / 2012, which will become enforceable in August 2013, is an important framework that will allow for the improvement of cdw management on the part of the city's authorities. This will be achieved by keeping registrations, inventories and control documents on cdw large generators, transporters and recipients.

Upon applying these mechanisms, they will provide up-to-date and real information on the type and amount of cdw produced by large generators, both public and private, as well as its destination and treatment, which will enable the ongoing improvement of the management model.

To this end the city must guarantee environmental follow up, which is the responsibility of the Assistant Director's Office of Environmental Control on the Public Sector, as well as the application of sanctions for verified infringements.

A database or directory with the information of the regularly registered transporters must be published and updated on the SDA and UAESP websites so they may be identified by the users, who may be made eventually accountable for hiring unauthorized agents.

It also proposes developing a standard instrument to record the movement of waste, in order to accredit its origin and the final destination as provided in Article 9º of this Resolution, thus leading to better controls and follow up on the part of users and inspection agents. In this sense, the application of a manifest is an alternative worth considering.

A manifest is a numbered page attached to each waste transfer that includes information such as the generator, type and amount of waste, information of the transporter and the final or intermediate destination site. The generator keeps a copy of the document signed by the transporter; the recipient keeps a copy of the document signed by the transporter and the generator, and the transporter keeps another copy signed by the generator and the recipient. The document allows the generator to systematize the information concerning the generation and disposal of its waste, empowers the inspection authorities to take action and enables the city to gather information and improve its management system.

d. Encouraging the Environmental Responsibility of CDW Large Generators

Considering that generators are legally responsible for the destination of their waste, and that the construction sector shows little commitment of its actors with sustainable environmental issues, it becomes necessary to come up with instruments that will encourage both public and private constructors to be more responsible.

In this sense, Resolution 1115 / 2012 has provided that large generators who are responsible for works needing a construction permit, submit beforehand a CWD Management Plan that specifies the procedure for the sound environmental management and disposal of their waste to the authorities as one of the requirements for receiving approval for the works.

However, a Guide on how to present said Management Plan must be prepared in order to ensure uniformity and relevant content, involving all aspects concerning description, classification and quantification of the waste that is expected to be generated, the procedures for selection, separation, conditioning and storage, minimization, reuse and recycling strategies at the worksites, the identification of the transporters and the destination of the different waste.

The CDW Management Guide must emphasize the 3Rs (reduce, reuse, recycle), the application of which entails endless possibilities in the context of CDW.

The promotion of workshops for the construction sector to foster technical and technological discussions and the exchange of information and success stories concerning minimization, reuse and recycling is also promoted.

Examples of the Application of the 3Rs in CDW Management

Reduce

In the construction sector, reducing waste represents savings and survival for the companies in a competitive market. Positive results are attained by using new materials and applying the best construction practices, such as the use of prefabricated elements and steel structures; the proper handling, transport and storage of input for construction, avoiding unnecessary losses; and the best qualification of the construction workers.

Reuse

Excavation soil may be used to level-out and raise the ground instead of disposing them at CDW landfills. Organic soils (black layer) are especially valuable, as they may be used to grow plants for landscaping or in urban agricultural projects. Instruments such as the “waste offer" may foster the transfer of soils directly from the excavation site to those interested in reusing them.

The creation of a website where generators may offer their excavation soils, specifying volumes, types of soil and location, to those interested in obtaining and reusing these materials, so they can contact them directly (or through the SDA), is suggested.

Recycle

Practicing source separation at construction and demolition worksites promotes recycling the different types of waste, thus reducing the disposal cost and generating income by selling these materials. (1)

(1) Source separation at the worksite

During extensive demolition, mobile equipment grinds the stony waste at the worksite, producing aggregates to be used in the new construction. (2)

(2) Mobile equipment for “in situ” cdw recycling

In new constructions, simple, portable and low-tech equipment recycles refuse and losses, converting them into mortar to be used at the worksite. (3)

(3) “ANVI500” used for “in situ” recycling, mortar from the CDW generated by construction works

CDW recycling plants process stone and ceramic waste, generating cheap aggregates that are widely used in construction, minimizing the volume of waste taken to disposal sites. (4)

(4) Fixed waste recycling plant

Asphalt paving waste may be easily recycled at asphalt plants and even at the application site. Nowadays there is modern equipment that can mill, add and reapply the asphalt in a single operation. (5)

(5) “TEREX RS425C” for milling, recycling and simultaneous application of asphalt pavement

e. Encouraging the Participation of Small Generators and the General Population

The participation of small generators and the general population is key to achieving the goal of reducing disposal at illegal sites and the resulting reduction of critical points directly related to the responsibilities of the UAESP.

The creation of voluntary drop-off points for cdw and bulky waste must be preceded and accompanied by an efficient explanatory and awareness campaign that explains the advantages it will bring to the community. The purpose of the voluntary drop-off point, the way in which to drop off waste and the materials that are acceptable and unacceptable must be explained in plain language, encouraging the selection of materials, thus favoring recycling later on.

With the support and participation of the garbage collection concessionaires, and in addition to the above, the creation of free periodical collection campaigns for bulky waste is also proposed, since it strengthens community participation, besides other practical results.

f. Revision of the Technical and Operating Rules; Establishing Quality Standards for Garbage Collection Services

In light of the diagnosed shortcomings, it is necessary to improve customer care, which is currently provided through the customer care line 110 and the website, expediting the response to calls requesting the collection of cdw, which will remain the responsibility of the UAESP through the garbage collection concessionaires.

It will also have to include the operation of the voluntary drop-off points, which must be the responsibility of the concessionaires in their corresponding areas of operation, under the UAESP's supervision. The equipment, materials and labor needed by the concessionaires for the proper operation of these facilities, as well as the business hours, surveillance and maintenance responsibilities must be determined.

4.3 Success Stories in CDW Management in Sao Paulo, Brazil

The city of de São Paulo, with its almost 20 million inhabitants, is the largest city in Brazil and the sixth largest worldwide.

In São Paulo, the law prohibits dumping construction waste on the road and in public areas, but allows each household to dispose of a maximum amount of 50 kg of CDW per day to be collected by the regular garbage collection service, as long as the waste has been properly conditioned. Another option for small generators is to take the waste to the "Ecopontos",

which are units where up to 1 m³ of CDW, wood, tree trimming remains and bulky objects per day may be deposited for free.

If the volumes exceeds that defined by the law, the generator is responsible for removing and eliminating the CDW produced, thus making it necessary to hire an authorized transporter.

The municipal administration publishes on its website the list of companies registered by the administration. Only licensed transporters can dump CDW in the areas authorized to receive CDW.

Each CDW transportation process must be accompanied by a Waste Transport Control [Control de Transporte de Residuos – CTR], which documents the delivery in the licensed area for the proper disposal of CDW.

By virtue of a resolution issued by the federal government, each municipality in Brazil must implement its own CDW Management Program, and the large generators must submit a new CDW Management Project for each new undertaking in order to obtain a construction license.

Municipal plans must include the registration of authorized public or private areas to receive, select, store temporarily, process and dispose of the waste; the rules for the concession of licenses for waste processing and disposal; the ban on disposing of waste in unauthorized areas; actions to foster the reintegration of recycled or reused waste into the productive cycle; the definition of criteria for the transporter registration or licensing; orientation, supervision and control action of the agents involved, and educational activities.

The plans formulated by the constructors must include the characterization and estimated quantification of the waste to be generated, along with the adjustment, transport and disposal procedures and the actions towards reusing and recycling the waste.

A technical standard establishes a CDW classification system, while the other technical standards define the quality standards for recycled aggregates resulting from CDW.

In order to counteract the irregular disposal of bulky waste and CDW, the São Paulo municipality, through the Municipal Services Secretariat, has created “Ecopuntos" for the voluntary and free drop-off of small volumes of waste (up to 1 m³), bulky objects (furniture, tree trimming remains, etc.) and other recyclable waste. The citizens may find here the different containers for the conditioning of each type of waste.

In 2010, when the city had 41 “Ecopontos” approximately 120 thousand m3 of material were received, 60% of which was bulky material, 33% CDW and 7% recyclable material. São Paulo currently has 56 “Ecopontos”, distributed throughout the entire city.

São Paulo has 5 ASTs managed by private companies, where CDW is received, classified and transferred to recycling, treatment or final disposal areas.

The recycling plants, which are located in the city and in the metropolitan area, receive and process part of the CDW to turn them into recycled aggregates. The part that cannot be recycled is taken to licensed landfills for inert materials.

A large part of the recycled aggregate is used to pave public roads, the projects of which must foresee the mandatory use of these materials.

The municipal administration often carries out free scheduled collections for bulky objects no longer in use, such as old couches, pieces of wood and metal, broken appliances, among other. The residents must leave the objects outside their home one hour prior to the previously informed route and schedules.

In September 2012, approximately 150 operations were organized, resulting in the collection of approximately 2300 tons of material.

Photos of an "Ecoponto", in São Paulo, Brazil

Source: Perfectura of São Paulo, website

Photos of an AST in São Paulo, Brazil

CDW combined with other waste

Recyclable materials separated in different containers

Clean waste ready for transfer to the recycling plant

Source: ATT Pari, São Paulo, SP

Chapter 5

Final Disposal

5 Final Disposal

The mechanisms for the UAESP to implement the Master Plan corresponding to the Final Disposal component appear below. They include, specifically, the actions required in order to increase the useful life and ensure the operation of the Doña Juana Landfill (RSDJ) while diminishing the vulnerability of the final disposal system along the short, medium and long term of the Master Plan (MP).

As mentioned in the description of the MP, the three strategies defined for the final disposal component are aimed at:

- Strategy 1: Maximizing the useful life of the Doña Juan Landfill (RSDJ).
- Strategy 2: Operating the RSDJ by complying with the regulations in force.
- Strategy 3: Implementing no landfills.

Action Plans were defined for each one of them, along with their corresponding goals, corresponding to:

Strategy 1:

- Action Plan 301: Minimizing the entry of usable waste to the RSDJ.
- Action Plan 302: Incorporating Phase II to the operation of the RSDJ.
- Action Plan 303: Incorporating the Master Plan to the operation of the RSDJ.
- Action Plan 304: Assessing alternatives concerning the usability of waste at the RSDJ.

Strategy 2:

- Action Plan 305: Operating the RSDJ pursuant to the regulations in force.
- Action Plan 306: Ensuring the adequate management of leachate.

Strategy 3:

- Action Plan 307: Habilitating the Landfill in the Western Sector.
- Action Plan 308: Habilitating the Landfill in the Northern Sector.

The Tables below show the goals of each Action Plan, the activities to undertake, their Schedule, as well as the entities that should carry them out. Subsequently, more background information concerning the objectives, goals and expected products in each Action Plan will be supplied.

Table 5-1: Action Plan – 301: Minimizing the Entry of Usable Waste to the RSDJ.

Goals		PARTY INVOLVED	Short Term 2013 – 2015			Medium Term 2016 – 2018			Long Term 2019 – 2027								
Minimizing the Entry of Usable Waste to the RSDJ			60% to compost; 100% combined			90% to compost			100% (2019) to compost								
No.	Actions		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Increasing the control of combined waste at RSDJ	UAESP/CONC		x													
2	Diverting and using the waste from lawn mowing and tree pruning	UAESP		x	x	x	x	x	x								

Table 5-2: Action Plan 302: Incorporating Phase II to the Operation of the RSDJ

Goals		PARTY INVOLVED	Short Term 2013 – 2015			Medium Term 2016 – 2018			Long Term 2019 – 2027								
Incorporating Phase II to the Operation of the RSDJ			Increased Capacity by 16,000,000 m³.														
No.	Actions		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Obtaining the environmental license	UAESP/CONC/CAR	x														
2	Habilitating Phase II	UAESP/INTERV/CONC	x	X													
3	Starting up Phase II operations	UAESP/INTERV/CONC		x													
4	Concluding Phase II operation	UAESP/CONC									x						
5	Starting up Phase II Closing Plan	UAESP/CONC									x						

Table 5-3: Action Plan 303: Incorporating the Master Plan to the Operation of the RSDJ

Goals		PARTY INVOLVED	Short Term 2013 – 2015			Medium Term 2016 – 2018			Long Term 2019 – 2027								
Incorporating the Master Plan to the operation of RSDJ									➢ 20 years (35,500,000 m³)								
No.	Actions		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Feasibility analysis of the Master Plan	UAESP/CONC		X	X												
2	Preparing studies and design of the project	UAESP/CONC				X	X										
3	Obtaining Environmental License for Master Plan	UAESP/CONC/CAR						X	X								
4	Habilitating 1st Stage of Master Plan	CONC/INTERV/UAESP								X							
5	Starting up operation of Master Plan	CONC/INTERV/UAESP									X						

Table 5-4: Action Plan – 304: Assessing alternatives concerning the Usability of Waste at the RSDJ

Goals		PARTY INVOLVED	Short Term 2013 – 2015			Medium Term 2016 – 2018			Long Term 2019 – 2027								
Assessing alternatives concerning the Usability of Urban Solid Waste (USW)			% depending on waste entered			% depending on waste entered			% depending on waste entered								
No.	Actions		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Reviewing agreement 344 of 2010 regarding contractual clauses for the usability of Urban Solid Waste.	CONCES/UAESP	X														
2	Analysis of feasibility of technologies for the usability of waste, defining usability % goal.	UAESP	X														

			Short Term			Medium Term			Long Term								
Goals		PARTY INVOLVED	2013 – 2015			2016 – 2018			2019 – 2027								
Assessing alternatives concerning the Usability of Urban Solid Waste (USW)			% depending on waste entered			% depending on waste entered			% depending on waste entered								
3	Pursuant to the results of the analysis, implementing the recovery project or not.	UAESP/CONC/CAR		X													
4	Building and habilitating the selected usability process.	CONCES/UASP			X												
5	Starting up the selected usability process.	CONCES/UASP			X												
6	Monitoring and Evaluating the implemented process by verifying the fulfillment of the USW usability.	UAESP				X	X	X	X	X	X	X	X	X	X	X	X
7	Analyzing the Technical and Legal aspects of the Process regarding the usability of USW aimed at the incorporation in the bidding process for the management and maintenance of the RSDJ.	UAESP						X									

Table 5-5: Action Plan 305: Managing the RSDJ pursuant to the Regulations in force

			Short Term			Medium Term			Long Term								
Goals		PARTY INVOLVED	2013 – 2015			2016 – 2018			2019 – 2027								
Ensuring the effectiveness of the RSDJ during 100% of the operating days			100% operating days			100% operating days			100% operating days								
No.	Actions		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Assessing the effectiveness and fulfillment of the management indicators regarding the operation and maintenance of the RSDJ	CONCES/INTERV/UAESP	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	Ensuring the Fulfillment of the Regulations in force regarding the operation and maintenance of the RSDJ.	CONCES/INTERV/UAESP/CAR	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	Verifying the fulfillment of the contractual obligations of the signatories of the DF concession agreement.	CONCES/INTERV/UAESP	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	Verifying the fulfillment of the contractual obligations of the signatories of the Biogás Concession Agreement	CONCES/INTERV/UAESP	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5	Verifying the fulfillment of the contractual obligations with the RSDJ neighboring community.	CONCES/INTERV/UAESP	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6	Preparing the terms of reference – bid for the operation concession of the RSDJ	UAESP							X	X							

Table 5-6: Action Plan 306: Ensuring the Adequate Treatment of Leachate

			Short Term			Medium Term			Long Term								
Goals		PARTY INVOLVED	2013 – 2015			2016 – 2018			2019 – 2027								
Ensuring the treatment of 100% of the leachate thus complying with the regulations			100% Generated Leachate			100% Generated Leachate			100% Generated Leachate								
No.	Actions		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Evaluating and selecting alternatives to adapt and optimize the treatment of leachate.	UAESP	X														
2	Preparing the PTL design and presentation of the request for a new waste water discharge permit before the Environmental Authority	CONCES/UAESP/CAR	X														
3	Obtaining the Waste Water permit.	CONCES/UAESP/CAR		X													
4	Building adjustment and/or extension works pursuant to the new design	CONCES/INTERV/UAESP		X													
5	Monitoring and Evaluating the implemented leachate treatment process	CONCES/UAESP			X	X	X	X	X	X	X	X	X	X	X	X	X
6	Determining the treatment requirements by taking into consideration the Master Plan, and suggesting a design for the Leachate Treatment Plant (LTP), if required.	CONCES/UAESP				X											
7	Designing the extension of the leachate treatment plant according to the results of the foregoing action.	CONCES/UAESP					X										
8	Waste water discharge permits – plant extension	CONCES/UASP/CAR						X									
9	Building plant extension	CONCES/INTERV/UAESP							X	X							

			Short Term			Medium Term			Long Term								
Goals		PARTY INVOLVED	2013 – 2015			2016 – 2018			2019 – 2027								
Ensuring the treatment of 100% of the leachate thus complying with the regulations			100% Generated Leachate			100% Generated Leachate			100% Generated Leachate								
10	Starting up the extension of the plant.	CONCES/INTERV/UAESP									X						

Table 5-7: Action Plan 307: Habilitating the Landfill in the Western Sector (RSOcc)

			Short Term			Medium Term			Long Term								
Goals		PARTY INVOLVED	2013 – 2015			2016 – 2018			2019 – 2027								
Incorporating a Final Solid Waste Disposal System located in the Western sector									Useful life: 30 years								
No.	Actions		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Reviewing the Cundinamarca study, preparing new studies, or incorporating new demands and products to the current study; analyzing the solution from a regional point of view and not exclusively from Bogotá.	UAESP	X	X													
2	Selecting the place and purchasing the land.	UAESP/CUNDINAMARCA			X												
3	Analyzing and Defining the Management Model (contractual relationship between the Capital District and the Department of Cundinamarca).	UAESP/CUNDINAMARCA				X											
4	Undertaking the specific studies at the selected site.	UAESP				X											
5	Analyzing and evaluating technologies	UAESP/CUNDINAMARCA				X											

			Short Term			Medium Term			Long Term								
Goals		PARTY INVOLVED	2013 – 2015			2016 – 2018			2019 – 2027								
Incorporating a Final Solid Waste Disposal System located in the Western sector									Useful life: 30 years								
	regarding the usability of waste and the feasibility of their implementation.																
6	Design and engineering aspects of the landfill and usability plant, if applicable.	UAESP/CUNDINAMARCA					X										
7	Approving permits and licenses for the implementation of the Project.	UAESP/CAR						X	X								
8	Preparing bidding bases for the concessions of the operation and maintenance of the projects – allocation.	UAESP/CUNDINAMARCA							X								
9	Starting up the RSOcc Concession.	CONCES/UAESP/CUNDINAMARCA								X							
10	Habilitating the RSOcc	CONCES/INTERV/UAESP								X							
11	Starting up the RSOcc Operation.	CONCES/INTERV/UAESP									X						
12	Ensuring the Fulfillment of the Regulations in force for the operation and maintenance of the RSOcc.	CONCES/INTERV/UAESP									X	X	X	X	X	X	X
13	Verifying the fulfillment of the contractual obligations of the parties.	CONCES/INTERV/UASP									X	X	X	X	X	X	X
14	Evaluating the effectiveness and fulfillment of the management indicators for the operation and maintenance of the RSOcc.	CONCES/INTERV/UASP									X	X	X	X	X	X	X

Table 5-8: Action Plan 308: Habilitating the Landfill in the Northern Sector (RSNor)

			Short Term			Medium Term			Long Term								
Goals		PARTY INVOLVED	2013 – 2015			2016 – 2018			2019 – 2027								
Incorporation of a Final Solid Waste Disposal System located in the Northern sector									Useful life: 30 years								
No.	Actions		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Selecting a site	UAESP/CUNDINAMARCA							X								
2	Purchasing the land	UAESP/CUNDINAMARCA								X							
3	Preparing the specific studies of the RSNor	UAESP									X						
4	Analysis and evaluation of technologies for the usability of waste and implementation feasibility.	UAESP									X						
5	Analyzing and Defining the Management Model (contractual relationship between the Capital District and the Department of Cundinamarca)	UAESP/CUNDINAMARCA									X						
6	Design and engineering aspects of the landfill and usability plant, if applicable.	UAESP										X					
7	Approval of permits and licenses for the implementation of the Project.	UAESP											X				
8	Preparing Bases for the Tender of the concession for the operation and management of the projects – allocation.	UAESP											X	X			
9	Starting up RSNor Concession.	CONCES/UASP/CUNDINAMARCA													X		
10	Habilitating RSNor	CONCES/INTERV/UAESP													X		
11	Starting up the operation of the RSNor.	CONCES/INTERV/UAESP														X	

			Short Term			Medium Term			Long Term								
Goals		PARTY INVOLVED	2013 – 2015			2016 – 2018			2019 – 2027								
Incorporation of a Final Solid Waste Disposal System located in the Northern sector									Useful life: 30 years								
12	Ensuring the Fulfillment of the Regulations in force concerning the operation and maintenance of the RSNor.	CONCES/INTERV/UAESP														X	X
13	Verifying the fulfillment of the contractual obligations of the parties.	CONCES/INTERV/UAESP														X	X
14	Evaluating the effectiveness and compliance of the management indicators of the operation and maintenance of the RSNor.	CONCES/INTERV/UAESP														X	X

Note:

CONCES: Concessionaire for the habilitation, operation and maintenance of the landfill.

INTERV: Supervision of the habilitation, operation and management agreement of the landfill.

5.1 Action Plan 301: Minimizing the entry of usable waste to the RSDJ

5.1.1 Objective and Goal

Currently, the Doña Juan landfill receives waste from lawn mowing, tree pruning, and from the mixed market. This waste is basically made up of organic waste which can undergo a composting process for it to be used. Likewise, the landfill receives waste that is called combined with high contents of inert waste (gravel, sand, etc.) that may also be used. In view of the foregoing, and taking into consideration that the goal is to increase the useful life of the RSDJ, the goal of this Action Plan is to lower the entry of this type of waste into the RSDJ by sending said waste to composting plants and to construction and demolition waste landfills with the recovery of materials.

Regarding the Goals through the implementation of this Action Plan, it is expected to lower 100% the entry of construction and demolition waste into the RSDJ in the short term, while a reduction of 60%, 90%, and 100% through composting is expected in the short, medium, and long term with respect to the waste derived from lawn mowing, tree pruning and the markets.

5.1.2 Organization

It is a duty of the UAESP to implement the Action Plan by generating the necessary projects for the composting of waste from lawn mowing, tree pruning, and the markets, while generating or promoting the necessary facilities for the separation of the combined waste and the construction and demolition waste for the use of the latter. In turn, it is a duty of the RSDJ Concessionaire to control and prevent this waste from entering the landfill.

5.2 Action Plan 302: Incorporating phase II to the operation of the RSDJ

5.2.1 Objective and Goal

Pursuant to the Environmental Licenses in place for the RSDJ, Phase I of the optimization comes to an end at the beginning of year 2014; if no new areas are presented for the disposal of waste, the useful life of the Doña Juan Landfill will conclude, and the city of Bogotá will have no place for the final disposal of its urban waste. Consequently, the short-term objective of this Action Plan is to present, obtain the environmental license and start the operation of the area called phase 2 optimization zone, which would allow increasing the capacity of the RSDJ by, approximately, 16,000,000 m^3 thus allowing the operation for a seven-year term.

A goal of this Action Plan is to increase the useful life of the RSDJ in seven years thus extending its useful life until year 2021.

5.2.2 Organization

It is the duty of the Concessionaire of the RSDJ to prepare and submit the projects before the CAR in order to obtain the corresponding Environmental License, and then undertake the works in order to adapt the site for receiving the solid waste. The UAESP must accompany the Concessionaire in these activities verifying, at the same time, that the Project and the Environmental License comply with its interests. The CAR must evaluate the projects and grant the corresponding environmental license.

5.2.3 Products

As a result of the activities included in the Action Plan, it is expected to have:

- The Design Project and the engineering details of the Optimization Phase II;
- The Environmental License and other permits pursuant to the regulations in force for Phase II;
- Adaptation of Phase II in order to start its operation in year 2014.

5.3 Action Plan 303: Incorporating the Master Plan to the Operation of the RSDJ

5.3.1 Objective and Goal

The UAEP has developed a pre-feasibility study aimed at optimizing the use of the space at the RSDJ which would habilitate expanding the capacity of the RSDJ for a period of over 20 years; this study analyzes, in particular, the possibility of building new waste cells in areas where solid waste has already been disposed of. This implies that the useful life of the RSDJ could be increased without the need to buy more land. This Action Plan has the purpose of evaluating this pre-feasibility study with the purpose of making the use of space more efficient by including new waste terraces over older areas already filled, thus increasing the useful life of the current landfill.

As a goal, this Action Plan has the intention of increasing the waste reception capacity of the RSDJ by more than 35,500,000 m^3, which would allow increasing the useful life well beyond year 2027.

5.3.2 Organization

It is the duty of the UAESP to undertake, directly or through third parties, the feasibility study (studies) that makes (make) the different pre-designs included in the Master Plan possible, to prepare the designs and the engineering details of the resulting projects and to obtain the corresponding environmental licenses and other required permits in order to habilitate and operate them. It shall be the responsibility of the Cessionaire to adapt and start

the different projects resulting from the feasibility of the Master Plan. It is the duty of the CAR to evaluate the projects and to grant the environmental licenses.

5.3.3 Products

The following results shall be obtained as part of this Action Plan:

- Feasibility study and definition of final projects to be developed as part of the Master Plan;
- Design and engineering details of the projects resulting from the feasibility study;
- Environmental License or Licenses of the projects as well as other permits pursuant to the regulations in force;
- Terms of reference to bid on the habilitation, operation, and maintenance concession of the RSDJ in the Master Plan stage;
- Concession agreement;
- Adaptation of the areas included in the projects that belong to the Master Plan in order to start operating in year 2021.

5.4 Action Plan 304: Assessing Alternatives concerning the Usability of Waste at the RSDJ

5.4.1 Objective and Goal

One way of increasing the useful life of the RSDJ is implementing a Project for the usability of waste entering into the landfill that has been previously assessed. The intention through this Action Plan is to assess the feasibility for the implementation of a Project of this kind at the RSDJ and its start-up, if possible.

The usability of part of the waste is set as a goal of this Action Plan; its percentage shall be defined upon conducting the feasibility study.

5.4.2 Organization

It is the duty of the UAESP to undertake, directly or through third parties, the feasibility study for the usability Project by evaluating technically, economically and environmentally the different available technologies for conducting a Project that is feasible and that lasts in time while benefitting the community. Likewise, and if the project is carried out, it is its responsibility to undertake, directly or through a third party, obtaining the environmental license and the permits required pursuant to the regulations in force. In the event of transferring the construction, operation and maintenance of the plant to third parties, the

UAESP shall be responsible for the corresponding bidding process and for the preparation of the corresponding agreement.

In the event of implementing a usability project, and that the UAESP transfers the construction and operation to a private party, then the corresponding Concessionaire shall implement and operate it. In turn, it will be the responsibility of the CAR to review and approve the project as well as to grant the environmental license and the corresponding permits.

5.4.3 Products

The development of this Action Plan shall have as a result, among others, the following products:

- Feasibility study for the implementation of a usability Project;
- Design and engineering details of the usability Project, if recommended by the feasibility study;
- Environmental license and permits required by the Project pursuant to the regulations in force;
- Terms of reference for bidding the habilitation, operation and maintenance concession of the usability Project;
- Concession agreement;
- Civil works, equipment and other items included in the usability Project.

5.5 Action Plan 305: Operating the RSDJ pursuant to the Regulations in Force

5.5.1 Objective and Goal

Ensuring the adequate disposal of solid waste not only depends on having enough space for burying it but also that its disposal must be carried out in an efficient manner and strictly complying with the provisions of the regulations in force and with the provisions of the Concession agreement. This Action Plan has been designed with the purpose of ensuring that the operation of the RSDJ meets what is set forth in the Environmental License and in the regulations in force, by generating the necessary required adaptations while verifying the fulfillment of the obligations imposed by the corresponding concession agreement(s), both to the concessionaire and to the UAESP.

The goal of this ACTION Plan is operating the RSDJ 100% of the days of the year.

5.5.2 Organization

It is the duty of the Concessionaire of the RSDJ to comply with and to adapt its operation to the provisions of the Environmental License and of the regulations in force, as well as complying with the provisions of the agreement. In turn, the Supervisory Authority has the duty of overseeing the fulfillment of the foregoing, the measurement and the evaluation of the quality indicators, and suggesting the UAESP corrective measures required by the Project. It is the duty of the UAESP to verify the effectiveness of the oversight of the Supervisory Authority, the effectiveness of the quality indicators, and to study and define changes to the operation of the project if required in order to comply with the regulations. This last aspect must be jointly studied with the Concessionaire. In turn, the CAR has the responsibility of enforcing the compliance with the regulations.

5.5.3 Products

The development of this Action Plan shall have as a result, among others, the following products:

- Determination and evaluation of quality indicators;
- Changes to the landfill's operating plan;
- Changes, or elimination, or incorporation of quality indicators for the operation of the RSDJ;
- Amendments to the Concession agreements, if required.

5.6 Action Plan 306: Ensuring the Adequate Treatment of Leachate

5.6.1 Objective and Goal

This Action Plan has been designed with the purpose of implementing the changes or extensions of the treatment plant for leachate, habilitating the treatment of 100% of the leachate generated at the RSDJ and, at the same time, that the effluent meets the regulations concerning waste water discharge thus ensuring the feasibility of the operation of the landfill.

The goal set is to ensure the treatment of 100% of the leachate generated at the RSDJ.

5.6.2 Organization

It is the duty of the RSDJ Concessionaire to evaluate the operation of the PTL, to optimize the treatment process, to evaluate the need of an extension of the plant, to generate the corresponding projects, and to obtain the permits set forth by the law. The supervisory authority is in charge of supervising the correct construction and operation of the plant, as

well as overseeing the thorough compliance concerning the quality of the effluent and of the regulations in force. The UAESP is responsible for accompanying and supporting the Concessionaire as per the foregoing activities and, at the same time, verifying that the solutions posed are related to its interests. It is the duty of the CAR to grant the corresponding permits as well as to enforce the provisions of the resolutions and of the regulations.

5.6.3 Products

The products expected from this Action Plan are the following:

- Evaluation report on the operation of the PTL and alternative solutions;
- Optimization and/or extension projects for the PTL;
- Permits related to the habilitation of the PTL;
- Change or extension of the civil works, equipment and other items of the PTL;
- Amendments to the Concession agreements, if required.

5.7 Action Plan 307: Habilitation of a Landfill in the Western Sector

5.7.1 Objective and Goal

One of the greatest weaknesses noticed concerning the handling of solid waste in the city of Bogotá is the existence of only one landfill for a population of around 7.5 million inhabitants. In fact, if there was a serious situation at the RSDJ, preventing its operation, or if the access roads collapsed or where not usable, over 6,000 tons of waste per day would have no destination, thus generating serious sanitary, environmental and health problems for the community which, in a few days, would become chaotic. Therefore, the objective of this Action Plan is to have, in the long term, a new landfill in operation, in the western sector, regional in nature, allowing the disposal of 50% of the waste for final disposal.

The goal is that, by year 2021, there will be a newly-operated landfill in the western sector, with a useful life of 30 years that receives 50% of the waste of Bogotá for its final disposal.

5.7.2 Organization

Since it is a regional landfill, it is the duty of the UAESP and of the Department of Cundinamarca to choose and buy a site for the landfill; to define the characteristics of the sanitary Project; to define and implement the management model for the administration of the Project; to jointly undertake the calls for bids; to prepare and enter into the corresponding agreement for the construction, operation and maintenance of the different components of the project. In addition, there should be an Auditing process, or another type of entity

undertaking the supervision of the project regarding the operating, administrative and legal aspects. It is also taken into consideration that, as in the case of the RSDJ, the operation shall fall under a concession; therefore, the corresponding Concessionaire shall be responsible for the construction, operation and maintenance of the project. In turn, the CAR shall be in charge of reviewing, evaluating and approving the projects, as well as of granting the environmental licenses and the corresponding permits, besides supervising the Project.

5.7.3 Products

The products expected from this Action Plan, among others, are the following:

- Selection of the site and subsequent purchase;
- Management Model for the administration of the project;
- Creation of an Association between the Capital District and the Municipalities of the Department of Cundinamarca for the management of the landfill;
- Design and engineering details of all the components of the project of the West landfill;
- Environmental license and permits required by the project;
- Terms of reference for the tender concerning the services of the landfill;
- Concession agreements;
- Construction of the infrastructure, civil works, general services, PTL, adaptation of areas for waste disposal, etc.

5.8 Action Plan 308: Habilitation of a Landfill in the Northern Sector

5.8.1 Objective and Goal

This Action Plan complements the previous Action Plan, giving a long-term solution concerning the final disposal of waste in the city of Bogotá. The objective of this Action Plan is to achieve, in the long term, the entry into operation of a new landfill allowing the disposal of 20% of the waste generated in the northern sector of Bogotá.

The goal set for year 2026 is the entry into operation of a landfill in the northern sector with a useful life of thirty years that receives 20% of the waste of Bogotá for its final disposal.

5.8.2 Organization

The same organization of the previous Action Plan is recommended.

5.8.3 Products

The same products identified in Action Plan 307 are expected.

Chapter 6

Hazardous Waste from Non-Industrial Sources

6 Hazardous Waste from Non-Industrial Sources

6.1 General Recommendations

Based on this diagnosis, greater participation of the district government is proposed to support post-consumer collection programs, particularly in the dissemination of these programs, education and awareness-building of consumers, and allocation of public spaces to install collection bins.

Greater participation of the central government, through the Ministry of the Environment and Sustainable Development, is also required in the monitoring of programs, evaluation and dissemination of results and coordination with other government instances to ensure compliance with the objectives established in the resolutions.

In an integrated manner, as must be the case for management of solid wastes, the voluntary delivery points proposed for receipt of sizeable waste and construction and demolition waste can also be used to place collection bins for the different products containing hazardous substances, such as medications, batteries, light bulbs, oils, contaminated containers and tires. The municipality can negotiate sponsorship quotas for the installation and maintenance of these points with the manufacturers and importers of the mentioned products.

As a supplement to private sector initiatives, the municipality can organize campaigns for receipt of post-consumer products in public squares, clubs, schools or associations in different areas of the city, on scheduled dates informed in advance, taking the opportunity to educate and create awareness regarding the need for differential management of hazardous wastes. These events must necessarily include participation of manufacturer and importer companies, or of entities responsible for the collection and disposal of these products.

With respect to waste treatment or recycling technologies, still scarce or non-existent in the Bogotá region, the government can support new endeavors promoting the exchange of information, opening financing lines for the execution of projects and purchase of equipment and ensuring celerity for the analysis and approval of licenses for undertakings that use clean and sustainable technologies.

6.2 Revision of PMIRS Goals and Objectives towards Improving Hazardous Waste Management in Bogotá

Based on the analysis and general recommendations submitted, it is possible to propose actions that will lead to improving hazardous waste management in Bogotá.

Since Bogotá already has a specific and detailed management plan for the hazardous waste of the different sectors, we present below only those actions relating to the goal of reducing the disposal of this waste at Doña Juana Landfill, within the scope of the UAESP.

Table 6-1: Action Plan of Hazardous Waste not from Industries

Specific Objective																
Reduce final disposal of hazardous waste at Doña Juana Landfill																
Strategy																
Promote environmental education and provide the people with efficient alternatives for the voluntary delivery or collection of hazardous waste, guaranteeing its transfer for recycling, treatment or proper final disposal																
Goals		2013 – 2015			2016 – 2018			2019 – 2027								
Achieve gradual reductions in the amount of hazardous waste disposed of at RSDJ		10% reduction			25% Reduction			50% reduction								
Achieve gradual increases in the amount of hazardous waste collected separately		50% Increase			100% increase			200% increase								
Actions	Party involved	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Expand the exchange of information among institutional entities	UAESP, SDA, MADS	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Support existing post-consumer collection programs, disseminating information and providing public areas to place bins	UAESP		x	x	x	x	x	x	x	x	x	x	x	x	x	x
Promote environmental education among the people regarding identification and source separation, by providing constant information and raising awareness, especially among the children, using the Guía de Manejo de los RESPEL Generados en las Viviendas [*Household Hazardous Waste Management Guide*]	UAESP, SDA, Education Secretariat		x	x	x	x	x	x	x	x	x	x	x	x	x	x
Resume and extend the ECOLECTA program, with the support of the manufacturers and importers of products that become hazardous waste	SDA		x	x	x	x	x	x	x	x	x	x	x	x	x	x
Study the feasibility of using the CDW voluntary drop-off points to place bins for certain household hazardous waste, such as WEEE, oils and containers	UAESP and SDA		x													

Chapter 7

Environment Education

7 Environment Education

7.1 Action Plan of Environment Education

The following is the Action Plan of Environment Education.

Table 7-1: Action Plan of Environment Education

GENERAL OBJECTIVE
Instill responsible consumption among the people and the proper management of the different type of waste, conducive to reduction, reuse and source separation.
Specific Objective
Raise awareness and educate the users of Bogota's garbage collection service to achieve reduction, reuse, source separation and differentiated disposal of solid waste (2.346.081 users)
Strategy
Raise awareness and provide education on actions conducive to reduction, reuse and 100% source separation at public and private schools in Bogotá (Total:2376: 360 public and 2016 private).

Goals	2013 – 2015	2016 – 2018	2019 – 2027
Raise awareness on actions conducive to reduction, reuse and 100% source separation at public and private schools in Bogotá (Total:2376: 360 public and 2016 private).			

No.	Actions	Party involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Prepare the contents and design of the teaching and communication material to be delivered to the schools, articulating the task of UAESP, SED, SDS,Aqueduct, Local Mayors' Offices, JAL promoters, etc.)		x														
2	Organize activities allowing for the dissemination of the actions conducive to the reduction, reuse and source separation in school (contests, workshops, newspapers, radio stations, young journalists network, creation of plays, paintings, graffiti, art experiences, video clips, awareness visits on the proper and responsible management of solid waste, organization of events and/or gatherings, among others, allowing to socialize and disseminate the subject)		x	x													
3	Make visible the results of the activities organized in the schools using online tools.		x	x													
4	Promote the implementation of actions towards reducing, reusing and source separation through the Red Infantil Juvenil Ambiental (RIJA) [Children & Youngster Environmental Network]		x	x													
5	Involve at least 5.000 public and private school teachers in the Teachers'		x	x													

No.	Actions	Party involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
	Environmental Network - Red Ambiental de Maestros																
6	Foster artistic expression activities, oral activities, reading and/or writing on reducing, reusing and source separation in each public school (IED)		x	x													
7	Evaluate the impact of the awareness activities carried out			x	x												

Goals	2013 – 2015	2016 – 2018	2019 – 2027
Educate 100% of city schools in reduction, reuse and source separation by incorporating guidelines for the implementation of these actions in the Schools' PIGA (Plan Institucional de Gestión Ambiental) [*Institutional Plan for Environmental Management*].			

No.	Actions	Party Involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Analyze the PIGA guidelines with respect to the legal provisions in force relating to the proper management of solid waste.		x														
2	Design a Technical Guide to implement the PIGA in the city's public schools (online booklet) to promote reduction, reuse and source separation.		x														
3	Disseminate the PIGA online booklet in 100% of the city's public schools		x	x													
4	Organize a pilot program for the implementation of the PIGA guidelines in the city's public schools		x	x													
5	Implement the guidelines in 100% of the city's public schools.			x	x												
6	Follow up to the PIGA's implementation in the city's schools.			x	x	x											
7	Evaluate the impact of the actions carried out through the PIGA					x	x										

Goals	2013 – 2015	2016 – 2018	2019 – 2027
Educate the city's public schools in reduction, reuse and source separation by disseminating and implementing actions conducive to reduction, reuse and source separation with the PRAE (Proyecto Ambiental Escolar) [*School Environmental Project*] leaders in the 360 public schools of the city.			

No.	Actions	Party Involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Identify the PRAES with emphasis on solid waste management		x														
2	Set up meetings with the PRAE leaders from the city's public schools to promote the implementation of actions relating to solid waste management.		x	x													
3	Plan and carry out teaching actions relating to solid waste management			x	x	x											

*7.1 **Action** Plan of Environment Education*

No.	Actions	Party involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
	to bring the PRAE into operation.																
4	Evaluate the impact of the actions carried out through the PRAE					x	x										
Goals			2013 – 2015			2016 – 2018			2019 – 2027								
Implement environmental education processes with groups of students of the environmental social service in city schools.																	
No.	Actions	Party Involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Build the pilot formation process in environmental education incorporating solid waste management.		x														
2	Invite the students to create social service groups that will promote solid waste management actions			x	x	x											
3	Implement the actions conceived in the framework of the social service			x	x	x											
4	Follow up to the implementation of the actions through the social service			x	x	x											
5	Evaluate the impact of the actions carried out during the social service					x	x										

Chapter 8

Community Relations

8 Community Relations

8.1 Action Plan of Community Relations

The following is the Action Plan of Community Relations.

Table 8-1: Action Plan of Community Relations

GENERAL OBJECTIVE
1. Guarantee the continuity and proper rendering of the Garbage Collection and Exploitation Service to the users. 2. Foster source separation, as well as an increase of Potentially Recyclable Material and the reduction of waste to be disposed of in landfills 3. Ensure the proper final disposal of ordinary waste 4. Reduce negative environmental impacts associated to the improper generation and disposition of solid waste by recovering those Potentially Recyclable Materials that should become part of productive chains.
Specific Objective
Raise awareness and train 100% of Bogota's population in order to instill responsible consumption habits and encourage proper management and disposal of urban solid waste to achieve reduction, reuse and source separation of Potentially Recyclable Material
Strategies (Inclusion Plan)
1. Implement communication campaigns regarding the "Bogota Basura Cero" (literally: 'Bogota Zero Garbage') Program, addressed to the population in Bogota through institutional channels, mass media (radio, press, television), and by means of alternative dissemination activities.
2. Disseminate the "Basura Cero" ('Zero Garbage') program throughout residential units, commercial - both mini and small - establishments, chain stores, and shopping malls given priority by the District Health Secretariat, local Mayor Offices, the IDPAC (District Institute for Participation and Community Action) and other entities, in order to inform them of the separation/sorting-at-the source process.
3. Disseminate the program among educational institutions. Give information about the actions envisaged in the "Cero Basura" Program in all the (2,376 district and 2,016 private) schools in Bogota. Incorporate in the District Schools' PIGA (Institutional Environmental Management Plan) the actions contemplated in the "Cero Basura" Program. Disseminate the actions included in the "Cero Basura" Program among the PRAE's leaders in district schools. Encourage pilot training processes in the area of environmental education with student groups of the social environment service in district schools.
4. Extend the Program to other institutions in order to make people aware of actions leading to reduction, reuse, and separation/sorting at the source

1.1. Goals			2013 – 2015			2016 – 2018			2019 – 2027								
Design 1 communication campaign addressed to all the citizens at large																	
No.	Actions	Party Involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Design a communication strategy aimed at promoting waste reduction, reuse, and separation/sorting at the source, and reviewing key contents for the community.		x														

1.2. Goals			2013 – 2015			2016 – 2018			2019 – 2027								
Keep disseminating information towards the reduction, reuse and separation/sorting at the source on notice boards or electronic means of the 6 SUPERCADES and the 18 CADES (Specialized District Service Centers) and 'Transmilenio' stations.																	
No.	Actions	Party Involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Design and produce virtual pieces concerning the "Basura Cero" (literally: 'Zero Garbage') program for publication in electronic media.		x														
2	Disseminate the virtual pieces concerning the "Basura Cero" Program on a rotating basis.		x	x	x												

1.3. Goals			2013 – 2015			2016 – 2018			2019 – 2027								
Reproduce on the Mayor's Office line 195 the information oriented towards waste reduction, reuse and separation/sorting at the source																	
No.	Actions	Party Involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Produce and record an audio with messages aimed at reduction, reuse and separation/sorting at the source on line 195		x														
2	Disseminate the message destined for waste reduction, reuse and separation/sorting at the source on the different 195 switchboards		x	x	x												

1.4. Goals			2013 – 2015			2016 – 2018			2019 – 2027								
Spread the "Basura Cero" Program message on 4 radio stations with high audience figures and wide coverage in the city and on 4 alternative and/or local radio spaces																	
No.	Actions	Party Involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Manage inter-institutional actions for media strategy implementation		x	x													
2	Produce and/or record the institutional message of the "Basura Cero" campaign to be sent to the media selected		x	x	x												

1.5. Goals			2013 – 2015			2016 – 2018			2019 – 2027								
Advertise in 7 mass television channels with wider coverage in the city, and 3 local TV channels																	
No.	Actions	Party Involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Request from the different media the best offer allowing for advertising in newsprint, radio, and television		x	x	x												

1.6.Goals			2013 – 2015			2016 – 2018			2019 – 2027								
Advertise in 6 print media with the widest coverage in the city and 6 alternative or community print media.																	
No.	Actions	Party Involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Broadcast the "Basura Cero" message on the media selected according to the media plan		x	x	x												

1.7. Goals			2013 – 2015			2016 – 2018			2019 – 2027								
Carry out 30 alternative activities on a bi-annual basis																	
No.	Actions	Party Involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Plan the alternative dissemination activities (for instance: Clean points, "reciclatones", itinerant exhibitions, free press, and so forth.)		x	x	x												
2	Implement the projected activities		x	x	x												
3	Assess achievement of the proposed objective in the activities carried out		x	x	x												

2.1. Goals			2013 – 2015			2016 – 2018			2019 – 2027								
Train 2 000 recyclers in the separation at the source program/client service for them to carry out their visits to residential units and commercial establishments																	
No.	Actions	Party Involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Create inter-institutional agreements for recycler preparation and training		x														
2	Identify those recyclers interested in carrying out the inspection visits to encourage separation/sorting at the source		x	x	x												
3	Call meetings to carry out the training sessions offered to recyclers.		x	x	x												
4	Carry out the recycler training plan		x	x	x												

2.2. Goals			2013 – 2015			2016 – 2018			2019 – 2027								
Visit 1,752.000 residential and 457,000 multifamily units, 247,029 commercial establishments, chain stores, shopping malls, 16 district market places ("IPES"), and 40 social economy centers ("IPES")																	
No.	Actions	Party Involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Plan with 20 localities the group trainers in order to carry out the visits projected (field distribution should be agreed upon with the different institutions with which a district agreement has been made).		x	x													
2	Carry out and keep a register of the programmed visits by locality		x	x	x												
3	Carry out the follow-up of programmed visits by locality		x	x	x	x	x										

2.3. Goals			2013 – 2015			2016 – 2018			2019 – 2027								
Spread the program in 20 CIGARRAS (at least 1 per locality)																	
No.	Actions	Party Involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Sign with the IDPAC the agreement leading to make the "Basura Cero" known through the CIGARRAs (Fostering Committees for the Governance of Water, Recycling, and Sanitation).		x														
2	Organize accompanying teams and define activities to be carried out in the CIGARRAs.		x														
3	Promote the dissemination of the "Basura Cero" program through the CIGARRAs		x	x	x												

3.1.Goals			2013 – 2015			2016 – 2018			2019 – 2027								
Inform and make aware 100% of the public (360) and private (2,016) district schools of actions leading to waste reduction, reuse and separation at the source																	
No.	Actions	Party Involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Create interinstitutional agreements for strategy implementation.		x	x	x												
2	Agree upon the contents and design of communication pieces and teaching material to be delivered to schools by articulating work among UAESP, SED and SDS Promoters, the Aqueduct, the local Mayors' Offices and JALs		x														
3	Plan with localities the visits to be paid to schools in order to carry out the activities (articulate work with UASP, SED, SDS promoters, the Aqueduct, the local Mayors' Offices and JALs)		x	x	x												
4	Carry out activities allowing for the dissemination of the program from schools (through contests, workshops, newspapers, radio stations, young journalist networks, the creation of stage plays, paintings, graffiti, artistic language experiences, video clips, insight and awareness visits regarding the proper and responsible management of solid waste, events and/or gatherings. Carry out informative meetings with Public School Principals, among others.)		x	x	x												
5	make visible through virtual tools the activities carried out in schools.		x	x	x												

Goals	2013 – 2015	2016 – 2018	2019 – 2027
Provide information relating to actions carried out on waste reduction, reuse and separation/sorting at the source to the RIJA (the Children and Young People's Environmental Network).			

No.	Actions	Party Involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Agree upon the contents of actions in the "Basura Cero" program to be informed on the Network.		x														
2	Promote visualization of "Basura Cero" actions on the Network		x	x	x												

3.3. Goals	2013 – 2015	2016 – 2018	2019 – 2027
Keep 100% of the private schools in Bogota informed of actions envisaging waste reduction, reuse and separation/sorting at the source			

No.	Actions	Party Involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Create inter-institutional agreements for strategy implementation		x	x													
2	Agree upon the contents and design of communication pieces and/or teaching material to be delivered to schools		x	x													
3	Carry out events and/or meetings from the Secretariat of Education serving to foster socialization and program dissemination.		x	x	x												

3.4. Goals	2013 – 2015	2016 – 2018	2019 – 2027
Provide 5,000 public and private school teachers with information			

No.	Actions	Party Involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Create an agreement for strategy implementation with the Secretariat of District Education - SED		x														
2	Agree upon the contents of actions to be informed to teachers regarding waste reduction, reuse and separation at the source		x														
3	Foster, with the teachers, those actions serving to make visible waste reduction, reuse and separation at the source processes		x	x	x												
4	Carry out actions with teachers to make visible waste reduction, reuse and separation at the source on the Teachers' Environmental Network.		x	x	x												

3.5. Goals	2013 – 2015	2016 – 2018	2019 – 2027
Incorporate in District Schools' PIGA (Institutional Environmental Management Plan) the guidelines for the implementation of waste reduction, reuse and separation at the source actions.			

No.	Actions	Party Involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Create the necessary agreements required for strategy implementation		x														
2	Analyze PIGA outlines in the light of the current legislation concerning proper solid waste management		x														
3	Design a Technical Guide for PIGA implementation in district schools (virtual booklet or guide) aimed at promoting reduction, reuse and separation-at-the-source actions		x														
4	Disseminate the virtual PIGA guide in 100% of schools in Bogota		x	x	x												
5	Carry out a pilot plan for the implementation of PIGA guidelines in District Schools		x	x	x												
6	Follow up the implementation of PIGA guidelines at District Schools in Bogota		x	x	x												

3.6. Goals	2013 – 2015	2016 – 2018	2019 – 2027
Spread among the leaders of Environmental School Projects (PRAEs) in the 357 district schools those actions oriented towards waste reduction, reuse and separation at the source			

No.	Actions	Party Involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Identify the PRAES with emphasis on solid waste management		x														
2	Organize meetings with the Schools' PRAE leaders in order to encourage the implementation of actions dealing with solid management at district schools		x	x													
3	Plan and carry out pedagogical actions aimed at waste reduction, reuse and separation at the source within the framework of the Environmental Week celebration as part of PRAE operation			x	x	x											

Goals	2013 – 2015	2016 – 2018	2019 – 2027
Promote processes addressing pilot training programs in environmental education with 22 social environmental student groups in district schools			

No.	Actions	Party Involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Build the pilot training program in environmental education with emphasis on solid waste management		x														
2	Invite students to organize social service groups aimed at fostering solid waste management actions		x	x	x	x	x										
3	Carry out the actions outlined within the social service framework		x	x	x	x	x										
4	Follow up the implementation of actions through the social service		x	x	x	x	x										
5	Follow up and evaluate the impact of actions carried out through the social service		x	x	x	x	x										

3.8. Goals	2013 – 2015	2016 – 2018	2019 – 2027
Foster 1 activity dealing with artistic and oral expressions, reading and/or writing oriented toward waste reduction, reuse and separation at the source in each IED (District Educational Institution)			

No.	Actions	Party Involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Create the necessary agreements required for strategy implementation		x	x													
2	Suggest activities consisting of artistic and oral expressions, reading and/or writing dealing with waste reduction, reuse and separation at source to be performed in district schools		x	x	x												
3	Plan the performance in each district school of the activities oriented towards waste reduction, reuse and separation at the source		x	x	x												
4	Carry out the activity oriented towards waste reduction, reuse and separation at the source as programmed by the district school		x	x	x												
5	make visible the results of activities oriented towards waste reduction, reuse and separation at the source as carried out in the district schools		x	x	x												

4.1. Goals	2013 – 2015	2016 – 2018	2019 – 2027

Visit 316 Nursery Schools/Kindergartens																		
No.	Actions	Party Involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Create agreements for strategy implementation		x														
2	Design the pieces containing information oriented to waste reduction, reuse and separation at the source to be delivered to kindergartens		x														
3	Carrying out activities leading to disseminate information (i.e. contests, workshops, and so forth), oriented towards waste reduction, reuse and separation at the source		x	x	x												

4.2. Goals			2013 – 2015			2016 – 2018			2019 – 2027								
Visit 250 Community Kitchens in order to promote actions leading to waste reduction, reuse and separation at the source																	
No.	Actions	Party Involved	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1	Enter into an agreement with the SDS (District Health Secretariat) for strategy implementation		x														
2	Design the pieces oriented toward waste reduction, reuse and separation at the source to be delivered to the community kitchens		x														
3	Carry out activities oriented to waste reduction, reuse and separation at the source serving to disseminate information (i.e. contests, workshops, and so forth).		x	x	x												

APPENDICIES

Appendix 1

Seminars and Public Relations

CONTENTS

Page:

1 Meetings and Seminars

1.1 JCC Meetings

1.2 C/P Meetings

1.3 Seminars

1.3.1 Kick-off Seminar

a. Objective

The objectives of the seminar are:

- To inform stakeholders of the objectives and outline of the project.
- To share the experiences in solid waste management between Japan and Bogota.

b. Date and Venue

- Date: June 1st, 2012
- Place: Auditorium of the UAESP, the 3rd floor

c. Participants

Approximately 20 people participated in the seminar from the following organizations:

- UAESP
- Localities of the Bogota
- APC – Colombia
- NGOs
- JICA

d. Seminar Program

The seminar program is shown in the table below.

Cheer person: Ms. Nhora USME, adviser of the external relations of UAESP

Hours	Topic	Presenter
7.30 – 8.00	Registration of participants	
8.00 – 8.30	Opening address by UAESP	Ms. Nhora USME -UAESP
8.30 – 9.30	Outline of the project and waste treatment technologies and eco-town in	Sr. Ikuo MORI -JICA

Hours	Topic	Presenter
	Japan	
9.30 – 10.00	"Inclusion Plan" of the Bogota D.C.	Ms. Nhora USME -UAESP
10.00– 11.00	Questions and answers	
11.00	Closing remarks by UAESP	Ms. Nhora USME -UAESP

1.3.2 Seminar on Training in Chile

a. Objective

The objective of the seminar is:

- To share the experiences of the training in Chile among UAESP officers

b. Date and Venue

- Date: September 21st , 2012
- Place: Meeting room of the UAESP, the 6th floor

c. Participants

Approximately 30 people participated in the seminar from the following organizations:

- UAESP
- JICA

d. Seminar Program

The seminar program is shown in the table below.

Cheer person: Mr. Pedro Ramos, sub-director of the department of final disposition of UAESP

Hours	Topic	Presenter
14.00 – 14.10	Opening address by UAESP	Mr. Pedro Ramos -UAESP
14.10 – 15.30	Experiences in the training in Santiago, Chile	Mr. Pedro Ramos & Argemiro Plaza -UAESP
15.30– 16.00	Questions and answers	
16.00	Closing remarks by UAESP	Mr. Pedro Ramos -UAESP

1.3.3 3R Seminar - Japanese Experiences towards Zero Waste

a. Objective

The objectives of the seminar are:

- To share the foreign experience and knowledge of solid waste management in terms of technology and policy in order to apply for the future design and plan of solid waste management in Bogota.
- To introduce the progress of revision of PMIRS

b. Date and Venue

- Date: December 13th, 2012
- Place: Auditorium Félix Restrepo of the University of Javeriana

c. Participants

Approximately 30 people participated in the seminar from the following organizations:

- University of Javeriana
- UAESP
- Localities of the Bogota
- Secretary of Environment
- Secretary of Planning
- ANDI
- JICA

d. Seminar Program

The seminar program is shown in the table below.

Cheer person: Dr. Jose Maria Castillo Ariza, professor of the Uni. of Javeriana

Hours	Topic	Presenter
7.30 – 8.00	Registration of participants	
8.00 – 8.30	Opening addresses by UAESP and JICA	Mr. Hidemitsu SAKURAI - JICA Dr. Nelly Mogollón - UAESP
8.30 – 9.00	General concept of 3R and Zero Waste	Dr. Sandra Méndez - Uni. of Javeriana
9.00 – 9.45	3R policy in Japan	Mr. Ikuo MORI -JICA

Hours	Topic	Presenter
9.45 – 10.15	Intermediate treatment technologies of solid waste management in Japan	Mr. Tamotsu SUZUKI - JICA
10.15 – 10.30	**Coffee break**	
10:30 - 11.00	Case study of integrated waste management model in Punta Cana of Dominican Republic	Dr. Victor Ojeda - Consultant
11:00 - 11.30	Case study of Santiago Recycle Action Plan	Mrs. Ximena Alegría - JICA
11.30 – 12.00	Progress of revision of PMIRS in Bogota	UAESP & District Secretary of Planning
12.00 – 12.45	Questions and answers	
13.00	Closing remarks by UAESP	Dr. Jose Maria – Uni. of Javeriana

1.3.4 Internal Seminar on PMIRS and Training in Japan

a. Objective

The objectives of the seminar are:

- To share the experiences of the training in Japan
- To introduce the progress of the revision of PMIRS among UAESP officers

b. Date and Venue

- Date: April 23rd, 2013
- Place: Auditorium of the UAESP, the 3rd floor

c. Participants

Approximately 30 people participated in the seminar from the following organizations:

- UAESP
- JICA

d. Seminar Program

The seminar program is shown in the table below.

Cheer person: Ms. Nhora USME, adviser of the external relations of UAESP

Hours	Topic	Presenter
2.00 – 2.30	Registration of participants	
2.30 – 3.00	Opening address by UAESP	Dr. Nelly Mogollón - UAESP
3.00 – 3.30	3R policy in Japan	Mr. Ikuo MORI -JICA
3.30 – 4.15	Experiences of the training in Japan	Mrs. Nhora USME, Mr. Pedro Ramos, Mrs. Angela Maria Gayon, Mr. Diego Humberto Triana, Mrs. Belquis Sepúlveda -UAESP
4:15 - 5.00	Progress of the revision of PMIRS	Mrs. Hilda Castro- UAESP
5.00	Closing remarks by UAESP	Mrs. Nhora USME - UAESP

1.3.5 Internal Seminar on PMIRS

a. Objective

The objective of the seminar is:

- To introduce the progress of revision of PMIRS among UAESP officers

b. Date and Venue

- Date: July 10th, 2013
- Place: Auditorium of the UAESP, the 3rd floor

c. Participants

Approximately 30 people participated in the seminar from the following organizations:

- UAESP
- JICA

d. Seminar Program

The seminar program is shown in the table below.

Cheer person: Ms. Nhora USME, adviser of the external relations of UAESP

Hours	Topic	Presenter
8.30 – 9.00	Registration of participants	
9.00 – 9.15	Opening address by UAESP	Mr. Ismael Martinez - UAESP
9.15 – 10.00	Presentation on PMIRS	Mr. Ikuo MORI -JICA
10.00 – 11.00	Progress of the revision of PMIRS	Mrs. Nhora USME
11:00 - 11.30	Questions and answers	
11.30	Closing remarks by UAESP	Mrs. Nhora USME - UAESP

1.3.6 Project Closing Seminar

a. Objective

The objectives of the seminar are:

- To share the foreign experiences in solid waste management
- To introduce the progress of the revision of PMIRS among all stakeholders in Bogota

b. Date and Venue

- Date: August, 28th, 2013
- Place: Hotel Tequendama, Salon Monserrate

c. Participants

Approximately 200 people participated in the seminar from the following organizations:

- UAESP
- 20 Localities of Bogota
- BID
- IPLA
- Ministry of Housing
- Ministry of Environment
- Secretary of Environment
- Secretary of Planning
- Secretary of Health
- Secretary of Education
- Acueducto

- Agua de Bogota
- ANDI
- CEMPRE
- ANDESCO
- ACODAR
- CRA
- RSDJ
- Contractor of the RBL
- Reciclers Association
- Recycling Enterprises
- Academy
- NGOs
- JICA

d. Seminar Program

The seminar program is shown in the table below.

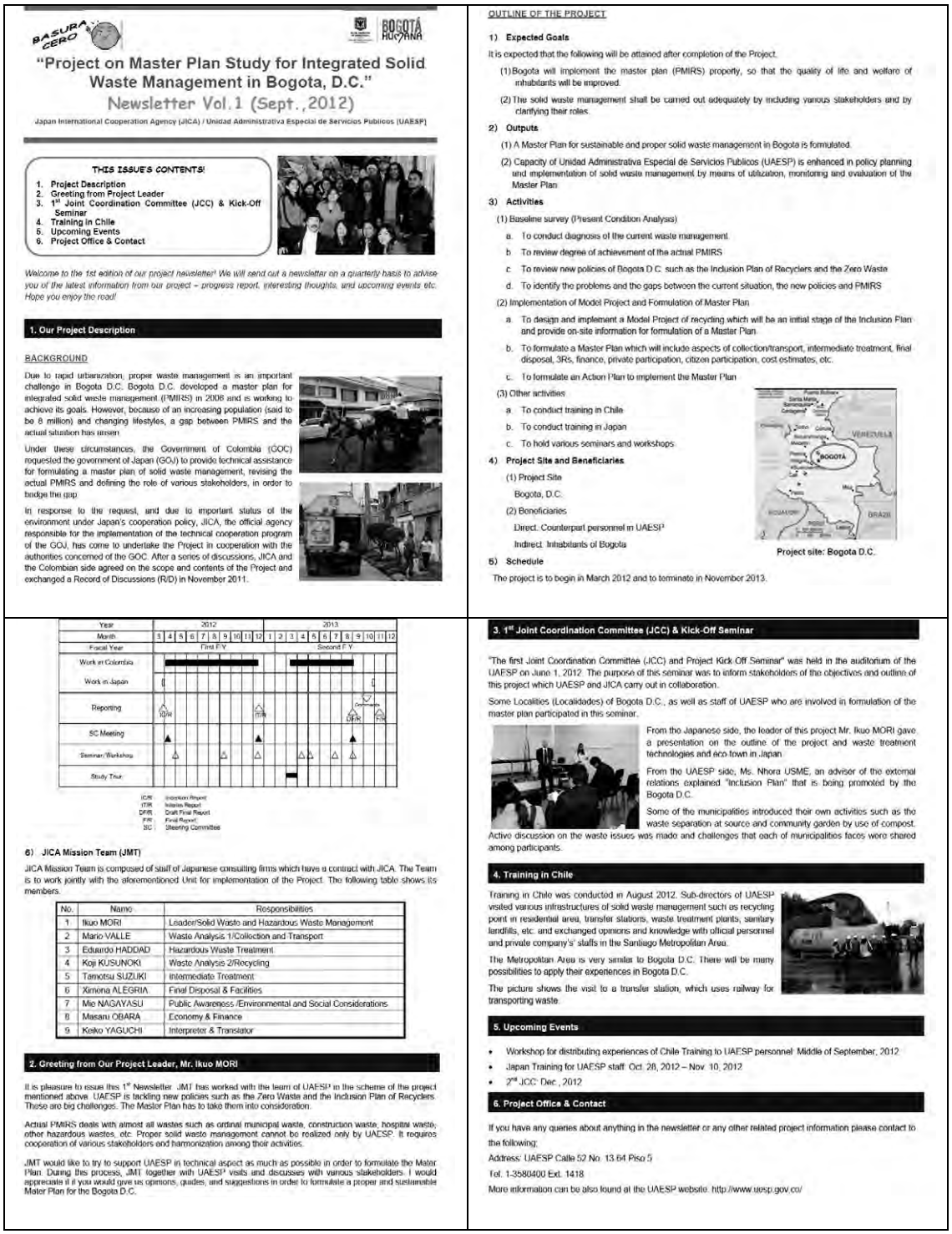
Cheer person: Ms. Nhora USME, adviser of the external relations of UAESP

Hours	Topic	Presenter
08:00-08:30	Registration of participants	
08:30-09:00	Opening address by UAESP	Mr. Hidemitsu SAKURAI-JICA, Dr. Nelly Mogollón - UAESP
09:00-09:45	3R policy in Japan	Mr. Koji KUSUNOKI -JICA
09:45-10:15	Experiences of the recycling in Chile	Mrs. Ximena Alegría - JICA
10:15-10:30	Coffee break	
10:30-11:00	Master Plan Project	Mr. Ikuo MORI - JICA
11:00-12:00	Action Plan for PMIRS	Sub-directors of RBL, Recycling, Final Disposal, Construction Waste, Organic Waste, Hazardous Waste, RAEE, Education
12:00-12:30	Progress of the revision of PMIRS	Mr. Fredy Rodriguez -District Secretary of Planning
12:30-13:00	Questions and answers	
13:00	Closing remarks by UAESP	UAESP

1.4 Public Relations Activities

1.4.1 Newsletters

Newsletters both in English and Spanish were published four times throughout the project. Contents of each newsletter are shown below.



"Project on Master Plan Study for Integrated Solid Waste Management in Bogota, D.C."

Newsletter Vol.1 (Sept., 2012)

Japan International Cooperation Agency (JICA) / Unidad Administrativa Especial de Servicios Publicos (UAESP)

THIS ISSUE'S CONTENTS!

1. Project Description
2. Greeting from Project Leader
3. 1st Joint Coordination Committee (JCC) & Kick-Off Seminar
4. Training in Chile
5. Upcoming Events
6. Project Office & Contact

Welcome to the 1st edition of our project newsletter! We will send out a newsletter on a quarterly basis to advise you of the latest information from our project – progress report, interesting thoughts, and upcoming events etc. Hope you enjoy the read!

1. Our Project Description

BACKGROUND

Due to rapid urbanization, proper waste management is an important challenge in Bogota D.C. Bogota D.C. developed a master plan for integrated solid waste management (PMIRS) in 2006 and is working to achieve its goals. However, because of an increasing population (said to be 8 million) and changing lifestyles, a gap between PMIRS and the actual situation has arisen.

Under these circumstances, the Government of Colombia (GOC) requested the government of Japan (GOJ) to provide technical assistance for formulating a master plan of solid waste management, revising the actual PMIRS and defining the role of various stakeholders, in order to bridge the gap.

In response to the request, and due to important status of the environment under Japan's cooperation policy, JICA, the official agency responsible for the implementation of the technical cooperation program of the GOJ, has come to undertake the Project in cooperation with the authorities concerned of the GOC. After a series of discussions, JICA and the Colombian side agreed on the scope and contents of the Project and exchanged a Record of Discussions (R/D) in November 2011.

OUTLINE OF THE PROJECT

1) Expected Goals

It is expected that the following will be attained after completion of the Project.

(1) Bogota will implement the master plan (PMIRS) properly, so that the quality of life and welfare of inhabitants will be improved.

(2) The solid waste management shall be carried out adequately by including various stakeholders and by clarifying their roles.

2) Outputs

(1) A Master Plan for sustainable and proper solid waste management in Bogota is formulated.

(2) Capacity of Unidad Administrativa Especial de Servicios Publicos (UAESP) is enhanced in policy planning and implementation of solid waste management by means of utilization, monitoring and evaluation of the Master Plan.

3) Activities

(1) Baseline survey (Present Condition Analysis)

a. To conduct diagnosis of the current waste management.
b. To review degree of achievement of the actual PMIRS.
c. To review new policies of Bogota D.C. such as the Inclusion Plan of Recyclers and the Zero Waste.
d. To identify the problems and the gaps between the current situation, the new policies and PMIRS.

(2) Implementation of Model Project and Formulation of Master Plan

a. To design and implement a Model Project of recycling which will be an initial stage of the Inclusion Plan and provide on-site information for formulation of a Master Plan.
b. To formulate a Master Plan which will include aspects of collection/transport, intermediate treatment, final disposal, 3Rs, finance, private participation, citizen participation, cost estimates, etc.
c. To formulate an Action Plan to implement the Master Plan.

(3) Other activities

a. To conduct training in Chile.
b. To conduct training in Japan.
c. To hold various seminars and workshops.

4) Project Site and Beneficiaries

(1) Project Site

Bogota, D.C.

(2) Beneficiaries

Direct: Counterpart personnel in UAESP

Indirect: Inhabitants of Bogota

Project site: Bogota D.C.

5) Schedule

The project is to begin in March 2012 and to terminate in November 2013.

Year	2012												2013											
Month	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12		
Fiscal Year	First F.Y.												Second F.Y.											
Work in Colombia																								
Work in Japan																								
Reporting																								
SC Meeting																								
Seminar/Workshop																								
Study Tour																								

ICR : Inception Report
ITR : Interim Report
DFR : Draft Final Report
FR : Final Report
SC : Steering Committee

6) JICA Mission Team (JMT)

JICA Mission Team is composed of staff of Japanese consulting firms which have a contract with JICA. The Team is to work jointly with the aforementioned Unit for implementation of the Project. The following table shows its members.

No.	Name	Responsibilities
1	Ikuo MORI	Leader/Solid Waste and Hazardous Waste Management
2	Mario VALLE	Waste Analysis 1/Collection and Transport
3	Eduardo HADDAD	Hazardous Waste Treatment
4	Koji KUSUNOKI	Waste Analysis 2/Recycling
5	Tamotsu SUZUKI	Intermediate Treatment
6	Ximena ALEGRIA	Final Disposal & Facilities
7	Mie NAGAYASU	Public Awareness /Environmental and Social Considerations
8	Masaru OBARA	Economy & Finance
9	Keiko YAGUCHI	Interpreter & Translator

2. Greeting from Our Project Leader, Mr. Ikuo MORI

It is pleasure to issue this 1st Newsletter. JMT has worked with the team of UAESP in the scheme of the project mentioned above. UAESP is tackling new policies such as the Zero Waste and the Inclusion Plan of Recyclers. Those are big challenges. The Master Plan has to take them into consideration.

Actual PMIRS deals with almost all wastes such as ordinal municipal waste, construction waste, hospital waste, other hazardous wastes, etc. Proper solid waste management cannot be realized only by UAESP. It requires cooperation of various stakeholders and harmonization among their activities.

JMT would like to try to support UAESP in technical aspect as much as possible in order to formulate the Mater Plan. During this process, JMT together with UAESP visits and discusses with various stakeholders. I would appreciate if if you would give us opinions, guides, and suggestions in order to formulate a proper and sustainable Mater Plan for the Bogota D.C.

3. 1st Joint Coordination Committee (JCC) & Kick-Off Seminar

"The first Joint Coordination Committee (JCC) and Project Kick Off Seminar" was held in the auditorium of the UAESP on June 1, 2012. The purpose of this seminar was to inform stakeholders of the objectives and outline of this project which UAESP and JICA carry out in collaboration.

Some Localities (Localidades) of Bogota D.C., as well as staff of UAESP who are involved in formulation of the master plan participated in this seminar.

From the Japanese side, the leador of this project Mr. Ikuo MORI gave a presentation on the outline of the project and waste treatment technologies and eco-town in Japan.

From the UAESP side, Ms. Nhora USME, an adviser of the external relations explained "Inclusion Plan" that is being promoted by the Bogota D.C.

Some of the municipalities introduced their own activities such as the waste separation at source and community garden by use of compost. Active discussion on the waste issues was made and challenges that each of municipalities faces were shared among participants.

4. Training in Chile

Training in Chile was conducted in August 2012. Sub-directors of UAESP visited various infrastructures of solid waste management such as recycling point in residential area, transfer stations, waste treatment plants, sanitary landfills, etc. and exchanged opinions and knowledge with official personnel and private company's' staffs in the Santiago Metropolitan Area.

The Metropolitan Area is very similar to Bogota D.C. There will be many possibilities to apply their experiences in Bogota D.C.

The picture shows the visit to a transfer station, which uses railway for transporting waste.

5. Upcoming Events

- Workshop for distributing experiences of Chile Training to UAESP personnel: Middle of September, 2012
- Japan Training for UAESP staff: Oct. 28, 2012 – Nov. 10, 2012
- 2nd JCC: Dec., 2012

6. Project Office & Contact

If you have any queries about anything in the newsletter or any other related project information please contact to the following;

Address: UAESP Calle 52 No. 13-64 Piso 5

Tel. 1-3580400 Ext. 1418

More information can be also found at the UAESP website: http://www.uesp.gov.co/

Figure 1-1: Newsletter No.1

BASURA CERO

BOGOTÁ HUMANA

"Project on Master Plan Study for Integrated Solid Waste Management in Bogota, D.C."

Newsletter Vol.2 (Dec.,2012)

Japan International Cooperation Agency (JICA) / Unidad Administrativa Especial de Servicios Publicos (UAESP)

THIS ISSUE'S CONTENTS!

1. Alqueria Model Project (AMP) for Separate Collection of Recyclables
2. Workshop on Training in Chile
3. JICA Training in Japan
4. Upcoming Events and Activities
5. New Project Office & Our Contact

Welcome to the 2nd edition of our project newsletter! In this edition, we would like to introduce you our model project, the Alqueria Model Project, and some interesting comments from the participants of the JICA Training in Japan etc. Hope you enjoy the read!

1. Alqueria Model Project for Separate Collection of Recyclables

As a part of our project activities, the JICA and UAESP are now planning to implement the model project for separate collection of recyclables called Alqueria Model Project (AMP) in the Central Kennedy UPZ 47 area.

The policies of the project have been set in order to verify the feasibility of the following objectives in the Master Plan for Integrated Solid Waste Management (PMIRS) in Bogota D.C.:

- To implement separate collection of recyclable materials as a public service
- To expand the covered area of separate collection in the entire city of Bogota and to establish recycling depot accordingly
- To promote waste separation at source of service users though public education
- To provide waste collection service based on the waste fee collection
- To establish a recyclers cooperative by organizing existing individual recyclers and authorized recycler organization (ORA), who is to be in charge of transportation of recyclables and operation of recycling depot

In the next year 2013, 16 ORAs will be made into one recyclers cooperative and registered. Each ORA is to sign on agreement on recycling service with the city and get paid by the city according to the agreement. The year 2014 onwards, the expansion of the separate collection area will be considered and the target year of expansion in the entire city will be set up.

2. Workshop on Training in Chile

In order to share the experiences of the training in Chile, a half-day workshop was held on Sept. 21, 2012 at the UAESP. Sub-directors of the UAESP who participated in this training made presentations on their own experiences and thoughts to other staff of the UAESP.

Many questions and comments on recycling facilities and waste transfer system in Chile were made among the participants.

Since the characteristics of the Metropolitan Area of Santiago are quite similar to Bogota D.C., they found that there were some possibilities to apply the Chilean technologies and experiences in Bogota D.C. for the future.

3. JICA Training in Japan

JICA provides various kinds of training program in Japan, whose objective is to develop human resources for strengthening institution to which they belong, so that they can contribute to find solutions of problems in its respective countries.

In order for the UAESP staff to obtain knowledge and skills regarding the 3R policy and advanced recycling technologies in Japan, nine staff participated in "Project Counterpart Training" from Oct. 29 to Nov. 10, 2012.

Besides that, one of the UAESP staff also participated in the JICA Group Training Course for "Integrated Solid Waste Management for Administrators in Central and South America" from Oct. 3 to Nov. 17, 2012.

Now we will listen to some of the interesting experiences they had in Japan!

~Interview with Ms. Belquis Sepulveda/Participant of the Project Counterpart Training~

Please introduce yourself.

My name is Belquis Sepulveda Mantope. I work as an officer of the department of final disposition at the UAESP and in charge of supervision of the operation and maintenance of the sanitary landfill Doña Juana of the the Bogotá city.

Please share with us your experiences you had in the training.

Thanks to the contribution of each one of the vivid experiences in the program, I could acquire technical, administrative, and cultural tools that allow me to establish strategies on the integral solid waste management in Colombia.

Even though the cultural and economic backgrounds are different between Japan and Colombia, it was interesting for me to see the convergence in such relating matters as environmental conservation and integrated solid waste management, implementing separation at source, material recovery, material recycle and implementing the policy of 3R's and zero waste.

What are your plans to realize what you have learned in Japan?

One of our objectives is to support in the development of the local policy of Bogotá "Zero Waste", and to drive these initiatives to different departments and municipalities of Colombia by sharing the experiences and trying to promote the strategy of "Zero Waste" as a tool that contributes to the sustainable development.

What kind of impression about Japan you had trough the training?

The training has been through more than my expectations actually. I personally hope to incorporate these values of Japanese punctuality, honesty, well-organized system, and effectiveness in development of our activities.

~Interview with Mr. Diego Martinez/Participant of the Project Counterpart Training~

Please introduce yourself.

My name is Diego Humberto Triana Domínguez. I am 29 years old and was born in Bogotá. I am specialized in the area of environmental and sanitary engineering. At present, I work as an officer of the department of waste collection and cleaning at the UAESP and in charge of developing supervision of operation of the public service in the area of exclusive service.

Please share with us your experiences you had in the training.

The vivid experiences in the training of Japan that enriched my concept were the followings:

The model city in Tokyo "Super Eco Town" where these separated and categorized waste by its type of material are treated in the different recycling plants such as incineration plant, organic waste plant and industrial waste processing center in the specific island under integrated waste management system.

The Japanese citizens were so committed to take actions with common sense to be a part of waste generators. They have the shared responsibility to take action and are chained up with the integrated management of all kinds of materials in their life cycle.

The level of commitment of all actors involved in the solid waste management such as private sector, public sector, and people in relation to the importance of the recyclable materials and the environmental conservation is very high.

There is the opportunity to improve the level of cooperation between our brother country Japan and Colombian society at all level.

I reaffirmed that what we learned from the training was that the functionality rather than form.

What are your plans to realize what you have learned in Japan?

To support in the technical component from consultation engineering area in realizing the master plan of integrated solid waste management of the capital district.

To change my consumption patterns and behaviors as a human being.

To help neighboring people change their behaviors to meet with the principle of the reality and the common sense.

What kind of impression about Japan you had trough the training?

Japan is a country with deep transformation phenomena and has the clearly defined ideas such as LIVE WITH A HIGH QUALITY OF LIFE, and A BETTER TOMORROW FOR ALL. It is my faithful understanding that we as human beings should reform our philosophy and lifestyle and understand that we are oneself universe and that the problem becomes for ourselves when not understanding that it is possible to have a better tomorrow if we make the better today.

Other thoughts?

The landscape, the public space and all the elements and objects that constituted of surprise you from the color of the land until the height of trees. There is the public inclusion of the people with physical and intellectual disabilities in Japan. Although Japan is a country that has only few natural resources in comparison to my country, it has an integrated formation in its peoples, which cannot be seen in the habitants in my country.

~Interview with Ms. Yira Bolaños/Participant of the JICA Group-Training Course~

Please introduce yourself.

My name is Yira Bolaños Enriquez. I am an environmental engineer specialized in environmental impact assessment and wide trajectory in the public sector. I have been working in the department of recycling at the UAESP for more than 2 years.

Please share with us your experiences you had in the training.

The JICA training program allowed me to know the advanced technologies that Japan has made in the solid waste management and the road that the Japanese society walked trough to develop and to transform into a society based on material recycling.

The lectures and discussions allowed me to strengthen my critical spirit, which will contribute to make decisions in the solid waste management in our country.

In my opinion, the course evidenced that the societies based on material recycling is possible to establish, so that the "Zero Waste" program is also not an utopia. It would be a long process but at the end of the day, we can make it reality with the commitment of all actors of the solid waste management and the political will.

It motivates me even more to continue strengthening the implementation of the program Bogotá Zero Waste of the municipality of the Capital District.

What are your plans to realize what you have learned in Japan?

What I have learned in the program will be applied in the establishment of the concept of 3R's in the Bogotá city through the Master Plan that is the oriented norm of the solid waste management in the city. In addition, it will be included in all the projects implemented by the department of recycling of the UAESP because it is the area where they take decisions and establish the recycling system for the city.

Although the culture of each country is different, the lectures and site visits allow me to take some important elements to apply in my country, in such topics as the normality, implementation of the programs, environmental projects and the environmental education campaigns that reach to a success.

What kind of impression about Japan you had trough the training?

I loved the Japanese sunsets and red trees of the autumn season. I was impressed by Japanese people's hospitality, strength to overcome their adversities, natures, and humans in this country.

4. Upcoming Events & Activities

- 3R Seminar : Japanese Experiences Towards Zero Waste : Dec. 13th, 2012 @ Auditorio Félix Restrepo S.J. of University of Javeriana
- Workshop for Distributing Experiences of Japan Training : End of Dec., 2012

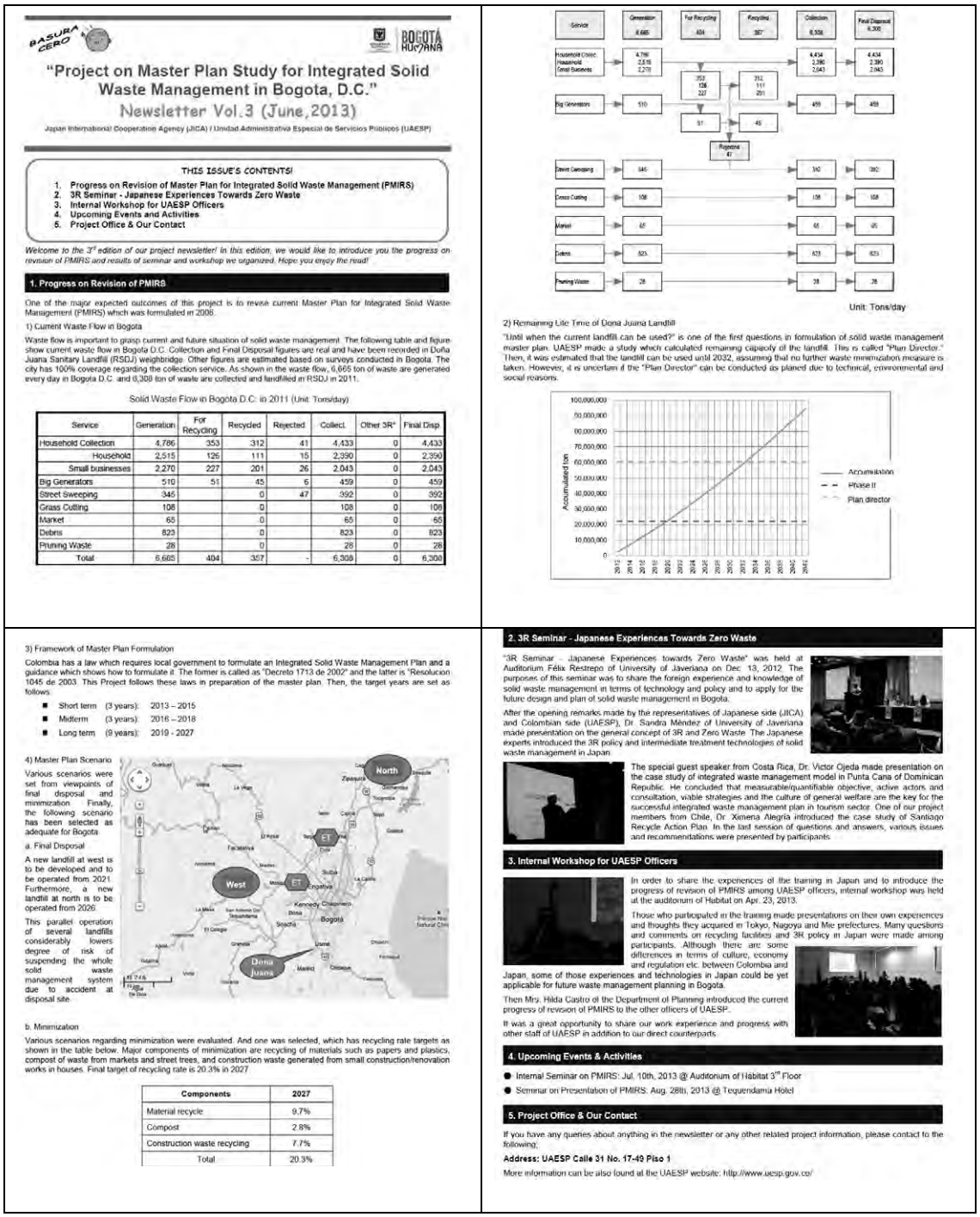
5. New Project Office & Our Contact

We have moved to the new office in November! If you have any queries about anything in the newsletter or any other related project information, please contact to the following;

Address: UAESP Calle 31 No. 17-49 Piso 1

More information can be also found at the UAESP website: http://www.uesp.gov.co/

Figure 1-2: Newsletter No.2



"Project on Master Plan Study for Integrated Solid Waste Management in Bogota, D.C."

Newsletter Vol.3 (June,2013)

Japan International Cooperation Agency (JICA) / Unidad Administrativa Especial de Servicios Públicos (UAESP)

THIS ISSUE'S CONTENTS!

1. Progress on Revision of Master Plan for Integrated Solid Waste Management (PMIRS)
2. 3R Seminar - Japanese Experiences Towards Zero Waste
3. Internal Workshop for UAESP Officers
4. Upcoming Events and Activities
5. Project Office & Our Contact

Welcome to the 3rd edition of our project newsletter! In this edition, we would like to introduce you the progress on revision of PMIRS and results of seminar and workshop we organized. Hope you enjoy the read!

1. Progress on Revision of PMIRS

One of the major expected outcomes of this project is to revise current Master Plan for Integrated Solid Waste Management (PMIRS) which was formulated in 2006.

1) Current Waste Flow in Bogota

Waste flow is important to grasp current and future situation of solid waste management. The following table and figure show current waste flow in Bogota D.C. Collection and Final Disposal figures are real and have been recorded in Doña Juana Sanitary Landfill (RSDJ) weighbridge. Other figures are estimated based on surveys conducted in Bogota. The city has 100% coverage regarding the collection service. As shown in the waste flow, 6,665 ton of waste are generated every day in Bogota D.C. and 6,308 ton of waste are collected and landfilled in RSDJ in 2011.

Solid Waste Flow in Bogota D.C. in 2011 (Unit: Tons/day)

Service	Generation	For Recycling	Recycled	Rejected	Collect.	Other 3R*	Final Disp.
Household Collection	4,786	353	312	41	4,433	0	4,433
Household	2,515	126	111	15	2,390	0	2,390
Small businesses	2,270	227	201	26	2,043	0	2,043
Big Generators	510	51	45	6	459	0	459
Street Sweeping	345		0	47	392	0	392
Grass Cutting	108		0		108	0	108
Market	65		0		65	0	65
Debris	823		0		823	0	823
Pruning Waste	28		0		28	0	28
Total	6,665	404	357	-	6,308	0	6,308

Unit: Tons/day

2) Remaining Life Time of Doña Juana Landfill

"Until when the current landfill can be used?" is one of the first questions in formulation of solid waste management master plan. UAESP made a study which calculated remaining capacity of the landfill. This is called "Plan Director." Then, it was estimated that the landfill can be used until 2032, assuming that no further waste minimization measure is taken. However, it is uncertain if the "Plan Director" can be conducted as planed due to technical, environmental and social reasons.

3) Framework of Master Plan Formulation

Colombia has a law which requires local government to formulate an Integrated Solid Waste Management Plan and a guidance which shows how to formulate it. The former is called as "Decreto 1713 de 2002" and the latter is "Resolucion 1045 de 2003. This Project follows these laws in preparation of the master plan. Then, the target years are set as follows:

- Short term (3 years): 2013 – 2015
- Midterm (3 years): 2016 – 2018
- Long term (9 years): 2019 - 2027

4) Master Plan Scenario

Various scenarios were set from viewpoints of final disposal and minimization. Finally, the following scenario has been selected as adequate for Bogota.

a. Final Disposal

A new landfill at west is to be developed and to be operated from 2021. Furthermore, a new landfill at north is to be operated from 2026.

This parallel operation of several landfills considerably lowers degree of risk of suspending the whole solid waste management system due to accident at disposal site.

b. Minimization

Various scenarios regarding minimization were evaluated. And one was selected, which has recycling rate targets as shown in the table below. Major components of minimization are recycling of materials such as papers and plastics, compost of waste from markets and street trees, and construction waste generated from small construction/renovation works in houses. Final target of recycling rate is 20.3% in 2027.

Components	2027
Material recycle	9.7%
Compost	2.8%
Construction waste recycling	7.7%
Total	20.3%

2. 3R Seminar - Japanese Experiences Towards Zero Waste

"3R Seminar – Japanese Experiences towards Zero Waste" was held at Auditorium Félix Restrepo of University of Javeriana on Dec. 13, 2012. The purposes of this seminar was to share the foreign experience and knowledge of solid waste management in terms of technology and policy and to apply for the future design and plan of solid waste management in Bogota.

After the opening remarks made by the representatives of Japanese side (JICA) and Colombian side (UAESP), Dr. Sandra Méndez of University of Javeriana made presentation on the general concept of 3R and Zero Waste. The Japanese experts introduced the 3R policy and intermediate treatment technologies of solid waste management in Japan.

The special guest speaker from Costa Rica, Dr. Victor Ojeda made presentation on the case study of integrated waste management model in Punta Cana of Dominican Republic. He concluded that measurable/quantifiable objective, active actors and consultation, viable strategies and the culture of general welfare are the key for the successful integrated waste management plan in tourism sector. One of our project members from Chile, Dr. Xenena Alegría introduced the case study of Santiago Recycle Action Plan. In the last session of questions and answers, various issues and recommendations were presented by participants.

3. Internal Workshop for UAESP Officers

In order to share the experiences of the training in Japan and to introduce the progress of revision of PMIRS among UAESP officers, internal workshop was held at the auditorium of Habitat on Apr. 23, 2013.

Those who participated in the training made presentations on their own experiences and thoughts they acquired in Tokyo, Nagoya and Mie prefectures. Many questions and comments on recycling facilities and 3R policy in Japan were made among participants. Although there are some differences in terms of culture, economy and regulation etc. between Colombia and Japan, some of those experiences and technologies in Japan could be yet applicable for future waste management planning in Bogota.

Then Mrs. Hilda Castro of the Department of Planning introduced the current progress of revision of PMIRS to the other officers of UAESP.

It was a great opportunity to share our work experience and progress with other staff of UAESP in addition to our direct counterparts.

4. Upcoming Events & Activities

- Internal Seminar on PMIRS: Jul. 10th, 2013 @ Auditorium of Habitat 3rd Floor
- Seminar on Presentation of PMIRS: Aug. 28th, 2013 @ Tequendama Hotel

5. Project Office & Our Contact

If you have any queries about anything in the newsletter or any other related project information, please contact to the following;

Address: UAESP Calle 31 No. 17-49 Piso 1

More information can be also found at the UAESP website: http://www.uesp.gov.co/

Figure 1-3: Newsletter No.3

"Project on Master Plan Study for Integrated Solid Waste Management in Bogota, D.C."

Newsletter Vol.4 (August, 2013)

Japan International Cooperation Agency (JICA) / Unidad Administrativa Especial de Servicios Publicos (UAESP)

THIS ISSUE'S CONTENTS!

1. **Summary of the Master Plan for Integrated Solid Waste Management (PMIRS)**
2. **Internal Workshops on PMIRS**
3. **Farewell from the JICA Project Leader Mr. Ikuo Mori**
4. **Farewell from the UAESP Sub director Mr. Pedro Ramos**

Welcome to the 4th edition of our project newsletter! We are going to finalize our project in September. In this last edition, we would like to introduce you to our project outcome, the summary of PMIRS and farewells from the Japanese and Colombian sides. We would like to express our sincere appreciation for all of your collaboration for our project.

1. Summary of the Master Plan for Integrated Solid Waste Management (PMIRS)

One of our major project outcomes, the Master Plan has been finalized. The summary is shown below.

1) Objectives and Goals

The following three general objectives were set for the Master Plan:

1. Guarantee the quality and continuity of the garbage collection service to the users.
2. Minimize the amount of solid waste.
3. Guarantee the proper final disposal for unused/unexploited solid waste.

The following specific objectives were defined pursuant to these general objectives:

No.	General/Specific Objectives	Present	Short Term 2013-2015	Medium Term 2016-2018	Long Term 2019-2027
1	**Guarantee the quality and continuity of the garbage collection service to the users.**				
1.1	Maintain coverage of the urban area	100%	100%	100%	100%
1.2	Increase coverage of the rural area	30%	100%	100%	100%
2	**Minimize the amount of solid waste**				
	(total minimization rate)	(5.4%)	(10.8%)	(12.7%)	(20.3%)
2.1	Promote recycling of materials (material recycling minimization rate)	Informal; Alqueria (5.4%)	85 tons/day to the system (6.2%)	427 tons/day to the system (6.2%)	1,074 tons/day to the system (9.7%)
2.2	Develop and extend the composting system (composting minimization rate)	- (0.0)	25 tons/day to the system (1.1%)	58 tons/day to the system (2.0%)	249 tons/day to the system (2.8%)
2.3	Develop and extend the combined CDW recycling system	-	redirect 100% from Doña	901 tons/day to the system	1,055 tons/day to the system
	(CDW minimization)	(0.0%)	Juana landfill: 850 tons/day to the system (3.5%)	(4.5%)	(7.7%)
2.4	Raise awareness and train users to succeed in achieving the reduction, reuse, separation at source and differentiated disposal of solid waste				
3	**Guarantee the proper final disposal of unused/unexploited solid waste**				
3.1	To ensure the operation of the Doña Juana landfill	Optimization Phase I	Optimization Phase II (17 million tons)		Master Plan (35 million tons)
3.2	To reduce the vulnerability of the current final disposal system	-	-	-	2 new landfills

2) Major Facilities

a. Transfer Stations

The plan is to establish two transfer stations, the Western Transfer Station and the Northern Transfer Station. The following is a summary of the facilities:

a.1 Western Transfer Station

Scale: Quantity of waste handled: 4,500 tons/day

Function: Transfer of waste from collection trucks to large trucks.

Location: This is in the western sector of Bogota D.C. Details of the location have not been defined.

Others: It will go into operation as of the year 2021.

a.2 Northern Transfer Station

Scale: Quantity of waste handled: 2,000 tons day

Function: Transfer of waste from collection trucks to large trucks

Location: This is in the northern sector of Bogota D.C. Details of the location have not been defined.

Others: It will go into operation as of the year 2021.

b. Gathering/Collection Center

Scale: Quantity of waste handled: 30 tons/day

Function: Recovery, weighing and collecting recyclable materials from separately collected waste

Location: 36 sites in Bogota D.C. Details of the location have not been defined.

Others: New centers do not necessarily have to be built, as the existing warehouses can be used after they have been improved.

c. Composting plant

Scale: Quantity of waste handled: 100 tons/day

Function: Composting of organic waste from market places, cut grass and tree pruning

Location: 3 sites inside or outside Bogota D.C. Details of the location have not been defined.

Others: New composting plants do not necessarily have to be built; private plants can be used or the private sector can build new plants.

d. CDW Recycling Plant

Quantity: Quantity of waste handled: 200 tons/day

Function: Mixed CDW recycling plant

Location: 3 sites inside or outside Bogota D.C., which are to be established within the disposal site for CDW or zones adjacent to these. Details of the location have not been defined.

Others: These do not necessarily have to be built by the public sector, as existing private plants can be used or new plants could be built by the private sector.

e. New Landfills

The plan is to establish two landfills: the Western Landfill and the Northern Landfill. The following is a summary of the facilities:

e.1 Western Landfill

Scale: Quantity of waste handled: 4,700 ton/day in 2027

Total capacity: approximately 55 million tons

Function: Final disposal of ordinary solid waste.

Location: The plan is for the zone to be outside Bogota D.C. to the west. Details of the location have not been defined.

Others: The landfill will go into operation as of the year 2021.

e.2 Northern Landfill

Scale: Quantity of waste handled: 2,800 tons/day in 2027

Total capacity: approximately 38 million tons.

Function: Final disposal of ordinary solid waste.

Location: The plan is for the zone to be outside Bogota D.C. to the north. Details of the location have not been defined.

Others: It will go into operation as of the year 2026.

At this stage of the study, none of the locations for installation has been defined. However, the following figure shows a projection image of the location of the landfills and the transfer stations, which are large scale facilities.

2. Internal Workshops on PMIRS

In order to introduce the progress of revision of PMIRS among UAESP officers, an internal workshop was held at the auditorium of Habitat on July 10th, 2013. Representatives of the stakeholders such as the secretary of Environment, Secretary of Planning, Secretary of Health as well as the UAESP officers participated in the seminar.

After the opening remarks made by Mr. Ismael Martinez of the Department of Planning of the UAESP, the project leader, Mr. Ikuo Mori made a presentation on the legal framework and objectives of the master plan. Mrs. Ximena Alegria made a presentation on the example of the action plan of the final disposal. Then Mrs. Nhora Usme, the adviser of the external relations of UAESP introduced the current progress of the action plan for the recycling and RBL. In the last session of questions and answers, various issues and recommendations were presented by participants.

3. Farewell from the JICA Project Leader Mr. Ikuo Mori

The goal of the JICA Project was to set up a Master Plan to meet the challenges faced by Bogota D.C. now and in the future, which helps provide a road map in updating the PMIRS to the UAESP. So the next step will begin with the updating of the PMIRS.

This Master Plan focuses on the ordinary waste which concerns the UAESP, but the PMIRS works with all types of solid waste, including hazardous waste, and construction waste generated from large works which do not fall under the responsibility of the UAESP. Consequently, it is expected that the updating of the PMIRS will take place through an articulate interaction of the different offices, such as the District Environment Secretariat, which has authority over said waste, and the District Planning Secretariat, which coordinates the definition of the regulations.

Once the PMIRS is updated, this Master Plan will have legal support and the budget can be allocated to the activities set forth in the Action Plans; it will also rely on the cooperation of other organizations. That is where the true structuring of the solid waste management system starts vis-à-vis the next 30 years.

We, the JICA Expert Team, are very happy to have been able to make many friends in Bogota. On behalf of the team, I would like to say thank you for all the people involved in this Project.

4. Farewell from the UAESP Sub director Mr. Pedro Ramos

In 1983, I graduated from the UNAL in engineering with the project: "Study of a thermal power plant for Bogota using the wastes collected in the city." In February 2012 I joined the UAESP, and had the opportunity to contribute to the mission of JICA experts in the study of revision of Bogota PMIRS. UAESP and JICA have given me the opportunity to visit and learn about different types of operational technologies using municipal solid waste such as the electric generation plant from landfill gas Lomas de los Colorados in Santiago, Chile, and thermoelectric plants in Eco town in Tokyo. It seemed like my thesis had worked out well.

The goals we have set are to be implemented; Bogotá has accepted the challenge of leading a new way of living; healthy and friendly with the environment and vulnerable people. During 2012 the department of final disposition developed the study "Analysis of technologies for MSW treatment". UAESP officials who visited Japan had a very significant contribution, which was formed into a data source on the different plants and technologies analyzed: conventional incineration, pyrolysis, and gasification of MSW, biogas, RDF plants, composting plants and processing plants of organic waste to produce animal foods.

We have not only deepened our expertise, but UAESP and JICA have allowed us to look internally at ourselves as Latinos, and to improve and implement a new cleaning model for Bogotá. In working side by side with the Japanese experts, we had the opportunity to experience firsthand their tremendous professionalism, commitment to efficiency and respect. I therefore express my deepest gratitude to the international team of experts that worked tirelessly for the future of Bogota citizens and Colombia as a whole.

Figure 1-4: Newsletter No.4

1.4.2 Project WEB sites

Project WEB sites were opened both in the UAESP homepage and the JICA homepage. Homepage addresses of the project are shown below.

- UAESP WEB site:
  http://www.uaesp.gov.co/uaesp_jo/index.php?option=com_flippingbook&view=book&id=2&page=1&Itemid=432
- JICA WEB site:

  http://www.jica.go.jp/project/colombia/001/index.html

Appendix 2

Minutes of Meetings

CONTENTS

RECORD OF DISCUSSIONS
ON
PROJECT ON MASTER PLAN STUDY FOR INTEGRATED SOLID WASTE MANAGEMENT IN BOGOTA, D.C.
IN
REPUBLIC OF COLOMBIA
AGREED UPON BETWEEN
UNIDAD ADMINISTRATIVA ESPECIAL DE SERVICIOS PUBLICOS
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Bogota, D.C., the 21st of November 2011

Mr. Kiyoshi YOSHIMOTO
Chief Representative
Colombia Office
Japan International Cooperation Agency

Mr. Juan Carlos JUNCA SALAS
Director General
Unidad Administrativa Especial de Servicios Publicos

Witness,

Ms. Catalina Crane Arango
Acting Director
Agencia Presidencial de Cooperación Internacional de Colombia
APC Colombia

Based on the minutes of meetings on the Detailed Planning Survey on the Project on Master Plan Study for Integrated Solid Waste Management in Bogota, D.C. (hereinafter referred to as "the Project") signed on September 9, 2011 between Unidad Administrativa Especial de Servicios Publicos (hereinafter referred to as "UAESP") and the Japan International Cooperation Agency (hereinafter referred to as "JICA"), JICA held a series of discussions with UAESP and relevant organizations to develop a detailed plan of the Project.

Both parties agreed the details of the Project and the main points discussed as described in the Appendix 1 and the Appendix 2 respectively.

Both parties also agreed that UAESP, the counterpart to JICA, will be responsible for the implementation of the Project in cooperation with JICA, coordinate with other relevant organizations and ensure that the self-reliant operation of the Project is sustained during and after the implementation period in order to contribute toward social and economic development of Bogota, D.C,.

The Project will be implemented within the framework of the Agreement on Technical Cooperation signed on December 22, 1976 (hereinafter referred to as "the Agreement") and the Note Verbale to be exchanged between the Government of Japan (hereinafter referred to as "GOJ") and Colombia (here in after referred to as "GOC").

Done in duplicate in the Spanish and English languages, both equally authentic. In case of divergence of interpretation, the English text shall prevail.

The effectiveness of the Record of Discussions is subject to the exchange of the Note Verbale.

Appendix 1: PROJECT DESCRIPTION
Appendix 2: MAINPOINTS DISCUSSED

Appendix 1

PROJECT DESCRIPTION

I. BACKGROUND

Due to the rapid urbanization, the problem of the waste management is one of the important issues in Bogota, D.C. (hereinafter "Bogota"). Although Bogota has developed master plan for integrated solid waste management (PMIRS) in 2006, and has tackled with the waste management, however, because of the increasing number of population (as is said to be 8 million) and the change of lifestyle, there are some gaps between PMIRS and actual situation. The issues that have been raised for PMIRS to be revised, as well as defining the role of various stakeholders on how to take part in integrated solid waste management within the PMIRS.

Under these circumstances, the GOC requested the GOJ to provide a technical assistance project to compile a Master Plan for solid waste management, in order to solve the actual problems in Bogota.

In response to the request, as the environment is one of the important sectors for Japan's cooperation policy, JICA, the official agency responsible for the implementation of the technical cooperation program of the GOJ, will jointly undertake the Project with the authorities concerned of the GOC.

II. OUTLINE OF THE PROJECT

1. Title of the Project
Project on Master Plan Study for Integrated Solid Waste Management in Bogota, D.C.

2. Expected Goals which will be attained after the Project Completion
(1) Goal of the Proposed Plan
Bogota will implement master plan (PMIRS) properly, so that the quality of life and welfare of Bogota inhabitants will be improved.

(2) Goal which will be attained by utilizing the Proposed Plan
The solid waste management shall be carried out adequately by including various stakeholders and by clarifying the role of those stakeholders.

3. Outputs
(1) To compile a Master Plan for sustainable and proper management of the solid waste in Bogota.
(2) To enhance capacity of UAESP for policy planning and implementation on the solid waste management by utilization, monitoring, evaluation of the Master Plan.

4. Activities

(1) Baseline survey (Present Condition Analysis)

a. To review and analyze the present Master Plan

b. To correct and review of relevant data and reports on Solid Waste management (Includes social and economic analysis, legal system, and financial and managerial conditions.)

c. To conduct field survey

d. To identify the problems and the gaps between the current situation and the present Master Plan

(2) Compilation of Draft Master Plan

A master plan will be drafted after implementation of pilot project(s). The plan will include the followings;

a. Strategy, dimensions of the plan and projects, finance and management plan, institution and organization plan, facility plan, enhanced 3R (Reduce-Reuse-Recycle) plan, human resource development plan, and developing the monitoring system of Master Plan.

b. Holding Workshop, seminar(s) and Training course(s)

c. Preliminary cost estimation

d. Implementation plan

e. Evaluation of the plan

5. Input

(1) Input by JICA

a. Dispatch of Mission

Team Leader / Solid Waste and Hazardous Waste Management Expert
Collection & Transportation Expert
Waste Analyst 1
Waste Analyst 2 / Intermediate Treatment and Recycle Expert
Final Disposal & Facility Planner
Public Awareness / Environment and Social Consideration Expert
Financial Analyst / Economist

b. Materials related to the study

c. Training in Japan

Input other than indicated above will be determined through mutual consultations between JICA and UAESP during the implementation of the Project, as necessary.

(2) Input by UAESP

UAESP take necessary measures to provide at its own expense:

a. Services of UAESP's counterpart personnel and administrative personnel;

b. Suitable office space with necessary equipment including running expenses necessary for the implementation of the Project (ex: gas, electricity, water, telephone line, internet access, etc.);

c. Supply or replacement of machinery, equipment, instruments, vehicles, tools, spare parts and any other materials necessary for the implementation of the Project other than the equipment provided by

JICA;

d. Information as well as support in obtaining medical service;
e. Credentials or identification cards; and
f. Available data (including maps and photographs) and information related to the Project.

6. Implementation Structure

(1) The Project organization chart is given in the Annex I

(2) Steering Committee

Steering Committee (hereinafter referred to as "SC") will be established in order to facilitate inter-organizational coordination. SC will be held whenever deems it necessary. Proposed members of SC will be consisted in the participants of PMIRS follow-up committee, in addition to the representative of JICA. The committee can invite national and regional level stakeholders, who are interested in solid waste management, shown in Annex III.

7. Project Site(s) and Beneficiaries

(1) Project Site

Bogota, D.C.

(2) Beneficiaries

Direct: Counterpart personnel in UAESP
Indirect: Inhabitants of Bogota

8. Duration

The project duration will be March 20th 2012 to November 19th 2013. The study will be carried out in accordance with the attached tentative work schedule (Annex II).

9. Reports

JICA will prepare and submit the following reports to the UAESP in Spanish.

(1) five copies of Inception Report at the commencement of the first work period in Colombia
(2) five copies of Progress Report approximately five months after the commencement of the first work period in Colombia
(3) five copies of Draft Final Report at the end of the last work period in Colombia
(4) five copies of Final Report within one (1) month after the receipt of the comments on the Draft Final Report

10. Environmental and Social Considerations

UAESP agreed to abide by 'JICA Guidelines for Environmental and Social Considerations' in order to ensure that appropriate considerations will be made for the environmental and social impacts of the Project.

III. UNDERTAKINGS OF GOC

Under the framework of the Agreement exchanged between GOC and GOJ the undertakings of the Colombian Government, through UAESP, are as follows:

(1) ensure that the technologies and knowledge acquired by Colombia nationals as a result of Japanese technical cooperation contributes to the economic and social development of Colombia, and that the knowledge and experience acquired by the personnel of Colombia from technical training as well as the equipment provided by JICA will be utilized effectively in the implementation of the Project; and

(2) grant privileges, exemptions and benefits to the members of the JICA missions referred to in II-5 (1) above and their families, which are no less favorable than those granted to experts and members of the missions and their families of third countries or international organizations performing similar missions in Colombia;

(3) provide security-related information as well as measures to ensure the safety of the members of the JICA missions;

(4) permit the members of the JICA missions to enter, leave and sojourn in Colombia for the duration of their assignments therein and exempt them from foreign registration requirements and consular fees;

(5) exempt the members of the JICA missions from taxes and any other charges on the equipment, machinery and other material necessary for the implementation of the Project;

(6) exempt the members of the JICA missions from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to them and/or remitted to them from abroad for their services in connection with the implementation of the Project;

(7) meet taxes and any other charges on the equipment, machinery and other material necessary for the implementation of the Project;

(8) provide transport and travel allowance the members of the JICA missions for official travel within Colombia;

(9) provide suitable furnished accommodation for the members of the JICA missions and their families;

(10) bear expenses necessary for transportation within Colombia of the equipment as well as for the installation, operation and maintenance thereof; and

(11) provide necessary facilities to members of the JICA missions for the

remittance as well as utilization of the funds introduced into Colombia from Japan in connection with the implementation of the Project.

UAESP will bear claims, if any arises, against the members of the JICA missions resulting from, occurring in the course of, or otherwise connected with, the discharge of their duties in the implementation of the Project, except when such claims arise from gross negligence or willful misconduct on the part of the members of the JICA missions.

IV. EVALUATION

JICA will conduct the following evaluations and surveys to mainly verify sustainability and impact of the Project and draw lessons. The UAESP is required to provide necessary support for them.

1. Ex-post evaluation three (3) years after the project completion, in principle

2. Follow-up surveys on necessity basis

V. PROMOTION OF PUBLIC SUPPORT

For the purpose of promoting support for the Project, UAESP will take appropriate measures to make the Project widely known to the people of Colombia.

VI. MUTUAL CONSULTATION

JICA and UAESP will consult each other whenever any major issues arise in the course of Project implementation.

VII. AMENDMENTS

The record of discussions may be amended by the minutes of meetings between JICA and UAESP.
The minutes of meetings will be signed by authorized persons of each side who may be different from the signers of the record of discussions.

Annex I ORGANIZATION CHART
Annex II TENTATIVE WORK SCHEDULE
Annex III LIST OF STEERING COMMITTEE MEMBER

Appendix 2

MAIN POINTS DISCUSSED

(1) Workshop and Seminar

During the Project, in order to disseminate the experience of establishing a master plan, workshop(s) and seminar(s) are planned to be held by the initiative of Japanese side with the cooperation of Colombia side.

(2) Disclosure

The master plan and also the result of baseline survey should be open to the public.

(3) Collaboration with the private company

Actually, in Bogota, much of amount of solid waste are treated by the said private company. These companies contract with Bogota and these companies' function is very important.

In that sense, the Japanese side requested Colombia side to take necessary arrangements to ask the private company to cooperate, especially for the smooth operation of the survey such as Time and Motion Survey etc.

(4) Undertaking of the Colombia side

(1) Office Space with necessary equipment

Office space and equipment will be prepared by UAESP

(2) Internal Transportation

Local transportation in Bogota necessary for the Project will be provided by UAESP

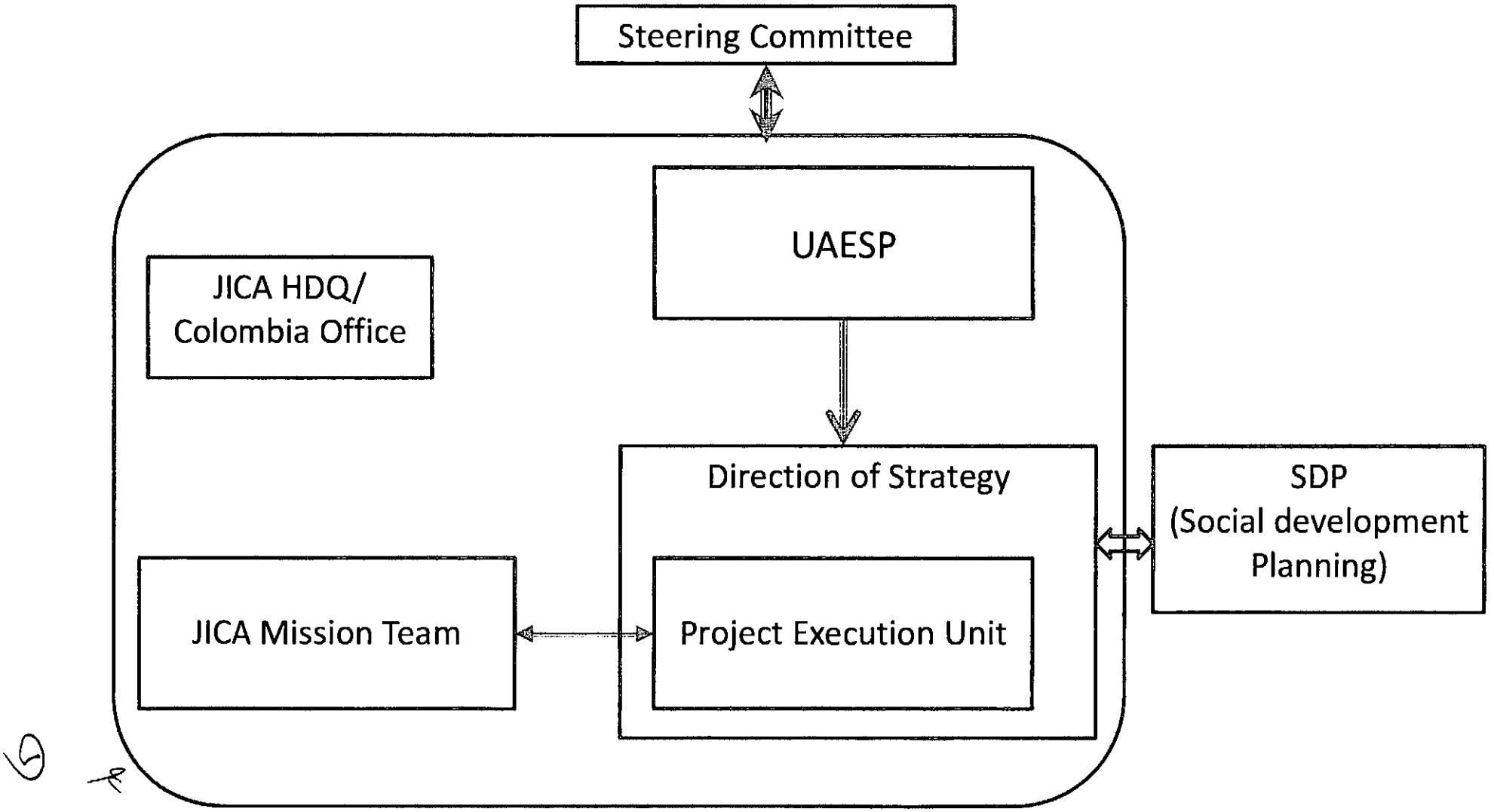
(3) Counterpart Assignment

During the Project, full time counterpart will be assigned by UAESP

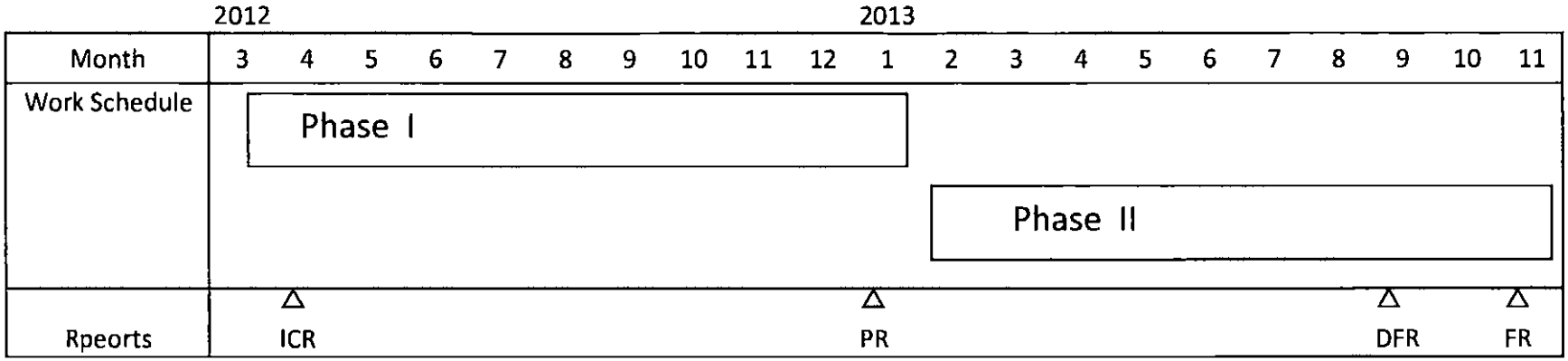
(5) Technology Transfer

Colombia side requested the Team to provide counterpart training in Japan and to hold seminars during the study to transfer technology. The team agreed to convey the above request to JICA Headquarters.

Annex I ORGANIZATION CHART



Annex II TENTATIVE WORK SCHEDULE



ICR : Inception Report
PR : Progress Report
DFR : Draft Final Report
FR : Final Report

Annex III LIST OF STEERING COMMITTEE MEMBER

1. Functions

Steering Committee (hereinafter referred to as "SC") will be established in order to facilitate inter-organizational coordination. SC will be held whenever deems it necessary. The major function of SC is as listed below;

(1) To review the overall progress and achievements of the Project;
(2) To examine major issues arising from or in connection with the Project; and
(3) To propose the modification of the activities depending on the necessity.

2. Committee Composition

The SC will be composed of the following members:

(a) Same members of PMRIS follow-up committee, which has been authorized by the regulation
- Representative from Secretaria Distrital de Habitat
- Representative from Secretaria Distrital de Planeacion
- Representative from Secretaria Distrital de Ambiente
- Representative from Secretaria Distrital de Salud
- Representative from Secretaria Distrital de Gobierno
- Representative from cooperative of recyclers organized by UAESP
- Representative from Mayors
- Representative from Comites de Desarrollo y Control Social de Servicio Publico de Aseo
- Representative from UAESP

(b) Additional members
- Ministerio de Ambiente Vivienda y Desarrollo Territorial (MAVDT)
- JICA Expert team
- Representative(s) of JICA Colombia Office
- Government of Cundinamarca
- Corporacion Autonoma Regional - CAR

(c) Observers
- Official(s) from Embassy of Japan

MINUTES OF MEETINGS
ON THE INCEPTION REPORT
OF THE PROJECT
ON MASTER PLAN STUDY
FOR INTEGRATED SOLID WASTE MANAGEMENT IN BOGOTA, D.C.
REPUBLIC OF COLOMBIA
AGREED UPON BETWEEN
UNIDAD ADMINISTRATIVA ESPECIAL DE SERVICIOS PUBLICOS-UAESP-
AND
JICA MSSION TEAM

The Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Mission Team on the Project for MASTER PLAN STUDY FOR INTEGRATED SOLID WASTE MANAGEMENT IN BOGOTA, D.C. (hereinafter referred to as "the Project") to the Republic of Colombia according to the Record of Discussions which was signed on 21st November 2011, in order to agree with the team designated by UAESP on the working plan which was presented in the Draft Inception Report.

As a result of discussions, both sides agreed to the matters described in this minutes and modified the Draft Inception Report.

Bogota, 30 April 2012

Guillermo Raúl Asprilla Coronado
Director General
Unidad Administrativa Especial de
Servicios Publicos

Ikuo MORI
JICA Mission Team Leader

Witnessed by

Kiyoshi YOSHIMOTO
Chief Representative
Colombia Office
Japan International Cooperation Agency

1. INTRODUCTION

JICA Mission Team (JMT) submitted Draft Inception Report (D-IC/R), ten (10) copies of English version and ten (10) copies of Spanish version respectively to the working group of Unidad Administrativa Especial de Servicios Publicos (UAESP). A series of meetings were held from April 10th to 27th in Bogota, Republic of Colombia, in order to agree about the working plan described in the D-IC/R. Names of officials having attended in the above meetings are given in the Appendix 1.

Detailed study method will be adjusted in the course of the Study by mutual cooperation between UAESP and JICA.

2. MAIN POINTS AGREED

Various issues were discussed and clarifications on the D-IC/R were made. Subsequently appropriate consensus was reached during the meetings. Main points agreed are outlined in the following paragraphs.

2.1 Organization of the Study

UAESP has set up a working team for Project Execution which works together with JMT. Members of the team are listed in Appendix 2.

Steering Committee, which was mentioned in the Record of Discussions in November 2011, will be established once the working plan presented in the D-IC/R is settled.

2.2 Technical topics on which JICA Mission Team focuses

On 20th March 2012 UAESP sent JICA Office in Bogota a letter (attached in Appendix 3) which mentioned about actions on which JMT should give priority. This was also mentioned in the first meeting held on 10th April 2012. In addition, UAESP showed JMT the Inclusion Plan of Recyclers in the Solid Waste Management, “Bogota Zero Waste” (el Plan de Inclusión de la Población Recicladora en la Gestión Pública de los Residuos, “Bogotá Basura 0”) (hereinafter referred to as the “Inclusion Plan 2012”) which was submitted to the Constitutional Court in order to respond to the Order 275 on 19th December 2011.

Taking into account the above mentioned, JMT considered these themes as important and agreed to work on them.

2.3 Implementation of site surveys

Initially JMT had considered that the following site surveys were necessary to be carried out in order to identify the current situation of solid waste management in Bogota:

- Waste Amount and Composition Survey (WACS)
- Recyclable Waste Survey
- Public Opinion Survey

However, as the working team of UAESP carried out surveys which obtained sufficient information for preparing the Inclusion Plan 2012 and for revising the Master Plan (PMIRS), the both parties agreed that it is not necessary to repeatedly carry out such site surveys.

2.4 Preparation schedule of PMIRS

Taking into consideration the instructions issued by the Constitutional Court, i.e., application of the Inclusion Plan 2012 in a short period, the both parties agreed to concentrate on activities of implementation of the Inclusion Plan in the rest of Year 2012, and carry out necessary adjustment in 2013 to the Master Plan for Integrated Solid Waste Management (PMIRS) included in the District Decree 312 in 2006.

2.5 Kick-off Seminar

It is agreed by both parties to hold a Kick-off seminar in the last week of May with the Steering Committee defined in the Annex III of the Record of Discussions on 21st November 2011. Purpose of the seminar is to announce the Inclusion Plan to various actors.

2.6 Counterpart training in Japan

Counterpart training in Japan will be conducted in October or November 2012. The duration of the training will be approximately 15 days.

3. Conclusion

3.1 With the above points agreed, D-IC/R was modified as IC/R. The project is conducted based on the IC/R.

Appendix 1

Attendance List

Colombian side (UAESP)

No	Name	Position/Responsibility
1	Guillermo Asprilla	Director General
2	Nhora Usme	Inter-institutional Relation & International Cooperation Management Office Advisor
3	Pedro Ramos	Alternative Technology Management Office Advisor
4	Henry Romero	Planning Office Chief
5	Guillermo Galvez	Education Office Advisor
6	Monica Castañeda	Communication Office Chief
7	German Cabuya	Information and Communication Technology Office Chief
8	María Fernanda Aguilar	Sub-director Collection, Sweeping and Cleaning
9	Libia Esperanza Cuervo	Sub-director Final Disposal
10	Argemiro Plaza	Sub-director Recycling
11	Federico Parra	Coordinator Inclusion Plan 2012
12	Henry Nieto	Sub-director Public Lighting and Cemetery
13	Carlos Jaimes	Public Lighting Project

Japanese side

No	Name	Position/Responsibility
1	Kiyoshi Yoshimoto	Chief Representative, JICA Colombia Office
2	Diego Martínez	Project Coordinator, JICA Colombia Office
3	Ikuo Mori	JMT Leader
4	Koji Kusunoki	JMT Member, Recycling
5	Tamotsu Suzuki	JMT Member, Intermediate Treatment
6	Mie Nagayasu	JMT Member, Public Awareness
7	Keiko Yaguchi	JMT Member, Interpreter

Appendix 2

Member of Project Execution Team

No	Name	Position/Responsibility
1	Guillermo Asprilla	Director General
2	Nhora Usme	Inter-institutional Relation & International Cooperation Management Office Advisor
3	Pedro Ramos	Alternative Technology Management Office Advisor
4	Henry Romero	Planning Office Chief
5	Guillermo Galvez	Education Office Advisor
6	Monica Castañeda	Communication Office Chief
7	German Cabuya	Information and Communication Technology Office Chief
8	María Fernanda Aguilar	Sub-director Collection, Sweeping and Cleaning
9	Libia Esperanza Cuervo	Sub-director Final Disposal
10	Argemiro Plaza	Sub-director Recycling
11	Federico Parra	Coordinator Inclusion Plan 2012
12	Henry Nieto	Sub-director Public Lighting and Cemetery
13	Carlos Jaimes	Public Lighting Project

Appendix 3

ALCALDÍA MAYOR
DE BOGOTÁ D.C.
HÁBITAT
Unidad Administrativa Especial de Servicios Públicos

Al contestar, por favor cite el radicado:
No.: **20121000021071**

Bogotá D.C., 20 de marzo de 2012

Doctor
KIYOSHI YOSHIMOTO
Representante Residente
Agencia de Cooperación Internacional del Japón
Carrera 10 No. 97 A - 13 Torre B Oficina 701
PBX: 7427719 fax: 7427717
Bogotá - D.C.

Asunto: Estudio del Plan Maestro de la Gestión Integral de Residuos Sólidos en Bogotá

Respetado Doctor Yoshimoto

En el marco del Proyecto de Cooperación para "El estudio del Plan Maestro de la Gestión Integral de Residuos Sólidosen Bogotá", suscrito entre la UAESP y JICA, me permito confirmarle las líneas sobre las cuales la UAESP desea orientar esta cooperación, las cuales le fueron expresadas en nuestra reunión del pasado 21 de febrero, teniendo en cuenta que la Política Distrital "*Bogotá humana"*, el Plan de Desarrollo y el proyecto"*Basura Cero"* implicanun ajuste al Plan de Manejo Integral de Residuos Sólidos de Bogotá, diseñado en el año 2006, para lo cual se deben tener en cuenta las siguientes acciones prioritarias:

a. Adelantar estudios que valoren las diferentes alternativas tecnológicas tendientes a sustituir el relleno sanitario Doña Juana, buscando la reducción de la disposición de basuras y el aprovechamiento del material dispuesto para la generación de energías alternativas, entre las cuales pueden considerarse: i) Bioreactores aeróbicos o anaeróbicos, ii) plantas de valoración energética iii) plantas de biomasa y /o compost, iv) plantas de generación de combustibles CRS, v) plantas de tratamiento y aprovechamiento de escombros y desechos

industriales específicos, vi) Optimización de la planta de biogás y de lixiviados existente.

b. Campañas para disminuir la cantidad de basura producida, priorizando la producción de bienes biodegradables o que puedan ser reutilizados o reciclados, buscando la reducción de la disposición de basura en los rellenos sanitarios.Por lo anterior, se busca promover en el sector empresarial el desarrollo de proyectos sostenibles a través del diseño de incentivos para la producción más limpia a fin de mejorar los indicadores de eco-eficiencia.

c. Campañas masivas de educación, comunicación y sensibilización, orientadas a maximizar la recolección diferenciada y la separación en la fuente, reduciendo el volumen y costos de residuos transportados y dispuestos en el relleno sanitario Doña Juana. Estas campañas estarán dirigidas a los centros educativos de todos los niveles, a los usuarios del servicio público, a las unidades residenciales, a los comercios y negocios. En este último caso se deben intensificar los comparendos ambientales.

d. Concertación de metas de reducción y separación en la fuente con los diferentes actores generadores de basura, que incluiría un diseño tarifario que reconozca y estimule la reducción y separación en la fuente.

e. Fomentar el diseño e implementación de modelos de negocios, tecnologías y prácticas ambientales adaptadas a las necesidades del Manejo integral de los Residuos sólidos en Bogotá, que contemplan igualmente la inclusión de la población que desempeña el oficio de reciclaje, como un eslabón esencial en esta cadena de valor. Estos modelos que incluyen el establecimiento de "alianzas estratégicas" entre las organizaciones de reciclaje, el sector privado y el sector público, buscan por un lado su profesionalización, el mejoramiento de la calidad de vida del reciclador a través de un ingreso estable, la formación y educación de las comunidades en el manejo de residuos sólidos y su aprovechamiento, la tecnificación de

procesos productivos y el fortalecimiento de la cadena de suministro a las empresas privadas, que redunda en una disminución de costos de operación y producción gracias a la materia prima recuperada.

f. Promover la creación de empresas y el desarrollo de tecnologías para la transformación y aprovechamiento del material reciclado, incluyendo el aprovechamiento de escombros, para lo cual se deben identificar terrenos para el montaje de parques de reciclaje y plantas de tratamiento de escombros.

Así las cosas y considerando su oficio del pasado 14 de marzo en el cual confirma la llegada de dos miembros del equipo de consultores el próximo 9 de abril, me permito informarle que se encuentra dispuesta la logística necesaria y el equipo de trabajo de la UAESP, para el desarrollo de esta misión. Por lo anterior le confirmo la reunión preliminar de presentación, para el día 10 de abril a las 10 a.m. en las instalaciones de la UAES.

Cordialmente,

GUILLERMO RAUL ASPRILLA CORONADO
Director General
Unidad Administrativa Especial de Servicio Público

Elaboró: LIGIA CASTAÑEDA
Revisó: NOHORA USME

MINUTES OF MEETINGS
ON THE INTERIM REPORT
OF THE PROJECT
ON MASTER PLAN STUDY
FOR INTEGRATED SOLID WASTE MANAGEMENT IN BOGOTA, D.C.
REPUBLIC OF COLOMBIA
AGREED UPON BETWEEN
UNIDAD ADMINISTRATIVA ESPECIAL DE SERVICIOS PUBLICOS-UAESP-
AND
JICA MSSION TEAM

UAESP and JICA Mission Team (hereinafter referred to as "JMT") had discussion in order to agree to the content of Draft Interim Report prepared by the later according to the work plan which was presented in the Initial Report on April of 2012, and important conditions for the preparation of the master plan.

As a result of discussions, both sides agreed to the matters described in this minutes.

Bogota, 14 December 2012

Nelly Mogollón Montañez
Director General
Unidad Administrativa Especial de
Servicios Publicos

Ikuo MORI
JICA Mission Team Leader

1. INTRODUCTION

JICA Mission Team (JMT) submitted Draft Interim Report (D-IT/R), English version and Spanish version respectively to the working group confirmed by UAESP. A series of meetings were held from December 10 to 14 in order to agree to the content of the report and important conditions for the preparation of the master plan.

2. MAIN POINTS AGREED

Various issues were discussed and clarifications on the D-IT/R were made. Subsequently appropriate consensus was reached during the meetings. Main points agreed are outlined in the following paragraphs.

2.1 Draft Interim Report

JMT presented the Draft Interim Report that has the contents of analysis and evaluation of the current situation of the solid waste management in the Bogota city. UAESP and JMT made clarifications and exchanged opinions. Finally, UAESP accepted the report.

2.2 Important Conditions for the Preparation of the Master Plan

UAESP and JMT established important conditions and scenarios for the preparation of the master plan, which are presented in the Annex 3.

2.3 Interim Report

The Interim Report will be prepared again in Japan. The report will be submitted to UAESP by means of the JICA Colombia Office.

2.4 Alquería Model Project

In the planning of the Alquería Model Project, there are still some points to be considered after the great change of the waste collection service in Bogota on December 18. UAESP requested JMT to return to Bogota as soon as possible to support them in concretion of the plan and implementation of the project. JMT answered that they would consider applying it in the future working plan.

2.5 Change of the Team Members for implementation of the Project

There were some changes of personal in UAESP, which is shown in the new list of the Team Members for Implementation of the Project (See Annex 2).

2.6 Way of Submission of the Reports

UAESP requested a change in way of submission of reports for JMT as it is not necessary to submit drafts in physical paper; but enough in electronic file, in order to

contribute to the "Zero Waste" Policy. JMT accepted the request of UAESP.

At the same time, both sides agreed that the defined reports such as the Interim Report and the Final Report will be prepared in physical paper and in electronic file.

3. Conclusion

3.1 In accordance with the above-mentioned points, the Draft Interim Report was received by UAESP

Annex 1

1. Attendance List

1) UAESP

No	Name	Position/Responsibility
1	Nelly Mogollon	Director General
2	Nhora Usme	Inter-institutional Relation & International Cooperation Management Office Advisor
3	Pedro Ramos	Sub-director Final Disposal, Alternative Technology Project Deputy sub-director Recycling
4	Henry Romero	Planning Office Chief
5	German Cabuya	Information and Communication Technology Office Chief
6	Ilva Herrera	Deputy sub-director Collection, Sweeping and Cleaning
7	Henry Nieto	Sub-director Public Lighting and Cemetery
8	Carlos Jaimes	Public Lighting Project

2) PMIRS Committee

No	Name	Position/Responsibility
1	Carlos E. Romero	UAESP/Recycling
2	William Camargo	SDP
3	Fredi Rodríguez	SDP
4	Nubia Stella Tapia	SDP-DAJ
5	Andrea Aragua	SCASP
6	Olga Cajica	SDS-VSP
7	Angela Ma. Escarra	SDTH-SSP
8	Ma. Consuelo Romero	SDTH-SSP
9	Iván Darío Vargas	SDG-DPSI
10	Fridis E. López	SDG-DAL
11	Ximena Alegría	JICA
12	Ikuo Mori	JICA
13	Diego Rodríguez	Alcaldía de Tunjuelito
14	Hilda Villamarín	SDS/VSP
15	Paola Avila	UAESP/Recycling
16	Luis Alberto Laverde	SDA-SCASP

No	Name	Position/Responsibility
17	Dina Castañeda	UAESP/A.L.
18	Sandra Montoya	SDA-SCASP
19	Yira Bolaños	UAESP
20	Angela Gayón	UAESP/Recycling

2. Japanese side

No	Name	Position/Responsibility
1	Ikuo Mori	JMT Leader
2	Mario Valle	JMT Member, Collection and Transport
3	Koji Kusunoki	JMT Member, Recycling
4	Tamotsu Suzuki	JMT Member, Intermediate Treatment
5	Ximena Alegría	JMT Member, Final Disposal
6	Mie Nagayasu	JMT Member, Public Awareness
7	Masaru Obara	JMT Member, Economy and Finance
8	Keiko Yaguchi	JMT Member, Interpreter

Anexo 2

Member of Project Execution Team

No	Name	Position/Responsibility
1	Nelly Mogollón	Director General
2	Nhora Usme	Inter-institutional Relation & International Cooperation Management Office Advisor
3	Pedro Ramos	Sub-director Final Disposal, Alternative Technology Project Deputy sub-director Recycling
4	Henry Romero	Planning Office Chief
5	German Cabuya	Information and Communication Technology Office Chief
6	Ilva Herrera	Deputy sub-director Collection, Sweeping and Cleaning
7	Henry Nieto	Sub-director Public Lighting and Cemetery
8	Carlos Jaimes	Public Lighting Project

Annex 3

Important conditions and scenarios for the preparation of the master plan

The followings will be considered important conditions and scenarios for the preparation of the master plan:

1. Target Years

Short term:	2013-15 (3 years)
Intermediate term:	2016-20 (5 years)
Long term:	2021-25 (5 years)

2. Generation Rate of Solid Waste

3%, which is the average rate in last seven years, between 2005 and 2011

3. Target of the Master Plan

The following rates are considered the target figures of the master plan.

1) Minimization rate (%)

= reduced quantity / total generation

= (total generation. – final disposition) / total generation

2) Recycling rate (%)

= recycled quantity / total collection

= (total collection – final disposition) / total collection

3) Final disposition rate(%)

= final disposition / total generation

4. Scenarios

Some scenarios will be considered with the combination of the following measures and one of the scenarios will be chosen for the preparation of the master plan.

- Recycled material (paper, plastic, glass, metal, etc.)
- Recycled debris
- Compost
- RPF (refused paper and plastic fuel)
- Organic treatment

MINUTES OF MEETINGS
ON THE WORK PLAN IN THE SECOND FISCAL YEAR
OF THE PROJECT
ON MASTER PLAN STUDY
FOR INTEGRATED SOLID WASTE MANAGEMENT IN BOGOTA, D.C.
REPUBLIC OF COLOMBIA
AGREED UPON BETWEEN
UNIDAD ADMINISTRATIVA ESPECIAL DE SERVICIOS PUBLICOS-UAESP-
AND
JICA MISSION TEAM

UAESP and JICA Mission Team had discussions in order to agree on the work plan of the second fiscal year and important conditions for preparation of the master plan.

As a result of discussions, both sides agreed on the matters described in this minutes.

Bogota, 19 April 2013

Nelly Mogollón Montañez
Director General
Unidad Administrativa Especial de
Servicios Publicos

Ikuo Mori
JICA Mission Team Leader

Witnessed by

Hidemitsu Sakurai
Chief Representative
Colombia Office
Japan International Cooperation Agency

1. INTRODUCTION

JICA Mission Team (JMT) made a presentation regarding works in the 2nd fiscal year to executives of UAESP on 8 March 2013, especially preparation of the Master Plan and implementation of the Alqueria Model Project. Consecutively, a series of meetings were held in order to agree on the work plan described in this minutes. Participants in the meetings are listed in Appendix 1.

2. MAIN POINTS AGREED

Various issues were discussed and clarifications on the presentation were made. Subsequently the both sides reached a consensus during the meetings. Main points agreed were outlined in the following paragraphs.

2.1 Major Issues

Major issues to be analyzed in preparation of the Master Plan are as follows;

- Remaining life time of Doña Juana disposal site
- Other final disposal site(s) than Doña Juana in the future waste management system
- Transfer and transport system in conjunction with other disposal site(s)
- Minimization measures such as material recycle, composting and energy recovery
- Financial resources for implementation of the Master Plan

2.2 Planning Time Frame

Taking into account the "Resolucion 1045 de 2003, Ministerio de Ambiente, Vivienda y Desarrollo Territorial", the planning time frame is to be 15 years and it is to be divided into three terms as follows:

- Short term; 2013-2015 (3 years)
- Medium term; 2016-2018 (3 years)
- Long term; 2019-2024 (6 years)

2.3 Organization

For preparation of the Master Plan, UAESP has assigned the Planning Office as a responsible section and has formulated two groups, i.e., Executive Group and Working Group. Members are listed in Appendix 2. JICA Mission Team is to work together with the groups. UAESP maintains these two groups and members until this JICA Project is concluded.

2.4 Alqueria Model Project

It is confirmed that the Alqueria Model Project is to be implemented basically according to the draft plan presented by the participants in the training course in Japan held in October – November 2012. The plan consists of two parts; one is improvement of working condition of

Alqueria separation plant, and the other is establishment of separate collection system in the area of UPZ 47 Kennedy Central.

JICA Mission Team is to make technical assistance in this regard.

2.5 Schedule of updating the PMIRS

JICA Mission Team is to prepare the Master Plan by the end of August 2013 working with the executive and working group. Meanwhile, UAESP is to conduct various works and coordination with other institutions concerned such as District Planning Secretary., Environment Secretary, Health Secretary and others. Integrating results of these works, UAESP is to take action to update the PMIRS.

Working schedule which was agreed on by the both sides is presented in Appendix 3.

3. Conclusion

3.1 In accordance with the above-mentioned points, the work plan described in this minutes in the Second Fiscal Year was approved by both UAESP and the JICA Mission Team, and witnessed by JICA Colombia Office.

Appendix 1: Attendance List

1. UAESP

No	Name	Position/Responsibility
1	Nelly Mogollon	Director General
2	Nhora Usme	Inter-institutional Relation & International Cooperation Management Office Advisor
3	Pedro Ramos	Sub-director Final Disposal, Alternative Technology Project
4	Leonardo Rodriguez	Sub-director Recycling
5	Carolina Abusaid	Planning Office Chief
6	Ilva Herrera	Advisor to Director General
7	Amparo Arbelaez	Advisor to Director General
8	Patricia Rozo	Communication Office Chief
9	Johana Laverde	Advisor to Director General

2. Japanese side

No	Name	Position/Responsibility
1	Ikuo Mori	JMT Leader
2	Mario Valle	JMT Member, Collection and Transport
3	Mie Nagayasu	JMT Member, Public Awareness
4	Keiko Yaguchi	JMT Member, Interpreter

Appendix 2: Groups for preparation of the Master Plan

1) Executive Group

No.	Name	Position/Responsibility
1	Nelly Mogollón	Director General
2	Nhora Usme	Advisor to Executive Office, International Cooperation and Inter-institution Relation, JICA Project Coordinator
3	Pedro Ramos	Sub-director Final Disposal, Alternative Technology Project
4	Leonardo Rodriguez	Sub-director Recycling
5	Carlos Rojas	Sub-director Collection Service
6	Carolina Abusaid	Planning Office Chief

2) Working Group

No.	Name	Position/Responsibility
1	Hilda Castro	Coordinator of the PMIRS
2	Johana Laverde	Public Awareness, Education
3	Diego Triana	Collection Service
4	Gilberto Corredor	ditto
5	Angela Gayon	Recycling
6	Yira Bolaños	ditto
7	Belquis Sepulveda	Final Disposal
8	Ivan Florian	ditto
9	Julian Gonzales	ditto
10	Gabriel Cordoba	Special Services; construction and demolition waste and hazardous waste
11	Mario Osorio	Finance
12	Diana Castañeda	Legal and Institution

Appendix 3: Work Schedule

	Item	March			April			May			June			July			August			Sept.		
		E	M	L	E	M	L	E	M	L	E	M	L	E	M	L	E	M	L	E	M	L
A	To define a planning framework																					
	1 to take into account Resolution 1045 in 2003 as a planning guide		■																			
	2 to define a planning time frame		■																			
	3 to formulate a working team		■																			
	4 to define work items in each field		■	■																		
B	To establish general objectives and goals																					
	1 To analyze objectives and goals of Plan Desarrollo and Plan Inclusion				■	■																
	2 To analyze accomplishment of objectives and goals of the actual PMIRS					■																
	3 To establish of general objectives and goals of the Master Plan					■																
C	To select a strategic scneario																					
	1 To analyze various strategic scenarios					■	■															
	2 To select a strategic scenario					■	■															
D	To formulate programs, projects and activities																					
	1 To prepare programs, projects and activiteis						■	■	■	■	■	■										
	2 to analyze financial viability										■	■	■	■								
	3 to check conformity with present laws										■	■	■	■								
E	To conduct consultation and dissemination																					
	1 Planning, Environment, Health, Housing and other Depts.					■							■						■			
	2 PMIRS Committee			■									■						■			
	3 Workshops, Seminars					■								■					■			
F	To prepare and submit documents																					
	1 Draft Final Report with Master Plan to be submitted by JICA Team																		■			
	2 documents for updating the PMIRS																			■	■	
F	To have internal meetings																					
	1 with the Executive Team	twice a week																				
	2 with the Working Team	once a week																				

MINUTES OF MEETINGS
ON THE DRAFT FINAL REPORT
OF THE PROJECT ON MASTER PLAN STUDY
FOR INTEGRATED SOLID WASTE MANAGEMENT IN BOGOTA, D.C.
REPUBLIC OF COLOMBIA
AGREED UPON BETWEEN
UNIDAD ADMINISTRATIVA ESPECIAL DE SERVICIOS PUBLICOS-UAESP-
AND
JICA MISSION TEAM

UAESP and JICA Mission Team had discussions on the contents of the Draft Final Report which describes the whole results of activities conducted throughout the project.

As a result of discussions, both sides agreed on the matters described in this minutes.

Bogota, 29 August 2013

Nelly Mogollón Montañez
Director General
Unidad Administrativa Especial de
Servicios Publicos

Ikuo Mori
JICA Mission Team Leader

Witnessed by

Hidemitsu Sakurai
Chief Representative
Colombia Office
Japan International Cooperation Agency

1. INTRODUCTION

JICA Mission Team (JMT) submitted the Draft Final Report to UAESP on 26 August 2013. The report contains the whole results of joint activities conducted by the both parties throughout the Project. Subsequently explanation and clarifications of the contents, especially about the Master Plan, were made as described in this minutes.

2. MAIN POINTS AGREED

Various issues were discussed and clarifications on the Draft Final Report were made. Subsequently the both sides reached a consensus during the meetings. Main points agreed were outlined in the following paragraphs.

2.1 Submission of the Draft Final Report

The reports in English and Spanish were submitted to UAESP in digital, as PDF files.

2.2 Explanation and Clarifications

JMT made explanation of the report and the both parties clarified the following points:

- The Master Plan and the Action Plans reflect what UAESP and JMT discussed and agreed by July 2013. Any progress after the date is appreciated, but it will not be included in the Final Report.
- UAESP will inform the new executive group with the comments by 20 September 2013.

2.3 Comments

JMT requested UAESP to send comments and/or clarifications if any by 20 September 2013 by means of email. UAESP accepted the request.

2.4 Preparation and Delivery of the Final Report

JMT will prepare the Final Report taking into account the clarifications and comments aforementioned. The report will be delivered to UAESP through the JICA Colombia Office approximately November 2013. Number of the reports to be delivered is as follows:

Language	Type of report	Nos.
English	Summary	20
	Main Report	20
Spanish	Summary	20
	Main Report	20

2.5 Revision Schedule of the Decree 312 in 2006, PMIRS

UAESP has promised to send the schedule of revision of the Decree 312 in 2006 with the comments aforementioned.

2.6 Utilization of the capacitated personnel in the revision and implementation of the PMIRS

UAESP emphasized their intention to utilize the persons capacitated by means of this project in the revision and implementation of the PMIRS.

2.7 Accounting information of the project

UAESP requested accounting information for the purpose of responding to requirements of control entities such as Consejo de Bogota, la Personeria, la Cotraloria etc. JMT will consult with JICA Headquarters about this issue.

3. Conclusion

3.1 In accordance with the above-mentioned points, the Draft Final Report was accepted by UAESP.

Appendix 1: Attendance List

1. UAESP

No	Name	Position/Responsibility
1	Nelly Mogollon	Director General
2	Carlos Rojas	Advisor to Director General
3	Pedro Ramos	Sub-director Final Disposal, Alternative Technology Project
4	Leonardo Rodriguez	Sub-director Recycling
5	Miguel Vigoya	Sub-director Collection and Sweeping
6	Mauricio Valencia	Sub-director Administration and Fiance
7	Amparo Arbelaez	Advisor to Director General
8	Patricia Rozo	Communication Office Chief
9	Johana Laverde	Advisor to Director General

2. Japanese side

No	Name	Position/Responsibility
1	Ikuo Mori	JMT Leader
2	Mario Valle	JMT Member, Collection and Transport
3	Koji Kusunoki	JMT Member, Recycling
4	Ximena Alegria	JMT Member, Final Disposal
5	Mie Nagayasu	JMT Member, Public Awareness
6	Masaru Obara	JMT Member, Economy and Finance
7	Keiko Yaguchi	JMT Member, Interpreter