

Plate 6: Pilot Project (1) Collection Improvement and Separation at the Source

Collection Improvement



The pilot project was explained to the residents before the commencement.



New containers necessary for the pilot project were installed

Separation at the Source



Explanation of the pilot project was explained before the commencement 16 times at the Municipality and 8 times at DIMAUD



Besides, explanation of the pilot project was conducted in person with leaflets



Composition analysis of recyclable waste



The counterparts have obtained skills and knowledge trough the pilot project

Plate 7: Pilot Project (2) Landfill Operation Improvement

Landfill Operation Improvement



1) Waste was placed within a specified working area



2) Heavy equipment fully compressed waste



3) Waste was covered with soil after compaction in order to avoid scattering and bad smell



4) After completion of the work, area was measured as a monitoring activity



Installment of landfill gas extraction pipe



Interview survey on the waste-pickers

Plate 8: Pilot Project (3) Environmental Education

Environmental Education



Symbol mark of the environment education, which was chosen from the public



A contest of drawings and poems about waste was held, and excellent works were awarded.



Workshop for teachers:
24 teachers from three schools participated in the workshops



Environmental education at schools

Model classes of environmental education were held at three schools in order to raise children's awareness on recycling



**Plate 9: Pilot Project (4) Environmental Education and Public Relations Enhancement
Technology Transfer: Counterpart Meetings and Seminars**



Workshops were held in some communities to carry out environmental education



Cleansing activities were held at communities following the workshops



Various activities were held together with the workshops to encourage participation of residents

Public Relations Enhancement



800ASEO, telephone information service, was strengthened through the pilot project

Counterpart Meetings



Counterpart meetings, which were important opportunities of technology transfer from the Study Team to the counterpart and vice versa

Technology Transfer Seminars



Technology transfer seminars were held involving participation from various organizations concerned to Solid Waste Management

Present



Phase 1 (before filling)



Phase 2 (before filling)



Plate 11: Present and Future Landscape of the New Landfill (Etapa III) (2)

Phase 3 (before filling)



Phase 4 (after filling)



After Closure



Contents

Maps

Location Map of the Study Area

Map of the Study Area

Plates

Plate 1 :	Field Survey	(1)	Waste Amount and Composition Survey
Plate 2 :	Field Survey	(2)	Waste Amount and Composition Survey
Plate 3 :	Field Survey	(3)	Time and Motion Survey and Public Opinion Survey
Plate 4 :	Field Survey	(4)	Recycle Market Survey and Water Quality Survey
Plate 5 :	Field Survey	(5)	Traffic Volume Survey and Topographic Survey
Plate 6 :	Pilot Project	(1)	Collection Improvement and Separation at the Source
Plate 7 :	Pilot Project	(2)	Landfill Operation Improvement
Plate 8 :	Pilot Project	(3)	Environmental Education
	Pilot Project	(4)	Environmental Education and Public Relations Enhancement
Plate 9 :	Technology Transfer		Counterpart Meeting and Seminars
Plate10 :	Present and Future Landscape of the New Landfill (Etapa III)	(1)	
Plate11 :	Present and Future Landscape of the New Landfill (Etapa III)	(2)	

Page:

1	Introduction	1-1
1.1	Background.....	1-1
1.2	Objectives of the Study.....	1-2
1.2.1	Objectives of the Study.....	1-2
1.2.2	Study Area	1-2
1.2.3	Solid Waste to be Covered Under the Study	1-2
1.2.4	Target Years.....	1-2
1.3	Key Assumptions.....	1-3
1.4	Work Schedule of the Study.....	1-5
1.5	Organization of the Study and the Assignment of the Study Team.....	1-7
1.5.1	Organizational Structure of the Study.....	1-7
1.5.2	Members of the Study Team.....	1-8
1.5.3	Member of the JICA Advisory Committee.....	1-8
1.5.4	Members of the Counterpart Personnel	1-9
1.5.5	Members of the Steering Committee	1-9
1.6	Technology Transfer.....	1-10
2	Profile of the Study Area	2-1
2.1	Natural Conditions.....	2-1
2.1.1	Location	2-1
2.1.2	Topography.....	2-1
2.1.3	Climate.....	2-1
2.1.4	Geological Conditions	2-2
2.2	Socioeconomic Conditions.....	2-3
2.2.1	Macro-economy of the Country.....	2-3
2.2.2	Regional Economy.....	2-5
2.2.3	Administration	2-7
2.2.4	Population.....	2-8

2.2.5	Education	2-9
2.2.6	Community Structure.....	2-10
2.2.7	Poverty Conditions	2-13
2.2.8	Public Health	2-14
2.3	Urban Structure.....	2-17
2.3.1	Generalities	2-17
2.3.2	Urban Plan	2-17
2.3.3	Land Use.....	2-19
2.3.4	Population Density.....	2-20
2.3.5	Transportation.....	2-21
2.4	Financial Conditions.....	2-21
2.4.1	Public Finance.....	2-21
2.4.2	Taxation System and Public Utilities.....	2-24
2.5	Environmental Policy	2-30
2.5.1	General Review.....	2-30
2.5.2	Organizations Concerned.....	2-33
2.5.3	Environmental Impact Evaluation Process in the Country	2-35
2.6	Other Infrastructure	2-38
2.6.1	Water Supply	2-38
2.6.2	Sewage and Drainage.....	2-38
2.6.3	Roads and Traffic System.....	2-39
2.6.4	Power Supply.....	2-39
2.6.5	Telephone, Internet and others.....	2-39
2.6.6	Priority Ranking of Infrastructure Investment.....	2-39
3	Field Survey	3-1
3.1	Waste Amount and Composition Survey	3-1
3.1.1	Waste Amount Survey	3-1
3.1.2	Waste Composition Survey	3-5
3.1.3	Findings	3-13
3.2	Time and Motion Survey	3-20
3.2.1	Objectives	3-20
3.2.2	The Survey Schedule	3-20
3.2.3	Survey Record	3-22
3.2.4	Findings	3-23
3.3	Public Opinion Survey.....	3-30
3.3.1	Objectives	3-30
3.3.2	Number of Samples	3-30
3.3.3	Formulation of Questionnaire.....	3-31
3.3.4	Results of the Survey	3-32
3.3.5	Findings	3-32
3.4	Recycle Market Survey.....	3-40
3.4.1	Objectives	3-40
3.4.2	Methodology.....	3-41
3.4.3	Results of the Survey	3-42
3.4.4	Findings	3-50
3.5	Water Quality Survey	3-51
3.5.1	Objectives	3-51
3.5.2	Survey Schedule	3-51
3.5.3	Survey Record	3-52

3.5.4	Findings	3-53
3.6	Traffic Volume Survey	3-54
3.6.1	Objectives	3-54
3.6.2	Survey Schedule	3-55
3.6.3	Survey Record	3-56
3.6.4	Findings	3-57
4	Current Situation of Municipal Solid Waste Management	4-1
4.1	Service Coverage and Hygiene Conditions	4-1
4.2	History of Municipal Solid Waste Management	4-1
4.3	Waste Stream	4-2
4.3.1	Concept of Waste Stream	4-2
4.3.2	Waste Generation Rate and Generation Amount	4-3
4.3.3	Waste Stream	4-8
4.4	Technical System	4-8
4.4.1	Discharge and Storage System	4-8
4.4.2	Collection and Haulage System	4-9
4.4.3	Processing, Treatment and Recycling System	4-34
4.4.4	Street Sweeping System	4-34
4.4.5	Final Disposal System	4-40
4.4.6	Other SWM Activities (NGO, community groups)	4-42
4.5	Institutional and Financial System	4-43
4.5.1	Institutional System for SWM	4-43
4.5.2	Financial and Accounting System	4-56
4.5.3	Financial System	4-61
4.5.4	Private Sector	4-65
4.6	Social Aspects	4-67
4.6.1	History of waste-pickers in Panama	4-68
4.6.2	General information	4-68
4.6.3	Basic infrastructure within the landfill and close communities	4-69
4.6.4	Working condition	4-70
4.6.5	Recovered material	4-71
4.6.6	Possibility to change the present situation	4-73
4.6.7	Recommendations by various groups	4-74
4.7	Environmental Education	4-75
4.7.1	Environmental Education System	4-75
4.7.2	Environmental Education Programs with Communities by Several Organizations	4-76
4.8	Relevant Studies	4-78
5	Industrial Waste Management	5-1
5.1	Current Situation of Industrial Waste Management	5-1
5.1.1	Definition of Industrial Waste	5-1
5.1.2	Quantification of Hazardous Industrial Waste	5-1
5.1.3	Large Generators of Industrial Waste	5-1
5.1.4	Present Treatment and Disposal of Industrial Waste	5-4
5.1.5	Control and Supervision System	5-4
5.1.6	Key Issues	5-5
5.2	Suggestions for the Present Management of Industrial Waste	5-6

5.2.1	Regulatory Framework	5-6
5.2.2	Strengthening the Structure of the Competent Authority	5-7
6	Medical Waste Management.....	6-1
6.1	Current Situation of Medical Waste Management	6-1
6.1.1	Definition of Medical Waste (MW).....	6-1
6.1.2	Quantification of MW.....	6-1
6.1.3	Major MW generators.....	6-1
6.1.4	Current in House Management, Treatment, Haulage and Final Disposal of MW	6-2
6.1.5	Control and Supervision System.....	6-3
6.1.6	Key Issues.....	6-4
6.2	Suggestions for Present MW Management	6-4
6.2.1	Institutional enforcement of the competent authority	6-4
6.2.2	Formation.....	6-5
6.2.3	Registration.....	6-5
7	Pilot Projects	7-1
7.1	Collection Improvement	7-1
7.1.1	Outline	7-1
7.1.2	Implementation Method.....	7-5
7.1.3	Results.....	7-13
7.1.4	Evaluation and Conclusions.....	7-16
7.1.5	Recommendations.....	7-19
7.2	Separation at the Source	7-22
7.2.1	Outline	7-22
7.2.2	Implementation Method.....	7-24
7.2.3	Results.....	7-29
7.2.4	Evaluation and Conclusion	7-37
7.2.5	Recommendations.....	7-38
7.3	Landfill Operation Improvement.....	7-39
7.3.1	Outline	7-39
7.3.2	Implementation Method (Design of Landfill Operation Method)	7-41
7.3.3	Results.....	7-46
7.3.4	Analysis and Evaluation of the Landfill Operation Method	7-52
7.3.5	Rule to Separate the Waste-pickers' Activities and the Landfill Operation.....	7-55
7.3.6	Evaluation and Conclusion of the Pilot Project	7-56
7.4	DIMAUD Management Improvement	7-56
7.4.1	Background.....	7-56
7.4.2	Implementation	7-58
7.4.3	Results and Evaluation.....	7-72
7.4.4	Recommendations.....	7-72
7.5	Environmental Education	7-73
7.5.1	Outline	7-73
7.5.2	Implementation Plan for the Pilot Project.....	7-77
7.5.3	Results.....	7-86
7.5.4	Evaluation and Conclusion	7-92
7.5.5	Recommendation	7-96
7.6	Public Relations Enhancement	7-96
7.6.1	Outline	7-96
7.6.2	Implementation Method.....	7-100

7.6.3	Results.....	7-107
7.6.4	Evaluation and Conclusion.....	7-120
7.6.5	Recommendations.....	7-121
8	Setting up Planning Framework for the Master Plan.....	8-1
8.1	Social Framework.....	8-1
8.1.1	Population Forecast.....	8-1
8.2	Economic Framework.....	8-2
8.2.1	Economic Growth.....	8-2
8.2.2	Industrial Structure.....	8-3
8.2.3	Individual Economy.....	8-3
8.3	Forecast of Future Waste Amount and Composition.....	8-4
8.3.1	Assumptions for Waste Amount Forecast.....	8-4
8.3.2	Waste Composition.....	8-5
8.3.3	Forecast of Future Waste Amount.....	8-7
8.3.4	Future Waste Stream.....	8-9
9	Selection of an Optimum Technical System.....	9-1
9.1	Priority Ranking of Key Issues.....	9-1
9.2	Overall System.....	9-1
9.2.1	Separate Collection.....	9-11
9.2.2	Transfer Transport System.....	9-15
9.2.3	Final Disposal System.....	9-15
9.2.4	Optimum System.....	9-15
10	The Master Plan.....	10-1
10.1	Outline of the Master Plan.....	10-1
10.1.1	Goals.....	10-1
10.1.2	Target Year.....	10-2
10.1.3	Policies.....	10-2
10.1.4	Targets.....	10-2
10.1.5	Outline of the Master Plan.....	10-4
10.1.6	Proposed Improvement Measures.....	10-5
10.1.7	Future Waste Stream.....	10-9
10.2	Description of the Master Plan.....	10-11
10.2.1	Waste Collection Coverage Improvement.....	10-11
10.2.2	Recycling System.....	10-11
10.2.3	Technical System.....	10-14
10.2.4	Institutional System.....	10-33
10.2.5	Financial and Accounting System.....	10-73
10.2.6	Social System (Environment Education and Community Participation).....	10-80
10.3	Phased Implementation Plan.....	10-81
10.4	Project Cost Estimation.....	10-82
10.4.1	Basic Conditions.....	10-82
10.4.2	Collection System.....	10-82
10.4.3	Transfer and Transport System.....	10-85
10.4.4	Material Recovery Facility.....	10-85
10.4.5	Landfill.....	10-86
10.4.6	Overall Cost.....	10-89

10.5	Evaluation of Master Plan	10-98
10.5.1	Technical Evaluation	10-98
10.5.2	Financial Evaluation	10-99
10.5.3	Economic Evaluation	10-110
10.5.4	Institutional Evaluation	10-112
10.5.5	Social Evaluation	10-114
10.5.6	Environmental Evaluation	10-115
10.5.7	Overall Evaluation	10-115
11	Feasibility Study and Pre-feasibility Study for Priority Projects	11-1
11.1	Outline of the Projects	11-1
11.1.1	Target	11-1
11.1.2	Outline of Projects	11-2
11.2	Preliminary Design of Technical System	11-4
11.2.1	Final Disposal Project	11-4
11.2.2	Pre-feasibility Study on Transfer and Transport System	11-31
11.3	Institutional Plan	11-49
11.3.1	Final Disposal Project	11-49
11.3.2	Transfer and Transport Project	11-57
11.4	Financial Analysis	11-59
11.5	Environmental Impact Assessment	11-60
11.5.1	Scope of EIA Work	11-60
11.5.2	Initial Environmental Examination	11-60
11.5.3	Environmental Impact Assessment of the Final Disposal System	11-64
11.6	Project Evaluation	11-108
11.6.1	Technical Evaluation	11-108
11.6.2	Institutional Evaluation	11-109
11.6.3	Social Evaluation	11-109
11.6.4	Environmental Evaluation	11-110
11.6.5	Financial Evaluation	11-110
11.6.6	Economic Evaluation	11-111
11.6.7	Total Evaluation	11-113
12	Conclusions and Recommendations	12-1
12.1	Conclusions	12-1
12.2	Recommendations	12-4

List of Tables

	Page:
Table 1-1: Population Forecast	1-3
Table 1-2: Projection of GDP Growth Rate	1-4
Table 1-3: Forecast of Waste Generation Amount.....	1-5
Table 1-4: Waste Composition of Panama Municipality	1-5
Table 2-1: Climatic Parameters recorded at Tocumen Meteorological Station (1996-2000) ...	2-2
Table 2-2: Economically Active Population (EAP).....	2-3
Table 2-3: Gross Domestic Product (GDP) Million USD.....	2-3
Table 2-4: Manufacturing Industry in Panama, 1999.....	2-4
Table 2-5: Value of Construction in 2000 (USD).....	2-4
Table 2-6: Consumer Price Index (CPI) (%).....	2-5
Table 2-7: Public Sector Debt in 1999 (Million USD)	2-5
Table 2-8: Comparative Population Results from 1960, 1970, 1980, 1990, and 2000 Census..	2-8
Table 2-9: Illiterate Population of 10 Years Old and More in Panama District.....	2-9
Table 2-10: Poverty Main Indicators of Panama District.....	2-14
Table 2-11: Matrix of Key Projects for Solid Waste Management in the Study Area foreseen in the Metropolitan Plan	2-18
Table 2-12: Population Density.....	2-20
Table 2-13: Executed 1999 Budget of the Central Government	2-22
Table 2-14: Municipal Budget of 1999 (Million USD)	2-23
Table 2-15: Income Statement 1999 of Panama City.....	2-23
Table 2-16: Houses without Electricity and without Water Supply.....	2-24
Table 2-17: Electricity Tariff, Second Half of 2000	2-26
Table 2-18: Income by Company and Tariff in 2000 (USD)	2-27
Table 2-19: IDAAN Fixed Charges by Customer Type.....	2-28
Table 2-20: IDAAN Differential Tariff Applicable to Tariff 20.....	2-29
Table 2-21: IDAAN Differential Tariff Applicable to Tariff 21	2-29
Table 2-22: IDAAN Differential Tariff Applicable to Tariff 22.....	2-29
Table 2-23: IDAAN Differential Tariff Applicable to Tariff 23-24	2-29
Table 2-24: IDAAN Differential Tariff Applicable to Tariff 25-26	2-30
Table 2-25: Environmental Conservation Group	2-35
Table 2-26: Social Interest Group	2-35
Table 3-1: Number of Sources and Samples	3-2
Table 3-2: Distribution of Sources (Households).....	3-2
Table 3-3: Results of Generation Rate Survey of Household Waste	3-3
Table 3-4: Estimation of Generation Rate of Household Waste	3-4
Table 3-5: Generation Rate of Commercial, Institutional and Market Wastes	3-4
Table 3-6: Generation Rate of Street Sweeping Waste	3-5
Table 3-7: Number of Samples of Waste Composition Survey	3-5
Table 3-8: Bulk Density of Household Waste.....	3-7
Table 3-9: Bulk Density of Commercial Waste	3-7
Table 3-10: Bulk Density of Institutional, Market and Street Sweeping Waste	3-8
Table 3-11: Bulk Density of Collection Vehicle Waste form Panama City.....	3-8
Table 3-12: Bulk Density of Collection Vehicle Waste form San Miguelito and Arraijan	3-8
Table 3-13: Physical Composition of Household Waste.....	3-9
Table 3-14: Physical Composition of Commercial Waste	3-9
Table 3-15: : Physical Composition of Institutional, Market and Street Sweeping Waste	3-9
Table 3-16: Physical Composition of Collection Vehicle from Panama City.....	3-10
Table 3-17: Physical Composition of Collection Vehicle from San Miguelito and Arraijan ..	3-10
Table 3-18: Results of Three Contents Analysis (for combustible matter).....	3-11
Table 3-19: Results of Elementary Analysis	3-12
Table 3-20: Results of Calorific Value Analysis (kilocalories)	3-13
Table 3-21: Results of Calorific Value Analysis (kilojoules)	3-13

Table 3-22: Results of Waste Generation Rate Survey	3-14
Table 3-23: Comparison of Waste Generation Rate in Latin American Countries	3-14
Table 3-24: Weighing Average of Waste Generation Rate	3-14
Table 3-25: Summary of Waste Composition	3-16
Table 3-26: Weighing Average of Three Contents for Combustible Matter	3-16
Table 3-27: Comparison of Lower Calorific Value	3-17
Table 3-28: Lower Calorific Value of Waste	3-18
Table 3-29: Estimated Lower Calorific Value of Wastes from Institution and Business Entities	3-19
Table 3-30: Lower Calorific Value of Mixed Waste Collected	3-19
Table 3-31: Comparison of Waste Calorific Value	3-20
Table 3-32: Areas Selected for Time and Motion Survey	3-20
Table 3-33: Schedule for Time and Motion Survey	3-21
Table 3-34: Time Elapsed for Each Activity and Type of Area	3-22
Table 3-35: Distance Traveled During Each Activity, Type of Area, and Number of Trips	3-23
Table 3-36: Disposal Amount for Every Area Selected for Time and Motion	3-23
Table 3-37: Comparative Table of Kg/Collection Time Indicator	3-24
Table 3-38: Breakdown for Aggregated Residential Area and Old Section of the City	3-24
Table 3-39: Comparative Table of Kg/Trip Indicator	3-25
Table 3-40: Bulk Density Comparison	3-26
Table 3-41: Waste Composition Comparison	3-26
Table 3-42: Comparative Table of Kg./km. Indicator	3-27
Table 3-43: Comparative Table of Kg/Worker/Trip or Kg/Worker/hr Indicator	3-28
Table 3-44: Comparative Table of Kgs/total kilometers Indicator	3-28
Table 3-45: Distribution of Households according to Income Level	3-31
Table 3-46: Distribution of Samples (Household)	3-31
Table 3-47: Samples of Business Establishments	3-31
Table 3-48: Do you have waste collection service?	3-33
Table 3-49: Outline of Samples	3-41
Table 3-50: Daily Recovery Amount of Street waste picker	3-43
Table 3-51: Waste Metal Export Amount (1996 to 2001)	3-47
Table 3-52: Purchase and Sales Price of Waste Paper	3-48
Table 3-53: Plastic Waste Export Amount in 1996 to 2001	3-49
Table 3-54: Outline of the Sampling Point	3-52
Table 3-55: Results of Waste Quality Analysis(1)	3-52
Table 4-1: Comparison of Waste Generation Rate in Latin American Countries	4-3
Table 4-2: Waste Generation Rate	4-4
Table 4-3: Household Waste Generation Rate	4-4
Table 4-4: Waste Generation Amount	4-5
Table 4-5: Waste Collection Amount	4-5
Table 4-6: Weighing Data at Cerro Patacon (August 2001 to July 2002)	4-5
Table 4-7: Workers Distribution per Shift	4-14
Table 4-8: Percentage of Workers by Range of Years of Service	4-14
Table 4-9: Tons and Trips derived from the Collection Department and Landfill Data for November 2001 and January 2002	4-23
Table 4-10: Active Equipment and Number of Units	4-28
Table 4-11: Compactor Vehicles in the Collection Department	4-29
Table 4-12: Shifts and Schedule for the Mechanical Section	4-32
Table 4-13: Personnel in Charge of the Repair and Maintenance Works	4-32
Table 4-14: Daytime Shift Street Sweeping Service	4-36
Table 4-15: Night-time Street Sweeping Shift	4-37
Table 4-16: Number of Personnel in the Street Sweeping Department (Day-time)	4-38
Table 4-17: Number of Personnel in the Street Sweeping Department (Night-time)	4-38
Table 4-18: Outline of Cerro Patacon Landfill Site	4-40
Table 4-19: Remaining Landfill Capacity	4-41
Table 4-20: DIMAUD Tariff Structure	4-57

Table 4-21:: Billing and Collection by IDAAN for DIMAUD in 2001	4-58
Table 4-22: DIMAUD Income Report	4-59
Table 4-23: DIMAUD Income Statement	4-60
Table 4-24: DIMAUD Balance Sheet	4-61
Table 4-25: DIMAUD Accounts Receivable	4-62
Table 4-26: Unit Cost of DIMAUD Service	4-63
Table 4-27: Admission of private vehicles into Cerro Patacon sanitary landfill, January 20024-66	
Table 4-28: Basic Conditions of the Communities located around the Cerro Patacon Lanfill 4-70	
Table 5-1: Quantification of Hazardous and Non-hazardous Industrial Waste by Group, Panama5-2	
Table 5-2: Large Potential Generators of Hazardous Industrial Waste in Panama District	5-3
Table 6-1: Major Generators in Panama District. 1998	6-2
Table 7-1: Number of Houses and Residents in the Pilot Project Area	7-3
Table 7-2: Project Design Matrix of the Pilot Project of Collection Improvement	7-4
Table 7-3: Indicators to Evaluate the Collection Service.....	7-6
Table 7-4: Performance of the Collection Service before the Pilot Project	7-6
Table 7-5: Indicators for Collection Work.....	7-7
Table 7-6: Waste Generation Amount in the Pilot Project Area	7-9
Table 7-7: Results of the Pilot Project	7-15
Table 7-8: Indicator Values before and after the Pilot Project.....	7-15
Table 7-9: Waste Amount Collected per Travel Distance before and after the Pilot Project... 7-15	
Table 7-10: Recommended Reporting Manners among the Departments in DIMAUD	7-21
Table 7-11: Project Design Matrix of the Pilot Project of Separation at the Source.....	7-24
Table 7-12: Work Schedule of the Pilot Project of Separation at the Source	7-26
Table 7-13: Separation Categories	7-27
Table 7-14: Measurement Items and Number of Samples of Separation at the Source.....	7-28
Table 7-15: Amount of White Paper at DIMAUD (Carrasquilla).....	7-29
Table 7-16: Amount of White Paper at Municipality (EDEM).....	7-29
Table 7-17: Amount of White Paper per Permanent Officer	7-30
Table 7-18: Amount of Other Recyclable Materials at DIMAUD (Carrasquilla).....	7-30
Table 7-19: Amount of Other Recyclable Materials at Municipality (EDEM).....	7-30
Table 7-20: Amount of Other Recyclable Materials per Permanent Officer	7-30
Table 7-21: Composition of Other Recyclable Materials at DIMAUD (Carrasquilla)	7-31
Table 7-22: Composition of Other Recyclable Materials at Municipality (EDEM).....	7-32
Table 7-23: Combined Composition of Other Recyclable Materials both DIMAUD (Carrasquilla) and Municipality (EDEM).....	7-32
Table 7-24: Density of Other Recyclable Material	7-33
Table 7-25: Participation to Workshops.....	7-34
Table 7-26: Results of Opinion Survey before the Pilot Project.....	7-34
Table 7-27: Results of Opinion Survey at the end of Pilot Project	7-35
Table 7-28: Project Design Matrix of the Pilot Project of Landfill Operation Improvement .. 7-40	
Table 7-29: Landfill Operation Method designed at the Beginning the Pilot Project.....	7-42
Table 7-30: Performance Capacity of Heavy Equipment	7-43
Table 7-31: Operation Hour	7-43
Table 7-32: Heavy Equipment used in the Pilot Project	7-47
Table 7-33: Waste Amount Disposed	7-48
Table 7-34: Operating Time of Heavy Equipment (by type of equipment)	7-48
Table 7-35: Operating Time of Heavy Equipment (by day)	7-49
Table 7-36: Finished Dimension of Cells	7-49
Table 7-37: Cover Soil	7-51
Table 7-38: Discharge Time (Pilot Project Area)	7-51
Table 7-39: Discharge Time (Etapa I).....	7-52
Table 7-40: Performance Capacity of Heavy Equipment	7-53
Table 7-41: Recommended Landfill Operation Method	7-55
Table 7-42: Project Design Matrix of DIMAUD Management Improvement.....	7-58
Table 7-43: Target Groups	7-74

Table 7-44: Profile of Pilot Project Areas	7-75
Table 7-45: Project Design Matrix for Environmental Education Pilot Project	7-76
Table 7-46: Activities of the Pilot Project.....	7-78
Table 7-47: Environmental Education Materials and other Complementary Tools.....	7-82
Table 7-48: Work Schedule for Environmental Education Pilot Project	7-85
Table 7-49: Questionnaire for Site Visit to Pilot Project Areas	7-89
Table 7-50: POS on Environmental Education Pilot Project	7-90
Table 7-51: Results of Evaluation of the Workshop (C/P)	7-94
Table 7-52: Results of Evaluation of the Workshop (T)	7-95
Table 7-53: Project Design Matrix of Use of the Existing Administrative Organization	7-98
Table 7-54: Project Design Matrix of Improvement of the 800 ASEO Service	7-99
Table 7-55: Numbers of Calls to 800 ASEO.....	7-104
Table 7-56: Total Calls Received (800Aseo), Period January-June 2002 per Type of Complaint.....	7-105
Table 7-57: Information Format on the Cleansing and Ornate Committees	7-117
Table 7-58: Recommended Strategy to Develop a Telephone Marketing Program.....	7-119
Table 8-1: Population Forecast	8-1
Table 8-2: Projection of GDP Growth Rate	8-2
Table 8-3: Example of Waste Generation Rate in OECD Countries	8-4
Table 8-4: Example of Waste Generation Rate in Developing Countries.....	8-4
Table 8-5: Waste Generation Rate	8-5
Table 8-6: Example of Waste Composition in OECD Countries.....	8-6
Table 8-7: Waste Composition of Panama Municipality	8-6
Table 8-8: Forecast of Future Population.....	8-7
Table 8-9: Forecast of GDP Growth Ratio and Number of Employee	8-8
Table 8-10: Forecast of Waste Generation Amount.....	8-8
Table 9-1: Priority Ranking of Key Issues.....	9-1
Table 9-2: Comparison of Technical System Alternatives	9-2
Table 9-3: Overall Physical Composition	9-4
Table 9-4: Impurity Rate in Intermediate Treatment Process	9-4
Table 9-5: Recovery and Reduction Ratio	9-5
Table 9-6: Reduction Effect of Final Disposal Amount (weight ton base).....	9-6
Table 9-7: Cost Comparison of Mixed and Separate Collection.....	9-8
Table 9-8: Costs of Alternative Technologies for Large Cities	9-8
Table 9-9: Cost Index.....	9-9
Table 9-10: Comparison of Scenarios for Separate Collection Introduction	9-13
Table 9-11: Impurity Rate of Recyclable Waste	9-13
Table 9-12: Potential Collection Amount of Recyclable Waste	9-13
Table 9-13: Separate Collection Amount and MRF Installation Plan.....	9-14
Table 9-14: Outline of Optimum System.....	9-16
Table 10-1: Policy and Target of the Master Plan.....	10-3
Table 10-2: Target Figures of the Master Plan.....	10-3
Table 10-3: Strategy for the Master Plan	10-3
Table 10-4: Outline of the Master Plan	10-4
Table 10-5: Proposed Improvement Measures (1)	10-5
Table 10-6: Proposed Improvement Measures (2).....	10-6
Table 10-7: Proposed Improvement Measures (3).....	10-7
Table 10-8: Proposed Improvement Measures (4).....	10-8
Table 10-9: Separate Collection Item.....	10-14
Table 10-10: Separate Collection Amount.....	10-15
Table 10-11: Assumption of Collection Vehicle Conditions	10-15
Table 10-12: Estimated Bulk Density	10-16
Table 10-13: Total DIMAUD Collection Amount.....	10-17
Table 10-14: DIMAUD Recyclable Waste Collection Amount.....	10-17
Table 10-15: DIMAUD Non-Recyclable and Mixed Waste Collection Amount	10-18
Table 10-16: Required Number of Vehicles	10-19

Table 10-17: Forecast of Waste Collection Amount in the East	10-20
Table 10-18: Required Capacity of Transfer Station in the East.....	10-20
Table 10-19: Outline of the Transfer and Transport System.....	10-20
Table 10-20: Execution Scheme	10-21
Table 10-21 : MRF Input Amount	10-21
Table 10-22: Impurity rate and MRF Recovery Ratio	10-22
Table 10-23:MRF Recovery Amount	10-23
Table 10-24: Original Design Parameter of Leachate Treatment Lagoon	10-29
Table 10-25: Required Capacity of Leachate Treatment Facility for the Existing Landfills	10-30
Table 10-26 : Discharge Limit to Water Bodies	10-31
Table 10-27: Relation Between Treatment Process and Treated Water Quality.....	10-31
Table 10-28: Prospect of Annual Waste Disposal Amount	10-32
Table 10-29: Prospect of Annual Landfill Volume.....	10-32
Table 10-30: Accumulated Landfill Volume	10-32
Table 10-31: Prospect of Required Landfill Volume and Construction Plan	10-33
Table 10-32: Present Collected Solid Waste Amount from Panama District (Over All).....	10-74
Table 10-33: Present Collected Solid Waste Amount from Panama District (ICI)	10-74
Table 10-34: Suggested Quantified Indicators.....	10-79
Table 10-35: Phased Implementation.....	10-81
Table 10-36 : Collection Vehicle Purchase Plan for Mixed Collection	10-83
Table 10-37 : Collection Vehicle Purchase Plan for Separate Collection.....	10-83
Table 10-38 : Condition of Cost Estimation	10-84
Table 10-39 : Results of Cost Estimation.....	10-84
Table 10-40: Overall Cost of Transfer / Transport System for the East	10-85
Table 10-41 : Outline of Facility.....	10-85
Table 10-42 : Result of Cost Estimation	10-86
Table 10-43: Unit Cost of Leachate Collection System per Hectare	10-86
Table 10-44: Unit cost of Final Cover and Rain Water Channel	10-86
Table 10-45: Total Unit Cost	10-86
Table 10-46: Total Project Cost for Chatarra.....	10-86
Table 10-47: Total Project Cost for Etapa I	10-87
Table 10-48: Overall Cost.....	10-87
Table 10-49: Approximate Cost of Leachate Treatment Improvement	10-87
Table 10-50: Overall Cost of Current Landfill Improvement	10-87
Table 10-51: Overall Cost of Landfill (Etapa 3)	10-88
Table 10-52 : Implementation plan	10-89
Table 10-53 : Overall Cost (1)	10-90
Table 10-54: Overall Cost (2)	10-91
Table 10-55: Overall Cost (3)	10-91
Table 10-56: Total Overall Cost.....	10-92
Table 10-57: MSW Unit Cost in 2001	10-93
Table 10-58: Cost Effect of Transfer and Transport System	10-93
Table 10-59: T/S handling Amount and Saving Cost	10-93
Table 10-60: Incremental Cost.....	10-94
Table 10-61: Unit Incremental Cost for Landfill Amount	10-94
Table 10-62: Examine Case for Concession	10-94
Table 10-63: Interest of JBIC Investment Credit	10-95
Table 10-64: Loan Conditions.....	10-95
Table 10-65: Borrowing Condition for Landfill.....	10-95
Table 10-66: Repayment Plan of Concessionaire for Landfill.....	10-95
Table 10-67: DIMAUD Repayment Plan for Landfill	10-96
Table 10-68: Borrowing Condition for Transfer System	10-96
Table 10-69: Repayment Plan of Concessionaire for Transfer System	10-96
Table 10-70: DIMAUD Repayment Plan for Transfer System.....	10-96
Table 10-71: Borrowing Condition for MRF	10-96

Table 10-72: Repayment Plan of Concessionaire for MRF	10-96
Table 10-73: DIMAUD Repayment Plan for MRF.....	10-96
Table 10-74: Case 1(Concession for Landfill).....	10-97
Table 10-75: Case 2 (Concession for Landfill and Transfer System).....	10-97
Table 10-76: Case 3 (Concession for Landfill, Transfer System and MRF).....	10-97
Table 10-77: Overall Cost.....	10-97
Table 10-78: Financial Situation without Master Plan.....	10-100
Table 10-79: DIMAUD Direct Implementation of M/P without Borrowed Funds.....	10-103
Table 10-80: Financing M/P with Borrowed Funds.....	10-103
Table 10-81: Master Plan under Concession of Sanitary Landfill	10-104
Table 10-82: Master Plan under Concession of Sanitary Landfill and Transfer & Transport.....	10-105
Table 10-83: Master Plan under Concession of Sanitary Landfill, Transfer & Transport and MRF.....	10-105
Table 10-84: Burden of Solid Waste Service Cost on Household Income, 2002	10-107
Table 10-85: Burden of Solid Waste Service Cost on Household Income with M/P	10-107
Table 10-86: Burden of Solid Waste Service Cost on Household Income with M/P under Concession.....	10-108
Table 10-87: Burden of Solid Waste Service Cost on Curundu Household Income (%)	10-108
Table 10-88: Sensitivity Analysis	10-109
Table 10-89: Study Case in Economic Evaluation.....	10-111
Table 10-90: Cost and Benefit	10-112
Table 10-91: EIRR and B/C	10-112
Table 11-1: Outline of the Final Disposal Project (Feasibility Study).....	11-2
Table 11-2: Outline of the Transfer and Transport Project (Pre-feasibility Study).....	11-3
Table 11-3: Effluent Standards set by ANAM.....	11-4
Table 11-4: Results of Permeability Survey.....	11-8
Table 11-5: Precipitation Data of Gamboa Station	11-10
Table 11-6: Precipitation Data of PMG Station	11-11
Table 11-7: Precipitation Data of B.AFF Station.....	11-12
Table 11-8: Monthly Average Temperature Data of Gamboa Station.....	11-13
Table 11-9: Monthly Average Temperature Data of B.AFF Station.....	11-13
Table 11-10: Average Monthly Sunshine Hours (1908 to 1965).....	11-14
Table 11-11: Prospect of Required Landfill Volume and Construction Plan	11-14
Table 11-12: Basic Concept of Site Development Plan	11-15
Table 11-13: Prospective Landfill Amount.....	11-15
Table 11-14: Earth Work Volume.....	11-17
Table 11-15: Total Volume of Surplus Soil Pile Up Site.....	11-17
Table 11-16: Major Causes of Synthetic Liner Damage.....	11-20
Table 11-17: Flow Calculation Table for Leachate Collection System	11-21
Table 11-18: Runoff Ratio for Peak Flow.....	11-22
Table 11-19: Flow Calculation Table for Rainwater Drainage System	11-23
Table 11-20: Calculation Cases.....	11-25
Table 11-21: Maximum Rainfall Year (1992 to 2001)	11-25
Table 11-22: Treatment Capacity and Regulation Amount	11-26
Table 11-23: Typical Data of Leachate Quality.....	11-26
Table 11-24: Design Conditions for Leachate Treatment Facility.....	11-27
Table 11-25: Summary of Leachate Treatment Facility	11-28
Table 11-26: Overall Cost.....	11-28
Table 11-27: Forecast of Waste Collection Amount in the East.....	11-34
Table 11-28: Forecast of Waste Collection Amount in the North.....	11-34
Table 11-29: Key Data for Break-even Analysis.....	11-34
Table 11-30: Required Capacity of Transfer Station in the East.....	11-36
Table 11-31: Transfer and Transport System in the East.....	11-36
Table 11-32: Cost Estimates for Transfer and Transport System for the East.....	11-36
Table 11-33: Required Capacity of Transfer Station in the North.....	11-38

Table 11-34: Transfer and Transport System in the North	11-38
Table 11-35: Cost Estimates for Transfer and Transport System for the North	11-38
Table 11-36: Waste Collection Amount for Design of Transfer and Transport System in the East	11-41
Table 11-37: Advantage and Disadvantage of Transfer Station Type	11-43
Table 11-38: Outline of the Project.....	11-43
Table 11-39: Design Parameters for Transport and Transport System	11-44
Table 11-40: Outline of Conceptual Design of Transfer Station	11-45
Table 11-41: Required Number of Transport Equipment	11-47
Table 11-42: Required Number of Collection Equipment	11-47
Table 11-43: Execution Scheme	11-47
Table 11-44: Staff Assignment for Transfer Station	11-48
Table 11-45: Inspection and Maintenance of Facilities	11-48
Table 11-46: Overall Cost of the Transfer and Transport System in the East	11-49
Table 11-47: Unit Cost of the Transfer and Transport System in the East	11-49
Table 11-48: Options for the PPS in Solid Waste Management	11-51
Table 11-49: Financial Analysis of Feasibility Study	11-60
Table 11-50: Results of Scoping	11-62
Table 11-51: Outline of the Project of Final Disposal System.....	11-66
Table 11-52: Items of Environmental Baseline Survey	11-69
Table 11-53: Annual Precipitation (1992-2001)	11-71
Table 11-54: Average Monthly Precipitation (1992-2001).....	11-71
Table 11-55: Average Annual Temperature (1992 – 2001).....	11-72
Table 11-56: Average Monthly Temperature (1992 – 2001)	11-72
Table 11-57: Average Monthly Direction and Wind Speed at Balboa Station (1992 – 2001)	11-72
Table 11-58: Average Annual Solar Radiation (1992-2001)	11-73
Table 11-59: Average Monthly and Annual Relative Humidity	11-74
Table 11-60: Results of Permeability Survey	11-75
Table 11-61: Results of Surface Water Quality Survey	11-77
Table 11-62: Surface Water Flow	11-78
Table 11-63: Groundwater Quality	11-79
Table 11-64: Air Quality (SO ₂ , NO _x and H ₂ S).....	11-80
Table 11-65: Air Quality (Particulate Matters)	11-80
Table 11-66: Daytime Noise Level	11-81
Table 11-67: Nighttime Noise Level.....	11-81
Table 11-68: Results of Vibration Measurement at Different Frequencies	11-82
Table 11-69: Results of Survey on Flora (Site 2).....	11-84
Table 11-70: Threatened Species found in the Survey.....	11-85
Table 11-71: Detected Fauna Species during the Survey (Mammals).....	11-86
Table 11-72: Detected Fauna Species during the Survey (Birds)	11-87
Table 11-73: Detected Fauna Species during the Survey (Reptiles).....	11-89
Table 11-74: Detected Fauna Species during the Survey (Amphibians)	11-89
Table 11-75: Results of Initial Environmental Examination on the Project of Final Disposal System	11-92
Table 11-76: Monitoring Program	11-106
Table 11-77: Results of Financial Analysis	11-111
Table 11-78: Benefit of Landfill	11-111
Table 11-79: Cost and Benefit (Final Disposal Project)	11-112
Table 11-80: WTP for the Existing SWM Service (ex. Landfill)	11-112
Table 11-81: Cost and Benefit (Transfer and Transport Project).....	11-113

List of Figures

	Page:
Figure 1-1: Overall Study Work Flow	1-6
Figure 1-2: Organizational Structure of the Study	1-7
Figure 3-1: Comparison of Lower Calorific Value	3-18
Figure 3-2: Collection Frequency	3-34
Figure 3-3: Punctuality of Collection Service.....	3-34
Figure 3-4: Degree of Satisfaction with Collection Service.....	3-35
Figure 3-5: Recycling Structure in the Study Area	3-46
Figure 3-6: Location of Sampling Point.....	3-51
Figure 3-7: Intersection of Via Ricardo J. Alfaro and Ave. La Paz	3-55
Figure 3-8: Via Transistmica.....	3-56
Figure 3-9: Via Jose A. Arango	3-56
Figure 3-10: Traffic Volume at the Intersection of Via Ricardo J. Alfaro and Ave. La Paz (Weekday)	3-57
Figure 3-11: Traffic Volume at the Intersection of Via Ricardo J. Alfaro and Ave. La Paz (Saturday)	3-57
Figure 3-12: Traffic Volume at the Intersection of Via Ricardo J. Alfaro and Ave. La Paz (Sunday)	3-58
Figure 3-13: Traffic Volume of Via Transistmica (Weekday).....	3-58
Figure 3-14: Traffic Volume of Via Transistmica (Saturday).....	3-58
Figure 3-15: Traffic Volume of Via Transistmica (Sunday).....	3-59
Figure 3-16: Traffic Volume of Via Jose A. Arango (Weekday).....	3-59
Figure 3-17: Traffic Volume of Via Jose A. Arango (Saturday)	3-59
Figure 3-18: Traffic Volume of Via Jose A. Arango (Sunday).....	3-60
Figure 3-19: Traffic Volume of Collection Vehicle at the Intersection of Via Ricardo J. Alfaro and Ave. La Paz (Weekday).....	3-64
Figure 4-1: Concept of Present Waste Stream	4-3
Figure 4-2: Estimated Waste Generation Sources in the Study Area.....	4-7
Figure 4-3: Current Waste Stream (daily average Aug.2001 to Jul. 2002).....	4-8
Figure 4-4: DIMAUD's Organizational Flow Chart.....	4-9
Figure 4-5: Collection Service Organizational Flow Chart.....	4-13
Figure 4-6: Overtime Hours per Collection Area.....	4-16
Figure 4-7: Collection Service Operative Flow Chart.....	4-17
Figure 4-8: Tons/hour Collected per Corregimiento	4-25
Figure 4-9: Hours of Work per Shift per Corregimiento.....	4-25
Figure 4-10: Percentage Distribution of Trucks Based on the Number of Days of Work During November 2001	4-30
Figure 4-11: Percentage Distribution of Trucks Based on the Number of Days of Work During January 2002.....	4-31
Figure 4-12: Organizational Structure of the Street Sweeping Department.....	4-35
Figure 4-13: View of "ranchitos" located in Cerro Patacon Landfill.....	4-69
Figure 7-1: Work-Schedule of the Pilot Project.....	7-5
Figure 7-2: Designed Collection Route (1-1).....	7-12
Figure 7-3: Designed Collection Route (1-2).....	7-12
Figure 7-4: Direct Collection Costs before and after the Pilot Project.....	7-18
Figure 7-5: Flow of the Pilot Project.....	7-41
Figure 7-6: Dimension of Cell	7-45
Figure 7-7: Consideration of Rainwater.....	7-46
Figure 7-8: Relation between Density and Compaction Time	7-54
Figure 7-9: General Scheme to Implement DB on Indicators.....	7-60
Figure 7-10: Pilot Project Areas.....	7-76
Figure 7-11: Implementation Procedure for Environmental Education Pilot Project	7-80
Figure 7-12: Structure of Customer Attention Administrative Unit	7-110

Figure 8-1: Waste Stream in 2005.....	8-9
Figure 8-2: Waste stream in 2010	8-9
Figure 8-3: Waste Stream in 2015.....	8-10
Figure 9-1: Tanner Triangle for Assessment of Combustibility of MSW.....	9-3
Figure 9-2: Flow Diagram of Alternatives.....	9-7
Figure 9-3: Relation Between Disposal Amount and Cost Index	9-10
Figure 9-4: Separate Collection Amount and MRF Installation Plan	9-14
Figure 9-5:Location Map	9-15
Figure 10-1: Waste Stream in 2005.....	10-9
Figure 10-2: Waste Stream in 2010.....	10-9
Figure 10-3: Waste Stream in 2015.....	10-10
Figure 10-4: Concept of Waste Minimization.....	10-11
Figure 10-5: Concept of Public Intervention for Resources Recovery	10-12
Figure 10-6 : Approach Sequence of Recycling Program.....	10-13
Figure 10-7 : MRF System Flow Sheet.....	10-22
Figure 10-8: Cerro Patacon Landfill Site	10-24
Figure 10-9: Closure Procedure of the Existing Landfill	10-25
Figure 10-10: Closure Design of the Existing Landfill (1)	10-26
Figure 10-11: Closure Design of the Existing Landfill.....	10-27
Figure 10-12: Layout of the Existing Landfill Facilities.....	10-28
Figure 10-13: Case 4	10-31
Figure 10-14: Proposed Organization Structure of DIMAUD	10-36
Figure 10-15: Information Flow in DIMAUD (Input Flow).....	10-71
Figure 10-16: Information Flow in DIMAUD (Output Flow)	10-72
Figure 11-1: Location Map of Cerro Patacon	11-5
Figure 11-2: Project Site	11-6
Figure 11-3: Location Map of Boring Survey.....	11-7
Figure 11-4: Direction of Ground Water Flow	11-8
Figure 11-5: Location of Meteorological Stations	11-9
Figure 11-6: Zoning Plan for Site Development.....	11-16
Figure 11-7: Surplus Soil Pile Up Site.....	11-17
Figure 11-8: Cross Section of Ground Water Drainage	11-19
Figure 11-9: Seepage Control Lining System	11-20
Figure 11-10: Concept of Maximum and Average Leachate Generation Amount	11-24
Figure 11-11: Concept of Leachate Regulation and Treatment Amount	11-24
Figure 11-12: Leachate Treatment Process Flow Sheet.....	11-27
Figure 11-13: Proposed Final Cover Structure.....	11-29
Figure 11-14: Zoning Plan	11-30
Figure 11-15: Break-even Analysis in the East.....	11-37
Figure 11-16: Break-even Analysis in the North	11-39
Figure 11-17: Recommended Location of Transfer Station in the East.....	11-42
Figure 11-18: Plan of Transfer Station (Phase I, 300 ton/day).....	11-46
Figure 11-19: Plan of Transfer Station (Phase II, 600 ton/day)	11-46
Figure 11-20: Project Site	11-68
Figure 11-21: Location Map of Baseline Survey (Surface Water, Groundwater, Air, Noise and Vibration)	11-70
Figure 11-22: Average Daily Solar Radiation (1992-2001).....	11-73
Figure 11-23: Average Daily Sunshine Hours (2000-2001)	11-74
Figure 11-24: Location Map of Boring Survey.....	11-75
Figure 11-25: Direction of Ground Water Flow	11-78
Figure 11-26: Flora and Fauna Survey.....	11-83
Figure 11-27: Camino de Cruces	11-91

Abbreviations

ANAM	National Environmental Authority
ATP	Ability To Pay
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
C/P	Counterpart
DF/R	Draft Final Report
DIMAUD	Municipal Bureau for Urban and Household Cleansing
EIA	Environmental Impact Assessment
F/S	Feasibility Study
GTZ	German Technical Cooperation
HW	Hazardous Waste
ICB	Institutional Capacity Building
IC/R	Inception Report
IEE	Initial Environmental Examination
IDAAN	National Waterworks and Sewerage Institute
IDB	Inter-American Development Bank
IPAT	Panamanian Institute of Tourism
IT/R	Interim Report
IW	Industrial Waste
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
MEF	Ministry of Economy and Finances
MICI	Ministry of Trade and Industry
MIDA	Ministry of Agricultural Development
MINSA	Ministry of Health
MIVI	Ministry of Housing
M/M	Minutes of Meeting
MOP	Ministry of Public Works
M/P	Master Plan
MRF	Material Recovery Facility
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
MW	Medical Waste
O&M	Operation and Maintenance
PAHO	Pan-American Health Organization
POS	Public Opinion Survey
P/P	Pilot Project
PPP	Polluter Pay Principle
P/R	Progress Report
PRTR	Pollutant Release and Transfer Register
S/W	Scope of Work
SWM	Solid Waste Management
TDS	Total Dissolved Solids
T&M	Time and Motion Survey
T/S	Transfer Station
WACS	Waste Amount and Composition Survey
WTP	Willingness to Pay