

PHILIPPINE ENVIRONMENTAL GOVERNANCE 2 PROJECT (EcoGov 2)

Comparison of Statistical Precision Between the 7-Day and 3-Day WACS Data

August 15, 2008

This publication was produced for review by the United States Agency for International Development. It was prepared by Development Alternatives, Inc.





The EcoGov 2 Project is an initiative of the Government of the Philippines, implemented in partnership with the Department of Environment and Natural Resources, Department of the Interior and Local Government, local government units and other stakeholders, funded by the United States Agency for International Development and managed by Development Alternatives, Inc. and its subcontractors:

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> > August 15, 2008

The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

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ACRONYMS

CV	-	Coefficient of Variations
DAI	-	Development Alternatives, Inc.
DENR	-	Department of Environment and Natural Resources
EcoGov	-	The Philippine Environmental Governance Project
ESWMA	-	Ecological Solid Waste Management Act
IEC	-	Information, Education and Communication
ISWM	-	Integrated Solid Waste Management
LGU	-	Local Government Unit
SWM	-	Solid Waste Management
USAID	-	United States Agency for International Development
WACS	-	Waste Analysis and Characterization Study

COMPARISON OF STATISTICAL PRECISION BETWEEN THE 7-DAY AND 3-DAY WACS DATA

1. INTRODUCTION

1.1. DESCRIPTION OF THE STUDY

The Republic Act 9003 or the Ecological Solid Waste Management Act (ESWMA) mandates all Local Government Units (LGUs) to prepare their 10-Year Integrated Solid Waste Management ISWM Plan. An important component of this Plan is the conduct of seven-day Waste Analysis and Characterization Study (WACS). Waste Analysis and Characterization Study (WACS) is the method used in collecting data on the quantity (expressed in tons/kilogram per day) and composition (biodegradable, recyclable, residual, special wastes) of solid wastes generated through the actual measurement and classification of samples from various waste generators and from waste brought to the dumpsite for disposal. It provides baseline information that facilitates decision-making among LGUs on their Integrated Solid Waste Management (ISWM) programs and activities. Essentially, WACS serves as a basis for identifying strategies towards waste reduction and diversion, thus, helping LGUs design relevant courses of actions related to waste segregation and reduction at source, transport and collection, material recovery and disposal management. WACS results, in particular, are useful in determining necessary ISWM Municipal/City Ordinance, Information, Education and Communication (IEC) and incentive programs that will target major waste sources. Thus, benefits derived from this process make this a prerequisite to the development of ISWM Plans addressing RA 9003's mandate of 25% waste diversion.

The Philippine Environmental Governance Project 2 (EcoGov 2), a United States Agency for International Development (USAID)-funded project implemented by the Development Alternatives, Incorporated (DAI) in collaboration with the Department of Environment and Natural Resources (DENR), conducted the WACS as part of its technical assistance to LGUs in incorporating good governance principles and practices in Solid Waste Management (SWM). This study covered 49 EcoGov 2 assisted LGUs which was an expansion of the WACS done in EcoGov 1 for 19 LGUs – 9 cities and 10 municipalities that generated data related to the major strategies on waste diversion and disposal.

The EcoGov's experience in this actual conduct of WACS has shown that seven-day WACS requires huge amount of financial and manpower resources. In line with this, three-day WACS and WACS typology are being studied as options for LGUs. In support of this, further statistical analyses of the WACS data of EcoGov's SWM LGUs is imperative.

1.2. OBJECTIVES OF THE STUDY

The general objective of this study is to undertake further statistical analyses of the WACS data of EcoGov's SWM LGUs in order to elicit more conclusive basis for a better economical method of conducting the WACS. Specifically, this study aims to do the following:

- Using available WACS data, perform statistical analyses to determine if there is significant difference between a 3-4 day and 7-day WACS data of individual LGUs in the EcoGov database.
- Conduct the analyses for three major groups of waste generators (households, establishments and institutions, and public market) and for the total waste generation of the LGU.
- Test if there is difference in the per capita waste generation (household waste) of groups of LGUs in the EcoGov database (categorized by LGU class, population size, province/region, etc).
- To come up with recommendations on how to improve the WACS sampling design/methodology and the use of WACS typology.

1.3. SCOPE OF THE STUDY

This investigation covers the data which was part of the WACS database involving 49 LGUs consisting of ten cities and 39 municipalities. The data was collected on different dates from 2001 to 2007 from waste generators or sources, namely, the food establishments, institutions, public markets and residentials. The types of waste considered in this study are the biodegradable, recyclable and the residual wastes.

2. METHODOLOGY

2.1. PROFILE OF THE SAMPLE LGUS AND COLLECTION SITES

The scope of the WACS analysis includes 49 LGUs: 15 in Mindanao, 21 in Visayas and 13 in Northern Luzon. Of these 49 LGUs, 29 conducted their WACS in 2003, 5 in 2004, 5 in 2005, 6 in 2006 and 6 in 2007. Among these LGUs, there are 13 cities and 36 municipalities. These sample LGUs are summarized in Annex Tables A.1.

2.2. DATA COLLECTED

a. Waste Type

The available data in the WACS data files are classified according to the different types of waste: biodegradable, recyclable, residual, and special waste. However, observed values on the special waste are so sparse to warrant a reliable statistical analyses; hence, special waste data are excluded in the analysis.

b. Waste Source:

Likewise, the available data in the WACS data files are also classified according to the different generators or sources of waste: food establishments, general stores, industries, institutions, public market, recreation centers, residential, service centers, slaughterhouse, and special waste generators.

This study focused its analyses only on four waste generators; namely, food establishments, institutions, public market, and residential. These generators include the following sub-categories:

- Food Establishments restaurants, eateries, food stalls and bakeries;
- Institutions banks, pawnshops, lending centers, large schools, medium schools, small schools, large churches, small churches, bog government offices and small government offices;
- Public Market dry goods section and wet goods section;
- Residential (Households) high income, middle income and low income;

c. Variables:

- Total waste classified as: total biodegradable, total recyclable, total residual; all in kg/day.
- The waste data are also classified according to the LGU and source classification.

d. Data Sets:

There are two sets of data for the analysis, namely:

- Set 1: 7-day WACS data from 40 LGUs, referred to in this study as actual 7-day WACS.
- Set 2: 3-day WACS data from 40 LGUs, referred to in this study as actual 3-day WACS.

These data sets are summarized in Annex Tables A.1 and A.2.

2.3. PRE-ANALYSIS PREPARATION OF DATA

a. Casewise deletion of cases with sparse and extreme values

Exploratory analyses and ocular inspections of the data were done before the statistical analyses of the data. It was noted that numerous cases have very sparse values like those with only one or two values for the 7 days collection. Another serious defect of the data is the presence of extreme values. Thus cases with very sparse and extreme values were casewise deleted.

b. Mean imputation of missing values

The data sets after the casewise deletions were further modified by imputing the values of missing observations in each case by the mean of the available observations in the case.

2.4. SAMPLE SIZES OF THE RESULTING DATA SETS FOR ANALYSES

After the preparatory cleaning of the data files as described in section 2.3 above, the resulting sample sizes are summarized in the Annex Tables A.3.1a - A.3.2c.

It is noted in these tables that the sample sizes in the LGU x Source cross-classifications of data are so small that no reliable statistical inference can be made on the LGU x Source subclassifications. Hence, the statistical inferences were done by LGUs and by Sources.

2.5. STATISTICAL ANALYSIS

a. Comparison of means between 3-day collection and 7-day collection data

The 3-4 day datasets were constructed by taking the observations in 1 or 2 market days and 1 or two non-market days. Then testing the significance of mean differences between the 7-day means and 3-day means was done by the paired t-test. This test was applied for each of the LGUs across waste sources and for each of the waste sources across LGU.

b. Comparison of variances between 3-day collection and 7-day collection data

It is noted that the WACS sampling design is analogous to the two-stage sampling where the secondary sampling units are the collection days and the primary sampling units are samples of the collection units (say sample of food establishments, etc.). With this consideration, the within sampling unit variance were computed for the 7-day and 3-day data. Then testing the significance of variance difference was done by the F-test. This test was applied for each of the LGUs across waste sources and for each of the waste sources across LGU.

c. Comparison of coefficient of variations between 3-day collection and 7-day collection data

The comparisons of the means and variances performed above make use of the related sample tests since the 7-day and 3-day data sets are observed on the same sample of units.

To compare the precision of the actual 7-day WACS data with the precision of the actual 3-day WACS data, the coefficients of variations are used instead of the variances.

d. Analytical Tools

For the technical notes on the descriptive statistics and statistical inference used in this study, refer to Annex B.

3. RESULTS AND DISCUSSION

3.1. COMPARISON OF MEANS BETWEEN 7-DAY AND 3-DAY WASTE COLLECTIONS

In terms of the means, the 7-day and 3-day WACS are generally comparable.

3.1.1. Comparison of Means of the Waste Collections by the Food Establishments.

The analysis covered the waste collection samples from the 10 cities and 31 municipalities as specified in the Annex Table A.3.1a. Since there was small number of sampling units in each LGU, the analysis was done across cities and across municipalities.

The summary of the analysis of waste collections by the food establishments are summarized in Table 3.1.1 below.

LGU Type/	Sample		7-day			3-day		Differ	t-test	
Waste Type	size	mean	s.e.	cv	mean	s.e	cv	mean	s.e	Sig.
All Cities										
Biodegradable	56	5.33	1.007	18.89	5.19	1.039	20.02	0.14	0.288	0.629
Recyclable	47	1.47	0.282	19.27	1.45	0.295	20.43	0.02	0.088	0.813
Residual	57	1.84	0.309	16.83	1.85	0.333	18.01	-0.01	0.146	0.961
All Municipalities										
Biodegradable	135	4.06	0.421	10.36	3.97	0.469	11.82	0.09	0.142	0.499
Recyclable	125	1.14	0.151	13.16	1.16	0.166	14.29	-0.02	0.039	0.729
Residual	123	1.04	0.128	12.31	1.06	0.156	14.64	-0.02	0.061	0.697
All LGU										
Biodegradable	191	4.44	0.420	9.46	4.33	0.451	10.41	0.11	0.131	0.405
Recyclable	172	1.23	0.134	10.84	1.24	0.145	11.70	-0.01	0.037	0.912
Residual	180	1.30	0.134	10.35	1.31	0.152	11.57	-0.01	0.062	0.765

 Table 3.1.1.
 Mean comparison between 7-day and 3-day wastes of food establishments.

* Note: The mean difference is not statistically different (at the 5% level of significance) if the t-test significance is greater than 0.05.

a. For biodegradable waste:

• <u>In all cities.</u> There were 56 sampling units of biodegradable wastes of food establishments from the 10 cities. For this, the 7-day mean was 5.33 kg/day and the 3-day mean was 5.19 kg/day. The difference of 0.14 kg/day was not statistically different.

- <u>In all municipalities.</u> There were 135 sampling units of biodegradable wastes of food establishments from the 31 municipalities. For this, the 7-day mean was 4.06 kg/day and the 3-day mean was 3.97 kg/day. The difference of 0.09 kg/day was not statistically different.
- The biodegradable waste collections from the cities were higher than those from the municipalities.
- <u>In all LGUs.</u> There were 191 sampling units of biodegradable wastes of food establishments from the 41 LGUs. For this, the 7-day mean was 4.44 kg/day and the 3-day mean was 4.33 kg/day. The difference of 0.11 kg/day was not statistically different.

b. For recyclable waste.

- <u>In all cities.</u> There were 47 sampling units of recyclable wastes of food establishments from the 10 cities. For this, the 7-day mean was 1.47 kg/day and the 3-day mean was 1.45 kg/day. The difference of 0.02 kg/day was not statistically different.
- <u>In all municipalities.</u> There were 125 sampling units of recyclable wastes of food establishments from the 31 municipalities. For this, the 7-day mean was 1.14 kg/day and the 3-day mean was 1.16 kg/day. The difference of 0.01 kg/day was not statistically different.
- The recyclable waste collections from the cities were higher than those from the municipalities.
- <u>In all LGUs.</u> There were 172 sampling units of recyclable wastes of food establishments from the 41 LGUs. For this, the 7-day mean was 1.233 kg/day and the 3-day mean was 1.237 kg/day. The difference of 0.004 kg/day was not statistically different.

c. For residual waste.

- <u>In all cities.</u> There were 57 sampling units of residual wastes of food establishments from the 10 cities. For this, the 7-day mean was 1.84 kg/day and the 3-day mean was 1.85 kg/day. The difference of 0.01 kg/day was not statistically different.
- <u>In all municipalities.</u> There were 123 sampling units of residual wastes of food establishments from the 31 municipalities. For this, the 7-day mean was 1.04 kg/day and the 3-day mean was 1.06 kg/day. The difference of 0.02 kg/day was not statistically different.
- The residual waste collections from the cities were higher than those from the municipalities.

• <u>In all LGUs.</u> There were 180 sampling units of residual wastes of food establishments from the 41 LGUs. For this, the 7-day mean was 1.29 kg/day and the 3-day mean was 1.31 kg/day. The difference of 0.02 kg/day was not statistically different.

3.1.2. Comparison of Means of the Waste Collection by the Institutions.

The analysis covered the waste collection samples from the 10 cities and 31 municipalities as specified in the Annex Table A.3.1a. Since there was small number of sampling units in each LGU, the analysis was done across cities and across municipalities.

The summary of the analysis of waste collections by the food establishments are summarized in Table 3.1.2 below.

a. For biodegradable waste:

- <u>In all cities.</u> There were 69 sampling units of biodegradable wastes of institutions from the 10 cities. For this, the 7-day mean was 22.19 kg/day and the 3-day mean was 21.44 kg/day. The difference of 0.75 kg/day was not statistically different.
- <u>In all municipalities.</u> There were 171 sampling units of biodegradable wastes of institutions from the 31 municipalities. For this, the 7-day mean was 5.38 kg/day and the 3-day mean was 5.33 kg/day. The difference of 0.05 kg/day was not statistically different.
- The biodegradable waste collections from the cities were higher than those from the municipalities.
- <u>In all LGUs.</u> There were 240 sampling units of biodegradable wastes of institutions from the 41 LGUs. For this, the 7-day mean was 10.21 kg/day and the 3-day mean was 9.96 kg/day. The difference of 0.25 kg/day was not statistically different.

LGU Type/	Sample		7-day			3-day		Diffe	t-test	
Waste Type	size	mean	s.e.	cv	mean	s.e	cv	mean	s.e	Sig.
All Cities										
Biodegradable	69	22.19	12.483	56.26	21.44	13.186	61.50	0.75	0.574	0.196
Recyclable	56	11.02	6.309	57.25	12.13	7.340	60.51	-1.11	1.314	0.405
Residual	75	5.72	2.654	46.37	5.89	2.766	46.99	-0.16	0.163	0.320
All Municipalities										
Biodegradable	171	5.38	0.726	13.49	5.33	0.787	14.77	0.05	0.163	0.755
Recyclable	154	1.79	0.275	15.36	1.77	0.257	14.53	0.02	0.054	0.712
Residual	149	1.75	0.222	12.68	1.79	0.248	13.89	-0.04	0.082	0.637
All LGU										
Biodegradable	240	10.21	3.641	35.64	9.96	3.845	38.59	0.25	0.202	0.213
Recyclable	210	4.25	1.707	40.16	4.53	1.980	43.69	-0.28	0.352	0.428
Residual	224	3.08	0.905	29.40	3.16	0.946	29.94	-0.08	0.077	0.298

 Table 3.1.2.
 Mean comparison between 7-day and 3-day wastes of institutions.

* Note: The mean difference is not statistically different (at the 5% level of significance) if the t-test significance is greater than 0.05.

b. For recyclable waste.

- In all cities. There were 56 sampling units of recyclable wastes of institutions from the 10 cities. For this, the 7-day mean was 11.02 kg/day and the 3-day mean was 12.13 kg/day. The difference of 1.11 kg/day was not statistically different.
- In all municipalities. There were 154 sampling units of recyclable wastes of institutions from the 31 municipalities. For this, the 7-day mean was 1.79 kg/day and the 3-day mean was 1.77 kg/day. The difference of 0.02 kg/day was not statistically different.
- The recyclable waste collections from the cities were higher than those from the municipalities.
- In all LGUs. There were 210 sampling units of recyclable wastes of institutions from the 41 LGUs. For this, the 7-day mean was 4.25 kg/day and the 3-day mean was 4.53 kg/day. The difference of 0.28 kg/day was not statistically different.

c. For residual waste.

- In all cities. There were 75 sampling units of residual wastes of institutions from the 10 cities. For this, the 7-day mean was 5.72 kg/day and the 3-day mean was 5.88 kg/day. The difference of 0.16 kg/day was not statistically different.
- In all municipalities. There were 149 sampling units of residual wastes of institutions from the 31 municipalities. For this, the 7-day mean was 1.75 kg/day and the 3-day mean was 1.79 kg/day. The difference of 0.04 kg/day was not statistically different.
- The residual waste collections from the cities were higher than those from the municipalities.
- In all LGUs. There were 224 sampling units of residual wastes of institutions from the 41 LGUs. For this, the 7-day mean was 3.08 kg/day and the 3-day mean was 3.16 kg/day. The difference of 0.08 kg/day was not statistically different.

3.1.3. Comparison of the Means of the Waste Collections by the Public Markets.

The analysis covered the waste collection samples from the 10 cities and 31 municipalities as specified in the Annex Table A.3.1b. Since there was small number of sampling units in each LGU, the analysis was done across cities and across municipalities.

The summary of the analysis of waste collections by the food establishments are summarized in Table 3.1.3 below.

LGU Type/	Sample		7-day			3-day		Diffe	t-test	
Waste Type	size	mean	s.e.	cv	mean	s.e	cv	mean	s.e	Sig.
All Cities										
Biodegradable	11	895.45	299.546	33.45	906.70	310.752	34.27	-11.25	20.19	0.590
Recyclable	11	54.43	22.482	41.30	57.75	24.089	41.71	-3.32	2.468	0.208
Residual	11	165.66	65.891	39.77	161.19	65.343	40.54	4.47	5.897	0.466
All Municipalities										
Biodegradable	25	333.50	65.803	19.73	347.59	72.644	20.90	-14.10	15.74	0.379
Recyclable	22	38.72	10.620	27.43	35.32	9.564	27.08	3.40	2.679	0.218
Residual	25	82.12	18.896	23.01	80.84	19.520	24.15	1.28	3.486	0.716
All LGU										
Biodegradable	36	505.20	108.683	21.51	518.43	113.334	21.86	-13.23	12.39	0.293
Recyclable	33	43.96	10.187	23.17	42.80	10.201	23.84	1.16	2.022	0.570
Residual	36	107.65	24.321	22.59	105.39	24.391	23.14	2.26	2.981	0.454

 Table 3.1.3.
 Mean comparison between 7-day and 3-day wastes of public markets.

* Note: The mean difference is not statistically different (at the 5% level of significance) if the t-test significance is greater than 0.05 .

a. For biodegradable waste:

- <u>In all cities</u>. There were 11 sampling units of biodegradable wastes of public markets from the 10 cities. For this, the 7-day mean was 895.45 kg/day and the 3-day mean was 906.7 kg/day. The difference of 11.25 kg/day was not statistically different.
- <u>In all municipalities</u>. There were 25 sampling units of biodegradable wastes of public markets from the 31 municipalities. For this, the 7-day mean was 333.50 kg/day and the 3-day mean was 347.59 kg/day. The difference of 14.10 kg/day was not statistically different.
- The biodegradable waste collections from the cities were higher than those from the municipalities.
- <u>In all LGUs</u>. There were 36 sampling units of biodegradable wastes of public market from the 41 LGUs. For this, the 7-day mean was 505.2 kg/day and the 3-day mean was 518.43 kg/day. The difference of 13.23 kg/day was not statistically different.

b. For recyclable waste.

- <u>In all cities</u>. There were 11 sampling units of recyclable wastes of public markets from the 10 cities. For this, the 7-day mean was 54.43 kg/day and the 3-day mean was 57.75 kg/day. The difference of 3.32 kg/day was not statistically different.
- <u>In all municipalities</u>. There were 22 sampling units of recyclable wastes of public markets from the 31 municipalities. For this, the 7-day mean was 38.72 kg/day and

the 3-day mean was 35.32 kg/day. The difference of 3.40 kg/day was not statistically different.

- The recyclable waste collections from the cities were higher than those from the municipalities.
- <u>In all LGUs</u>. There were 33 sampling units of recyclable wastes of public markets from the 41 LGUs. For this, the 7-day mean was 43.96 kg/day and the 3-day mean was 42.80 kg/day. The difference of 1.16 kg/day was not statistically different.

c. For residual waste.

- <u>In all cities</u>. There were 11 sampling units of residual wastes of public markets from the 10 cities. For this, the 7-day mean was 165.66 kg/day and the 3-day mean was 161.19 kg/day. The difference of 4.47 kg/day was not statistically different.
- <u>In all municipalities</u>. There were 25 sampling units of residual wastes of public markets from the 31 municipalities. For this, the 7-day mean was 82.12 kg/day and the 3-day mean was 80.84 kg/day. The difference of 1.28 kg/day was not statistically different.
- The residual waste collections from the cities were higher than those from the municipalities.
- <u>In all LGUs</u>. There were 36 sampling units of residual wastes of public markets from the 41 LGUs. For this, the 7-day mean was 107.65 kg/day and the 3-day mean was 105.39 kg/day. The difference of 2.26 kg/day was not statistically different.

3.1.4. Comparison of the Means of the Waste Collections by the Households.

The analysis covered the waste collection samples from the 10 cities and 31 municipalities as specified in the Annex Table A.3.1b. Unlike the food establishments, institutions and public markets, there were larger numbers of sampling households in the LGUs, hence the analysis was done in each cities and municipalities.

a. For biodegradable waste:

The summary of the analysis of the biodegradable waste collections by the households are summarized in Table 3.1.4a below.

- Among cities. Of the 10 cities, significant differences in the 7-day and the 3-day means were observed in 4 cities: in Bayawan City, Lamitan City, Tacurong City and Tanjay City. The 7-day and the 3-day means were not significantly different in the other 6 cities.
- <u>Among municipalities</u>. Of the 29 municipalities with sampling units (Diffun and Talibon had no household sampling units), significant differences in the 7-day and the 3-day means were observed only in 4 municipalities: in Amlan, Aritao, Sta.

Catalina and Wao. The 7-day and the 3-day means were not significantly different in the other 25 cities.

- The biodegradable waste collections from the cities were comparable to those from the municipalities.
- <u>In all LGUs</u>. There were 863 sampling households of biodegradable wastes of public market from the 39 LGUs. For this, the 7-day mean was 1.63 kg/day and the 3-day mean was 1.60 kg/day. The difference of 0.03 kg/day was not statistically different.

b. For recyclable waste.

The summary of the analysis of the recyclable waste collections by the households are summarized in Table 3.1.4b below.

- Among cities. Of the 10 cities, no significant differences in the 7-day and the 3-day means were observed.
- <u>Among municipalities</u>. Of the 29 municipalities with sampling units (Diffun and Talibon had no household sampling units), significant differences in the 7-day and the 3-day means were observed only in 4 municipalities: in Corella, Jagna, Maddela and Solano. The 7-day and the 3-day means were not significantly different in the other 25 cities.
- The recyclable waste collections from the cities were comparable to those from the municipalities.
- <u>In all LGUs</u>. There were 804 sampling households of recyclable wastes of households from the 39 LGUs. For this, the 7-day mean was 0.70 kg/day and the 3-day mean was 0.67 kg/day. The difference of 0.03 kg/day was not statistically different.

c. For residual waste.

The summary of the analysis of the residual waste collections by the households are summarized in Table 3.1.4c below.

- <u>Among cities</u>. Of the 10 cities, only Pagadian City was observed to have significant difference in the 7-day and the 3-day means. The 7-day and the 3-day means were significantly different in all other cities.
- <u>Among municipalities</u>. Of the 29 municipalities with sampling units (Diffun and Talibon had no household sampling units), significant differences in the 7-day and the 3-day means were observed only in 2 municipalities: in Bayombong and Jagna. The 7-day and the 3-day means were not significantly different in the other 27 cities.

- The residual waste collections from the cities were comparable to those from the municipalities.
- <u>In all LGUs</u>. There were 829 sampling households of residual wastes from the 39 LGUs. For this, the 7-day mean was 0.54 kg/day and the 3-day mean was 0.0.56 kg/day. The difference of 0.02 kg/day was not statistically different.

т	CU/SOUDCE	Sample		7-day			3-day		Differ	ence	t-test
I	GU/SOURCE	size	mean	s.e.	cv	mean	s.e	cv	mean	s.e	Sig.
	Cities										
1	Bais City	26	1.73	0.171	9.88	1.69	0.177	10.47	0.04	0.074	0.610
2	Bayawan City	40	1.60	0.152	9.50	1.90	0.177	9.32	-0.30	0.064	0.00
3	Cauayan City	24	1.47	0.221	15.03	1.61	0.337	20.93	-0.15	0.153	0.345
4	Danao City	25	1.92	0.341	17.76	1.78	0.314	17.64	0.14	0.096	0.151
5	Isabela City	30	1.41	0.178	12.62	1.28	0.182	14.22	0.13	0.100	0.208
6	Lamitan City	50	1.74	0.096	5.52	1.51	0.148	9.80	0.23	0.102	0.032
7	Pagadian City	26	0.98	0.109	11.12	1.08	0.162	15.00	-0.10	0.079	0.221
8	Tacurong City	29	1.41	0.142	10.07	1.15	0.141	12.26	0.26	0.121	0.038
9	Tagbilaran City	14	1.94	0.281	14.48	1.88	0.293	15.59	-0.06	0.134	0.652
10	Tanjay City	15	1.61	0.284	17.64	1.39	0.351	25.25	0.22	0.100	0.042
	Municipalities										
1	Alburquerque	12	1.67	0.159	9.52	1.71	0.137	8.01	-0.03	0.142	0.819
2	Amlan	9	2.74	0.733	26.75	1.83	0.532	29.07	0.92	0.373	0.040
3	Aritao	18	1.74	0.256	14.71	1.36	0.207	15.22	0.37	0.123	0.008
4	Baclayon	11	0.81	0.188	23.21	0.49	0.088	17.96	0.31	0.167	0.091
5	Bagabag	27	2.41	0.668	27.72	1.71	0.236	13.80	0.70	0.676	0.313
6	Baler	20	0.93	0.122	13.12	0.88	0.135	15.34	0.05	0.077	0.534
7	Bambang	40	1.59	0.102	6.42	1.64	0.200	12.20	-0.05	0.060	0.387
8	Bayombong	24	1.64	0.193	11.77	1.56	0.200	12.82	-0.07	0.052	0.186
9	Buug	21	1.49	0.293	19.66	1.78	0.448	25.17	-0.29	0.215	0.190
10	Cabarroguis	25	1.60	0.293	18.31	1.46	0.265	18.15	0.15	0.132	0.282
11	Corella	19	1.71	0.232	13.57	1.71	0.246	14.39	0.003	0.144	0.981
12	Cortes	18	1.05	0.186	17.71	0.95	0.186	19.58	0.10	0.063	0.126
13	Dauin	14	2.04	0.552	27.06	1.79	0.422	23.58	0.26	0.307	0.419
14	Dauis	11	2.04	0.394	19.31	2.22	0.399	17.97	-0.19	0.218	0.398
15	Diffun	-		-		-	-		-	-	-
16	Duero	17	1.52	0.177	11.64	1.56	0.211	13.53	-0.04	0.094	0.694
17	Dupax del Norte	18	1.63	0.348	21.35	1.54	0.394	25.58	0.09	0.125	0.492
18	Ipil	20	1.61	0.387	24.04	2.05	0.716	34.93	-0.44	0.369	0.248
19	Jagna	17	1.21	0.194	16.03	1.14	0.224	19.65	0.07	0.064	0.282
20	Lila	27	1.14	0.179	15.70	1.14	0.191	16.75	0.01	0.080	0.939
21	Maddela	9	0.63	0.172	27.30	0.55	0.158	28.73	0.08	0.044	0.121
22	Maria Aurora	16	2.79	0.708	25.38	3.33	1.101	33.06	-0.53	0.510	0.315
23	Maribojoc	24	1.29	0.155	12.02	1.17	0.157	13.42	0.12	0.086	0.163

 Table 3.1.4a.
 Mean comparison between 7-day and 3-day biodegradable wastes of households.

т	CUSOUDCE	Sample		7-day			3-day		Differ	t-test	
1	GU/SOURCE	size	mean	s.e.	cv	mean	s.e	cv	mean	s.e	Sig.
24	Pamplona	8	1.53	0.210	13.73	1.47	0.262	17.82	0.06	0.098	0.547
25	Panglao	9	0.58	0.171	29.48	0.50	0.183	36.60	0.08	0.120	0.501
26	Quezon	25	2.51	0.344	13.71	2.44	0.390	15.98	0.07	0.200	0.734
27	San Jose	17	1.68	0.203	12.08	1.70	0.210	12.35	-0.015	0.066	0.826
28	Solano	33	1.27	0.119	9.37	1.21	0.130	10.74	0.06	0.048	0.225
29	Sta. Catalina	50	2.28	0.140	6.14	2.60	0.231	8.88	-0.31	0.122	0.013
30	Talibon	-	-	-		-	-		-	-	-
31	Wao	25	1.48	0.136	9.19	1.62	0.147	9.07	-0.14	0.049	0.009
	ALL LGU	863	1.630	0.045	2.76	1.600	0.049	3.06	0.030	0.032	0.340

* Note: The mean difference is not statistically different (at the 5% level of significance) if the t-test significance is greater than 0.05.

	CUSOUDCE	Sample		7-day			3-day		Diffe	rence	t-test
	LGU/SOURCE	size	mean	s.e.	cv	mean	s.e	cv	mean	s.e	Sig.
	Cities										
1	Bais City	25	0.81	0.090	11.11	0.77	0.112	14.55	0.04	0.050	0.401
2	Bayawan City	37	0.75	0.085	11.33	0.70	0.088	12.57	0.06	0.033	0.107
3	Cauayan City	24	0.74	0.107	14.46	0.75	0.128	17.07	-0.006	0.066	0.931
4	Danao City	22	0.61	0.082	13.44	0.63	0.094	14.92	-0.02	0.040	0.586
5	Isabela City	30	0.30	0.030	10.00	0.29	0.026	8.97	0.01	0.030	0.748
6	Lamitan City	50	0.70	0.049	7.00	0.61	0.049	8.03	0.09	0.055	0.097
7	Pagadian City	21	0.55	0.090	16.36	0.58	0.105	18.10	-0.03	0.033	0.358
8	Tacurong City	28	0.36	0.040	11.11	0.33	0.026	7.88	0.03	0.032	0.354
9	Tagbilaran City	6	0.75	0.401	53.47	0.69	0.328	47.54	0.06	0.079	0.470
10	Tanjay City	12	0.27	0.057	21.11	0.24	0.057	23.75	0.03	0.025	0.336
	Municipalities										
1	Alburquerque	12	0.85	0.108	12.71	0.86	0.121	14.07	-0.01	0.055	0.796
2	Amlan	9	0.83	0.161	19.40	0.77	0.184	23.90	0.06	0.164	0.726
3	Aritao	18	0.51	0.084	16.47	0.59	0.125	21.19	-0.08	0.051	0.131
4	Baclayon	7	0.41	0.146	35.61	0.46	0.219	47.61	-0.05	0.077	0.557
5	Bagabag	25	0.81	0.105	12.96	0.76	0.118	15.53	0.05	0.058	0.387
6	Baler	2	0.47	0.103	21.91	0.44	0.104	23.64	0.03	0.035	0.342
7	Bambang	38	1.06	0.080	7.55	1.07	0.104	9.72	-0.01	0.059	0.882
8	Bayombong	22	0.95	0.120	12.63	0.93	0.129	13.87	0.01	0.059	0.857
9	Buug	21	0.65	0.258	39.69	0.58	0.201	34.66	0.07	0.114	0.523
10	Cabarroguis	25	0.88	0.218	24.77	0.65	0.170	26.15	0.23	0.172	0.196
11	Corella	14	0.37	0.059	15.95	0.45	0.082	18.22	-0.07	0.032	0.043
12	Cortes	18	0.61	0.108	17.70	0.63	0.106	16.83	0.02	0.051	0.728
13	Dauin	14	0.70	0.101	14.43	0.69	0.130	18.84	0.01	0.090	0.950
14	Dauis	11	2.08	0.579	27.84	2.01	0.530	26.37	0.06	0.291	0.837
15	Diffun	-	-	-		-	-	-	-	-	-
16	Duero	17	0.71	0.161	22.68	0.73	0.214	29.32	-0.02	0.069	0.760

 Table 3.1.4b.
 Mean comparison between 7-day and 3-day recyclable wastes of households.

Т	CUSOUDCE	Sample		7-day			3-day		Diffe	rence	t-test
1	LGU/SOURCE	size	mean	s.e.	cv	mean	s.e	cv	mean	s.e	Sig.
17	Dupax del Norte	17	0.84	0.199	23.69	0.84	0.160	19.05	0.01	0.081	0.931
18	Ipil	19	0.69	0.210	30.43	0.50	0.118	23.60	0.19	0.110	0.095
19	Jagna	14	0.58	0.151	26.03	0.43	0.132	30.70	0.15	0.053	0.017
20	Lila	18	0.46	0.137	29.78	0.42	0.103	24.52	0.04	0.051	0.477
21	Maddela	9	0.41	0.056	13.66	0.26	0.043	16.54	0.15	0.044	0.009
22	Maria Aurora	16	0.81	0.177	21.85	0.80	0.140	17.50	0.01	0.126	0.960
23	Maribojoc	22	0.52	0.127	24.42	0.53	0.126	23.77	-0.01	0.025	0.831
24	Pamplona	8	0.80	0.150	18.75	0.73	0.130	17.81	0.07	0.100	0.505
25	Panglao	10	0.26	0.109	41.92	0.27	0.106	39.26	-0.01	0.025	0.714
26	Quezon	25	1.05	0.246	23.43	0.88	0.185	21.02	0.17	0.218	0.450
27	San Jose	19	0.93	0.124	13.33	0.94	0.152	16.17	-0.01	0.065	0.868
28	Solano	32	0.58	0.060	10.34	0.50	0.057	11.40	0.09	0.035	0.018
29	Sta. Catalina	48	0.90	0.089	9.89	0.93	0.091	9.78	-0.03	0.042	0.452
30	Talibon	-	-	-		-	-	-	-	-	-
31	Wao	21	0.28	0.052	18.57	0.29	0.059	20.34	-0.01	0.019	0.730
	ALL LGU	804	0.70	0.024	3.43	0.67	0.022	3.87	0.03	0.023	0.308

* Note: The mean difference is not statistically different (at the 5% level of significance) if the t-test significance is greater than 0.05 .

1	CU/SOURCE	Sample		7-day			3-day		Diffe	erence	t-test
	LGU/SUUKCE	size	mean	s.e.	cv	mean	s.e	cv	mean	s.e	Sig.
	Cities										
1	Bais City	26	0.63	0.080	12.70	0.55	0.074	13.45	0.08	0.048	0.120
2	Bayawan City	39	1.02	0.085	8.33	0.97	0.102	10.52	0.05	0.055	0.344
3	Cauayan City	24	0.43	0.067	15.58	0.45	0.072	16.00	-0.02	0.022	0.347
4	Danao City	25	0.44	0.057	12.95	0.48	0.081	16.88	-0.05	0.042	0.279
5	Isabela City	30	0.27	0.050	18.52	0.23	0.044	19.13	0.04	0.027	0.154
6	Lamitan City	50	0.40	0.054	13.50	0.38	0.049	12.89	0.02	0.034	0.618
7	Pagadian City	27	0.49	0.046	9.39	0.54	0.040	7.41	-0.05	0.023	0.031
8	Tacurong City	30	0.61	0.063	10.33	0.56	0.056	10.00	0.06	0.048	0.247
9	Tagbilaran City	15	0.66	0.078	11.82	0.71	0.095	13.38	-0.04	0.029	0.146
10	Tanjay City	15	0.34	0.051	15.00	0.29	0.042	14.48	0.05	0.031	0.131
	Municipalities										
1	Alburquerque	12	0.74	0.081	10.95	0.83	0.133	16.02	-0.09	0.076	0.251
2	Amlan	4	0.71	0.286	40.28	0.56	0.172	30.71	0.15	0.119	0.284
3	Aritao	20	0.62	0.092	14.84	0.58	0.070	12.07	0.05	0.059	0.439
4	Baclayon	10	0.28	0.083	29.64	0.35	0.155	44.29	-0.08	0.077	0.352
5	Bagabag	26	0.54	0.079	14.63	0.48	0.081	16.88	0.06	0.037	0.144
6	Baler	20	0.31	0.051	16.45	0.33	0.054	16.36	-0.02	0.041	0.622
7	Bambang	40	0.63	0.059	9.37	0.66	0.074	11.21	-0.03	0.035	0.425
8	Bayombong	24	1.37	0.241	17.59	1.82	0.381	20.93	-0.46	0.159	0.008
9	Buug	21	0.72	0.247	34.31	1.11	0.548	49.37	-0.39	0.313	0.223
10	Cabarroguis	25	0.25	0.039	15.60	0.27	0.043	15.93	-0.02	0.015	0.297

 Table 3.1.4c.
 Mean comparison between 7-day and 3-day residual wastes of households.

		Sample 7-day					3-day		Difference		t-test
	LGU/SOURCE	size	mean	s.e.	cv	mean	s.e	cv	mean	s.e	Sig.
11	Corella	21	0.45	0.094	20.89	0.44	0.093	21.14	0.01	0.025	0.630
12	Cortes	18	0.66	0.091	13.79	0.62	0.087	14.03	0.04	0.046	0.416
13	Dauin	12	0.42	0.083	19.76	0.45	0.091	20.22	-0.04	0.029	0.234
14	Dauis	4	0.59	0.328	55.59	0.47	0.220	46.81	0.12	0.125	0.395
15	Diffun	-	-	-		-	-		-	-	-
16	Duero	17	0.66	0.143	21.67	0.65	0.214	32.92	0.01	0.102	0.893
17	Dupax del Norte	18	0.63	0.081	12.86	0.57	0.068	11.93	0.05	0.046	0.250
18	Ipil	20	0.54	0.149	27.59	0.60	0.245	40.83	-0.06	0.118	0.629
19	Jagna	17	0.44	0.066	15.00	0.33	0.056	16.97	0.11	0.048	0.042
20	Lila	27	0.27	0.069	25.56	0.30	0.074	24.67	-0.03	0.023	0.235
21	Maddela	9	0.21	0.041	19.52	0.20	0.038	19.00	0.01	0.034	0.685
22	Maria Aurora	16	0.57	0.147	25.79	0.50	0.126	25.20	0.07	0.080	0.413
23	Maribojoc	24	0.61	0.099	16.23	0.63	0.116	18.41	-0.02	0.056	0.686
24	Pamplona	3	0.48	0.138	28.75	0.51	0.140	27.45	-0.03	0.047	0.596
25	Panglao	10	0.46	0.194	42.17	0.63	0.347	55.08	-0.17	0.159	0.320
26	Quezon	24	0.60	0.109	18.17	0.75	0.212	28.27	-0.14	0.134	0.314
27	San Jose	-	-	-		-	-		-	1	-
28	Solano	32	0.70	0.079	11.29	0.62	0.082	13.23	0.08	0.057	0.169
29	Sta. Catalina	49	0.38	0.027	7.11	0.37	0.030	8.11	0.01	0.015	0.723
30	Talibon	-	-	-		-	-		-	-	-
31	Wao	25	0.29	0.033	11.38	0.32	0.043	13.44	-0.02	0.031	0.474
	ALL LGU	829	0.54	0.018	3.77	0.56	0.025	5.52	-0.02	0.013	0.156

* Note: The mean difference is not statistically different (at the 5% level of significance) if the t-test significance is greater than 0.05

3.2. COMPARISONS OF VARIANCES BETWEEN 7-DAY AND 3-DAY WASTE COLLECTIONS.

▶ In terms of the variances, the 7-day and 3-day WACS are generally comparable.

3.2.1. Comparisons of the Variances of Waste Collections by the Food Establishments.

The analysis covered the waste collection samples from the 10 cities and 31 municipalities as specified in the Annex Table A.3.1a. Since there was small number of sampling units in each LGU, the analysis was done across cities and across municipalities.

The summary of the analysis of waste collections by the food establishments are summarized in Table 3.2.1 below.

LGU Type/Waste Type	Sample	Variance o	f the mean	F test	
	size	7-day	3-day	Sig.	
All Cities					
Biodegradable	56	1.014	1.080	0.408	
Recyclable	47	0.080	0.087	0.381	
Residual	57	0.095	0.111	0.294	
All Municipalities					
Biodegradable	135	0.177	0.220	0.107	
Recyclable	125	0.023	0.027	0.147	
Residual	123	0.016	0.024	0.016	
All LGU					
Biodegradable	191	0.176	0.203	0.165	
Recyclable	172	0.018	0.021	0.147	
Residual	180	0.018	0.023	0.046	

 Table 3.2.1.
 Variance comparison between 7-day and 3-day wastes of food establishments.

* Note: The two variances are not statistically different (at the 5% level of significance) if the F-test significance is greater than 0.05

a. For biodegradable waste:

- In all cities. There were 56 sampling units of biodegradable wastes of food establishments from the 10 cities. For this, the 7-day variance was 1.014 kg²/day and the 3-day mean was 1.080 kg²/day. These two variances were not statistically different.
- <u>In all municipalities</u>. There were 135 sampling units of biodegradable wastes of food establishments from the 31 municipalities. For this, the 7-day variance was 0.177 kg²/day and the 3-day variance was 0.220 kg²/day. These two variances were not statistically different.
- <u>In all LGUs</u>. There were 191 sampling units of biodegradable wastes of food establishments from the 41 LGUs. For this, the 7-day variance was 0.176 kg²/day and the 3-day mean was 0.203 kg²/day. These two variances were not statistically different

b. For recyclable waste:

- In all cities. There were 47 sampling units of recyclable wastes of food establishments from the 10 cities. For this, the 7-day variance was 0.080 kg²/day and the 3-day mean was 0.087 kg²/day. These two variances were not statistically different.
- In all municipalities. There were 125 sampling units of recyclable wastes of food establishments from the 31 municipalities. For this, the 7-day variance was 0.023 kg²/day and the 3-day variance was 0.027 kg²/day. These two variances were not statistically different.

• In all LGUs. There were 172 sampling units of recyclable wastes of food establishments from the 41 LGUs. For this, the 7-day variance was 0.018 kg²/day and the 3-day mean was 0.020 kg²/day. The difference of 0.11 kg/day was not statistically different.

c. For residual waste:

- <u>In all cities</u>. There were 57 sampling units of residual wastes of food establishments from the 10 cities. For this, the 7-day variance was 0.095 kg²/day and the 3-day mean was 0.111 kg²/day. These two variances were not statistically different.
- <u>In all municipalities</u>. There were 123 sampling units of residual wastes of food establishments from the 31 municipalities. For this, the 7-day variance was 0.016 kg²/day and the 3-day variance was 0.024 kg²/day. These two variances were statistically different.
- In all LGUs. There were 180 sampling units of residual wastes of food establishments from the 41 LGUs. For this, the 7-day variance was 0.018 kg²/day and the 3-day mean was 0.023 kg²/day. These two variances were statistically different

3.2.2. Comparisons of the Variances of Waste Collections by the Institutions.

The analysis covered the waste collection samples from the 10 cities and 31 municipalities as specified in the Annex Table A.3.1a. Since there was small number of sampling units in each LGU, the analysis was done across cities and across municipalities.

The summary of the analysis of waste collections by the food establishments are summarized in Table 3.2.2 below.

a. For biodegradable waste:

- <u>In all cities</u>. There were 69 sampling units of biodegradable wastes of institutions from the 10 cities. For this, the 7-day variance was 155.831 kg²/day and the 3-day mean was 173.860 kg²/day. These two variances were not statistically different.
- <u>In all municipalities</u>. There were 171 sampling units of biodegradable wastes of institutions from the 31 municipalities. For this, the 7-day variance was 0.528 kg²/day and the 3-day variance was 0.620 kg²/day. These two variances were not statistically different.
- <u>In all LGUs</u>. There were 240 sampling units of biodegradable wastes of institutions from the 41 LGUs. For this, the 7-day variance was 13.256 kg²/day and the 3-day mean was 14.875.203 kg²/day. These two variances were not statistically different.

LGU Type/Waste Type	Sample	Variance o	of the mean	F test	
	size	7-day	3-day	Sig.	
All Cities					
Biodegradable	69	155.831	173.860	0.325	
Recyclable	56	39.805	53.876	0.130	
Residual	75	7.041	7.649	0.360	
All Municipalities					
Biodegradable	171	0.528	0.620	0.146	
Recyclable	154	0.076	0.066	0.203	
Residual	149	0.049	0.062	0.084	
All LGU					
Biodegradable	240	13.256	14.785	0.199	
Recyclable	210	2.915	3.920	0.016	
Residual	224	0.820	0.895	0.256	

 Table 3.2.2.
 Variance comparison between 7-day and 3-day wastes of institutions.

* Note: The two variances are not statistically different (at the 5% level of significance) if the F-test significance is greater than 0.05

b. For recyclable waste:

- <u>In all cities</u>. There were 56 sampling units of recyclable wastes of institutions from the 10 cities. For this, the 7-day variance was 39.805 kg²/day and the 3-day mean was 53.8756 kg²/day. These two variances were not statistically different.
- <u>In all municipalities</u>. There were 154 sampling units of recyclable wastes of institutions from the 31 municipalities. For this, the 7-day variance was 0.076 kg²/day and the 3-day variance was 0.066 kg²/day. These two variances were not statistically different.
- <u>In all LGUs</u>. There were 210 sampling units of recyclable wastes of institutions from the 41 LGUs. For this, the 7-day variance was 2.915 kg²/day and the 3-day mean was3.920 kg²/day. The difference of 0.11 kg/day was statistically different.

c. For residual waste:

- <u>In all cities</u>. There were 75 sampling units of residual wastes of institutions from the 10 cities. For this, the 7-day variance was 7.041 kg²/day and the 3-day mean was 7.649 kg²/day. These two variances were not statistically different.
- <u>In all municipalities</u>. There were 149 sampling units of residual wastes of institutions from the 31 municipalities. For this, the 7-day variance was 0.049 kg²/day and the 3-day variance was 0.062 kg²/day. These two variances were statistically different.
- <u>In all LGUs</u>. There were 224 sampling units of residual wastes of institutions from the 41 LGUs. For this, the 7-day variance was 0.820 kg²/day and the 3-day mean was 0.895 kg²/day. The difference of 0.11 kg/day was statistically different.

3.2.3. Comparisons of the Variances of Waste Collections by the Public Markets.

The analysis covered the waste collection samples from the 10 cities and 31 municipalities as specified in the Annex Table A.3.1b. Since there was small number of sampling units in each LGU, the analysis was done across cities and across municipalities.

The summary of the analysis of waste collections by the food establishments are summarized in Table 3.2.3 below.

LGU Type/Waste Type	Sample	Variance of	F test	
	size	7-day	3-day	Sig.
All Cities				
Biodegradable	11	89727.604	96566.931	0.453
Recyclable	11	505.432	580.266	0.411
Residual	11	4341.653	4269.741	0.489
All Municipalities				
Biodegradable	25	4330.072	5277.170	0.312
Recyclable	22	112.786	91.471	0.314
Residual	25	357.064	381.011	0.436
All LGU				
Biodegradable	36	11811.944	12844.656	0.401
Recyclable	33	103.772	104.067	0.497
Residual	36	591.525	594.930	0.493

 Table 3.2.3.
 Variance comparison between 7-day and 3-day wastes of public markets.

* Note: The two variances are not statistically different (at the 5% level of significance) if the F-test significance is greater than 0.05

a. For biodegradable waste:

- In all cities. There were 11 sampling units of biodegradable wastes of public markets from the 10 cities. For this, the 7-day variance was $89727.604 \text{ kg}^2/\text{day}$ and the 3-day mean was $96566.931 \text{ kg}^2/\text{day}$. These two variances were not statistically different.
- <u>In all municipalities</u>. There were 25 sampling units of biodegradable wastes of public markets from the 31 municipalities. For this, the 7-day variance was 4330.072 kg²/day and the 3-day variance was 5277.170 kg²/day. These two variances were not statistically different.
- <u>In all LGUs</u>. There were 36 sampling units of biodegradable wastes of public markets from the 41 LGUs. For this, the 7-day variance was 11811.944 kg²/day and the 3-day mean was 12844.656 kg²/day. These two variances were not statistically different.

b. For recyclable waste:

- <u>In all cities</u>. There were 11 sampling units of recyclable wastes of public markets from the 10 cities. For this, the 7-day variance was 505.432 kg²/day and the 3-day mean was 580.266 kg²/day. These two variances were not statistically different.
- <u>In all municipalities</u>. There were 22 sampling units of recyclable wastes of public markets from the 31 municipalities. For this, the 7-day variance was 112.786 kg²/day and the 3-day variance was 91.471 kg²/day. These two variances were not statistically different.
- <u>In all LGUs</u>. There were 33 sampling units of recyclable wastes of public markets from the 41 LGUs. For this, the 7-day variance was 103.772 kg²/day and the 3-day mean was 104.067 kg²/day. These two variances were not statistically different

c. For residual waste:

- <u>In all cities</u>. There were 11 sampling units of residual wastes of public markets from the 10 cities. For this, the 7-day variance was 4341.653 kg²/day and the 3-day mean was 4269.741 kg²/day. These two variances were not statistically different.
- <u>In all municipalities</u>. There were 25 sampling units of residual wastes of public markets from the 31 municipalities. For this, the 7-day variance was 357.064 kg²/day and the 3-day variance was 381.011 kg²/day. These two variances were statistically different.
- <u>In all LGUs</u>. There were 36 sampling units of residual wastes of public markets from the 41 LGUs. For this, the 7-day variance was 591.525 kg²/day and the 3-day mean was 594.930 kg²/day. These two variances were statistically different.

3.2.4. Comparisons of the Variances of Waste Collections by the Households.

The analysis covered the waste collection samples from the 10 cities and 31 municipalities as specified in the Annex Table A.3.1b. Unlike the food establishments, institutions and public markets, there were larger numbers of sampling households in the LGUs, hence the analysis was done in each of the cities and municipalities.

a. For biodegradable waste:

The summary of the variances analysis of the biodegradable waste collections by the households are summarized in Table 3.1.4a below.

• Among cities. Of the 10 cities, significant differences in the 7-day and the 3-day means were observed in 3 cities: in Cauayan City, Lamitan City, and Pagadian City. The 7-day and the 3-day means were not significantly different in the other 7 cities.

- <u>Among municipalities</u>. Of the 29 municipalities with sampling units (Diffun and Talibon had no household sampling units), significant differences in the 7-day and the 3-day means were observed only in 7 municipalities: in Amlan, Aritao, Sta. Catalina and Wao. The 7-day and the 3-day means were not significantly different in the other 22 cities.
- The biodegradable waste collections from the cities were comparable to those from the municipalities.
- <u>In all LGUs</u>. There were 863 sampling households of biodegradable wastes of public market from the 39 LGUs. For this, the 7-day mean was 1.63 kg/day and the 3-day mean was 1.60 kg/day. The difference of 0.03 kg/day was not statistically different.

b. For recyclable waste.

The summary of the analysis of the recyclable waste collections by the households are summarized in Table 3.1.4b below.

- <u>Among cities</u>. Of the 10 cities, no significant differences in the 7-day and the 3-day means were observed.
- <u>Among municipalities</u>. Of the 29 municipalities with sampling units (Diffun and Talibon had no household sampling units), significant differences in the 7-day and the 3-day means were observed only in 4 municipalities: in Corella, Jagna, Maddela and Solano. The 7-day and the 3-day means were not significantly different in the other 25 cities.
- The recyclable waste collections from the cities were comparable to those from the municipalities.
- <u>In all LGUs</u>. There were 804 sampling households of recyclable wastes of households from the 39 LGUs. For this, the 7-day mean was 0.70 kg/day and the 3-day mean was 0.67 kg/day. The difference of 0.03 kg/day was not statistically different.

c. For residual waste.

The summary of the analysis of the residual waste collections by the households are summarized in Table 3.1.4c below.

- <u>Among cities</u>. Of the 10 cities, only Pagadian City was observed to have significant difference in the 7-day and the 3-day means. The 7-day and the 3-day means were significantly different in all other cities.
- <u>Among municipalities</u>. Of the 29 municipalities with sampling units (Diffun and Talibon had no household sampling units), significant differences in the 7-day and the 3-day means were observed only in 2 municipalities: in Bayombong and

Jagna. The 7-day and the 3-day means were not significantly different in the other 27 cities.

- The residual waste collections from the cities were comparable to those from the municipalities.
- <u>In all LGUs</u>. There were 829 sampling households of residual wastes from the 39 LGUs. For this, the 7-day mean was 0.54 kg/day and the 3-day mean was 0.0.56 kg/day. The difference of 0.02 kg/day was not statistically different.

Table 3.2.3a. Variance comparison between 7-day and 3-day biodegradable wastes of households.

		Sample	Variance o	F test		
	LGU	size	7-day	3-day	Sig.	
	Cities					
1	Bais City	26	0.034	0.042	0.282	
2	Bayawan City	40	0.027	0.043	0.069	
3	Cauayan City	24	0.060	0.149	0.015	
4	Danao City	25	0.126	0.120	0.451	
5	Isabela City	30	0.039	0.046	0.336	
6	Lamitan City	50	0.017	0.034	0.007	
7	Pagadian City	26	0.015	0.035	0.019	
8	Tacurong City	29	0.028	0.032	0.376	
9	Tagbilaran City	14	0.086	0.101	0.382	
10	Tanjay City	15	0.100	0.150	0.220	
	Municipalities					
1	Alburquerque	12	0.036	0.055	0.237	
2	Amlan	9	0.652	0.460	0.305	
3	Aritao	18	0.087	0.076	0.394	
4	Baclayon	11	0.072	0.011	0.002	
5	Bagabag	27	0.648	0.073	0.000	
6	Baler	20	0.018	0.027	0.200	
7	Bambang	40	0.013	0.045	0.000	
8	Bayombong	24	0.040	0.044	0.407	
9	Buug	21	0.119	0.335	0.011	
10	Cabarroguis	25	0.097	0.105	0.422	
11	Corella	19	0.067	0.093	0.239	
12	Cortes	18	0.039	0.050	0.305	
13	Dauin	14	0.370	0.230	0.193	
14	Dauis	11	0.174	0.214	0.372	
15	Diffun	-				
16	Duero	17	0.042	0.069	0.156	
17	Dupax del Norte	18	0.127	0.163	0.300	
18	Ipil	20	0.222	0.879	0.002	
19	Jagna	17	0.042	0.060	0.239	
20	Lila	27	0.038	0.055	0.185	
21	Maddela	9	0.034	0.030	0.438	
22	Maria Aurora	16	0.685	2.098	0.016	

		Sample	Variance o	F test	
	LGU	size	7-day	3-day	Sig.
23	Maribojoc	24	0.030	0.035	0.346
24	Pamplona	8	0.052	0.077	0.297
25	Panglao	9	0.036	0.041	0.418
26	Quezon	25	0.150	0.204	0.223
27	San Jose	17	0.047	0.055	0.375
28	Solano	33	0.017	0.026	0.099
29	Sta. Catalina	50	0.028	0.082	0.000
30	Talibon	-			
31	Wao	25	0.023	0.037	0.119
	ALL LGU				

Note: The two variances are not statistically different (at the 5% level of significance) if the F-test significance is greater than 0.05.

		Sample	Variance of	F test	
	LGU	size	7-day	3-day	Sig.
	Cities				
1	Bais City	25	0.0128	0.0241	0.060
2	Bayawan City	37	0.0110	0.0201	0.035
3	Cauayan City	24	0.0230	0.0515	0.024
4	Danao City	22	0.0180	0.0329	0.075
5	Isabela City	30	0.0080	0.0134	0.107
6	Lamitan City	50	0.0100	0.0149	0.097
7	Pagadian City	21	0.0120	0.0213	0.099
8	Tacurong City	28	0.0100	0.0128	0.241
9	Tagbilaran City	6	0.1770	0.1435	0.402
10	Tanjay City	12	0.0270	0.0363	0.310
	Municipalities				
1	Alburquerque	12	0.0220	0.0507	0.085
2	Amlan	9	0.1410	0.2107	0.279
3	Aritao	18	0.0280	0.0492	0.127
4	Baclayon	7	0.0790	0.0524	0.302
5	Bagabag	25	0.2290	0.0327	0.000
6	Baler	2	0.0440	0.0963	0.316
7	Bambang	38	0.0090	0.0164	0.032
8	Bayombong	22	0.0170	0.0206	0.326
9	Buug	21	0.1000	0.1746	0.105
10	Cabarroguis	25	0.0590	0.0639	0.420
11	Corella	14	0.0210	0.0506	0.055
12	Cortes	18	0.0160	0.0268	0.151
13	Dauin	14	0.0750	0.0691	0.440
14	Dauis	11	0.3540	0.3352	0.464
15	Diffun	-			
16	Duero	17	0.0360	0.0698	0.093
17	Dupax del Norte	17	0.0460	0.0343	0.275

Table 3.2.3b. Variance comparison between 7-day and 3-day recyclable wastes of households.

		Sample	Variance of	F test	
	LGU	size	7-day	3-day	Sig.
18	Ipil	19	0.1200	0.3992	0.006
19	Jagna	14	0.0280	0.0288	0.480
20	Lila	18	0.0280	0.0377	0.277
21	Maddela	9	0.0070	0.0073	0.494
22	Maria Aurora	16	0.2150	0.9056	0.003
23	Maribojoc	22	0.0220	0.0272	0.325
24	Pamplona	8	0.0300	0.0249	0.394
25	Panglao	10	0.0180	0.0184	0.484
26	Quezon	25	0.0920	0.0859	0.435
27	San Jose	19			0.157
28	Solano	32	0.0060	0.0127	0.020
29	Sta. Catalina	48	0.0160	0.0381	0.002
30	Talibon	-			
31	Wao	21	0.0080	0.0219	0.013
	ALL LGU				

Note: The two variances are not statistically different (at the 5% level of significance) if the F-test significance is greater than 0.05.

Table 3.2.3c. Variance comparison between 7-day and 3-day residual wastes of households.

		Sample	Variance of	F test	
	LGU	size	7-day	3-day	Sig.
	Cities				
1	Bais City	26	0.0090	0.0090	0.497
2	Bayawan City	39	0.0087	0.0131	0.107
3	Cauayan City	24	0.0067	0.0115	0.098
4	Danao City	25	0.0040	0.0085	0.031
5	Isabela City	30	0.0030	0.0025	0.343
6	Lamitan City	50	0.0053	0.0052	0.481
7	Pagadian City	27	0.0026	0.0024	0.445
8	Tacurong City	30	0.0047	0.0037	0.242
9	Tagbilaran City	15	0.0070	0.0106	0.213
10	Tanjay City	15	0.0031	0.0020	0.212
	Municipalities				
1	Alburquerque	12	0.0085	0.0230	0.049
2	Amlan	4	0.1302	0.0550	0.212
3	Aritao	20	0.0098	0.0086	0.382
4	Baclayon	10	0.0087	0.0289	0.036
5	Bagabag	26	0.0089	0.0095	0.438
6	Baler	20	0.0042	0.0050	0.342
7	Bambang	40	0.0056	0.0102	0.030
8	Bayombong	24	0.0605	0.1509	0.015
9	Buug	21	0.0845	0.3165	0.002
10	Cabarroguis	25	0.0203	0.0175	0.357
11	Corella	21	0.0094	0.0101	0.429
12	Cortes	18	0.0102	0.0137	0.273

		Sample	Variance o	f the mean	F test Sig.	
	LGU	size	7-day	3-day		
13	Dauin	12	0.0103	0.0175	0.188	
14	Dauis	4	0.2093	0.3166	0.349	
15	Diffun	-				
16	Duero	17	0.0241	0.0595	0.035	
17	Dupax del Norte	18	0.0100	0.0115	0.381	
18	Ipil	20	0.0369	0.0664	0.099	
19	Jagna	17	0.0062	0.0054	0.396	
20	Lila	27	0.0070	0.0086	0.301	
21	Maddela	9	0.0046	0.0021	0.133	
22	Maria Aurora	16	0.0317	0.0304	0.468	
23	Maribojoc	24	0.0132	0.0243	0.071	
24	Pamplona	3	0.0366	0.0609	0.343	
25	Panglao	10	0.0402	0.1211	0.048	
26	Quezon	24	0.0634	0.0585	0.423	
27	San Jose	-				
28	Solano	32	0.0074	0.0077	0.470	
29	Sta. Catalina	49	0.0023	0.0064	0.000	
30	Talibon	-				
31	Wao	25	0.0013	0.0025	0.056	
	ALL LGU					

Note: The two variances are not statistically different (at the 5% level of significance) if the F-test significance is greater than 0.05.

3.3. COMPARISONS OF COEFFICIENTS OF VARIATIONS (CV'S) BETWEEN 7-DAY AND 3-DAY COLLECTION.

▶ In terms of the CV's, the 7-day and 3-day WACS collections are generally comparable.

The analysis covered the waste collection samples from the 10 cities and 31 municipalities as specified in the Annex Table A.3.1a. Since there was small number of sampling units in each LGU, the analysis was done across cities and across municipalities.

3.3.1 CVs of the Waste Collections of the Food Establishments.

The results of the CVs of the waste collections by the food establishments are summarized in Table 3.3.1a below.

LGU Type/		Food Esta	blishments	
Waste Type	Sample size	7-day CV	3-day CV	Difference
All Cities				
Biodegradable	56	18.89	20.02	1.13
Recyclable	47	19.27	20.43	1.16
Residual	Residual 57		18.01	1.18
All Municipalities				
Biodegradable	135	10.36	11.82	1.46
Recyclable	125	13.16	14.29	1.13
Residual	123	12.31	14.64	2.33
All LGU				
Biodegradable	191	9.46	10.41	0.95
Recyclable	172	10.84	11.70	0.86
Residual	180	10.35	11.57	1.22

 Table 3.3.1a.
 Comparisons of the CVs between 7-day and 3-day wastes collections of the food establishments.

a. For biodegradable waste:

- <u>In all cities</u>. There were 56 sampling units of biodegradable wastes of food establishments from the 10 cities. For this, the 7-day CV was 18.89% and the 3-day CV was 20.02%.
- <u>In all municipalities</u>. There were 135 sampling units of biodegradable wastes of food establishments from the 31 municipalities. For this, the 7-day CV was 10.36% and the 3-day CV was 11.82%.
- <u>In all LGUs.</u> There were 191 sampling units of biodegradable wastes of food establishments from the 41 LGUs. For this, the 7-day CV was 9.46% and the 3-day CV was 10.41%.

b. For recyclable waste:

- <u>In all cities</u>. There were 47 sampling units of recyclable wastes of food establishments from the 10 cities. For this, the 7-day CV was 1 and the 3-day CV was 580.266 kg²/day.
- <u>In all municipalities</u>. There were 125 sampling units of recyclable wastes of food establishments from the 31 municipalities. For this, the 7-day CV 13.16% and the 3-day CV was 14.29%.
- <u>In all LGUs</u>. There were 172 sampling units of recyclable wastes of food establishments from the 41 LGUs. For this, the 7-day CV was 10.84% and the 3-day CV was 11.70%.

c. For residual waste:

- <u>In all cities</u>. There were 57 sampling units of residual wastes of food establishments from the 10 cities. For this, the 7-day CV was 16.83 and the 3-day CV was 18.01%.
- <u>In all municipalities</u>. There were 123 sampling units of residual wastes of food establishments from the 31 municipalities. For this, the 7-day CV was 12.31% and the 3-day CV was 14.64%.
- <u>In all LGUs</u>. There were 180 sampling units of residual wastes of food establishments from the 41 LGUs. For this, the 7-day CV was 10.34% and the 3-day CV was 11.57%.

3.3.2. CVs of the Waste Collections of the Institutions.

The results of the CVs of the waste collections by the institutions are summarized in Table 3.3.1b below.

Table 3.3.1b	Comparisons	of	the	CVs	between	7-day	and	3-day	wastes	collections	of	the
	institutions.											

	Institution					
Waste Type	Sample size	7-day CV	3-day CV	Difference		
All Cities						
Biodegradable	69	56.26	61.50	5.24		
Recyclable	56	57.25	60.51	3.26		
Residual	75	46.37	46.99	0.62		
All Municipalities						
Biodegradable	171	13.49	14.77	1.28		
Recyclable	154	15.36	14.53	-0.83		
Residual	149	12.68	13.89	1.21		
All LGU						
Biodegradable	240	35.64	38.59	2.95		
Recyclable	210	40.16	43.69	3.53		
Residual	224	29.40	29.94	0.54		

a. For biodegradable waste:

- <u>In all cities</u>. There were 69 sampling units of biodegradable wastes of institution from the 10 cities. For this, the 7-day CV was 56.26% and the 3-day CV was 61.50%.
- <u>In all municipalities</u>. There were 171 sampling units of biodegradable wastes of institution from the 31 municipalities. For this, the 7-day CV was 13.49% and the 3-day CV was 14.77%.

• <u>In all LGUs</u>. There were 240 sampling units of biodegradable wastes of institution from the 41 LGUs. For this, the 7-day CV was 35.64% and the 3-day CV was 38.59%.

b. For recyclable waste:

- <u>In all cities</u>. There were 56 sampling units of recyclable wastes of institution from the 10 cities. For this, the 7-day CV was 57.25% and the 3-day CV was 61.50%.
- <u>In all municipalities</u>. There were 154 sampling units of recyclable wastes of institution from the 31 municipalities. For this, the 7-day CV 15.36% and the 3-day CV was 14.53%.
- <u>In all LGUs</u>. There were 210 sampling units of recyclable wastes of institution from the 41 LGUs. For this, the 7-day CV was 40.16% and the 3-day CV was 43.69%.

c. For residual waste:

- <u>In all cities</u>. There were 57 sampling units of residual wastes of institution from the 10 cities. For this, the 7-day CV was 16.83 and the 3-day CV was 18.01%.
- <u>In all municipalities</u>. There were 123 sampling units of residual wastes of institution from the 31 municipalities. For this, the 7-day CV was 12.31% and the 3-day CV was 14.64%.
- <u>In all LGUs</u>. There were 180 sampling units of residual wastes of institution from the 41 LGUs. For this, the 7-day CV was 10.34% and the 3-day CV was 11.57%.

3.3.3. CVs of the Waste Collections of Public markets

The results of the CVs of the waste collections by the public markets are summarized in Table 3.3.1c below.

market.						
	Public Markets					
LGU Type/ Waste Type	Sample size	7-day CV	3-day CV	Difference		
All Cities						
Biodegradable	11	33.45	34.27	0.82		
Recyclable	11	41.30	41.71	0.41		
Residual	11	39.77	40.54	0.77		
All Municipalities						
Biodegradable	25	19.73	20.90	1.17		
Recyclable	22	27.43	27.08	-0.35		
Residual	25	23.01	24.15	1.14		
All LGU						
Biodegradable	36	21.51	21.86	0.35		
Recyclable	33	23.17	23.84	0.67		
Residual	36	22.59	23.14	0.55		

 Table 3.3.1c
 Comparisons of the CVs between 7-day and 3-day wastes collections of the public market.

a. For biodegradable waste:

- <u>In all cities</u>. There were 11 sampling units of biodegradable wastes of public market from the 10 cities. For this, the 7-day CV was 33.45% and the 3-day CV was 34.27%.
- <u>In all municipalities</u>. There were 25 sampling units of biodegradable wastes of public market from the 31 municipalities. For this, the 7-day CV was 19.73% and the 3-day CV was 20.90%.
- <u>In all LGUs</u>. There were 36 sampling units of biodegradable wastes of public market from the 41 LGUs. For this, the 7-day CV was 21.51% and the 3-day CV was 21.86%.

b. For recyclable waste:

- <u>In all cities</u>. There were 11 sampling units of recyclable wastes of public market from the 10 cities. For this, the 7-day CV was 41.0% and the 3-day CV was 41.71%.
- <u>In all municipalities</u>. There were 22 sampling units of recyclable wastes of public market from the 31 municipalities. For this, the 7-day CV 27.43% and the 3-day CV was 27.08%.
- <u>In all LGUs</u>. There were 33 sampling units of recyclable wastes of public market from the 41 LGUs. For this, the 7-day CV was 23.17% and the 3-day CV was 23.84%.

c. For residual waste:

- <u>In all cities</u>. There were 11 sampling units of residual wastes of public market from the 10 cities. For this, the 7-day CV was 39.77% and the 3-day CV was 40.54%.
- <u>In all municipalities</u>. There were 25 sampling units of residual wastes of public market from the 31 municipalities. For this, the 7-day CV was 23.01% and the 3-day CV was 24.15%.
- <u>In all LGUs</u>. There were 36 sampling units of residual wastes of public market from the 41 LGUs. For this, the 7-day CV was 22.59% and the 3-day CV was 23.14%.

3.3.4. CVs of the Waste Collections of Households

The results of the CVs of the waste collections by the households are summarized in Table 3.3.1c below.

L CIL T-ma/	Households				
Waste Type	Sample size	7-day CV	3-day CV	Difference	
All Cities					
Biodegradable	279	4.21	5.12	0.91	
Recyclable	255	5.23	5.95	0.72	
Residual	281	5.07	5.72	0.65	
All Municipalities					
Biodegradable	584	4.07	4.80	0.73	
Recyclable	549	4.86	4.91	0.05	
Residual	548	4.92	5.70	0.78	
All LGU					
Biodegradable	863	3.12	3.71	0.59	
Recyclable	804	3.86	3.86	0.00	
Residual	829	3.77	5.52	1.75	

 Table 3.3.1d.
 Comparisons of the CVs between 7-day and 3-day wastes collections of the households.

a. For biodegradable waste:

- <u>In all cities</u>. There were 279 sampling units of biodegradable wastes of household from the 10 cities. For this, the 7-day CV was 4.21% and the 3-day CV was 5.12%.
- <u>In all municipalities</u>. There were 584 sampling units of biodegradable wastes of household from the 31 municipalities. For this, the 7-day CV was 4.07% and the 3-day CV was 4.80%.
- <u>In all LGUs</u>. There were 863 sampling units of biodegradable wastes of household from the 41 LGUs. For this, the 7-day CV was 3.12% and the 3-day CV was 3.71%.

b. For recyclable waste:

- <u>In all cities</u>. There were 255 sampling units of recyclable wastes of household from the 10 cities. For this, the 7-day CV was 5.23% and the 3-day CV was 5.95%.
- <u>In all municipalities</u>. There were 549 sampling units of recyclable wastes of household from the 31 municipalities. For this, the 7-day CV 4.86% and the 3-day CV was 4.91%.
- <u>In all LGU</u>s. There were 804 sampling units of recyclable wastes of household from the 41 LGUs. For this, the 7-day CV was 3.86% and the 3-day CV was 3.86%.

	Households					
UGU Type/ Waste Type	Sample size	7-day CV	3-day CV	Difference		
All Cities						
Biodegradable	279	4.21	5.12	0.91		
Recyclable	255	5.23	5.95	0.72		
Residual	281	5.07	5.72	0.65		
All Municipalities						
Biodegradable	584	4.07	4.80	0.73		
Recyclable	549	4.86	4.91	0.05		
Residual	548	4.92	5.70	0.78		
All LGU						
Biodegradable	863	3.12	3.71	0.59		
Recyclable	804	3.86	3.86	0.00		
Residual	829	3.77	5.52	1.75		

c. For residual waste:

- <u>In all cities</u>. There were 281 sampling units of residual wastes of household from the 10 cities. For this, the 7-day CV was 5.07% and the 3-day CV was 5.72%.
- <u>In all municipalities</u>. There were 548 sampling units of residual wastes of household from the 31 municipalities. For this, the 7-day CV was 4.92% and the 3-day CV was 5.70%.
- <u>In all LGUs</u>. There were 829 sampling units of residual wastes of household from the 41 LGUs. For this, the 7-day CV was 3.77% and the 3-day CV was 5.52%.

3.4 COMPARISON BETWEEN THE ACTUAL 7-DAY WACS AND THE ACTUAL 3-DAY WACS.

3.4.1. Means, Standard Errors and the CVs of the Actual 3-day WACS

The details of the results of the descriptive analysis of the actual 3-day waste collection are given in the Annex Tables 3.4.1a to 3.4.1d.

a. Descriptive Statistics for the Actual 3-day Waste Collections of Food Establishments

The summary of the descriptive statistics of the actual 3-day waste collection of the food establishments are shown in Table 3.4.1a.

LGU	Sample	3-day	Standard	CV	
	size	Mean	error	(%)	
Biodegradable					
All Cities	45	27.76	8.77	31.59	
All Municipalities	21	3.35	1.82	54.46	
All LGU	66	19.99	6.15	30.77	
Recyclable					
All Cities	29	1.29	0.69	53.81	
All Municipalities	11	0.19	0.07	35.6	
All LGU	40	0.99	0.51	51.28	
Residual	Residual				
All Cities	45	2.66	0.77	28.95	
All Municipalities	20	0.88	0.33	38.04	
All LGU	65	2.11	11.001	16.04	

 Table 3.4.1a.
 Summary of the means, standard errors and the CVs of the waste of food establishments.

b. Descriptive Statistics for the Actual 3-day Waste Collections of Institutions

The summary of the descriptive statistics of the actual 3-day waste collection of the institutions are shown in Table 3.4.1b.

Table 3.4.1b. Summary of the means, standard errors and the CVs of the waste of institutions.

LCU	Sample	3-day	Standard	CV		
100	size	Mean	error	(%)		
	Biodegradable					
All Cities	72	4.49	1.50	33.37		
All Municipalities	31	4.79	1.78	37.23		
All LGU	103	4.58	1.17	25.62		
Recyclable	Recyclable					
All Cities	70	2.11	0.65	30.74		
All Municipalities	18	0.24	0.08	31.31		
All LGU	88	1.73	0.52	30.16		
Residual						
All Cities	75	1.10	0.32	28.97		
All Municipalities	31	0.74	0.22	29.84		
All LGU	106	0.99	0.23	23.55		

c. Descriptive Statistics for the Actual 3-day Waste Collections of Public Markets

The summary of the descriptive statistics of the actual 3-day waste collection of the public markets are shown in Table 3.4.1c.

LCU	Sample	3-day	Standard	CV	
LGU	size	Mean	error	(%)	
Biodegradable					
All Cities	3	3,226.16	2,630.42	81.53	
All Municipalities	6	792.70	390.05	49.21	
All LGU	9	1,603.85	844.41	52.65	
Recyclable					
All Cities	3	51.50	20.17	39.17	
All Municipalities	6	49.22	25.60	52.01	
All LGU	9	49.98	17.82	35.66	
Residual	Residual				
All Cities	3	312.05	209.91	67.27	
All Municipalities	6	151.087	70.34	46.56	
All LGU	9	204.74	80.59	39.36	

 Table 3.4.1c.
 Summary of the means, standard errors and the CVs of the waste of public markets.

d. Descriptive Statistics for the Actual 3-day Waste Collections of Households

The summary of the descriptive statistics of the actual 3-day waste collection of the households are shown in Table 3.4.1d.

Table 3.4.1d. Summary of the means, standard errors and the CVs of the waste of households.

LGU	Sample	3-day Mean	Standard	CV
	Biode	egradable	enor	(70)
All Cities	0	-	-	-
All Municipalities	91	0.74	0.09	12.49
All LGU	91	0.74	0.09	12.49
Recyclable				
All Cities	0	-	-	-
All Municipalities	56	0.11	0.03	23.58
All LGU	56	0.11	0.03	23.58
Residual				
All Cities	0	-	-	-
All Municipalities	91	0.23	0.03	12.12
All LGU	91	0.23	0.03	12.12

3.4.2. Comparisons of the CVs of the Actual 7-day and Actual 3-day Waste Collections

It is noted here that the descriptive statistics of the actual 7-day waste collections and the actual 3-day waste collections are not comparable due to the differences in the sample sizes and the LGUs, their CVs are compared only to indicate the relative efficiencies.

a. Comparisons of the CVs of the Waste Collections of Food Establishments

The summary of the comparisons of the CVs of the actual 7-day waste collections and the actual 3-day waste collections of the food establishments are shown in Table 3.4.2a.

I GU Type/	Actual 7-day	y collection	Actual 3-day collection	
Waste Type	Sample size	7-day CV	Sample size	3-day CV
All Cities				
Biodegradable	56	18.89	45	31.59
Recyclable	47	19.27	29	53.81
Residual	57	16.83	45	28.95
All Municipalities				
Biodegradable	135	10.36	21	54.46
Recyclable	125	13.16	11	35.60
Residual	123	12.31	20	38.04
All LGU				
Biodegradable	191	9.46	66	30.77
Recyclable	172	10.84	40	51.28
Residual	180	10.35	65	16.04

Table 3.4.2a. Comparisons of the CVs between actual 7-day and actual 3-day wastes collections of the food establishments.

b. Comparisons of the CVs of the Waste Collections of Institutions

The summary of the comparisons of the CVs of the actual 7-day waste collections and the actual 3-day waste collections of the institutions are shown in Table 3.4.2b.

Table 3.4.2b. Comparisons of the CVs between actual 7-day and actual 3-day wastes collections of the institutions.

LGU Type/	Actual 7-day	y collection	Actual 3-day collection	
Waste Type	Sample size	7-day CV	Sample size	3-day CV
All Cities				
Biodegradable	69	56.26	72	33.37
Recyclable	56	57.25	70	30.74
Residual	75	46.37	75	28.97
All Municipalities				
Biodegradable	171	13.49	31	37.23
Recyclable	154	15.36	18	31.31
Residual	149	12.68	31	29.84
All LGU				
Biodegradable	240	35.64	103	28.97
Recyclable	210	40.16	88	30.16
Residual	224	29.40	106	23.55

c. Comparisons of the CVs of the Waste Collections of Public Markets

The summary of the comparisons of the CVs of the actual 7-day waste collections and the actual 3-day waste collections of the public markets are shown in Table 3.4.2c.

LGU Type/	Actual 7-da	lay collection Actual 3-day collection		y collection
Waste Type	Sample size	7-day CV	Sample size	3-day CV
All Cities				
Biodegradable	11	33.45	3	81.53
Recyclable	11	41.30	3	39.17
Residual	11	39.77	3	67.27
All Municipalities				
Biodegradable	25	19.73	6	49.21
Recyclable	22	27.43	6	52.01
Residual	25	23.01	6	46.56
All LGU				
Biodegradable	36	21.51	9	52.65
Recyclable	33	23.17	9	35.66
Residual	36	22.59	9	39.36

 Table 3.4.2c.
 Comparisons of the CVs between actual 7-day and actual 3-day wastes collections of the public markets.

d. Comparisons of the CVs of the Waste Collections of Households

The summary of the comparisons of the CVs of the actual 7-day waste collections and the actual 3-day waste collections of the households are shown in Table 3.4.2d.

Table 3.4.2d. Comparisons of the CVs between actual 7-day and actual 3-day wastes collections of the households.

LGU Type/	Actual 7-da	y collection	Actual 3-day collection	
Waste Type	Sample size	7-day CV	Sample size	3-day CV
All Cities				
Biodegradable	279	4.21	0	-
Recyclable	255	5.23	0	-
Residual	281	5.07	0	-
All Municipalities				
Biodegradable	584	4.07	91	12.49
Recyclable	549	4.86	56	23.58
Residual	548	4.92	91	12.12
All LGU				
Biodegradable	863	3.12	91	12.49
Recyclable	804	3.86	56	23.58
Residual	829	3.77	91	12.12

Notes:

- 1. The observed higher precisions of the actual 7-day WACS data over the actual 3-day WACS data can be due to the sufficiently larger sample sizes in the former than in the latter.
- 2. Barring the differences in sample sizes, there seems to be no substantial difference in the precisions of the two actual data sets.

4. LIMITATIONS AND PROBLEMS ENCOUNTERED

4.1. LIMITATION OF DATA FOR SPECIFIC OBJECTIVES

• One specific objective of this study is to test if there is difference in the per capita waste generation (household waste) of groups of LGUs in the EcoGov database (categorized by LGU class, population size, province/region, etc.).

Like in the first specific objective, this second objective requires basic or un-aggregated data, particularly those data on per capita waste generation obtained or measured on each household in the sample of households in each LGU. It is noted that any test of mean difference requires a measure of sampling errors and sampling error can only be computed if measurements on each sampling unit is available. In this analysis at hand, the sampling units are the households and the per capita data required are those obtained from each household in the sample. Since the per capita data available are already those aggregated at each LGU, then they are not the appropriate data required for this particular objective.

Because of this data limitation, the second objective was not done in the analysis.

• Another specific objective of this study is to come up with recommendations on the use of WACS typology.

The results of the analyses done do not yet provide very conclusive evidence that the use of typology works in WACS data analyses. Since the results on the different LGUs are observed to be different on some groups of LGUs and similar to some groups, the use of WACS typology is another alternative. To undertake a more comprehensive typological analysis, a wide scope of socio-economic, demographic and other parameters should be considered.

Since income classification and baseline population are the only data available for the LGU classifications then WACS typology was not done in the analysis.

• Another limitation on this study is that some samples on some LGUs and waste generators are prohibitively small.

As a general rule in sampling, a domain of interest needs a sample of size 25 units or more. Thus smaller domains are grouped together (e.g. all cities instead of individual cities) in the analysis.

4.2. PROBLEMS ENCOUNTERED

• One problem that delayed the analysis of the WACS data was that the data sets were in different Excel formats.

Separate data sets used in this study were in Excel with different formats. As such, considerable time was spent on consolidating and reformatting the data as required for the SAS and SPSS implementation. Several sets of data are already aggregated or in summary form (not the raw data required for statistical analysis). In this case, these data sets were excluded in the analysis.

5. RECOMMENDATIONS

5.1. RECOMMENDATIONS AND POLICY IMPLICATIONS

• Use of the 3-day WACS collection as the more economical WACS collection alternative to the 7-day collection.

Given all the analyses done, the overall recommendation is the shift to 3-day WACS collection. In general, the 7-day WACS and 3-day WACS collections are comparable in terms of precision. In some instances, there are observed significant differences in some LGUs or types of waste. However, most of these cases are due to small sample size.

The shift to 3-day WACS collection will entail a considerable saving in resources compared to the 7-day WACS collection. As a safety net of compensating the reduction of the number of collection days, an increase in the number of sampling units is recommended. For this end, a summary table of sampling strategies may be constructed for the different LGUs and waste generators (or equivalent typology).

5.2. TYPOLOGY AND FURTHER IMPROVEMENTS

- Consider more socio-economic, demographic and other parameters for a more conclusive typology.
- Increase sample size for each LGU and waste generator.
- Widen the scope of the study by investigating the other waste generators

ANNEX TABLES

No	LCU	Year of Baseline		Income	Population,
INU.	LGU	7-day WACS		Class	at Daseillie
		/-uay	WACS		
MIN	DANAO				
1	Isabela City	2003	Basilan	5th	77,325.0
2	Lamitan City	2003	Basilan	2nd	60,729.0
3	Pagadian City	2003	Zamboanga del Sur	1st	156,047.0
4	Buug	2003	Zamboanga Sibugay	3rd	35,818.0
5	Ipil	2003	Zamboanga Sibugay	2nd	53,946.0
6	Wao	2004	Lanao del Sur	5th	39,458.0
7	Tacurong City	2003	Sultan Kudarat	5th	81,780.0
VISA	YAS				
9	Alburquerque	2003	Bohol	5th	9,364.0
10	Baclayon	2005	Bohol		
11	Corella	2003	Bohol	6th	5,953.0
12	Cortes	2003	Bohol	5th	13,262.0
13	Dauis	2003	Bohol	4th	27,693.0
14	Duero	2003	Bohol	5th	17,218.0
15	Jagna	2003	Bohol	4th	32,934.0
16	Lila	2006	Bohol		
17	Maribojoc	2003	Bohol	5th	16,482.0
18	Panglao	2003	Bohol	4th	22,569.0
19	Tagbilaran City	2003	Bohol	3rd	85,768.0
20	Talibon	2003	Bohol	2nd	57,939.0
21	Danao City	2003	Cebu	3rd	104,725.0
22	Amlan	2003	Negros Oriental	5th	19,735.0
23	Bais City	2003	Negros Oriental	2nd	70,542.0
24	Bayawan City	2003	Negros Oriental	5th	107,212.0
25	Dauin	2003	Negros Oriental	4th	22,218.0
26	Pamplona	2003	Negros Oriental	4th	33,811.0
27	San Jose	2003	Negros Oriental	5th	16,688.0
28	Sta. Catalina	2003	Negros Oriental	2nd	71,284.0
29	Tanjay City	2003	Negros Oriental	5th	71,964.0
LUZ	ON			-	
	Aritao	2005	Isabela		
	Baler	2005	Quezon		
30	Cauayan City	2005	Isabela	4th	118,369.0
31	Bagabag	2004	Nueva Vizcaya	3rd	33,290.0
32	Bambang	2003	Nueva Vizcaya	3rd	43,651.0
33	Bayombong	2004	Nueva Vizcaya	3rd	53,251.0
34	Dupax del Norte	2005	Nueva Vizcaya	4th	24,583.0
35	Quezon	2005	Nueva Vizcaya	5th	17,915.0
36	Solano	2005	Nueva Vizcaya	2nd	56,296.0
37	Cabarroguis	2003	Quirino	4th	27,162.0
38	Diffun	2003	Quirino	3rd	42,771.0
39	Maddela	2003	Quirino	1st	34,432.0
40	Maria Aurora	2005	Aurora	3rd	36,737.0
	3-day WACS	1	1		
1	Lebak	2004	Maguindanao	2nd	77,937.0
2	Cotabato City	2007			
3	Gen. Santos City	2006			
4	Marawi City	2007			
5	San Francisco	2007			
6	Tungawan	2007			

Annex Table A. Profile of the WACS LGUs: Seven-day and three-day WACS

Technology The second stress of the second strese second stress of the sec		LGU	PROVINCE	Inclusive Dates	Start	End	
1 Alburguerque Bohol June 30 - July 7, 2003 Thu Wed 3 Aritano Isabela October 11-17, 2005 Tue Mon 4 Baclayon Bohol August 1, 2, 2005 Tue Mon 5 Bagabag Nueva Vizcaya January 12-18, 2004 Mon Sun 6 Baix City Negros Oriental July 30 - August 6, 2003 Thu Wed 7 Bayamon City Negros Oriental June 13 - 20, 2003 Sat Fri 10 Bayombong Nueva Vizcaya October 14 - 20, 2003 Tue Mon 11 Buug Zambo Sibugay August 12 - 18, 2003 Tue Mon 12 Cabaroguis Quirino August 12 - 18, 2003 Thu Wed 12 Cabaroguis Quirino August 12 - 18, 2003 Thu Wed 14 Corcila Bohol June 12 - 18, 2003 Thu Wed 14 Corcila Bohol June 12 - 18, 2003 Thu W		1	1	7-day WACS			1
2 Anian Negros Oriental August 1 - 7, 2003 Fri Thu 4 Baclayon Bohol August 12-18, 2005 Fri Thu 5 Bagabag Nueva Vizcaya January 12 - 18, 2004 Mon Sun 6 Bais City Negros Oriental July 30 - August 6, 2003 Thu Wed 7 Baler Quezon November 13 - 19, 2005 Sun Sat 9 Bayawan City Negros Oriental June 13 - 20, 2003 Sat Fri 10 Bayombong Nueva Vizcaya October 14 - 20, 2003 Tue Mon 11 Bung Zambo Sibogay August 11 - 19, 2003 Tue Mon 12 Cabarroquity Quirino August 12 - 18, 2003 Thu Wed 13 Causyan City Isabela Jana 26 - February 1, 2004 Mon Sun 14 Corelta Bohol June 1 - 7, 2003 Wed Tuu 15 Cortes Bohol June 13 - 0, 2003 Tuu	1	Alburquerque	Bohol	June 30 - July 7, 2003	Thu	Wed	
3 Aritao Isabela October 11-17, 2005 Tue Mon 4 Baclayon Bohol August 12-18, 2005 Fri Thu 5 Bagabag Nueva Vizcaya January 12-18, 2004 Mon Sun 6 Baix City Negros Oriental July 30 - August 6, 2003 Thu Wed 7 Balgawan City Negros Oriental June 13 - 20, 2003 Sat Fri 10 Bayombong Nueva Vizcaya October 14 - 20, 2003 Tue Mon 11 Bung Zambo Sibngay August 1 - 18, 2003 Tue Mon 12 Cabarroguis Quirino August 1 - 18, 2003 Tue Mon 13 Cauyan City Isabela Jau 26 - February 1, 2004 Mon Sat Fri 16 Danao City Cebu March 28 - Apri 4, 2003 Sat Fri 17 Dauin Negros Oriental July 30 - August 5, 2003 Wed Tue 10 Danao City Cebu March 28 - 29, 2	2	Amlan	Negros Oriental	August 1 - 7, 2003	Fri	Thu	
4 Baclayon Bohol August 12-18, 2005 Fri Thu 5 Bagabag Never Vizcaya January 12-18, 2004 Mon Sun 6 Bairs City Negros Oriental July 30 - August 6, 2003 Thu Wed 7 Baler Quezon November 13 - 19, 2005 Sun Sat 9 Bayawan City Negros Oriental June 13 - 20, 2003 Sat Fri 10 Bayombong Never Vizcaya October 14 - 20, 2003 Tue Mon 11 Buug Zambo Sibugay August 1 - 19, 2003 Mon Tue 12 Cabarroguis Quirino August 1 - 19, 2003 Thu Wed 12 Cabarroguis Quirino June 12 - 18, 2003 Thu Wed 13 Cauayan City Esbela Jan 26 - February 1, 2004 Mon Sun 14 Corella Bohol June 13 - 12, 2003 Mon Sun 15 Orters Bohol Jule 30 - August 5, 2003 Wed	3	Aritao	Isabela	October 11-17, 2005	Tue	Mon	
5 Bagabag Nueva Vizcaya January 12-18, 2004 Mon Sun 6 Bais City Negros Oriental July 30 - August 6, 2003 Thu Wed 7 Baler Quezon November 13 - 19, 2005 Sun Sat 8 Baryawa City Negros Oriental June 13 - 20, 2003 Sat Fri 10 Bayomborg Nueva Vizcaya October 14 - 20, 2003 Tue Mon 11 Bugu g Zambo Sibugay August 11 - 19, 2003 Mon Tue 12 Cabarroguis Quirino August 1 - 18, 2003 Tue Mon 13 Cauayan City Isabela Jan 26 - February 1, 2004 Mon Sun 14 Corella Bohol June 11 - 17, 2003 Wed Tue 15 Cortes Bohol June 13 - August 5, 2003 Mon Sun 16 Danao Grity Cehu March 28 - April 4, 2003 Tue Mon 19 Diffun Quirino July 32 - 3003	4	Baclayon	Bohol	August 12-18, 2005	Fri	Thu	
6 Bais City Negros Oriental July 30 - August 6, 2003 Thu Weed 7 Baler Quezon November 13 - 19, 2005 Sun Sat 8 Barnbang Nueva Vizzaya October 11 - 17, 2003 Sat Fri 9 Bayawan City Negros Oriental June 13 - 20, 2003 Tue Mon 10 Bayomong Nueva Vizzaya October 14 - 20, 2003 Tue Mon 11 Buug Zambo Sibugay August 12 - 18, 2003 Mon Tue 12 Cabarroguis Quirino August 2 - 18, 2003 Tue Mon 13 Cauayan City Isabela Jan 26 - February 1, 2004 Mon Sun 14 Corella Bohol June 12 - 18, 2003 Tue Mon 15 Cortes Bohol June 30 - July 7, 2003 Tue Mon 16 Danao City Cebu March 28 - April 4, 2003 Mon Tue 16 Danais Bohol Jule 30 - July 7, 2003 Tue </td <td>5</td> <td>Bagabag</td> <td>Nueva Vizcaya</td> <td>January 12 -18, 2004</td> <td>Mon</td> <td>Sun</td> <td></td>	5	Bagabag	Nueva Vizcaya	January 12 -18, 2004	Mon	Sun	
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35SolanoNueva VizcayaSeptember 13 - 19, 2003SatFri36Sta. CatalinaNegros OrientalJune 13 - 19, 2003FriThu37Tacurong CitySultan KudaratMarch 25 - April 1, 2003WedTue38Tagbilaran CityBoholJune 30 - July 7, 2003TueMon39TalibonBoholAugust 26 - September 1, TueMon40Tanjay CityNegros OrientalJune 23 - 30, 2003TueMon41WaoLanao del SurMay 19 - 25, 2004WedTue5Santos CityDecember 14-16, 2007FriSun3Gen. Santos CitySeytember 5-8, 2007WedSat4Marawi CitySeptember 5-8, 2007WedSat5San FranciscoOctober 19-21, 2007FriSun6TungawanSeptember 21-23,2007FriSun7PolomolokMarch 26 - 28, 2006SunTue8SurallahMarch 12 - 14, 2006SunTue	34	San Jose	Negros Oriental	July 8 – 14, 2003	Tue	Mon	
36Sta. CatalinaNegros OrientalJune 13 – 19, 2003FriThu37Tacurong CitySultan KudaratMarch 25 - April 1, 2003WedTue38Tagbilaran CityBoholJune 30 - July 7, 2003TueMon39TalibonBoholAugust 26 - September 1, 2003TueMon40Tanjay CityNegros OrientalJune 23 - 30, 2003TueMon41WaoLanao del SurMay 19 - 25, 2004WedTueS-day WACS1LebakMaguindanaoSeptember 23-26,2004SunTue2Cotabato CityDecember 14-16, 2007FriSun3Gen. Santos CitySeptember 5-8, 2007WedSat4Marawi CitySeptember 5-8, 2007FriSun5San FranciscoOctober 19-21, 2007FriSun6TungawanSeptember 21-23,2007FriSun7PolomolokMarch 26 - 28, 2006SunTue8SurallahMarch 12 - 14, 2006SunTue	35	Solano	Nueva Vizcaya	September 13 - 19, 2003	Sat	Fri	
37Tacurong CitySultan KudaratMarch 25 - April 1, 2003WedTue38Tagbilaran CityBoholJune 30 - July 7, 2003TueMon39TalibonAugust 26 - September 1, 2003TueMon40Tanjay CityNegros OrientalJune 23 - 30, 2003TueMon41WaoLanao del SurMay 19 - 25, 2004WedTueJanao del SurMay 19 - 25, 200441LebakMaguindanaoSeptember 23-26,2004SunTue2Cotabato CityDecember 14-16, 2007FriSun3Gen. Santos CitySeveral in Sept -Oct, 20064Marawi CitySeptember 5-8, 2007Wed4Marawi CitySeptember 5-8, 2007FriSun5San FranciscoOctober 19-21, 2007FriSun6TungawanSeptember 21-23,2007FriSunTue8SurallahMarch 26 - 28, 2006SunTue	36	Sta. Catalina	Negros Oriental	June 13 – 19, 2003	Fri	Thu	
38Tagbilaran CityBoholJune 30 - July 7, 2003TueMon39TalibonAugust 26 - September 1, 2003TueMon40Tanjay CityNegros OrientalJune 23 - 30, 2003TueMon41WaoLanao del SurMay 19 - 25, 2004WedTueJune 23 - 30, 2003Tue41WaoLanao del SurMay 19 - 25, 2004WedTueJune 2Cotabato City1LebakMaguindanaoSeptember 23-26,2004SunTue2Cotabato CityDecember 14-16, 2007FriSun3Gen. Santos CitySeveral in Sept -Oct, 20064Marawi CitySeptember 5-8, 2007WedSat5San FranciscoOctober 19-21, 2007FriSun6TungawanSeptember 21-23,2007FriSun7PolomolokMarch 26 - 28, 2006SunTue8SurallahMarch 12 - 14, 2006SunTue	37	Tacurong City	Sultan Kudarat	March 25 - April 1, 2003	Wed	Tue	
39TalibonBoholAugust 26 - September 1, 2003TueMon40Tanjay CityNegros OrientalJune 23 - 30, 2003TueMon41WaoLanao del SurMay 19 - 25, 2004WedTue3-day WACS1LebakMaguindanaoSeptember 23-26,2004SunTue2Cotabato CityDecember 14-16, 2007FriSun3Gen. Santos CitySeveral in Sept -Oct, 20064Marawi CitySeptember 5-8, 2007WedSat5San FranciscoOctober 19-21, 2007FriSun6TungawanSeptember 21-23,2007FriSun7PolomolokMarch 26 - 28, 2006SunTue8SurallahMarch 12 - 14, 2006SunTue	38	Tagbilaran City	Bohol	June 30 - July 7, 2003	Tue	Mon	
39Talibon2003Image: Constraint of the system40Tanjay CityNegros OrientalJune 23 - 30, 2003TueMon41WaoLanao del SurMay 19 - 25, 2004WedTue3-day WACS1LebakMaguindanaoSeptember 23-26,2004SunTue2Cotabato CityDecember 14-16, 2007FriSun3Gen. Santos CitySeveral in Sept –Oct, 2006Image: Constraint of the systemSeptember 5-8, 20074Marawi CitySeptember 5-8, 2007WedSat5San FranciscoOctober 19-21, 2007FriSun6TungawanSeptember 21-23,2007FriSun7PolomolokMarch 26 – 28, 2006SunTue8SurallahMarch 12 – 14, 2006SunTue			Bohol	August 26 – September 1,	Tue	Mon	
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3Gen. Santos CitySeveral in Sept –Oct, 20064Marawi CitySeptember 5-8, 2007Wed5San FranciscoOctober 19-21, 2007Fri6TungawanSeptember 21-23,2007Fri7PolomolokMarch 26 – 28, 2006Sun8SurallahMarch 12 – 14, 2006Sun	2	Cotabato City		December 14-16, 2007	Fri	Sun	
4Marawi CitySeptember 5-8, 2007WedSat5San FranciscoOctober 19-21, 2007FriSun6TungawanSeptember 21-23,2007FriSun7PolomolokMarch 26 - 28, 2006SunTue8SurallahMarch 12 - 14, 2006SunTue	3	Gen. Santos Citv		Several in Sept –Oct. 2006			
5San FranciscoOctober 19-21, 2007FriSun6TungawanSeptember 21-23,2007FriSun7PolomolokMarch 26 – 28, 2006SunTue8SurallahMarch 12 – 14, 2006SunTue	4	Marawi City		September 5-8. 2007	Wed	Sat	
6 Tungawan September 21-23,2007 Fri Sun 7 Polomolok March 26 – 28, 2006 Sun Tue 8 Surallah March 12 – 14, 2006 Sun Tue	5	San Francisco		October 19-21. 2007	Fri	Sun	
7 Polomolok March 26 – 28, 2006 Sun Tue 8 Surallah March 12 – 14, 2006 Sun Tue	6	Tungawan		September 21-23.2007	Fri	Sun	
8 Surallah March 12 – 14, 2006 Sun Tue	7	Polomolok		March $26 - 28, 2006$	Sun	Tue	
	. 8	Surallah		March 12 – 14, 2006	Sun	Tue	

Annex Table B. Schedule of the WACS data collection: Seven-day and three-day WACS.

		Food Establishment Institutions Public Market		Households									
		Biode-	Recy-	Resi-	Biode-	Recy-	Resi-	Biode-	Recy-	Resi-	Biode-	Recy-	Resi-
	LGU	gradable	clable	dual	gradable	clable	dual	gradable	clable	dual	gradable	clable	dual
1	Bais City	4	4	5	6	7	1	1	1	26	25	26	8
2	Bayawan City	4	4	5	3	3	1	1	1	40	37	39	5
3	Cauayan City	8	7	7	9	9	1	1	1	24	24	24	9
4	Danao City	2	2	2	4	2	2	2	2	25	22	25	4
5	Isabela City	2	2	2	9	10	1	1	1	30	30	30	10
6	Lamitan City	4	4	4	2	2	1	1	1	50	50	50	1
7	Pagadian City	7	7	7	9	7	1	1	1	26	21	27	9
8	Tacurong City	13	13	13	5	5	2	2	2	29	28	30	5
9	Tagbilaran City	8	2	8	9	4	1	1	1	14	6	15	11
10	Tanjay City	4	2	4	13	7	-	-	-	15	12	15	13
	Sub-total	56	47	57	69	56	11	11	11	279	255	281	75
1	Alburquerque	3	2	3	8	6	2	2	2	12	12	12	8
2	Amlan	5	5	3	4	4	1	1	1	9	9	4	2
3	Aritao	4	4	4	10	8	1	1	1	18	18	20	10
4	Baclayon	2	1	3	2	1	1	1	1	11	7	10	3
5	Bagabag	3	3	3	3	3	1	1	1	27	25	26	3
6	Baler	2	2	2	7	7	1	1	1	20	20	20	7
7	Bambang	10	10	10	3	3	1	1	1	40	38	40	3
8	Bayombong	5	5	5	7	6	1	0	1	24	22	24	6
9	Buug	8	8	8	7	7	1	1	1	21	21	21	7
10	Cabarroguis	1	1	1	4	4	1	1	1	25	25	25	4
11	Corella	2	2	2	3	3	-	-	-	19	14	21	3
12	Cortes	2	2	2	2	1	-	-	-	18	18	18	2
13	Dauin	7	7	7	8	8	1	1	1	14	14	12	5
14	Dauis	2	3	2	5	6	1	1	1	11	11	4	2
15	Diffun	2	1	1	5	5	1	1	1	-	-	-	5
16	Duero	6	6	5	6	7	1	1	1	17	17	17	5
17	Dupax del Norte	5	5	4	9	9	1	1	1	18	17	18	9
18	Ipil	8	7	8	4	5	1	1	1	20	19	20	5
19	Jagna	3	3	3	9	6	1	1	1	17	14	17	9
20	Lila	6	2	6	5	1	1	1	1	27	18	27	5

Annex Table C. Sample sizes of the actual 7-day WACS by LGU, waste source and waste type

		Food Establishment Institutions Public Market				ţ		Households					
	LGU	Biode- gradable	Recy- clable	Resi- dual	Biode- gradable	Recy- clable	Resi- dual	Biode- gradable	Recy- clable	Resi- dual	Biode- gradable	Recy- clable	Resi- dual
21	Maddela	5	5	5	6	6	1	1	1	9	9	9	6
22	Maria Aurora	4	4	4	6	6	1	1	1	16	16	16	6
23	Maribojoc	3	2	3	2	2	-	-	-	24	22	24	2
24	Pamplona	5	5	0	7	7	1	1	1	8	8	3	0
25	Panglao	5	5	5	5	3	1	0	1	9	10	10	5
26	Quezon	3	3	3	5	5	-	-	-	25	25	24	5
27	San Jose	4	4	0	6	6	-	-	-	17	19	0	0
28	Solano	4	4	4	8	8	1	1	1	33	32	32	8
29	Sta. Catalina	6	5	7	2	1	2	1	2	50	48	49	1
30	Talibon	5	4	5	6	5	-	-	-	-	-	-	6
31	Wao	5	5	5	7	5	1	1	1	25	21	25	7
	Sub-Total	135	125	123	171	154	25	22	25	584	549	548	149
Overa	all Total	191	172	180	240	210	224	36	33	36	863	804	829

		Fo	od Establishm	ent		Institutions			Public Marke	t		Household	
	LGU	Biode gradable	Recy- clable	Resi- dual	Biode- gradable	Recy- clable	Resi- dual	Biode gradable	Recy- clable	Resi- dual	Biode- gradable	Recy- clable	Resi- dual
1	Cotabato City	0	0	0	0	0	2	2	2	0	0	0	0
2	Gen. Santos City	45	29	45	69	67	0	0	0	0	0	0	72
3	Marawi City	0	0	0	3	3	1	1	1	0	0	0	3
	Sub-total	45	29	45	72	70	3	3	3	0	0	0	75
4	Lebak	10	5	10	13	10	1	1	1	30	25	30	14
5	Polomolok	0	0	0	0	0	1	1	1	0	0	0	0
6	San Francisco	2	1	3	12	4	1	1	1	34	26	34	10
7	Surallah	0	0	0	0	0	1	1	1	0	0	0	0
8	Tungawan	9	5	7	6	4	2	2	2	27	5	27	7
	Sub-Total	21	11	20	31	18	6	6	6	91	56	91	31
	Overall Total	66	40	65	103	88	106	9	9	9	91	56	91

Annex Table D. Sample sizes of actual 3-day WACS by LGU, waste source and waste type

LGU	Sample	3-day	Standard	CV					
100	size	Mean	error	(%)					
Biodegradable									
Cotabato City	0	-	-	-					
Gen. Santos City	45	27.76	8.77	31.59					
Marawi City	0	-	-	-					
All Cities	45	27.76	8.77	31.59					
Lebak	10	1.15	0.35	30.19					
Polomolok	0	-	-	-					
San Francisco	2	2.92	1.18	40.56					
Surallah	0	-	-	-					
Tungawan	9	5.88	4.20	71.44					
All Municipalities	21	3.35	1.82	54.46					
All LGU	66	19.99	6.15	30.77					
	Recy	clable							
Cotabato City	-	-	-	-					
Gen. Santos City	29	1.29	0.69	53.75					
Marawi City	-	-	-	-					
All Cities	29	1.29	0.69	53.81					
Lebak	5	0.27	0.12	44.96					
Polomolok	-	-	-	-					
San Francisco	1	-	-	-					
Surallah	-	-	-	-					
Tungawan		-	-	-					
All Municipalities	11	0.19	0.07	35.6					
All LGU	40	0.99	0.51	51.28					
	Res	idual							
Cotabato City	-	-	-	-					
Gen. Santos City	45	2.66	0.77	28.95					
Marawi City	-	-	-	-					
All Cities	45	2.66	0.77	28.95					
Lebak	10	0.45	0.17	38.38					
Polomolok	-	-	-	-					
San Francisco	3	3.89	1.433	3.005					
Surallah	-	-	-	-					
Tungawan	7	0.22	0.044	0.054					
All Municipalities	20	0.88	0.33	38.04					
All LGU	65	2.11	11.001	16.045					

Annex Table E.1. Summary of the means, standard errors and the CVs of the waste of food establishments

Annex Table E.2.
Summary of the means, standard errors and the CVs of the waste of institutions

ICU	Sample	3-day	Standard	CV
LGU	size	Mean	error	(%)
	Biode	gradable	<u>.</u>	
Cotabato City	0	-	-	-
Gen. Santos City	69	3.70	1.43	38.59
Marawi City	3	22.49	10.82	48.11
All Cities	72	4.49	1.50	33.37
Lebak	13	2.56	0.82	32.16
Polomolok	0	-	-	-
San Francisco	12	5.47	1.99	36.35
Surallah	0	-	-	-
Tungawan	6	8.269	8.19	99
All Municipalities	31	4.79	1.78	37.23
All LGU	103	4.58	1.17	25.62
	Rec	yclable		
Cotabato City	0	-	-	-
Gen. Santos City	67	1.97	0.67	33.91
Marawi City	3	5.10	1.93	37.88
All Cities	70	2.11	0.65	30.74
Lebak	10	0.25	0.12	48
Polomolok	0	-	-	-
San Francisco	4	0.26	0.13	50.15
Surallah	0	-	-	-
Tungawan	4	0.19	0.10	53.93
All Municipalities	18	0.24	0.08	31.31
All LGU	88	1.73	0.52	30.16
	Re	sidual		
Cotabato City	0	-	-	-
Gen. Santos City	72	0.87	0.28	31.96
Marawi City	3	6.711	2.84	42.27
All Cities	75	1.10	0.32	28.97
Lebak	14	0.404	0.29	72.24
Polomolok	0	-	-	-
San Francisco	10	0.94	0.32	34.25
Surallah	0	-	-	-
Tungawan	7	1.12	0.62	54.95
All Municipalities	31	0.74	0.22	29.84
All LGU	106	0.99	0.23	23.55

ICU	Sample	3-day	Standard	CV						
	size	Mean	error	(%)						
	Biodegradable									
Cotabato City	2	-	-	-						
Gen. Santos City	0	-	-	-						
Marawi City	1	-	-	-						
All Cities	3	3226.16	2630.42	81.53						
Lebak	1	-	-	-						
Polomolok	1	-	-	-						
San Francisco	1	-	-	-						
Surallah	1	-	-	-						
Tungawan	2	-	-	-						
All Municipalities	6	792.70	390.05	<i>49.21</i>						
All LGU	9	1,603.85	844.41	52.65						
	Rec	cyclable								
Cotabato City	2	-	-	-						
Gen. Santos City	0	-	-	-						
Marawi City	1	-	-	-						
All Cities	3	51.50	20.17	39.17						
Lebak	1	-	-	-						
Polomolok	1	-	-	-						
San Francisco	1	-	-	-						
Surallah	1	-	-	-						
Tungawan	2	-	-	-						
All Municipalities	6	49.22	25.60	52.01						
All LGU	9	49.98	17.82	35.66						
	Re	esidual								
Cotabato City	2	-	-	-						
Gen. Santos City	0	-	-	-						
Marawi City	1	-	-	-						
All Cities	3	312.05	209.91	67.27						
Lebak	1	-	-	-						
Polomolok	1	-	-	-						
San Francisco	1	-	-	-						
Surallah	1	-	-	-						
Tungawan	2	-	-	-						
All Municipalities	6	151.087	70.34	46.56						
All LGU	9	204.74	80.59	39.36						

Annex Table E.3. Summary of the means, standard errors and the CVs of the waste of public markets.

LCU	Sample	3-day	Standard	CV					
LGU	size	Mean	error	(%)					
Biodegradable									
Cotabato City	0	-	-	-					
Gen. Santos City	0	-	-	-					
Marawi City	0	-	-	-					
All Cities	0	-	-	-					
Lebak	30	1.11	0.16	14.8					
Polomolok	0	0	0	0					
San Francisco	34	0.76	0.16	20.95					
Surallah	0	0	0	0					
Tungawan	27	0.30	0.11	36.27					
All Municipalities	91	0.74	0.09	12.49					
All LGU	91	0.74	0.09	12.49					
	Rec	yclable							
Cotabato City	0	_	-	-					
Gen. Santos City	0	-	-	-					
Marawi City	0	-	-	-					
All Cities	0	-	-	-					
Lebak	25	0.15	0.04	29.71					
Polomolok	0	0	0	0					
San Francisco	26	0.08	0.03	41.26					
Surallah	0	-	-	-					
Tungawan	5	0.02	0.01	59.16					
All Municipalities	56	0.11	0.03	23.58					
All LGU	56	0.11	0.03	23.58					
	Re	sidual							
Cotabato City	0	-	-	-					
Gen. Santos City	0	-	-	-					
Marawi City	0	-	-	-					
All Cities	0	-	-	-					
Lebak	30	0.25	0.05	19.04					
Polomolok	0	-	-	-					
San Francisco	34	0.29	0.05	17.41					
Surallah	0		-	-					
Tungawan	27	0.14	0.04	29.05					
All Municipalities	91	0.23	0.03	12.12					
All LGU	91	0.23	0.03	12.12					

Annex Table E.4. Summary of the means, standard errors and the CVs of the waste of households.

Technical Notes on the Statistical Inference Used in the Analyses

For each LGU, the two-stage sampling was employed. In the *first stage sampling*, the primary sampling units were the waste generators (food establishments, institutions, public markets or residentials). In this stage, random samples of the primary sampling units were drawn. *The second stage sub-sampling* was done by taking the seven-day or three-day waste collections from each of the primary sampling units.

1. Comparison of the Means Between the 7-day and 3-day Waste Collection

For each LGU, let n be the number of waste generator sample, say sample of food establishments, and m be the number of waste collection days. Then the two-stage sample mean, denoted as $\overline{\overline{y}}$, is given by

$$\overline{\overline{y}} = \frac{1}{n} \sum_{i=1}^{n} \overline{y}_{i}$$

where: \overline{y}_i is the mean of the ith sampling unit (over the seven or three days waste collections).

According to sampling theory, the $\overline{\overline{y}}$ is an unbiased estimate of the true LGU mean.

Let \overline{x}_i and \overline{y}_i be the means of the 7-day and 3-day waste collections on the ith sampling unit, respectively, so that $d_i = \overline{x}_i - \overline{y}_i$ is the difference of the paired means of the ith sampling unit. Given a group of sampling units (say all institutions), the overall means are computed as

$$\overline{\overline{x}} = \frac{1}{s} \sum_{i}^{s} \overline{x_i}$$
, the overall mean of the 7-day collections, and

$$\overline{\overline{y}} = \frac{1}{s} \sum_{i}^{s} \overline{y}_{i}$$
, the overall mean of the 3-day collections.

Then the test of the significance of the difference between the $\overline{\overline{x}}$ and $\overline{\overline{y}}$ is the paired t test with statistic

$$t = \frac{\overline{d}}{\sqrt{s_d^2/n}}$$
, where: \overline{d} is the mean difference or also the difference $\overline{\overline{x}} - \overline{\overline{y}}$.

The mean difference is concluded to be significant at the 5% level if the p-value of the computed t statistic is less or equal to 0.05.

➤ For a given LGU, municipality type or waste type, the means of the 7-day WACS collections and the 3-day WACS collections were evaluated by testing the significance of the mean difference by this t-test.

2. Comparison of the Standard Errors Between the 7-day and 3-day Waste Collection

> As a measure of the precision of the $\overline{\overline{y}}$, the standard error of $\overline{\overline{y}}$, denoted as s.e.($\overline{\overline{y}}$), is computed as

$$s.e.(\overline{\overline{y}}) = \sqrt{\frac{s_b^2}{n} + \frac{s_w^2}{nm}}$$

where: S_b^2 is the variance between sampling units, computed as

$$s_b^2 = \frac{1}{n-1} \sum_{i=1}^n (\overline{y}_i - \overline{\overline{y}})^2$$

 \boldsymbol{S}_{w}^{2} is the variance within the sampling units, computed as

$$s_w^2 = \frac{1}{n(m-1)} \sum_{i=1}^{n} \sum_{j=1}^{m} (y_{ij} - \overline{y}_i)^2$$

The smaller is the s.e.($\overline{\overline{y}}$), the higher is the precision of the $\overline{\overline{y}}$.

So For a given LGU, municipality type or waste type, the precision of the 7-day WACS collection and the 3-day WACS collection were evaluated by comparing their s.e.($\overline{\overline{y}}$).

3. Comparison of the Coefficients of Variations Between the 7-day and 3-day Waste Collection

Another measure of the precision of the $\overline{\overline{y}}$ is the coefficient of variation of the $\overline{\overline{y}}$, denoted as $CV(\overline{\overline{y}})$, given by

$$CV(\overline{\overline{y}}) = \frac{s.e.(\overline{\overline{y}})}{\overline{\overline{y}}} \ge 100\%$$

The smaller is the $CV(\overline{\overline{y}})$, the higher is the relative precision of the $\overline{\overline{y}}$ over another mean $\overline{\overline{y}}$ with a lower CV.

The $CV(\overline{\overline{y}})$ is also particularly useful in comparing the relative precisions of two estimates obtained from different samples (of different sample sizes and sampling methods) and or locations.

- So For a given LGU, municipality type or waste type, the relative precision of the 7-day WACS collection and the 3-day WACS collection were evaluated by comparing their $CV(\overline{\overline{y}})$.
- The $CV(\overline{\overline{y}})$ was also used to compare, the relative precision of the 7-day WACS collections in a group of LGUs and the 3-day WACS in another group of LGUs.

4. Comparison of Variances Between the 7-day and 3-day Waste Collection

Given a group of sampling units (say all institutions), the overall variances $Var(\overline{\overline{x}})$ and $Var(\overline{\overline{y}})$ are computed following the formula for *s.e.*($\overline{\overline{x}}$) and *s.e.*($\overline{\overline{y}}$). Then the test of the equality of the two variances is the F test with statistic

$$F = \frac{Q_1}{Q_2}$$

where: Q_1 is the larger variance and Q_2 is the smaller variance.

Note: Since the $s.e.(\overline{\overline{x}}) = \sqrt{Var(\overline{\overline{x}})}$, then this F test for the equality of two variances is also equivalent to the test of the equality of the corresponding standard errors.

The two variances are concluded to be significantly different at the 5% level if the p-value of the computed F statistic is less or equal to 0.05.