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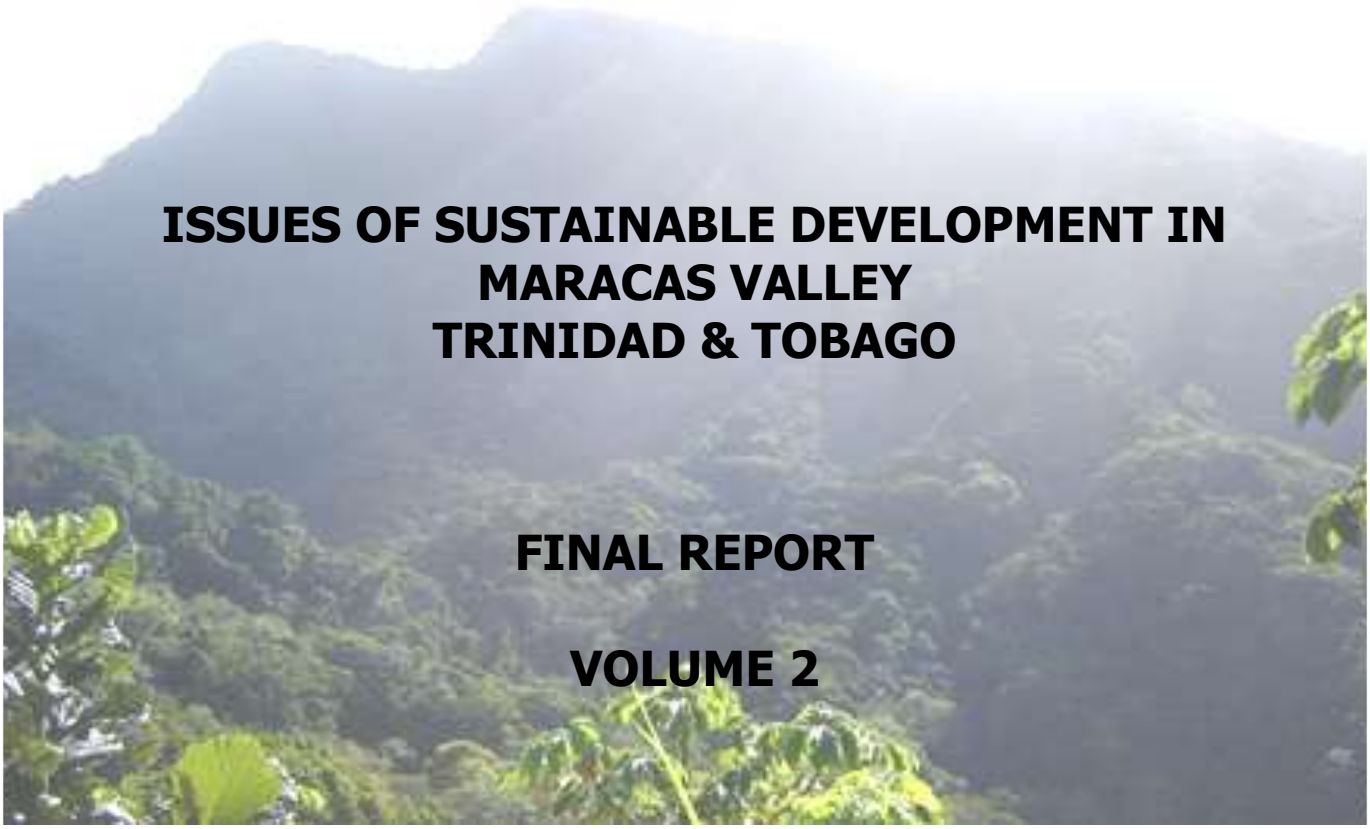

ISSUES OF SUSTAINABLE DEVELOPMENT IN MARACAS VALLEY TRINIDAD & TOBAGO

FINAL REPORT

VOLUME 2

MARACAS VALLEY ACTION COMMITTEE

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A SOCIO-ECONOMIC PROFILE OF MARACAS VALLEY ST. JOSEPH

FINAL REPORT

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INTRODUCTION

The report presents the findings of a household survey carried out between June and July 2009 in the Maracas Valley, St. Joseph, referred to hereafter as the Area of Study (AOS). The primary objective of the survey was to provide a socio-economic profile of the AOS with a view to identifying its particular population characteristics, social, economic, environmental problems and needs. In these respects the report will be divided into 9 major sections which include: (i) the methodology of study; (ii) demographics of the population; (iii) housing conditions; (iv) economic activity;(v) educational achievement; (vi) personal safety and crime; (vii) community organization and relations and (viii) the environment and health and (ix) positive developments.

1. METHODOLOGY

The study was based on a random sample survey of households in the AOS. The sample amounted to 450 households and was selected by the Central Statistical Office of Trinidad and Tobago. For the purpose of this study, the AOS comprised 17 small communities which included: La Mango Village, Balata, La Baja, Poolside, La Seiva, Wharf Trace, Maracas Gardens, River View Gardens, Avondale, Mountain View, El Toucouche, Valley View, Maracas Village, Alta Gracia, El Luengo, Acono and Green Hill. Because several of these communities overlap and for convenience of analysis, they were broken down into 8 communities. The sample of households was distributed as follows across the 8 communities (see Table 1): Maracas St. Joseph had the largest number of households sampled, 139, followed by La Baja (79), Acono (59), Alta Gracia(43) and La Seiva (43) both of which had the same number, Riverview Gardens (37), La Mango (30), and El Toucouche (20).

Table 1. Distribution of Sample within AOS

Area	Number
Acono	59 (13.1)
Alta Gracia	43 (9.6)
La Mango	30 (6.7)

La Baja	79 (17.6)
Maracas St Joseph	139 (30.9)
La Seiva	43 (9.6)
El Toucouche	20 (4.4)
Riverview Gardens	37 (2.2)
Total	**100.0 (450)**

As regards the actual conduct of the survey, there was a near 100% response rate for, of the 450 questionnaires administered (see Appendix I), 97.1% were completed, 2.7% partially completed with 0.1% or 1 refusal. The survey therefore had an extremely low non response rate.

In examining the different findings of the study, comparison will be made to the situation nationally on the various indicators where relevant data exist in order to give a sense or better understanding of the developmental problems or challenges which might exist in the Valley.

2. DEMOGRAPHIC CHARACTERISTICS

In examining the demographics of the population we focus primarily on such characteristics as sex, age, ethnic origin and religion. In addition, we also look at the length of time inhabitants have been living in the Valley as well their geographical origins in order to get a sense of the level of migration into the area.

In relation to sex, 49.2% in the AOS are male and 49.6% are female. Similar to the situation nationally (49.4% vs. 50.3%), women slightly outnumber men in the AOS but this cannot be conclusive because of the 1.1%, amounting to 19, who did not state their sex (Table 2).

Table 2. Composition of Households, by Sex (%)

Sex	AOS	Nationally (2005)*
Male	49.2	49.4
Female	49.6	50.3
Not stated	1.1	0.2
Missing	.1	

Total	**1,683**	**15,218**

***Source**: 2005 Survey of Living Conditions: 45.

Table 3. Sex, by Community (%)

	Community				
Response	**Acono**	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Male	51.8	53.6	47.9	48.6	49.0
Female	48.2	46.4	49.5	50.1	50.7
Not stated	0.0	0.0	2.6	1.3	0.3
Total	**199**	**110**	**309**	**762**	**302**

The sex breakdown by community showed a more mixed distribution of males and females as neither group was in complete ascendancy (Table 3). For instance, while males outnumbered females in Acono (51.8% vs 48.2%) and Alta Gracia (53.6% vs. 46.4%), females outnumbered males in La Seiva (50.7% vs. 49%), Maracas/St. Joseph (50.1% vs 48.6%) and La Baja (49.5% vs 47.9%), albeit by very small proportions in both the case of males and females. There is no significant gender disparity therefore in terms of numbers across the AOS.

In relation to age, the population of the AOS is generally similar to that of the national population with some minor variations (Table 4). While the meaning of the terms of 'youth', 'young', 'senior' and 'old' are known to be highly variable, the data show that those who might be considered 'very young', in the age group 29 and under amount to 48.3% of the AOS, just marginally less than the corresponding national population of 49% by 0.7%. What this suggest is that almost half of the population of the AOS can be considered 'youthful' which is very significant since it has implications for a range of needs such as education, employment, housing and leisure. As for the older age group, 30-64, these represent 41.2% of the AOS, just 0.4% less than the corresponding national figure of 41.6%. For those in the age group of 65 and up, traditionally seen as the retirement zone, although many retire earlier, the proportion for the AOS and the nation were the same, 9.1%. What the data generally suggest therefore is that the population of the AOS is not any more or any less older or younger than the population nationally although this does not necessarily make the task of its development any less challenging.

Table 4. Age Distribution within AOS (%)

Age Group	AOS	Nationally (2005)*
0-14	22.6	22.0
15-24	17.8	19.1
25-29	7.9	7.8
30-44	20.4	20.7
45-64	20.8	20.9
65+	9.1	9.1
Not stated	1.2	0.3
Missing	.2	----
Total	**1,683**	**15,218**

***Source:** 2005 Survey of Living Conditions: 43.

In relation to race/ethnicity, the AOS has a diverse population like the situation nationally but significant variations exist (Table 5). For instance, whereas Indians represent the largest group nationally (40.1%), the largest group in the AOS are the mixed, 38.3%, which is the third largest group nationally with 21.4%. Those of African descent are the second largest group in the AOS (32.7%), similar to the situation nationally (37.8%) but 5.1% less in terms of numbers. They are followed next by those of Indian descent (12.2%), Spanish descent (8.9%), also known popularly as Cocoa panyol, Dougla (5.3%), Chinese (0.7% vs 0.2% nationally) and Caucasian (0.4% vs. 0.5%) with the latter two groups showing very fractional variations from their proportions in the national population. The prominence of the 'mixed', whom together with the Spanish/Cocoa *Panyol*, represent a near majority of the AOS (47.2%) is reflective of its history and colonial pattern of settlement.

Table 5
Composition of Area of Study, by Race/Ethnicity (%)

Race/Ethnicity	AOS	Nationally (2006)*
African	32.7	37.8
Caucasian	0.4	0.5
Chinese	0.7	0.2
Dougla	5.3	---
Indian	12.2	40.1
Mixed	38.3	21.4
Other	0.7	0.0
Spanish (Panyol)	8.9	----
Not stated	0.4	0.1

Total	**449**	**1,230,129**

Source: cited in SLC Report 2005: 146.

Table 6. Race/Ethnicity, by Community(%)

Response	Community				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/ St. Joseph**	**La Seiva**
African	23.7	51.7	35.4	29.7	37.5
Caucasian	1.7	0.0	0.0	0.5	0.0
Chinese	0.0	0.0	1.3	0.0	2.5
Dougla	6.8	3.4	5.1	6.9	1.3
Indian	23.7	6.9	11.4	5.9	22.5
Mixed	35.6	34.5	39.2	42.6	30.0
Other	1.7	0.0	0.0	1.0	0.0
Spanish (Panyol)	6.8	3.4	6.3	12.4	6.3
Not stated	0.0	0.0	1.3	1.0	0.0
Total	**59**	**29**	**79**	**202**	**80**

The community breakdown showed some similarities as well variations in the race/ethnic distribution of the local population compared to the general pattern for the AOS (Table 6). Firstly, the three main race/ethnic groupings across all communities were those of Mixed, African and Indian descent. Secondly, the mixed were the largest grouping in Maracas/St. Joseph (42.6%), La Baja (39.2%) and Acono(35.6%), but those of African descent were the largest grouping in Alta Gracia (51.7%) and La Seiva (37.5%). Thirdly, those of Indian descent can be found more in Acono (23.7%) and La Seiva (22.5%). Fourthly, while they constitute a very small minority in all communities, more of the 'cocoa panyol' can be found in Maracas/St. Joseph (12.4%).

With respect to religion, the AOS contains a varying range of denominations (Tables 7 and 8) but, as might have been expected, the largest group are the Roman Catholics as they represent 59.1% of the population, which is twice times their proportion (25.6%) in the national population. The next largest grouping are the 'Other Christian' denominations who represent around one quarter of the population (26.4%) compared to 42.5% in the national population. Hindus and Muslims represent only 2.7% and 1.1% respectively of the AOS compared to their corresponding figures of 20.2% and 5.7% in the national

population. In terms of race/ethnicity and religion therefore, the AOS is dominated by those of mixed, African and Roman Catholic origin.

Table 7. Distribution of Population by Religion

Religion	Per cent
Hindu	2.7 (12)
RC	59.1(266)
Presbyterian	2.0 (9)
SDA	9.3 (42)
Pentecostal	9.1 (41)
Spiritual Baptist	5.6 (25)
Muslim	1.1 (5)
Anglican	2.0 (9)
Baptist	0.9(4)
Christian	0.7(3)
Full Gospel	0.2 (1)
Moravian	0.2(1)
Evangelist	0.2(1)
Rastafarian	0.4(2)
Jehovah Witness	1.3(6)
Latter Day Saints	0.2(1)
Methodist	0.2(1)
Other	1.1(5)
None	3.3(15)
DK	0.2(1)

Total	**450**

Table 8
Distribution of Population, by Religion (%)

Religion	**AOS**	**Nationally(2005)***
Hindu	2.7	20.2
Muslim	1.1	5.7
RC	59.1	25.6
Other Christian	26.4	42.5
Spiritual Baptist	5.6	----
Other	1.5	2.9
None	3.3	1.9
Don't know	0.2	----
Not stated	----	1.1
Total	**450**	**15,218**

***Source:** 2005 Survey of Living Conditions.

As might be expected, Roman Catholics were the largest religious group across all communities (Table 9). They were the largest in Alta Gracia (72.4%), followed by La Seiva (63.8%), Maracas/St. Joseph (61.7%), Acono (55.9%) and La Baja (49.3%). The second largest religious group was 'Other Christian' who amounted to 28.3% in Maracas/St. Joseph, 28.2% in La Baja, 25.1% in Acono, 20.1% in La Seiva and 13.6% in Alta Gracia. Hindus and Muslims were sprinkled throughout: Hindus ranged between 1.3% in La Seiva and 5.1% in Acono while Muslims ranged between 0.0 % and 3.8%.

Table 9. Religion, by Community(%)

Religion	**Community**				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/ St. Joseph**	**La Seiva**
Hindu	5.1	3.4	1.3	2.5	1.3
Muslim	1.7	0.0	0.0	0.5	3.8
RC	55.9	72.4	49.3	61.7	63.8
Other Christian	25.1	13.6	28.2	28.3	20.1
Spiritual Baptist	5.1	0.0	16.0	3.0	3.8
Other	0.0	0.0	1.3	1.5	2.6
None	5.1	10.3	1.3	2.5	3.8
Don't know	1.7	0.0	0.0	0.0	0.0
Total	**59**	**29**	**75**	**201**	**80**

2.1 Length of Time Living in Valley

There is a view that over the last 5-10 years, many persons have moved into the Maracas Valley lured primarily by the boom in housing construction in the area. Consequently, in order to probe the extent of this recent migration, respondents were asked to indicate how long they have been living in the Valley and, in order to get an idea of the geographical origins of these recent migrants, they were also asked to indicate where they last lived before moving to the area. With respect to the duration of their residence in the Valley, it was found that only a minority or 12.5% could be possibly considered very recent migrants to the area as they have been living there for 10 years or less (Table 10), while 10.2% have been there for between 11-20 years. The data suggest that the vast majority of inhabitants of the Valley have deep roots in the area for around 75% have been living there for over 21 years and of these, around 45% have been living there for 41 years and over.

Table 10
Length of Time Living in Valley(%)

Years	Percent
5 and under	7.8
6-10	4.7
11-20	10.2
21-40	29.8
41-60	30.3
61-80	14.7
81-100	2.4
Total	**100.0 (449)**

The breakdown by community revealed some interesting variations (Table 11). In this regard, the community which had the most recent arrivals living 5 years or less in the AOS was Maracas/St. Joseph (9.4%), followed closely by La Baja (8.9%), Acono (8.5%), Alta Gracia (6.9%) and La Seiva(2.5%). However, when we measure 'recent' in terms of the 10 years and under category, we find that Alta Gracia (20.7%) leads the way with the most recent arrivals followed by La Baja (14%), Maracas/St. Joseph (13.9%), Acono (10.2%) and La Seiva (6.3%). As regards, the longer categories of residing, the patterns in the individual communities followed the general patters for the AOS but there were also variations. Firstly, consistent with the general finding, the vast majority of the residents in the communities examined, in the region of 70%+, have been living in the AOS for over 21 years. This was led by Alta Gracia (79.2%), followed closely by Acono (78%), La Seiva (77.6%), La Baja (77.2%) and Maracas/St. Joseph (76.7%). Secondly, for those living 41years and over in the AOS, La Baja led the way with 50.6% followed by Maracas/St. Joseph (48.5%), Acono (47.5%), La Seiva (46.3%) and Alta Gracia (34.4%). From this data, we can draw two major conclusions which are: on the one hand the community in the AOS which appears to have the most recent arrivals or inhabitants are Maracas/St. Joseph and Alta Gracia while on the other, those having the longest residential population are La Baja and Maracas/St. Joseph although the proportions separating the former and the latter were generally marginal.

Table 11. Length of Time Living in Valley, by Community(%)

Years	Community					
	Acono	Alta	La	Maracas/St.J	La Seiva	Entire AOS

		Gracia	Baja			
≤5	8.5	6.9	8.9	9.4	2.5	**7.8**
6-10	1.7	13.8	5.1	4.5	3.8	**4.7**
11-20	11.9	0.0	8.9	9.4	16.3	**10.2**
21-40	30.5	44.8	26.6	28.2	31.3	**29.8**
41-60	32.2	31.0	35.4	27.7	30.0	**30.3**
61-80	15.3	0.0	13.9	16.8	15.0	**14.7**
81-100	0.0	3.4	1.3	4.0	1.3	**2.4**

In an attempt to ascertain the origins of the inhabitants of the Valley and moreso those who moved to the area relatively recently, respondents were asked to indicate where they last lived before they moved to the area. In this regard, it was found that the Valley contained a smattering of persons who came from all over Trinidad and Tobago and abroad including the Caribbean and North America (Table 12). However, the more significant proportions came from two main regions of the country: Tunapuna/Piarco (14%), of which the Valley forms a part and San Juan/Laventille (10.9%); much smaller proportions came from Port of Spain (4.9%), Diego Martin (2.7%). Arima (2.7%) and the Caribbean (2.7%) which included such countries as St. Vincent, Grenada, Dominica, St. Lucia, Guyana, St. Kitts and Jamaica. It is logical to assume that the movement of those persons from various islands of the Caribbean into the Valley might be directly related to the University of the Southern Caribbean, which attracts many such persons. Fifty one point seven (51.7%) of inhabitants, however, indicated that they 'always lived' in the Valley no doubt the descendants and children of some of the early settlers of the area

Table 12. Last Place of Residence Before Moving to Valley(%)

Origins	Percent
Port of Spain	**4.9**
Arima	2.7
Borough of Chaguanas	0.4
San Fernando	1.1
Borough of Point Fortin	0.4
Diego Martin	2.7
San Juan/Laventille	**10.9**
Tunapuna/Piarco	**14.0**
Sangre Grande	1.8
Mayaro/Rio Claro	0.4

Couva/Tabaquite/Talparo	2.7
Penal/Debe	0.4
Princes Town	0.2
Siparia	0.7
Tobago	1.1
Caribbean	2.7
Other (North America)	0.7
Always lived in Valley	**51.7**
Not stated	0.4
Total	**100.0 (449)**

Table 13 presents the distribution of the recent, relatively recent and longtime inhabitants of the AOS across its various sub-communities. We can make four major observations. Firstly, while a varying majority of inhabitants in Acono (66.1%), Alta Gracia (55.2%), and Maracas/St. Joseph (52.5%), always lived in the AOS consistent with the finding for the entire AOS, this was not the case in La Baja and La Seiva where the corresponding figures were 46.8% and 42.5%, respectively. Secondly, while the geographical origins or last place of residence of the inhabitants across all the sub-communities were diverse, their numbers varied from community to community. In Acono and Alta Gracia for instance, 3.4% came from Port of Spain, but in La Baja, the figure was 6.3%. Thirdly, it was previously found that the two main origins of some of the inhabitants of the AOS were San/Juan Laventille and Tunapuna/Piarco, of which the AOS forms a part. With respect to those from San Juan/Laventille, most were found in La Baja (22.8%), followed by smaller proportions in Alta Gracia(10.3%), La Seiva(10%), Acono (8.5%), and Maracas/St. Joseph (7.4%). In the case of Tunapuna/Piarco, most of these were almost evenly distributed across La Baja (19%), La Seiva (18.8%), Alta Gracia (17.2%), and Acono (15.3%) with just 9.4% in Maracas/St. Joseph. Fourthly, it is interesting to note that Acono had the largest proportion of those who came from both San/Juan Laventille (22.8%), and Tunapuna/Piarco (19%).

Table 13. Last Place of Residence, by Community(%)

Years	**Community**					
	Acono	**Alta Gracia**	**La Baja**	**Maracas/ St. Joseph**	**La Seiva**	**Entire AOS**
Port of Spain	3.4	3.4	6.3	5.9	2.5	**4.9**
Arima	1.7	0.0	1.3	3.5	3.8	2.7
Borough of Chaguanas	0.0	0.0	0.0	0.5	1.3	0.4

San Fernando	0.0	3.4	0.0	1.5	1.3	1.1
Borough of Point Fortin	0.0	3.4	0.0	0.5	0.0	0.4
Diego Martin	1.7	3.4	0.0	2.5	6.3	2.7
San Juan/Laventille	8.5	10.3	22.8	7.4	10.0	**10.9**
Tunapuna/Piarco	15.3	17.2	19.0	9.4	18.8	**14.0**
Sangre Grande	0.0	0.0	2.5	3.0	0.0	1.8
Mayaro/Rio Claro	0.0	0.0	0.0	1.0	0.0	0.4
Couva/Tabaquite/Talparo	0.0	0.0	0.0	3.5	6.3	2.7
Penal/Debe	0.0	0.0	1.3	0.0	1.3	0.4
Princes Town	0.0	0.0	0.0	0.5	0.0	0.2
Siparia	1.7	0.0	0.0	0.5	1.3	0.7
Tobago	0.0	3.4	0.0	1.5	1.3	1.1
Caribbean	0.0	0.0	0.0	4.5	3.8	2.7
Other (North America)	1.7	0.0	0.0	1.0	0.0	0.7
Always lived in Valley	**66.1**	**55.2**	**46.8**	**52.5**	**42.5**	**51.7**
Not stated	0.0	0.0	0.0	1.0	0.0	0.4

3. HOUSEHOLD STRUCTURE AND COMPOSITION

This subsection examines household structure and composition as they relate to the issues of head of household, main income earner, number of members and children under 5.

As regards household leadership, in most of the households, 41.4%, the head of household is the father, while in one third or 30.1% it is the mother (Table 14). In a near quarter of households however (24.3%), the person who served as household head may have included a brother, grand father/grandmother, aunt, the eldest, uncle, boyfriend and sister. For 4 percent of households, headship was equally shared between mother and father, while for 0.2% the stepfather served as head.

Table 14. Head of Household in AOS (%)

Head	Percent
Mother	30.1
Father	41.4
Equally shared-mother/father	4.0
Step-father	0.2
Other (brother, aunt, uncle etc.)	24.3
Total	**100.0 (449)**

The community breakdown replicated the general pattern as more fathers were designated household heads than mothers across all communities (Table 15). This was highest in Alta Gracia (58.6%), followed by Acono (49.2%), La Seiva (47.5%), La Baja (36.7%), and Maracas/St. Joseph (36.1%). The proportion of female household heads ranged between 26.6% in La Baja and 32.2% in Maracas/St. Joseph. We also note that alternate heads of households (i..e, brother, aunt, uncle) amounted to 32.9% in La Baja, followed by Maracas/St. Joseph (25.7%), La Seiva (20%), Acono(18.6%) and Alta Gracia (13.8%).

Table 15. Head of Household, by Community (%)

Response	Community				
	Acono	Alta Gracia	La Baja	Maracas/St.J	La Seiva
Mother	28.8	27.6	26.6	32.2	30.0

Father	49.2	58.6	36.7	36.1	47.5
Equally shared-mother/father	3.4	0.0	3.8	5.4	2.5
Step-father	0.0	0.0	0.0	0.0	0.0
Other	18.6	13.8	32.9	25.7	20.0
Total	**59**	**29**	**79**	**202**	**80**

In the majority of households (65.5%), the main income earner was the head of household (Table 16), while for smaller and varying minorities it was equally shared between mother and father (17.6%), some other household member such as a son/daughter (9.8%), a 'spouse/partner' (4.5%) or some other non-household member (2.7%).

Table 16. Main Income Earner in AOS(%)

Income Earner	Percent
Head	65.5
Spouse/Partner	4.5
Equally shared-mother/father	17.6
Other household member	9.8
Other person (not from same household)	2.6
Total	**100.0 (449)**

The main income earner across all communities is also the head of household (who could be mother/father/uncle/aunt) but in varying proportions as it amounted to 81.4% in Acono, 71.3% in La Seiva, 63.9% in Maracas/St. Joseph, 58.6% in Alta Gracia and 54.4% in La Baja. The breadwinner function was equally shared in a minority of cases which varied between 1.3% in La Baja and 13.8% in Alta Gracia (Table 17).

Table 17. Main Income Earner, by Community (%)

	Community				
Response	**Acono**	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Head	81.4	58.6	54.4	63.9	71.3
Spouse/Partner	8.5	13.8	1.3	3.0	5.0
Equally shared-mother/father	10.2	20.7	35.4	14.4	12.5
Other household					

member	0.0	6.9	6.3	14.9	8.8
Other person (not from same household)	0.0	0.0	2.5	4.0	2.5
Total	**59**	**29**	**79**	**202**	**80**

In relation to the size of households or the number of members they contain, this varies from household to household as can be expected: from as low as 1 (13.6%) to as high as 13 (0.4%) (Table 18). The vast majority of households however or 82.3% have 5 members or less while a very small minority or 17.7% have more than 5 members. The average household size is 3.74 which compares favorably to the national figure of 3.64 (CSO 2000: xvi).

Table 18. Household Size in AOS

Number of Members	**Percent**
1	13.6 (61)
2	19.3(87)
3	16.7 (75)
4	19.6 (88)
5	13.1(59)
6	8.9(40)
7	3.6(16)
8	2.7(12)
9	0.9(4)
10	0.9(4)
11	0.4(2)
13	0.4(2)
Total	**100.0 (450)**

When examined by community (Table 19), the vast majority of households across all communities were found to have 5 or less members which was highest in Alta Gracia (86.2%) followed by Acono (84.8%), Maracas/St. Joseph (82.7%), La Baja (76%) and La Seiva (71.3%).

Table 19. Household Size, by Community (%)

	Community				
Number	**Acono**	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**

1	15.3	13.8	16.5	12.4	12.5
2	22.0	20.7	16.5	18.8	18.8
3	20.3	10.3	13.9	19.3	15.0
4	15.3	20.7	17.7	18.3	25.0
5	11.9	20.7	11.4	13.9	11.3
6	10.2	6.9	15.2	6.4	8.8
7	5.1	0.0	3.8	4.0	3.8
8	0.0	0.0	2.5	4.5	1.3
9	0.0	3.4	0.0	1.0	1.3
10	0.0	3.4	0.0	1.0	1.3
11	0.0	0.0	0.0	0.5	1.3
13	0.0	0.0	2.5	**0.0**	0.0
Total	**59**	**29**	**79**	**202**	**80**

As it relates specifically to children (Table 20), the vast majority of households or 76.9% do not have children less than 5 years of age; 16.9% of households have at least 1 child below 5 years of age while 6.1% have between 2 to 5 children under 5.

Table 20
Children Under 5 Years of Age in AOS

Number	Percent
0	76.9 (346)
1	16.9 (76)
2	4.4 (20)
3	1.3 (6)
4	0.2 (1)
5	0.2 (1)
Total	**100.0 (450)**

A large majority of households across all communities do not have children less than 5 years of age (Table 21). This was highest in La Baja (82.3%), closely followed by Alta Gracia (80%), Acono (78%), Maracas/St. Joseph (76.2%) and La Seiva (71.3%). Just a small minority of households ranging between 1.5% in Maracas/St. Joseph and 22.5% in La Seiva had at least 1-3 children under 5 years of age.

Table 21. Children Under 5 Years of Age, by Community (%)

	Community				
Number	**Acono**	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
0	78.0	80.0	82.3	76.2	71.3

1	15.3	16.7	12.7	16.8	22.5
2	6.8	3.3	1.3	4.5	6.3
3	0.0	0.0	3.8	1.5	0.0
4	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.5	0.0
Total	**59**	**30**	**79**	**202**	**80**

4. BUILDING AND HOUSING INFRASTRUCTURE

In this section, we examine the building and housing infrastructure that characterizes the Valley. In examining this infrastructure, we look at the following features: building type, date of construction, patterns of ownership, the type of material from which buildings are constructed; water supply and frequency; toilet facilities as well household possessions or conveniences.

4.1. Building Type and Ownership Patterns

Based on definitions supplied by the Central Statistical Office (Census of Population 2010: 2):

A building is defined as any physical structure separate and independent of any other comprising one or more rooms, or other spaces, covered by a roof and enclosed within external walls or dividing walls which extend from the foundation to the roof. It is designed for residential, agricultural, commercial, industrial or cultural purposes, or for the provision of services. Detached rooms relating to the main building are treated as part of the main building.

Data from the survey reveals that almost all of the buildings in the Valley amounting to 98.4% are of a residential nature with just 1.3% belonging to the mixed category of 'residential/commercial/' and 0.1% to that of 'community/service/private/government' (Table 22). Similar to other parts of the country therefore, the Valley is largely a residential community without any significant commercial establishments.

Table 22. Type of Buildings in AOS (%)

Type	AOS
Residential	98.4
Residential/commercial	1.3
Residential/Professional	---
Commercial	---
Industrial	---
Community/Service/Private/Govt	0.2
Other	---
Not stated	---
Total	**100.0 (449)**

The breakdown of building types by community followed the same general pattern of the AOS although in both Alta Gracia and La Baja 100% of the buildings were residential, while the figures for La Seiva (98.8%), Acono (98.3%) and Maracas/St. Joseph (97.5%) fell marginally below this absolute figure (Table 23).

Table 23. Type of Buildings, by Community (%)

Tenancy	Community				
	Acono	Alta Gracia	La Baja	Maracas/ St. Joseph	La Seiva
Residential	98.3	100.0	100.0	97.5	98.8
Residential/commercial	1.7	0.0	0.0	2.0	1.3
Residential/Professional	0.0	0.0	0.0	0.0	0.0
Commercial	0.0	0.0	0.0	0.0	0.0
Industrial	0.0	0.0	0.0	0.0	0.0
Community/Service/Private/Govt	0.0	0.0	0.0	0.5	0.0
Other	0.0	0.0	0.0	0.0	0.0
Not stated	0.0	0.0	0.0	0.0	0.0
Total	**59**	**29**	**79**	**202**	**80**

As regards their date of construction, while this is variable, the majority of the building or housing stock in the Valley, 54.3%, was built before the 1990s, while one third or 30.5% was built between 1990 and 2009, up to the time of the survey; 14.9% of respondents did not know the date or period of construction of their building (Table 24). A further examination of the data would reveal that the bulk of the present building stock in the Valley was constructed during the period spanning the 1960s and 1980s when construction increased steadily from 10.2% in the 1960s, to 17.6% in the 1970s and 18.5% in the 1980s

where it peaked. This increase was no doubt influenced by the oil boom from around the early 1970s to the early 1980s. However, since reaching that peak, there has been a steady decline in housing construction as it fell to 15.8% in the 1990s and 14.7% so far for the period 2000-2009 (**July**). Given the fluctuating nature of housing construction, the data reveals that just around 30.5% of the housing stock in the Valley can be considered new (1990-2009) while 36.1% (1970s/1980s) can be considered old and 18.2% (1959-1969) very old.

Table 24
Period of Building Construction (%)

Period	AOS
1959 or earlier	8.0
1960-1969	10.2
1970-1979	17.6
1980-1989	18.5
1990-1999	15.8
2000-2004	8.2
2005-2009	6.5
Don't Know	14.9
Not stated	0.1
Total	**100.0 (449)**

The community breakdown exhibited similarities as well as differences from the findings for the AOS as a whole (Table 25). Firstly, consistent with the AOS generally (54.3%), a varying majority of the housing stock in La Seiva (61.4%), Acono (59.4%), Maracas/St. Joseph (53.5%), and La Baja (50.6%) was built before the 1990s, but for Alta Gracia the figure was 41.3%. Secondly, for the period spanning 1990-2009 (up to the time of the survey), it was only in Alta Gracia (55.1%) that a majority of houses had been built in this period, almost 25% more than the finding for the AOS as a whole(30.9%), followed by varying minorities for Acono (39%), La Seiva (33.9%), Maracas/St. Joseph (27.6%) and La Baja (19%). The latter two communities had the lowest levels of housing construction in the period 1990-2009. Except for Alta Gracia therefore, and consistent with the general finding for the AOS, a varying majority of the housing stock across all the communities can be considered 'old', while a varying minority can be considered 'new.' Thirdly, the pace or peak of housing construction across the communities also varied. In this regard, it was found that construction peaked in Maracas/St. Joseph in the 1970s (23.3%); in La Seiva (25%), and La Baja (17.7%) in the 1980s while Acono peaked in the 1990s (27.1%)

and Alta Gracia in the 2000s (34.4%). Relatedly, declines in housing construction were experienced by Acono in the 2000s , as well as La Seiva in the 1990s and 2000s while increases were experienced by Alta Gracia, La Baja and Maracas/St. Joseph.

Table 25. Housing Construction, by Community (%)

Year	Community				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
1959 or earlier	6.8	6.9	10.1	8.4	6.3
1960-1969	13.6	10.3	8.9	7.4	16.3
1970-1979	15.3	3.4	13.9	23.3	13.8
1980-1989	23.7	20.7	17.7	14.4	25.0
1990-1999	27.1	20.7	7.6	13.3	20.1
2000-2004	3.4	17.2	8.9	6.9	11.3
2005-2009	8.5	17.2	2.5	7.4	2.5
Don't Know	1.7	3.4	**30.4**	17.8	5.0
Not stated	0.0	0.0	0.0	0.5	0.0
Total	**59**	**29**	**79**	**202**	**89**

While a building is a more inclusive category that can include commercial as well as residential structures, the concept of dwelling relates more specifically to places of residence or where people live. The CSO (2010: 3) defines a dwelling thus:

A dwelling unit is any building or separate and independent part of a building in which a person or group of persons (private household) are living at the time of the census enumeration.

In any event, since almost all of the 'buildings' in the Valley are of a residential nature the distinction might not seem to be too relevant in this context. Nevertheless, such dwelling units were distinguished by type (Table 26). In this regard, it was found that the majority of them or 77.7% took the form of separate houses, 6.9% below the national figure of 84.6%, while a minority or 20.9% were private apartments and 1.1% was part of a commercial building. It is interesting to note that the proportion of private apartments in the Valley is some 12.4% more than the corresponding national figure of 8.5%.

Table 26. Type of Dwelling Units in AOS (%)

Type	AOS	Nationally (2005)*

Separate House	77.7	84.6
NHA Apartment	---	2.8
Private Apartment	20.9	8.5
NHA Townhouse	---	0.2
Private Town House	---	1.1
Part of Commercial Building	1.1	2.1
Out Room	---	0.1
Group Dwelling	---	0.4
Don't know	---	0
Not stated	0.2	0.1
Total	**100.0(449)**	**100.0(4,258)**

***Source:** Survey of Living Conditions 2005.

A varying majority of dwelling units in each community took the form of 'separate houses' and in several, the proportions were greater than the figure for the AOS (i.e., 77.7%): Alta Gracia led the way in this regard with 89.7% followed closely by Acono (88.1%), La Seiva(81.3%), with La Baja (75.9%) and Maracas/St. Joseph (72.3%) following further down with relatively smaller majorities (Table 27). Each community also had a varying minority of private apartments: Maracas/St. Joseph had the most with 25.7%, followed by La Baja (24.1%), La Seiva(16.3%), Acono (11.9%) and Alta Gracia(10.3%).

Table 27. Type of Dwelling Units, by Community (%)

Tenancy	Community				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/ St. Joseph**	**La Seiva**
Separate House	88.1	89.7	75.9	72.3	81.3
NHA Apartment	---	---	---	---	---
Private Apartment	11.9	10.3	24.1	25.7	16.3
NHA Townhouse	---	---	---	---	---
Private Town House	---	---	---	---	---
Part of Commercial Building	---	---	---	2.0	1.3
Out Room	---	---	---	---	---
Group Dwelling	---	---	---	---	---
Don't know	---	---	---	---	---
Not stated	---	---	---	---	1.3
Total	**59**	**29**	**79**	**202**	**80**

As regards ownership, the vast majority of dwellings or 81.7% were owned by the occupants, 8.2% were privately rented, 0.2% were rented from the Government, 0.2% were privately leased while 8.5% were occupied 'rent free' (Table 28).

Table 28. Tenancy of Dwelling Units in AOS (%)

Tenancy	AOS	Nationally(2005)*
Owned	81.7	77.7
Rented (Private)	8.2	12
Rented (Gov't/NHA)	0.2	1.9
Leased (Private)	0.2	0.1
Leased (Govt)	---	0
Rent Free	8.5	7
Squatted	---	0.3
Other	0.9	0.5
Don't know	---	0.2
Not stated	0.2	0.1
Total	**100.0 (449)**	**100.0 (4,258)**

***Source:** Survey of Living Conditions 2005.

A large and varying majority of dwelling units across all communities were self-owned. This was largest in the communities of Acono (89.8%), La Seiva (87.5%) and Alta Gracia(86.2%) followed by Maracas/St. Joseph (79.2%) and La Baja (74.7%) which had smaller majorities (Table 29). It should be noted that except for La Baja, the proportion

of home ownership for all the communities was greater than the corresponding national figure of 77.7% by 1.5 to 12.1 percentage points.

Table 29. Tenancy of Dwelling Units, by Community (%)

Tenancy	Community				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Owned	89.8	86.2	74.7	79.2	87.5
Rented (Private)	3.4	13.8	8.9	10.4	3.8
Rented (Gov't/NHA)	0.0	0.0	0.0	0.5	0.0
Leased (Private)	0.0	0.0	0.0	0.5	0.0
Rent Free	6.8	0.0	15.2	8.4	6.3
Other	0.0	0.0	1.3	1.0	1.3
Not stated	0.0	0.0	0.0	0.0	1.3
Total	**59**	**29**	**79**	**202**	**80**

4.2 Housing Conditions

The examination of housing conditions pays particular attention to the following in order to get a sense of the standard of living or quality of life within the community: the material out of which dwellings are constructed, the nature and regularity of water supply, toilet facilities, type of lightning, energy used in the home as well as the number of bedrooms.

The majority of dwelling units in the Valley or 67.5% are made out of 'brick/concrete', almost the same as the national figure of 68%, 16.9% are made of a combination of wood/brick/concrete, 1.5% more than the national figure of 15. 4%, while 11.8% are made of just wood, 0.9% less than the corresponding national figure of 12.7% (Table 30). In short, the construction material from which dwellings are made in the Valley compare very favorably to the situation nationally.

Table 30. Dwelling Units in AOS, by Construction Material(%)

Material	AOS	Nationally(2005)*
Brick/Concrete	67.5	68.0
Wood/Brick/Concrete	16.9	15.4
Wood/Galvanize	1.1	2.2
Wood	11.8	12.7

Wattle/Adobe/Tapia	1.6	0.6
Box Board/Plywood	0.4	0.6
Other	0.7	0.6
Not stated	---	0.4
Total	**100.0(449)**	**100.0 (4,258)**

***Source**: Survey of Living Conditions 2005.

The community breakdown of housing conditions gave a better picture of the developmental variations within the AOS (Table 31). As regards the quality or type of building material, it was found that only 42.5% of the dwellings in La Seiva were made of brick/concrete, some 25% less than the average for the country (68%) and the AOS (67.5%) (Table 30). However, in Maracas/St. Joseph (75.7%), Alta Gracia (72.4%), Acono (69.5%), La Baja (68.4%), in that order, a varying majority of dwellings were made of similar material, which was generally better than the corresponding figures for the country and the AOS by 0.4 to 7 percentage points. La Seiva also had the largest proportion of dwellings made of WBC-'wood, brick, concrete' (40%) compared to 6.9% for Alta Gracia, 8.9% for La Baja, 13.4% for Maracas/St. Joseph, and 13.6% for Acono. In terms of dwellings made of wood, Alta Gracia had the largest share of those dwellings with 20.7% followed by La Seiva (17.5%), Acono (15.3%), La Baja(13.9%), and Maracas/St. Joseph (6.4%).

Table 31. Material of Outer Walls, by Community (%)

Material	**Community**				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Brick/Concrete	69.5	72.4	68.4	75.7	42.5
WBC	13.6	6.9	8.9	13.4	40.0
Wood/Galvanize	0.0	0.0	2.5	1.5	0.0
Wood	**15.3**	**20.7**	**13.9**	**6.4**	**17.5**
WAT	0.0	0.0	5.1	1.5	0.0
BBP	0.0	0.0	1.3	0.5	0.0
Other	1.7	0.0	0.0	1.0	0.0

WBC: Wood, Brick, Concrete

WAT: Wattle/Adobe/Tapia
BBP: Box Board/Plywood

In relation to water, a large majority of households in the Valley or 82.6% receive a public supply of water directly into their dwellings, 11.9% more than the national figure of 70.7%, but for 6.7% that supply only reaches their yard, 1.4% less than the national figure of 7.1% (Table 32). The public stand pipe is also a source of water but only for 2.9% of households, 3% less than the national figure of 5.9%. Equally small or smaller minorities in the Valley depend on private sources for water (2%), truck borne supply (0.4%) and the most ancient of all sources: the 'spring/river' (2.2%).

Table 32. Dwelling Units in AOS, by Water Supply(%)

Tenancy	AOS	Nationally(2005)*
PPD	82.6	70.7
PPY	6.7	7.1
PRPD	0.2	4.4
PCNP	1.8	5.4
PSP	2.9	5.9
Truck Borne	0.4	1.9
Spring/River	2.2	1.1
Other	3.1	3.3
Not stated	---	0.2
Total	**100.0 (449)**	**100.0 (4,258)**

***Source**: Survey of Living Conditions 2005.

Key:

PPD: Public Piped into Dwelling
PPY: Public Piped into Yard
PRPD: Private Piped into Dwelling
PCNP: Private Catchment Not Piped
PSP: Public Standpipe

A large and varying majority of dwellings in all communities also received a direct public supply of water that compared more than favorably with figures for both the AOS (82.6%) and country (70.7%) (Table 33). The figures were 100% in Alta Gracia, 89.8% in Acono, 84.8% in La Baja, 81.7% in Maracas/St. Joseph and 71.3% in La Seiva. Also consistent with the patterns for the AOS and the country, a very small and varying minority of households depended on the public stand pipe as a source of water supply: this was led by Acono with 5.1%, followed by La Seiva (5%), Maracas/St. Joseph (2.5%), and La Baja (1.3%). In Alta Gracia no household reported use of the public stand pipe.

Table 33. Water Supply, by Community (%)

Supply	Community				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
PPD	89.8	100.0	84.8	81.7	71.3
PPY	1.7	0.0	6.3	7.9	10.0
PRPD	0.0	0.0	1.3	0.0	0.0
PCNP	0.0	0.0	0.0	4.0	0.0
PSP	5.1	0.0	1.3	2.5	5.0
Truck Borne	0.0	0.0	2.5	0.0	0.0
Spring/River	0.0	0.0	1.3	0.5	10.0
Other	3.4	0.0	2.5	3.5	3.8
Total	**59**	**29**	**79**	**202**	**80**

Key:

PPD: Public Piped into Dwelling
PPY: Public Piped into Yard
PRPD: Private Piped into Dwelling
PCNP: Private Catchment Not Piped
PSP: Public Standpipe

However, while 82.6% of households receive a direct supply of water, only 68.6% report having a continuous or daily supply, which is still 10.2% more than the national figure of 58.4% (Table 34). Fifteen point two percent (15.2%), receive water only '3 times or more weekly', 4.9% less than the national figure of 20.1%, 5% receive at least 'twice weekly', compared to 7.3% nationally, while 5.2% receive less than 'two times a week', compared to 7.2% nationally. While the frequency or regularity of the water supply in the AOS is relatively better than the situation nationally, there is still room for much improvement.

Table 34. Frequency of Water Supply in AOS(%)

Frequency	AOS	Nationally(2005)*
Continuous/daily	68.6	58.4
3 times or more weekly	15.2	20.1

Twice weekly	5.0	7.3
<2 times weekly	5.2	7.2
Other	5.5	6.2
Not stated	0.5	0.8
Total	**100.0(440)**	**100.0 (4,258)**

***Source**: Survey of Living Conditions 2005.

However, while large majorities across all communities receive a public supply of water, the frequency of this water supply reflected sharper variations (Table 35). For instance, while large majorities of households (82.8%) in Acono, Maracas/St. Joseph (80.8%) and a smaller majority in La Baja (58.2%) report a daily supply of water, minorities in Alta Gracia (48.3%) and La Seiva (44.7%) reported similarly. La Seiva had the largest proportions of households (40.8%) receiving water '3 times or more weekly,' compared to 13.8% in Alta Gracia, 12.1% in Acono, 11.4% in La Baja and 8.1% in Maracas/St. Joseph. Alta Gracia also had the largest proportion of households (20.7%) which receive water twice weekly.

Table 35. Frequency of Water Supply, by Community (%)

	Community				
Frequency	**Acono**	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Daily	82.8	48.3	58.2	80.8	44.7
3 or more weekly	12.1	13.8	11.4	8.1	40.8
Twice weekly	1.7	20.7	8.9	2.0	5.3
<2 weekly	1.7	10.3	11.4	2.0	7.9
Other	1.7	6.9	10.1	6.6	0.0
Not stated	0.0	0.0	0.0	0.5	1.3
Total	**58**	**29**	**79**	**202**	**80**

Given the general inadequacy or unreliability of the supply of water, a large majority of households (83.9%) have had recourse to water tanks to store water, 0.9% more than the corresponding figure nationally (Table 36). A much smaller minority or 10% use barrels to store water in the Valley compared to 21.5% nationally.

Table 36. Method of Storing Water(%)

Response	AOS	Nationally (2005)*
Water tank	83.9	83.0
Barrel	10.0	21.5
Other	5.8	9.1
Not stated	0.3	
Total	**449**	**2,969**

***Source**: Survey of Living Conditions 2005.

Similarly, given the reliability challenges of the public supply of water, a large majority across all communities have had recourse to other methods of obtaining water, particularly the use of water tanks, even those which reported a daily supply of water, consistent with the pattern for the AOS (83.9%) and nationally (83%) (Table 37). Leading the way in this regard was Alta Gracia where 100% or all dwellings had water tanks, followed by La Baja (86.3%), La Seiva (84.6%), Acono (81.6%) and Maracas/St. Joseph (80.8%). Given their problems with a more regular water supply, it should not be surprising that Alta Gracia and La Seiva figure prominently in the recourse to water tanks in order to help alleviate this problem.

Table 37. Method of Storing Water, by Community (%)

Method	Community				
	Acono	Alta Gracia	La Baja	Maracas/St.J	La Seiva
Water tank	81.6	100.0	86.3	80.8	84.6
Barrel	10.2	0.0	9.6	9.0	15.4
Other	6.1	0.0	4.1	10.3	0.0
Not stated	2.0	0.0	0.0	0.0	0.0
Total	**49**	**24**	**73**	**156**	**78**

As regards toilet facilities, some 19.4% of dwellings still rely on pit latrines, 1% more than the corresponding national figure of 18.4%; just 1.1% have toilets linked directly to a

sewer, compared to 18.3% nationally (Table 38). The majority of households however or 78% rely on a septic tank or soak away, compared to 62.6% nationally.

Table 38. Toilet Facilities in AOS(%)

Facility	AOS	Nationally(2005)*
Pit Latrine	19.4	18.4
WCLS+	1.1	18.3
Septic tank/soak away	78.0	62.6
Other	0.4	0
None	0.9	0.6
Not stated	0.2	0
Total	**449**	**4,258**

***Source**: Survey of Living Conditions 2005.

+WCLS-Water Closet Linked to Sewer

Pit latrines exist in all the communities, which is disconcerting although they represent a minority (Table 39). La Seiva has the largest proportion with 30% followed by Alta Gracia (27.6%), La Baja (21.5%), Acono (18.6%) and Maracas/St. Joseph (13.4%), which has the least. Except for Maracas/St. Joseph, the figures for La Seiva, Alta Gracia and La Baja were greater than those for both the AOS (19.4%) and the country (18.4%). However, a varying majority of dwellings in Maracas/St. Joseph (83.2%), Acono (81.4%), La Baja (73.4%), Alta Gracia (72.4%) and La Seiva (68.8%) had 'septic tanks/soak aways' which compared favorably and even better to the figures for the AOS (78%) and the country (62.6%).

Table 39. Toilet Facilities, by Community (%)

Facility	Community				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Pit Latrine	**18.6**	**27.6**	**21.5**	13.4	**30.0**
WCLS+	0.0	0.0	3.8	1.0	0.0
Septic tank/soak away	81.4	72.4	73.4	83.2	68.8
Other	0.0	0.0	1.3	0.5	0.0
None	0.0	0.0	0.0	2.0	0.0
Not stated	0.0	0.0	0.0	**0.0**	1.3
Total	**59**	**29**	**79**	**202**	**80**

The sources of energy that households used for lightning and cooking presented a much more encouraging picture. As regards the former, 96.4% of households use electricity which was 1.4% more than the national figure of 95% (Table 40). Very small minorities used other sources such as kerosene (2.7%) and gas (0.7%).

Table 40. Lighting in AOS, 2000(%)

Lighting	AOS	Nationally (2005)*
Electricity	96.4	95
Gas	0.7	0.1
Kerosene	2.7	3.9
Other	0.2	0.8
Not stated	---	0.1
Total	**449**	**4,258**

***Source**: Survey of Living Conditions 2005: 118.

In relation to cooking, 96.7% of all households use gas, 3.4% more than the national figure of 93.4%; 2% use electricity, 3.4% less than the corresponding national figure (Table 41).

Table 41. Type of Fuel for Cooking in AOS (%)

Fuel	AOS	Nationally(2005)*
None	0.4	0.4
Electricity	2.0	5.4
LPG/Cooking Gas	96.7	93.4
Kerosene	0.2	0.3
Wood/charcoal	0.2	0.4
Other	0.2	0
Not stated	0.2	0.1
Total	**449**	**4,258**

***Source**: Survey of Living Conditions 2005: 119.

Consistent with the pattern for the AOS and the country, the major source s of energy for lightning and cooking across all the communities were electricity and LPG/Cooking gas (Tables 42 and 43). In relation to electricity, La Baja led the way with 100%, followed by Alta Gracia (96.6%), La Seiva (96.3%), Maracas/St. Joseph (96%), and Acono (93.2%). In relation to cooking gas, Acono and Alta Gracia led the way with 100% followed by Maracas/St. Joseph (97%), La Baja (94.9%) and La Seiva (93.8%).

Table 42. Type of Lighting, by Community (%)

Lighting	Community				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Electricity	93.2	96.6	100.0	96.0	96.3
Gas	0.0	0.0	0.0	0.5	2.5
Kerosene	6.8	3.4	0.0	3.0	1.3
Other	0.0	0.0	0.0	0.5	0.0
Total	**58**	**29**	**79**	**202**	**80**

Table 43. Type of Fuel for Cooking, by Community (%)

Lighting	Community				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
None	0.0	0.0	0.0	1.0	0.0
Electricity	0.0	0.0	3.8	0.5	6.3
LPG/Cooking Gas	100.0	100.0	94.9	97.0	93.8
Kerosene	0.0	0.0	0.0	0.0	0.0
Wood/charcoal	0.0	0.0	0.0	0.5	0.0
Other	0.0	0.0	1.3	0.0	0.0
Not stated	0.0	0.0	0.0	0.5	0.0
Total	**58**	**29**	**79**	**202**	**80**

4.3 Other Household/Modern Conveniences

Due to the development of technology there has arisen a fine line between what can be considered traditional, modern, luxury or need. However, bearing this in mind as another measure or indicator of the standard of living, we also examined ownership or access to a range of modern conveniences that include household appliances, motor cars, telephones, computers and the internet among others. We would focus here on those that can be generally considered more significant or fundamental.

As regards the more traditional appliances or necessities, it was found that varying large majorities of households had such basics as stove (97.5%), refrigerator (90.2%), television (94.2%), and washing machine (77.9%) (Table 44). In relation to telephones, and reflecting the times in which we live, just around 48.4% had fixed telephone lines while 94.9% had cell phones; 75.% had DVD players but 68.7%% had stereos/radios with CD players. In relation to computers, only a small minority had either desk tops (33.3%) or laptop computers (22.9%) and just 33.4% had internet access. A small but larger minority of households, 42%, had a motor vehicle.

Table 44. Household Conveniences in AOS(%)

Item	AOS
Telephone	

Fixed Line	48.4
Cell-phone	94.9
Stereo/radio with CD Player	68.7
DVD player	75.4
Computer	
Desktop	33.3
Laptop	22.9
Internet Access	33.4
Television	94.2
Cable	60.9
Direct TV	5.1
Motor Vehicle	42.0
Refrigerator	90.2
Deep Freeze	31.5
Electric Polisher	2.9
Sewing Machine	27.2
Vacuum Cleaner	24.6
Washing Machine	77.9
Clothes Dryer	14.7
Water Heater	12.5
Shower Heater	27.7
Microwave Oven	68.5
Wood eater/Bush Wkr/Lawn Mower	18.6
Stove	97.5
Air Conditioner	6.7

While large and varying majorities across all the communities possessed some of the basic amenities such as refrigerators, microwave ovens, washing machines and stoves, there were some inter-community differences, some marginal, others major (Table 45). For instance, we note that while refrigerator ownership ranged from 88.1% in Acono to 91.1% in Maracas/St. Joseph, washing machine ownership ranged from 73.1% in La Baja to 80.2% in Maracas/St. Joseph; those having micro wave ovens ranged from 59.7% in La Baja to 79.7% in Acono. However, the proportions having stoves was much higher as it ranged from 97.5% in Maracas/St. Joseph to 100% in Alta Gracia and Maracas/St. Joseph. Large majorities (in the 90s) also had cell phones and television across all communities but much smaller majorities varying between 52.5% in Acono to 69.3% in Maracas/St. Joseph had cable television and even less had Direct TV, which varied between 3.4% in Alta Gracia and 8.5% in Acono. In addition, unlike the more traditional conveniences, very small and varying minorities had computers

(desktop and laptop) as well as internet access. Those having desktops ranged from 18.6% in Acono to 41% in La Baja, while laptop ownership was even lower as it ranged from 13.6% in Acono to 28.8% in La Seiva. Motor vehicle ownership also showed significant variations. It was only in two communities, Acono (54.2%) and La Seiva (51.3%) that a majority of households owned a motor vehicle which were still small majorities. For the other communities, a varying minority of households owned motor vehicles in La Baja (47.4%), Alta Gracia (37.9%) and Maracas/St. Joseph (33.2%). This general lack of motor vehicle ownership has implications for the provision and use of public transportation to and from the AOS.

Table 45. Select Household Conveniences, by Community (%)

Convenience	Community				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Telephone					
Fixed Line	54.2	41.4	50.0	50.0	40.0
Cell-phone	93.1	89.7	94.9	94.6	98.8
Stereo/radio with CD Player	74.6	65.5	73.1	62.4	77.2
DVD player	79.7	65.5	83.3	71.6	77.5
Computer					
Desktop	**18.6**	**37.9**	**41.0**	**36.1**	**27.5**
Laptop	**13.6**	**13.8**	**28.2**	**22.6**	**28.8**
Internet Access	**23.7**	**34.5**	**37.2**	**33.5**	**36.3**
Television	91.4	95.6	97.4	92.6	96.3
Cable	52.5	58.6	52.6	**69.3**	55.0
Direct TV	8.5	3.4	3.8	4.0	7.5
Motor Vehicle	**54.2**	**37.9**	**47.4**	**33.2**	**51.3**
Refrigerator	88.1	89.7	89.6	91.1	90.0
Washing Machine	78.0	75.9	73.1	80.2	77.5
Microwave Oven	79.7	75.9	**59.7**	68.3	68.8
Stove	98.3	100.0	93.6	97.5	100.0
Total	**58**	**29**	**79**	**202**	**80**

5. EDUCATION AND LITERACY

It is universally accepted that both education and literacy play a critical role in the process of development at all levels, the individual, the community and the nation. While it is recognized that there are limitations to using success in examinations as the sole benchmark of educational success, it remains a critical determinant of an individual's movement from primary to secondary to tertiary education and ultimately their opportunities in the job market. Consequently, based on this recognition, respondents were asked to indicate the highest examination they have passed (Table 46). The results were generally mixed at best. A small minority or 17.8% never passed any examination, 7% more than the national figure of 10.8%. At the primary school level, 24% had passed 'common entrance/SEA', 8.2% more than the national figure of 15.8% and 7.1% had passed 'school leaving,' compared to national figure of 4%. At the secondary level, 0.5% in the AOS had passed CXC Basic proficiency, compared to 2.6% nationally; a larger minority or 19.3% had passed CXC General Proficiency/O'Levels, 1.5% more than the national figure of 17.8% but 1.5% had passed the Advanced level of secondary school examination compared to 2.2% nationally. At the primary and secondary levels therefore the educational performance within the Valley compared to the national level was generally mixed: in some cases it did better, in others it did worst. The same general pattern existed at the higher levels of the educational ladder: whereas 2.9% in the Valley had received some 'certificate', 4.7% had done so nationally; 1.8% were successful with 'diplomas' compared to 3.1% nationally. The Valley however did better in relation to 'associate/undergraduate degrees' (4.1%) as well as masters degrees (1.1%) compared to the situation nationally where the figures were, 2.1% and 0.6%, respectively. At the PhD level, the achievement level in both the Valley and nationally were the same but extremely small at 0.1%. While the levels of educational success both in the Valley and nationally are generally low, and worrisome, the Valley does better on several indices, particularly in the area of CXC General proficiency examinations, undergraduate and Masters degrees.

Table 46. Highest Examination Passed in AOS(%)

Examination	AOS	Nationally(2005)*
None	17.8	10.8
Common Entrance/SEA	24.0	15.8
School Leaving	7.1	4.0
CXC Basic	0.5	2.6
CXC Gen./O'Levels	**19.3**	17.8
A'Level	**1.5**	**2.2**
Certificate	2.9	4.7
Diploma	1.8	3.1
Associate Degree	**0.7**	0.6
Undergraduate Degree	**3.4**	1.5
Masters	**1.1**	0.6
PhD	0.1	0.1
Other	0.2	1.0
Not stated	2.3	35.0
Not applicable	16.9	----
Total	**100.0 (1,683)**	**100.0 (15,209)**

***Source**: Survey of Living Conditions 2005: 88.

Educational performance at the community level was generally low consistent with the general patterns for the AOS with minor variations (Table 47). At the secondary level, small minorities ranging between 16.4% in Alta Gracia and 27% in Acono had some measure of success at this level. For the other levels, the results were even more dismal. For instance, at the Advanced level secondary school examinations, those with some measure of success ranged from 0.3% in La Seiva to 2% in Acono. At the Higher education level, the best results were registered by Alta Gracia where 6.2% had some sort of undergraduate University education but this was followed by La Seiva with 3.6% , Maracas/St. Joseph with 3.3%. Alta Gracia, 0.9% and Acono, 0.5%.

Table 47. Highest Examination Passed, by Community (%)

Examination	Community				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
None	38.8	20.0	30.7	40.4	28.1
Common Entrance/SEA	28.0	36.4	25.2	20.2	25.8
School Leaving	1.0	19.1	1.6	5.8	15.6
CXC Basic	0.5	0.9	0.3	0.0	0.7
CXC Gen./O'Levels	**27.0**	**16.4**	**18.3**	**18.2**	**19.9**
A'Level	2.0	1.8	1.6	1.8	0.3
Certificate	0.5	0.0	4.9	3.3	2.3
Diploma	0.0	0.0	2.9	1.8	2.3
Associate Degree	0.0	2.7	0.7	0.7	0.3
Undergraduate Degree	0.5	0.9	**6.2**	3.3	**3.6**
Masters	**1.5**	0.0	1.3	1.2	0.7
PhD	0.0	0.0	0.0	0.3	0.0
Other	0.0	1.8	0.3	0.0	0.0
Not stated	0.0	0.0	5.9	2.5	0.3
Total	**196**	**110**	**306**	**760**	**302**

To probe further the question of educational attainment or training, respondents were asked to indicate if they were doing any 'continuing education studies'. In this regard, it was found that around one third or 34% were pursuing 'continuing studies' which is encouraging given the low level of educational achievement in the Valley (Table 48). However, on the other side of the coin, some 63% were not doing so which does not augur well for the future.

Table 48. Continuing Education (%)

Response	Percent
Yes	34.2
No	62.8
Missing	2.9
Total	**100.0 (1,399)**

Table 49. Continuing Education, by Community (%)

Response	Community				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Yes	28.3	37.3	33.8	27.2	27.5
No	71.7	62.7	66.2	72.8	72.5
Total	**198**	**110**	**281**	**755**	**298**

Consistent with the general patterns for the AOS, a varying minority is pursuing further education (Table 49): this was highest in Alta Gracia (37.3%) followed by La Baja (33.8%), Acono (28.3%), La Seiva (27.5%) and Maracas/St. Joseph (27.2%). Rather, relatively large majorities across all communities were not pursuing further education: this was led by Maracas/St. Joseph (72.8%), followed by La Seiva (72.5%), Acono (71.7%), Alta Gracia (62.7%), and La Baja (66.2%). The educational outlook in the AOS therefore is not too encouraging.

5.1 Literacy

However, apart from education per se, another important factor that can affect the pursuit of education itself and the development process is literacy. In examining and measuring this crucial issue, respondents (those 11 years and over only) were asked questions in relation to reading and writing which included the following:

i. Reading a short text such as from the daily newspaper.
ii. Reading the words on a road sign, such as "do not enter."
iii. Writing a few sentences on a simple topic.
iv. Writing or signing his or her name.

Based on these questions, it was found that 95.2% of those 11 years and over had no problems reading or writing (Table 50). Nevertheless, it was still found that 0.9% had problems reading, 0.6% had problems writing, while 3.3% had problems both reading and writing. Those having literacy problems based on these questions therefore amounted to 4.8%.

Table 50
Literacy in AOS (Persons 11 years and over) (%)

Response	Percent
No problems	95.2
Problem Reading	0.9
Problem Writing	0.6
Problem Reading and writing	3.3
Total	**100.0 (1,386)**

Table 51. Literacy, by Community (%)

	Community				
Response	**Acono**	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
No problems	95.8	100.0	96.5	94.8	92.5
Problem reading	0.0	0.0	1.6	1.1	2.0
Problem writing	0.0	0.0	1.6	0.8	0.8
Problem reading and writing	4.2	0.0	0.0	3.1	4.8
Total	**168**	**88**	**257**	**621**	**252**

A very large majority across all communities reported no problems reading and writing (Table 51). In the case of Alta Gracia, 100% reported no such problems while large majorities in La Baja (96.5), Acono (95.8%), (Maracas/St. Joseph (94.8%), and La Seiva (92.5%) reported similarly. Only extremely small statistical minorities reported problems either reading in Maracas/St. Joseph (1.1%), LaBaja (1.6%), La Seiva (2.0%) or writing in La Baja (1.6%), Maracas/St. Joseph (0.8%) and La Seiva (0.8%). However slightly larger statistical minorities reported having problems both reading and writing which was more prevalent in La Seiva(4.8%), Acono (4.2%), and Maracas/St. Joseph (3.1%). In spite of the latter, the data does generally suggest that basic literacy is not a major or critical problem in the AOS.

However, in addition to the above questions, respondents were also given a practical task to perform which involved reading the instructions for Aspirin (see Questionnaire-Appendix I). Based on this task it was found that 82.1% had no problem reading and understanding as they followed the instructions correctly (Table 52). However, 13.6% followed the instructions incorrectly suggesting problems of either reading, understanding

or both. Functional illiteracy therefore appears to be a problem in the community but this would require a more rigorous survey on literacy by itself.

Table 52. Following Instructions for Aspirin(%)

Response	Percent
Correct	82.1
Incorrect	13.6
Not applicable (Partially blind/mute)	3.6
Not stated	0.7
Total	**100.0 (441)**

The community breakdown showed that functional illiteracy is a problem across all communities although in varying degrees (Table 53). In this regard, while large majorities in La Seiva (88.8%), Acono (87.9%), Maracas/St. Joseph (82.4%), consistent with or even better than the figure for the AOS(82.1%), interpreted the instructions correctly, for both La Baja (75.7%) and Alta Gracia (65.5%), much smaller majorities got it correct. Invariably, those providing the incorrect interpretation was highest in Alta Gracia with 31%, followed by La Baja (20.3%), Acono (12.1%), Maracas/St. Joseph (11.1%) and La Seiva (8.8%). Consequently, while basic literacy does not appear to be a critical problem in the Valley based on the questions asked in this survey, there does seem to be a greater problem with functional literacy.

Table 53. Following Instructions for Aspirin, by Community (%)

	Community				
Response	**Acono**	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Correct	87.9	65.5	75.7	82.4	88.8
Incorrect	12.1	31.0	20.3	11.1	8.8
Not applicable	0.0	3.4	4.1	5.0	2.5
Not stated					
Total	**59**	**29**	**76**	**201**	**80**

6. ECONOMIC ACTIVITY/EMPLOYMENT

The examination of economic activity or employment within the AOS is based on an evaluation of four major indicators which included: (i) the main sectors or industries in which persons are employed; (ii) the type of occupations held; (iii) category of worker (i.e., whether state or private sector) and (iv) involvement in various government work programs (e.g., URP, CEPEP etc.). In addition, respondents were also asked to indicate their mode(s) of transportation to work.

6.1 Employment by Sector/Industry

The sectoral distribution of persons employed in the Valley follows the same pattern nationally with some variations (Table 54). The majority of those employed in the Valley or 59.6% are located in the services sector (e.g. education, finance, public sector, guest houses, transportation), 17.8% more than the national figure of 41.8%; which is followed by construction where some 21.1% were employed, 10.1% more than the corresponding national figure of 11%; then by manufacturing where 11% in the Valley are employed, compared to 6.2% nationally. The relatively high level of employment in the construction sector is telling for it is surely connected to the apparent housing construction 'boom' in the Valley itself. The sectors where there is least employment in the Valley are agriculture, 3.4%, 0.1% more than the national figure of 3.3% and petroleum/gas, 0.7%, 1.6% less than the national figure of 2.3%.

Table 54
Persons Employed in AOS, by Industry/Sector (%)

Industry	AOS	Nationally(2006)*
Agriculture	3.4	3.3
Petroleum/Gas	0.7	2.3
Mining &Quarrying	---	0.1
Manufacturing	11.0	6.2
Construction	**21.1**	11.0
Services	59.6	41.8
Not stated	4.1	0.3
Not applicable	---	34.9
Total	**705**	**100.0**

***Source**: CSO 2006.

Consistent with the broader pattern nationally and the AOS, the two major sources/sectors of employment in the AOS are services and construction in that order (Table 55). As regards the service sector, varying majorities were employed in this sector which was led by Maracas/St. Joseph (63.3%), followed by La Seiva (62.1%), La Baja (54.0%), and Acono (52.1%) while 43.3% were employed in Alta Gracia. As for construction, Alta Gracia led employment in this sector with 36.2%, followed by Acono (26%), La Seiva (21.9%), La Baja (19.5%) and Maracas/St. Joseph (17.6%). It is interesting to note that the proportion of those employed in this sector was greater than the national figure(11%), by relatively large margins varying between 6 and 25 percentage points. A decline or slowdown in this sector thus would have significant repercussions for the AOS. The sector which was the third major source of employment was manufacturing although the figures employed were much smaller, ranging from 7.1% in La Baja to 14.5% in Acono. However notwithstanding the relative size of the figures, the proportions employed in this sector were greater than the national figure (6.2%) by 0.9 to 8 percentage points.

Table 55. Employment in Industry/Sector, by Community (%)

Sector	Community				
	Acono	Alta Gracia	La Baja	Maracas/ St. Joseph	La Seiva
Agriculture	2.1	4.3	7.0	2.9	0.8
Petroleum/Gas	2.1	2.1	0.0	0.3	0.8
Mining &Quarrying	0.0	0.0	0.0	0.0	0.0
Manufacturing	14.5	12.7	7.1	9.9	14.1
Construction	**26.0**	36.2	**19.5**	17.6	**21.9**
Services	**52.1**	**43.3**	**54.0**	**63.3**	**62.1**
Not stated	3.1	0.0	7.0	5.2	0.8
Total	**96**	**47**	**128**	**306**	**128**

6.2 Employment by Type of Occupation and Worker

As it relates to occupation, these are distributed across 9 major groupings or categories from what might be [socially] considered 'highest' to 'lowest' in social status terms (Table 56). At the top of the occupational ladder, almost a quarter or 24.8% of those employed in the Valley work in professional occupations, 4.3% more than the national figure of 20.5%; 24.1% work in clerical/service and sales, 2% less than the national figure of 26.1%; 1.7% work in agricultural occupations, 1.4% less than the national figure of 3.1%; 21.3% work in craft and related occupations, 7.2% more than the national figure of 14.1%; 7.1% work as plant/machinery operators/assemblers compared to 9.6% nationally while 20.3% work in elementary occupations, 3.5% less than the national figure of 23.8%. While in both the Valley and nationally professional occupations were more in the minority than the majority, there is a greater proportion of professionals in the Valley than nationally. We also note though that while there are more 'craft and related' workers in the Valley (21.3%) than nationally (14.1%), there are also marginally less elementary workers (20.3% vs 23.8%). Thus although the Valley has its fair share of 'lower status' occupations, it contains slightly more white collar type professional workers than the country as a whole.

Table 56. Persons Employed in AOS, by Occupation(%)

Occupation	AOS	Nationally(2005)*
LSM	6.8	6
Professional	7.5	5

TAP	10.5	9.5
Clerical	10.2	11.8
Service and sales	13.9	14.3
AFFH	1.7	3.1
Craft & related	21.3	14.1
PMOA	7.1	9.6
Elementary	20.3	23.8
Not stated	0.7	2.9
Total	**705**	**2,513**

***Source**: Survey of Living Conditions 2005: 65,70.

LSM: Legislator, Senior Official, Manager
TAP: Technicians and Associate Professionals
AFFH: Agriculture, Forestry, Fishery and Hunting
PMOA: Plant & Machinery Operators & Assemblers

While the distribution of occupations across communities replicated the same basic pattern for the AOS and country there were variations (Table 57). There is no clearly dominant occupation or occupational group across ALL the communities. Professionals, like all other groups, constitute a minority, but is largest in La Seiva(29.8%), followed by La Baja(25.1%), Acono (25.0%), Maracas/St. Joseph (23.8%) and Alta Gracia (17.1%), which had the least. Those in clerical/services/sales amounted to 25% in La Seiva , 24.8% in Maracas/St. Joseph, 23.4% in La Baja, 22.9% in Acono and 21.3% in Alta Gracia. Occupations in 'agriculture' were largely 'negligible' in La Baja (4.7%), Alta Gracia (2.1%), Maracas/St. Joseph (1.3%), Acono (1.0%) and non-existent in Alta Gracia (0%). Craft and related occupations ranged from 16.7% in Acono to 29.8% in Alta Gracia with the figure in the latter some 8-15 percentage points greater than figures for the AOS (21.3%) and country(14.1%). For the category of PMOA, the figures employed ranged between 4.3% in Alta Gracia and 10.4% in Acono. Elementary occupations were highest in Alta Gracia (25.5%), followed by Acono (22.9%), Maracas/St. Joseph (21.9%), La Baja(18.0%) and La Seiva (14.8%). When we collapse or add together what might be considered the lower status occupations (clerical/sales, craft, PMOA, elementary jobs), we find that they constitute the majority of the employed across all the communities: Alta Gracia had the largest proportion with 83% followed by Maracas/St. Joseph(75.1%), La Baja (74.2%), Acono (73.9%) and La Seiva (70.2%).

Table 57. Occupation, by Community (%)

Occupation	Community				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/ St. Joseph**	**La Seiva**
LSM	7.3	8.5	6.3	5.2	10.2
Professional	4.2	4.3	9.4	7.5	9.4
TAP	13.5	4.3	**9.4**	11.1	10.2
Clerical	7.3	8.5	11.7	11.1	9.4
Service and sales	15.6	12.8	11.7	13.7	**15.6**
AFFH	1.0	2.1	4.7	1.3	0.0
Craft & related	**16.7**	**29.8**	**19.5**	**21.2**	**23.4**
PMOA	10.4	4.3	**8.6**	5.9	7.0
Elementary	**22.9**	**25.5**	18.0	**21.9**	14.8
Not stated	1.0	0.0	0.8	1.0	0.0
Total	**96**	**47**	**128**	**306**	**128**

As it relates to 'type of worker', this seeks to capture whether employment is in the public or state sector as opposed to the private sector and the nature of that private sector employment (Table 58). In these respects, it was found that a majority or 52.1% worked in the business or private sector, while varying minorities worked with the Government (23.2%) or are self-employed (20.4%). If we combine the self-employed (20.4%) category with the category for 'private sector' (52.1%), this increases the size of this category to 72.3%.

Table 58. Type of Worker in AOS(%)

Occupation	AOS
Government	23.2
Private Enterprise	50.4
Employer	4.0
Own Account/Self Employed	20.2
Unpaid family worker	0.3
Paid family worker	0.7
Pensioner	0.7
Not applicable	0.4

Total	**100.0 (702)**

Most of those employed across all communities worked in the 'private enterprise' sector (Table 59): this was led by La Baja (52.8%), followed by La Seiva (50.8%), Maracas/St. Joseph (49.8%), Acono(49.5%), and Alta Gracia (49%). Alta Gracia had the highest proportion of 'own account/self employed' (30.6%) which was followed by La Seiva (21.4%), Maracas/St. Joseph (20.3%), Acono (18.9%) and La Baja(15.7%). Employment with the Government ranged from 16.3% in Alta Gracia to 23.2% in Acono. What these figures suggest thus is that there is no employment dependency on the State in the Valley.

Table 59. Type of Worker, by Community (%)

Worker	Community				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/ St. Joseph**	**La Seiva**
Government	23.2	16.3	19.6	22.1	17.5
Private Enterprise	**49.5**	**49.0**	**52.8**	**49.8**	**50.8**
Employer	2.1	2.0	7.1	2.0	7.9
Own Account/Self Employed	**18.9**	**30.6**	**15.7**	**20.3**	**21.4**
Unpaid family worker	0.0	0.0	0.0	0.3	0.8
Paid family worker	0.0	0.0	1.6	0.3	1.6
Pensioner	4.2	0.0	0.8	0.0	0.0
Not applicable	2.1	2.0	0.0	0.0	0.0
Total	**95**	**49**	**127**	**305**	**126**

While there is a relatively low dependence on 'government' employment, the survey also sought to ascertain the level of employment in various 'government work programmes' that are aimed particularly at the youth and unemployed (Table 60). In this regard, it was found that the vast majority or 92.5% did not work in any of the stated programmes while extremely small minorities worked in the URP (2.6%), CEPEP (2%), CCC (0.1%), HYPE (0.1%), and the Reforestation Programme (1%). This finding admits three possible interpretations: either there is a lack of these programmes in the Valley, or access to these programmes is lacking or there is a lack of interest in them where they exist.

Table 60
Employment in Government Work Programme(%)

Employment	AOS
Unemployment Relief Programme (URP)	2.6 (18)
CEPEP	2.0 (14)
On Job Placement (OJP)	0.3 (2)
Civilian Conservation Corp	0.1 (1)
Helping Youth Prepare for Unemployment Programme (HYPE)	0.1 (1)
Youth Apprenticeship Programme in Agriculture (YAPA)	---
Reforestation Programme	1.0 (7)
Other	0.6 (4)
None	92.5 (641)
Not applicable	0.7 (5)
Total	**100.0(693)**

Vast majorities across all communities are not employed in any of the government run work or training programmes (Table 61) which was highest in La Seiva with 96.6%, followed by Maracas/St. Joseph (93.1%), La Baja (92.8%), Alta Gracia (87.8%) and Acono (87.4%). A very small minority was employed in the URP, which ranged from 0.8% in La Seiva to 5.3% in Acono. No one worked on this programme in Alta Gracia. As regards CEPEP, the highest level of involvement in this programme (and for all of the programmes) was found in Alta Gracia which amounted to a still minuscule 12.2% ; followed by 2.3% in Maracas/St. Joseph, 1.1% in Acono 2% and 0% in both La Baja and La Seiva. For this part of the country therefore, participation in these programmes is very negligible.

Table 61. Employment in Government Work Programme, by Community (%)

Employment	Community				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/ St. Joseph**	**La Seiva**
URP	5.3	0.0	4.0	2.3	0.8
CEPEP	1.1	**12.2**	0.0	2.3	0.0
On Job Placement (OJP)	0.0	0.0	0.8	0.0	0.8
CCC	0.0	0.0	0.8	0.0	0.0
HYPE	0.0	0.0	0.0	0.0	0.8
YAPA	0.0	0.0	0.0	0.0	0.0
Reforestation Programme	0.0	0.0	0.0	2.3	0.0
Other	1.1	0.0	1.6	0.0	0.8
None	**87.4**	**87.8**	**92.8**	**93.1**	**96.6**
Not applicable	5.3	0.0	0.0	0.0	0.0
Total	**95**	**49**	**125**	**305**	**119**

CCC- Civilian Conservation Corp
HYPE-Helping Youth Prepare for Unemployment Programme
YAPA- Youth Apprenticeship Programme in Agriculture

In examining employment, we also sought to ascertain the mode(s) of transport used to get to work (Table 62). In this regard, it was found that the more dominant modes of transport used were ‘taxis’(57.4%) and ‘PH cars’ (55.7%), in that order, followed lower down by ‘regular maxi taxis’ (41%) and ‘private cars/vehicles’ (31.2%). Much smaller minorities either ‘walked’ (12.8%) or used public transport -‘PTSC bus’ (3.7%).

Table 62
Mode(s) of Transportation to Work (%)

Mode	AOS
PTSC Bus	3.7
School Bus/Maxi Taxi	0.3
Regular Maxi Taxi	41.0
Taxi	57.4
Private Car/Vehicles	31.2
PH Car	55.7
Walk	12.8
Other	4.2
Not stated	0.3
Not applicable	6.2
Total	**680**

There are four major means of transportation across the communities (Table 63) which comprise: taxis, 'PH cars', 'private car/vehicle' and 'regular maxi/taxi.' The use of taxis varied from 43.7% in La Seiva to 64% in Maracas/St. Joseph; the use of 'PH cars' ranged from 42.9% in Alta Gracia to 63.5% in Acono; 'private car/vehicles' ranged from 23.4% in Maracas/St. Joseph to 40% in Acono and La Seiva, while use of the 'regular Maxi/Taxi ranged from 17.3% in Acono to 55.1% in Alta Gracia. The use of public transportation (PTSC) was extremely minimal ranging between 1.4% in Acono and 6.3% in La Baja. Transportation to work therefore, and one suspects that this applies generally to other areas of life, depends largely on private rather than on government funded or subsidized provision.

Table 63. Mode(s) of Transportation to Work, by Community (%)

Mode	Community				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/ St. Joseph**	**La Seiva**
PTSC Bus	1.4	2.0	6.3	3.6	3.2
School Bus/Maxi	0.0	0.0	0.8	0.3	0.0
Regular Maxi Taxi	17.3	55.1	35.9	49.0	35.7
Taxi	**63.1**	**63.3**	**49.2**	**64.0**	**43.7**
Private Car/Vehicles	**40.0**	**30.6**	**35.9**	**23.4**	**40.0**
PH Car	**63.5**	**42.9**	**50.0**	**63.0**	**43.7**
Walk	1.4	4.1	19.5	15.5	9.5
Other	6.4	4.1	8.6	1.0	6.3
Not stated	1.3	0.0	0.0	0.3	0.0
Not applicable	28.0	6.1	2.3	5.3	6.3

7. PERSONAL SAFETY AND CRIME

Due to the increasing number of homicides in Trinidad and Tobago over the last 5 years together with the incidence of kidnapping, and the nature of media reporting of these issues, crime has become a burning issue nationally. In this context, the survey sought to probe issues relating to the fear of crime, the incidence of crime, the reporting of crime, police reaction to crime reports and the preventative measures households have used to deal with the problem.

Respondents were first asked to indicate whether they were fearful of crime (Table 64). In this regard, a vast majority or 70.7% answered affirmatively, not too far from the corresponding national figure of 77.9%, confirming the all pervasive nature of the concern with safety and security. However, a minority or 29.3% answered 'no', 7.8% more than the national figure of 21.5%.

Table 64. Fear of Crime (%)

Response	AOS	Nationally (2005)*
Yes	70.7	77.9
No	29.3	21.5
Not stated	---	0.6
Total	**450**	**4,258**

***Source**: Survey of Living Conditions 2005: 124.

Consistent with the general pattern, large majorities expressed a fear of crime which was highest in Acono (82.5%), followed by Maracas/St. Joseph (71.6%), La Baja (70.1%), and La Seiva(69.3%). However, Alta Gracia deviated from this general pattern as only 35.7% expressed a fear of crime while 64.3% did not. Minorities in La Seiva (30.7%), La Baja (29.9%), Maracas/St. Joseph (28.4%), and Acono (17.5%) had no fear of crime (Table 65).

Table 65 . Fear of Crime, by Community (%)

Response	Community				
	Acono	Alta Gracia	La Baja	Maracas/St.J	La Seiva

Yes	82.5	35.7	70.1	71.6	69.3
No	17.5	64.3	29.9	28.4	30.7
Total	**57**	**28**	**67**	**176**	**75**

Having established the extent of the fear of crime, respondents were further asked to indicate which crime(s) they feared the most (Table 66). In doing so, crime was divided into two broad categories, crimes against the person and property crimes. Although variations exist from crime to crime, for every single category of crime whether against the person or property, the level of fear in the Valley was far greater than corresponding levels nationally, which paled in comparison The crimes feared the most were in descending order: murder (81.2% vs. 43.5% nationally), robbery (74% vs. 7.7% nationally), assault and battery (61.3% vs 2.6% nationally), rape (60.1% vs 5.2% nationally), burglary (59.2% vs 2.5% nationally), kidnapping (58.3% vs. 13.8% nationally), larceny/theft (50.3% vs.0.9% nationally), abduction (47% vs. 0.4% nationally), arson (35.2% vs. 0.3%), praedial larceny (28.6% vs. 0.1% nationally) and domestic violence (13% vs. 0.1% nationally) which was the least feared crime. In short, while the fear of crime varied between 0.1% and 43.5% nationally, it was between 28.6% and 81.2% in the Valley. It is difficult from this survey to explain the possible reasons for the much higher levels of 'crime fear' in the Valley. However, one major consideration may have nothing to do with the Valley per se but the different time periods in which the national data and the Valley data were collected. In this regard, the national data used here were derived from the Survey of Living Conditions (SLC) which was conducted in 2005 when level of homicides were not as high as during the last four years up to the time that the survey in the Valley was conducted in June-July 2009. However, this possible reasoning is problematic at best for it must bear in mind that the level of reported fear of crime nationally in 2005 (77.9%) was still marginally higher than the reported figure for the Valley in 2009 (70.7%) although crime would have been comparatively lower back in 2005.

Table 66. Crime Feared Most(%)

Crime	AOS	Nationally (2005)*
Murder	81.2	43.5
Manslaughter	---	0.1
Assault and Battery	61.3	2.6

Rape	60.1	5.2
Kidnapping	58.3	13.8
Abduction	47.0	0.4
Domestic Violence	11.0	0.1
Robbery	74.0	7.7
Larceny/Theft	50.3	0.9
Arson	35.2	0.3
Burglary	59.2	2.5
Praedial Larceny	28.6	0.1
Other	1.3	0.2
Not stated	0.6	22.6
Total	**319**	**4, 258**

***Source**: Survey of Living Conditions 2005: 126.

There were intra and inter community variations in crimes that were most feared the figures for which were more and less than corresponding figures for the AOS and the country (Table 67). In La Baja, murder was feared the most by 91.7% of households, but this declined to 87.2% in Acono, 79.5% in Maracas/St. Joseph, 78.8% in La Seiva and 40% in Alta Gracia where the fear of murder was the lowest. The fear of assault and battery ranged from 40% in Alta Gracia to 84.8% in Acono; fear of rape ranged from 53.8% in La Seiva to 75% in La Baja; kidnapping, from 48.1% in La Seiva to 77.1% in La Baja; fear of robbery was almost evenly distributed as it ranged from 70% in Alta Gracia to 78.8% in La Seiva. The crime that was consistently feared the least across all communities was domestic violence as it ranged from 0% in Alta Gracia to 14.6% in La Baja.

In which community or communities could we possibly say that the fear of crime in general was the highest or lowest? In order to determine this, the author counted the number of times a particular crime was feared by a majority in each community out of the 11 identifiable crimes reported in Table 66. Based on this rough measure, it was found that the fear of crime was lowest in Alta Gracia and La Seiva where there were only 4 instances in which a particular crime was feared by a majority in those communities; conversely the fear of crime was highest in La Baja (10 majority instances out of a possible 11) while for Acono and Maracas/St. Joseph the fear of crime could be considered moderate as there were only 7 and 6 reported majority instances respectively, of a crime being feared the most out of a possible 11.

Table 67. Crime Feared Most, by Community(%)

Crime	Community				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Murder	**87.2**	40.0	**91.7**	79.5	78.8
Assault and Battery	**84.8**	40.0	**83.3**	53.5	48.1
Rape	60.9	70.0	75.0	57.5	53.8
Kidnapping	63.8	60.0	77.1	55.1	48.1
Abduction	50.0	40.0	57.4	46.5	42.3
Domestic Violence	11.1	0.0	14.6	13.4	7.7
Robbery	**76.6**	**70.0**	**77.1**	**71.7**	**78.8**
Larceny/theft	**69.6**	**50.0**	**70.8**	43.3	36.5
Arson	28.3	10.0	**58.3**	33.9	26.9
Burglary	**70.2**	40.0	**62.5**	**52.0**	**71.2**
Praedial Larceny	45.7	0.0	**50.0**	23.6	13.5
Other	0.0	10.0	2.1	0.8	1.9
Not stated	0.0	0.0	0.0	1.6	0.0
Total	**45**	**10**	**48**	**127**	**52**

However, although the fear of crime remains high both in the Valley and nationally, the vast majority of persons never experienced any crime: which amounted to 85.9% in the former and 91.2% in the latter (Table 68). As a corollary, in spite of the high fear of crime, the actual number of persons who are known to have actually experienced crime is extremely small varying between 0.2% and 5.9% in the Valley and 0% and 3.6% nationally. One can still identify however three main crimes in both, although their occurrence in the Valley was fractionally greater: robbery (5.9% in Valley vs. 3.6% nationally); assault and battery (3.2% in Valley vs. 1.1% nationally); burglary (3.2% in Valley vs 1.7% nationally). The fear of crime therefore remains much higher than the incidence of crime itself.

Table 68. Victim of Crime Over Last 12 months (%)

Crime	AOS	Nationally (2005)*
Murder	0.7(3)	**.**2
Manslaughter	0.2	.0
Assault and Battery	**3.2**	**1.1**
Rape	0.7	.3
Kidnapping	0.2	.1

Abduction	0.2	.1
Domestic Violence	Nil	.3(14)
Robbery	**5.9**	**3.6**
Larceny/theft	1.8	2.0
Arson	0.9	---
Burglary	**3.2**	**1.7**
Praedial Larceny	1.1	.5
Other	0.5	.2
None	**85.9**	**91.2**
Total	**100.0 (448)**	**100.0 (4,231)**

***Source**: Survey of Living Conditions 2005: 127.

However, consistent with the same pattern for the AOS and nation, although varying majorities expressed a fear of certain crimes across all communities, at the same time, large varying majorities have never experienced any crime (Table 69): this figure was 93.3% in La Seiva, 92.9% in Alta Gracia, 91% in La Baja, 84.1% in Maracas/St. Joseph and 73.7% in Acono. The findings reinforce the need to distinguish between the actual incidence or experience of crime and the media influenced fear of same.

Table 69. Victim of Crime over Last 12 Months, by Community(%)

Crime	Community				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Murder	0.0	0.0	0.0	1.1	0.0
Manslaughter	0.0	0.0	0.0	0.0	0.0
Assault and Battery	5.7	3.6	1.5	2.8	0.0
Rape	0.0	3.6	1.5	0.0	0.0
Kidnapping	0.0	0.0	0.0	0.0	0.0
Abduction	0.0	0.0	0.0	0.0	1.3
Domestic Violence	0.0	0.0	0.0	0.0	0.0
Robbery	13.2	0.0	4.5	7.4	1.3
Larceny/theft	5.7	0.0	1.5	0.0	2.7
Arson	1.9	0.0	0.0	1.1	0.0
Burglary	3.8	0.0	1.5	4.0	1.3
Praedial Larceny	0.0	0.0	1.5	1.1	0.0
Other	0.0	0.0	3.0	0.0	3.0
None	**73.7**	**92.9**	**91.0**	**84.1**	**93.3**
Total	**57**	**28**	**67**	**176**	**75**

Of the minority of households which had some experience with crime, 69.4% made a report to the policy while 30.6% did not which were the same figures nationally (Table 70). And, of those who did report the crime, 34% indicated that action was taken by the police, 13.9% less than the national figure of 47.9%, while 66% reported that no action was taken, 8.3% more than the national figure of 51.7% (Table 71). In both situations, the high level of police non-response is a cause for concern and itself requires further investigation.

Table 70. Reporting Crime to Police (%)

Response	AOS	Nationally (2005)
Yes	69.4	69.4
No	30.6	30.6
Total	**62**	**402**

***Source**: Survey of Living Conditions 2005: 128.

Table 71. Police Reaction to Crime Report (%)

Response	AOS	Nationally (2005)*

Action taken	34.0	47.9
No action taken	66.0	51.7
Not stated	---	0.4
Total	**100.0 (47)**	**100.0 (279)**

***Source**: Survey of Living Conditions 2005: 128.

When examined by community, it was found that of the few residents who experienced some form of crime, a varying majority across all communities made a police report (Table 72): Acono stood out in this regard with 80% making a report followed by La Seiva (66.7%) and Alta Gracia (66.7%), Maracas/St. Joseph (63%) and La Baja (60%)

Table 72. Reporting of Crime, by Community(%)

	Community				
Response	**Acono**	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Yes	80.0	66.7	60.0	63.0	66.7
No	20.0	33.3	40.0	37.0	33.3
Total	**15**	**3**	**5**	**27**	**6**

However, while a majority made reports to the police, police reaction was discouraging as large majorities in Acono (83.3%), La Baja (80.0%) and La Seiva (75%) reported no police action being taken, while a bare majority in Alta Gracia (50%) and 47.4% in Maracas/St. Joseph reported similarly (Table 73). There were only two communities in which a majority, albeit slim, reported that police action was taken: Maracas/St. Joseph (52.6%) and Alta Gracia (50%); in La Seiva (25%), La Baja (20%) and Acono (16.7%) small minorities reported similarly.

Table 73. Police Reaction to Crime, by Community (%)

	Community				
Response	**Acono**	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Action Taken	16.7	50.0	20.0	52.6	25.0
No Action Taken	83.3	50.0	80.0	47.4	75.0

Total	**12**	**2**	**5**	**19**	**4**

However, although there is a high fear of crime in both the Valley and nationally, 60.9% and 52.8% of households respectively, had taken no preventative measures to deal with this fear (Table 74). However, of those who did take some measure or measures, the most common or preferred ones in the Valley were burglar proofing (24%) followed by guard dogs (12.5%); while the least preferred were 'Other' (7.9%), neigbour hood crime watch (1.1%), alarm systems (0.9%) and security guards (0.7%). The 'other' category included: 'self imposed curfew', 'fencing home', 'security lights', 'keep doors locked', 'cameras', 'staying indoors', praying, 'electronic gate' and 'sleeping with cutlass under bed.' Nationally, the measures taken followed the same pattern but, except for the 'Other' category, (marginally) more took these measures than those in the Valley as follows: burglar proofing (31.1% vs. 24%), guard dogs (21.8% vs. 12.5%), alarm system (3.8% vs. 0.9%), crime watch (3.8% vs. 1.1%) and security guards (1.2% vs. 0.7%).

Table 74. Crime Prevention Measures (%)

Measure	**AOS**	**Nationally (2005)***
Burglar proofing	24.0	31.1
Alarm system	0.9	3.8
Crime watch	1.1	3.8
Guard dogs	12.5	21.8
Security Guards	0.7	1.2
Other	7.9	5.4
None	**60.9+**	**52.8**
Total	**441**	**4,222**

***Source**: Survey of Living Conditions 2005: 130.
+Numbers wont add up to 100 because question admitted more than one response.

Table 75. Crime Prevention Measures, by Community (%)

Response	**Community**				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Burglar proofing	20.0	17.9	31.3	27.3	14.7
Alarm system	2.0	0.0	1.5	0.6	1.3
Crime watch	0.0	0.0	0.0	0.6	1.3
Guard dogs	4.0	0.0	16.4	18.8	0.0
Security Guards	0.0	0.0	1.5	0.6	0.0
Other	10.0	17.9	1.5	9.7	5.3

None	**75.9**	**64.3**	**59.7**	**50.6**	**78.7**
Total	**50**	**28**	**67**	**176**	**75**

Although many report that they are fearful of crime, majorities across all communities had taken no preventative measures to protect themselves against its occurrence (Table 75): this was highest in La Seiva (78.8%), Acono (75.9%), and Alta Gracia (64.3%) and lowest in La Baja (59.7%) and Maracas/St. Joseph (50.6%). The proportions taking some preventative measure were in the minority and ranged between 0.6% and 31.3%. Of all the identified measures, burglar proofing appeared as the most common across all communities: employed by 31.3% in La Baja, followed by Maracas/St. Joseph(27.3%), Acono(20%), Alta Gracia(17.9%), and La Seiva (14.7%); guard dogs were also used in Maracas/St. Joseph (18.8%), La Baja(16.4%) and Acono (4%).

8. COMMUNITY NEEDS, ORGANIZATION AND RELATIONS

This subsection examines a range of issues related to community development, organization and social relations. These include: perceived needs, the functioning of the Village Council, membership in groups/organizations, sources of group funding, community collaboration, family togetherness, and the level of social trust. However, unlike with the previous sections, there is no data for the country as a whole with which to make comparisons.

It is important to note that the question which asked respondents to identify 'some of the most important needs' in their community was an open ended one meaning that there were no pre-given or *a priori* set of responses on the questionnaire. Bearing this in mind, several needs were identified (Table 76) and, although they represented a minority, the three most numerically significant needs were 'access roads/drainage/pavement/street lights' (31.1%), 'community center/sport facilities' (26.2%) -which included a 'playground and swimming pool'-, and 'security' (22.5%) which is consistent with the high fear of crime in the region . The other needs identified related to programmes for youths (14%), utilities (10.8%), taking care of environment (6.8%), education (4.5%), employment/training (2.7%), health (2.7%), transportation (2.7%), social assistance (1.1%), and housing (0.1%).

Table 76. Community Needs in AOS (%)

Need	Percent
Community Centre/Sport facilities	**26.2**
Education	4.5
Employment/Training	2.7
Environment	6.8
Health	2.7
Housing	0.9
Security	**22.5**
Social Assistance	1.1
Transportation	2.7
Access Roads/Drainage/Pavement	**31.1**
Utilities	10.8
Youths	14.0
Other	4.3
None	2.9
Don't know	3.8

There was no community consensus (intra and inter) on what are the 'important needs' within the AOS, as these varied significantly and received very little majority support (Table 77). There were only two needs, which received some majority support, but in just two communities: these included a 'community centre/sport facilities,' identified by 56.7% in La Baja and 'roads/drainage/pavement', identified by 53.3% in La Seiva. However, the need for 'community center/sport facilities' was identified by small minorities in Maracas/St. Joseph(23.3%), Acono(20%), Alta Gracia (14.3%) and La Seiva (8%), while the need for 'roads/drainage/pavement' was identified by slighter larger minorities in Alta Gracia (39.3%), La Baja (25.4%), Maracas/St. Joseph (22.7%) and Acono (22.6%). The other need that received some significant support was security but although it was identified by 47.2% in Acono, smaller minorities identified it in Maracas/St. Joseph (26.1%), Alta Gracia(21.4%), La Seiva (13.3%) and La Baja (10.4%). Given the high fear of crime in the AOS one might have expected security to be identified as an 'important need' by much more but this may also just mirror the reality that the actual experience with crime among residents is quite negligible thus diminishing it as an 'important need.' It is interesting and perhaps instructive that the following were not identified by more significant numbers as important needs: education, employment/training, environment, health, and housing given their contemporary significance.

Table 77. Needs in AOS, by Community (%)

Need	Community				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Community Centre/Sport facilities	**20.0**	14.3	**56.7**	**23.3**	8.0
Education	0.0	0.0	3.0	7.4	4.0
Employment/Training	0.0	3.7	0.0	4.5	0.0
Environment	1.9	0.0	3.0	5.7	17.3
Health	3.8	0.0	1.5	4.0	0.0
Housing	0.0	0.0	0.0	0.0	0.0
Security	**47.2**	21.4	10.4	**26.1**	13.3
Social Assistance	3.8	0.0	0.0	0.6	1.3
Transportation Access	3.8	3.6	3.0	1.7	2.7
Roads/Drainage/Pavement	**22.6**	**39.3**	**25.4**	**22.7**	**53.3**
Utilities	1.9	17.9	9.0	9.1	**22.7**
Youths	9.6	**28.6**	16.4	16.5	4.0
Other	1.9	0.0	4.5	6.3	4.0
Don't know	13.2	0.0	1.5	2.3	4.0
None	1.9	7.1	1.5	4.5	1.3
Total	**52**	**28**	**67**	**176**	**75**

As it relates to the existence of a Village/Community Council (Table 78), 68.8% stated that there was one for their 'area', while what might be considered a significant minority (31.3%) were either 'not sure' (20.1%) or stated that none existed (11.2%). While the Village Council provides numerous services, they were identified by an extremely small, varying number of respondents and appeared numerically insignificant (Table 79). These services related to: sport (8.3%), education (6.7%), social assistance (5.4%); fund raising/social celebrations (5.1%); employment (4.1%), road repairs (4.1%), environmental protection (1.6%) and housing (0.3%). However, almost one quarter opined that the Council did nothing (24.5%), and 44.1% either did not know (29.2%) or were not sure (15.9%).

Table 78. Existence of Village Council (%)

Response	Percent
Yes	68.7
No	11.2
Not sure	20.1

Total	**100.0 (448)**

Table 79
Services Provided by Village Council (%)

Service	Percent
Education	6.7
Employment	4.1
Environment	1.6
Fund raising/celebrations	5.1
Housing	0.3
Road repairs	4.1
Social Assistance	5.4
Sport	8.3
Other	1.6
None	24.5
Not sure	15.9
Don't know	29.2

Majorities in four communities stated that a Village Council existed for their 'area': La Baja (80.6%), La Seiva(74.7%), Alta Gracia (71.4%) and Maracas/St. Joseph (70.5%) (Table 80). However, only 36.8% in Acono indicated the same while 47.4% were 'not sure.' A small minority across all communities, varying between 7.1% and 15.8%, indicated that there was no village council in 'their area' while 10.4% to 21.4% were not sure. In respect of its provision of services (Table 81), significant majorities in Alta Gracia (90.5%), Maracas/St. Joseph (87.8%), La Baja (85.2%), and La Seiva (53.6%), indicated that the Village Council provided no services. And while only 5.6% responded similarly in Acono, some 57.9% either 'Don't know' (47.4%) or are 'not sure' (10.5%). Just a sprinkling of small minorities ranging between 0.8% and 15.8% indicated that some service was provided.

Table 80. Existence of Village Council, by Community(%)

	Community				
Response	**Acono**	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Yes	36.8	71.4	80.6	70.5	74.7
No	15.8	7.1	9.0	14.2	9.3
Not sure	47.4	21.4	10.4	15.3	16.0
Total	**57**	**28**	**67**	**176**	**75**

Table 81. Services Provided by Village Council, by Community(%)

	Community				
Service	**Acono**	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Education	0.0	0.0	3.6	9.2	10.7
Employment	11.1	0.0	3.7	3.8	7.1
Environment	0.0	0.0	1.9	2.3	1.8
Fund raising/celebrations	5.6	0.0	13.0	4.6	1.8
Housing	5.6	0.0	0.0	0.0	0.0
Road repairs	15.8	0.0	0.0	5.3	1.8
Social Assistance	11.1	0.0	3.7	6.9	1.8
Sport	0.0	9.5	3.7	13.0	3.6
Other	11.1	0.0	0.0	0.8	1.8
None	**5.6**	**90.5**	**85.2**	**87.8**	**53.6**
Not sure	10.5	0.0	29.6	16.8	5.4
Don't know	**47.4**	4.8	29.6	32.8	21.4
Total	**19**	**21**	**54**	**131**	**55**

As it relates to the actual functioning of the Village Council, a majority or 54.7% were dissatisfied with its performance, only 24.2% were satisfied while around 21% were 'not sure' or 'did not know' what to say (Table 82).

Table 82. Functioning of Village Council (%)

Response	Percent
Very satisfied	3.0
Satisfied	21.2
Dissatisfied	40.1
Very dissatisfied	14.6
Not sure	8.6
Don't know	12.6
Total	**100.0 (302)**

Dissatisfaction with the Village Council is widespread but varies from community to community (Table 83). Alta Gracia had the highest level of dissatisfaction with 80.9% followed by La Baja (60.5%); Maracas/St. Joseph (53%) and La Seiva (51%). In Acono, while just 10% were dissatisfied, some 55% were either 'not sure' (15%) or 'did not know' (40%). Minorities in Acono (35%); La Seiva (30.9%); Maracas/St. Joseph (22.7%); La Baja (21.0) and Alta Gracia (19.1%) expressed satisfaction with the operations of the Village Council.

Table 83. Functioning of Village Council, by Community(%)

	Community				
Response	**Acono**	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Very satisfied	5.0	4.8	4.7	1.5	1.8
Satisfied	30.0	14.3	16.3	21.5	29.1
Dissatisfied	10.0	33.3	41.9	39.2	45.5
Very dissatisfied	0.0	47.6	18.6	13.8	5.5
Not sure	15.0	0.0	11.6	6.2	12.7
Don't know	40.0	0.0	7.0	17.7	5.5
Total	**20**	**21**	**43**	**130**	**55**

The level of involvement in civic or community groups was not very encouraging as only 15% were members of a community group or organization, while 80.6% were not and 4.4% were no longer members (Table 84). The existing groups or organizations carried out a range of activities that included in descending order (Table 85): charitable work (38.3%), sport (16.4%), environmental protection (13.3%), education (10%), cultural activities (8.3%) and housing assistance (3.3%).

Table 84
Membership of Community Group/Organization(%)

Response	**Percent**
Yes	15.0
No	80.6
Not anymore	4.4
Total	**100.0 (434)**

Table 85. Activities of Group/Organization (%)

Activity	**Percent**
Sport	16.4
Charitable (help needy)	38.3
Culture (‘best village’)	8.3
Education (homework centre)	10.0
Environment (clean up campaign; oppose quarrying)	13.3
Housing Assistance	3.3
Other (bringing youths together)	19.0

Consistent with the general finding for the AOS, large majorities in Acono (93%), La Seiva (90.4%), La Baja (76.7%), and Maracas/St. Joseph (74.7%) did not belong to any community group but in the case of Alta Gracia, the figure was 100% (Table 86). Those belonging to groups amounted to 20.8% in La Baja, 19% in Maracas/St. Joseph, 9.4% in La Seiva and 7% in Acono. The level of civic involvement in the AOS therefore remains very negligible.

Table 86. Membership of Community Group/Organization, by Community(%)

	Community				
Response	**Acono**	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Yes	7.0	0.0	20.8	19.0	9.4
No	**93.0**	**100.0**	**76.7**	**74.7**	**90.4**
Not anymore	0.0	0.0	5.0	6.3	2.7
Total	**57**	**26**	**60**	**174**	**73**

The extent of group activities across the various communities was understandably very patchy or negligible given the low level of group membership in the AOS . Those activities that assumed some statistical prominence, related to 'charitable activities' identified by 55.6% in La Baja and 40.6% in Maracas/St. Joseph and 'education,' identified by 60% in La Seiva. We note that 50% identified 'culture' as well as the 'environment' in Acono but we also note that the actual number is just 1 (Table 87).

Table 87. Activities of Group/Organization, by Community(%)

Response	Community			
	Acono	**La Baja**	**Maracas/ St. Joseph**	**La Seiva**
Sport	33.3 (1)	22.2(2)	15.6 (5)	20.0 (1)
Charitable (help needy)	0.0 (1)	**55.6 (5)**	**40.6 (13)**	0.0 (0)
Culture ('best village')	**50.0** (1)	22.2(2)	3.1 (1)	0.0(0)
Education (homework centre)	0.0 (0)	11.1(1)	3.1 (1)	**60.0(3)**
Environment (clean up campaign; oppose quarrying)	**50.0** (1)	11.1 (1)	12.5(4)	0.0(0
Housing Assistance	0.0	0.0	3.1(1)	50.0(1)
Other (bringing youths together)	0.0(0)	0.0(0)	29.0(9)	25.0(1)

In terms of funding for their activities, a large majority or 90.3% raised their own funds, but private (19.4%) and government grants (11.3%) also represented a small proportion of funding sources (Table 88).

Table 88 . Source(s) of Funds (%)

Source	Percent
Raise own funds	90.3
Private grants	19.4
Government grants	11.3
Other	14.5

When broken down by community, consistent with the general pattern, group activities are largely self financed: this was noted by 100% in both Acono and La Seiva followed by 87.9% in Maracas/St. Joseph and 77.8% in La Baja (Table 89). Small minorities also used other sources of funding: private grants were identified by 33.3% in La Baja, 20% in La Seiva and 18.2% in Maracas/St. Joseph; government grants were identified by 40% in La Seiva and 9.1% in Maracas/St. Joseph. Funding from the State and private sector therefore contributes very little to the activities of community groups in the AOS.

Table 89. Funding of Group/Organization by Community(%)*

Response	Community			
	Acono	**La Baja**	**Maracas/ St. Joseph**	**La Seiva**

Raise own funds	**100.0(3)**	**77.8(7)**	**87.9 (29)**	**100.0(5)**
Private grants	0.0(0)	33.3(3)	18.2(6)	20.0(1)
Government grants	0.0	0.0	9.1(3)	40.0(2)
Other	33.3(1)	11.1(1)	15.2(5)	20.0 (1)

*Numbers will not add up to 100% because question allowed for multiple responses from respondent.

The extremely low membership in community groups is also reflected in a very low level of interaction or collaboration among communities in the Valley (Table 90). In this regard, only 20.8% indicated that their community collaborated or worked together, a near one third (29.5%) stated 'no', while a near majority or 49.7% did not know which does not say much for community involvement or spirit.

Table 90. Community Collaboration (%)

Response	**Percent**
Yes	20.8
No	29.5
Don't know	49.7
Total	**100.0 (447)**

Not surprisingly, inter-community collaboration in the AOS appears very negligible: 34.7% reported collaboration in Maracas/St. Joseph, 10.4% in La Baja, 5.4% in La Seiva, 5.3% in Acono and 0.0% in Alta Gracia (Table 91). Those reporting 'no collaboration' was greatest in Alta Gracia with 71.4% and La Seiva with 51.4% followed by Maracas St. Joseph (23.9%), La Baja (22.4%), and Acono (19.3%). We note however that the proportion of those who 'don't know' whether there is collaboration is relatively high in Acono (75.4%), La Baja (67.2%), La Seiva(43.2%), Maracas/St. Joseph(41.5%) and relatively low in Alta Gracia (28.6%).

Table 91. Community Collaboration, by Community (%)

	Community				
Response	**Acono**	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Yes	5.3	0.0	**10.4**	**34.7**	**5.4**
No	19.3	71.4	22.4	23.9	51.4

Don't know	75.4	28.6	67.2	41.5	43.2
Total	**57**	**28**	**67**	**176**	**74**

And of those few communities that collaborated or worked together, those with whom there was most collaboration were identified in descending order as Acono (47.3%), 'El Luengo' (37.4%), La Seiva (33%) and 'All in Valley' (14.3%) (Table 92). Those with whom there was least collaboration were **Maracas Central** (6.6%), **El Chorro (5.5%), Guaratta (**5.5%), Wharf Trace (2.2%), Alta Gracia (2.2%), La Rue Pomme (2.2%), Popper Village (2.2%), Santa Barbera (1.1%), and Uana (1.1%).

Table 92
Communities Involved in Collaboration (%)

Community	Percent
El Luengo	37.4
La Seiva	33.0
Wharf Trace	2.2
La Mango	4.4
Acono	47.3
All in Valley	14.3
Maracas Central	6.6
Alta Gracia	2.2
La Rue Pomme	2.2
El Chorro	5.5
Guaratta	5.5
Popper Village	2.2
Santa Barbera	1.1
Uana	1.1
Other	2.2
Don't know	2.2

Communities collaborate or interact through several activities but the most dominant activity was sport which was identified by 77% (Table 93). The other activities however paled in significance and included culture (6.9%), environment (5.7%), religious (4.6%), charity (4.6%), education (3.4%), and fund raising (3.4%)

Table 93. Forms of Collaboration (%)

Activity	Percent
Sport	77.0
Culture	6.9
Education	3.4
Fund raising	3.4
Religious	4.6
Environment	5.7
Charity	4.6
Other	3.4

Consistent with the general finding for the AOS, the most popular source or medium of collaboration was sport, identified by 100% in Acono, 83.3% in La Baja, 76.3% in Maracas/St. Joseph and 66.7% in La Seiva (Table 94). Both 'culture' and 'the environment' were identified by 50% in Acono as a medium of collaboration but this amounted to just 1 respondent.

Table 94 . Forms of Collaboration, by Community(%)*

	Community			
Response	Acono	La Baja	Maracas/ St. Joseph	La Seiva
Sport	100.0(3)	83.3 (5)	76.3(45)	66.7 (2)
Culture	50.0(1)	0.0 (0)	1.7(1)	0.0 (0)
Education	0.0 (0)	33.3 (2)	1.7(1)	0.0 (0)
Fund raising	0.0 (0)	0.0 (0)	5.1(3)	0.0(0)
Religious	0.0 (0)	16.7 (1)	0.0(0)	33.3(1)
Environment	50.0(1)	0.0(0)	6.8(4)	0.0(0)
Charity	0.0(0)	0.0(0)	6.8(4)	0.0(0)
Other	0.0(0)	0.0(0)	3.4(2)	0.0(0)

*Figures will not add up to 100 because question admitted multiple responses.

A part from probing the activities of community groups/organizations, an attempt was also made to ascertain some of the specific activities in which household members were actually involved particularly in relation to leisure/recreation (Table 95). In descending order these activities included going to the beach/river (69.4%), sport (40.3%), cinema (30.9%), hiking (18.6%), and 'liming (hanging) on the block' (11.9%) which was the least preferred activity.

Table 95. Leisure Activities (%)

Activity	Percent
Beach/river	69.4
Cinema	30.9
Hiking	18.6
Lime on block	11.9
Sport	40.3
None	17.7
Other	13.2

Involvement in leisure activities was generally low and varied within and across communities. The most popular leisure activity across all communities was going to 'beach/river', as varying majorities took part in this activity which was highest in La Baja (74.6%) and Maracas/St. Joseph (72.7%) followed by Acono (64.9%)/La Seiva (64.9%), and Alta Gracia (50%) (Table 96). The only other leisure activity in which a majority took part was sport but this was only in Maracas/St. Joseph where 54% took part, compared to 38.8% in La Baja, 31.6% in Acono, 17.9% in Alta Gracia and 17.6% in La Seiva. For all the other activities and communities, participation in leisure was undertaken by a varying minority. For 'going to cinema' this varied from 7.1% in Alta Gracia to 41.8% in La Baja; hiking, 4.1% in La Seiva to 29% in Maracas/St. Joseph; 'liming on block,' 1.4% in La Seiva to 20.5% in Maracas/St. Joseph.

Table 96. Leisure Activities, by Community (%)

Response	Community				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Beach/river	64.9	50.0	74.6	72.7	64.9
Cinema	40.4	7.1	41.8	33.5	14.9
Hiking	12.3	7.1	16.4	29.0	4.1
Lime on block	5.3	7.1	9.0	**20.5**	1.4
Sport	31.6	17.9	38.8	**54.0**	17.6
None	29.8	25.0	17.9	15.9	13.5
Other	1.8	21.4	3.0	6.8	45.9
Total	**57**	**28**	**67**	**176**	**74**

However, in spite of the low levels of group membership, community participation and interaction, there was still a relatively significant level of trust, as 56.8% felt that 'social trust' was high in their community, while 32.5% felt it was low, and 10.7% felt it did not exist (4.7%) or were unable to say (6%) (Table 97).

Table 97. Level of Social Trust(%)

Response	Percent
Very High	13.0
High	43.8
Low	26.2
Very Low	6.3
None exists	4.7
Cant say	6.0
Total	**100.0 (447)**

The level of trust also varied by community (Table 98). It was highest in La Seiva with 68.9% followed by Maracas/St. Joseph (62.8%), La Baja (62.7%), Alta Gracia (46.4%), and Acono (21.1%). However a large majority or 68.4% in Acono stated that social trust was low, followed by Alta Gracia with 50% and minorities in Maracas/St. Joseph (24.6%), La Baja (22.4%) and La Seiva (8.2%).

Table 98. Level of Social Trust, by Community (%)

Response	Community				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**

Very High	1.8	0.0	23.9	17.7	5.4
High	19.3	46.4	38.8	45.1	63.5
Low	56.1	39.3	19.4	18.3	20.3
Very Low	12.3	10.7	3.0	6.3	6.8
None exists	7.0	0.0	4.5	6.3	1.4
Cant say	3.5	3.6	10.4	6.3	2.7
Total	**57**	**28**	**67**	**176**	**74**

As a further check on the nature of social relations within the Valley, respondents were asked to indicate whether they had done a favour for their neighbor recently (within 'last six months'). In this regard, while some 64.9% had done some favour, one third or 35.1% either had done none (26.1%), or were unable to recall (9%) (Table 99). In addition, the favours that were done did not appear numerically significant as they were identified by very small and varying minorities of respondents. These favours included in descending order: 'giving/sharing' (30.2%), 'housing repairs' (22.4%), 'watching property' while away (10.8%), 'watching kids' (6.8%), 'visiting/helping sick' (6.4%), doing errands (6.4%), 'transportation' (6.1%), 'Other' (5.1%), lending money (3.4%), and education (2.0%). The category of 'Other' included 'feeding dogs', 'car repairs', providing 'parking for vehicle', 'doing hair' and 'preventing house from catching afire'.

Table 99
Favors For Neighbour in Last Six Months(%)

Favor	Percent
Give/share	30.2
Housing repairs	22.4
Watch property	10.8
Watch kids	6.8
Visit/help sick	6.4
Transportation	6.1
Loan money	3.4
Education	2.0
Errand	6.4
Other	5.1
None	26.1
Cant recall	9.0

While the level of social trust was relatively fair at best, this was not reflected in the extent to which neighbours did favours for each other across communities (Table 100). In fact, a majority or 54.5% reported doing no favours in Acono, although minorities reported doing the same in La Baja (28.4%), Maracas/St. Joseph (24.6%), La Seiva (18.9%) and Alta Gracia (10.7%). And of the many favours reported, they were carried out by small minorities varying between 1.1% and 32.1%. One can possibly suggest two favors which assumed some small measure of statistical prominence: giving/sharing which was reported by 32.1% in Alta Gracia, 28.4% in La Seiva and 20% in Maracas/St. Joseph; and 'housing repairs' which was reported by 28.6% in Alta Gracia. These findings, together with the low level of community group membership, do not present a picture of a community characterized by a high level of communal solidarity and neighbourliness.

Table 100. Favors for Neighbours, by Community (%)

Response	Community				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Give/share	7.5	**32.1**	10.4	**20.0**	**28.4**
Housing repairs	5.5	**28.6**	10.4	**15.4**	14.9
Watch property	11.1	3.6	16.4	6.3	2.7
Watch kids	5.7	3.6	7.6	2.3	2.7
Visit/help sick	7.5	3.6	1.5	2.9	9.5
Transportation	0.0	7.1	4.5	2.9	8.1
Loan money	3.8	3.6	0.0	2.9	1.4
Education	3.8	3.6	0.0	1.1	1.4
Errand	1.9	3.6	3.0	8.0	0.0
Other	1.9	0.0	7.5	2.9	2.7
None	**54.5**	**10.7**	**28.4**	**24.6**	**18.9**
Can’t recall	1.9	3.6	10.4	11.4	9.5

9. ENVIRONMENT AND HEALTH

The principal aim of this section is to examine some of the major environmental and environmental related problems such as health complaints and garbage disposal which possibly exist in the Valley. In this regard, the major questions here were based on a closed or pre-given set of possible responses (see Questionnaire-Appendix I).

The most frequently cited environmental problems seen to be confronting the Valley in descending order were (Table 101): flooding (36.3%), landslides (27.7%), destruction of forest (27.6%), water pollution (24.4%), quarrying (21.3%), air pollution (21.4%), uncontrolled housing construction (17%), fire hazards (13.1%), 'Other' (12.9%), squatting (6.6%), and sewerage (5%). The category of 'Other' included the following; poor drainage, noise from trucks, bad access roads/dumping, loud music, river erosion, uncontrolled burning, rat infestation, improper garbage disposal, mosquitoes, 'slash and burn' and stray dogs. For 16.1% however, there were no environmental problems in the Valley.

Table 101
Environmental Problems in AOS (%)

Problem	Percent
Flooding	36.3
Forest Destruction	27.6
Fire Hazards	13.1
Air pollution	21.4
Water pollution	24.4
Landslides	27.7
Uncontrolled housing	17.0
Squatting	6.6
Quarrying	21.3
Sewerage	5.0
Other	12.9
None	16.1

There was variation both within and across communities in what was identified as 'major environmental problems' and only five such problems were identified by majorities but only in three communities, Acono, Alta Gracia, and La Seiva (Table 102). Flooding and landslides were identified by 60.7% in Alta Gracia, air pollution and quarrying by 68.5% and 63.6%, respectively, in Acono and water pollution by 51.4% in La Seiva. The

environmental problems that did not receive majority support in any community included: forest destruction, fire hazards, uncontrolled housing, squatting and sewerage. To highlight further the striking nature of these divergences, we can probe further some of the responses to this question. For instance, while flooding was identified by 60.7% as a problem in Alta Gracia, it was so classified by 42.9% in Maracas/St. Joseph and 7.5% in Acono. Although air pollution was identified by 68.5% as a problem in Acono, the figures ranged between 7.1% and 17.7% in the other communities; and while uncontrolled housing was identified by 48.6% in La Seiva as a problem, the figures varied between 0% and 16.4% in the others. What these sharp divergences strongly suggest therefore is that there is no clear consensus on the nature of the environmental problems that may exist in the AOS as this seems to be related to where you live and presumably, to who is doing the defining.

Table 102. Environmental Problems, by Community(%)

Problem	Community				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Flooding	7.5	**60.7**	34.3	42.9	31.1
Forest Destruction	11.5	21.4	34.3	23.4	40.5
Fire Hazards	1.9	10.7	31.3	13.7	2.7
Air pollution	**68.5**	7.1	9.0	17.7	9.5
Water pollution	23.1	32.1	11.9	16.6	**51.4**
Landslides	22.2	**60.7**	23.9	22.9	35.1
Uncontrolled housing	0.0	10.7	16.4	9.7	48.6
Squatting	3.8	3.6	4.5	9.7	2.7
Quarrying	**63.6**	21.4	4.5	18.9	13.5
Sewerage	1.9	0.0	10.4	6.3	0.0
Other	18.9	14.3	7.6	14.9	8.1
None	5.8	0.0	20.9	22.4	13.5

9.1 Garbage Disposal and Collection

Although it only gained mention in the 'other' category, the issue of garbage disposal was asked as a separate question all together but with a composite character. This means that several questions were asked on the matter in relation to methods of garbage disposal, particularly of 'heavy forms of garbage' (e.g., fridges, car batteries, and stoves), use of the

special ‘glass disposal/recycling bins’ in the Valley, frequency of garbage collection as well as the level of satisfaction with the garbage collection service.

As regards methods of garbage disposal, more persons in the Valley or 56.1% used nearby ‘dumps/bins’, compared to 18.3% nationally, while less relied on the ‘garbage truck’ (42.5%), unlike the situation nationally where the majority or 78.6% relied on the ‘garbage truck’ (Table 103).

Table 103. Methods of Garbage Disposal (%)

Methods	AOS	Nationally (2005)*
Garbage truck	42.5	78.6
Dump/bin close by	56.1	18.3
Other	1.3	3.1
Not stated	---	0.1
Total	**100.0 (449)**	**100.0 (4,258)**

***Source**: Survey of Living Conditions 2005: 119.

The approach to garbage disposal also varied by community (Table 104**).** Unlike the pattern for the AOS however, a majority of households in Maracas/St. Joseph (55.9%), and La Baja (51.9%) used the garbage truck but minorities in Acono (27.1%), Alta Gracia(20.7%), and La Seiva (18.8%) did the same. Large majorities used dumps/nearby bins in La Seiva (80%), Alta Gracia (75.9%) and Acono (71.2%) much more than the figures for the AOS(56.1%) and the country (18.3%). However, less than a majority used this option in La Baja (46.8%) and Maracas/St. Joseph (43.1%).

Table 104. Methods of Garbage Disposal, by Community (%)

Methods	Community				
	Acono	Alta Gracia	La Baja	Maracas/St.J	La Seiva
Garbage truck	27.1	20.7	51.9	55.9	18.8
Dump/bin close by	71.2	75.9	46.8	43.1	80.0
Other	1.7	3.4	1.3	1.0	1.3
Total	**59**	**29**	**79**	**202**	**80**

As regards the frequency of garbage collection in the AOS, 42.8% noted that garbage was collected on a daily basis in their area which was better than the national situation where it was 13.6% while for 15.4% it was collected 'every other day' compared to 65.6% nationally (Table 105). In the AOS, one third or 35.2% cited some other time in which garbage was collected and these times were 2 times, 3 times and 5 times per week. The 'other' category amounted to 11.6% nationally but what constitutes it is not known. Two point seven percent (2.7%) in the Valley also had garbage collected on a weekly basis compared to 5.8% nationally. The data suggest therefore that garbage is collected more frequently in the AOS than nationally.

Table 105. Frequency of Garbage Collection (%)

Times	**AOS**	**Nationally (2005)***
Daily	42.8	13.6
Every other day	15.4	65.6
Weekly	2.7	5.8
Other	35.2	11.6
Don't know	4.0	2.6
Not stated	0.8	0.8
Total	**100.0 (449)**	**100.0 (4,258)**

***Source**: Survey of Living Conditions 2005: 120.

In relation to the specific communities, the frequency of garbage collection in Acono seems to be extremely good as 93.2% of households reported that garbage was collected on a daily basis, which was exceedingly better than similar figures for the AOS (42.8%) and the country (13.6%) (Table 106). However, the opposite was the case in Maracas/St. Joseph (39.6%), La Seiva (36.3%, and La Baja (35.4%) where minorities reported daily garbage collection; while this was much better than the national figure, it was still less than the figure for the AOS itself. Small, varying minorities reported garbage collection everyday which was led by Maracas/St. Joseph (39.6%), La Seiva (36.3%), and La Baja (35.4%). However, for majorities in Alta Gracia (93.1%) and La Seiva (53.8%) as well as minorities in La Baja (34.2%) and Maracas/St. Joseph (30.2%), garbage was collected at other varying periods which included 2, 3, and 5 times per week.

Table 106 . Frequency of Garbage Collection, by Community(%)

	Community

Frequency	Acono	Alta Gracia	La Baja	Maracas/St.J	La Seiva
Daily	93.2	0.0	35.4	39.6	36.3
Every other day	5.1	6.9	19.0	21.8	6.3
Weekly	1.7	0.0	0.0	5.4	0.0
Other	0.0	93.1	34.2	30.2	53.8
Don't know	0.0	0.0	11.4	3.0	3.8
Not stated					
Total	**59**	**29**	**79**	**202**	**80**

As regards the efficiency of the garbage disposal service, a vast majority or 78.8% rated it as good (51.1%) or very good (27.7%) while a small minority of 16.3% rated it as 'poor' (14.1%) or 'very poor' (2.2%) (Table 107). There was no corresponding national data on this question.

Table 107
Rating of Garbage Disposal Service (%)

Rating	Percent
Very Good	27.7
Good	51.1
Cant say	4.7
Poor	14.1
Very Poor	2.2
Don't know	0.2
Total	**100.0 (448)**

However, while it is variable, the generally frequent nature of the garbage collection service, could account for the fact that significant and varying majorities rated the servicer as good/very good in Maracas/St. Joseph (85.7%), Acono (84.8%), La Baja (75.7%), La Seiva (67.6%), and Alta Gracia (58.7%), where it received the lowest positive rating (Table 108). Not surprisingly, Alta Gracia showed the highest level of dissatisfaction with the garbage disposal service as 41.4% rated it as poor/very poor, followed by La Seiva (26.3%), La Baja (19.2%), Acono (10.2%) and Maracas St. Joseph (9.4%).

Table 108. Rating of Garbage Collection Service, by Community(%)

Rating	Community				
	Acono	Alta Gracia	La Baja	Maracas/St.J	La Seiva
Very Good	35.6	17.2	29.5	32.7	11.3

Good	49.2	41.4	46.2	53.0	56.3
Cant say	5.1	0.0	5.1	4.5	6.3
Poor	10.2	41.4	14.1	7.9	22.5
Very Poor	0.0	0.0	5.1	1.5	3.8
Don't know	0.0	0.0	0.0	0.5	0.0
Total	**59**	**29**	**79**	**202**	**80**

In relation to the special glass disposal/recycling bins in the Valley, only 3.5% indicated using them, 1.3% of which was 'sometimes'; 42.1% did not use them while a majority of 54.3% do not know about them (Table 109). The latter finding suggest the need for a greater public awareness campaign in relation to this facility.

Table 109
Use of Glass Disposal/Recycling Bins (%)

Response	Percent
Yes	2.2
No	42.1
Sometimes	1.3
Don't know	54.3
Total	**100.0 (449)**

Consistent with the general finding for the AOS, large majorities in Alta Gracia (96.6%), Acono (79.7%) and La Seiva (71.3%) did not use this facility while small minorities in Maracas/St. Joseph (21.8%), and La Baja(16.5%) did (Table 110). It was only in Acono and Maracas/St. Joseph that there was any reported use of this facility but this amounted to just 11.9% and 1.5% in each community, respectively. The non-usage of this facility in some communities could be linked to the fact that not many know about it: in La Baja this figure amounted to 83.5%, Maracas/St. Joseph, 74.3%, and in La Seiva, 28.8%. Increased usage of this facility would require greater promotion and public education of its existence and function.

Table 110. Use of Glass Disposal/Recycling Bins, by Community(%)

	Community				
Response	**Acono**	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Yes	11.9	0.0	0.0	1.5	0.0
No	79.7	96.6	16.5	21.8	71.3
Sometimes	1.7	0.0	0.0	2.5	0.0
Don't know	6.8	3.4	83.5	74.3	28.8
Total	**59**	**29**	**79**	**202**	**80**

To dispose of heavy forms of garbage (e.g., fridges, batteries, stoves), the vast majority or 86.6%

rely on the County Council, 2.9% make use of the Beetham landfill [near Port of Spain], while 10.5% use 'other' means which include a mixture of 'private pick up'; placing them at the side of road for the taking, and burning (Table 111).

Table 111
Disposal of Heavy Forms of Garbage (%)*

Methods	Percent
Beetham	2.9
County Council	86.6
Other	10.5
Total	**100.0 (449)**

*Include stuff like fridges, batteries and stoves.

Consistent with the general finding for the AOS, large majorities in all communities disposed of heavy garbage by using the service provided by the County Council: this was highest in La Seiva (98.8%), followed closely by Alta Gracia (96.5%), Acono (94.9%), Maracas/St. Joseph(82.7%) and La Baja (72.2%), which had the lowest usage (Table 112). La Baja also had the largest minority percentage (20.3%) using 'other means' followed by Maracas/St. Joseph(14.4%), Acono (3.4%), Alta Gracia (3.4%) and La Seiva (1.3%).

Table 112. Disposal of Heavy Forms of Garbage, by Community(%)

	Community				
Method	**Acono**	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Beetham	1.7	0.0	7.6	3.0	0.0
County Council	94.9	96.6	72.2	82.7	98.8
Other	3.4	3.4	20.3	14.4	1.3
Total	**59**	**29**	**79**	**202**	**80**

In general, the disposal of garbage in the AOS appears to be quite satisfactory; even better than the country as a whole. Whether this has contributed in any away to the low incidence of possible environment related health problems is not known, but a vast majority or 71.1% reported having no health problems since living in Maracas Valley (Table 113). And of those experiencing health problems, 15.5% had asthma, 4.8% skin infections, 3.4% bronchitis, 2.5% cancer although the type of cancer was not stated, and 6.2%, 'Other' problems which included such things as 'lung infection due to dust, chest problems, headache, respiratory allergies, migraines, wheezing, stroke, and kidney pain.'

Table 113. Health Problems in AOS(%)

Problem	Percent
Bronchitis	3.4
Skin infection	4.8

Cancer	2.5
Asthma	12.5
Other	6.2
No/none	71.1

Significant majorities across all communities never experienced a health problem while living in the AOS consistent with the general finding (Table 114): this was greatest in La Seiva (78.4%), followed by La Baja (77.3%), Acono(70.9%), Alta Gracia(70.4%) and Maracas/St. Joseph (67.1%). And of the various health problems reported, this only affected small minorities. For bronchitis, this ranged from 1.3% in La Seiva and La Baja to 6.9% in Acono; skin infections, between 3% in Maracas/St. Joseph and 7.4% in Alta Gracia; cancer,1.5% in La Baja to 3.7% in Alta Gracia and for asthma, 4.5% in La Baja to 18.5% in Alta Gracia. Of all the health problems, asthma had the highest figures, with 18.5% in Alta Gracia and 16.5% in Maracas/St. Joseph.

Table 114. Health Problems, by Community(%)

	Community				
Problem	**Acono**	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Bronchitis	6.9	0.0	1.3	4.5	1.3
Skin infection	5.5	7.4	6.1	3.0	5.4
Cancer	3.6	3.7	1.5	1.8	0.0
Asthma	7.3	18.5	4.5	16.5	13.5
Other	5.5	0.0	9.1	7.6	1.4
No/none	70.9	70.4	77.3	67.1	78.4
Total	**55**	**27**	**66**	**170**	**74**

10. POSITIVE DEVELOPMENTS

Apart from examining a host of possible problems or concerns whether in relation to infrastructure, literacy, crime and the environment, respondents were also asked to indicate whether there were any positive developments in the Valley over the last 10 years. On this score, a majority of 63% answered in the affirmative, 35.7% stated no while 1.3% did not know (Table 115).

Table 115
Positive Developments in AOS (%)

Response	Percent
Yes	63.0
No	35.7
Don't know	1.3
Total	**100.0 (446)**

There was no unanimous majority inter-community view that there have been positive developments in the AOS over the last 10 years (Table 116). While varying majorities in Alta Gracia (75%), Maracas/St. Joseph (67.2%), La Baja (65.7%), La Seiva (56.8%), responded in the affirmative, this amounted to 47.5% in Acono. In Acono a majority or 52.6% responded in the negative, followed by minorities in La Seiva(40.5%), La Baja (34.3%), Maracas/St. Joseph (31%), and Alta Gracia(25%). Both across and within the various communities therefore there exists a divergence of view as it relates to positive developments in the AOS over the last 10 years.

Table 116. Positive Developments, by Community(%)

Response	Community				
	Acono	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Yes	47.5	75.0	65.7	67.2	56.8
No	52.6	25.0	34.3	31.0	40.5
Don't know	0.0	0.0	0.0	1.7	2.7
Total	**57**	**28**	**67**	**174**	**74**

Of the positive developments identified however the only one that assumed majority significance was better 'roads/pavements/street lights' as it was identified by 66.7 % (Table 117). The other 'positive developments' were identified by very small minorities which included in descending order, the areas of sport (17.3%), utilities (13.4%), housing (8.8%), environment (6.4%), education/training (1.8%) and employment (1.8%).

Table 117. Positive Developments in AOS(%)

Development	Percent
Better Roads	66.7(190)
Education/training	1.8 (5)
Employment	1.8 (5)
Environment	6.4(18)
Health	0.7 (2)
Housing	8.8 (25)
Security	0.7 (2)
Sport	17.3 (49)
Utilities	13.4 (38)
Other	0.7 (2)

'Better roads' was the sole positive development that was identified by a varying majority across all the communities: the largest majority was found in Alta Gracia (90.9%), followed by Acono (77.7%), La Seiva (75%), La Baja(77.3%), and Maracas/St. Joseph(52.9%) (Table 118).The other positive developments were identified by very small minorities across the AOS and in several cases were identified by no one in some communities. For instance, 'education/training' was identified by 25% in La Baja, but 2.5% in Maracas/ St. Joseph and no one in Acono, Alta Gracia and La Seiva. The other positive developments that were identified by relatively significant small minorities were

sport, identified by 27.7% in Maracas/St. Joseph, utilities, identified by 27.3% in Alta Gracia and 23.3% in La Seiva. When we disaggregate 'positive developments' by community therefore, we find that there were very little numerically significant positive developments in the AOS.

Table 118. Positive Developments, by Community(%)

	Community				
Response	**Acono**	**Alta Gracia**	**La Baja**	**Maracas/St.J**	**La Seiva**
Better Roads	77.7	90.9	77.3	52.9	75.0
Education/training	0.0	0.0	25.0	2.5	0.0
Employment	0.0	0.0	0.0	3.4	0.0
Environment	7.4	0.0	6.8	9.2	2.3
Health	0.0	0.0	0.0	0.8	0.0
Housing	14.8	0.0	6.8	12.6	0.0
Security	0.0	0.0	0.0	1.7	0.0
Sport	0.0	9.1	6.8	27.7	18.6
Utilities	0.0	27.3	15.9	7.6	23.3
Other	3.7	0.0	0.0	0.0	0.0

CONCLUSION

Base on the data generated by the social survey, the developmental conditions and challenges faced by residents of the Valley are at best mixed. While commonalities exist there is also much variation within the AOS in relation to the various social, educational, economic and environmental issues examined in what can be considered a pioneering, baseline survey of the region. Notwithstanding their relatively small size, the communities seem to be characterized more by difference and dissensus rather than commonality and consensus. In such a situation, making generalizations or trying to capture major trends, patterns or tendencies is always problematic. The following observations therefore are made and have to be read within the above empirical parameters.

On the positive front, the AOS can boast of high levels of home ownership, relatively good housing conditions (e.g., electricity, gas, water supply, basic household conveniences (except for La Seiva), although pit latrines remain a concern, no overcrowding of households, good garbage disposal, little or no major health and environmental problems, greater community financial self reliance, no dependence on government employment or work programmes (such as URP, CEPEP etc.), a larger cadre of white collar professionals, little or no crime and a relatively high level of social trust. In addition, there has been no major or significant influx of new persons into the Valley and contrary to a popular perception or concern, there has been actually a decline in housing construction in the area as a whole although there were increases in Alta Gracia, La Baja and Maracas/St. Joseph.

On the negative side however, educational performance is generally dismal and combined with the issues of functional illiteracy, low numbers pursuing further studies, a definite digital divide (low computer ownership and internet access) are a cause for concern. In relation to employment, dependence on the volatile construction sector is prominent which is generally consistent with the predominance of low status occupations among residents. The functioning of the system of local government however which has been going through much talked about reform over the last 5-10 years at least received rather mixed reviews. This is so for while on the one hand there was general satisfaction with garbage collection in the AOS, significant dissatisfaction was expressed towards the functioning of the local

Village Council which does not seem to be meeting the full expectations of residents many of whom do not even know whether one exist in the first place. The Valley also suffers from low police action on reported crime and equally important, a low level of civic engagement measured in terms of low group membership, community participation and interaction, and a limited tendency to do favors which translate into little social solidarity and neighbourliness. In addition, there is no consensus on what can be considered important community needs or positive developments (apart from roads, pavements and the like) within the AOS over the past decade (2000-2009). Surprisingly, issues like deforestation, uncontrolled housing did not receive widespread numerical support. In this regard, it is worth noting that in the three communities which experienced increases in housing construction (Alta Gracia, La Baja and Maracas/St. Joseph), neither 'uncontrolled housing construction' nor 'deforestation' was identified as major environmental concerns (see Table 102). And, of these three communities, it was only in Alta Gracia that any environmental issue, namely 'flooding' and 'land slides,' stood out as major concerns. Relatedly, there was little use or knowledge of special glass disposal/recycling bins to help deal with garbage disposal. What all this suggest is that much more may need to be done to educate and conscientize the residents about the importance of the environment and the environmental perils that face the Valley. Interestingly, the survey found that some of the major problems that confront the Valley relate not to health, crime or the environment but the lack of social solidarity and neighbourliness or in short social capital although the level of social trust appears relatively high.

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Appendix I

Project: Issues of Sustainable Development for Maracas Valley, Trinidad and Tobago

Project component: Change analysis using GIS

Client: Global Environment Facility's Small Grants Programme (GEF/SGP), UNDP, Trinidad and Tobago

Executing agency: Maracas Valley Action Committee (MVAC)

Report of Change Analysis using GIS, Maracas Valley, Trinidad

Submitted by

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May 2010

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1.0 Background

There are many issues of concern in Maracas Valley, northern Trinidad that are seen to be impacting or likely to negatively impact the environment in the area. These have been identified as major housing expansion in recent years on slopes that are prone to erosion; educational institutional expansion, particularly that proposed by the University of Southern Caribbean; present and proposed quarrying activities; low water supply; reduction in forest cover; loss of biodiversity; degradation of water quality; disruption in water supply; increase in noise and dust pollution; increase in traffic congestion; damage to existing road infrastructure; slash and burn farming; soil erosion; and flooding.

In an attempt to obtain a clear assessment of the nature of land use change in the Valley, a change analysis was carried out using Geographic Information Systems (GIS).

2.0 The Terms of Reference for the GIS Analysis

The GIS component of the project was used to:

1. **Map the present status of the land cover of Maracas Valley**

To do this, a review of available datasets received was undertaken to determine their usefulness for the project. New categories to provide a comprehensive database for the project were decided on by the MVAC Committee.

Other features to be added, if possible, from IKONOS imagery provided were:

- Quarries
- Squatter settlements
- Historical sites and attractions
- Tourist attractions
- Landslide occurrence
- Flooded areas
- Building categories – residential, commercial, industrial, educational

Of the features listed above, historical sites and attractions, landslide occurrences, flooded areas, and commercial and industrial buildings were not obtained.

2. **Perform a change analysis of land use**

This entailed the following:

- Performing feature extraction from IKONOS imagery provided
- Deriving slope classes from elevation data provided
- Updating the spatial and attribute database provided
- Assessing:
    1. % addition of new road network
    2. % growth of built-up areas in relation to elevation
    3. % loss of dense forest cover in relation to elevation
    4. % bare ground from the most recent data provided

Of the activities listed above, the % addition of the new road network was calculated from 2005 to 2009; the % growth of built-up areas in relation to elevation was done at elevations between 91 m (300ft) to over 213 m (700ft) in the study area. The % loss of forest cover was calculated between 1970s to 2005. Bare ground calculation was incorporated into the area designated as scrub.

3.0 The study area

The study area, 4038 ha in extent, is located in the Maracas St. Joseph watershed in the Northern Range of Trinidad, and ranges in height from 915 m at Mt El Tucuche to 91 m in the valley floor, with the Maracas River flowing in a southerly direction to join the Caroni River at St. Joseph as shown in Figure 1. The study area is approximately 8.3 km long by 6.25 km wide and covers an area of 4038 ha. The boundary of the study area was delineated using those of the Electoral Districts designated by the Central Statistical Office. The study area contains 29 villages strung along the valley floor from La Mango in the south to El Luengo in the north, all within 91m (300ft) elevation, covering 6.5% of the study area as seen in Figure 2. These villages are served by one road, Maracas Royal Road, 8.5 km long, which is the only entrance and exit into and from the valley.

There are three primary, one secondary and one tertiary educational institutions, the largest of which is the University of the Southern Caribbean. The valley is a popular scenic area that encourages swimming in mountain pools, hiking to the Maracas waterfalls, El Tucuche and to Las Cuevas beach on the north coast. The relief of the study area is shown in Figure 2.

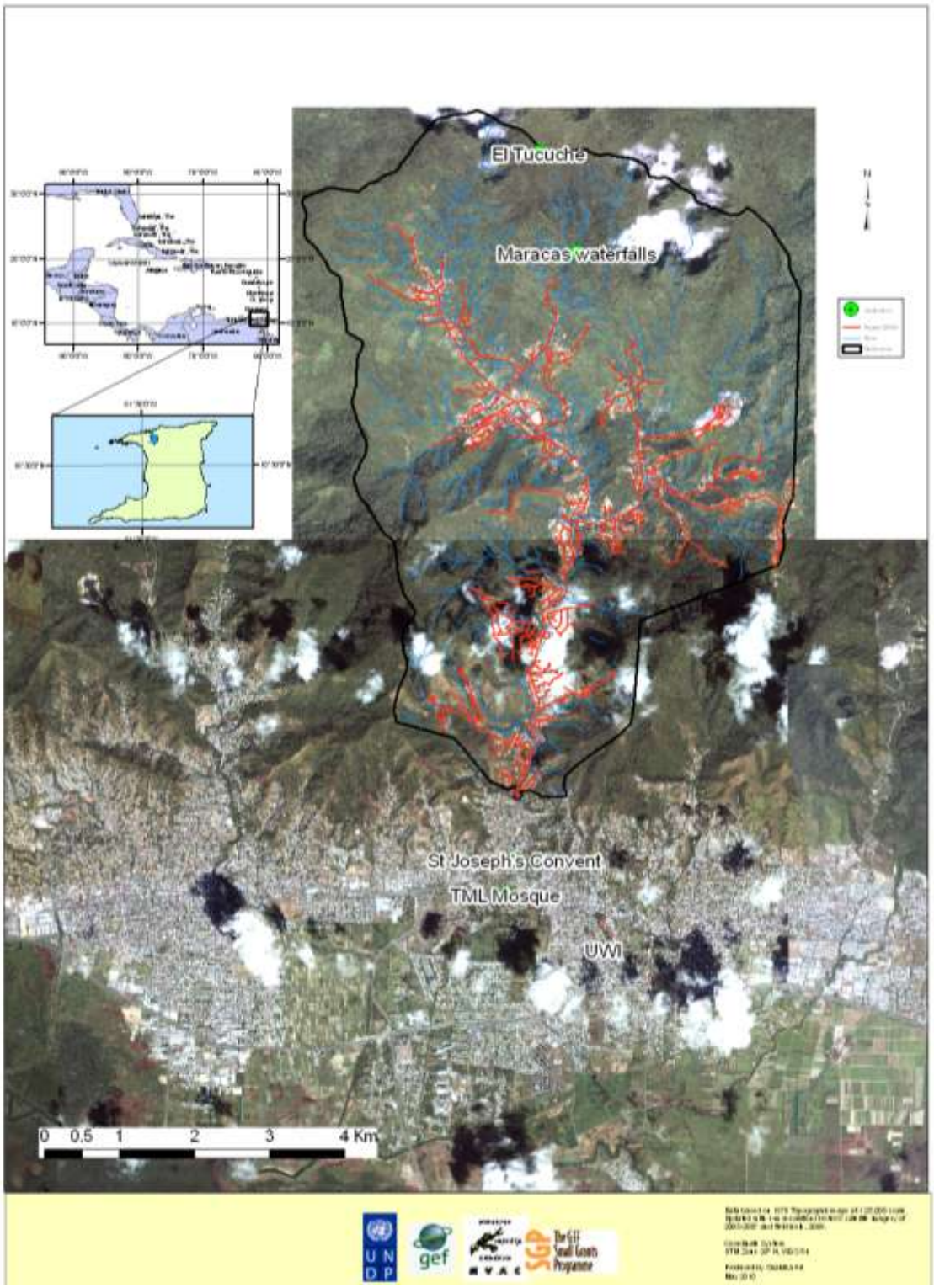


Figure 1: General location of study area, Maracas Valley, Trinidad

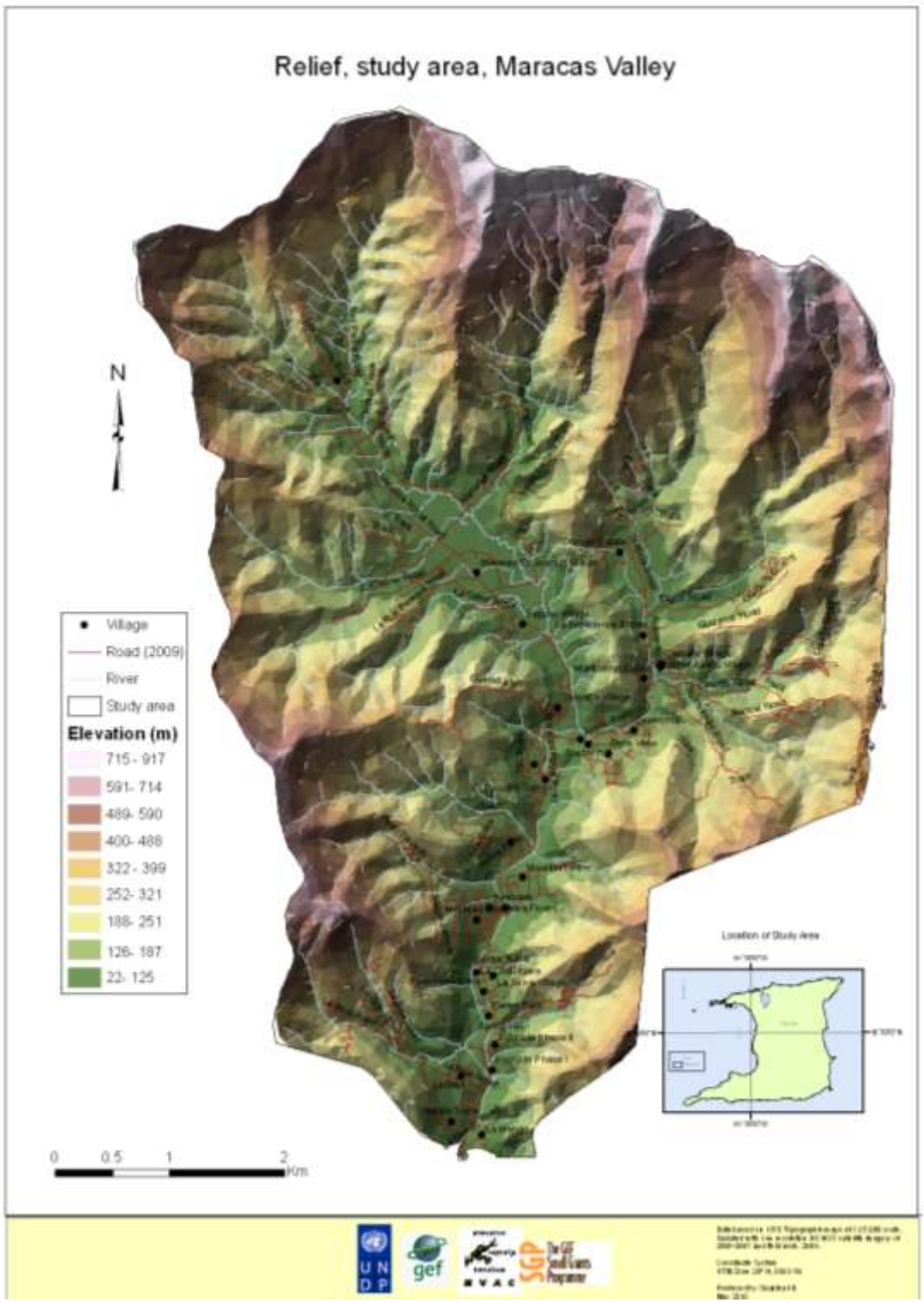


Figure 2: Villages and relief within the study area, Maracas valley

Using the 300 ft (91m) contour line as the recommended height at which to build by the Town and Country Planning Division, analysis revealed that 6.5% of the study area lies below 91 m (~300ft) elevation, 19.2 % between 91 and 152 m (500ft), 17% between 152 to 213 m (700ft) and 57.3% above 213 m. The area lying within 91 m is used to analyse

relationships between built-up areas, locations of buildings, land cover and soil types in the valley. The soils of the study area are mainly sandy clay loam.

4.0 GIS analysis

The application of GIS assisted in determining the changes in population, road network, land use/land cover and the built environment in the study area. It involved data acquisition, database design, data automation, feature extraction, geoprocessing, and map preparation.

4.1 Data acquisition

The oldest land use maps available for analysis were created using topographic maps from the 1970s. In 1994, Lands and Surveys Division updated land use maps for Trinidad, available in digital format. The most recent land use map of the study area used for analysis was created by feature extraction from 2005 IKONOS imagery at 1m resolution. The land use change analysis is therefore restricted to these periods.

Datasets for the project were available for time spans of 1970, 1990, 1994, 2000, 2002, 2005, 2008, and 2009 but with inconsistencies between spatial and attribute data for the years listed. The data accompanying these time frames are given in Table 1.

Table 1: Datasets acquired for MVAC Project

Year	Scale of input data	Theme	Name of layer
2009	From GPS data	Updated buildings and road network from field work undertaken in June 2009	*New Blocks.shp* *New buildings.shp* *New roads.shp*
2005 – 2007	1m	IKONOS satellite imagery	*Ikon300* *Ikon300c1* *Ikon300c2* *Ikon300c3*

			Ikon301 *Ikon301c1* *Ikon301c2* *Ikon301c3*
	1:10,000	compiled from Satellite imagery above	*Roads.shp*
2005		This data set was compiled from the 1994 photomosiac and updated for the most part using the Ikonos imagery by Bheshem Ramlal. They are of same vintage as the images.	*Buildings.shp*
2004	1:10,000	Parcel Index - Compiled by the Lands and Surveys Division from Cadastral Index sheets 1:10,000 in 2004. This is more an index than anything else. The boundary of State lands and the Northern Range Forest Reserve were derived from this.	*Cadastral parcels.shp*
2000	Unknown	CSO 2000 Census data	*Enumeration districts.shp*
2002	Unknown	Town and Country Planning Division	*Maracas policy 2002.shp*
1994	1:10,000	CSO – for information only	*Land use.shp*
1994		Aerial photograph of study area from Town and Country Planning Division	*1994 ap_mvc3*
1970s	1:25,000	From WASA	*Watersheds.shp*
		From topographic map series, L&S	*Rivers.shp*
		This data was compiled from the 1:25,000 topographic maps from 1970 done by the Lands and Surveys Division. The contours were digitized and a TIN created. Points of the Vertices of the Triangles were extracted to form the spot height point file. The contours were 15 m contour interval created by Bheshem Ramlal.	*Elevation data.shp*
		Land use- compiled from the 1:25,000 topographic maps by the Lands and Surveys Division by J.Opadeyi and S.Ali	*MVLanduse.shp*
1960s	1:25,000	From soil map series from 1960s produced by Min of Agriculture, T&T and UWI. Digitized by Dr. J. Opadeyi, Department of Surveying and Land Information. Some attribute data added by Bheshem Ramlal	*Soils.shp*
1959	1:100,000	Geology of Trinidad, H. Kugler, 1959	*Geology.shp*

4.2. Mapping the present status of the land cover of Maracas Valley

Data was extracted from a selection of IKONOS imagery covering the Maracas/St. Joseph study area. The georeferenced and rectified pan sharpened colour images for the area were collected between 2005-2007 at 1-metre resolution. Data derived from these images are dated as 2005 in this report. A similar set of IKONOS images was made available by the TCPD for comparison and appears to be of the same date as the 2005 but they were dated by TCPD as 2003. The lineage of the IKONOS images, therefore, needs to be clarified for more accurate land use change analysis.

Land use categories used were rationalised from data sets of 1970, 1994 and 2005 as shown in Table 2.

Road network and buildings were updated spatially using GPS from field survey carried out in June, 2009. Road names were added to the updated road network. Villages and facilities were located and named.

Table 2: Rationalised Land use /Land cover categories

Land use categories from topo map sheets of 1970s, L&S (based on 1967 aerial photography)	**Land use categories, 1994**	**Land use categories for 2005 analysis**
Built-up area	Residential Commercial Industrial Mt. Hope Hospital	Built-up
Forest	Forest	Forested
	Broken forest (Sparse forest)	
	Clear felled (stripped of vegetation)	Bare ground
Mangrove		Other vegetation types
Bamboo		
Swamp		
Pond	Water	
Citrus	Agricultural (all types)	Agricultural (Vegetable garden)
Coconut		
Rice		
Sugar cane		
Vegetable garden		
Other crop and production		
Savannah	Grassland	Scrub
	Grassland and swamp	
Scrub	Scrub (Fire-burnt or permanently dwarfed vegetation)	
Without information (often		Built-up

coincided with built-up areas)		

4.3 Data extraction from IKONOS

The land cover categories were initially derived from an unsupervised classification then reclassified to 9 classes and subjected to five passes of a majority filter. The nine classes were further reclassified to five classes, namely Built-up, Forested, Bare ground, Vegetable garden and Scrub. The resolution was reduced by 3 to convert the raster layers to vector shapefiles. These files did not distinguish clearly the difference among the land cover classes plus they were too large, as much as 429 MB, to manipulate efficiently in the GIS programme. As a result the land cover layers were derived by on-screen digitizing with the use of the expert knowledge of a member of the MVAC Project. These layers extracted from the IKONOS imagery still need to be ground truthed to produce a land use map for the area for 2010.

4.4 Change analysis in the study area

Change analysis for done for population growth, development of road network, the spread of built-up areas, the addition of buildings from 1970s to 2009, and loss of forest cover in the study area.

Data gathered for the land use analysis varied in terms of spatial coverage and attribute information. Data was of different years and input scales. This varied mix of dates and spatial coverage limited the analysis in terms of consistency among the data sets. Table 3 shows the mix of datasets in terms of currency of data and their use in the type of change analysis.

Table 3: Currency of Data for Change Analysis, MVAC Project

Type of Change analysis	1970	1990	1994	2000	2005	2009
Population growth	Estimated from houses	CSO data	-	CSO data	Estimated from housing density	Estimated from housing density
Road network and relief	Road network	-	-	-	Road network	Road network
	Elevation data/slope data	-	-	-	-	-
Land use and soils	Land use	-	Land use	-	Land use	-
	Soils	-	-	-	-	-
Change of built-up area extent	Built-up	-	Built-up	-	Built-up	-
Buildings and relief	Buildings	-	Buildings	-	Buildings	Buildings
Soils and built-up area	Built-up area	-	Built-up area	-	Built-up area	-

Table 4 shows the status of the analysis requested by the MVAC Project.

Table 4: Status of the analysis requested by the MVAC Project.

Analysis requested by MVAC	Interpretation	Status
Inventory of current land use	Land cover map derived	Extracted from IKONOS 2005
Classify lands based on ground slope	TIN created	To create from TIN
Classify lands under forest cover	Forest and broken forest	Done
Classify lands under cultivation/ tree crops/horticultural/food crops	Difficult to interpret these classifications	To some extent (vegetable garden)
Classify lands used for residential	Polygons around buildings form layer provide and form IKONOS image; Updated by field work	Done
Classify lands used for non-residential	Too generalized a request	Not done
Classify lands used for Institutional/educational/primary, secondary, tertiary	Buildings identified	Done
Classify lands used for mining/quarrying	From IKONOS image	Done
Classify lands used for commercial	Not possible from IKONOS image	Not done
Classify lands used for recreational/private public	Only as far as possible with identifiable	Incomplete

	features on the ground	
Define road network- main roads, secondary roads, paved	Done; updated with IKONOS and field work	To classify
Define right of way, bridle paths, unpaved roads	Requires expert knowledge to id right of ways	To add attributes

4.5. Change analysis results

Results of the analysis are given with respect to population, land cover, the built environment, road network, elevation, slopes and soils in the study area.

4.5.1 Population Change Analysis

Change analysis required population data obtained from the Central Statistical Office (CSO) from the 2008 sample census for the Maracas Valley area of the Tunapuna /Piarco Region. This figure was not used as it showed a decline in population that did not seem to be realistic. Population statistics used for estimating population growth were obtained from Ivan Laughlin, Goswami for 1970, 1980 and 1986; CSO statistics for 1990 and 2000; and an estimated number of persons per household from Laughlin in a previous study that was made available to MVAC. Population growth was therefore calculated for 1970, 1980, 1986, 1990, 2000 and 2009 and an anticipated population for 2015. The population for 2009 was estimated by multiplying the number of residential buildings obtained from feature extraction of buildings using the IKONOS imagery of 2005 by an average household size of 4.2 persons.

Figure 3 shows the increasing trend for population growth for 1970 to 2009, and an anticipated population for 2015 based on recent, ongoing and proposed construction in the study area.

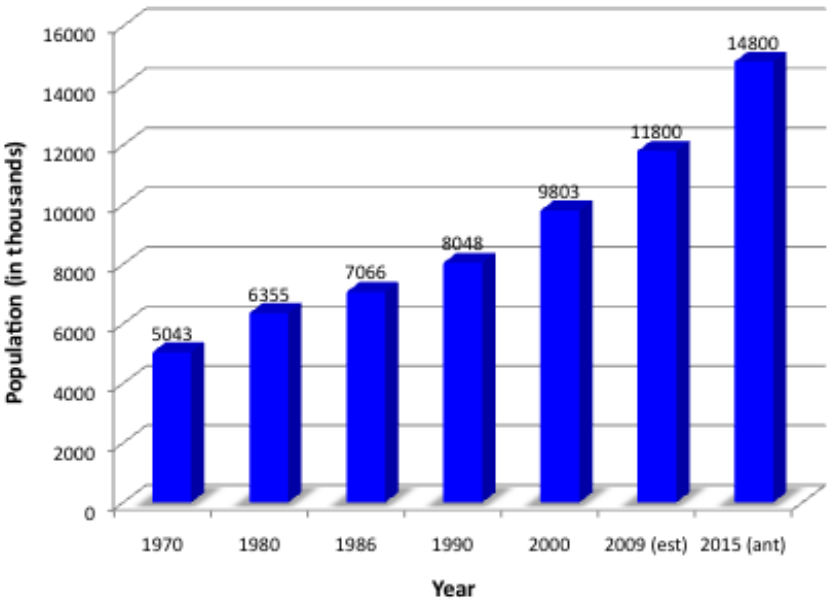


Figure 3: Population growth in study area, 1970 - 2015

There appears to be a 134 % increase in population in the study area from 1970s to 2009. and an overall increase in population density from 1.25 persons/hectare to 2.9 persons/ hectare over the same period. When the population density was calculated for 2008 within the 91m elevation, the population density figure for Acono was the highest at roughly 190.4 persons /ha, followed by Lower Maracas/St. Joseph with roughly 27 persons/ ha, and Maracas/St. Joseph with roughly 26.8 persons/ha. The National Physical Development Plan categorises a population density of 5 persons/ha as rural, 6-22.2 persons/ha as low-density and more than 22.2 persons/ha as high density. Population density in the study area is seen to be nine times that of the high density class. This more precise calculation shows that the study area can be considered highly urbanised. Figure 4 shows the population density within the 91 m elevation.

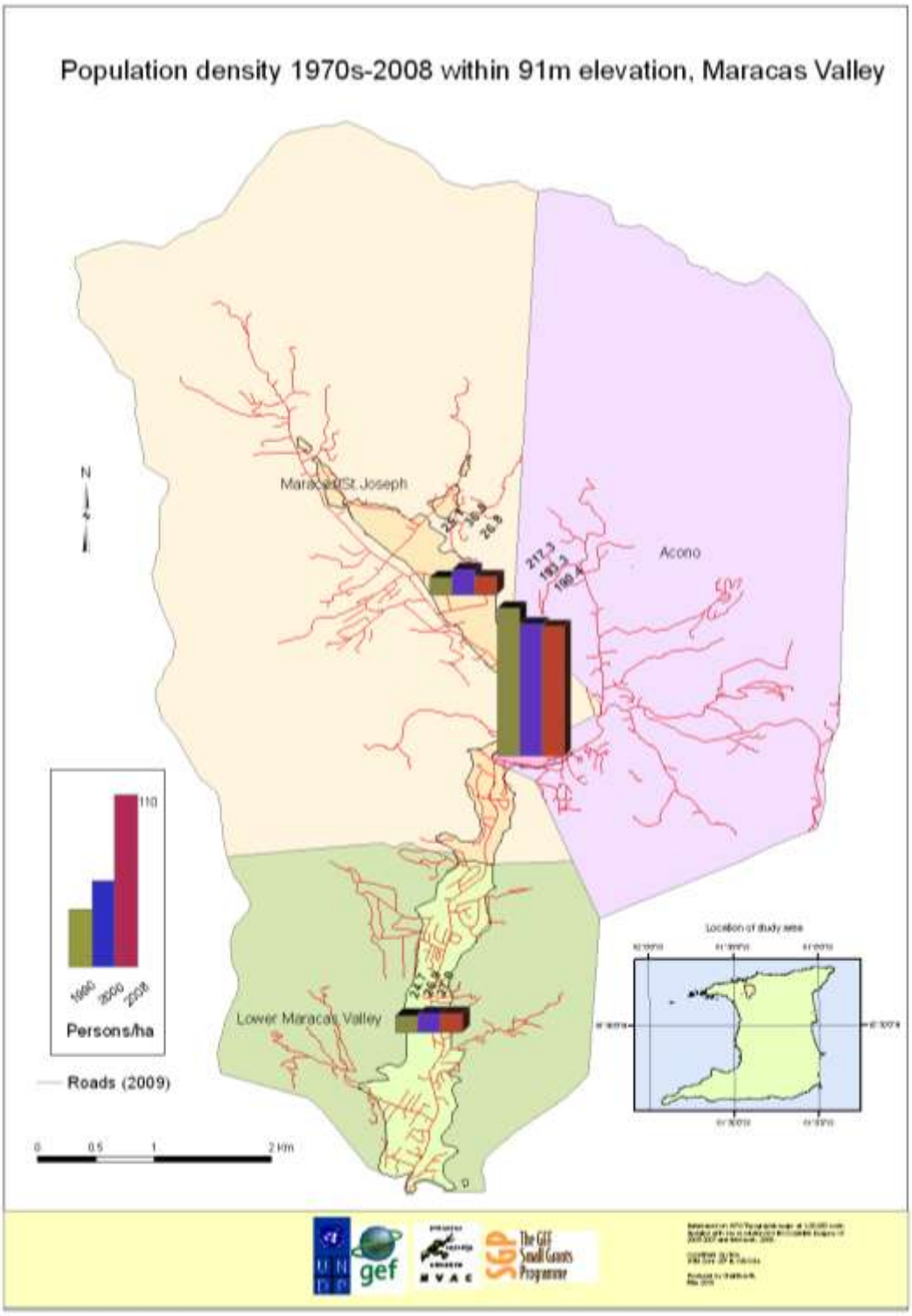


Figure 4: Population density within 91 m elevation of study area, 1970s–2008, Maracas Valley

4.5.2 Land cover change

Table 5 shows the results of the land cover classification from the IKONOS imagery of 2005. Forested areas cover 76.4% of the study area, 7% of which is the Northern Range Forest Reserve. Forested areas are those areas with continuous forest canopy and broken forest cover. Areas under scrub were identified based on the colour of the ground and the burnt-out appearance of the areas. Bare ground was clearly identified as distinct brown patches often occurring within the areas designated as scrub which covers 12.4 % of the study area. Small patches of bare ground were in close proximity to tracks at higher elevations in forested areas in the valley, suggesting small scale agriculture. The areas designated as bare ground were those outside of similar patches that occurred within the built-up areas, and as such appear small. Figure 5 shows the land cover for the study area for 2005.

Table 5: Land cover in study area, Maracas Valley, 2005

Land cover category	**Area (ha)**	**% of study area**
Built-up	401	10
Scrub and bare ground	500	12.4
Vegetable garden and agriculture	28	0.7
Quarry	23	0.5
Forested	3086	76.4
Total	**4038**	**100**

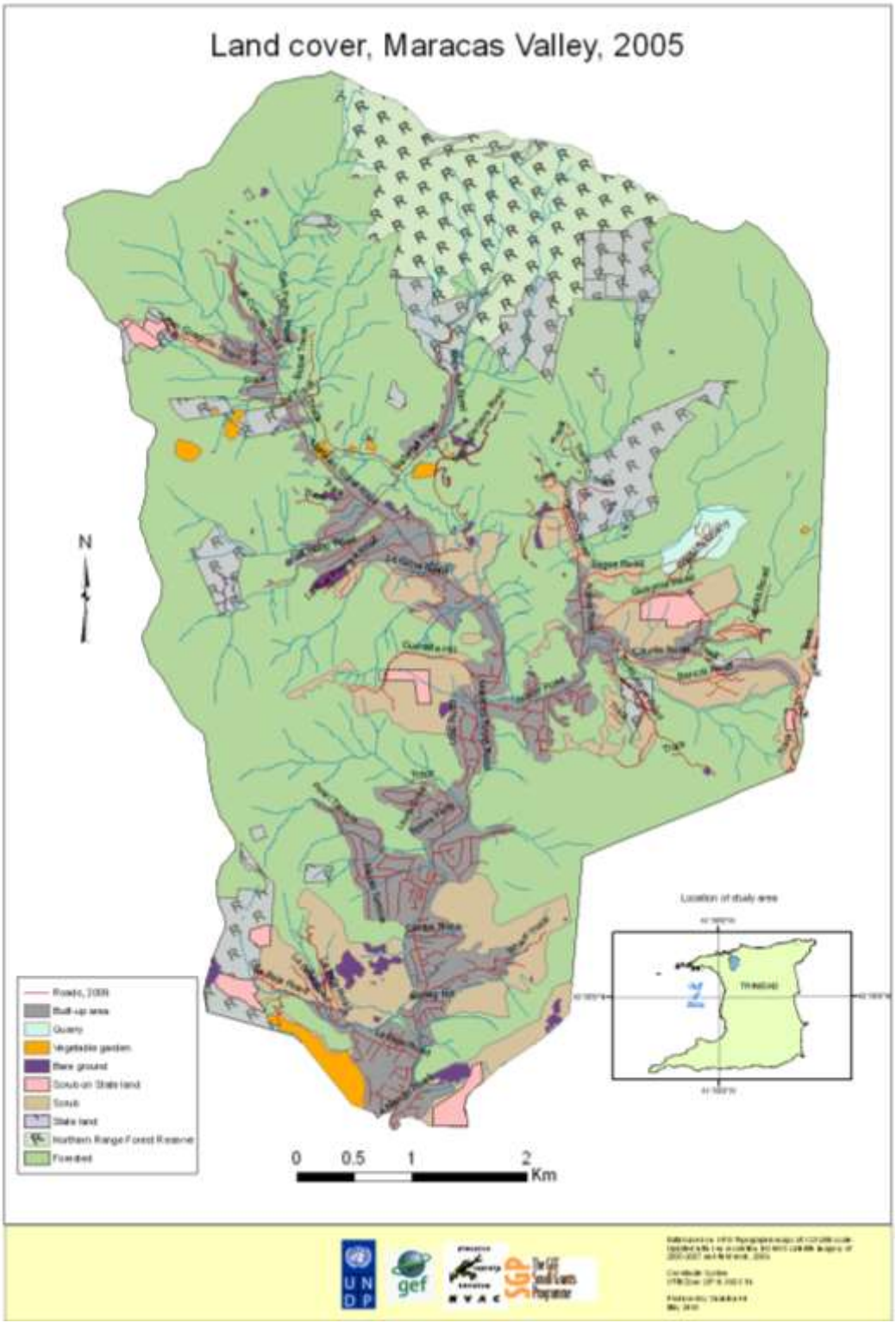


Figure 5: Land cover in study area, Maracas Valley, 2005

Data for the land cover/land use change analysis is incomplete as land use/land cover categories were not consistent in the feature extraction from 1970 to 2005 by the different

agencies that produced the data. This could be due to the different selection criteria for assigning areas to scrub/grassland as opposed to forest and illustrates the high degree of subjectivity in classifying land use. It was not known whether the 1994 data was ground truthed, making it a more correct figure than that for 2005.

Table 6 shows that the built-up areas and Coosal's quarry are the only ones that afford some comparison over the years, in which the built-up areas showed an 86 % increase between 1970s to 1994, and 17% increase between 1994 to 2005, and the quarry showed a great increase in size of 283% from 1970s to 2005. The 1994 data has the lowest area under forest and the highest for scrub/grassland for the time period under study. However, there has been 17.5 % loss of forest cover between the 1970s to 2005 in the study area that could be possibly attributed to an increase in built-up areas, quarrying activities, vegetable gardening or forest fires.

Table 6: Land use/Land cover change analysis, 1970s, 1994, and 2005

Land use/land cover (ha)	**1970s**	**1994**	**% change (1970s to 1994)**	**2005**	**% change (1994 – 2005)**
Forested	3619.2	2847	22	3086	8
Built-up	185.1	344	86	401	17
Agriculture	233.7	-	??	28	??
Scrub/grassland and bare ground	-	785		500	
Quarry	6.0	15 ha (estimated	133	23	283
Other vegetation type	-	62.0	-	-	-
Study area (ha)	**4038**	**4038**		**4038**	

4.5.3 Buildings Change Analysis

The number of buildings mapped was compared for 1970, 1994, 2005 and 2009 and at elevations of within 91m, between 91-152 m, 152-213 m, and above 213 m. The results are shown in Figure 6 and Table 7.

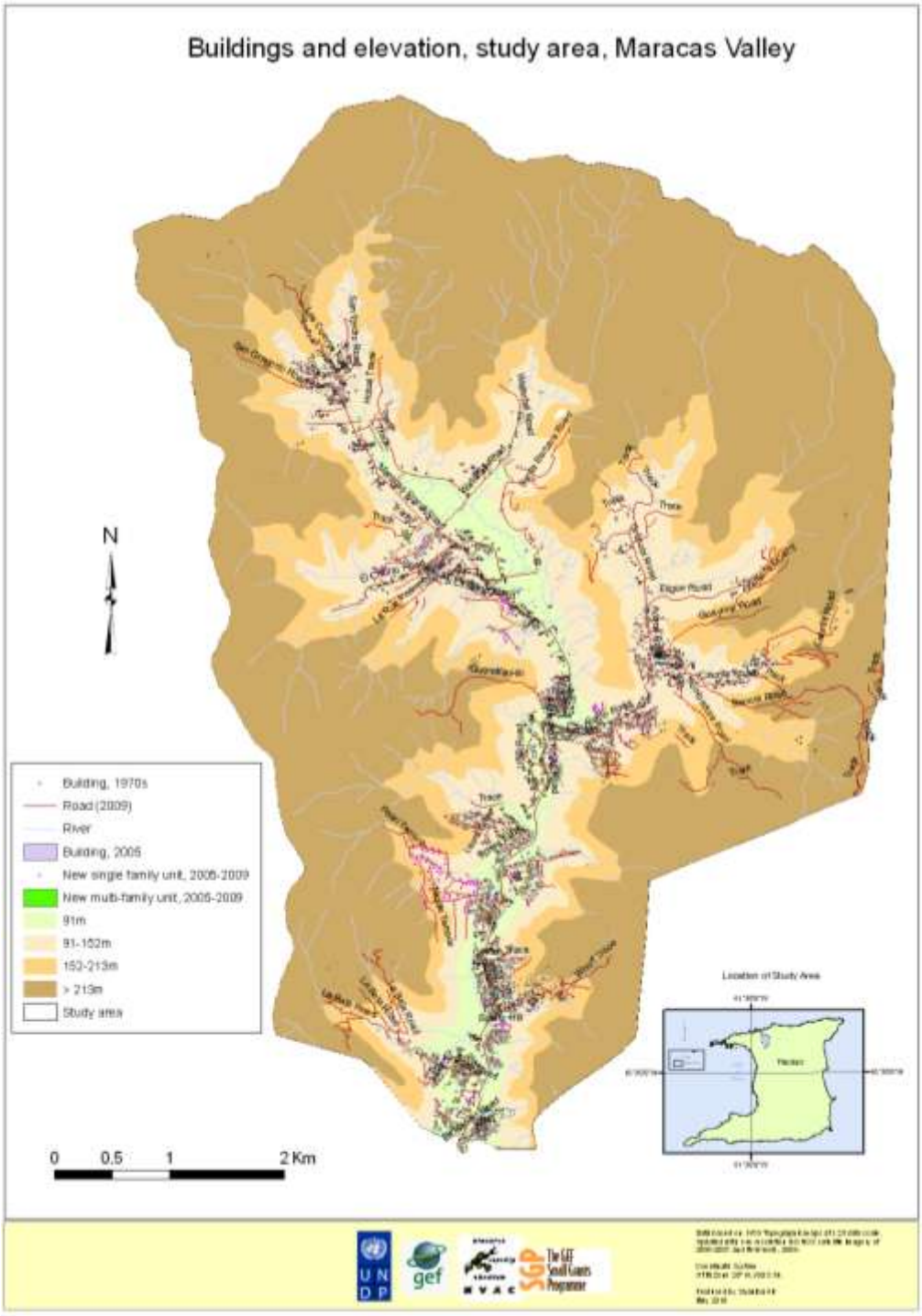


Figure 6: Buildings within elevation categories, Maracas Valley, 1970s-2009

Table 7: Buildings and elevation analysis

Year	Total no	No. houses within 91 m	Bldg density (bldg/ ha)	No. houses within 91-152m	Bldg density (bldg/ ha)	No. houses within 152-213m	Bldg density (bldg/ha)	No. houses within >213m	Bldg density (bldg/ha)
1970	846	359	3.2	453	0.6	26	<1	8	<1

1994	2684	960	3.6	1453	1.9	269	<1	14	<1
2005	2804	997	3.8	1477	1.9	272	<1	29	<1
2009	2985	1063	4.0	1540	2.0	290	<1	63	<1

Building density appears to be increasing markedly within the 91 m elevation. The 2009 data still needs updating to include areas that were not visited due to reasons of inaccessibility and time constraints in the field work. Nevertheless, there has been roughly a 250 % increase in building construction in the study area over the 40 year period. It is interesting to note the increase in building construction taking place is in areas over 91 m elevation during the period 1970 to 2005, particularly within 152-213 m elevation, which experienced roughly 1000% increase. There seems to be an increasing trend (63 dwellings in 2009) to build above the 213m (700ft) contour line, a demarcation used by TCPD to leave land at such elevation under forest.

Total number of buildings for 2015 included an estimated 1000 new units to be constructed and recently constructed, as shown in Figure 7.

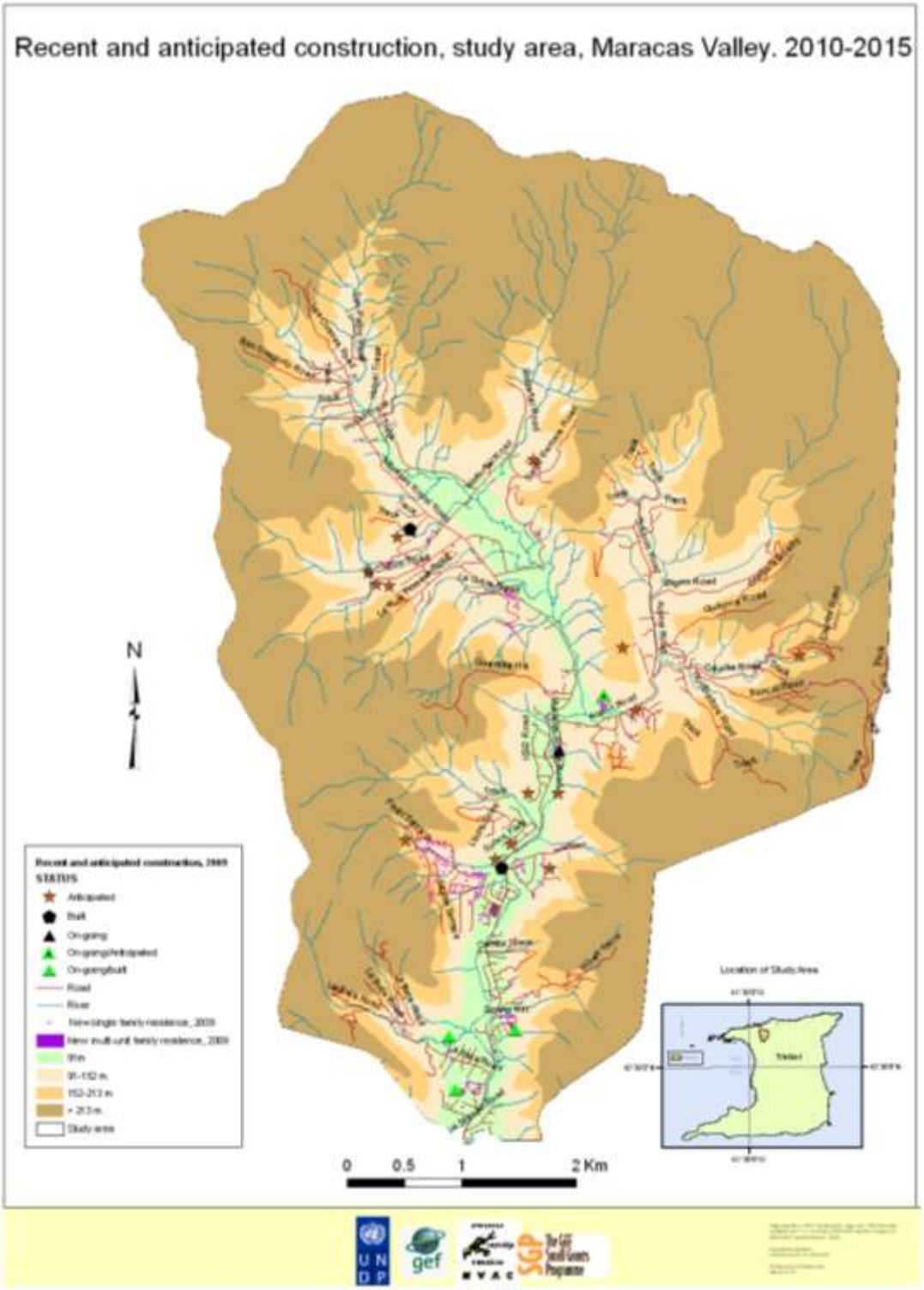


Figure 7: Recent and anticipated construction, Maracas Valley, 2010-2015

4.5.4 High-risk construction areas

Analysis of the slope distribution in the study area showed that 65 % (2616 ha) of the area has a slope of 1:4 or less, and 35% (1422 ha) of the area has slopes steeper than 1:4, as seen in Figure 8. Forest cover is present on 61% of slopes greater than 1:3, and 39% on slopes of 1:3 and lower.

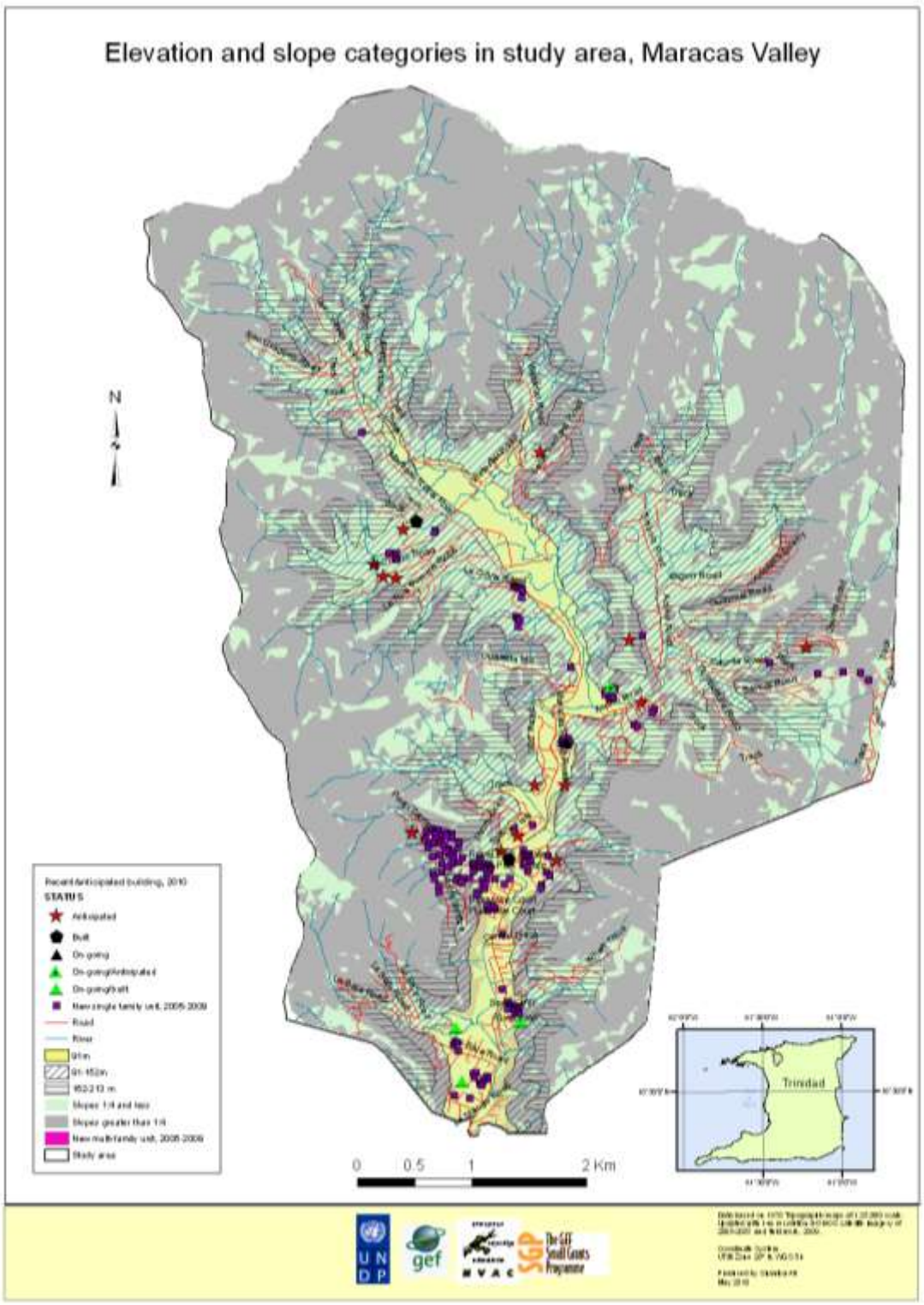


Figure 8: Elevation and slopes of 1: 4, study area, Maracas Valley

Table 8 shows the results of analysis of slopes of 1:4 within the study area. 31% the area between 91-152 m and 63.9% between 152-213m had slopes greater than 1:4. The area

within 91 m had no slopes greater than 1:4, while the area above 231m contained 82.6% of slopes greater that 1:4. It appears that the higher the elevation, the greater the slopes in the study area.

Table 8: Occurrence of slopes greater than 1:4 within the study area.

Within 91 m		**91-152m**		**152-213m**		**Above 213m**	
ha	**%**	**ha**	**%**	**ha**	**%**	**ha**	**%**
0	0	240	31	439.5	63.9	1909	82.6

Areas considered posing a high risk to construction were those less than 700ft and with slopes greater than 1: 4. Analysis revealed that 20% of the area under 700 ft had slopes greater than 1:4. This is significant given the fact that the sandy clay loam, prone to erosion, is the dominant soil type in the study area.

An attempt was made to map the location of squatter settlements in the study area, using expert knowledge of members of MVAC. These boundaries are not precise as they were estimated without parcel boundaries data. The development of squatter settlements is rooted in the history of the study area where ex-slaves settled on lands within and near the estates on which they laboured. Such settlements are in the areas at La Seiva, La Mango, Acono, El Luengo and Maracas/St. Joseph Settlement. The development of more recent squatter settlements, however, is due to the movement of people from outside the Maracas Valley. At present, only two areas within squatter settlements have been regularized. These are at La Mango and Guamal Road. Figure 9 shows the relationship among the location of squatter settlements, recent and anticipated construction and the areas that pose a high risk to construction in the study area.

Figure 9 clearly shows that many squatter areas as well as new single and multi-family residences (Maracas Gardens) are situated in high risk construction sites (situated on slopes steeper than 1: 4) and within the 700ft contour. Some new residences are also planned above the 700ft contour (Acono Ridge). This obviously poses a risk for building/slope stability and increases the incidence of run off and erosion.

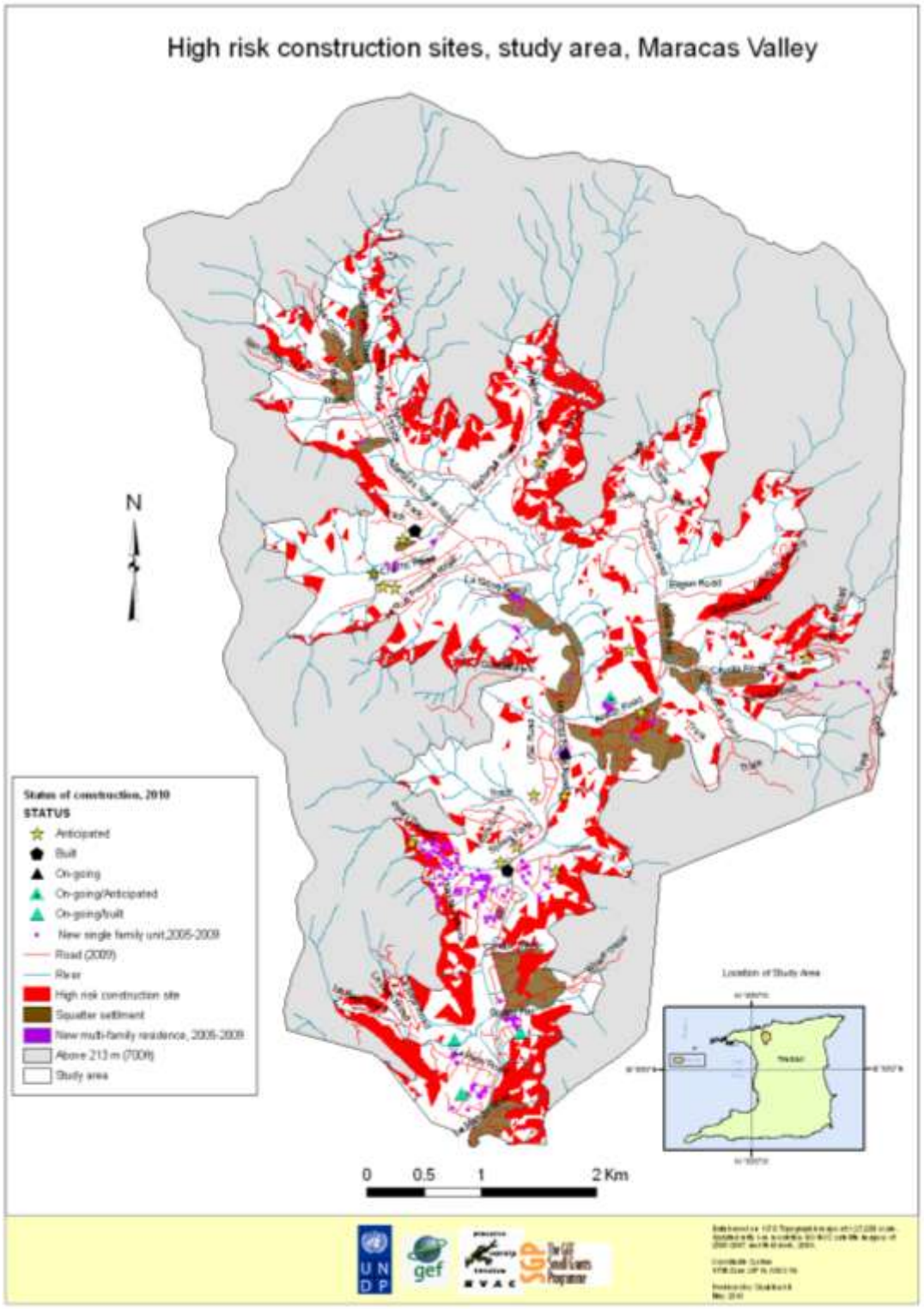


Figure 9: High-risk construction area, study area, Maracas Valley

4.5.5 Built-up area analysis

The area considered built-up was extracted for the land use maps of 1970 and 1994 and compared with that derived from the 2005 IKONOS satellite imagery. Table 9 shows the results of the analysis for built-up areas in which there is an overall increase of 117% in the built- up areas between 1970 and 2009. Figure 10 shows the change in built-up areas for 1970, 1994 and 2005.

Table 9: Change in Built-up areas in the study area within Maracas Valley

Size of study area - 4038 ha

Built-up area	**1970s**		**1994**		**2009**	
	(ha)	%	(ha)	%	(ha)	%
	185	4.6	344	8.5	401	9.9

The apparent mis-match of the layers that suggests that some built-up areas ‘disappeared’ between 1994 and 2005 is indicative of the coordinate and projection system problem experienced in the analysis in which some layers did not overlay precisely for more accurate calculation.

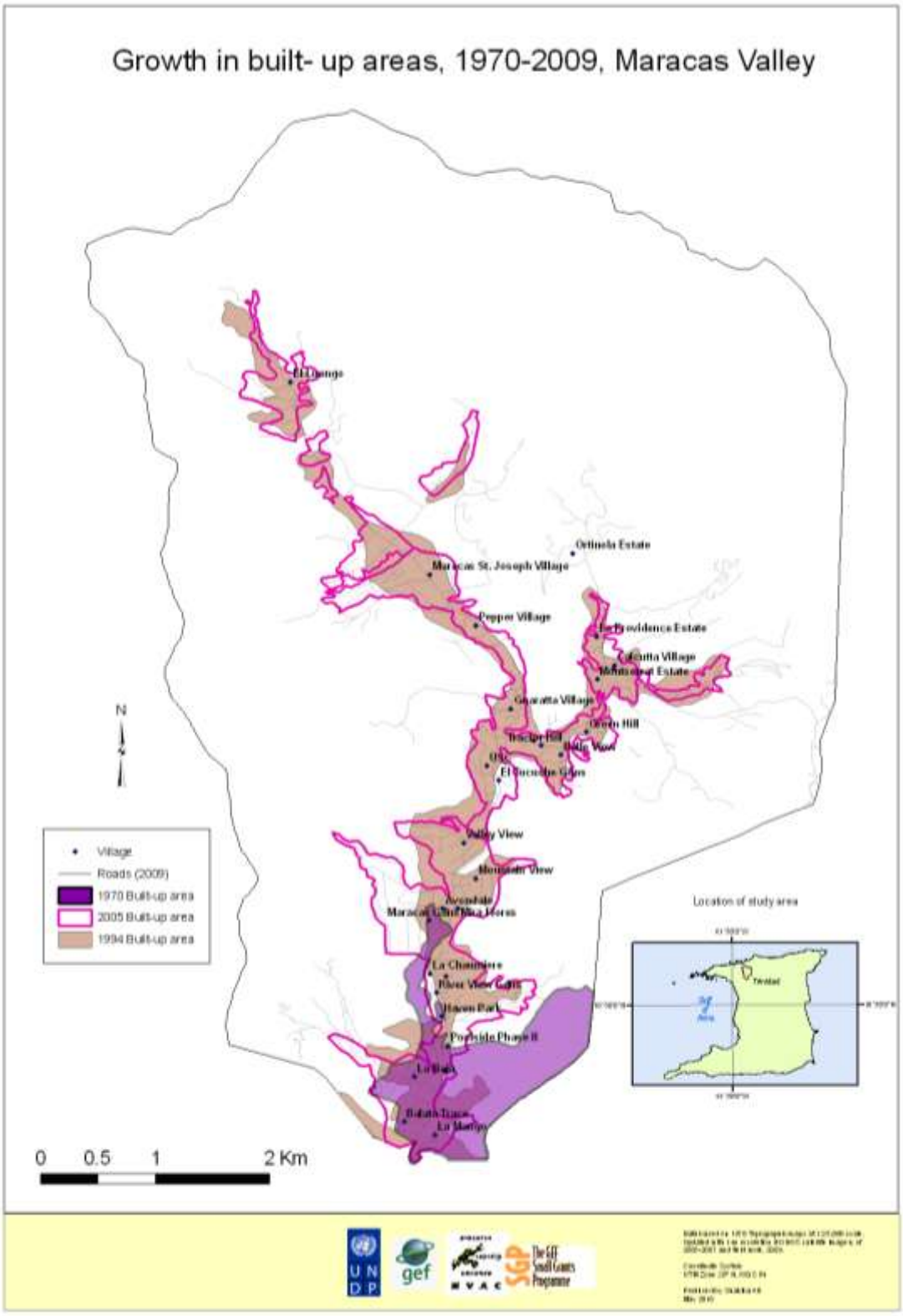


Figure 10: Change in built-up areas, study area, Maracas Valley.

4.5.6 Road network analysis

There appears to be a 226 % increase overall in the road network between 1970 and 2009 in the study area. In looking at this increase with respect to elevation, there has been a 117 % increase in areas within 91m elevation, 207 % increase between 91-152 m, 500 % increase between 152 m – 213 m and 108 % increase above 213 m in the study area, as seen in Table 10. Figure 11 shows the road network in relation to elevation.

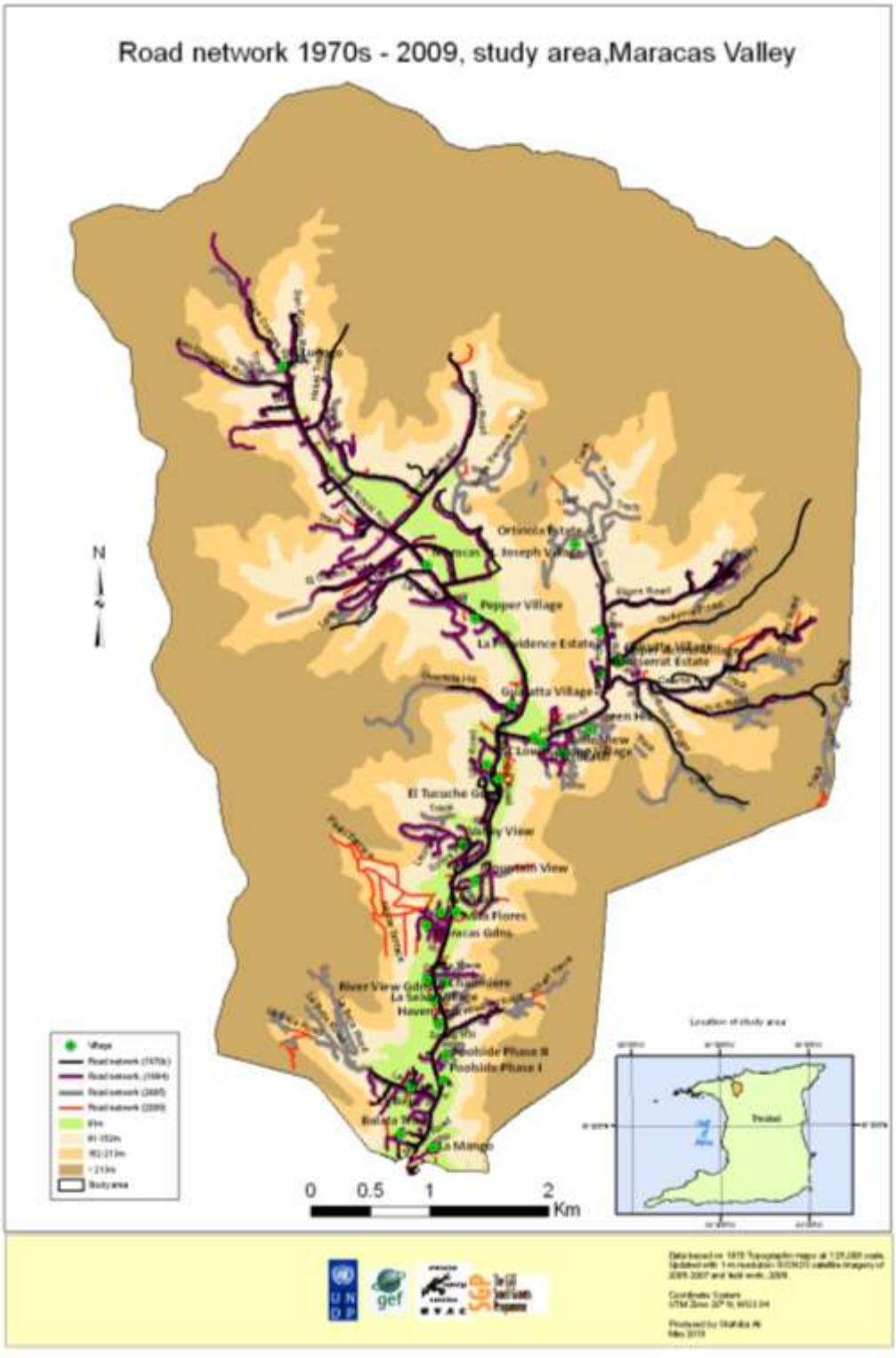


Figure 11: Road network growth, 1970s-2009, study area, Maracas Valley

Table 10: Road network and elevation analysis

Year	Total length (km)	Within 91 m (km)	91-152m (km)	152-213 m (km)	>213m (km)
1970	28.5	11.7	13.2	2.5	1.0
1994	53.4	21.0	25.1	4.9	2.4
2005	80.6	21.7	35.7	11.3	11.8
2009	92.8	25.4	40.6	15.0	11.8

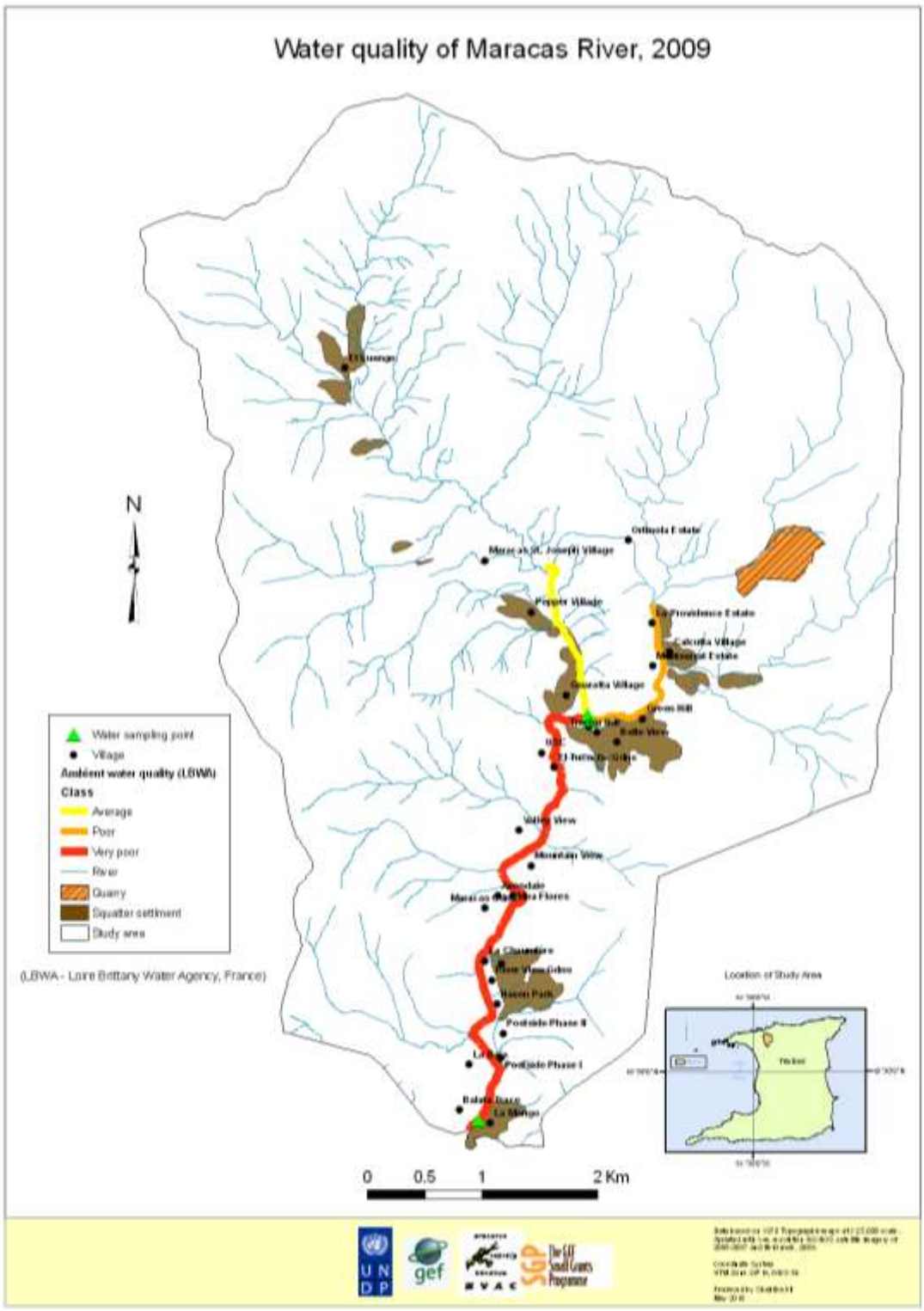
As shown in Table 10, the road network increased by 87 % from 1970 to 1994, 50% from 1994 to 2005 and 15 % from 2005 to 2009. Between 1970 and 2009, the highest increase in the road network has occurred between 152 – 213 m (500-700ft) and is equal to 500%! This indirectly reflects the gradual encroachment of housing along the valley's slopes.

4.6 Water quality in study area

Figure 12 shows the status of the water quality estimated from three sampling points at Upper Maracas River (upstream junction with Acono River), the Acono River (upstream junction with Maracas River) and Lower Maracas River (upstream Silver Bridge) during a period of drought that the country had not experienced over the last 40 years. The water was sampled on 15 March, 2010 between 9:45 am and 10:30 am using a grab sample method. Total coliforms, BOD_5 (biological oxygen demand) and P_2O_5 (phosphates) were analysed from among other parameters collected. Results revealed that the flow from the Upper Maracas River is of average water quality (Classes 1B and 2[1]) whereas there is poor water quality (Classes 2 and HC) from the westerly flowing tributary (Acono River) that flows into the Maracas River at Acono junction. This might be due to waste discharges from residents in the area. The southerly flow of the Maracas River however, has a very poor water quality (Classes 3 and HC) due to discharge of contaminated effluents from four dysfunctional package waste-water treatment plants at Poolside Phase II, Maracas Gardens, Mira Flores and Mountain View, in addition to direct discharges of waste-water from the compound of the University of the Southern Caribbean.

[1] For definition of River Water Quality Classes, refer to Section XX « River Water Quality » of this UNDP Report

The classification of the ambient water quality used for the analysis was based on that of the Loire - Britanny Water Agency, France[2].



[2] For definition of River Water Quality Classes, refer to Section XX « River Water Quality » of this UNDP Report

Figure 12: Ambient water quality, Maracas River

4.7. Soils in the study area

The dominant soil type in the study area is the Maracas/Matelot sandy clay loam, covering 81 % of the study area with the other soil types covering less than 5% each, as seen in Table 11. River Estate fine sandy loam, the best agricultural soil in the study area covers only 4% of the study area. Maracas/Matelot sandy clay loam accounts for 81% of the study area, and has been classified as Land Capability class VI and VII, with recommendation to be kept under forest, as shown in Table 12. The soil in the study area is prone to slight (class 1) to severe erosion (class3). Figure 13 shows the soils of the study area. The Land Capability and erosion classes were obtained from *A Publication of the Land Capability Survey of Trinidad and Tobago,* (Eds) L.L. de Verteuil, K.K. Cunningham and A.J. Vlitos, 1973)

Table 11: Soils in the study area

Soil series name	**Land capability class**	**Erosion class**	**Area (ha)**	**% of study area**
Acono fine sandy loam	4,5	1,2,3	186.9	5
Guanapo sandy clay loam	3	1	77.7	2
Anglais clay	2,5	1,3	76.8	2
Maracas/Matelot sandy clay loam	3,4,6,7	1,2,3	3275	81
River Estate fine sandy loam	1,2	1	174.2	4
Santa Cruz fine sandy loam	2,3,4	1,2	95.1	2.3
St. Joseph fine sandy clay	3,4,5	1,2	52.9	1.3
La Pastora sandy clay	4,5,6	1,2	99	2.4

Table 12: Land capability class in Study area

Soil series	**Land Capability Class**	**Description**	**Area (ha)**	**% of study area**
River Estate fine sandy loam	1	▪ Very good land that can be easily cultivated	▪ 1 12.5	▪ 3
Anglais clay; River Estate fine sandy loam; Santa Cruz fine sandy loam	2	Very good land that can be easily cultivated, simple protective measures required	81.3	2
Guanapo sandy clay loam; Santa Cruz fine sandy loam; Maracas sandy clay loam; St. Joseph fine sandy clay	3	Good land, requires moderate to intensive conservation and management practices	114.9	3
Acono fine sandy loam; La Pastora sandy clay; Maracas sandy clay loam; Santa Cruz fine sandy loam; St. Joseph fine sandy clay	4	Moderately good land, requires intensive conservation and management practices	763.5	18.9
Anglais clay; Acono fine sandy loam, La Pastora sandy clay; St. Joseph fine sandy clay	5	Fairly good land, should be used for forest, tree crops, grazing and buildings depending on the slope	220.8	5.5
Maracas sandy clay loam; La Pastora sandy clay	6	Unsuitable for agriculture due to slope and/or water limitations, should be left under indigenous growth or forest	1313.9	32.5
Maracas sandy clay loam	7	Unsuitable for agriculture due to very steep slopes. Should be left under indigenous growth or forest	1431	35.4

- **Table 13: Soil erosion classes**

Erosion Class	**Description**
0	No apparent erosion
1	Slight erosion
2	Moderate erosion
3	Severe erosion
4	Very severe erosion
5	Extremely severe erosion
9	Accretion

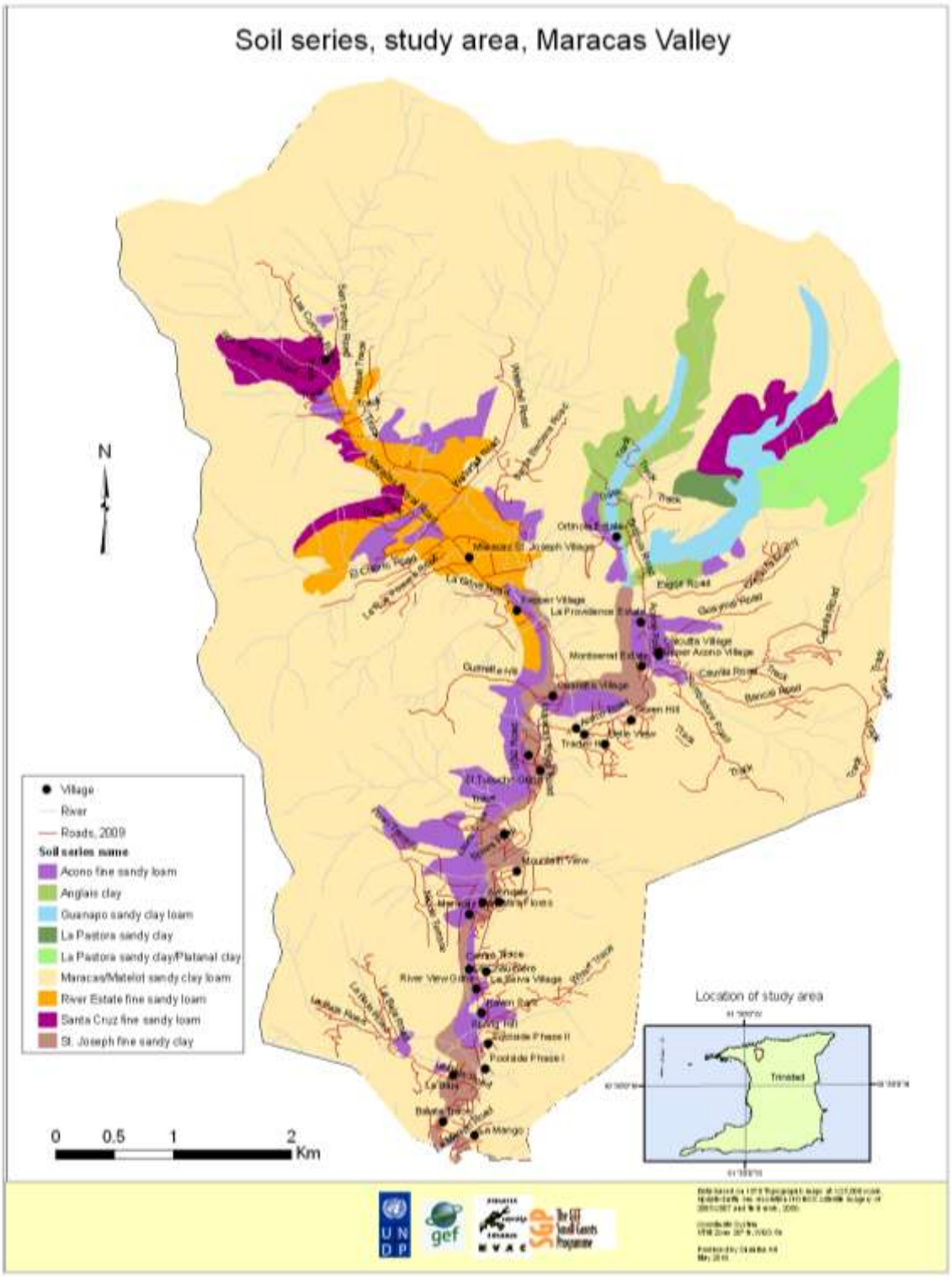


Figure 14: Soils within the study area, Maracas valley

As expected, the dominant soils series found in the built-up areas is the Maracas/Matelot sandy clay loam, covering 54 % of the study area and the Acono fine sandy loam, covering 17% of the study area. Table 14 and Figure 14 show the soil types in the built-up areas,

with River Estate fine sandy loam, extremely suitable for agriculture accounting for 10% of the soils under built-up areas. These soils are prone to slight to severe erosion.

Table 14: Soils under built-up areas, 2009

Soil series name	**Land capability class**	**Erosion class**	**Area (ha)**	**% of built-up area**
Acono fine sandy loam	4,5	1,2,3	64	16.6
Anglais clay	2,5	1,3	0.2	<1
Maracas/Matelot sandy clay loam	3,4,6,7	1,2,3	198	54
River Estate fine sandy loam	1,2	1	36	9.6
Santa Cruz fine sandy loam	2,3,4	1,2	18	4.8
St. Joseph fine sandy clay	3,4,5	1,2	55	15

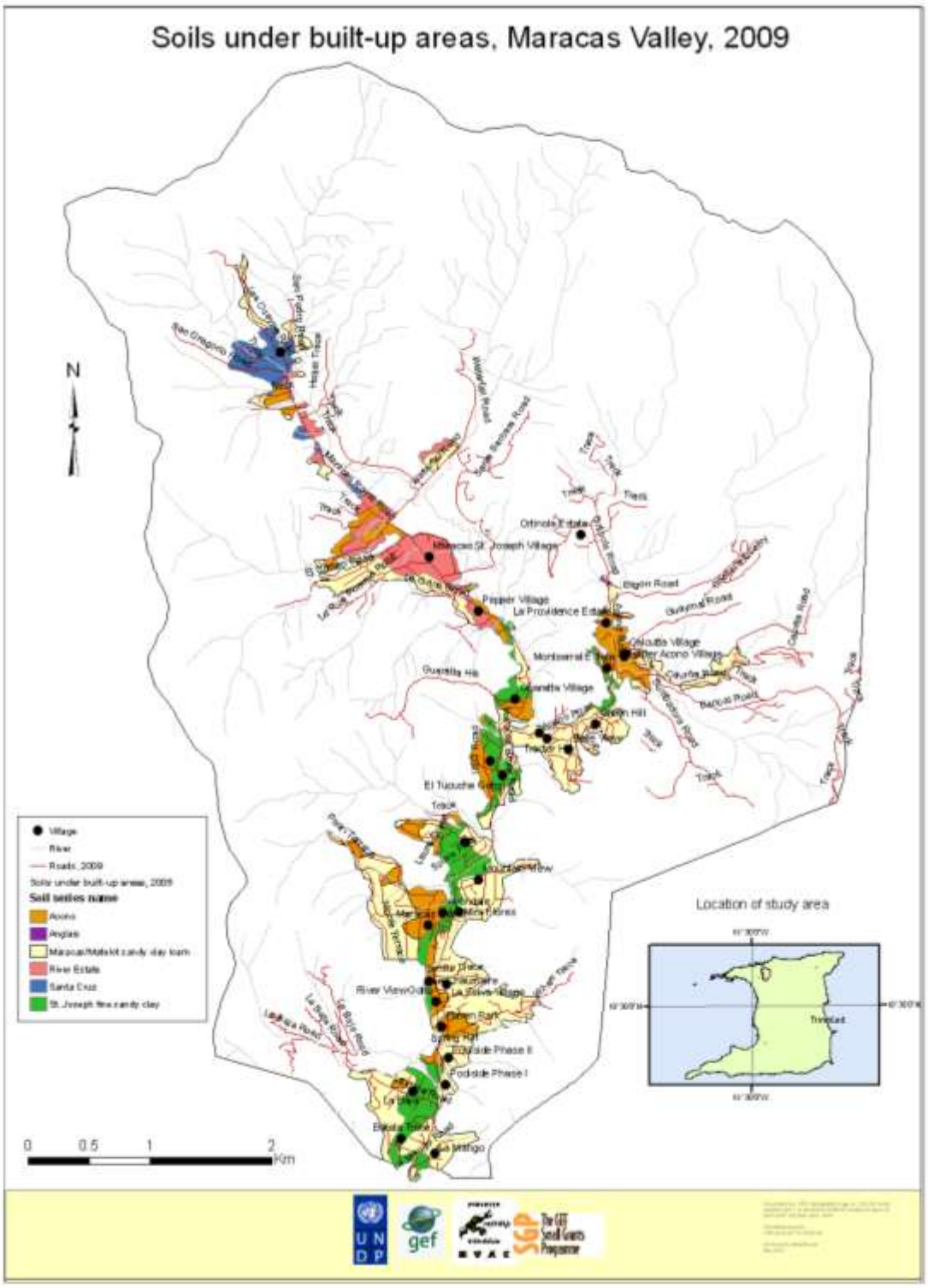


Figure 14: Soils under built-up area, study area, Maracas Valley

4.8 Status of State lands

Examination of the occurrence of scrub on State lands revealed that 17% of State lands in 2005 were converted to scrub vegetation from forested lands on lands above 152m for the most part. This needs to be further investigated to find out whether these lands are being used by squatters for agriculture and /or settlement. It also has implications for soil erosion, landslide occurrences and siltation of rivers at lower elevations in the study area. Table 15 and Figure 5 show the land cover in relation to State lands.

Table 15: Land cover on State lands, 2005

Land cover category	Area (ha)
State lands	337
Scrub on State lands	52.5

5.0 Limitations to change analysis

The greatest challenge faced in the change analysis was the inconsistent time periods of the datasets for land use/land cover, population growth, road network development and buildings. Bringing all data layers to the same coordinate system posed another challenge to the overlay process as coordinate system and projection information did not accompany all data layers. Limited and sometimes conflicting information was provided on the lineage, accuracy and verification of the data used. Nevertheless, the data provided was sufficient to derive statistics and maps that indicate that the study area within the Maracas Valley may be approaching its capacity to house a growing population without further negative consequences.

6.0 Conclusion

Analysis showed that there was a 134 % increase in population in the study area from 1970s to 2009, and an overall increase in population density for subdivisions from1.25

persons/ha to 2.9 persons/ha over the same period. This gives the impression that there is a low population density for the area. However, when the population density for 2008 was calculated for areas within 91m (300ft) elevation, the elevation in which the greatest number of buildings were found, the population density figure showed a more accurate picture of its urbanised nature with values ranging from 26.8 persons/ha for Maracas/St. Joseph to 190.4 persons/ha for Acono than just for the valley as a whole. These population densities are consistent with those encountered in the East – West Corridor thus emphasizing the urban nature of Maracas Valley

There was an overall increase of 250 % in the number of buildings constructed in the study area over the 40 year period, accompanied by an increase of 117% in the built- up areas between 1970 and 2009. The above figures indicate an increase in building density over the past 40 years and consequently an increase in population density within the built up areas (as the number of persons/household has not dropped correspondingly).

The change analysis performed showed a great increase in the road network of 226 % between 1970 and 2009 in the study area. In looking at this increase with respect to elevation, there has been a 117 % increase in areas within 91m elevation, 207 % increase between 91-152m, 500 % increase between 152m – 213m and 108 % increase above 213m in the study area. This also testifies to the gradual encroachment of buildings along the valley's slopes.

Twenty per cent (20%) of the area under 700 ft and having slopes greater than 1:4 posed a high risk to construction. Thirty-one (31%) of the area between 91-152 m and 63.9% between 152-213 m had slopes greater than 1:4. This is significant given the fact that the sandy clay loam, prone to erosion, is the dominant soil type in the study area.

There was a 17.5 % loss of forest cover between the 1970s to 2005.

7.0 Recommendations

There is no single agency in the country that has the responsibility for producing data that permits consistency in data collection and distribution. The establishment of such an agency is urgently needed for further estimation of change in the study area and for other threatened areas in the country. Until this is achieved, greater inter-agency collaboration needs to take place to rationalise boundaries for units of analysis, to improve the accuracy of the road network, road classification and street names, to verify land use classification, to bring all data to one common projection and coordinate system, and to ground truth all data derived from aerial photographs and satellite imageries.

To arrive at a more accurate assessment of change in built-up areas, aerial photos of time periods at shorter intervals need to be examined.

To achieve a more realistic picture of the status of the Maracas Valley study area, the analysis needs to include updated cadastral maps, proposed quarries, areas experiencing loss of heritage and degradation of aesthetic quality. Flood and landslide events need to be mapped to improve the at-risk-to-construction map. A soil classification for engineering purposes and an accompanying map need to be developed for the country.

The analysis needs to be expanded to show the capability of the study area to manage disasters, particularly as there is only one main access road into the Valley.

To prevent further damage to other watersheds in the country, it is recommended that relevant agencies and organisations perform change analysis of this nature in those areas.

ANALYSIS OF RIVER WATER QUALITY
MARACAS RIVER – APRIL 2010

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OBJECTIVES

A flow gauging and water quality sampling exercise was carried out on 15th march 2010 in the Maracas and Acono Rivers for the purpose of determining dry season river base flows and river water quality.

Flow gauging was undertaken by AQUATECH Engineering Ltd. and water sampling and analyses by CARIRI. CARIRI's Service Project Report detailing the results of river water analyses was completed on 29th March 2010.

This report presents successively:

1. The analysis of river flows;
2. The river water quality analysis;
3. The calculation of pollution loads discharged to the Maracas and Acono Rivers;
4. Conclusions.

ANALYSIS OF RIVER FLOWS

UPPER MARACAS RIVER (UPSTREAM JUNCTION WITH ACONO RIVER)

1. Date: 15 March 2010
2. Time: 10:30am
3. Sampling Point Coordinates GPS:
    a. X = 10° 41.739 N
    b. Y = 61°24.242 W
4. Measured River Flow Rate: 0.045 m3/s (45 l/s - instantaneous measurement)

ACONO RIVER (UPSTREAM JUNCTION WITH MARACAS RIVER)

1. Date: 15 March 2010

2. Time: 10:20am
3. Sampling Point Coordinates GPS:
    a. X = 10° 41.711 N
    b. Y = 61°24.224 W
4. Measured River Flow Rate: 0.025 m3/s (25 l/s - instantaneous measurement)

LOWER MARACAS RIVER (UPSTREAM SILVER BRIDGE)

1. Date: 15 March 2010
2. Time: 09:45am
3. Sampling Point Coordinates GPS:
    a. X = 10° 39.821 N
    b. Y = 61°24.775 W
4. Measured River Flow Rate: 0.12 m3/s (120 l/s - instantaneous measurement)

ANALYSIS - COMMENTS

1. The above dry season flows (river base flows) are compatible with average base flows measured over the past decades in the Maracas River (WRA data):
    a. 1970s: 0.08 m3/s
    b. 1980s: 0.26 m3/s
    c. 1990s: 0.09 m3/s
2. Between junction Maracas/Acono Rivers and Silver Bridge, the Maracas River receives an additional 0.05 m3/s (50 l/s). This additional flow originates from:
    a. Aquifer discharge into the Maracas River (probably very low when the measurement was carried out - middle of a particular dry season);
    b. Discharge from of the four dysfunctional package waste water treatment plants (WWTP) in:
        i. Poolside Phase II
        ii. Maracas Gardens

iii. Mira Flores

iv. Mountain View

c. From direct discharge of waste water into Maracas River as observed during field surveys (notably 3 such direct discharges from USC compound);

3. The following section deals with river water quality analysis. The section thereafter deals with the combined use of flow and quality data (CARIRI analyses) to determine pollutant discharges to the Maracas River;

4. The last section highlights relevant conclusions as regards river water quality and pollutant discharges.

RIVER WATER QUALITY ANALYSIS

RESULTS

Results are reported in the following table:

Table **Error! No text of specified style in document.**-1 Results Water Analyses - Maracas and Acono Rivers - 15th March 2010

	Strength							
Location	**Flow**	**TSS**	**P2O5**	**NH3**	**COD**	**BOD5**	**Faecal Coliforms**	**Total Coliforms**
	m3/h	mg/l	mg/l	mg/l	mg/l	mg/l	CFU/100ml	CFU/100ml
Upper Maracas	162	2	0.47	0.03	< 30	< 6	1,390	10,600
Acono	90	2	0.26	0.41	< 30	6.5	24,300	35,000
Silver Bridge	432	1	0.3	0.48	< 30	30.8	13,600	31,900

Complete set of water quality results are reported in CARIRI's Service Project Report in Appendix 1.

ANALYSIS - COMMENTS

1. It is reminded that the analyses were performed on grab samples and not on daily composite samples (samples taken over a 24h period with sample proportionate to flow measurements) the latter being more representative of the daily river water quality;

2. Also, samples were taken on a particular day of the year and thus no weekly or monthly trends were derived. The use of WRA ambient water quality data (for Maracas River) for the purpose of trend analysis was also fruitless as the WRA data is sparse and inconsistent at best;

3. Sampling and analyses were carried out at the height of an exceptionally dry season (linked to the El Nino climatic phenomena). Dilution of pollutants discharged to the River is thus at a minimum and their effect on the river water quality maximum. In the rainy season, the dilution factor will increase;

4. Sampling was programmed between 9:30am and 10:30am which previous studies have identified as being the period of peak waste water discharge to the Maracas River (reference, "Expansion and Integration of Wastewater Systems in Trinidad along the East West Corridor and its Environs" - SAFEGE 2005). Refer to Figure 2.1 below (blue curve - weekday);

5. Caution should therefore be exercised while interpreting the results and this undertaking should be construed as being merely a snapshot of the ambient water Maracas River water quality during the critical period of peak wastewater discharge. Future river flow gauging and water sampling campaigns could be programmed to expand on this exercise and derive trends;

6. Many organisations and countries have attempted to arrive at ambient (river, lake) water quality criteria but have been prevented from producing definitive standards due to the heterogeneous nature of freshwater ecosystems that makes generalisations difficult. Table 2.2 (below) shows criteria that were arrived at by Phillip (1998) by using several criteria that were applicable to freshwater in tropical areas. The criteria compiled by Phillip were used in the assessment of rivers in a fish biodiversity study in Trinidad. Phillip's criteria, which also define three (3) ambient quality classes, include BOD5 but not Faecal Coliform or Total Suspended Solids (TSS);

7. For the purpose of this analysis, use was made of ambient water quality classification proposed by the Loire - Brittany Water Agency - France which uses a complete set of parameters to classify ambient water quality (refer to Tables 2.3 and 2.4 below);

8. TSS values are not significant in the dry season. TSS values should rise significantly in the rainy season as a result of the effect of run off on denuded hillsides and other erodible lands;

9. COD values are normally higher than BOD5 values (COD includes BOD5) and thus, the COD value for the Lower Maracas River - Silver Bridge point is suspicious (COD < 30mg/l and BOD5 = 30.8 mg/l !). Furthermore, all COD results are given as COD < 30mg/l and are thus of little relevance in the analysis;

10. Upper Maracas River:

a. Has reasonably good water quality as regards P2O5 and BOD5 parameters;

b. For BOD5 and P2O5 parameters, it would be classified in Class 1B on a scale of 1A (excellent quality) to HC (very poor water quality) - Reference: Loire - Brittany Water Agency - France (LBWA);

c. It has a NH3 value slightly higher than 0.025mg/l (threshold between Classes 1B and 2);

d. For NH3, Total and Faecal Coliform parameters, it would be classified in Class 2;

e. Overall river water quality classification according to LBWA would be between Classes 1B and 2;

11. Acono River:

a. Water quality is more degraded than that of the Upper Maracas River (for parameters P2O5, NH3, BOD5, Total and Faecal Coliform) but better than that of the lower Maracas River (see bullet point 6 below);

b. For parameter BOD5, the classification according to the aforementioned LBWA is Class 2;

c. The NH3 value is very high and is an indication of contamination by human waste. The NH3 parameter would set it in the HC class (the worst !);

d. The Total and Faecal Coliform counts would classify it in Classes 2 and 3 respectively;

e. Overall river water quality classification according to LBWA would be between Classes 2 and HC.

12. Lower Maracas River

a. Has a very degraded river water quality according to parameters BOD5, NH3, Total and Faecal Coliform counts;

b. The NH3 value is very high and is an indication of contamination by human waste;

c. BOD5 value is close to that of targets for treated sewerage !! (Water Pollution Rules - 2001, discharge into Inland Surface Water – Refer to Appendix 2);

d. The NH3 and BOD5 parameters would set it in the HC class (the worst);

e. The Total and Faecal Coliform counts would classify it in Classes 2 and 3 respectively;

f. Overall river water quality classification according to LBWA would be between Classes 3 and HC.

13. If Philip's classification is used, river water quality can be classified as follows:

    a. Upper Maracas River:

        i. Clean for NH3;

        ii. Perturbed for BOD5.

    b. Acono River:

        i. Clean for NH3;

        ii. At the threshold of Perturbed and Very Polluted for BOD5.

    c. Lower Maracas River:

        i. Clean for NH3;

        ii. Very Polluted for BOD5.

14. When comparing Loire Brittany Water Agency and Phillip's classification, it is somewhat surprising that Phillip uses relatively high NH3 values which lead to the classification "Clean" for all 3 samples whereas these samples are classified Class 2 for Upper Maracas and Class HC (the worst) for Acono and Lower Maracas;

15. From the above, it is possible to conclude that the use of the ambient water classification from Loire Brittany Water Agency (which uses a larger set of parameters as compared to Phillip's classification) leads to more consistency in the classification of river samples;

16. Microbiology criteria for river bathing are as follows:

    a. Total Coliform (counts 100ml): Guide: 500, Max: 10,000

    b. Faecal coliform (counts 100ml): Guide: 100, Max: 100

    c. Escherichia Coli (counts 100ml): Guide: 100, Max: 2,000

17. Considering the above, none of the samples meet the Faecal Coliform requirement and thus, in the dry season, the Lower Maracas River is not suitable for bathing. Some upstream sections of the Acono and Upper Maracas Rivers are probably suitable for bathing and this could be verified via sampling and analyses;

*Figure **Error! No text of specified style in document.**-1 Wastewater flow Measurements 24h period in Maracas Gardens Pilot Area*

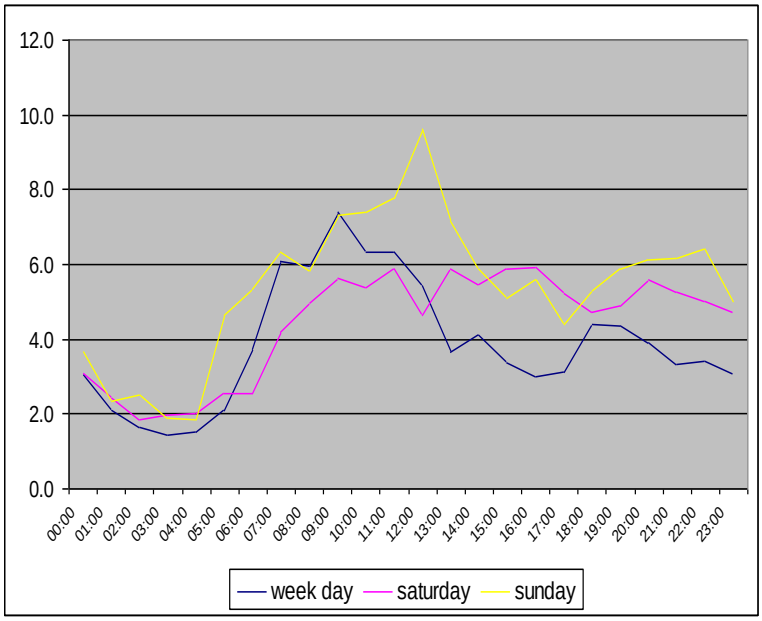


*Table **Error! No text of specified style in document.**-2 General Quality Assessment for Deriving Water Quality of Trinidad and Tobago Rivers (Phillip, 1998)*

PARAMETER	CLEAN	PERTURBED	VERY POLLUTED
BOD_5 (mgl^{-1})	0-4	4-6	>6
pH	6-9	5-6	<5
NH3 (mgl^{-1})	0-1	1-3	>3
P (mgl^{-1})	0-0.12	0.12-0.5	>0.5
Cu (mgl^{-1})	0.001-0.019	0.019-0.050	>0.05
Zn (mgl^{-1})	0.001-0.100	0.1-0.2	>0.2
Oil (mgl^{-1})	0.0-1.0	10-80	>80

*Table **Error! No text of specified style in document.**-3 Ambient Water Quality - Loire Britanny Water Agency – France*

	QUALITY CLASSES	1A	1B	2	3	HC
4a	Temperature °C	20	22	25	30	
5a	pH if TH > 5°F	←	6.5	to	8.5 →	
a	if TH < 5°F	←	6	to	8.5 →	5.5 à 9.
a,e	If active photosynthesis			← 6.5 à 9 →		
6a	**Dissolved O2** mg/1	7	5	3		
7a	**O2** % saturation	90	70	50		
8a	Raw water **BOD5** mg/1 02	3	5	10	25	
9a	**Oxidizability KMnO4** mg/1 O2	3	5	8		
10a	**COD** raw water mg/1 O2	20	25	40	80	
11f	**TSS total** mg/1		25	70	150	
12b	**SO4=** mg/1			250		
13a	**NH4+** mg/1	0.1	0.5	2	8	
14	**NH3** mg/1		0.025		0.08	
15c	**N kjeldahl** mg/1	1	2	3		
16d	**NO2** ¯ mg/1	0.1	0.3	1	2	
17b	**NO3** ¯ mg/1			50	100	
18c	**PO4 =** mg/1	0.54		0.94		
19c	**Anionic detergents** mg/1	0.2		0.5		
29a	**Total iron** mg/1	0.5	1	1.5		
30a	**Total mn** mg/1	0.5	0.25	0.5		
31	**Color** (visual appreciation)	**without special color**		**slightly colored**		**very colored**
32c	**Color** mg Pt/1	10	50	100	200	
33a	**Perceived odor**	non perceptible		slight	strong	
34	**Odor (**dilution factor at 25°C)	3	10	20	100	
35a	**SEC** Substances extractibles					
	chloroform mg/1	0.2	0.5	1		
36a	**Phenols** (index) mg/1		0.001	0.05	0.5	
37a	**Oils and fats**	**absent**		**traces**	**present**	
38b	**CN** ¯ mg/1			0.05		
39b	**Total chromium** Cr mg/1			0.05		
40c	**Fluoride F** ¯ mg/1	0.7		1.7		
41b	**Lead** Pb mg/1			0.05		
42b	**Selenium** Se mg/1			0.01		
43c	**Copper** CU mg/1		0.05	1		
44b	**Arsenic** AS mg/1		0.05	0.1		
45b	**Cadmium** Cd mg/1			0.005		
46b	**Mercury** Hg mg/1			0.001		
47c	**Total Coliforms** N/100 ml	50	5000	50000		
48c	**Faecal Coliforms** N/100 ml	20	2000	20000		
49c	**Faecal Streptococci** N/100 ml	20	1000	10000		

*Table **Error! No text of specified style in document.**-4 Ambient Water Quality - Loire Britanny Water Agency – France*

Water Quality Classes		
1A		Excellent
1B		Good
2		Average
3		Poor
HC		Very Poor

CALCULATION OF POLLUTION LOADS DISCHARGED TO THE RIVER

METHODOLOGY

After the analysis of river flows and river water quality, the next step consisted in the calculation of pollutant loads discharged to the river.

The basic principles are as follows:

1. At a given site, for a given parameter: Measured River Flow (m3/h) x Measured River Quality (kg/m3) = Calculated Pollution Load (kg/h);

2. Extrapolation over 24hours assumes that sample taken during daily peak river flow (see Figure 2.1 above) and that daily peak factor (dry weather river flow) is 1.3;

3. Note: Measured peak factor for effluent discharge in the Maracas Gardens Pilot Area is 1.8 (reference, "Expansion and Integration of Wastewater Systems in Trinidad along the East West Corridor and its Environs" - SAFEGE 2005);

4. The multiplication factor (in hours) for extrapolating peak loads (in kg/h) to daily loads (in kg/day) is thus: (1/1.3) x 24 = 18 hours;

5. Measured unit per capita loads for the various pollutants (derived from aforementioned SAFEGE Study - 2005) is as follows:

    a. Unit per capita load TSS = 90 g/c/day

    b. Unit per capita load PT = 9 g/c/day

c. Unit per capita load NTK = 2 g/c/day

d. Factor NH3/NTK = 0.6

e. Unit per capita load NH3 = 1.2 g/c/day

f. Unit per capita load COD = 115 g/c/day

g. Unit per capita load BOD5 = 58 g/c/day

h. Unit per capita flow = 450 l/c/day

6. For a given site and for a given parameter, calculation of Equivalent Habitants contributing to pollutant discharges (in other words, number of inhabitants discharging effluents directly into the river) is attained by dividing daily pollutant loads (for the said parameter) by unit per capita loads (for the said parameter);

7. For each site, average Equivalent Habitant can then be calculated as the average of Equivalent Habitants calculated for each parameter;

8. For this study, in light of the comments given in Section 2 above and given that NH3 and DBO5 parameters are closely linked to effluent discharge, these two parameters were used for the purpose of calculating Equivalent Habitants discharging directly or indirectly into the three following river sections:

   a. Upper Maracas River;

   b. Acono River;

   c. Lower Maracas River (between junction Upper Maracas / Acono Rivers and Silver Bridge).

× RESULTS

Results for daily load calculations are presented in Table 3.1 below:

*Table **Error! No text of specified style in document.**-5 Calculation of Daily Pollutant Loads kg/day at three (3) Sites*

Location	Flow	Factor	Loads				
			TSS	P2O5	NH3	COD	BOD5
	m3/h	Hour	kg/day	kg/day	kg/day	kg/day	kg/day
Upper Maracas	162	18	6.0	1.4	0.1	89.7	17.9
Acono	90	18	3.3	0.4	0.7	49.8	10.8
Silver Bridge	432	18	8.0	2.4	3.8	239.2	245.6
Upper + Acono					0.8		28.7
Silver Bridge - (Upper + Acono)					3.1		216.9
WWTP Theoretical					0.0		0.0
Other non accounted for (CUC etc.)					3.1		216.9

Results for Equivalent Habitant calculations (discharging effluents to river) are presented in Table 3.2:

*Table **Error! No text of specified style in document.**-6 Calculation of Daily Pollutant Loads Eq/hab at three (3) Sites*

Location	Flow	Factor	Calculation Eq.hab					Average
			TSS	P2O5	NH3	COD	BOD5	
	m3/h	Hour	Eq.hab	Eq.hab	Eq.hab	Eq.hab	Eq.hab	Eq.hab
Upper Maracas	162	18			75		309	**192**
Acono	90	18			567		186	**377**
Silver Bridge	432	18			3,192		4,235	**3,714**
Upper + Acono					642		495	**569**
Silver Bridge - (Upper + Acono)					2,550		3,740	**3,145**
WWTP Theoretical					800		800	**800**
Other non accounted for (CUC etc.)					1,750		2,940	**2,345**

× ANALYSIS – COMMENTS

× Calculation of Population (Equivalent Habitants) Discharges into the Rivers

The above table shows:

1. Close to 200 equivalent habitants discharge effluents directly or indirectly into the Upper Maracas River (before junction with Acono River);

2. Close to 380 equivalent habitants (almost twice as much as in Upper Maracas River) discharge effluents directly or indirectly into the Acono River (before junction with Maracas River);

3. Close to 3,150 equivalent habitants discharge effluents directly or indirectly into the Maracas River between the junction of the Upper Maracas/Acono Rivers and the Silver Bridge;

4. In the river segment considered above, approximately 800 equivalent habitants are connected to 4 dysfunctional package WWTPs as follows:

    a. WWTP Mira Flores 90 Eq/hab

    b. WWTP Maracas Gardens 230 Eq/hab

    c. WWTP Mountain View 280 Eq/hab

    d. WWTP Poolside 200 Eq/hab

5. Therefore, the number of equivalent habitants (outside the four developments listed above) discharging into the Lower Maracas River segment is close to 2,350. This figure is very high and worrying !

6. After site visits were carried out along that river section, it can reasonably be inferred that part of these 2,350 equivalent habitants are within the University of Southern Caribbean (USC). Indeed, three discharges of seemingly poorly treated sewage from USC were observed on the day of the survey (15th March 2010);

7. Direct sampling of these three points (USC discharges to river) as well as sampling from the four dysfunctional WWTPs (listed above) should be undertaken as a matter of urgency to ascertain the precise contribution of these major pollutant sources (considering the low dilution capability of the river in the dry season) ;

8. The Water Pollution Rules - 2001 enacted in 2006 (Refer to Appendix 2) have mechanisms for pollutant declaration, permitting and monitoring which should be used in this instance.

× Evaluation of Strength of Effluent Discharges into the Maracas River

Based on the measurements and analyses undertaken on 15 March 2010, an attempt was made to evaluate the strength (pollutant concentration) of the sewage effluents discharged into the Maracas River in the segment comprised between the junction of the Acono and Maracas Rivers and the Silver Bridge.

This constitutes an indirect assessment of the pollution loads as opposed to a direct assessment which in any case should be undertaken as a matter of urgency (refer to section 3.3.3 below).

1. Between the junction of the Upper Maracas River / Acono River and the Silver Bridge, the Maracas River was receiving (during the exercise held on 15-3-2010) 50 l/s (equivalent to 180 m3/hr) of effluent discharges;

2. By comparing the water quality (BOD5 parameter) at the junction and that at the Silver Bridge, it is possible to calculate by difference the average BOD5 concentration (in mg/l) of the 180 m3/hr effluent discharges;

3. The calculation gives an average BOD5 concentration of 65 mg/l for the 180m3/hr effluent discharge;

4. It is reminded that the Water Pollution Rules - 2001 (EMA) define permissible levels (maximum values) of water pollutants for effluent discharges into the environment. For BOD5, the permissible levels are:

    a. 30mg/l for discharge into inland surface waters (should apply in Maracas River);

    b. 50mg/l for discharge into coastal nearshore;

    c. 100mg/l for discharge into marine offshore

    d. 10mg/l for discharge into an Environmental Sensitive Area;

5. The calculated average level of BOD5 (180m3/hr effluent discharge) is thus more than twice the permissible level and violates the stipulations of the Water Pollution Rules - 2001;

6. However, finger pointing and mitigation measures will have to be preceded by the precise identification of the culprit(s) based on effluent monitoring from suspected pollutant sources;

7. As mentioned above, the suspected major pollutant sources in the section of river considered are the four dysfunctional wastewater treatement plants (Mountain View, Maracas Gardens, Mira Flores, Poolside), discharges from USC (including College Health Foods) and possibly other polluters not yet identified.

× Water Pollution Rules 2001 (EMA)

Regarding the Water Pollution Rules - 2001 (EMA):

1. They were finally enacted in 2006 and the registration process of water polluters commenced in 2007 (still ongoing);

2. If pollutant discharges into the environment are within the permissible limits, the applicant is given a Registration Certificate by the EMA;

3. If pollutant discharges into the environment are above the permissible limits, the applicant enters the Permitting Process whereby:

    a. Effluents are monitored (measured and analysed) over a period of time;

    b. A plan for the gradual decrease of pollutant discharges to the environment is agreed upon between the EMA and the applicant;

    c. The EMA establishes in each permit:

        i. The water pollutants authorised to be released;

        ii. The quantity, conditions and concentrations the permittee may release;

        iii. The exact location where the sampling of teh release shall be performed;

        iv. Reporting requirements

4. It is my understanding that the GoRTT (EMA) is gradually extending the Water Pollution Rules across Trinidad and Tobago on a catchment basis rather than on a sectorial basis;

5. They have recently been focusing on East Port Of Spain and have also been tackling quarries;

6. WASA adopted in 2005 the wastewater plants run by public entities (NHA etc...). However, there are approximately 200 privately run package wastewater plants in Trinidad and Tobago (including the 4 package plants in lower Maracas Valley mentioned above), most of which are in a dire state of disrepair;

7. Recently, WASA has launched consultancy tenders to refurbish the package wastewater treatment plants with the objective to adopt some of them (the most critical ?). Mountain View wastewater treatment plant (the worst performing WWTP in Maracas Valley) has been earmarked for refurbishment and adoption by WASA

CONCLUSIONS - RECOMMENDATIONS

CONCLUSIONS

The main conclusions are presented hereafter:

1. A river gauging and water sampling exercise was carried out in Maracas Valley on the 15th March 2010 in the midst of a severe dry season where the impact of direct and indirect effluent (wastewater) discharge to the river is maximum (dilution factor negligible);

2. Three sites were monitored namely:

    a. Upper Maracas River (upstream junction with Acono River);

    b. Acono River (upstream junction with Maracas River);

    c. Lower Maracas River (upstream Silver Bridge).

3. River flows (instantaneous flows) were respectively:

    a. **Upper Maracas River: 45 l/s**

    b. **Acono River: 25 l/s**

    c. **Lower Maracas River: 120 l/s**

4. The above measurements were taken between 9:30am and 10:30am considered to be the period of peak effluent discharge to river (refer to Figure 2.1 above extracted from "Expansion and Integration of Wastewater Systems in Trinidad along the East West Corridor and its Environs" - SAFEGE 2005);

5. For the purpose of this analysis, use was made of **ambient (river) water quality classification proposed by Phillip** (General Quality Assessment for Deriving Water Quality of Trinidad and Tobago Rivers - Trinidad 1998) and the **classification proposed by the Loire - Brittany Water Agency** - France which uses a complete set of parameters to classify ambient water quality (refer to Tables 2.3 and 2.4 above). The latter classification produced more consistent results than that of Phillip;

6. As regards classification of river water quality:

    a. **Upper Maracas River: Overall river water quality classification according to LBWA is between Classes 1B and 2;**

    b. **Acono River: Overall river water quality classification according to LBWA is between Classes 2 and HC;**

c. **Lower Maracas River: Overall river water quality classification according to LBWA is between Classes 3 and HC;**

7. None of the samples meet the Faecal Coliform requirement for river bathing (Max count 100ml: 100) and thus, in the dry season, **the Lower Maracas River is not suitable for bathing**. Some upstream sections of the Acono and Upper Maracas Rivers are probably suitable for bathing and this could be verified via sampling and analyses;

8. Close to **200 equivalent habitants discharge effluents directly or indirectly into the Upper Maracas River** (before junction with Acono River);

9. Close to **380 equivalent habitants (almost twice as much as in Upper Maracas River) discharge effluents directly or indirectly into the Acono River** (before junction with Maracas River);

10. Close to **3,150 equivalent habitants discharge effluents directly or indirectly into the Maracas River between the junction of the Upper Maracas/Acono Rivers and Silver Bridge**;

11. Field visits revealed a number of poorly treated effluent discharges into the Maracas River of which three originated from USC campus;

8. It is reminded that the Water Pollution Rules - 2001 (EMA) define permissible levels (maximum values) of water pollutants for effluent discharges into the environment. For BOD5, the permissible levels are 30mg/l for discharge into inland surface waters (should apply in Maracas River);

9. On 15-3-2010, **the calculated average level of BOD5 effluent discharge into the section of the Maracas River** comprised between the junction of Acono and Maracas Rivers and the Silver Bridge **is 65mg/l thus more than twice the permissible level and violates the stipulations of the Water Pollution Rules - 2001**;

12. **Direct sampling of these three points (USC discharges to river)** as well as **sampling from the four dysfunctional WWTPs** (listed above) **should be undertaken as a matter of urgency** to ascertain the precise contribution of these major pollutant sources (considering the low dilution capability of the river in the dry season). This would be the first step towards the identification/development of mitigation measures to lower the negative impact of these discharges to the Maracas River and the riverine environment.

× RECOMMENDATIONS

As regards actions towards the restoration of the water quality of the Maracas and Acono Rivers, the following could be undertaken:

1. Determine what is the staus of the suspected polluters (4 package planst + USC + College Health Foods) with regards to the Water Pollution Rules. Have they registered with the EMA and have they obtained a a Registration Certificate or a Permit ?

2. If not (as it is most probable), invite the suspected polluters to register with the EMA and pressure the latter to initiate the permitting process;

3. As shown above, the current effluent discharges to the lower Maracas River violate permissible levels set by the Water Pollution Rules and dry season measurements have shown that the river is not suitable for bathing;

4. To give impetus to the permitting process, measurements (initiated by EMA or directly by polluter or by default by MVAC) should be carried out at the discharge point to ascertain the precise pollutant loads discharged to the environment;

5. This should then inform the permitting process and assist with the development of mitigation plans to reduce pollutant discharges to the environment (minimization of liquide waste and construction of functional package sewerage plants);

6. WASA could be approached to ascertain the refurbishment schedule for the Mountain View WWTP. Pressure could be applied for the Authority to adopt the other three WWTPs (Maracas Gds, Mira Flores, Poolside) as only WASA has the capacity to effectively run and maintain these plants;

7. Ultimately, as package plants rarely perform well and are a burden to the operations of a utility, the laying of a sewer line (with pump stations) along the Maracas Royal Road should be undertaken. Comprehensive plans and designs for the sewerage of the East West Corridor (Mount Hope to Sangre Grande including Maracas Valley) have been developped by Consultants in 2004-2005 for WASA. As of today, implementation has not yet begun !!!

8. These actions are long overdue and it is time that we reclaim our rivers !!!

Stéphane Quash

Hydraulic Engineer

MVAC Project Committee Member

April 2010 - St Joseph

Appendix 1 CARIRI Service Project Report – 29th March 2010

Appendix 2 Water Pollution Rules 2001 - EMA

ANALYSIS OF WATER SUPPLY IN MARACAS VALLEY MAY 2010

CONTENTS

LIST OF TABLES

× OBJECTIVES

The objectives of this report are:

1. To determine the status of water supply in Maracas Valley in 2007 and 2010;
2. To evaluate the effect of the current 2010 dry season on water supply in Maracas Valley;
3. To evaluate the effect of the proposed Ortinola Quarry on Maracas Valley water supply:
    a. In 2010;
    b. In 2015.

This report presents successively:

5. The 2007 water balance (water supply versus water demand);
6. The 2010 water balance (water supply versus water demand):
    a. In the rainy season;
    b. In the dry season;
7. The effect of the proposed Ortinola Quarry on the:
    a. 2010 water balance;
    b. 2015 water balance.
8. Conclusions & Recommendations

× SUMMARY OF WATER BALANCE (WATER SUPPLY VERSUS WATER DEMAND)

The table summarizing the water balance in Maracas Valley (water supply versus water demand) at various horizons and with varying hypotheses is given hereafter:

*1. Table **Error! No text of specified style in document.**-7 Summary Water Balance Maracas Valley (Water Supply versus Water Demand)*

No	Designation	Without Ortinola Quarry			With Ortinola Quarry		
		2007	2010		2010		2015
			Dry Season	Rainy Season	Dry Season	Rainy Season	
1	Water Supply (m3/day)	5,800	3,700	5,800	3,700	4,700	4,700
2	Water Demand (m3/day)	6,100	6,500	6,500	6,500	6,500	6,400
3	Water Balance (1 - 2) (m3/day)	- 300	- 2,800	- 700	- 2,800	- 1,800	- 1,700
4	Water Balance Deficit / Surplus in % (= 3 / 1)	- 5%	- 76%	- 12%	- 76%	- 38%	- 36%
5	Comments	Near Equilibrium	Very Large Deficit	Slight Deficit	Very Large Deficit	Important Deficit	Important Deficit

The detailed calculations are reported in Sections 2 to 4. Conclusions and recommendations are given in Section 5.

WATER SUPPLY VERSUS WATER DEMAND IN 2007

WATER SUPPLY

Maracas Valley is fed by two water supply systems namely:

1. Acono Water Works;
2. Lluengo Water Works.

Measurements carried out in June 2007 (transition period in terms of rainfall) gave the following average daily water supplies:

1. Acono Water Works:
    a. Well: 1,712 m3/day
    b. River Intake: 1,079 m3/day (from the Ortinola River only)
2. Lluengo Water Works:
    a. River Intake: 2,937 m3/day
    b. Rural supply: 36 m3/day

Total Acono: 2,791 m3/day

Total Lluengo: 2,973 m3/day

Grand Total Water Supply: 5,764 m3/day (rounded to 5,800 m3/day)

WATER DEMAND

The 2007 water demand can be calculated as follows:

1. Maracas Valley Population in 2000 (CSO Census 2000): 9,803 inhabitants
2. Estimated Maracas Valley Population (MVAC) in 2007: 11,300 inhabitants[3]

[3] Based on population estimates of 11,800 in 2009 and assuming linear progression between 2000 and 2009

3. Per Capita Water Demand (WASA Guidelines - 2003): 350 litres/person/day

4. Water Consumption Maracas Valley: 3,955 m3/day

5. Leakage @35% of water supply (national average 50% - 60%): 2,129 m3/day

6. Total Water Demand in Maracas Valley (3+4): 6,084 m3/day

Grand Total Water Demand: 6,084 m3/day (rounded to 6,100 m3/day)

× WATER BALANCE (SUPPLY VERSUS DEMAND)

As the above figures show, the 2007 water supply balance was at a near equilibrium as water supply (5,800 m3/day) practically equated water demand (6,100m3/day). This assertion is further vindicated by the fact that water production figures given were those measured in June 2007 (a transition month in terms of rainfall and water production) and that monthly water production figures are usually higher in the rainy season.

However, that near equilibrium is contingent upon the following assumptions:

1. Population in Maracas Valley in 2007 was effectively in the vicinity of 11,300 inhabitants;

2. Water transfers outside the valley (St Joseph Hill)[4] were not significant when compared with volumes supplied within the valley itself;

3. Leakage levels at 35% of water supply were below the national average (50% to 60% of water supply).

The last two assumption are somewhat optimistic as it is very probable that:

1. Water transfers to the St Joseph Hill (up to Caiman Road before Medical Associates) did account for a non negligible part of water production in 2007;

2. Leakage levels were closer to the national average.

Thus, in 2007, water demand (= water consumption + leakage) probably exceeded water supply and the water supply system was at a (slight) deficit.

[4] No figures available from WASA for these water transfers to the St Joseph Hill

WATER SUPPLY VERSUS WATER DEMAND IN 2010

WATER SUPPLY

Obtaining 2010 water production figures from WASA has proven to be a challenge as a result of the tight communications strategy adopted by the Authority.

Some production figures for the Acono and Lluengo Water Works were however obtained for 2010 (first four months). The valley's total water production levels does not significantly differ from that of 2007 though there has been an increase in water production from the Lluengo water works and a decrease in production from the Acono water works (probably due to the drying up of Ortinola River in the dry season).

Thus, the 2010 Grand Total Water Supply is in the viscinity of 5,800 m3/day.

It should however be noted that as a result of the severe drought experienced in 2010:

1. The Acono River (from Coosal Quarry) is currently (May 2010) dry;
2. The level of the Ortinola River is currently below the crest of WASA's intake weir and caption of the Ortinola River is sporadic at best;
3. The capacity of the Acono Water Works (during the current dry season) is thus substantially reduced and measurements have given (April 2010): 981 m3/day;
4. Meanwhile, the dry season capacity of the Lleungo water works have not substantially reduced and have been measured (April 2010) at 2,744 m3/day;
5. Thus, the Grand Total Water Supply (2010 dry season) is :3,725 m3/day (rounded to 3,700 m3/day)

WATER DEMAND

The 2010 water demand can be calculated as follows:

1. Maracas Valley Population (Estimates 2009): 11,800 inhabitants[5]
2. Maracas Valley Population (Estimates 2010): 12,021 inhabitants[6];

[5] Derived from ongoing UNDP financed study "Issues of Sustainable Development for Maracas Valley"
[6] Assuming a linear progression between 2000 and 2010

3. Per Capita Water Demand (WASA Guidelines - 2003): 350 litres/person/day
4. Water Consumption Maracas Valley: 4,207 m3/day
5. Leakage @35% of water supply (national average 50% - 60%): 2,265 m3/day
6. Total Water Demand in Mcs. Valley (3+4): 6,472 m3/day

Grand Total Water Demand: 6,472 m3/day (rounded to 6,500 m3/day)

× WATER BALANCE (SUPPLY VERSUS DEMAND)

× Rainy Season

1. Water Supply: 5,800 m3/day;
2. Water Demand: 6,500 m3/day.

The 2010 rainy season water balance shows a 12% deficit (of water supply) as water demand (6,500 m3/day) exceeds water supply (5,800 m3/day).

× Dry Season

2. Water Supply: 3,700 m3/day;
3. Water Demand: 6,500 m3/day.

The 2010 dry season water balance shows an important 76% deficit as water demand (6,500 m3/day) exceeds water supply (3,700 m3/day).

This important dry season deficit results in:

1. Increased water shortages;
2. Increased water scheduling;
3. Lower network pressures;
4. Reduced water quality as a result of soil water ingress into non pressurised pipelines via leaks;
5. Generally, reduced level of water supply service.

It should also be noted that if water transfers from Maracas Valley to the St Joseph Hill[7] are taken into account, the 2010 dry and rainy season deficit would be even higher.

× IMPACT OF THE PROPOSED ORTINOLA QUARRY OF THE WATER SUPPLY OF MARACAS VALLEY

× 2010 WATER SUPPLY WITH ORTINOLA QUARRY

It can safely be predicted that the Ortinola Quarry will spell the "death sentence" of WASA's river intake on the Ortinola River and that only the Acono well would be operational in future (at Acono Water Works).

Indeed, the preceding sections have shown that in its present near pristine state, the Ortinola River catchment has capacity limitations as the river has run dry in the height of the exceptional 2010 dry season. The opening of the proposed 17acres quarry in Ortinola will exacerbate the already precarious situation and result in:

1. A decrease in river base (dry season) flows as a result of reduced infiltration in the catchment and;

2. An increase in river peak (wet season) flows as a result of run-off from the quarry.

This prediction is supported by the tangible effects of present quarrying activities in Acono. Indeed, Coosal's quarrying operations have led WASA to abandon their second Acono River Intake (on branch of river passing through Coosal's quarry) as a result of the degradation of river water quality both in dry and rainy season, notwithstanding the sediment traps installed by Coosal.

Moreover, whenever the Acono River (from Coosal's quarry) overflows into the Ortinola River (upstream of WASA's intake on the Ortinola River) during significant rainy events, WASA is obliged to interrupt water abstraction from the Ortinola River due to the severe degradation of river water quality.[8]

In the event of such a scenario (opening of the Ortinola River), the water supply of Maracas Valley would be reduced to:

1. Acono Water Works: 1,712 m3/day (well only)

2. Lluengo Water Works: 2,973 m3/day (unchanged)

[7] No figures available from WASA
[8] Attributable to high levels of suspended solids (TSS parameter) from run-off from Coosal's Quarry.

Future Grand Total Water Supply: 4,685 m3/day (rounded at 4,700 m3/day)

This represents a 19% (rounded to 20%) reduction in the water supply capacity of Maracas Valley (currently 5,800 m3/day).

Regarding Coosal's Quarry, there is little scope to reclaim the river while quarrying operations are ongoing. Coosal is currently using most of the river water upstream of the quarry for his operations (including washing agregates, equipment and tools etc.). This process water is then sent back to the Acono River after having transited in basins which act as sediment traps. These sediment traps do not seem to be very effective as the Acono River dowstream of Coosal quarry has a high turbidity content and the situation is exacerbated when it rains and there is run off from the quarry (denuding the hillside for quarrying has impeded infiltration and exacerbated runoff and erosion).

Having said that, it should be mandatory for quarry operators to bear the cost of land reclamation on closed or non productive sections of the quarry (this is the case in many countries). This could include land grading and re-vegetation, improvement of sediment traps so as stem runoff and erosion and improve infiltration. These measures will likely take a few years to bear fruit after which WASA might be able to reclaim to some extent the Acono river water which flows past Coosal' s quarry .

2010 Water Balance with Ortinola Quarry

The 2010 water balance with the Ortinola Quarry would be as follows:

Rainy Season

1. Water Supply: 4,700 m3/day
2. Water Demand: 6,500 m3/day

With the Ortinola Quarry, the 2010 rainy season water balance shows a 38% deficit as water demand (6,500 m3/day) exceeds water supply (4,700 m3/day).

Dry Season

With the Ortinola Quarry, the dry season water supply is calculated as follows:

1. Acono Water Works (well only) : 981 m3/day;
2. Lluengo Water Works: 2,744 m3/day;
3. Thus, the Grand Total Water Supply (2010 dry season) is :3,725 m3/day (rounded to 3,700 m3/day)

The water balance (2010 dry season with Ortinola Quarry) is thus:

1. Water Supply: 3,700 m3/day
2. Water Demand: 6,500 m3/day

With the Ortinola Quarry, the 2010 dry season water balance shows a 76% deficit as water demand (6,500 m3/day) exceeds water supply (3,700 m3/day).

Comments

The impact of the Ortinola Quarry would therefore have severe repercussions on the water supply of Maracas Valley as the relative equilibrium between water supply and water demand enjoyed in 2007 and the 12% deficit calculated in 2010 (rainy season) would evolve into a:

1. Rainy season 2010: 1,800 m3/day deficit (38% of water supply);
2. Dry season 2010: 2,800 m3/day deficit (76% water deficit)

The above deficits are probably higher when water transfers from Maracas Valley to the St Joseph Hill are taken into account.

The water supply deficit attributable to the proposed Ortinola Quarry would also exacerbate the 2010 water deficit observed in the dry season as a result of reduced infiltration and diminishing well yields at WASA's Acono Water Works though it is difficult to quantify such an effect at this stage..

With the Ortinola quarry, chronic water shortages, scheduled water supply, reduced water quality, increased incidenses of water borne diseases etc. would become a common occurence in Maracas Valley which has enjoyed up to now a relatively good water supply.

WASA has already officially expressed concern over the quarrying plans in Ortinola.

2015 WATER BALANCE WITH ORTINOLA QUARRY

2015 Water Demand

The 1990 census gave 8,080 inhabitants in Maracas Valley and the 2000 census 9,803. That represents a 21% increase (more than 4 times the national average over the same period !)..

The 2010 population was estimated at 12,020 inhabitants (rounded to 12,000) on the basis of a count of new residences completed since 2000 within the valley9. This is equivalent to a 23% increase and seems to be a conservative figure.

Also, based on the inventory of new housing schemes in the pipeline, an additional 3000 inhabitants are expected in the valley at horizon 2015.

The total anticipated population in Maracas Valley in 2015 is thus: 15,000 inhabitants.

The following hypotheses are also made for 2015:

1. Per Capita Water Demand is reduced to 300 litres/person day as a result of the introduction of Universal Metering and higher water tariffs.[10]

2. Leakage is reduced to 30% of water supply as a result of an aggressive leakage reduction campaign by WASA;

3. Maracas Valley continues to rely on the two sources within the valley (Acono and Lluengo water works) and no new water resources from within or from outside the valley are made available.

2015 Water Demand can thus be estimated as follows:

1. Maracas Valley Population (2015 estimate): 15,000 inhabitants

2. Per Capita Water Demand: 300 litres/person/day

3. Water Consumption Maracas Valley: 4,500 m3/day

4. Leakage @30% of water supply: 1,929 m3/day

5. Total Water Demand in Mcs. Valley (3+4): 6,429 m3/day rounded to 6,400 m3/day

Grand Total Water Demand 2015: 6,400 m3/day

× 2015 Water Supply with Ortinola Quarry

As shown in Section 4.1, the future water supply with the proposed Ortinola Quarry is 4,700 m3/day.

[9] Derived from ongoing UNDP financed study "Issues of Sustainable Development for Maracas Valley"

[10] The RIC (Regulated Industries Commission) should be issuing a determination on increased water rates shortly.

2015 Water Balance with Ortinola Quarry

In 2015, the impact of the Ortinola Quarry would negatively affect the water balance of Maracas Valley as follows:

1. 2015 Water Supply: 4,700 m3/day
2. 2015 Water Demand: 6,400 m3/day
3. 2015 Water Deficit (1-2): 1,700 m3/day (36% of 2015 water supply)

It is again confirmed that in 2015, the Ortinola Quarry would continue to have severe repercussions on the water supply of Maracas Valley notwithstanding the fact that leakage levels and per capita water use are expected to fall.

It is illusory to believe that a more substantial reduction of leakage levels could be achieved by WASA in Maracas Valley by 2015 thus augmenting volumes for consumption. Achieving water balance equilibrium in 2015 would indeed require reducing leakage levels from the present 40% to 6% !!!!! (national average 50% - 60%). In other words, mission impossible for WASA which is already overstretched with 40,000 leak repairs per year and ineffective leakage control policies and practise (especially as regards invisible leaks).

CONCLUSIONS & RECOMMENDATIONS

CONCLUSIONS

The WASA operated Acono and Lluengo water works currently provide water supply to Maracas Valley and sections of the St Joseph Hill. Despite intermittent water shortages in some areas and chronic water supply problems in other areas (Upper Warf Trace for example), Maracas Valley currently enjoys a reasonably good water supply.

In 2007, the water balance (water supply versus water demand) was at a near equilibrium. As a result of population increase, no meaningful action on water wastage and leakage, the water deficit augmented to 12% in 2010 (rainy season).

The exceptional 2010 dry season has however further increased the water supply deficit which has been estimated at 76% of water production. This is however not a systemic problem but a seasonal one and the situation should improve with the onset of the rainy season.

The proposed Ortinola quarry would have serious repercussions on the water supply of Maracas Valley as it would lead to the closure of the river intake at the Acono Water Works thus reducing WASA's water supply capacities in Maracas Valley by 19% (if no new water sources within the valley are tapped or no water transfers from outside the valley are mobilised).

With the Ortinola Quarry, the 2010 water deficit has been calculated at 38% of water supply in the rainy season and 76% of water supply in the dry season !! This last figure is deemed to be conservative and the deficit in the dry season would probably be higher as a result of reduced yields at the Acono well, a consequence of reduced infiltration rates due to quarry operations at Ortinola.

In 2015, notwithstanding the anticipated drop in leakage levels and per capita water use, the Ortinola Quarry would continue to have severe repercussions on the water supply of Maracas Valley as the 2015 deficit has been calculated in the vicinity of 36%.

It is illusory to believe that a more substantial reduction of leakage levels could be achieved by WASA in Maracas Valley by 2015 thus augmenting volumes for consumption. Achieving water balance equilibrium in 2015 would indeed require reducing leakage levels from the present 40% to 6% !!!!! (national average 50% - 60%). In other words, mission impossible for WASA which is already overstretched with 40,000 leak repairs per year and ineffective leakage control policies and practise (especially as regards invisible leaks).

Also, there is limited scope to tap new surface water resources within the valley as this would lead to the virtual drying up of the Maracas River during periods of drought. Indeed, measurements carried out in March 2010 at confluence of Upper Maracas and Acono Rivers gave 45 l/s in the Upper Maracas River and 25 l/s in the Acono River (and this includes non negligible elements of waste-water).

Finally, reclaiming (for water supply purposes) the Acono River which passes through Coosal's quarry calls for major undertakings which realistically, will only be achieved once quarrying operations have been scaled down and site remediation measures have been implemented (landscaping with backfilling and grading, improving site drainage and sediment traps, revegetation and reforestation etc…).

The above does not preclude (quite the contrary), the quarry operator (Coosal) from taking effective steps to reduce the amount of river water abstracted for his daily operations, to improve site drainage/sediment traps thus reducing current levels of sediments discharged to the Acono River.

To conclude, current quarry operations have reduced WASA's water supply capacity within Maracas Valley (at Acono Water Works) and thus contribute to the current water deficit.

The opening of a new quarry at Ortinola would definitely condemn WASA's intake on the Ortinola River, further reduce WASA's water supply capabilities at Acono and aggravate the water supply deficit in the valley. From an exporter of water to neighbouring areas (St Joseph Hill), Maracas Valley would become a net importer of potable water to limit the severe water supply deficit. Where this water would come from is presently unknown as other areas of the East West Corridor are already on scheduled water supply and are experiencing water deficits.

× RECOMMENDATIONS

The following recommendations are given:

1. Preserving WASA's water supply capacity within Maracas Valley (Acono and Lluengo water works) is of prime importance as importing water into the valley from neighbouring catchments is both expensive and currently not feasible due to the severe water deficit experienced in most areas of the East West Corridor;

2. This objective is in line with Maracas Valley's role as an important water catchment within the Northern Range. This role is currently being severely challenged as a result of unchecked development within the valley (including hillsides with slopes greater 1 in 4), abusive land use practises (slash and burn agriculture, deforestation etc…);

3. The observed increase in river peak flows and the degradation of river water quality over the last decades are a testimony of the degradation of the Maracas Valley water catchment with less infiltration, more runoff and erosion;

4. Maintaining the present capacity of WASA's Acono and Luengo water works requires the abandonment of the proposed Ortinola Quarry which would invariably spell the death sentence of WASA's catchment on the Ortinola River due to increased runoff and turbidity in the rainy season and diminished river base flows in the dry season. The sorry state of the Acono River which runs through Coosal's Quarry bears testimony to this prediction;

5. Take energetic steps to reclaim the Acono River which passes close to Coosal's Quarry by reducing water abstraction for quarrying operations, improving drainage and effectiveness of sediment traps, remedial landscaping (including backfilling and grading), reduction of run-off etc. These measures are compulsory for quarry operators in many countries;

6. More aggressive leakage control (especially as regards invisible leaks) and the introduction of universal metering should be actively pursued by WASA as it would result in effective water demand management (reduction in leakage levels on WASA's mains and water wastage at customer premises);

7. Universal metering should be rolled out by WASA in 2010 starting with areas with 24/7 water supply. Maracas Valley areas which qualify should thus be included in this important exercise;

8. The above should somewhat improve the water balance though it is acknowledged that some water mains are beyond repair and should be replaced (it does not always make economic sense to systematically repair the same main on a regular basis). When annual cost of leakage repairs (combined with the production cost of lost water) exceeds the annual depreciation cost of a new pipeline, it is cost effective to change the pipeline;

9. Some areas of Maracas Valley suffer from chronic water shortages (upper Warf Trace for example). The installation of a booster and a water tank midway up Acono hill would alleviate this problem. WASA should address this issue as a matter of emergency;

10. Generally speaking, a reliable source of water supply is a basic human requirement which impacts on health, comfort levels and living standards. The fact that Maracas Valley, one of the prime water catchments of the Northern Range, cannot sustain its own potable water requirements speaks lengths on the relentless pace of unchecked urbanization and the continued degradation of the water catchment. This should be reversed as a matter of urgency with special emphasis on water catchment protection, greater control and regulation of housing developments, implementation of check dams to stem runoff and increase infiltration, reforestation, reforestation or terracing of cultivated hillsides etc.

11. Though sewerage has not directly been addressed in this paper, it is inseparable from the water supply issue and has a direct impact on the river water quality, especially in the dry season. Currently (2010), only 7% of the valley's population is connected to a sewerage package plant, 93% relying on household sanitation (septic tanks and soakaways). Unfortunately, the four package plants operating in the valley are poorly designed, operated and maintained and this results in discharges of poorly treated sewerage into the Maracas River. Also, as attested during site visits conducted in March 2010, a number of large institutions (including USC) discharge poorly treated sewerage directly into the Maracas River. Measurements have shown that BOD5 (a parameter indicative of biodegradable pollution) discharges to the Maracas River levels between the Acono junction and the Silver bridge are twice as high as the maximum levels given in the Water Pollution Rules - 2001. Theses rules are thus violated with impunity and the Maracas River is unfit for bathing.;

12. The River water quality should be restored with the following measures:

a. WASA should adopt the four package sewerage plants (Mountain View, Mira Flores, Maracas Gardens and Poolside) as only the Authority has the knowhow and the resources to rehabilitate, operate and maintain these plants;

b. Discharges of raw sewerage from households and major institutions within the valley should be discontinued and closely monitored by the EMA as they constitute a direct violation of the water pollution rules;

c. Gradually, the master plan for the sewerage of the East West Corridor (including the Maracas Valley catchment) is implemented by WASA. This plan includes laying a sewerage main (and lift stations) under the Maracas Royal Road and replacing the existing package plants with lift stations. Residences relying on household sanitation systems would gradually be connected to this new sewerage system. A major waste-water treatment plant (WWTP) would be built by WASA south of the East West Corridor (Bamboo site proposed for a major WWTP);

Stéphane Quash

Hydraulic Engineer

MVAC Project Committee Member

May 2010 - St Joseph

TRAFFIC COUNT REPORT

MARACAS ROYAL ROAD

AND

RIVERSIDE ROAD

July 2010

1.0 INTRODUCTION

This report outlines the results of classified traffic counts undertaken on the Maracas Royal Road and Riverside Road in St. Joseph. The report has been prepared for the use of the Maracas Valley Action Committee (MVAC).

In November 2007, MVAC undertook a traffic survey in which the number and distribution of vehicles using the Maracas Royal Road and Riverside Road was determined. The results of that traffic count were presented in a report dated November 2007. In November and December 2008, additional counts were done as a follow up to determine the trends in the traffic patterns within the valley. Those results are included in a report dated February 2009. In February 2010 additional counts were undertaken. The results of the 2010 traffic counts are presented in this report and they are compared to the data obtained in the previous counts.

The Terms of Reference were developed in discussions with members of the committee. The primary objectives of the study are as follows:

- Determine the daily traffic count volumes on the Maracas Royal Road
- Determine the peak traffic volumes on the Maracas Royal Road
- Determine the percentage of trucks and other heavy vehicles utilizing the road

- Determine the percentage of trucks and heavy traffic traversing Bridge 1/1 (Silver Bridge)
- Compare the data from 2010 with the data obtained in previous years.

2.0 METHODOLOGY

The automatic traffic counts were carried out using a MetroCount © vehicle classifier system. Each vehicle has a minimum of two axles. E.g. motor cars have two axles, trucks and other heavy vehicles may have multiple axles. The axle movements are detected by means of two parallel pneumatic tubes installed across the road. The direction of the vehicle is determined by the sequence of the impact, i.e. which tube is impacted first. The size of the vehicle is determined by the weight of the axle and the time between the impact of the front and other subsequent axles.

The pneumatic tubes are connected to an electronic roadside unit, which stores all wheel impacts on the tubes. The information stored in the roadside unit is then downloaded to a computer after the completion of the counts in the area.

The 2010 traffic counts on the Maracas Royal Road and Riverside Road were taken between Friday February 5, 2010 and Tuesday February 9, 2010.

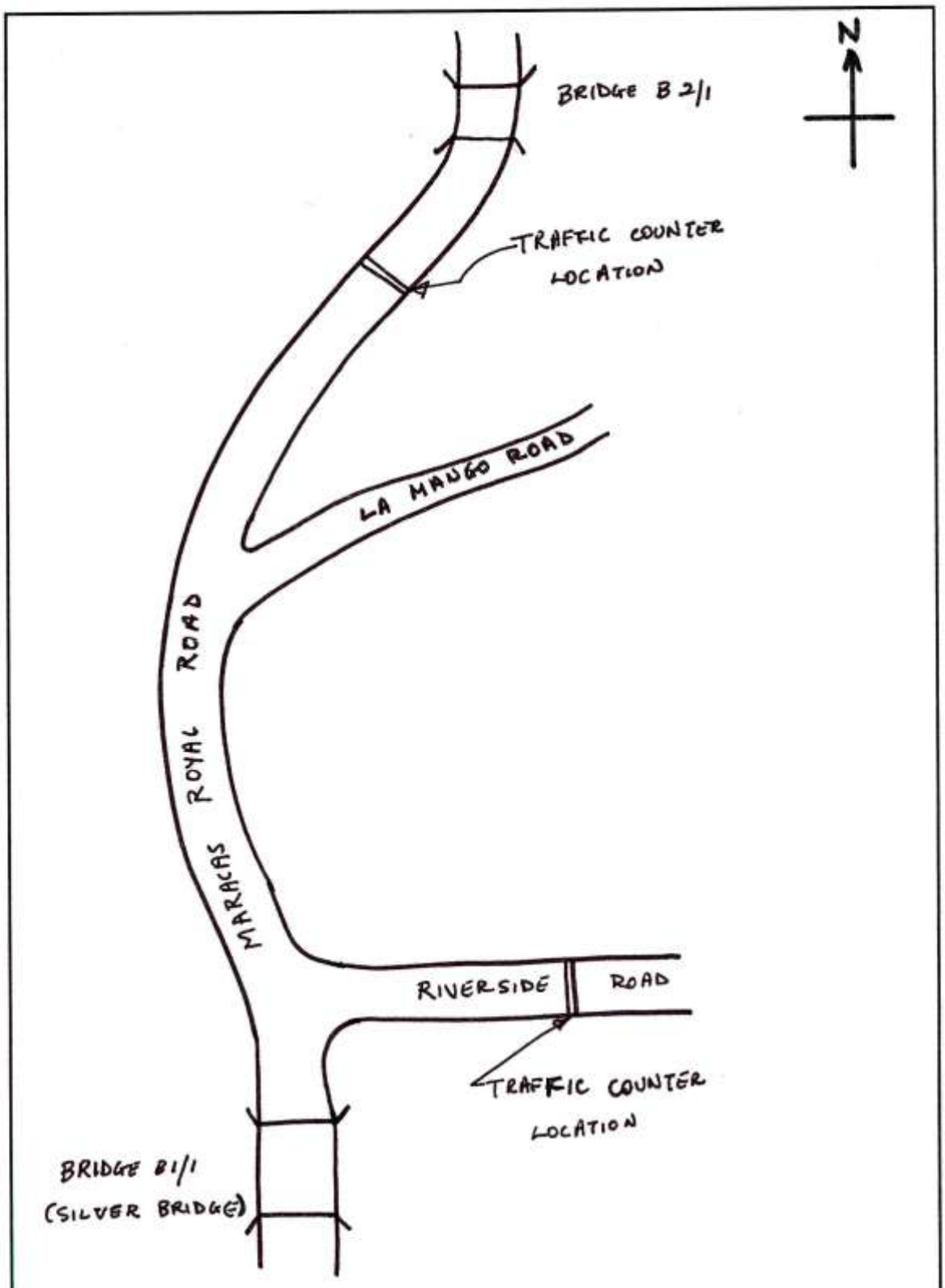
The details of the location of the counters and the exact hours between which readings were taken for the 2007 counts, the 2008 counts and the 2010 counts are given in Table 1. The locations are shown on Figure 1.

Table 1 Traffic Count Locations and Times

Road	Location	Start date	End Date	Start Time	End time	Duration (hours)
Maracas Royal Ro	180m north of Bridge B1/1 Silver Bridge 30 m south of Bridge B 2/1	Feb. 5, 2010	Feb. 9, 2010	9.46am	10.30am	96.75
Maracas Royal Rd.	180m north of Bridge B1/1 Silver Bridge 30 m south of Bridge B 2/1	Nov. 3 2008	Nov. 7, 2008	2.10pm	11.25am	93.8
Maracas Royal Rd.	180m north of Bridge B1/1 Silver Bridge 30 m south of Bridge B 2/1	Oct. 31, 2007	Nov. 2, 2007	11:15am	15:10pm	51.9
Riverside Road	85 m east of intersection with Maracas Royal Road	Feb. 5, 2010	Feb. 9, 2010	9.38am	10.50am	97.4
Riverside Road	85 m east of intersection with Maracas Royal Road	Dec. 3, 2008	Dec. 10, 2008	12.00 Noon	10.05 am	166.1
Riverside Road	85 m east of intersection with Maracas Royal Road	Oct. 31, 2007	Nov 2, 2007	11:40am	15.14	51.4

The choice of locations of the traffic counters is intended to get the traffic count on the Maracas Royal Road and the split of traffic on Riverside Road and Abercromby Street St. Joseph. Ideally to accomplish this, the traffic counters should have been placed as close as possible to the intersection between these two roads. However, for the proper functioning of the counters, the section of road should be reasonably straight in both directions. The closest location north of the intersection was just north of La Mango Road. Therefore the traffic from this community was not reflected in the count on the Maracas Royal Road. However, based on the size of this community, it is anticipated that the volumes from this community are relatively small in relation to the other traffic on the Maracas Royal Road. Therefore the error thus generated would have been in an acceptable range.

For the 2010 counts, the traffic counters were set up to take four full days of counts on the Royal Road and on Riverside Road. The days for the traffic counts (Friday to Tuesday) were chosen to capture both the weekday activity as well as the weekend activity. The counts were also done at a time when schools would be in session as the traffic generated in transporting children to and from school is significant.



LOCATION PLAN FOR TRAFFIC COUNTERS | FIGURE 1

3.0 RESULTS

3.1 Traffic Volumes

Maracas Royal Road

The traffic counts showed the following for the Maracas Royal Road. For ease of reference, the 2010 figures are italicized and highlighted.

	Parameter	
	Southbound	
2010	***Average daily weekday Traffic***	***7756***
2008	Average Daily Weekday Traffic (Nov 4-6 2008)	7804
2007	Total daily traffic (Thur. Nov. 1, 2007)	7619
	Percentage increase from 2007 to 2010	1.01%
2010	***Morning Peak hourly volume***	***759***
2008	Morning Peak hourly volume	739
2007	Morning Peak hourly volume	738
2007/2008	Time of morning peak	7:15-8:15
2010	***Afternoon Peak hourly volume***	***549***
2008	Afternoon Peak hourly volume	545
2007	Afternoon Peak hourly volume	506
2008	Time of peak hourly volume	18:45-19:45
	Northbound	
2010	***Average Daily weekday traffic***	***7718***
2008	Average Daily Traffic (Nov 4-6 2008)	7786
2007	Total daily traffic (Thursday Nov. 1, 2007)	7554
	Percentage increase from 2007 to 2010	1.02%
2010	***Morning Peak Volume***	***487***
2008	Morning Peak hourly volume	493
2007	Morning Peak hourly volume	451
2007/2008	Time of peak hourly volume	8:00-9:00
2010	***Afternoon Peak Hourly Volume***	***728***
2008	Afternoon peak hourly volume	680
2007	Afternoon peak hourly volume	646
2007/2008	Time of afternoon peak hourly volume	15:15-16:15

The above data is shown on Figures 1 and 2. The counts showed that the traffic in the Maracas Valley has two daily peaks. These take place during the hours of the morning commute and also in the hours of the afternoon commute.

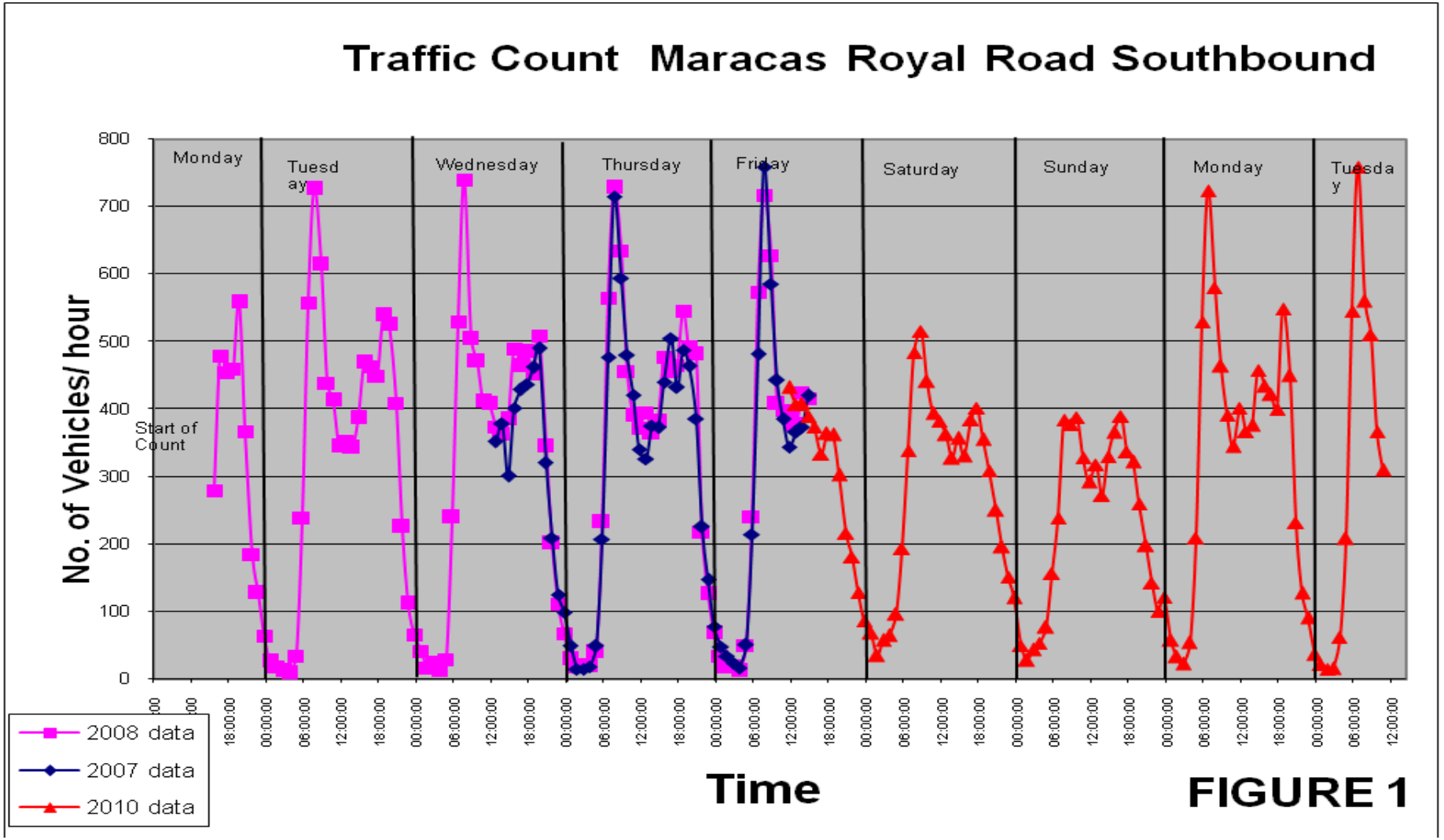

Traffic Count Maracas Royal Road Southbound
No. of Vehicles/ hour
800
700
600
500
400
300
200
100
0
Start of Count
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Monday
Tuesday
2008 data
2007 data
2010 data
Time

FIGURE 1

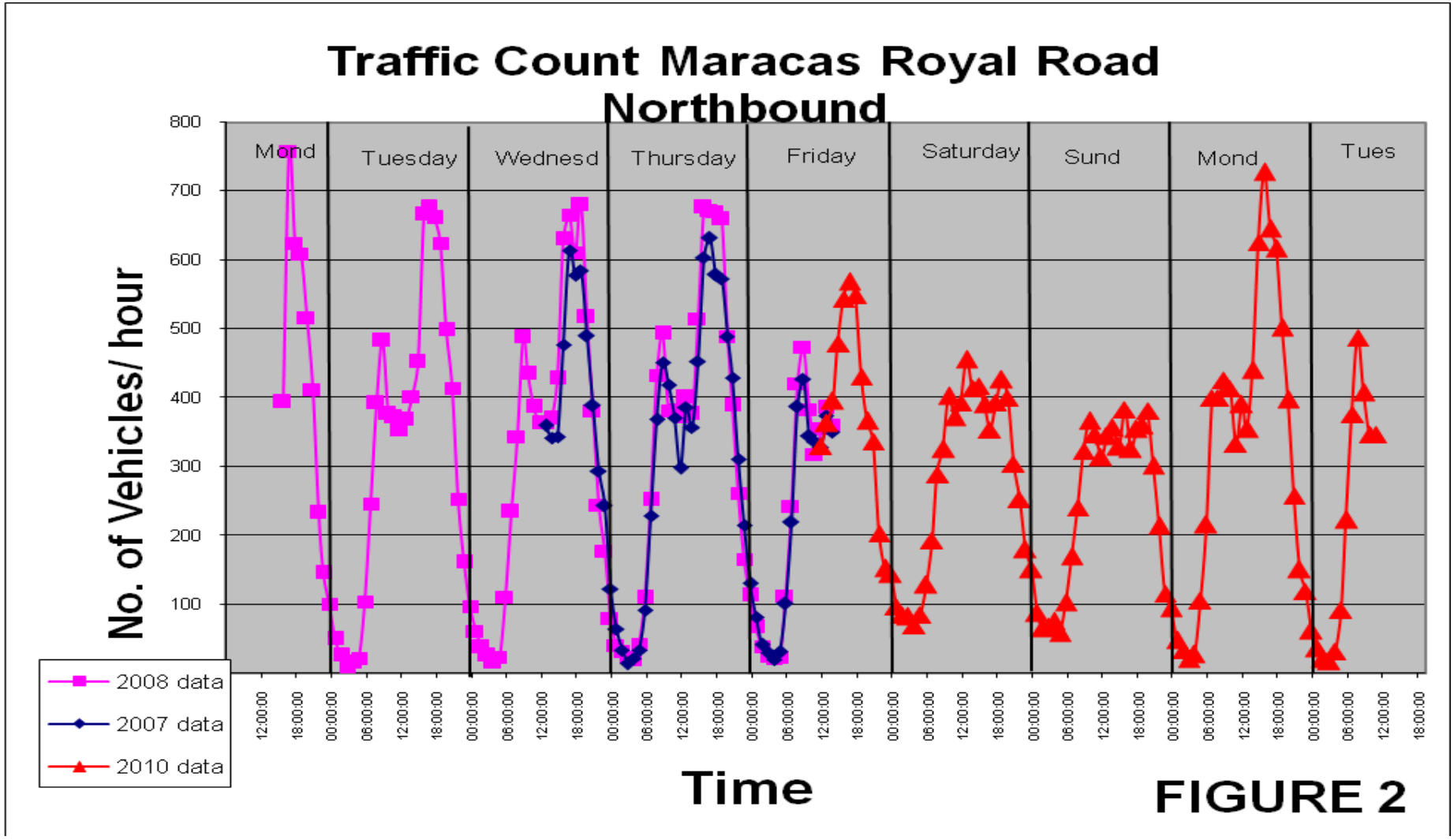

Traffic Count Maracas Royal Road
Northbound
No. of Vehicles/ hour
800
700
600
500
400
300
200
100
Mond
Tuesday
Wednesd
Thursday
Friday
Saturday
Sund
Mond
Tues
2008 data
2007 data
2010 data
12:00:00
18:00:00
00:00:00
06:00:00
Time

FIGURE 2

The morning peak is more concentrated and has a higher volume than the afternoon peak. This is consistent with a wider spread of time over which persons return home. This trend is consistent with the fact that the Maracas Valley tends to have dormitory communities and few employment opportunities. Therefore most of the traffic is generated by persons who live in the valley but who commute to work and school outside of the valley.

It should be noted that there was a slight decrease in the total traffic volume between 2010 and 2008. However the decrease is less than 1% and is therefore not considered to be statistically significant.

Riverside Road

The traffic counts showed the following for the Riverside Road

	Parameter	**Value**
	Eastbound	
2010	**Average Weekday Traffic**	**1718**
2008	Average Weekday Traffic	2054
2007	Total daily traffic (Thur. Nov. 1, 2007)	3772
	Percentage decrease from 2007 to 2010	54.4
2010	**Morning Peak hourly volume**	**240**
2008	Morning Peak hourly volume	253
2007	Morning Peak hourly volume	361
	Time of morning peak	7:15-8:15
2010	**Afternoon peak hourly volume**	**131**
2008	Afternoon peak hourly volume	242
2007	Afternoon Peak hourly volume	294
	Time of afternoon peak hourly volume	14:00-15:00
	Westbound	
2010	**Average weekday traffic**	**2586**
2008	Average Weekday Traffic	2441
2007	Total daily traffic (Thur. Nov. 1, 2007)	3585
	Percentage decrease from 2007 to 2010	27.9
2010	**Morning Peak hourly volume**	**317**
2008	Morning Peak hourly volume	253
2007	Morning Peak hourly volume	404
	Time of peak hourly volume	7:15-8:15
2010	**Afternoon Peak Hourly Volume**	**239**
2008	Afternoon Peak hourly volume	242
2007	Afternoon Peak hourly volume	279
	Time of afternoon peak hourly volume	17:30-18:30

This information is shown graphically on Figures 3 and 4.

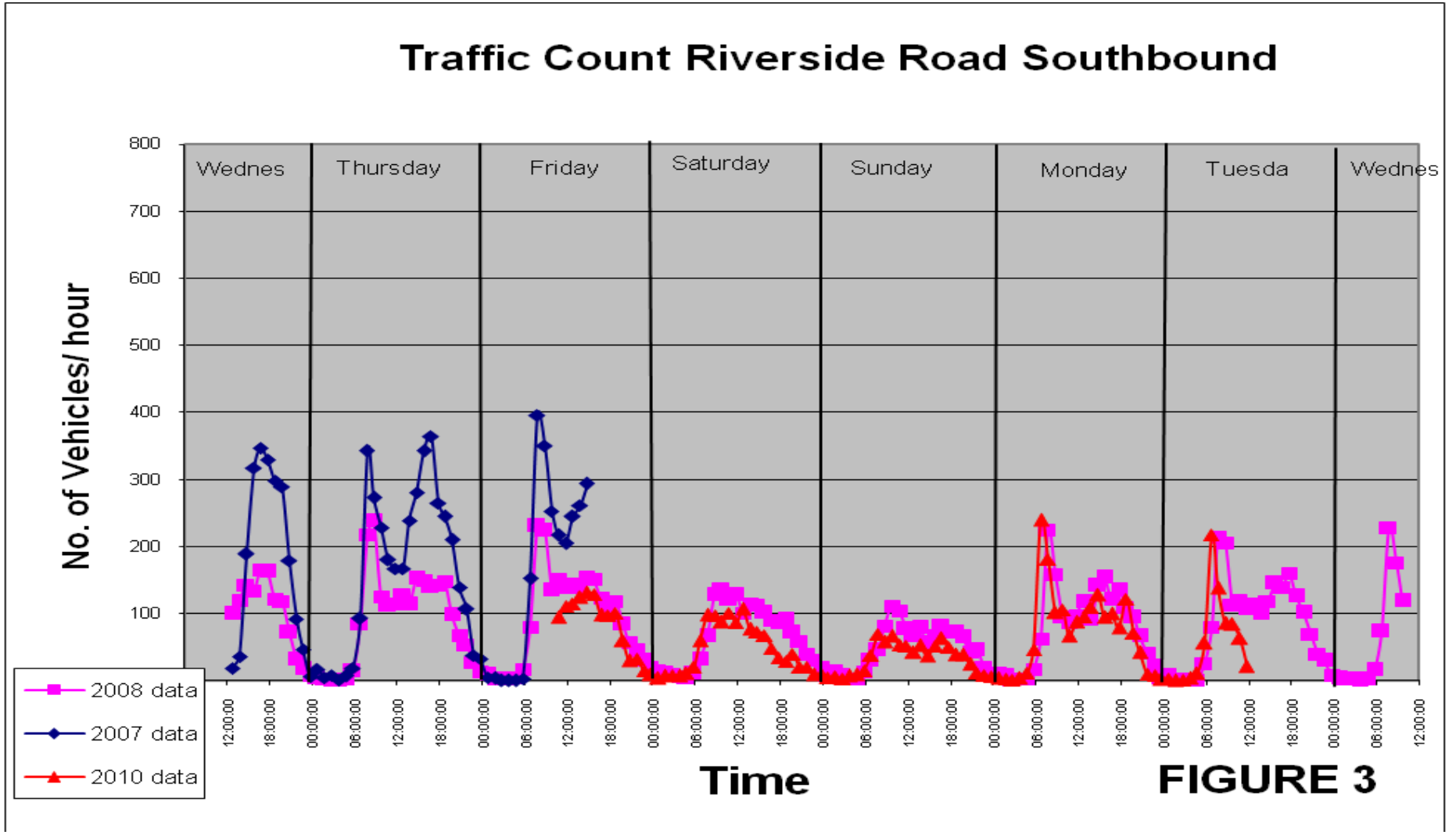

Traffic Count Riverside Road Southbound
No. of Vehicles/ hour
800
700
600
500
400
300
200
100
Wednes
Thursday
Friday
Saturday
Sunday
Monday
Tuesda
Wednes
2008 data
2007 data
2010 data
12:00:00
18:00:00
00:00:00
06:00:00
Time

FIGURE 3

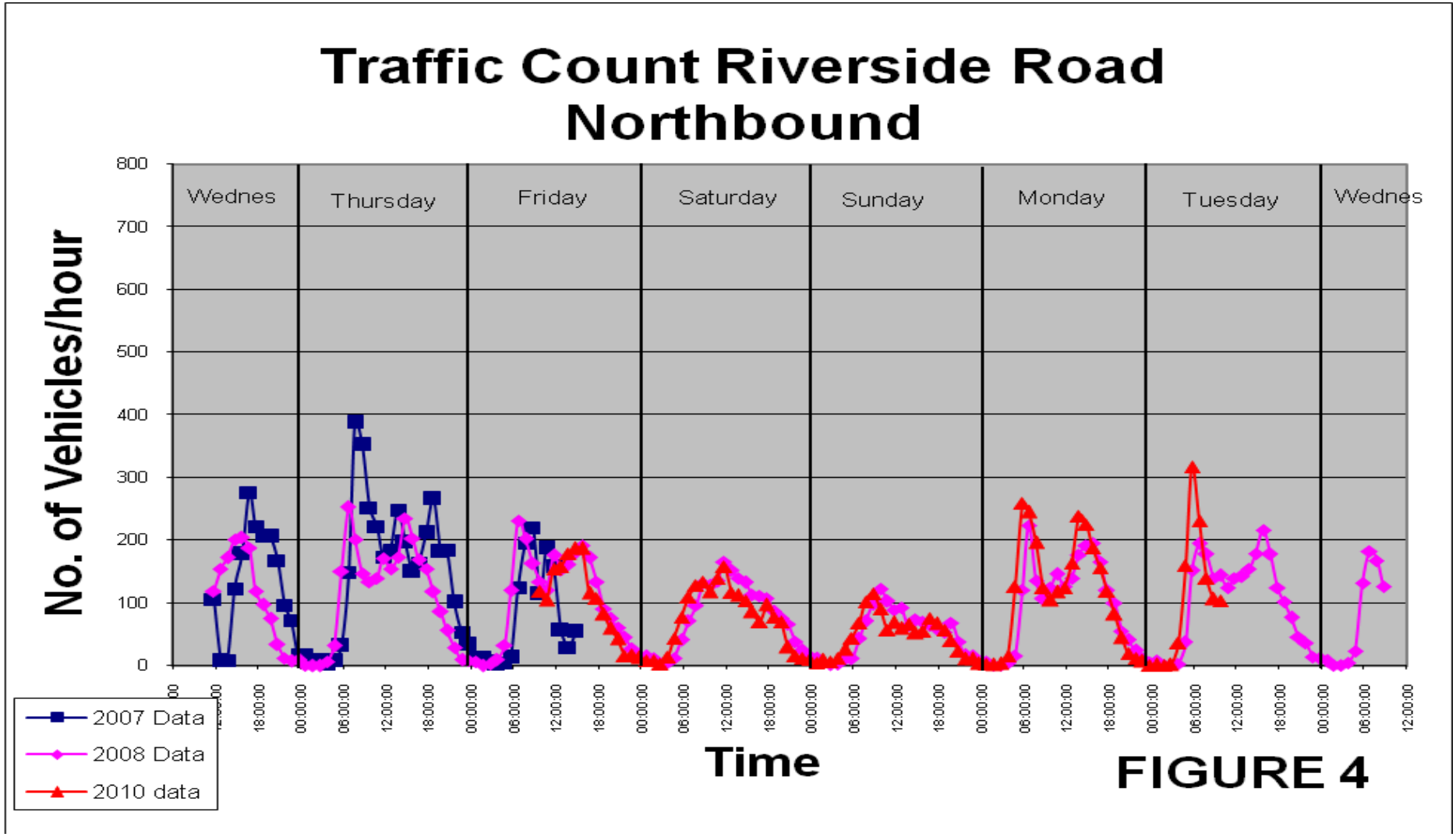

Traffic Count Riverside Road
Northbound
No. of Vehicles/hour
800
700
600
500
400
300
200
100
0
Wednes
Thursday
Friday
Saturday
Sunday
Monday
Tuesday
Wednes
2007 Data
2008 Data
2010 data
Time

FIGURE 4

The counts on Riverside Road showed the same pattern of a morning and an afternoon peak as the Maracas Royal Road. What was very significant to note was that there was a reduction in the traffic on Riverside Road between 2007 and 2010. In the eastbound direction, (towards Curepe) this reduction is by 54.4%. In the westbound direction (towards the valley) this reduction was by 27.9%.

This trend was also observed in the 2008 readings. It suggests that commuters are opting to utilize Abercromby Street in St. Joseph as the main route to exit the Maracas Valley.

3.2 Vehicle Classification

The classified counts showed the following percentages of vehicles:

Year	Road	% Motor cycles	% Cars and pickups	% Trucks and other heavy vehicles
2010	**Maracas Royal Road (Weekdays)**	**0.1**	**96.6**	**3.3**
2008	Maracas Royal Road (Weekdays)	0.2	82.3	17.5
2007	Maracas Royal Road (Weekdays)	0.1	95.4	4.5
2010	Maracas Royal Road Weekend	**0.1**	97.1	2.8
2010	**Riverside Road (Weekday)**	**0.0**	**94.1**	**5.9**
2008	Riverside Road (Weekdays)	0.1	92.3	7.6
2007	Riverside Road (Weekday)	0.5	90.8	8.7
2010	**Riverside Road (Weekend)**	**0.0**	**93.4**	**6.6**
2008	Riverside Road (Weekends)	0.1	97.0	2.9

The data shows that there is a significant increase in heavy truck traffic on the Maracas Royal Road between 2007 and 2008, however there was a significant decline in truck numbers in 2010.

4.0 DISCUSSION

4.1 Road Capacity

The capacity of any road is based on several factors, related to the geometry of the road and the type of usage.

In an ideal situation, a two lane road with a lane width of 3.5m, a hard shoulder, and simple vertical and horizontal geometry (i.e. flat and relatively straight) and few intersections would have a theoretical capacity of 2,000 vehicles per hour in any direction. However, as the situation deviates from the ideal, the capacity needs to be reduced to reflect the actual conditions.

For the Maracas Royal Road, reductions in the theoretical capacity would have to be made because of the following factors.

1. The average lane width is less than 3.5m.
2. The road has no shoulder therefore the safe driving speed is reduced.
3. The road has complex horizontal geometry (it is winding).
4. There are areas where the grade is in excess of 6%.
5. The road has areas in which the sight distance is reduced both in the horizontal (blind corners) and vertical plane (areas where the road has small peaks or valleys which prevents the driver from seeing vehicles in the distance).
6. There are a number of minor access roads into communities.
7. There are a number of driveways to residences.
8. There are several small businesses with no parking spaces on the side of the road.
9. There is friction to traffic especially in the vicinity of the more built-up areas in the valley. Simply put, if there is a parked or stopped vehicle, there is a reduction in the effective width of the road into a single lane road.

Taking all of these factors into account, the theoretical capacity of the road is estimated at between 800 to 1000 vehicles per hour.

The morning peak hourly volume has been in the south bound direction. Between 2007 and 2010 the peak hourly volume has

increased from 738 to 759 vehicles. This means that during the peak morning hour, the road is operating at close to capacity.

4.2 Comparison of Data for 2007 to 2010

The data has shown that there has been a slight increase in the total traffic volume on the Maracas Royal Road between 2007 and 2008 (between 2.5% and 3.1%) but there was a decrease between 2008 and 2010 of just over 1.2%.

Between 2007 and 2008 there was a significant increase in the percentage of heavy vehicles on the Maracas Royal Road. This increase is from 4.5% in 2007 to 17.5% in 2008. However by February 2010, there was a significant drop in the percentage to 3.3%. The increase between 2007 and 2008 and the subsequent decrease in 2010 is a clear barometer of the construction activity within the country. In 2008, there was a peak in construction activity within Trinidad. However due to the global economic downturn and its subsequent effect on the Trinidad economy, there has been a reduction in construction 2010. As a result, the changes in the volume of truck traffic are likely attributable to the increased and subsequent decrease in quarrying activity in the Maracas Valley arising from the changes in demand for aggregate for the construction sector.

The data however shows a significant decrease in the traffic volumes on Riverside Road. In 2008, it was believed that this could have been the result of decreased traffic in December 2008. However the continuing trend suggests that there may be some change in driver behaviour resulting in drivers exhibiting a preference to using Abercromby Street St. Joseph over Riverside Road.

5.0 CONCLUSIONS

1. Based on the characteristics of the road, the estimated capacity of the Maracas Royal Road is between 800 to 1000 vehicles per hour.

2. There are two daily peaks on the Maracas Royal Road consistent with the morning and afternoon commute periods.

3. The morning peak is spread out over a two hour period, whereas the afternoon peak is spread out over a three hour period.

4. At the morning peak, the Maracas Royal Road has approximately 750 vehicles in the southbound lane. The road is therefore operating close to the peak capacity.

5. There was a significant increase in truck traffic on the Maracas Royal Road between 2007 and 2008, but an equally significant decrease between 2008 and 2010.

6. Future traffic monitoring is strongly recommended.

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APPENDIX A

TRAFFIC COUNT DATA FOR MARACAS ROYAL ROAD

APPENDIX B

TRAFFIC COUNT DATA FOR RIVERSIDE ROAD

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Vision: *Growing leaders….influencing positive behavioral changes*

Qualitative Economic Cost Assessment

Of

The MVAC/UNDP Project

Issues of Sustainable Development of the Maracas Valley

Consultant: Indera Sagewan-Alli
Research Assistant: Kavita Maharaj

June 2010

TABLE OF CONTENT

1.0 Introduction

Environmental degradation is defined as damage to the natural ecosystem such that it can no longer revert to its natural state without active and costly rehabilitation by humans. In most cases it is caused by human activity, such as deforestation, unsustainable agricultural practices, unplanned development, as well as by natural events such as hurricanes and droughts.[11] The consequential damage is evidenced by decreasing levels of biodiversity, soil quality, resilience against floods, and assimilative capacity of the environment to pollution,[12] all of which can have negative socio-economic effects on people and requires an assessment of both biophysical and socio-economic dimensions.

Where there is evidence of such environmental degradation it is important to find ways not only to determine the exact nature and causes of the damage so that measures to both curb and rehabilitate can be effected, but also to employ methods to quantify the damage whether quantitatively or qualitatively. This latter exercise is particularly vital for policy formulation as it provides hard estimates of the lost to an entire country of mismanagement of its natural environmental endowment.

The purpose of this study is therefore to develop and where possible apply a methodology for estimating the environment degradation which has occurred in the Maracas Valley as part of the overall UNDP funded project "Issues for Sustainable Development of the Maracas Valley". The study will therefore;

1. Review established International literature and methodologies for economic cost assessment of environmental degradation

[11] Land Degradation in the Caribbean (FAO, Rome. 2005)
[12] EMA SOE 2001 an 2002

2. Design a methodology for calculating the economic costs of environmental degradation for the valley
3. Where data allows, apply the methodology to the findings of the overall UNDP/MVAC project
4. Make recommendations for policies which would guide future development, especially with respect to Maracas Valley.

2.0 Economic Cost Assessment

The cost of environmental degradation can be understood as a measure of lost welfare of a nation due to environmental degradation. Such a loss in welfare includes (but is not necessarily limited to)[13]

1) Loss of healthy life and well-being of the population (e.g.: premature death, pain and suffering from illness, absence of a clean environment, discomfort).

2) Economic losses (e.g.: reduced soil productivity and reduced value of other natural resources, lower international tourism).

3) Loss of environmental opportunities (e.g.: reduced recreational value for lakes, rivers, beaches, forests).

A State of the Environment Report prepared by the Environmental Management Authority of Trinidad and Tobago (2004) identified the following forces currently affecting the Maracas Valley;

a) Demographic: urbanization and pressure for housing space.
b) Economic: search by some groups for livelihoods and housing space; increasing Incomes by others creating demand for superior housing sites
c) Land use: permitted land use inconsistent with land capability studies and

[13] Maria Sarraf "Cost of Environmental Degradation, The Case of Lebanon and Tunisia (World Bank, DC. 2004)

Characteristics; unauthorized housing and agriculture (slash-and-burn)

d) Institutional: lack of rules or rigorous application in planning and authorization of developments
e) Cultural: increased demand for recreational opportunity; misuse of environment; Lack of understanding, care and sensitivity by users.
f) Environmental: increasing variability in weather patterns.
g) Public policy: lack of holistic plan; absence of co-ordination; ineffective management; no monitoring or accountability for impacts.

The Millennium Ecosystem Assessment programme under the United Nations[14] devised the framework known as the Millennium Ecosystem Assessment Conceptual Framework for use in measuring the impact of environmental degradation. It identified five key components of human well–being; (MA 2005).

1. Basic material needs for a good life
2. health
3. good social relations
4. security,
5. freedom and choice

The Northern Range assessment conducted by the EMA adapted aspects of human well-being from the MA framework and selected for priority attention:[15]

a) Livelihoods
b) Housing
c) Health and nutrition
d) Recreation
e) Personal/environmental security

In assessing the impact of environmental degradation in the Maracas Valley, we will use these aspects as our reference points.

14 For more information on the Millennium Ecosystem Assessment, see the Millennium Ecosystem Assessment website - www.millenniumassessment.org.

3
15 EMA SOE report 2004.

A Lebanon and Tunisia study that examined the cost of environmental degradation provides the following three step approach to valuing environmental degradation:[16]

1) Quantification of environmental degradation (e.g. monitoring of ambient air quality, river/lake/sea water quality, soil pollution).

2) Quantification of the consequences of degradation (e.g. negative impacts on health from air pollution, changes in soil productivity, changes in forest density/ growth, reduced natural resource based recreational activities, reduced tourism demand)

3) A monetary valuation of the consequences (e.g. estimating the cost of ill health, soil productivity losses, reduced recreational values).

Any robust valuation of the impact of environmental degradation must include both the biophysical and the socio-economic dimensions. Economists have developed a range of indices to measure the various consequences of environmental degradation. In the final analysis, it is for the analyst to determine which methods are best suited to the specific variables under study.

2.1 Economic Cost Indices/Measurement

Economic cost assessment of environmental degradation is a new and emerging area of analysis. Given the challenges in both identifying and quantifying with precision the negative outcomes of environmental degradation, a range of indices and methods of estimations have evolved each with its inherent advantages and disadvantages. In this

[16] Maria Sarraf "Cost of Environmental Degradation, The Case of Lebanon and Tunisia (World Bank, DC. 2004

section we present a range of such indices which economist use in quantifying the cost of environmental degradation. In any estimation, the objective is to determine the

2.1.1 Total economic value (TEV)

Any project or policy that destroys or depreciates an environmental asset needs to include in its costs the TEV of the lost asset. Similarly, in any project or policy that enhances an environmental asset, the change in the TEV of the asset needs to be counted as a benefit. Economists have the following range of indices.

2.1.2 Revealed preference valuation

This describes a range of approaches to estimate the economic value of non market or intangible impacts of environmental degradation. These methods use market information and behaviour to infer the economic value of an associated non-market impact. The World Bank developed two approaches to revealed preference valuation; the dose-response function approach and the "behavioural" approach.

The dose-response function estimates the impacts of the environmental change in quantitative terms (for example, cases of illness avoided, improvements in visibility, or changes in agricultural yield) and then estimates a monetary value. Valuation usually proceeds by multiplying the impact by a price or unit monetary value (such as hourly wage in the case of illness avoided, crop price in the case of changes in yield). Alternatively a 'willing-to-pay' for avoiding the damage (WTP) could be used. This would require people to understand the epidemiology or atmospheric chemistry linking damage to physical effect therefore rendering it a more difficult method.

The second measure values people's behavioural reaction to the environmental change, regardless of the existence of an impact, such as a change in health or productivity. For example, water quality changes may not result directly into changes in health. The response in this case can be observed in individuals buying more bottled water for drinking purposes or individuals purchasing houses in 'cleaner' neighbourhoods. When environmental degradation is 'revealed' in an observable change in people's behaviour, we refer to revealed preferences techniques.

In some cases, environmental preferences are not evident from people's choices. Some categories of values cannot be observed either in the market place or through some implicit price of related marketed goods. Imagine the value of the 'panda bear': no markets exist to buy or sell panda bears and few people go all the way to China to see one. Still, conservation NGOs has been raising funds for their protection. People are indeed willing-to-pay simply for the existence of an environmental good or service or a natural resource, regardless of being able to ever use or directly enjoy it. The contingent valuation method (CVM) elicits these types of value through the application of surveys. The CVM can be also used for consumed environmental goods (i.e. water) when no market prices exist and data on observed behaviour is difficult to obtain.

2.1.3 Stated preference valuation: contingent valuation

Stated preference techniques of valuation utilise questionnaires which either directly ask respondents for their willingness to pay (accept), or offer them choices between "bundles" of attributes and from which choices the analysts can infer "willingness to pay" (WTP) or "willingness to accept" (WTA). Generally WTP is the preferred approach. Stated preference methods more generally offer a direct survey approach to estimating individual or household preferences and more specifically WTP amounts for changes in provision of (non-market) goods, which are related to respondents' underlying preferences in a consistent manner.

The Contingent valuation method enables economic values to be estimated for a wide range of commodities not traded in markets. This method uses survey techniques to establish the value of goods and services that are not exchanged in markets and therefore have no prices associated with them. The CVM involves asking a randomly chosen sample of people what they are WTP for a clearly defined change in the provision of a good or service, or to prevent a change. It can also be used to elicit what people are willing-to accept (WTA) to forgo a change or tolerate a change. The most commonly applied approach in the CVM is to interview people and ask them what they are WTP towards the preservation of that asset. Analysts can then calculate the average WTP of respondents and multiply this by the total number of people who enjoy the environmental site or asset in question to obtain an estimate of the total value which people have for the asset.

2.1.4 Health and life Valuation

This involves assessing the "value of a statistical life" (VOSL). One of the main issues has been how to "transfer" VOSLs taken from non-environmental contexts to environmental contexts. Non-environmental contexts tend to be associated with immediate risks such as accidents. In contrast, environmental contexts are associated with both immediate and future risks such as the impact on heath of quarrying and air pollution. This suggests *a)* that valuations of immediate risk might be transferred to environmental immediate risk contexts (provided that the perception of the risk is the same) but *b)* future risks need to be valued separately.

Some environmental risks fall disproportionately on the very young and the very old. A complex issue arises with valuing risks to children. This is solved by adults' valuations of the risks *on behalf of* children. The literature on which to base such judgements is only now coming into existence. Preliminary findings suggest that the resulting values of WTP may be higher for adults valuing on behalf of children than they are for adults speaking on behalf of themselves. The safest conclusion at this stage is that bringing the effects on children into the domain of cost benefit analysis is potentially important, with a default position being to use the adult valuations of "own" life risks for the risks faced by children.

2.1.5 Valuing mortality with the human capital approach

The first studies that attempted to attach a monetary value to *mortality* focused on lost productivity and lifetime earnings. Value estimates are obtained by calculating the present discounted value of an individual's lifetime earnings. The attraction of this approach is its ease of definition and calculation. Some obvious problems with this approach include the lack of applicability to unemployed individuals, children, and the elderly, and the use of interpolated "earnings" for housewives derived from average wage levels for housekeepers.

2.1.6 Valuing morbidity through the cost of illness approach

The cost of illness (COI) method estimates the change in costs incurred as a result of a change in the incidence of a particular *illness*. Both direct costs (e.g. cost of doctor visits, treatment costs, etc.) and indirect costs (e.g. loss of wages) are included in the estimation. In cases where some of the costs are borne by medical insurance, COI measures will not be limited to a patient's "out-of-pocket" expenses but should include the additional costs borne by the insurance company or the treatment facility to capture the social benefits of the reduced risk.

The COI approach is used widely in the environmental economics literature when WTP estimates are not available, in part because of its ease of application and the abundance of useable information. However, it is important to note that it is *not* a measure of WTP for two basic reasons. First, COI reflects additional costs incurred *after* the illness has occurred whereas WTP measures reflect the value an individual places on a risk change *before* the health risk lottery resolves itself. Second, COI does not capture the additional amount an individual would be willing to spend to avoid the pain and suffering associated with the illness or the costs associated with averting behaviours. In spite of these limitations, COI is sometimes considered to be a lower-bound estimate of WTP.

2.1.7 Productivity Method

This method measures losses in production. The technique focuses on environmental resources as an input to the production of goods or services. When an input is degraded, this leads to a reduction in the services provided to production with a resulting loss in profit for the producer. This is of particular application where land is used for farming.

First a pressure over-grazing/ deforestation lead to an environmental impact (soil erosion). This in turn leads to a productivity impact (reduced capacity of soil to sustain crops). This alters farmers' income. This framework is commonly used to analyze cause and affect relationships. Another typical example is that of health. For example, increased vehicle use (behaviour), leads to air pollution (environmental impact). This in turn results in an increased number of workers with respiratory infections caused by the air pollution (productivity impact). The loss of workdays leads to a loss in wages for the workers.

2.2 Application of Measurement Indices

2.2.1 Applications of the Productivity Method

The approach can be used for a wide range of valuation problems. It has been widely used due to its ease of explanation and justification. The following are areas in which it is used:

soil erosion (decline in on-site crop yields and the resulting downstream effects such as blockage of irrigation systems and sedimentation of reservoirs), a**ir pollution** (damage on human health resulting from air pollution and its impact on workdays), a**cid rain (** resulting damage to trees), p**ollution of fisheries (a**s waters are polluted, it reduces its capacity to sustain fish stocks. This has an effect on the income of fishermen, s**alinity of Croplands (**declining yields and at its most serious eliminates the ability of soil to sustain crops).

Steps in the Practical Application of the Productivity Approach

Step 1: Determine the physical impact -this involves determining the physical impact arising solely from the driving force or behaviour we are interested in. Economists rely on scientists to provide this information.

Step 2 : Attach market values to the losses - use market prices to value the loss in production, or the cost of increased inputs, catering where necessary for price distortions (subsidies, taxes, import protection, monopoly etc.) ,

One aspect that is often ignored in the analysis is that a change in production may alter costs. For example, if increased salinity reduces yields, there will be a corresponding reduction in harvesting costs. The opposite may happen in the case of a chemical spill killing off a large proportion of the fish population. In this case, costs may go up as it takes more time to catch the same number of fish.

Where products are not marketed and so have no market price, it will be necessary to estimate costs. This can be done using either an estimation of the benefits of the product (medicinal plants) or costing of substitutes or alternatives

2.2.2 Application of Revealed Preference

Three methods are discussed here; averting behaviour, travel costs and hedonic pricing.

1. Theory of Averting Behaviour

Recommended when (i) people understand the environmental hazards to which they are exposed; (ii) they take action to protect themselves; (iii) the actions taken can be observed and their cost measured. Used to determine the health impact of pollution

The application of this approach to valuation is based on the assumption that individuals recognize the existence of a hazard and take actions to avoid it. The steps to be followed in the analysis are the following:

1) Identification of the environmental hazard and the affected population
2) Observation of the responses of individuals
3) Measurement of the cost of taking actions

Step 1 – Identification of the environmental hazard and population affected

Typical environmental hazards that result in averting and mitigating actions include water pollution, noise from airports or roads, soil degradation in a rural area, and air pollution. Monitoring equipment is important to measure such variables and check whether certain critical levels are being reached.

It is necessary to define the population at risk. This is a delicate aspect of the analysis. The averting behaviour approach is based on observed actions and fully relies on data about the affected population. If observations are taken from individuals only marginally affected by the hazard, the analysis will underestimate the values. If observations are taken only from individuals who are significantly affected by the hazard, and this is then applied to all individuals who are

marginally affected, then the analysis will overestimate the values. Practical considerations and common sense have to be adopted.

Step 2 – Observation of individuals' actions

There are various ways to collect information on the actions taken by individuals. One can ask all potential victims, when their number is limited. Alternatively, one can choose a representative sample of the affected population and carry out a survey. The survey method needs to be carefully designed in order to avoid common problems such as biased samples, strategic bias, and self-selection.

In addition, consider the case in which out-of-pocket expenses, such as the purchase of medicines, are being paid by the government through the national health system. Would these expenses be recorded by observing averting behaviour? The answer is no, but they should be. Even if someone else pays the costs of treatment they must be factored in.

Step 3 – Measuring costs of taking actions

As a final step, actions have to be valued in monetary terms. Prices are usually available for environmental substitutes such as bottled water, double glazing, air purifiers and so on. However, the purchase of environmental substitutes may not be perfectly related to the level of the hazard. For example, a certain level of the hazard may be tolerated before taking action. Only when the environmental threat reaches a certain critical level, will defensive expenditures start.

2. Travel Cost Method

Used where impact affects use of recreational facilities. The underlying assumption is that if an individual is willing to pay (WTP) the cost of visiting a recreational site then he should value the affected site at least as much as what he was willing to pay to visit it. Since many natural areas have low or no admission prices, this approach uses travel cost as a proxy for estimating consumer surplus. Data is usually collected through surveys in which an individual states the amount of time and money he spent travelling to a park, tourist center, fishing spot, and so on. The travel cost approach is different from the contingent valuation method in that the behaviour of subjects is observed in real markets rather than in hypothetical circumstances. If there is an

admission charge this must be added on to the cost of travel to obtain the willingness to pay for the experience.

Step 1 – Gathering information on travel cost, number of visits and other variables

Questionnaires are used to ask visitors /users of the recreational sites where they have travelled from. From visitors' responses one can estimate their travel costs and relate this to the number of visits per year. Where users live in vicinity of facility, an alternative approach would be to factor the travel cost to the closest substitute facility.

The 'travel cost' data should include all explicit and implicit costs related to visit a park. It is possible to identify at least the following categories: costs necessary to reach the site, e.g. gasoline and vehicle maintenance relative to a particular trip, train or bus ticket, Time cost of travel and time spent on site using wage approximation to estimate opportunity cost value.
This information might be collected by surveys sent to all—or a random sample of individuals who use the facility.

3. Hedonic Prices Method

Commonly used in the context of property and labour markets. In the first case, the assumption is that environmental quality is an attribute of the real estate and its price reflects people's preferences for environmental quality. In the case of labour markets, the assumption is that health risk is an attribute of a job and the wage rate should then reflect the willingness to be compensated for taking such risks.

When buying a good or service, it can be thought of as buying a bundle of characteristics that the good or service is comprised of. When renting or buying an apartment we will usually consider its size, number of rooms, neighbourhood, distance from commercial centers, and distance from public schools. Consider two apartments that are identical in all respects (such as neighbourhood, location, age, etc.), but one is larger than the other. The larger apartment will cost more than the smaller one because it is bigger. If we could hold all other characteristics constant, we could measure the price increase corresponding to increases in size only. In other words we could measure the implicit price of size. The same can be done for environmental aspects, such as the quality of the air around the apartment, or the level of noise.

Hedonic pricing is based on the idea that an individual's decision to buy goods or services is based on this bundle of characteristics. It is a revealed preference method when environmental quality is one of these characteristics the value people place on it can be inferred from what is paid for the good. The hedonic price method essentially consists of estimating a *demand for environmental quality* by observing the value people place on environmental attributes when buying a good or ser
vice. The methodology follows the following steps:

1) Specify the hedonic price function
2) Data collection
3) Estimate the correlation between environmental quality and market price for good

Step 1 - Specify the hedonic price function

We first need to identify those attributes that are likely to determine the price of housing in the market. It is important to bear in mind that all relevant variables should be included in the analysis as their omission could lead to under or over estimating the value of environmental benefits. However, the inclusion of irrelevant variables could lead to weaker results. There are mainly three groups of elements that can be expected to affect the price.

a) Physical characteristics of the property – size of the house, the number of rooms, the availability of common facilities

b) Neighbourhood characteristics – existence of good public services, such as transport, waste disposal, water connections, the level of crime, proximity to commercial areas, local firehouse, school, office or work.

c) Environmental characteristics – level of air quality, noise, smell and other environmental characteristics.

The hedonic price function is Price = f (Physical Qualities, Neighbourhood Qualities, Environmental Qualities)

Step 2 - Data collection

A proper econometric analysis requires a large amount of data. By data we usually mean observations on price and characteristics of different properties in a given period (*cross-section data*). We may also use information on properties over time (*time series)* but this information may be more difficult to gather. Data is collected using surveys and censuses.

Step 3 - Estimate the implicit price of air quality

Once physical, neighbourhood and environmental variables have been identified, the function relating such variables to the price of the property is estimated. Econometricians usually perform this operation and estimate the parameters that best fit the available data.

Each parameter relates a characteristic of the apartment to its price. Take for example the parameter for 'air quality'. It is basically telling us how a change in air pollution changes the value of property.

2.2.3 Applying the Contingent Valuation Method

Used where real markets do not exist for environmental goods such as "clean air" and it is necessary to create hypothetical markets in order to estimate a value. The steps are as follows:

1 - Setting up the hypothetical market

The first step is to set up a hypothetical market for the environmental service in question. The following issues should be considered when setting up the hypothetical scenario. The valuation scenario should be well defined, fully explaining the good in question and the nature of the change. This may be done with the use of images such as photographs or illustrations.

It should also be made clear how the payment will be made. Commonly used payment methods include taxes, fees, price changes, or donations.

2 - Obtaining bids

Bids can be elicited using several survey techniques: face-to-face interviewing, telephone interviews or mail. Face-to-face interviews with well-trained interviewers offer the greatest scope for detailed questions and answers. The purpose of the survey is to elicit an individual's maximum WTP in order to have the environmental improvement go ahead (or their maximum WTP to prevent a deterioration in environmental quality occurring. Follow-up questions such as "Do you think the environmental service would improve the quality of life in your community?" should be administered in order to understand the motives behind each respondent. This can help eliminate protest or invalid responses.

3 - The analysis

Once the data has been collected, the difficult work of making sense of it begins. The wealth of information collected can be used in different ways and for a variety of purposes. The possible outputs we can obtain from a CVM study are presented below.

Once bids have been gathered, an average bid can be calculated. Average WTP or WTA can be used to have a quick assessment of the value a resources has for a particular population. "Protest" bids are usually omitted from the calculation. Protest bids are zero bids given for reasons other than a zero value being placed on the resource in question. For example, a respondent may refuse any amount of compensation for loss of a unique environmental resource such as the Grand Canyon, as they believe it is the government's responsibility to protect it, or simply that they do not wish to take part in the survey. A decision must also be taken over how to identify and treat outliers. The follow-up questions can help with this.

The following table provides a summary of the valuation methods that can be used to measure the various impacts of environmental degradation for the Maracas Valley.[17]

Table 1 Showing Valuation Methods for Maracas Valley Study

Activity	Impact	Valuation Method

Quarrying	Agricultural losses	Productivity method Cost of Replacement
	Habitat/biodiversity losses	Contingent Valuation Method (Travel Cost Method)
	Flooding	Hedonic Pricing Averting Behaviour
Deforestation	Habitat/biodiversity losses	Contingent Valuation method Hedonic pricing
	Flooding	Averting behavior Willingness to pay
Illegal Unplanned Development	Habitat loss	Travel Cost Method Contingent Valuation Method
	Property values	Hedonic method
Water Pollution	Health Impacts	Medical Cost Human Capital Averting Behaviour Contingent Valuation
	Loss of Ecosystem	Travel Cost Method

		Hedonic Pricing Contingent Valuation
Recreational		Travel Cost Method Hedonic Pricing
Drugs and Crime	Lowering of property values Safety	Averting/Mitigating Behaviour Hedonic Pricing Contingent valuation
Urbanisation	Habitat Loss Flooding Traffic Crime Pressure on Public Utilities Urban Pollution	Travel Cost Method Contingent Valuation Hedonic Pricing Averting/Mitigating Behaviour Hedonic Pricing Averting/Mitigating Behaviour Hedonic Pricing Averting/Mitigating Behaviour Contingent Valuation Averting/Mitigating Behaviour Human Capital Approach

		Medical Costs Approach Contingent Valuation

2.3 Application of measurement tools to the MVAC/UNDP Project

The key components of the MVAC/UNDP study can be summarized as follows:

A. The land Use/GIS study provide findings with respect to changes in the following variables
   - population
   - land cover
   - built environment
   - road network
   - elevation, slopes and soils in the study area.

B. The River Quality study evaluated the quality of the river for bathing and in particular the impact of faecal discharge into the rivers from developments.

C. The Water Quality component of the study analysed the Valley's capacity to meet domestic water demand and the impact of the existing Coosal Quarry and potential impact of a proposed quarry at Ortinolla on the water quality of the Valley.

D. The Traffic count study sought to determine the carrying capacity of the road network and to further ascertain how close current usage is to peak capacity.

E. The Stakeholder Consultations elicited from the valley's residents what they determined to be the priority issues affecting both the environment and socio-economic development

F. The Socio-Economic Survey used a more scientific sampling approach to determine provide an updated profiling of the socio-economic structure and issues confronting the valley.

In applying the methodology to the findings of the Maracas Valley/UNDP project on issues of sustainable development, the Land Use/GIS study identified the following as the major variables negatively impacting the environmental sustainability in the Maracas Valley:

- ✓ major housing expansion in recent years on slopes that are prone to erosion; educational institutional expansion, particularly that proposed by the University of Southern Caribbean;
- ✓ present and proposed quarrying activities;
- ✓ low water supply;
- ✓ reduction in forest cover;
- ✓ loss of biodiversity;
- ✓ degradation of water quality;
- ✓ disruption in water supply;
- ✓ increase in noise and dust pollution;
- ✓ increase in traffic congestion;
- ✓ damage to existing road infrastructure;
- ✓ slash and burn farming;
- ✓ soil erosion and flooding.

This is reinforced in large part by both the stakeholder consultations and the socio-economic survey:

- Flooding (36.3%)
- Landslides (27.7%)
- Destruction of forest (27.6%) (#2 stakeholder consultation)

- Water pollution (24.4%)
- Quarrying (21.3%) (#1 stakeholder consultation)
- Air pollution (21.4%)
- Uncontrolled housing construction (17%) (#3 stakeholder consultation)
- Fire hazards (13.1%)
- 'Other'- e.g., drainage/soil erosion/dumping- (12.9%), squatting (6.6%), sewerage (5%). (#4 stakeholder consultation)

Unfortunately, the data sets emanating from these studies are inadequate to allow for the quantification of the economic costs resulting from environmental degradation in the Maracas Valley. It does allow us to make informed qualitative assessment and make recommendations as to the way forward for quantitative determination.

Having reviewed the findings of the studies outlined above, the following framework has been designed to outline firstly the key causal factors impacting the environment of the valley and then to identify the range of consequences which must be estimated to derive the cost function. These are listed as follows:

Table 2: Findings of Study to be valued

CAUSAL FACTORS	NEGATIVE IMPACTS		
Unplanned Development on the slopes (Housing/University)	1. loss of forest cover 2. soil erosion 3. flooding 4. traffic 5. loss of agricultural lands 6. forest fires 7. loss of recreational use of rivers 8. water catchment 9. loss of biodiversity		

	10. loss income (Farmers/Fishermen)		
Quarrying	1. loss of forest cover 2. soil erosion 3. flooding 4. noise and air pollution 5. health related problems 6. increased costs of health care 7. impact on carrying capacity of road 8. loss of biodiversity 9. water catchment 10. Quality of water 11. Water borne diseases		
Population Growth	1. pressure on existing service grids 2. drugs, crime and safety 3. changed rural/urban dynamic		
Inadequate sewage systems	1. degradation of rivers (sewage) 2. poor water quality 3. water borne diseases		

In addition to estimating values for the above using the appropriate costing method outlined in table 1, it is also necessary to do estimates of the costs of remedial work to reinstate the environment not necessarily to its original state but to one that will allow for greater protection and sustainability. Because consequences can emanate from more than one causal factor, it is difficult to clearly segregate valuations. In effect the rest of this paper concentrates on discussing in the broadest and qualitative sense what the findings of the various reports means with respect to the economic costs of the degradation found

to have occurred in the Maracas Valley with recommendations towards moving to quantitatively estimating these costs.

The Economic Costs of Environmental Degradation to the Maracas Valley

The Land Use/GIS study revealed an increase in built-up areas of 86 % between 1970s to 1994, and 17% increase between 1994 to 2005 with a roughly 250 % increase in building construction in the study area over the 40 year period. Noting that the Town and Country approval system designates land for approved building below the 91m level, the increasing trend (63 dwellings in 2009) to build above the 213m (700ft) contour line (a demarcation used by TCPD to leave land at such elevation under forest) is evidence of increasing costs in economic terms. In addition, within 152-213 m elevation there was 1000% increase in building construction. This in effect contributing to the 17.5% loss of forest cover between the 1970's to 2005.

To value in dollar terms the economic costs of the loss of forest cover caused by increased buildings, we would need to conduct a study to determine the total economic value of the approximately 500 ha of forest cover lost, this would include using a Contingent Valuation Method which seeks to determine people's willingness to pay to protect the forest cover, the use of travel cost method to estimate the lost in recreation (site seeing, hunting, camping etc) which may have been loss, a productivity method to ascertain the loss of income that might have resulted to those who earned a living from the natural resources of the forest.

With respect to issues of soil erosion and flooding, the study found that the dominant soils series found in the built-up areas is the Maracas/Matelot sandy clay loam, covering 54 % of the study area and the Acono fine sandy loam, covering 17% of the study area. The built-up areas are characterized by River Estate fine sandy loam which is extremely suitable for agriculture. This accounts for 10% of the soils under built-up areas. These soils are prone to slight to severe erosion. In effect, here is evidence of agricultural sacrificed for residential development. The productivity costing method would be employed to determine the value lost as a consequence of agricultural displacement. This

would involve an estimation of number of farmers and farms displaced, type and value of crops lost, farmer income lost, where displaced farmers go on social welfare programs; the cost to the State of providing such support.

The issue of soil erosion has negatively impacting river siltation levels and done damage to property through land slippage and flooding particularly during the rainy season. It would be necessary to survey those affected to determine the level of losses incurred. Issues such as forest fires, loss of recreational use of rivers, water catchment, and loss of biodiversity, loss income by farmers which were not estimated or referred to in any of the studies will have to be determined for the purpose of economic cost assessments. Further the costs of recovery to a state of sustainability will have to be established with regard to all negative fallouts.

The evidence from others study segments suggests that the costs are high. Quarrying negatively impacts the following; loss of forest cover, soil erosion, flooding, noise and air pollution, health related problems, increased costs of health care, impact on carrying capacity of road, loss of biodiversity, water catchment, quality of water and water borne diseases. In effect, part of the 17.5% forest cover loss has resulted from quarrying and if plans to introduce additional quarries as in Ortinola are pursued, we can see expect greater forest cover losses.

The socio-economic survey asked whether persons suffered air pollution related diseases, the response was negligible, 71% suffer no health problems identified on questionnaire, 15.5% had asthma, 4.8% skin infections, 3.4% bronchitis, 2.5% cancer, 6.2% 'Other' (e.g. lung infection, headache, wheezing, chest problems). This could have been because the survey sampled the entire valley. Even the stakeholder consultations did not reveal any significant findings, though intuitively it is felt that there has been a worrying amount of negative health related consequences due to quarrying. What is required is the use the averting behaviour (revealed preference) approach which will seek to isolate the immediately affected population around the quarry and survey that population to determine the health related impact from quarrying. Such a survey would also elicit information on items such as costs of health care which persons have incurred due to infections.

With respect to the impact of quarrying, the Land Use study found a significant increase in size of 283% from 1970s to 2005. The water quality study found that the impact of the Coosal quarrying operations have led WASA to abandon their second Acono River Intake (on branch of river passing through Coosal's quarry) as a result of the degradation of river water quality both in dry and rainy season, notwithstanding the sediment traps installed by Coosal. Also, whenever the Acono River (from Coosal's quarry) overflows into the Ortinola River (upstream of WASA's intake on the Ortinola River) during significant rainy events, WASA is obliged to interrupt water abstraction from the Ortinola River due to the severe degradation of river water quality.

This has negatively impacted the Valley's ability to meet the demand requirement of its population. The study showed the trend between 2007 and 2010. In 2007, total water supply was 5,764 m3/day and total water demand 6,084 m3/day resulting in a supply deficit of 12%. In the 2010 rainy season, water balance shows a 38% deficit of water supply as demand (6,500 m3/day) exceeds water supply (5,800 m3/day). Even worst, the 2010 dry season saw a 76% deficit water supply (3,700 m3/day) over demand (6,500 m3/day).

In effect, the economic costs associated will require an estimation on people's expenditure re tanks and pumps in order to deal with situation. Further we will have to estimate the remedial costs to clean up the river course in order to bring equilibrium between supply and demand. It should also be identified that the water quality studied noted that the deficit could be much larger as no allocations were made for the water supply being used to service out of valley demand which is highly probable and which would mean that the costs to valley residents to secure a reliable water supply would be higher.

The study noted that the sediment traps put in place by the quarry operators are ineffective and that Acono River dowstream of the quarry has high turbidity content and the situation is exacerbated when it rains and there is run off from the quarry which impedes infiltration and exacerbates runoff and erosion. The study concludes that once quarrying continues, reclamation is impossible. The economic costs of meeting water demand are further increased especially when the population growth element of the valley is factored in.

There has been a 134 % increase in valley population from 1970s to 2009, and an overall increase in population density from1.25 persons/ha to 2.9 persons/ha over the same period. While this gives the impression that there is a low population density for the area, when the population density for 2008 was calculated for areas within 91m (300ft) elevation (greatest number of buildings found), the population density figure showed values ranging from 26.8 persons/ha for Maracas/St. Joseph to 190.4 persons/ha for Acono . These population densities are consistent with urban construct of the East – West Corridor thus emphasizing the urban nature of Maracas Valley. In addition, there was an overall increase of 250 % in the number of buildings constructed over last 40 year period, accompanied by an increase of 117% in the built- up areas between 1970 and 2009, indicative of increased building density.

Much of this construction has been unplanned and the impact on the quality of the river water as a consequence of direct sewage flow was examined in the river water quality study. The results have serious costs implications both for the sustainability of the valley and the health of its inhabitants. The study found that only 7% of the valley's population currently connected to a sewerage package plant while 93% rely on household septic tanks and soak ways. The study further estimates that close to 3,150 equivalent habitants discharge effluents directly or indirectly into the Maracas River between the junction of the Upper Maracas/Acono Rivers and the Silver Bridge;

The four package plants operating in the valley are poorly designed, operated and maintained resulting in discharges of poorly treated sewerage into the Maracas River. Additionally, a number of large institutions (including USC) discharge poorly treated sewerage directly into the Maracas River. Measurements have shown that BOD5 (a parameter indicative of biodegradable pollution) discharges to the Maracas River levels between the Acono junction and the Silver bridge are twice as high as the maximum levels given in the Water Pollution Rules -2001. The Maracas River is therefore unfit for bathing.

Estimating the economic costs of this situation would entail applying travel cost, averting behaviour, productivity and human capital methods of costing. It would entail estimating the what the recreational value lost due to this level of pollution by surveying what people pay for transportation and if appropriate entrance to an alternative bathing river, persons willingness pay for restoration of the river, confirming the incidence of water borne diseases, costs of health care, cost of preventative measures, the loss to fishermen in terms of fish, cost to fishermen of changing vocation or finding alternative fishing sources. In addition, it would be necessary to factor in the costs of mitigation (regardless of who bares the cost), the costs of upgrading current treatment plants and installation of new plants to remedy the situation.

The road network analysis of the Land use study found a 226 % increase overall in the road network between 1970 and 2009 in the study area as follows, a 117 % increase in areas within 91m elevation, 207 % increase between 91-152 m, 500 % increase between

152 m – 213 m and 108 % increase above 213 m in the study area. The highest increase in the road network has occurred between 152 – 213 m (500-700ft) and is equal to 500%. This indirectly reflects the gradual encroachment of housing along the valley's slopes, above the height generally approved by the Town and Country for development.

The traffic count study sought to determine capacity usage given the population, development and quarrying increases which have taken place. It estimated a carrying capacity of the Maracas Royal Road - based on its characteristics- to be between 800 to 1000 vehicles per hour. It found a significant increase in the percentage of heavy vehicles on the Maracas Royal Road from 4.5% in 2007 to 17.5% in 2008. This is likely attributable to the increased quarrying activity in the Maracas Valley to meet the increased demand for aggregate for the construction sector. It confirmed two peak periods morning and afternoon found that during the morning peak, the Maracas Royal Road has approximately 750 vehicles in the southbound lane. The road is therefore operating close to the peak capacity on mornings.

An economic cost assessment would be interested in determining the loss of productivity due to extended time spent on road during the morning peak period, safety implications of having only one major road in and out of the Valley, the cost of constructing and alternative, whether the increases incidence of heavy vehicles impacts the integrity of he road, implication for safety and life of road.

2.4 Conclusion and Recommendations

It is evident from the above qualitative assessment that the economic cost resulting from the environmental degradation of the Maracas Valley as a consequence of unplanned development particularly on the slopes, quarrying, population growth, poor sewage disposal, removal of forest cover has been and continues to be significant. The impacts are evidenced by the soil erosion and flooding, poor and insufficient water quality, unhealthy river water levels, loss of agriculture and loss of recreational facilities. In addition, the cost of recovery and restoration will indeed be high.

To move to the level of quantitative costs assessment can indeed be undertaken as a next stage of the project. This would entail several things including; the determination of period over which to collect data, crafting of appropriate target survey instruments to collect primary data as there is no established institution to which one can get data for example on the number of fishermen 20 years ago and the number today, or the number of users of the rivers for recreational purposes then as compared to now.

This would then be the first stage of the data collection. The format of the questionnaire would also be guided by the choice of costing method. If for example a willingness to pay approach is adopted, the questions would have to be crafted to solicit appropriate answers. On the issue of the health impact of quarrying, there would be need firstly, to scientifically determine the range within which the catchment population would be affected, then to survey this population to ascertain the incidence of air-borne diseases and the expenditure on associated health care using a human capital approach.

While it is evident even from the qualitative assessment that the cost the country of poor environmental management of the Maracas Valley has been and continues to be high, a quantitative valuation is important to really state the monetary lost suffered. This though is a very expensive next step which will involve experimental technique, not exact in nature though credible enough to get the job done.