Annex 12

Illegal Dumping Survey

12 Illegal Dumping Survey

An illegal dumping survey was carried out from late June - mid-July in DSM. The Disposal Interview Survey (DIS) carried out during WACS identified that there are basically two types of illegal dumping:

- the dumping of waste in the immediate vicinity of households (mainly by residents);
- the dumping of waste along the sides of roads and in large open areas.

The illegal dumping survey was divided into two parts in order to quantify these two types of illegal dumping; namely:

- residential block illegal dumping survey;
- trunk road illegal dumping survey (estimation and interview).

Particularly in the city centre area, a lot of waste is collected by handcart operators and illegally dumped, especially along Morogoro Rd at Jangwani. Hence a third survey was conducted of handcart operators involved in this activity in order to understand this system of illegal dumping.

12.1 Objectives

- To determine the amount of waste which is illegally dumped in DSM according to the categories used in this study (UA, SUPA, SUUA, RA).
- To relate the illegal dumping which occurs in different areas to the conditions in those areas with respect to living conditions, refuse collection and formal/informal sector business activities.
- To understand the system of illegal dumping of waste by handcart operators, their working conditions and the amount of waste dumped daily by them.
- To locate any scavengers of recyclable materials from waste which has been illegally dumped.

12.2 Residential Block Illegal Dumping Survey

12.2.1 Method

6 areas ("blocks"), each consisting of several streets, were selected for surveying. One block was selected from each of the five areas from which sampling points for WACS were chosen (5 blocks) following consultation with the Ward Secretary/Street Chairman in each area. Four of these blocks were in residential areas (one in each of the four ward classification categories used in this study) with only one of these blocks having a regular refuse collection service provided by Multinet. The fifth block was in a mixed residential/commercial area in Kariakoo ward where there was no DCC or Multinet refuse collection service at that time. The 6th block selected was in a mixed residential/commercial area in Mchafukoge ward in the city centre where Multinet is operating a refuse collection and street sweeping service. The six blocks thus selected

constitute a reasonable cross-section of DSM. This survey was carried out from 28 June - 2 July.

A scale map of each block was drawn and the area of each block measured (by striding). Two Study Assistants spent 3-4 hours in each area carrying out the following tasks:

a) counting and mapping the number of places where waste is dumped illegally. For each site, the type of waste (e.g. food waste, cans/tins, paper, car wrecks, etc.) and whether it had just been dumped (D) or burned (B) were recorded. The size of each dump site was estimated.

b) The number and location of petty traders operating in each block was recorded, together with the goods being traded (e.g. used clothes, household goods, coconuts, egg/chips vendors, fruit vendors/stalls, etc.) and whether they are mobile or stationary traders.

c) The number and location of official traders operating within each block was recorded together with the goods being traded.

d) any people seen scavenging for recyclable items from waste dumped outside were recorded and interviewed where possible.

12.2.2 Results

The illegal dumping, official trader and petty trader results are summarised in Table 12-1, Table 12-2 and Table 12-3 respectively. In Table 12-1, the "illegal waste density" is a parameter used to indicate the extent of illegal dumping in any one area. It is defined as the volume of illegally dumped waste in the block/area of block (litres/sq.m.).

The maps of each of the blocks surveyed are shown in Figure 12-8 - Figure 12-13. The illegal dumps, petty traders and official traders are all numbered in these figures.

Table 12-1: Summary of Residential Block Survey Results

Illegal Dumping	Description of Waste	No. of illegal Dumps	Vol. of Waste (litres)	Area of Block (sq.m.)	Illegal Waste Density (litres/sq.m.)
Mchafukoge (UA)	approx. 50% fo including some co; remaining is me, pa, pl	2	450	71,450	0.0063
Upanga West (UA)	approx. 52% ga; remaining is bo, ca, co, ct, fo, pa, pl, ty, wo	14	3,575	65,000	0.0550
Kariakoo (UA)	approx. 32% fo; remaining is ct, hu, pa, pl, sh, wo	22	7,676	26,600	0.2886
Mwananya-mala (SUPA)	approx 82% ga and 18% fo	14	4,462	6,588	0.6773
Keko (SUUA)	approx. 66% ga; 33% fo and 1% pa, pl, te	20	26,636	8136	3.2738
Ubungo (RA)	approx. 52% ga; 38% fo and 10% ca	11	18,450	11,328	1.6287

Note: bo = glass bottle; ca = car/vehicle wreck; co = coconuts; ct = cans/tins; fo = food; ga = garden; hu = cereal/rice husks; me = other metal; pa = paper (boxes); pl = plastics; sh = shop; te = textiles; ty = tyre; wo = wood

Table 12-2: Summary of Official Trader Census Results in each Surveyed Block

Type of Trading Enterprise	Mchafukoge (UA)	Kariakoo (UA)	Upanga West (UA)	Mwananya-mala (SUPA)	Keko (SUUA)	Ubungo (RA)
Restaurants	0	1	0	0	0	0
Other Food	5	2	0	0	0	2
Hardware	30	38	0	1	0	0
Stationery	16	3	0	0	0	0
Electrical Goods & Accessories	23	14	0	0	0	0
Clothing	41	39	0	0	0	0
Medical	6	2	0	0	0	0
Household items	27	9	3	0	0	0
Other	14	2	0	0	0	0
Total	**162**	**110**	**3**	**1**	**0**	**0**

Note: "Other" covers those enterprises which were not identified as they were closed when the survey was conducted.

Table 12-3: Summary of Petty Trader Census Results for each Block Surveyed

Type of Petty Trading Enterprise	Mchafukoge (UA)		Kariakoo (UA)		Upanga West (UA)		Mwananya-mala (SUPA)		Keko (SUUA)		Ubungo (RA)	
	M	St	M	St	M	St	M	St	M	St	M	St
Food												
* canteen (cooked food)	0	2	0	0	0	2	0	2	0	0	0	0
* stall (cooked food))	0	2	1	4	0	0	0	1	0	0	0	0
* packaged food	5	5	5	2	2	0	0	1	0	0	2	0
* fruit & vegetables	5	0	8	2	1	3	0	1	2	1	0	1
* coconuts/sugar cane	4	1	4	2	3	0	0	0	0	0	0	0
Small Items	14	7	9	5	1	0	1	0	1	0	0	0
Clothes	12	2	21	2	2	0	1	0	2	0	0	0
Small repair/ manufacturing	2	7	4	4	0	3	0	1	0	0	0	0
carpentry	0	0	0	0	0	0	0	2	0	0	0	0
recycled products	0	0	0	1	0	0	0	0	0	0	0	0
small shops	0	0	0	0	0	2	0	0	0	2	0	0
sub-total	42	26	52	22	9	10	2	8	5	3	2	2
Total	**68**		**74**		**19**		**10**		**8**		**4**	

Notes: 1) M = mobile; St =stationary
2) Small items covers those traders selling items such as cigarettes, cassette tapes, batteries, mirrors, newspapers, traditional medicine, etc. which produce little waste.
3) Small repair/manufacturing covers those traders engaged in bicycle and watch repairs, shoe repairs and shoe shining, rubber stamp makers, tailoring, etc.

12.2.3 Discussion

12.2.3.1Mchafukoge

This central city area is a high density mixed residential/commercial area with a high concentration of official and petty traders. 162 official trading enterprises and 68 petty traders were counted during the period of the survey.

Multinet is operating a refuse collection service in the central city wards including the areas surveyed and is also responsible for street sweeping in these wards. Their refuse collection trucks and street sweepers usually begin work between 0630-0730. According to their collection schedule, their refuse trucks first collect waste from all places where it has just been dumped outside. Usually, this work is completed by

0900-0930 after which time, they begin to collect waste from households and businesses. There are a number of such sites where waste is commonly dumped outside and then subsequently collected by Multinet. This practise is categorised as illegal dumping as these are not official, approved community collection points even though they are functioning as such.

The city centre survey was carried out between 0915-1430 and only two illegal dumps were located in the area surveyed. Presumably, the other sites had already been cleared by Multinet by 0915 so this result is not surprising. The waste had been dumped without burning in both cases and both dumps were small in size. Consequently, the illegal waste density calculated for the city centre area is very small, being 1-2 orders of magnitude less than in other areas surveyed.

12.2.3.2Upanga West

Upanga West is a high income residential area and one of the wards in which Multinet is operating a refuse collection service. According to the DIS results, the majority of residents in this ward utilise this service. There are much fewer trading operations in this ward compared with the other two urban wards surveyed with 19 petty traders and 3 official trading operations being counted. 14 illegal dumps were counted (13 - dumped only; 1 - burned) including 2 car wrecks. Unlike Kariakoo and the City centre blocks which had no garden waste, the illegally dumped waste in Upanga West consisted of over 52% garden waste. The remaining 48% consisted mainly of food (domestic kitchen) waste, paper and plastics. The illegal waste density here is an order of magnitude greater than that in the city centre but 20% of the dumping density in Kariakoo.

12.2.3.3Kariakoo

Kariakoo is a densely populated mixed residential/commercial area. Multinet stopped collecting waste from here in Jan. 1996 and from then until when this survey was conducted, there has been no waste collection service in this area. According to the DIS results, many residents and businesses pay for handcart operators to remove their waste while other people dump their waste illegally, often at night. There is a high concentration of official and petty traders operating in this area, with 110 official traders and 74 petty traders being counted during the period of the survey. The amount of waste illegally dumped here was much greater than in the city centre with 22 illegal dumps (20 - dumped only; 2 - burned) being located within the block surveyed and the illegal waste density was 50 times greater than that in the city centre. Furthermore, many large dumps of greater than 1 cu.m. in size were observed in other areas of Kariakoo.

The food waste contained approximately equal proportions of domestic kitchen waste and petty trading waste, especially orange peelings, coconut remains and sugar cane residue in the latter case. The illegally dumped waste contained a smaller but significant proportion of "shop sweeping" waste and paper/plastic waste originating from trading activities. Wood waste mainly consisted of charcoal remains/ash which again could be linked to petty trading operations. In some cases, it was possible to relate the waste observed to a particular trading operation. For example, cassava peelings packed in plastic bags together with wood charcoal was dumped not far away from a petty trader selling roasted cassava.

12.2.3.4Mwananyamala

Mwananyamala is a mixed income semi-urban planned area with no refuse collection service. 10 petty traders and 1 official trader were counted in the block surveyed. According to the DIS results, the majority of households here dispose of their waste by self-disposal or illegal dumping. There is a large illegal dump adjacent to the area surveyed which is utilised by many residents in the area surveyed (see Section 12.3.3). 14 illegal dumps were located (9 - dumped only; 5 - burned) in this area. Approximately 82% of the illegally dumped waste consisted of garden waste and the remaining 18% was food (domestic kitchen) waste together with some rubber offcuts from a nearby sandal/bush manufacturer's operations. The illegal waste density was 2.3 times greater than that in Kariakoo, mainly due to the high proportion of garden waste.

12.2.3.5Keko

Keko is a mixed income semi-urban unplanned area with no refuse collection service. 8 petty traders and no official traders were counted in the block surveyed. According to the DIS results, the majority of households in this ward dispose of their waste by self-disposal or illegal dumping. 20 illegal dumps ((17 - dumped only, 3 - burned) were counted in the block surveyed with 66% of the waste being garden waste, 33% food (kitchen) and 1% paper/plastics/textiles waste. The illegal waste density is highest in this block of all the areas surveyed due to the high proportion of garden waste.

12.2.3.6Ubungo

Ubungo is a mixed income, rural area with no refuse collection service. According to the DIS results, the majority of households in this ward dispose of their waste by self-disposal or illegal dumping. 4 petty traders and 2 official traders were counted in the block surveyed. 11 illegal dumps (8 - dumped only; 3 - burned) were counted with 52% of the waste being garden waste, 38% food (kitchen) waste and 10% car wrecks. The illegal waste density was high again due to the high proportion of garden waste.

12.2.3.7Scavenging

No people scavenging for recyclable materials from waste dumped outside were located in any of the areas surveyed.

12.2.4 Total Amount of Illegally Dumped Waste in Residential Blocks

The illegal waste density values were used to estimate the total amount of illegally dumped waste in each of the ward classification categories. The following assumptions were used in this calculation:

1. the quantity of waste which is illegally dumped in any ward is proportional to the population living in that ward;
2. the density of illegally dumped waste (vol of waste/area) is constant throughout a ward and equal to the waste density measured in this survey for a particular block in that ward.

The method used is set out as follows:

1. Calculate A = waste density for each ward surveyed = volume of waste in block in ward/area of block.
2. Calculate B = amount of illegally dumped waste in each ward = A x (ward area).
3. Calculate C = total amount of illegally dumped waste in each ward classification category =B x (total population in classification category) /(population in ward surveyed).
4. The urban area is a special case and is split into 3 sub-categories:

- Mchafukoge, Kisutu and Kivukoni wards are mixed residential/commercial areas where Multinet operates a refuse collection/street sweeping service. Total amount of illegally dumped waste in the 3 wards = B x (total population in the 3 wards)/(population in Mchafukoge).
- Upanga West and Upanga East are predominantly residential areas where Multinet operates a refuse collection service. Total amount of illegally dumped waste in the 2 wards = B x (total population in the 2 wards)/(population in Upanga West).
- Kariakoo is a mixed residential/commercial area where there is no DCC or Multinet refuse collection service. Total amount of illegally dumped waste = B.

The results of these calculations are tabulated in Table 12-4.

Table 12-4: Calculation of total Volume and Amounts of Illegally Dumped Waste

Ward Classification Category	Waste Density (litres/sq.m.)	Area (sq.km)	Vol. of illegal waste in ward (cu.m.)	Population in ward	Vol. of illegal waste in category (cu.m.)
Urban					
* Mchafukoge	0.0063	0.6	3.8	7,037	11
* Upanga West	0.0550	1.0	55.0	11,199	109
* Kariakoo	0.2886	0.7	202.0	13,396	202
Semi-urban planned	0.6773	6.0	4063.8	107,127	29,451
Semi-urban unplanned	3.2738	3.2	10,476.2	50,622	199,295
Rural	1.6287	63.2	102,933.8	80,720	298,368
TOTAL					527,436

Notes: This survey measures illegal waste dumped by residential and other sources but the method of calculation is based on the residential population and does not take into account the number of commercial activities operating in any area.

12.3 Trunk Roads

12.3.1 Method

All of the trunk roads within DSM were surveyed to locate and identify the size of any illegal dumping sites. The main types of waste constituting each illegal dump were recorded and the dumps were categorised according to the area classifications used in this study (UA, SUPA, SUUA and RA) and to their size as specified below.

Classification	Vol (cu.m.)
small	0-10
medium	10-100
large	over 100

For some of the large illegal dumps surveyed, information on the dump was gathered by interviewing nearby residents/workers using a questionnaire survey. This questionnaire is included in section 12.6.2.

The presence of any scavengers at any of these illegal dumping sites was recorded and some scavengers were interviewed where possible.

12.3.2 Illegal Dumping Amount Results

12.3.2.1Total Illegal Dumping Amount along Trunk Roads

The results for illegal dumping along trunk roads in DSM according to area and dump volume are shown in Table 12-5 below. Figure 12-1 shows the distribution of trunk roads and the area classifications. The roads surveyed are identified in the accompanying key to Figure 12-1. The full survey results are in section 12.6.4.

Table 12-5: Trunk Road Illegal Dumping Survey Results by Area and Dump Volume

a. Small Illegal Dumps (0-10 cu.m.)

Area	St/ Rd	Illegal dump		No. of dumps containing these types of waste													vol (cu.m.)
		No.	B	bo	ca	ce	co	ct	fo	ga	ma	pa	pl	sw	te	oth	
ua	7	26	10	0	0	3	0	8	19	10	6	17	23	0	0	3	42.8
supa	20	147	64	14	10	8	6	48	82	96	24	70	117	8	15	27	292.9
suua	8	83	24	13	4	2	6	19	58	32	19	41	65	7	20	11	148.8
ra	6	33	9	4	8	3	4	9	25	10	11	17	23	5	5	8	61.3
Tot.		289	106	31	22	16	16	84	184	148	60	145	228	20	40	48	545.8

b. Medium Illegal Dumps (10-100 cu.m.)

Area	St/ Rd	Illegal dump		No. of dumps containing these types of waste													vol (cu.m.)
		No.	B	bo	ca	ce	co	ct	fo	ga	ma	pa	pl	sw	te	oth	
ua	3	3	1	0	0	1	1	1	1	1	0	2	3	0	0	1	89.7
supa	10	26	9	5	2	6	1	10	14	21	6	8	20	1	3	10	574.7
suua	6	18	2	1	7	0	1	4	11	7	6	7	12	1	3	3	601.0
ra	5	21	3	3	4	3	1	6	13	11	9	10	19	4	5	8	762.0
Tot.		68	15	9	15	10	4	21	49	40	21	27	54	6	11	22	2027.4

c. Large Illegal Dumps (> 100 cu.m.)

Area	St/ Rd	Illegal dump		No. of dumps containing these types of waste													vol (cu.m.)
		No.	B	bo	ca	ce	co	ct	fo	ga	ma	pa	pl	sw	te	oth	
ua	1	2	2	1	1	1	1	1	2	2	2	1	2	0	1	1	1651
supa	5	6	4	4	3	0	2	6	6	6	4	5	6	2	2	1	2825
suua	2	5	0	3	3	0	0	2	5	1	3	3	5	0	1	1	1976
ra	1	4	1	0	1	1	0	1	4	3	0	2	4	1	0	2	2263
Tot.		17	7	8	8	2	3	10	17	12	9	11	17	3	4	5	8715

Notes: 1) No. = number of illegal dumps counted; B = number of illegal dumps counted where at least 50% of the waste was burned (partially or completely).
2) Types of waste: bo = glass bottle; ca = car wreck; ce = ceramic; co = coconut; ct = can/tin; fo = food; ga = garden; ma = other metal; pa = paper (box); pl = plastic; sw = sawdust; te = textile; oth = other
3) Other includes soil, charcoal, glass, feathers, shoes, animal manure; hair, etc.

12.3.2.2Discussion

Three illegal dumps which were surveyed have been excluded from the results in Table 12-5 as they represent special cases as explained in the following section. Some general comments concerning these results are made below:

- for 128 or 34% of the total of 374 illegal dumps surveyed, waste is burned.
- The frequency of occurrence of different types of waste is highest for cans/tins, food, garden, other metal, paper and plastics waste.
- In terms of overall quantities of items dumped, food and garden waste constitute the bulk (>50%) of illegally dumped waste. There are smaller but significant quantities of bottle, cans/tins, paper and plastics while coconuts, ceramic, sawdust and textiles were found in relatively small quantities. There was also a large number of car wrecks in the illegally dumped waste.

Key to Figure 12-1:

UA	
Ali Hassan Mwinyi Rd	1
Bibititi Mohamed Rd	2
Jamhuri St	3
Maktaba St	4
Morogoro Rd	5
Ocean Rd	6
Uhuru St	7

SUPA	
Ali Hassan Mwinyi Rd	1
Bagamoyo Rd	8
Chan'gombe Rd	9
Gerezani Rd	10
Haile Selassie Rd	11
Kilwa Rd	12
Kimweri St	13
Kinondoni Rd	14
Makanya St	15
Mbagala Rd	16
Migombani St	17
Mwinyijuma St	18
Nelson Mandela Rd	19
Njia Panda St	20
Nyerere Rd	21
Old Bagamoyo Rd	22
Rashidi Kawawa Rd	23
Sam Nujoma Rd	24
Temeke Rd	25
Toure Drive	26
Uhuru St	7

SUUA	
Chan'gombe Rd	8
Kigogo Rd	27
Kiwa Rd	12
Makanya St	15
Morogoro Rd	5
Nelson Mandela Rd	19
Nyerere Rd	21
Shekilango Rd	28
Uhuru St	7

RA	
Kigogo Rd	27
Morogoro Rd	5
Nelson Mandela Rd	19
Nyerere Rd	21
Pugu Rd	29
Sam Nujoma Rd	24

Illegal Dumps	
Jangwani 1	A
Jangwani 2	B
Mbagala Kizinga	C
Mtoni	D
Mwananyamala	E
RK1	F
RK2	G

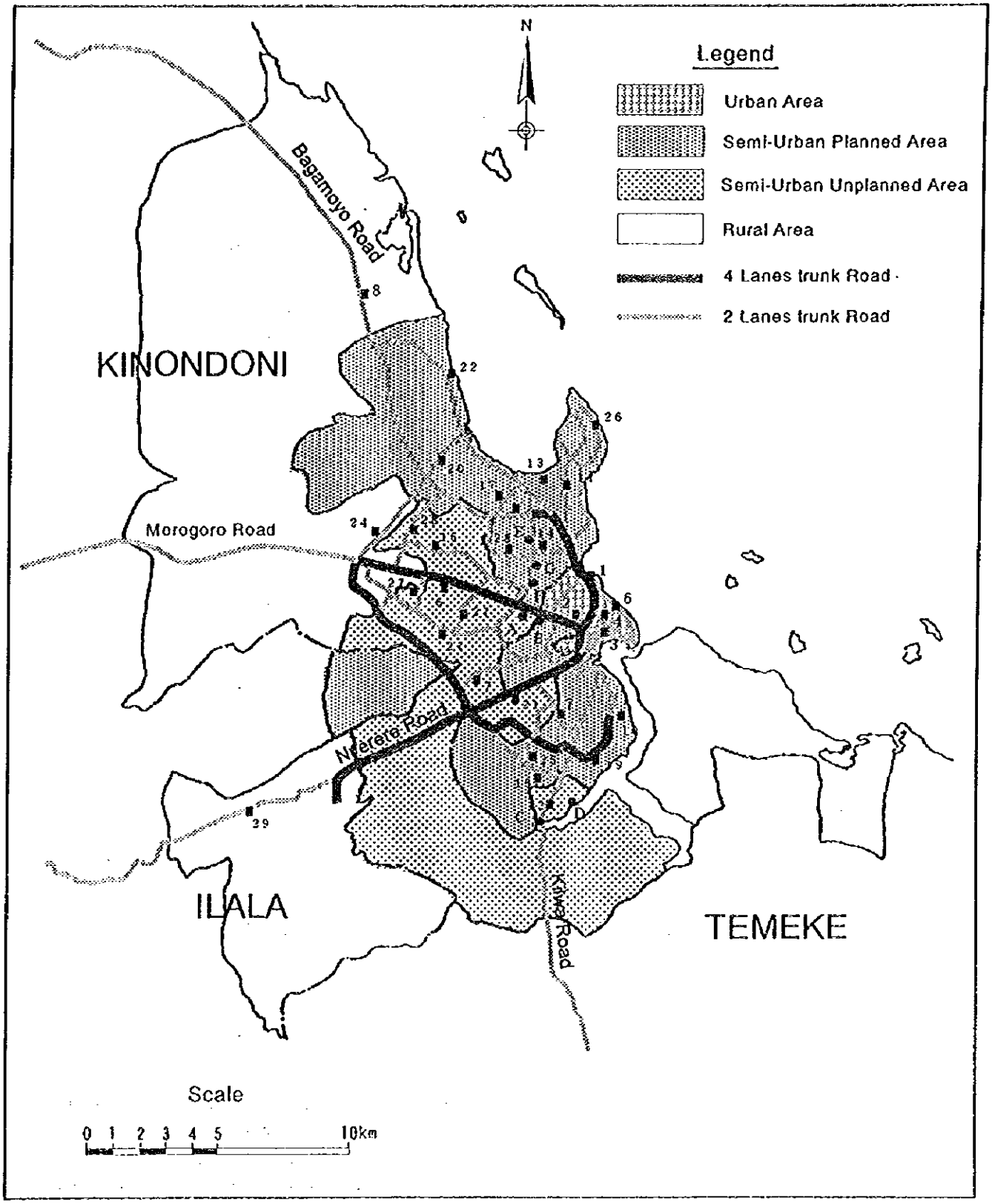


Figure 12-1: Identification of the Trunk Roads Surveyed in different Areas of DSM and location of the Large Illegal Dumps selected as Interview Points

12.3.3 Illegal Dumping Interview Survey Results

The interview results conducted at some of the illegal dump sites are summarised below.

12.3.3.1Morogoro Rd: Jangwani 1 and 2

Dumping began along this stretch of Morogoro Road towards the end of 1995 at site A, approximately 200m closer to the city from the present Jangwani 2 dump. Presumably, this was due to cessation of Multinet's collection service in Kariakoo. DCC subsequently stationed a policeman at A to prevent further dumping. However, people responded by continuing to dump waste at A during the night and to begin dumping further along the road near houses and on vacant land next to a small stream at B. Most of the waste has since been removed from A by DCC and heavy rain in April-May this year has carried away the bulk of the waste at B. Some dumping still occurs at A and B but since April, the main dumping place has shifted to the two sites referred to as Jangwani 1 and 2 and these sites are described in more detail below. Both of these dumps are not located close to housing but complaints have still been received concerning the smell. Furthermore, smoke from burning creates a traffic hazard on Morogoro Road, one of the busiest roads in the city.

Jangwani 1: Waste is dumped here directly off Morogoro Rd in the Jangwani valley area, approximately 1.6 km from Kariakoo market. The waste dumped here mainly consists of residential and commercial waste: food, paper, boxes, cans/tins, bottles, plastics, textiles, wood charcoal and car tyres. Approximately 30-40% of the waste is burnt. The waste is dumped here primarily by handcarts originating from the central city area, particularly Kariakoo. Many petty traders, esepcially coconut and orange sellers also dump their waste here, usually at the end of the day. Waste is dumped during the day and night, especially in the early morning and evening. The estimated volume is 910 cu.m.

There is a group of people who break stones into little pieces based next to the dump and one of them was interviewed. It was estimated that over 50 scavengers collect items from this dump. These may be classified into three groups:

- the majority of scavengers are mobile, spending a short time here and then moving on.
- a few youths from the stone breakers collect some recyclable items as they are dumped and then sell them to scavengers;
- a few large scale scavengers who stockpile collected items near to the dump, particularly boxes and cans/tins. Once a sufficient quantity has accumulated, they transport these to scrap dealers for sale.

This dump was initially approved for use by the DCC as a transfer station for handcart operators only coming from the Kariakoo area. Usually once per week, DCC refuse trucks transferred waste to the Vingunguti Disposal site so that the volume of waste stayed approximately constant. Presently DCC has changed its policy and is trying to prevent dumping at this point. However DCC trucks continue to transfer waste from here to Vingunguti regularly.

Jangwani 2: This is a long, narrow dump of approximately 100 m length along the edge of Morogoro Road leading down from the road to the valley below. All types of waste

are dumped here and about 40% of the waste is burnt. The estimated volume is 280 cu.m. and the dump is slowly growing in size. Dumping is prohibited here but still continues, especially during the night. Waste is mainly dumped by handcart operators fom Kariakoo and by nearby residents. There are many mobile scavengers who collect recyclable items from this dump.

12.3.3.2Mbagala Kizinga

This dump began in 1993 on both sides of Kilwa Rd along the bottom of a valley at Mbagala Kizinga following approval by the Council Ward authorities. Hence it is treated as a special case. This area is very prone to flooding and the main purpose of dumping was land reclamation. The land has now been raised approximately 5m to the level of the road for a length of about 200m and width of 25-30m on each side of the road (volume = 55,000 cu.m.). Car wrecks, construction waste, household waste, cereal husks, sawdust, slag from metal manufacturing industries, tins, papers and plastics were dumped here during the main reclamation stage which finished around 1.5 years ago. This has caused some water pollution. There are now a large number of small enterprises established on the dump site including mattress manufacture, metal working, carpentry and the sale of recycled items. About 150 people work on the dump site and they have formed their own organisation: "Umoja wa Maelewano Kizinga". The chairman of this organisation stated that there is no plan to reclaim further land. Dumping continues but on a much smaller scale than in the past and the dumping of food and other waste that would produce odour problems is prohibited. There are many scavengers who collect recyclable items from the dump. Some are actually based at the dump site while others are mobile scavengers.

12.3.3.3Mtoni

This dump is located on one side of a residential area where the land drops off to the estuary at Mbagala. It began in 1995 following a request by a committee of local residents to DCC for refuse collection trucks to dump waste here in order to prevent erosion which was threatening some houses in the area. After alleviating the erosion problem dumping by DCC ceased. The estimated volume is 2,630 cu.m. The dump is slowly decreasing in size due to decomposition and compaction even though local residents and some other parties continue to dump waste here during the day and at night. None of the waste is burned. Hence it is treated as a special case.

There are a small number (5-10) of scavengers based here, mainly involved in collecting boxes. A large stockpile of boxes was evident near the dump but a request to interview the workers was refused. Some local residents have complained about the smell from the dump, the negative impact on their health and multiplication of the fly population. Furthermore, there is a large mangrove area located in the estuary about 100-200m directly in front of the dump.

12.3.3.4Mwananyamala

Illegal dumping occurs in a large open area next to the primary school and a small lake. Waste is widely scattered over this area. Most of the waste is residential in origin consisting of food (domestic kitchen), papers, boxes, plastics, cans/tins, ceramics, textiles and garden waste. There is a significant amount of sawdust, which presumably comes from a sawmill in the areas and some small carpentry businesses. Some car

wrecks are present. Most of the waste is burnt. The estimated volume is 1,820 cu.m. and the dump appears to be growing slowly in size.

12.3.3.5Rashidi Kawawa Road

These are two large illegal dumps located in a valley, off the side of the road, referred to as RK1 and RK2.

At both these dumps, waste is dumped by nearby residents and handcart operators at any time (day or night). For both dumps, most of the waste is residential in origin consisting of food (domestic kitchen), bottles, tins, boxes, plastics and garden waste. There is also a large number of coconuts from petty traders and some car wrecks. Approximately 40% of the waste is burned. The interviewees stated that there are many scavengers who collect recyclable materials from these dumps. Most of them come early in the morning but it is possible to find scavengers there at any time throughout the day. They collect mainly bottles, cans/tins and metals.

RK1 is located at a point as the road climbs out of the valley where the terrain drops off steeply from the road to the valley below. Waste is dumped here in order to avoid soil erosion and has saved one house from being washed away. The occupant of this house was interviewed. Approximately 40% of the waste is burnt. Burning is done regularly and this can pose a traffic hazard when smoke is blown across the road. The estimated volume is 750 cu.m. This area has been used for dumping waste since 1988. Its size is relatively stable as the amounts of waste dumped are relatively small and the waste volume is reduced by burning and compaction. In addition, during the wet season, a lot of the light materials and ash are carried away by the rain.

RK2 is located in a low lying part of the valley which is subject to flooding during the rainy season. Waste has been dumped here since 1994 for the purpose of land reclamation. The estimated volume is 144 cu.m. and the dump is slowly growing in size. Nearby residents complain of smoke from burning at the dump, the smell and a large increase in the fly population.

12.3.4 Scavengers

Some scavengers were located at different illegal dumps surveyed, especially large ones, as discussed briefly in the previous section. 13 scavengers were interviewed and these results are presented in annex 9.

12.4 Summary of Illegal Dumping

The results of the Residential Block and Trunk Road surveys are summarised in Table 12-6.

Table 12-6: Total Amount of Illegally Dumped Waste

Source of Data	Vol. of Illegally Dumped Waste (cu.m.)	Mass of Illegally Dumped Waste (t)
Residential Block Survey	527,436	203,060
Trunk Road Survey	11,288	4,350
Trunk Road Survey - Special Cases:		
Jangwani 1	910	350
Mbagala Kizinga	(55,000)	(21,170)
Mtoni	2,630	1,010
Total	**542,264**	**208,770**

Note: 1) The Mbagala Kizinga dump volume is excluded from the total volume and mass of illegally dumped waste as most of the stated waste volume was dumped over two years ago.
2) A weighted average density for household waste of 390 kg/cu.m. is used to convert the volumes to masses.

The calculated figure of 208,770 t represents a cumulative amount of illegal dumping. Comparing this figure with the calculate illegal dumping waste amount of 840.3 t/d, the cumulative illegal dumping amount corresponds to 250 days of illegally dumped waste from all the sources considered within the scope of this Study.

12.5 Handcart Operator Survey

A survey of handcart operators and other people dumping waste was carried out at the Jangwani 1 Illegal dump along Morogoro Rd by two Study Assistants on Thursday, 18 July. The main objectives were:

- to estimate the daily amount of waste that is illegally dumped at this site by handcart operators and other people;
- to determine the sources of this waste;
- to determine the handcart operators' working conditions.

The survey questionnaire used and full results are shown in section 12.6.4.

12.5.1 Method

1. A census of all handcart operators and other people dumping waste at this point was conducted between 6:30am-6:30pm. For each load of waste dumped, the following details were recorded: type of waste; mode of transport used; source of waste and estimated volume.
2. Small loads were all transported by basket or sack. The volumes of waste were estimated by first measuring the dimensions of 2-3 different size baskets and sacks and the height of the waste in each container amongst the first loads of waste brought for dumping. These results were then used to estimate the volumes of waste in subsequent loads brought for dumping.
3. For handcarts, the length and width of each handcart and the height of the waste in the handcart were measured in order to calculate the volume.
4. Volumes were then converted to weights using the appropriate density, according to the type of waste, as determined in the WACS survey.

5. A questionnaire survey of 20 handcart operators was carried out at the same time.

12.5.2 Illegal Dumping Waste Amount Results

The calculated amounts of waste illegally dumped by handcart operators, people bringing baskets and sacks and others are summarised in Table 12-7.

Table 12-7: Summary of Amounts and Sources of Waste at Jangwani 1 dump.

Dumping Agent	Vol (cu.m.)	Mass (kg)	Sources
handcart	14.23	4,213.7	Kisutu, Kariakoo, Mchafukoge
person with basket/sack	3.06	747.2	Gerezani, Kariakoo
other	1.42	498.0	not determined
Total	18.71	5,458.9	

Note: 1) Kariakoo is a middle/high income area and the household waste density used to convert the volumes measured in this survey to mass was the average of the WACS middle and high income household densities.
2) For market waste the WACS market waste density was used.
3) For mixtures of household/market waste the average of the handcart household/market waste densities was used.

All of the waste brought by handcarts came from the Kariakoo and Gerezani area and could be classified as household or market waste or a mixture of the two. 20 trips were recorded during the period of the survey; the average volume and weight per trip being 0.71 m^3 and 211 kg respectively.

31 trips of people bringing baskets or sacks of waste were counted during the period of the survey; 16 of these were sack loads of waste and 15 baskets. 4 of these dumped household waste with 3 of them doing so very early in the morning while the remaining were petty or market traders who came on bicycles after 4pm to dump their waste before returning home. 10 were coconut sellers, who buy the coconuts from Kigamboni or Mbagala and then sell them in the city centre (Kisutu, Kariakoo and Mchafukoge wards). The remaining 17 brought waste from Kariakoo and Tandale markets and petty trading operations in baskets or sacks to dump. Most of the sacks contained orange peelings, with the people dumping them having bought the oranges in Kariakoo or Tandale markets and then sold them in the city centre. The average volumes of coconut and orange waste brought by a single person are 150 and 100 l respectively which using the market waste density to convert to masses are equivalent to 34 and 23 kg respectively. These figures are indicative of the amount of waste that can be produced from such petty trading operations.

During the day, two pickup vehicles dumped household waste here, despite efforts made to prevent them by a watchman stationed there. The waste dumped by these vehicles is classified under "other".

The total amount of waste dumped by these three sources is equivalent to 18.7 m^3/d or 5.5 t/d.

12.5.3 Questionnaire Survey

All 20 handcart operators interviewed were male. The work of a handcart operator is their only job and they all work more than 20 days per month. Four of them work up to 4 hr/d; six work 4-8 hr/d and the remaining ten over 8 hr/d (Figure 12-2). Seven of these

transport waste exclusively; the other thirteen use their handcarts for other tasks as well, such as transporting produce, water, construction materials, scrap metals and boxes.

All of them work for themselves although most hire their handcarts. The cost of hiring is variable with two figures of 500/- and 1,500/- per day being quoted by interviewees. By comparison, the purchase price of a new handcart was quoted to be 35,000/-.

Most of them have been transporting waste by handcart for a relatively short time with 8 having been doing this for up to 6 months and another 6 for up to 1 year (Figure 12-3). One reason for this is that until late 1995, Multinet was collecting waste from the Kariakoo area.

Figure 12-4 shows the income distribution of the handcart operators. 60% of them earn on average over 60,000/- per month.

The distribution in the amount earned per trip is shown in Figure 12-5. The income per trip depends upon the source of waste and the quantity of waste loaded and there is a lot of variation. The median income per trip is 2,000-3,000 Tsh. For example:

- one operator stated that he will charge 100/- for each bucket of waste collected and the handcart can fit about 15 buckets of waste. It was not specified if the charge depends upon the source of waste;
- another stated that a full load of market waste will provide him with an income of 2,500-3,000/- while the same quantity of household waste is worth 6,000-9,000/-;
- another stated that a full load of hotel/restaurant waste is worth 8,000/-.

The amount earned by handcart operators will also depend upon the number of trips carried out per day. The trip distribution is shown in Figure 12-6. 80% do 4 trips or less per day.

The main collection sources are summarised in Figure 12-7. 4 operators collect from one source only; the remainder collect from 2 or more sources. Most of the waste is collected from households and "markets" predominantly in Kariakoo ward although 4 also collect waste from Gerezani, 1 from Kisutu, 1 from Mnazi Mmoja and 1 from the city centre. Markets in this context refers to unofficial markets (i.e. not Kariakoo or Kisutu markets) which typically are set up on the sides of streets.

All operators dump the waste at Jangwani 1 illegal dump site. This is a relatively new dump as large scale illegal dumping along this stretch of Morogoro Road began at the end of 1995 and at Jangwani 1 itself in April 1996. Some of the older operators said that in the past they used to dump the waste near Uhuru School or Kisutu Post Office.

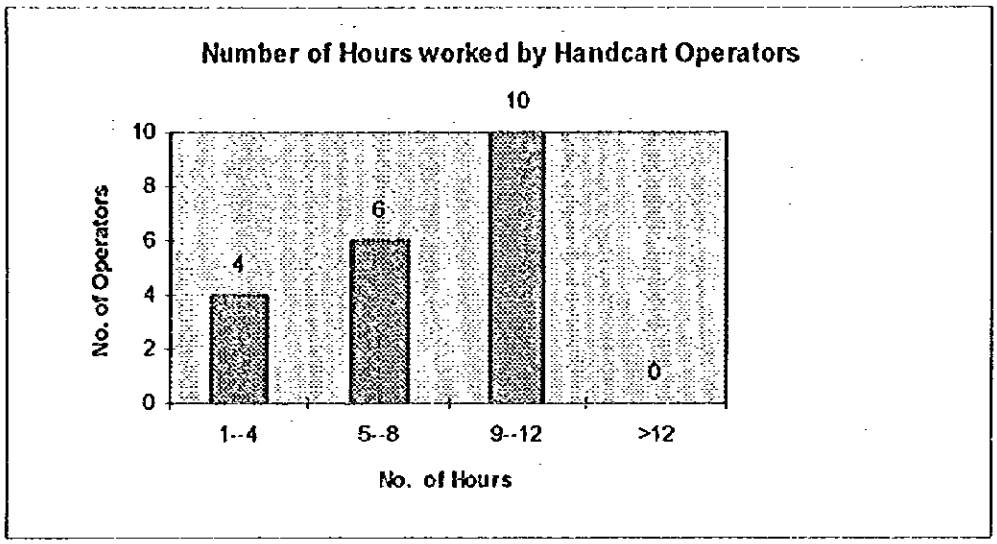


Figure 12-2: Distribution in Working Hours for Handcart Operators

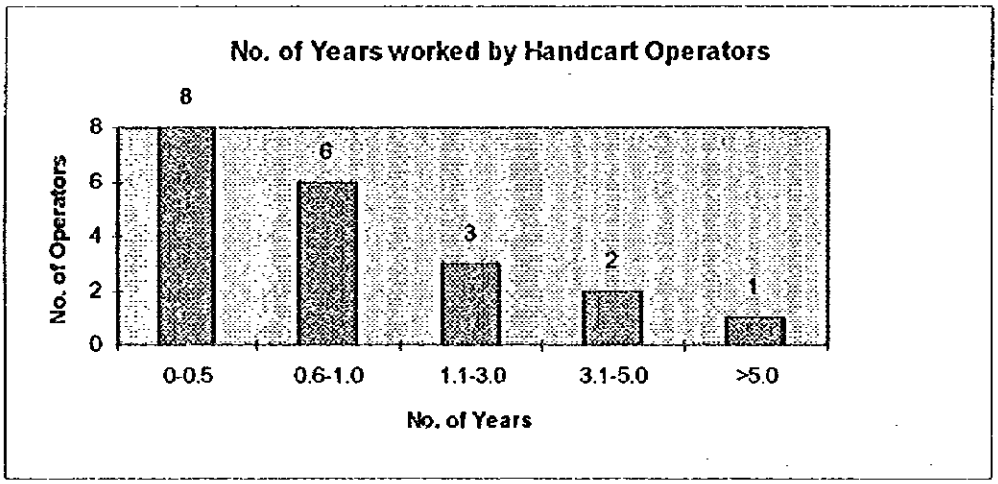


Figure 12-3: Distribution in Working Years for Handcart Operators

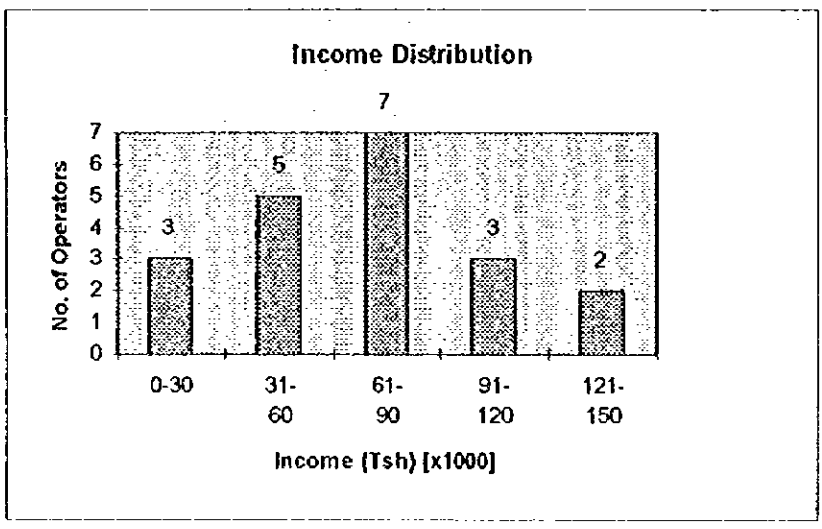


Figure 12-4: Income Distribution for Handcart Operators

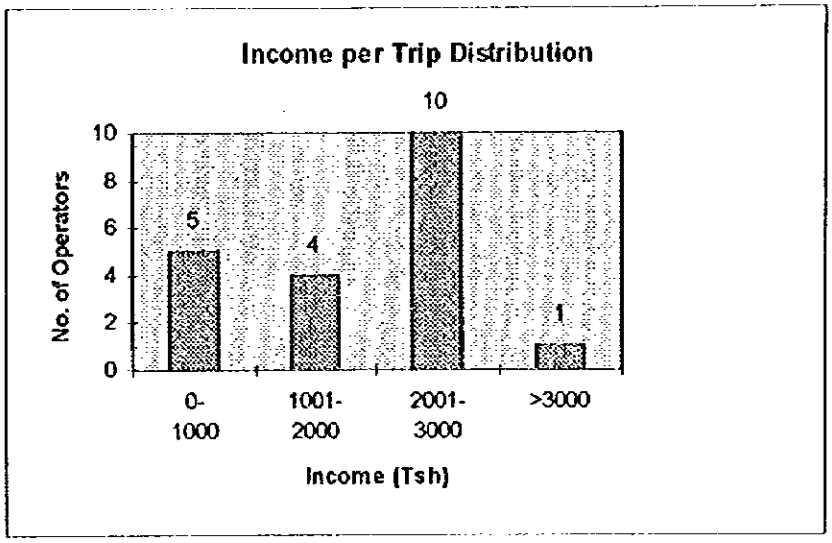


Figure 12-5: Distribution in Income per Trip for Handcart Operators

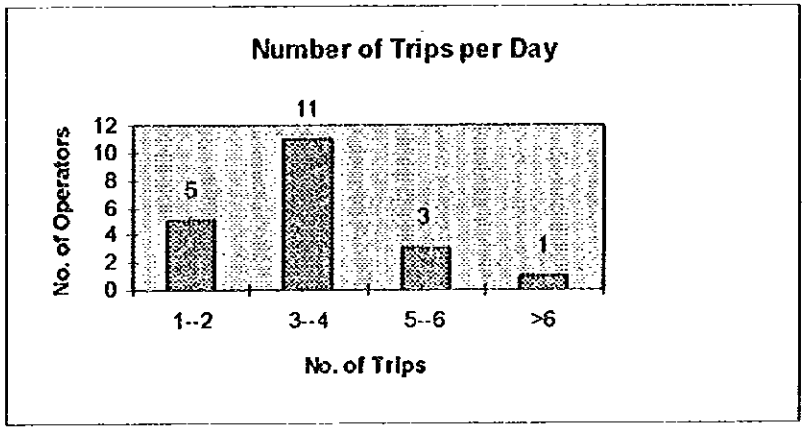


Figure 12-6: Distribution in the Daily Number of Trips completed by Handcart Operators

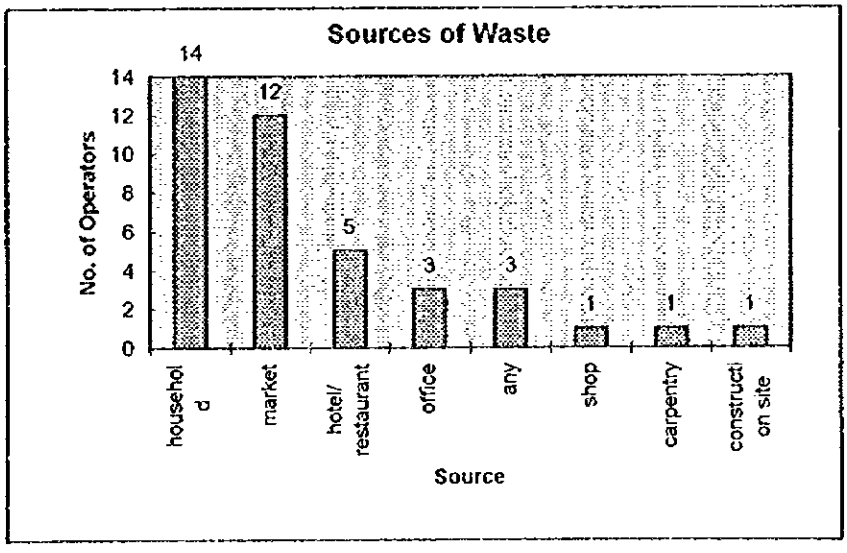


Figure 12-7: Sources of Waste Collected by Handcart Operators

12.5.4 Problems Experienced by Handcart Operators

The problems experienced by handcart operators are summarised below in Table 12-8.

Table 12-8: Summary of Problems Experienced by Handcart Operators

Description of Problem	No. of Operators listing this problem
police harassment	3
hiring of handcart is expensive	3
small payments from some customers	2
lack of tools (gloves, boots, etc.)	2
car congestion	2
punctures	2
tiredness	1
lack of work	1
difficulty in collecting payments from some customers	1
bad smell	1
DCC opposition to dumping at Jangwani 1	1
no permanent place for waste disposal	1
suffering shame and jokes from other people	1

12.6 Detailed Survey Data

12.6.1 Residential Block Illegal Dumping Survey Maps

These are set out on the following pages:

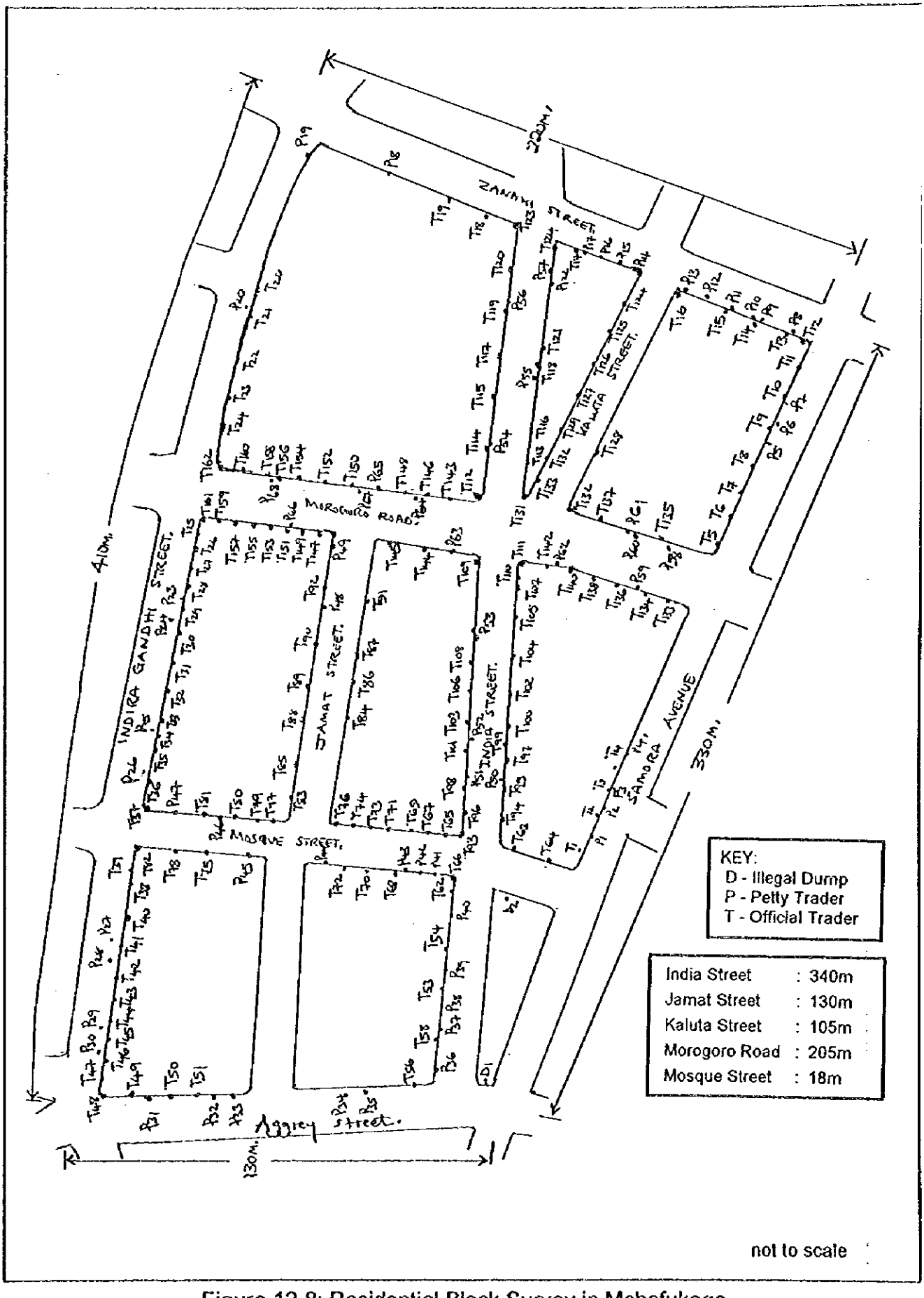


Figure 12-8: Residential Block Survey in Mchafukoge

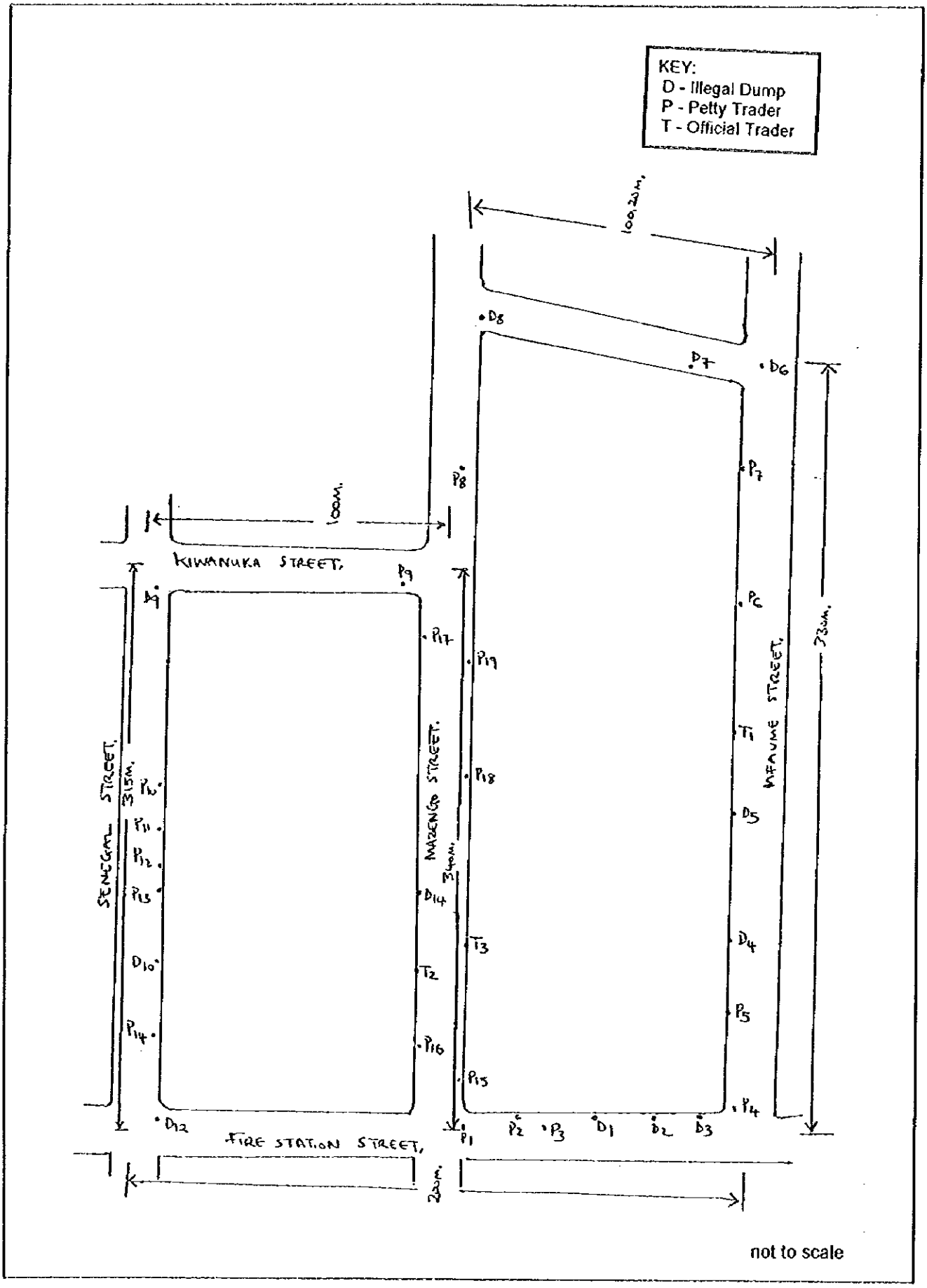


Figure 12-9: Residential Block Survey in Upanga West

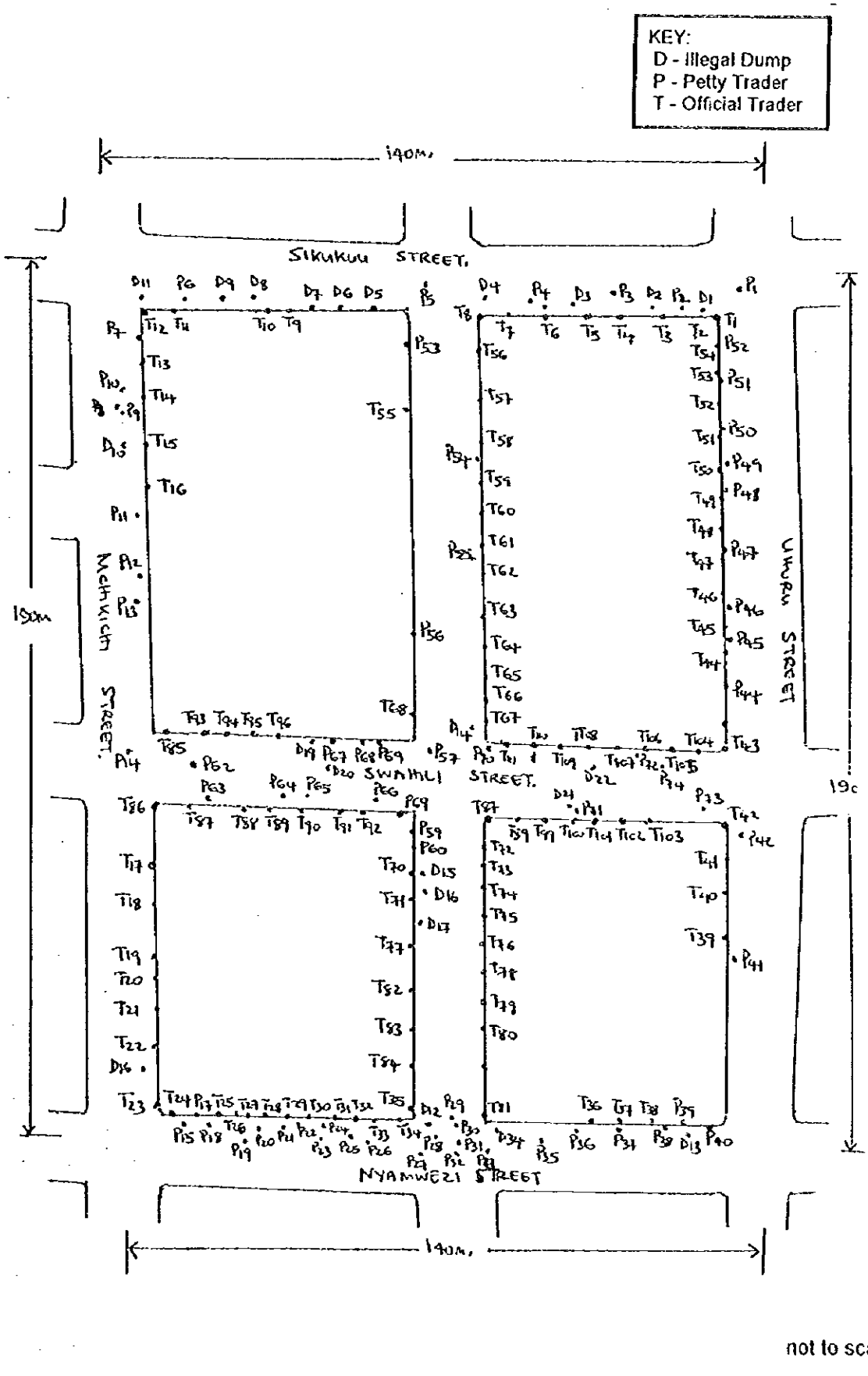


Figure 12-10: Residential Block Survey in Kariakoo

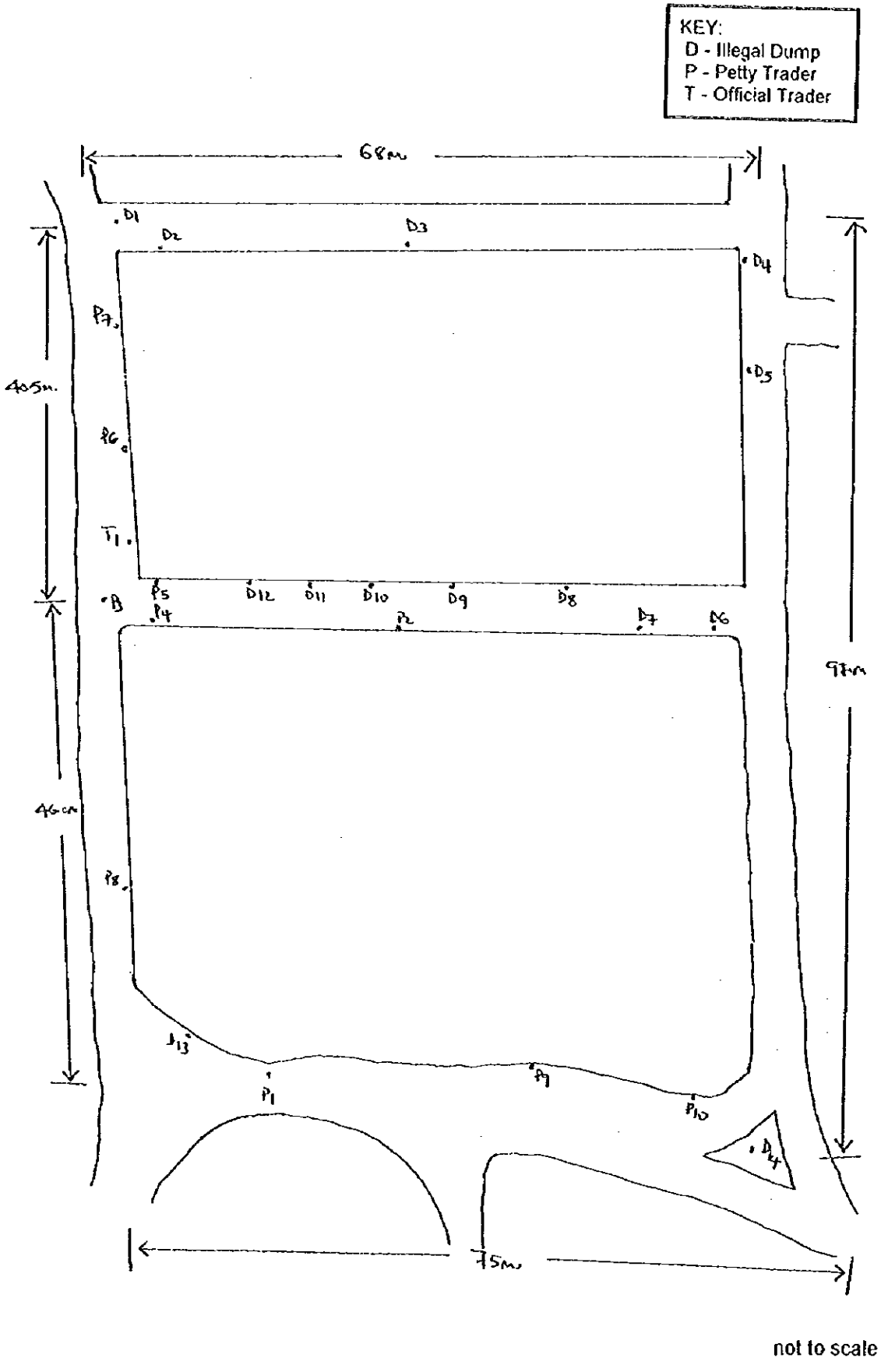


Figure 12-11: Residential Block Survey in Mwananyamala

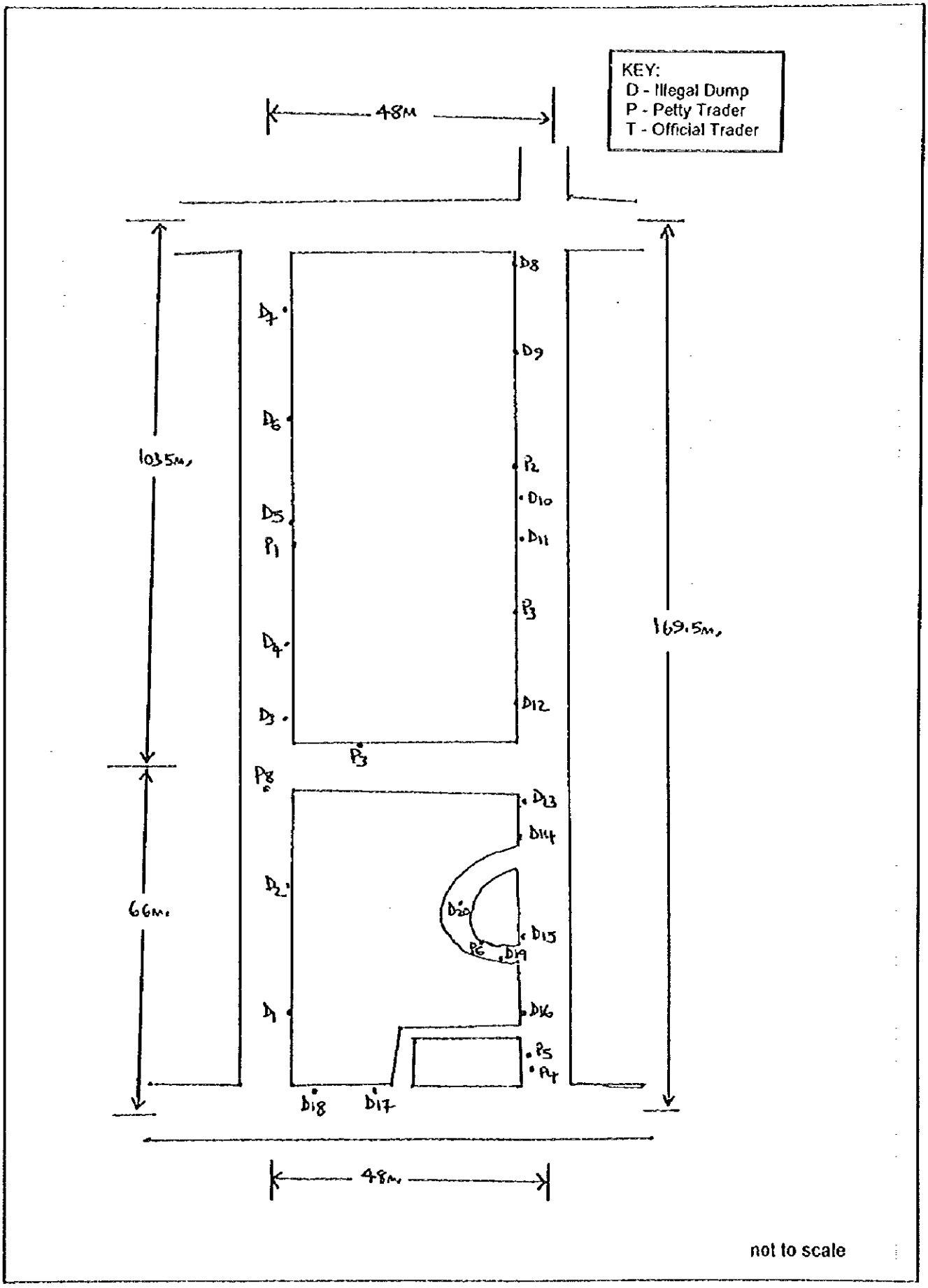


Figure 12-12: Residential Block Survey in Keko

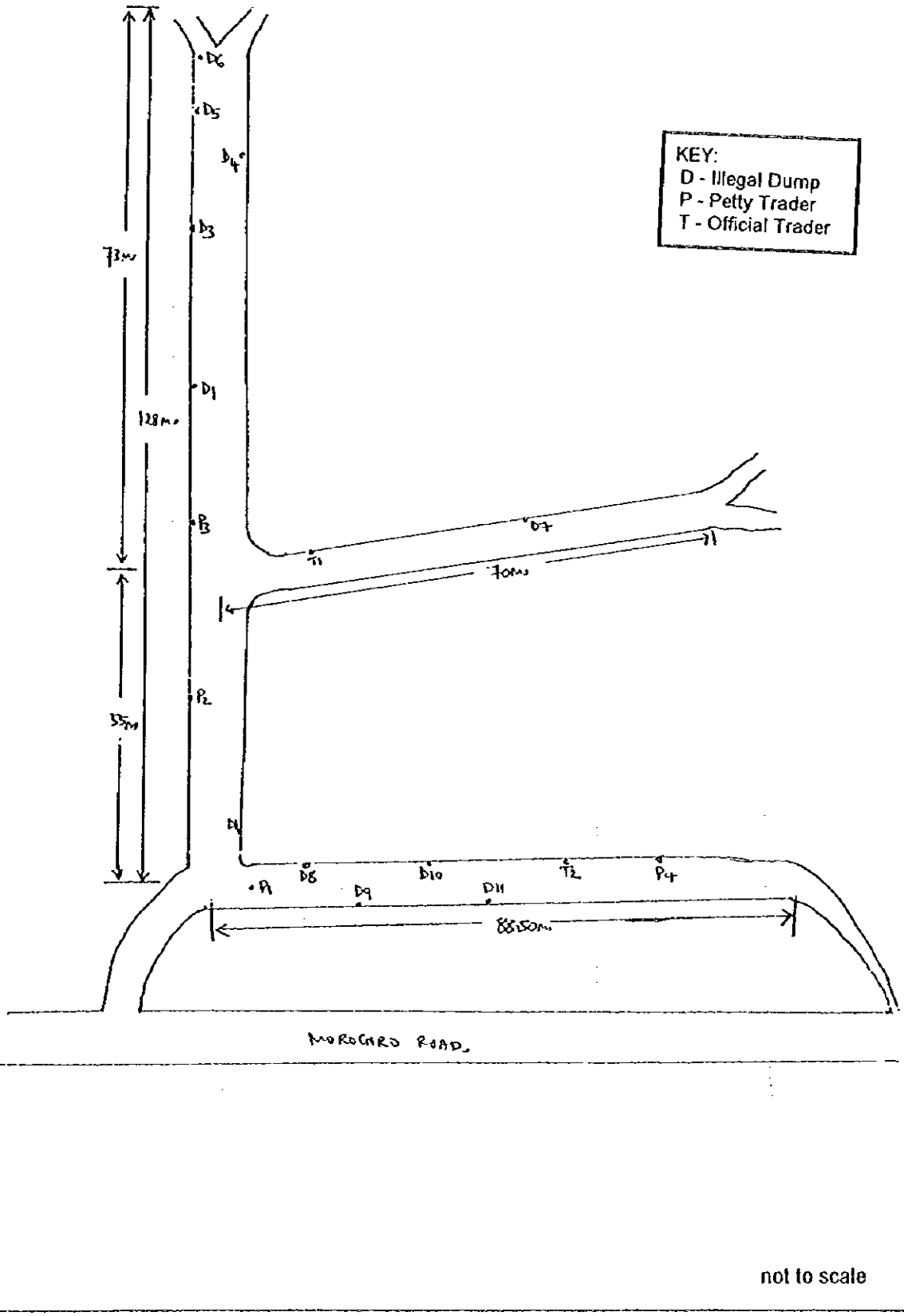


Figure 12-13: Residential Block Survey in Ubungo

12.6.2 Trunk Road Illegal Dumping Survey Questionnaire

A. For Interviewer:

Location:

Description of dumping location:

Type of Waste dumped here:
Area of Dump (m^2): Volume of dump (m^3):
Percentage of the waste burned? Waste contaminates water? Yes/No
Other Comments:

B. Questions for Interviewee:

Name of Interviewee:

1. Who dumps waste here?

a) nearby residents b) businesses (specify)
c) people from vehicles d) petty traders
e) market traders f) handcart operators
g) DCC refuse collection trucks h) Multinet refuse collection trucks
i) other (specify)

2. When is waste dumped here?

a) morning b) afternoon
c) night d) don't know

3a. Do any scavengers collect some materials from the dump?
3b. If yes, please try to answer the following questions:

* how many of them work here?
* at what time(s) do they normally work here?
* what materials do they collect?

4. Is any of the waste burned after dumping? If yes, who burns the waste?

a) person dumping b) another person (specify)
c) self-combustion d) other

5. For how long has this area been used for dumping waste?

6. Is the waste heap growing in size? If yes, at what rate is it growing?

7a. Which groups have made efforts to prevent dumping at this point?

a) nearby residents b) Street Chairman
c) Ward Secretary d) DCC
e) other (specify)

7b. hat measures have these groups taken? What was the result of these measures?

8. What are the opinions of nearby residents concerning the waste dumped here?

12.6.3 Trunk Road Illegal Dumping Survey Results

These results are shown in the following tables:

Table 12-9: Illegal Dumping Results for Trunk Roads in UA

Area Category: UA

Road/Street	Illeg. dump		No. of Dumps containing these types of waste													Vol.	Comm-
	No.	burnt	bo	ca	ce	co	ct	fo	ga	me	pa	pl	sw	te	oth	cu.m.	ents
small																	
Ali Hassan Mwinyi	1	1					1		1			1				0.39	
Bibititi Mohamed	1								1			1				0.08	
Jamhuri	1										1	1				1.5	
Maktaba	3	2			1			2	1		2	2			1	2.71	*1
Morogoro	9	4			1		5	9		6	5	8				20.85	
Ocean	9	3					2	6	6		7	8			1	8.04	*2
Uhuru	2				1			2	1		2	2			1	9.18	*1
sub-total	26	10	0	0	3	0	8	19	10	6	17	23	0	0	3	42.75	
medium																	
Gerezani	1	1				1	1	1	1		1	1				48	
Morogoro	1				1							1				24.04	
Uhuru	1										1	1			1	17.67	*1
sub-total	3	1	0	0	1	1	1	1	1	0	2	3	0	0	1	89.71	
large																	
Morogoro	2	2	1	1	1	1	1	2	2	2	1	2		1	1	1651	*3
sub-total	2	2	1	1	1	1	1	2	2	2	1	2	0	1	1	1651	
Total	31	13	1	2	5	2	10	22	13	8	20	28	0	1	5	1783.5	

Note: The 3 large dumps on Morogoro Rd are of estimated volume 280 (Jangwani2) & 461 cu.m.

Key:

1) No. = the no. of illegal dumps in each street/road
2) burnt: the no. of illegal dump sites where at least 50% of the waste has been burnt (partially or completely)
3) For items, the numbers indicate the no. of illegal dumps in each street/road where these items were found
4) Items: bo = glass bottle; ca = car/other vehicle wreck; ce = ceramic; co = coconut; ct = cans/tins; fo = food leftovers;
   ga = garden waste; hu = cereal/rice husks; me = other metal; pa = paper (boxes); pl = plastics; sw = sawdust; te = textiles; ty = tyres; oth = other
5) Vol. = estimated total volume of illegal dumps in each street/road
6) small, medium and large indicates the size of each dump. Small = 0-10 cu.m ; medium = 10-100 cu.m; large = > 100 cu.m.
7) Comments: These relate to the other items column where *1 = soil; *2 = charcoal; *3 = tyres; *4 = glass; *5 = cereal/rice husks; *6 = feathers; *7 = shoes; *8 = egg shells; *9 = animal manure; *10 = maize cobbs; *11 = gravel/stone; *12 = tubelights; *13 = hair; *14 = dog carcass; *15 = garage wastes (oily rags, etc.); *16 = ceiling board

Table 12-10: Illegal Dumping Survey results for Trunk Roads in SUPA

Area Category: **SUPA**

Road/Street	Illeg. dump			No. of Dumps containing these types of waste												Vol.	Comments
	No.	burnt	bo	ca	ce	co	ct	fo	ga	me	pa	pl	sw	te	oth	cu.m.	
small																	
Ali Hassan Mwinyi	4	3					1	2	4			4				10.22	
Bagamoyo	1		1				1	1								0.09	
Chan'gombe	3	1					2	3	1	1	1	3	1			9.17	
Gerezani	2	0		1				1	1		2	2				5.4	
Haile Selassie	26	15	4		2		15	6	24	1	7	19			2	64.29	*1
Kilwa	6	1		2		2		5	2		4	2				2.24	
Kimweri	4	3		1	1		1	2	1			4	1		3	6.89	*4,*5
Kinondoni	13	12	3	2	1		7	9	9	4	6	10			2	22.75	*1,*6
Makanya	2	0					1	2		1	1	2		1	1	7.75	*7
Mbagala	10	3		1			1	7	4	1	4	9	2	1		22.72	
Migombani	5	2	1						10		2	1				4.35	
Mwinyijuma	1	0						1	2	1	1	1				0.41	
Nelson Mandela	8	1	1	1		1	3	7	1	1	3	6	1	1		16.96	
Nyerere	9	3					1	8	2	2	4	9		1	1	22.28	*8
Old Bagamoyo	12	4	2		3		5	4	9	2	11	11		2	5	30.63	*2,*6,*9
Rashidi Kawawa	7	0					1	6	5		5	7		3		8.46	
Sam Nujoma	1	1					1				1	1				0.06	
Temeke	15	6	1	1	1	3	1	6	9	4	11	11	1	6	7	19.91	*1,*3,*10,*11
Toure Drive	7	5	1				5	1	7	1	1	4	2		3	21.09	*7,*11,*12
Uhuru	11	4	1	1			2	11	5	5	6	11			3	17.21	*3,*5,*13
sub-total	147	64	15	10	8	6	48	82	96	24	70	117	8	15	27	292.88	
medium																	
Gerezani	1							1	1		1	1				25	
Haile Selessie	3	2	2		1		2	2	2	1	1	2			1	88.42	*1
Kilwa	2	2					2		2	1		2				42.75	
Kinondoni	2	2		1	1				2	1					1	38	*1
Mwinyijuma	1								1		1	1	1		2	20	*9,*13
Nelson Mandela	2			1			1	2	1	1	1	2			1	126	*3
Njia Panda	2		2		2	1	1	2	2	1		2		2	1	33	*4
Old Bagamoyo	8	3			1		2	6	6	1	3	7			1	123.46	*9
Rashidi Kawawa	2						1	1	2		1					38.9	
Toure Drive	3		1		1		1		2			3		1	3	39.2	*1,*4,*14
sub-total	26	9	5	2	6	1	10	14	21	6	8	20	1	3	10	574.73	
large																	
Chan'gombe	1						1	1	1	1	1	1	1			140	
Mwananyamala	1	1	1	1			1	1	1	1	1	1	1			1390	
Rashidi Kawawa	2	2	2	2		2	2	2	2	2	2	2		2		894	
Nelson Mandela	1		1				1	1	1		1	1			1	205	*9
Old Bagamoyo	1	1					1	1	1			1				196	
sub-total	6	4	4	3	0	2	6	6	6	4	5	6	2	2	1	2825	
Total	179	77	24	15	14	9	64	102	123	34	83	143	11	20	38	3692.6	

Note: 1) The 2 large dumps on Rashidi Kawawa Rd are of estimated volume 750 (RK1) and 144 (RK2) cu m.
2) The dump at Mwananyamala is located approximately 100m from Rashidi Kawawa Road

Table 12-11: Illegal Dumping results for Trunk Roads in SUUA

Area Category: SUUA

Road/Street	Illeg. dump		No. of Dumps containing these types of waste													Vol.	Comments
	No.	burnt	bo	ca	ce	co	ct	fo	ga	me	pa	pl	sw	te	oth	cu.m.	
small																	
Chan'gombe	10	4					2	4	6	2	3	6	1	2		8.76	
Kigogo	26	7	6	2	1	3	3	19	11	6	14	18		13	4	38.36	*1,*2,*3,*7
Kilwa	6	2					3	5	2	1	5	5	2		1	22.7	*13
Morogoro	7	3	1	1			1	4		2	3	6	1	3	1	15.8	*3
Nelson Mandela	13	3		1			3	8	6	3	4	12	2		1	16.13	*9
Nyerere	8	2					1	7	2	2	4	8			1	22.22	*8
Shekilango	4		2			3	3	3	2	1	3	3		2	2	8.98	*4,*13
Uhuru	9	3	4		1		3	8	3	2	5	7	1		1	15.83	*1
sub-total	83	24	13	4	2	6	19	58	32	19	41	65	7	20	11	148.78	
medium																	
Kigogo	3	1		2				1		1	1	1				41.19	
Kilwa	6	1					2	4	5	2	3	4		2	1	246.7	*9
Makanya	1			1		1				1	1	1		1		15	
Nelson Mandela	3		1	2			1	2			1	3	1		1	144.8	*9
Nyerere	2							2	2			1				63.35	
Uhuru	3			2			1	2		2	1	2			1	90	*3
sub-total	18	2	1	7	0	1	4	11	7	6	7	12	1	3	3	601.04	
large																	
Nelson Mandela	3		3	2			2	3	1	3	3	3		1	1	1336	*1
Nyerere	2			1				2				2				640	
sub-total	5	0	3	3	0	0	2	5	1	3	3	5	0	1	1	1976	
Total	106	26	17	14	2	7	25	74	40	28	51	82	8	24	15	2725.8	

Note: 1) The 3 large dumps on Nelson Mandela Rd are of estimated volume 720, 504 and 112 cu.m.
2) The 2 large dumps on Nyerere Rd are of estimated volume 480 and 160 cu.m.

Table 12-12: Illegal Dumping Survey results for Trunk Roads in RA

Area Category: RA

Road/Street	Illeg. dump		No. of Dumps containing these types of waste													Vol.	Comments
	No.	burnt	bo	ca	ce	co	ct	fo	ga	me	pa	pl	sw	te	oth	cu.m.	
small																	
Kigogo	6					2	2	5	1	3	2	5	1			3.16	
Morogoro	7	3		2	1		4	4		4	3	5		1	2	19.31	*1,*15
Nelson Mandela	5	2	1				1	4		1	4	5	2	1	2	11.31	*1,*8
Nyerere	2							2	2							2.32	
Pugu	4		1				1	3	2	1	1	1				11.15	
Sam Nujoma	9	4	2	6	2	2	1	7	5	2	7	7	2	3	4	14.06	*1,*3,*13,*15
sub-total	33	9	4	8	3	4	9	25	10	11	17	23	5	5	8	61.31	
medium																	
Kigogo	4						1	1	2	2	4	4		2		152	
Morogoro	3	1	1	1	2			2		2		3	1		1	120.11	*10
Nelson Mandela	6	2		3			2	3	4	3	2	5	1		3	284.04	*3,*8,*15
Pugu	4		1		1		1	3	3	1	1	4	1		2	123.46	*1,*13
Sam Nujoma	4		1			1	2	4	2	1	3	3	1	3	2	82.35	*2,*13
sub-total	21	3	3	4	3	1	6	13	11	9	10	19	4	5	8	761.96	
large																	
Pugu	4	1		1	1		1	4	3		2	4	1		2	2263.2	*1
sub-total	4	1	0	1	1	0	1	4	3	0	2	4	1	0	2	2263.2	
Total	58	13	7	13	7	5	16	42	24	20	29	46	10	10	18	3086.5	

Note: 1) The 4 large dumps on Pugu Rd are of estimated volume 672, 115, 576 and 900 cu m.

12.6.4 Handcart Operator Survey Questionnaire

1a. Name (optional):
1b. Sex:
1c. Type of transport used for dumping waste:
1d: Do you use this transport for the work of waste disposal only?
1e. If no, what other work do you use it for?

2. [Note for Interviewer: This question applies to the work of waste disposal only and not other activities]
2a. For how many years have you been doing this work?
2b. How many hours do you work per week?
2c. For each day, at what time do you start work and when do you finish?
2c. How many days do you work per month?
2d. How much can you earn per month from this work?
2e. How many jobs do you have?

3. Who do you work for?

a) yourself
b) another person
c) cooperative
d) company
e) other (specify)

Please specify the name of the cooperative/company if applicable:

4a. Who do you collect materials from?

a) households
b) shops
c) offices
d) hotels/restaurants
e) markets
f) petty traders
g) small workshops
h) other (specify)

4b. Which areas of the city do you collect materials from? (e.g. Kariakoo, Gerezani, etc.)

5. How much do people pay you to take their waste for each of the sources you collect from? (specify if it is per kg or per day or per week or per plastic bag (+ what size plastic bag) etc.)

6a. How many units (bags, kg, etc.) can you fit into your mikokoteni?
6b. How many trips per day can you do?

7a. Where do you dump the waste?
7b. Have you always dumped waste here?
7c. If not where else do you dump waste?

8. Please describe any problems you have from this work:

Annex 13

Private Collectors Survey

13 Private Collectors Survey

A survey of private SWM contractors was made primarily through interviews with DCC, Multinet and Mazingira staff, together with the collection of some written documentation from these sources, especially DCC. The results of this survey are summarised in Table 13-1.

Table 13-1: Private Contractors Survey Summary

Type of Collector	Generation Sources					
	Residential	Commercial	Institutional	Market	Health facilities	Other
Private Contractors	1	1	1	1	1	1
CBOs[1]	2,3	2,3	2	2	2	2
Individual Operators	2,4	2,4	--	4	--	4

Note: 1 = waste collection under DCC contract including collection of the refuse collection charge (RCC)
2 = voluntary waste collection (i.e. without collection of RCC)
3 = waste collection with illegal RCC
4 = illegal waste collection with illegal RCC

In Table 13-1, private contractors have been grouped into three categories, each of which are different in nature and mode of operation as elaborated on in the following sections.

13.1 Private Contractors

These are contractors which:

- operate legally under contract to DCC.
- are obliged to collect waste from the officially privatised areas which have been contracted to them.
- have authority under DCC by-laws to collect the refuse collection charge (RCC).

The advent of private contractors as defined above dates back three years to the initiation of the DCC privatisation programme. Under the first phase of this programme, only one company (Multinet Africa Ltd.) was contracted on a concession basis to operate refuse collection services in 10 city centre wards. The contractor was also responsible for street sweeping within the contracted area and for the collection of the RCC from customers. Multinet began operation in September 1994 but a number of disputes subsequently arose between DCC and Multinet, resulting in Multinet being forced to withdraw its operations from 5 wards in January 1996.

In May 1996, following revision of the original contract, the privatisation exercise entered its second phase in which privatisation of refuse collection was expanded to cover more wards and some markets in the city. Under Phase II, five companies were granted contracts to service various wards and markets as indicated in .

[1] CBO = Community Based Organisation

Table 13-2: Phase II: Contractors and Contracted Areas

Name of Contractor	Wards/Markets Serviced
Multinet Africa Ltd.	Mchafukoge, Kivukoni, Kisutu, Upanga East, Upanga West, Jangwani, Gerezani, Kariakoo, Ilala, Mchikichini wards
Mazingira (1994) Environmental Protection Ltd.	Msasani, Kawe, Kinondoni, Mwananyamala, Manzese, Tandale wards
Kamp Enterprises	Ubungo and Kagera markets
Allyson Traders	Magomeni, Ndugumbi, Mzimuni
Kimangele Enterprises	Temeke, Magurumbasi and Keko markets

Multinet remained the major private contractor and was allocated ten wards in total, including the five previously withdrawn wards. It resumed operation in these wards towards the end of July 1996. However, four months later in November 1996, it withdrew operations again from the same five wards (Jangwani, Gerezani, Kariakoo, Ilala and Mchikichini) citing unwillingness of the residents of these wards to pay the RCC as the main reason.

A second company, Mazingira (1994) Environmental Protection Co., was allocated 6 wards - Msasani, Kawe, Kinondoni, Mwananyamala, Manzese and Tandale - and started collecting refuse in these wards in August 1996. However, Mazingira is presently only providing refuse collection services on a point by point basis to the commercial sector within these wards.

The other three companies have yet to complete DCC contracting formalities and hence have not begun operation.

Both of the two private contractors currently operating collect waste from all generation sources listed in Table 13-1 and dispose of it at Vingunguti disposal site.

13.2 CBOs

There are a few Community Based Organisations (CBOs) which are fulfilling a need in DSM by providing some form of refuse collection services at a local community level in certain areas within the city, particularly those not serviced by DCC or the private contractors listed in section 13.1 above.

These include Kinondoni Moscow Women's Association operating in the Hana Nasifu area and POCA. CBOs such as these primarily collect refuse from households and commercial enterprises on a regular basis.

There are also a number of other small "self-help" type organisations which have been loosely categorised as CBOs here. Their activities include carrying out environmental cleanliness operations, including the removal of solid waste, on an infrequent voluntary basis in a particular locality such as from an institution (e.g. school), market and even health facility. Tanzania Environmental Cleanliness Association (TECA) is one such association and their members were pictured cleaning up Uhuru Girls Primary School in the June 19, 1996 issue of the *Daily News*.

There are primarily two motivating factors for CBOs to be involved in refuse collection:

- improving the cleanliness of the local environment, thus motivating other members of their community to care for the environment and to keep their community clean.

- to collect some revenue in return for providing a refuse collection service which can then be used to support their operations or other activities within the community.

These organisations have few links with DCC, meaning cooperation between DCC and CBOs is often minimal. Some of their activities may conflict with DCC policy and possibly even with the law. Furthermore, their concerns are primarily focused on their target communities and the immediate locality. This can create some problems, one example of this in the context of refuse collection being the issue of final disposal of the waste collected by CBOs. Transportation of the waste to Vinguguti disposal site either by the CBO itself or through arrangement with DCC or a private contractor would greatly reduce the profitability of a refuse collection service for the CBO. Hence, many CBOs choose to illegally dump the collected waste in relatively close proximity to the communities they serve, thus increasing the amount of illegally dumped waste in the city.

Another issue concerns the acceptance of CBO activities by the communities in which they operate. Some members of these communities do raise questions about certain CBO activities, especially when it comes to the issue of payment and the level of service charges. This is primarily because there is neither an authority informing them nor regulation requiring community members to pay CBOs any service charges.

13.3 Individual Operators

Individual operators consists of many contractors, most of whom are self-employed. They operate in all parts of the city and use various methods for the removal of waste including transporting it on foot in baskets on their heads, using bicycles or handcarts.

They are fulfilling a need in the city by providing refuse collection services throughout the city, particularly in areas where there is no refuse collection system or refuse collection is inadequate. The services provided by these contractors are well utilised by the public, especially households, shops, restaurants and hotels. Generally, health facilities and institutions do not use such services. The main reason for their popularity are that such services are normally cheap and readily available and in many areas of the city there is no other alternative.

However, these contractors are regarded as illegal operators and DCC is actively trying to minimise the scale of their operations. This is primarily because they seldom dump the waste collected at Vinguguti disposal site. Instead, the collected waste is dumped anywhere, usually within a 500-1,000 m radius of the area from which it is collected. Typical dumping places include near electrical pylons, at junctions/roundabouts, in open spaces, etc. Hence, these contractors are increasing the amount of illegally dumped waste in the city.

13.4 Summary

Multinet and Environmental Protection Co. are considered to be providing an acceptable refuse collection service as they currently collect waste and dispose of it in a legal manner; that is, by dumping at the Vinguguti disposal site. However, both companies experience serious problems with the collection of the RCC, especially from residents in the wards serviced.

Conversely, CBOs and individual operators are not considered to be providing an acceptable refuse collection service as although they are fulfilling a need for refuse collection in many parts of the city, most CBOs and virtually all individual operators subsequently dispose of this waste in an illegal manner.

However, it is acknowledged that CBOs and individual operators do provide a useful collection service, particularly in areas of the city not easily accessible to vehicles. There is considerable potential for utilising such organisations and individual operators in community based refuse collection systems which could link such methods of refuse collection with DCC or private contractors' vehicles to ensure that the waste collected is subsequently disposed of in a legal manner.

Annex 14

Assessment on the Candidate Sites for the Future Disposal Sites

14 Assessment on the Candidate Sites for the Future Disposal Sites

14.1 Introduction

14.1.1 Background

There is only one existing official waste disposal site for the DSM city, which is the Vinguguti disposal site, operated by DCC. As it is located only 10 km from the city centre, it is a convenient site in terms of waste transportation. However, nearby residents' complaints have been numerous since its opening, as it has produced many environmental problems such as public nuisance, odour, smoke, dust, vibration and traffic congestion due to the current crude dumping nature of operation and being close to a densely populated residential area. Vinguguti road, which is used by refuse trucks access to the disposal site, is also used as a main community road for Vinguguti ward. Refuse trucks are increasing the congestion of this road which is narrow, untarmaced and always very busy with pedestrians and vehicles.

As the reserve capacity of Vinguguti is very limited, the plan for funding for the extension of the site were rejected by the World Bank and it is very unlikely that any other donors will provide funds following this rejection[1]. Thus Vinguguti can be a cost effective and expedient solution but will not comply with long term environmental requirements. The development of new landfill sites is, therefore, a crucial and urgent issue.

14.1.2 History of Siting Disposal Sites

The DSM Master Plan prepared in 1979 proposed five general locations for the future disposal sites, as shown in Figure 14-1. Not even one has not been implemented.

Tabata disposal site which is located 4 km away from the city centre was used from the 1960's to 1991. In the late 1980's the Tabata residents started to complain about dangers and inconvenience caused by smoke, odour, etc. because many people had settled down near to the site. In 1989, the residents of Tabata dump site took their case to the Courts and won. However DCC's appeal to the High Court gave them 2 periods, each of one year, as an extension to use Tabata disposal site while looking for an alternative site.

DCC then started to use the Mbagala-Kilungule site which had been in the Master Plan. However, this site was forced to close due to residents' protest.

After failure to use the Mbagala-Kilungule site, DCC tried to use the Kunduchi site, 20 km away from the city centre, as an alternative, but again they were turned away by Kunduchi residents who took their case to the Court and won.

Then in 1992 the disposal site was shifted to the existing disposal site at Vinguguti which is located 10 km from the city centre. Because the Vinguguti site is located close

[1] Privatisation of Solid Waste Collection and Road Sweeping Services in DSM, Manus Coffey, Jan. 1996

to a high density residential area and sanitary landfill operation is not being used, complaints from residents are frequent.

In 1991 a committee was inaugurated by the City Director to study siting a new disposal site and 11 sites were studied. In 1992 a geological and hydrological study was done for the Kinzudi B site. However, siting work of a new disposal site has not advanced further since no action had been taken for land acquisition and site implementation.

Figure 14-1: General Locations for the Disposal Sites Proposed by Master Plan in 1979

14.2 Study Schedule for the Disposal Site

In this study to successfully conduct planning for the proposed disposal sites, the following schedule has to be followed.

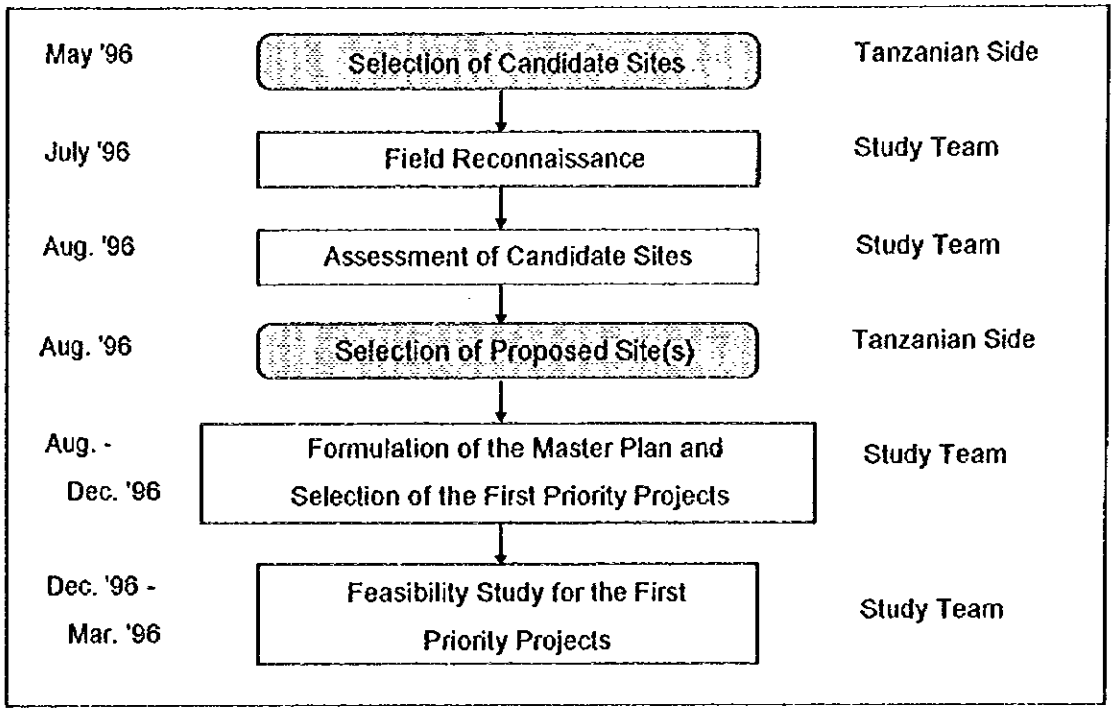


Figure 14-2: Study Work Schedule for Future Disposal Site(s)

This report is within at the stage where assessment of candidate sites to be conducted in August 1996 in the above shown schedule is in progress. The Tanzanian side has been requested to make a decision on the selection of the proposed site(s) in the meeting of Progress Report (2) to be inaugurated in late August so that the study team can conduct further study works according to the agreed study schedule presented in the inception report.

14.3 Candidate Sites for Evaluation

The study team was informed of the six candidate sites, as shown in Table 14-1, for final disposal by the DCC's letter, ref.no.DCC/CP.G/137Vol.II/10, dated 10 May 1996.

In this regard, the study team made the following requests to the Tanzanian side in the Minutes of Meeting for Progress Report (1) Dar es Salaam, 13th June, 1996.

- To indicate the locations of candidate sites more specifically.
- To investigate the availability and the present status of the candidate sites.

However, since the replies to the above requests had not reached the study team by the middle of July 1996, the study team assumed the exact location of each proposed site and its most likely boundaries in collaboration with the counterparts.

As for Kunduchi Mtongani Quarries, its indication is very general and ambiguous. Therefore this site was regarded as two sites, Kunduchi Old MECO quarry site and Kunduchi New MECCO[2] quarry site based on field reconnaissance.

Table 14-1: List of Candidate Sites

District	Candidate sites informed	Candidate sites studied	
Kinondoni	Kinzudi "B"	A-1	Kinzudi "B"
	Kunduchi Mtongani Quarries	A-2	Kunduchi Old MECCO quarry
		A-3	Kunduchi New MECCO quarry
Temeke	Mbagala behind St. Anthony (Mbagala) Sec. School	B-1	Mbagala behind St. Anthony (Mbagala) Sec. School
	Mbagala Kilungule	B-2	Mbagala Kilungule
	Mbagala Zakhem Sand Quarry	B-3	Mbagala Zakhem Sand Quarry
Ilala	Pugu Kajiungeni at the old ADUCO quarry	C-1	Pugu Kajiungeni at the old ADUCO quarry

14.4 Results of Field Reconnaissance for the Candidate Sites

14.4.1 Results of Field Reconnaissance

Seven candidate, as shown in Figure 14-3, sites were investigated.

[2] MECCO: Mwananchi Engineering and Construction Company

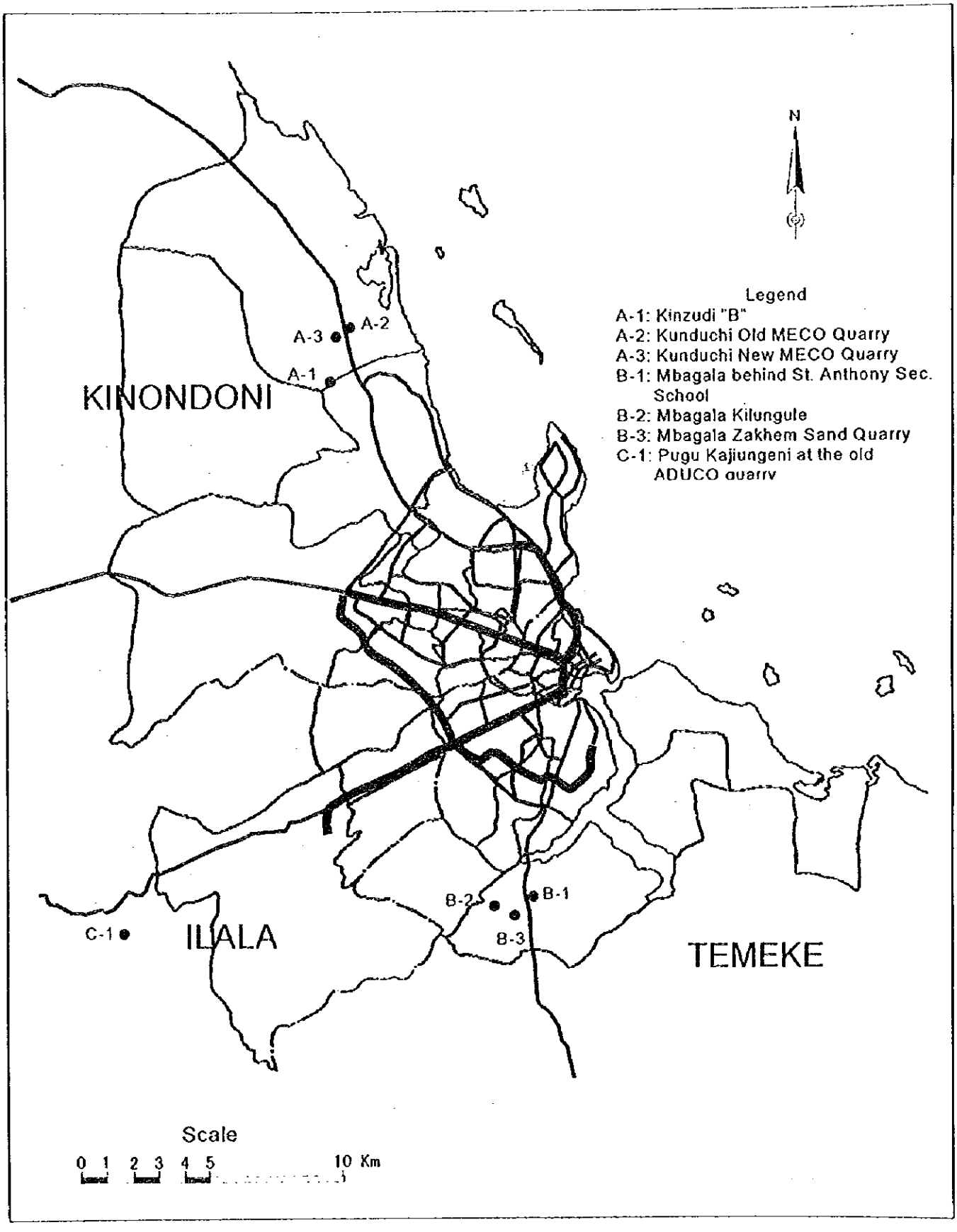


Figure 14-3: Location of Candidate Sites for Final Disposal

No: A-1

Name of the site: Kinzudi "B"

District: Kinondoni

1. Key Indicators

Location:	S06°41'38", E39°11'25", in Kunduchi and Kawe wards
Distance from the city centre:	20.4 km including 3.8 km of new road construction
Area and capacity:	18.5 hectares, 5.5 million m^3
Type of terrain:	Valley bounded by moderately dissected ridge
Present land use:	Agricultural land
Surrounding area:	Agricultural land
Status of land:	under the control of MLHUD
Displacement:	about 5 houses

2. General description

Kinzudi "B" is located about 18 km north of the city centre along Bagamoyo Road. This site, generally indicated in the Master plan in 1979, has an area of 18.5 hectares and a capacity of about 5.5 million cubic metres. Because this site is surrounded by a ridge of 100 masl (metre above mean sea level), there is a difference in elevation of about 50 metres between Bagamoyo Road and the site.

An environmental Survey for the proposed sanitary landfill for Kinzudi "B" was conducted by S. Mgana in 1992. This study, including a soil characteristics survey and hydrological survey of the site and neighbourhood, concluded that this was an suitable site environmental impact would be minimal based on the physical parameters investigated. It also proposed that the City Council should immediately act to utilise this site as a localised landfill for the nearby areas. However, the final part of this report mentioned that accessibility development costs and waste transportation costs from the city centre would be enormous. It should be noted that this study focused only on technical and environmental aspects and not financial or social aspects.

At present the Kinzudi "B" site is sparsely inhabited. No serious farming is taking place. There is only light cultivation of mainly seasonal crops such as corn and vegetables and few scattered permanent crops such as coconut, cassava, banana and mango. It was observed that the situation at this site has not changed seriously since 1992. The study team's opinion on this site is, therefore, similar to Mgana's report generally.

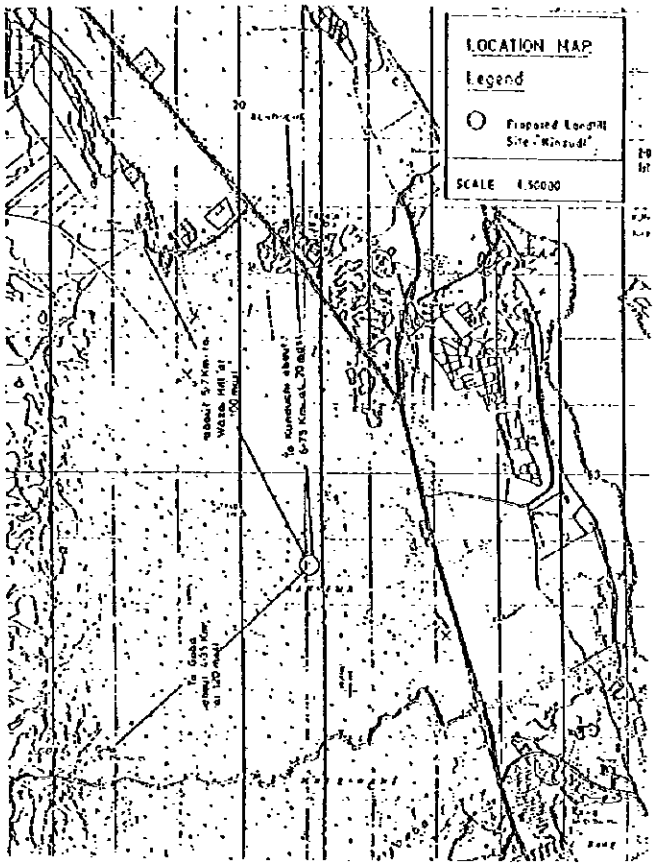
3. Main Advantages and Disadvantages

Main Advantages

- The number of residents to be affected is few.
- Coverage soil can be obtained from the nearby quarry.

Main Disadvantages

- It requires construction of a new access road for 3 km.
- The access road to be constructed will be steep.
- Maintenance of the natural environment within the site will not be possible.



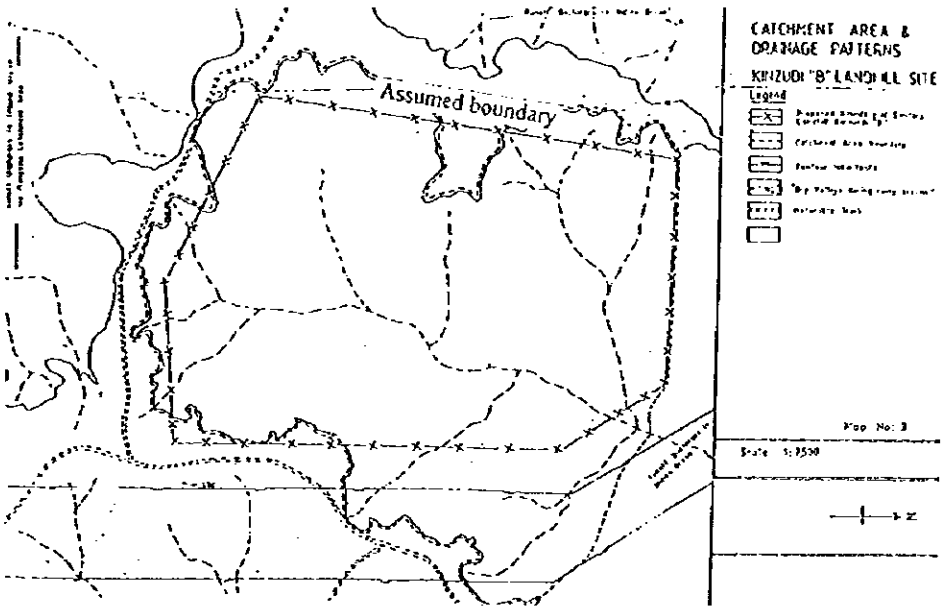


Figure 14-4: Kinzudi "B" Site

Code No: A-2

Name of the site: Kunduchi Old MECCO Quarries

District: Kinondoni

1. Key Indicators

Location:	S06°40'38", E39°11'41", in Kunduchi ward
Distance from the city centre:	19.3 km along Bagamoyo Road
Area and capacity:	400 hectares, 28 million m^3
Type of terrain:	Cavity
Present land use:	Quarry
Surrounding area:	Residential area in the east side, quarries in the other sides
Status of land:	under the control of MWEM
Displacement:	about 10 to 20 houses

2. General description

Kunduchi Old MECCO Quarry site is located about 19.3 km north of the city centre next to Bagamoyo Road. This site has an area of 50 hectares and a capacity of about 5 million cubic metres. This site was forced to be closed immediately after use as a disposal site in 1992 due to residents' strong protests.

The main quarry operation seems to have been ceased because most materials have been exhausted. However, small scale quarry operations are still being conducted at various points within the quarry. In the completed area of quarry operation some houses have been constructed and are inhabited. The development of a quarry as a disposal site will result in displacement of some illegal residents, numbering about not more than 100 people.

This site is considered to be usable as a disposal site provided that sufficient mitigation measures for negative environmental impacts caused by the disposal site are taken because there are many residents living the east side of this site.

3. Main Advantages and Disadvantages

Main Advantages

- Small negative environmental impacts, because the natural environment in this site has been damaged by quarry operation.
- Coverage soil can be obtained within the site.
- The road from the city centre to this site is tarmaced and good condition.

Main Disadvantages

- The site is able to be seen from Bagamoyo Road as it faces it. The site is also to be seen from the sea side because it is located on a gradual down slope.
- There are quite a few residents and also a military camp on the eastern side of the site. The eastern side of this site is designated as a residential area.
- The cavity area is wide but not as deep as the Kunduchi New MECO site and therefore the construction cost for the disposal site is expected to be more expensive than that site.

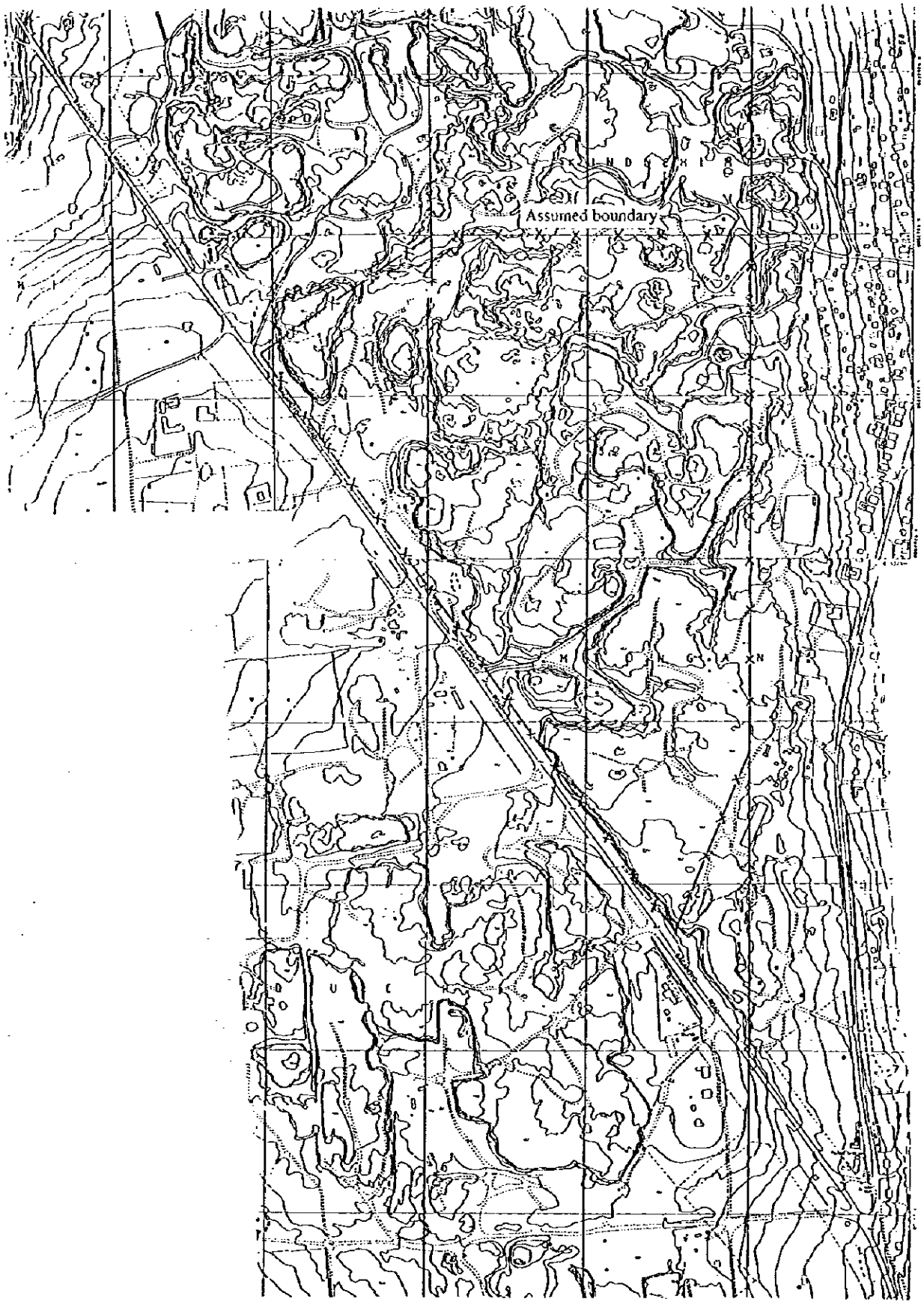


Figure 14-5: Kunduchi Old MECCO Quarry Site

Code No: A-3
Name of the site: Kunduchi New MECCO Quarry
District: Kinondoni

1. Key Indicators

Location:	S06°41'12", E39°11'45", in Kunduchi ward
Distance from the city centre:	19.3 km along Bagamoyo Road
Area and capacity:	35 hectares, 6 million m^3
Type of terrain:	Cavity
Present land use:	Quarry
Surrounding area:	Quarries in the north and east sides, Agricultural land in the west and south sides
Status of land:	Ministry of Works is operating a crushing plant. This land is under the control of Ministry of Energy and Mineral.
Displacement:	0

2. General description

Kunduchi Old MECO Quarry is located about 19.3 km north of the city centre next to Bagamoyo Road. This site has an area of approximately 35 hectares and a capacity of about 6 million cubic metres.

The crushing plant is being operated by the Ministry of Works although the activities level of operation is low ceased because most materials have been exhausted. Manually, quarry excavation is also being carried out at various points by individual workers. In the completed area of quarry operation no houses and inhabitants have been seen. Therefore development of the site will not need any displacement.

This site is considered to be suitable as a disposal site providing that sufficient mitigation measure for negative environmental impacts caused by the disposal site are taken.

3. Main Advantages and Disadvantages

Main Advantages

- Small negative environmental impacts because the natural environment in this site has been damaged by quarry operation.
- Coverage soil can be obtained within the site.
- Disposal operation can be screened by planting trees along Bagamoyo Road.
- The road from the city centre to this site is tarmaced and in good condition.
- The present value of this land is very little.
- No displacement will be involved.

Main Disadvantages

- No particular disadvantages.

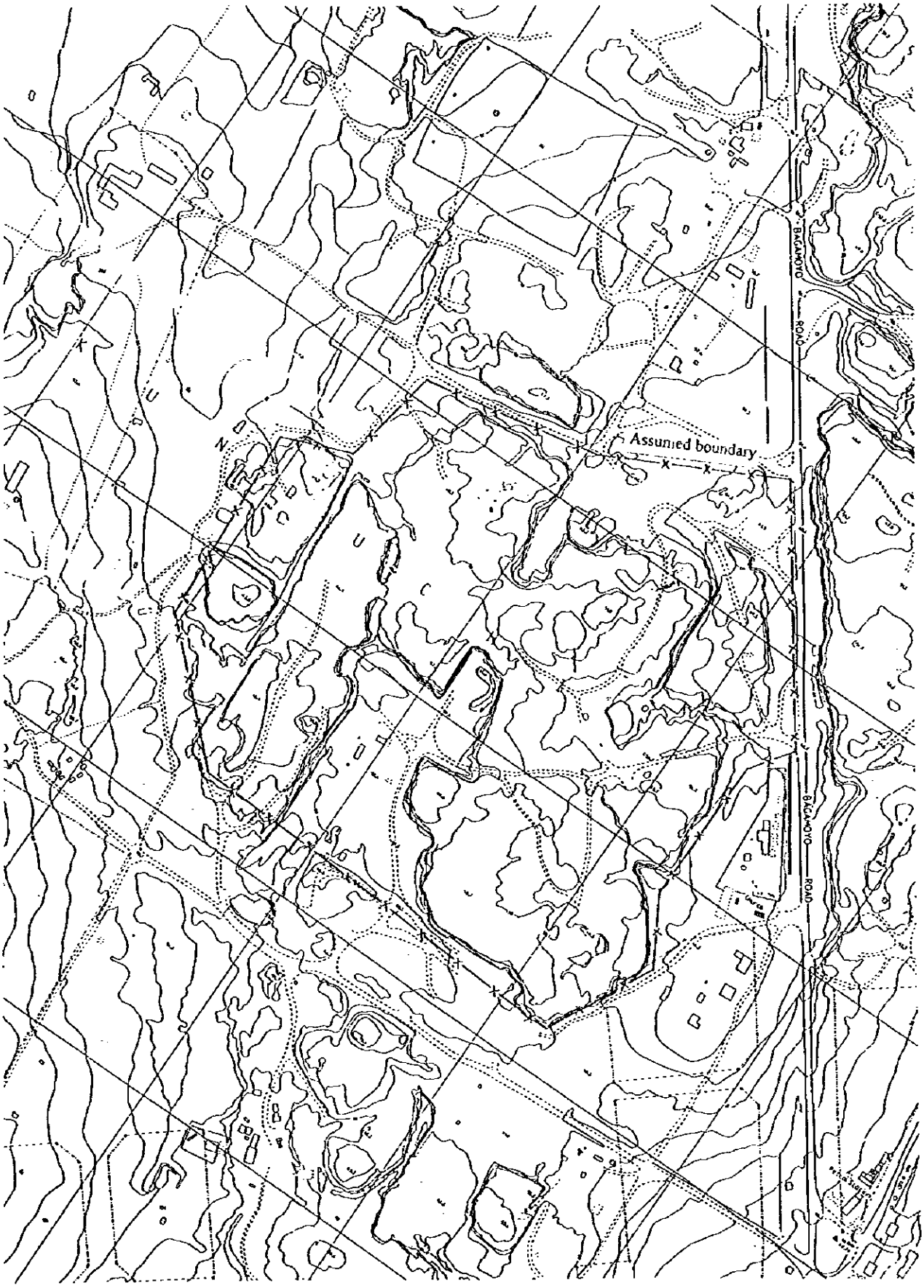


Figure 14-6: Kunduchi New MECCO Quarry Site

Code No: B-1

Name of the site: Mbagala Behind St. Anthony Secondary School

District: Temeke

1. Key Indicators

Location:	S06°54'42", E39°15'11", in Kunduchi ward
Distance from the city centre:	11.7 km along Kilwa Road
Area and capacity:	not applicable
Type of terrain:	Valley
Present land use:	Agricultural land partially
Surrounding area:	Residential area
Status of land:	under the military control
Displacement:	Displacement will be involved but their number is unknown at this moment.

2. General description

This site is located of 0.7 km from western side of the St. Anthony Secondary School which is located at 11 km south from the city centre. The area between the St. Anthony Secondary School and the site is a densely populated planned residential area, as shown in the map. The site is a valley of about 20 metres deep. This site is currently under military control, and therefore the study team could not enter the site.

Although we failed to enter this site, it was found from observation from outside that this site was unsuitable as a disposal site. Because a densely populated planned developed residential area is located close to the site, many people would not be able to escape from negative impacts by passage of refuse collection trucks and disposal site operation even if great efforts for environmental protection measures are taken. Moreover, because of being located along the valley and its topographical features, it is expected to be difficult to prevent polluting water by leachate generated by waste. Finally the site is too small for a new disposal site which would result in the construction and operation cost per ton for waste disposal being very expensive.

This site is, therefore, unsuitable for use as a disposal site.

3. Main Advantages and Disadvantages

Main Advantages

- The distance from the city centre is shorter than the all other candidate sites.

Main Disadvantages

- Highly populated planned residential area is very close to this site.
- Large population would be directly affected.
- Large population would be indirectly affected, for example, by water pollution.
- The site is too small, resulting in expensive construction and operation costs.
- To obtain nearby acceptance would be extremely difficult.
- Reduced possibility of donor co-operation.
- This site is under control of the Military.

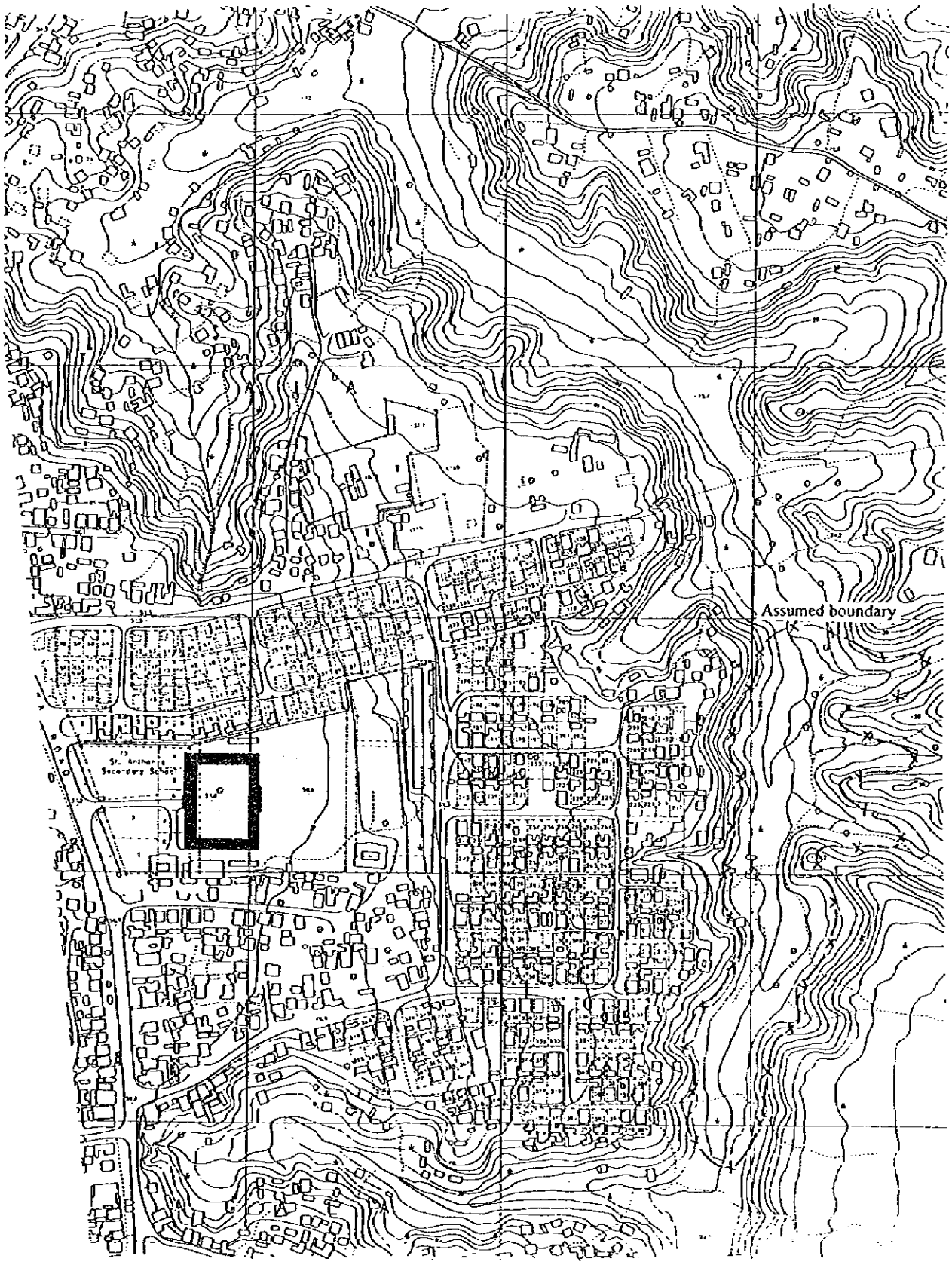


Figure 14-7: Mbagala Site Behind St. Anthony Secondary School

Code No: B-2

Name of the site: Mbagala Kilungule

District: Temeke

1. Key Indicators

Location:	Mbagala ward
Distance from the city centre:	about 15 km including 3 km of new road construction
Area and capacity:	4 hectares, 200,000 m^3
Type of terrain:	Cavity
Present land use:	Cavity
Surrounding area:	Agricultural and wild land
Status of land:	Irregular sand quarrying is operational. The land is under control of MLHUD.
Displacement:	0

2. General description

Although we visited Mbagala Kilungule site with the Study team counterpart, the counterpart who guided us was also not confident whether it was Mbagala Kilungule site. The site visited was an excavated cavity of about 5 metres depth located about 15 km, south of the city centre. This contained a lot of clean and as it may visit in the dry season, July, this water was judged to be ground water.

Mbagala Kilungule site was used for dumping in 1991 following closure of Tabata dump, but was forced to close immediately due to neighbours' protest. The main reasons were as follows[3].

1. The community near the dump site, some of whom invaded the dump site, protested because the dump site is very close to their houses. This is basically a "planned" site but the site was not protected against invasion.
2. The site was upstream of water sources such as shallow well aquifers and Mtoni water works which supplies water to about 10 % of the city population.
3. Fears that the site will be converted to another Tabata, thus creating health risks from smoke and odour nuisance to the nearby residents.

3. Main Advantages and Disadvantages

Main Advantages

- The distance from the city centre is relatively near.

Main Disadvantages

- The site would pollute the water source for 10 % of the DSM population.
- Reduced possibility of donor co-operation for the above reason.

[3] "Management of Solid Wastes in Dar es Salaam", NEMC, May 1996

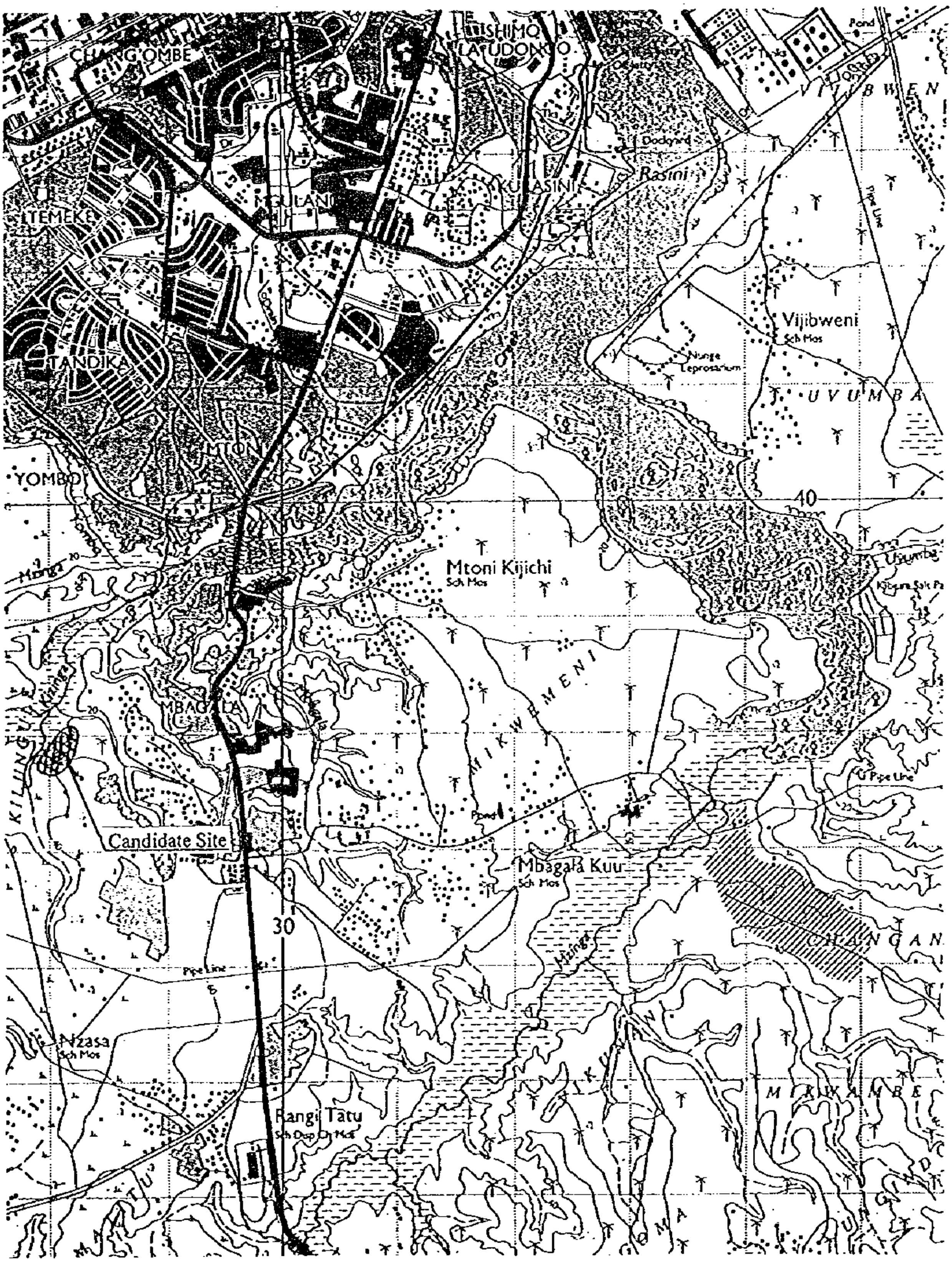


Figure 14-8: Mbagala Kilungule Sand Quarry Site

Code No: B-3

Name of the site: Mbagala Zakhem Sand Quarry

District: Temeke

1. Key Indicators

Location:	S06°54'42", E39°15'11", in Mbagala ward
Distance from the city centre:	12.6 km including 1 km of new road construction
Area and capacity:	10 hectares, 0.5 million m^3
Type of terrain:	Stream land
Present land use:	Agricultural and residential land
Surrounding area:	Residential area
Status of land:	There is small scale rice farming and shallow wells as neighbourhood source of water supply. The land is under control of MLHUD.
Displacement:	about 20 houses

2. General description

Mbagala Zakhem sand quarry site is an old sand quarry. It is located about 12.6 km on the southern side of the city centre. This site has an area of approximately 10 hectares and a capacity of about 0.5 million cubic metres. The eastern side of this site is a residential area and including planned residential areas. Refuse trucks have to pass residential area for 1 km to gain access to the site.

A small stream is flowing in this site and the stream water is being utilised by many nearby residents because of no water supply system. Thus, this stream is a very important water source for many people.

In addition, this site is also located upstream of Mtoni where NUWA is intaking water for the DSM city. Therefore the use of this site might be objected to by the Ministry of Water.

3. Main Advantages and Disadvantages

Main Advantages

- The distance from the city centre is relatively small.

Main Disadvantages

- The disposal site would pollute the water source for 10 % of the DSM population.
- The development of this site deprives nearby residents of their water source.
- There are many nearby residents.
- Reduced possibility of donor co-operation.

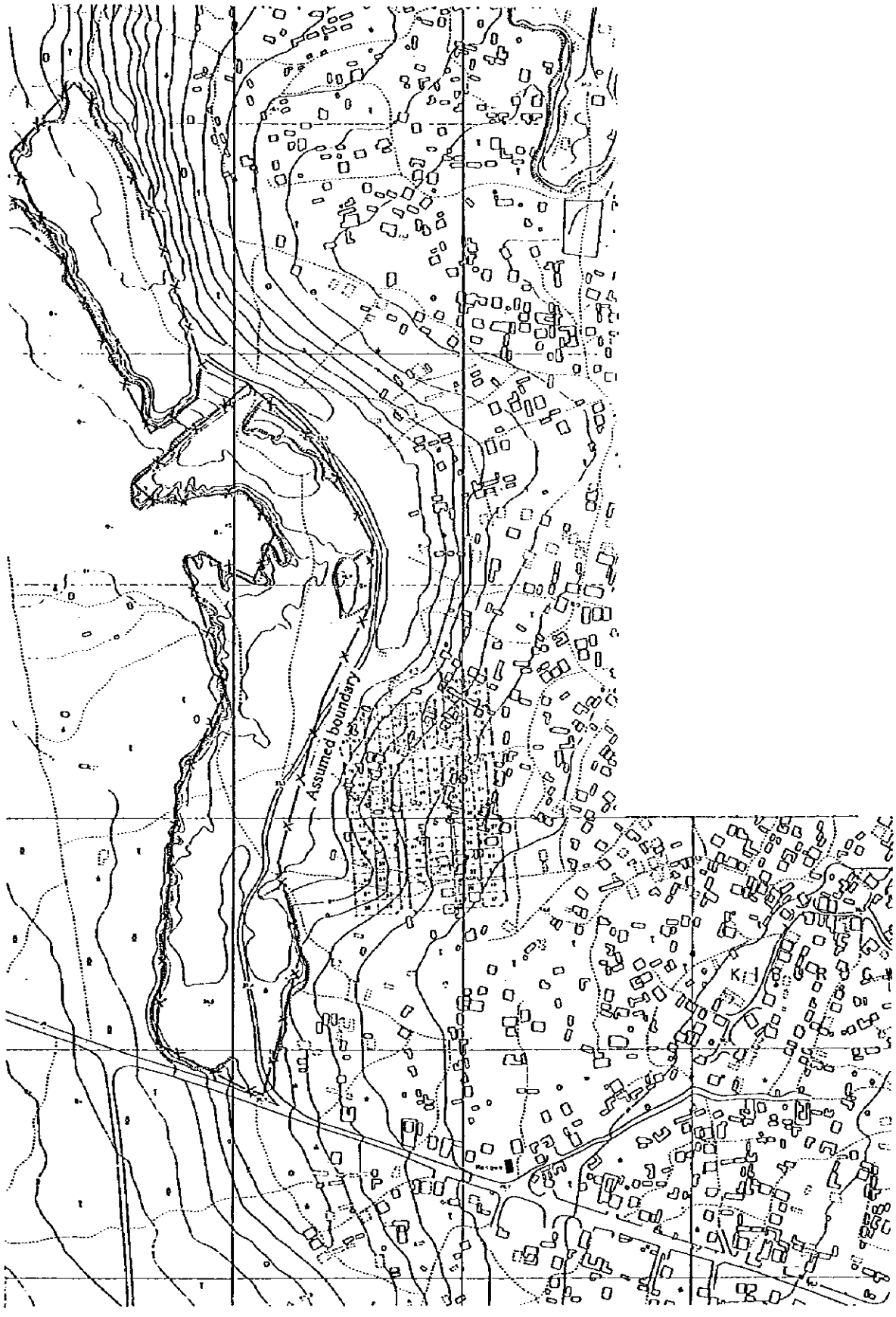


Figure 14-9: Mbagala Zakhem Sand Quarry

Code No: C-1

Name of the site: Pugu Kajiungeni site at the old ADUCO quarry

District: Ilala

1. Key Indicators

Location:	S06°55'11", E39°06'30", in Pugu ward
Distance from the city centre:	18.8 km including improvement of road for 1.2 km
Area and capacity:	2 hectors, 100,000 m^3
Type of terrain:	Slope
Present land use:	Small sand quarry
Status of land:	Irregular sand quarrying by ADUCO and there is small scale gravel crushing. It is under control of MWEM.
Displacement:	0

2. General description

Pugu Kajiungeni site is located about 18.8 km west of the city centre. Most of the road to the site is Pugu road which is in fair condition.

The critical problem of this site is that it is too small for a new disposal site for DSM city.

Another problem is that it is located too close to TAZARA railway. Disposal operation involve problems such as scattered waste, smoke, etc. which might cause railway accidents.

This site is, therefore, concluded to be unsuitable for use as a disposal site.

3. Main Advantages and Disadvantages

Main Advantages

- Coverage soil can be obtained within the site.
- Few nearby residents.

Main Disadvantages

- The area of the site is too small.
- The site is too close to the TAZARA railway.
- The access road passes the residential area for maintenance workers of TAZARA.

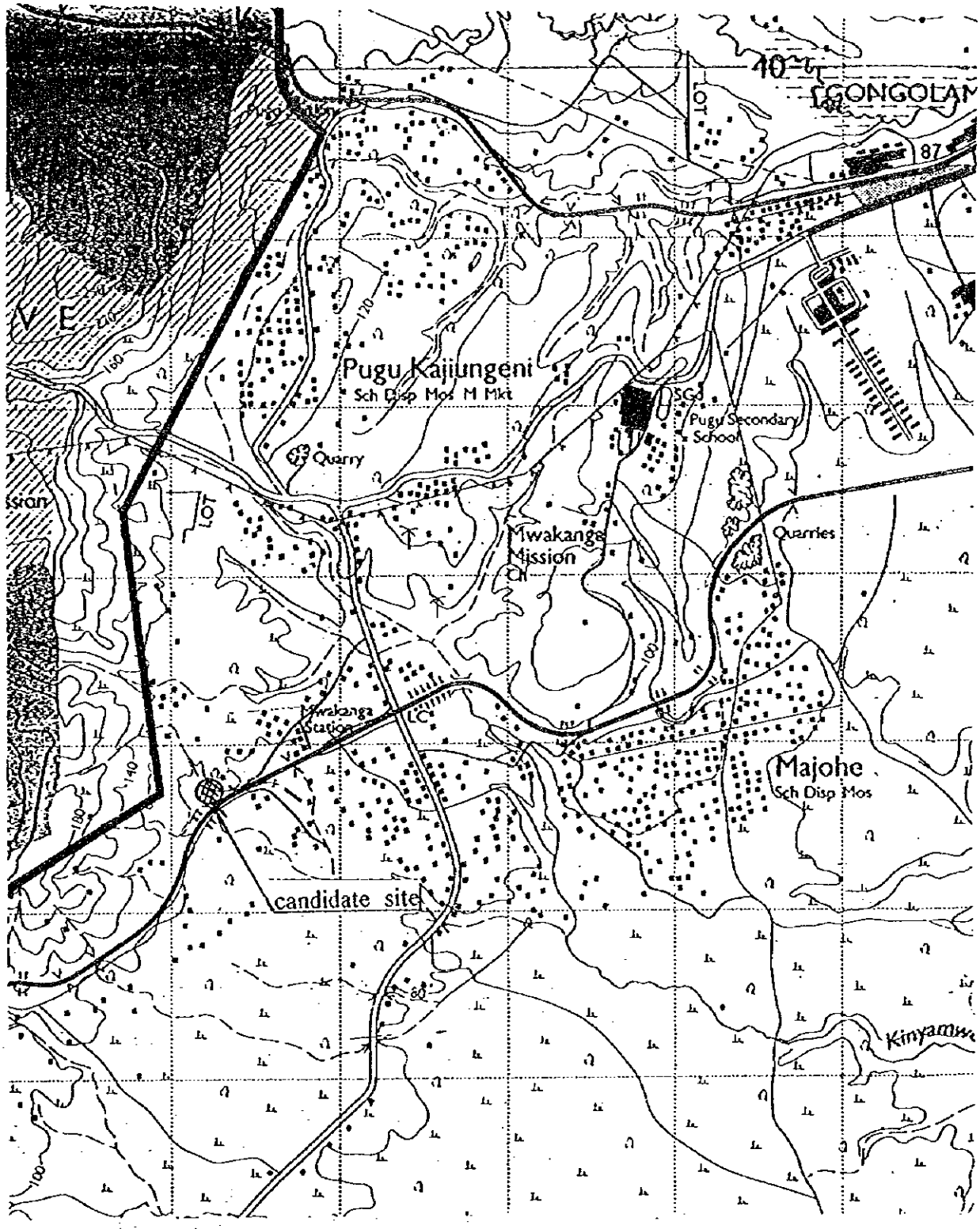


Figure 14-10: Pugu Kajiungeni site at the old ADUCO quarry

14.4.2 Summary of Field reconnaissance

The results of field reconnaissance are summarised in Table 14-2.

Table 14-2: Summary of General Indicators of Candidate Sites

	A-1	A-2	A-3	B-1	B-2	B-3	C-1
Name	Kinzudi "B"	Kunduchi Mtogani Quarries	Kunduchi New MECO Quarry	Mbagala behind St. Anthony (Mbagala) Sec. School	Mbagala Kilungule	Mbagala Zakhem Sand Quarry	Pugu Kajiungeni at the old ADUCO quarry
Ward	Kunduchi and Kawe	Kunduchi	Kunduchi	Mbagala	Mbagala	Mbagala	Pugu
District	North	North	North	South	South	South	West
Location	S06°41'38"	S06°40'12"	S06°41'12"	S06°54'42"	-	S06°55'12"	S06°55'11"
	E39°11'25"	E39°11'41"	E39°11'45"	E39°15'11"	-	E39°06'30"	E39°06'30"
Distance	20.4 km	19.3 km	19.3 km	11.7 km	13.6 km	12.6 km	18.8 km
Area	18.5 ha	50 ha	35 ha	difficult to estimate	4 ha	10 ha	2 ha
Capacity	5.5 Mm^3	5 Mm^3	6 Mm^3	0.5 Mm^3	0.2 Mm^3	0.5 Mm^3	0.1 Mm^3
Type of terrain	Valley	Cavity	Cavity	Valley	Cavity	Stream	Slope
Land use	Agricultural land	Old quarry	Old quarry	Agricultural and natural	Old quarry	Old quarry	Old quarry
Displacement	5 houses	10 houses	0	difficult to estimate	0	20 houses	0

14.5 Evaluation of Candidate Sites

14.5.1 Aspects to be considered for Siting Disposal Sites

In order to choose the appropriate disposal sites for the DSM city, the following aspects are proposed for the siting criteria, taking account of the present situation.

1. Existing basic concept for disposal site allocation
2. Social aspects
3. Environmental aspects
4. Technical aspects
5. Financial aspects

a. Existing Basic Concept for the Future Disposal Sites

There has been a basic concept for future disposal site allocation for DSM city which is that each district should have a disposal site for disposing of all waste generated within that district. This concept has been agreed not only by DCC but also at the ministerial level.

Considering the wide area and large population of the city, this basic concept is considered to be appropriate. Therefore this study shall comply with this basic concept.

The city consists of three districts, Ilala, Kinondoni and Temeke and in general terms they are located in the north, in the middle, and in the south of the city respectively. Hence, there should be three disposal sites sited in the north, in the west, and the south of the city.

b. Social Aspect

Since 1989 three disposal sites have been forced to be closed due to residents' strong protests and also by Court rulings. Thus, siting of future disposal sites must give due consideration to social issues. As obtaining public acceptance is considerably important for the development of new disposal sites in order to secure their continuous and stable operation. Therefore, the social aspects of each candidate site are to be assessed.

c. Environmental Aspect

The role of disposal sites is to store waste material including that of a hazardous nature until they are fully decomposed. Therefore disposal sites are always associated with risks of negative impacts even when sufficient protection measures are taken. Once negative environmental impacts occur, the damage can be huge. Therefore, it is important to select sites having minimal environmental risks.

d. Technical Aspect

The use of very simple technology is considered to be suitable for the disposal sites and its operation system considering the current technological level. Thus, important technical aspects of a disposal site are mainly the availability of coverage soil and access road condition.

e. Financial Aspect

Because the construction cost for the disposal site can not be estimated due to no available technical data at this moment, the financial aspects are focused on transportation costs and the construction cost of a new access road.

14.5.2 Critical Aspects for Selection of the New Disposal Site

The sites shall be assessed based totally on the above aspects. However, there are some critical conditions which must satisfied for any site to be considered:

1. Not more than one site shall not be selected in each district.
2. The new disposal site should have enough capacity until the year 2005 or at least one third of the capacity until the year 2005 due to the difficulty of development of new disposal sites.
3. The selected site shall have minimal negative social and natural environmental impacts.

When new disposal sites are selected based on the assessment results, the site shall be failed if it does not meet one of the above conditions.

14.5.3 Required Capacity of the New Disposal Site

The required capacity of the new disposal site is preliminary estimated based on the waste amount survey result and the population projection.

Assumptions:

- The total waste generation rate is 1.0 kg/cap/day.
- The waste collection rate is assumed at 60 %.
- The operation of the new disposal site will start at the beginning of 2000.
- The waste density is assumed at 900 kg/m^3 when compacted in the disposal site.

Table 14-3: Required Capacity of Disposal Site

Year	Population projection	Waste generation	Collect rate	Waste collection	Waste Disposal at the New Site		
	million	tons/day	%	tons/day	Daily tons/day	Yearly m^3/year	Accumulated m^3
1996	2.0	2,000	10	200			
1997	2.2	2,200	10	220			
1998	2.3	2,300	10	230			
1999	2.5	2,500	40	1,000			
2000	2.7	2,700	50	1,350	1,350	550,000	550,000
2001	3.0	3,000	60	1,800	1,800	730,000	1,280,000
2002	3.3	3,300	60	2,000	2,000	810,000	2,090,000
2003	3.6	3,600	60	2,200	2,200	890,000	2,980,000
2004	4.0	4,000	60	2,400	2,400	970,000	3,950,000
2005	4.5	4,500	60	2,700	2,700	1,100,000	5,050,000

The required capacity of the disposal sites by the year 2005 was estimated as 5,050,000 m^3 accordingly. The disposal sites shall be installed at three places according to the basic concept, and therefore each new disposal site shall have a capacity of 2 million m^3 at least.

14.5.4 Assessment Items

The assessment items and their indices are summarised in Table 14-4 based on the above discussion.

Table 14-4: Summary of Assessment Items

Assessment Items	Description	Indices
Social Aspect		
Land acquisition		Present user
Public acceptance	Nearby residents' acceptance	Location and area of communities
Social separation	Separation of community	Location and area of communities
Displacement	Impact on residents	Number of houses to be displaced
Religious matter	Impacts on churches, mosques, cemeteries	Location of churches, mosques, cemeteries
Public facilities	Impacts on public facilities	Location of schools and hospitals
Visibility of landfill site	Aesthetic	Visibility from outside
Future land use near the site	Possible future residential area	Land use plan
Environmental Aspect		
Water pollution	Water use downstream of the site	Water use of stream water or well
Odour		Location and area of communities
Noise		Location and area of communities
Vibration		Location and area of communities
Landscape		present land use
Flora	Impact on existing flora	Existence of natural forest
Fauna	Effect on fauna	Existence of wild animals
Inundation		Condition of present topography
Technical Aspect		
Capacity	Volume for waste	volume
Availability of coverage soil		Existence of coverage soil nearby
Accessibility	Condition of access road	Surface, gradient & winding of road
Financial Aspect		
Transport cost	Transport cost for waste	Transport distance
Construction cost of road		Newly constructed road length

The assessment result will be expressed by marks given to each assessment item. The allocation of marks are shown in Table 14-5.

Table 14-5: Allocation of Marks

Assessment Items	Marks	Description
Public acceptance	0	Many nearby residents
	1	Few nearby residents
	2	Few nearby residents within 300 m
Social separation	0	Community exist in the site.
	1	Community exist nearby.
	2	No community within 300 m
Displacement	0	Many inhabitants
	1	A few inhabitants
	2	No inhabitants within the site
Religious matter	0	Religious facilities within the site
	1	Religious facilities within 300 m
	2	No religious facilities within 300 m
Public facilities	0	Public facilities within the site
	1	Public facilities within 300 m
	2	No public facilities within 300 m
Aesthetic	0	Visible
	1	Partially visible
	2	Screened
Future land use near the site	0	Residential area in all surrounding areas
	1	Residential area on some sides
	2	Industrial area, Agricultural area
Water pollution	0	Many people using stream and well water
	1	Not many people using stream and well water
	2	No use of stream and well water
Odour	0	Many residents within 300 m
	1	Not many residents within 300 m
	2	No resident within 300 m
Noise	0	Many residents within 300 m
	1	Not many residents within 300 m
	2	No resident within 300 m
Vibration	0	Many residents within 300 m
	1	Not many residents within 300 m
	2	No resident within 300 m
Landscape	0	Steep slope
	1	Gentle slope
	2	Flat
Flora	0	Abundant natural condition
	1	Some natural condition
	2	No natural condition
Fauna	0	Abundant natural condition
	1	Some natural condition
	2	No natural condition
Inundation	0	Stream within the site
	1	Stream by the site
	2	No stream nearby
Capacity	0	Less than 1 million m^3
	3	1 million m^3 - 5 million m^3
	5	More than 5 million m^3
Availability of coverage soil	0	Not available nearby
	1	Available nearby
	2	Available within the site
Accessibility	0	Steep, Winding, Untarmaced section of road
	1	Some steep, winding
	2	Flat
Transportation cost	0	Less than 15 km
	1	15 - 25 km
	2	More than 25 km
Construction cost of road	0	More than 5 km
	1	0 - 5 km
	2	No new road construction

Table 14-6: Assessment Result Summary of the Sites

Assessment Items	Indices	A-1		A-2		A-3		B-1		B-2		B-3		C-1	
Social Aspect															
Public acceptance	*Existence of communities*	*No*	*2*	*Near*	*1*	*No*	*2*	*Yes*	*0*	*Yes*	*0*	*Yes*	*0*	*No*	*2*
Social separation	Existence of communities	No	2	No	2	No	2	Near	1	Near	1	Near	1	Near	1
Displacement	Number of houses involved	about 5	1	about 15	1	None	2	about 20	0	None	2	about 20	1	None	2
Religious matter	Church, Mosque, Cemetery	No	2	Near	1	No	2	No	2	No	2	Near	1	No	2
Public facilities	School, Hospital	No	2	Near	1	No	2	Yes	1	No	2	Near	1	No	2
Aesthetic	Visibility from outside	Partially	1	Visible	0	Screened	2	Visible	0	Visible	0	Visible	0	Partially	1
Future land use near the sit	Land use plan	Agricultur	2	Residential	1	Industrial	2	Residential	0	Residential	0	Residential	0	Agricultural	2
Sub-total			12		7		14		4		7		4		12
Environmental Aspect															
Water pollution	Use of river and well water	Some	1	Some	1	Some	1	Many	0	Many	0	Many	0	No	2
Odour	Existence of communities	No	2	Some	1	No	2	Yes	0	Yes	0	Yes	0	No	2
Noise	Existence of communities	No	2	Some	1	No	2	Yes	0	Yes	0	Yes	0	No	2
Vibration	Existence of communities	No	2	Some	1	No	2	Yes	0	Yes	0	Yes	0	No	2
Landscape	Topography	Slope	1	Cavity	2	Cavity	2	Valley	0	Cavity	0	Yes	0	Slope	0
Flora	Existence of natural condition	Yes	0	No	2	No	2	Some	1	No	2	No	2	Some	1
Fauna	Existence of natural condition	Yes	0	No	2	No	2	Some	1	No	2	No	2	Some	1
Inundation	Topography	No	2	No	2	No	2	Yes	0	Yes	0	Yes	0	No	2
Sub-total			10		12		15		2		4		4		12
Technical Aspect															
Capacity	*Estimated capacity (m3)*	*5.5*	*5*	*5*	*5*	*6*	*5*	*0.5*	*0*	*0.2*	*0*	*0.5*	*0*	*0.1*	*0*
Availability of coverage soil	Available at nearby	Yes	2	Yes	2	Yes	2	No	0	No	0	No	0	Yes	2
Accessibility	Surface, gradient, winding of road	Steep	0	Good	2	Good	2	Fair	1	Fair	1	Fair	1	Fair	1
Sub-total			7		9		9		1		1		1		3
Financial Aspect															
Transport cost	Transport distance (km)	20.4	1	19.3	1	19.3	1	11.7	2	11.5	2	12.6	2	18.8	1
Construction cost of road	Newly constructed road length (km	3.8	1	0	2	0	2	0.7	1	3	1	1	1	2	1
Sub-total			2		3		3		3		3		3		2
Total Marks		31		31		41		10		15		12		29	
Rank		**2**		**3**		**1**		**Fail**		**Fail**		**Fail**		**Fail**	
Note 1: Italics indicate critical aspects.															
Note 2: Bold italic indicate failed critical items.															

14.6 Conclusion

Seven candidate sites were investigated and evaluated for their possibilities and applicability for future disposal sites for DSM.

In the Kinondoni district, it was found that all three sites are more or less suitable for new disposal sites because three of them satisfied the critical requirements. However, as the result of overall evaluation, A-3 site, Kunduchi New MECCO quarry site, is concluded to be the most appropriate site for a new disposal site in terms of social, environmental, technical and financial aspects. A-3 site is, therefore, recommended for the new disposal site for the Kinondoni district.

As for the Temeke district, none of the three candidate sites were found to be suitable for future disposal sites because none of them could satisfy the required capacity. In addition, all of them are not suitable from social and environmental aspects. Although Mbagala Kilungule was proposed to be one of disposal sites by the Master Plan in 1979, it was found from the field reconnaissance that Mbagala area has little potential as a future disposal site at present because the situation in Mbagala ward has changed completely since 1979 due to an increase in inhabitants. It is, therefore, recommended that DCC continues to look for appropriate sites for the south district in Charambe, Toangoma, and Kipawa wards instead of Mbagala ward.

In the Ilala district, only C-1 site, Pugu Kajungeni site at the old ADUCO quarry was investigated. Although this site was rejected due to its small capacity, it was realised during the field reconnaissance that Pugu ward has a high potential for future disposal sites. It is recommended that DCC should continue to look for suitable disposal sites in Pugu ward for the west district.

It was concluded that only A-3 site, Kunduchi New MECCO quarry site, would be recommended as the new disposal site to be examined in the feasibility study to be conducted in the third phase in this study. This recommendation was officially adopted by DCC at the Interim Report meeting on 20th December 1996.

However, the existing consensus for disposal sites that each district should have each disposal site shall be respected for the SWM Master Plan because its concept is very reasonable and appropriate.