SANITATION IN KIBERA:A CASE OUTLINE AND SOME FUTURE DIRECTIONS

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INTRODUCTION:

During the months march and april 1994 (dry season and rainy season), the authors did an unstructured field survey in the nine villages which comprise Kibera. Gitonga and Kodo both work as community development officers for KWAHO, a Kenyan NGO which specializes in water and sanitation. Wegelin, who is presently a resident in Nairobi, is working for IRC International Water and Sanitation Centre and is an urban sanitation specialist. KWAHO has a field office in Kibera, where two of the authors work, and is currently involved in the provision of water supply through water committees with funds from UNICEF. During the field survey, in each village, members from the local water committee guided the authors, assisted in the interviews with the residents and explained the particular conditions in their village. The survey focussed on latrines, but in view of the integrated nature of environmental sanitation, also water supply, drainage, solid waste and access were taken into account.

LOCATION:

Kibera is the largest squatter settlement in Nairobi and covers an area of 225.6 hectares. The authors estimate an average number of 600 dwelling units per hectare and a population of 470.000. But estimates differ widely as population numbers of 250.000 (Matrix, 1993) and 450.000 (Macharia, 1992) are also reported. Kibera started as a Nubian enclave in 1928, when the British colonial government settled its Nubian soldiers there. By 1952 the Kibera population was about 2000, composed of mainly Nubians and Kikuyus. Today the population is a representation of many tribes found in Kenya and due to the attractive location of the settlement vis-a-vis the city centre and the industrial estate, densities keep increasing and growth rate is estimated to be 12% per year.

The settlement is built on one side of a valley, sloping from a ridge towards the bottom of the valley where there is a lake and a small river. There are steep slopes, flat ground and even marshy areas near the bottom of the valley, while a number of streams run through the area. In some parts the ground consist of hard rock, but most is stone with a layer of soil on top. The ground is generally stable and permeability is reported to be adequate for latrines. Most dwelling units are rooms of 3 m.sq.in row houses in a compound, usually made of mud-and-wattle walls, which are sometimes plastered but also wooden walls are found. The floors are either made of mud or cemented. Almost all have corrugated iron roofs. The average monthly rent is Ksh. 340, with a range from Ksh. 80-600 (Matrix, 1993).

SOCIAL ORGANIZATION:

Kibera is divided into 9 villages, the land belongs to the state and temporary occupation licences are obtained through the area chief (an administrative post) or his assistant chief. For building any new structure permission has to be obtained from the chief, this includes latrines and watertanks.

The majority of the residents are tenants (98%) and although many consider themselves to be temporary residents in Kibera, the length of stay of most people interviewed was more than five years. Most tenants are households and it is estimated that 70% of the households is female headed. The landlords are predominantly Nubians and Kikuyus and about two-thirds are Kibera residents, the percentage of female landlords is not known. The absentee landlords, usually have agents to handle their affairs and their compounds are often less well maintained.

Household incomes are in the range of Ksh.700 to Ksh. 1800 per month. A survey conducted in Kibera in 1991 showed that income is obtained in wage employment (38%), agriculture (26%) and self-employment (49%). Kibera has 7,300 enterprises and a third of all households have a small enterprise activity (Matrix 1993). For many of the landlords, the rent is their main source of income.

There are many community organizations active, such as church groups, self-help groups and women groups. There are watercommittees in every village which have been established with the help of KWAHO. They are active not only in selling water, but also in giving information on hygiene and environmental sanitation as a number of the members have been trained as community health volunteers. All of the watercommittees have men and women, but the majority of the members (about 70%) members are women. Some of these groups are actively engaged in the management of environmental sanitation and there is a marked difference in the environment in those villages.

INFRASTRUCTURE:

Access:

There are two unsurfaced roads which allow vehicular access and a number of small roads which are wide enough to allow carts. All other access roads are footpaths. All roads are poorly maintained with potholes, natural drains in the middle or on the side and during the rainy season most of them are hardly passable.

Water supply:

There are several water mains running through Kibera. A metered connection to the mains can be obtained through the City Water Commission, after permission from the chief at a cost of about Ksh. 2000 for meter and license. The cost of the waterpipes from the main to the village also have to be borne by the applicant. Pressure in the various mains differs and as a result of a general water shortage in Nairobi as a whole, some of the mains may have very little or no water for weeks, especially at the end of the dry season and during the Nairobi Fair when water is diverted to the fairgrounds. An additional problem is the use of boosterpumps by some individuals, resulting in other kiosks not being able to get any water. During the whole year, many mains have water only for restricted hours per day, usually early morning.

Most people obtain their water through water kiosks which are usually owned by private persons, who sell the water for 1 to 3 shilling per 20 litre container. There are also kiosks run by watercommittees which have been established with the help of KWAHO, and are funded by UNICEF. These kiosks have aluminum tanks, which enable the sale of water even when the mains are dry. Water there is sold at Ksh. 1 per 20 litre container, with the intention that overall waterprices will go down and people will start using more water to improve personal and household hygiene. The number of kiosks in Kibera is estimated to be around 500, but in general long waiting lines for water are rarely seen. Only if some of the mains have no water, long waiting times are experienced at the kiosks which do have water. The amount of water used per capita is dependent on the household economy and on the distance from the kiosk. Macharia (1992) found a per capita consumption of 22.5 litres per day, she also reported that only 28% of the people could get water as and when they needed it. This shows that availability is restricted to the times when there is water in the mains for those kiosks which do not have a tank and for the tank kiosks only as long as the reserve supply lasts. In combination with cost and distance, this situation has a negative effect on water consumption. The result is a level of water use which endangers personal and environmental hygiene and indeed water and sanitation related diseases and skin infections are very common.

Solid waste disposal:

There is no solid waste collection system and heaps of garbage are scattered throughout the area. In some villages, communities have organized themselves and have dug pits in which they burn the waste, but due to population pressure most of these pits have become mountains. The places where the garbage is dumped are infested with flies and rats, and there is a pervasive stench.

Waste water disposal:

Waste water is simply allowed to drain away through the roads. Natural drains have formed in the roads, either at the side or in the middle. In many places there are pools of stagnant water and during the rainy season the roads and paths turn into a muddy nightmare. Where manmade drains exist, these are often full of waste. There are a number of streams in the area, in which the water from the roads drain but all are unlined and full of garbage. The streams run into the river and the lake, which are so severely polluted that the water is not used at all.

Human excreta disposal:

Excreta disposal is principally covered by traditional pit latrines. There are sewer lines through the area, but no connections are allowed because Kibera is considered an illegal settlement and city services are therefore not provided. Although almost all households have access to a pit latrine, actual access is limited as many latrines serve between 50 and 200 persons. Apart from the insufficient number of latrines, the main problem with the latrines is the difficulty to empty the full pits, as space to dig new pits is often not available. Emptying services are provided by the city council, but most of the pits cannot be reached, the service is very expensive (Ksh 1000 per load) and unreliable (fees have to be paid in advance and the vehicle may come after some months or may not come at all). This situation forces people to look for alternatives to empty their pits and one of the methods in use is to open the pit during the rainy season and let the contents spill out and drain away over the roads. The implications of this for environmental and health conditions are obviously very severe.

CONSTRUCTION AND MAINTENANCE OF LATRINES:

Latrines are considered the responsibility of the landlords. Usually a landlord owns a rowhouse divided up in rooms which are rented out separately. The number of rooms varies from 5 to 40 and often only one latrine for all tenants is provided, usually on the plot, but sometimes away from the plot in an open space. There are no separate latrines for men and women and usually each tenant household has a key to the latrine. Many landlords construct as many rooms as possible, leaving very little space for the latrine, resulting in inadequate space to shift the latrine when full.

The latrine pits have a depth varying from 10 ft to 20 ft, most are between 10 ft and 15 ft deep. The length is between 4-6 foot and the width 3 foot. The soil is very stable and therefore most pits are unlined. The cost of excavation of a single pit is Ksh 200 per foot depth. The slabs are usually made on top of a base made of termite resistant wood and consist of wooden planks with a square hole in the middle.

Sometimes tin sheeting is put on top of the planks. The slab is mortared only rarely, as people find this too expensive. The superstructure is generally made of temporary materials such as matting, wooden sticks or planks. Although some of the pits smell, especially when they are almost full, most are quite odourless. But all are very difficult to keep clean and therefore quite unhygienic. In addition, flies abound and other vectors such as rats are also present.

The latrines are kept clean by the landlady, if she also lives on the compound, which is frequently the case. Sometimes maintenance is done in turn by the tenants, but proper cleaning is prevented by lack of water and the cost of water as well as the materials used for the slab. Also, none of the latrines has a facility for handwashing in the vicinity. The result is a high incidence of diarrhoeal diseases, especially among children. Generally people feel sanitation is inadequate, because of the insufficient number of latrines and the unhygienic state most are in. But tenants are not willing to get involved in the improvement of sanitation facilities, they pay rent and therefore they hold the landlord responsible for the provision of latrines. There is no apparent difference in rent for the compounds with a latrine or those without a latrine. The rental differences are a result of the condition and space of the rooms rather than a result of the facilities available. If there is no latrine or the latrine is full, people use the latrine of a neighbour, use the wrap-and-throw method or defecate in the open spaces where garbage is thrown or along the railway line at night.

KWAHO has been constructing VIP latrines as demonstration in all villages of Kibera between 1984 and 1989. The latrines are mainly constructed in communal places and at institutions, although some have been built for interested landlords. Most of these latrines are still functioning well, the only problem being the virtual impossibility of having them emptied. However, very few individuals have followed the demonstration examples because the VIP latrines are considered to be too expensive with an estimated present cost of Ksh. 18,000. The problem of rapid filling up as a result of the large number of users, is exacerbated by the fact that the latrines are often also used as a bathroom as most compounds do not have a separate bathing room.

In 1990, KWAHO obtained a mini vacuum tanker, especially meant for operation in congested areas. Management of the services was carried out from the Kibera KWAHO office until november 1991. Per 2 m3 load of sludge Ksh 150 had to be paid by the client. The tanker was operated by a driver and one assistant, employed by KWAHO. People who wanted their pits desludged came to the KWAHO office where they paid for the service. Each day a list was made of pits to be emptied which were more or less located in the same neighbourhood. Demand was very high because no other desludging services were rendered in Kibera and the cost of desludging was very low. Records were kept of the client requests, the fees collected and the maintenance

expenses occurred. The records from the period Jan-Oct 1991 show an average cost per load of Ksh. 137.68, including fuel and oil, maintenance and repair, and wages. Maintenance cost were only 2% of the total cost, probably due to the fact that during the period covered the vehicle was less than a year old. Amortization of the capital cost was not included in the fees. There was no proper monitoring system for operation and maintenance of the tanker established, but with the help of a sanitation advisor of the World Bank, registration forms and maintenance forms were drawn up in november 1991 (Broome, 1991).

The sludge collected by the tanker, was disposed of in the Nairobi sewers leading through Kibera with permission of the Sewerage Department and without any cost. Problems experienced with the van were the bad state of the roads, difficult access to some of the latrines and the solidity of the sludge. Water needed to liquidify the sludge was often not available. The very bad state of the roads, moreover, caused many punctures and break-downs of the vehicle. The crew was also advising people whose pits they were emptying on ways to improve the hygiene in their latrines, mainly by suggesting to cement the slab (if the structure was sufficiently stable).

Although KWAHO was managing the daily operations of the vehicle, there was also a management committee consisting of thirteen members (the chief of Kibera, a member from KWAHO as secretary and residents, selected by the chief). Under pressure from the chief, the management committee took over the daily operational management in november '91, without KWAHO involvement. The registration and maintenance forms which had been drawn up were never used. Because insufficient funds were being kept aside for maintenance there was always a problem to have the vehicle repaired when it had broken down. This resulted in the vehicle being out of order for weeks at the time and the previous reliability of the service was affected. Since 1993, the mini tanker has been completely out of operation.

OPTIONS FOR IMPROVEMENT:

Although the densities in Kibera would indicate the feasability of some form of reduced cost sewerage to improve sanitation conditions, the scarcity and cost of water and the fact that people use solid materials (paper, corncobs, leaves) for anal cleansing more or less preclude any option for a sanitation system using water. Also, experience in other peri-urban areas in Kenya shows that sewered latrines become blocked within a few months because the users cannot adapt to the different requirements of a water borne system. Moreover, since landlords already spent funds on digging pits and constructing latrines, it seems advisable to concentrate on options to upgrade the existing types of latrines. However, people are unlikely to be willing to spend funds on improvement if the main problem, that is inability to empty the pits, is not dealt with simultaneously.

Presently, with help from UNICEF, KWAHO is looking into possibilities to reobtain custody of the mini vacuum tanker and to repair it. It has become clear, however, that the charges per load have to be increased considerably to cover not only operation and maintenance, but also amortization of the capital cost. Maintenance cost are likely to become higher than the 2% in the previous period. Usually these cost are estimated at between 10% and 15% of purchase price per year. If a useful life of 5 years is assumed, the additional cost would be Ksh 226 per load for amortization on top of the Ksh 137.68 based on the '91 records (1991 prizes and exchange rate, Broome 1991). At present rates, the cost per load should be somewhere between Ksh 500 and Ksh 700. Landlords were asked how much they would be willing to pay for emptying and the figure of Ksh 500 seemed acceptable and Ksh 700 would probably also be acceptable as it is still lower than the rates charged by the Nairobi Sewerage Department, while the service is more reliable.

But the mini tanker is not able to serve all houses as many can only be reached by the footpaths. Therefore, another emptying system is needed to complement the exhauster van. In Dar es Salaam, Tanzania, a manual pit emptying technology (MAPET), has been developed by a consultant in support of the Dar es Salaam City Council and has proved to be technically feasible. The system consists of 1) a pumpcart: vacuumpump and flywheel mounted on a pushcart; 2) a mobile vacuumcart: two oildrums welded together and adapted in the same way, mounted on a pushcart to repeatedly transport the 400 litre contents for disposal elsewhere - the pushcart can also be used to carry hosepipes and tools to the site of operation; 3) hosepipes: at least 3m of 20mm diameter airhose between pump and drum and at least 4m of minimum 75mm sludge hosepipe; 4) mixing tools to stir contents with water to decrease its viscosity ; 5) a hook to pull out rags. The sludge is disposed either on plot (bury the sludge in a hole) or in transfer stations.

Both emptying systems have the advantage that the pit can be emptied through the drophole. The slab does not have to be demolished and this may well induce people to start improving their slabs. The best option to do this would be the SAN-plat, which was developed in Mozambique and was subsequently modified and implemented in Malawi (Brandberg, 1985). At present it is being used in many African countries, modified to suit local conditions. The SAN-plat is a small pre-cast un-reinforced concrete sanitation platform, with the following features:

- a hard and smooth surface sloping towards the drop hole, which makes cleaning easy;
-elevated footrests, which help the user to find the right position when using the latrine;
- a key-hole shaped drop hole which makes the latrine safe also for the smallest children;
- a tight-fitting lid which stops not only flies and cockroaches, but also smell.

The slab can be fitted on existing latrine, provided that the base is sufficiently strong or it can be incorporated in new latrine construction. The advantage of it being pre-cast is that a well proven design can be replicated easily, accurately and with a high degree of quality control. Its relatively small size and weight means that its distribution is made easier. Also, the superstrucure can be made of temporary materials as the inside of the superstructure does not have to be dark as is the case with VIP-latrines. Moreover, once the system is introduced in Kibera, for instance by KWAHO and accompanied by a promotion and hygiene education campaign, it may be possible that if demand is established, the informal sector takes over the production of the slabs.

At present SAN-plats are being used in the Lake Basin Water and Sanitation project, Kenya, at a cost of about Ksh 400, including the plug of the drophole. SAN-plats are also produced by Approtec, Nairobi at a cost of Ksh. 730 for a slab with a diameter of 1.50 m.and about half of that for a smaller slab with a diameter of 0.6 m.

In case the existing latrine superstructure is made of permanent materials, the SAN-plat can incorporate another hole to fit a ventpipe (present cost Ksh 550). In this case the tight fitting lid for the drophole is not necessary and the latrine becomes a VIP-latrine.

For those compounds which are difficult to reach and have sufficient space to allocate two pits, there are two options. The first one is to shift the SAN-plat to a second pit when the first one is filled. The contents of the first one can be taken out manually after about two years and the pit could be used again. A more expensive option is to construct a double-pit VIP latrine. The advantage of the double pit latrine is that the depth may be reduced from the presently common 10-15 ft, depending on the number of users.

Reduction of depth of the latrines would reduce the cost considerably. Traditionally people prefer to have deep pits, but if there is a reliable emptying service, it may well be that people will consider reducing the depth. A comparative research on performance and effectiveness of three emptying technologies in Tanzania, that is large vacuum tanker, mini vacuum tankers and MAPET, shows that in practice, all of the technologies empty the pits only partially. MAPET only takes out small volumes with consequently shallow suction depths, the mini tankers take out only the 2 m3 top volume with a suction depth of less than 2.4 ft since most customers do not pay for more than one tank load and even the large tanker rarely exceeds a suction depth of 6 ft for the same reason. The optimal size of a pit, will have to be calculated taking into account the number of users, the cost of digging per foot and the cost of emptying.

CONCLUSIONS:

There is ample scope for sanitation improvements in Kibera and the technological basis for most of these improvements does already exist. However, the current situation shows that environmental conditions can only be improved with an integrated approach. If water availability increases by the addition of watertanks, drainage of waste water has to be tackled at the same time to avoid the increase of stagnant waste water. Similarly if drainage is being improved, the problem of solid waste has to be approached, otherwise all drains will be clogged by garbage, resulting in even worse environmental conditions than present. The same applies for sanitation. If latrines are improved, but nothing is done about the problem of emptying the latrines, the situation can get worse, especially if full pits are opened up in the rainy season to drain away the contents.

Thus, repair of the mini vacuum tanker is an absolute necessity and introduction of the MAPET system would broaden the emptying services to the extent that almost all latrines can be reached. However, the past experience with the mini vacuum tanker shows that ample thought has to be given to the management of the service. It seems logical that KWAHO would initially manage the service, but since KWAHO may not be in Kibera for ever, right from the start initiatives have to be taken to assess different possibilities of management. This could be the jua kali sector, but given the cost of operation and maintenance of the vehicle, this may not work out. Management by the community probably would have the same problem. The chief already has proven to be incapable of managing the service. Another possibility would be the Department of Water and Sewerage, but their existing desludging services are not very efficient, moreover the tanker should be managed from Kibera to ensure timely services and to avoid similar problems as presently exist to get desludging services from the department.

Most probably local or community management of the MAPET service can more easily realized as the MAPET technology is comparatively simple and operation and maintenance less costly. But here again, it would be advisable to start the service from KWAHO and then decide with the community on the best solutions for the management of the service. Once the MAPET system is introduced and has become known, it may well be possible to privatize these services.

The same applies for the SAN-plat system. Approtec has developed production equipment and techniques which allow for simple and high quality mass production of the slabs. If the local jua kali (informal) sector realizes the potential demand for the slabs, they may well be motivated to start a slab making business, which can be established for Ksh. 20,000 including a full set of slab making equipment and enough working capital to make the first 30 slabs.

Any improvements in technology will have to be based on community consultations. People will not be interested in technological improvements for which they will have to pay if they do not take part in a decision making process. This they can only do if they are able to make an informed choice on the type of improvements feasible, the type of latrines suitable for the area and the financial and managerial implications of their choice. In view of the fact that in Kibera, latrines are deemed the responsibility of the landlords/landladies, these people would have to be approached first. The different roles of men and women in the sanitation process have to be taken into account in decisions on design, construction, financing and operation and maintenance. Experience with the watercommittees established with the help of KWAHO shows that where women are in the majority and hold the post of treasurer, the groups function a lot better.

In addition to technical improvements in the latrines, a lot of effort should go into hygiene education, not only related to operation and maintenance of latrines, but also to water use and storage, the need for handwashing after latrine use and before cooking and eating, and the implications for personal and envrionmental hygiene of the carelessness with solid waste and waste water as is being displayed at present. Subjects of hygiene education will have to be based on a thorough analysis of present behaviour related to these activities.

Current Conversion Rate is Ksh 59 to 1 US$

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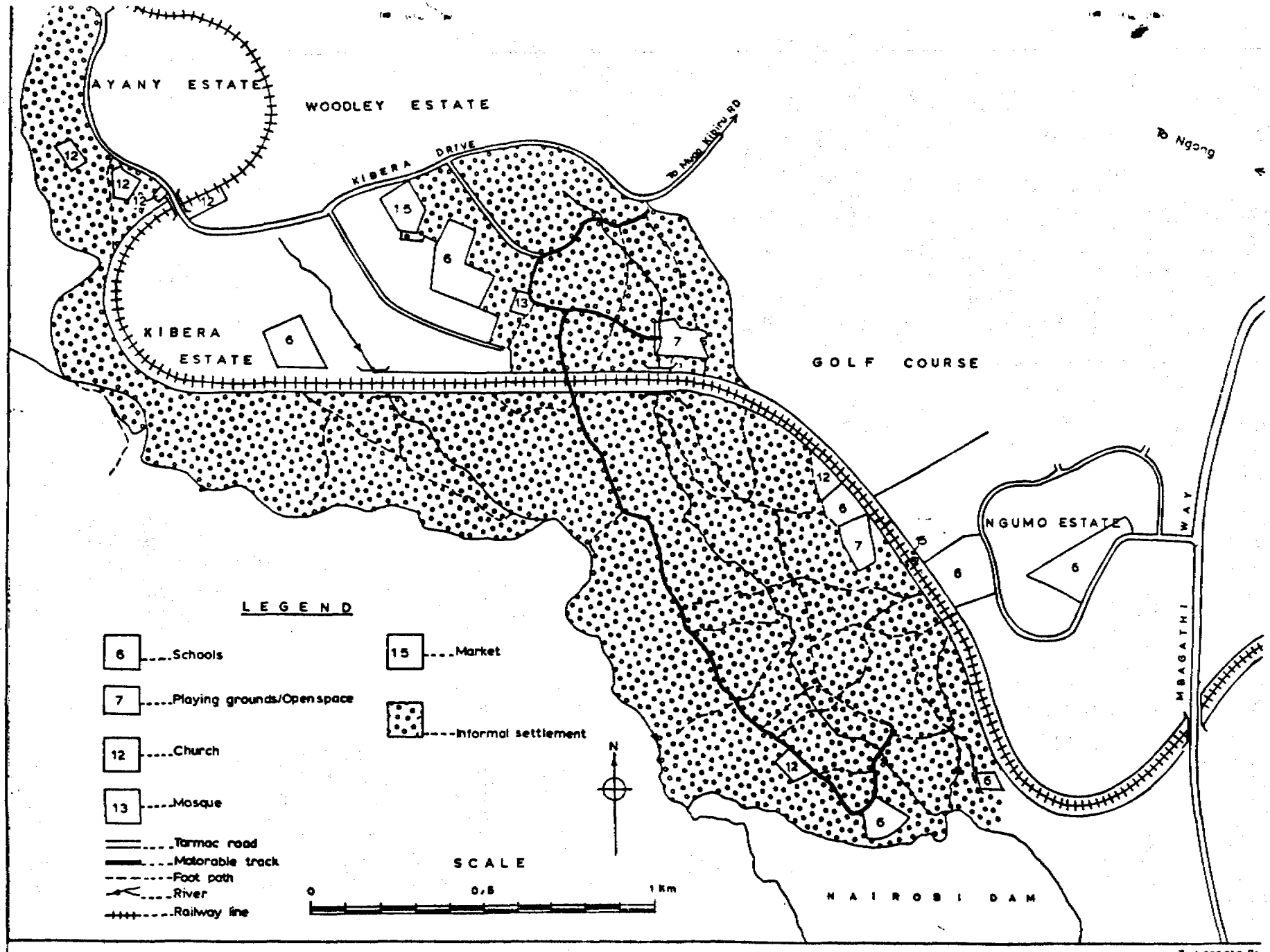

B. Aerial photographs of Jan 1993
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MATRIX DEVELOPM