Erosion Control in Inner City Maputo: Sustained Livelihood Impact?

Kerry Sylvester

Introduction

A study of the impact of infrastructure works on livelihoods in urban settings was undertaken by CARE Mozambique in Maputo in July/August 2003. Approximately three years previously, the worst flooding in 100 years in Maputo city created widespread destruction of infrastructure, public and private housing and disrupted water and electricity services. The study was part of a DFID KaR sponsored research project coordinated by Practical Action.

On 5 and 6 February 2000, record amounts of rain fell on southern Mozambique, in the midst of an abnormally heavy rainy season. Large areas of Maputo, the country's capital, flooded badly, forcing people from their homes to the safety of higher ground. In other areas, the saturated soil gave way in sudden landslides, taking with it houses, roads, water pipes and electricity poles. Fortunately, residents of these areas had some warning that the land was collapsing and were able to evacuate. No human lives were lost in the landslides.

The areas of Maputo most affected by landslides were the contiguous neighbourhoods of Polana Caniço A and B. These 'cane cities' were so named because of the building material used by many early residents, most of whom were rural families displaced by Mozambique's insurgency war, which lasted from 1976 to 1992. These families have since been joined by numerous people seeking economic opportunity in Maputo, and today Polana Caniço A and B are among the most densely populated, under-served, and poverty-stricken zones of the city. The houses are now generally constructed of conventional material but the infrastructure within the area is extremely weak, with no tarred or paved roads and inadequate drainage channels.

During the rainy season of 1998, a tremendous landslide occurred on the edge of these neighbourhoods and today a trench, forty feet deep and two kilometres long, is all that remains of a large section of a major road connecting Maputo to the rest of the country. The February 2000 rains caused six major, and numerous minor, landslides perpendicular to this trench, reaching into Polana Caniço A. Over 100 homes were lost in the four nights of torrential rain. If the new trenches had been left unattended they would have lengthened and deepened with each rainfall, taking with them more homes and vital social infrastructure. While Maputo's major rains fall between December and March, its position in a subtropical zone means that rain occurs in every month of the year. Thousands of poor families in Polana Caniço A were literally living on the edge, and in danger of losing their homes, belongings and even their lives at any time.

[Photograph 1. Caption: Houses destroyed by landslides and others at risk of collapse]
Photo source © CARE

The aim of the emergency erosion control works was to stabilize gullies that were opened up in Polana Caniço A during the torrential rains of February 2000. The gullies swallowed up a portion of the neighbourhood with a loss of homes, household possessions and livelihoods. The main primary school in the area, serving 4,000 children, was damaged and under threat of collapse and one of the gullies was approximately 500 metres from the neighbourhood health centre.

Emergency stabilization work was carried out over a period of twelve months, to ensure that no further damage occurred. Parts of the destroyed infrastructure (roads) were rehabilitated and an internal drainage system was installed in the neighbourhood to prevent the opening up of further gullies.

The work was carried out under the auspices of the Municipal Council, the clients for the work. The work was designed and supervised by a Mozambican Consultant Engineering Firm and an International Technical Auditing Firm who were contracted to oversee the process for CARE Mozambique. The emergency erosion work was contracted out to firms through a tender process presided over by the Municipal Council. Open community meetings were held to inform the public and discuss the scope of the works to be carried out and begin discussions of how the communities would be responsible for the up-keep of the erosion measures and the drainage system.

The estimated cost of the project was US$900,000. The eventual total cost of the project was in the region of US$3.5 million, of which CARE raised US$1.7 million; the Municipal Council of bilateral donors raised the remainder of the money. The increased costs were due to the decisions taken by the Municipal council to restore and rebuild roads and drainage systems within the neighbourhood to prevent further erosion in the future.

This research study examined the impact of the massive infrastructure works on the livelihoods of the population in Polana Caniço A, and assessed, as far as possible, the interrelations between infrastructure improvement and livelihood security. The research will also took into account the project implementation approach when analysing the impact on urban livelihoods.

The objectives of the study were to understand the inter-relationships between livelihoods (specifically income earning) and the improvement of infrastructures in the neighbourhood, in order to improve the design of future urban development projects.

The study set out to investigate the following issues:

- The impact of the improvement of infrastructures on livelihoods of the householders in the area of intervention.
- The impact of the erosion control measures on organizations, social institutions and policies in the area of intervention.
- The impact on the reduction of vulnerability of the households to natural disasters.

Research design

Kuyakana is the name of the Livelihood Improvement Project of CARE International in Mozambique. *Kuyakana* means 'to build together' and to 'support – raise up – vulnerable members'. The approach taken by the project rested on two assumptions success of the erosion control measures *per se* and the positive impact of the measures on household livelihoods:

- The immediate impact of the erosion works is on habitation security due to increased stability, resulting in a possible increase in housing prices.
- The impact of the erosion control measures on the environment is positive, creating increased awareness of environmental issues, increased investment in housing, basic infrastructures, and improvements in sanitation.
- Risk reduction and a decrease in vulnerability levels of the households were evident in the project area.

Additional factors included:

- Increased financial security through the improvement of the infrastructures.
- Improved social cohesion through the improvement of the physical infrastructures.
- Higher political profile, which benefits the local population.

To test the validity of these correlations, a household survey was carried out covering Polana Caniço A and also in Polana Caniço B, the adjacent settlement where no erosion control measures were implemented. In A, the households selected for survey were those close to erosion sites, those in the path of the erosion halted by the measures and more generally users of services. In B the households selected for survey were those close to erosions site, those in the potential further erosion and general users of services in the area. Sixty households were interviewed, focus group discussions were held and interviews carried out with key informants, including, health staff, teachers, administrator's traders, and people linked to housing and land acquisition.

Background information

Urban Poverty in Mozambique

Over the past 25 years Mozambique has experienced rapid urbanization, fuelled by war and the search for employment. The proportion of the population living in urban areas has increased from 13 per cent in 1980 to an estimated 28-35 per cent in 1997[1]. Given current trends over half of Mozambique's population will live in urban centres by the year 2015 (UN, 1996). The Greater Maputo area accounts for 40 per cent of Mozambique's (increasing) urban population.

Social stability in urban areas is critical for wider political stability. Mozambique has successfully maintained peace and fostered impressive economic growth following the end of a devastating 15-year civil war. The government is committed to the process of gradual decentralization and increasing democratic participation at the local as well as national government. A milestone was reached in 1998, with elections held to establish the first *autárquicas locals* (local authorities) for governance of 33 designated urban centres; this has been followed by the second municipal elections in 2004 that was contested by all major parties in the country. Newly created municipal councils and the members of the local chamber of elected councillors, are the centrepieces of the new local structure, with the authority to determine how budgets will be spent in areas under their jurisdiction and to raise funds through taxation. Efficient mechanisms of communication between poor urban communities with their representatives and service providers however, are practically non-existent. The livelihood project approach to livelihood strengthening was to foster stronger relations between these fragile democratic structures so that they could begin to respond to the pressing needs of their constituents.

In general, the characteristics of urban life in Mozambique include weak urban infrastructure, densely populated poor urban communities, and low levels of capacity and resources within Municipalities for both the planning and implementation of urban services.

Rates of urban poverty in Mozambique are extremely high, with 62 per cent of the urban population falling below the poverty line[2]. Moreover, in marked contrast to other countries in the region, mean household size in urban areas is greater than in rural areas of Mozambique (5.4 versus 4.6)[3], with many families housing non-nuclear kin. Problems in urban areas are distinct from rural areas. In urban areas one finds densely populated poor areas with inadequate infrastructure and employment opportunities, which can lead to high levels of criminality and the overall breakdown of social cohesion. These areas are also particularly vulnerable to severe disease outbreaks, such as cholera and the rapid spread of AIDS.

Investment in urban areas has been severely limited, as government policy over this period of rapid urbanization has concentrated on investing in rural economic infrastructure and improving the availability of market services. Changes in recent years, including decentralization processes, which give Municipalities greater power and responsibility, and a move towards the

privatization of basic services, provide a key opportunity to create an integrated approach to the challenges of urban planning and delivery in Mozambique.

Approximately 40 per cent of Mozambique's urban population live in the capital city of Maputo and its contiguous sister city of Matola. These areas are the most urbanized the country, with high population densities (3,220 persons per square kilometre in Maputo), and the majority of the population purchasing, not growing, their own food[4]. The disparity between the well-off and the poorest elements of society is most striking in Maputo, where densely populated *bairros* (a mixture of precarious *caniço* housing and solid cement structures with inadequate drainage, sewage, and water systems) lie adjacent to opulent suburban areas.

Case study locations

Between 1998 and 2004, CARE International conducted an extensive participatory project and information gathering process with relevant stakeholders in Maputo. CARE also implemented a livelihood project in Municipal District 3 in Maputo, with a total population of 210,511 people, living in approximately 42,000 households. An estimated 62 per cent of the households in the area live in absolute poverty.

The present case study was carried out in two of the most densely populated neighbourhoods in Municipal District 3 in inner-city Maputo. Polana Caniço A (intervention area) and Polana Caniço B (control area) are adjoining neighbourhoods. The population of the two areas exceeds 60,000 people. Both areas before 2000 were affected by erosion, however, with the torrential rains of 2000, Polana Caniço A lost over two hundred houses in four days as major ravines opened within the densely populated zones of the neighbourhood. The ravines threatened both the only primary school in the area and the health centre, as well as the water and electricity supply. Extensive repairs were carried out in the area. The control area has severe erosion, however, as the area did not suffer from the dramatic losses seen in Polana Caniço A, intervention has been slow to non-existent. CARE was active in Polana Caniço at the time of the torrential rains and worked with the Municipal Council to minimize future damage through erosion.

Polana Caniço A . Thumbnail sketch

Polana Caniço A is an inner-city neighbourhood with an estimated population of over 42,000 inhabitants. The neighbourhood lies between the affluent suburb of Summershield, and the escarpment that overlooks Maputo Bay. The neighbourhood has a mixed habitation pattern. Early residents have lived in the neighbourhood since the 1970s and were generally workers in the city service industries. In the late 1980s displaced people from the rural areas flooded the area as the war in the southern provinces intensified. With the influx of the new residents the rudimentary street plan of the neighbourhood with clearly defined housing plots was severely disrupted and aerial photographs (before and after) show a dense band of informal settlements on

the edge of the neighbourhood (on the escarpment), destroying the eucalyptus trees that protected the steep embankment that drops to the sea plain below.

At the end of the war in 1992 a series of reforms in the housing sector resulted in a large number of city flat dwellers selling 'the keys'[5] to their homes and moving to Polana Caniço to build on the newly designated plots. The area became rapidly highly populated with unregulated building taking place throughout the 1990s. The neighbourhood has access to minimal basic services, such as electricity, telecommunications and water. However, household level access to these services is patchy and dependent on the levels of economic security of the individual families. The neighbourhood was part of the city water supply but due to long-term gradual erosion, the main water pipe was fractured on numerous occasions and before the major flooding in 2000, the majority of households bought water from other neighbourhoods. The sanitary situation is complex with the majority of households relying on pit latrines. The neighbourhood is not connected to the city sewerage system. Cholera is endemic in the area, often attaining epidemic levels in the rainy season.

The dramatic rains in February 2000 created a catastrophic natural reaction in Polana Caniço A, with ravines cutting through the neighbourhoods and thousands of tones of sandy soil rushing down the escarpment to the sea. In four days of rain over 100 homes were completely destroyed and a further estimated 100-150 homes were threatened with destruction due to the erosion. The water pipes were destroyed, as were the electricity and telecommunication lines. The ravines continued to expand and stretch through out the neighbourhood as rain fell steadily through March 2000. Extensive erosion control works were carried out in the neighbourhood in 2000/1.

Between 50 per cent and 85 per cent of households in the survey reported loss of goods, damage to housing and loss of services such as water and roads. More than a third of the respondents mentioned damage to the health centre and the primary school in the area. A quarter of the households lost businesses in the destruction and a fifth of the households referred to the people who had left the area and relocated to new zones.

Polana Caniço B . Thumbnail sketch

Polana Caniço B is a close neighbour to Polana Caniço A but stretches further down the escarpment and runs towards a vast sprawling informal market on the edge of the industrial area of Maputo City. Polana Caniço B has a similar built environment to Polana Caniço A: high density and unregulated building expansion in the 1990s; poorly serviced by the water and electricity services; creeping erosion due mainly to destruction of trees and ground cover, and high levels of run off from washing and latrines. Polana Caniço B did not suffer as dramatically during the 2000 floods and although the crevices in the neighbourhood widened and deepened during the rains there was not the extensive loss of property and displacement as seen in Polana Caniço A. No erosion control work was undertaken in the neighbourhood. Polana Caniço B was surveyed as a control area.

The erosion in Polana Caniço B was not of the same dramatic nature as the erosion over four days of torrential rain in 2000 in Polana Caniço A. The respondents in Polana Caniço B reported on the impact of the gradual erosion over a period of 5 years. Over 50 per cent of respondents indicated that erosion has caused damage to houses and created severe road access problems. Nearly all households in the area reported that the erosion has caused serious problems with access to water.

Summary of erosion protection works

Kuyakana worked through multiple partners to enhance urban good governance and improve the livelihoods of the urban poor. The methodology adopted aimed to promote social cohesion and encourage political stability, using working practices to ensure the sustainability of activities. Better options were sought for linking municipal service providers with neighbourhood residents, and improving the ability of the latter to influence policy and the nature of these service options. Kuyakana's inclusive approach, in terms of its style of working with stakeholders, resulted in a diverse set of solid relationships.

After the severe flooding in February 2000, the project area was affected by extensive erosion and CARE was in a position to provide both financial and technical support to the Municipal Council to undertake substantial erosion protection works. A massive erosion protection scheme involving gabions and underlying pipes was carried out in Polana Caniço. A primary school was rehabilitated, and 1.5 kilometres of road paving, using concrete blocks, was undertaken to prevent further erosion and protect key facilities, such as the health centre. These activities were undertaken under the auspices of the Municipal Council and did not involve direct intervention by Kuyakana. A Memorandum of Understanding (MoU) signed between Kuyakana and the Municipal Council established a functional agreement in which Kuyakana provided funding and the Municipal Council was responsible for the contracting and supervision of the works. Kuyakana played a further role in generating an atmosphere of openness between the Municipal Council, the consulting engineers, the firm carrying out the work and the community. This productive relationship resulted in rapid, high quality infrastructure interventions that have been extremely effective in controlling the severe erosion in the neighbourhood.

Both ravines in the project area have been successfully stabilized. One of the ravines was stabilized using rock filled gabions and a new paved road with appropriate drainage was built to secure access to the health centre and ensure proper drainage within the suburb. Plans for the second ravine were altered during the project as the Municipal Council stated that they wished to reinstate the road that had been destroyed. Pipes were laid in the bottom of this ravine to stabilize the erosion during the rainy season. The Consulting Engineers and the advisory engineer agreed that the laying of pipes was the most cost effective temporary measure in the circumstances, and would ensure further damage during the rainy season. Neither ravine suffered extensive damage during the rainy season (2000/1 or 2002/3). The engineering works were formally handed over to the

Municipal Council in June of 2001 in a ceremony attended by the Mayor of the City, his staff, foreign embassy officials, CARE, the engineering team and the community. Subsequently a paved road was been laid after the filling of the ravine. Internal communication has been restored within the neighbourhood and a comprehensive drainage system installed.

[Photograph 2: Caption. Erosion protection works – gabions and drainage]
Source: © CARE

The local community was involved in a number of ways.

- Information dissemination was carried out through photographic exhibitions in the suburb, numerous community meetings and information carried on the radio and T.V.
- Work was provided to over 300 local men over a period of 10 months. The Municipal Council is now considering ways to register the workforce in order that they could be used for periodic maintenance work in the future.
- Erosion control messages have been developed and a Memorandum of Understanding has been signed with the Ministry of the Environment to carry out educational campaigns with the community collaborators (youth groups) in the community.

Groundwork laid for the resumption of other city services to the affected areas

- Water was been re-established in most areas of the suburb affected by the floods. CARE continued to work with the communities, the Municipal Council and the Private Water Company on ways of improving water delivery service.
- Road communications have been significantly improved due to the building of the new paved road.
- The primary school has been rehabilitated and is now fully functional
- The health centre is now not at risk from erosion and has improved access due to the new road

<u>Capacity building to enable the Municipal Council to carry out similar work in future</u>

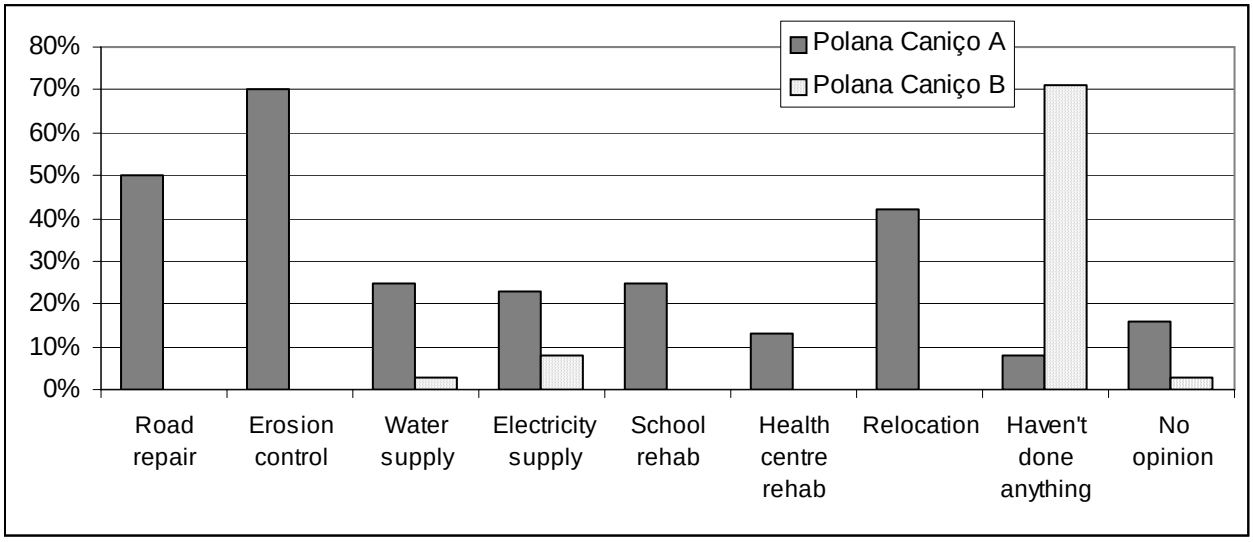
All activities carried out were done through the Municipal Council. This involved the drawing up of the original terms of reference, the contracting procedures, the inspection of works and the community level involvement. Different departments of the Municipal Council were involved at various points in the procedure. The main department involved was the Dept for Water and Sanitation, later the senior engineer of the newly created Technical Office, the Director of Roads and Bridges, the District administrator and his staff. All contracts for the erosion control measures were made directly with the Municipal Council, with the exception of the contract with Scott Wilson that was made exclusively with CARE. CARE signed a MoU with the Municipal Council to provide funding for the works It was clear throughout the whole process that the Municipal Council has an acute lack of resources, both human and financial, to address the infrastructure problems facing the city.

Impacts of the intervention

It was clear from the research that the erosion works were highly appreciated by the residents of Polana Caniço A and recognized as a major commitment by the Municipal Council to the area. There appears to be less recognition of the role of the Municipal Council in re-establishing the electricity and water supply, or in the rehabilitation of the School and the securing of the Health Centre.

This is in sharp contrast to the answers given by residents of Polana Caniço B (Figure 1) where the lack of intervention by the council or other entities is clearly felt, with 71 per cent of the respondents stating that the Municipal Council has not done anything to stop the erosion. The respondents stated that although information has been given to the Council about the predicament of the most endangered households no further action to relocate the families has been taken.

Figure 1: Role of the Municipal Council as seen by residents in affected neighbourhoods



Source. Household interviews and key informant interviews. Polana Caniço A and B

It is interesting to note that very few households or key informants (not directly involved in Kuyakanas activities) were aware of the role played by CARE in the infrastructure work. This can be seen a success achieved due to the NGO approach to the problem of facilitation, not implementation.

The inclusive approach to public works, from the planning stage to the implementation and maintenance, resulted in the completion of high quality engineering works in a high-density suburb. The following sections will be used to draw conclusions about the effectiveness of the approach used by the urban livelihood project to achieve greater livelihood security.

Impact 1: Habitation security, resulting in a possible increase in housing prices

The most obvious effect of the erosion protection works was to increase the habitation security of the households in the immediate area of the ravines with 45 per cent[6] of all respondents stating that they felt their homes were now safe from erosion damage (Table 1). The research showed that houses in each of the survey sites in Polana Caniço A felt positively affected by the erosion protection works, as demonstrated by the 75 per cent of the households who responded positively that the erosion had been arrested and 81 per cent of households stating that drainage had improved.

Table 1: Habitational security

	Positive				**Negative**				
	House safe	Stop. erosion	Land protected	Drainage improved	Lost wall	Lost garden	Lost part house	Increased rubbish	No change
P.Caniço A	45%	75%	33%	81%	25%	30%	3%	85%	13%
P.Caniço B	n/a	n/a	n/a	n/a	58%	70%	8%	n/a	n/a

The positive responses given by households in Polana Caniço A were not applicable to households in Polana Caniço B as no engineering works were carried out to control the erosion. In Polana Caniço B negative responses also included 100 per cent of the households mentioning the increased risk from the spread of the erosion, as well as the extreme problems in traffic circulation due to the erosion criss-crossing the neighbourhood.

The negative impacts exemplified above for Polana Caniço A are the result of the rehabilitation work that took place in the area that required the re-establishing of minimum urban planning standards (drainage channels and width of road). Implementing these standards required the voluntary realignment of gardens and garden walls. This was carried out through community meetings with engineers, the Municipal Council and the householders affected by the rehabilitation plans. Further interviews were carried with householders who had removed their walls and lost part of their gardens during the rehabilitation, the following is an extract from one of the interviews, and is a typical response. On balance householders felt the sacrifice was worthwhile.

> *I had to take down my wall and lost three metres off my yard. I was not pleased and the council said they couldn't compensate me because I had built my wall in the wrong place. On the other hand the road is great, and the drainage ditches protect my house. I was really worried that we would disappear down the ravine one of these days. Now I feel quite safe.* Householder. Polana Caniço A

The greater habitational security is also manifested by the increased investment in properties in the intervention neighbourhood when compared to the control area. A number of interviews were carried out with householders on the edge of the erosion sites to discuss any investments made to their homes since the erosion control works.

Common investments that were mentioned were in piped household water systems, fences and walls around properties, and electricity installation. Families that had not made any investments stated that the problem was lack of finance and not due to reluctance to improve the property.

Initially we hypothesized that housing prices may be a way of measuring an increase in habitational security. However, it was difficult to access information about the movement of house prices since 2000. Key informants[7] indicated that there was an increase in house prices, however, this may reflect the housing shortage rather than increased value of the properties in the intervention area.

There is a clear difference between the house prices in the target area and in the control areas; this can be as large as ten times the value of similar houses in the zone that continues to suffer from uncontrolled erosion.[8] Further specific analysis of the housing market will have to be carried out to improve understanding of this complex issue.

Relocated Families

Interviews were carried out with people who had lost their houses during the torrential rains in 2000 and had been relocated to other neighbourhoods on the outskirts of the city. In general people were satisfied with the move as their original housing plots no longer existed and there were no possibilities of re-location within the same neighbourhood. There were, however, problems of transport in the new areas, which are found on the edge of the city. This resulted in financial problems for some households and, often, family members with jobs in the formal sector only returned to the new areas at weekends.

BOX: Displaced Households from Polana Caniço to Marrucuene

Families resettled from the city of Maputo found themselves with more space and privacy than previously experienced in the overcrowded suburbs. One of the women in Mumeme[9] stated that 'we are better here, we have space, there are no criminals and the girls dress more modestly, we have much better latrines and more space in the garden'. However, these families were faced with having to reinvent livelihood strategies; the women have become farmers instead of petty traders; and there was considerable social disruption with the male members of the household staying in the city during the week and only returning home at weekends in order to maintain jobs and other income earning opportunities. The majority of households in Marracuene

were pleased with the new housing arrangements and felt that the fresh start may help to create a community spirit not apparent in the city, where criminality was one of the major risks to household livelihood security. (Extract from Post Flood Research carried out for Provention by ANSA, 2002)

Impact 2: Environmental benefits from erosion control, raised awareness and investment in housing, basic infrastructures and improvements in sanitation

People were clear that great improvements have been made in the general environment in Polana Caniço A, in particular in relation to drainage, access to the area and erosion control. The erosion control works have made significant improvements. When comparing answers and discussions from the control neighbourhood one is aware that erosion (loss of property, loss of life and assets, destruction of infrastructures) continues to be the main concern of the population. This is no longer true for the population in the intervention area.

Basic Services and Infrastructure

People were clear that basic service delivery had improved since the erosion control works had been completed. This included both electricity supply and water supply. In the control neighbourhood this continues to be problematic with no investment in water sources and intermittent electricity supply due to the instability of the land.

		Services mentioned as having improved
Polana Caniço A:	Water	
		Drainage
		Protection (against erosion)
		Sanitation
		Rubbish collection
		Electricity
Polana Caniço B:	Water (introduction of water management committees)	
Polana Caniço B	**Services mentioned as having deteriorated**	
		Drainage
		Erosion Control

	Sanitation
	Rubbish collection
	Electricity
	Water

Source. Household interviews and focus group discussions

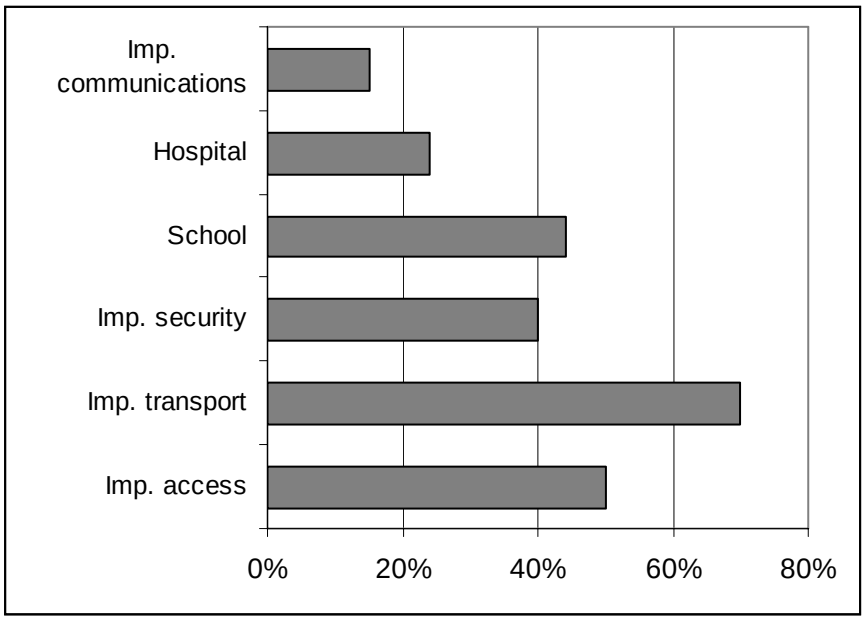
Water was mentioned both negatively and positively by households in Polana Caniço B. Water supply has deteriorated in the neighbourhood because of the increasing erosion, however, because of new models for the management of public stand-pipes[10] there is now increased confidence in management of the water supply. In work recently carried out it was shown that the residents of Polana Caniço B have high levels of confidence in the water committees[11], although there still appear to be problems concerning the transparency of the processes involved with the selection of the operator and the functioning of the water committees. The management model has been piloted in a number of neighbourhoods in Maputo and Matola since 2002 in response to the privatization of the city water supply.

Infrastructure Improvements and infrastructure problems

The main improvements noted by families concern access to the neighbourhood through the improved transport (semi-public transport) to the area (Figure 2). This is extremely important and breaks some of the isolation that even inner-city neighbourhoods suffer from through lack of public transport services. The low percentage of households mentioning improved telecommunication is probably linked to the growth in mobile phone use that does not depend on fixed landlines.

Information about the security situation in the area is complex. When asked about infrastructure improvements, people mentioned the improved public illumination that helps the security situation, for example a 19-year old student from Polana Caniço A commented: '*I study at night and only return home at 11-o-clock in the evening, the public lighting helps me get home safely'.* However, when discussing some of the problems created by the erosion control measures, people mention that criminality has increased because of the ravines that have not been filled in. This creates deep corridors made of gabions through the neighbourhood that criminals can use to hide in or escape from the police.

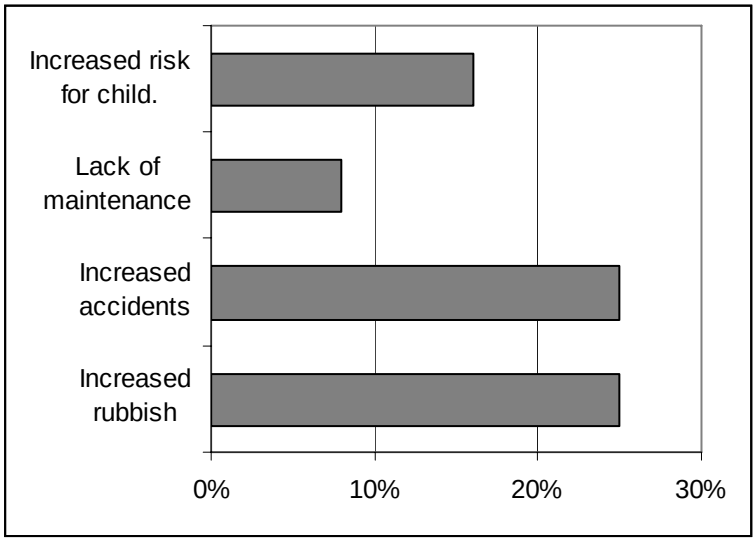
Figure 2: Positive impacts of infrastructure rehabilitation in Polana Caniço A



Source. Household interviews and key informant interviews. Polana Caniço A and B

Other negative impacts of the erosion control works were also highlighted including increased dumping of solid waste and increased road accidents (Figure 3). People are particularly concerned with child safety on the new roads as these have a tendency to become racetracks for drunk drivers. Children have no notions of road safety and are often seen taking great risk as they play on the roads and run across without taking any precautions.

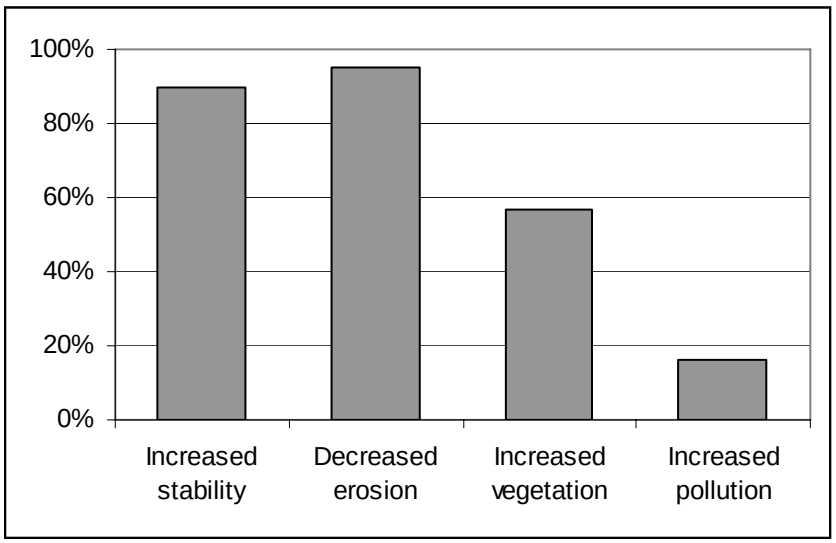
Figure 3: Negative impacts of infrastructure rehabilitation in Polana Caniço A



Source. Household interviews and key informant interviews. Polana Caniço A and B

The erosion control works consist of roads building and rehabilitation, use of gabions to stabilize the bottom of the ravines and planting of vegetation to stabilize the slopes of the remaining ravines. Over half the households interviewed felt that the increased vegetation in Polana Caniço A was a positive sign and was an improvement to the environment (Figure 4). Only 16 per cent of the households felt that there was increased pollution due to the increase in road traffic. For the majority of people, the advantages of the new road system far outweigh the unseen price to be paid in air pollution[12].

Figure 4: Environmental impacts in Polana Caniço A



Source. Household interviews and key informant interviews. Polana Caniço A and B

Impact 3: Environmental risk reduction and reduced vulnerability of the households

An analysis of the environmental risks affecting the urban communities in the study identified the following risks as the most important.

Box 4. Top Three Environmental Risks

Polana Caniço B: Control Areas	Polana Caniço A: Intervention Area
Erosion	Solid waste collection
Water	Traffic accidents
Solid waste collection	Water

Source: Focus groups of men, women and youths in the two areas (pair-wise ranking)

It is clear that in the intervention area the immediate threat from erosion is no longer considered to be an important risk and has been replaced by the problem of solid waste disposal. This is seen, by a number of households living near the erosion control works, to be affecting health status in the area exacerbating problems of malaria and cholera; both of which are endemic to the zone. A new factor was introduced into the matrix, that of problems of traffic accidents. The majority of people felt that the increased access to and within the neighbourhood was positive, however, the drawbacks included excessive speed and drunken drivers causing accidents.

In the control area, erosion and water continue to be the main concerns for the residents. They fear for their homes and the basic service infrastructure (stand-pipes) and recognize that they are at extreme risk of losing their homes.

Impact 4: Increased financial security through the improvement of infrastructure

There is evidence of increased commerce in the neighbourhood that people attributed to increased access to the areas because of the improved roads and drainage. The area is replete with informal traders who have stalls on the side of the road. Due to the increased public lighting trading can carry on safely for longer periods thus extending trading time.

Financial assets

Over 80 per cent of households in both neighbourhoods have one member who is engaged in informal trade. The scale of the trading varies from selling fresh products at the gate of the house to fixed selling spots in the vast street markets in the area. Other income sources for the households interviewed include: skilled workmen (carpenters, welders, electricians etc); formal employment (guards, domestic workers, teachers, nurses and police). Many of the households stated that the members were unemployed and had no source of income. The majority of the households said that there was no significant change in their income sources from before and after the erosion control works (or the floods). The only notable difference was a slight increase reported in informal trading in Polana Caniço A due to increased street lighting and improved traffic circulation which extends trading hours. It was not possible from the analysis of the data collected to ascertain whether this translated into higher household income or represented merely a further diversification of income sources.

For households that relocated to other areas income sources changed significantly. The members of the families that had formal employment often managed to maintained that employment but complained about the cost of transport or found ways of staying in town during the working week (see Box 1). However, women were often able to move into new spheres of work such as farming and trading of fresh produce due to increased opportunities in the peri-urban areas.

Availability of products

Questions were asked about changes in the availability of household products after the floods. Most respondents (85 per cent) said that products had increased in availability in Polana Caniço A but there was no reported change in Polana Caniço B. This was attributed to the increase in informal trading and longer trading hours

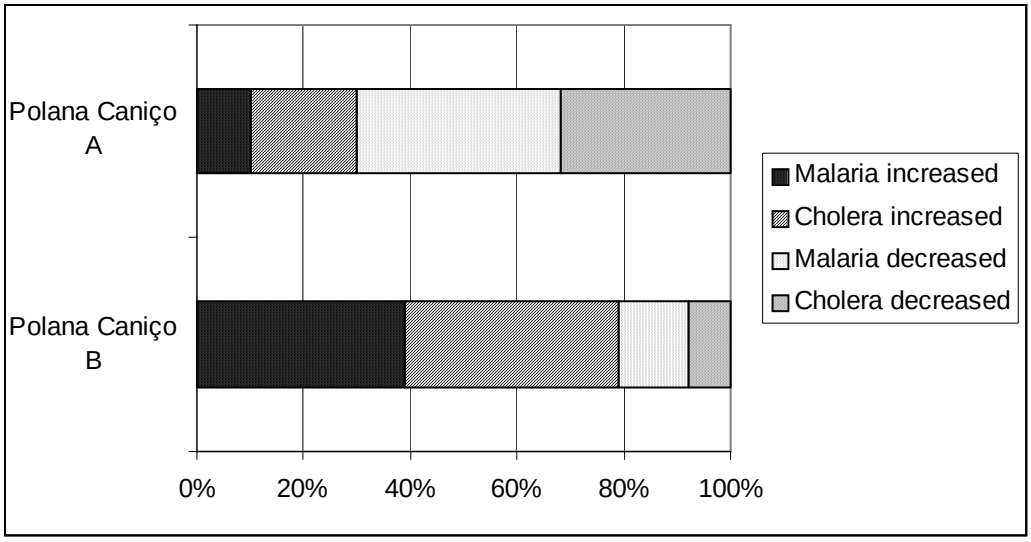
Box: Interview with informal trader (Male, 21 years old)
He stated that there had not been great changes in his business of selling bags and belts in the neighbourhood, but he was able to sell for longer due to the street-lighting and the fact that the drinking stalls stayed open later on the road side. This meant he was able to capitalize on potential customers. He was not able to estimate by how much his business had expanded.
Key informant interview- young street trader. Polana Caniço A

Impact 5: Additional factors

Human assets

There are a number of additional ways in which the people in Polana Caniço A feel that their lives have improved due to the infrastructure rehabilitation in the neighbourhood. These are linked to improved public health and improved access to schooling for primary school children. For example people felt that malaria (one of the main diseases causing high levels of both morbidity and mortality in Mozambique) has significantly decreased due to the improved drainage that removes standing water from the neighbourhood (Figure 5). In contrast the families in Polana Caniço B feel that the situation of both cholera and malaria are alarming in the neighbourhood; over 80 per cent of the families interviewed considered that the public health situation has deteriorated since 2000 floods. It is not possible to verify these assertions against health statistics as these are not representative of out-patient consultations. Health staff interviewed in the main health centre felt that the situation had improved but that malaria continued to be a major threat to health and life in the area.[13]

Figure 5: Health impacts

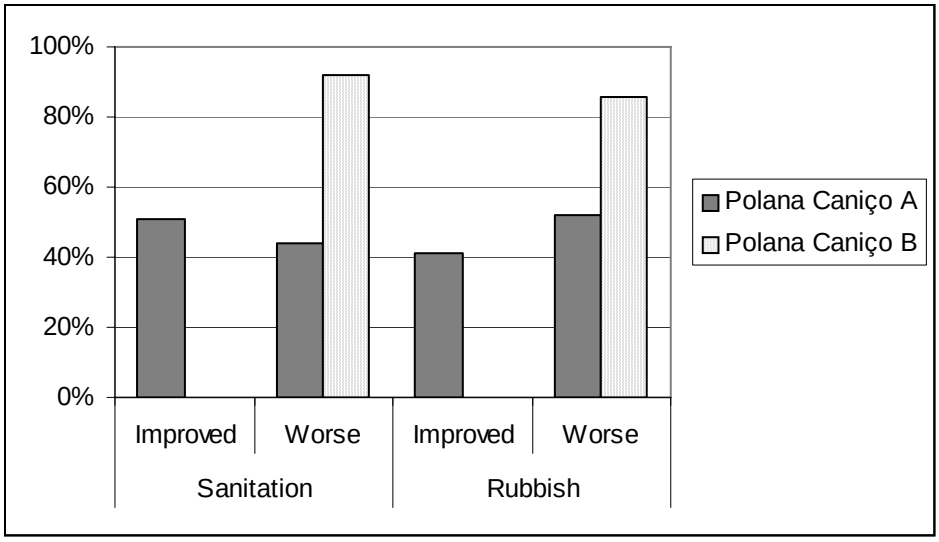


Source. Household interviews and key informant interviews. Polana Caniço A and B

Households in Polana Caniço A also noted improved physical access to hospital facilities resulting from the construction of a paved road. However, there were comments about the cost of health care, still the greatest barrier to obtaining health care in the neighbourhood. There have been no major outbreaks of cholera in Polana Caniço A (although cholera is still endemic in the area) since the erosion control measures and the improvement in water supply to the neighbourhood.

Opinions about the impact of the rehabilitation on the sanitary conditions in the neighbourhoods are divergent. In terms of latrines, sanitation in public places and the problem with solid waste disposal, approximately 50 per cent of the families felt that the situation had improved and 50 per cent that the situation was worse than before. It is clear from the work carried out in the neighbourhood that the presence of the ravines in the neighbourhood have become the focus for rubbish dumping on a large scale, and as these ravines are thoroughfares from one part of the neighbourhood to another, the problem is both visible and unpleasant.

Figure 6: Health and sanitation impacts



Source. Household interviews and key informant interviews. Polana Caniço A and B

Solid waste collection is a huge problem and mentioned by all of the respondents. This affirmation is true for both sites but there were indications that given the easy road access, things have deteriorated in the intervention area because cars arrive from neighbouring areas and dump in the erosion controlled ravines[14]. This is seen as major challenge for area and has an impact on safety, health and hygiene. People living near the erosion control works felt that their health was being affected by the presence of the mountains of household waste.

Due to extensive campaigns in the area people are also much more aware of the dangers of poor sanitation and therefore more vocal about the problems. In terms of household sanitation (latrines) there appears to be a higher demand for improved latrines or piped water for conventional toilets due to increased habitation security. People are prepared to invest in their homes but the cost of installing toilets and bathrooms is extremely high and out of the reach of the majority of inhabitants

Improvements in the education sector

There were also mixed reactions to questions about access to school or improved educational possibilities for children. Although households recognized that the rehabilitation of the primary school was important there are still obstacles to obtaining school places in the neighbourhood. These include lack of places, illegal charges for matriculation fees, and the cost of school material. People also complained about the quality of education with large classes and that teachers are not dedicated. These are general complaints about the education system in the city of Maputo and not exclusive to the neighbourhoods studied.

Improved social cohesion through the improvement of the physical infrastructures.

The issue of social capital is complex and the responses from the households interviewed and the discussions held in the focus groups demonstrate this complexity. There are no clear cut answers as to whether the infrastructure improvements can be said to have increased social capital, not had any effect at all or further deteriorated an already difficult social situation.

Polana Caniço A and B are considered by the police force to be amongst the most difficult areas in the city[15] with high levels of unemployed youth, easy access to the more affluent areas of the city and a labyrinth of under-policed alleys and walk-ways criss-crossing the neighbourhood. Although attempts have been made to form community watch groups to patrol the areas these have not been successful and the areas continue to be dangerous with high levels of criminal activity.

Over one third of the interviewed households considered that the rehabilitation work had been instrumental in an increase in criminality in the neighbourhood, mainly due to the thoroughfares created by the gabion reinforced ravines (Once again informants referred to the problem of increased danger to children because of driver's lack of care and pedestrian's lack of experience of road safety. The roads were built without speed bumps although these were added at a later date in response to concern of the residents. This aspect was also reinforced when people spoke of increased drunkenness, inebriated men driving and causing accidents.

Table 2). There are no statistics to support these claims, as the police force does not systematically collect data on petty crime in the area. It should also be noted that majority of the crimes committed are not reported to the police due to lack of confidence in the performance of the untrained police force.

Once again informants referred to the problem of increased danger to children because of driver's lack of care and pedestrian's lack of experience of road safety. The roads were built without speed bumps although these were added at a later date in response to concern of the residents. This aspect was also reinforced when people spoke of increased drunkenness, inebriated men driving and causing accidents.

Table 2: Negative impact of infrastructure improvements on social capital

	Increased criminality	**Increased drunkenness**	**Increased danger to children (roads)**	**Increased danger for children (ravines)**
P.Caniço A	36%	58%	16%	11%
P.Caniço B	n/a	n/a	n/a	n/a

The problems mentioned by households Polana B are not related to erosion control works, as they do not exist but to the general situation in the neighbourhood. They list the following social problems.

- Difficult access to school for children
- Health problems that can cause the break-up of families[16]
- Very little social organization
- Difficult communication and circulation
- High criminality due to lack of street lighting at night

The analysis of social cohesion proved the most elusive to evaluate and we will present a series of illustrative examples of the positive and negative issues raised by the residents in the intervention area (Polana Caniço A) linked to the erosion control works to try to capture some of the issues raised.

BOX: Street theatre working for lasting change

A group of young voluntary workers from Polana Caniço A formed a theatre group and were particularly interested in learning about environmental issues after the erosion occurred. Kuyakana carried out a series of capacity building courses for the volunteers and from this basis they developed a number of plays. The group performed street theatre on and around the ravines, as well as organizing cleaning and planting campaigns to maintain the gabions, the slopes of the ravines and the drainage ditches. The group collaborated with the CARE project, but also with the Municipal Council, the schools and the health centre in the area. Four years after the floods the theatre group has obtained official credentials from the district administration and is recognized by many of the institutions in the area as a competent and important force for change in the area.

They perform regularly in the area, at the primary school and in street theatre festivals in the city of Maputo raising awareness on environmental and public health issues.

Source. Interview with Sigyvona. Youth Theatre group. Supported by Kuyakana. Care Urban livelihood project

BOX: Social cohesion is still a distant dream

A number of attempts were made by CARE, the Municipal Council and the few youth groups that exist in the area to build a sense of community spirit and ownership of the erosion works. Meetings were held to discuss maintenance plans for the drainage ditches, the gabions and the rehabilitated roads. Play areas were created for children and meetings about recreation for infants were discussed in the neighbourhood. The attempts to work with the construction gangs on the formation of maintenance groups for future work was not successful, and without immediate guarantees of income the men were not interested in building relationships with the Municipal Council. Within weeks of the building of the small playground for the children the swings, see-

saws and benches had been dismantled and the material carried off for construction. There is little expectation or belief that a better social environment can be created and the prevailing attitude is that working and living in the city means that one has to look out principally for oneself (and family). A resident of Polana Caniço A explained how they saw the political and economic changes in recent years in Mozambique; since the end of the war and the start of the multi-party democracy: '*Ah democracy, yes, I understand democracy, it means everyone for themselves.' Interviewee, participatory research 1999.*

Higher political profile benefiting the local population

The dramatic nature of the destruction of the erosion and the significant engineering works drew attention from the media and the politicians. The study revealed that people clearly felt that the attention from the Municipal Council was positive. People attributed the following benefits to the higher profile.

- Money raised for erosion works and road-works
- Politicians listening to the problems in the neighbourhood
- Extra resources for water and sanitation.

However, the success of the erosion works in Polana Caniço A does not seem to have resulted in fund raising for the extreme erosion problems in neighbouring areas. Without the imperative of a dramatic natural disaster the Municipal Council does not have means and/or political will to resolve remaining erosion problems in the inner city neighbourhoods.

Conclusions

The results from the work carried out in the two adjacent inner city urban areas points clearly to an improvement in habitation security for residents of Polana Caniço A, in stark contrast to residents in Polana Caniço B where no urban improvements have been carried out. A number of hypotheses were tested during the research and the following conclusions have been drawn.

The project approach was instrumental in the success of the intervention. The involvement of all key stakeholders in the considerable engineering works was an innovative approach to carrying out public works in Maputo city and bore fruit in terms of collaboration of the community, increased awareness of environmental issues, health and sanitation, leading to increased demands from the public for higher public health and sanitation standards. The role of the Municipal Council was seen as crucial to improvements and the neighbourhood gained a higher political profile because of the spectacular nature of both the damage and the repairs/rehabilitation.

Increased habitation security led to increased investment in the housing sector by homeowners and removed some of the barriers to investment in basic services. The infrastructure rehabilitation was important for creating stability and led to an improvement in water and electricity supplies in the area.

Environmental awareness was raised because of the catastrophic nature of the erosion and the subsequent major engineering works. Community youth groups have worked tirelessly to raise awareness on issues relating to erosion, sanitation and solid waste disposal.

Public health continues to be a challenge in both areas although some improvements were seen in Polana Caniço A where, although people perceive that here has been some improvement in malaria and cholera since the completion of the erosion control works, there are still serious concerns about solid waste disposal and sanitation. The solid waste issue has not been solved by the erosion protection works and is felt by many to have made the situation much worse by providing easy access to the ravines that are used as dumping grounds not just for residents but also for neighbouring areas that drive in to dump household waste in the ravines. In Polana Caniço B (control area) where no rehabilitation was carried out people stated that both cholera and malaria remain a serious threat to health.

Some negative effects of the erosion protection works were identified, including increased risk of road accidents (involving children) and increased criminality due to the thoroughfares created by the protected ravines.

There is no direct evidence that the rehabilitation works had a direct effect on financial security of households, although there is some evidence that informal trading has expanded due to improved physical access to the area and longer trading hours. In the future the stability of the area may prove the greatest asset for families when they can capitalize on their properties. At present this is extremely difficult as the loans and mortgage market is underdeveloped and does not cater for poorer households with no fixed income.

There are mixed conclusions regarding social capital in the area. Many households referred to the increased safety of inhabitants due to the street lighting, but equally people referred to the problem of criminals hiding in the protected ravines. Criminality is an extremely important problem and although improved lighting can help, criminality is a profound urban poverty problem linked to the lack of training of the police force, the lack of administrative and legal structures in the country, overwhelming poverty, unemployment and frustration of youth. Simply improving the physical environment in which people live will not solve these problems.

Lessons Learned

Empowerment through partnership

By empowering the Municipal Council using a facilitation approach to programme implementation, it is possible to stimulate positive dialogue between residents and the Municipal Council on service provision. Kuyakana worked in the city in the midst of a major crisis, and were in a position to mobilize resources to join together many partners to find solutions. Crisis proved to be a growth point and provided the environment for the creation of a productive partnership between highly skilled (and paid private sector) the municipality, the NGO and the community. Together these stakeholders were able to successfully tackle a major infrastructure disaster.

The leverage for CARE was the ability to raise the money and the insistence on partnership and municipal ownership. Once all the major actors were engaged in the problem and felt they could tackle the issue CARE was able to move towards strengthening the community representation and keeping the voice of the beneficiary in the forefront of the discussion.

Infrastructure improvement as a catalyst for urban renewal

Infrastructure improvements can be a catalyst for urban renewal, providing a firm backdrop for further development. However, the Municipal Council needed to be far sighted and organized in order to take advantage of the opportunity provided by the high quality engineering works that were undertaken immediately after the floods.

Development from disaster

The mobilization of people after dramatic events (such as a natural disaster) can have a long-lasting effect on social cohesion as seen through the youth work that is still evident in Polana Caniço A. The approach of Kuyakana to facilitate work through partners was instrumental in this process.

Rehabilitation and stability and the provision of basic services

Service providers, such as water and electricity utilities, can be stimulated to provide improved services if basic infrastructures are in place (roads, drainage etc), as seen by the improved water supply in Polana Caniço A.

Public health and access to health care

Public health can be improved through infrastructure development. However, the wider question linked to access to adequate health care is dependent on social policy and provision of financially accessible health care.

Social Capital in the context of urban renewal

Infrastructure rehabilitation cannot be expected to resolve the problem of lack of social cohesion in poor high-density urban areas. However, the various positive impacts of urban renewal, such as improved basic services, greater environmental awareness, and higher political visibility, make some inroads into the negative social situation in the poorest areas of the city.

LIST OF ABBREVIATIONS USED

DFID Department for International Development

KaR Knowledge and Research (Programme)

MoU Memorandum of Understanding

NGO Non-Governmental Organization

Bibliography

CARE International 2000/3. Internal project documents for the Kuyakana Urban Livelihood Project. Unpublished internal documents.

Christie F. and Hanlon J. 2001. Mozambique and the Great Flood of 2000. International African Institute in association with James Currey and Indiana University Press.

DNA, 2002, Ministry of Public Works and Housing. Urban Water Supply Management Models. 2002. Internal Working Document.

Rodriques, Andrea. 2002. Formative Review of Kuyakana Urban Livelihood Project

Government of Mozambique / UNDP. 2000b. Floods in Mozambique- Final Report. International Reconstruction Conference, Rome 3-4 May 2000. CD-ROM.

Ministry of Public Works and Housing. August 2003. Millennium Goals for the Water Sector: Steps to Follow. Internal working document.

Provention Consortium. World Bank. 2003. (Unpublished). Post Emergency Recovery, Mozambique Case Study.

Sylvester, Kerry. June 2003. Kuyakana: Lessons Learnt in Urban Livelihood Programming. Internal CARE International document.

UNDP 2002. Mozambique. Gender, women and human development: An agenda for the future. National Human Development Report 2001.

[1] Earlier figures are from published census data. 1997 figures are estimates obtained from statisticians currently processing the 1997 census data (Instituto Nacional de Estatística, Maputo).

[2] National Household Survey. 1996/7. Ministry of Planning and Finance.

[3] Ibid.

[4] According to the 1997 preliminary census results, the second largest city, Beira, has a population of approximately 488,000 persons and a population density of 771 persons per square kilometre. The fourth largest, Nampula city, has a population of 305,000 persons and a population density of 953 persons per square kilometre (INE, 1998). The majority of poor households in both provinces still have access to agricultural land.

[5] Although it was not initially legal to sell ones home, there was provision in the public sector housing sector to exchange "keys" of homes. This was usually accompanied by a money bonus for the people moving into the high density suburbs, and vacating the desirable city flats and houses.
[6] The households further from the erosion did not cite home safety as one of the positive aspects of the erosion protection works as their homes had not been directly affected. Nearly 100% of households close to the ravines felt that their homes were now safe.
[7] Key informants: Local leaders, volunteers with the Kuyakana project, District Administrator.
[8] The housing market is complex in Mozambique as people generally sell on the informal market and not legally (as many do not have official title deeds for their properties). Similarly the renting market is complex as people are reluctant to talk about how much rent is being charged. This is an attitude that harks back to the days when it was illegal to buy, sell or rent property and all housing stock was nationalized (1975- early 1990s).
[9] Mumeme is an expanding area in the District of Marracuene, approximately 20km from the centre of Maputo city.
[10] The model for the management of public standpipes was introduced by the government investment board (FIPAG), the water regulatory board (CRA), and the private sector water company (AdM). It was supported by the Municipal Council and the NGOs operating in the urban water sector. The model consists of private operators for the standpipes, supervised by water committees selected by residents of the neighbourhoods. The private operators have contracts with the Water Company and are supervised by the water committees, who in term are accountable to the communities served by the public standpipes.
[11] Survey carried out as part of the final evaluation of the Private Public Partnership project. CARE/UNDP. 2004.
[12] In discussion groups the question of air pollution was raised but there is little awareness of the dangers of exhaust fumes by the community.
[13] The impact of the erosion works on malaria statistics is further complicated by the high levels of HIV/AIDS in the area that often manifests as serial episodes of malaria that are not cured.
[14] Two of the major ravines were not filled due to cost constraints. Gabions were used to control further erosion and bridges and pathways were made in the ravines. These are now thorough-fares within the neighbourhood.
[15] Interview with Police Chief for the area
[16] Possibly a veiled reference to HIV and AIDS that is still highly stigmatized and causes social problems within families.