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Integrated Project
Global Change and Ecosystems

Deliverable 5.2.4 - Annex 1

Improving Urban Water Quality based on a Stakeholder Oriented Planning Approach in Accra's Odaw-Korle Catchment, Ghana

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5.2.4 Action Research and Demonstrations on the Use of Water for Urban Agriculture

Work package 5.2

The aim of work package 5.2 is to contribute to a paradigm shift in wastewater management and sanitation towards a recycling-oriented closed loop approach. The work package is being implemented in three cities; Accra, Beijing and Lima, and includes the identification and integration of appropriate productive re-use of urban freshwater, storm and waste-water for agriculture into the policy and planning frameworks of these cities.

The deliverables of the work package follow a sequence of implementation. Based on a situation and stakeholder review (del. 5.2.1), working groups are formed, meet and are linked to the Learning alliances (del. 5.2.2), they receive training in multi-stakeholder action planning (del. 5.2.3 A), and are involved in, and informed on, specific research by consultants, MSc and PhD or action research linked to the demonstrations, (all under del. 5.2.4). Information has been disseminated in publications, magazines and newsletters (del. 5.2.5), and guidelines and related training material has been developed (del 5.2.3 B and C). The leading institutes here are ETC (WP coordinator), IWMI (Accra), IGSNRR (Beijing) and IPES (Lima), other institutions involved were WUR, IRC and NRI- GUEL.

As part of deliverable 5.2.4, this product contains information on the work of Ernest Abraham on Odaw-Korle Catchment Area.

Contributing products included in this document are:

5.2.4 Ab Briefing Sheet

5.2.4 Ab1 PhD Proposal Ernest Abraham (IWMI, GUEL)

Improving Urban Water Quality based on a Stakeholder Orientated Integrated Planning Approach in Accra's Odaw-Korle Catchment, Ghana.

5.2.4 Ab3 The Challenge of urban flood control: The case of Accra's Korle Lagoon

E.M. Abraham, P. Drechsel and O. Cofie. 2009.

5.2.4 Ab4 Water-dependent livelihoods in selected communities: Analysis of practices and perception of water quality in Accra Ernest Mensah Abraham, Olufunke Cofie, Liqa Raschid-Sally, Adrienne Martin, IWMI, GUEL. 2009. Presented at the SWITCH SC meeting, Delft

The Full PhD report is listed under PhD and MSc reports, theme 5, (forthcoming in July 2011).

Improving Urban Water Quality based on a Stakeholder Orientated Integrated Planning Approach in Accra's Odaw-Korle Catchment, Ghana

(Draft PhD proposal)

Ernest Mensah Abraham

Summary

In Ghana, regular dumping of domestic waste into drains and streams is a major problem which leads to the extreme pollution of especially urban and peri-urban water bodies. An important case is the Korle Lagoon and the Odaw River complex in Accra. The situation constrains the use of urban water bodies and surrounding areas for livelihood activities as well as urban biodiversity. The proposed PhD research thus aims to understand the interrelationship between livelihood activities, stakeholder interventions and institutional responses and the impacts on the biophysical environment, specifically urban water quality. This understanding will contribute to influencing urban water planning approaches to become more integrative in support of both urban water based livelihoods and improved water quality. The research will analyse how interactions between different stakeholders occur and could be encouraged. The research will recognize the impact agents and identify community actions and institutional responses to address unsustainable utilization of the water resources in the catchment with a focus on those communities which are hot spots of pollution as well as those in most need of safer water sources for livelihoods and multiple purposes.

In analyzing the use of these urban water sources for multiple purposes, the research will investigate users' access to urban water and the conditions which make them able or unable to obtain maximum benefits from their water dependent productive activities. Secondly it will investigate how stakeholders are organizing themselves to negotiate for access to the water with special emphasis on the different livelihood circumstances; the different social relations; and whether these livelihood circumstances and social relations affect behaviour while conditioning opportunities and responses to change. The research employs a multistakeholder approach, involving key stakeholders. The ultimate beneficiaries in this project range from the communities to water management institutions as well as the city authorities and those urban dwellers and tourists looking for recreation in the urban environment.

1. Introduction

Ghana is experiencing a high level of pollution in her water bodies particularly where they are located near human settlements, industrial (including mining) estates and agricultural undertakings (MWH, 1998; JICA, 1999; Akufo, 1998). Dumping of solid and liquid domestic waste into rivers and streams in Ghana is a major problem with the waste finally ending up in the sea in coastal towns like Accra its capital (Ansa-Asare, 2001; Abraham, 2001). These practices have resulted in the extreme pollution of some water bodies, such as Accra's Odaw River and Korle Lagoon, which is currently in the final phase of its ecological restoration process. The Odaw/Korle catchment drains 60% of the city (Boadi and Kuitunen, 2002; map in annex I). The catchment context is unique with a gradual ecological transition from the watershed to the Atlantic coastal zone. A diverse set of ecosystems including freshwater streams, a lagoon and a coastal zone are all linked to the transition from rural, periurban to urban environments and its sewage system. Freshwater (both surface and groundwater), brackish water and marine (coastal) water and the related biodiversity are all together threatened by pollution inflow from the city of Accra where less than 10% of the wastewater enters a sewer and solid waste collection lacks the capacity to service crucial parts of the city. It was estimated that the BOD load in the Odaw River and Korle Lagoon in 2000 was 132,000 kg/day (Biney, 1998). Several studies confirmed the low quality of the stream water, which is, however, still used for irrigation, fishing and other purposes (Armar-Klemsu *et al.*, 1998; Sonou, 2001; Zakariah *et al.*, 1998). Especially the faecal coliform levels are high, typically ranging between 10^3 - 10^8 /100ml (Amoah *et al.*, 2005, 2006).

The polluted nature of the water constrains its use for livelihood activities, as the quantity and quality of some products have been impacted negatively. Livelihood activities of which urban water quality is of immense concern are considerably threatened. Several studies carried out within the catchment have confirmed the use of urban and household water for several livelihood activities, contributing significantly to the income of the practitioners. Some of the activities identified include urban farming, floriculture, car washing, food vending, among others. For some practitioners about 100% of their income is generated from these activities. Therefore measures that will enhance the water quality for multiple purposes will be of great importance.

However, the various studies carried out in the catchment so far did not go beyond a descriptive situation analysis, focusing mostly on the technical side of the key issues. Thus the PhD research seeks to analytically link the impacts on the biophysical environment to livelihood activities, stakeholder interventions and institutional responses. Such an analysis will deepen the knowledge in urban water planning suggesting measures on how to make urban water planning integrative as this is necessary for prioritizing and financing interventions in the catchment as municipal resources are limited. It will designate the impact agents, and identify community actions and institutional responses to address current unsustainable utilization of the water resources in the catchment in support of an integrated urban water planning strategy.

1.1. Overall research hypothesis:

Prioritizing interventions for improving water quality in an urban water catchment requires a planning approach that relates livelihoods and consequences (positive and negative) on the biophysical environment, to impact agents. Such agents may be communities polluting the water, or institutional responses. The different communities adjoining the Odaw River contribute to the total pollution load of the Odaw-Korle catchment; making the water unsafe for its multiple uses such as crop cultivation, recreation, fishing and other livelihood activities. Institutional responses may be the organizations, rules and regulations that influence urban planning as well as environmental health. Key stakeholders would be involved via institutional consultations and results presentation workshop.

1.2. Statement of the problem

The urban water of Accra, which in the past supported several livelihood activities, such as fisheries, aquaculture, urban agriculture, bathing and washing, and household chores, among others, is constrained due to its low quality resulting from pollution. Today Accra's waters support only a limited number of these activities and this could mean a reduction in the contribution of these livelihood activities to the income of the practitioners. The reduced quality of the water is attributed to a complex of lack of enforcement of regulations, institutional lapses and human behaviour and practices within the catchment. This is a significant challenge as different effluent, waste, and by-products of activities are discharged into the water bodies. Several regulations exist on how urban water resources should be managed and planned but the enforcement has been problematic. The current water management process does not incorporate livelihoods considerations. Thus urban water users are denied the space to present their concerns. Further, stakeholders have at best worked at the sectoral level, but in an uncoordinated way, and so have been unable to address the challenges in the urban water sector. It is also unclear what role the urban planning process has played so far in securing the water resources of the city. This problem is further exacerbated by the seemingly lawless

operations of the estate development sector where individuals have built on flood zones. The categories of practitioners in the water based-livelihoods sector are people within the low income bracket. Therefore any lapses in the water planning process which constrains their activities are likely to impact on their incomes and hence poverty levels.

1.3. Research goal (s)

GOAL

To understand the interrelationship between livelihood activities, stakeholder interventions and institutional responses and the impacts on the biophysical environment, specifically urban water quality in order to influence urban water planning to be integrative.

1.4. Research objectives

1.4.1 Objective 1

To investigate the different water-based livelihood activities and their impact on household income and well-being

Specific objectives

- To inventorise sources of urban water and methods and techniques for accessing it
- To investigate the different water based livelihood circumstances and strategies, and quantify contribution to household income
- To investigate the existing social relationships or networks of livelihood groups and how it influence access to water for productive activities

1.4.2. Objective 2

To investigate the impact of quality of urban water sources on water use for livelihood activities and how polluting behaviours might be influenced

Specific objectives

- To identify stakeholders' criteria for water quality
- To inventorise land and water use in relation to water quality from the upstream through to the downstream of the Odaw River and determine possible impact on water use for productive activities and well-being.
- To investigate water polluting behaviours of people and how this might be changed in the catchment.

1.4.3. Objective 3

To analyse the different stakeholder groups and institutional responses on urban water planning and how this influence urban water quality

Specific objectives

- To analyze key stakeholders in urban water to ascertain roles, responsibilities, rights, relations and organisational culture and how these influence urban water planning
- To carry out institutional analysis of existing arrangements in urban water planning
- To investigate whether there are linkages between impacts on the biophysical and stakeholder and institutional responses
- To investigate how urban water is integrated into spatial planning
- To investigate the urban water planning process

Rationale for the research

The research aims to understand the interrelationship between livelihood activities, stakeholder interventions and institutional responses and the impacts on the biophysical environment, specifically urban water quality. This understanding will contribute to influencing urban water planning approaches to become more integrative and stakeholder orientated. Mapping out the water quality situation of the Odaw-Korle complex will help the Accra Metropolitan Assembly to relate environmental problems with institutional and human behavioural responses. Several activities could affect the water quality within the Odaw-Korle catchment and it is important that these are mapped out to enable good management decisions to be taken in preventing continuous pollution of the river and the lagoon. Many economic activities take place within this catchment and measures to preserve the water resources are laudable. The livelihood analysis will identify the present state of local leadership attitudes, which can help the metropolitan authorities to design management strategies for the catchment. Appropriate measures to protect the water resource will also be identified.

The quality of the water will be enhanced over time because activities releasing substances which compromise its quality will be regulated. The quality of a water body determines the various uses to which it could be put. Thus access to good quality water means a probable improvement in quality of specific products, thus helping to maximize the benefits of the water use. The research is expected to identify actions which relevant and key stakeholders could adapt to address practices impacting negatively on water use in the catchment. The research adds up to the body of knowledge in urban water management.

The proposed project will offer numerous benefits to urban dwellers. A protected catchment and regulated stream and river discharges may result in availability of freshwater for economic, aesthetic, and ecological purposes. It is expected to deepen understanding of the social structure as it investigates the livelihoods and the productivity of the practitioners. The study will consolidate existing opportunities for collaboration in integrated urban water planning. It will explore how the communities will be integrated in any intervention. The community is thus expected to demonstrate ownership for the water resources and propose viable initiatives which will help protect the catchment. This will feed into government efforts on alternatives to address unsustainable utilization of water resources. More generally, knowledge concerning stakeholder engagements in planning process on urban water will be deepened.

2.2. Background theory and literature

2.2.1. Water Based Livelihoods in the Context of the Sustainable Livelihoods Framework

Water resources come in different forms and have multiple uses. Water is present in surface stocks (lakes, ponds) and flows (rivers), as groundwater in aquifers or as soil moisture. All can be used directly in livelihood activities and all are important to the viability of ecosystems on which livelihoods depend (Soussan, 1998).

Soussan, 1998, suggested that if the goal of Livelihoods Analysis or intervention is to enhance the assets available to the poor, from a water resources perspective then there is need for understanding: the potential resource base, including both the quantity and the quality of water resources available within the area which one is concerned ; the existing and potential pattern of use of these resources, including which groups are using which particular resources and the contribution that these resources are making to their livelihoods; the legal , policy and institutional context within which resource use takes place and access is granted; the local, social and institutional context of water resources use, including the processes through which decisions are reached and the links between local level and external institutions involved in water resources management; and the trajectory of change for all of these factors.

In relation to the Odaw-Korle River Catchment, the Sustainable Livelihoods Framework serves as a guide for a logical analysis of the use of the water for livelihood activities in Accra. The following section explains how this Framework will be applied in the study. The Sustainable Livelihoods Framework is a tool for understanding livelihoods, particularly of the poor and according to Carney (1998): “A livelihood comprises

the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future while not undermining the natural resource base". The livelihood approach itself builds on the findings of participatory poverty assessments carried out previously (Booth *et al.*, 1998; Hanmer *et al.*, 1997).

The Figure 1 below shows a conceptual representation of the Sustainable Livelihoods Framework and the internal and external relationships.

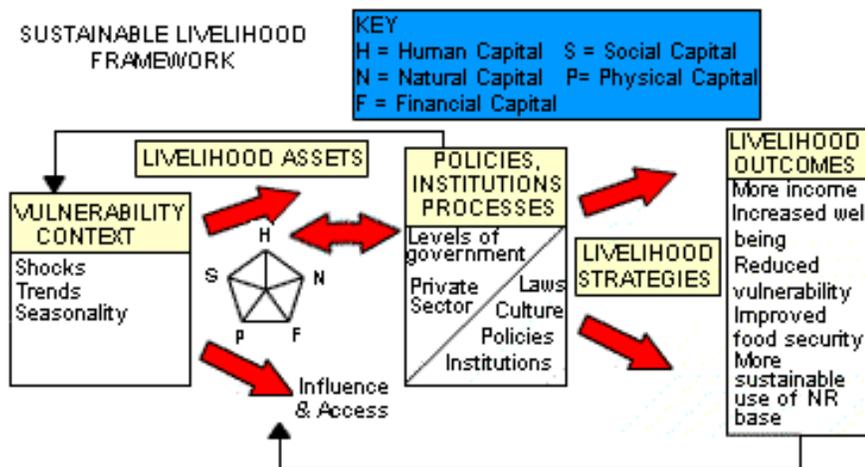


Figure 1: Sustainable Livelihood Framework

The significance of the Framework

As an entry point to study livelihoods, stakeholder interventions, and impacts on the biophysical environment and how they influence planning urban water in Accra, the Framework presents the main factors that affect people's livelihoods and the relationships existing between these factors. The livelihoods Framework was designed by British Department for International Development (DFID Guidance Sheets). The Framework is people centered, adopts a stakeholder approach, and does not work in a linear manner or attempt to present a model of reality. It enables stakeholders to have different perspectives to engage in structured and coherent debate about the many factors that impact on livelihoods, their comparative importance and the extent to which they interact. People centered analysis within the Framework is most likely to begin with people's assets, their objectives and the strategies adopted to achieve these objectives.

Water based livelihoods and the Vulnerability Context

Factors making the Vulnerability Context are important because they have a direct impact upon people's asset status and the options that are open to them in pursuit of beneficial water based livelihood outcomes. Trends typically include: population trends, resource trends (including conflict) national or international economic trends, trends in governance (including politics), and technological trends. Shocks can destroy

assets directly (in the case of floods, storms, civil conflict etc) or compel people to abandon assets and dispose them off prematurely as part of coping strategy. There have been instances in Accra where urban farms were destroyed due to flooding of farms from rains (personal communication, 2006). Increasing numbers of people will consequently be a major driver of water resource for at least another 50 years globally (Gardener-Outlaw and Engelman, 1997). Water-related disasters are one of the major challenges of modern world today. This is expected to be exacerbated by the impacts of climate change. Seasonal shifts in prices, employment opportunities, and food availability are some of the greatest and most enduring sources of hardships for poor people in developing countries.

Livelihood Assets

The Livelihoods Framework (DFID Guidance Sheets, 1999) identifies five key assets categories or capital types upon which livelihoods are built (Figure 1): these are human, social, natural, physical, and financial. The Framework seeks to have accurate and realistic understanding of people's strengths (assets or capital endowment) and how they try to convert these into positive livelihood outcomes. Assets combine in several different ways to generate positive livelihood outcomes and understanding the highly complex relationship within the Framework is a major step in the process of livelihood analysis which will eventually lead to action to reduce poverty. The five asset types are briefly elaborated below.

Human Capital represents the skills, knowledge, ability to labour and good health that together enable people to pursue different livelihood strategies and achieve their objectives. Though not sufficient it is necessary in achieving positive livelihood outcome. Social Capital represents the social resources upon which people draw in pursuit of their livelihood objectives. These are developed through networks and connectedness, either vertical (patron/client) or horizontal (between individuals with shared interest) that increases people's trust and ability to work together and expand their access to wider institutions, be it political or civic bodies. Natural Capital comprises the natural resource stock from which resource flows and services (e.g. nutrient recycling, erosion protection) useful for livelihoods are derived. There is considerable evidence that making even relatively small amounts of water available for personal and productive uses to poor people can transform their lives (Polak *et al.*, 2002; Lipton and Litchfield 2003). Though many factors underlie low crop productivity for instance, inadequate and unreliable supply of water is a significant factor in many cases (Merry *et al.*, 2004).

Physical Capital consists of the basic infrastructure (changes to the physical environment which help people to meet their basic needs and be productive) and producer goods (tools and equipment that people use to

function more productively) needed to support livelihood. Whereas financial Capital denotes the financial resources that people use to achieve their livelihood objectives.

Policies , institutions, and processes

These are the organizations, institutions, policies and legislations which shape people's livelihoods. They operate at all levels including households and effectively determine: access (to various types of capital, livelihood strategies and to decision-making bodies and sources of influences; the terms of exchange between different types of capital; and returns (economic and otherwise) to any livelihood strategy. They also have a direct impact on whether people are able to have a feeling of inclusion and well-being. It is important to always think beyond the policies, institutions, and processes to the extent that these have on the livelihood of different water-based livelihood groups.

The organizations include both private and public which set and implement policy and legislation, deliver services, purchase, and trade and perform all kinds of functions which affect livelihoods. In Ghana, the Ministry of Water Resources, Works and Housing host Ghana's Water Resources Commission (WRC) established by an Act of Parliament (ACT 522 of 1996) with the mandate to regulate and manage the country's water resources and to co-ordinate government policies on it as well as the activities of other institutions, which already deal with the resource (Drechsel and Owusu-Bennoah, 2007). The Processes are the way in which organizations and institutions individually operate and interact. Processes are crucial and complex and affect every aspect of livelihood. Apart from the fact that there are many of them operating at different levels, there may also be overlaps and conflicts between them. Policies inform the development of new legislation and provide a framework for the actions of the public sector implementing agencies and their sub-contractors. Institutions have been variously defined as the 'rules of the game', 'standard operating practices', 'conventions' and customs' or the way things are done. These are informal practices that tend to structure relationships and to some extent make the behaviour of organisations predictable. Institutions tend to be embedded in and develop out of the culture of communities or larger societies.

The National Water policy of Ghana (MWRWH, 2007) was launched in 2007 with the overall goal of achieving sustainable development, management and use of Ghana's water resources to improve health and livelihoods, reduce vulnerability while assuring good governance from present and future generations". This will be achieved by addressing relevant issues under water resources management, urban water supply and community water and sanitation.

Livelihood Strategies

Livelihood Strategy refers to the range and combination of activities and choices which people make in order to achieve their livelihood goals (including productive activities). In some other literature the term adaptive strategy is used instead. Adaptive strategy is differentiated from coping strategy which people resort to when in crisis. The Sustainable Livelihoods approach seeks to develop an understanding of the factors which belie people's choice of livelihood strategy and then to reinforce the positive aspects while mitigating the constraints or negative factors.

Recent surveys across 50 cities in Asia, Africa and Latin America showed that wastewater (urban water) irrigation is a common reality in three-fourths of the cities. Global estimates of the total area under raw and diluted waste water (urban water) irrigation are still fragmentary, but might range from 3 to 3.5 million hectares. In Ghana, dry-season irrigation with wastewater allows an average extra income of 40-50%. In addition, jobs are created for the traders who market the produce, input suppliers, and other service providers (Danso *et al.*, 2005). In Accra, research by IWMI-RUAF in 2006 identified about 1000 farmers on 7 large sites along streams and drains cultivating vegetables for the city on about 100ha in the dry season only. A rapid survey of water based livelihoods in Accra, (Abraham *et al.*, 2007) also identified informal water based livelihood activities such as: tea and beverage vending; porridge vending, fast food joints; "chop bar" ; and hair and beauty salon operating; livestock keeping, floriculture, vegetable farming, and car washing. Further details on the use of household water for livelihoods are provided below.

Use of household water for livelihood activities

The concept of 'productive use' refers to water used for small scale, often informal activities whose primary purpose is improved nutrition and/or income generation. The term 'household level' is used to refer to the relatively small scale of the activities (and quantities of water involved), and the primary social unit at which the use of this water takes place (Moriarty *et al.*, 2004). Many informal enterprises in Accra use substantial amounts of water in relation to their activity. In terms of livelihoods significance, for many the income from these informal enterprises represents 100 % of their earnings as there is demand for such services, and in addition they provide employment and support a chain of beneficiaries. Better understanding of the real and major contribution to livelihoods improvement and poverty reduction that household water can play and does play is however lacking in much of the discussion on household water issues (Soussan, 2003). There is increasing evidence however that these productive uses, which are unintended in household water systems, appear to be significant if valued in terms of numbers of direct and indirect beneficiaries, the contribution to their household income and the services they provide to the city population (Abraham *et al.*, 2007; WaterAid 2001)

Livelihood outcomes

The different livelihood strategies are expected to produce livelihood outcomes (Figure 1). People aspire to a range of positive outcomes (Carney, 1998). Thus it is important to listen to those with whom one works with in order to learn from them about their own objectives, their own understanding of what it is to be in and escape from poverty.

Contextualizing poverty

Poverty is a complex, multi-dimensional phenomenon that includes both material and non material features of life, that differs in its expression from person to person and place to place, and that can only be sustainably addressed where the *assets* and *capabilities* that the person possesses are improved. The poor are particularly far more vulnerable to trends, shocks, and seasonalities that disrupt their livelihoods and set back any small progress and achievement. The poor are far less resilient and may suffer from multiple vulnerabilities. The poor also constitutes a heterogeneous group and therefore for people with very few or no assets, then the opportunities provided by improved access to good quality water for productive purposes may be significant.

Many of the studies carried out so far in Accra however fall short of systematically linking to key issues on livelihoods by considering issues bordering on well-being. Therefore this study will specifically relate water and livelihood activities to the practitioners' assets or capital, institutions and processes, strategies, and outcomes. An attempt will also be made to link the livelihood activities to the prevailing policy environment within which the activities occur. This is to encourage future water planning to integrate livelihoods.

2.2.2 The urban water situation

Water and the urban environment

Though urban water provides useful environmental and economic services globally, it faces several challenges. Mismanagement of water resources, growing competition for the use of freshwater, degraded sources: sometimes by pollutants of unpredictable effects, only aggravate these challenges. High growth of urbanization particularly in the developing world and the formation of megacities through intensive internal migration, tend to worsen the problem by impacting the hydrologic cycle.

Urban water refers to rivers, streams, ponds, and lakes in cities and urban areas as well as the wastewater system. Domestic effluent and urban run-off contribute the bulk of inflow into urban water bodies in Ghana. Domestic wastewater usually contains greywater (sullage), that is wastewater from washrooms, laundries,

and kitchen and can also contain blackwater, which is generated in toilets. Blackwater might contain besides urine and faeces/exceta also some flush water. The mixture is termed sewage if it ends up in a sewerage system or septage if it ends up in a septic tank (Obuobie *et al.*, 2006). Wastewater is also differentiated from faecal sludge, which is all sludge collected and transported from on-site sanitation systems by vacuum trucks for disposal or treatment (Strauss *et al.*, 1997). Increasing population increases the pressure on the urban water resources

Drainage in Accra

Drainage in Accra usually consists of natural drains and a few major storm water drains. A network of small drains known as gutters are in place to serve a dual purpose of storm water drain and conduit for domestic effluent. In the case of the Korle Lagoon, its auxiliary function as a central drainage system emptying its content into the sea, resulted in it becoming shallow over time due to excess siltation and waste finding its way into the water body with runoff (Biney, 1982). This necessitated the process of ecological restoration started in the year 2000.

The Odaw-Korle catchment covers an area of 250 km². It's a complex of the Odaw River and the Korle Lagoon. The Odaw River drains into the Lagoon. The course of the river is natural but constructed at some points as it flows through the city. The principal streams that drain the catchment are the Odaw River and its tributaries, the Nima, Onyasia, Dakobi and Ado. The principal outlet for water in this catchment is the Korle Lagoon. The Korle-Odaw catchment contains the major urbanised areas of Accra. About 60% of Accra is drained by the Odaw-Korle catchment (Annex I). Many of the drainage channels are poorly developed and maintained. Erosion and siltation of drains is a major problem. In low-lying areas seasonal flooding is a problem, with some houses being inundated by floodwaters during and after heavy rains resulting in loss of property. This also has implication on water quality of the river as debris is washed into it. Other smaller drainage basins exist in Accra and provide respective economic and environmental services to the city.

Urban water pollution and its effect on quality

Pollutants are potentially harmful, if found at the wrong place above the natural background level. They may have been released on purpose, for example pesticide or may be an unwanted waste product dumped into the environment, such as partly treated or untreated liquid and solid waste (Newman, 2000). Pollution of surface waters occurs when wastes and other debris enter them. The main sources of such wastes include: domestic and municipal; industrial; farming; and mining. When pollution is linked to a particular source, it is said to be point source in form, otherwise it is said to be diffused. Thus the main contaminants found in water could include: detergents, pesticides, petroleum and derivatives, toxic metals, fertilisers and other plant nutrients,

oxygen-depleting compounds, polyaromatic hydrocarbons (PAH), nutrients, and disease-causing agents that is pathogenic microorganisms responsible for various infections of the body (Anton, 1993; Ellis and Mitchell, 2006). This is affecting a number of the world's major rivers.

Cities have a price to pay for urban water pollution in terms of water related diseases which is a major cause of morbidity in the world. In developing countries, water related diseases are the main cause of mortality among children less than 5 years of age. Water-related diseases include those due to micro-organisms and chemicals in water that people are exposed to (WHO, 2006). These water related diseases may be: water-borne caused by ingestion of water contaminated by human or animal faeces or urine containing pathogenic bacteria or viruses. (Faecal-oral diseases such as cholera, typhoid, amoebic dysentery and other diarrhoeal diseases.); water-washed caused by lack of water (water quantity) and linked to poor hygiene (Trachoma, scabies, foot disease); water-based caused through contact with water via aquatic invertebrate intermediate hosts (*Schistosomiasis, dranculiasis*,); water-related insect vector which to a certain extent transmission is through vectors proliferating in water reservoirs, other stagnant water, and through certain agricultural practices (Malaria, dengue, lymphatic filariasis) (Ince, 1999 ; Pruss *et al.*, 2002).

Human activities constitute a major factor in urban water pollution. In China, of the various consequences in the changing environment, water contamination imposes imminent threat on China's society. Rapid urbanization and intensive agriculture have been increasing the demand on water, and at the same time contaminating surface and ground water and causing adverse biological, chemical and health effects. Over the past 40 years, nitrogen contamination has increased dramatically in the Yangtze River (Chen *et al.* 2000; Liu *et al.* 2003), and the Han River has become one of its most nitrogen contaminated tributaries (Liu *et al.* 2003) in addition to its rich suspended sediments (Chen *et al.* 2000; Yang *et al.* 2002; Gu *et al.* 2008) and slightly heavy metal contamination (Li *et al.* 2008).

In the urban context, (Zaranyika, 1997; Kamudyariwa, 2000; Moyo and Worster, 997), the water quality of the Mukuvisi River in Harare was found to have been significantly affected by human activities, especially wastewater discharges.

Similarly, Ghana is experiencing a high level of pollution in her water bodies particularly where they are located near settlements, industrial (including mining) estates and agricultural undertakings (MWH, 1998). In Accra, Biney (1998), classified the main types of pollution reaching the Odaw-Korle catchment as: substances which contribute to increase in biochemical oxygen demand (BOD) originating from domestic sewage, industrial effluents, dump leachates, and urban run-off. Industrial pollutants include substances such

as trace metals, suspended solids, organic poisons and oil, pesticides, and nutrients arising from domestic, agricultural and industrial activities.

Other studies have corroborated the contaminated nature of the water and provided some facts on the effect it had on products of certain water-based livelihood activities. Amoah *et al.*, (2005) observed that irrigation water sources in Accra showed considerable variation in total and faecal coliform considerations and the WHO guidelines (1×10^3 100ml⁻¹) for unrestricted irrigation of crops likely to be eaten raw were exceeded in the majority of the cases for faecal coliform levels (WHO, 1989). Crops were contaminated, and in almost all cases, faecal coliform levels were more than 1000 100g⁻¹ lettuce (wet weight) and can be considered, according to the ICMSF (International Commission on Microbiological Specifications for Food) guidelines as “undesirable” (ICMSF, 1974, cited in Amoah *et al.*, 2005).

Ascaris lumbricoides was the most predominant helminth species recorded in the water with population ranging between 2 and 4 eggsl⁻¹, exceeding the recommended level of < 1 egg l⁻¹ for unrestricted irrigation (WHO, 1989). Cornish *et al.*, (1999) equally recorded a range of 1-5 helminth eggs l⁻¹ in both urban and peri-urban irrigation water sources including shallow wells. Though it is admitted that there could be other sources of contamination, as field trials with treated water showed, irrigation with urban water could be a major one. The study (Amoah *et al.*, 2005), however recognized that the measures to address the contamination of crops required a holistic approach.

The above studies show that much still needs to be done in terms of detailed analysis of how the use of low quality water impacts on livelihoods within the catchment, since most of the studies on water quality focused more on the technical side. The research will thus investigate: stakeholders’ criteria for assessing water quality; land use in the Odaw-Korle catchment and how it impacts on water quality; the extent of impact of water quality on productive water based livelihood activities including well-being of practitioners; and the approach that must be adopted in changing behaviours and practices which negatively impact on the water quality. The next section thus provides a theoretical basis for the perception studies on how polluting behaviours could be changed or influenced in order to protect and preserve urban water resources for productive activities and clean environment.

2.2.3. Grounded theory approach to theory building

One of the qualitative approaches to studying water and land polluting behaviours, is the Grounded Theory. According to Goulding (1999), the roots of grounded theory can be traced back to a movement known as symbiotic interactionism whose origins lie in the work of Charles Cooley (1864-1929) and George Herbert

Mead (1863-1931). The development of grounded theory was an attempt to avoid highly abstract sociology and was part of an important growth in qualitative analysis in the 1960s and 1970s. The main impetus behind the movement was to bridge the gap between theoretically “uninformed” empirical research and empirically “uninformed” theory, by grounding theory in data. As a formal theory, Grounded Theory was first presented by Glasser and Strauss in their 1967 book *The Discovery of Grounded Theory*. The book was premised on a strong intellectual justification for using qualitative research to develop theoretical analysis.

Given its emphasis on new discoveries, the method is usually used to generate theory in areas where little is already known, or to provide a fresh slant on existing knowledge about a particular social phenomenon. Grounded theory requires understanding of related theory and empirical work in order to enhance theoretical sensitivity (Flick, 2002).

Grounded theory “is a detailed grounding by systematically” and “intensively analysing” data, often sentence by sentence, or phrase by phrase of the field notes, interview, or other document. Through constant comparison, data are extensively collected and coded” using appropriate operations, thus producing a well constructed theory. Grounded theory is based on a concept-indicator model, which directs the conceptual coding of a set of empirical indicators. The latter are actual data such as behavioural actions and events, observed or described in documents and in the words of interviewees and informants. These data are indicators of concept, the analysis derived from them, at first provisionally but later with more “certainty”. Many indicators (behaviour, actions/events) are examined comparatively by the analyst who then “codes”, naming as indicators of a class of events/behavioural or actions (Strauss 1987; Walker and Myrick, 2006).

Generating theory

Theory has been considered as a set of well-developed categories (e.g. themes, concepts) that are systematically inter-related through statements of relationships, to form a theoretical framework that explain some relevant social, psychological, educational, nursing, or other phenomenon. The statement of relationships explain who, what, when, where, why, how, and with what consequences an event occur.

Developing theory is a process. It is work that entails not only conceiving or intuiting ideas (concepts) but also formulating them into a logical, systematic, and explanatory scheme. It is important that the idea is explored fully and considered from many different angles or perspectives (Strauss and Corbin, 1998). As the data are collected, they should be analysed simultaneously by looking for all possible interpretations. This usually starts with open coding where the data is disintegrated into distinct units of meaning. In addition to open coding it is important to incorporate memos which are notes written immediately after data collection as a means of documenting the impressions of the researcher. So the memo records all the ideas

emerging through the data collection and analysis process and can help the researcher to organise his thoughts to construct the emerging theory.

In discovering theory, one generates conceptual categories or their properties from evidence; then the evidence from which the category emerged is used to illustrate the concept. The discovered theoretical category lives on until proven theoretically defunct for any class of data, while the life of the accurate evidence that indicated the category may be short. One key aspect of generating theory by this approach is the use of comparative analysis (Glaser and Strauss, 1967).

Substantive and formal theory

Comparative analysis can be used to generate two basic kinds of theory: substantive and formal. By substantive theory, it is developed for substantive or empirical area of sociological inquiry, such as patient care, race relations, and professional education, delinquency, or research organisations. Formal means that it is developed for a formal, or conceptual area of sociological inquiry such as stigma, deviant behaviour, formal organisations, socialisation, status congruence, authority and power, reward systems, or social mobility. These two forms can be considered “middle-range because they fall between the “minor working hypotheses” or every day life and the all-inclusive grand theories. Substantive and formal theories exist on distinguishable levels of generality, which differ only in terms of degree. Therefore, in any one study, each type can shade at points into the other. But the analyst should follow clearly on one level or the other, or on a specific combination, because of the different strategies for arriving at each. Both substantive and formal must be grounded in data (Glaser and Strauss, 1967).

Elements of the theory

The elements of theory that are generated by comparative analysis are, first, conceptual categories and their conceptual properties; and second, hypotheses or generalised relations among the categories and their properties. A category stands by itself as the conceptual elements of the theory. A property, in turn, is a conceptual aspect or element of a category. Both categories and properties are concepts indicated by the data (and not the data itself); and both vary in degree of conceptual abstraction. The constant comparing of many groups draws the sociologist’s attention to their many similarities and differences. Considering these leads him to generate abstract categories and their properties, which, since, they emerge from data, will clearly be important to a theory explaining the kind of behaviour under observation (Glaser and Strauss, 1967). A basic process in theory generation by the grounded theory approach is what is called theoretical sampling. It is the process of data collection for generating theory whereby the analyst collects, codes, and analyzes data and

decides what data to collect next and where to find them, in order to develop his theory as it emerges. This process of data collection and analysis is determined by the emerging theory, substantive or formal.

The first in theory building is conceptualising. A concept is a labelled phenomenon. It is an abstract representation of an event, object, or action/interaction which a researcher identifies as being significant in the data. In this case those which share common characteristics can be grouped under a common heading or classification. Data is abstracted, broken down into discrete incidents, ideas, and acts which are then given a name which stands for these. They may be from the researcher or in vivo (from respondents). Particular properties of an event or object evoke similar imagery in one's mind, and because of that they are grouped together. The concepts are then grouped into categories (Straus and Corbin, 1998). Once a category is identified, the analyst can begin to develop it in terms of its specific properties. The idea is to give specificity to the category through definition of its particular characteristics. With each additional property and dimension, the knowledge about the category is increased along the variations of the category.

Micro analysis

This constitutes the set of analysis which field data is subjected to in order to develop the theory. Microanalysis includes open and axial coding and makes use of many analytic techniques. It involves very careful, often minute examination and interpretation of data (Straus and Corbin, 1998). The tools for this analysis are referred to as the analytic tools which are devices and techniques used by analysts to facilitate the coding process. The process includes *questioning, the flip-flop technique, Systematic comparison of two or more phenomena among others*. Open coding is the analytic process through which concepts are identified and their properties and dimensions are discovered in data. Though data is in text form, during the analysis it is converted into concepts which stand for those words

Axial coding follows open coding and the purpose is to begin the process of reassembling the data that were fractured during open coding. Procedurally, axial coding is the act of relating categories to subcategories along the lines of their properties and dimensions to form more precise and complete explanations about a phenomena. It looks at how categories crosscut and link. It consists of intense analysis done around one category at a time, in relation to specific attributes. This leads to a pile of knowledge about relationships between that category and other categories and subcategories. The relationship between categories takes place at a conceptual level (Strauss, 1987).

2.2.4. Integrated urban water planning

General definitions

Planning, as used in the ‘wider sense’, refers to the process of anticipating future occurrences and problems, exploring their probable impact, and detailing policies, goals, objectives, and strategies to solve them. This often includes preparing options, documents, considering alternatives, and issuing final plans. Whereas in the ‘narrower sense’ it refers to those intentional public actions which impact on the built and natural environment and which are frequently accompanied by political processes of some kind. This narrow sense refers to the activity of urban or town planning. Indeed different groups may have their own definition of what planning means to them. Whatever the case may be, there is planning as a technical process done by planners and other forms of planning. In the context of this study, the planning envisioned is the wider definition which encompasses planners and urban water stakeholders in decision making processes.

“When plans are constructed for the future, they make coordination easier. Plans help coordinate both individual activities over time and individual activities with activities of others. By settling on a plan for the future, present deliberations are able to influence later behaviour; thus the influence of one’s deliberation is extended beyond the present moment. Plans turn desires into intentions that anticipate and so include future consequences and relations. Equally, plans, as produced by professionals selectively describe features of urban complexity that help a specific audience understand how to anticipate and respond to future changes within a specific urban system (Bratman, 1987).

Normative theories of planning

To contextualize the research, it is important to shed some light on some of the normative theories of planning which consider planning outside the usual technical context. The principles may apply in the wider sense of planning as well.

The first is what is called the communicative theory of planning. Watson (2002) reported that Habermas’s thinking is central in this theory. Habermas was concerned with how to protect and extend democracy, and so conceptualized the “life-world” (or public space) as separate from and outside ‘the system’ of formal economy and government. Habermas believed that within the life world it is possible for rational and inherently democratic being to reach consensus, and coordinate action, through the process of communication (communicative rationality). In this process, it is the ‘force of the better argument’ which will determine the final validity of a particular position.

The second normative theory of planning is the multicultural theory proposed by Leonie Sandercock. According to Watson, (2002), this theory of planning in multicultural societies (Sandercock, 1998a, 1998b, 2000, cited in Watson, 2002) may be regarded as a variant of, or development of, communicative planning theory, although there are some important differences with it. Like the communicative planning theorists Sandercock is strongly influenced by postmodernism and “cultural-turn” thinking (Storper, 2001, cited in Watson, 2002). She holds with the notion of civil society as an autonomous site of resistance and social movements as primary agents of change. She places her own work within what she terms a ‘radical planning model’ with roots in advocacy planning, happening outside the formal structures of state and economy.

On the idea of universal citizenship, her society is structured by relationships between culturally different groups, in relation to sexuality, ethnicity, gender or race. She affirms a society made of different groups and is of the view that the claims of groups should be recognized and facilitated. The planner in this context should be able to link knowledge with action to empower the marginalized and oppressed, to resist exploitation and the denial of their authenticity. The difference with Sandercock is that she is concerned to build consensus between groups (which affirms and valorizes differences rather than erase them) which could take the form of resistance to the state.

The third theory is the Fainstein’s theory of a Just City. Fainstein’s theoretical base, rooted in a post Marxist political economy (which encompasses a more complex view of social structure and social benefits than was envisioned by material analysis) provides a number of commonalities between her position and those discussed above. She, like Sandercock, holds with a society structured primarily by groups rather than classes; however with less concern for a planning which aims to valorize and promote the claims (material and non-material) of these groups and rather with how such groups can benefit from redistributive planning actions. Fainstein, along with the two theories above is also concerned with planning processes and participation. She is however closer to Sandercock in seeing her primary audience as the leadership of urban ‘social movements’ rather than government which may be neither neutral nor benevolent. Her faith in the reformative power of civil society is thus in line with other postmodern normative thinkers. She however, concedes that certain individuals within the state may act in the interest of marginalized groups.

In the context of the study on urban water, the above theories: emphasize the importance of stakeholder engagement and community participation in the decision making process for integrated urban water planning; provide a theoretical perspective on the role and positioning of planning in society; constitute important insights that planners draw from in their work; stress the importance of civil society-based groups in planning processes and recognize the fact that there are ‘different voices’ within civil society worth considering in

urban water planning; emphasize the political nature of the planning process; move planning beyond a technical process; emphasize that in both the 'narrower' and the 'wider' context planners have a role to play in the urban water planning process; indicate that though the interpretations of planning processes may differ, through consensus and dialogue these gaps may be bridged to ensure a good planning process, and in this case integrated urban water planning.

Thus water management at the lowest appropriate level is important in any urban water planning process (Abraham, *et al.*, 2006). In principle, narrowly sectoral approaches to water development have led to serious problems in many river basins (Merry *et al.*, 2004). It is also recognized that durable and effective river basin level institutions can only be built on strong foundation of local institutions. Since this takes a long time, there should be a forum where the diverse stakeholder interests would be represented (Moench *et al.*, 2003, cited in Merry *et al.*, 2004).

In Ghana, so far, sectoral approaches were not able to achieve any breakthrough in addressing the challenges of urban water management or planning. An example of such an approach is the Korle Lagoon Environmental Restoration Project (KLERP), which started in the year 2000. A larger, intersectoral approach to the KLERP would have indicated that it is not enough trying to restore a disturbed natural ecosystem downstream without any measure to deal with the challenge at the upstream and midstream sections of the Odaw River, which eventually drain into the Korle Lagoon (Abraham *et al.*, 2006).

Stakeholder Analysis

In the context of the research, this section highlights some concepts in stakeholder engagement for the urban water planning process. According to Grimble (1998), stakeholder analysis (SA) has been defined variously and one of such goes as “a methodology for gaining an understanding of a system, by means of identifying the key stakeholders and assessing their respective interest”. “It is also a process of systematically gathering and analyzing qualitative information to determine whose interests should be taken into account when developing and /or implementing a policy or programme” (Chevalier, 2001). Stakeholder analysis recognizes the different interest groups involved in a particular process and provides tools that help to identify and resolve trade-offs and conflicts of interest. It is useful in improving the selection and design of research projects and addressing better the distributional, social and political impacts of research projects (Grimble, 1998).

Who are stakeholders

Chevalier (2001) defined it as “groups, constituencies, social actors, or institutions of any size or aggregation that act at various levels (domestic, local, regional, national, international, private and public), have a

significant and specific stake in a given resources, and can affect or be affected by resource management problems or interventions”. Schmeer (2000) has defined it as actors (persons or organizations) with a vested interest in a policy being promoted. The stakeholders or “interest parties” can usually be grouped into the following categories: international/donors, national political (legislators, governors), public (government ministries, departments and agencies), labour, (unions, and associations), commercial/private for profit, nonprofit (non governmental organizations [NGOs]), civil society, and users/consumers.

Key stakeholders in urban water planning will include departments in charge of facility development and maintenance, policy makers, planners and administrators in government, commercial bodies or non-governmental organizations. The most fundamental division between stakeholders will probably be those who affect (determine) a decision or action-and those who are affected (positively or negatively). This is not always the case as is possible in some cases to have local individuals involved actively and passively.

Purpose of stakeholder Analysis

Stakeholder analysis has the advantage of being a flexible, context specific paradigm that helps focus attention on specific problems, actors, and opportunities for change. Stakeholder analysis is used to seek stakeholder input into development projects, policy development, and interventions. The purpose is to indicate whose interest should be taken into account when making a decision. If an actor or group is in a position to damage or weaken the authority or political support of the decision maker or the organization, then it should be taken into account. Secondly, if the group’s presence and/or support provides a net benefit or strengthens an organization and/or enhances the decision-maker’s authority (and capacity to secure compliance to decision), then it should be accorded due recognition and attention. Thirdly, if a group is capable of influencing the direction or mix of an organization’s activities, it needs to be counted as a stakeholder Crosby (1991).

Approaches to stakeholder analysis

A stakeholder analysis will consider often knowledge of a policy/issue, interests related to the policy/issue, position for or against the policy, potential alliances with other stakeholders, and ability to affect the policy process (through power and/or leadership)(Schmeer, 2000).

Though there is no format for stakeholder analysis, flexibility and common sense are essential, and the steps may include (Chevalier, 2001):

- clarification of the objectives of the analysis;
- placing issues in a system context;

- identification of decision-makers and other stakeholders;
- investigation of stakeholder interest and agendas; and
- investigation of patterns of interaction and dependencies (conflicts and compatibilities, trade-offs and synergies).

Little information seems to be present on how water is planned in Accra. The proposed research intends to address the gaps in the studies carried out to date on urban water and urban water-based livelihoods in Accra, by examining the planning processes and the degree to which they integrate stakeholder concerns and participation. It will analyse how interactions between different stakeholders occur and could be encouraged. It will seek to deepen the knowledge on how to make urban water planning more integrative in support of both urban water based livelihoods and improved water quality.

2.3 Key Research Questions

The research questions will address three closely related issues on urban water planning as well as the inter-linkages among these issues. The questions focus on water use for livelihood activities and the various institutional responses and arrangements in relation to impacts on the biophysical environment, particularly water quality. The ultimate aim is to be able to influence processes which will enable any planning approach to be integrative. The research questions are elaborated below.

2.3.1. Research question 1:

What are the different water based productive livelihood activities and their impact on household income and well-being?

- i. What sources of urban water are available and how are they accessed?
- ii. What are the different water-based livelihood circumstances and strategies and their contribution to household income?
- iii. What urban water user networks exist and are some livelihood groups excluded?

2.3.2. Research question 2:

What is the state of water quality in the Odaw-Korle River Catchment and how is it impacting on productive water based livelihood activities? Do these livelihood circumstances and social relations affect behaviour while conditioning opportunities and responses to change?

- i. What are the stakeholders' criteria for water quality?

- ii. What land and water uses are found in the Odaw-Korle Catchment in relation to water quality and how do these impact on productive water-based livelihood activities and well-being from upstream through to downstream?
- iii. What approach must be adopted in changing behaviours and practices which impact on the water quality?

2.3.3. Research question 3:

What are the existing institutional arrangements on stakeholder orientated integrated urban water planning and how do these influence catchment water quality? How is urban water planned in Accra and what role do planners play?

- i. What are the roles, responsibilities, rights, relations, and organizational culture (including strengths and weaknesses) amongst stakeholders and how do these influence urban water planning?
- ii. What are the formal and informal institutional arrangements (policies, rules, rights, laws) in urban water use and planning, and are there any collisions between these two? What are the failures and successes of these institutional arrangements?
- iii. Is there any relationship between the impact on the biophysical environment and stakeholder interventions?
- iv. What is the degree of integration between water and spatial planning? What channel exists for planners' input in the urban water planning process?
- v. What process is adopted in planning urban water in the city of Accra by water authorities? What are the strengths, weaknesses, opportunities, threats to this process?

2.4. Outputs of the study

- Urban water sources and techniques for accessing documented
- Report on preliminary stakeholder analysis and stakeholder criteria for water quality
- Land and water uses surveyed
- Contribution of water based livelihood activities to household income documented
- Social networks of livelihood groups investigated
- Water and soil quality of the catchment mapped out
- Impact of water quality on livelihoods and human capital (health) investigated
- Theories on changing water polluting behaviours and making livelihood choices developed
- Stakeholder and institutional analysis documented

- Report of results presentation to stakeholders
- Thesis

2.5. Summary of activities

- Inventory of livelihoods including water based livelihood activities and urban water sources and techniques for accessing the water, preliminary stakeholder analysis and identification of stakeholder criteria for water quality,
- Land and water uses mapping
- survey of selected people to identify livelihood circumstances and strategies and estimate contributions to household income
- Survey of existing social relationships and networks of livelihood groups
- Soil and water sampling and analysis
- Survey on practitioner well-being and challenges with water use
- Further development of perception studies on land and water polluting behaviours and how this might be changed
- Stakeholder and institutional analysis
- Results presentation forum
- Thesis write-up

3.0 Summary of research strategy and methods

3.1. Research Hypothesis 1:

Water from the catchment is used for several income generating activities, which are an important component of household income.

Method: Following consultation with key actors in productive uses of the water and reference to existing literature, an exploratory study along the river using Focus Group discussions, interviews, checklist, and transect walk, will be carried out to collect information. This will be followed by a structured questionnaire survey on a sample set of households, for each type of activity. A simplified livelihoods framework will be used. Annex II details the approach for the entire study whereas Annex III focuses on the livelihoods study.

3.2. Research Hypothesis 2:

Land and water use within the catchment contribute in different degrees to the total pollution load of the Odaw-Korle catchment and this impacts on livelihoods and well-being.

Method: Water quality will be mapped (GIS) along the Odaw across the city. Data will be compared with land and water use practices, availability of sanitation facilities, and general environmental conditions in the city. For this purpose, communities will be stratified based on identified indicators in the inventory. Field surveys and participatory transect walks will make use of structured questionnaires, supported by focus group discussion with key individuals and groups. Existing data and maps of the Municipality and its Waste Management Department will be used as the whole city is already digitally mapped. In developing further, perception on land and water polluting behaviours and how this might be changed, the grounded theory approach will be used.

3.3. Research hypothesis 3:

Stakeholders are neither integrated nor coordinated in their approach towards planning of urban water and this has led to a deterioration of catchment water quality with impact on livelihoods

Method: Using available information from previous scoping studies carried out under the SWITCH and RUAF projects, and supplemented by more detailed interviews on specific issues of interest; roles, responsibilities, strengths and weaknesses of the stakeholders will be mapped and overlaps identified. Existing institutional cultures will also be investigated. Supported by existing literature and interviews, analysis of laws, by-laws, policies, rights, and institutional arrangements will also be carried out.

3.4. Research materials needed

Geographical positioning system

Recorder

Camera

Water sampling bottles and ice chest

Wellington boots

Laboratory coat

Cutlass

Field note books

4.0. Expected Results

It is expected that knowledge will be deepened on the relationship between urban water based livelihoods, water pollution, stakeholder interventions and institutional responses. This will enhance the urban water planning process in Accra to ensure a clean environment and improved urban water quality

5.0 Conclusion /Discussion

Water based livelihoods will be improved and the city authorities will be able to plan better on urban water use in the city. The process of planning urban water use can be applied in other parts of the world.

7.0. Budget

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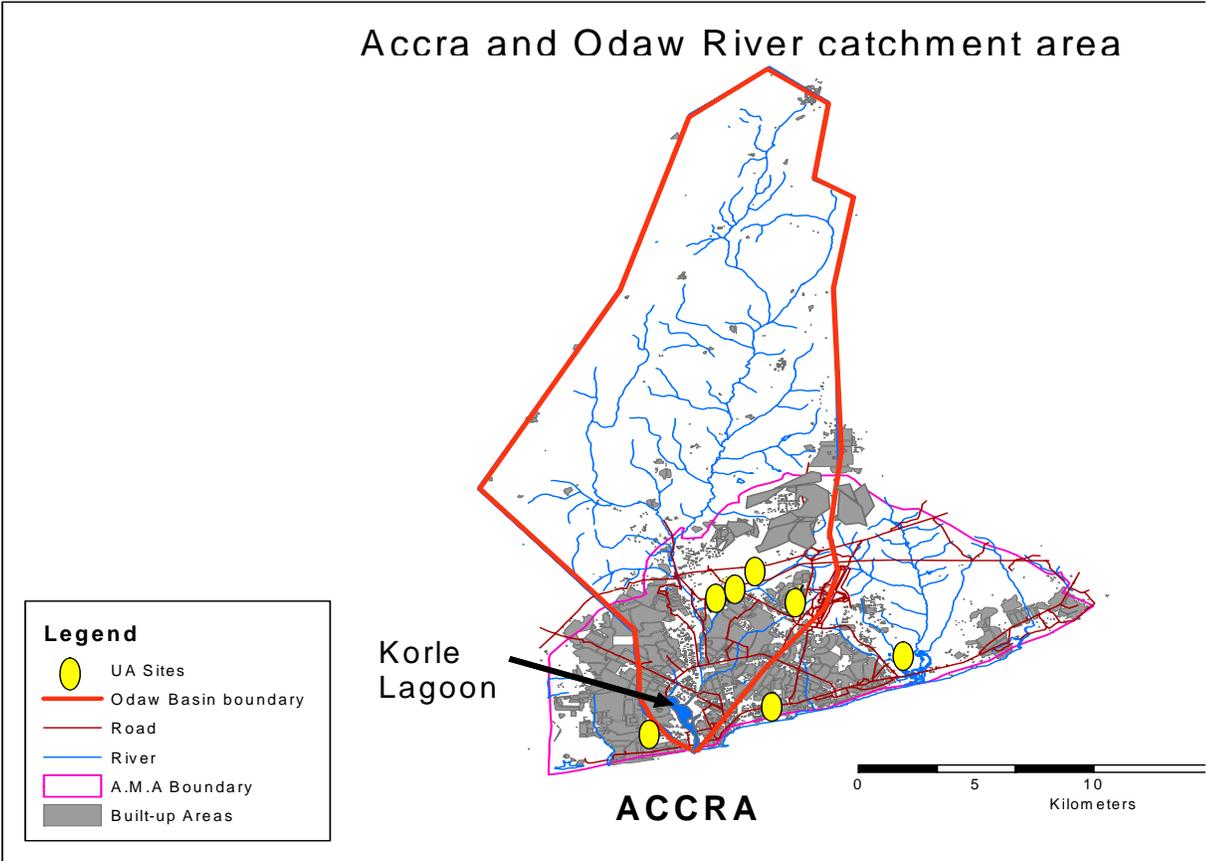
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Annex I

Accra and Odaw River catchment area



The Challenge of urban flood control: The case of Accra's Korle Lagoon

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Abstract

In urban Sub-Saharan Africa there are three main problems related to water, namely drinking water supply, wastewater handling, and seasonal flooding. Mega Accra has a functional population of 2.7 million inhabitants with about 60 percent of the Metropolitan dwellers living in informal settlements or slums in the centre of the city while the middle and upper class move to its periphery. Like in all cities in the subregion, Ghana is experiencing a high level of pollution in its water bodies particularly where they are located near human settlements, industrial (including mining) estates and agricultural undertakings. About 60% of the Metropolis lives in the catchment of the Odaw River and Korle Lagoon and contribute to the environmental problems which result in flood situations. This is a major challenge to city authorities in instituting flood control measures. The aim of the study is to develop a planning framework to address the complex nexus between flood control and sanitation, which should include all key stakeholders and a multi-disciplinary approach based on a careful stakeholder analysis. Several key questions relating to pollution, hydrology, sociology and the local economy of the inhabitants of the Odaw River- Korle Lagoon catchment are addressed.

Keywords

Flood control, urban water quality, urban drainage, waste management, sanitation, urban agriculture

INTRODUCTION

In urban Sub-Saharan Africa there are three main problems related to water, namely drinking water supply, wastewater handling, and seasonal flooding. In our context we will focus on the linkages between flood control and sanitation on the example of Accra, the administrative, political and commercial capital of Ghana located at the coast of the Gulf of Guinea.

Accra's population growth rate is about 3.4 % annually, which is constrained by the outdated boundary of the city. The actual population growth takes place behind this boundary where the Ga and Tema districts grew between 1984 and 2000 at a rate of 6.4 and 9.2%, respectively. Including both districts, we get the functional boundary of (Mega) Accra, as the urban dwellers perceive it, with 2.7 million inhabitants (Twum-Baah, 2002).

Accra covers an area of 229 km². About 60 percent of the Metropolitan dwellers live in informal settlements or slums in the centre of the city while the middle and upper class moves to its periphery. The Accra Metropolitan Assembly (AMA) is struggling to provide basic services to its growing population and at the same time to create and maintain a healthy urban environment. It is facing a number of challenges, especially in its central slum areas:

- o increasing coverage of safe water supply and sanitation facilities

- improve collection, transport and treatment of wastewater and solid waste and finding suitable ways for its disposal or reuse
- appropriate drainage of storm water

Like in all cities in the subregion, Ghana is experiencing a high level of pollution in its water bodies particularly where they are located near human settlements, industrial (including mining) estates and agricultural undertakings (MWH, 1998). Rivers flowing through cities, towns and villages serve not only as sources of water supply for the inhabitants but also as open sewers. The official sewer systems, even in the capital Accra, cover seldom more than 5% of the households. The aim of the PhD study is to develop a planning framework to address the complex nexus between flood control and sanitation.

MATERIAL & METHODS

The study will involve all key stakeholders in a multi-disciplinary approach based on a careful stakeholder analysis. It will explore existing planning constraints and look for opportunities in terms of options for platform building, Learning Alliances and capacity building at different levels.

RESULTS AND DISCUSSION

As the project did not start yet, only a first overview on the problem is provided:

Stormwater management

Accra experiences a bimodal rainfall regime, which occurs from March to July (major rainy season) and from September to November (minor rainy season). Average annual rainfall is about 810mm. Rainfall is usually intensive with short storms, giving rise to annual local flooding where drainage channels are missing or obstructed.

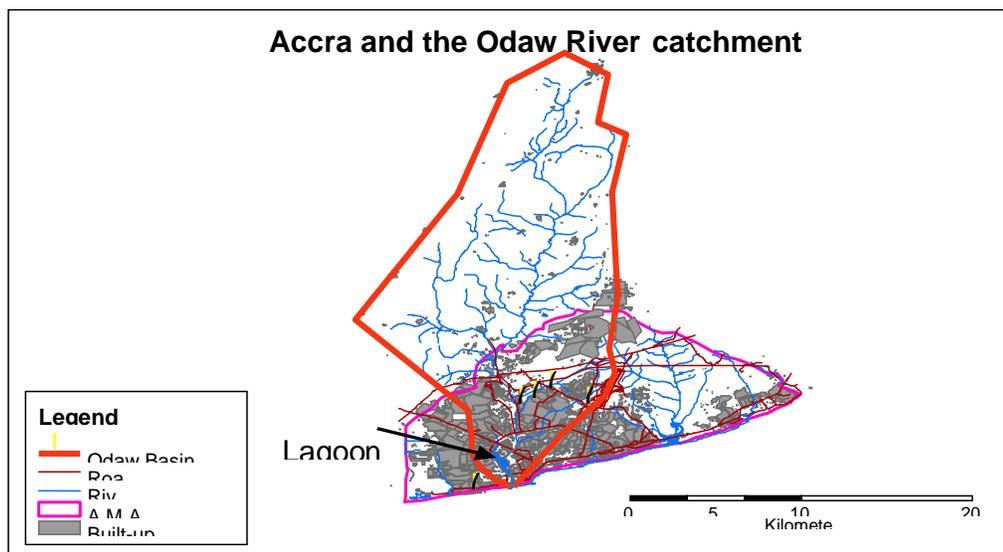


Figure 1 Map of Accra showing the Odaw catchment and the Korle Lagoon

Some of Accra's slum areas are the most affected. Of special focus in this study is the Odaw River which flows into the ocean through the Korle Lagoon, one of the "world's dirtiest places" (IDRC, 1996) (Figure 1). The Lagoon is the principal outlet to the sea for the city of Accra, and about 60% of the Metropolis lives in the catchment of the Odaw stream and Korle Lagoon. Prior to the explosion of the city's population and the onset of the severe pollution of the Korle Lagoon in Accra, i.e. in the early 1950s, the lagoon supported a thriving fishery of both fin and shellfish, which served as a source of income for people in the nearby shantytowns. The fisheries have now been lost (Biney and Amuzu, 1995). The lagoon receives water from a total catchment area of 400km². It receives discharges from three main sources—the Odaw River and two major drains in its western and eastern sections. As these drains are open, they collect all kinds of debris and silt into the lagoon (Mensah, 1976). It has been estimated that a biochemical demand (BOD) load of 10,500 kg day⁻¹ is generated within the slums and shantytowns near the Korle Lagoon, with appreciable quantities of this reaching the Lagoon due to the inadequacy of waste disposal sites (Biney and Amuzu, 1995). This, however, is probably only a small part of the inflow through the Odaw. It is therefore important that measures are put in place to manage stormwater and wastewater influx so as to minimize the amount of pollutants entering important water bodies like the Odaw River and the Korle Lagoon. Presently, there is not any comprehensive plan by the city regarding stormwater management via streams and constructed drains in view of their dependency on an appropriate waste management. This obviously must change if urban water would be managed and the resources harnessed to ensure healthy living of city dwellers especially within the Odaw-Korle catchment.

Drainage in Accra

Drainage in Accra usually consists of natural drains and a few major stormwater drains. There is also a network of small drains known as gutters to serve a dual purpose as storm water drain and as well convey domestic effluent. In the case of the Korle lagoon, its auxiliary function as a central drainage system emptying its content into the sea, has resulted in it becoming shallow over time due to excess siltation and waste finding their way into the water body with runoff (Biney, 1982). As the Lagoon is heavily silted, the outlet is often blocked, and the water fails to flow into the sea fast enough to avoid becoming stagnant. This leads to periods of flood when it rains (Boadi and Kuitunene, 2002). Due to Accra's limited sanitation infrastructure, the lagoon receives a huge amount of wastewater as well as solid waste through the Odaw River (Boadi and Kuitunen, 2002). Figure 2 shows Agboglobshie drain entering the Korle Lagoon with all kinds of debris.

Fig. 2: Korle Lagoon (right) and the Agboglobshie drain (below)



The social dimension

A particular problem with high socio-political significance is Accra's major slum known as Old Fadama or Sodom & Gomorrah. The slum is located directly at the Korle Lagoon, near the suburb of Agbogbloshie. Old Fadama occupies about 31 ha with a squatter community of estimated 30,000 people. In view of the precarious situation of the highly polluted Lagoon, the slum is believed to constitute its primary source of pollution, especially since the landfill opposite to Old Fadama was closed down and rehabilitated. However, alternative assessments say that only a few percent of the total pollution load entering the lagoon comes from the slum area (COHRE, 2004). Still, the waste flows coming out of the slum through the Agbogbloshie drain and Odaw River are uncontrolled and ultimately end in the Korle lagoon.

The sanitary situation within the slum at Korle Lagoon is disastrous. In general, any larger storm water gutters are lacking, and smaller ones around individual houses/shelter are not connected, or blocked by solid waste and stagnant rain and wastewater poses serious health risks. In most other parts of Accra, much emphasis is put on a network of gutters which function as open sewers-cum-storm water drains discharging their load into the ocean or natural waterways, like the Odaw River. As the Korle Lagoon also functions as a buffer against flooding, there are a number of self-constructed and locally managed communal toilets but people also defecate free-range along the Lagoon. As there is no safe dumping site for content of buckets and pans, dumping into the Korle Lagoon is likely. There is a local waste dump close to the river, managed by the community without public support. Small-scale entrepreneurs provide independent sanitation services (public bath houses, sachet water supply, waste transport) and obtain a livelihood out of providing these services, but are possibly also polluting the lagoon. The community shows commitment and is self-organizing cleaning campaigns, supported by the NGO "Peoples Dialogue" and local Federations.

Three limitations in the drainage system in Accra are - institutional limitation, infrastructural/financial limitation, and behaviour of the citizens. The lack of adequate institutions with the capacity to plan and ensure proper management of stormwater and drainage is implicated in the current environmental challenges which confront the city today. The insufficiency of stormwater drains in the city, or under capacity drains have not helped in addressing challenges of seasonal flooding in the city during rainy seasons. The additional inability of the Waste Management Departments to collect all solid waste generated in the city leads to illegal dumping, preferably into streams and drains. People normally clean just their immediate environment but remain careless about what happens in the river or lagoon next to them. With this mentality, individuals within the city, and especially in the low income areas have the general propensity of dumping refuse and other waste into the river or the lagoon as occurs along the whole Odaw River, not only near Old Fadama. The impact of urban sanitation for a successful storm water management can thus not be over-emphasized.

Addressing the challenges of drainage and stormwater management

The need for inter-sectoral approaches

So far, sectoral approaches were not able to achieve any breakthrough in addressing the challenges of urban flood control. An example of such an approach is the Korle Lagoon Environmental Restoration Project (KLERP), which started in the year 2000. This Project is

the largest of its kind addressing Accra's natural resources problems. It was carried out in two phases so far. The objective of the project is to restore the Korle Lagoon, as far as possible, to its former state in which marine life was abundant and offered substantial improvements to the drainage systems in Accra by way of ensuring efficient floodwater conveyance to the sea. The project, however, focused on the lagoon itself and a related sewage system but was not extended to the incoming waste load via the Odaw River from the heart of Accra. Facing its inability to succeed, the KLERP asked for the removal of the Old Fadama community as most "obvious" obstacle. This echoes Accra's efforts to restore the Lagoon as a wetland. Since May 2002, the residents are under the official threat of eviction.

The KLERP included sanitation control measures, the construction of a sewage treatment plant with a total capacity of $1300 \text{ m}^3 \text{ day}^{-1}$. As well as 3100 m network of drains for the diversion of the dry weather flows, as well as the construction of a new sea outfall pipe from the treatment plant of 1.5 km in length (Boadi and Kuitunen, 2002).

A larger, intersectoral approach to the KLERP would have indicated that it is not enough trying to restore a disturbed natural ecosystem **at the end of the pipe** without any measure to deal with the challenge at the upstream and midstream sections of the Odaw River, the main river draining into the Korle Lagoon. In addition, the discussion about the neighboring slum showed clearly that drainage is not only a technical issue but requires a sensitive approach and **social impact assessments** to analyze feasible options for the people concerned.

The institutions indicated in Figure 2 below must necessarily all be involved in such an important project of addressing challenges of stormwater management and drainage systems in Accra to ensure improved life of the city dwellers. For instance the linkages shown on figure 2 indicate that the Ministry of Environment, Science and Technology works together with the Ministry of Works and Housing in addressing the drainage and stormwater management issues in Accra whereas the Environmental Protection Agency offers the main support in terms of SEA technical advise and enforcement of regulations.

In the process of intersectoral management of stormwater and drainage one aspect that emerges is integrated (urban) water resources management (IWRM) where water bodies, wetlands and streams within an urban context are crucial for various (sometimes competing) uses, while at the same time they are the receivers of many different waste flows, creating externalities between uses and users, calls for management at the lowest appropriate level and taking a catchment approach to capture the hydrological dependencies. In an urban context, the type of intervention envisaged influences the choice of the unit of work. Neighbourhoods are for example the typical unit at which to organise sanitation or solid waste services. A hydrological catchment would be most relevant for applying pollution control and monitoring measures. Integrated Water Resources Management in an urban context will need to straddle both catchment and administrative or social boundaries and will need specific adaptations to the urban planning context.

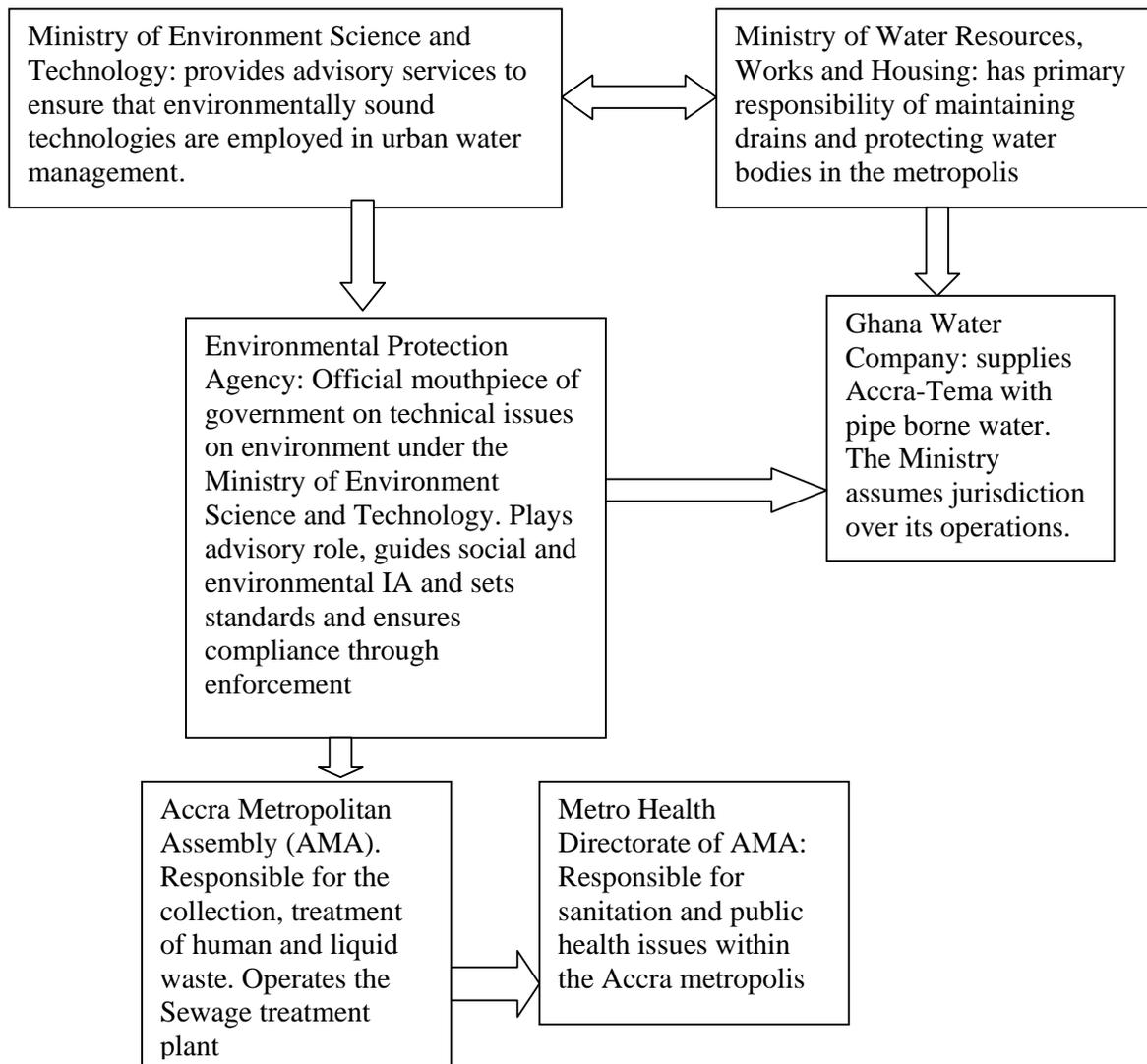


Figure 2: Key stakeholders in urban water management

Urban agriculture, sanitation and flood control

The Odaw/ korle catchment used to support fishing and vegetable cultivation along its border. However following the formation of the slum and the subsequent restoration project, farmers were compelled to abandon the catchment since conditions, including access to land and (safe) water were no more favourably. Inspection of urban agriculture sites within the city indicate that such sites are generally clean because farmers would not allow any one to dump refuse at such sites. These farms are located mostly along open drains, streams, and other water bodies to facilitate easy access to water for irrigation. The water is carried in watering cans or in some cases a motorized pump is used to pump the water to the farm site. Streams used are usually blocked or diverted for use in irrigation. Not only does urban agriculture keep the sites tidy and free from waste but ensures that the soils are receptive for rain while avoiding erosion. This supports flood control. The farmers occupying such lands also maintain a constant urban

greening and the cultivated lands serve as sinks to floodwater and reduce pressure on stormwater drains. Illegal occupants such as squatters are also prevented since it is the incipient stage of slum creation with its concomitant environmental and health problems. This has been termed as the control function of urban agriculture in ensuring good sanitary conditions within the city. Urban agriculture is significant in Accra there are presently about 1000 farmers on 7 large sites, along streams and drains in Accra. Of this number, 600 farmers cultivate exotic vegetables throughout the year while 400 farmers located in one site cultivate indigenous vegetables like okro, tomatoes, garden eggs in the rainy season and occasionally depend on polluted streams and drains like the exotic farmers.

Capacity building in addressing these challenges

Participatory research and capacity building e.g. in Geographic Information Systems (GIS), Multistakeholder Processes for Action Planning and Policy Formulation (MPAP), Strategic Environmental Assessment (SEA) including costs and benefits of externalities, and other tools, applied in the context of this study are also important. Training will ensure that the stakeholders involved in the restoration project for instance are at a common leverage regarding knowledge base, perception, orientations and general understanding of the core issues which will influence decision making in the project execution. In the restoration of the lagoon it was observed that the success of the project depended heavily on the capacity of the Environmental Protection Agency to effectively monitor and regulate industrial activities in the Odaw-Korle Lagoon complex. This is quite important in addressing the main challenges of drainage and stormwater management.

Local action and provision of alternatives

This will involve the active participation of the people who are directly affected by the restoration of the lagoon. There is need for them to also understand and appreciate the implications of their activities on the Odaw/Korle catchment. Within such communities the opinion leaders, which in this case will include the Assembly man for the area and a few people with some form of education could mobilize themselves and institute strategies to help address the drainage, sanitation and seasonal flooding within the catchment. One important component in finding solutions to water problems of such magnitudes is the provision of alternatives. For instance, one way of reducing the dumping of refuse into Odaw River upstream is to make sure that sufficient waste collection points have been designated and that waste is not allowed to accumulate but are collected by trucks on time. Once the waste is collected on time the issue of waste being washed into the River to induce siltation, which could lead to flood situation, is also avoided. Availability of well constructed drains and sanitation facilities will address haphazard discharges of domestic effluent and human waste onto the environment.

Key research questions

- How severe is the contribution of Old Fadama to the pollution and flooding of the Lagoon and what could be done to reduce it?
- How unsuitable is the area of Old Fadama for human settlements, also in comparison with other parts of the capital?
- How many people live in this informal settlement, under what kind of conditions and with which livelihood support?
- Which low-cost temporary sanitation improvements are possible to provide the local population with the dignity the law requires, with or without “upgrading” the slum?
- How would any action influence the restoration of the wetland?

- Fadama?
- How could Accra address the basin-wide water pollution challenge to sustain fishing in the lagoon, aquaculture and urban farming?
- What are the key issues relating to flood control within the Odaw River/Korle Lagoon catchment
- What are the key hydrological data to be collected for decision support?

CONCLUSIONS

Mega Accra has a current population of about 3 million. It is the most populated and the fast growing metropolis in Ghana with an annual growth rate of 4.6%. The Accra Metropolitan Assembly (AMA) is struggling to provide basic services to its growing population and at the same time to create and maintain a healthy urban environment. The paper thus seeks to ascertain innovative ways of addressing the challenges of storm water and drainage management, flood control and provision of sanitation facilities for city dwellers. This is necessary as the Odaw/Korle catchment receives about 60% of the storm water in Accra. Secondly the catchment is home to a major slum known for its unhealthy living conditions which gives the whole a strong social component. The most appropriate approach to address this complex situation is an intersectoral one tapping expertise from different disciplines. The involvement of key institutions is important for the success of any attempt to address the above stated challenges.

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