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Addressing Accra's urban water challenges within a sustainable development context

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Like most major cities in Africa, Accra is undergoing a rapid pace of urbanization fueled by economic development, population growth and rural to urban migration. The city faces major challenges with the provision of adequate and effective urban water infrastructure. The challenges associated with perennial flooding in Accra are reviewed in the context of recommended policy, institutional and organizational changes that are deemed to provide a more sustainable and holistic approach to urban water service provision. These have the potential of increasing the interactions of multiple stakeholders including the public, system designers, urban planners, entrepreneurs, activists, etc. and fostering an even closer link between professional practice and community participation providing the scope for spurning innovation, capacity building and job creation at a local level.

Introduction and background

The rapid pace of urbanization coupled with rural urban migration and incessant population growth that is occurring in most of the main cities in sub-Saharan Africa has resulted in major challenges associated with the provision of adequate, appropriate and effective urban water infrastructure. Nearly midway through the second decade of the 21st century, it is evident that the quest for more sustainable approaches to urban water management and urban water infrastructure provision as a whole, needs a new paradigm, particularly in the developing country context where the conventional practices deployed to date have been found to be unsustainable, too costly and in some instances inappropriate for the given social cultural context. For example, open channels in addition to being sullage and stormwater conveyance systems, have become receptacles for solid waste.

In an era where the world faces a number of looming challenges such as climate change, growing urban populations and related rapid pace of urbanization with its associated water stress, urban water in its various forms (e.g. stormwater) is now increasingly being seen as valuable reusable resources rather than for instance a nuisance runoff stream that needs to be gotten rid off as quickly as possible.

Increasingly a shift towards a more holistic, integrated catchment wide approach to urban water management is now taking root in a number of developed world regions, based on a better understanding and appreciation of the need for conservation of resources, improved land use and management, realization of the adverse impacts of increasing the impermeability of urbanizing catchments and the consequent increase in flooding and pollution of local water courses, streams, rivers, lagoons and other receiving environments.

Green Infrastructure (GI) in the USA, Sustainable Urban Drainage (SUDs) in the UK and Water Sensitive Urban Design (WSUD) in Australia, have all become synonymous with diffused urban stormwater management. There is a recognition now that water quantity and water quality are inexorably linked in the interplay of the natural hydrological cycle and that the adoption and implementation of newer paradigms which mimic nature's way of distributed controls, localized stores and infiltration, centered on prevention rather than cure as a core principle or tenet (Andoh, 1994, 1995), provides more cost-effective and environmentally sustainable alternative(s) to conventional approaches. These newer more decentralized approaches for example provide a means of reducing urban water runoff and discharges of polluted water

into receiving environments whilst maintaining or restoring to the maximum extent feasible, the predevelopment hydrology and hydro-geology of catchments.

Addressing the perennial flooding challenges in Accra, Ghana

Historical flooding in context

Accra, the capital of Ghana is located in the The Greater Accra Region which is the smallest of the 10 administrative regions in the country and occupies a land surface area of 3,245 square kilometres or 1.4 per cent of the total land area of Ghana. The region is located in the south-central part of the country and has an estimated urban population of 2.27 million with the total population for Greater Accra Region itself estimated at about 4 million people which is roughly 16% of the total population of Ghana, making it the second-largest metropolitan conglomeration in Ghana by population and the eleventh-largest metropolitan area in Africa.

Accra has seen an accelerating pace of urbanization in recent decades fuelled mainly by growth and high rural-urban migration to the city. Provision of appropriate and adequate urban infrastructure and related services has not not been able to keep pace with the scale and pace of growth resulting in a rise of large slums. Accra currently has 9 slums or "shanty towns". These slums (e.g. "Sodom and Gomorrah") tend to be located in the most vulnerable environments. The primacy of the Accra Metropolitan Area as the Greater Accra region's administrative, educational, industrial and commercial centre continues to be the major lure for its population growth, with migration contributing to over 35% of the city's population growth in recent times. Accra's pace of urbanization is not too dissimilar to that of other cities in the sub-region. In sub-Saharan Africa, urbanization has become virtually synonymous with slum growth (UNFPA, 2007) with the slum population of sub-Saharan Africa almost doubled in 15 years, reaching nearly 200 million in 2005 with an estimated seventy-two percent of the region's urban population living under slum conditions.

The unremitting urban sprawl and population growth in Accra is putting increasing pressure on this coastal city; with drainage infrastructure particularly at most risk. Flooding in Accra has become a perennial problem and over the past several decades, beginning in 1995, floods have claimed several lives, and destroyed public infrastructure and property to the tune of several millions of Ghanaian Cedis. As a coastal city, Accra is also vulnerable to the impacts of climate change and sea level rise.

The outfall of the Korle Basin is the principal outlet through which all major drainage channels through central Accra discharges stormwater runoff into the sea through the Korle Lagoon. This outfall is estimated to receive runoff from a total catchment area of 400km^2 representing about 60% of the urbanized areas of the city. The Korle Lagoon and its environs, which were once a natural wetlands habitat teeming with abundant wildlife and fish, is now surrounded by shanty towns including the Sodom and Gomorrah slum area.

The record of historical flooding in Accra (see Table 1) highlights that until as recently as 2010, most of the severe flooding that occurred in Accra was driven by rainfall events in the peak period (i.e. around June) of the primary rainy season. The flooding records however show an increase in the flooding frequency; particularly from 2010 onwards with floods occurring in some instances more than twice a year on a year on year basis. Some flooding has even occurred in what would nominally be deemed the dry season (e.g. November 2011 and February 2014). These observations suggest that the flooding that occurs in Accra has now become more frequent (more than an annual event). A number of factors could be responsible for this including possible changing micro-climatic conditions resulting from heat island effects caused by urbanization and its associated land-use changes. Another factor could be the major structural changes that have occurred in key parts of the main drainage network of the city such as the Korle Lagoon Environmental Restoration Project (KLERP).

Table 1. Record of Historical Flooding in Accra, Ghana

Year	Date 1	Date 2	Date 3
1968	4th July	-	-
1995	5th July	-	-
1997	13th June	-	-

2001	28th June	-	-
2003	9th June	13th June	-
2005	12th March	-	-
2007	13th June	-	-
2008	27th March	-	-
2009	19th June	-	-
2010	5th May	22nd June	-
2011	24th February	1st November	-
2012	June	October	-
2013	31st May		
2014	3rd February	6th June	4th July
2015	3rd June	9th October	

Current regulatory framework – the lack of focus on Integrated Stormwater Management

From a ministerial or sector perspective, urban drainage in Ghana falls under the purview of the Ministry of Water Resources Works and Housing (MWRWH) – the ministry responsible for the water cycle. Ghana Water and Sewerage Corporation (GWSC), was initially established in 1965 under an Act of Parliament (Act 310) as a legal public utility entity with responsibilities for water supply and sanitation in rural as well as urban areas. This responsibility and mandate however did not include stormwater management. Since its establishment, GWSC has largely experienced operational difficulties because of inadequate funding. The Environmental Protection Agency (EPA) was established in 1994 to ensure that water operations would not cause any harm to the environment and the Water Resources Commission (WRC) was founded in 1996 to be in charge of overall regulation and management of water resources utilization.

Since the establishment of the Water Resources Commission (WRC), a National Water Policy has been developed to provide a framework for the sustainable development of Ghana's water resources (MWRWH, 2007). The policy recognizes the various cross-sectoral issues related to water-use and the links to other relevant sectoral policies such as those on sanitation, agriculture, transport and energy. A key tenet of the policy is the recognition of the potential for Rainwater Harvesting (RWH) to increase water availability and that with appropriate technology and incentives, rainwater harvesting could provide a reasonable amount of water for household and other institutional water needs thereby reducing demand on the pipe-borne systems. Beyond the immediate option of water storage and use, RWH is seen to serve the complimentary function of stormwater reduction, a benefit that has to be trumpeted as part of the strategies of managing urban stormwater. The policy recommends that to harness this potential, government will enact appropriate legislation to be implemented through authorities such as the Metropolitan, Municipal and District Assemblies, and also provide incentives towards making rainwater harvesting a viable option to supplement household and institutional water requirements.

Though increasingly there is an identified need and call for integrated water resources management, the National Integrated Water Resources Management Plan (WRC, 2012) hardly treats the subject of integrated stormwater management as a component of the water cycle. Its focus appears largely to be on water supply and sanitation. Flooding is mentioned only in the context of its devastating impacts. The National Environmental Sanitation Strategy and Action Plan (NESSAP) produced by the Environmental Health and Sanitation Directorate of the Ministry of Local Government and Rural Development (MLGRD 2010) devotes a section of the document to stormwater drainage and sullage conveyance; albeit in the context of materials in transition. These are hardly comprehensive enough to meet the current and future needs of a policy framework for managing a sustainable urban water cycle that includes stormwater management.

The lack of a policy focus on stormwater management has meant that stormwater management practice in Ghana has been more of an afterthought than a key area of focus with objectives for the development of a holistic, comprehensive and integrated stormwater management strategy and associated plans to compliment other facets of the urban water cycle management. Stormwater management and practice in Ghana has evolved mainly from the practice of Highway Drainage Design. The current edition of the highway drainage manual (which in essence is the key reference document for drainage design in Ghana) is clearly antiquated and is based on the traditional approaches to stormwater drainage design geared towards the assessment of peak flow capacities and post development runoff flow rates with no mention of flow control, attenuation, infiltration, downstream conveyance capacity considerations or the more modern practices of Low Impact Development, Sustainable Urban Drainage Design, Water Sensitive Urban Design or Best Management Practices.

Policy and regulatory regime changes – focus on Holistic Integrated Stormwater Management

It is evident from the foregoing that there is a policy, regulatory and strategy gap in Ghana in relation to a holistic approach to Integrated Stormwater Management with no clear policy guidance or regulatory imperative providing the impetus for a strategy that drives the development and evolution of a comprehensive masterplan for Stormwater Management developed for the city of Accra and the Greater Accra Metropolitan Region in general and by that, other cities and related urbanized conurbations in the country.

For starters, to stem the tide in terms of increasing stormwater runoff from newly developing areas in the periphery of the city and (or) infill developments within the city limits from contributing increasing stormwater runoff flows and volumes to the already overloaded drainage systems, there has to be a new policy backed by an appropriate and enforceable legislative instruments or requirements that ***stipulates the need for post development runoff rates not to exceed pre-development levels***. This in essence ensures provisions are in place to preserve the hydrologic and hydro-geologic characteristics of a basin through the application of appropriate structural controls that curtail the increasing runoff rates with increasing urbanization (or impermeability).

In order to achieve a focussed approach to Stormwater Management in Urban environments, it is recommended that a ***Stormwater Utility*** similar in concept to the Ghana Water Company ltd; but with a sole focus on Urban Drainage and related stormwater management service provision, be set up. Learning from the challenges faced by GWSC, at its inception, this stormwater utility company should be well financed and have adequate and appropriate mechanisms for revenue collection and related financing for on-going service maintenance as well as the procurement of capital development projects to address drainage and stormwater management needs on a going concern basis.

Given that the main driver for a catchment or drainage basins' response to rainfall (i.e. stormwater runoff flows) is the degree and extent of impermeable surfaces. The stormwater utilities' ***rates or tariff structure could be based on the extent, scope and area of impermeable surfaces*** on residential, commercial or industrial properties in a given catchment area or drainage basin as this is what contributes to the overall impermeability and hence total runoff flows and volumes in the drainage basin. The property owner would be the responsible party for paying the relevant stormwater fees or tariff. Where properties can demonstrate a given specific set of verifiable measures have been undertaken to reduce runoff from their property (e.g. installation of rainwater harvesting system and or infiltration of surface runoff through porous or permeable paving), they would then qualify for a rebate of sorts. The PURAC could be the economic regulatory body responsible for ensuring appropriate levels of tariffs etc. This would essentially be along the lines of "the polluter pays principle".

Though the NRWHS is currently at an early stage of implementation as a cross-cutting strategy, this is reliant on existing structures and institutions, involving multi-stakeholders from government, private and non-governmental organizations, the academia and community based organizations. It has been proposed that cooperation and delegation of responsibilities will take place rather than the need for creation of very elaborate organizational units. It is the author's view that rainwater harvesting will not take off in a meaningful and sustainable fashion unless there are clear legislative drivers, a focused institutional imperative backed by commercial and market prospects; supported by well developed policies and strategies. From a water resources perspective (i.e. the water supply side of the water cycle), there is no immediate or short-term need for rainwater harvesting. This plus the fact that government institutions are not known to be adept at creating, driving and sustaining new markets and industries, means that there is a need

for a different framework for RWH if its more immediate benefits from a stormwater management perspective are to be realized. In this regard, the proposed Stormwater Utility could be the center for the focused institutional imperative as the need for widespread deployment and implementation of RWH is more of an urgent need to address stormwater management challenges in urbanizing catchments; as a form of source control. Widespread adoption of RWH would create jobs for appropriately trained artisans with plumbing and related skills. There would obviously be the need for the development of appropriate design guides, standards etc. which is where the Institutions, Standards Board, Trade Bodies, Community organizations and Academia for example would be involved as multi-stakeholders.

The stormwater utility would be a statutory consultee on all drainage impacted schemes within the drainage basins they have responsibility for. Given that the drainage basin boundaries are not necessarily concomitant with the established administrative boundaries, this approach would facilitate the establishment of priorities that take account of drainage catchment needs and not necessarily politically motivated needs. This utility would no doubt liaise with the appropriate urban planning and urban beautification or landscaping authorities or functions to ensure that projects and schemes include appropriate water sensitive features to facilitate effective stormwater management.

The utility would also be responsible for the production of integrated stormwater management master plans for the drainage basin and have oversight for functions such as planning and design, implementation, operations and maintenance, flood forecasting and coordination of emergency response and climate change adaptation and resilience. The proper delineation of the utilities' remit and its focused mandate for stormwater management entailing participatory approaches taking account of multi-stakeholder interests would be relevant and appropriate for interfacing with a heterogeneous constituency comprising a complex network of interactions in the urban water cycle; including the built environment, institutions and people; and avert fragmentation and overlapping areas of responsibility.

Ghana can draw from the experiences of stakeholder involvement being practiced in world regions where IUWM practice is highly evolved. In the US for example this has created burgeoning Industries (e.g. Stormwater Industry) with attendant creation of jobs, markets, standards and levels of service and a regulatory regime that has spurned an expanded role for the private sector in infrastructure service provision, skills and technology development, systems maintenance, management and capacity building. Thus in addition to solving the urban stormwater management challenge in an integrated fashion, this has resulted in an environment that is stimulating continuous innovation. If such an industry were to be developed in Ghana, it would put the country ahead of the curve and provide the impetus for exporting the know how and related technologies to other countries in the sub-region to help address the inevitable urban water challenges associated with the rapid urbanization occurring across the region.

Conclusions

In developing countries such as Ghana, urbanisation is increasing at a fast pace such that public infrastructure service provision along traditional lines cannot cope. There is obviously a need for a different approach to urban water management both from a technical / technological view point as well as organizational, policy, institutional and social engagement perspectives. It is recommended that an Integrated Urban Water Management (IUWM) utility modelled on a public-private participatory mode of service delivery be established to provide a focussed approach to integrated stormwater management that is participatory, consensus driven, inclusive, transparent, decisive, accountable and has a market/ commercial imperative backed by appropriate policies and legislation that is enforced. The above discussions in relation to the challenges faced in Accra, Ghana, should provide a context for deliberations and interaction processes that should result in the evolution of an IUWM utility and industry involving multiple stakeholders such as; city authorities, engineers, entrepreneurs, communities and activist etc. This will facilitate the adoption of best practice, the acquisition of new knowledge and spur innovation for implementation and maintenance of appropriate urban water systems.

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