

Dwindling Urban Water-bodies of Dhaka and the City Fabric: A Post-mortem

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Introduction

Geo-morphology has always played a significant role in the formation and growth of a settlement. Dhaka is no exception. The Dhaka conurbation, as a meeting point of major riverine routes, served as an outlet to a vast hinterland. Dhaka has grown from a small settlement within the confines of River Bouriganga and the Dholai *Khal* (canal) to a sprawling metropolis of about 13 million people. Dhaka is encircled by Bouriganga River on its south and south-west, Turag River on its west-northwest and Balu River on its east connected to Turag by Tongi (khal) River to the North. The spatial development followed the prong of flood free terrace originating from the old nucleus along Bouriganga River towards north as a part of Madhupur terrace (Dhaka Terrace) of pre-ostacian age. The Dhaka Terrace sloped towards eastern and western flood plains, marshes and Rivers. Water bodies and Rivers have historically played an important role in the spatial development, life and liveability of Dhaka.

Dhaka, with 400 years of history as a capital city behind it, is now at crossroads. Urbanization, without considering the geo-morphology of Dhaka during recent times has left a deep scar in the city's environment. It needs some strategic decisions and quick actions to remain liveable. Water logging, pollution, changes in hydro-geological system, land subsidence and building collapse are some of the severe consequences of these environmental changes.

This study attempts to trace the past and present settlement pattern vis-à-vis natural and manmade water bodies in Dhaka and their generic nature. Geo-morphological and hydrological features were also explored to ascertain an appropriate role of the natural factors in the rejuvenation and integration of the city fabric.

Historical and Physiographic Contexts

In 1765, James Rennel (1792) the English Surveyor wrote, "*the Kingdom of Bengal, particularly the eastern part (Bangladesh) is naturally the most convenient for trade within itself of any country in the world; for the rivers divide into such a number of branches that the people have the convenience of water carriage to and from any principal place.*" Situated at the centre, Dhaka was able to command all these great water routes. This locational advantage gave rise to various urban settlements during various points in history. "*...the largest town being Dacca city (90,542)...there are ruins at Bikrampur, at one time the head-quarters of the Sen Dynasty (9th & 10th century AD), and at Sonargaon, the first capital of the Muhammadens in eastern Bengal; an ancient legend also attach to remains at Rampal, Durduria, Savar and elsewhere*"(IGI, 1908). Dhaka was the seat of provincial Mughal administration for about one hundred years from 1610 AD, and later the capital of the newly formed East Bengal-Assam province (1905-11) during the British colonial period for a couple of years. In 1947, Bengal was partitioned between India and Pakistan and subsequently Pakistan's portion of Bengal became independent in 1971 under the name of Bangladesh. Dhaka, being the major city in the area was naturally chosen as the capital of the independent nation. There were political ups and downs affecting the city's size and morphology. But, it never ceased to be an important urban centre in this region because of its location and geo-morphology (Figure 1).

Study of Pre-Mughal settlements in Dhaka and its environs show that those settlements were in response to the need to control the trade and commerce of the region and their locations were determined by the areas from where they could command major (water ways) trade routes (Ahmed, 1960). The strategy was to retreat towards marshy south in the event of attack from the west or north (where powerful kingdoms existed). Sonargaon was a natural choice for that purpose and in the Sultanat period it is precisely what has happened. Banglabazar-Sutrapur area of Dhaka within the confines of River Bouriganga and the Dholai *Khal* being natural harbour became the trade outpost for Sonargaon.

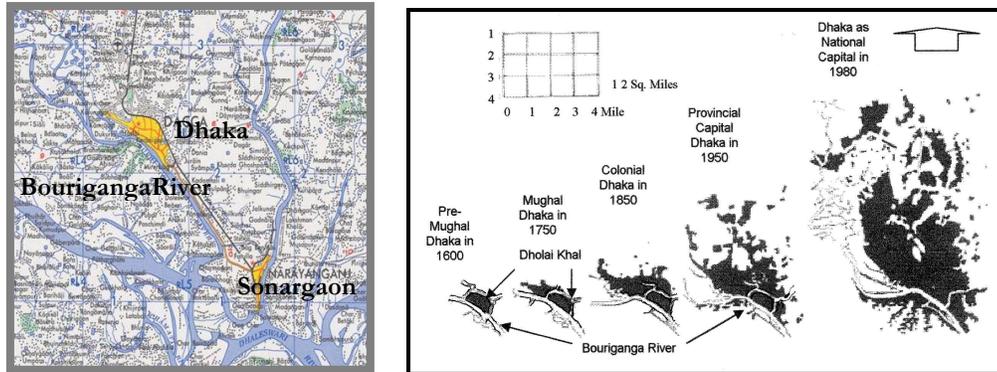


Fig. 1: Physiographic setting of Dhaka and its growth.

Contrary to the pre-Mughals, the considerations for Mughals in establishing a Flotilla Headquarters in Dhaka during the reign of Emperor Akbar was mainly to guard against the incursion of independent and semi-independent 'Bhuyan' chiefs or to keep out Magh and Portuguese raiders coming from south and east who use to plunder this land frequently (Karim, 1991). Hydrography of Dhaka shows that it is strategically as well as commercially important centre and was a watch post to protect the eastern borders/lands of the vast Mughal Empire which was upgraded to the position of 'Capital of Suba-e-Bengal' in 1610 AD during the reign of Emperor Jahangir. Since their agenda was not defence or retreat but rather offensive, Lalbagh area with an older Afghan fort was strategically and geo-morphologically more suited to them. They made it the centre of their administration. Unlike other medieval cities, Mughal did not have to develop a walled city. The city was well protected by a natural system of rivers and a network of canals and low lands. The Mughals had a number of river forts strategically located to control the water ways down streams i.e. Idrakpur fort, Sonakanda fort, Hajiganj forts etc. The city could be approached from the south-east by river, hence a series of forts were built on the way and two forts (Beg Murad fort 1&2) were built on either sides of Dholai *Khal* at Postogola¹ in 16th century, at the entry point of the city. The Postogola watch post were to oversee entries from the south, second line of defence being the older settlement within the Dholai *Khal* confines.

Bouriganga River at that time flowed near present Bara Katra and Chota Katra and at a little distance from there towards west it converged upwards near Lalbagh fort² or Posta.³ The city

¹ 'Postogola' is said to derive from 'pusht Killa' in Persian or 'behind the fort' in English.

² Lalbagh Fort and Jinjira Forts were Palace forts for Mughals eastern capital- but perhaps never completed.

³ Again corrupt form of Persian word 'Pusht' or behind (Lalbagh Fort). A palace was built in Posta, south of Lalbagh fort, by prince Azam in early 18th Cent which was washed away by the river (Dani,1962,p.40).

was entered from Bouriganga River in the south from Chandnighat and Swarighat, the path leading to the *Chauk* (the city square) from the river *ghat* (landing piers) had two caravansaries on its two sides i.e. Bara and Chotta Katra. Two principal streets crossed each other at Chouk, one east-west running parallel to the river and another from the river to the defence outpost in the north to Tongi through Tejgaon. A formal gate on the northern road in Badshahi Bagh (Ramna) marked the northern limits of the city core. Beyond the gate were the royal pleasure gardens and suburb settlements again with lot of water bodies. Islam Khan, the Mughal General and the Governor, added a canal in the topography of Dhaka to connect Bouriganga River near Pukur Teer (Pakurtali) with Dholai. It was to protect the Mughal sector as well as to create a short cut waterway to Lakhya from Chandnighat Navy base (Karim, 1991). The Dholai taking off from the Balu near Demra flowed south-westward through Dhaka to join Bouriganga near the Modern Mill Barrack area. The Balu rises from the Lakhya near Kapsasia and joins the same river at Demra. These water bodies had shaped the Mughal Dhaka.

Traditional Response toward Water Bodies in Dhaka

The Dhaka terrace was crisscrossed by numerous water channels that drained the city as well as served as a main source of service, water supply and communication line. The physiographic effect of water and land can be seen on the settlement pattern, which sited on available ground or on artificial mounds created on the flood plains (Mowla, 2005). Due to this local geo-climate and water based spatial development, Dhaka was once befittingly called the Venice of the east (Taylor, 1840).

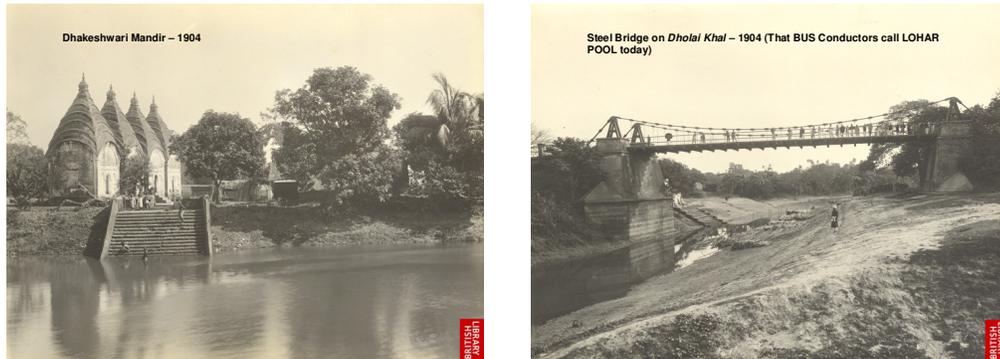


Fig. 2: Dhakeswari Mandir and Dholai Khal with Iron Bridge (lohar pool) in 1904.

The settlement pattern of the pre-partition (1947) period in comparison to the contemporary one presents a richly woven urban fabric at the human scale. The rivers spilling over the flood plains and into canals / *khals* or connecting inland depressions or lakes together provided a hierarchy and network of water bodies and navigation routes giving rise to settlements alongside. There were flights of steps, locally known as *ghats* at intervals rising up to the lanes or community spaces (Figure 2). The *ghats* (landing piers) on the bigger water bodies or rivers were major community spaces where the daily activities take place such as bathing, washing or religious or commercial activities. Historic pattern reveal that the relationship of urbanization and water bodies was positive and complementary. *Ghats* were community spaces and urban nodes as well besides providing a hydraulic character to the settlements in the area.



Fig. 3: Pattern Evolving out of traditional development with water body as focus.

The traditional system was of dig-elevate-dwell whereby ensuring water retention during floods and reservoir for lean period. The system protecting the homesteads above flood levels with crop fields around helped create adequate biomass was a time tested approach of the settlement pattern for sustainability in the area (Mowla, 2005 & 2008). In Dhaka traditionally the settlement structure evolved in consonance with water bodies (Figure 3). The water bodies were the main transport corridors, streets being secondary to it. Planning deep inland together with European planning principles changed the development pattern giving emphasis on automobiles and discouraging water mobility. Contemporary urban planning and design in Dhaka has its roots in the colonial period which ignored the traditional pattern resulting in the settlements to turn its back to the water bodies whereby causing hydro-geological as well as health, sanitation and water logging problems.

Evolving Pattern

Dhaka is located in the midst of an active delta – the largest in the world. Almost whole of Bangladesh is formed by the alluvial deposits brought down by the mighty rivers – the Ganges, the Bramhaputra and their tributaries. Siltation process is simultaneously going on for ages in both water channels as well as in the flood plains thereby their relative depth remains almost constant and the shore line moves south ward with the accretion of new lands.

Historically Dhaka's urban life and living was interwoven with the system of rivers, canals, lakes and ponds scattered and crisscrossing the city (Mowla, 2008). Water channels like the Dholai Khal, the Gerani Khal, the Segunbagicha Khal or the Beguni Bari Khal played an important role in the indigenous city life. Most of these *Khals* lie east-west, that used to serve an important purpose of intracity communication, besides other needs. The prong of flood free Dhaka terrace averages about 6 km in width and the growth has generally been northwards from the old nucleus along the Buriganga River. Boats were the primary means of communication, through numerous *Khals* within Dhaka until the Mughal period when narrow alleys and roads started to appear in the scene to give way to carts (Taylor, 1840). The effect of physiography can be seen on the settlement pattern rather than on building structures themselves. Settlements are sited on available ground or on artificial mounds. Most of the settlement pattern is linear (Muktadir & Hasan, 1985) in nature, at a regional scale and circular at homestead scale, its location along the river or some sort of water bodies as the main source of service and communication line. Before the contemporary era network of natural canals within the city served as the means of drainage of the rain run off and water during the events of flood, besides these canals served as a good means of transportation.

At the time of partition of 1947, about 50% of present Dhaka was low lying flood plain and water bodies. Dhaka relied on the gravity drainage system based on 'khals' and 'wetlands'. Historically, wetlands and water bodies in Dhaka were the main source of water. Water bodies also offered highly valuable environmental and recreational asset for the area. But gradually in course of time this natural water supply and drainage system is being almost destroyed. Many of the roads in Dhaka are developed by filling the water bodies or by making box culverts, thus shrinking the water carrying capacity as well as reducing ground water replenishment (e.g. Dholai Khal and Panthapath). Destruction of these water channels and depressions has resulted in the disruption and alteration of the natural process of land accretion, land formation and ecosystems. Traditional Architecture, Urban Design and planning in this region offers the best and integrated solutions towards human needs, in their relation with the nature, ecosystems and the community but contemporary development ignored living with nature. Water logging is an inherent problem associated with uncontrolled urbanization and lack of holistic planning in Dhaka.

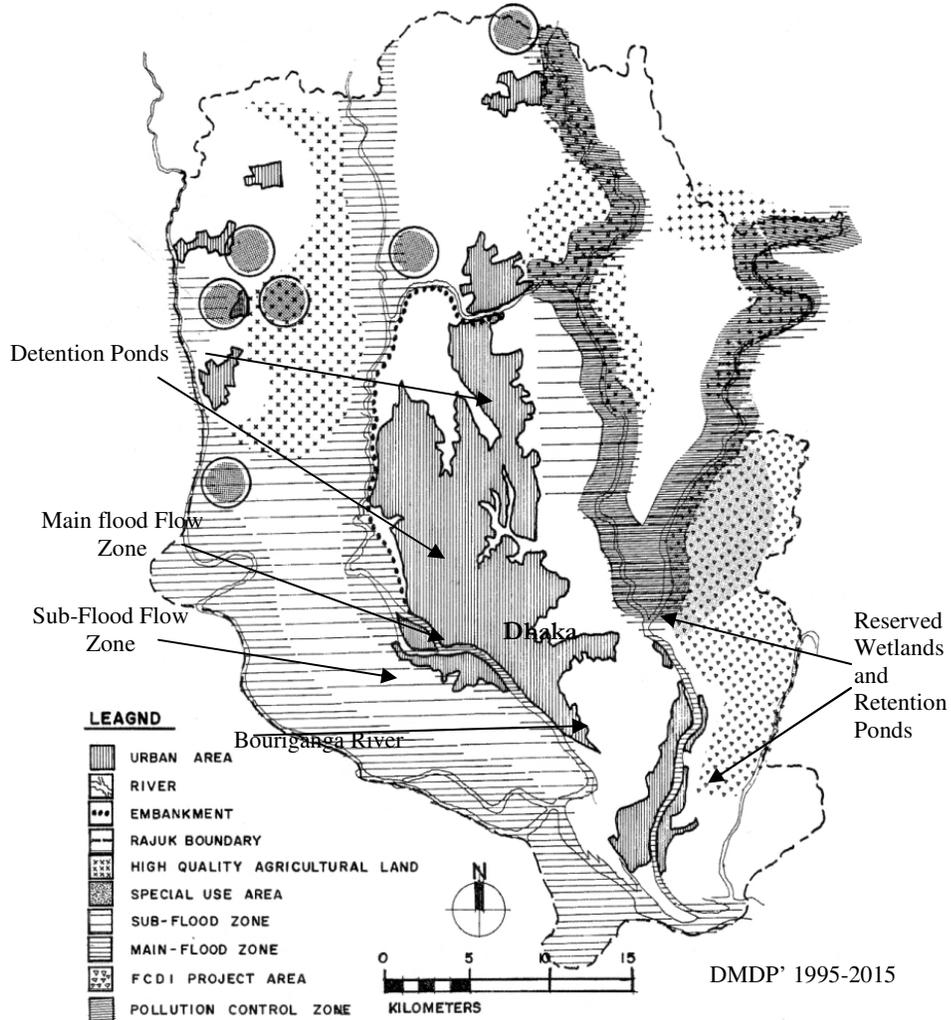


Fig. 4: Structure Plan Policy Areas - built and natural areas of Dhaka.

Contemporary Scenario of Dhaka's Water

Dhaka Metropolitan Development Plan (DMDP, 1995)(Figure 4) considered retaining at least eight flood-flow zones undisturbed – Dhaka West; DND Triangle; Eastern Fringe; Narayanganj West; Dhaka NW; and Narayanganj East (Nagario Prokoton, 1995). It is said that Dhaka must have at least 20 retention ponds of Hatirjheel size to tackle the storm water (Bangladeshnews, 2009a). Transparency International Bangladesh-TIB informed that around 1,000 ponds, which were in the city, have now been totally destroyed. TIB is trying to recover 13 out of 52 canals but could not succeed so far (Bangladeshnews, 2009b). TIB reports that 800 acres of land in 5 rivers including Bouriganga and Sitalakkhya were illegally grabbed violating the Wetland Protection Act, 2000. The fact is that the contemporary planning process never took water systems as the driving force in any physical planning in this delta. IRS images of 1996 and 2000 clearly show that water bodies measuring about 2300 sq.m. were filled in by the Bashundhara and Bashumoti housing estates and 66 acres filled by Aftabnagar Housing. In 1996 there were 211 acres of water bodies in the Mohamadia Housing Estate and Adabor area of which 91 acres disappeared between 1996 and 2006 and 68 acres from 2006 to 2009 (Rahman, 2010). RAJUK, the main planning body for Dhaka is the major violator of its own plans. RAJUK initiated a residential project in the southern part of Bouriganga River covering an area of 381 acres – over the last two years 3000 sq.m. of natural water bodies has already disappeared. Purbachal housing is another recent example of many such violations of DMDP.



Fig. 5: Planning with water bodies was never in the development agenda: 1st photo shows BGMEA building built in the Bagunbari Canal's main flow area and 2nd & 3rd photos show Kalyanpur canal encroached indiscriminately.

Studies show that around 40% of the wetlands of Dhaka city has disappeared in 20 years due to indiscriminate filling up of lowland and flood flow zones (both by public and private agencies) that also has reduces its drainage capacity (Figure 5). It says that the temporary wetland area in DMDP, 1995 was 1,528 sq. km. which was 40,765 hectare in 1989 and came down to 35,740 hectare in 1999 and 24,208 hectare in 2005 (Bangladeshnews, 2010). Same study informs that to protect eastern Dhaka from floods, at least 40% (66 sq.km) of the drainage catchment area must be delineated and protected as wetlands and water bodies under Wetland Protection Act, 2000, considering this as an 'ecologically critical area'. Of the recommended 40% drainage area, a minimum of 12% (about 20 sq. km) can be made available as reserved ponds or lakes and another 38% (about 46 sq. km) protected as natural wet lands for retention of storm water (Figure 6). A Dhaka University study reveals that the government owns about 33 lakh acres of khas (Government) land of which about a quarter is water bodies. DAP (2007) covers the area of DMDP, 1995 but did not follow the planning guidelines provided in it. Against the 40% requirement, DAP, 2007 recommends 21% of Dhaka's land as water bodies where no development would be permitted. DAP recommends 50m land from riverbanks to be earmarked for walkway or driveway; enlisting parks, playgrounds and open spaces; and marking existing canals in the CS and RS maps (DAP, 2007). No basis of this recommendation is given.

Surface water (River, Canals, Wetlands, Ponds, etc.) compliment and supplement underground water. There is a continuous tendency in contemporary times to destroy the surface water channels but underground water is also not spared. The ground water replenishment rate is much slower than the extraction rate. In 2001, underground water table in Dhaka was at a depth of between 200-300 feet. In 2010, this has deepened to 1,000 -1200 feet. This is not a matter of concern only with respect to water supply but because a large vacuum between surface and under-groundwater has developed which might trigger land slide or subsidence particularly in the event of earth quakes.



Fig. 6: Dhaka during floods and water logging in the city roads after rainfall.

Looming Catastrophe and Mitigation Strategy

Bangladesh is a deltaic country and has abundant rainfall, but due to the absence of clear policy-guidelines, useable water quantity is declining fast. Most countries have water policy and regulatory laws for water use (particularly ground water). Wetland Protection Act, 2000 in Bangladesh restricts change in the wetland areas but doesn't regulate the use of water. Neither the building construction rules, or building code or any planning regulation nor wetland act calls for integrating natural water bodies or channels into the urban planning and design frame work.

Given the fact that Dhaka is subject to frequent flooding, an appropriate plan for living with flood is needed. A formal holistic policy and plan at national level sets priorities identifying major areas and quantities of uses i.e. Forest, wetlands & water bodies, natural areas, agricultural, rural, urban and industrial areas. Urban structure plan (SP such as DMDP, 1995) is the second level plan within broad national urbanization policy guidelines of national vision. The level three planning and designing is the detail area plan (DAP) within the planning guidelines set in SP. In the fourth level is small area and plot level designing. Such a sequential plan is not evident in the Detailed Area Plan (DAP, 2007), which rather than setting aside adequate space for water retention ponds and for permeable surfaces (including parks and other unpaved surfaces), focuses instead on roads and buildings, embankment and pump oriented flood control approach which further intensified the suffering of Dhaka residents due to flooding. Considering the geo-morphology of Dhaka, contrary to the embankment- and pump-oriented flood control and drainage management approach of DAP, 2007, flood management and a detention reservoir-based gravity drainage system is expected to be more reliable and appropriate for storm water drainage system in a floodplain landscape like Dhaka with rivers encircling the city (Mowla,2010). Some sporadic attempts to integrate water bodies with the settlement pattern are observed in Dhaka without any link with upper and lower level planning and design framework (Figures 7& 8).

To assess the sustainability status of integrating water bodies in the urban design under contemporary context without compromising on the social, environmental and economic interests, a hypothetical project was introduced in the Level-4 urban design studio of the

Department of Architecture, BUET with the title 'Integrating the Urban Water Bodies in Dhaka's Fabric: An Imperative Issue of Sustainable City'. A day long workshop with the same title was also organized (BUET, 2009) which was participated by the level-4 BArch students of BUET and 5th year architecture students from KUL (Belgium). One of the many proposals submitted by the students (Fig. 09) suggest that traditional approach of planning and design of living with nature is still valid without sacrificing contemporary needs and that natural areas be strictly controlled by regulations. It is also suggested that the Planning and regulatory agencies like RAJUK must not indulge in (real estate) development since monitoring and execution are conflicting roles with conflict of interest (like judiciary and bureaucracy).

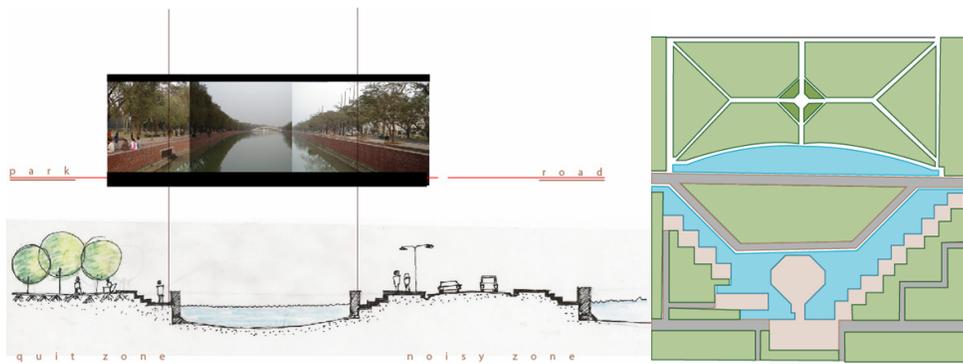


Fig. 7: Shangshad Bhaban Precinct design considering water bodies as its integral part.

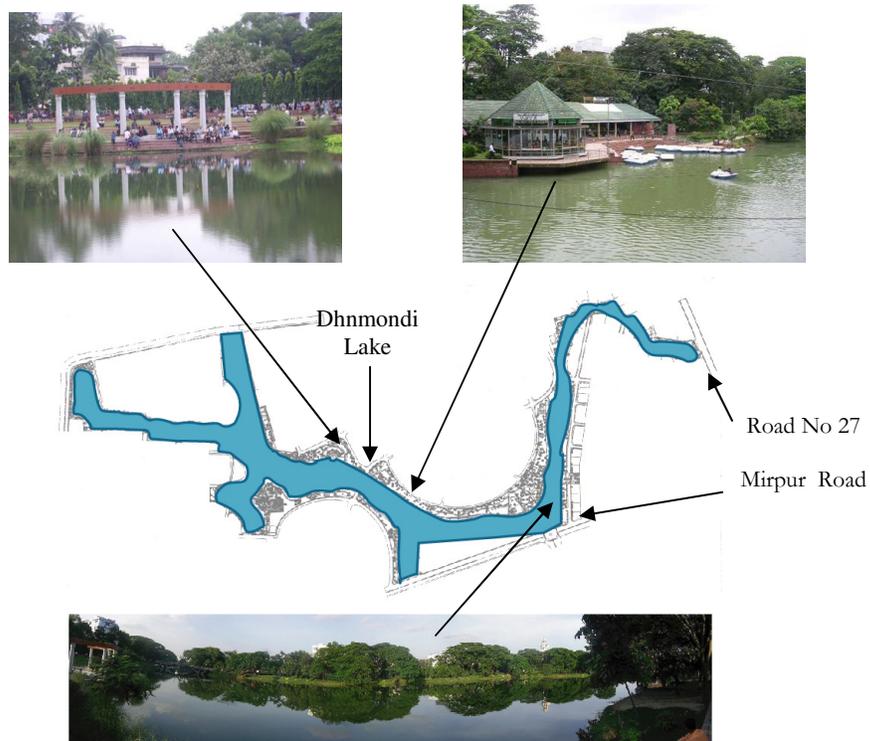


Fig. 8: Dhanmondi R/A Designed with water-bodies but not integrated.

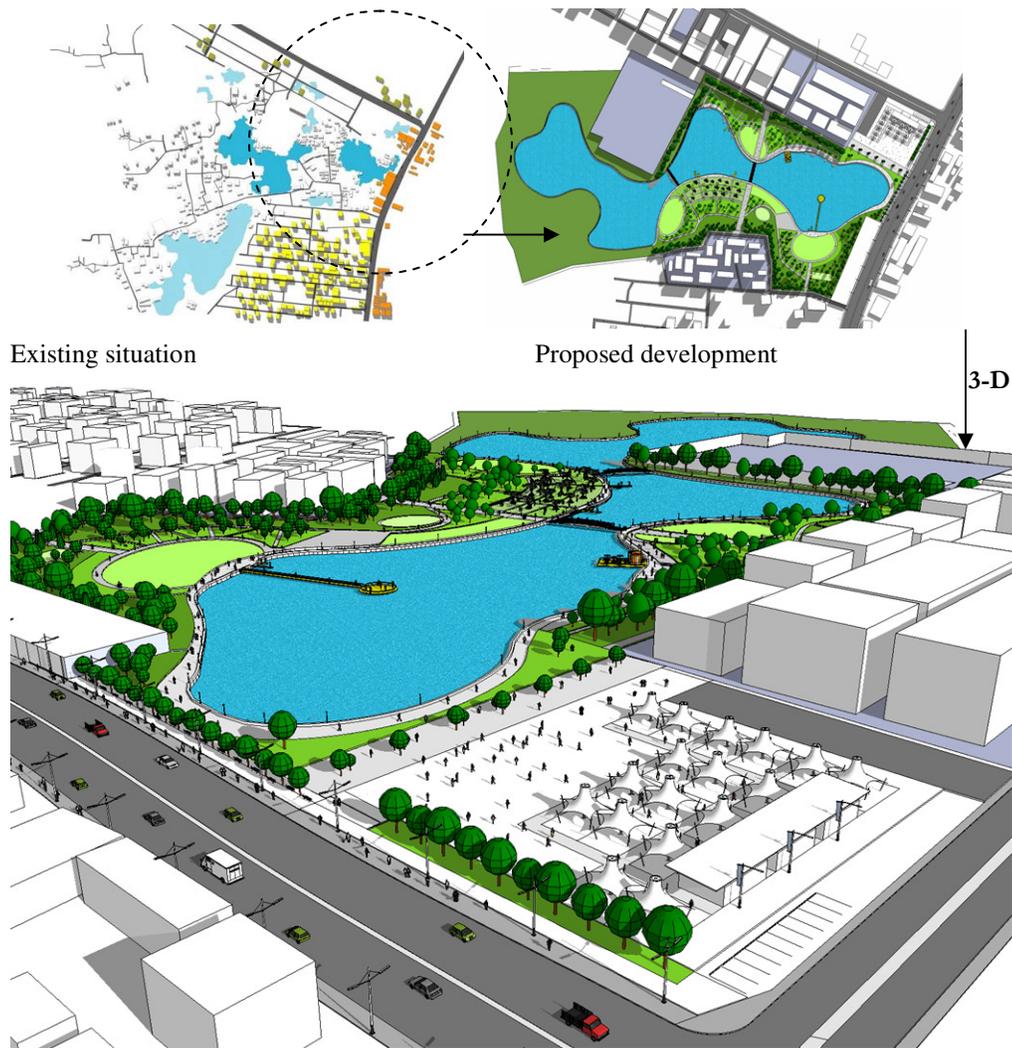


Fig. 9: Badda retention pond development area- students' vision of development without sacrificing density or contemporary needs, but integrating nature with the development.

Considering the geo-morphology of Dhaka, it seems essential that if and when needed the earth cutting to fill / raise lands must be judiciously planned and invariably done on the channel ward side that would get rapidly filled up by the natural process of siltation / accretion. The western embankment of Dhaka is a response to the floods of 1988. The attitude of zero tolerance for floods amounts to demanding equal protection from floods along different stretches of rivers irrespective of the geographical difference found there, which in practice is not possible. It increases the ferocity of flood flow in the lower reaches. Embankments saves some areas at the expense of some other areas but have a long term effect of higher river beds than their surrounding, insufficient percolation and diminishing soil fertility. According to noted water resources expert Prof Shahjahan (Mowla, 2000) 'such flood control and irrigation projects tend to focus exclusively on engineering aspects, neglecting the people, water, soil, fish, vegetation – many vital concern.' Bernier (an English

traveller of 17th century) observed that the overflow irrigation combated malaria, provided an abundant harvest of fish and vegetation, enriched the soil and made congestion of the river impossible.

Conclusion

Historically Dhaka's development responded well with the hydro-geological realities of the place. Traditional Architecture, Urban Design and planning in this region offered the best and integrated solutions towards human needs, in their relation with the nature, ecosystems and the community but contemporary development ignored living with nature. After abusing urban water bodies through the years of hard use and neglect, when it has retaliated with unthinkable magnitude, there is a realization on the stake holders that they are valuable natural assets / resource for the community.

Urban development with water bodies as focus was not given a trial during the rapid urbanization over the last 100 years. Review of Dhaka's geomorphology reveals that for the sake of ecological, hydrological integrity and development sustainability, natural systems must be protected and can be protected. DAP, 2007, though quite conservative, if strictly followed is expected to improve this situation. Studies show that much greater environmental as well as socio-economic success or advantages can be achieved through design with ecological principles in mind than without it. Fragmented approach of planning must be avoided.

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