Symbiosis Between Water and Architecture:
Towards Hydro Based Urbanism in Keraniganj, Dhaka

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Abstract: Bangladesh is located in the world's largest delta where the relationship with water is totally different from rest of the world. The satellite image of Dhaka city shows the presence of water bodies that girdle the city in east and west periphery. At present Dhaka, the capital of Bangladesh is growing with mind-numbing speed, filling up these lowlands for the extra population, as all the highlands are increasingly being built or covered. These wetlands which generally acted as flood basin for Dhaka is now unable to fulfill its purpose and thus increasing flood magnitude and its elongation period. This approach to land development is affecting the resilience of the city. This disturbance on environment can be termed as 'ecological disaster' making the situation worse for the people of Dhaka city. The analysis on pre-urban and post-urban context will express how the situation gets worse for unwise and unplanned decision-making and for not respecting the hydrology and its functions. The important observation is, the strategy of 'flood-free land' should be transformed to 'flood-free building' in the new innovative housing model in this context, which can relate to our society and culture and for reviving the relation with water which was very much prominent in the past. This way there will be more space for water during monsoon and flood. The study first asks the question of how can the diverse ecology and unique natural dynamics of Delta environment be restored and integrated with new and existing urban residential development in and around Dhaka city and aims to come up with a model of the new housing typology where human and other species and the natural functions of wetland can coexist.

Key words: Ecological Urbanism, suburban, housing, landscape urbanism, wetland.

Introduction

Bangladesh is located in the world's largest delta with more than eight hundred waterways and the country was known as a "Land of water" or better still "water in land" (Novak 1994). For thousands of years, the local people have depended on the rivers flowing through the country for transportation, trade, and generating livelihoods. Like many other cities in the world, Dhaka the capital of Bangladesh started its journey from the bank of River Buriganga that was formerly the original bed of Ganges and, is now a branch of Dhalesshari (Taylor, 1840). After its growth in 19th and 20th century, the city got its shape by Balu River on the east, Turag River on the west, the Buriganga River on the west and south and the Tongi Khal on the north. Over the last four hundred years of rapid urban development, Dhaka has completely lost its im-

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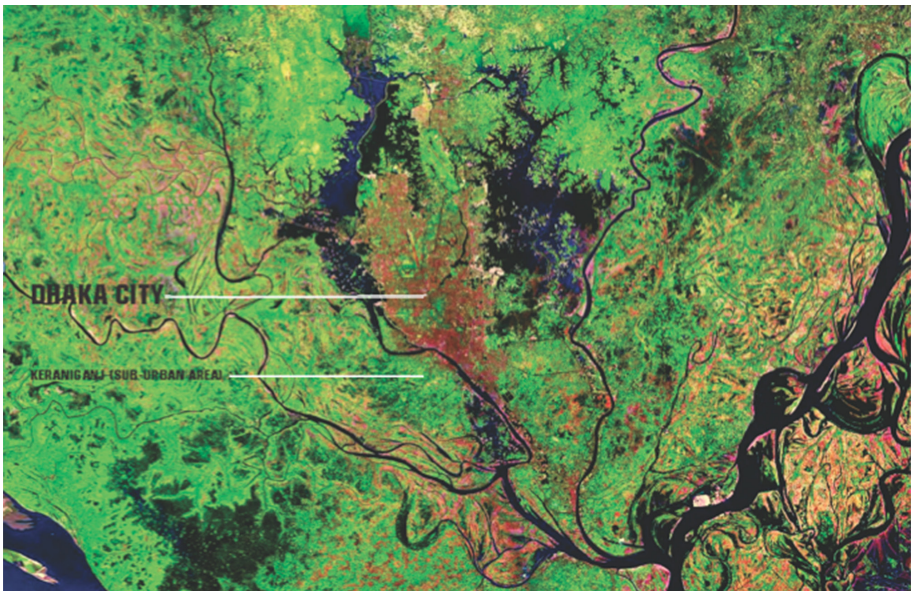

Fig.1. Satellite image showing the presence of water bodies at the periphery of Dhaka city. (Source: Website: News and Information about Geology)

age of 'Venice of the East or the City of Channels' as remarked by James Taylor (Dani, 1962) and presently stands as 'City of concrete'. Consequently the 'River-front' city transformed to 'River-back' city due to lack of visioning and proper planning. Dhaka is now growing infinitely in every direction, encroaching rivers, swallowing up wetlands and agricultural land with mind-numbing speed and greed to meet its appetite for urban land, and throwing off balance a precious ecological and hydrological system (Ashraf 2003). About 18.72 km2 of Rivers & Canals and about 76.67 km2 of wetland are lost during last 30 years from 1978 to 2009 (Mahmud et al, 2011). In order to avoid an impending environmental crisis, the existing natural matrix throughout the country need to be taken as a starting point for envisioning the future development of the city. Keraniganj is one of the closest suburban areas of the city connected by three bridges over Buriganga river. Demand of low-income and middle-income housing near the city core accelerates its development. But in its case, taking up its low-lying lands, simply filling them up, running streets in grid pattern, making number of small plots and selling them to individuals do not make a sensible approach for planned housing. Instead of building up on a plot in an isolated manner, if pooling 8 to 10 plots together to develop one single housing complex with various internal facilities including meeting areas and generous open spaces, play areas, or gardens for the whole complex (Ashraf, 2003). In that place, architect can use his/her freedom of creating open space with meaningful relation with surroundings. For example in case of preserving wetlands this type of approach will be more effective for connecting water bodies within large scale housings. A design proposal presented in this paper is shown by conceptual diagrams, exploring the possible strategies for a new matrix of water, land and other infrastructures. The paper begins with understanding the context

and historical overview, changing hydrological pattern with the demand of population growth and urbanization, addressing rising problems specially flood and drainage issues, recently proposed DAP proposal and other guidelines for housing based on available documents and field survey. Finally it develops a checklist for developing housing in such site and develops possible design approaches for different parts of a housing exploring meaningful relation with the surrounding waterscape preserving its natural functions.

Contextual Brief:

Topography of Dhaka is a combination of highland and lowland and development followed this topography from ancient times. But because of population boost now land grabbers are going for the surrounding lowlands. This massive unplanned growth or the man-made action can be compared with 'wave' as it is moving forward and its height or magnitude is getting higher rapidly. Its reaction is generally occurs in form of flood that is also expected to be more terrifying in future than before.

In the chronological sequence of unplanned urban sprawl of Dhaka, infrastructure (such as roads) worked as a catalyst for such development. It is also the main catalyst for land speculation as the land price gets higher which is the pull factor for the land grabbers or developers to take up the lowlands and wetlands at the periphery. The space for monsoon water consequently filled up by the current approach, thus 'the Reaction' in form of flood likely to be more devastating in the upcoming days if proper measures not taken immediately.

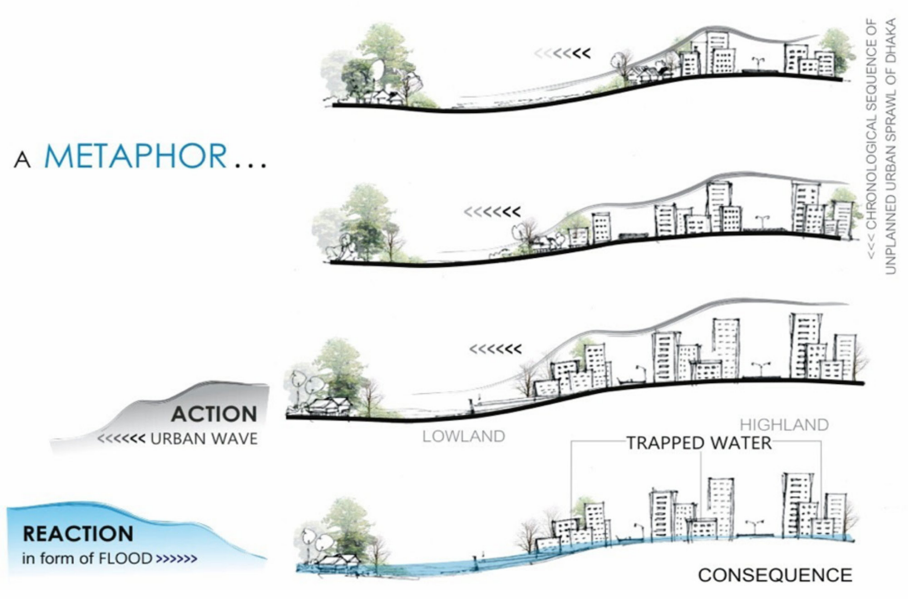

Fig.2. The Metaphor, 'urban wave' as 'action' and 'reaction' in form of flood (by author)

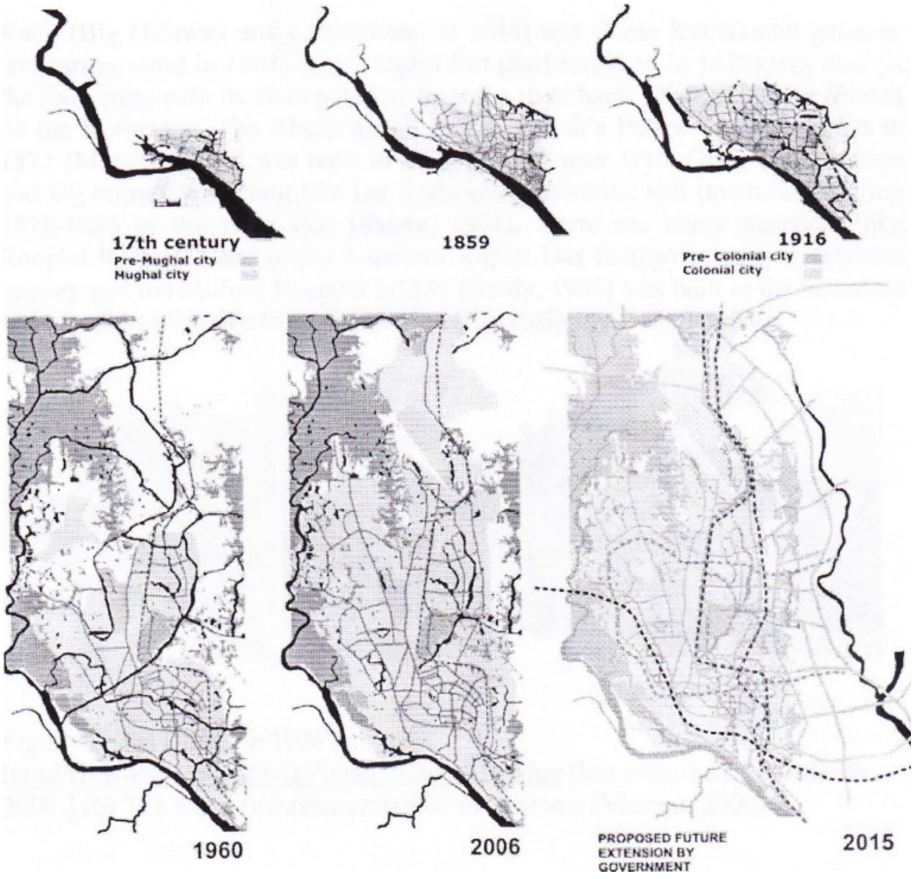

Fig.3. The Shifting Dialogue between the River Buriganga and Historical City of Dhaka (Ahmed, 2000)

Context of Dhaka

Dhaka as the capital city has a history of more than 400 years starting from Pre-Mughal and Mughal period. Later it went through British period for about 200 years, Pakistan period about 24 years and finally named as the capital city of independent Bangladesh in 1971. After some declining and stagnant period, the population of the Dhaka city started to rise after transferring the power to the British East India Company in 1958. The north portion of what is now called 'Old Dhaka' at the river bank of Buriganga, was mostly lowlands, began to be filled up from that time. Moreover, during that time Buckland Embankment was constructed at the edge of Buriganga to protect the city from flood. The city began to expand its footprint after the British period. The city area expanded from 85 sq-km in 1950 to 336 sq-km in 1974 and to 1530 in 2001, while the population increased from .4 million in 1950 to 2 million in 1974 and to 10 million in 2001 (Hossain, 2008). Keeping pace with the unprecedented growth and urbanization, almost all the highlands and lowlands of the central Dhaka has been covered and the landgrabbers started to move rapidly towards its surrounding suburban areas after around 1990-2000.

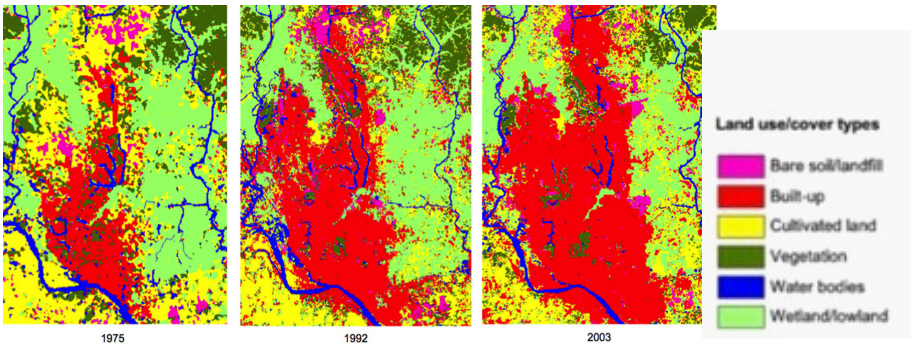

Fig.4. GIS and RS Analysis showing Dhaka's land-use changing Pattern (Dewan, 2007)

Context of Keraniganj

The riverside part of Keraniganj, a suburban area located at the south west of Dhaka city is almost covered up by haphazard filling and unplanned development but the inner part of Keraniganj still reveals its 'delta character'. Jhilmil Housing by RAJUK, the development authority of Bangladesh, itself is a huge landfill project filling about 168 acres of land. Land-filling and plot division for unplanned housing has been increased since 2000 and destroying its deltaic character rapidly. To stop this ecological shift, innovative housing approach is a crying need to preserve these lowlands.

Fig.5.Glimpses of present scenario in Keraniganj (source: website and newspaper)

Flood and Drainage

Dhaka City is located in the watersheds of Buriganga River within the Ganges-Brahmaputra deltaic region. The amount of impervious hard surface in these watersheds has increased significantly due to rapid urban expansion over the last few decades. For example, in a city that is totally served by storm drains, and where more than 60% of the land surface is covered by roads and buildings (like Dhaka City), floods are almost six times more numerous than before urbanization. (Khalequzzaman, 2001; Pipkin and Cunnings, 1983)

An appropriate plan for flood control is necessary for the Dhaka city as it has

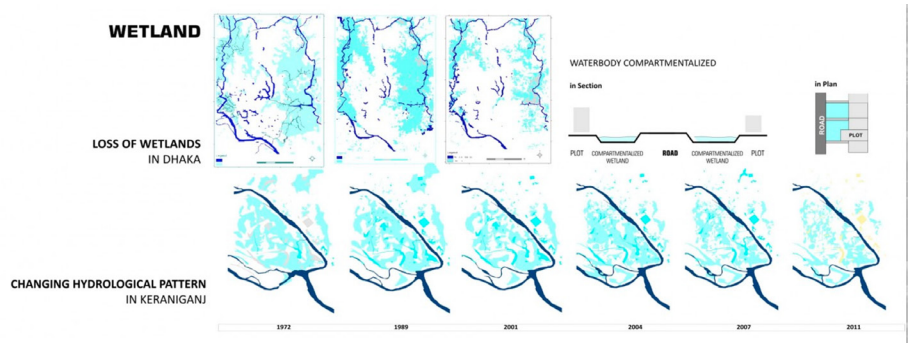

Fig.6. Loss of lowlands in Dhaka (Hoque, M. M., Rahman, R., and Rashid, S., 1999) and in Keraniganj (by author)

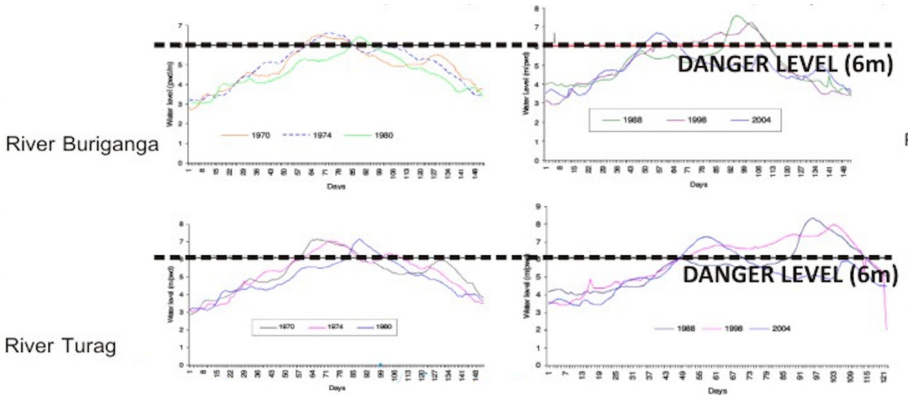

Fig.7. Effects of unwise flood control measures through pre-urban and post urban river data (IWM)

beed suffered from frequent flooding for the last few decades, specially in the 'post-urban' period of 1980 to till date. Detail Area Plan (DAP, 2007) a part of Dhaka Metropolitan Development Plan (1995- 2015) has designated 'Flood Flow Zone' through out the periphery of the city along with dispersed 'Residential Development Zone'. Without any comprehensive guideline for these residential zones, it focuses more on roads, retention ponds, embankment and pump oriented flood control approach (Mowla, 2010). Such approach rather than mitigating, will further intensify the environmental degradation and the suffering of Dhaka and Keraniganj residents due to increasing flooding.

Analysis and Findings:

Wetland is an unique condition where water and land are the two elements closely related to each other with its surrounding and landscape. Intervention should be minimum to preserve its whole setting. Only preserving the water will not be enough.

Fig.8. Inundated roads and water logging in Keraniganj (source: Nilufar, F.)2007)

It may serve the aesthetic purpose but to preserve these lowlands, the total system including ecology and its underlying natural processes need to be considered. The edge in wetland condition is termed as 'Ecotone' where each of its part play vital role in the ecosystem. A planned and innovative symbiotic relation is necessary between manmade and natural interface to create a meaningful relation.

Analysis on edge condition between land and water:

The edge is very vital particularly in case of wetland in such context. The term 'Wetland' reveals the unique relationship of water and land, which coexist in a dynamic way with the seasonal flux. It performs important roles, not only holding excess

Fig.9. Proposed symbiosis, preserving wetland gradient (by author)

flood water or recharging ground water but also it has a great ecological value for its unique biodiversity. For its extreme dynamic behavior where fluctuation of water with seasonal flux is about 3-5m in an annual cycle in local context, hard edge or embankment approach cannot be an economical or feasible solution. Rather soft infrastructure needs to be promoted for hydrological responsive development.

Within the housing site, the local land development authority has defined thirty percent mandatory open spaces for common functions, like park, playing field and other common facilities. In such suburban context this open area can be increased depending on the topography and site conditions. The soft edge can be practiced adjacent the open park or fields. A partial or fragmented wetland gradient can be incorporated in case of adjacent built structures.

Analysis on nature interface:

Wetlands are considered the richest element within the food web and habitat consciousness today is particularly focused on preserving these wetlands. Wetlands are decreasing all over the world and study reveals, about two third of all extinct spe-

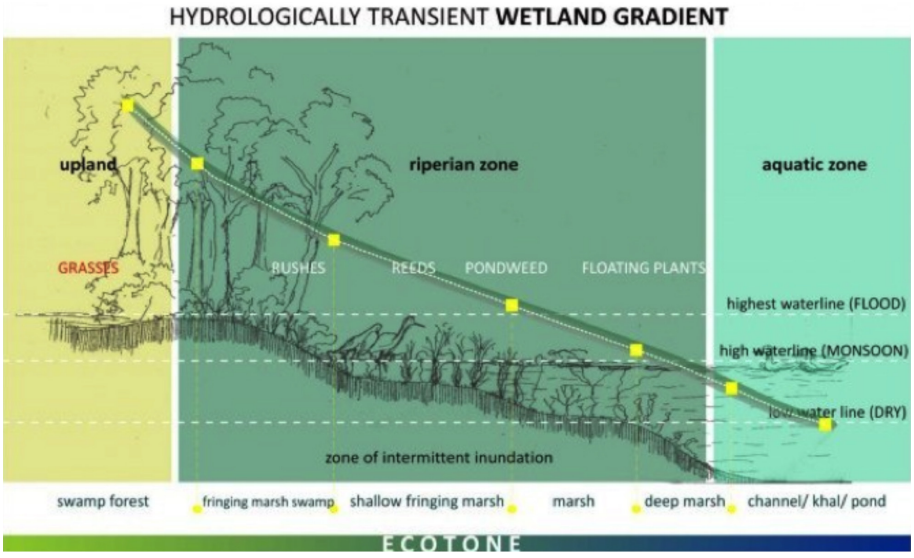

Fig.10. Wetland Gradient (by author)

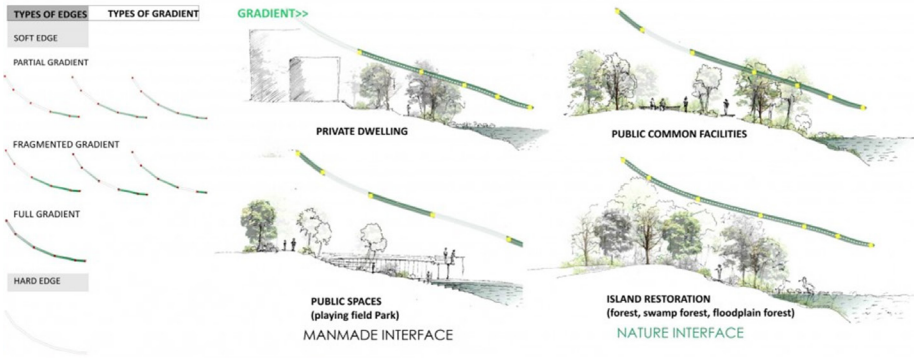

Fig.11. PEdge proposal in different parts of housing (by author)

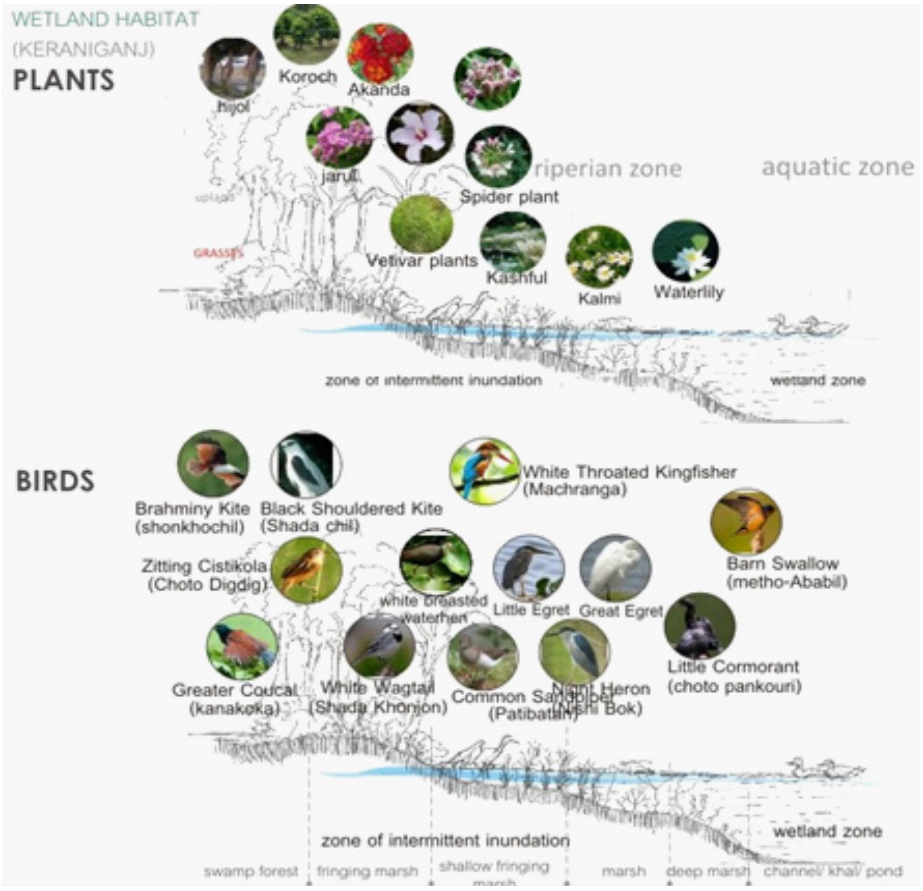

Fig.12. Local plants and birds found in the wetland gradient of Keraniganj, Dhaka (by author)

cies are particularly from the edge of wetlands. Considering the rich biodiversity of this edge, this part of study is dedicated to collect information on the species found in the local context of Keraniganj. A healthy march wetland serves as a source of organic nutrient, pollution filter and also acts as a buffer against flooding and soil erosion.

Analysis on man-made interface:

The consequence of flood or inundation on the proposed soft edge is critical. Connections can be lifted over land like bridges in some intersecting places to avoid fragmentation during inundation. Both the waterway and land way communication is possible to create near the edge. Casting sunlight on the ground is very much necessary to avoid unhealthy situation. Thus the building form should welcome sunlight to cast on the ground to avoid dark, damp condition of the soft ground. In this way, the building can be lifted up with the ground free, and the plinth can be slopped or recessed to accommodate water in extreme conditions, for example, in case of extreme

Fig.13.Proposed two options for the edge-side buildings (by author)

Fig.14. Responsive Building Sections in the transient scape (by author)

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Final Proposals:

1. Connecting waterbodies if present in the site.
2. Land can be divided in two interfaces that is nature interface and manmade interface.
3. High land above flood level should be defined first and selected for minimum physical intervention for housing.
4. Maintain at least 30% of the site area for nature interface which may include in RAJUK's defined 30% mandatory open space in housing site.
5. Soft edge must be used where possible.
6. Density has to be defined concerning every viewpoint.
7. Agriculture can be retained if present in considerable land area within site.
8. To achieve density, if some part of land has to be filled then the filling material should be dredged from the lowland to maintain water level
9. Connection features over water should be avoided as much as possible.
10. Sometimes Island restoration may take place that can be used for passive recreation.

Conclusion:

Of the classical elements – air, water, earth and fire – only one is symbolic of Banagldesh: water (Novak, 1994). Historically Dhaka and its people were closely connected with its surrounding rivers, canals, lakes and ponds. Just like the human body, the city also depends on its soul to function properly. Quick actions with innovative holistic design approach is necessary for the new matrix of highland and lowland for the future development at the periphery of the Dhaka city.

Fig.15.Undergraduate thesis proposal for integrated housing in Keraniganj (by author)

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