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DELTA FORCE: New Cartographies of the Sundarbans Alternative Design Concepts for Khulnâ & Environs

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Abstract
The territory of southwest Bangladesh has recently been through trials and travails – from the process of de-industrialization to devastation in the wake of Cyclone Sidr. A state of uncertainty hovers over the region as jute mills close in Khulna, Mongla port has yet to take off and the frequency and severity of natural calamities appears to be on the rise. The resilience of the region is being tested as future scenarios are debated. Meanwhile, large-scale investment in infrastructure proceeds as the Southern Bypass and Rupsa Bridge have been completed and there is discussion of new airports and a second bypass in the vicinity of Khulna. A new master plan is being developed for the Jessore-Khulna-Mongla region while the Khulna Development Authority and Khulna City Corporation struggle for political buoyancy amidst the nation-wide corruption crackdown. Strategic intervention in the larger territory is compounded further by the contestations amongst a multitude of ministries and over-lapping jurisdictions. Traditional master-planning is incapable of reconciling the complex relationships at play in this territory. This article presents an alternative design approach – a new series of projective cartographies – for simultaneous operation at the larger regional scale, the city scale and the local scale.

1. The Agency of Mapping

The complexities of the region extend beyond the uncertainties and sectoral/political manoeuvring to the spatial qualities of the territory itself. The creation of maps and layered reading of the region at multiple scales makes clear the interplays between landscape, infrastructure and urbanization. The specificity of the context is embedded with inherent logics which are often in conflict with the impositions of sectoral-based master plans. In order to make design projections and new cartographies for the region, research began from the notion that interpretative mapping is a first step towards transformation of a territory. The reading of sites – from diachronic and synchronic perspectives – was necessary in order to create modifications that relate to the particularities of places and situations. Interpretative mapping allowed for multiple perspectives and methods of looking at history, contemporary reality and data. The interplay between paradigms, discourses – be they political, scientific or populist – forces, circumstances and hazards has resulted in a territory that is neither smooth nor understandable from a single perspective. The implicit and explicit translation of discourses to physical form is further modified by continuous practices of everyday life.

The notion of 'descriptive (landscape) urbanism' was used as a method and a critical discourse for analysis. The critical assessment and construction of mappings, overlays, narratives and urban biographies convey social realities on the ground. And since the paradigmatic and the descriptive can never be fully disassociated from one another, the urban analysis demands a back-and-forth method oscillating between the two – involving different scholarly and creative skills: scientific researcher, participating observer, stirring narrator. After all, urban design operates as much in the domain of design interventions as it does in the creation of a mindset or a shared vision.

The 'agency of mapping' is exploited as the initiation of 'design research.' As Corner writes, 'Mapping is a fantastic cultural project, creating and building the world as much as measuring and describing it…. Analytical research through mapping enables the designer to construct an argument, to embed it within the dominant practices of a rational culture, and ultimately to turn those practices towards more productive and collective ends. In this sense, mapping is not the indiscriminate, blinkered accumulation and endless array of data, but rather an extremely shrewd and tactical enterprise, a practice of relational reasoning that intelligently unfolds new realities out of existing constraints, quantities, facts and conditions' [Corner 1999: 213,251].

Fig. 1: The potentials of Khulna's under-utilised riverfront and railway networks

Maps – as projects in the making – unfold and uncover potentials through their inevitable abstraction, selection and omission of facts. Drawing is a tool to select, compare, combine, analyze and describe tendencies and the latent capacities of the landscape and its relation to urbanization. Mapping is operative in the sense that it reformulates the reading of existing territories and sets the stage for the inauguration of new worlds. The urbanist's gaze and descriptive map-making can be instrumental in clarifying the territories' essence, revealing hidden potential and disclosing conditions for the emergence of new realities. Working between multiple scales allowed for the discovery of potential sites for intervention and where the social needs of the inhabitants could be negotiated within the present process of unbalanced development. Understanding the shifting relationships (smooth and conflictual) between landscape, infrastructure and urbanization became a base for descriptive (landscape) urbanism. The link of various qualities and opportunities of the territory to their typo-morphological settlements were mapped in order to gain insights into the *logics* of development [Shannon 2008a].

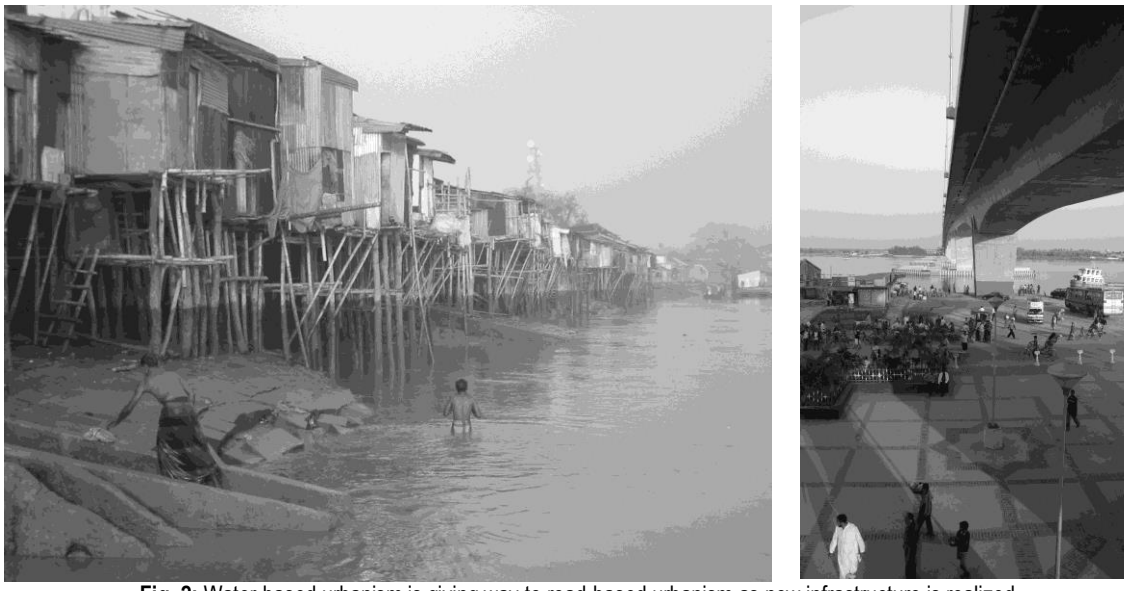


Fig. 2: Water-based urbanism is giving way to road-based urbanism as new infrastructure is realized.

1.1 Existing Spatial Logics of the JKM Region & Khulna

In the Jessore-Khulna-Mongla (JKM) region, urban analysis 'from above' included the layered mapping of the territory [1]. Linear dispersion, a settlement pattern along banks of waterways raised by silt deposits and linked to a long tradition of a productive economy, is the dominant form of (rural) settlement in the area north of the Sundarbans. While the organized dispersal is consistent with the structuring logics of hamlets linked to agricultural production, the contemporary economies of scale and shift from predominantly wet-rice cultivation towards more lucrative aquaculture

is changing the urban/rural concentrations, settlement hierarchies and sizes and structure of plots. As well, there are evident relations of settlement to soil types and the (increasing) extent of coastal saline intrusion, which also determines vegetation patterns and types of agro/aqua-culture production. Nevertheless, the whole of the territory is dramatically under-serviced in terms of infrastructure (basic sanitation, sewerage, drainage, clean water provision and public facilities ('social infrastructure' of education and healthcare facilities).

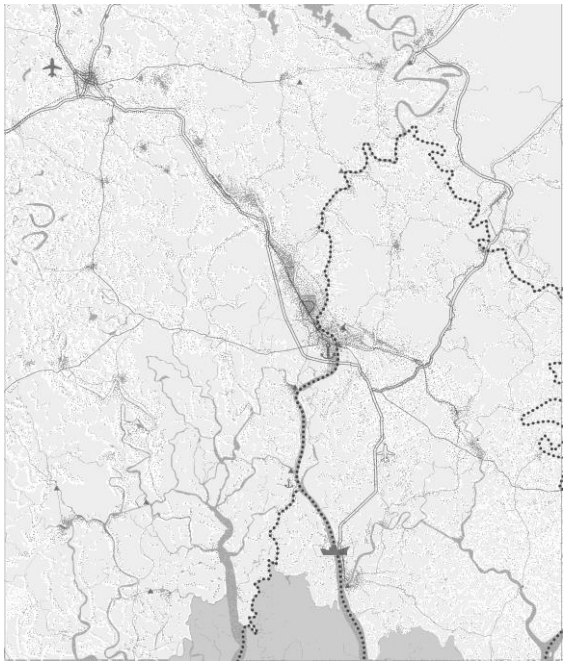


Fig. 3: The Jessore-Khulna-Mongla region and its urbanization pattern.

In the inter-lacing cross channels of the watery mosaic of the region, the slightest differences in topography revealed different settlement morphologies. The lower lands in the mazes of the riverine network serve as productive land. In the more urban agglomerations, the quintessential pattern is a densely vegetated natural or man-made levee on banks of rivers safeguarding habitation from regular flooding events. Khulna serves as an illustration of the region's denser areas. The spatial growth of the city itself is explained by its topography; it developed as a linear city. In pre-colonial times, the settlements occurred on the deposited sediment natural levee (2-4.2m above sea level) of west-side of the Rupsa and Bhairab riverbeds. During the British colonial era, Khulna grew due to its role as a river trading port city with administrative headquarters and market centre. The Jessore Road was an important transport link to the north and the corridor urbanized over time. In 1885, the road was paralleled by an important railway link with Calcutta (which has only recently been restored). Originally Khulna operated as a collection point for hinterland agricultural production (primarily jute, rice, tobacco, sugar cane and more recently shrimp) and natural resources (primarily fish and wood). It was established as a significant industrial base – specializing in jute mills with raw materials supplied from the nearby Sundarbans. The large and prosperous mills were linked to the riverfront and serviced by an extensive railway network. After Partition in 1947, the jute mills flourished under East Pakistani management and housing colonies, schools and social/cultural amenities augmented the progressive mill layouts. Once Bangladesh gained independence in 1971, the mills became state enterprises and slid into a vicious cycle of under-investment, an inability to properly compensate workers, dwindling orders from the world market (as plastic gained in popularity) and strikes. Mill after mill began closing their doors. The city lost its economic driver.

Meanwhile, new infrastructures and programs have located in Khulna. Its urbanized area is rapidly growing due to a rural-urban migration, with a large proportion of the population occupied in informal market activities. The demographic composition of the population is out of balance with a large dependant group of children and few adults, putting high demands on professionally active people. Spatially, the dense core of the city remains bundled along a stretch of 15km between the Rupsa/Bhairab River and the parallel Jessore Road; however, with development of the Bypass Road to the west, both planned and speculative urbanization has begun. The university campus promises to be a new core area and all the plots adjacent to the highway have been sold. At the same time, the water-based urbanism of the city is falling into disrepair and the massive industrial platforms, structures and infrastructural networks are abandoned. The

State remains the owner of a vast amount of property – significant holdings are in the under-utilised rail yards. The city, nonetheless, remains a centre for a largely productive hinterland, a relationship no longer based on the vast network of waterways, but one that is rapidly transforming into a road based system. The logic of the latter not necessarily follows the rules of the hydrology and topography that are inherent to the former.

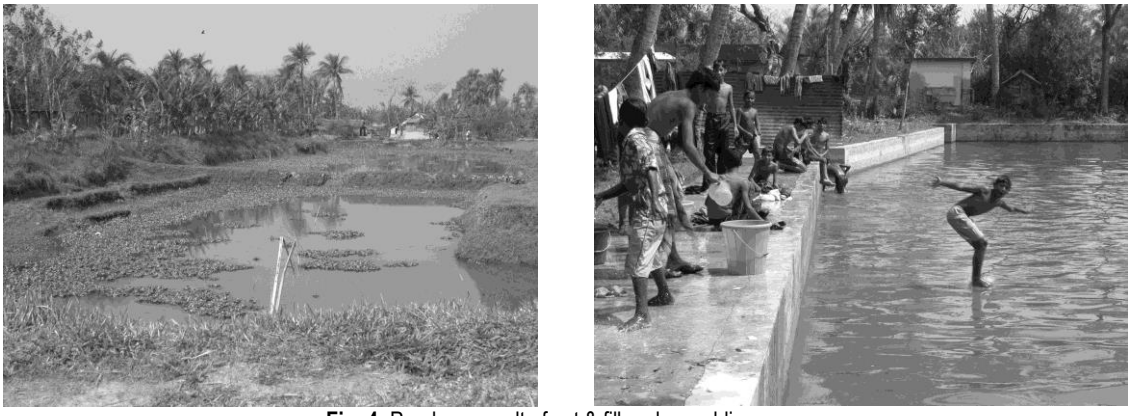


Fig. 4: Ponds as result of cut & fill and as public space.

Urban and rural areas alike are the result of a subtle and fragile balance between water and land, permeable and impermeable surfaces, organized by the necessary hydraulic territorial systems for water management and soil stabilization. Levels of inundation determine distinct land uses and therefore the definition of wet/dry, productive/inhabited, safe/unsafe component parts of the land mosaic are essential. In a land where the difference of a few centimetres creates completely diverse conditions, the primitive manipulation of topography becomes a powerful tool. The village mound, *dibi,* and low-lying marshy depressions, *beels* [Novak 1993:24,27] and *tanks*, geometrically defined ponds, are often the result of a cut-and-fill operation. Artificial high grounds are created as 'safe' lands for habitation, while resultant water retention ponds also serve as centres of public life and daily domestic routines of drinking, bathing and washing. Beels and tanks are also used for irrigation and fishing. However, whereas *beels* are often dry in the winter and expand to fresh water lagoons in the monsoon season, *tanks* are explicitly designed to collect rain waters for use in the dry season. Pump wells are often located on their perimeter, accentuating their function as centres of social gathering.

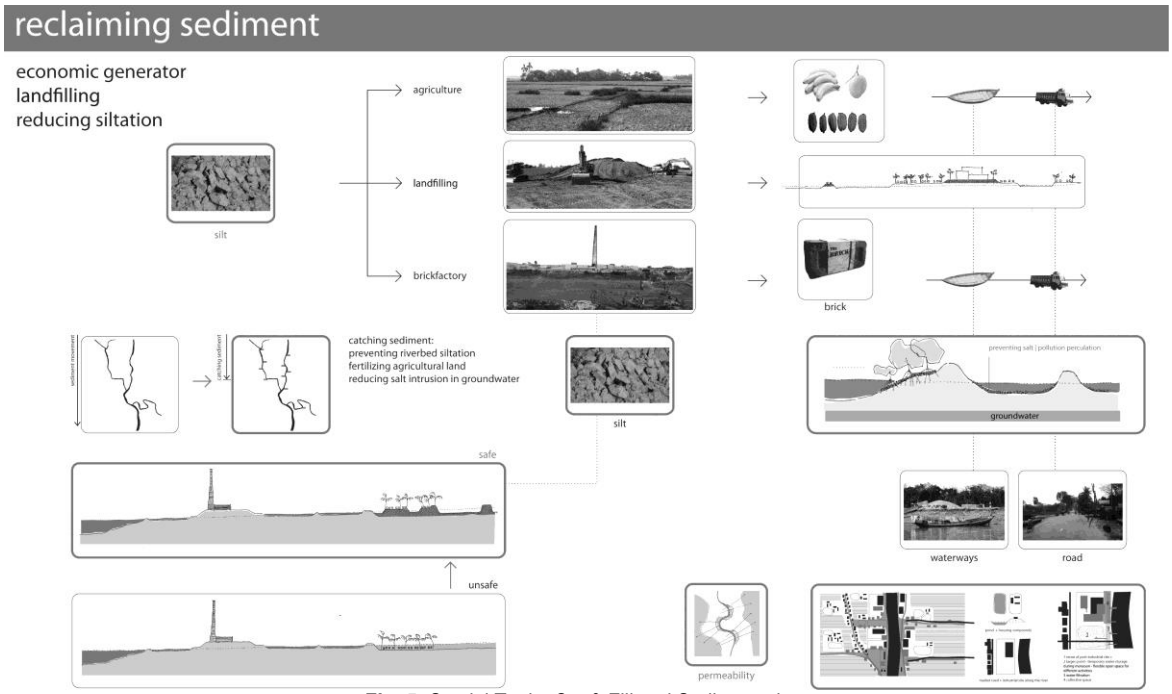


Fig. 5: Spatial Tools: Cut & Fill and Sedimentation.

Another tool that perhaps warrants reconsideration in the city-building process is that of sediment reclamation. As Ashraf has stated, there is a constant remoulding of the nation's territory as 'the land, formed primarily by silt deposits, is constantly shaped and reshaped by rivers, which themselves are constantly shifting and changing' [Ashraf 1997:9]. The harnessing of the dynamic natural process is employed by brick factories which are situated in the optimal flow of clay sediment. The irrigation system too profits from the over-flow of nutrient rich sedimentation for natural fertilization of agricultural fields. Well-placed spatial interventions could develop the logics of the natural process further – thus 'naturally' creating higher ground of a re-moulded topography.

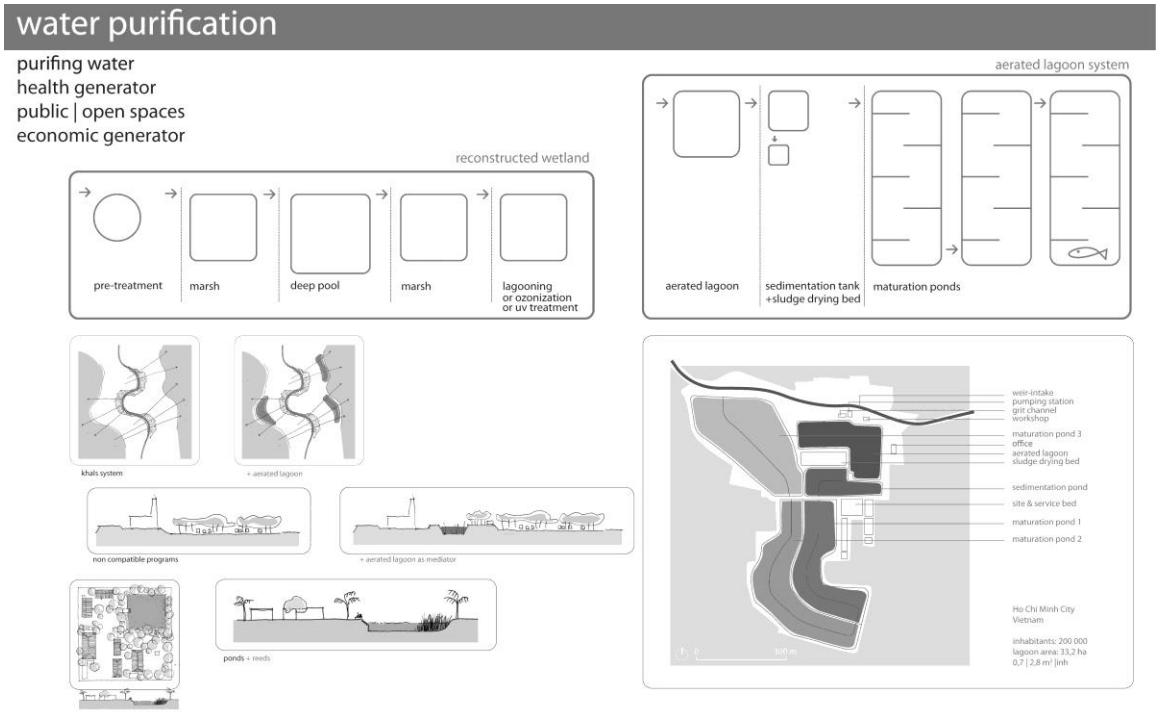


Fig. 6: Spatial Tools: Water Purification.

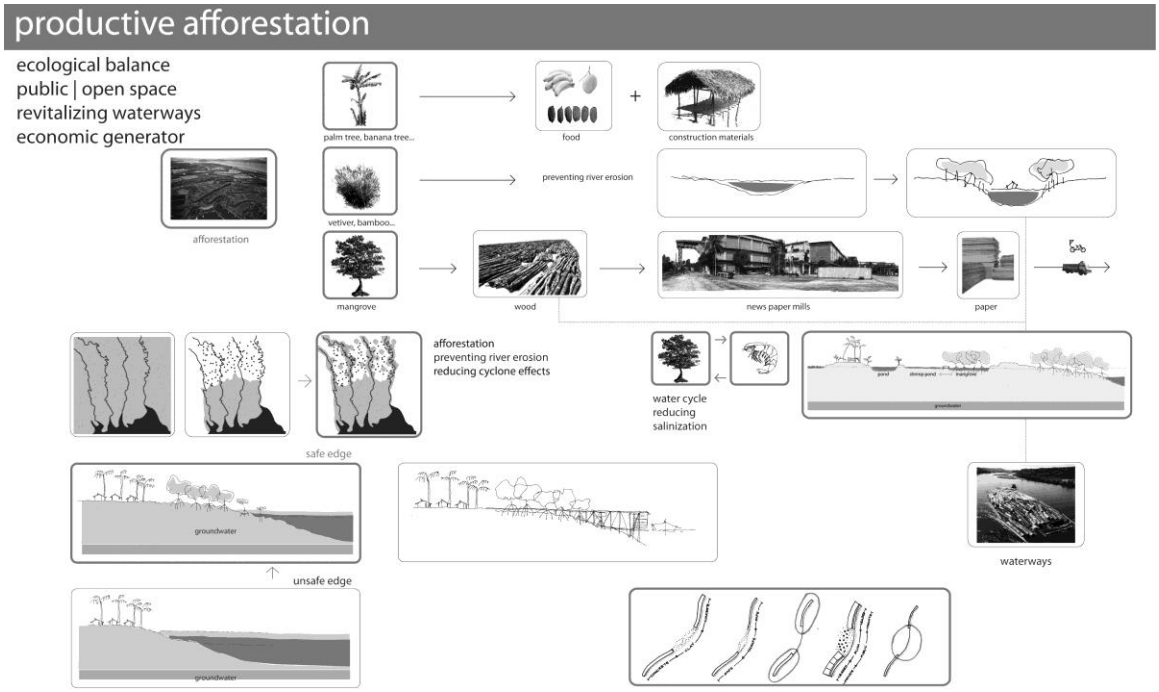


Fig. 7: Spatial Tools: Afforestation.

Two tools that were researched for their potential to work across scales, guide urbanization and address fundamental environmental problems were those of water purification and afforestation. It is paradoxical that the nation with perhaps more water in the world has severe shortcoming with regards to potable water. The constructed wetlands and aerated lagoons prove interesting not only for their low-cost, natural and maintenance-free, but also their capacity to act as land banks and open spaces that off-set urbanization and can be designed to be elements of an enlargened civic space. Afforestation was envisioned as an important strategic project for the environmental protection of the southern part of the country and was justified by the May 2008 announcement of a national programme of planting 100 million trees as a 'natural fence' along the coast to mitigate disasters [AFP 2008]. The afforestation could be coupled with the concept of 'social forestry' whereby unused and fallow land is planted, maintained and harvested by the common man with economic returns profiting the community participation in the management of natural resources. In particular 'extension forestry' – where plating alongside canals, roads and railways – was viewed to be interesting in order to not only improve ecology, but also beautify areas, create economies and eventually lead to a green network of an expanded public realm. Strategic sites could as well host a series of touristic and research-oriented programs.

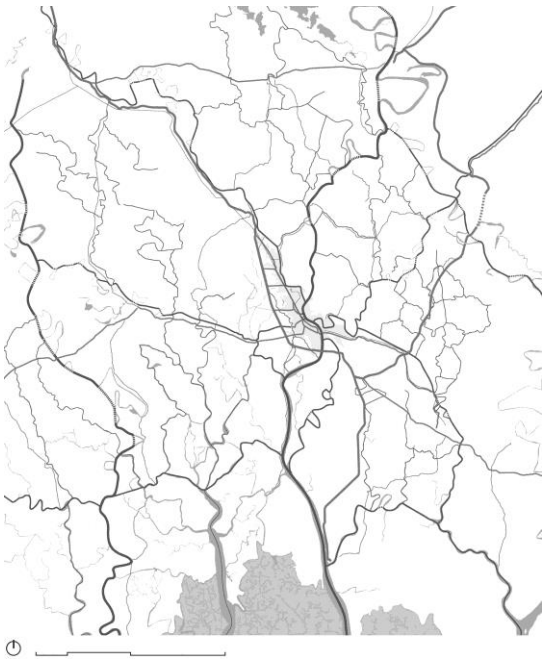


Fig. 8: JKM 'conduits'.

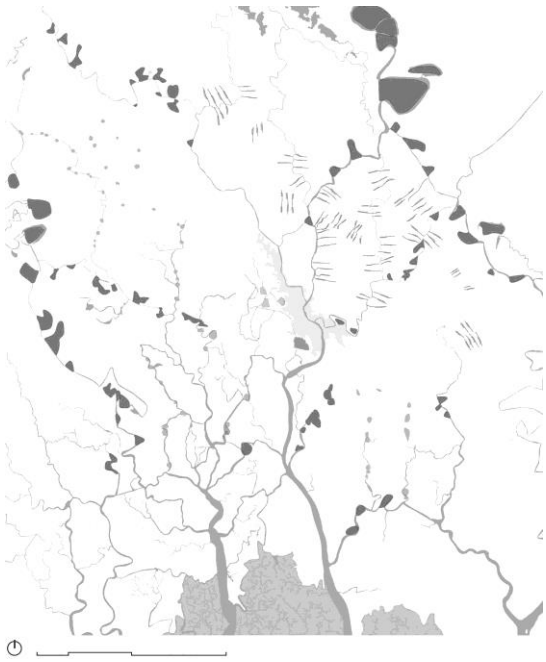


Fig. 9: JKM 'feeders'.

1.2 Territorial [Re] Structuring

The mapping of the territory and design tools research led to restructuring the JKM region and Khulna to work more with the inherent dynamics of a delta landscape. The deltaic region's envisioned transformation is conceptualized through four primary interventions: conduits, feeders, insulators and transformers. (use figs 8-11 near here) 'Conduits' are transport corridors. Interventions aim to re-assert water-based transport as a desirable and fully functional complement to road-based transport. The existing water hierarchy is rationalized and optimized to emphasize routes which re-enforce two primary corridors of interdependency between productive hinterland and major processing and export hubs – Mongla Port, Khulna and Jessore Airport. Shrimp production, for example, could re-align itself to water conduits, allowing live transport of fresh shrimp to export processing zones. 'Feeders' are productive, storage and cleaning water bodies. An underlying basis of interventions is the provision of various reservoirs, fishing ponds, water treatment and irrigation systems. Responding to a manifest drinking water problem, feeders aim to separate uses of the numerous ponds in the territory, providing an alternative to the arsenic-polluted groundwater wells, and clear systems for drainage and irrigation needs. The added benefit is the open space gained for often overcrowded settlements and the social life that comes along with the ponds. 'Insulators' re-establish the territory's inherent ecology. Interventions build upon existing programmes of afforestation to prevent river erosion, to rebalance water salinity and to increase food production. Insulator intervention would be guided through a priority of planning within the Sundarbans and northwards along the two strongly defined north-south water conduits. Mangrove afforestation is a necessary insulator for the delta landscape and could operate in a linear way along major waterways, leaving the more inland patches free for agricultural production. 'Transformers' are various types of public programmes (schools, clinics,

mosques) that the under-serviced territory requires. Based on a cut-and-fill principle, they are coupled with water treatment systems and located on new high-land. These public programmes vary in scale according to existing and desired inhabitation densities. With these interventions in place, urbanization (or de-urbanization) is guided by the conditions created by conduits, feeders, insulators and transformers. Over-time, larger areas for agriculture at a new economy of scales will evolve as the dispersed systems would be implicitly re-organized.

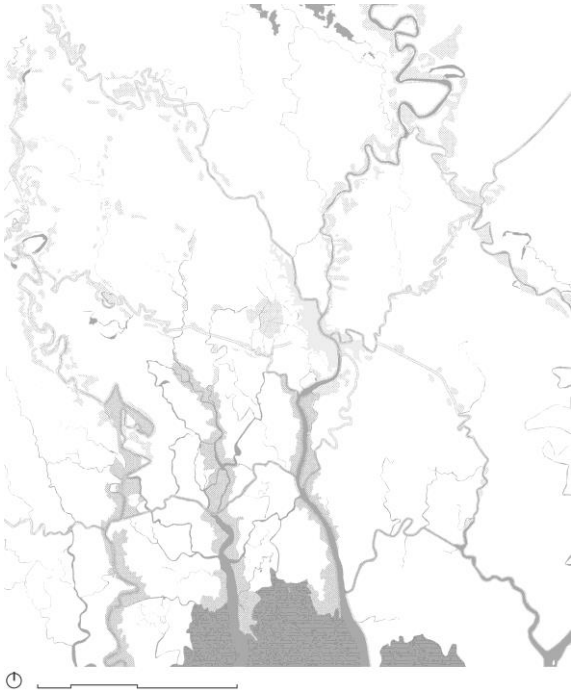


Fig. 10: JKM 'insulators'.

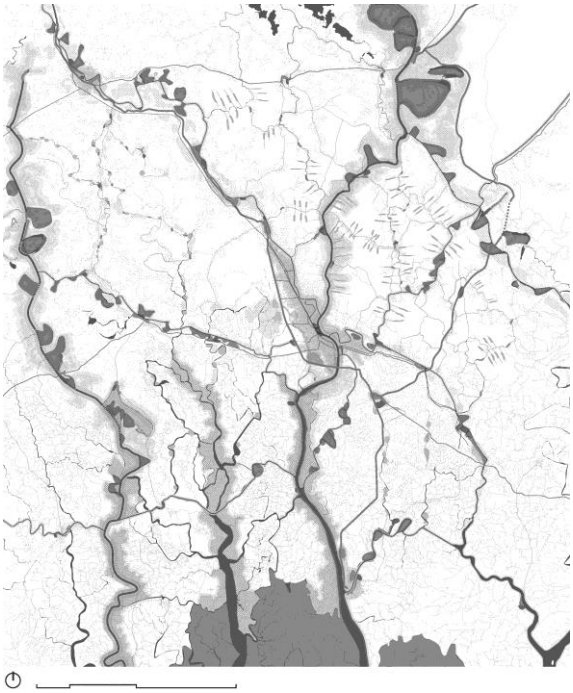


Fig. 11: JKM possible spatial future.

The same four layers from the JKM scale are developed at the Khulna city scale. Water 'conduits' are stressed near the western and eastern city edges – counterbalancing the new highway and providing connections from the productive hinterland. This allows farmers to transport efficiently and cheaply his goods to Khulna. As well, various water channels are re-instated, creating a logical drainage system for the city. In terms of roads, the network's missing links are completed – particularly connecting the city to the new highway by a series of east-west transversals. Special design attention is given to selected intersections where the transfer between road and water – in both directions – can be facilitated. 'Feeders' are strung along the new water conduits. Reservoirs and fishing areas are more peripherally located while water treatment is developed at both the city-wide and various neighbourhood scales. A large reconstructed wetland is created in the southern part of the city, working as a final cleaning mechanism before water is released back into the Rupsa-Bhairab River. Insulators are primarily located along the Rupsa-Bhairab River re-establishes the territory's inherent ecology. Within the city, social forestry creates micro-climates, provides new economies, creates transitions from water conduits to settlement areas and provides recreational spaces. 'Transformers' are strategically inserted into the fabric where most needed. They are also placed in water / road or water / water conduit intersections in order to induce urbanization, up-grading and densification.

1.3 Mapping Urban Tissues

The major structuring elements of the cities and landscapes are relatively easy to map and even project anew whereas understanding the urban fabric – the often uncelebrated (predominantly residential) infill – is more complex. However, it can be argued that the anonymous fabric is at least as significant in defining the character and culture of any given territory as are the larger structures. To further understand Khulna, a 1969 method of fabric analysis – by Caminos, Turner and Steffian of Massachusetts Institute of Technology [2] – was revisited. The systematic representation of 400x400m sample tissues revealed the correlation between various settlements, their topographic and socio-cultural contexts. The creation of the sample squares often literally included the putting on the map elements un-recognized, not officially mapped and documented. The compilation of an urban tissue atlas of sorts facilitates comparative analysis and remains a useful testament to the variety and richness of settlement morphologies. Admittedly, the danger

of such analysis lies in the ease to which it can become highly mechanistic. However, if well-balanced, it can reveal the inner-workings and provide a materiality to Khulna and its neighbourhoods.

Fig. 12: Khulna possible spatial future.

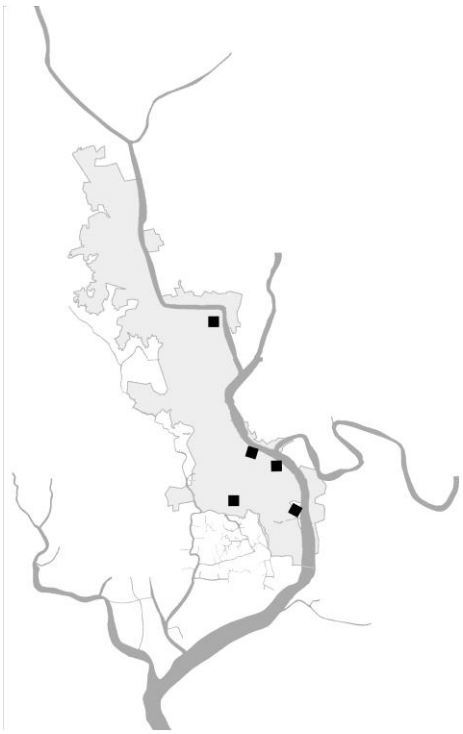


Fig. 13: Khulna's sample urban tissues.

In Khulna, five extremely contrasting fabrics were mapped. 'Bara Bazar' – the original area of settlement in Khulna – is the super-dense, primarily wholesale and storage area sandwiched between the main vehicular road (Jessore Road) and the Rupsa and Bhairab River. Narrow streets are appropriated by street vendors and the relation to the river is purely pragmatic – a backside for loading goods. The Rupsa slum, located in a lowland, is similar in terms of ground cover, but not nearly as dense – consisting of low-rise katcha (temporary structures) and timber industries perpendicular to the river; the sample fabric also hosts a gated housing community for Christians. Khalishpur, in the city's former economic heart, along the river, hosts a number of jute mills on government property (the analysed area includes one of the few working mills – Crescent Jute Mill). There is informal appropriation by slum dwellers on the non-gated areas of the neighbourhood. In Nirala/Bagmara there is an apparent spatial collision of very different grains and tissues. The southern fringe of the city was once low-lands and marshes; in the 1990s, part of the area has been reclaimed for planned, upper-middle class housing 'colonies' of 3-5 floors (Nirala) by the Khulna Development Authority. Surrounding the new development is Bagmara, an informal housing area of semi-permanent or temporary housing structures with predominately rural typologies. Clusters small grain housing are incrementally developed and nestled amongst dense vegetation and small water bodies. Finally, a tissue of the colonial fabric was analyzed. It represents the oldest planned residential area of the city and is typical of a British garden city colonial settlement. Today, the area is clearly a high-class neighbourhood; the streets are wide, tree-lined, in good condition, unoccupied by hawkers, have proper drainage (some of them even footpaths) and there are no retail shops at the roadside. The result is that they're only used for through-traffic and are rather empty in comparison with other streets in Khulna. In some parts of the area (mainly along the river side, with personal ghats), high-class officers reside (judges, district commissioners, etc.), but most of the buildings are used for administrative and governmental functions (court, jail, Sundarbans Forest info-centre, etc.). There was additional analysis completed which made more visible the invisible structuring logic of different settlement patterns. For instance, a highland/lowland comparison between the tissue of Rupsa and Nirala confirms that the low economic classes are often left to the most vulnerable and fragile ecologies. Land-filling is an expensive undertaking and larger-footprint, formal housing develops, while the marshy, unhygienic lowlands become illegally appropriated by the poor. As well, real and perceived, explicit and implicit boundaries of Rupsa and Colonial sample tissues revealed that the visual and physical fragmentation of the fabric by gates, fences and walls is complemented by unseen divisions of religion, social groups, etc.

Fig. 14: Khulna's sample urban tissues: figure/ground and inverse figure/ground.

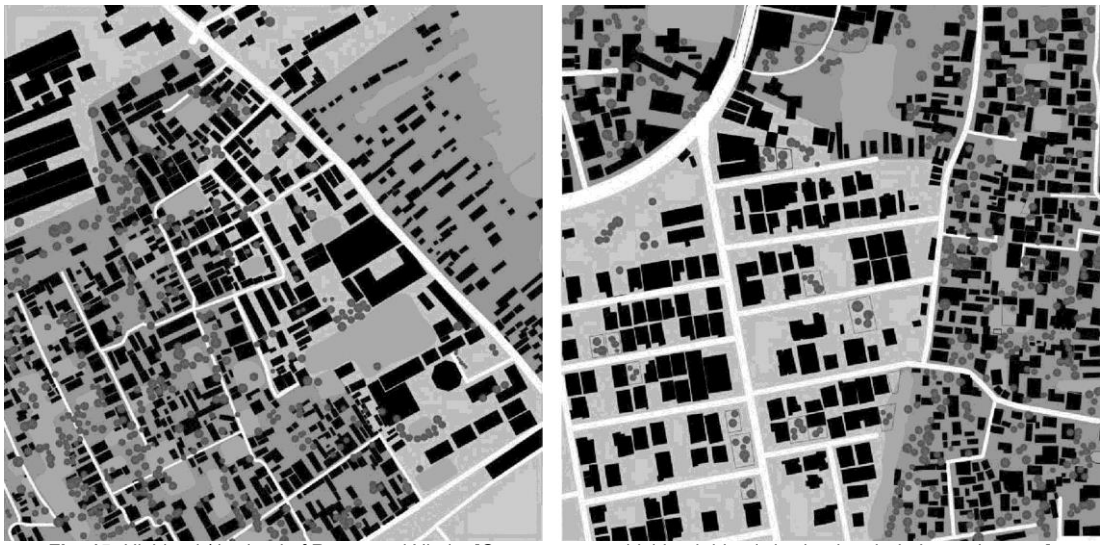


Fig. 15: Highland / lowland of Rupsa and Nirala. [Grey represents highland; blue is lowland and dark grey is water].

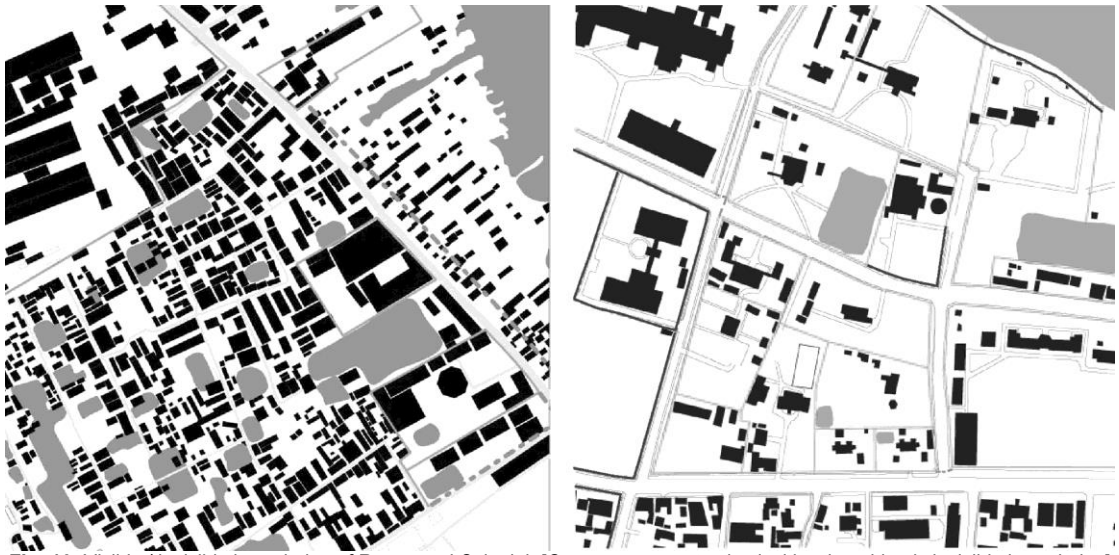


Fig. 16: Visible / invisible boundaries of Rupsa and Colonial. [Orange represents physical borders; blue is invisible boundaries]

2. Designing R-urban Tissues

The creation of new tissues followed the understanding of the existing logics. In Khulna, the railway yard is the biggest open area in the centre of the city, a key location close to Bara Bazar and at the confluence of four 'conduits': road, river, rail and waste. While the land has been underutilized since the decline of the major industries along the water, several illegal have settlements sprouted up between stretches of marshland, railtracks and abandoned factories. Recently, planning agencies have begun to acknowledge the potential of the centrally located site, as shown in the often contradictory plans by both the Khulna Development Agency as well as the State Railway Department.

Fig. 17: Possible spatial future for Khulna's rail-yards.

In the development of a strategic project, the non-operative railway yard is turned into an operative water infrastructure. Aerated lagoons are designed to clean water, conserve the railway infrastructure and create open public areas which connect the city with the riverfront. The riverfront is transformed to provide place for new urban development. New urbanity is structured to alternate with productive river-edges where sedimentation can be caught. To service the settlements in-between the rails, productive afforestation patches and civic amenities on new high-land are developed along the trajectory of the water treatment facility. Accessibility to the site is improved via new road conduits and the new transformer of the passenger train/bus terminal. The proposed productive landscape and infrastructure guide the nature of the urbanization between the rails, going from more rural patches to the city's new development hot spot.

Fig. 18: Possible densification along urban periphery highway.

In the peri-urban periphery of Khulna, strategies of densification are developed in order to counter rural-urban migration. The new r-urban tissue aims to strengthen the sustainability of rural settlements along water and/or road infrastructure lines by providing social infrastructure , water purification (constructed wetlands and aerated lagoons) and public space which guides new urbanization. Water storage and irrigation systems are used to catch silt and sand, respectively to fertilize agricultural land and shape topography. By re-moulding topographic conditions, the design provides higher (safer) spaces: transformers equipped with civic amenities that re-define open spaces for water.

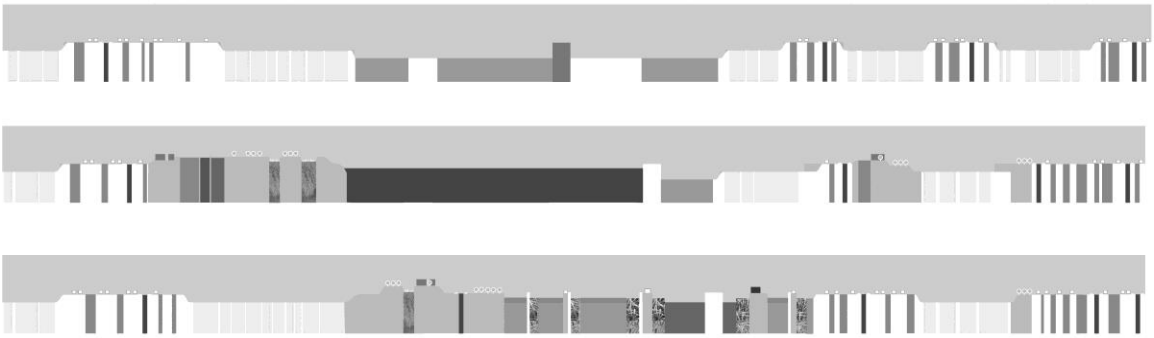
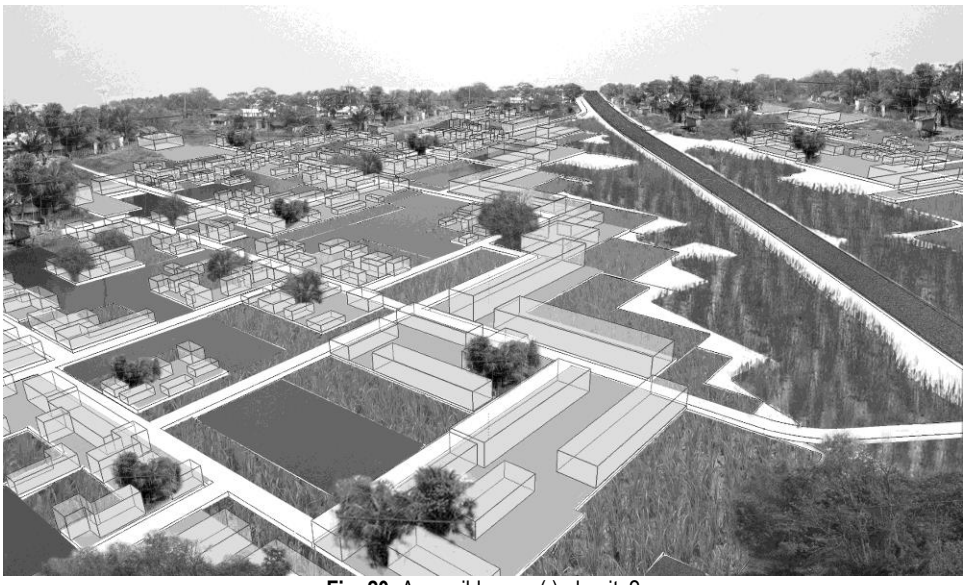


Fig. 19: Manipulation of topography as primary tool.

3. Bending, Not Breaking

The Jessore-Khulna-Mongla region's deep state of uncertainty is reflective of the larger notion of co-existence of permanence/impermanence, safe/unsafe in Bangladesh's deltaic landscape. The forces of the delta require innovative ways of understanding and designing the dynamic condition. New interpretative mapping and projective cartographies need replace master plans – with their unremitting tendency towards over-determined and functional zoning. The radical shift from a water-based towards a capital-intensive road-based urbanism need be seriously questioned. Basic sanitation remains a pressing need and the priorities of investments can be inclusive of new development sites and innovative economies, while also addressing more mundane concerns. Following an understanding of Southwest Bangladesh's interdependencies of landscape, infrastructure and urbanism, it is possible to project new relationships. Through a dynamic interplay of urban visions and strategic projects – designs can then make realistic, yet radical, amendments to the region's project mode – which in its orientation towards the liberal private market has seemingly forgotten to provide public services to the majority of its inhabitants. Design can overcome antitheses that are insolvable in non-spatial terms (political claims, social programmes, etc.). Bangladesh, in general, and the JKM region, in particular, has an opportunity to subtly re-mould its topography in order to increase the territory's resilience – allowing its structures to bend but not break in the wake of ever-more urbanization and natural calamities.



Fig, 20: A possible new (r)urbanity?

Notes

[1] All drawings / design proposals are from the KU Leuven Khulna Studio and Khulna theses projects. The studio was guided by Kelly Shannon and Ward Verbakel and with Bruno De Meulder, André Loeckx, Paola Viganò, Bernardo Secchi, Jörg Retkikke, Antje Stokman and Viviana D'Auria as jurors. Students in the course were: Sahdia Khan (Belgium), Makarand Salunke (India), Devangi Ramakrishnan (India), Tin Meylemans (Belgium), Wim Wambecq (Belgium), Karen Landuyt (Belgium) Sabina Favaro (Italy). Additional students who joined the fieldwork were: Piet Kiekens (Belgium), Anna Cornelis (Belgium), Elshima Mustafa Awad Elkarim (Sudan), Casmil Ntobangi Musobi (Tanzania), Barbara Roosen (Belgium) and Sephania Solomon (Tanzania). Work is also cited from two theses: first master's theses by Phebe Dudek and Evelyne Van Houtte (guided by Kelly Shannon and Bruno De Meulder) and a European Masters of Urbanism thesis by Sabina Favaro (guided by Kelly Shannon and Paola Viganò). The studio is grateful for the collaboration with Jörg Retkikke and his landscape students at the University of Wageningen (The Netherlands) and support from BUET and CUS in Dhaka, KDA and Khulna University in Khulna.

[2] Urban Dwelling Environments, published in 1969 by MIT Press aimed '1) to dramatize the correlation between settlements and the geographic and cultural context ... 2) to illustrate various levels and aspects of the physical environment 3) to compare and contract different 'products' and their relationship to effective demands 4) to find a framework for a more comprehensive approach to settlement development and design'. The authors sought 'to better understand the relationship between people and their dwelling places in the context of rapid social change.' And for them, 'analyses are no more than catalysts for leading questions about the relationships between socioeconomic contexts, housing demands and environmental products and no more than raw material for the formulation of hypotheses [Caminos et. Al 1969: v,vi].

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