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abstract

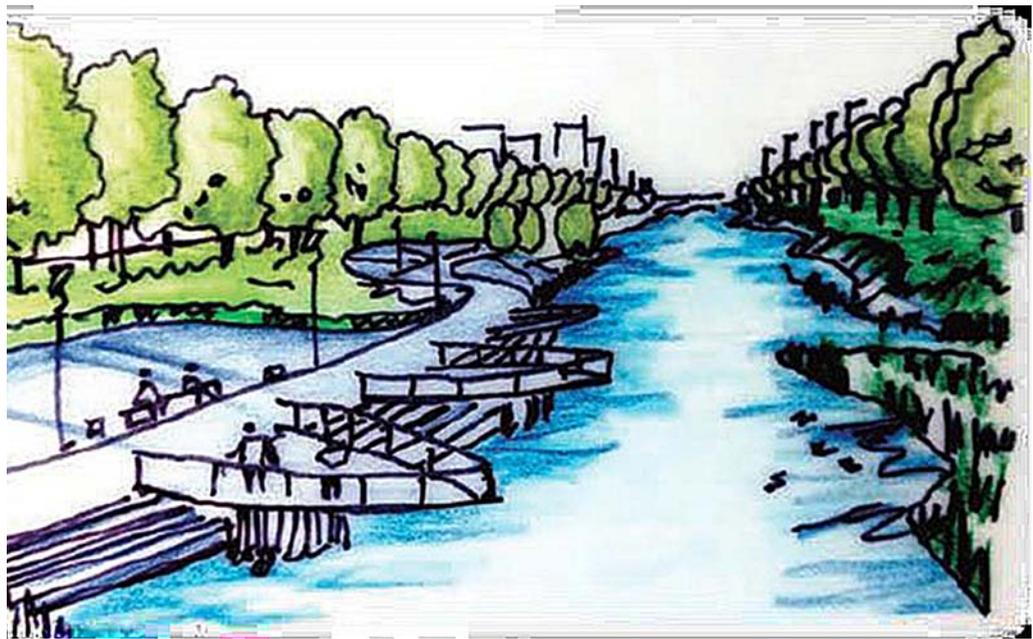
Canal-Oriented Development: Integrating an urban canal front with the city

Soumyadeep Dutta, Sanghamitra Sarkar

Abstract

Water like food is an indispensable resource which is essential for our daily existence. The construction of canals was motivated by the wide range of activities it can perform, ranging from irrigation, storm-water management, transportation to sewage disposal. Apart from these, canals also served in keeping the micro climate in check while giving a pleasant aesthetic appeal to the area.

India has had an extensive canal network most of which were laid by the British for their own benefit. However, post-independence with rapid urbanization over time these canals have not only lost their identity but also the purpose for which it was built. Most of them lie neglected, choked with effluents that are hazardous for human health. The



situation is only worsening as the country is facing more and more shortage of clean water. This paper is an attempt towards understanding the need for integrating an urban canal front with the city to increase the vitality of the surrounding areas and generate utilitarian public spaces alongside safeguarding the urban environment. A study on Urban Acupuncture, a relatively modern concept in conjunction to Canal-Oriented Development facilitates in the assemblage of diverse interpretations pertaining to the implementation of design ideas at site level. Owing to its small scale, budget friendly localized interventions urban acupuncture plays a decisive role in addressing the minuscule yet substantial issues concerning the canal precincts. An overview of Beliaghata Canal has been discussed to further the discussion on integrating an urban canal front with the urban fabric incorporating urban acupuncture with respect to local context..

KEYWORDS:

Canal-Oriented Development, Revive, Restore, Urban acupuncture, Urban canal front.

Sviluppo canal-oriented: integrare i canali urbani con la città

L'acqua come il cibo è una risorsa indispensabile alla nostra esistenza quotidiana. La realizzazione di canali è dovuta dall'ampia attività legate all'acqua, dall'irrigazione, alla gestione delle piogge, al trasporto allo smaltimento delle acque reflue, oltre al controllo del microclima e del paesaggio.

L'India ha una vasta rete di canali, la maggior parte dei quali è realizzata dagli inglesi. Tuttavia, la rapida urbanizzazione successiva all'indipendenza ha danneggiato la loro identità e funzionalità. La maggior parte viene trascurata, anche a danno delle popolazioni. La situazione sta oggi peggiorando causa della progressiva penuria di acqua pulita. Questo contributo è un tentativo di comprendere la necessità di integrare canali urbani con la città per aumentare la vitalità delle aree circostanti, generare spazi pubblici e salvaguardare l'ambiente cittadino.

Uno studio sull'agopuntura urbana, un concetto relativamente moderno in combinazione con lo sviluppo *canal-oriented*, mette a sistema diverse interpretazioni relative al design a scala locale. Gli interventi localizzati e a basso costo dell'agopuntura urbana sono fondamentali per affrontare le questioni sostanziali riguardanti il canali. È stata proposta una panoramica del canale di Beliaghata per studiare l'integrazione del canale con il tessuto urbano, indirizzando l'agopuntura urbana verso il contesto locale.

PAROLE CHIAVE:

Sviluppo canal-oriented, Rigenerare, Recuperare, Agopuntura urbana, canale urbano.

Canal-Oriented Development: Integrating an urban canal front with the city

Soumyadeep Dutta, Sanghamitra Sarkar

1. Introduction

1.1 Canal – its emergence and types

A canal is an artificial waterway. The word “canal” origins from the Old French word chanel, which means “channel.” Sometimes it is also known as navigation (Ellin, 2010).

Canals, during ancient times were often used to shorten routes between two points. Now, with advent of modern technologies and innovative design solutions, canals are constructed for irrigation, inland water transport and also in transportation of global commerce. Utility of canals cannot be limited to its key functions but needs more encyclopedic insight into the diversified domain it encompasses. Carrying storm water in case of heavy rains thereby protecting the immediate vicinity from flooding, having a direct impact on the micro-climate of the area, providing the public with a much-needed visual comfort, balancing the ecology and preventing pollution levels are some of the key uses of canals. These have been subdivided into various types depending on certain parameters. These are enlisted in table below:

Tab. 1: Types of Canals based on different parameters. (Source: <https://civiltoday.com/water-resource-engineering/open-channel/265-what-is-a-canal-types-of-canals>)

SL.NO	PARAMETER	TYPES OF CANAL
1	Based on USAGE	• Aqueducts
		• Waterways
2	Based on DISCHARGE	• Main canal
		• Branch canal
		• Major distributary
		• Minor distributary
		• Watercourse or field channel
3	Based on PROVIDER	• Unlined canals
		• Lined canal
4	Based on ALIGNMENT	• Contour canal
		• Watershed canal
		• Side slope canal

The inter-relationship between canal and city can be attributed to various facets studied below.

1.2 Canal and the city

Relationship of canal and city is harmonious pertaining to multi-dimensional behavioural pattern yielding mutual benefits. Both bear a symbiotic congenial existence which can be seen in terms of functional and physical characteristics. Canals are an integral part of innumerable cities around the world. Evolution of the city has direct impact on canal system. In some cities like Stockholm, Amsterdam, Bruges and Bangkok canals serve as lifeline to the city's water system. In addition to inland water transport and border security, canals bestow a unique urban character reinforcing imageability of the place.

The impact of globalization poses major challenge in maintaining a constant balance between canal and city. Reviving the defunct canals to its past glory is laced with various impediments and needs a collaborative approach involving stakeholders, policy makers and local community.

The other challenges of development along areas near canal especially in cities are as follows:

- Community's openness to the canal,
- Municipality's and Water Agency's commitment to assisting development around the canal,
- Flexibility of building codes and regulations as it pertains to mixed-use development,
- Financing assistance and flexibility; and the degree to which district design standards, planning guidelines, and planned public investments create walkable environments.

The above discussion leads to concept of canal-oriented development as a tool for reviving cities.

1.3 Canal-oriented development (COD)

Canal-oriented development (COD) is a placemaking concept that aims to create mixed use developments along canal banks using image and utility of the waterfront as a natural attraction for social and economic activity. COD has the potential for landlocked cities, which are lacking a traditional harbour, to pursue waterfront development (Buckman, 2016). The major advantage of COD is that it provides the luxury to develop numerous sites along the area it drains. In case of harbour front the number is restricted to one. There can be distinctive zones based on activity and size along the trail based on the sense of place driven by water sensitivity. Creation of functional districts with sustainable built environment, can go a long way in setting vibrant and inclusive neighbourhood and public spaces.

The canals have been built or constructed for some specific purposes aiding COD, which are enlisted below:

- Transportation of goods.

- Recreational and tourism purposes.
- Inland water transport – to commute passengers.
- Sustain the ecological balance.
- Intermixing of socio-cultural zones.
- Providing a perfect harmonising backdrop for building sites.
- Bolster local economy for the people of the vicinity.
- Control rising water levels if properly maintained.

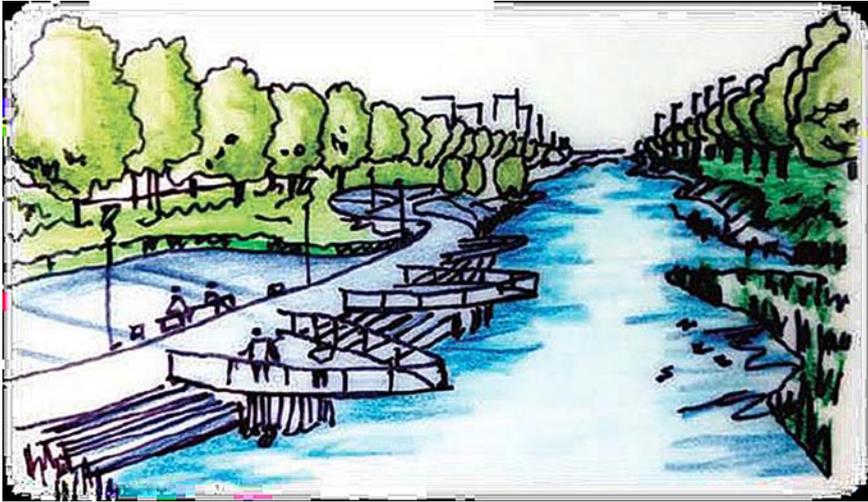


Fig. 1: An artist impression of a typical canal front development (Source: Author's illustration)

1.3.1 The concept of Urban Acupuncture

Manuel de Sola Morales (architect and urbanist from Barcelona) first coined the term which was recently advocated by Finnish architect Marco Casagrande. Essentially urban acupuncture is an amalgamation of urban design with traditional Chinese medical theories of acupuncture. It offers an interesting theoretical view into another dimension of our cities – how they are not merely conglomerations of buildings, spaces, streets, and people (Lerner, 2014), but “complex energy organisms” with overlapping flows of “qi”, energy that can be tapped, manipulated, or repaired (Casagrande, 2013).

Large scale urban renewable techniques that involve conventional rudimentary forms is more time consuming and chaotic. Thus, urban acupuncture focuses on instantaneous result-oriented schemes for neighbourhood. Urban acupuncture focuses on local resources rather than capital-intensive municipal programs and promotes the idea of citizens installing and caring for interventions (West, 2011). They are not restricted to localized needs but also operate on a city-wide scale converging at pivotal nodes. The revitalization of the whole (city) can be achieved by the management and healing of the consisting parts (sensitive points).

Enlisted below are few characteristics which help in defining urban acupuncture:

- a stepwise approach,
- contextualized solutions,
- no long-term obligations,
- high reward potential at low investment and risk,
- politically and economically beneficial,
- expansion of social assets and synergic alliance.

By fixating its attention towards minute, profound, bottom-up mediations that mobilizes community energy in productive ways to alleviate urban blight and revamp cityscape, urban acupuncture has made it possible to develop an eye for details with unrestrained artistry and flexibility. It is more of a people-centric planning process where each person has the privilege to adopt city space and evolve his physical setting according to

his intent. Urban acupuncture can also be acknowledged as a design tool where expeditious directions assist to conceive urban development. The community gardens and urban farms of Taipei are an excellent instance where urban acupuncture has been successfully adopted to renew the city with low cost small scale localized projects.

1.3.2 Incorporating Urban Acupuncture in Canal Oriented Development

Canals constitute as the quintessential component to the natural structure of the city fabric. On further analysis, few key similarities can be found between Urban Acupuncture and COD. Both aim at participatory planning involving community engagement and improving economy. The focal point in the integration of urban acupuncture with COD is creation of vibrant, attractive and sustainable places at local context. Urban acupuncture areas in case of water urbanism include underground stormwater reservoirs and plays a vital role in flood relief by acting as a sponge and bio-filters. Pollution control is also possible using this process. Development of the canal precincts is not the sole criteria but a holistic approach encompassing multiple interventions from removal of blighted areas to determination of sensitive points.

In case of COD, urban acupuncture can be used to prescribe small-scale interventions to maximize the functional effect of a social catalyst. COD projects being long term with limited resources and budgetary constraints needs the pinpointed approach that operates in a phased manner. Although there are no predefined path or process for pursuing urban acupuncture while developing canals, few strategies can be inferred from the theories of pioneers and authenticated literary sources. Individual strategies for built spaces for implementation of regenerative and impactful water management practices include rain grading and rain tanks. In case of points near the vicinity of the canal methods like parkway basins, infiltration trenches, permeable pavement and maintaining healthy soil can contribute a great deal in the embodiment of urban acupuncture. Spaces that are leftover or lying vacant or abandoned can also be considered for small scale remediation. Urban acupuncture is more process-oriented than design-oriented. It recognizes the socio-spatial relations within the urban fabric. The local and context-based approach not only reinvigorates public spaces but also raises political consciousness enhancing quality of life and resources.

Canals in Kolkata have been existing even before British rule. These were built for specific purposes like transportation and security. The British later refined the art of constructing canals with highly sound engineering techniques. The fact that it remained the capital from 1772-1911 implied a well-knit network of water transport system.

1.4 Canals of Kolkata

The city of Kolkata is often described as 'triple-blessed': possessing a river for drinking water, another to dispose of waste, and the wetlands between to treat its sewage and produce its food. Today, urban development trajectories of the city have increa-

singly placed the East Kolkata Wetlands (EKW) at risk (Banerjee & Chowdhury, 2012). The canal system was a multipurpose waterway system in the Lower Gangetic Basin. It played a major role for movement of agricultural products, irrigation and provided vital nutrients to the 'bheries (Chattopadhyay, 1990) in the EKW. It has also played a role as carriers of the city's refuse into Bidhyadhari - Kulti River System. It has led to gradual development of urban environment of Kolkata, replete with slums, which occupy its banks (Bandhyopadhyay, 1989).

Kolkata has witnessed transformations in drainage pattern and flow of water in canals over the years. The system of canals throughout the city gave definitive advantages in terms of functionality and characteristics. Originally, the extents of the city were between Circular Canal in the north and Tolly Nala in the south. Tolly Nala also known as "Adi Ganga," was used as pilgrimage route and as a source of irrigation. Gradually with urbanization more canals were added to the system. Bagjola canal and Eastern canal essentially served as transportation routes but were later redundant.

1.5 A chronological look into the emergence of canal system in Kolkata

- 1775-1777, Major William Tolly of the East India Company canalized the Adi Ganga from Hugli at Hastings to Garia. The canal officially opened to traffic from 1777.
- The result the headwaters of Bidhyadhari was diverted and siltation increased in the lower reaches.
- The eastern canal, a shallow channel partly dry at low water, extended from Dhapa along Salt Water Lake to Chadpal Ghat on the Bhagirathi (Hooghly, today) across Entally, Circular Road and Creek Row.
- Choking of the canal from Circular Road to Chadpal Ghat in 1800 led to excavation of Circular canal in 1810. It provided alternative approach to Calcutta for boats coming from the East. It helped to improve, widen, and lengthen the existing canal westward.
- 1821, Mr. Schalch, Deputy Assistant Quarter Master General stressed on need to relieve pressure on Tolly's Nala and proposed extension of Beliaghata canal.
- Circular Canal was excavated in 1831.
- The Government opened the canal for traffic on 10th August, 1881.
- Construction of the artificial canal as Calcutta storm water and sewage, was undertaken and discharged into Eastern Canals below Dhapa.
- Tolly Nala and circular canal were linked.
- To eliminate the longer route, a much shorter Krishnapur Canal was undertaken in 1910. It joined the New Cut Canal with the Bhangore Khal.
- In 1935, it was decided that sewage and storm water of the city will be discharged in Kulti river. The river disappeared from the region in 1942.

The early part of the twentieth century saw degeneration in nature of canals, restricting navigation. The canals became carriers of city's refuse into Bidhyadhari-Kulti systems. The Dry Water Channel and the Storm Water Channel were likewise constructed

to carry city's waste and rainwater (Bhattacharjee, 2014).

The following canals that are found around the city:

- a) Bagjola Canal
- b) Circular Canal –
 - (i) Beliaghata Canal
 - (ii) New Cut Canal
 - (iii) Lake Channel
- c) Tolly's Nala – Kaorapukur Khal
- d) Eastern Canals –
 - (i) Inner Boat Route
 - (ii) Outer Boat Route
- e) The Municipal Drainage Channel –
 - (i) Dry Weather Flow
 - (ii) Storm Water Channel.

The aim of this paper is to understand connection between urban canal and city and identify key issues plaguing the city. The objectives are as follows:

- To understand the connection of canal and the city and impacts of COD.
- To study and analyze similar case studies related to COD.
- To study the relationship of canals with the city of Kolkata.
- To identify key issues related to the canals of Kolkata and surrounding urban development.

2. Discussion

2.1 Canal oriented development and city

Developmental strategies in case of projects relating to canals are termed differently viz, Canal-oriented development, canal revitalization etc. The objectives pertinent to COD are (Martin, 2003) –

- To remove barriers to development,
- To convert the waterfront from a practical utility to a public amenity,
- To preserve and interpret the area's history,
- To develop a mixed-use community.

Two case examples related to COD in connection to urban acupuncture have been studied to understand the localized interventions and their impact on the public realm.

2.1.1 The Cheonggyecheon Canal Restoration Project, Seoul

Background:

Downtown Seoul was experiencing serious traffic congestion and poor air quality from

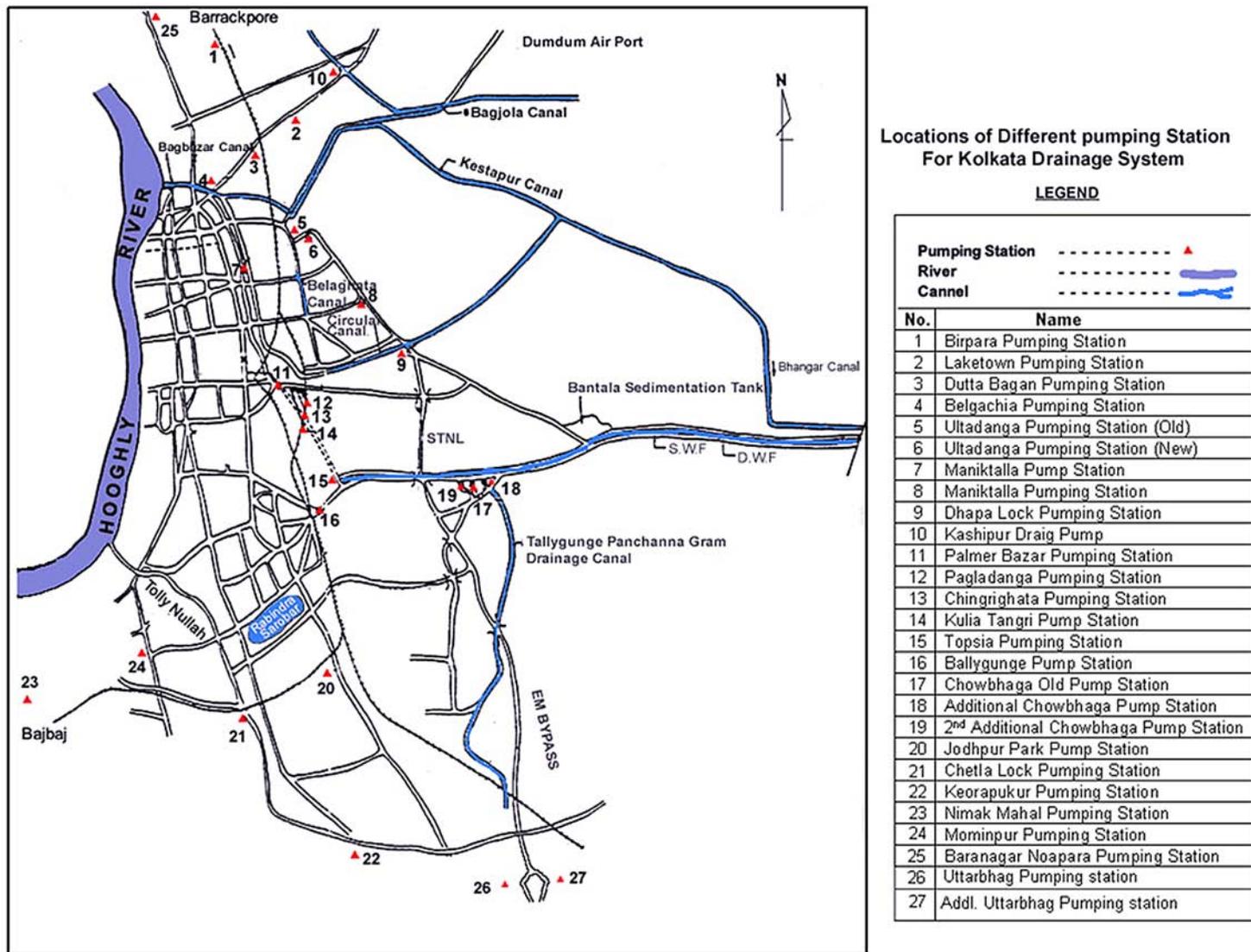


Fig. 2: Map showing the different canals of Kolkata and location of various pumping stations. (Source : <https://medium.com/@anjan.chatterjee/an-overview-of-kolkata-drainage-system-major-outfall-channels-7fdff15d8aa2>)

mass use of private vehicles in the elevated highway (Lee, 2005). Open spaces and public recreation opportunities degraded due to rapid industrialisation and urbanization. Urban development had taken place on south side of Cheonggyecheon, but the north side was dilapidated (GRN - Global Restoration Network, 2007). Rather than repairing the highway, Seoul Metropolitan Government decided to restore the stream, using it as an opportunity to tackle several of these problems at once.

Issues:

- The stream was culverted and buried underneath a 12-lane highway.
- Severe degradation of surrounding area.
- Poor water quality, natural environment and lack of plant and wildlife.

Pre-conditions:

- To complete the project as soon as possible to minimize economic loss to nearby

businesses.

- To maintain a two-lane road on both sides of the stream.

The total construction section was divided into three zones of 2 km-long each. The ‘design-build’ method was adopted (Lee, 2004). The first zone depicted history; second zone emphasized on urban culture while the third focused on nature in the middle of the city. Urban designers, planners and engineers gave special impetus to channelize interests of the citizens and improve climatic condition. Urban acupuncture has been adopted in a phased manner at different stages of the project. The first stage focusses on preserving the history and traditions of the area by redirecting underground streams to create new stream bed with landscaped banks and seating. The second phase concerns urban culture with creation of recreation areas in the centre of city. Attention to details along the corridor justifies the successful implementation of urban acupuncture. The final phase sheds light on the design of ecologically sensitive areas and wetlands for



balancing nature with built environment for the future. Each stage is fixated towards explicit schemes to address the local issues for a comprehensive development of the overall urban fabric.

2.1.2 The Mae Kha Canal Revival Project, Chiang Mai

Background:

The Mae Kha defines historical outer borders of Chiang Mai, and today still accompanies parts of the outer wall as historical monuments. The canal was long considered a valuable environmental asset, as a source of fish, rice and fresh water, flood prevention, transport and recreation (Mettes, 2014).

Issues:

- Water pollution and lack of water flow.
- Land property rights.
- Unorganized settlement along canal.
- Poor edge condition and no streetscape.

Fig. 3: The before and after image of the Cheonggyecheon canal showing how the elevated highway made way for the canal to open up for the public. (Source: <https://www.ser-rrc.org/project/south-korea-restoration-of-the-cheonggyecheon-river-in-downtown-seoul/>)

Interventions :

- Strengthening the edge.
- Incorporating wetland park, recreation zones.
- Community upgradation along the canal.

Revival of this historic area in phases not only gave impetus to community life but also to thousands of tourists. The urban landscape changed with greater emphasis on natural and green techniques and creation of active public spaces. The Mae Kha Canal revival has various layers involving the realization of urban acupuncture. Areas of development has been subdivided into distinct zones namely commercial (tourist centric), cultural and hierarchy of green spaces. The amalgamation of small developments with local community forms the basis of this entire intervention. Urban acupuncture in this resolves the key issues of Mae Kha which is quality of water at various levels of the



Fig. 4: The before and after image of the Mae Kha canal indicating how the once unchecked polluting stream has been transformed into an organized system yielding economic and social benefits. (Source: <https://ourchiangmai.com/2011/04/24/clean-green-mae-kha/> and <https://www.chiangmainews.co.th/page/archives/797064>)

existing infrastructure. They have been successful in advocating site specific strategies using urban acupuncture as a process oriented tool to cope with the magnanimity of the project covering miles.

2.2 Canal oriented development and kolkata

Earlier canals of Kolkata served dual purpose of drainage and navigation. The urban metropolis of Kolkata is now dependent on pumped drainage. Canals nowadays mostly serve the purpose of surface drainage within Kolkata Municipal Area. On the east of river Hooghly, an extensive network of drainage channels carries storm water and sewage. Churial, Monikhali, Tolly Nala and Circular Canal discharge water into Hooghly from east bank. Bagjola canal, Khardah canal, Storm water flow channel discharges into Bidhyadhari river. Northern canal system consisting of Kestopur, New Cut canal, Circular canal are used for navigation. Over the years, Kolkata has seen several attempts to develop canals. Irrigation and Waterways Department, Kolkata Municipal Corporation and Kolkata Environmental Improvement Program have worked separately on multiple projects but mostly in vain.

The city of Kolkata has witnessed several interventions on canal system aimed at addressing planning issues, yet a major part of it was related to public health engineering. Imperceptibly with increasing stress on sewage and storm water management, developmental proceedings were hampered as canals became disposal site for sewage. Civic authorities set up pumping stations and lock gates to control the flow of water. With stark increase in waste disposal, flow of water came to a standstill and few canals became defunct. Numerous canals have been severely affected as a result of unmonitored disposal and lack of protection policy. The EKW, the largest self-sustaining sewage fed aquaculture in the world, has shrunk in size as a result of these changes. Rapid urbanization has had an adverse impact on the entire canal system. The degeneration of canals and their poor up keeping has raised discussion on regeneration and revival.

Kolkata is a linear city along the river Hooghly. Outgrowth of this city however does not follow the same pattern. New canals were cut to fulfil the requirements of excess run off and control flooding. There are consequences of changes in spatial structure of urban fabric on the canals of Kolkata. Inadequate water depth, broken lock gates, excess sedimentation, sludge from sewage have culminated in causing stagnation of water in canals. Increased water logging in the eastern parts which receive an annual rainfall of 160 cm. Degeneration of Bidhyadhari, the easternmost river due to ill planned dredging and canalization in early 19th century, is geomorphologic disaster. Presently, sewage and storm waters are being diverted into river Kult. The closing of the bheries of EKW and lack of recycling waste has caused choking of canals (Bhattacharjee, 2014).

Enumerated below are few major issues from an urban design point of view which is affecting the canal system of the city:

- Lack of connectivity with the public realm – No access for the public to the canal front causing a feeling of disconnect.
- Waste disposal and poor maintenance of the canal banks – Leakage and waste disposal have led to serious problems causing the water to become stagnant.
- Inactive edge – Stream edge is not well defined with broken embankments and eroded banks.
- No activity points – People do not gather along canals due to unhygienic conditions and lack of public amenities, hence no points of economic or social activity.
- Walkability is deterred – Narrow footpaths and degraded condition of canals deters walkability.
- Lack of visibility and perforations – One cannot see the canal from the other side of the road. High fencing and concrete walls have hampered visibility and restricted people from enjoying the view of the canal front.

2.3 Canal-oriented development: a case of beliaghata canal, kolkata

The Beliaghata Canal in the twelfth century, during the period of Ballal Sen, we can find the location of this creek, which started from Bhagirathi and ended in the salt water lake. The confluence of the creek with Bhagirathi was near the opposite of famous “Tamralipta” port, which served as a major centre of trade. In the seventeenth century

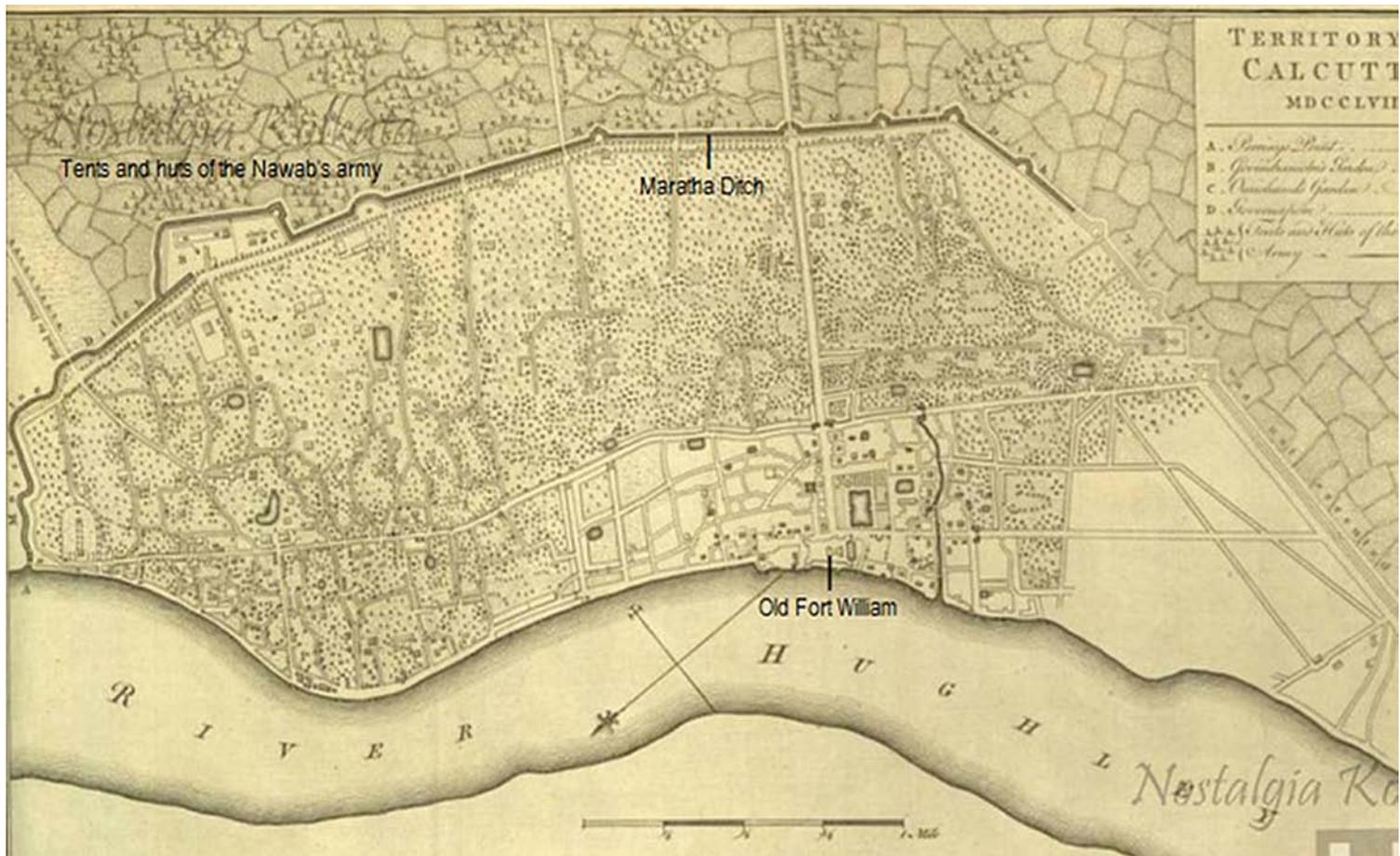
the “Sabarna Roy Chaudhury” became the zaminders of three villages Sutanuti, Govindapur and Kolkata (Nandi, et al., 2007).

2.3.1 In the Early British Settlement

On 24th August of 1690 Job Charnok started trade for East India Company in Kolkata. A small creek passed by the north of Dharmatala flowing from Chandpal ghat to Beliaghata. This creek flowed through Hasting Street, Bentick Street and Wellington square. This channel was then widely used, as a means of transport. The area where the canal met the salt water lake was known as Baliaghat, and according to this, it got its name as Beliaghata Canal (Dasgupta, 1908). In 1742, Maratha warriors attacked Kolkata. To save Kolkata, the British proposed Nawab Alibardi Khan to construct a circular canal around Kolkata. This canal was known as “Maharatta Ditch”. It was a circular canal started from Chitpur creek and ended in Beliaghata canal (Mitra, 1980).

Fig. 5: The “Maharatta Ditch” was dug by the citizens of Calcutta in the mid-1700s to guard against a possible Maratha attack. (Source: <https://nostalgiaolkata.blogspot.com/2016/05/views-of-calcutta-part-1-1690-1757.html>)

After the Battle of Plassey in 1757, the rule of East India Company started at Kolkata. During this period the company formed a “Lottery Committee” to design the Metropolitan of Calcutta. The “Maharatta Ditch” was filled up from Chitpur to Beliaghata canal due to construction of roads and buildings. This is how the Beliaghata Canal lost its connection from Bhagirathi. A road was constructed parallel to the former Maharatta



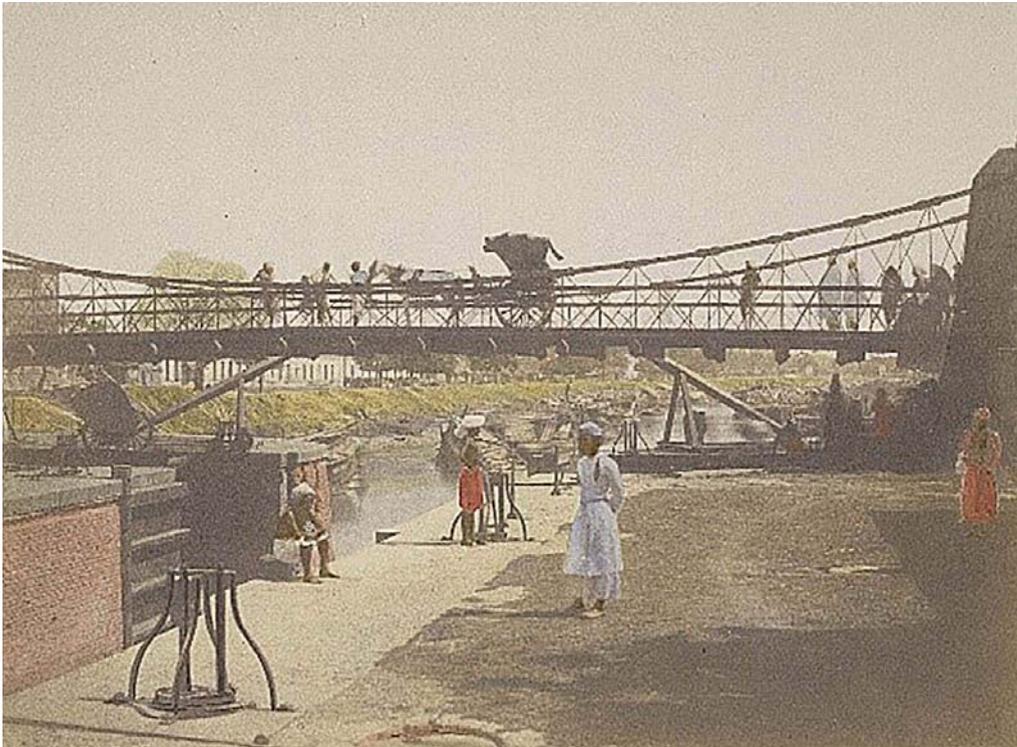


Fig. 6: The canal at Chitpur was revitalized in 1824, when the municipal authorities decided to use the waterway for transport. (Source: <http://calcuttaconfusion.blogspot.com/2017/04/calcutta-bridges-chitpur.html>).

Ditch encircling Calcutta and this road was known as the “Circular Road”. In 1810, this canal was fully reformed for the navigation purpose.

Major William Tolly proposed the company to excavate and repair the canals for water transportation within Calcutta. In 1858 another canal was excavated, which started at from Circular canal near Belgachia and ended in Beliaghata Canal near Dhapa. After formation of the Circular Canal the main stream of Beliaghata Canal, would flow through Circular Canal. In 1831, the famous Rashmoni bazaar, a major centre of trade was started on the banks of Beliaghata Canal (Mukhopadhaya, 1915).

2.3.2 Post-Independence

After Independence, a rapid increase in the population took place in and around Kolkata. Slums came up near the banks and navigation came to a standstill. In 1960, the Irrigation Department (Thankappan, 1989) planned to fill up the Beliaghata Canal, but it was not executed. The recent reports of the Irrigation and Waterways Directorate states that the Circular Beliaghata Canal after crossing the EM Bypass near Dhapa lock pumping station is known as Eastern drainage canal and outfalls in Kestopur canal at a distance of 6 km from Ultadanga. This canal drains the areas of Chitpur, Cossipore, Bagbazar, Maniktala, Salt Lake and Beliaghata encompassing a number of road and railway bridges, namely Chitpur bridge, R.G.Kar bridge, Aurobindo Setu, Maniktala bridge, Sealdah railway bridge, Beliaghata bridge, Rashmoni bazaar bridge and Dhapa bridge (Ghosal, 1999).

Beliaghata Canal has a long-standing history; hence its revival would require long-

term holistic design solutions involving heavy budgetary and infrastructural constraints. The main benefit of urban acupuncture is tapping of readily available local resources at strategic points which require instantaneous rectification. Urban acupuncture with its variegated advantages in addition to being economically feasible can serve as one of the potent methods to revitalize the Beliaghata canal precincts.

2.4 Bellaghata canal: current scenario & future implications

The entire stretch of Beliaghata Canal is disengaged from public sphere. Developments near the vicinity of the canal included old campus of Government College of Leather Technology founded in 1999 which later came to be known as RCC Institution of Information Technology. The West Bengal Infrastructure Development Corporation (WBIDC) had set up a Garment Park named “Paridhan” in two phases along the South Canal Road. A reformation of this canal was done in the year 2002. In spite of these developments there is no access for public to access the canal front thereby rendering it defunct.

A well-defined edge signifies a strong notion of continuity and visual appropriateness. The Canal East Road, Canal West Road and the Chaulpatty Road traverses about 18 km on both sides of the Beliaghata Canal. The local councillor set up a few small parks for recreational purposes to enhance the vitality of the canal front. The beautification project taken up by Kolkata Municipal Corporation in 2014 was restricted to only metal fencing and plantation to remove encroachments. However, the canal can hardly be seen from both sides of the road.

Walkable environment is primarily needed for providing a sense of richness to the place. Footpaths though present is used for parking or throwing garbage. Owing to the unhygienic condition near the canal edge we hardly see any pedestrians using them. Developments along the South Canal Road like Beliaghata Store Water Housing Corporation, Siddha Housing Complex, RRMEDI Engineering have come up but have not been able to impact their surroundings. There are no public activity points present along the 8.4 km stretch. This is mainly since people do not access the canal front for recreational

Tab. 2: Spatial Coverage of Drainage and flow Patterns in the City. (Source: Chapter VI: Drainage Network of Calcutta City, CMC - 2005).

SYSTEM	WARDS COVERED		AREAS SERVED	COVERAGE OF UGD SYSTEM	CANAL	KMC's PROJECT COVERAGE
	FULL	PART				
MANICKTALA	13, 29-35, 41	5	Ultadanga, Kankurgachi, Phoolbagan, Beliaghata	90%	Circular Canal	Project Nikashi
TOPSIA - TANGRA	56, 57, 59	58, 66	Topsia, Tangra, Chingrihata	30%	Circular Canal, Town Head Cut Channel	KEIP



Fig. 7: The contaminated condition of the canal. (Source: Taken by author)

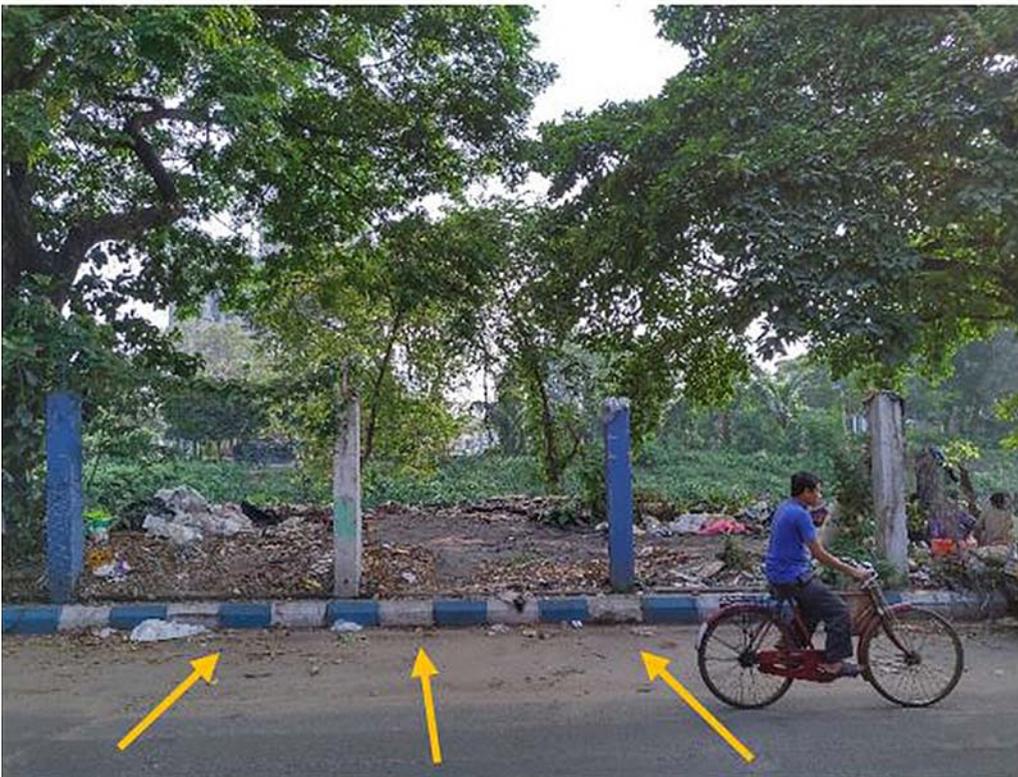


Fig.e 8: Lack of visual as well as physical connectivity to the canal. (Source: Taken by author).

purpose.

In order to achieve the desired vision a multi-faceted and multi-disciplinary approach needs to be adopted that encompasses in depth on-ground research. The key underlying issues have to be listed and discussed with not only the civic authorities but also the people in concerned localities. Public awareness and their active participation are a must if we are to revive the canal to its original state. This is where urban acupuncture plays a crucial role as it allows users to customize their built environment according to their preferences without altering the natural setting. Roads on both sides with the canal running through the middle is an ideal scenario for a pragmatic yet enterprising scheme of design. To what extent Beliaghata Canal can be revived in future relies upon the approach taken from conceptualization to realization. A more detailed derive the parameters and study the stretch is to be carried out in the next stages for addressing the issues specifically relating to urban design. Data interpretation and analysis both at primary and secondary level is required before providing design interventions at the local context.

3. Conclusion

The 'khal' or canal system of the city was once integral to the life and economy of Kolkata. However, this system has almost been wrecked by unchecked construction, related land-fill, the lack of proper waste management and periodic maintenance (Basu, 2019). A definite set of design guidelines based on data interpretation and analysis should be formulated. The Beliaghata Canal in particular being located at a strategic location possesses tremendous scope for development. It is the only canal that connects the two most important ecosystems, namely river Hooghly and the EKW which serve as the "functional lungs" of the city. Remediation of the issues concerning the canal has to be discerned taking into account all probable causes.

COD would help provide a comprehensive solution which may even include the principles of Water Sensitive Urban Design (WSUD). Development cannot be restricted to only beautification. The unionization of Urban Acupuncture, a more recent theory at the site level postulates a holistic approach for canal front development. This concept can be categorically and selectively applied to sensitive points which needs to be rejuvenated for wider acceptance. Consideration must be given to resuscitate the linkage between canal and public realm. A bottom-up phased proposal engaging all stakeholders especially community participation should be prioritized. The influx of localized activities to activate a space and make it walkable in the existing underutilized areas of the urban fabric is the mainstay principal of urban acupuncture. Since there are no pre-ordained guidelines or substantiated proceeding, urban acupuncture is often designated as a design tool that constitutes diversified techniques like green gentrification, bio-remediation, efficient storm water management, riparian buffers which can be inculcated depending on the urban design parameters. The possibilities are endless and the future potential is

magnanimous given that we identify accurate solutions keeping the urban ecological balance unblemished. Futuristic development should not compromise with present needs alongside protecting the non-renewable resources. The revival of this canal will not only aggravate the vitality of the area but also generate people centric development.

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