

# Urban Development and Ecological Imbalance on the Eastern Fringes of Kolkata

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**Abstract**—The Eastern fringes of Kolkata viz. the East Kolkata Wetlands is a Ramsar site and is considered to be one of the most diverse ecosystems in the region. It serves as a natural purification system for the city. The existence of these wetlands is threatened by the rampant urban development activities that have taken place in the last few decades. Development Planning seems to have failed to understand or refuses to take cognizance of the important role this natural system has in maintaining the overall ecological balance of the city and its environs. The approaches and efforts till date have been more prescriptive and inclined towards engineering measures in nature rather than integrating it into the overall framework of the urban development to make it more sustainable and holistic in nature. The present paper attempts at assessing the various linkages of the city of Kolkata to the East Kolkata Wetlands, appraising the role of various stakeholders including the civic bodies; and to look at various approaches and measures that have been taken till date and to see if lessons could be drawn and applied to preserve and restore the wetland.

## 1. INTRODUCTION

Kolkata, one of the largest metropolis of India, was built on the levee of the River Hooghly which is one of the largest tributary of the River Ganges. The city is bounded by River Hooghly in the west and salt water and brackish swamps/wetlands in the east. The eastern fringes of Kolkata city (22° 27' N 88° 27' E), mostly referred as 'The East Kolkata Wetlands (EKW)', comprises a large number of water bodies distributed across the districts of South and North 24 Parganas. The wetlands are bordering the Salt Lake Township on one hand and the upcoming new township at Rajarhat on the other.

The East Kolkata Wetlands is considered to be one of the most diverse ecosystems in the region and serves as a natural purification system for the city, often referred as the kidneys of Kolkata. The wetland ecosystem is spread over an area of 12,500 hectares along with the 264 sewage-fed fisheries, agriculture, solid waste farms and few built up areas. The resource recovery system developed by the local people over many years using waste water from the city is the largest and the only one of its kind in the world. It also helps in water treatment and is home to a large biodiversity. It is the largest

sewage-fed aquaculture in the world. In the beginning of this century, East Kolkata Wetlands were declared a 'Ramsar Site' making it a wetland of International Importance.

## 2. WHAT IS A WETLAND?

Wetlands have been described as lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. The importance of wetlands lie in the fact that it maintains the food chain, helps in ground water recharge, flood control, absorb pollution, treat sewage, provide habitat to a variety of biodiversity and fulfills the socio-economic requirement through consumptive use (fishes) and non-consumptive use (recreation).

According to Ramsar Convention (1971), wetlands are defined as, "areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh brackish, or salt, including areas of marine water the depth of which at low tide does not exceed six metres".

The Asian Bureau (1991) defined the wetlands of south and west Asia as: "Estuaries and deltas, salt marshes, mangroves and mud flats, coastal lagoons, fresh water lakes and marshes oasis, salt marshes, seasonal flood plain wetlands, swamp, forests, rivers and streams, man managed systems such as rice fields, fish ponds and reservoirs".

The main biotic feature of wetland ecosystem is the shallow depth of water cover over the soil which makes them occupy a position intermediate between terrestrial (dry) and aquatic (deep-water) ecosystems. Due to shallow depth of water, sunlight can penetrate up to the bottom and with the existing nutrients wetlands can have abundant growth of plants, which can further support the lives of secondary and tertiary tropic levels.

The world convention held in Ramsar, Iran in 1971 recognized the importance of wetlands and focused on halting their world wide loss and their protection. Over the last 4 decades, the perception of Ramsar convention has undergone significant

change from waterfowl's habitat protection to a whole range of wise-use practices which includes fisheries, tourism, biodiversity conservation, waste recycling etc. The list of sites under Ramsar convention has also increased significantly along with the number of participating countries. The 1996 convention meet at Brisbane, Australia dealt at length on the future direction.

India, as one of the signatories of Ramsar convention has so far been able to declare six sites as of international importance. These are: Chilka (Orissa), Loktak (Manipur), Wular (Jammu and Kashmir), Sambhar (Rajasthan), Bharatpur (Rajasthan), and Harike (Punjab). Around the year 2000, Ramsar Bureau selected 17 case study sites all over the world to demonstrate and understand wetlands. In that list, East Kolkata Wetlands (EKW) was the only entry from India. In 2002, East Kolkata Wetlands was declared a 'Ramsar Site' and area was included in the Ramsar Bureau List established under Article 8 of the Ramsar Convention, making it a wetland of International Importance.

### 3. HISTORY OF EAST KOLKATA WETLANDS

Around 1690 Job Charnock, the Agent of the East India Company decided to establish the trading post of the 'company' at Calcutta in spite of strong disfavor from the Board at St. George Fort at Madras (Chennai) who were constantly advocating the choice of Chittagong port. There is a postulation that the wetlands in the east of Calcutta providing protection from any possibility of onslaught in those days of sail ships, was a strong factor in the making choice of Calcutta by Job Charnock. Since the establishment of Calcutta city, the drainage problem has been a major issue. However, during early days of settlements, the Britishers were more concerned with transportation of goods for commerce from the hinterlands of Bengal (like Assam, Chandpur, Khulna, Dhaka or Barisal) than the drainage system of the upcoming city.

The city of Kolkata evolved over time virtually without any proper sewerage and solid waste management system, and thereby also subject to frequent drainage issues which resulted in health impacts. The waste initially to begin with was dumped into the River Hooghly, a practice that had to be abandoned as it did not help in draining out the city's sewage nor discharge the annual inundation occasioned by the rise of the river or by excessive rainfall during the south west monsoon; and also due to frequent outbreaks of cholera. Numerous committees were set up from time to time to look into the aspect of alternate solutions to the drainage problems. It was recommended transferring all wastes to the salt lakes/wetlands, as the natural slope of the city was eastwards. The wetlands located on the eastern fringes of the city were almost 2.5m below the highest point of the city. This recommendation saw the beginning of a series of sewers and pumping stations being constructed towards the direction of the wetlands.

In the year 1864 a large area of the salt lakes was designated for dumping of solid waste. The solid waste dumping area (popularly known as Dhapa) on the western fringes of the wetlands were gradually converted for horticulture and subsequently agriculture farms during sometime around 1876. The first attempt to wastewater aquaculture is reported to be somewhere around 1918. Subsequent construction of wastewater channels in the city increased access to wastewater and the flow of sewage was regulated in a skillful manner on the basis of the detention time needed to improve the water quality appropriate for growing fish.

The whole East Kolkata Wetlands area has come to be recognized almost officially as Waste Recycling Region for the city of Kolkata and is a classic example of harnessing natural resources of the wetland system for fisheries and agriculture through ingenuity of local communities with their traditional knowledge.

### 4. PRESENT STATUS OF EAST KOLKATA WETLANDS

#### Landuse Pattern & Biodiversity

The total East Kolkata Wetlands area can be broadly divided into four types of land uses viz. water body area (47%), agricultural area (38%), garbage farming area (5%) and the settlement area (10%). The settlement area can be sub divided into urban settlement area and rural settlement area. There are number of canals flowing through this region. The deeper and wider canals are used for fetching the city sewage to this area and are taken care of by the Irrigation and Waterways Department, Govt. of West Bengal. Narrow canals are owned and maintained by fishery owners or fishery cooperatives. The garbage dumping ground in the East Kolkata Wetlands area falls under the jurisdiction of Kolkata Metropolitan Area (KMA) and Kolkata Municipal Corporation (KMC) manages the solid waste dumping activity in this area.

The East Kolkata Wetlands harbors diverse flora and fauna and is suitable for fish growth and as a waterfowl habitat. The area is well known for migratory birds. Aquatic vegetation in the sewage fed ponds is mainly dominated by floating microphytes. The diversity of flora in the wetlands show several economically important plant resources of which the numbers of species are in use of medicine, paper pulp, thatching materials, vegetables, food for water fowl, as green manure and compost, water purifiers and fodder etc. Flora along the banks of the wetland have a very significant role for their existence and sustenance through checking erosion and rapid eutrophication, supplying essential nutrients and harbouring innumerable biodiversity. The fauna diversity comprises of species of zooplanktons, fishes, amphibians, reptiles, fresh water tortoise and number of species of birds are found throughout the year (Institute of Environmental Studies and Wetland Management under the Dept. of Environment, West Bengal).

### Role of East Kolkata Wetlands as Waste Recycling Region

As per EKWMA, 2014 data, the Kolkata Municipal Corporation area (141 wards with 4.6 million population spread over 185 square kilometer of area) generates roughly 600 million liters of sewage and wastewater every day and more than 3500 metric tons of garbage which is collected daily and dumped at various designated sites in the East Kolkata Wetland. The wastewater is used for aquaculture in around 254 fisheries and also for irrigation in vegetable cultivation, the daily yield of which is estimated to be around 150 metric tons. It is one of the largest assemblages of sewage fed fish ponds (locally called bheries) spread over an area of 12,500 ha and perhaps one of the world's largest and oldest integrated resource recovery systems, wherein nutrients are extracted from the city's wastewater through fish farming and agriculture and forms the mainstay of the city's food security and provides livelihood support to a large population of around 27,000 families.

In addition there is the average rainfall of 1605mm a year with occasional heavy and continuous precipitation in this coastal area (120 km area of away from Bay of Bengal) necessitates a discharge area where the River Hooghly bank in the west of this "urban strip" is gradually sloping east ward to this Ramsar Site. Creation of Salt Lake City and Newtown Rajarhat further accentuates the continuous dependence on the East Kolkata Wetland for disposal of waste of both solid and fluid nature.

### Environmental and Scio-Economic Importance of East Kolkata Wetlands

East Kolkata Wetlands serves many environmental and socio-economic benefits to the city of Kolkata which are as below:

- Absorb and treat in the most efficient, economical and natural way the huge volume of sewage and wastewater and urban solid and air wastes generated by the city of Kolkata
- Absorb the pollution and purify the air that citizens breathe;
- Absorb and pass to downstream creeks and to the sea, the flood waters that the monsoon brings to this coastal city;
- Provide a habitat for a variety of flora and fauna and living organisms endemic to wetlands;
- Maintain the micro-climatic condition of the region;
- Maintain the delicate ecological balance in a fragile environment and ecosystem
- Provide the food chain and waste-to-wealth recycling so unique and essential to this city;
- Fulfill substantially the requirement of fish, vegetables and some food grains for the city;
- Provide livelihood support for thousands of locals who also put to use the unique way of using wastewater to grow fish and vegetable and thereby help sustain a stable urban fringe.

The East Kolkata Wetlands continue to remain indispensable for the physical survival of the inhabitants of the city of Kolkata quite often being referred to as the 'Kidney' of the city of Kolkata. The wetland of 22,000 hectare have alarmingly shrunk to 12,000 hectare over the years due to urbanization and needs immediate concerted effort of all concerned to prevent any further shrinkage. Revival, restoration and rejuvenation of East Kolkata Wetland is an essential ingredient for survival of the Kolkata Metropolitan Area (KMA) in the east bank of River Hooghly. Sincere measures to be adopted in a very serious manner on an urgent basis.

### 5. DECLARATION OF 'EKW' AS A RAMSAR SITE

Located on the eastern peri-urban interface of Kolkata City, the wetland has been under constant pressure of reclamation and urban development. The proposals for converting the wetland to accommodate ever-expanding Kolkata City were made as early as in 1830s. Nearly 1,000 hectare of the northern portion of the wetland and hundreds of fishponds were reclaimed for establishment of the Salt Lake City in the year 1960. In 1969, redistribution of land through land reforms further saw filling up of approximately 2,500 hectare of water bodies for conversion into paddy fields for cultivation. The last decade saw the development of the New Town and the Rajarhat Area, which has further impacted these wetlands.

The East Kolkata Wetlands are indispensable for the physical survival of the inhabitants of the city of Kolkata and are being referred to as the 'Kidney' of the city of Kolkata. The wetland of 22,000 hectare have alarmingly shrunk to 12,000 hectare over the years due to urbanization. Changes in land use, hydrological regimes, and stakeholder conflicts are rapidly degrading the system. A group of environmental experts questioned the very act of reclamation of wetlands for urban settlements. Around 1980s, the Government of West Bengal recognised the importance of the region and initiated a systematic research into the wetland and its waste recycling systems. The first map of the waste recycling area was subsequently prepared around 1985.

The High Court of Kolkata passed an order in 1992, in response to a PIL by a group of NGOs, in favour of maintaining the overall environmental values of the wetland system, and banned any conversion or changes in land use and directed the state government to take remedy to statutory cover to stop any encroachment.

The Government of India declared EKW as a Wetland of International Importance under Ramsar Convention in 2003, realising its immense ecological and socio-cultural importance. Designation of a wetland as a Ramsar site (Site No.1208) marks the commitment of the Contracting Party, i.e. Government of India, to undertake measures for ensuring its wise use. The 'Wise Use' concept of the Ramsar Convention provides an overarching framework for management planning

for wetlands. Wise use of wetlands is defined in the Ramsar Convention text as 'the maintenance of their ecological character, achieved through implementation of ecosystem approaches, within the context of sustainability.

Accordingly, in 2006 East Kolkata Wetland (Conservation & Management) Act was enacted and laid the foundation of the East Kolkata Wetland Management Authority to maintain and manage the existing land use along with its unique recycling activities.

## 6. KEY ISSUES

### Environmental Issues

- a. There has been a progressive change in the land use within East Kolkata Wetlands leading to a gradual dominance of agriculture, which accounts for nearly 40 percent of the wetland area. The area under fish farms has reduced from about 7,300 ha in 1945 to about 5,842 ha in 2003. Construction of fish farms, bunds and roads within the wetland and fish farms have further reduced the effective area under water bodies to 2,481 ha.
- b. Despite having a large direct catchment of 1,625 sq. km inflows to the wetland are largely governed by the sewage generated from the Kolkata Municipal Corporation (KMC). Of the total precipitation, more than 95 percent is siphoned off from the wetland to reduce waterlogging within the Kolkata city. The drastic reduction of freshwater flows and gradual dominance of marine flows that has induced rapid siltation within the system.
- c. Management of hydrological regimes within East Kolkata Wetlands is now heavily biased towards flood management in Kolkata city through engineering features and structures without considering the flow requirements for maintenance of ecological processes within the wetland system.
- d. In these wetlands there has been an alarmingly rapid change in biodiversity due to various changes in hydrological regimes and land use. Of the 271 species of birds recorded from the wetlands about a half a century ago, only 162 species have been variably noted during the last 30 years. It is assessed that 109 species of birds have become locally extinct, majority being aquatic birds. Similarly, there has been significant loss of vegetation diversity, particularly those of mangroves (sundari trees - *Heritiera littoralis* Ait) and other brackish water species.
- e. Metal deposition in the canal sludge rendering the waste water incapable of ensuring the edible quality of the fish and vegetable grown in the wetland is another recent threat.

## 7. SOCIO – ECONOMIC ISSUES

- a. The current farm management systems indicate a skewed incentive towards the large private farmers, as against the small and medium size cooperatives. Water allocation too is biased towards human uses ignoring ecological purposes.
- b. Despite living within a highly resource rich area, the communities living within East Kolkata Wetlands have high rates of poverty incidence. There is absence of any life or health insurance facilities and less than 35 percent of the total population living within East Kolkata Wetlands has access to safe drinking water and adequate sanitation facilities leading to high frequency of waterborne diseases.
- c. There is lack of institutional credit from rural banks and only less than one fourth of the total households living within East Kolkata Wetlands have access to formal economic infrastructure for credit and saving needs.
- d. There is loss of income during non-crop season and there is no crop insurance facility for them.
- e. The literacy level is poor in the communities living in the East Kolkata Wetlands and most of the women folk are illiterate.
- f. Improper inlet-outlet management of sewage for operating bheris (local fish farms) and cultivating paddy and non-cooperation amongst bheri-owners themselves for sharing sewage.
- g. There is tenurial instability in the garbage farms owned by the Kolkata Municipal Corporation and the workers' managed cooperative fish farms
- h. There are threats of encroachment from real estate developers leading to general level of insecurity and law and order problems.

## 8. KEY MANAGEMENT ISSUES

- a. There is lack of coordination among the various government departments and agencies viz. irrigation & waterways, fisheries, agriculture, urban development, labour, health, environment, CMC, CMDA, CMW&SA limiting implementation of the East Kolkata Wetlands (Conservation and Management Act), 2006. Involvement of multiple agencies with sectoral approaches limits adoption of a holistic management approach and strategy.
- b. There is absence of appropriate monitoring and evaluation mechanisms limiting assessment of impacts of implementation of action plans.
- c. Lack of involvement of stakeholders, particularly marginalized communities in planning and decision making.
- d. Lack of baseline information and asymmetry in available information for planning and decision making.

- e. Violations in contravention of the court judgment are also quite frequent especially in areas adjacent to the east of Eastern Metropolitan bye pass running north-south.

## 9. KEY MANAGEMENT STRATEGIES

The methodology for management planning for East Kolkata Wetlands is based on the 'New Guidelines for Management Planning for Ramsar Sites and Other Wetlands' as adopted by Contracting Parties to the Ramsar Convention on Wetlands in their seventh meeting held in 2002 at Valencia, Spain. The goal of management planning for East Kolkata Wetlands is "conservation and sustainable resource utilisation for ecological security and economic improvement of stakeholders. The purpose is to establish effective management practices for East Kolkata Wetlands and providing economic incentives to stakeholders through coordinated actions at river basin level integrating coastal processes". Few of the management strategies are enumerated below:

### • Management Zoning

Implementing a multiscalar and hierarchical inventory and assessment of wetlands at basin level (Lower Gangetic Delta-1: 1,000,000 scale), East Kolkata Wetlands Basin (1:250,000 scale), East Kolkata Wetlands and associated wetlands (1:50,000 scale) and East Kolkata Wetlands (1:10,000 scale) to support management planning and decision making. Regulating developmental activities through a zoning plan. Entire East Kolkata Wetlands to be declared as core zone with complete implementation of EKWMA Act, 2006 to guide developmental activities. Lake basin may be demarcated as buffer zone with focus on ensuring hydrological connectivity with freshwater and coastal processes. Activities need to be regulated balancing ecosystem conservation and development.

### • Water Management

Enhancement of the hydrological connectivity within the direct basin through rejuvenation of derelict water courses of Sunti, Nowaee, Nonagong, Adiganga, Bidhyadhari and Piyali. Rehabilitation of inflow regimes through selective dredging of KMC network and primary and secondary channel network within East Kolkata Wetlands and its downstream reaches needs to be taken up. Upgradation of the Palmer's Bazaar pumping station and the Ballygunge drainage and pumping station needs to be done to ensure effective sewage delivery. Improving water quality through management of Dhapa landfill to reduce percolation to the East Kolkata Wetlands; solid waste availability be organized by ensuring waste segregation at source and promoting rag picker unions for improvising waste handling. Comprehensive sanitation coverage within core area needs to be ensured through establishment of 3,000 ecosan units. Water allocation for human and ecological purposes through assessing and implementing environmental flows as a basis for operation of

all the hydraulic structures in the upstream and downstream reaches.

### • Biodiversity conservation-

Making an inventory and assessment of key water bird habitats within East Kolkata Wetlands basin, ie Bartee Beel (big waterbody), Gobadiabad Beel, Nalban and Goltalabe carried out. Plantation of phragmites, shola, typha and other indigenous species be undertaken and community reserves be created at Goltala, Nalban, Birtee and Gobariabad beels to restore water bird habitats. Bird protection committees with conservation incentives be formed to control poaching. Networking with national and international treaties be done to strengthen habitat conservation efforts. Enhancing fish biodiversity through establishing a centre for culture of indigenous fish species at Goltala. Establishing units for standardization of captive breeding of endangered species at Captain Bheri

### • Ecotourism Development

Construction and operationalisation of an interpretation centre north of Krishnapur Canal with facilities as panel displays, interactive maps, 3D models, dioramas, audiovisual rooms, viewing galleries, play areas. Development of recreational facilities as board walks, nature trails, guided boat rides, landscape gardens as effective tool for communicating ecosystem values as well as livelihood diversification of communities. Specific training programmes for various target groups may be undertaken as an integral part of the activities. Signages, communication and non-polluting transport facilities (manned boats, battery operated autos, ropeways etc.) be developed for complete tourist education and recreation experience.

### • Sustainable Resource Development and Livelihood Improvement

Enhancement of fish yield through establishing four hatcheries at Dhapa- Manpur, Tardah-Kapasiti, Kantipota, and Kharki with production capacity of 1.5 million fingerlings /operation to ensure better availability of fingerlings within the wetland area. The management be entrusted within fisher self-help groups. Microfinance linked desiltation programme be implemented for beries facing siltation problem (about 277 in number). Improvement of harvesting and post harvesting. Community utility centres to be established for improvement and maintenance of crafts and gears.

Infrastructure for seven fish markets (Krishnapur, Chingrighata, Goltala, Chaubhaga, Bamanghata, Garia and Gangajoara) may be improved through construction of sheds, vehicle transportation facility, water and electricity access, storage facilities etc.

Promoting rainwater harvesting in agricultural fields to enhance availability of freshwater.

Diversification of cropping pattern. Low irrigated rabi season crops (mung bean, mustard, chilli, cotton); high value vegetables; floriculture (jasmine, marigold, sunflower) and

medicinal plants (tulsi, aloe vera) be introduced in 1,000 ha of agricultural lands for crop diversification and ensuring better returns to farmers.

Development of vegetation based micro enterprise, ornamental fish culture, goatery, piggery, fish cum duck rearing for livelihood diversification of East Kolkata Wetland communities.

Construction of safe drinking water units for enhancing freshwater availability within the wetland communities

#### • Institutional Development

Restructuring EKWMA for effective management planning and coordination amongst the line departments and agencies. Governing Body be established chaired by the Chief Minister/Chief Secretary for overall policy directions and performance. High level steering committee be constituted below the governing body for ensuring interagency cooperation. Project Implementation Committee needs to be constituted with representation of all line departments for MAP implementation. Scientific and community advisory groups may be constituted to advice on implementation. Implementation of specific action plans may be undertaken through project management units.

Enhancing technical and infrastructural capacity of EKWMA through training on wetland management and related aspects and procurement of necessary equipment.

Multi-stakeholder working groups needs to be established to resolve conflicts and develop shared vision for management planning.

Results based monitoring and evaluation at activity, output, outcome and impact level be developed to guide implementation. Inventory and assessment information to support implementation and mid-term corrections.

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