An Approach to Link Water Resource Management with Landscape Art to Enhance its Aesthetic Appeal, Ecological Utility and Social Benefits

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NEED OF THE STUDY:

Availability of water with acceptable quality is crucial for the health of the ecosystem, human health and well-being. Freshwater resource management is increasingly becoming challenging with the increasing quantity of grey water as a result of rapid urbanization coupled with industrialization, worldwide.

Optimum reuse of all kind of wastewater is needed to enhance the urban water security and environmental sustainability.

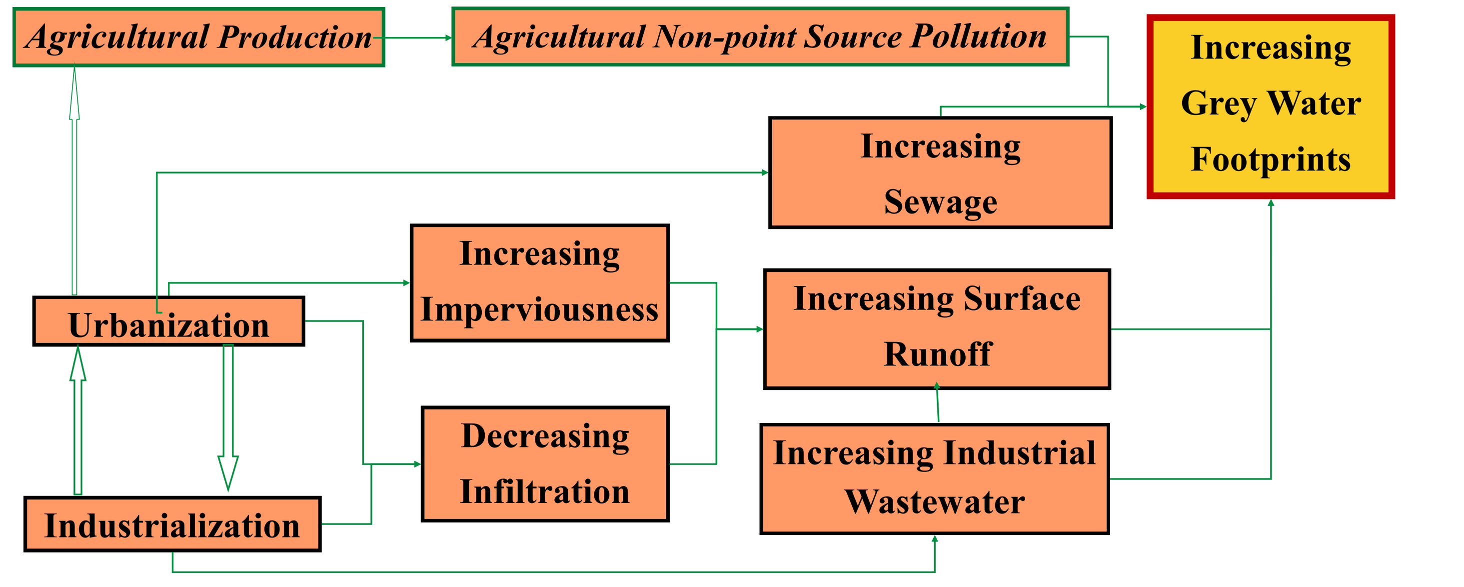


Fig.1. Flow-chart showing the driving factors for increase in grey water footprints

LOW-COST ECO-FRIENDLY WASTEWATER MANAGEMENT:

According to the International Water and Sanitation Centre (IRC), waste stabilization ponds are the most cost-effective, low-energy intensive with low-tech infrastructure wastewater treatment technology for small communities and as a final stage treatment in large municipal systems [Tilley et al., 2014; Cooper et al., 1996].

Regions with year-round high insolation and water temperature are suitable for this technology.

Wetlands improve water quality by acting as sediment sinks, filters, and sponges for nutrients and toxicants.

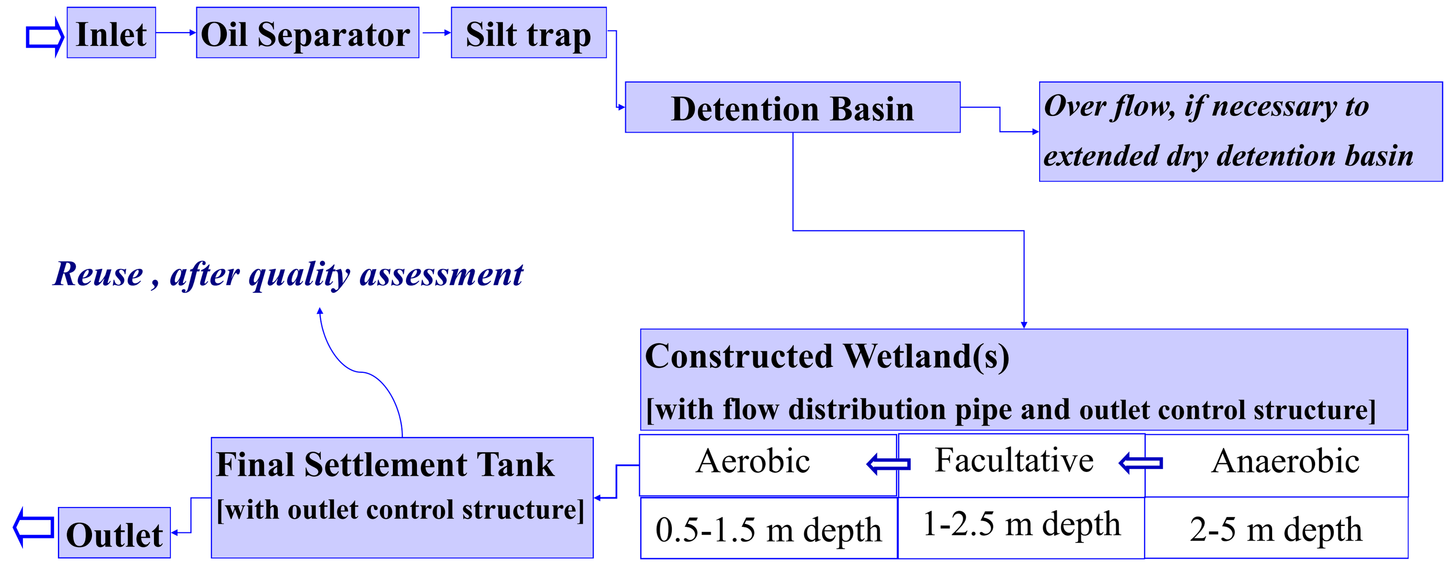


Fig.2. Flowchart showing Idealized Constructed Wetlands

A wetland is formed when a permanent pool in a detention basin is sustained with a water depth greater than 6 inches. Preferably, the width-to-length ratio to be greater than two so that the flow could be expanded and diffused into the water body while enhancing the sedimentation process. The maximum probable runoff should be able to pass through an emergency spillway (Guo, J., 2006; EPA, 2006), **indeed important criteria to be used for site selection.**

OBJECTIVE:

Incorporation of landscape art in developing detention basins and constructed wetlands, using less used water-bodies (paleo-channels, lakes or moribund channels) for wastewater treatment and re-use, cases from West Bengal, India.

Sources of Secondary Data:

* *Census of India 2001 and 2011*
* *From bhuvan.nrsc.gov.in Digital Elevation Model (DEM) Cartosat-1 and Resourcesat-1 (LISS-III) satellite images*

Software Used: *ERDAS Imagine 2014 and ArcGIS 10.2.1*

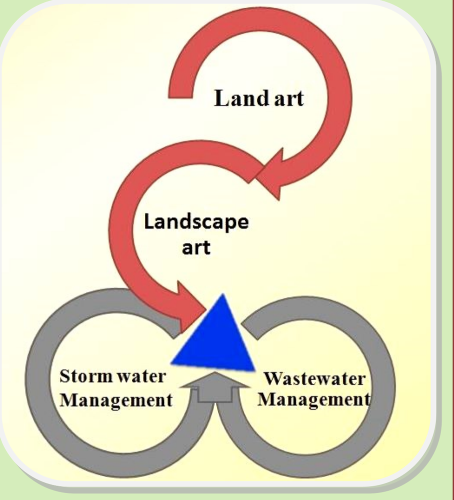
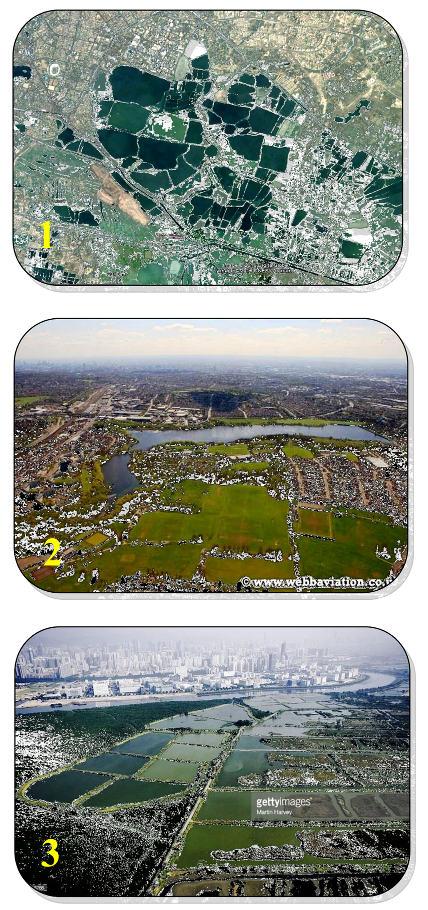


Fig. 3 Scope of The Study



LANDSCAPE ART:

Landscape art is the **scientific application of artistic skill** to **integrate man-made structure** with the **natural landscape** for planning, resources management, preservation and rehabilitation of natural and built environment.

While Landscape art incorporate the concept of land art *or Earthworks (coined by Robert Smithson), it* ***expands its applicability from non-site Earth art to multipurpose landscape planning*** *for environmental sustainability.*

Landscape art may not be ephemeral in nature **as Land art**; But. it **encourages use of natural materials** such as soil, rock, organic media, and water as much as possible with introduced materials such as concrete, metal, asphalt, etc.

Examples of some constructed wetlands are given hereafter: (1, 2, and 3)

1: East Kolkata Wetlands, India., 2. Welsh Harp reservoir, UK., 3. Mai Po Marshes, Hong Kong

Some of the inspirational monumental land art projects are given above (A, B and C)

A: Spiral Jetty by Robert Smithson (1970), a 1500 ft long spiral-shape jetty into Great Salt Lake in northern Utah, U.S.

B: Polderland of Love and Fire, Netherlands, by Daniel Libeskind, 1997

C: Installation by Paul de Kort in De Biesbosch National Park, Netherlands

PROPOSAL-I (Conceptual Layout):

Study area-I:

Kalyani-Gayespur Region of Nadia District of the state of West Bengal, India.

Climate: Humid-Tropical

Annual Rainfall: 1353 mm

Average annual temperature: 28°c

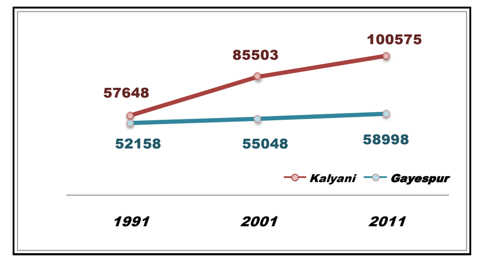


Fig.6 Population growth in Kalyani and Gayespur

Kalyani Municipality (29.14 sq. km.) was developed as a planned town in the 1950s. It has an underground sewage system. Kalyani has a delineated industrial zone al-

In Kalyani, there is one Sewage Treatment Plant (11 Trickling Filter and 6 Oxidation Pond), but not sufficient.

In **Gayespur municipality** (30.2sq. km.), there is no planned sewerage system. Untreated drain-water drains into the lakes/river.

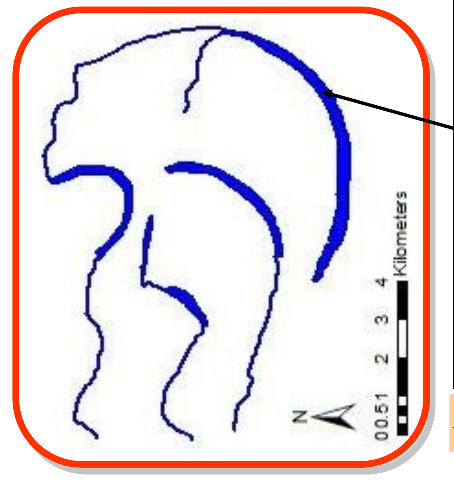


Fig.5 Layout of proposed wastewater and stormwater treatment network in Kalyani-Gayespur region

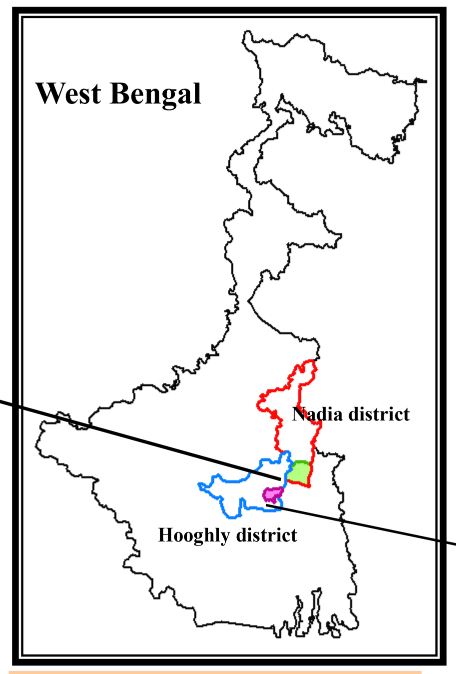
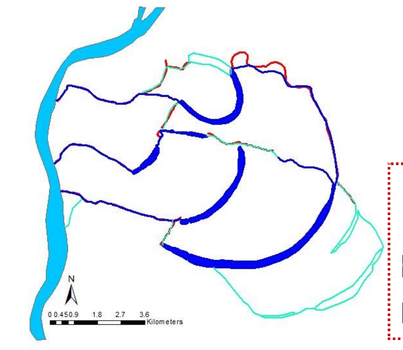


Fig. 4 Location Map of Study Areas

Kalyani-Gayespur Region

Singur Region



INDEX

- Hooghly River
- Proposed wet channels
- Proposed dry channels
- Existing wet channels

Fig.7 Proposed drainage network of wastewater and stormwater treatment overlay on existing water-bodies and channels

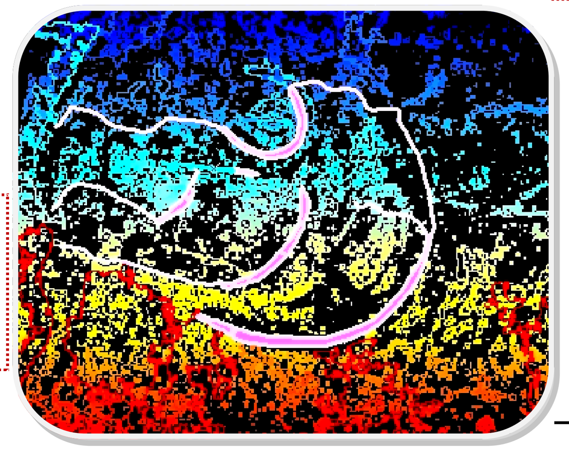
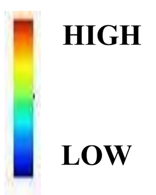


Fig.8 Contours showing slope of Kalyani-Gayespur region



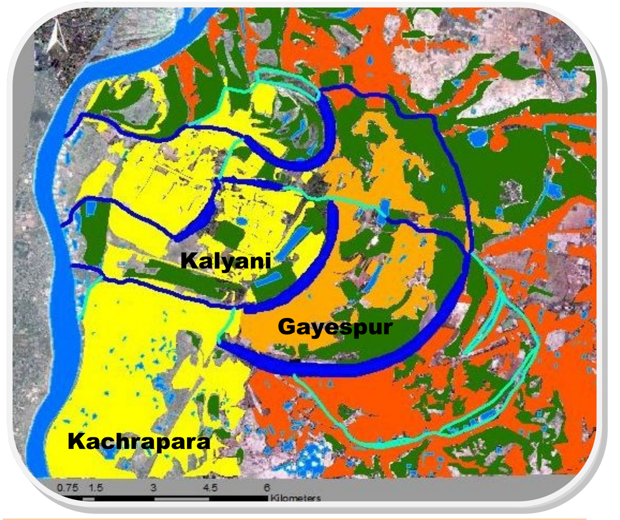


Fig.9 Landuse map of Kalyani-Gayespur region

INDEX

- Hooghly River and inland water-bodies
- Wet paleochannels with connecting channels
- Dry paleochannels with connecting channels
- Agriculture field
- Urban Settlement
- Sub-urban Settlement
- Rural Settlement

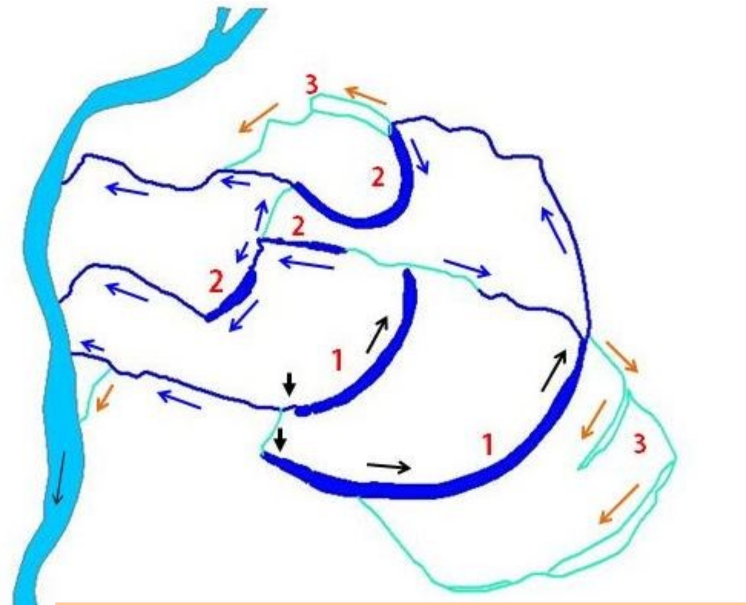


Fig.10 Proposed layout with direction of flow of water

- Inlet of Wastewater
- Direction of flow of wastewater
- Direction of flow of treated/storm water
- Direction of flow when spill out

1. Constructed wetlands for wastewater treatment
2. Wet detention basins for stormwater treatment
3. Dry detention basins when spill out

PROPOSAL-II (Conceptual Layout):

Study area-II:

Singur Region of Hooghly District of West Bengal, India.

Climate: Humid-Tropical

Annual Rainfall: 1538 mm

Average annual temperature: 26°c

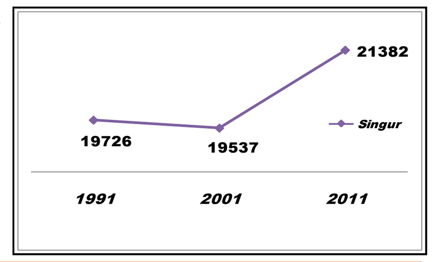


Fig.12 Population growth in Singur

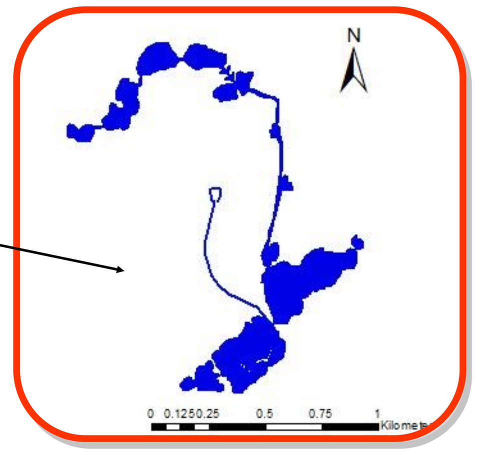


Fig.11 Layout of proposed wastewater and stormwater treatment network in Singur region

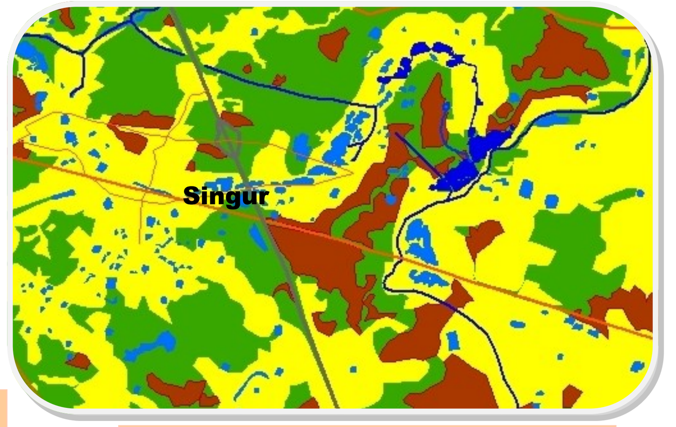


Fig.13 Landuse map of Singur region

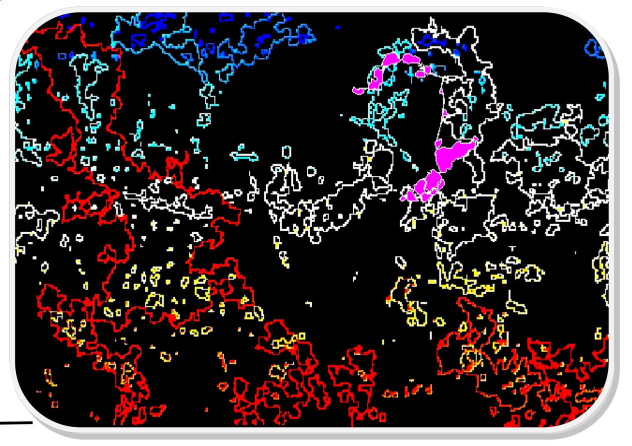


Fig.14 Contours showing slope of Singur region

INDEX

- Inland water-bodies
- Water-bodies considered for proposing layout
- Sub-urban Settlement
- Agriculture field
- Fallow and waste land

Reconnaissance survey for selection of study area and proposing the primary layouts was done primarily based on the secondary data sources. Detailed primary field survey is required before implementing the proposal.

CONCLUSION:

An effort was made to include the concept of land art in landscape planning for developing wastewater treatment network. With the minimum alteration of the existing water bodies and topography, an artistic landscape layout could be achieved through a series of constructed wetlands and detention basins.

* Such efforts can give an aesthetically pleasing and multi-functional landscape. Besides, they provide a valuable ecological habitat for wildlife.
* Aquaculture, reuse of water for irrigation and non-potable uses and production of biogas may also be explored on such constructed wetlands for an economically viable solution.
* Reduction of water-logging from urban surface runoff during the peak rainy seasons.
* Reclamation of paleochannels and moribund rivers could be a part this effort and promote awareness to conserve the valuable water resources.

Finally, the concept is a continuation of the historical movement for developing land art and expands its applicability in the process of sustainable development.

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SOURCES OLF PHOTOGRAPHS: A: https://en.wikipedia.org/wiki/Spiral_Jetty, B and C: www.pauldekort.nl

1: Google earth, 2: http://www.webbaviation.co.uk/gallery/v/greater_london/brent/BrentReservoir-eb12656.jpg.html, 3:http://www.gettyimages.in/detail/photo/fish-ponds-in-a-nature-reserve-mai-po-high-res-stock-photography

ANNOTATIONS:

Grey Water Footprint : It is defined as the volume of freshwater that is required to assimilate the load of pollutants based on existing ambient water quality standards. It is an indicator of freshwater pollution.

Waste Stabilization Ponds : They are large, man-made water bodies in which grey water or faecal sludge are treated by natural occurring processes and the influence of solar light, wind, microorganisms and algae. The ponds can be used individually or linked in a series for improved treatment.

Paleochannels : Palaeochannels are remnant or abandoned paths of once active rivers or streams that changed their course either due to tectonic movement or meander cut off; they had been either filled or buried by younger sediment..

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