

Revitalization of Lake Precinct, Khanugaon Bhopal

A DESIGN THESIS

Submitted

In partial fulfillment of the requirements
For the award of the degree of

MASTER OF LANDSCAPE ARCHITECTURE

By

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Under the Guidance of

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DECLARATION

I Nazeem Shaikh, Scholar No. 2015MLA020 hereby declare that the thesis titled “**Revitalization of Lake Precinct, Khanugaon Bhopal.**” submitted by me in partial fulfillment for the award of Master of Landscape Architecture in School of Planning and Architecture Bhopal, India, is a record of bonafide work carried out by me. The matter embodied in this thesis has not been submitted to any other University or Institute for the award of any degree or diploma.

Signature of the Student

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CERTIFICATE

This is to certify that the declaration of **Nazeem Shaikh** is true to the best of my knowledge and that the student has worked for one semester in preparing this thesis.

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1.0 Abstract

Lakes and water bodies have always attracted and shaped many urban developments, resulting in a close and integrated water-city relation. Dramatic changes occurred due to the industrial revolution affecting the relationship with water bodies. Understanding the idea of nature in the city. Landscapes that reflect the idea of wilderness or untamed nature are important vignettes of our surrounding environment. Redevelopment of upper lake precinct is aimed towards revitalization of the Kohefiza and Khanugaon and its surrounding areas into an integrated, enhanced and unified lake precinct at the gateway of Bhopal.

As a vital civic heritage in the humid subtropical climate context, the lake has always had strong historic and cultural links that can be strengthened to foster tourism and reinstall civic pride. The proposal envisions the lakefront as an agent of socio-economic revitalization and a crucial step towards re-linking the lake system with Bhopal. This is achieved by improving accessibility to the precinct, creating gateways and public spaces, water front retrofitting to sustain water, restoring the lake ecology and enhancing the historic lake system.

1.0 सार...

झीलों और जल निकायों ने हमेशा कई शहरी विकासों को आकर्षित किया है और आकार दिया है, जिसके परिणामस्वरूप एक घनिष्ठ और एकीकृत जल-शहर संबंध होते हैं। जल निकायों के साथ संबंध को प्रभावित करने वाली औद्योगिक क्रांति के कारण नाटकीय परिवर्तन हुआ, शहर में प्रकृति के विचार को समझना परिदृश्य जो जंगल या अदम्य प्रकृति के विचार को प्रतिबिंबित करते हैं, हमारे आसपास के वातावरण के महत्वपूर्ण विगनेट्स हैं ऊपरी झील की सीमा का पुनर्विकास, कोहेफीज़ा और खानुगांव और इसके आसपास के इलाकों में भोपाल के प्रवेश द्वार पर एक एकीकृत, बढ़ाया और एकीकृत झील के किनारे के क्षेत्र में पुनर्जीवित करने के उद्देश्य से है।

आर्द्र उप-उष्णकटिबंधीय जलवायु संदर्भ में एक महत्वपूर्ण नागरिक विरासत के रूप में, झील में हमेशा ऐतिहासिक ऐतिहासिक और सांस्कृतिक संबंध होते हैं जो पर्यटन को बढ़ावा देने और नागरिक गौरव को फिर से स्थापित करने के लिए मजबूत किया जा सकता है। यह प्रस्ताव सामाजिक-आर्थिक पुनरोद्धार के एक एजेंट के रूप में लॉफ़फ़्रन्ट को और भोपाल के साथ झील प्रणाली को पुनः जोड़ने के लिए एक महत्वपूर्ण कदम के रूप में तैयार किया गया है। यह परिसर की पहुंच में सुधार, गेटवे और सार्वजनिक स्थान बनाने, पानी को बनाए रखने, पानी को बनाए रखने, झील पारिस्थितिकी को पुनर्स्थापित करने और ऐतिहासिक झील प्रणाली को बढ़ाने के लिए सुधार के द्वारा हासिल किया गया है।

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2.0 INTRODUCTIONS

2.1 Lake Precinct redevelopment.

2.2 Importance of upper lake.

2.3 Need of leisure space on lake front development at upper lake.

2.4 Aim and objectives.

2.5 Scope and limitation.

2.6 Methodology.

2.7 Design aspect.

2.1 lake precinct redevelopment

Lakes and water bodies have always attracted and shaped many urban developments, resulting in a close and integrated water-city relation (Butuner, 2006; Breen et al., 1996). Dramatic changes occurred due to the industrial revolution affecting the relationship with water bodies, yet by the mid-20th century industrial activities began to move to outer city zones, leaving vast lands and presenting an opportunity for revitalizing these areas (Butuner, 2006). Lakes have an unquestionable value as an ecological, recreational and economic resource to urban areas. Nonetheless, lakes are subject to serious pollution problems as they function as sinks for streams and lakeside activities, both from point sources such as domestic and industrial and non-point sources such as agricultural run-off and land use activities (Abdullah, 2009; Golubev, 1989). A sustainable approach should find a balance between human needs and the ability of the water resource to recover and regenerate. Such an approach need recognize the intricate relationship between the land activities and the water body. Planning practices often disregard the lake ecosystem resulting in permanent damage and costly remedial action to restore it (Dinar et al., 1995). Land Use Planning (LUP) can be a way forward as it aims to adopt land uses in the most efficient manner, so as to satisfy the various needs of society, reflecting the economic and social conditions, maximizing the use of land and water potentials whilst conserving the fragile ecosystems (Leung, 2003).

Lakefronts are considered densely populated developed areas on a lake. Land uses include residential, recreational, commercial, shipping or industrial uses (CZMA, 1972). Lakefronts are of the most complex and challenging urban lands, considered a national asset yet expected to fulfil daily needs of local residents. They have a strong potential to provide diversified opportunities for economic development, public enjoyment and civic identity. The variety of land uses reduce the economic vulnerability to one use, such as tourism, eagerly adopted in revitalization plans (Dong, 2004; Craig-Smith et al., 1995).

Yet the compatibility of uses with each other and with the ecological conditions of the lake is a precondition for a lakefront sustainable use. Craig-Smith

et al. (1995) also point to the level of integration with the lake and the degree of dependency which can act as a patron to the conservation of a lake rather than the neglect and abandonment some have witnessed. Seven principles were developed by the Lake Environment Committee (ILEC, 2003) of Japan in collaboration with the UNEP, for sustainable lake management, these are: a harmonious relationship between humans and nature; a lake drainage basin for planning and management actions; long-term preventative approach to causes of degradation; sound science and best available information to be the base of policy decision making; resolution of conflicts among competing users (nature, present and future generations); stakeholder participation to identify and resolve critical problem; and finally, good governance system based on fairness, transparency and empowerment of all stakeholders. These principles are quite useful in uncovering the underlying problems faced in the area of the case study as well as providing a blueprint for the sustainable management of a lakefront.

2.2 Importance of Upper Lake

Understanding the idea of nature in the city. Landscapes that reflect the idea of wilderness or untamed nature are important vignettes of our surrounding environment. Redevelopment of upper lake precinct is aimed towards revitalization of the Kohefiza and Khanugaon and its surrounding areas into an integrated, enhanced and unified lake precinct at the gateway of Bhopal.

As a vital civic heritage in the humid subtropical climate context, the lake has always had strong historic and cultural links that can be strengthened to foster tourism and reinstall civic pride. The proposal envisions the lakefront as an agent of socio-economic revitalization and a crucial step towards re-linking the lake system with Bhopal. This is achieved by improving accessibility to the precinct, creating gateways and public spaces, water front retrofitting to sustain water, restoring the lake ecology and enhancing the historic lake system.

2.3 Need of Leisure Space at Upper Lake

-This Is a Historically and Geographically Important Water Catchment Area.

- Rapid Urbanization And Fast Growing Population Of The City Has Resulted In The Degradation Of Lake Edges And Its Original Nature. Also Increasing The Demand Of Fresh Water In The Developing Civilization, There Need Of Restoration And Management Of Lake Which Are The Main Accessible Source Of Water.

- Though Lack of Open Spaces along Lake Front Corporation Encroaching In To the Lake Edge, The Riparian Edge Is Vanishing, Revitalizing The Lake Edge Riparian Edge Will Enhance The Water Quality And Enhancing The Beauty Of Lake.

2.4 Aim and Objectives

Aim:

-Revitalization of Lake Precinct, Kohefiza to Khanugaon, Bhopal

Objective:

-To Revitalize Lake Edge (Healthy Riparian Edge)

-To Revitalize Lake View (Enhancing the Scenic Quality of Lake and Lake Precinct)

-To Understand The Idea Of Nature In The City.

-With The Overall Objectives Of The Master Plan To Build A Positive Attitude To The Waterfronts, Following Factors Were Considered:

-To Study Issues and Concerns of the Lake Edge and Come up With the Landscape Proposal.

-Restoring The Riparian Edge And Its Habitat.

-Enhancing the new landmark within the city, to provide an urban recreational space which provides a medium through which communicate in city takes place and depicts the culture of city.

-Outdoor passive and active zones shall be introduces at strategic location for public and neighborhood with required leisure space (trail for bird watching, view point to enjoy city at glance with their cultural and natural backdrop, plaza for gathering.)

-Upgrading the lake: a potential environmental resource.

Historic background:

- Built Badatalab precinct. One of the eminent features was the fort wall, Rani Kamlapati palace, Gauhar Mahal, Taj-ul-Masajid.

Ecological aspect:

- waste water outlets of Khanugaon into the lake cause water pollution
- Newly build R.C.C wall to develop Lake Front destroyed the lake ecosystem
- Excessive growth water hyacinth hampered the aquatic ecosystem.

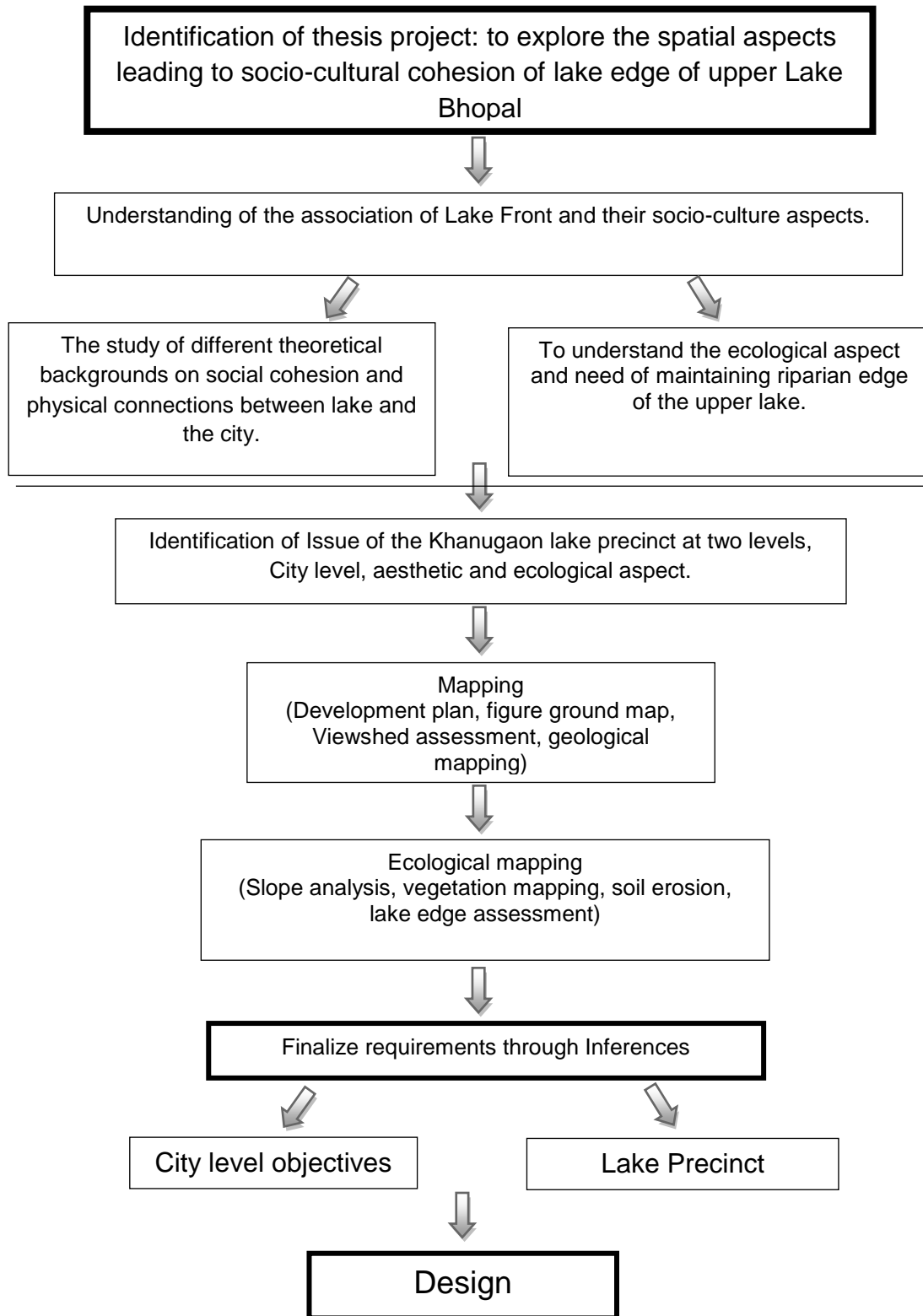
Urban context:

- lake is surrounded by lush green forest near van Vihar on the right, dense old city on the left
- People stand along the road side with lake edge is the tendency of citizen to enjoy Lake Front, not having deck or open space along VIP Road.

2.5 Scope and limitation.

The project will consider the entire lake edge of Bhopal city for contextual studies and a part of entire lake edge of Khanugaon precinct for detail intervention.

2.6 Methodology.



2.7 Design Aspects

- Identify primary users
- Identifying people who will use this space
- Defining individual need
- Determining characteristics behavior
- Inviting multidisciplinary cooperation

Design sense

- **security**, serenity, and safety
- **variety of spaces** for multiple user groups
- visible location of the amenities **clear directions**, Include degree of enclosure and separation from outside
- Divide space for **varying levels of privacy**.
- Interior and exterior spaces should be **complimentary**
 - **Planting**
- Areas for safe **seclusion and social interaction**.
- **Seasonal changes**- remind rhythm and nature cycle. Attract birds etc.
- **Creating natural habitat** in dense urban sprawl.
 - **Pathways / Trails**
- Throughout **vista, spaces, panorama view**.
- **Paving surfaces** suitable for wheelchairs and differently abled peoples
- **Easily accessible** entrances and convenient use.
- Physical and physiological **movements**.

Spaces

- **Social interaction** spaces formal- informal
Shelter, mound, Deck, Plaza etc.
- Forest mounds (to create a hidden wildness opportunity)
- **Sense of mystery** with focal points and surprise elements

Analysis:

To conserve the lake as historical heritage and retain its identity and sense of belonging.

To review and restore the aquatic ecosystem.

To retaining the activity of immersing without hampering the ecosystem

Being an open space and lake front it has a scope for proper development of creating it into a lively recreational space.

Developing and maintaining the waterfront will attract people which will help to reduce the antisocial activities and misuse of open space.

3.0 case study

3.1 Case study: Seaside Korbecke

3.2 Case study: Barangaroo-Reserve, Sydney Australia

3.1 Case study: Seaside Korbecke

Location: 59519 Möhnesee Körbecke Germany

Design year: competition 2012, 1. prize

Year of construction: 2015 – 2016

Area: 35.000 qm

Image credits: wbp Landschaftsarchitekten GmbH, Claudia Dreyße, Meinolf Griese

Description:

through distinctive entrances and transitions to the location, through attractive views and links to the lake, as well as by a good zoning and functional furnishing of different quality areas. The topography plays a special role in terraces with different usage zones. There are a lot of possibilities down to the lake to play or to linger on the lawn. Depending on the water level, the lake stage, which projects into the lake, offers a special area directly at the water.¹



¹ <http://www.landezine.com/>

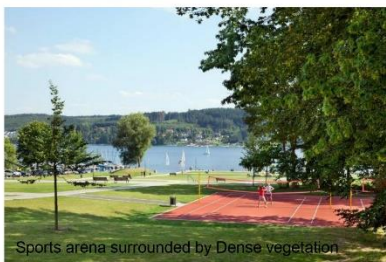
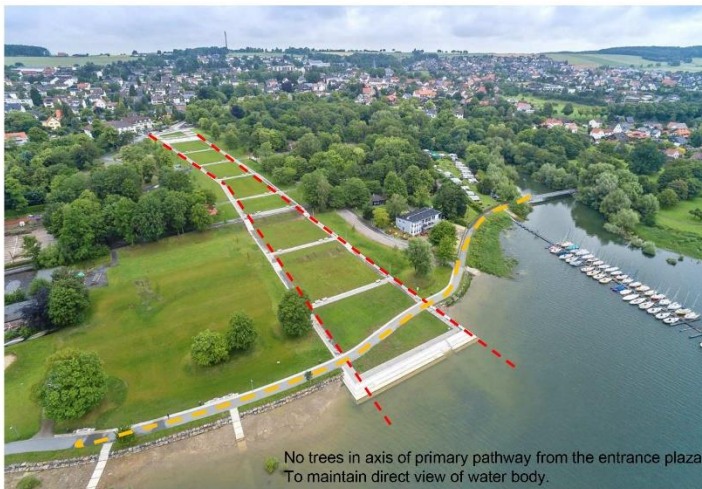
Figure 1 Plan Seaside Korbecke



Figure

2

zoning

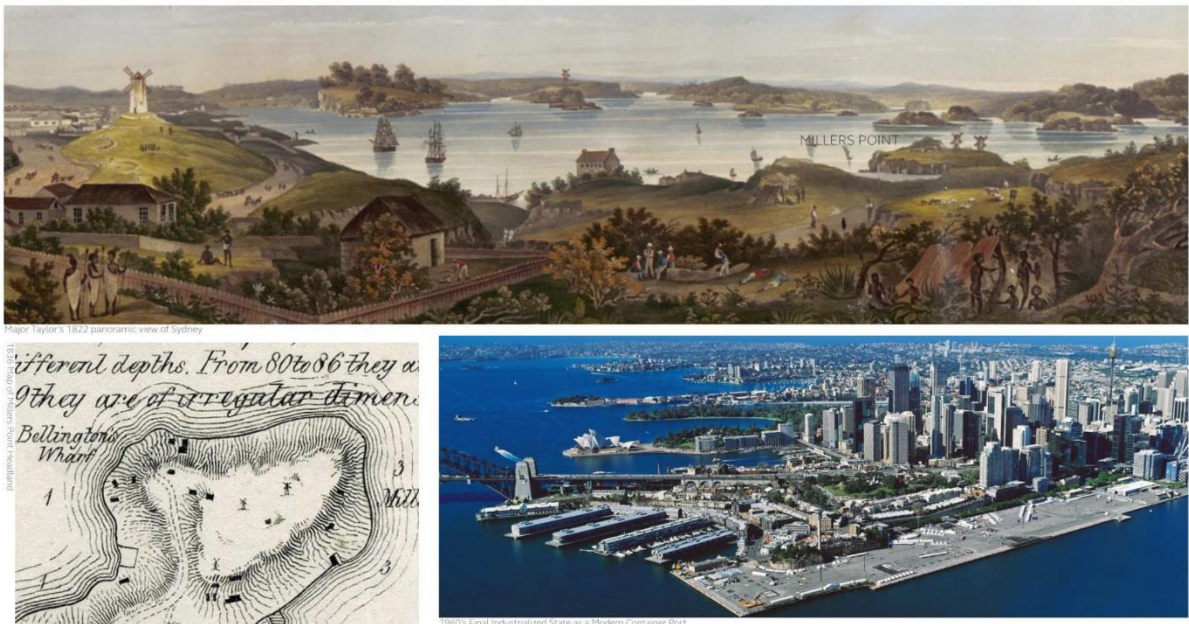


3.2 Case study: Barangaroo-Reserve, Sydney Australia

Barangaroo is an inner-city suburb of Sydney, New South Wales, Australia. It is located on the north-western edge of the Sydney central business district and the southern end of the Sydney Harbor Bridge. It is part of the local government area of the City of Sydney, and was part of the territory of the Cadigal people, the traditional owners of the Sydney city region. The area was used for fishing and hunting by Indigenous Australians prior to colonial settlement.

In 2003, the Government of New South Wales determined that the precinct would be redeveloped from shipping and stevedoring facilities to provide more commercial office space and recreational areas. This redevelopment has moved from design contest to concept plan from 2005 to 2012²

Landscape architect: Johnson Pilton Walker in association with Peter Walker and Partners Landscape Architecture WMK Architecture for The Cutaway



² www.barangaroo.com Barangaroo Delivery Authority

01. The park was to be entirely naturalistic, restricting architectural elements, and to follow the approximate shape and three dimensional form as recorded in historical maps and paintings from around 1836 this new urban park would need to be built to modern code and therefore was impossible to be made a purely natural re-creation.

02. The cultural centre was to be concealed below the landscape and to follow the topography of the re-created headland form.

03. The foreshore walk was to aspire to a civic scale in keeping with the great public foreshore promenades of Sydney such as the royal botanic gardens and designed to last 100 years. It needed to be continuous, connecting the last 2.5 km of remaining water front edge which was denied public access for more than 200 years.



Figure 3 Old and new profile of park and foreshore of Barangaroo-Reserve.



Figure 4 Plan showing the connectivity of park with neighborhood.



Figure 5 Section showing the new profile Barangaroo-Reserve, with respect to neighborhood.

The Cutaway

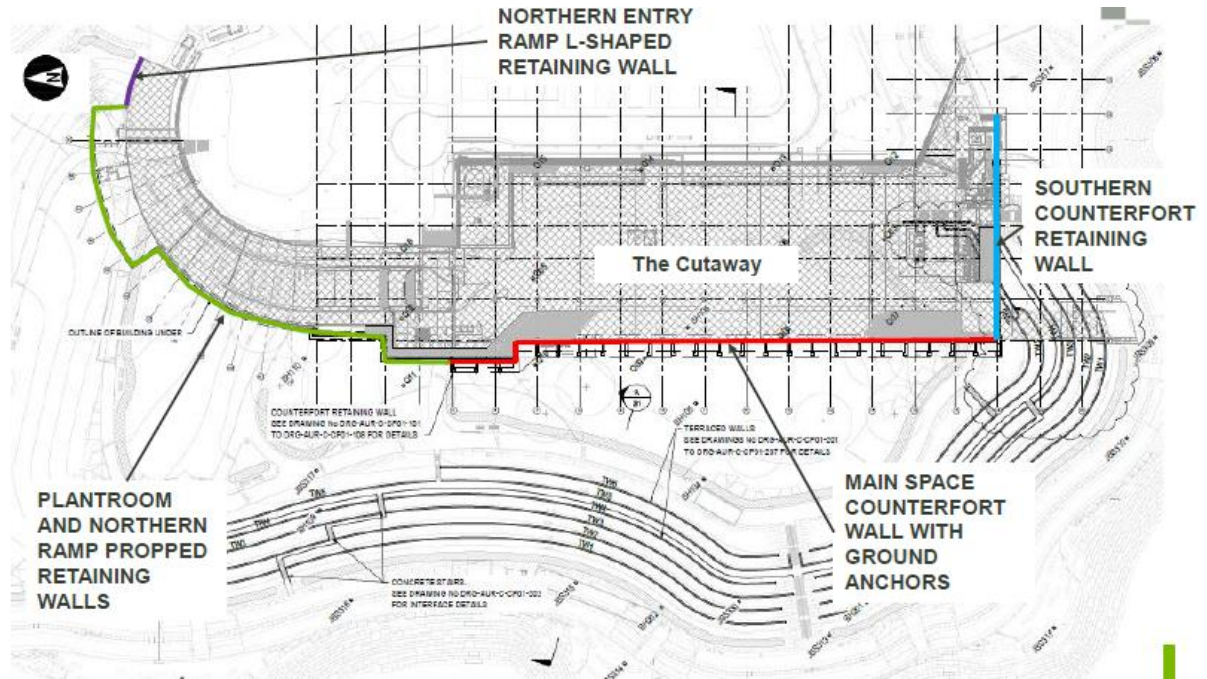


Figure 6 Plan the Cutaway

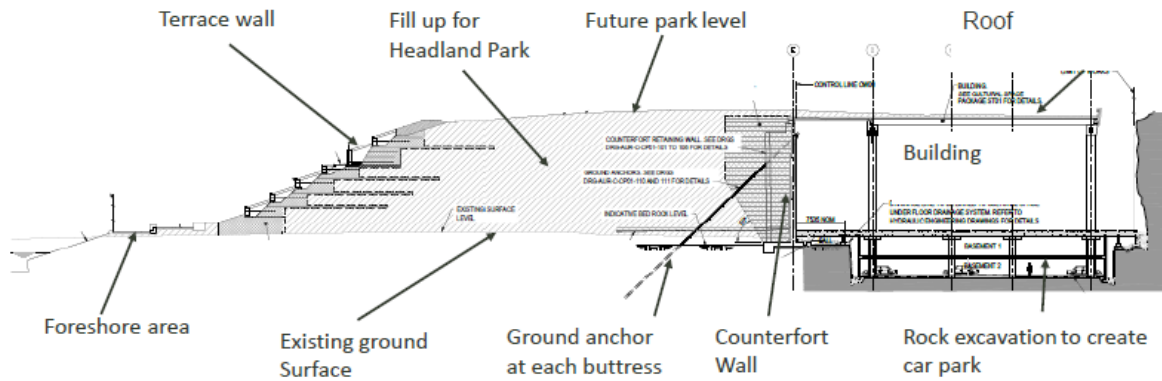
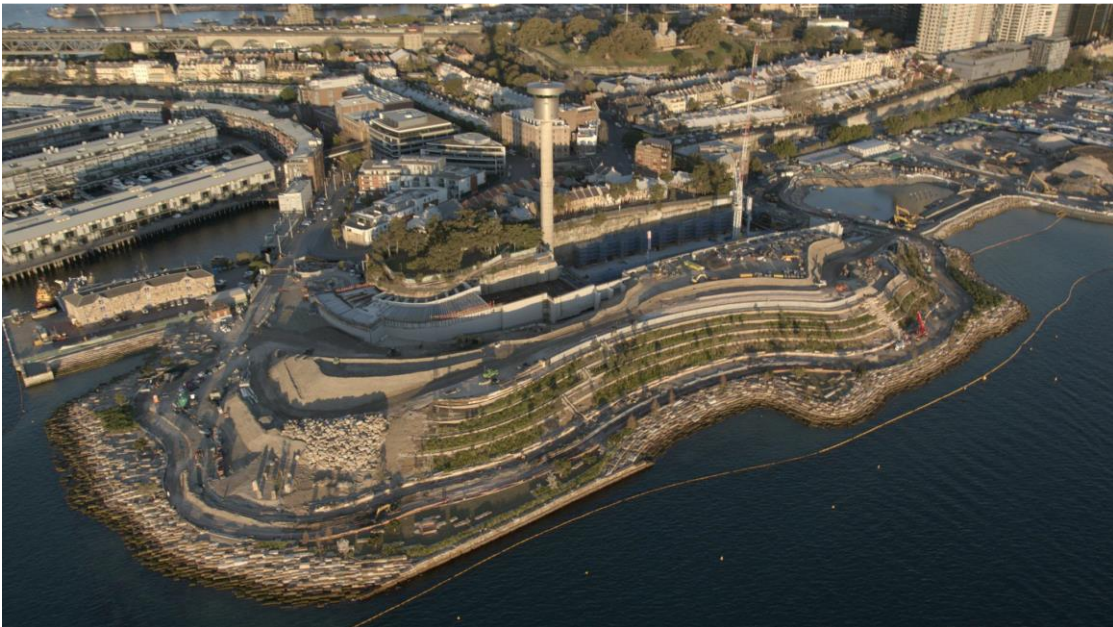


Figure 7 Section the Cutaway

Key features

- 145 m long and retains 19.5 m of general fill with no movement joints
- Buttresses at 6 m centers constructed vertically.–Buttresses were are a constant 550 mm thick, front wall varies in thickness over the height.
- Supports The Cutaway roof structure.
- Separates the park from the building with a maximum retained height of 19 m.
- Provides restraint to the roof against 1 in 2500 earthquake loading in the N-S direction and western direction.
- Supports two future floors at RL8.5 and RL13.0.
- Located on the western ledge of the sandstone extraction pit.
- No waterproofing membrane applied
- GeosheetCS15F used for drainage system behind the walls in combination with vapour membrane ³



³ Aurecon consultancy



Figure 8 Plan Barangaroo-Reserve



4.0 Lake and City Association

4.1 Background of City

4.2 Evolution of Bhopal

4.3 Geological Structures

4.4 Background of Lake

4.5 Biodiversity Values

4.6 Social and Cultural Values

4.1 Background of city

- Bhopal has an average elevation of 550-600 meters above MSL. Bhopal is located in the central part of India, and is just north of the upper limit of the Vindhya mountain ranges.
- Located on the Malwa plateau, it is higher than the north Indian plains and the land rises towards the Vindhya Range to the south.
- The city has uneven elevation and has small hills within its boundaries. The major hills in Bhopal comprise of Idgah Hills from where VIP Road runs parallel and Shyamala Hills in the northern region and Arera Hills in the central region.
- It has two very beautiful big lakes, collectively known as the Bhoj Wetland. The lakes are the Upper Lake and the Lower Lake. Locally these are known as the Bada Talab and Chota Talab respectively. The catchment area of the Upper Lake is 361 km² while that of the Lower Lake is 9.6 km². The Upper Lake drains into the Kolar River.

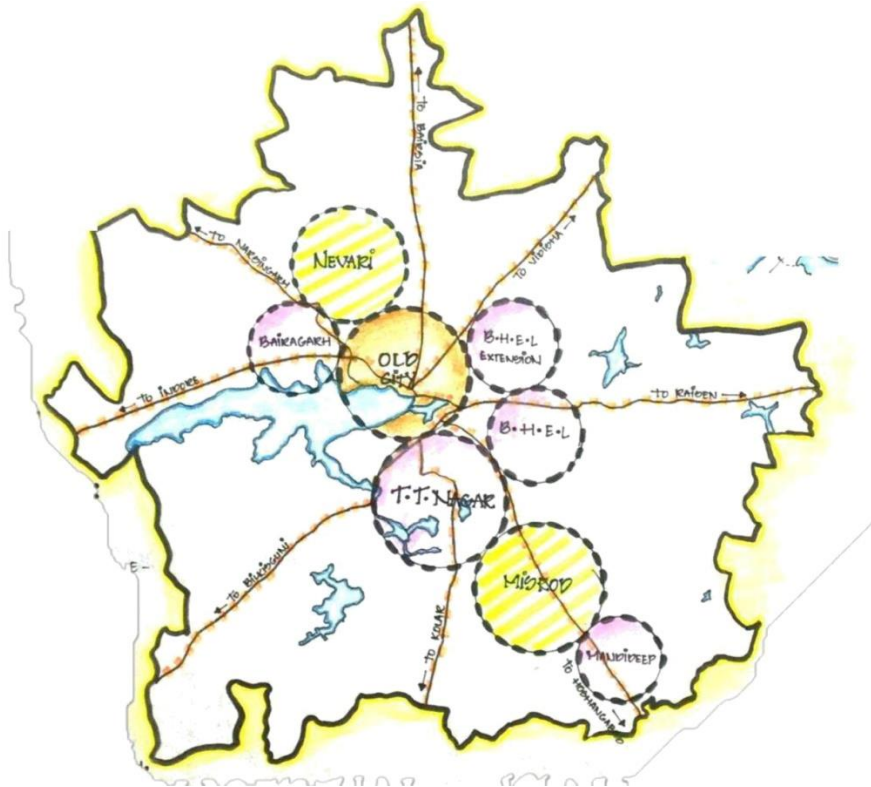


Figure 9 Bhopal and Neighborhood Context

4.2 Evolution of Bhopal - Urban Sprawl

A- 1000-1200AD. Bhopal Founded Lakes Created.

B- 1201-1800AD. Fortified City Constructed.

C- 1801-1850AD. Bhopal becomes British Protectorate

D- 1851-1880AD. Jama Masjid Built By Qudsia Begum.

E- 1881-1900AD. Taj Mahal by Shahjahan Begum.

F- 1931-1950AD. Rapid Expansion under Hamidullah Khan.

G-1951-1972AD. Independence of India Governance Shifts to Near Growth Areas in the South of Bhopal.

H- 1973-1996AD. Establishment of Large Industrial Centers Viz. Govindpura and BHEL.

I-1995-2006AD. VIP Road Establish To Bypass The Old City.⁴

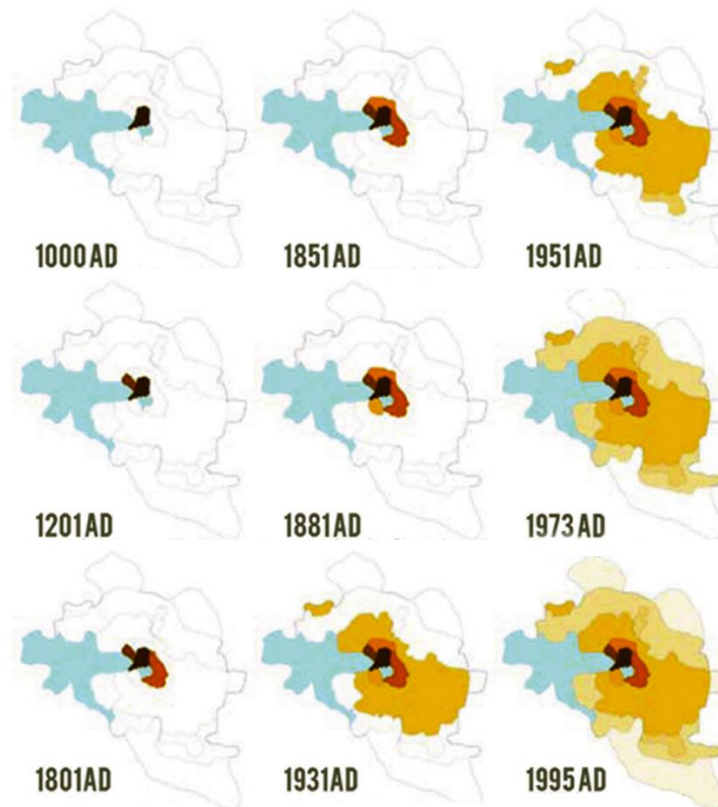


Figure 10 Evolution of Bhopal - Urban Sprawl

⁴ <http://adrianopupilli.com.au/>

4.3 Geological Structures

GEOLOGICAL STRUCTURE

- Bhopal stands on Red Sandstone strata on the Malwa Plateau with various hillocks in and around the city.
- The top portion of various hillocks and the slopes have mostly hard red soil mixed with boulders.
- Black cotton soil of depth 1 to 2.5 mts is found in north-eastern and south-eastern sides of the city and also in certain valleys in the west.
- Better agricultural land is found on the northern side along the Berasia road and on the north-eastern side.
- The city is rich in Sandstone, Black Basalt and Morum (all used as building materials)

4.4 Background of Lake

This upper lake was created in the early-11th century by King Bhoj by construction of an earthen dam across the Kolans River, a rain-fed tributary of the Betwa River. In the late-18th century, another lake downstream of the earthen dam of the Upper Lake was constructed by Nawab Chhote Khan (a Minister of Nawab Hayat Mohammed Khan's regime) to enhance the beauty of the city.

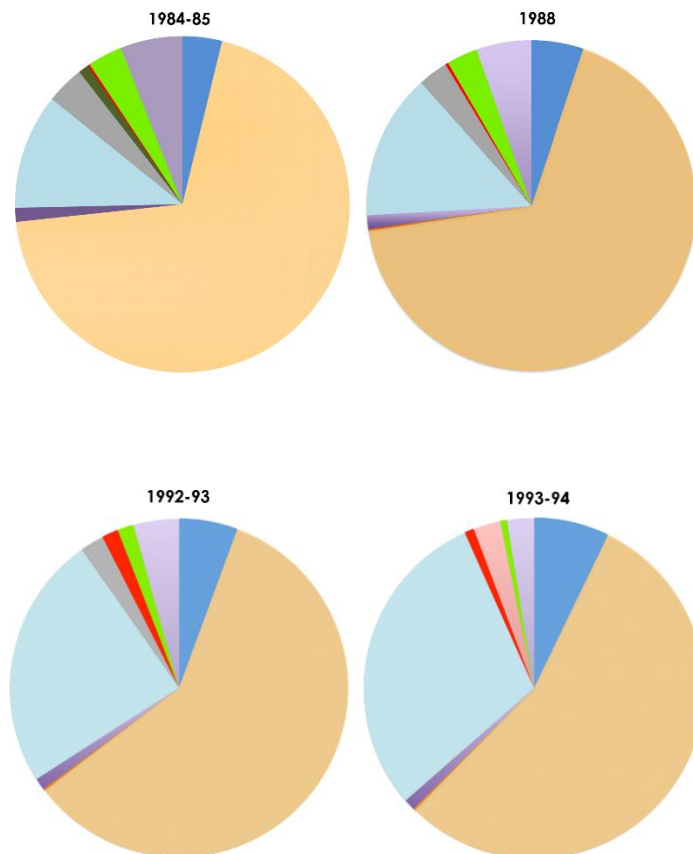
	Upper Lake	Lower Lake
Riparian countries	India	
Lake origin	Man-made (11th century)	Man-made (Late-18th century)
Climatic region	warmer humid (humid subtropical)	
Drainage basin type	Open	
Salinity type	Fresh	
Altitude	503.5 m	500 m
Surface area	36 km ²	1.29 km ²
Drainage basin area	361 km ²	9.6 km ²
Volume	0.117 km ³	0.004 km ³
Maximum depth	11.7 m	9.5 m
Average depth	6 m	

Figure 11 Features of the Bhoj Wetlands

Changing Landuse Area of the Catchment of the Upper Lake

SL. NO.	DESCRIPTION	1984-1985 (SQ. KM.)	1988 (SQ. KM.)	1992-1993 (SQ. KM)	(SQ. KM)	REMARKS
1.	BUILT-UP LAND	14.24	19.075	20.855	25.667	AREA INCREASING BECAUSE OF URBANIZATION.
2.	CROP LAND	258.817	250.911	219.05	197.265	
3.	PLANTATION	-	0.67	0.67	0.58	AGRICULTURAL ACTIVITY DECREASING
4.	OPEN FOREST	5.0	4.939	4.225	3.825	AREA DECREASING
5.	LAND WITH/WITHOUT SCRUB	41.355	52.827	90.292	106.45	HIGHLY INCREASING
6.	BARREN ROCKY/STONY	13.645	10.975	8.465	3.295	DECREASING DUE TO URBANIZATION
7.	WATERLOGGED	3.75	-	-	-	WATERLOGGED AREA HAD VANISHED
8.	AQUATIC VEGETATION	0.77	1.075	5.875	9.175	INCREASING RAPIDLY
9.	EXPOSED LAKE BED	12.525	11.351	5.745	2.325	REDUCING
10.	LAKES AND PONDS	22.32	20.075	16.17	9.095	WATER SPREAD AREA OF THE LAKE DRASTICALLY REDUCED
11.	TOTAL GEOGRAPHICAL AREA	372.352	372.352	372.352	372.352	

Figure 12 Changing Landuse Area of the Catchment of the Upper Lake



Effects of the Recent Development of the Lake

SL. NO.	PROBLEMS	REMARKS
1.	REDUCTION OF WATER STORAGE CAPACITY OF THE LAKES.	INFLOW OF SILT AND ORGANIC MATERIALS FROM URBAN AND RURAL CATCHMENTS ALONG WITH MONSOON RUNOFF AND DRY WEATHER FLOWS; ADDITION OF CLAY AND NON-BIODEGRADABLE MATERIALS THROUGH IMMERSION OF IDOLS.
2.	OBSTRUCTIONS TO SMOOTH WATERFLOW THROUGH THE UPPER LAKE'S SPILL CHANNEL, RESULTING IN A THREAT TO THE STABILITY OF THE EARTHEN DAM.	CONSTRUCTION OF THE SPILL CHANNEL, DUE TO DEPOSITION OF SILT.
3.	DETERIORATION OF WATER QUALITY	INFLOW OF UNTREATED SEWAGE FROM HABITATIONS; DUMPING OF MUNICIPAL WASTES NOT COLLECTED BY THE MUNICIPAL CORPORATION; DISSOLVING OF PAINTS IN WATER DURING IMMERSION OF IDOLS; CHEMICAL FERTILIZER RUNOFF FROM THE CATCHMENT; ACTIVITY OF WASHING OF CLOTHES BY WASHMANS RESULTING IN RELEASE OF DETERGENTS; LEAKAGE OF OIL DURING MOTOR BOATING.
4.	FLOURISHING GROWTH OF INVASIVE AQUATIC PLANTS.	HIGH NUTRIENT LOAD TO LAKES FROM INFLOW OF SEWAGE AND AGRICULTURAL WASTES.
5.	REDUCTION OF WATER SPREAD AREA.	ENCROACHMENT ON THE LAKE FRINGE AREA, WHICH BECOMES EXPOSED WHEN THE LAKE WATER LEVEL DROPS AFTER RAINS END.

Figure 13 Effects of the Recent Development of the Lake

4.5 Biodiversity Values

FLORA

106 species of Macrophytes (belonging to 87 genera of 46 families), which includes 14 rare species and 208 species of Phytoplankton comprising 106 species of Chlorophyceae, 37 species of Cyanophyceae, 34 species of Euglenophyceae, 27 species of Bacillariophyceae and 4 species of Dinophyceae.

FAUNA

The lakes of Bhopal are an important wetland inhabiting more than 700 species of diverse groups including phytoplankton and zooplankton. The wetland is also an important site of avian fauna with more than 150 species of both migratory and resident birds. However the rich biodiversity of the wetland in past few years has been subjected to various anthropogenic pressure and natural calamities, Because of dryness,

Aquatic biodiversity has enormous economic and aesthetic value and is largely responsible for maintaining and supporting overall environmental health. Humans

are long depended on aquatic resources for food, medicines, and materials as well as for recreational and commercial purposes such as fishing and tourism.⁵

Flora

S.No	CATEGORY	FAMILY	GENUS	SPECIES	COMMON NAME
1.	SHRUB	Ebenaceae	<i>Diospyros</i>	<i>melanoxylon</i>	Tendu
2.	SHRUB		<i>Lagerstroemia</i>	<i>parviflora</i>	Lendia.
3.	SHRUB	Sapindaceae	<i>Schleichera</i>	<i>oleosa</i>	Kusum
4.	SHRUB	Boraginaceae	<i>Cordia</i>	<i>macleodii</i>	Dainyar
5.	SHRUB	Apocynaceae	<i>Vinca</i>	<i>rosea</i>	Periwinkle
6.	HERB	Rubiaceae	<i>Gardenia</i>	<i>turgida</i>	Safed phendra
7.	HERB	Oleaceae	<i>Nyctanthes</i>	<i>arbortristis</i>	Harsinghar
8.	HERB	Apocynaceae	<i>Holarrhena</i>	<i>antidysenterica</i>	Kurchi.
9.	HERB	Caesulpinaceae	<i>Cassia</i>	<i>tora</i>	panwar
10.	HERB	Mimosoideae	<i>Mimosa</i>	<i>pudica</i>	touch me not
11.	WEED	Shoreline	<i>Trapa</i>	<i>bispinosa</i>	Singhara
12.	WEED	Shoreline	<i>Nelubium</i>	<i>speciosum</i>	Indian Lotus
13.	WEED	Emergent	<i>Ipomoea</i>	<i>aquatica</i>	Water Morning Glory
14.	WEED	Emergent	<i>Polygonum</i>	<i>glabrum</i>	Common marsh buckwheat
15.	WEED	Floating	<i>Eichhornia</i>	<i>crassipes</i>	<i>Jal Kumbhi</i>
16.	WEED	Floating	Lemna	Minor	Duck Weed
17.	WEED	Submerged	Hydrilla	Verticulata	Indian star-wine

Figure 14 Flora



⁵ <http://www.bhopalbirds.com/>

Birds depending on the wetland

6

	COMMON NAME	SCIENTIFIC NAME	MIGRATORY
1	GREY HERON	Ardea cinerea linnaeus	Resident
2	LITTLE EGRET	Egretta garzeta	Resident
3	MARSH HARRIER	Circus Aeruginosus	Migratory
4	MEDIAN EGRET	Mesophoyx intermedia	Resident
5	OPEN BILL STORK	Anastomus Oscitans	Local Migratory
6	PIED KINGFISHER	Ceryle rudis	Resident
7	POND HERON	Ardeola grayii	Resident
8	RED WATTELED LAPWING	Vanellus indicus	Resident
9	RIVER TERN	Sterna aurantia	Resident
10	SMALL BLUE KINGFISHER	Alcedo atthis	Resident
11	WHITE BREASTED KINGFISHER	Halcyon smrnensisy	Resident
12	WHITE BREASTED WATERHEN	Amourornis phoenicurus	Resident
13	WIRE TAILED SWALLOW	Hirundo smithii leach	Resident
14	BRONZE WINGED JACANA	Metopidious indicus	Resident
15	BROWN HEADED GULL	Larus brunnicephalus	Migratory
16	CATTLE EGRET	Bubulcus ibis	Resident
17	COMMON COOT	Fulica atra linnaeus	Migratory
18	PHESANT TAILED JACANA	Hydrophasianus chirurgus	Resident

Figure 15 Birds depending on the wetland



⁶ <http://www.bhopalbirds.com/>

4.6 Social and Cultural Values

Ever since the lake was constructed in the 11th century, the Bhopal city has grown around it. Life of the people of Bhopal is very much centralized in and around the twin lakes and the people are religiously and culturally attached to the lakes. They meet their needs of daily potable water supply, washing clothes, cultivation of water chestnut in upper lake and lotus in lower lake. The idols of god and Goddesses are also immersed in the lake during religious festivals. The Takia Island in Upper Lake has a tomb of the Shah Ali Shah Rahamatullah Alla, which has religious and archaeological significance.

7

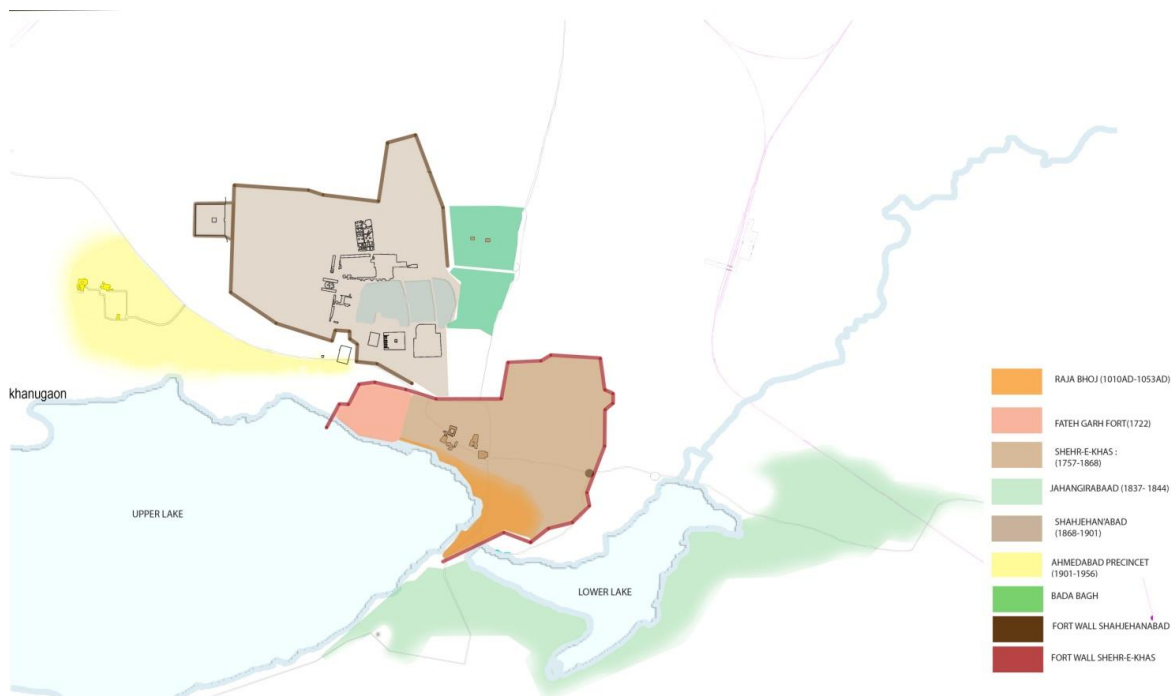


Figure 16 Historic Precinct of Bhopal

⁷ Gazetteer of Madhya Pradesh

5.0 Site Selection

5.1 Connectivity with Lake

5.2 Activity along Lake

5.3 Viewshed Area from the Site

5.4 Figure Ground Map of Bhopal

5.5 Development Plan Map of Bhopal

5.6 Finding Potential of the Site (Khanugaon Precinct)

5.1 Connectivity with Lake

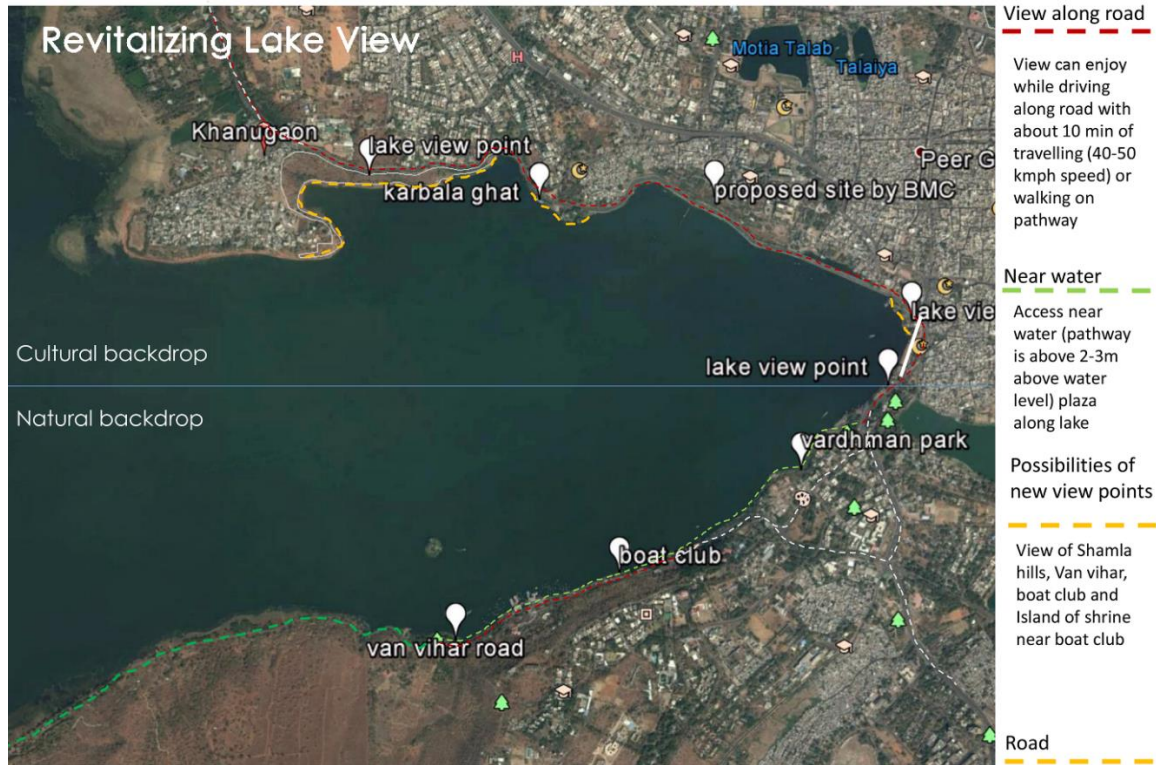


Figure 17 Connectivity with Lake

Landmarks

Upper Lake has a diverse nature. Ecology of that place makes it a scenic place and a gives a memorable walk on the whole stretch with picturesque landscapes with different components at different time periods. The VIP road along the upper lake which provides a whole new foreground and background to different points. The scenes from the entry point (Khanugaon) up to the exit point (Kohefiza) changes according to the season, sky visibility, foreground, and backdrop by existing vegetation, time of visiting.

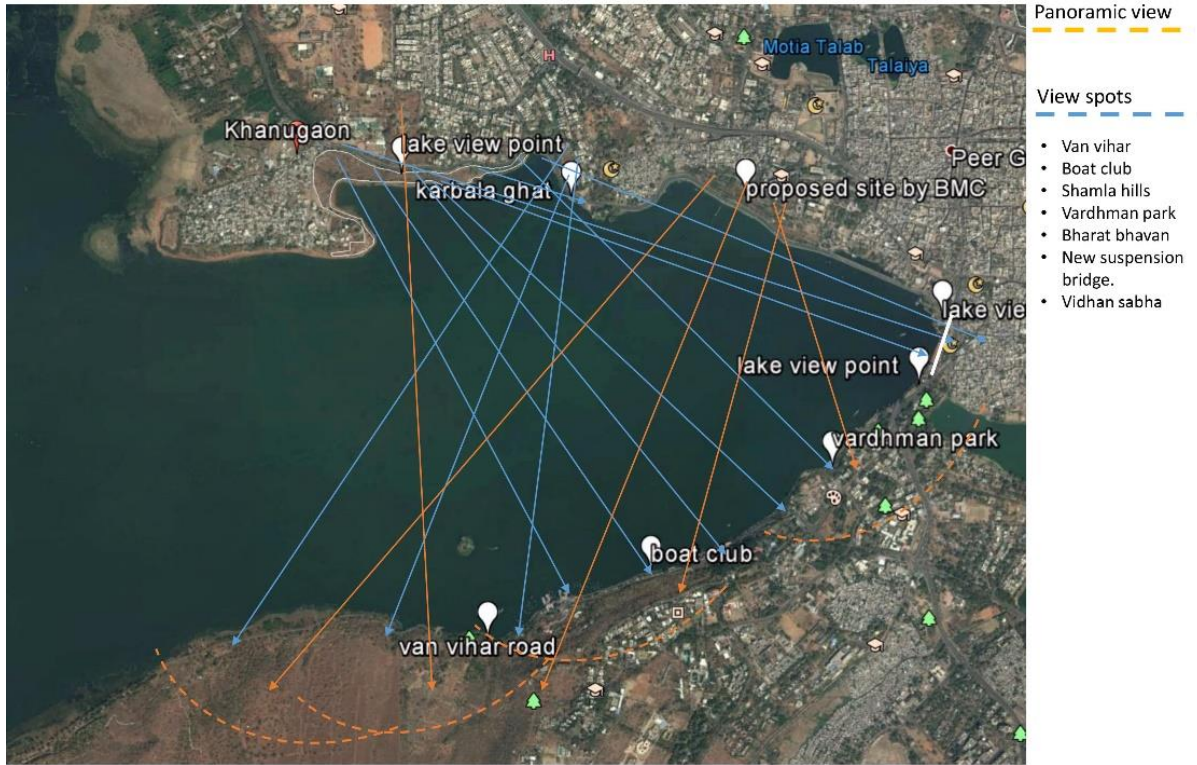
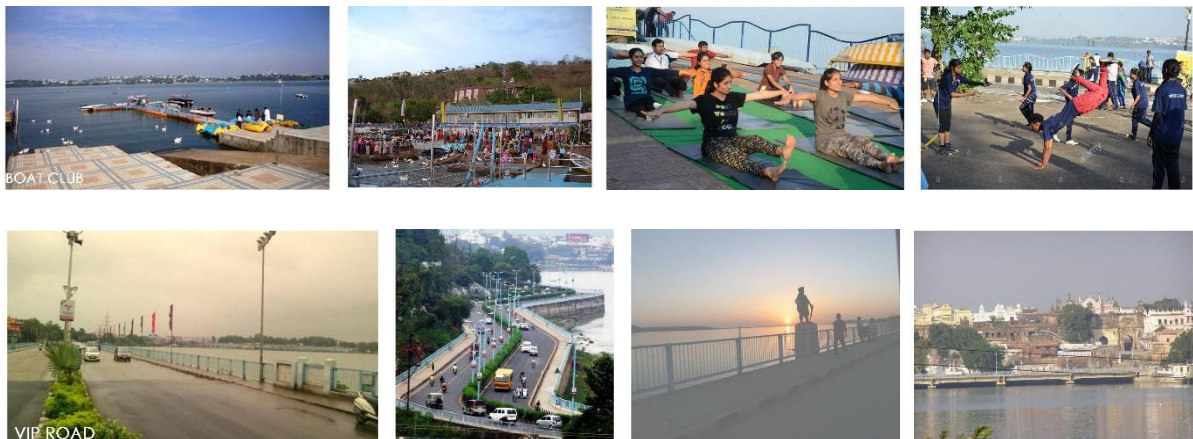


Figure 18 Visual Connectivity with Lake

5.2 Activity along Lake



5.3 Viewshed Area from the Site

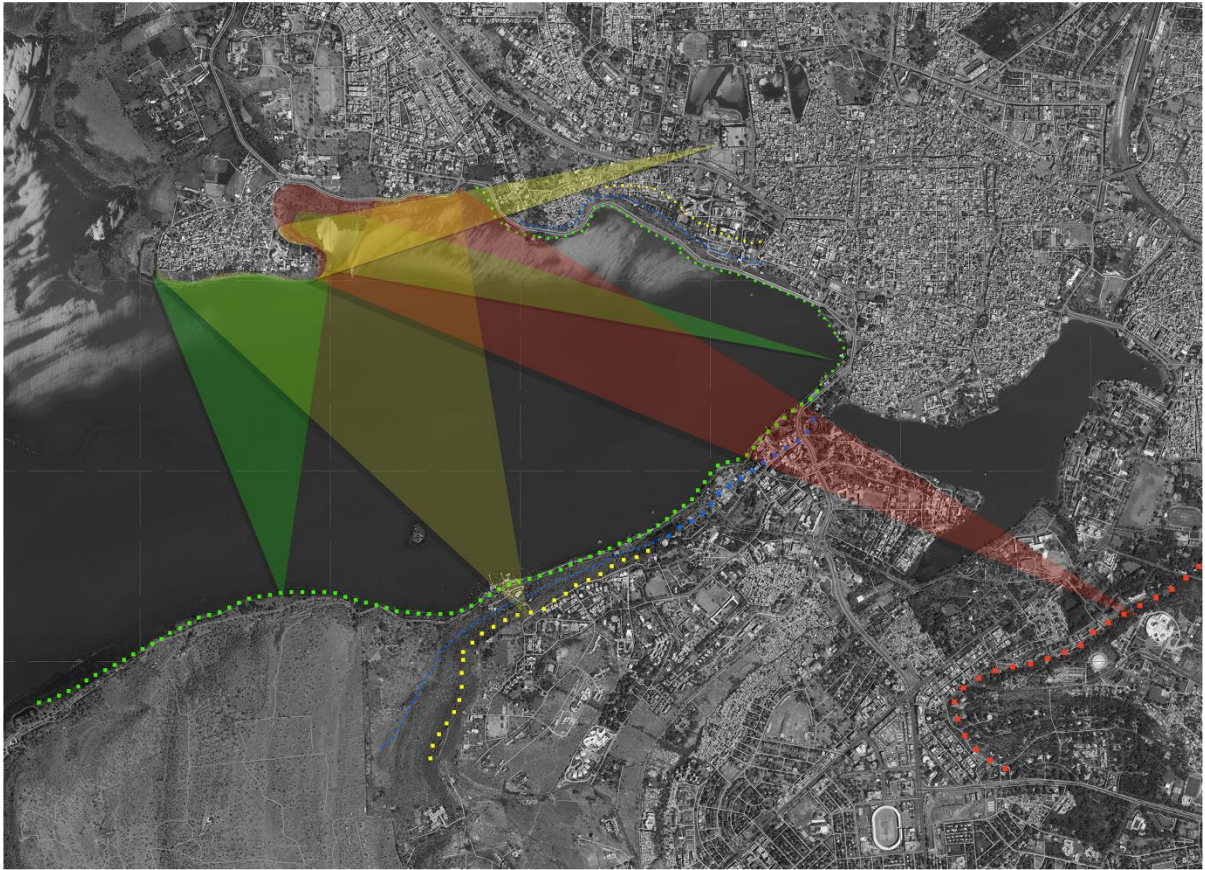


Figure 19 Viewshed Area from the Site



Taj Ul Masajid



New Bridge



Vidhan Bhavan



Shamla Hills



Boat Club



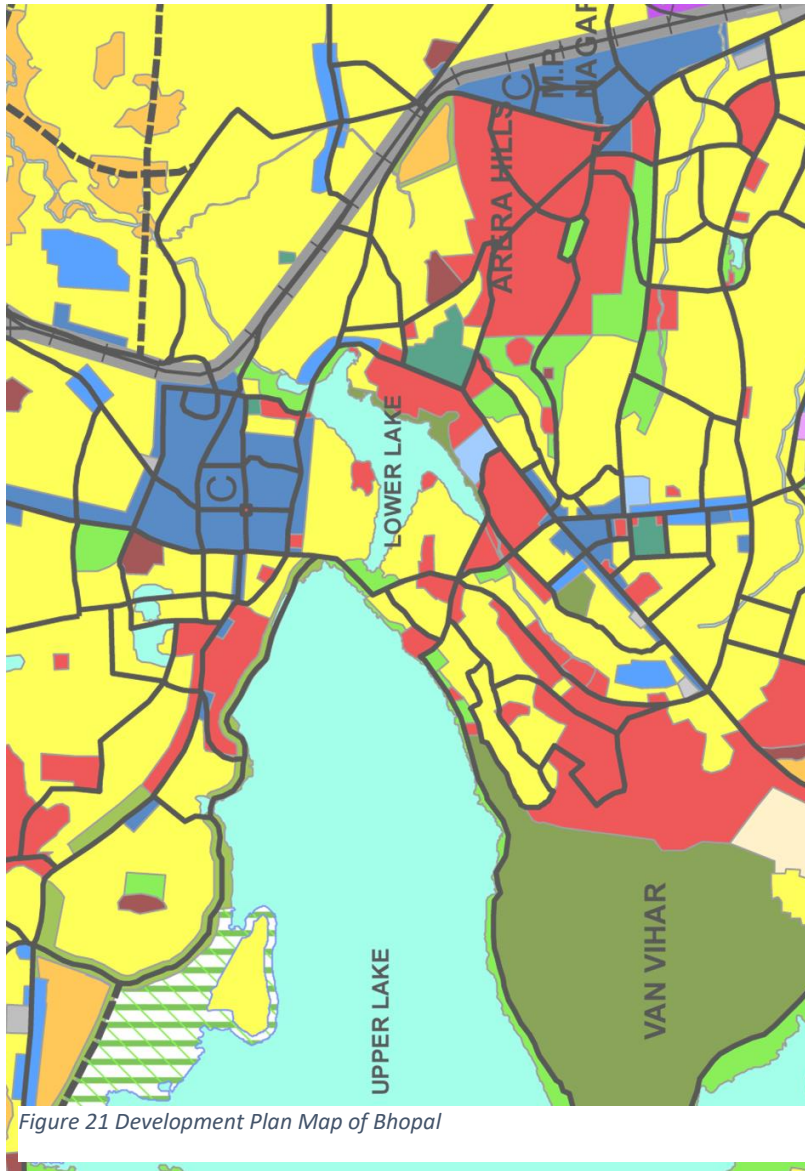
Van Vihar National Park

5.4 Figure Ground Map of Bhopal



Figure 20 Figure Ground Map of Bhopal

5.5 Development Plan Map of Bhopal⁸



LEGEND		PUBLIC UTILITIES AND FACILITIES	
EXISTING	PROPOSED		
RESIDENTIAL		PUBLIC UTILITIES AND FACILITIES	
Yellow	Orange	Dark Red	STP, Power Supply, SWM, Fire Station, Graveyard/Cremation Ground etc.
	Light Orange	PUBLIC AND SEMI PUBLIC	
		Red	Social, Cultural, Administrative, Education and Health
COMMERCIAL		RECREATIONAL	
Dark Blue	Light Blue	Green	Regional Park, Botanical Garden, Zoological Park etc.
	Light Blue with 'C1'	Light Green	City Park, Other Parks including Slope of Hilly Areas
	Blue with 'C'	Light Green with diagonal lines	Exhibition and Mela Ground
	Dark Blue with 'C'	Light Green with vertical lines	City Forest and Afforestation
		Light Green with horizontal lines	Play Ground, Stadium, and Sports Complex
		Light Green with horizontal lines	Lakefront Development
		Light Green with diagonal lines	Reserved Forest

⁸ bhopal development authority

5.6 Finding Potential of the Site (Khanugaon Precinct)

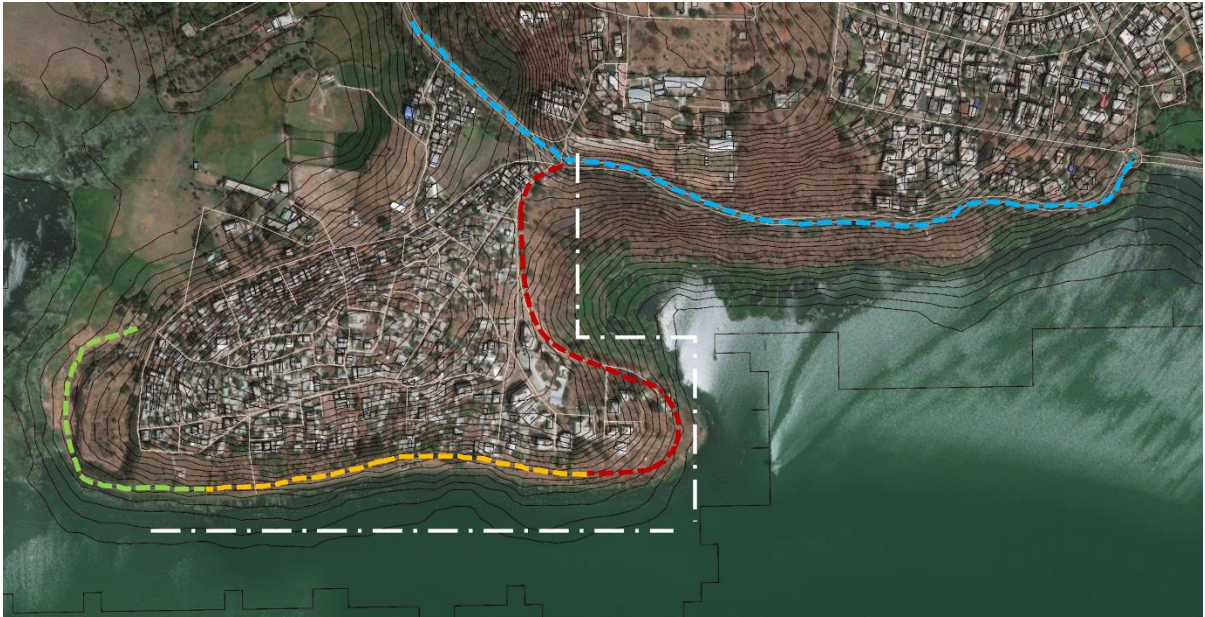


Figure 22 Khanugaon Precinct

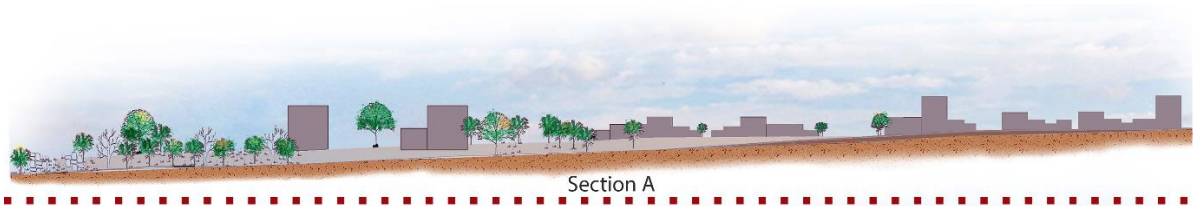


Figure 23 Schematic Section A

Schematic Section through the transect walk looking towards the settlement

A sinuous line of a road winding across an undulating landscape; its shape is compatible with the landform and so no tensions are created. Here the enclosures developed gradually without a preordained plan, which produces a more varied pattern of shapes on the hillside.

A rough textured, rounded, flowing landform. Textures here we related to interval & size of the elements.

Land use patterns show a range of textures or grain. Built-up areas are also been seen as textures at particular viewing distances.

Perception By Means Of the Senses:

1. The natural lake edge is now being concretized by the authorities which is not appreciated, as it is visually disturbing the natural setting of the landform and also the flora-fauna of the place.
2. This felt more of the modern civilization / development.
3. The landscapes appeal most because of:
 - Water
 - Open clearings and meadows
 - Grazing animals
 - Distant views

Elements which contributes to create a character to the place here:

1. The boulders loosely placed in a pattern.
2. The Hide & show of built-mass
3. The sparsely spaced vegetation.

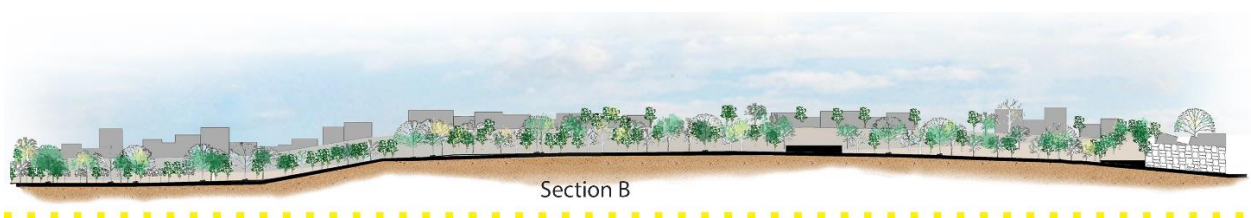


Figure 24 Schematic Section B

Schematic Section through the transect walk looking towards the settlement

-Large and tall forms are of the boulders and some trees are impressive exert some kind of power or depth or they anchor the place. Smaller forms of grasses & trees have low impact.

-The dominance of systematically arranged boulders now give transect a very different character with its shape, size, color & texture.

-Imaginary line in this landscape produces a sense of direction and invites

Perception By Means Of the Senses:

1. Display of several textures, which derived from the materials and their inherent textures and the way they were used.
2. While at the edge, one feels the density of built mass is increased towards the edges; but when within the settlement the pattern is denser towards the middle with decreasing intervals.
3. Sensations of movement present in static images or objects. The position of elements and their shapes suggested an illusion of visual movement.
4. It has an extremely strong sense, the sensory mix of sights, sounds and smells combined to create a very powerful mix. Picturesque views beyond intensify the experience yet further.

Elements which dominated to create a character to the transect were:

1. The boulders placed in a systematic Pattern
2. The dominance of built-mass
3. The dense vegetation

Images show the findings through different elements or arrangement of the same making the place different & unique character.



Figure 25 Different Elements on Site

6.0 Site Analysis

6.1 Climate

6.2 Slope Analysis

6.3 Vegetation and Settlement Mapping

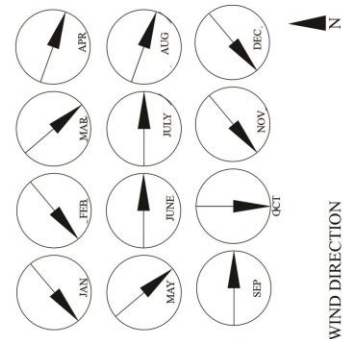
6.4 Observations and Inferences

6.1 Climate

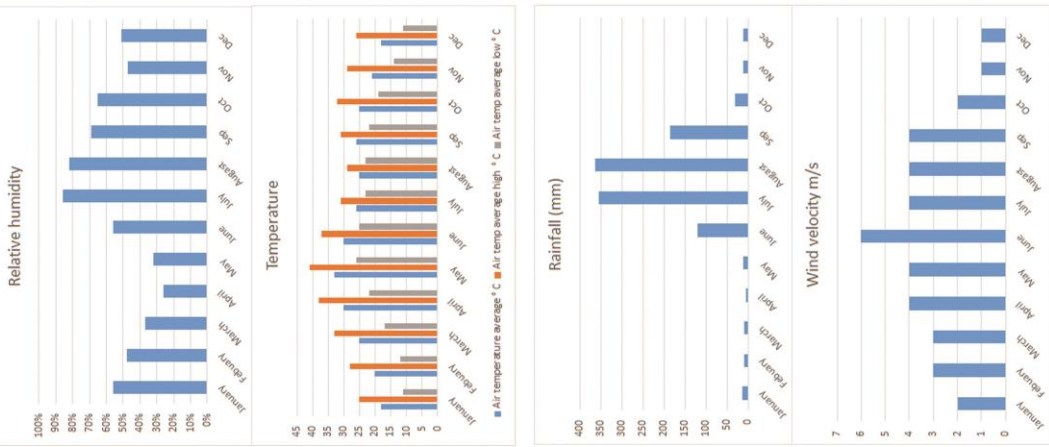
DATA TABLE

unit	Relative humidity %	Air-temperature average °C	Air temp average high °C	Air temp average low °C	Rainfall mm	Wind velocity m/s	wind direction ° (angle from north)
January	56%	18	25	11	13.2	2	50
February	48%	20	28	12	8.7	3	50
March	37%	25	33	17	8.4	3	320
April	26%	30	38	22	4.3	4	290
May	32%	33	41	26	11.7	4	320
June	56%	30	37	25	120.2	6	270
July	86%	26	31	23	354.1	4	270
August	82%	25	29	23	363.3	4	290
Sep	69%	26	31	22	185.1	4	270
Oct	65%	25	32	19	31	2	0
Nov	47%	21	29	14	12.1	1	50
Dec	51%	18	26	11	11	1	50
source	ishrae	ishrae	NMC	NMC	NMC	ishrae	ishrae

ISHRAE: Indian Society of Heating Refrigerating and air-conditioning engineers (data from climate design data 2009 handbook)
 NWC : Norwegian Meteorological Institute (www.weatherbase.com)



Bhopal Physiography and Wind Direction



6.2 Slope Analysis

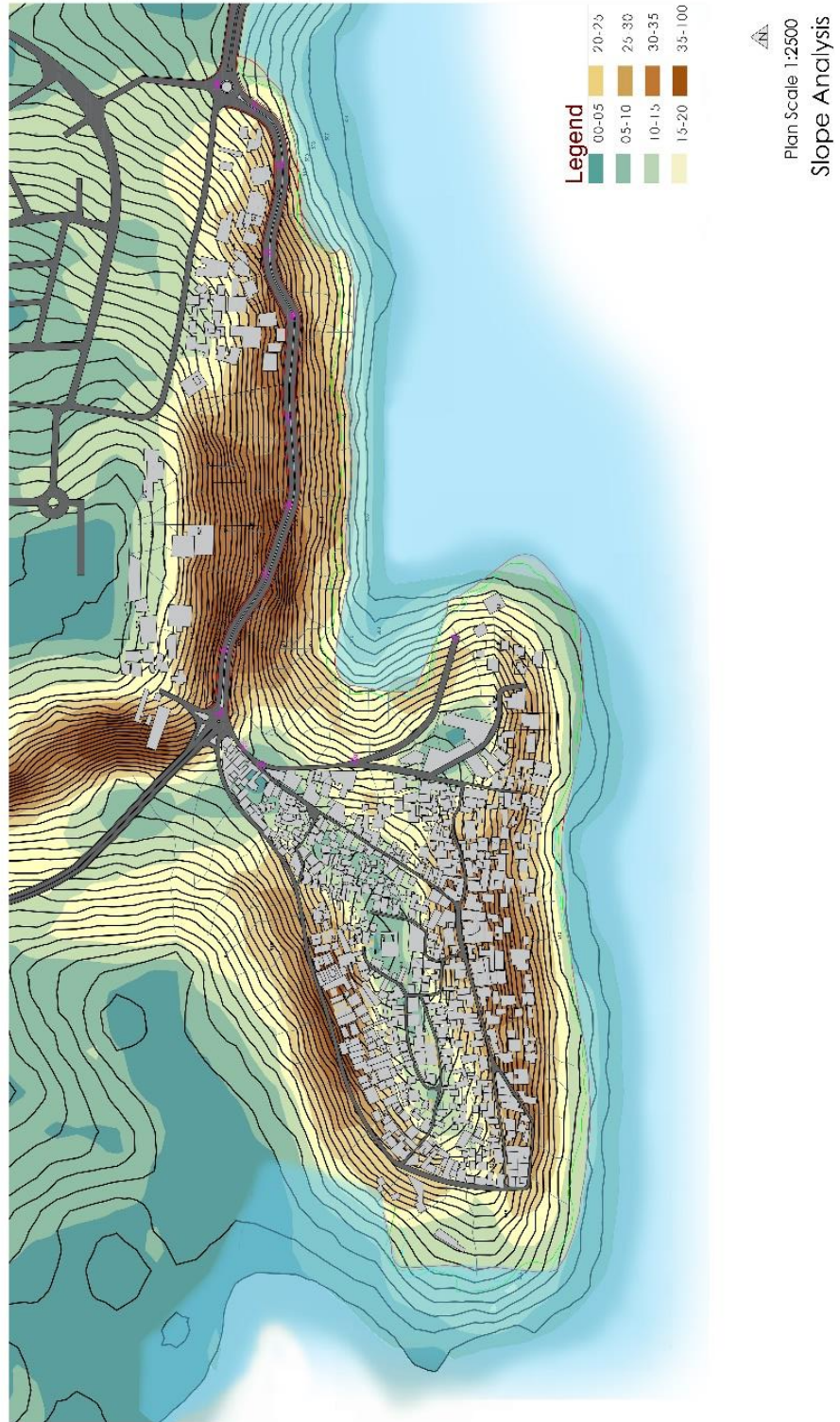


Figure 26 Slope Analysis Map

6.3 Vegetation and Settlement Map

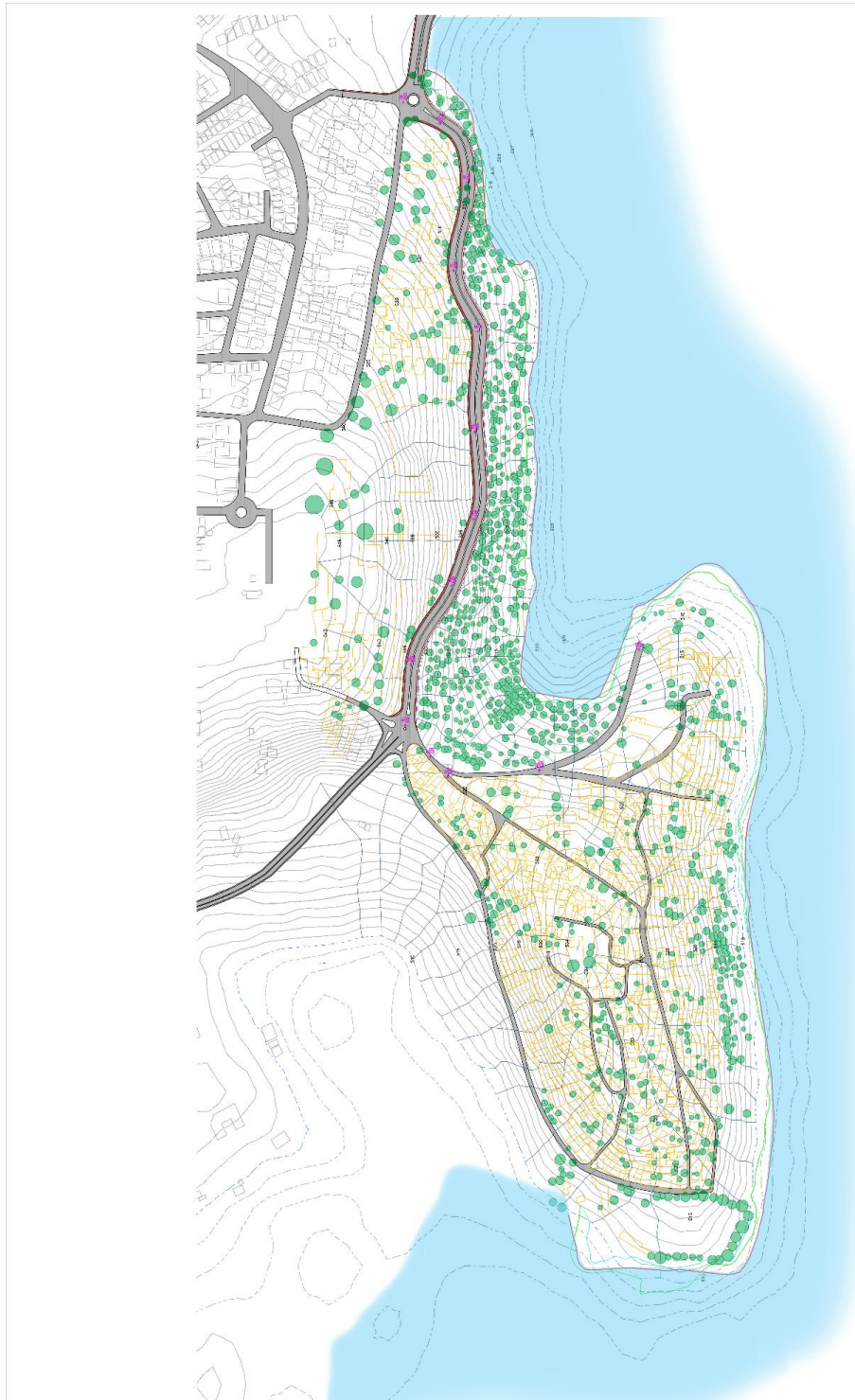


Figure 27 Vegetation and Settlement Map

6.4 observations and Inferences

Observing the Sky



Observing the Opposit Edge



Observing the Edge



Observing the Opposit Edge



Observing the ground:

looking at the topography and ground cover a component involves identifying the variety of plant species of the area.

Layers defining depth and height:

to understand the multiple layers forming the depth and height of the space. This includes understanding the setting of the foreground and background of the scene; and the multiple storeys it possesses.

Perception while moving

This includes identifying small sections from the whole and observing and understanding them spatially.

Observing the Sky:

Understanding and analyzing the sky cover and character of the



Observing the Sky



Observing the Ground



Observing the Edge



Observing the Opposit Edge



THE ROAD ITSELF DIRECTS THE VISITOR TOWARDS THE LAKE VIEW POINT DUE TO THE VISUAL SCALE OF THE VEGETATION AND FOREGROUND OF WATER. CONTACT OF NATURAL ELEMENTS WITH THE SIDEWALKS ABOUT THE PRESENCE OF A PLACE, MAKING THE VISITOR TO THINK ABOUT THE PREFERENCE OF PLACE.

THE VIEWS OPENS UP TO THE LAKE WITH VERY LESS FOREGROUND AND FULL VISIBLY OF THE SKY MAKING IT A FRAGILE SCENE WHICH MAY OR MAY NOT CONTINUE TO THE NEXT PART. THE ENTRY POINT HAS A UNIQUENESS WITH VARIOUS LANDSCAPE CONDITIONS, PRESENCE OF VEGETATION, WATER AND SKY.

7.0 Interventions

7.1 Reviving Riparian Edge

7.2 Floating Wetland

7.3 Bioswales

7.1 Reviving Riparian Edge

What are riparian zones?

Riparian zones are those areas that surround water bodies in the watershed and are composed of moist to saturated soils, water-loving plant species and their associated ecosystems. These ecosystems consist of complex interactions between the water, soil, microorganisms, plants and animals. Riparian zones may be found surrounding lakes, estuaries and streams and rivers. Wetlands as a whole may also be considered riparian zones. Riparian zones are important transition areas that connect the water with the land, and support a wide diversity of plant and animal life.

Why are riparian zones important?

Riparian zones link ecosystems within a landscape. Landscapes are composed of (often overlapping) patches of different types of vegetation, soil and available nutrients, moisture and light. Disturbances in the landscape, such as fire, pest outbreaks or even the death of a single tree, create these patches, which provide different types of habitat. This diversity of habitats is important, but so is connectivity between them. Riparian zones allow wildlife to travel between habitat “islands” by providing transportation corridors, and help to circulate nutrients between different ecosystems. Since riparian zones are wetter than the surrounding landscape, they also often resist destruction by fire, and recover more quickly. This helps the landscape as a whole to recover.

The vegetation that grows in riparian zones is specially adapted to wet soil conditions, and can tolerate periodic flooding. This vegetation fills an important niche that connects the water’s edge with dry land, and in so doing accomplishes a number of functions:

- Trees and shrubs that border and overhang streams and lake shores moderate the temperature through shading and the cooling effect of evapotranspiration. This directly benefits fish and aquatic invertebrates, and prevents excess algae growth.
- The roots of plants growing along and near stream banks, lake shores and estuaries provide structure and strength, collect sediment and thus prevent banks and shorelines from being washed away.
- Leaves, twigs, needles and whole trees that fall into water bodies provide nutrients to aquatic invertebrates, which in turn nourish fish.
- Large trees that have fallen into streams help to dissipate the energy of flowing water, protect stream banks and create pools and hiding places for fish.

The animals that live in riparian zones also contribute to the function of these ecosystems. For example, birds and mammals help to disperse the seeds of shrubs and trees. Invertebrates, such as many insects, molluscs (e.g. slugs and snails) and worms help to break down plant and animal matter, making it more readily available as nutrients to other organisms. Salmon fulfill a unique role by connecting the ocean, freshwater and the land, during the course of their life cycle, which begins and ends in stream corridors. Complex predator-prey relationships between animal species are also necessary to maintain a healthy balance among populations. Healthy riparian zones therefore provide habitat for a huge array of animals. Studies have shown that about 80 percent of wildlife species depend on riparian areas in whole or in part⁹.

⁹ <https://www.crd.bc.ca/education/our-environment/ecosystems/freshwater/riparian-zones>

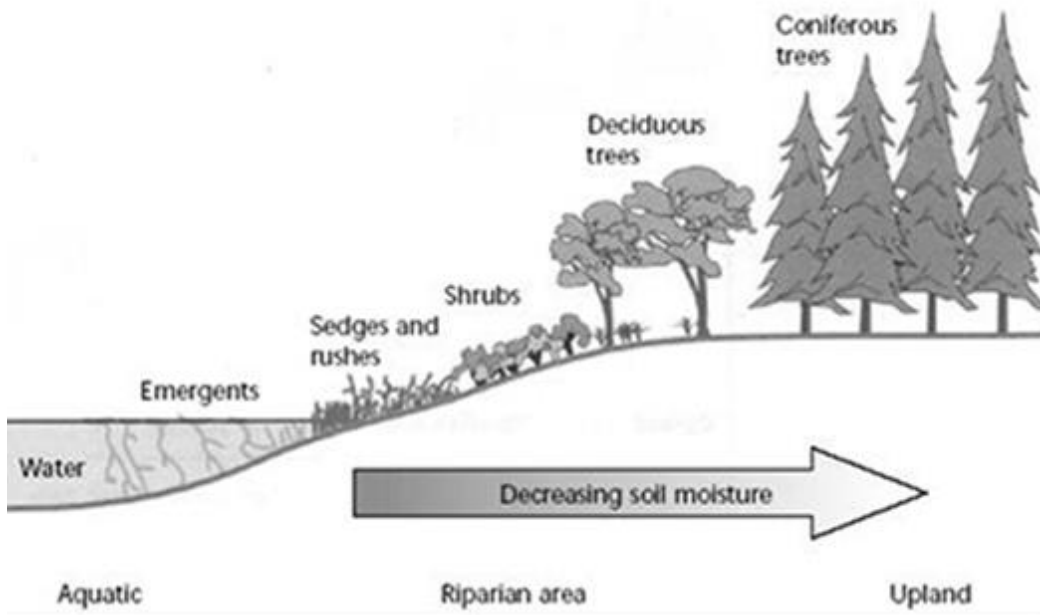


Figure 28 Illustration of the moisture gradient in a typical riparian ecosystem

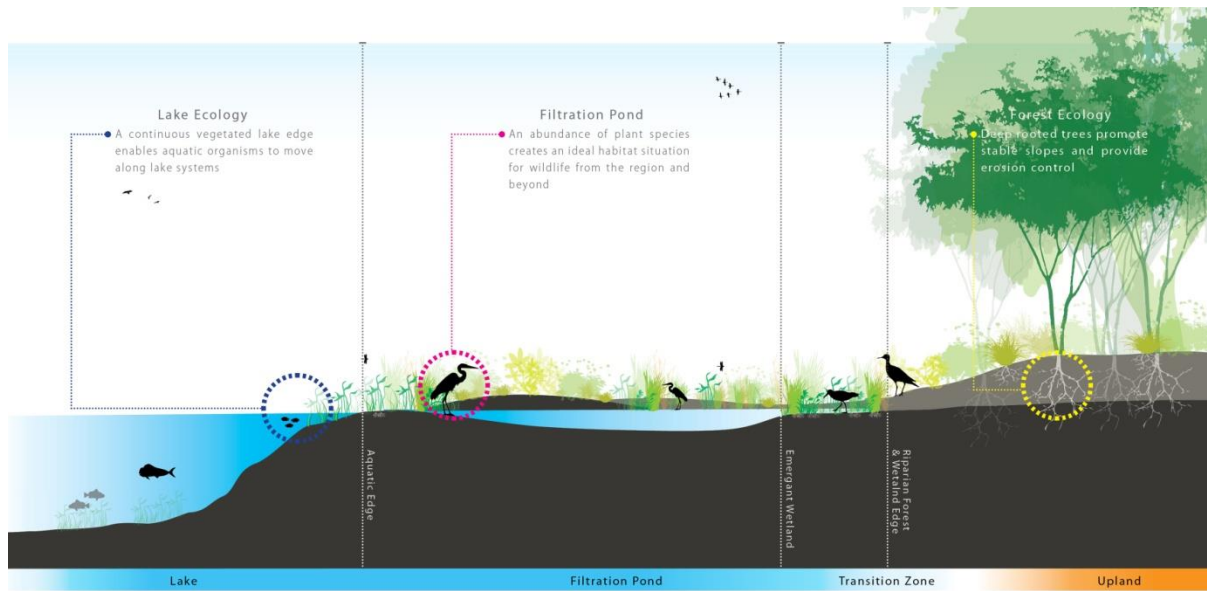


Figure 29 Riparian zone Ecosystem

7.2 Floating Wetland

Floating treatment wetlands (FTWs) are manmade ecosystems that mimic natural wetlands. FTWs are created using floating rafts that support plants grown hydroponically. The rafts float on a wet pond water surface and can be used to improve water quality by filtering, consuming, or breaking down pollutants (e.g., nutrients, sediment, and metals) from the water (fig. 1). FTWs may represent a relatively low cost and sustainable engineered best management practice (BMP) for reducing pollution in storm water

Three major pollutant reduction mechanisms have been identified in FTWs:

1. Plants directly uptake pollutants, especially nutrients, from the water, using a process known as biological uptake.
2. Microorganisms growing on the floating rafts and plant root systems break down and consume organic matter in the water through microbial decomposition.
3. Root systems filter out sediment and associated pollutants. These pollutant-removal mechanisms constitute a system that could be a low-cost, sustainable method for removing pollutants from storm water.

Where Can FTWs Be Used?

If it can be demonstrated that FTWs effectively remove waterborne pollutants, FTWs could be placed on most existing lakes and ponds. Many of these ponds located in urban settings are used as storm water catchments.

When used in conjunction with a storm water wet pond, FTWs are generally placed close to the shoreline at the point(s) where storm water enters the pond either through the buffer area or through an inflow pipe. This is so they will intercept the most polluted runoff entering the system. FTWs located near the shoreline attenuate wave action and reduce undercutting and bank/ shoreline erosion.

Potential Advantages of FTWs

- Provides design flexibility. FTWs can be sized to fit into almost any pond or lake.
- Enhances the pollutant-removal effectiveness of existing stormwater wet ponds.
- Provides a sustainable pollutant-removal system and wildlife habitat.
- Offers resiliency. FTWs can tolerate storm-event driven water-level fluctuations as long as they are anchored to the bottom or tethered to the shoreline so they are not damaged or lost by flowing through the outlet structure of the pond.
- Improves aesthetics. FTW can be used to enhance the visual appeal/interest of surface water features like ponds and lakes.

Potential Limitations

- Anchoring FTWs can be a challenge.
- For maximum nutrient-removal efficiency, FTWs need to be harvested or removed seasonally. Current environmental policy would likely require harvest of plant material in the fall to receive any credit for nutrient removal as a treatment. This requires a potentially significant labor effort.
- FTWs occupy open water surface and may block access or reduce available area for lake/pond recreational use. Minimum water depth should be no lower than three feet (four to five feet is recommended). Plants on the FTWs can root into sediments in shallow water and cause the floating rafts to be submerged when pond water level rises during storm events.
- Some contaminants, such as oil and herbicides, in urban runoff could damage the plants and harm microorganisms.

- Non-native and invasive species (plants) should not be planted on the FTWs and may need to be weeded out of the FTWs to avoid adverse effects to local ecosystems.¹⁰

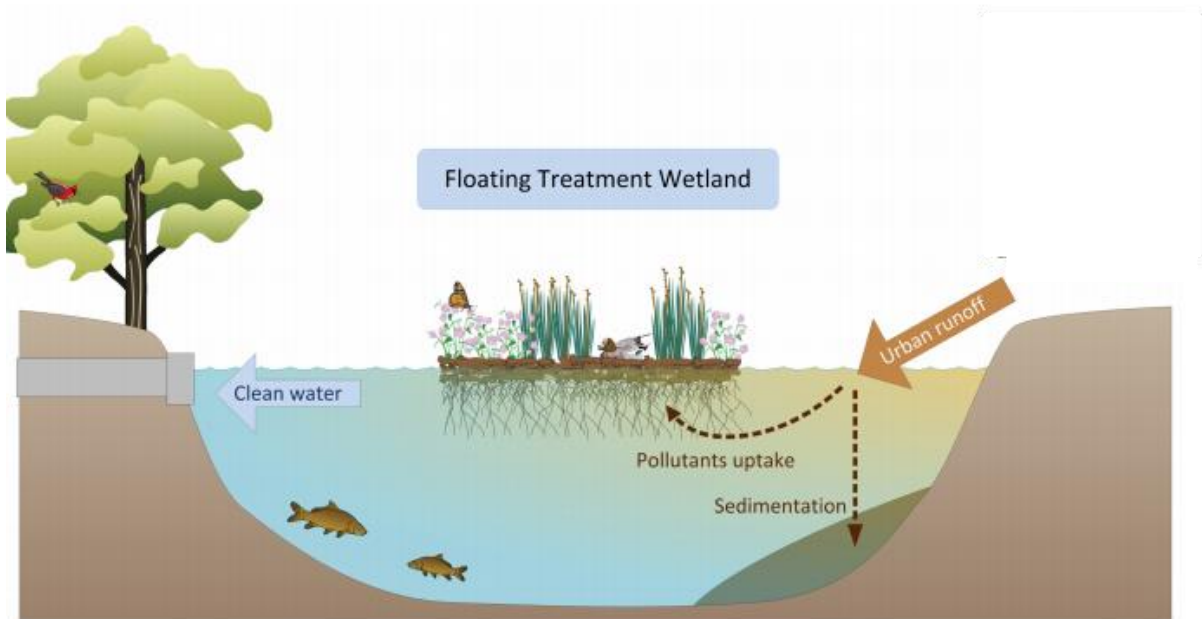
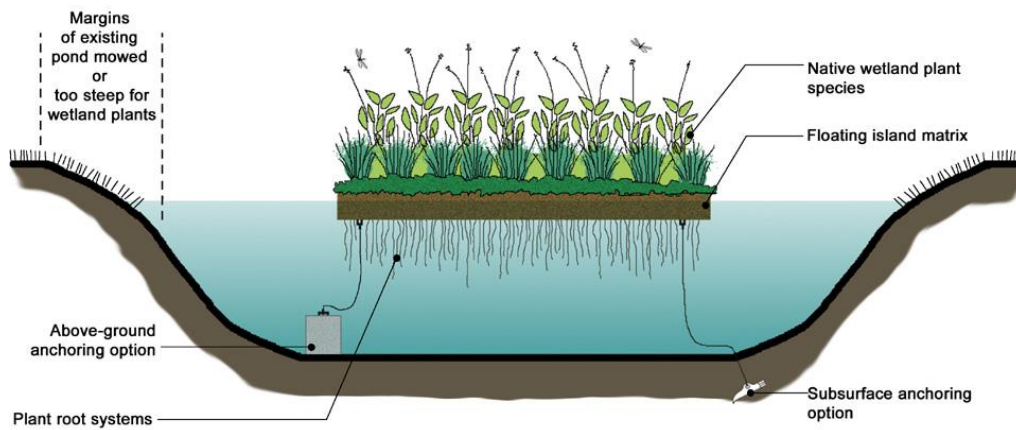


Figure 30 Floating Wetland



¹⁰ Innovative Best Management Fact Sheet No. 1: Floating Treatment Wetlands David J. Sample, Assistant Professor and Extension Specialist, Biological Systems Engineering, Virginia Tech

7.3 Bioswales

A Bioswales is an earth-friendly alternative form of water drainage that filters and absorbs polluted water. In contrast to typical pipes and concrete ditches found in residential and commercial zones, Bioswales are landscaped shallow troughs comprised of natural materials, such as native plants, rocks and soil. With the use of Bioswales around hard surfaces like roads, buildings and parking lots, organizations can promote environmental sustainability while improving the aesthetics of their surroundings. The word Bioswales is a combination of the Greek prefix bio-, meaning life, with the modern word swale, meaning “a low tract of land.”

How do Bioswales work?

1. After it rains, runoff from hard surfaces drains into the Bioswales through a gradual slope that mimics natural waterways.
2. Once inside the Bioswales, the top layer of soil absorbs the water slowly.
3. Next, the water passes through native plant roots, which filter out many of the pollutants.
4. The water then moves to another filtration level made of sand or rocks.
5. After it has made its way through the Bioswales multiple layers, the purified water continues its original journey to the local ocean or waterway.

Consideration for design

When designing a Bioswales, it is best to seek expert guidance. The main elements to consider are:

Slope – Make sure the Bioswales is shallow enough to slow down the water so that it absorbs into the soil, but steep enough to keep water from stagnating.

Width – How much space do you have? The wider the Bioswales, the more water absorbed.

Location – As enticing as the Bioswales will appear, people should be educated on its use and taught to avoid walking in its pathway.

Native plants – Your landscape should situate plants according to how much water they need – the thirsty plants should be placed in the area that will receive the most water.

When water is released from rain or gardening, it eventually drains back into the oceans, canals and rivers. On its journey to these sources, it picks up many pollutants. Think of all the trash on the sidewalk drains, the oil and grease on the roads, the extra fertilizers from lawns, and any other potentially-damaging materials in the ground. If water is not absorbed into the ground, filtered by vegetation, or evaporated back into the air, it becomes surface runoff. This runoff water collects the pollutants with which it comes into contact along the way, and then releases them into our oceans and waterways. By using a Bioswales, organizations can filter the water and keep our natural waterways clean.¹¹

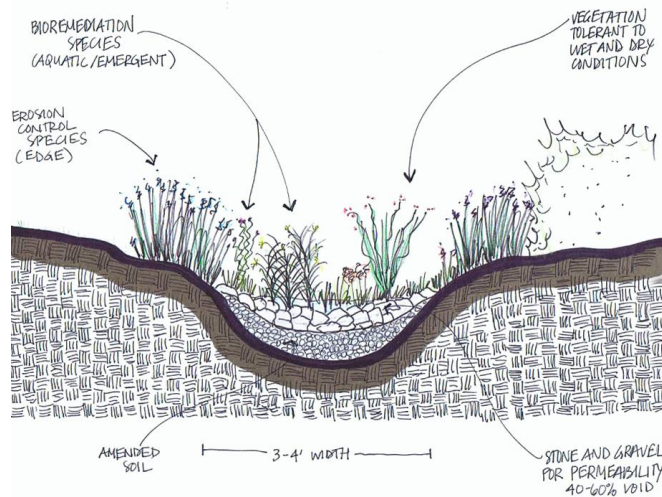


Figure 31 Bioswales

11

<http://www.eoearth.org/view/article/150668/> http://surfwritergirls.blogspot.com/2013_02_01_archive.html
<http://www.cityofsalem.net/DEPARTMENTS/PUBLICWORKS/ADMINISTRATION/WATERRESOURCES/KROGERPARKRESTORATION/Pages/W hatisaBioswale.aspx>

8.0 Design

8.1 Concept

8.2 Requirements

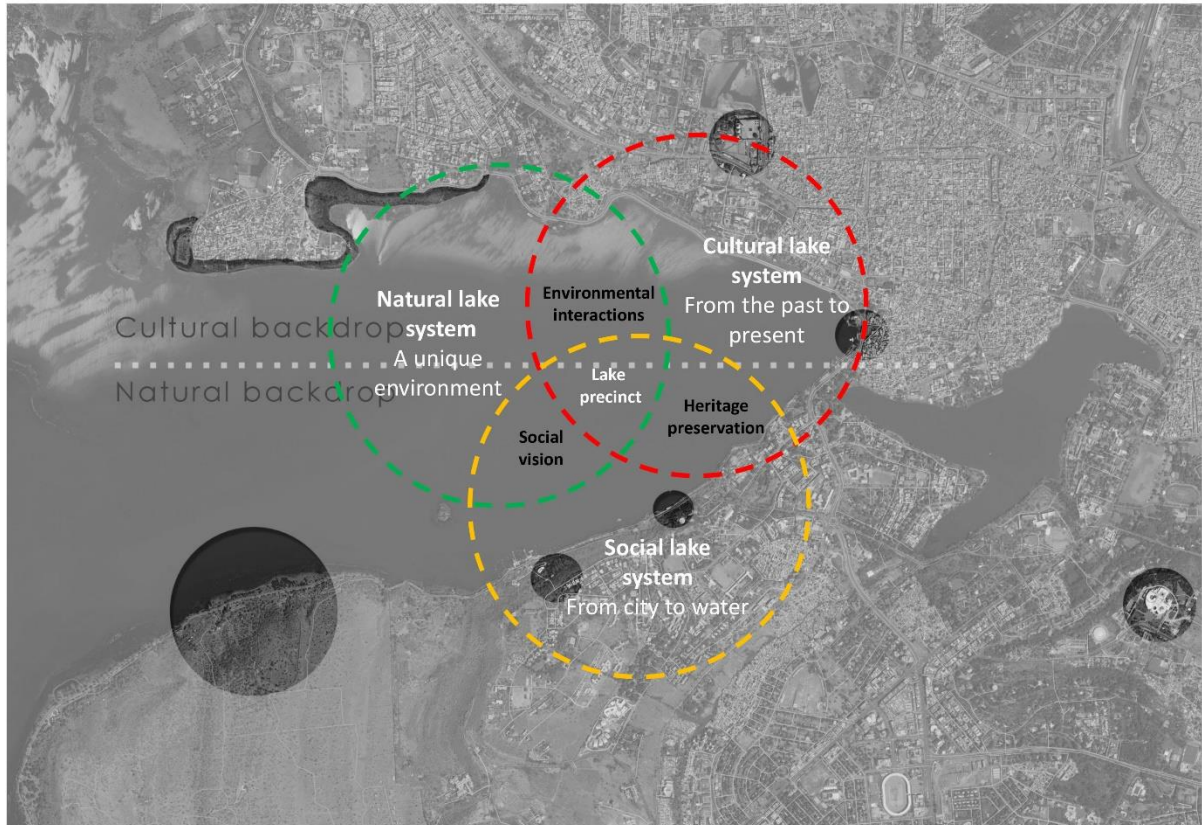
8.3 Zoning and Circulation

8.4 Site Plan

8.5 Part Plan 01

8.6 Part Plan 02

8.1 Concept



- With the overall objectives of the master plan to build a positive attitude to the waterfronts, following factors were considered
- To study issues and concerns of the lake edge and come up with the landscape proposal. Restoring the riparian edge and its habitat.
- Enhancing the new landmark within the city, to provide an urban recreational space which provides a medium through which communicate in city takes place and depicts the culture of city.

Outdoor passive and active zones shall be introduced at strategic location for public and neighbourhood with required leisure space (trail for bird watching, view point to enjoy city at glance with their cultural and natural backdrop, plaza for gathering).

Upgrading the lakes a potential environmental resources.

8.2 Requirements

Design intervention:

- parking and cafeteria with ramp leading towards Lake Plaza Water promenade.
- Trail to enjoy forest like environment and bird watching Interactive space.
- Accessibility for physically challenge peoples. (Considering gradient)
- Street furniture.
- Mound, bridge walk.
- feature wall representing the culture, history and future of Bhojtal and Bhopal.

Ecological conservation:

- Bioswales and bunding to reduce top soil erosion along valley.
- reviving natural riparian edge
- floating wetlands.

Basic amenities

- Parking
- (4w , 2w,)
- Ticket counter
- Toilet (M/F)
- Drinking water
- Entrance Plaza

Morning activity (06am-11am)

Users: Peoples coming for exercise and walk, photography, bird watching etc.

- Play area
- Indoor(semi covered)
- Outdoor.
- Lawn/ play ground

- Outdoor gym
- Jogging track
- Yoga plaza.
- Cycle track.

Afternoon activity (11am-4pm)

User's behaviour: Peoples coming for reading, studying, hang out with friends,

Exhibition, Artwork etc.

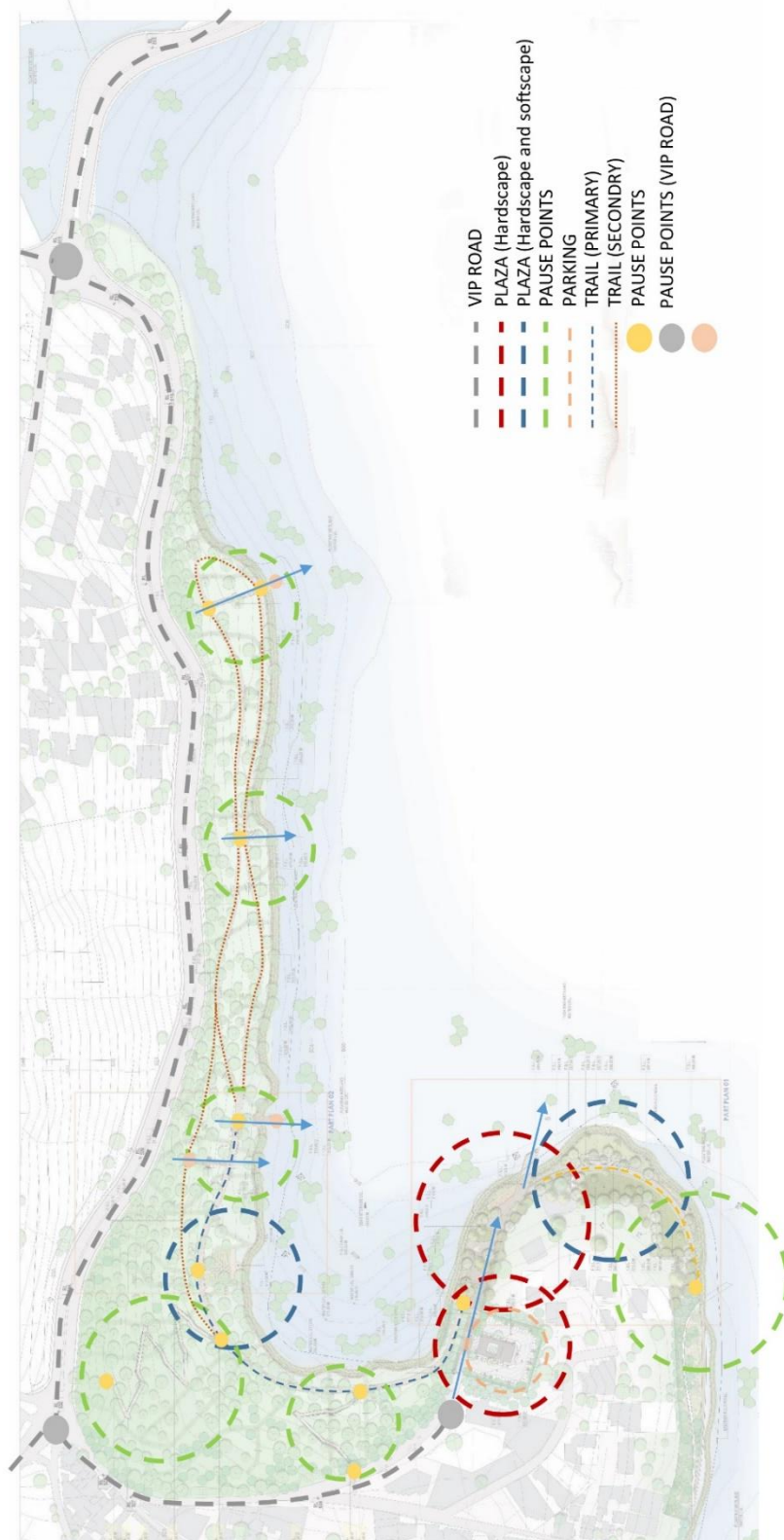
- Display area.
- Informal seat out
- Open air theatre.
- Plaza.
- Indoor/outdoor spaces
- Indoor/outdoor library
- trail

Evening activity (4pm to 8pm)

User's behaviour: Family with children's, students, few peoples for exercise and walk. Performances, play, music,Speech, lectures, Artwork etc.

- Plaza
- Lawn
- Stage
- Open air theatre

8.3 Zoning and Circulation



8.4 Site Plan

8.5 Part Plan 01

8.6 Part Plan 02

Section

