Baseline Report

ENVIRONMENT

MPD-2041 as an Enabling Strategic Plan
(A DDA-NIUA Collaboration)

National Institute of Urban Affairs

March 2020

Disclaimer

The baseline exercise was conducted in 2018-19 with the purpose of developing an understanding of the status quo of the city and assessing the gaps and strengths in each sector. The baseline report has been prepared using secondary data and information received from various agencies and departments as well as reports and studies. The analysis and maps in the report represent the present situation and are for general information. DDA does not accept any legal liability for the accuracy of information presented in the report or for any consequences arising from the use of this material.

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1 BACKGROUND AND CONTEXT

1.1 Objective of the baseline preparation:

The baseline for the environment sector seeks to answer a number of crucial questions that will inform the overall strategy for the environment in Delhi for the planning horizon (2021-2040). For the purpose of this baseline, the environmental aspects in Delhi have been categorized under three heads:

- Natural features and resources
- Pollution
- Recreational greens

The baseline attempted to investigate the following key questions under each of these heads to the extent possible.

Natural features and resources

a) Which are the environmental features that need to be conserved and protected in line with latest regulations and policies?
b) For already notified areas, what is the status of conservation and protection?
c) What are the activities that are allowed/prohibited in the protected areas?
d) Are there any DCRs that impede the conservation and protection of resources?

Pollution

a) What is the spatially disaggregated status of air pollution across the city (intensity, duration, and seasonality)?
b) What is the spatially disaggregated status of noise pollution across the city (intensity and duration)?
c) What is the status of water pollution in the river Yamuna and the other water bodies in the city.
d) Where are the pollution hotspots in terms of air, water and land pollution?
e) Are the existing DCRs adequate for long-term pollution control?

Planned greens

a) Does the city have enough green cover as per international standards? How is the green cover spread across the city?
b) Do citizens have good access to green spaces?
c) Are the quality of greens adequate in context of Delhi?
d) Are there any DCRs that impede efforts to augment green spaces?

1.2 Methodology adopted for the baseline preparation

Four avenues were employed in order to carry out the baselining exercise.

a) *Data collection:* An exhaustive data collection exercise was undertaken to quantify the baseline. In addition to referring to website and published report, a Baselining Expert Group (BG) comprising of senior officers from environment-related government agencies in Delhi was also formed. The BG members helped facilitate data access from their respective agencies and provided strategic advice for the baselining activity. **Dr. Meenakshi Dhote (SPA Delhi)**

was engaged as the Sector Advisor to provide expert and technical guidance for the preparation of the bassline.

b) *Focused group discussions*:
FGDs were organized when very little data or information was available on specific topics. Hence, domain experts were invited to the FGDs to share their knowledge help plug the information gaps to as extent.

c) Interaction with subject experts
There are number of national and international experts who have worked extensively on different aspects of the environment. Efforts were made to engage with some of these experts to enhance the quality of the baseline preparation.

d) Site visits
A site visit was carried out in the 'O' Zone along the Yamuna River to ground truth aspects related to encroachment in the flood plains, and presence of unauthorized colonies in critical areas.

Annexure A provides details of the various avenues employed for the baseline preparation.

1.3 Structure of the report

The findings of the baselining study for the environment sector are organized in the following manner. Section 2 provides an overview of the environmental sector in Delhi highlighting the key features, concerns, challenges, and the role and responsibilities of the stakeholders. Section 3 delves into a comprehensive review of the Environment Chapter of MPD 2021 in terms of gaps that need to be addressed in MPD 2041. The section also takes stock of the status of the milestones and targets set in MPD 2021. Sections 4, 5 and 6 depict the existing state of affairs in different domains of the environment sector—natural features and resources; planned greens; and pollution. Section 7 provides information on some of the key projects and initiatives that are being implemented or are in the pipeline. Section 8 throws light on the key environmental regulations and policies applicable in Delhi, while also attempting to match the regulations with areas where they are applicable. The chapter concludes with section 9 that summarizes the baselining exercise, and highlights the key aspects and challenges in the environment sector that MPD 2041 will have to address.

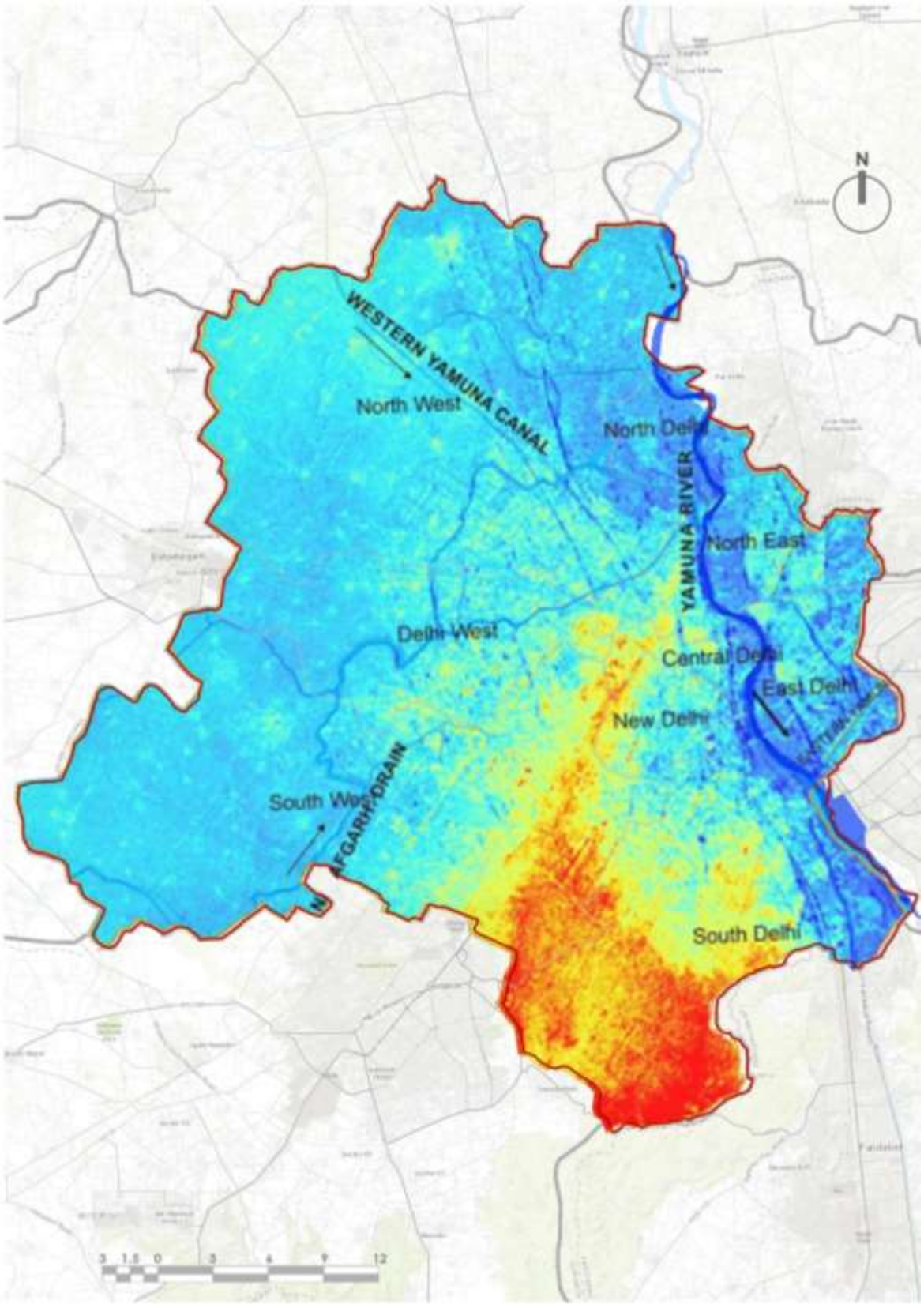
2 OVERVIEW OF THE ENVIRONMENTAL SECTOR IN DELHI

2.1 Physical environment

2.1.1 Topography

The topography of Delhi can be divided into three different parts—the Plains, the Yamuna Floodplain, and the Ridge (Aravalli Range). As per the topography, Delhi is located on the western fringes of the Gangetic Plains. As seen in ***Map 1***, the Ridge area is at a higher elevation, with some parts of it located at 318 m above mean sea level. Conversely, the Yamuna Floodplain is situated at the lowest elevation. The ridge originates in the south and surrounds its western, the North Western and North Eastern part.

Map 1: Digital Elevation Model for Delhi



Source: CGWB, 2017

2.1.2 Climate

Delhi experiences extremes of weather owing to its geological location. The climatic conditions of Delhi are similar to that of the temperate grasslands with hot, dry summers, and cold winters. The summers in Delhi start from the month of April and continue until the month of July. It is very hot and dry in the summer months, with temperature soaring up to 45°C. There has been a noticeable trend of warmer summers in the last few years. In June 2019, Delhi recorded the hottest day in its history when the temperature soared to 48°C. ***Maps 2 and 3*** present the average maximum temperature of the hottest month (May) of the year, and the average minimum temperature of the coldest month (January) of the year for 2018. As seen, the Western side is slightly warmer than the Eastern side in summers. In winters, the trend is reversed with the Eastern side considerably warmer than the Western.

The monsoon starts in late June and lasts until mid-September, with about 797.3 mm[1] of rain. It continues until the month of October. Winter starts in November and peaks in January, with average temperatures around 6–7 °C. Although winters are cold, Delhi's proximity to the Himalayas results in cold waves leading to lower apparent temperature due to wind chill. Delhi is notorious for its heavy fogs and haze during the winter season.

2.1.3 Lithology[2]

Delhi comprises Alwar series of rocks. They are seen outcropping in the Southern and South-eastern part of the city. The rest of the area is covered by Alluvium of variable thickness and composed of clays, silts, sands and subordinate gravels, pebbles interbedded. The quartzite are hard, compact, massive and jointed outcrops with steep Easterly or South-westerly dips. They are interbedded with quartz sericite schists and are occasionally intruded by pegmatite and quartz veins. The thickness of the Alluvium depends upon the bedrock topography, which appears to be undulating. Whereas Alluvium as thick as 10-30m only has been encountered, for example, near the Mall road and Vikramaditya Marg, there are areas e.g. in the vicinity of the Najafgarh drain where the depth to bedrock may be around 100 m. There are still other areas, for example, at Dhansa and Pindavala Kalon or Rohini sector where bedrock may or may not be even within 300 m. Lithological, lenticular beds of sand in numbers one or more, with comparatively thick clay horizons intervening at different levels are encountered sub-surface during drilling.

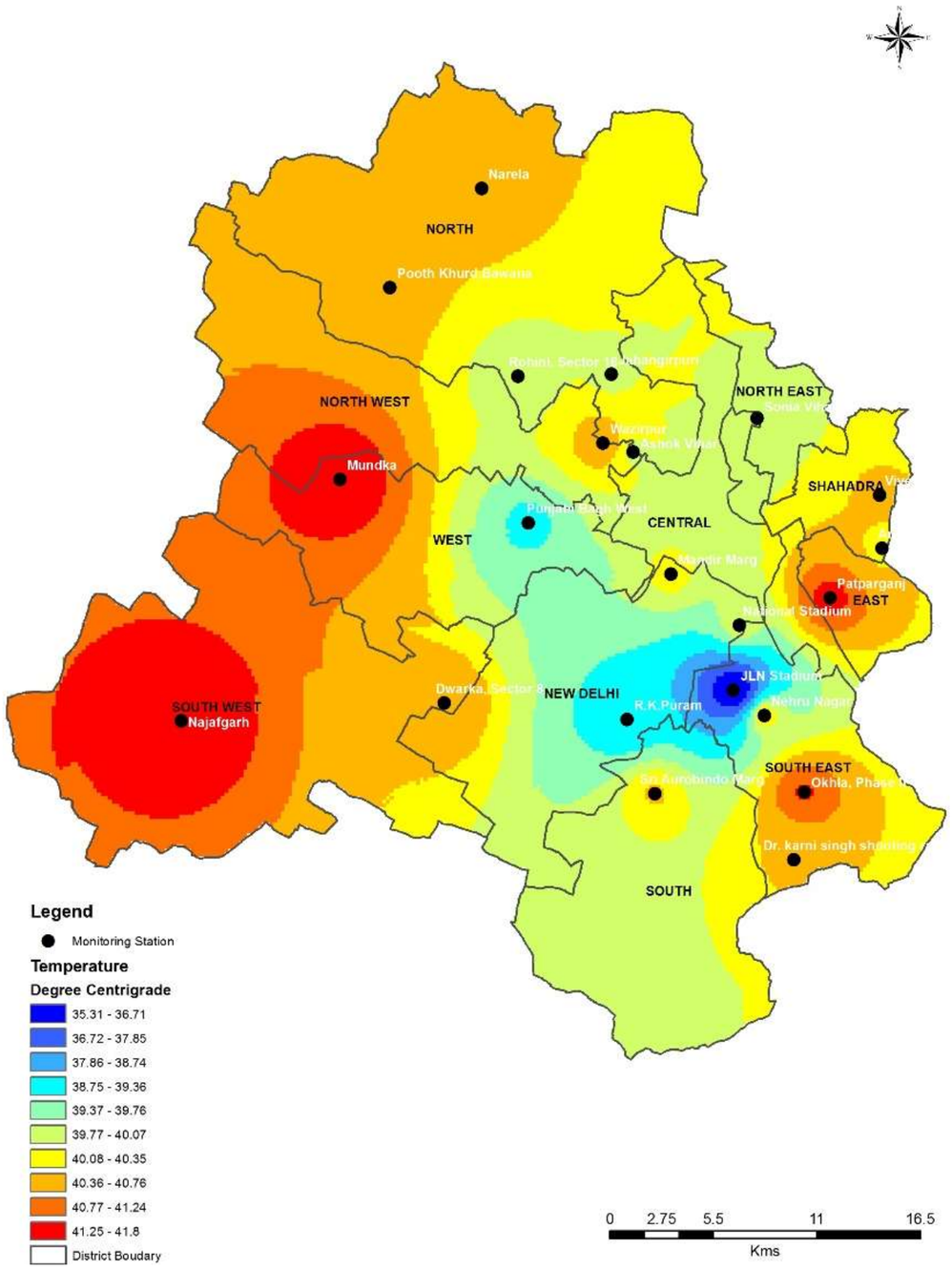
Map 4 presents an overview of the lithological features of Delhi.

2.1.4 Natural environmental features of Delhi

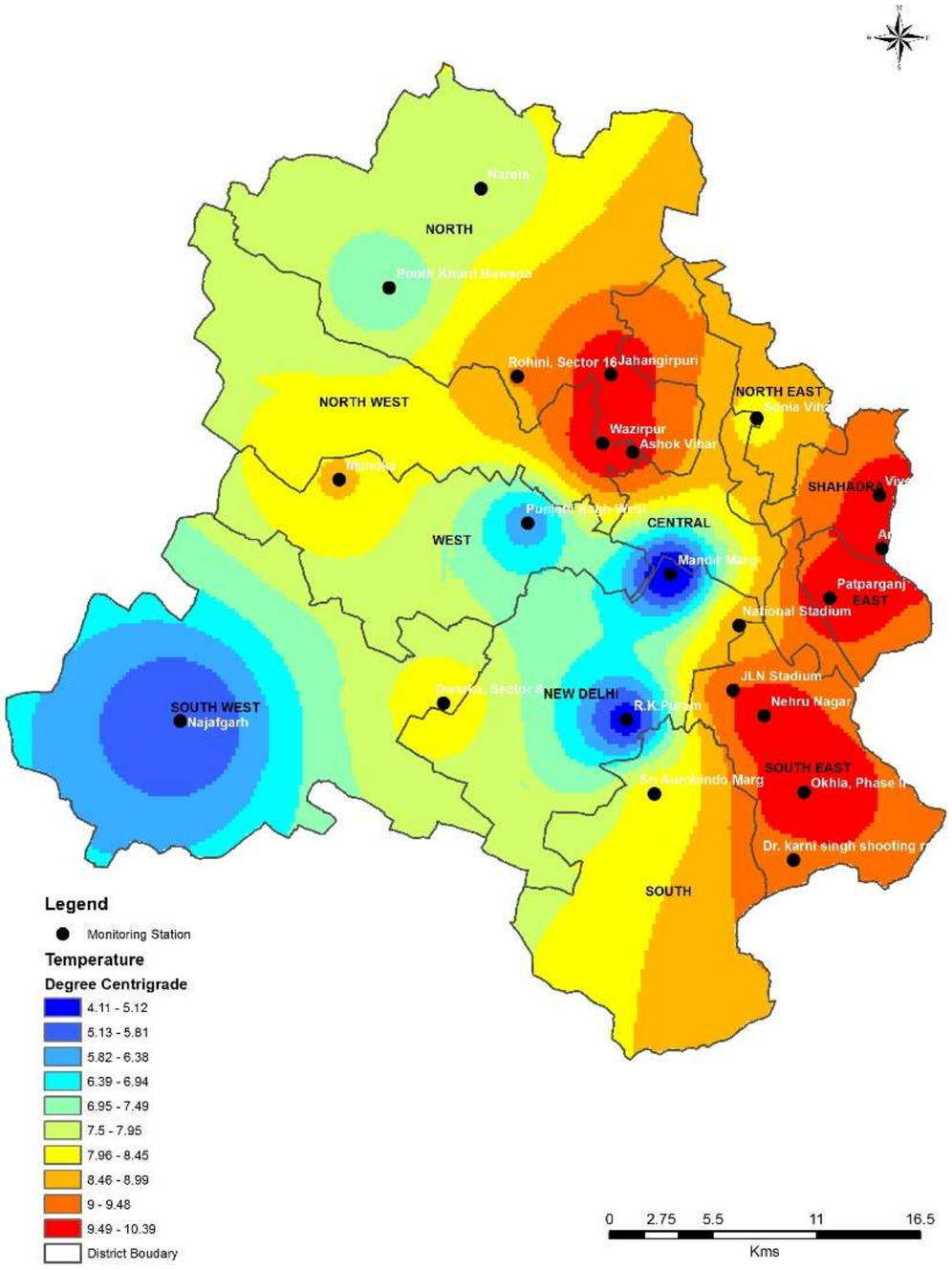
The natural environmental features of Delhi are centred on the Ridge and the Yamuna River. The Ridge is the terminating point of the 15 million year old Aravalli which flank the west coast of the country as the 'Western Ghats' starting from deep South, terminating in Delhi. The Yamuna is the largest tributary of the Ganga River, originating in the Yamnotri glacier and merging into the Ganga at Prayagraj. The Ridge and the river formed a network of ponds, lakes and canals. Additionally, there are a number of natural drains flowing through the city today that once served as freshwater overflow canals, to absorb the backflow of the river during the monsoon floods. ***Map 5*** highlights the key natural and planned environmental features in Delhi.

[1] Indian Meteorology Department
[2] NCRPB Functional Plan for Drainage for NCR.
http://ncrpb.nic.in/pdf_files/FP%20on%20Drainage/Chapter%202%20-%20THE%20REGION.pdf

Map 2: Mean temperature (Summer) - May 2018

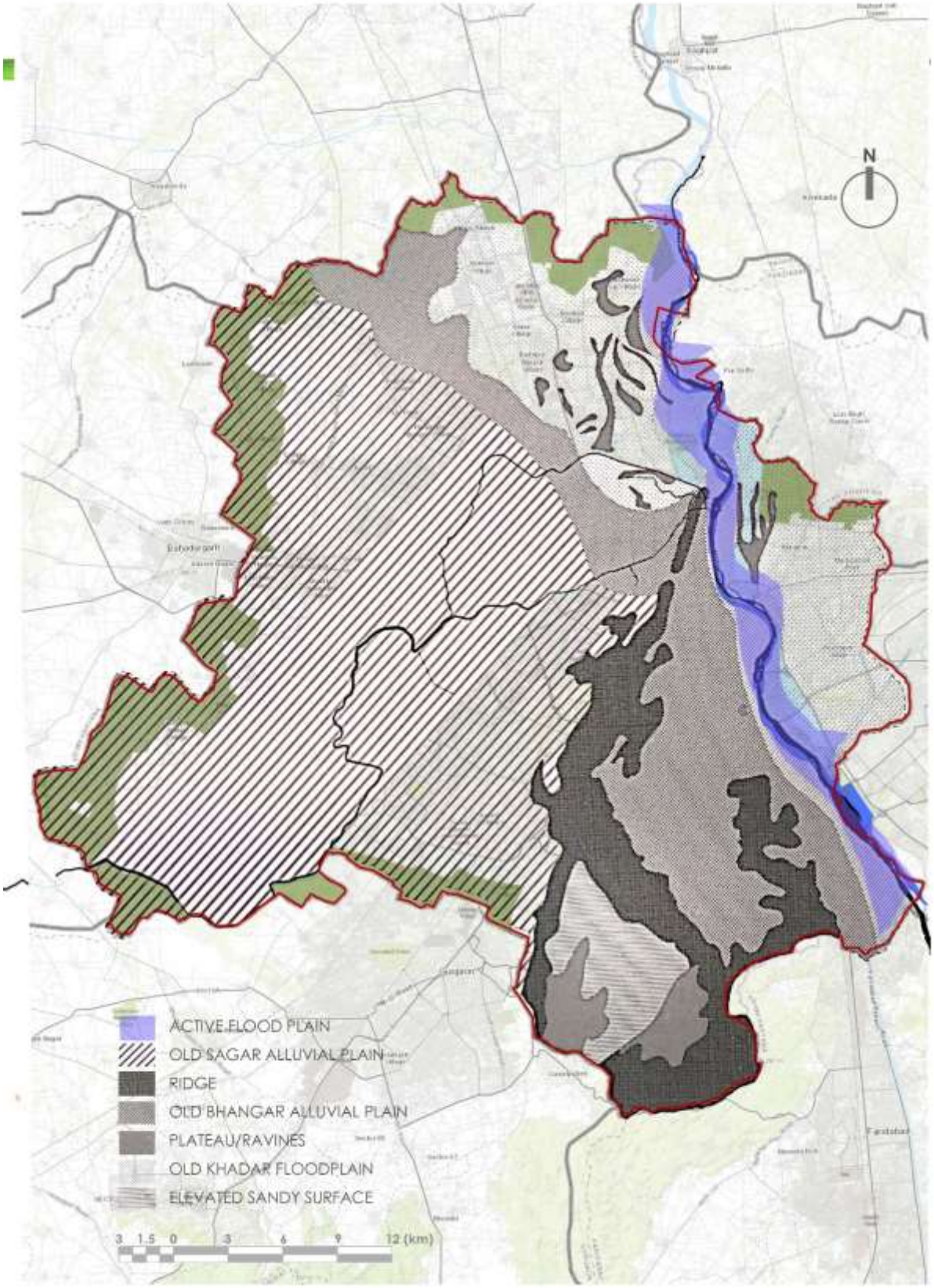


Map 3: Mean temperature (Winter) - January 2018



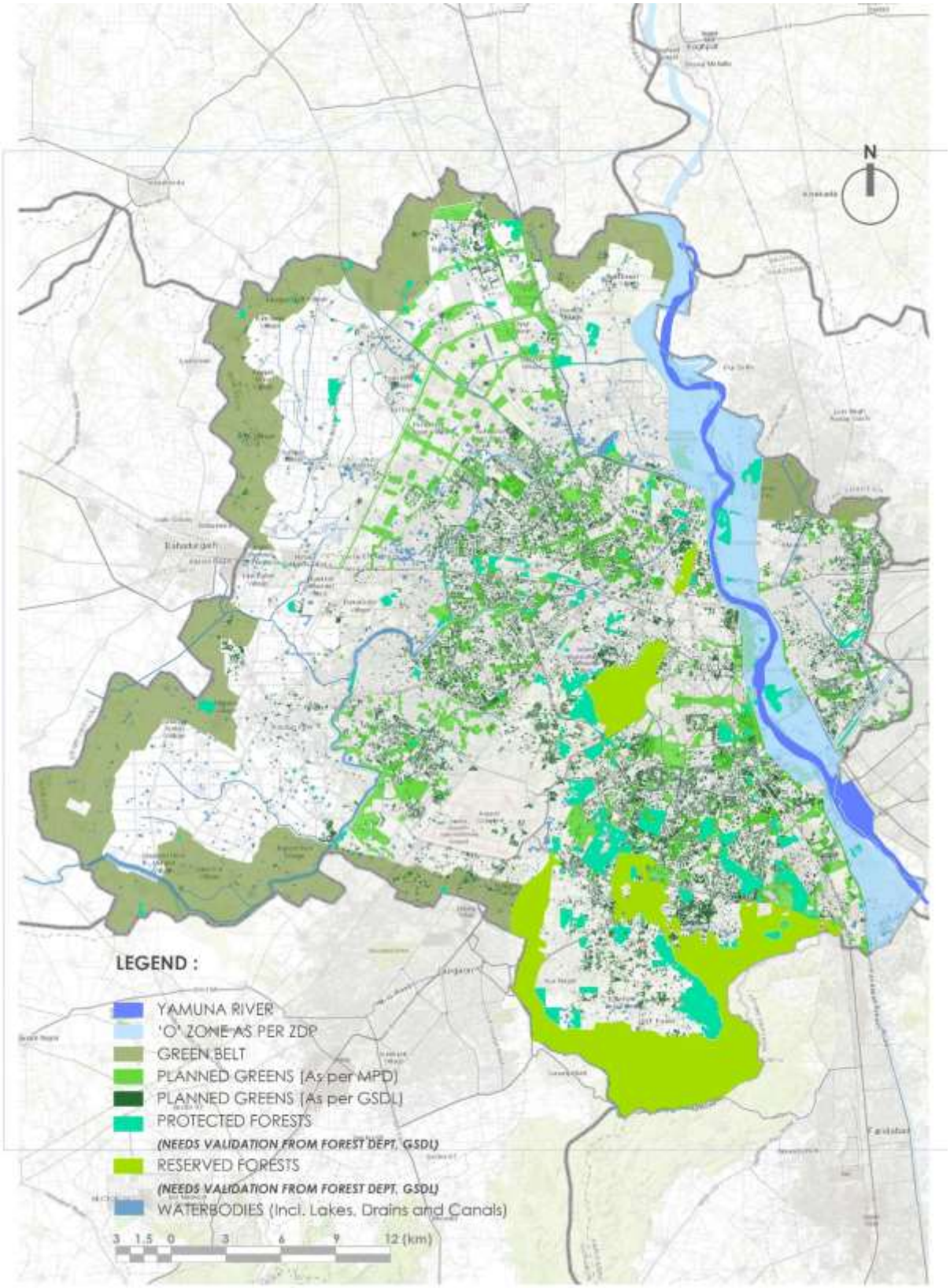
Source: Delhi Pollution Control Committee (DPCC) and Indian Meteorological Department (IMD), Analysis: NIUA

Map 4: Lithological features of Delhi



Source: University of Virginia, 2017

Map 5: Spatial coverage of the natural and planned environmental features in Delhi



Source: DPGS, DDA, GSDL, I&FC (2019), Analysis: NIUA

[Map to be verified by concerned authorities]

2.2 Key environmental statistics and trends

19 m^2 per capita green cover [a]
But,
4.84 m^2 Per capita cover for parks and gardens [b] (2019)

115% Increase in green cover from 2001 to 2019 [a]

142 Ha Reduction in area under recreational land use due to CLUs in MPD since 2007 [c]

10 years Life expectancy reduced due to air pollution [d] (2016)

10th Most polluted (air) city in the word (PM2.5) [e] (2020)

2% Yamuna's length in Delhi Responsible for **70%** total pollution load in the river [f] (2018)

200+ Natural drains [g]
900+ Water bodies [b,c]
(2019)

17,000+ parks with approx. **8,000+** Ha area [b] (2019)

7% Reduction in area of water bodies from 1999 to 2012 [h] (2015)

0.5-2m Decline in groundwater level every year [i] (2018)

10+ Agencies concerned with environment management [j]

2nd Noisiest city in the world in 2017 [k]

Source: [a]Delhi Forest Department (2019); [b]DPGS (2019); [c]DDA (Annexure B); [d]Energy Policy Institute at the University of Chicago (2016); [e] IQAir (2020)); [f]DPCC; [g]Drainage Master Plan for Delhi (2018); [h]INTACH (2015), [i]CGWB (2018), [j]Baselining group for MPD 2041; [k]Mimi Hearing Technologies GmbH (published in World Economic Forum, 2017)

2.3 Environmental governance in Delhi

There are a number of stakeholder agencies responsible for environmental management in Delhi. The mandate of some agencies is focused on developing regulations on different aspects of environment management, and monitoring those. While the others are implementing /maintenance, agencies concerned with on-the-ground actions. ***Figure 1*** depicts an overview of the roles of the various agencies with respect to three environmental aspects—protection and conservation of natural resources and features; pollution control; and augmenting green spaces. The Figure also presents details of the responsibilities of these stakeholders.

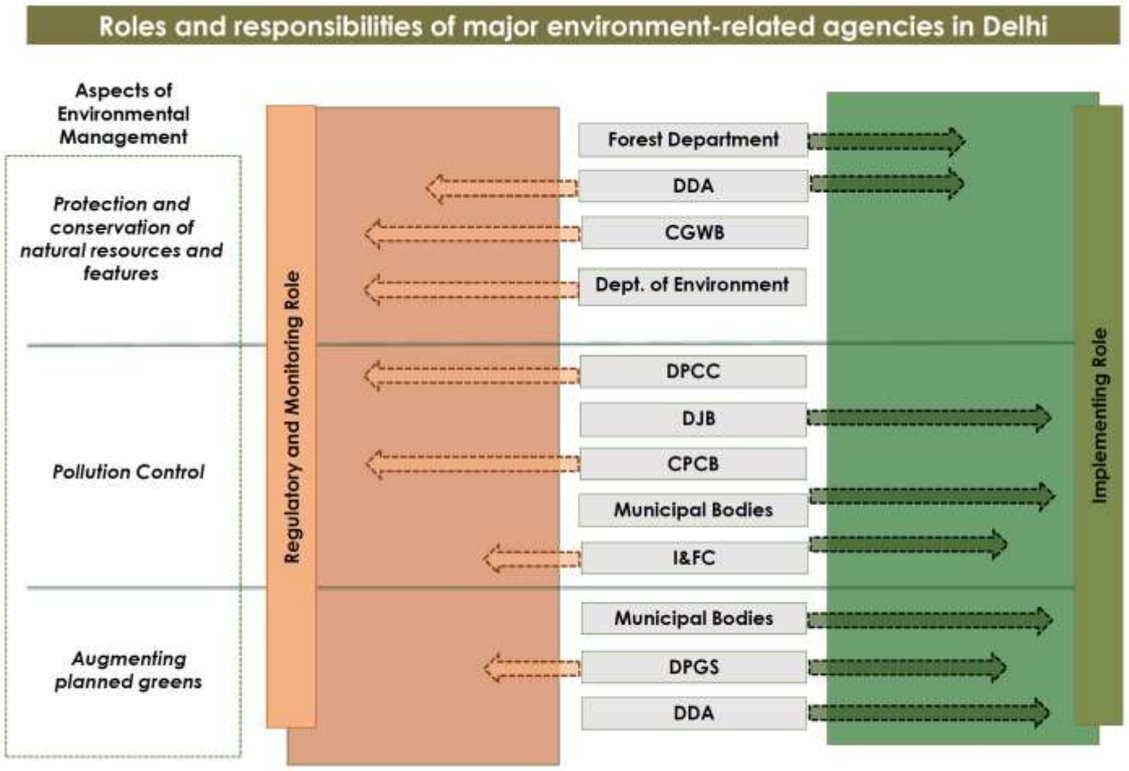
As gleaned from the ***Figure 1***, some agencies perform a dual role of regulating/monitoring and implementing/maintenance. The length of the arrows against these in either direction is indicative of their involvement with respect to the two roles.

3 REVIEW OF THE ENVIRONMENTAL CHAPTER OF MPD 2021

3.1 Thematic review

Dr. Meenakshi Dhote (Sector Advisor), as well as subject experts within NIUA, reviewed the Chapter-9 of MPD-2021 on 'Environment'. ***Table 1*** presents the main points that emerged from the review.

Figure 1: Role and responsibilities of major environment-related agencies in Delhi (Analysis based on insights developed in the baselining group meetings)



DEPARTMENT OF FORESTS

- Enforce the forest-related regulations in Delhi *(Indian Forest Act, 1927, the Wildlife(Protection) Act,1972, the Forest (Conservation) Act, 1980, the Delhi Preservation of Trees Act, 1994]* and directions issued by the Hon'ble Supreme Court of India and Delhi High Court
- Protect forests, trees and dependent wildlife.

DELHI DEVELOPMENT AUTHORITY

- Protect and develop Zone 'O' in Delhi (Yamuna flood plain) in an environmentally friendly manner.
- Undertake and maintain greening initiatives (parks and gardens) throughout the city.
- Develop biodiversity parks for conservation of natural habitat (flora and fauna).

CENTRAL GROUND WATER BOARD

- Monitor groundwater exploitation within the city.
- Produce periodic reports on various groundwater parameters.

DEPARTMENT OF ENVIRONMENT

- Create awareness on critical environmental issues and motivate citizens to proactively engage in protection and conservation of environmental assets.
- Promote environmentally friendly practices such as composting, recycling, waste segregation, tree planation drives, and others.
- Lead a coordinated effort among the various agencies to combat climate change.

DELHI PARKS AND GARDENS SOCIETY

- Identify suitable areas for greening projects.
- Maintain parks and gardens and related water bodies.
- Incentivize use of treated wastewater in horticulture.

MUNICIPAL BODIES

- Develop and maintain parks, and gardens.
- Facilitate roadside tree planation and other greening initiatives.
- Manage the efficient collection and disposal of solid waste

IRRIGATION AND FLOOD CONTROL DEPT.

- Execute and maintain flood protection & river training works.
- Maintain major drains and bunds
- Monitor flood situation in the river basin and issue warning to citizens.
- Provide irrigation facilities to the agriculture sector of Delhi
- Revive and maintain water bodies

DELHI JAL BOARD

Manage the efficient collection and disposal of wastewater

CENTRAL POLLUTION CONTROL BOARD

- Advise the Central Government on prevention & control of pollution.
- Provide technical assistance and guidance to DPCC
- Collect, compile and publish technical and statistical data relating to water and air pollution.

DELHI POLLUTION CONTROL COMMITTEE

- Advise the Delhi Government on matters concerning prevention and control of water and air pollution.
- Disseminate data relating to water and air pollution and the measures for mitigation and prevention.
- Generate awareness on the prevention, control or abatement of water and air pollution.
- Prepare regulations for treatment and disposal of sewage and trade effluents as well as for stack gas cleaning devices, stacks and ducts.
- Lay down standards for treatment of sewage, emissions from automobiles, industrial plants, and other polluting source.
- Inspect wastewater treatment installations, air pollution equipment, industrial plants or manufacturing process .
- Issue Consent Certificate to the Industries falling in conforming areas under Green and Orange Categories.

Table 1: Highlights of the review of the Environment Chapter of MPD-2021

Review elements	Observations on MPD 2021	Suggestions for MPD 2041
Objective	Creation of a sustainable physical and social environment for improving quality of life.	The narrative must emphasize on the notion that economic development does not have to come at the cost of environment degradation. It is quite the contrary, in fact. Sustained economic growth cannot be achieved without protecting the environment.
Strategy	Addresses three aspects—Services and infrastructure management to abate pollution; conserving natural features; developing open spaces, greens and recreational areas	In addition to the strategies in MPD-2021, emphasis could also be on stepped up citizen engagement by actively involving citizens in environmental management (e.g. through the formation of citizen groups)
Scope of the chapter	• The scope has centred on the Ridge and the Yamuna. • The geographical scope is understandably limited to Delhi but does not acknowledge regional linkages that are very evident in Delhi (e.g. for air pollution, water pollution, groundwater abstraction, etc.)	• The scope could also explicitly include features like water bodies, wetlands, and city forests given that resources are in a bad shape. MPD 41 needs to protect whatever of the resources remain. • While the geographical scope must be on Delhi, its linkages with neighbouring states must be acknowledged. • Inter-sectoral linkages such as that with transport must be looked at holistically to decide on appropriate planning interventions. • A number of guiding documents and policies are available that will help establish the scope of the environment chapter. These include Climate Action Plan 2010 and its updated version; Clean Air Action Plan; Local Biodiversity Action Plan which is mandated under NBSAP 2008; Delhi Government's Vision 2030; NCRPB Plans; recommendations from important studies on Air Pollution, Wetlands, Emission Inventories, Biodiversity Assessments, Greenways etc.
Coverage of the chapter	• The chapter covers most of the critical environmental issues that were applicable at the time the Plan was developed. • It emphasizes on the greening of the urban areas with a hierarchy of parks, which have	• Management of Natural Resources needs to be emphasised by going into more detail. This would be possible by addressing each resource and including strategies to manage and monitor them at Zonal Level apart from the NCT level. • Emerging issues such as climate change mitigation and adaptation; water-sensitive development;

	been designed and are maintained to a large extent.	
Structure of the chapter	• The structure of the Chapter allows for sequential flow of information. However, the contents need to be updated or modified. • Aspects related to Natural Resource Protection, Pollution control, waste management, open space protection and an overall emphasis on the Master Plan 2041 being able to include enabling guidelines to address the various missions (Clean Air and Water, Climate Action, Biodiversity Conservation, waste management Sanitation etc., of the Government of India need to be included in various sections. • Delete CDM and Carbon credits	• The chapter should begin with the current status of the resources based on the baseline study • The sub-section on water resources highlight decentralized approached such as constructed wetlands; best practices in water body rejuvenation along with successful examples; monitoring rainwater harvesting; green way system, among others. • The sub-section on air could allude to the studies on urban heat island, source apportionment of air pollution, updating of emission norms for vehicles and policy for Electric Vehicles. • A new section on Unified Building Bye-Laws Risk Management and Environmental Management could be included.
Adequacy of norms and standards	Detailed norms and standards have been provided for: • Recreational areas and parks at neighborhood and sub-city level provided. • Multipurpose grounds and amusement parks provided. • Activities permitted in different zones stipulated Green belt, regional park, city park, district park, community park, multipurpose grounds. • Green cover targets • Regional parks notifications.	Norms and standards need updating and upgradation. These include norms for: • Open space standards – need to be updated as per URDPFI guidelines 2015 • Pollution standards – air, noise and water pollution norms and rules relating to their regulation to be incorporated in various sections of the Master Plan Document. • Implementation guidelines from waste management rules notified in 2016 to be included in relevant sections. • Norms for regulated zones along River, Protected Areas, Ridge, storm water drains to be worked upon.

		• There are some NGT reports[3] [4] [5] that can be referred to update norms and standards.
Adequacy of recommendations made	• Recommendations have been made on a number of key environmental issues. These include aspects like integrating water-sewerage-drainage system; promotion of water conservation through an integrated and a community driven model; Encouraging rainwater harvesting; ambitious wastewater treatment and reuse targets; conservation/development of the Yamuna River Bed area; transportation planning; sound pollution control; local area environment management plans. • However, recommendations are quite generic and appear to be guidelines rather than enforceable items.	• The recommendations need to be strengthened w.r.t policies and guidelines spelling out clearly the implementable aspects at local level. • Policies under various missions of Government of India relating to control of air pollution, protection of wetlands, building resilience towards climate change, protection of biodiversity, waste management need to be sourced and included along with their implementation mechanism where provided. • So far, the open space system and hierarchy has been detailed to an implementable level. However, protection of Ridge and River Yamuna needs to be detailed further. • Each resource protection has to be addressed in a hierarchical manner by understanding what needs to be done at plot level, housing area level, neighbourhood level up to the city level.

[3] Shailaja Chandra and B.S. Sajwan (2019). Interim report of the monitoring committee for the rejuvenation of the river Yamuna & abatement of pollution
[4] C.R. Babu, A.K. Gosain and Brij Gopal (2018). Restoration and Conservation of River Yamuna. Final Report Submitted to the National Green Tribunal with reference to Main Application no. 06 of 2012
[5] A.K. Gosain, Brij Gopal, and C.R. Babu (2015)Flood Plain Survey and Recommendations – October 2015

3.2 Status of milestones and targets

Chapter 18 of MPD 2021 lists down nine targets for the environment. These targets and the status of their achievement is presented in ***Table 2***.

Table 2: Status of targets of MPD 2021

Sl. No	Component	Cumulative Target (up to 2016)	Cumulative Target (up to 2021)	Achievement (as of July 2019)
1	City park	6	9	Data Constraints
2	District park	12	18	Data Constraints
3	Community park	60	90	Data Constraints
4	City multipurpose ground	6	9	Data Constraints
5	District multipurpose ground	12	18	Data Constraints
6	Community multipurpose ground	60	90	Data Constraints
t7	Divisional sports centre	6	9	Data Constraints
8	District sport centres	12	18	Data Constraints
9	Community sport centres	60	90	Data Constraints

4 STATE OF KNOWLEDGE OF NATURAL ENVIRONMENTAL RESOURCES

4.1 Forests

4.1.1 Green cover and forest cover

Green cover comprises forest cover and tree cover. Tree cover also includes avenue trees, and trees inside properties. Forest cover as per the Forest Survey of India (FSI), is not necessarily notified forest, but any area greater than 1 hectare with visible tree cover on satellite imagery. As per latest reports[6], the green cover of NCT of Delhi is 324.44 sq. km, which constitutes about 21.88% of NCT's total area. Of this 195.44 Sq.km. is the Forest Cover and 129 Sq.km is the tree cover. The Recorded forest area is 102 sq km of which 78 sq km is Reserved Forest and 24 Km is Protected forest. ***Table 3*** presents the forest cover in the different districts of Delhi. ***Map 6*** presents the total green cover for Delhi. Prof. P.K. Joshi from JNU developed this map as part of a study that his research team undertook. The mapping was done by observation of satellite images and captures all forms of greens, except agricultural greens. The map is not officially endorsed by a government agency but can serve as a tool for studies and broad analysis.

[6] Forest Survey of India Report (2019) Available at: https://https://fsi.nic.in/isfr19/vol2/isfr-2019-vol-ii-delhi.pdf

Table 3: District - wise forest cover in Delhi

District	Geographic area (sq. km)	Forest Area (sq. km)			Total
		Very Dense	Moderately Dense	Open Forest	
Central Delhi	21	0	2.08	2.86	4.94
East Delhi	63	0	1.05	2.70	3.75
New Delhi	35	1.69	5.47	9.31	16.47
North Delhi	61	0	2.83	1.76	4.58
North East Delhi	62	0	0.99	3.00	3.99
North West Delhi	443	0.09	8.72	9.18	18.04
South Delhi	247	2.59	17.68	64.29	84.63
South West Delhi	421	2.35	14.86	34.93	52.19
West	130	0	2.56	4.27	6.85
Total	**1,483**	**6.72**	**56.24**	**132.30**	**195.44**

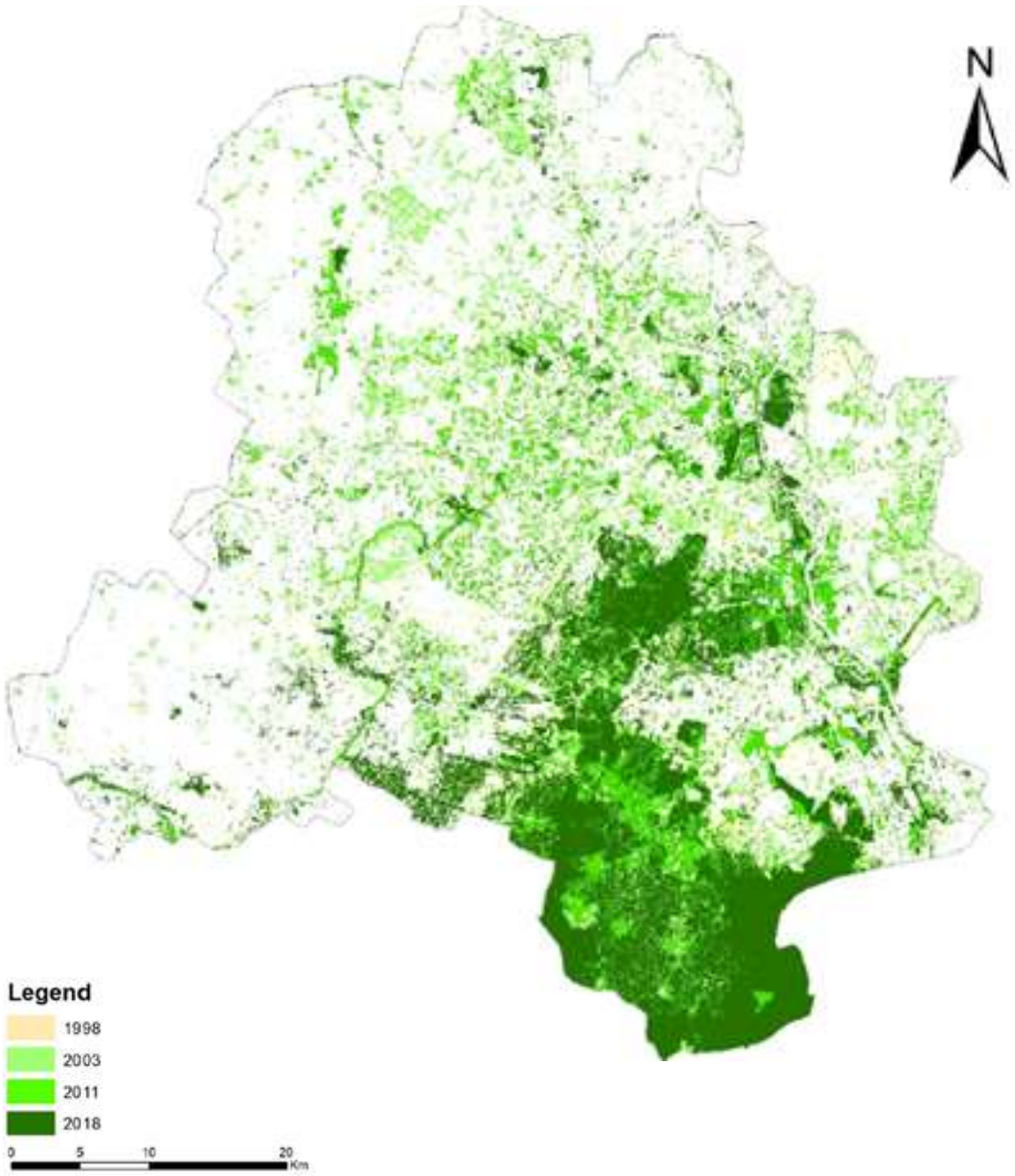
Source: Forest Survey of India, 2019

Very Dense: All land with tree cover (including mangrove cover) of canopy density greater than 70%

Moderately Dense: All land with tree cover (including mangrove cover) of canopy density between 40% and 70%

Open Forest: All land with tree cover (including mangrove cover) of canopy density between 10 and 40%

Map 6: Total green cover for Delhi (2018)



Source: JNU (2018), developed by observation of satellite images and captures all forms of greens, except agricultural greens.

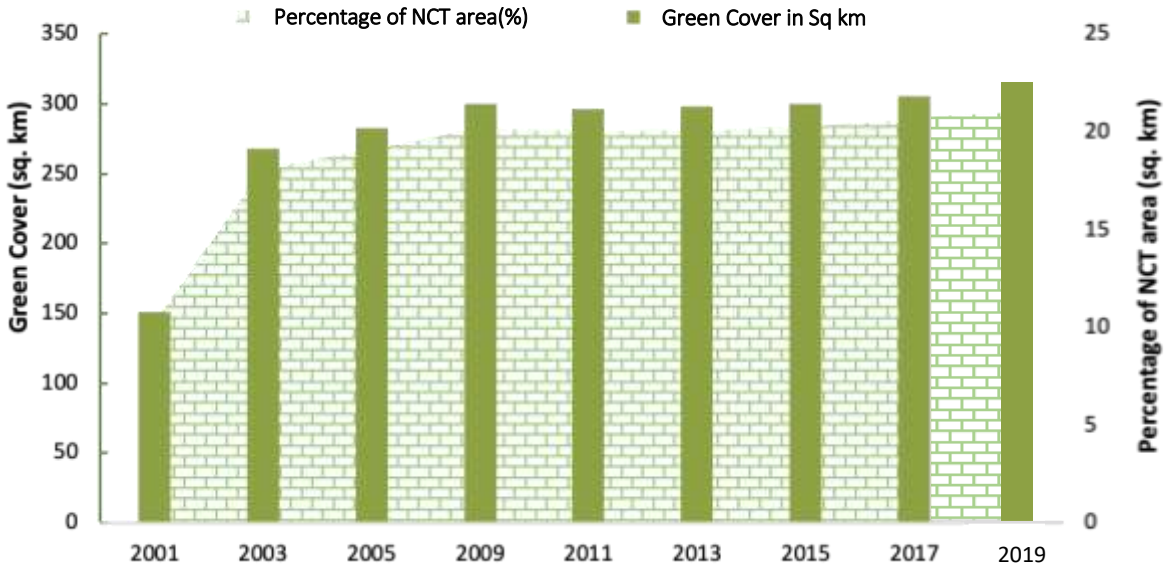
4.1.2 Temporal trend of green cover in Delhi

Delhi's green cover has nearly doubled from 151 sq. km. in 2001 to 324.44 sq. km. in 2019[7]. This is equivalent to a 115% increase. As a result, the green cover as percentage of the land area has also increased from 10.18 to 21.88. However, the area under 'very dense' and 'moderately dense' forests

[7] Delhi Forest Department website (http://forest.delhigovt.nic.in/wps/wcm/connect/doit_forest/Forest/Home/Forests+of+Delhi/)

have reduced over this period. This suggests that the increase in green cover is mostly because of tree cover and open forests. ***Figure 2*** presents the temporal trend in this regard.

Figure 2: Temporal trend of increase in green cover in NCT



Source: Delhi Forest Department, 2018

4.1.3 Categories of natural forests

The Indian Forest Act, 1927 is the primary legal framework for the protection and preservation of natural forests in the country. It defines three categories of forests:

- Reserved forests: that are under the direct supervision of the government and no public entry is allowed for collection of timber or grazing of cattle.
- Protected forests: that are looked after by the government, but the local people are allowed to collect fuel-wood/timber and graze their cattle without causing serious damage to the forests.
- Unclassified forests: are those in which there is no restriction on the cutting of trees and grazing of cattle.

Reserved Forests

In Delhi, the Ridge forms the reserved forest. Spread over an area of 7784 Ha, the Ridge constitutes nearly 5.2% of NCT[8]. The Delhi Ridge is a northern extension of the Aravalli Hill Ranges, which extend from Gujarat through Rajasthan to Haryana–Delhi. The Delhi Ridge stretches over a distance of 35 km, from Bhatti Mines to Southeast of Tughlaqabad, branching in different directions, and finally tapering towards the Northern end near Wazirabad on the western banks of Yamuna River. Once contiguous, it is now divided into five fragmented zones namely, Northern Ridge, Central Ridge, South Central Ridge, Southern Ridge and Nanakpura South Central Ridge. ***Table 4*** presents key details of the Ridge.

The Delhi ridge is categorised as the Regional Park in the MPD-2021. Besides the ridge, pockets of protected and unclassified forests also exist as bird sanctuaries and city forests respectively. Of the total recorded forest area in Delhi, the ridge constitutes 76.5%.

[8] Delhi Forest Department, 2018

Table 4: Sectional details of the Delhi Ridge

Section of the Ridge	Area (Ha)	Location	Existing land use	Managing agencies
Northern Ridge (also called Old Delhi)	87		Institutional Residential (plotted) Residential (informal) Residential (detached housing)	DDA : 73 Ha MCD : 11 Ha Forest Dept: 3 Ha
Central Ridge (also called New Delhi)	864		Institutional Residential (plotted) Residential (informal) Industrial Cantonment	Forest Dept : 423 Ha Army : 202 Ha DDA : 85 Ha CPWD : 37 Ha NDMC : 25 Ha MHA : 6 Ha MCD : 3 Ha Railways : 11 Ha L&DO : 70 Ha Others : 2 Ha
South Central Ridge (also called Mahrauli)	626		Institutional Residential (plotted) Residential (informal) Archaeological Park	DDA : 626 Ha
Southern Ridge (also called Tughlakabad)	6200		Villages Residential (detached) Residential (informal) Wildlife Sanctuary	Forest Dept: 1938 Ha DDA : 120 Ha SAI : 32 Ha G Sabha : 4207 Ha* *Some portion of the Gaon Sabha land have not been handed over to Forest dept.
Nanakpura South Central Ridge	7			

Source: Delhi Forest Department, 2019

Protected Forests

There are 26 protected forests within NCT[9], spread over a total area of 1658 Ha and constituting about 0.1% of NCT's area. ***Table 5*** provide details of the areas in Delhi that have been notified as Protected Forests under Section 29 of the Indian Forest Act, 1927 vide Notifications as mentioned against each.

Map 7 shows the spatial spread of these protected forests.

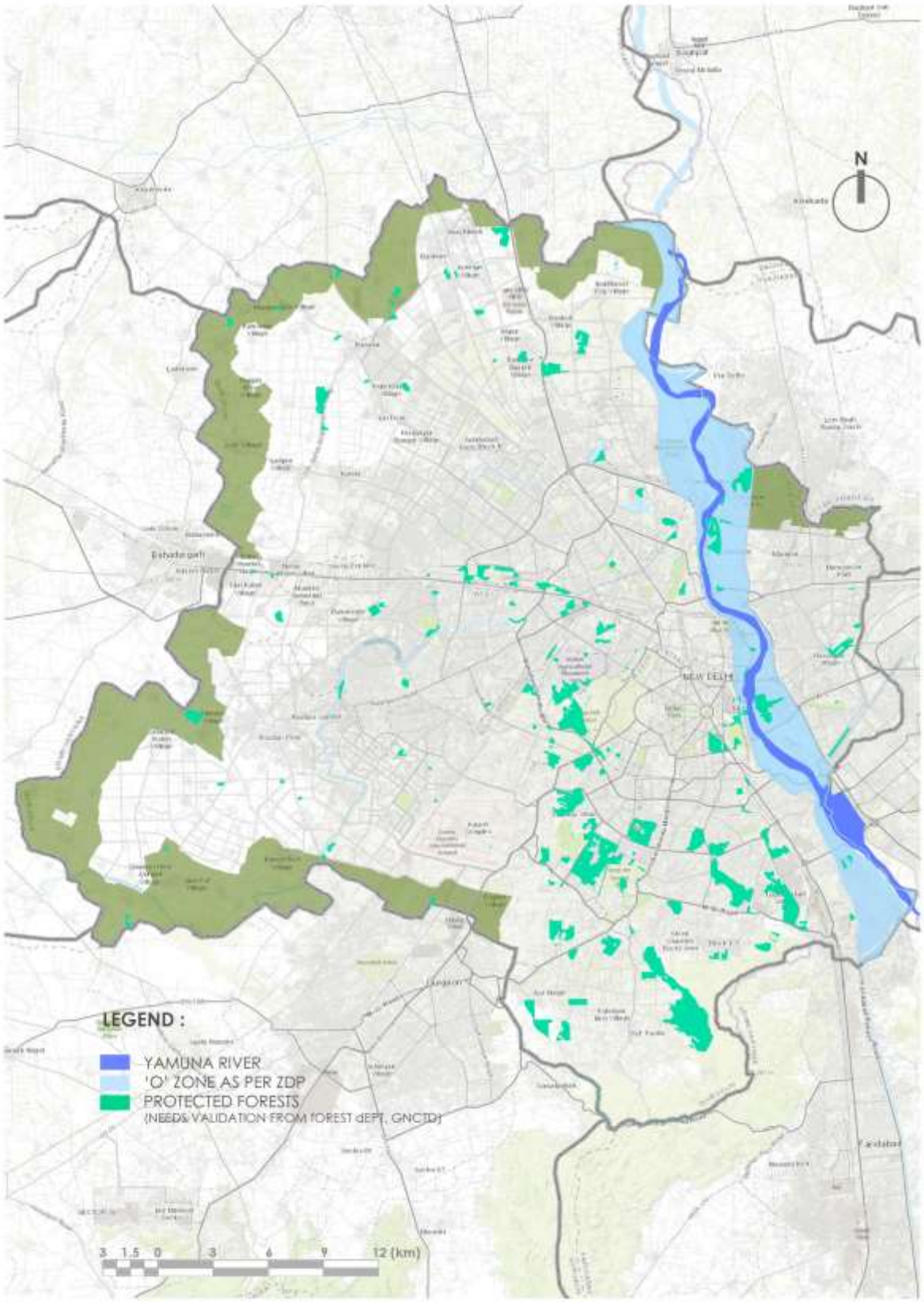
[9] Department of Forests, GNCTD website (2019)

Table 5: Areas notified as protected forests in Delhi

No.	Name of the Protected Forests and Agency	Area in Acre	Area in Ha	Notification No. Date.
1	Mitraon (Forest)	105	42.29	F.8(2)/48 (IX) P&D, Dtd. 6.05.1948
2	Sultanpur (Forest)	120	48.56	F.8(2)/48-(I)P&D, Dtd. 6.05.1948
3	Mukhmelpur (Forest)	133	53.82	F.11 (38)/54-P&D-I Dtd. 2.3.1955
4	Rajokhari (Forest)	600	242.81	EV-7/97/58(i) Dtd. 21.08.1959
5	Tughlakabad (Forest)			F.8(2)/48(V) P&D dated 6.5.1948
6	Distt. Park I/c Hauzkhas picnic Hut ,lake, Garden etc (DDA)	400.00	161.87	SCO.32(C)/Noti-80-81/6974 –81 Dt. 10.04.80
7	City Forest (DDA)	800.00	323.74	-do-
8	Basant Nagar, Moradabad Pahari Area (DDA)	200.00	80.93	-do-
9	Vasant Vihar Distt. Park (DDA)	20.00	8.09	-do-
10	Dhaula Kuan Complex ((DDA)	200.00	80.93	-do-
11	Nehru University Afforestation (DDA)	200.00	80.93	-do-
12	Distt. Park Gokulpuri (DDA)	7.50	3.03	-do-
13	Distt. Park Jhilmil Taharpur (DDA)	20.00	8.09	-do-
14	Zonal Green Area Kalyanpuri, Trilokpuri, Khichripur, Ghazipur etc. (DDA)	373.00	150.94	-do-
15	Orchard between Sindhora Kalan, Nimri, Gulabi Bagh & Darbar Khan Nursery and Other Areas (DDA)	100.00	40.46	-do-
16	Area Between Hill Road & Ludlow Castle Road (DDA/L&DO)	17.00	6.87	-do-
17	Orchard in Wazirpur Near Bharat Nagar and Nimri Colony (DDA)	120.00	48.56	-do-
18	Mayapuri Green belt (DDA)	5.00	2.02	-do-
19	Hastsal Afforestation (DDA)	40.00	16.18	-do-
20	Area between Inderpura Narayana J. J. Colony (DDA)	32.00	12.94	-do-
21	Afforestation M P Green area Tagor Gargen (DDA)	55.26	22.36	-do-
22	Orchard Nangloi Sayed (DDA)	257.56	104.23	-do-
23	Distt. Park Rohtak Road Co-operative Society (DDA)	35	14.16	-do-
24	Afforestation MP green G-8 Tihar	65	26.30	-do-
25	Afforestation M.P.Green Area Najafgarh Drain (DDA)	54.58	22.08	-do-
26	Distt. Park in between Pritampura Co-operative Society (DDA)	185.00	74.86	-do-
	TOTAL	**4144.90 (1658 Ha.)**		

Source: Delhi Forests Department, 2018

Map 7: Protected forests in Delhi



Source: GSDL, Analysis: NIUA (to be verified by Delhi Forest Department).
This does not match the list provided by the Delhi Forest Department.

Unclassified Forest

The Department of Forests, GNCTD has raised plantations on the Gram Sabha and other government lands and maintained them as City Forests. Besides 13 old City Forests, the Department during the year 2007-10 developed 27 New City Forests. The location - wise details of the old and new city forests are presented in ***Table 6***. Many of these are likely to be notified as Protected Forests in order to ensure their preservation. The total area under this category of forests is 1090.60 ha (excluding Rewla Khanour, Pendwala Khurd, Malikpur, Daurala, Goylakhurd, Kharkhari Jatmal, Garhi Mandu, Jaunapur, and Neb Sarai/Dera Mandi).

Table 6: List of city forests in Delhi

Old city forests (ha)		New city forests (2007-08) in Ha		New city forests (2008-09) in Ha		New city forests (2008-09)
Nasirpur	28	Issapur	66.25	Rewla Khanpur	8.09	Rewla Khanpur
Alipur	19.5	Rewla Khanpur	22.85	Shikarpur	44.11	Pendwala Khurd
Hauzrani	28.8	Kharkhari Jatmal	50	Rajokhari	6.27	Malikpur
Mitraon	40	Sultanpur Dabbas	24.76	Najafgarh Drain	29.6	Daurala
Sultanpur	48	Mungeshpur	13.5	Qutubgarh	11.97	Goylakhurd
Ghumenhera	32	Qutabgarh	22.77	Mukhmelpur	5.26	Kharkhari Jatmal
Ghoga	10.4	Hindon Cut Ghazipur	9.33	Raj Vidya Kendra	14.97	Garhi Mandu
Shahapur Garhi	8	Harewali	24.80	Aya Nagar	10.11	Jaunapur
Mamurpur	56	Mukhmelpur	19.43	Burari Bund	3.23	Neb Sarai/ Dera Mandi
Jindpur	47.6					
Mukhmelpur	53					
Bawana	32					
Garhi Mandu	300					

Source: Delhi Forests Department, 2018

4.1.4 Quality of flora cover in forests

While the forest and tree cover in Delhi has increased significantly over the years, there has been little attention paid to the quality of the forest cover. Delhi's ecology is most suitable for deciduous trees. However, the proclivity of the agencies concerned with forest management is towards evergreen trees, which require more water and moisture. For instance, Arjun—an evergreen— tree thrives only on the banks of perennial streams and therefore is inappropriate for Delhi's dry climate. ***Figure 3*** presents the range of indigenous or native species that have proved their adaptation to dry, rocky conditions on the Central Ridge[10]

Invasive Alien Species (IAS): Prosopis Juliflora (Vilayti Kikar) is the most prevalent inasive alien species in Delhi. Prosopis juliflora (***Figure 4***) was brought to Delhi from Mexico by the British. The exotic plant became invasive and wiped out most of the native plants and along with it the animals, which once inhabitated the ridges. Its deep roots has also impacted the city's groundwater.

[10] Based on a presentation made by Mr. Pradeep Krishen in the FGD on Managing the Delhi Ridge

Figure 3: Examples of native tree species of Delhi well adapted to soil conditions in the Ridge

Balanites Roxburghii

Capparis

Clerodendrum Phlomidis

Crateva Adansonii

Dichrostachys Cinerea

Diospyros Cordifolia

Flacourtia Indica

Flueggea Leucopyrus

Grewia Tenax

Gymnosporia Senegalensis

Figure 4: Presence of Prosopis Julifera throughout Delhi

It is possible to remove *Prosopis Juliflora* and re-wild the ridge using native species that respond to local ecology and soil conditions. However, the Delhi Preservation of Trees Act (DPTA), 1994 does not easily allow felling of any tree, including Prosopis Juliflora**.** There is a growing body of experts that

argue that the Act should be amended to pave way for re-wilding schemes that will improve the quality of greens in the Ridge. Ideally, the act should in *special scenarios* (like in the case of rewilding schemes), allow for removal for IAS after seeking an approval from the competent authority.

4.1.5 Compensatory afforestation

Compensatory afforestation[11] is carried out when a large portion of the forestland is expected to cleared out to accommodate projects in public interest (such as the metro, etcIn case of the Ridge, a request is submitted to the Ridge Management Board (RMB). RMB recommends a project to a Centrally Empowered Committee (CEC) appointed by Supreme Court, only if it is unavoidable. Upon seeking CEC's approval, the project is presented to the Supreme Court. Twice the amount of lost forest land is "transferred and mutated" for compensatory afforestation.[12] After the geo-coordinates are received for compensatory land, the project submitted to MoEF&CC to allow diversion of forest land for non-forest purposes. The following are some practices and observations in regards to compensatory afforestation.

- Of the total number of trees felled, the exotic species (like Su-Babool, Prosopis Juliflora and Eucalyptus) are excluded, and only the remaining species are transplanted. Of these, minimum 80% should be transplanted while the remaining trees could be saplings. It is only once these criteria are satisfied, that the proposal is considered for tree felling.
- DPTA's ratio for felled to transplanted trees is amongst the highest in the country (1:10). According to Delhi's Draft Tree Transplantation Policy 2018, this compensatory afforestation is to be done by user agency, or by DDA/ Forest Department once the user agency deposits an amount for the maintenance of the planted trees for a period of 10 years.[13]
- However due to paucity of land, afforestation parcels are majorly allotted by DDA in the O Zone. While tree cover is lost from urban areas for urban projects, transplantation is majorly possible in the floodplains, which is inaccessible to general public.

4.2 River Yamuna

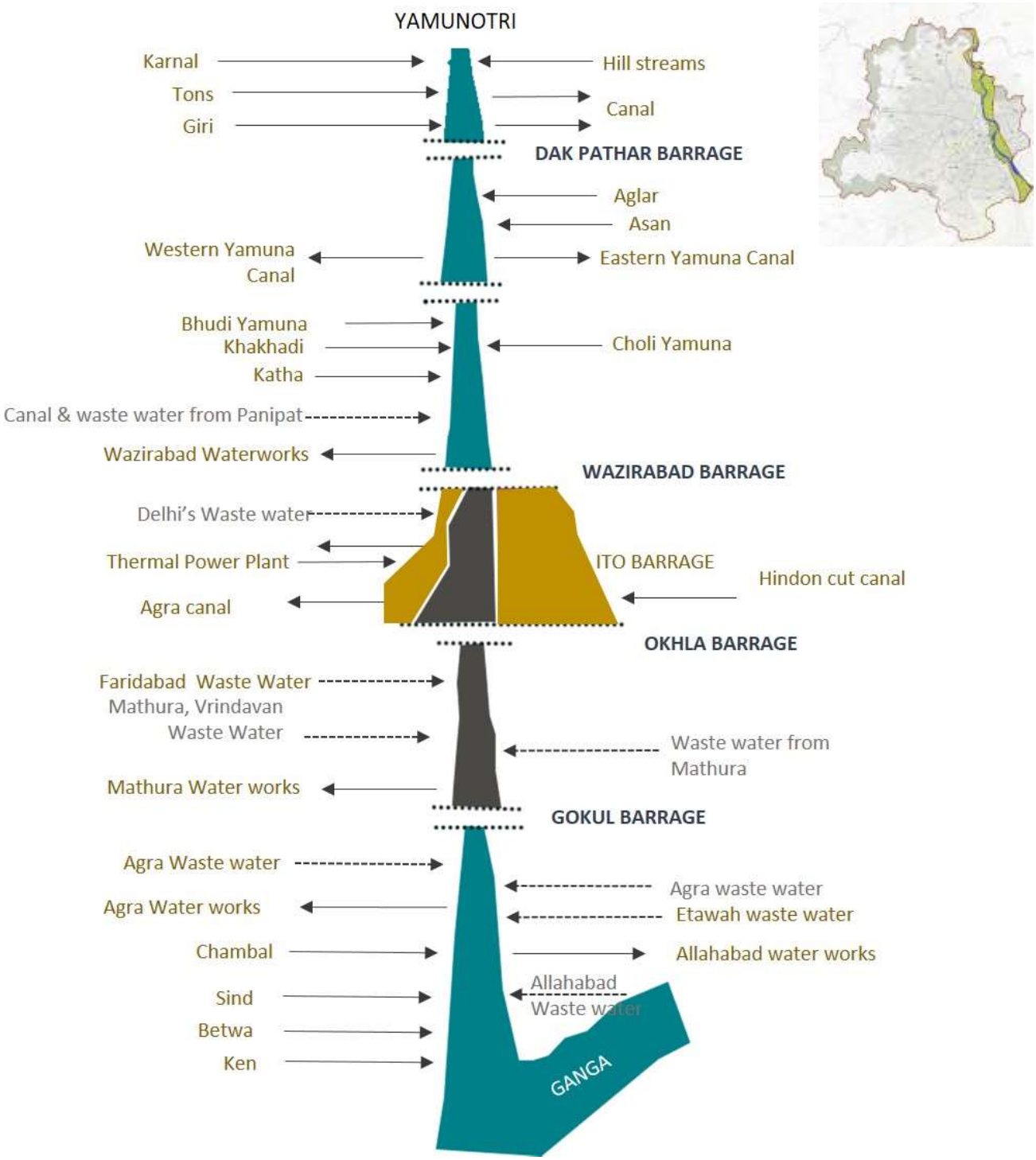
4.2.1 Origin and morphology

River Yamuna originates from a glacier in the Himalayas. It is one of the major tributaries of the river Ganges. Total length of Yamuna up to its point of confluence with Ganges is around 1,370 km. Its catchment area is spread over 366,220 km^2 and it falls in six different states of Himachal Pradesh, UP, Haryana, Delhi, Rajasthan and Madhya Pradesh. However, the riparian states are Himachal Pradesh, Haryana, Delhi and UP. Yamuna has four main tributaries in the Himalayan region viz. Rishi Ganga, Hanuman Ganga, Tons, and Giri. In the plains, the main tributaries are Hindon, Chambal, Sind, Betwa and Ken.

Although the Yamuna River flows only for 54 km from Palla to Badarpur in Delhi, the 22 km stretch from Wazirabad to Okhla, which is less than 2% of the river length, accounts for about 70% of the pollution load in the river[14]. The width of the river between Wazirabad Barrage to Okhla varies from 1-3 km[15]. During the dry season, spreading over nearly nine months of the year, the river has no fresh water downstream of Wazirabad and the only flow available is sewage, both treated and untreated, flowing through 17 drains that join the river Yamuna during it journey through Delhi[16]. ***Figure 5*** depicts the flow path of river Yamuna from its origin to its confluence with the Ganges.

[11] Delhi Preservation of Trees Act (1994).
[12] Guidelines for diversion of forest land for non-forest purpose under Forest Conservation Act (2014)
[13] Draft Tree Transplantation policy 2018
[14] MPD 2021
[15] MPD 2021 (2019 non-notified version; for reference only not to be cited)
[16] MPD 2021 (2019 non-notified version; for reference only not to be cited)

Figure 5: Path of Yamuna from its origin to its confluence with the Ganges



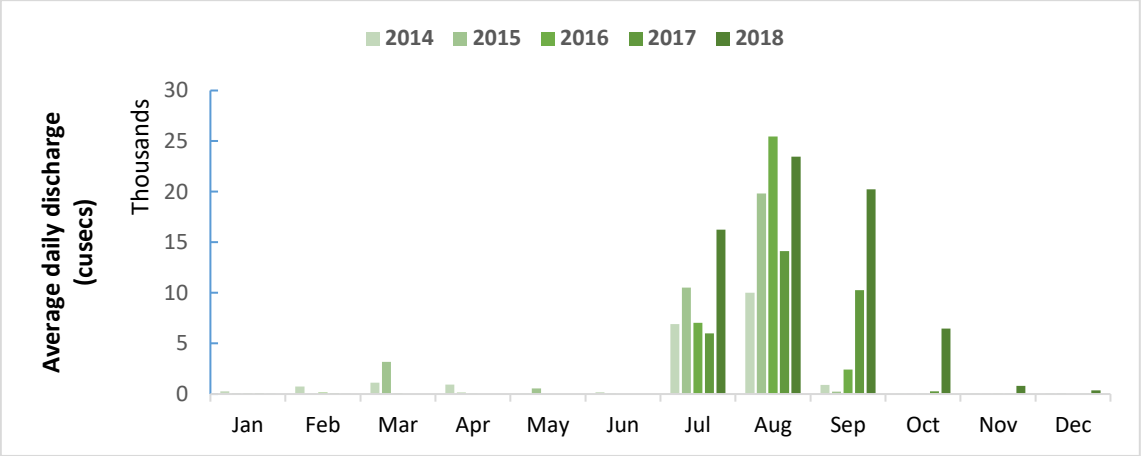
Source: Analysis by NIUA; Adapted from The Yamuna River Project, 2017

4.2.1 Flow in the river

Yamuna is a perennial river. However, there is hardly any flow in the river downstream of Wazirabad during lean season. Only 10 cumecs of flow is released by the State of Haryana at Hathanikund during lean season[17]. Most of it evaporates or percolates before it reaches Wazirabad. ***Figure 6*** throws light on the inter-annual trend of water discharged from the Hathinikund Barrage through the year

[17] Cited in Shailaja Chandra and B.S. Sajwan (2019). Interim report of the monitoring committee **f**or the rejuvenation of the river Yamuna & abatement of pollution

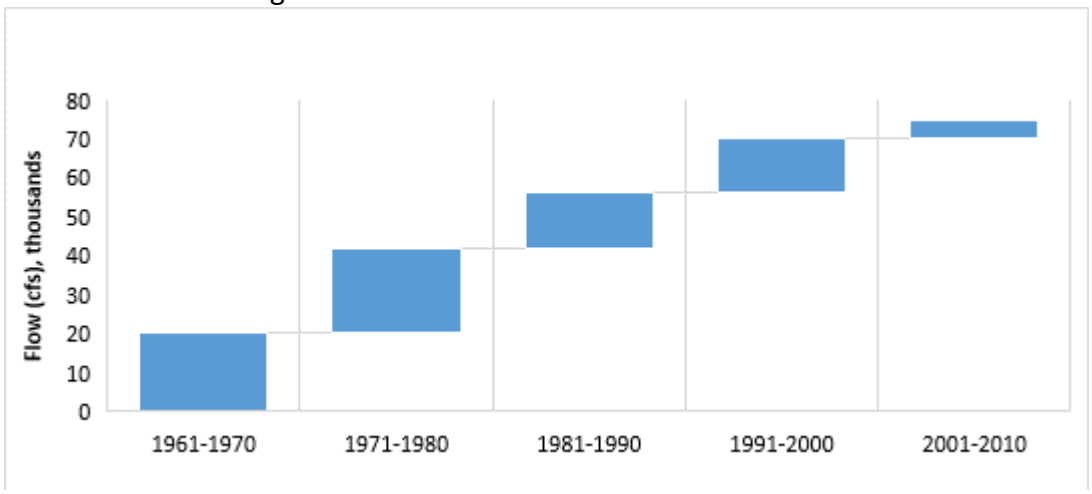
Figure 6: Inter-annual trend of discharge at Wazirabad



Source: DJB and UP Irrigation Department, 2019

The river flow in Yamuna has decreased over past few decades ***(Figure 7).*** The increasing encroachment to the river flood plains increases ecological damages while simultaneously increases potential hazards to the existing population and its urban infrastructure.

Figure 7: Trend of decadal flow in the Yamuna



Source: University of Virginia, 2017

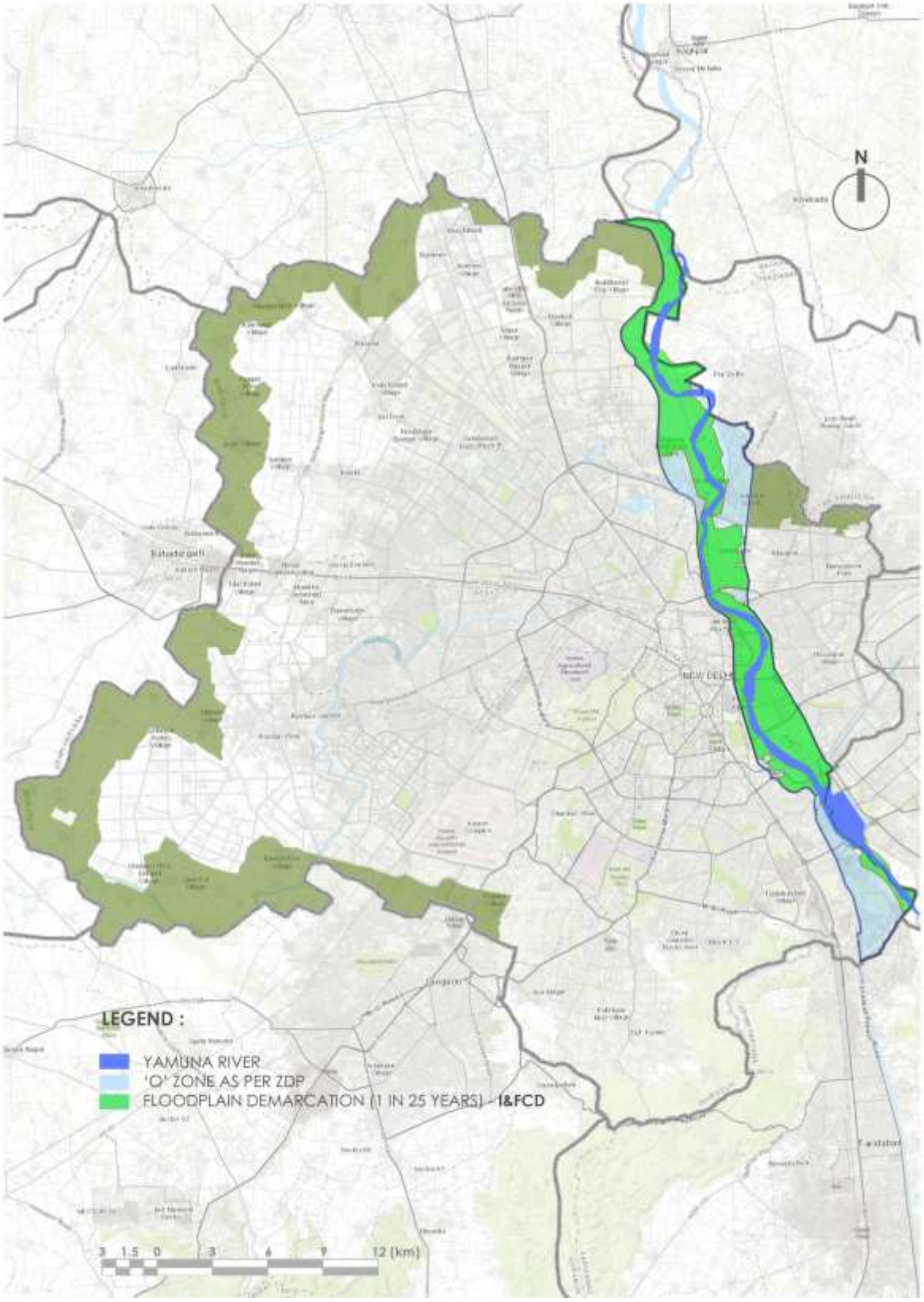
4.2.2 Yamuna flood plain

As per the notification of Ministry of water resources, river development and Ganga rejuvenation, flood plain is defined as such area of the river, which comes under water either side of it due to floods corresponding to its greatest flow or with a flood of frequency once in hundred years[18]. In interest of ecology, biodiversity and river flow, flood plain of Yamuna is demarcated by area under flood once in twenty-five years [19]. ***Map 8*** shows the location of the Yamuna flood plains.

[18] MoWR notification dated 07.10.2016. http://www.indiaenvironmentportal.org.in/files/file/Yamuna-river-floodplain-NGT-Order.pdf

[19] O.A no. 06/2014 NGT order dated 13.01.2015

Map 8: Demarcation of the Yamuna Floodplain (1 in 25 years), and its overlay with Zone 'O'



Source: Floodplain extent extracted from I & FC website; Zone 'O' boundary, DDA , 2018

The Planning Zone 'O' comprises of the Yamuna and most of its flood plains. The area of Zone 'O', as provided in MPD-2021 is approximately 8070 Ha. As per the Zonal Development Plan, Zone 'O' has been divided into 8 sub-zones. While all nine categories of land use are permitted in the Zone, the actual development has deviated significantly from the planning norms. ***Table 7*** summarizes the status of current development in each sub-zone.

Table 7: Land use in the 'O' Zone (text in BLUE indicates non conformant to planning norms)

Sub-Zone	Description of Area	Existing characteristics/ Developments in Zone 'O'	
		West	East
1	NCTD Boundary to Wazirabad Barrage	Agriculture, Biodiversity Park, Jagatpur Village, Wazirabad Village, Monuments, Unauthorized colonies, Wazirabad Waterworks, Ghats.	Agriculture, Water works, Facility centre, CRPF Camp, Delhi Police Firing range, Unauthorized colony.
2	Wazirabad Barrage to ISBT Bridge	Unauthorized Colonies, Unauthorized Religious Structures, CNG station, Bathing Ghat.	220 KV Electric Sub Station, Water Ponds, Grass Farms, Marshes, Gurudwara & Agriculture.
3	ISBT Bridge to Old Yamuna Rail cum Road Bridge	Nigambodh Ghat, Unauthorized Growth of Yamuna Bazaar, Salimgarh Fort, Ghats, ESS.	Unauthorized colony, Agriculture, DMRC Depot, IT Park, PSP Site.
4	Old Yamuna Bridge to ITO Barrage	Electric Crematorium, Vijay Ghat, Shanti Van, Shakti Sthal, Raghat, Gandhi Darshan, I.G. Stadium Complex, Power House, Delhi Secretariat, Fly Ash Brick Plant.	Agriculture, Cremation Ground.
5	ITO Barrage to Nizamuddin Rly Bridge	IP Power House, Gas Turbine Power House, STP.	Agriculture, Forest, Site for DMRC Depot & Station.
6	Nizamuddin Rly Bridge to NH 24	Fly Ash Pond, Fly Ash Brick Plant.	Agriculture, PSP (Public and Semi-Public) Site, Akshardham Temple Parking, CWG Village Complex.
7	NH24 to Okhla Barrage	Electric Crematorium, Rajiv Gandhi Smriti Van, Unauthorized Petrol Pump, Unauthorized Encroachment, ESS, UGR, Unauthorized Colonies.	Agriculture.
8	Okhla barrage to NCTD Boundary	Unauthorized Colonies, Water Body, Agriculture, Madanpur Khadar Resettlement Scheme, LPG bottling plant.	Agriculture & Water body

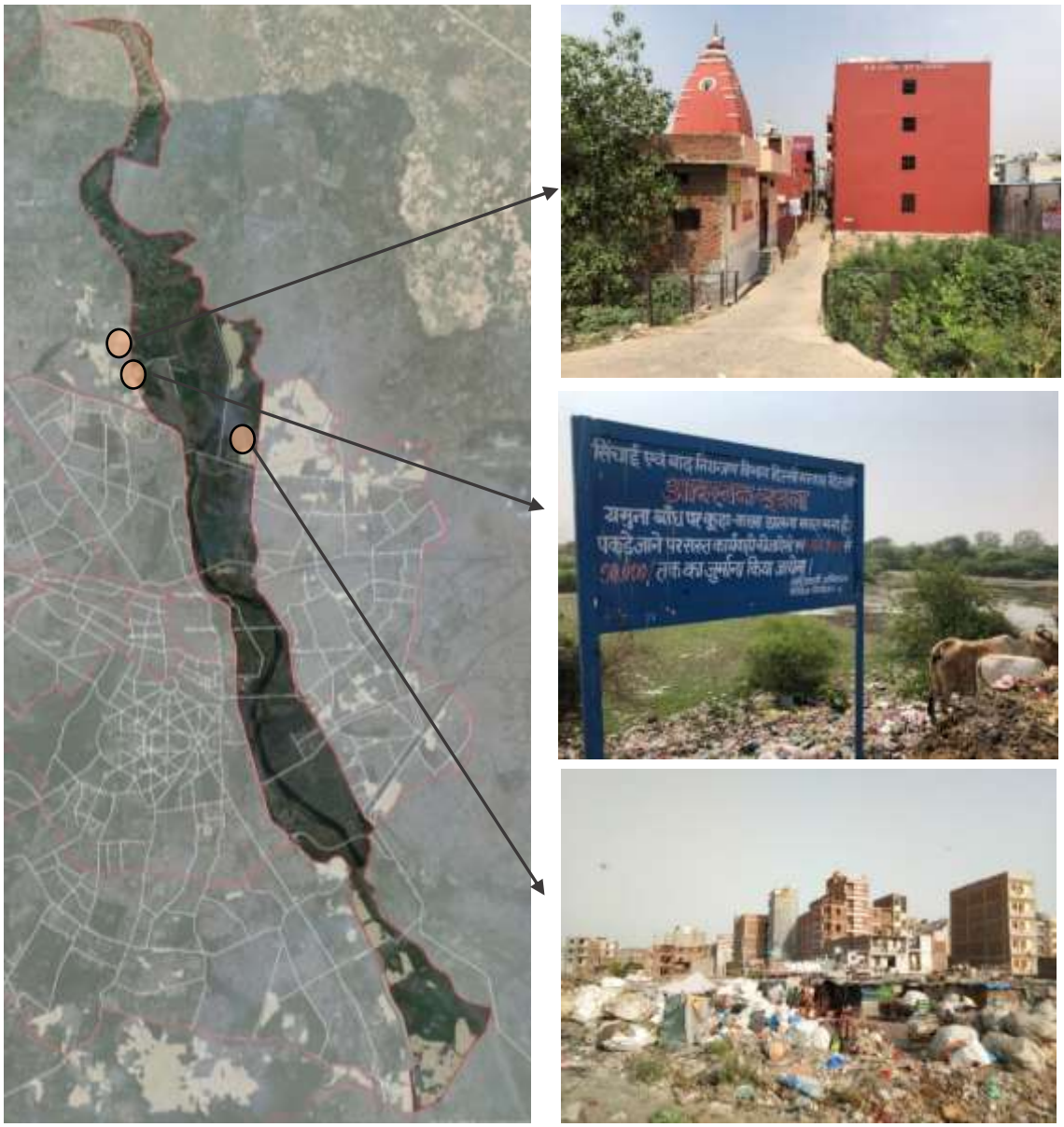
Source: Zonal Development Plan of Zone 0 [20], DDA

Some areas in the Zone 'O' are developed/ to be developed by DDA as planned greens, such as the Yamuna Biodiversity Park (Phase-2), Golden Jubilee Park, etc. There are also areas demarcated for compensatory afforestation and wetlands. In the recent past, there have been intrusive developmental incursions into the river's active flood plain in form of pseudo bridges as well as

[20] Available at https://dda.org.in/tendernotices_docs/august10/Report%20of%20ZDP%20of%20Zone%20O%20Notified%20on%2010Aug10.pdf

barrages and roads in the central stretch, which have frozen the river's meander and compromised the ability of the flood water to spread and flow downstream. Few avoidable 'advance / forward bunds' raised well into the active flood plain in all the three stretches have further reduced the flood way available to the river and rendered the floodable lands into flood prone, but which remain an integral part of the flood plain nonetheless . Any restoration plan shall need to consider these developments especially in the light of high floods that the river has seen during 1978, 1988, 1995, 2010 and 2013[21]. Three distinct stretches in the river zone can be considered. The 'Northern stretch' running over 26 km from the Palla village till the Wazirabad barrage cum road. The 'Central stretch' running over 22 km from the Wazirabad barrage till the Okhla Barrage and the 'Southern stretch' running over some 4 km from the Okhla barrage till the Jaitpur Village. ***Map 9*** throws light on the state of affairs in the flood plains.

Map 9: Extent of built up area in the Zone 'O' (left); Unauthorized structure (top right); Solid waste hot spots (Centre right and bottom right)



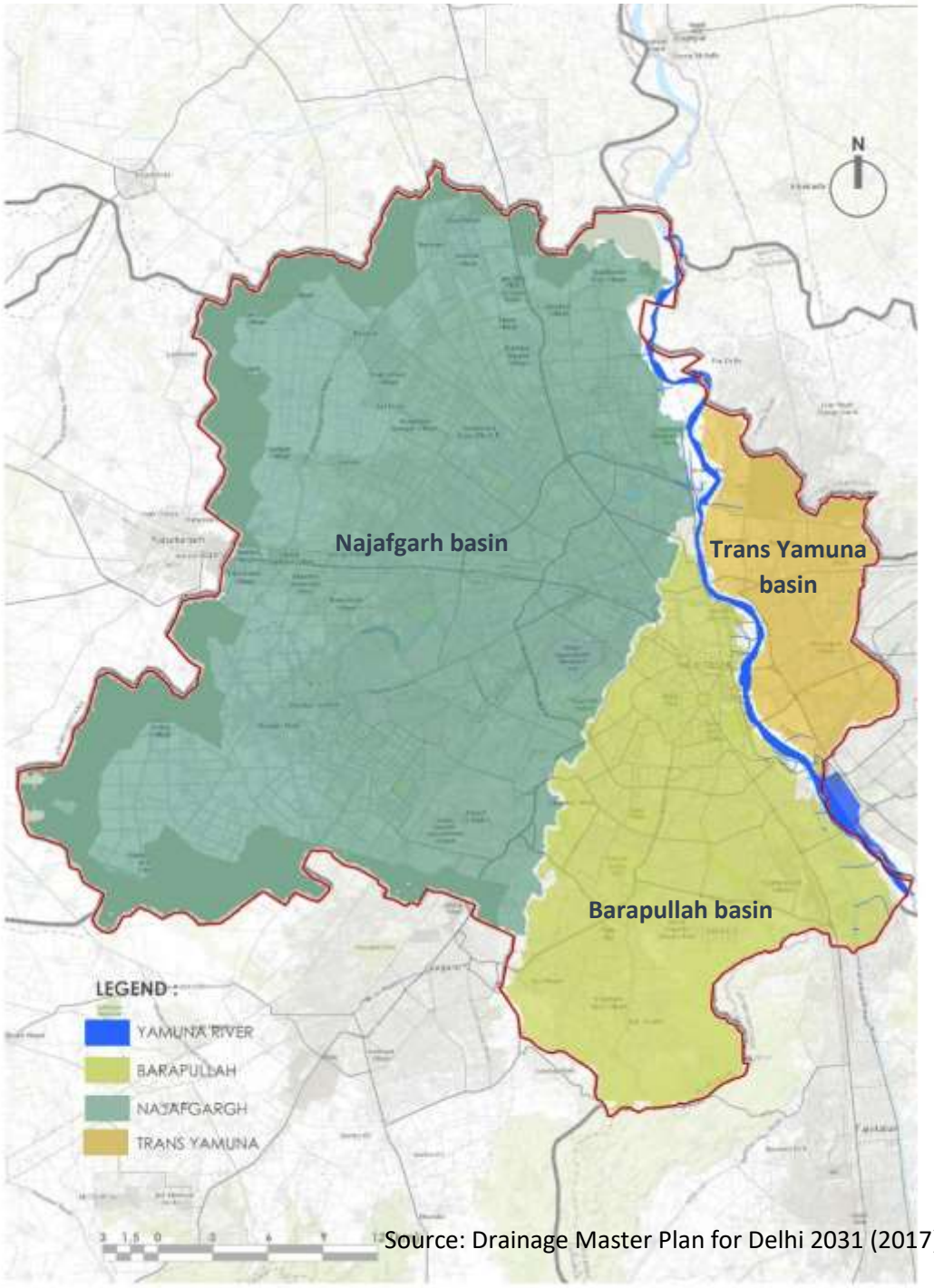
Source: From the field visit (2019), NIUA

[21] Gosain, Gopal and Babu (2015). Flood Plain Survey and Recommendations – October 2015

4.3 Drains

Although there are more than 4,000+ drains in Delhi, there are 201 major natural drains in the three drainage basins[22] as per the 1976 Drainage Master Plan for Delhi. The basins are Nagafgarh, Trans Yamuna and Barapullah as shown ***Map 10***. 123, 34, and 44 drains natural drains lie in these basins respectively. However, data from the I&FC Department suggests that 19 of these drains are no more in existence. Furthermore, it was not possible to mark 20 drains during the preparation of the 2017 Drainage Master Plan for NCT. Map 11 is an extract from the Drainage Master Plan that provides an indication of the drainage network.

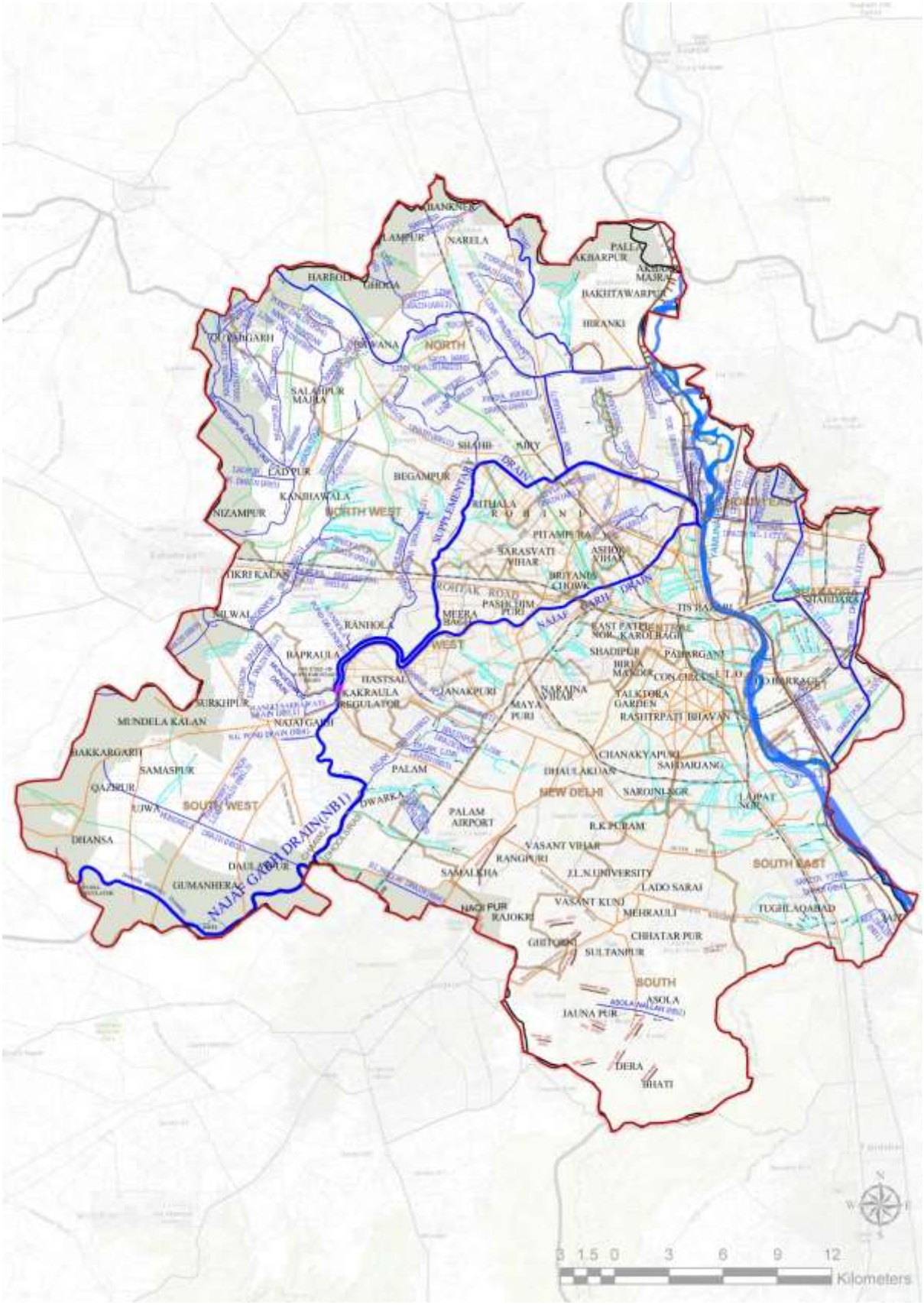
Map 10: Major drainage basins of Delhi



Source: Drainage Master Plan for Delhi 2031 (2017)

[22] Drainage Master Plan for Delhi 2031 (2017).

Map 11: Drainage map of Delhi (as per 1976 Drainage Master Plan)



Source: Delhi Drainage Master Plan 2031(2017)

There are a number of places where the drains are connected with parks and water bodies. This information will be useful is developing a network of blue-green infrastructure for Delhi.

4.4 Water bodies

Delhi has always had an abundance of water bodies. However, as seen from ***Table 8***, the number and area under water bodies has reduced by 7% from 1999 to 2012, a reduction from 2,435 Ha to 2,258.95 Ha. Given that the built up area has increased significantly in the same period; it is evident that several water bodies have been encroached upon.

Table 8: Change in Waterbodies Area [1999 – 2012] In NCT Delhi

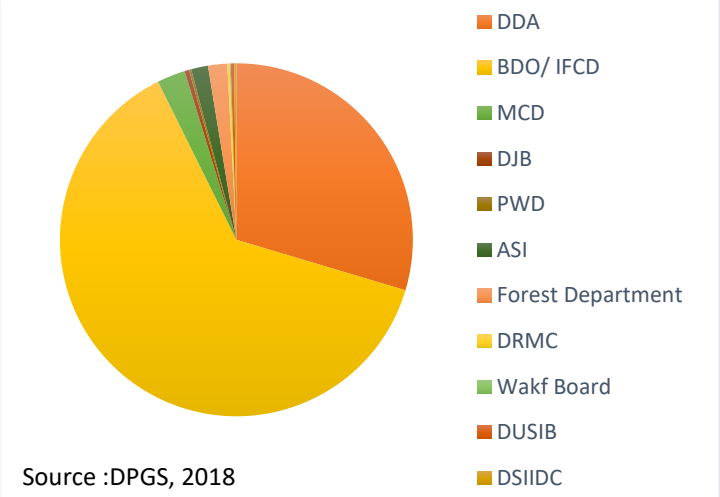
Category	Area 1999		Area 2012		Change in area	
	Hectare	%	Hectare	%	Hectare	%
Built up	70,162	47.31	83,536.08	56.33	13,374.08	9.02
Agriculture	62,279	42.00	51,133.01	34.48	-11,145.99	-7.52
Green Areas	7,015	4.73	6,282.05	4.24	-732.95	-0.49
Wastelands	6,079	4.10	4,760.62	3.21	-1,318.38	-0.89
Water bodies	2,435	1.64	2,258.95	1.52	-176.05	-0.12
Others	330	0.22	329.29	0.22	-0.71	0.00
Total	1,48,300	100	1,483,300	100		

Source: INTACH 2015

As per the data received from the Delhi Parks and Gardens Society (DPGS), there are 1009 water bodies in the city[23]. Out of these, the DPGS report suggests that 969 are traceable (40 are not). However, only 700 out of these 969 are distinctly identifiable through satellite images. ***Map 12*** shows the locations of these 700 water bodies. Because the DPGS data did not include boundary and area[24] details, the water bodies have been marked as point locations only to give a sense of the spread of these features across the city. Some reasons why a large number of water bodies are untraceable are as follows:

- There is discrepancy in the data entry of the coordinates, which lead to errors when tracing these via satellite images.
- Water bodies could have been encroached upon
- Water bodies could have dried up.

Figure 8: Ownership of water bodies in Delhi

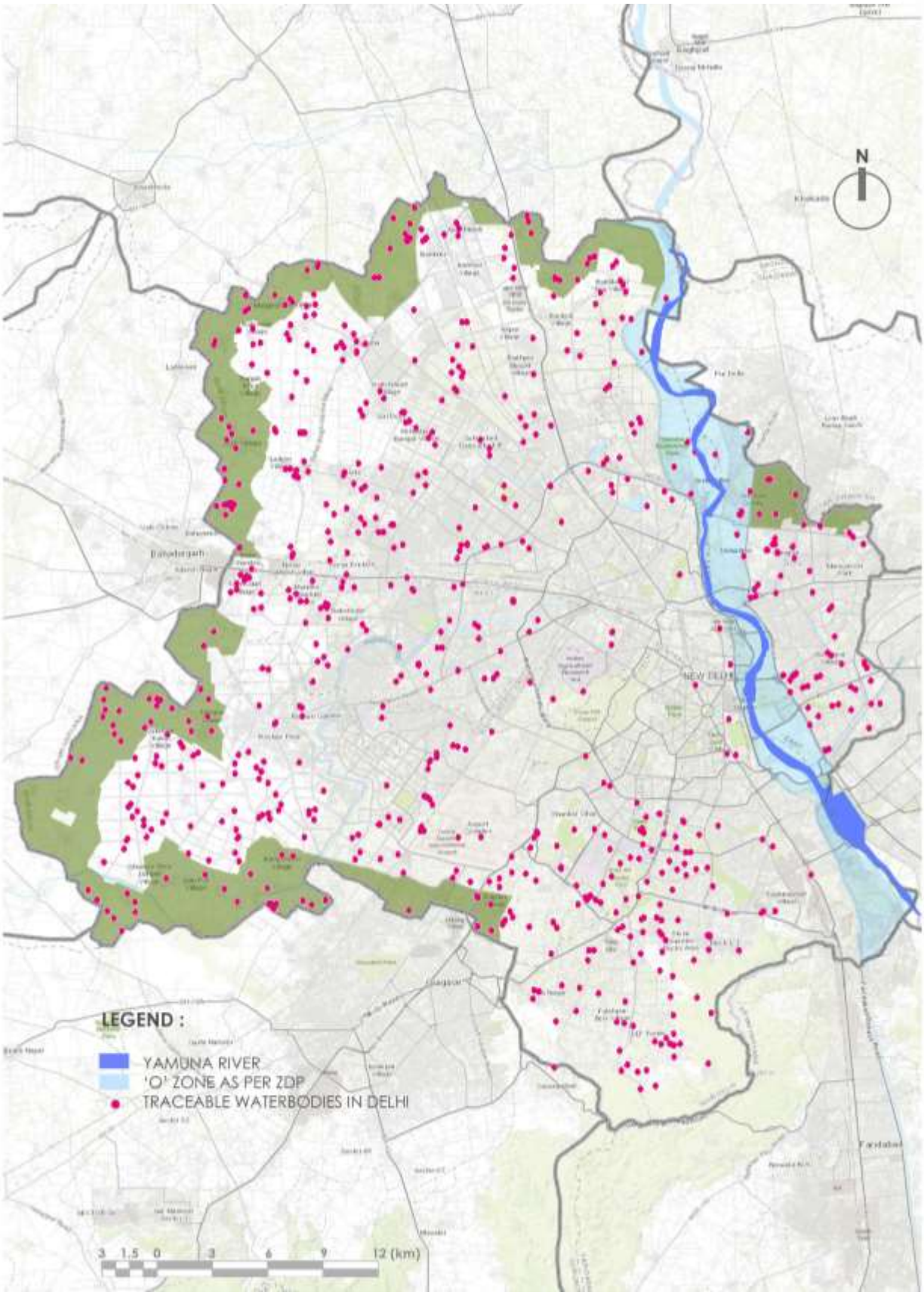


Source :DPGS, 2018

The ownership and maintenance of water bodies lie with multiple agencies. As seen in ***Figure 8***, almost 90% of the water bodies are managed by the Block Development Officer (BDO)/ I&FC Dept, and DDA. In recent years, there has been increased awareness about the importance of rejuvenating water bodies to enhance water security. I&FC Dept. and DJB are reviving 201 bodies, as of data available in June 2019. The locations of these are marked in ***Map 12***.

[23] Data received from DPGS in April 2019.
[24] Only some areas are available. Also, most of the areas do not match satellite observations.

Map 12: Traceable water bodies (point locations only)



Source: DPGS (2018). Analysis NIUA. Point locations are indicative

4.5 Natural Conservation Zones (NCZ)

4.5.1 Nature of NCZs

The NCR Regional Plan 2021 identifies four major land use zones:

a) Controlled/development/regulated zone
b) Highway corridor zone
c) Natural conservation zone (NCZ)
d) Agricultural (Rural) zone outside controlled /development/regulated areas.

The NCZ comprise environmentally sensitive areas that should be conserved for their intrinsic environmental value. These areas are:

- The extension of Aravalli Ridge in Rajasthan, Haryana and NCT-Delhi
- Forest areas;
- Rivers and tributaries of Yamuna, Ganga, Kali, Hindon and Sahibi
- Sanctuaries
- Major lakes and water bodies such as Badkal lake, Suraj Kund and Damdama in Haryana Sub-region and Siliserh lake in Rajasthan etc.
- Ground water recharging areas such as water bodies, ox-bow lakes and paleo-channels

4.5.2 Location of NCZs in Delhi

Based on the criteria listed in 4.5.1, NCZs are delineated in 156 locations in Delhi, and are spread over a total area of 106.7 Sq.km. constituting nearly 7.2% of NCT's area[25]. ***Map 13*** shows the locations of the NCZs. ***Annexure C*** has the full list of the NCZ locations.

4.5.3 Activities allowed in NCZs

As per the NCRPB regional plan the following uses activities may be permitted in the NCZs:

a) Agriculture and horticulture
b) Pisiculture
c) Social forestry/plantations including afforestation.
d) Regional recreational activities with no construction exceeding 0.5% of the area with the permission of the competent authority.

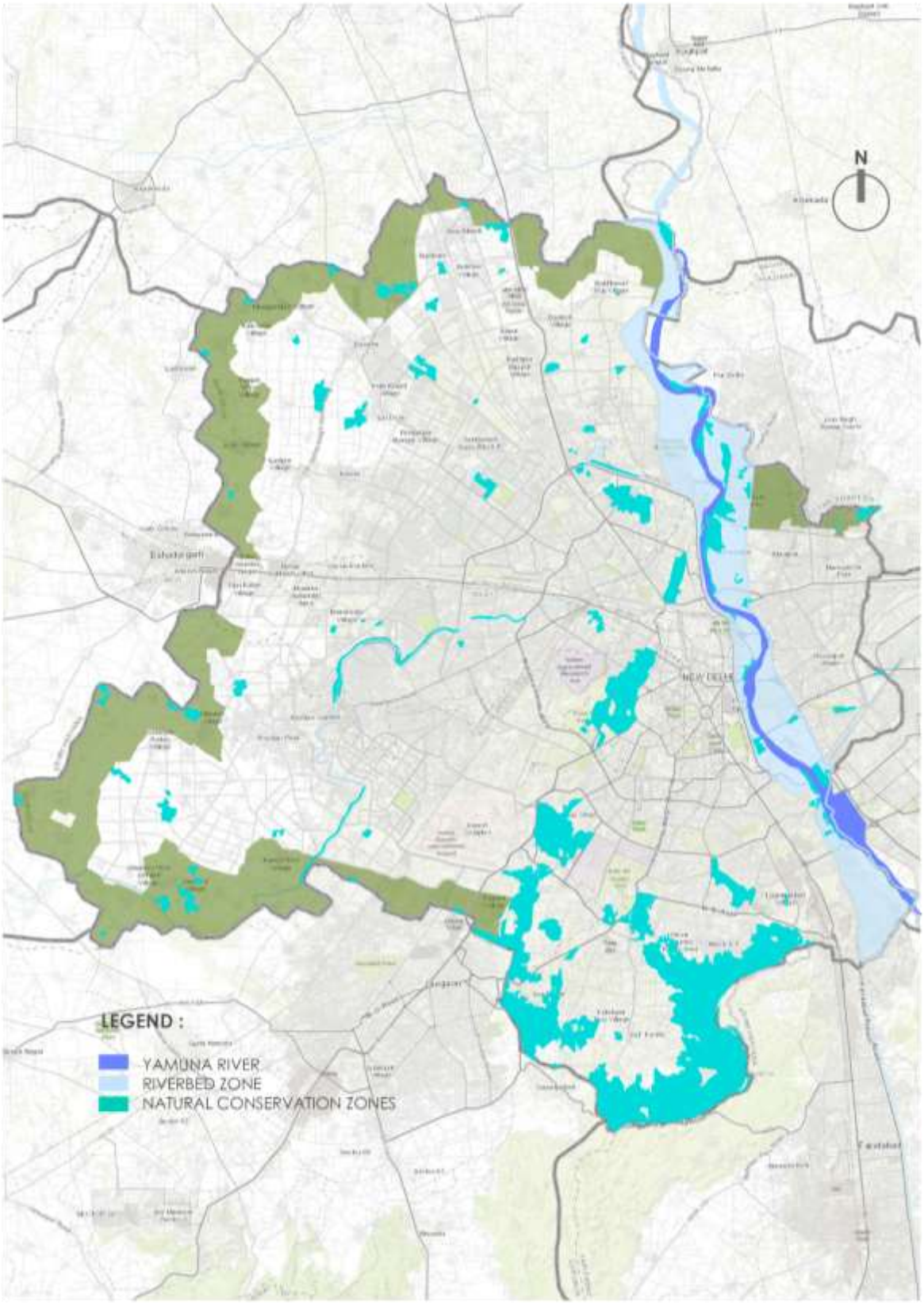
4.6 Eco-Sensitive Zones (ESZ)

4.6.1 Nature of ESZs

ESZs special areas identified by the Ministry of Environment, Forests and Climate Change (MoEFCC) under Environment Protection Act, 1986 as special areas within 10 km around National Parks and Wildlife Sanctuaries in 2002. The aim is to regulate certain activities around National Parks and Wildlife Sanctuaries to minimise the man-animal conflict and avoid negative impacts of harmful activities on the fragile ecosystem encompassing the protected areas. They act as a 'shock absorber' for protected areas and act as a 'transition zone' between protected and unprotected areas. However, since many states cited constraints in meeting the 10 km buffer, the proposal was re-examined by National Board for Wildlife in 2005 and it was decided that the *'delineation of eco-sensitive zones would have to be site specific and relate to regulation, rather than prohibition, of specific activities*'. Since then, there have been several examples where the ESZ has been adjusted to suit the local context. E.g., the extent of ESZ of the Okhla Bird Sanctuary ranges from 100 meters to 1.27 kms from the boundary of the

[25] Report received from (May 2019) "Status Report- Variation of Natural Conservation Zone (NCZ) in NCT Delhi"

Map 13: Natural Conservation Zones (within Delhi) 2012



Source: DDA (2018); Graphics: NIUA

Sanctuary in the district of Gautam Budh Nagar of Uttar Pradesh and South East District of the National Capital Territory of Delhi[26].

4.6.2 Activities allowed in ESZs

Prohibited activities: Commercial mining, saw mills, industries causing pollution (air, water, soil, noise etc.), establishment of major hydroelectric projects (HEP), commercial use of wood, tourism activities like hot-air balloons over the National Park, discharge of effluents or any solid waste or production of hazardous substances.[27]

Regulated activities: Felling of trees, establishment of hotels and resorts, commercial use of natural water, erection of electrical cables, drastic change of agriculture system, e.g. adoption of heavy technology, pesticides etc., widening of roads.

Permitted activities: Ongoing agricultural or horticultural practices, rainwater harvesting, organic farming, use of renewable energy sources, and adoption of green technology for all activities.

4.6.3 Notified ESZ in Delhi

As per the ESZ notification for Delhi dated September 12, 2017, in Delhi, the Eco-sensitive Zone constitutes 17.92 Sq km. of area. The ESZ has an extent upto 1 km from the ***Asola Bhatti Wildlife Sanctuary,*** comprising a total of 15.55 sq km area while, the ESZ around the part of the ***Okhla Bird Sanctuary***[28] falling in NCT is 2.42 sq km as seen in ***Map 14***. The Asola Bhatti sanctuary consists of a mixture of indigenous and exotic species of Flora and is known to harbor around 83 species of trees, around 30 species of shrubs, around 95 species of herbs, around 18 species of grasses and around 4 species of sedges. In addition, there are about 193 species of birds, more than 80 species of butterflies, hundreds of other insects, mammals such as leopards, Nilgai (blue bull, the largest antelope of the country), blackbuck (fastest land animal surviving in the wild in the country), black-naped hare, Indian crested porcupine, small Indian civet, golden jackal and jungle cat.[29]

5 STATE OF KNOWLEDGE ON PLANNED GREENS

5.1 Parks

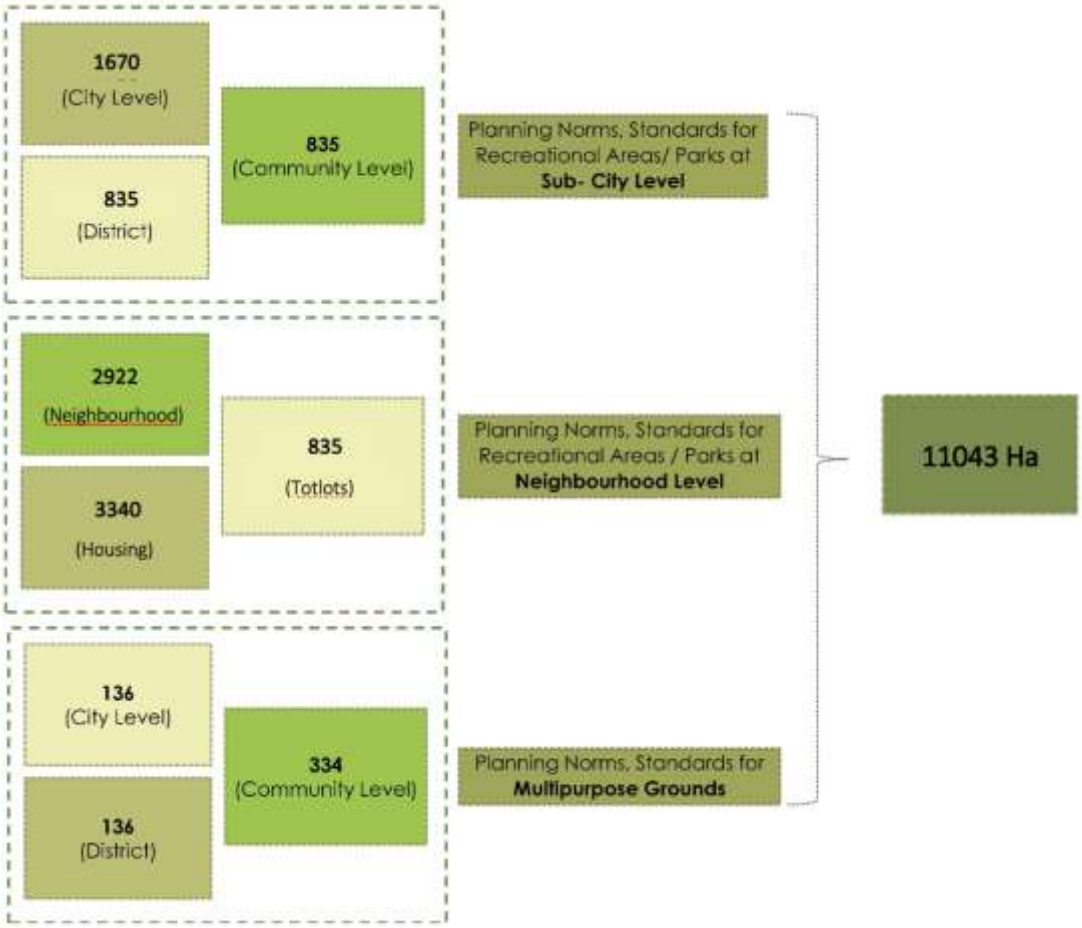
Urban planned green spaces can play significant role in sustainable development of urban settlements by providing multiple services like- improving environment through reduction of pollution, enhancing quality of urban life, providing places for meetings and learning and so on. Infact, the WHO recommends 9.5 sq. m green open space per city dweller[30]. As per the 1996 UDPFI (Urban Development Plans Formulation and Implementation) guidelines of the Urban Development Ministry, recreational areas should comprise 20-25% of the total developed area in metropolitan (million plus population) cities, 18-20% in medium towns/large cities, and 12-14% in small towns. Currently, around 21.88% of NCT's total area is under forest and tree cover[31]. The green/recreational use as per Master Plan in 2001 is 19% of the total urban area. i.e., 8,722 ha of the total urban land area of 44,777 ha. This includes 1577 ha. under the Northern, Central and South Central Ridge (the remaining area of the Ridge was in the rural area). The area under recreational/green use which are planned i.e. 7145 ha. is

[26] https://credai.org/assets/upload/central/resources/moef-notification-for-declaration-of-ecosensitive-zone-esz-around-okhla-bird-sanctuary-in-nct-delhi-and-up.pdf
[27] ESZ Notification September 12th, 2017
[28] ESZ Notification dated August 2015. Available at https://credai.org/assets/upload/central/resources/moef-notification-for-declaration-of-ecosensitive-zone-esz-around-okhla-bird-sanctuary-in-nct-delhi-and-up.pdf
[29] Ibid
[30] M. R. Maryanti, H. Khadijah, A. Muhammad Uzair & M. A. R. Megat Mohd Ghazali , 2016. Ecology and The Environment, Vol 210, WIT Press. Available at: https://www.witpress.com/Secure/elibrary/papers/SDP16/SDP16031FU1.pdf
[31] Delhi Forest Department website

in the form of District Parks, City Parks, Community Parks etc. comprising around 15% of the total urban land area. In addition to this, a large chunk of green area is provided in the form of neighbourhood parks/ tot lots in the gross residential use zones, plantations/greens in large campuses like President's Estate, JNU, IARI, Delhi University, plantations along drains and roadside plantations. This information is captured holistically in ***Figure 9.***

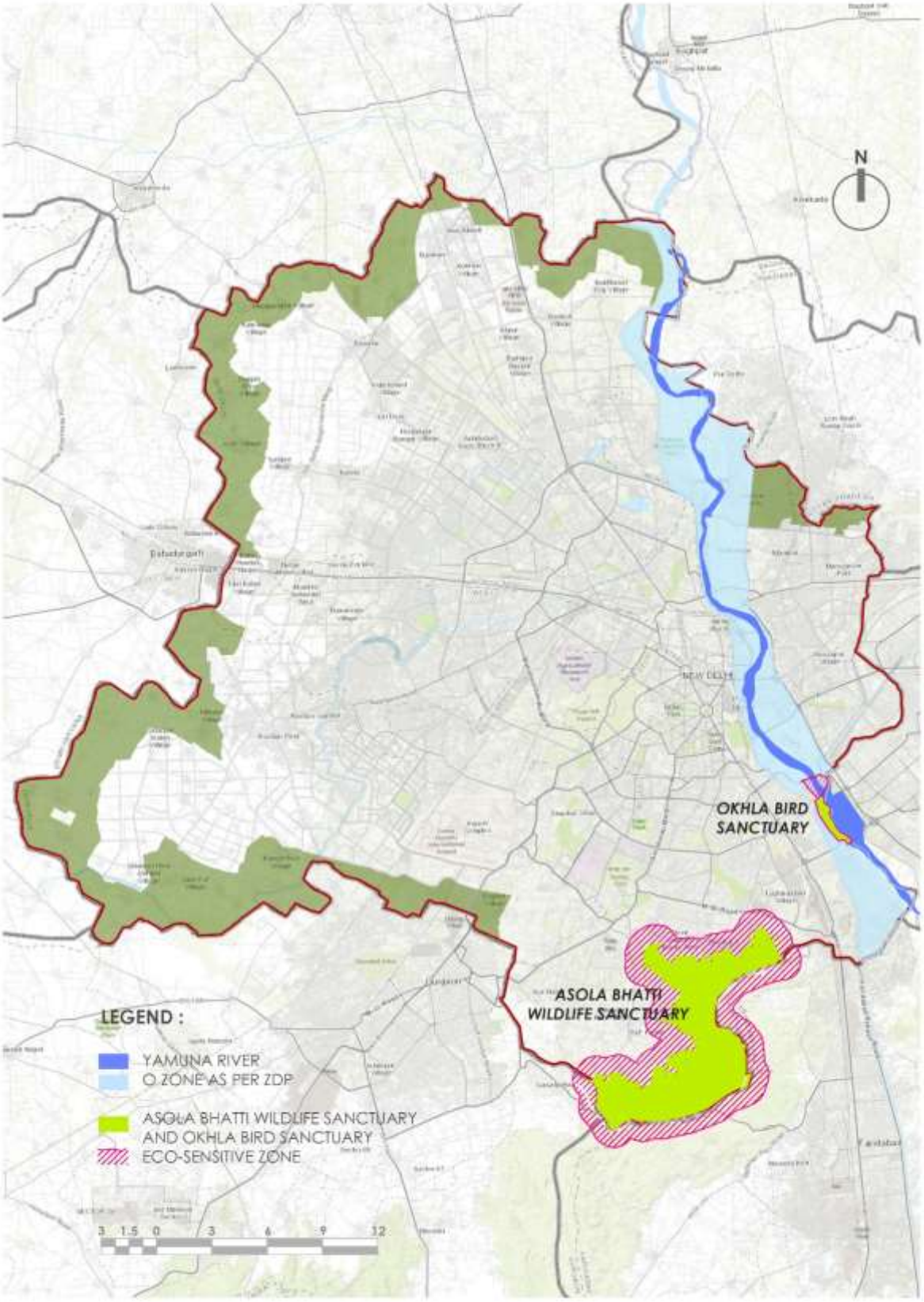
There are more than 18,000 parks and gardens in NCT spread across 8,000 ha in various locations throughout Delhi. ***Map 15*** shows these parks and gardens. The parks are managed by various agencies like MCD, DDA, NDMC, PWD, CPWD etc.

Figure 9: Minimum green provision (in Ha) as per MPD 2021



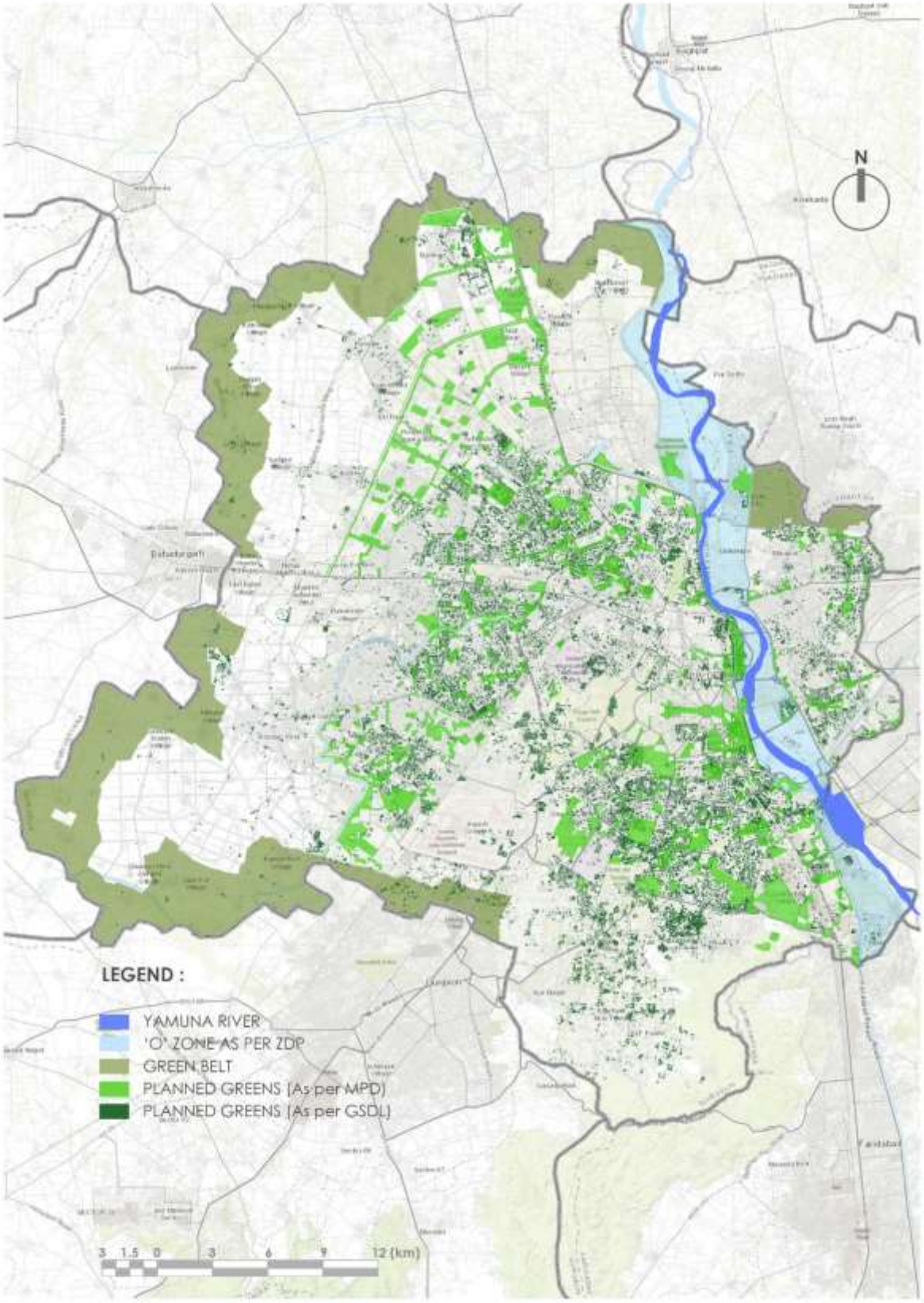
Therefore, for a population of 1.67 cr of Delhi (census 2011), if planned as per MPD 2021 norms, the total planned greens in the city will be 11,043 Ha, almost 6.61 sq m per person.

Map 14: Eco-Sensitive Zones within Delhi



Source: ESZ Notification dated September 12, 2017 and August, 2015; Graphics: NIUA

Map 15: Parks and gardens in Delhi



Source: GSDL, DPGS and DDA, Graphic: NIUA
Boundaries are approximate and need to be ground-truthed by DDA

5.1 Biodiversity parks

DDA in collaboration with the Centre for Environmental Management of Degraded Ecosystems (CEMDE), University of Delhi has identified (and been developing) six habitats as Biodiversity Parks. This network of Biodiversity Parks serves as an ecological model for conservation of natural heritage in urban landscapes through an innovative approach – ecological assemblages of species that form self-sustaining communities on degraded/barren landscapes. These areas seek to conserve keystone species and other threatened flora & fauna, protect the ecologically rich area from being taken up for urban infrastructure needs, serve as effective filters for various sources of pollution within the city, act as ground water recharge zones while impounding flood-waters and preventing surface run off, improve the microclimate while contributing to climate resilience, provide for the urban recreational needs, serve as an instrument to promote education on environmental awareness and nature conservation, among its vast range of other ecological services.

The six Biodiversity Parks in Delhi are spread over an area of approx. 740 hectares, namely the Yamuna Biodiversity Park (Phase-I & II), the Aravalli Biodiversity Park, the Neela Hauz Biodiversity Park, the Northern Ridge (Kamla Nehru Ridge), the Tilpath Valley Biodiversity Park and the Tughlaqabad Biodiversity Park. Details of the parks are presented in ***Table 9.***

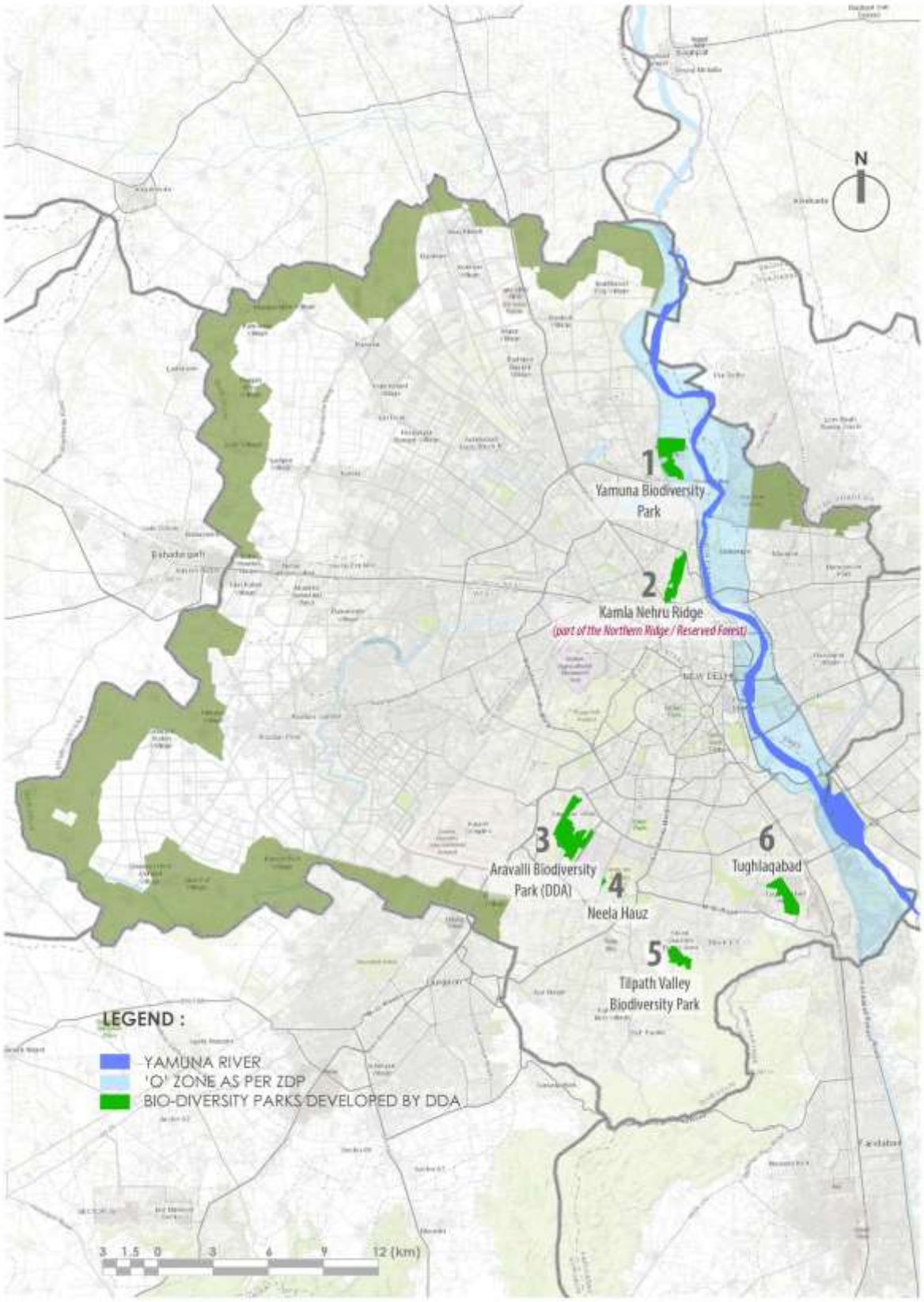
Table 9: Biodiversity parks in Delhi

S. No.	Name	Location	Area
1	Yamuna Biodiversity Park	Near Wazirabad village	Phase I – 63.56 Ha Phase II – 121.45 Ha
2	Aravalli Biodiversity Park	On South Central Ridge, near Vasant Vihar	277.00 Ha
3	Neela Hauz Biodiversity Park	Near South Central Ridge, along Aruna Asaf Ali Road	3.90 Ha
4	Northern Ridge (Kamla Nehru Ridge)	Near Delhi University	123.44 Ha
5	Tilpath Valley Biodiversity Park	Near Sainik Farms	70.00 Ha
6	Tughlaqabad Biodiversity Park	Along Maa Anandmai Marg	80.97 Ha

Map 16 shows the locations of these Biodiversity Parks in Delhi. Apart from these six, another Biodiversity Park has been proposed on the western bank of Yamuna floodplains adjacent to DND Flyway as South Biodiversity Park, to be developed over an area of approx. 115 hectares. The area currently receives wastewater from nine unauthorised colonies, the largest being Kilokri Village, and has become a mosquito breeding ground.

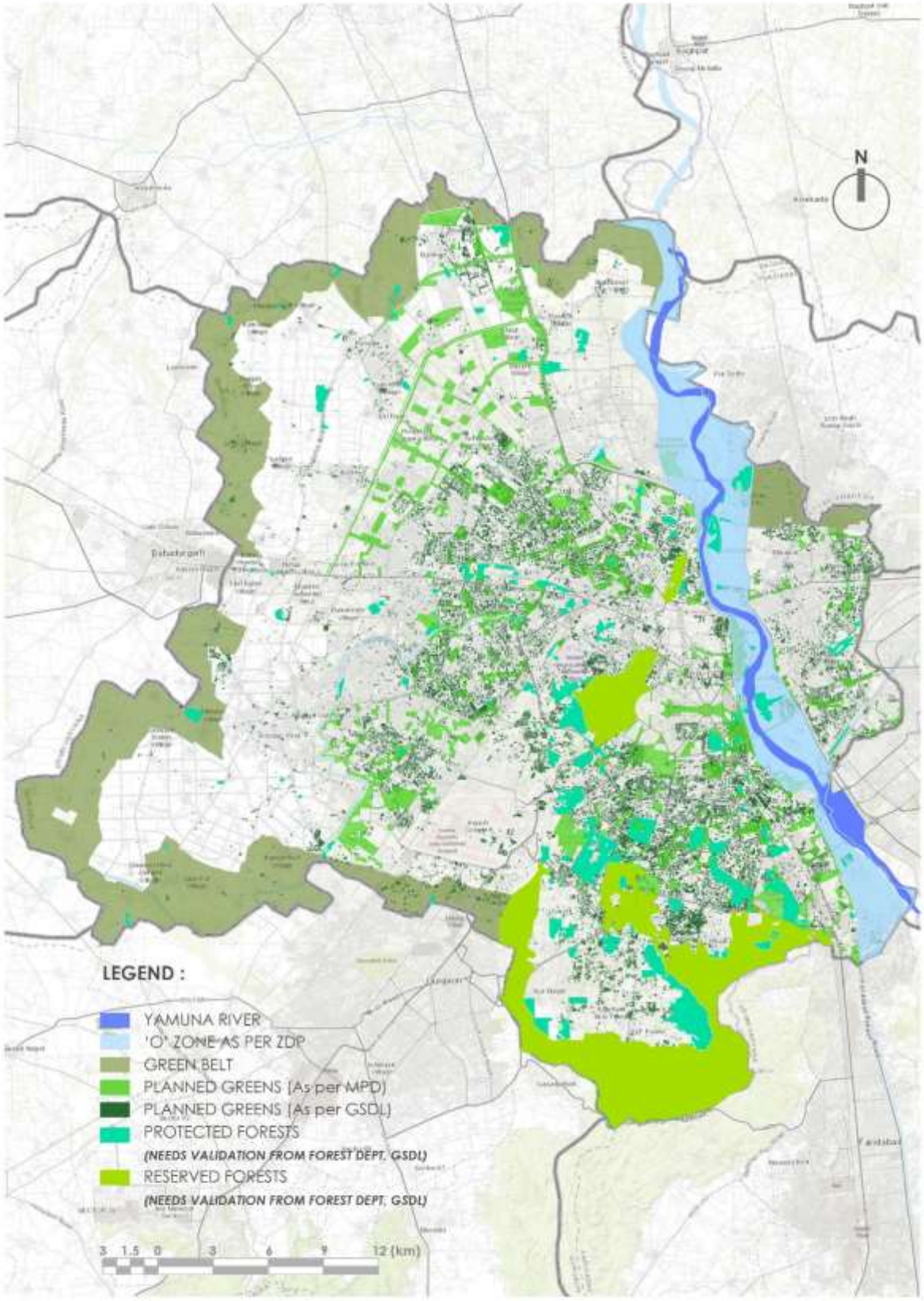
Map 17 overlays all natural and planned greens with water bodies to present an overview of the blue green landscape in Delhi.

Map 16: Location of the six biodiversity parks in Delhi



Source: Single coordinates provided by DDA for each park; (Mapping carried out by NIUA based on satellite image observations. Boundaries are approximate and need to be ground truthed by DDA)

Map 17: Blue green landscape for Delhi



Sources: DDA, DPGS, GSDL, Delhi Forest Department; I&FC).
Boundaries subject to verification by relevant authorities.

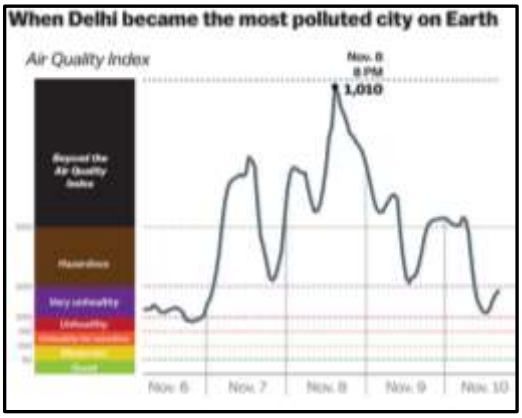
6 STATE OF KNOWLEDGE ON POLLUTION

6.1 Air

6.1.1 Air pollution crisis

In the winter of 2017, the Chief Minister of Delhi compared the city to a "gas chamber". He did this to highlight the unprecedented plight of air pollution that the city was facing. During this period, infamously referred to as the *Great Smog of Delhi*, the Particulate Matter (PM) 2.5 and PM 10 crossed 999 micrograms per cubic meter. To put things in context, the safe limits for those parameters are 60 and 100 respectively. Furthermore, only concentrations up to 500 micrograms per cubic meter are captured in the Air Quality Index. So, effectively during the Great Smog of Delhi, the pollutant concentrations were beyond the Air Quality Index ***(Figure 10).***

Figure 10: Air pollution crisis in Dec-Jan 2017



Source: US State Department

The situation has not changed much since late 2017. In May 2018, the World Health Organization ranked Delhi as the sixth most polluted city in the world in terms of PM 2.5 levels. A World Bank study[32] by reputed research team from India, Singapore and Thailand revealed that Delhi is only behind Shanghai and Beijing in the number of premature deaths because of air pollution.

6.1.2 Unique nature of Delhi's air pollution setting

Pollution cycle: The air pollution cycle in Delhi is quite unique. Peak pollution levels occur in the winters when the cool air stagnates over the city, keeping the pollution close to the ground. Delhi's persistent winter fog adds to the problem. Delhi's geography makes it prone to a meteorological phenomenon called inversion where warm air rests above the colder air closer to the ground, preventing it from mixing upwards. This effectively traps the pollution, not letting it disperse. The situation is further exacerbated by influx of pollutant load from burning of the stubble in fields by farmers in the neighbouring states to mark the end of the harvest season. Because of the stagnated nature of the air, the pollution levels remain more or less constant during the day in winters. In summers, however, the pollution levels are lower and much more variable over the day. Delhi gets some respite from the pollution in the monsoon, when the heavy rainfall helps to clear up the air. It is during the monsoon that the Air Quality Index sometimes falls down to "moderate" severity.

Pollution sources: Another unique feature about Delhi's pollution are the sources that cause it. Most of the pollution in Delhi comes from outside its geographic boundaries. A study commissioned by the Ministry of Heavy Industries and Public Enterprises revealed that only 26% of the pollution in Delhi is indigenous during the summer. The figure is slightly higher at 36% in the winters. While much of the non-indigenous pollution emanates from the neighboring states, the study points out that a good fraction also comes from outside India (especially in summers).

[32] The Health Effects of Air Pollution in Delhi, India. *World Bank*. 2013. http://web.worldbank.org/archive/website01004/WEB/IMAGES/126526-2.PDF

Figure 11: Sources of pollution in Delhi

Sources of Pollution	Winters	Summers
Delhi itself	36%	26%
NCR except Delhi	34%	26%
Upwind region outside NCR	17%	17%
Upwind region outside India	13%	33%

Source: Ministry of Heavy Industries and Public Enterprises (2018)

Polluters: Around 45% of the indigenous PM2.5 is because of dust and construction[33]. Delhi is perhaps the only mega city in the world where dust and construction is the largest polluter. This comes from poor road conditions, unpaved footpaths, and even manual sweeping of roads. The next serious polluter is the transportation sector which account for 20% of the total pollution. Emissions from households, waste burning, industry and diesel generator sets make up the rest.

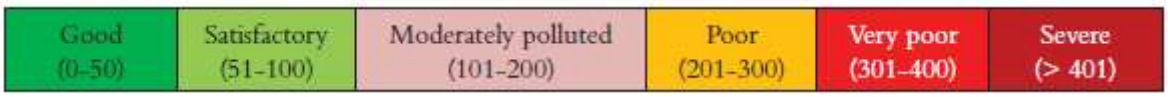
6.1.3 Air quality monitoring

The monitoring is undertaken by various organizations viz. Central Pollution Control Board (CPCB), Delhi Pollution Control Committee (DPCC), and System of Air Quality and Weather Forecasting and Research (SAFAR) of Indian Institute of Tropical Meteorology (IITM), Pune. In addition, several foreign embassies and private organizations also monitor the air quality. DPCC has 26 monitoring stations, CPCB has 11, while SAFAR has 8. The parameters monitored are:

- Particulate Matter 10 (PM 10)
- Particulate Matter 2.5 (PM 2.5)
- Sulphur Dioxide
- Nitrogen Dioxide
- Carbon Monoxide
- Ammonia
- Ozone
- Lead

The air quality is represented through an index called Air Quality Index (AQI), which accounts for the effects of the individual pollutants. As seen in ***Figure 12***, AQI values upto 50 indicates a non-polluted state. Conversely, values above 400 are considered critical. The winter season AQI values in Delhi are generally in the 'severe' range.

Figure 12: Ranges of the Air Quality Index (AQI)



6.1.4 Spatial analysis of air quality in Delhi

Map 18 shows the spatial representation of the AQI is Delhi for the monsoon season (July, August and September, when the pollution is least severe) and winter season (November, December, and January,

[33] IIT Kanpur (2016) Comprehensive Study on Air Pollution and Green House Gases (GHGs) in Delhi

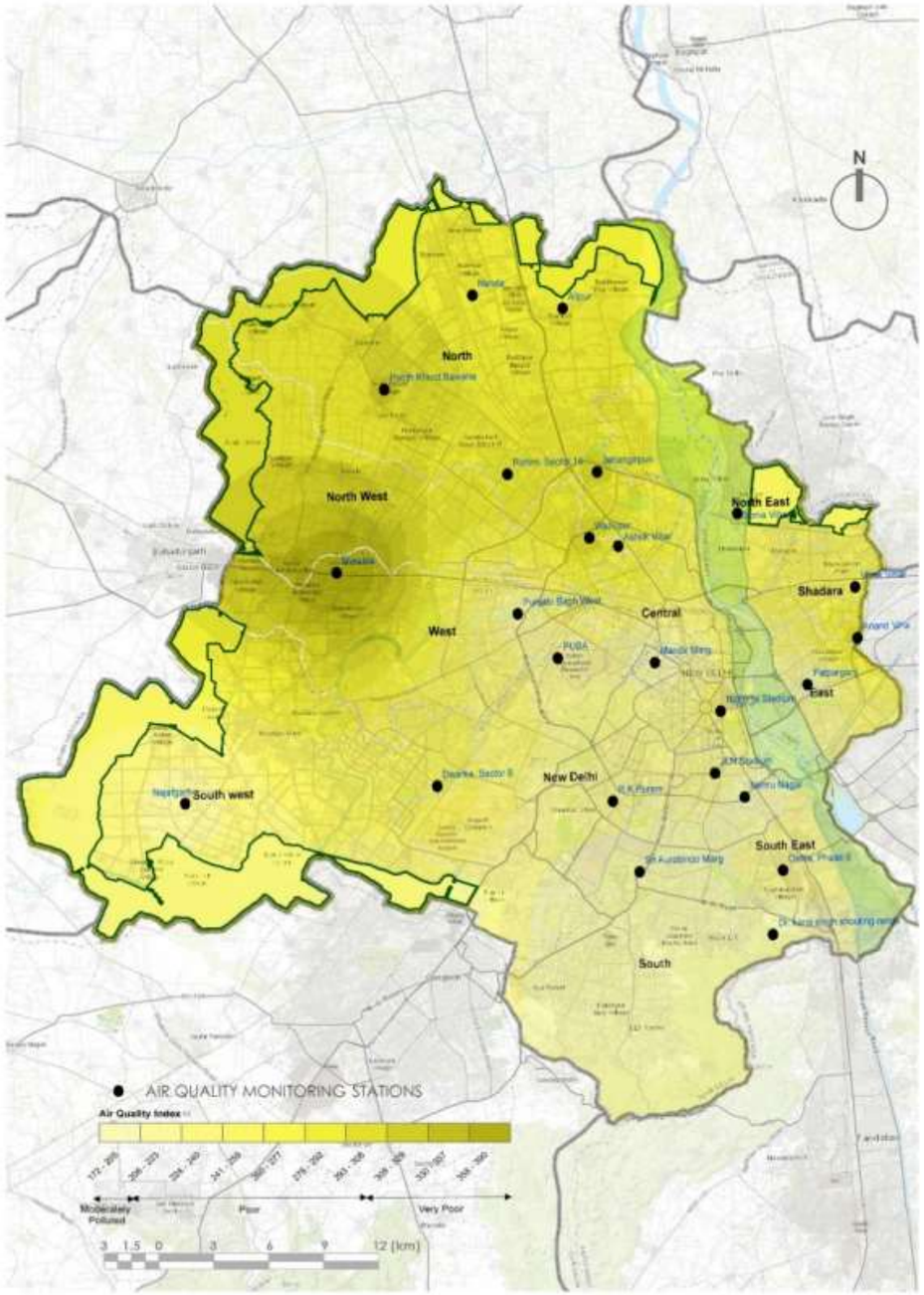
when pollution is most severe). The most recent data (for the year 2018) has been used for the analysis. Understandably, the pollution levels in the monsoon are relatively lower. However, even then for most areas in Delhi, especially in the North, the condition still varies between 'poor' and 'very poor'. In winter, the situation for entire Delhi is 'very poor' to 'severe'. The air quality in the North West District is particularly alarming, and is most likely because of industrial activities in the area coupled with crop burning emissions from neighbouring states.

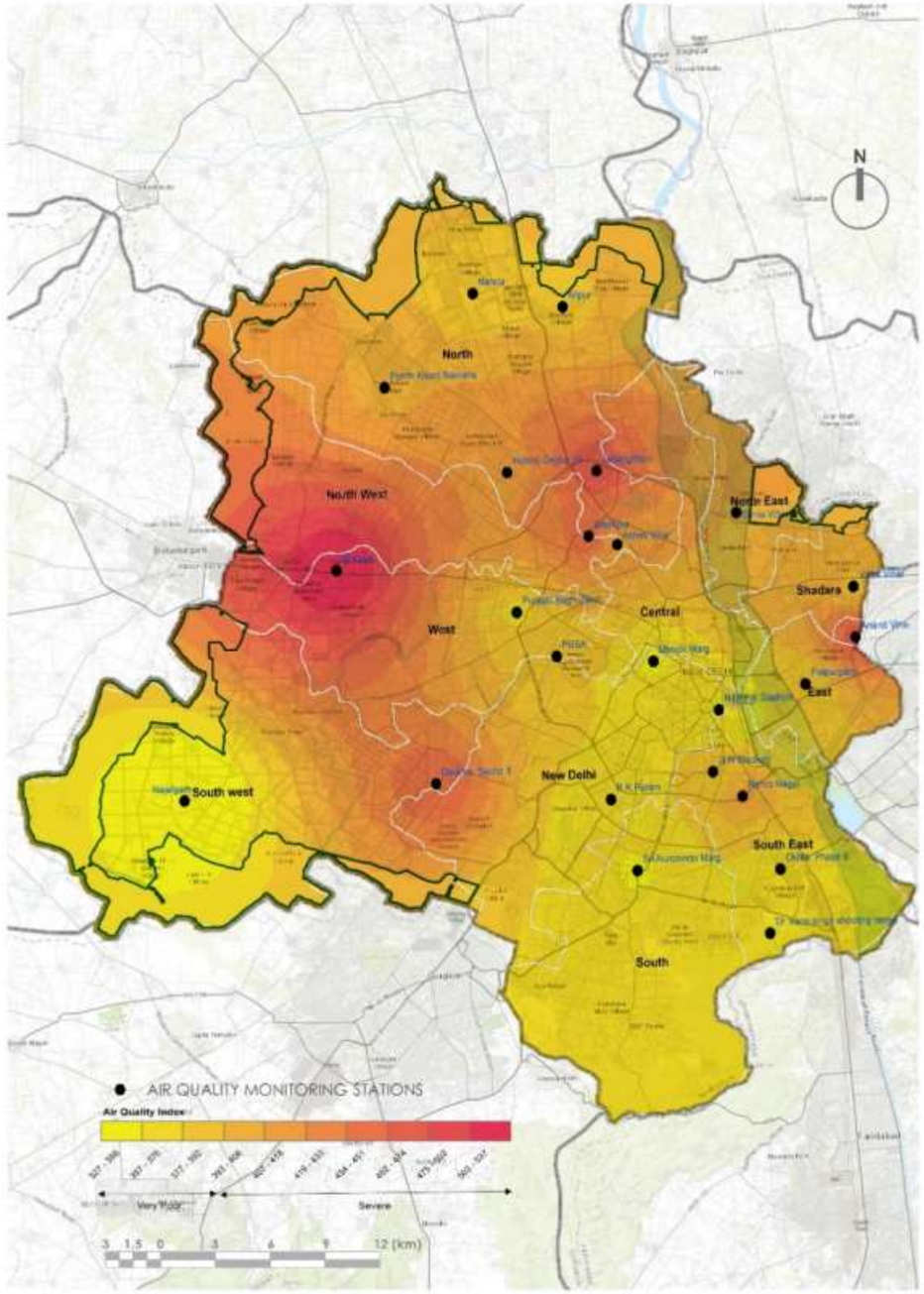
Map 19 shows the spatial representation of PM 2.5, which is a major cause of concern in Delhi. The trend for PM 2.5 is very similar to that of the AQI, thereby reflecting the significance of PM 2.5 in the overall air pollution setting of the city.

Map 20 presents the results of an IIT Kanpur (2016) study that takes stock of the causes of GHG emissions in Delhi. It is quite evident that vehicular emissions make the most significant contribution to the GHG overall emissions.

Map 21 examines the effect of green cover on air pollution

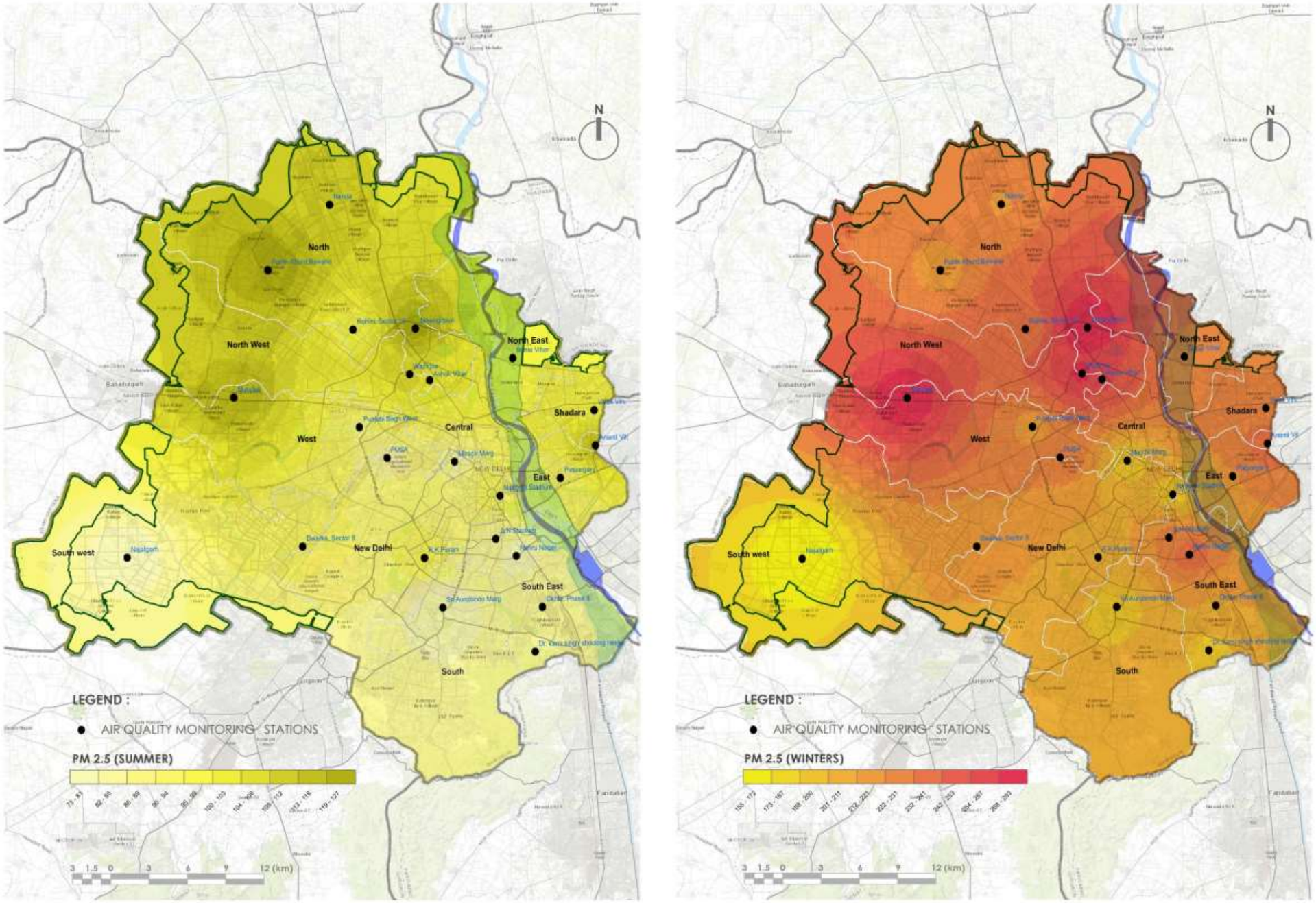
Map 18: AQI representation in monsoon 2018 (left) and winter 2018 (right)





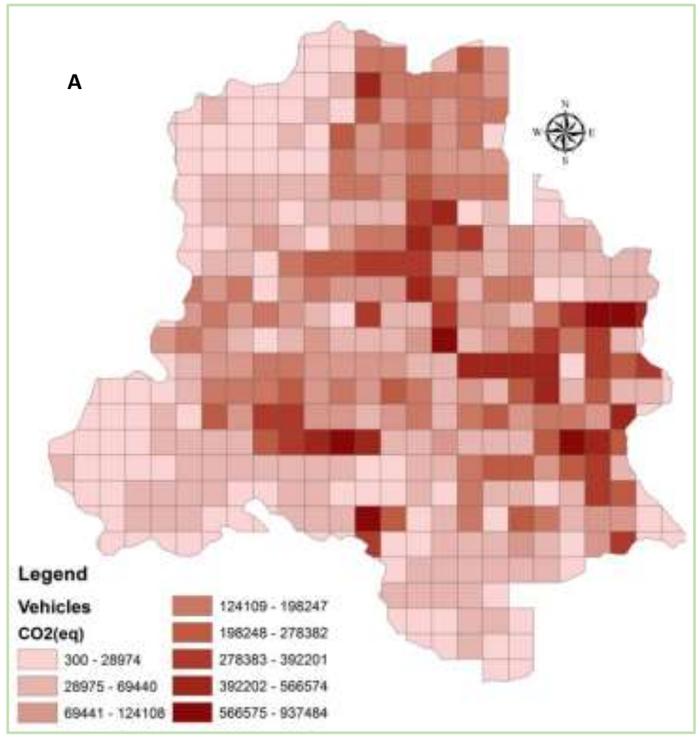
Source: DPCC, Analysis: NIUA

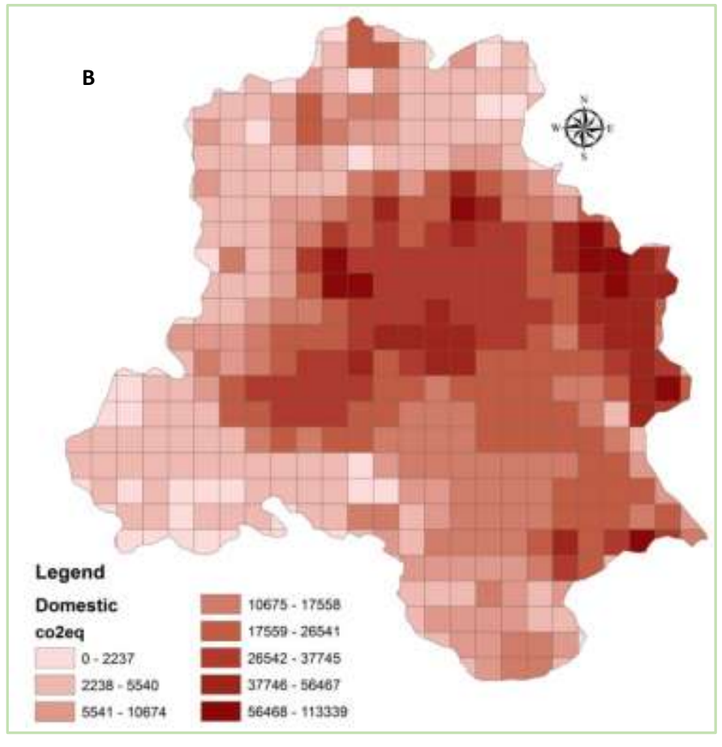
MAP 19: PM 2.5 representation in monsoon 2018 (left) and winter 2018 (right)

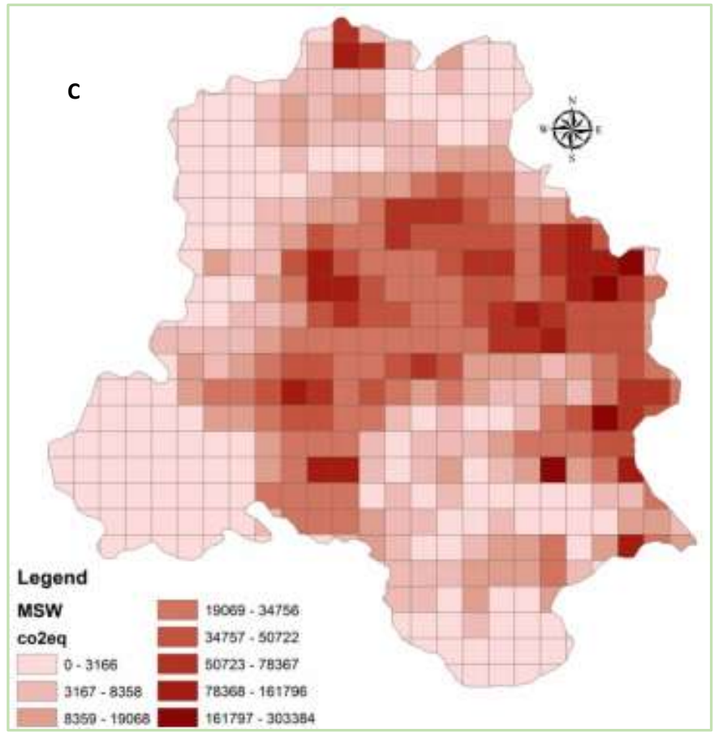


Data Source: DPCC, Analysis: NIUA

Map 20: GHG emissions (as tC02e) from (a) vehicles, (b) domestic sources, and (c) municipal solid waste burning

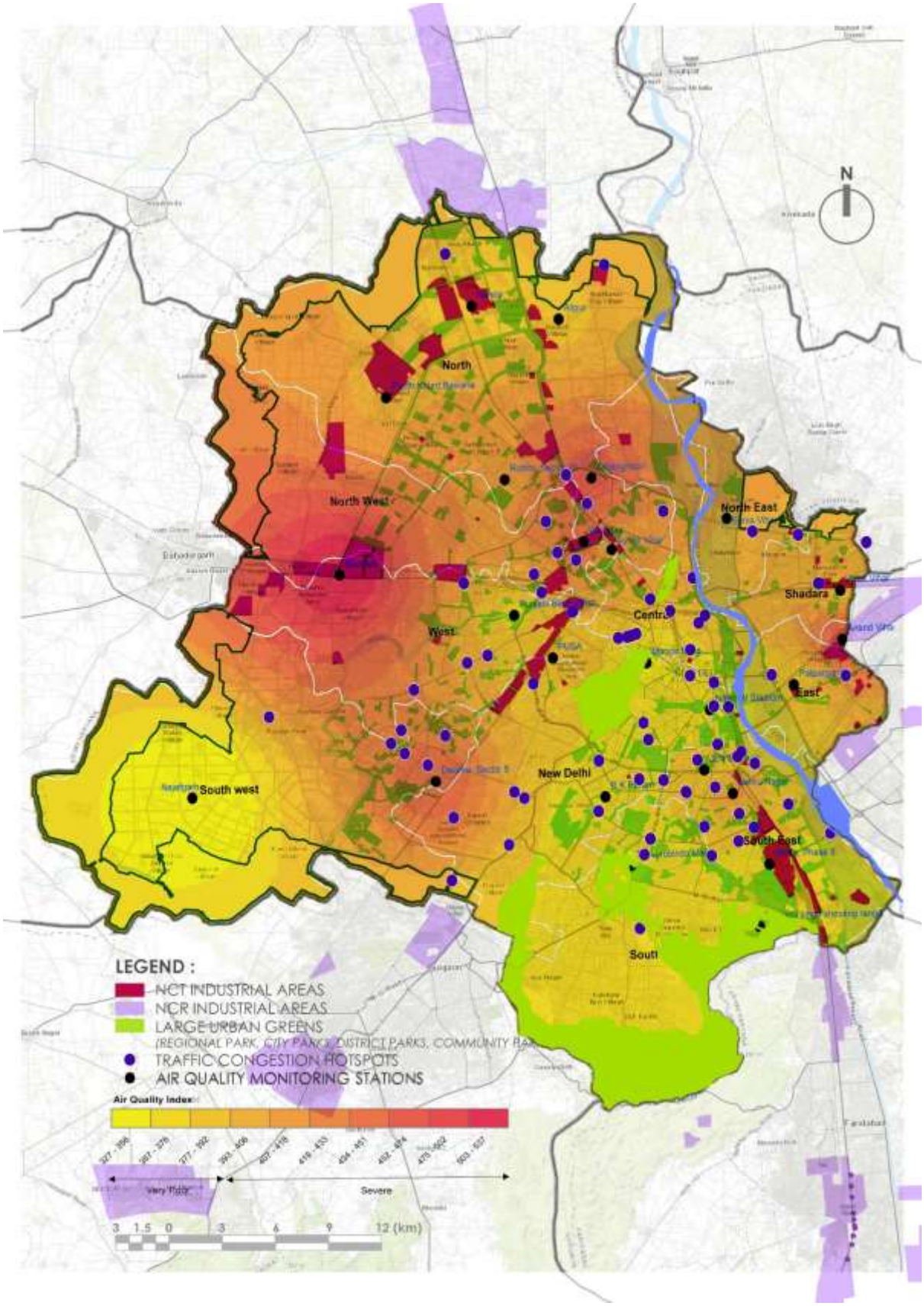






Source IIT Kanpur (2016)

Map 21: Green cover and air pollution, Winter 2018



Source: DDA, Gurgaon Master Plan, Sonipat Master Plan DPCC, Delhi Police; Analysis: NIUA.

6.2 Water

6.2.1 Drains

As already mentioned in Section 4.3, there are 180+ natural drains in Delhi. Unfortunately, not a single drain is free from pollution. Out of these, 24 major drains are responsible for most of the pollutant loading in the Yamuna River and are monitored by DPCC. These drains are:

Najafgarh	**Drain No 14**
Metcalf House	**Barapulla**
Khyber Pass	**Maharani Bagh**
Sweeper Colony	**Kalkaji**
Magazine Road	**Sarita Vihar (Mathura Road)**
ISBT	**Tehkhand**
Tonga Stand	**Tuglakabad**
Moat	**Drain near LPG Bottling Plant**
Civil Mill	**Drain near Sarita Vihar Bridge**
Power House	**Shahdara**
Sen Nursing Home	**Sahibabad**
Drain No 12A	**Indrapuri**

DPCC carries out monthly monitoring of each of these drains. Four parameters are measured:

a) pH : Standard [5.5-9.5]
b) Biochemical Oxygen Demand (BOD) : Standard [Max 30 mg/L]
c) Chemical Oxygen Demand (COD) : Standard [Max 250 mg/L]
d) Total Suspended Solids (TSS) : Standard [Max 100 mg/L]

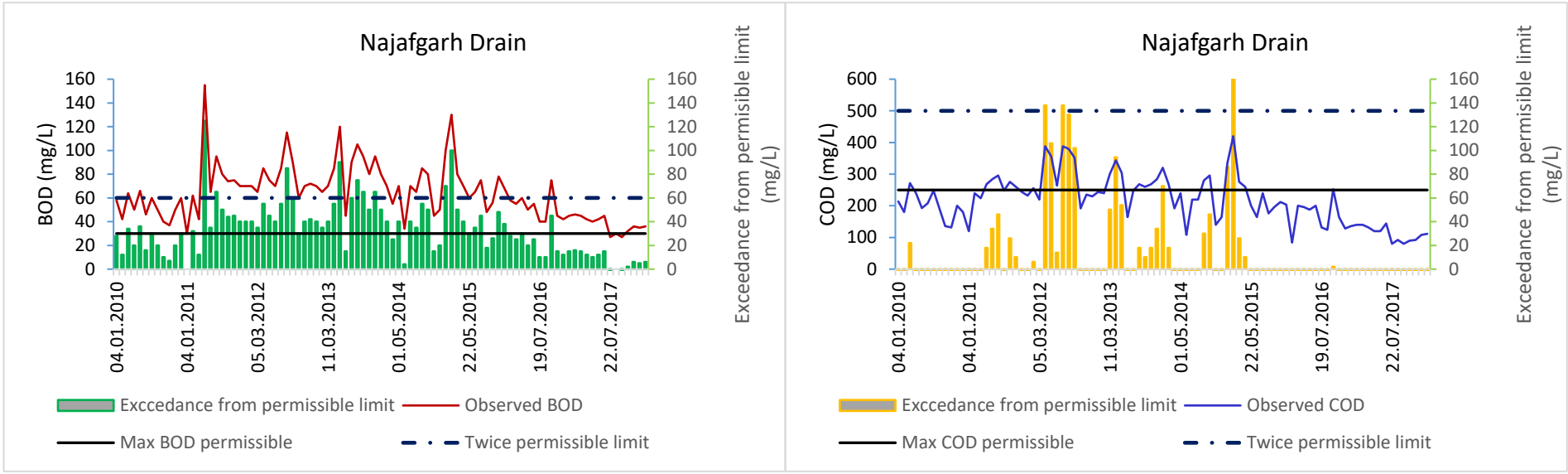
For the baseline, each of the drains were analysed to investigate their conformance to the standards. ***Figure 13*** presents the results of the analysis for the Najafgarh drain, which carried the maximum pollutant load into the Yamuna based on sheer volume. As seen, the BOD and TSS concentrations in the drain have consistently been more than four times the allowable limit. The COD concentrations are slightly better. There is also a very noticeable trend of reduced concentrations for all three parameters over the last few years. This is quite encouraging given that there have been several actions taken to arrest the trend of pollution in the Najafgarh.

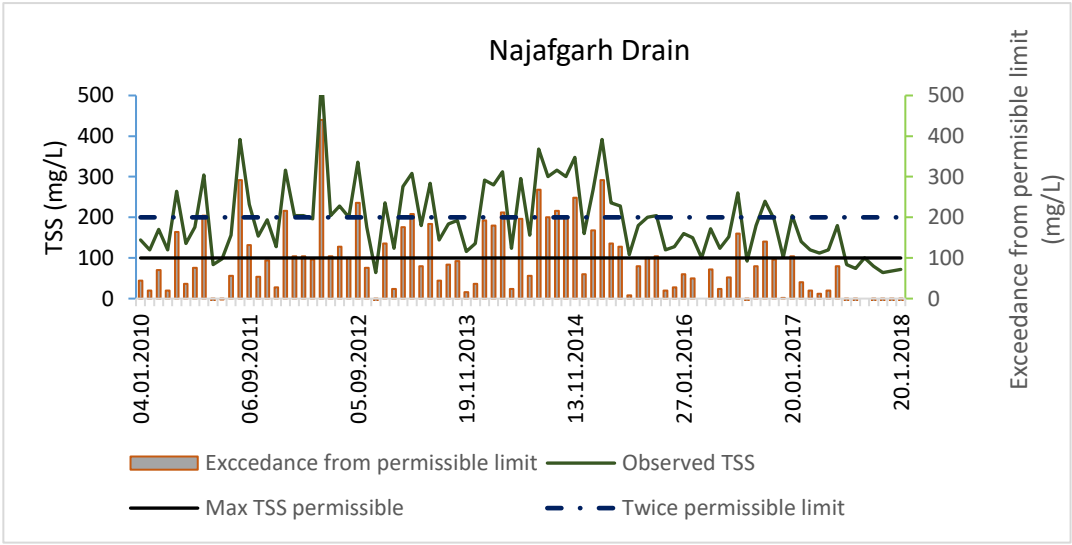
From the analysis, it was found that the Sahibabad, Shahdara, Indrapuri, Tehkhand drains are clearly the more polluted drains with respect to all parameters (BOD, COD, TSS) in terms of absolute concentrations. However, the other drains vary in terms of pollution severity. Hence, a **Pollution Severity Index** was developed to compare drains from an overall pollution point of view. The index would help in (a) Prioritizing rehabilitation interventions, (b) Systemizing investments, and (c) Monitoring and Evaluation.

The following method was used to develop the Pollution Severity Index

a) BOD, COD and TSS have the same units of measurement but different ranges.
b) To facilitate comparison, all values were standardized between the range 0 and 100.
   Standardized value = $(Y - Ymin)/(Ymax - Ymin)$X100
c) Weights used for the parameters
   BOD: 50% COD: 30% TSS: 20%
d) Pollution Severity Index = (0.50*BOD) + (0.3*COD) +(0.2*TSS)

Figure 13: Temporal trend of BOD, COD and TSS for the Najafgarh drain

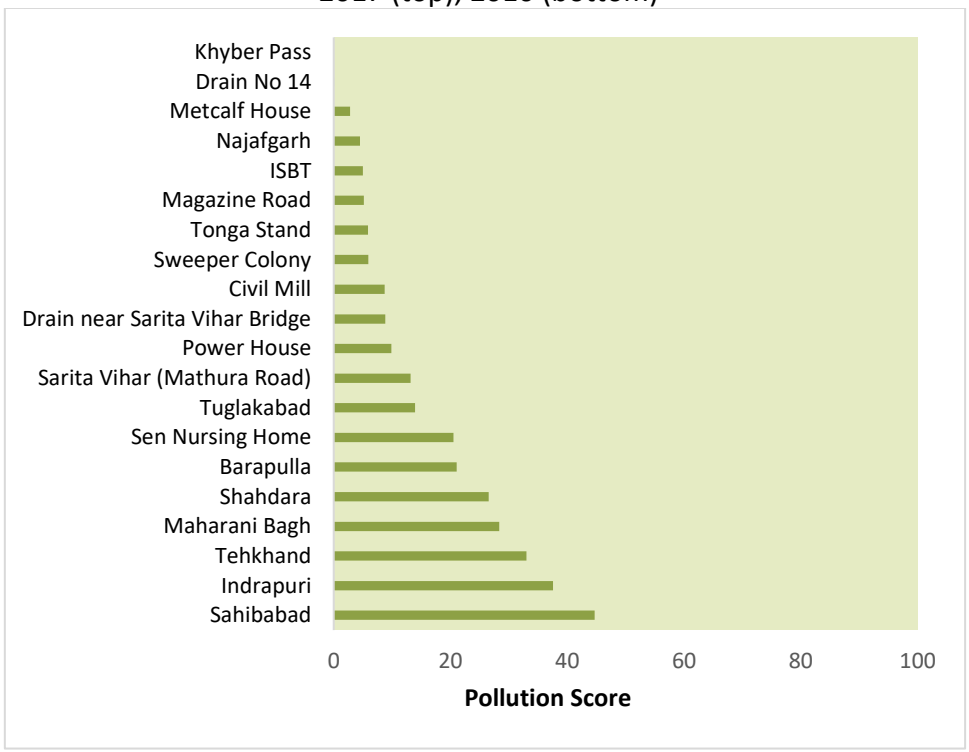


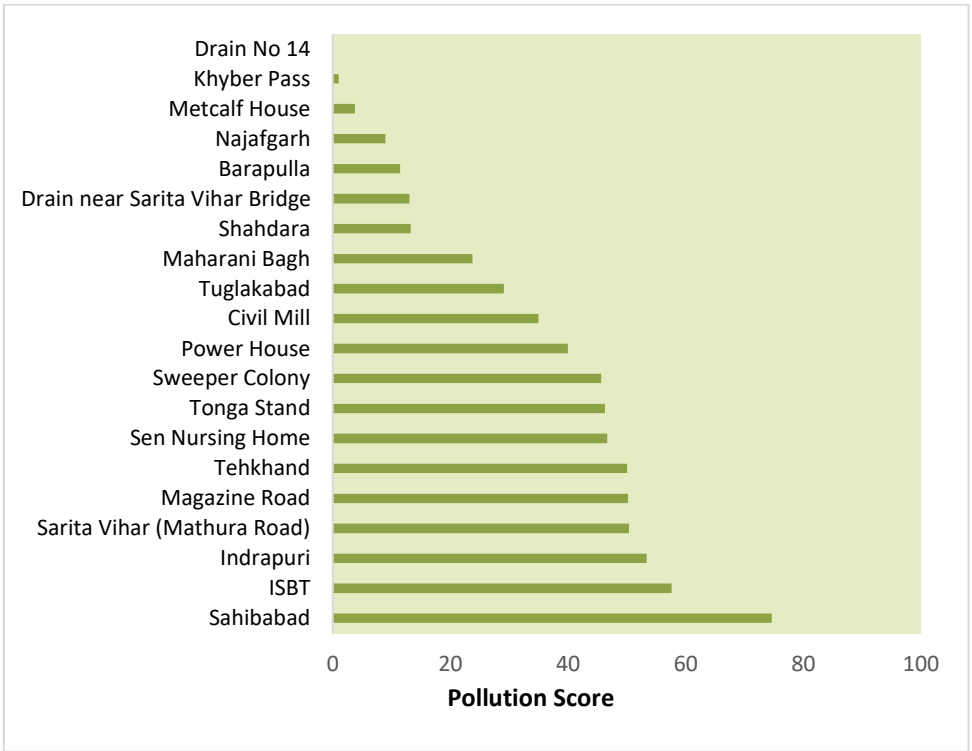


Source: DPCC(2018); Analysis:NIUA

Figure 14 shows the results of the analysis for pollution severity. It is evident that even though the Najafgarh deposits the maximum volume of pollutants into the Yamuna, in terms of pure concentration it is less polluted than most of the drains. Hence, both concentrations and volume of discharge must be used in order to decide on interventions to manage the pollution in the drains.

Figure 14: Pollution Severity Index for major polluting drains in Delhi, 2017 (top), 2010 (bottom)





Data Source: DPCC (2018); Analysis: NIUA

6.2.2 Yamuna River

The pollution in the Yamuna has been at alarming levels for a long time now. The Yamuna is in a relatively much better state when it enters Delhi at Wazirabad. However, by the time it leaves Delhi at Okhla it is virtually a flowing sewer. Water pollution in the Yamuna is monitored by the DPCC at nine locations. These are:

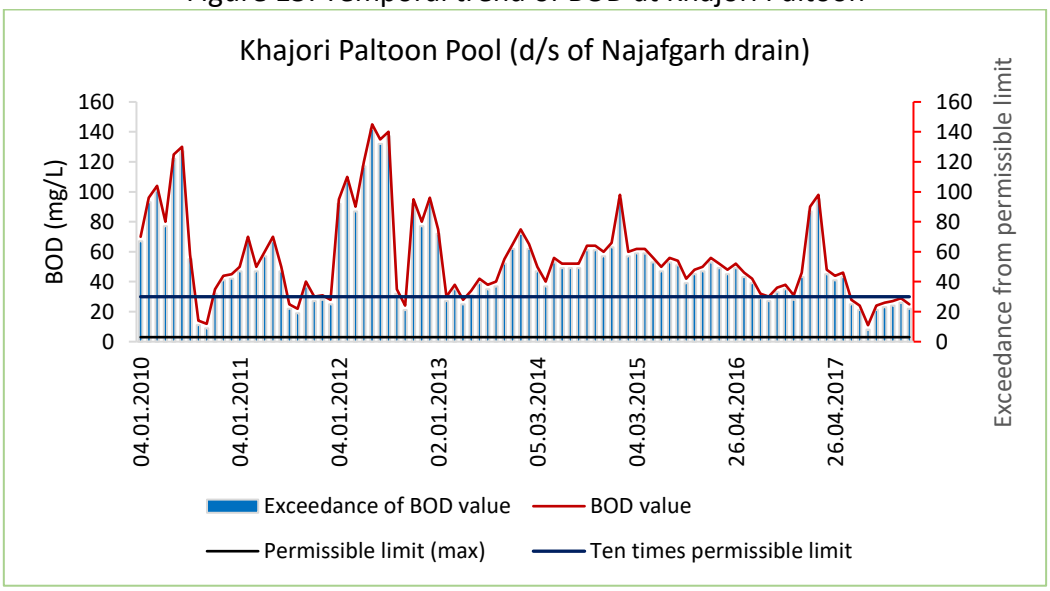
a) Palla
b) Surghat (d/s of Wazirabad barrage)
c) Khajori Paltoon Pool (d/s of Najafgarh drain)
d) Kudesia Ghat
e) ITO Bridge
f) Nizamudin Bridge
g) Agra Canal (Okhla)
h) After meeting Shadara drain (d/s of Oklha barrage)
i) Agra Canal (Jaitpur)

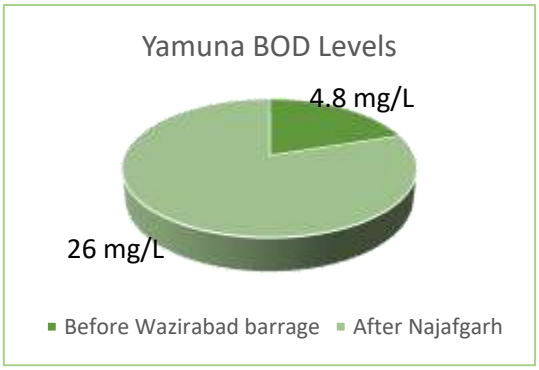
Five parameter are monitored:

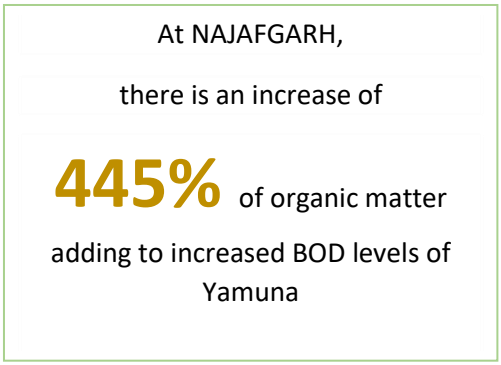
a) Biochemical Oxygen Demand (BOD) : Standard [Max 3 mg/L]
b) Chemical Oxygen Demand (COD) : Standard [Max 10 mg/L]
c) Dissolved Oxygen (TSS) : Standard [Min 4 mg/L]
d) Total Coliform : Standard [Max 5000 MPN/100 ml]
e) Faecal Coliform : Standard

Figure 15 presents the trend of the pollution levels at Khajori Paltoon Pool after the Najafgarh meets the Yamuna.

Figure 15: Temporal trend of BOD at Khajori Paltoon







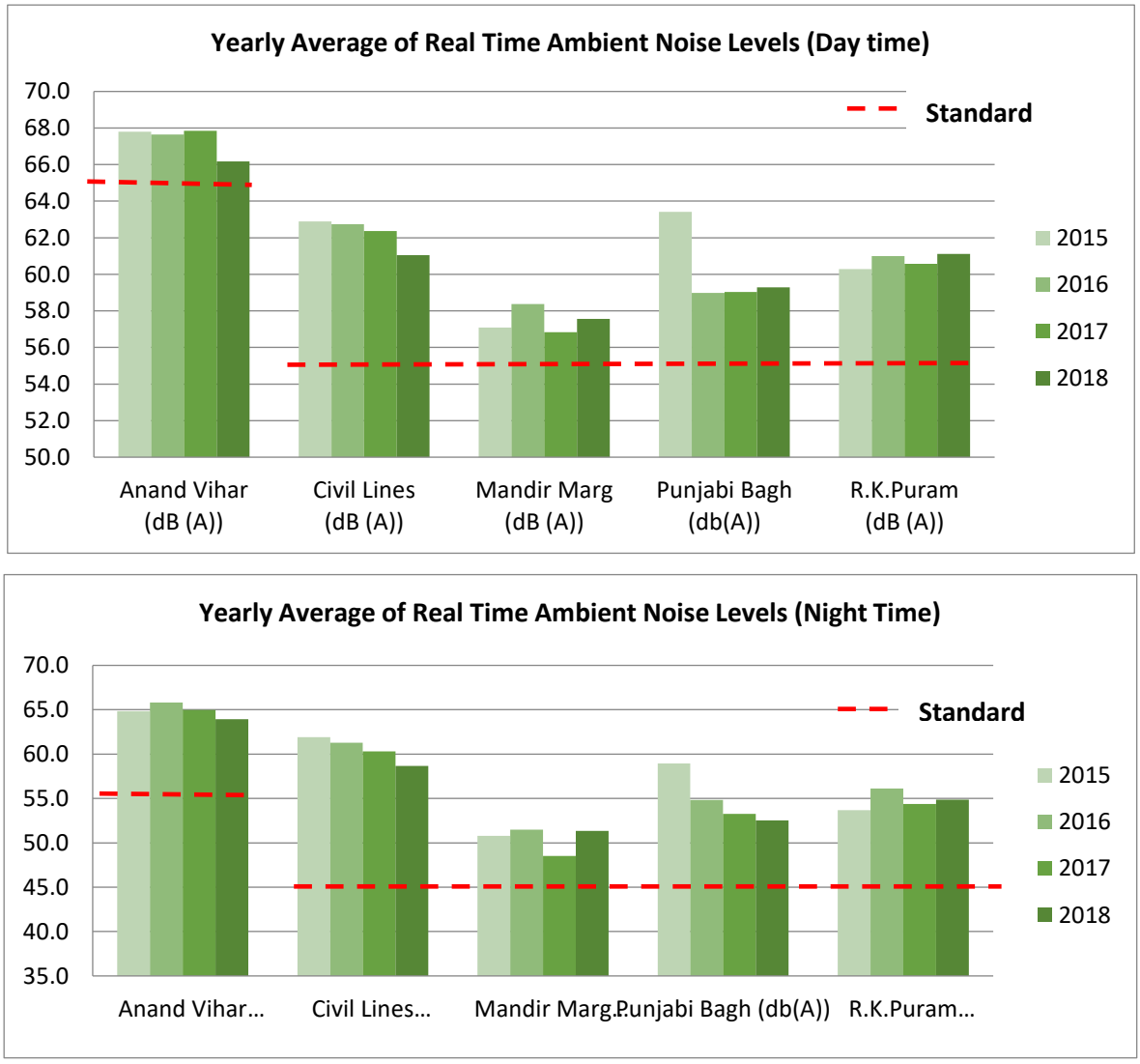
Source: DPCC (2018); Analysis: NIUA

6.3 Noise

Noise pollution in Delhi has not received as widespread attention as air and water pollution, despite it being a serious concern. In 2011, the Centre for Science and Environment (CSE) conducted a decibel survey, which showed that Delhi had some of the noisiest roads in India. The ITO junction in Delhi registers around 74 decibel (dB) of sound on a typical day, almost 10db over the limit for commercial areas. In 2017, a Worldwide Hearing Index ranked Delhi as the second-noisiest city in the world (the first being Guangzhou), followed by Cairo and Mumbai[34]. The study also reports that that resident of Delhi have the maximum amount of hearing loss proportionate to their age.

Noise levels in Delhi are monitored by DPCC at five locations—Anand Vihar, Civil Lines, Mandir Marg, Punjabi Bagh, and R.K. Puram. Figure 16 presents the average real time ambient noise levels results of these locations. Recently, 26 new noise monitoring networks have been added by DPCC. These stations were installed in different land use areas to assess the real time noise levels.

Figure 16: Noise quality at selected locations in Delhi during day (top) and night (bottom) time



Source: DPCC (2018); Analysis: NIUA

[34] World Economic Forum (2017) https://www.weforum.org/agenda/2017/03/these-are-the-cities-with-the-worst-noise-pollution/

The noise quality standards as per the CPCB [35] are:

Area Code	Category of Area/Zone	Limits in db(A) Leq	
		Day time	Night time
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence zone	50	40

From ***Figure 16***, it is evident that noise quality levels are beyond the prescribed limit at all locations both during the day and night.

7 CURRENT& EXPECTED PROJECT PIPELINES (OR INITIATIVES) BY GOVERNMENT AGENCIES

7.1 Water-related

- DPGS is providing one-time financial assistance to RWAs/NGOs for setting up of decentralized STPs @ 2 Lakh per Acre after receiving NOC from the concerned land owning agency and area MLA.
- To assess the minimum required environmental flow of river Yamuna for stretch between Hathinikund to Okhla, a comprehensive study has been assigned to National Institute of Hydrology (NIH), Roorkee by National Mission for Clean Ganga on 24.12.2018.
- Delhi Jal Board initiated the process of laying of interceptor sewers along 3 major drains (Najafgarh Drain, Supplementary Drain and Shahdara Drain). Sewage generated from the colonies will be trapped before reaching the major drains and the same would be diverted to the existing unutilized STPs/new STPs.

7.2 Air-related

- To reduce air pollution, Graded Response Action Plan (GRAP) along with Comprehensive Action Plan (CAP) and 41 directions issued by CPCB under Air Act are being implemented by the Civic Agencies, Transport Department. Urban Development Department, Traffic Police and Pollution Control Committee of Delhi. Apart from this, various Court and NGT directions are being complied. Air Pollution Control is being monitored at GNCTD as well as the Government of India level.
- To receive the public complaints in order to stop the burning of Garbage/ Waste material/ Leaves, DPCC has opened "WhatsApp account with mobile number 9717593574" and "9717593501". Complaints received on WhatsApp Nos. 9717593501 & 9717593574 of DPCC (including complaints of CPCB Teams) received as on October 2018 – 1833.
- With the view to promote non-polluting e-vehicles, Govt. has announced subsidy schemes for adopting various kinds of e-vehicles such as Two-Wheeler, Four-Wheelers and also e-rickshaws. Owners of newly purchased battery operated 4 wheelers and 2 wheelers are given subsidy by GNCTD, in addition to a subsidy by Govt. of India @ 2000-5500 for two-wheelers and 30000/- to 1,50,000/- for four wheelers. One time fixed subsidy of 30,000/- is given to

[35] The Noise Pollution (Regulation and Control) Rules, 2000 http://cpcbenvis.nic.in/noisepollution/noise_rules_2000.pdf

Battery Operated e-rickshaw owner, authorized by Transport Department and registered in the NCT of Delhi.

- In compliance with the order dated 09.10.2015 and 16.12.2015 of Hon'ble Supreme Court, Environment Compensation Charge (ECC) is levied on Delhi bound light and heavy duty commercial goods vehicles. Notifications have been issued as per Hon'ble Supreme Court directions.

7.3 Land-related

- Environment Department of Delhi Govt. has deployed Home Guard (HG) volunteers as Environmental Marshals. 83 home guards have been deployed in wards of three Municipal Corporations. They have been instructed to act as eyes of Environment Dept./DPCC and report the instances of violations.
- The Government of Delhi has passed a Green Budget wherein provisions have been made for providing a subsidy to the following:
  Conversion of industries to PNG
  Conversion of coal based Tandoors to Gas based
- Future plans of GNCTD include:
  Augmentation of solid waste processing facilities by MCDs
  Greening of an unpaved area
  Water sprinkling on roads to control dust pollution
  Non-fossil fuel based transport systems
- Delhi State Action Plan on Climate Change (SAPCC) is being prepared on the lines of the National Action Plan on Climate Change (NAPCC).
- In order to protect Delhi's Ridge, a Ridge Management Board (RMB) under the chairmanship of the Delhi Chief Secretary, had been constituted. For any project to be undertaken in the Ridge area, clearance has to be obtained from the RMB.

8 ENVIRONMENTAL REGULATIONS

There are a number of environmental regulations and polices applicable in Delhi. This section lists these down.

8.1 General Environment

- Article 48A and 51A of Constitution
- The Environment Protection Act, 1986
- The Environment Protection Rules, 1986

8.2 Natural Environmental Resources and Assets

Table 10: Environmental regulations for Natural resources and assets

S.No.	Sector	Acts/ Policies	Rules/ Notifications	Guidelines/ Plans
1.	Forests	a) The Indian Forest Act, 1927 b) The Wildlife Protection Act, 1972 c) Forest (Conservation) Act, 1980	a) Forest(Conservation) Rules, 2003 b) Compensatory Afforestation Fund Rules (Draft), 2018	a) The Regional Plan 2021-National Capital Region, 2005

		d) The Delhi Preservation of Trees Act, 1994		
2.	River Yamuna	a) National Water Policy, 2012 (by Ministry of Water Resource, GOI) b) Water Policy of Delhi, 2018		a) URDPFI Guidelines, Vol 1, 2015 (by Ministry of Urban Development (MoUD)) *b)* 'Restoration and Conservation of River Yamuna'- Final Expert Report *(submitted to NGT vide order no. K-1301/2/2013-NRCD Dated 13 September, 2013)* c) 'Rejuvenation of the River Yamuna and Abatement of Pollution'- Interim Report of the Monitoring Committee, January 2019 *d)* Indicative Guidelines for Restoration of Water Bodies, 2019 (by Central Pollution Control Board (CPCB)) *(in compliance to Hon'ble NGT Order dated 10.05.2019 in M.A.No. 26/2019 in OA.No. 325 of 2015)*
3.	Drains	a) National Water Policy, 2012 (by Ministry of Water Resource, GOI) b) Water Policy of Delhi, 2018		a) URDPFI Guidelines, Vol 1, 2015 (by Ministry of Urban Development (MoUD)) b) Indicative Guidelines for Restoration of Water Bodies, 2019 (by Central Pollution Control Board (CPCB)) *(in compliance to Hon'ble NGT Order dated 10.05.2019 in M.A. No. 26/2019 in OA. No. 325 of 2015)*
4.	Water Bodies	a) National Water Policy, 2012 (by Ministry of Water Resource, GOI) b) Water Policy of Delhi, 2018		a) URDPFI Guidelines, Vol 1, 2015 (by Ministry of Urban Development (MoUD)) *b)* Indicative Guidelines for Restoration of Water Bodies, 2019 (by Central Pollution Control Board (CPCB)) *(in compliance to Hon'ble NGT Order dated 10.05.2019 in M.A. No. 26/2019 in OA. No. 325 of 2015)* c) Guidelines for Urban Water Conservation (by Jal Shakti Abhiyan)

5.	Natural Conservation Zone			a) The Regional Plan 2021-National Capital Region, 2005 (by National Capital Region Planning Board)
6.	Eco-Sensitive Zones		a) Notification on declaring Eco-Sensitive Zone around Asola Bhatti Wildlife Sanctuary, 2017 (by Ministry of Environment, Forests and Climate Change (MoEFCC)) b) Notification for declaration Eco-Sensitive Zone around Okhla Bird Sanctuary in the NCT of Delhi and State of Uttar Pradesh, 2015 (by Ministry of Environment, Forests and Climate Change (MoEFCC))	a) Guidelines For Declaration of Eco-Sensitive Zones around National Parks and Wildlife Sanctuaries, 2011 (by Ministry of Environment, Forests and Climate Change (MoEFCC))

8.3 Planned Greens

Table 11: Environmental regulation for planned greens

S.No.	Sector	Acts/ Policies	Rules/ Notifications	Guidelines/ Plans
1.	Parks	a) The Delhi Preservation of Trees Act, 1994	a) The Delhi Preservation of Trees Rules, 1996	a) Urban Greening Guidelines, 2014 (by Ministry of Urban Development (MoUD)) b) The Regional Plan 2021-National Capital Region, 2005 (by National Capital Region Planning Board) c) URDPFI Guidelines, Vol 1, 2015 (by Ministry of Urban Development (MoUD)) d) Guidelines for Urban Water Conservation (by Jal Shakti Abhiyan)
2.	Biodiversity Parks			

8.4 Pollution control

Table 12: Environmental regulations for pollution control

S.No.	Sector	Acts/ Policies	Rules/ Notifications	Guidelines/ Plans
1.	Air	a) The Air (Prevention & Control of Pollution) Act, 1981 (by Central Pollution Control Board (CPCB), India)	a) The Air (Prevention & Control of Pollution) Rules, 1982 (by Central Pollution Control Board (CPCB), India)	a) Graded Response Action Plan for Delhi & NCR, 2016 (by Central Pollution Control Board (CPCB), India) b) National Clean Air Program, 2019=0-- c) Classification of Industrial Sectors under Red, Orange, Green and White Categories, February 2016 (by Central Pollution Control Board (CPCB), India)
2.	Water	a) The Water (Prevention and Control of Pollution) Act, 1974 (by Central Pollution Control Board (CPCB), India)	a) The Water (Prevention and Control of Pollution) Rules, 1975 (by Central Pollution Control Board (CPCB), India)	a) 'Restoration and Conservation of River Yamuna'- Final Expert Report *(submitted to NGT vide order no. K-1301/2/2013-NRCD Dated 13 September, 2013)* b) 'Rejuvenation of the River Yamuna and Abatement of Pollution'- Interim Report of the Monitoring Committee, January 2019 c) Classification of Industrial Sectors under Red, Orange, Green and White Categories, February 2016 (by Central Pollution Control Board (CPCB), India)
3.	Land		a) Biomedical Waste Management Rules, 2016 b) E-Waste (Management) Rules, 2016 c) Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 d) Construction and Demolition Waste Management Rules, 2016 e) Plastic Waste Management Rules, 2016	a) Classification of Industrial Sectors under Red, Orange, Green and White Categories, February 2016 (by Central Pollution Control Board (CPCB), India)

			f) Solid Waste Management Rules, 2016	
4.	Noise		a) The Noise Pollution (Regulation and Control) Rules, 2000 (by Central Pollution Control Board (CPCB), India)	

9 SUMMARY AND REFLECTIONS

9.1 Data and information gaps

- The forest-related maps used in this report are based on GIS layers received from GSDL, which were prepared several years ago. The boundaries in these maps, therefore, do not conform accurately to the ground reality in the present times. The Department of Forests has recently performed an exhaustive mapping of the forest areas in some regions, which will be more useful for subsequent analysis. Despite several requests, this data has not been received.
- Morphological Ridge is defined as that part of Ridge area, which does not fall under any notifications, but has similar features as the Ridge, and forms part of the extension of the Aravallis. Both Delhi High Court and Supreme Court have emphasized on the importance of the morphological ridge. It is, therefore, important to map this feature. It is understood that the Forest Department has begun work on this.

9.2 Key insights and areas of concerns

9.2.1 Sanctity of the Natural Conservation Zones

The NCRPB has identified 156 locations in Delhi to be maintained as NCZs. A careful examination of these sites revealed that there are several sites that have already been built on. Some sites have been partially built up on. ***Map 22*** presents details of these locations. The areas marked in violet are the locations that are intact (as observed from satellite images). Hence, these could be either natural greens or planned greens and have the potential to be maintained as NCZs. The areas marked in magenta are almost built up completely (>75%), and cannot be classified as NCZs. Areas marked in green are slightly built up (up to 25%). Areas marked in yellow are built up between 25 and 50%. Areas marked in pink are built up between 50-75%. Because certain activities land use types are permitted in the NCZs, a site examination of these semi-built up sites will be required to ascertain their status.

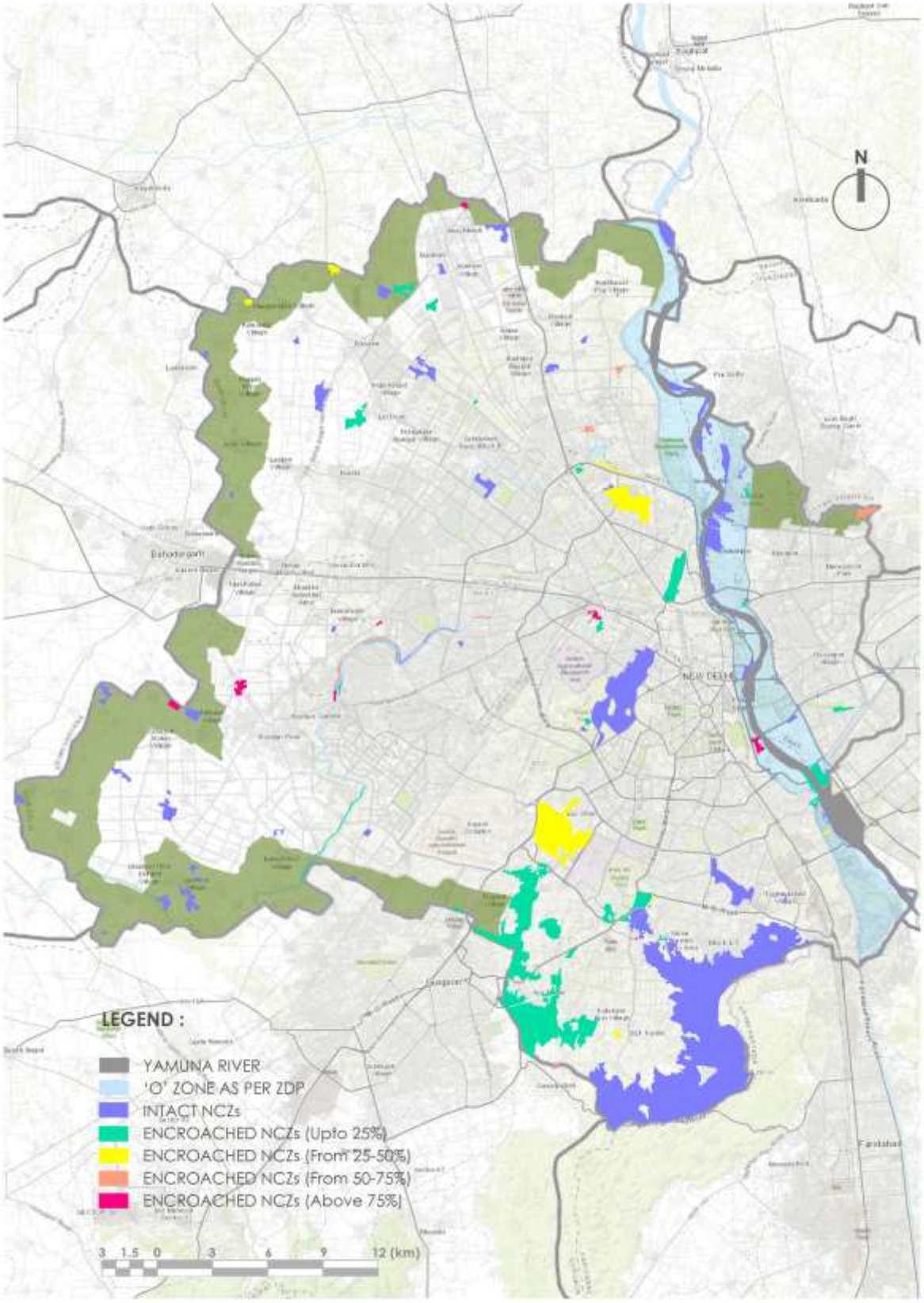
9.2.2 Per capita green cover

It is often said that Delhi has a very high per capita greens as compared to the rest of the country. While this is factually correct, this argument fails to take into account that the area under green cover (reserved and protected forests and tree cover) is significantly higher than that under parks (324.41 vs. 81.23 sq. km respectively). Furthermore, a good portion of the tree cover is covered in parks (almost 60%[36]). This further effectively reduces the area under parks. Hence, the per capita park space availability is quite low. This is captured in ***Map 23***, where it is quite evident that in all districts(except

[36] Based on satellite image observations of a couple of parks – Neighbourhood Park in Defence Colony; and District Park in Rohini.

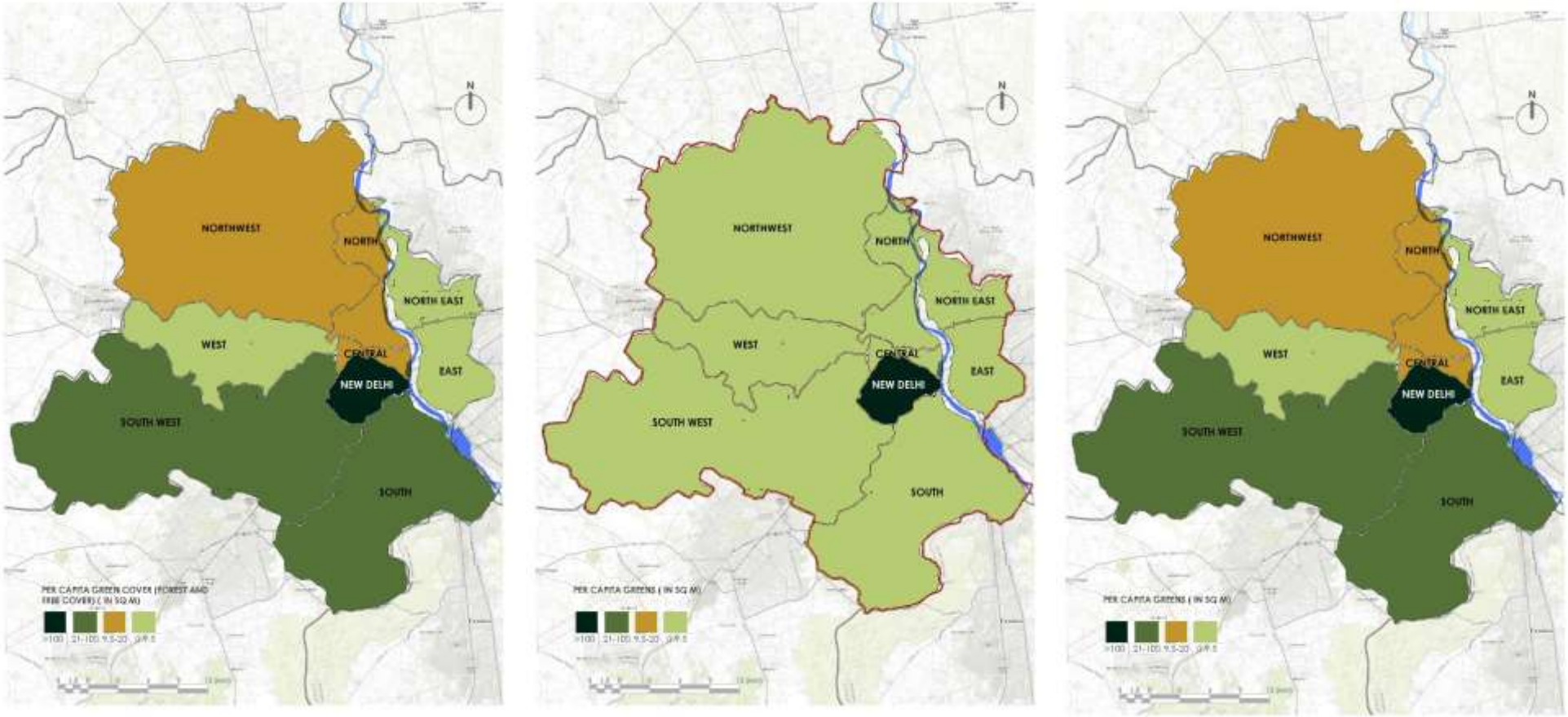
New Delhi), the per capita park space is less than 9.5 sq. m. Incidentally, the WHO recommends a per capita green cover (freely accessible) of 9.5 sq. m per person. The green cover in this context refers to accessible greens, which people can visit freely. While most of the greens in Delhi are technically accessible, common citizens mostly access the parks, biodiversity parks and gardens. The remaining greens in the forests are perhaps semi-accessible. Some forests like Sanjay van have a heavy footfall but the others (especially areas in the Central and Southern Ridge) do not see such footfall. These areas no doubt contribute to the physical health of the city (by mitigating pollution and preventing warming) but do not really make a significant contribution to the mental health of the city (by providing an avenue for people to convene and socialize). Furthermore, it is clear from Map 23 and Table 13 that the even if the per capita total greens (green cover + parks) is taken into consideration, the North East, East and West districts do not meet the WHO recommendations. This suggests that the per capita green is unevenly spread across the city. For example, the New Delhi district has a per capita green of 261.26 sq.m while the North East district has a per capita green of only 3.10 sq.m.

Map 22: Status of the sanctity of Natural Conservation Zones in Delhi



Analysis: NIUA

Map 23: Per capita green cover (left); Per capita park space (centre); and Per capita total greens (right) for Delhi



Source: DPGS (2018), Analysis: NIUA

Table 13: District-wise analysis of accessible greens in Delhi (based on 2018 data)

District	Population	Area (km^2)	Parks (km^2)	Green cover[37] (km^2)	Per capita parks (m^2)	Per capita green cover (m^2)	Per capita green and park covers[38]
Central	5,82,320	25	1.86	7.11	3.20	12.21	13.18
New Delhi	1,42,004	35	19.62	19.51	138.18	137.42	262.74
North	8,87,978	59	6.09	9.71	6.86	10.93	14.33
North East	22,41,624	60	1.15	9.21	0.51	4.10	3.22
East	17,09,346	64	8.23	9.32	4.81	5.45	8.31
West	25,43,243	129	8.27	18.07	3.25	7.10	7.71
South	27,31,929	250	24.1	106.38	8.82	38.93	42.98
South West	22,92,958	421	5.64	88.81	2.45	38.73	31.60
North West	36,56,539	440	6.29	56.31	1.72	15.40	10.84
Total	**1,67,87,941**	**1483**	**81.28**	**324.44**	**AVG: 4.84**	**AVG: 19.32**	**AVG: 19.55**

Source: Population data and district area data 2011 census; Parks data: DPGS, 2018; Green cover data: Delhi Forest Department, 2019

9.2.3 Potential greens

Land availability in Delhi is limited. Hence, there are constraints when exploring options for greening. One option that can be readily tapped into is the industrial area within the core of Delhi that has now been asked by the Supreme Court to relocate to the periphery. These locations within the heart of Delhi are expected to redeveloped to have a 70% green cover as shown in ***Map 24***.

9.2.4 Regional approach for air pollution management

Map 25 overlays the spatial spread of PM 2.5 and SO_2 with traffic hotspots (winter season) and industrial areas in order to have a general understanding of the sources of pollution. Usually vehicular emissions are considered a major source of PM 2.5. However, as gleaned from the map there does not seem to be direct correlation between the two. This view is in line with the findings of the IIT Kanpur study on source apportionment that suggested that dust particles resulting from burning of wood and coal are actually the major source of PM 2.5 in Delhi.

In order to analyse this phenomenon further, the trend of SO_2 was overlaid traffic hotspots and industrial areas. There does not appear to be much difference between the two maps suggesting that the same sources cause both PM 2.5 and SO_2 pollution in Delhi (i.e. burning of wood and coal). Thermal power plants are the main source of SO_2 pollution, accounting for 40% of the total emissions. There are hardly any power plants in Delhi. However, there are eleven in the NCR region as per a CE study[39].

[37] Green cover = Forest cover + Tree cover
[38] Some green cover (tree) is included in parks. Because only a single figure for tree cover is available. Hence, a weighted deduction was made.
[39] Centre for Science and Environment (2018). Off Target: Status of Thermal Power Plants in NCR http://www.indiaenvironmentportal.org.in/files/file/Off-Target---Status-of-Power-Stations-Report.pdf

These are:

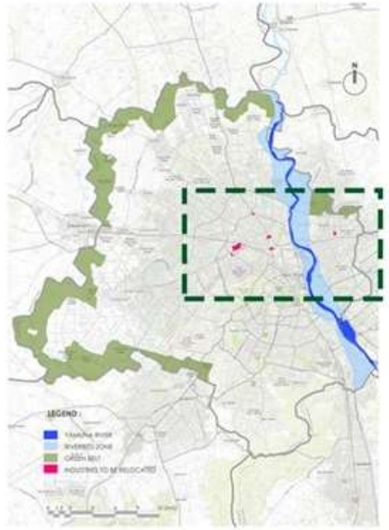
1. Panipat TPS, Punjab
2. Deenbandhu Chhotu Ram Thermal Power Plant, Yamunanagar, Haryana
3. Rajiv Gandhi Thermal Power Station, Hissar,Haryana
4. Guru Hargobind Thermal Power Station, Lehra Mohabat, Punjab
5. Guru Gobind Singh Super Thermal Power Station, Ropar, Punjab
6. Harduaganj TPS, UP
7. National Capital Power Station, NTPC Dadri, UP
8. Aravali Thermal Power Plant, Jhajjar Haryana
9. Mahatma Gandhi TPS, Jhajjar, Haryana
10. Rajpura Thermal Power Plant, (Nabha Power), Punjab
11. Talwandi Sabo Thermal Power Plant, Punjab

To combat the pollution load from coal power plants, the Ministry of Environment, Forest & Climate Change in December 2015 announced emission control standards for coal-based thermal power plants. Existing plants were given two years (up to December 2017) to comply with these revised standards. On the other hand, plants commissioned after 1 January 2017 had to comply from the start of their operations. However, as pointed out by the aforementioned CSE study, implementation of SO2 control measures is still at early stages across the region, suggesting that thermal power plants continue to be source SO2 pollution. This, coupled, with the crop burning in the winter season, and other forms of burning (municipal solid waste) in the city appear to be the main sources of PM 2.5 and SO2 pollution in Delhi.

Map 24: Relocated industries into potential greens

ASHOKA COLOR MILLS

GD RATHI STEELS DELHI STEEL ROLLING MILLS NOVA MILLS

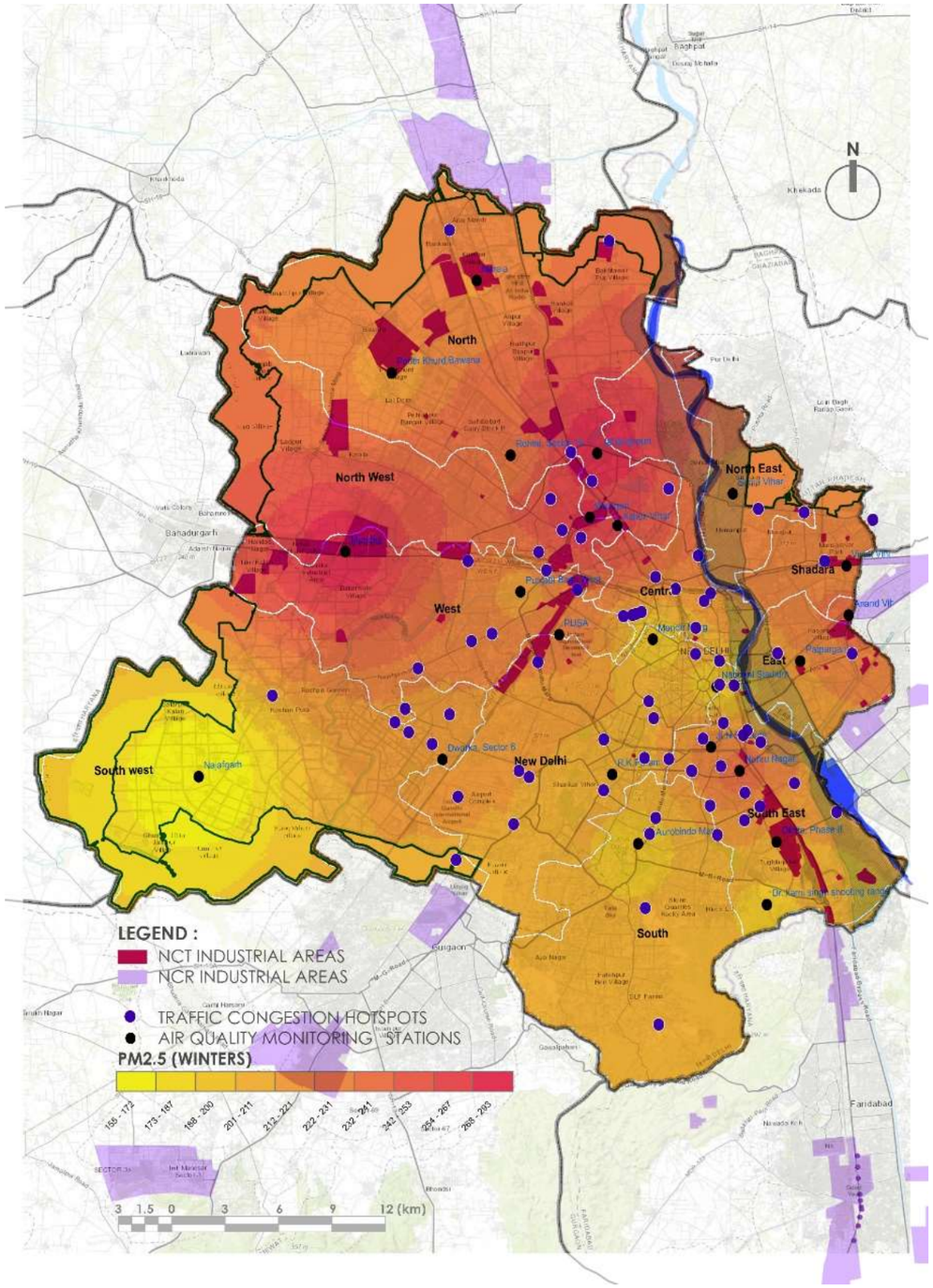


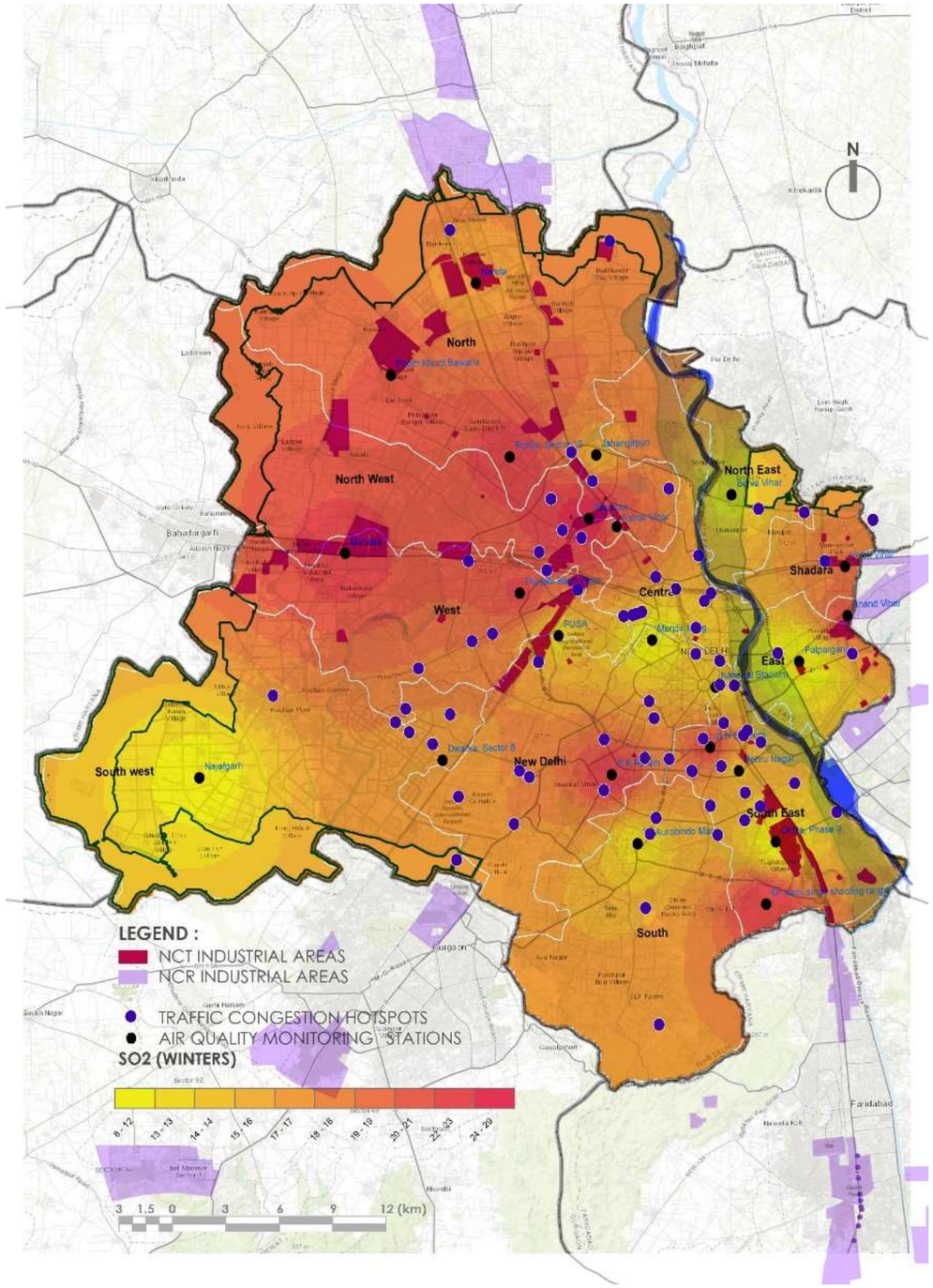
SWATANTRA BHARAT MILLS

BIRLA MILLS

Source: Area Planning Unit, Delhi Development Authority, 2019

Map 25: Comparison and contrast of PM 2.5 and SO2 pollution in Delhi





Source: DPCC; Analysis: NIUA]

Key challenges and potential areas

- Delhi is rich in terms of Green-blue assets with highest level of overall per capita greens, presence of forests, ridge and parks, a dense network of drains and waterbodies and perineal river Yamuna flowing through the city.
- So far, Delhi has not been able to celebrate the river Yamuna and strong linkages of its green-blue assets to the heritage. The city is constantly losing its green spaces and water bodies to encroachments and unsustainable sprawl.
- Revival of the river, drains and combating the alarming levels of air and water pollution are the urgent challenges that the city needs to address.

Data Gaps

- The forest-related maps used in this report are based on GIS layers received from GSDL, which were prepared several years ago. The boundaries in these maps, therefore, do not conform accurately to the ground reality in the present times.
- Morphological Ridge is defined as that part of Ridge area, which does not fall under any notifications, but has similar features as the Ridge, and forms part of the extension of the Aravallis. It is, therefore, important to map this feature. It is understood that the Forest Department has begun work on this.
- Characteristics of the Yamuna Flood plain is not very clear (Spatial delineation of the Yamuna Flood plain, permissible activities and its overlap with Zone O, encroachments)
- Spatial data on 18000+ parks and 1000+ water bodies in Delhi.

10 ANNEXURES

Annexure A: Methodology adopted for the Baseline preparation

Three avenues were employed in order to carry out the baselining exercise.

a) ***Data collection:***

A baselining group was formed comprising of senior officers from fourteen environment-related government agencies in Delhi. Details of the composition of the group are presented in *Table A1*. The BG primarily supported the planning team in getting access to data and information from their departments. The group also provided insights into the implementation of the previous Master Plan (MPD-2021), particularly in terms of challenges faced which would have to be addressed by MPD 2041. The BG group met on four occasions during the course of the baseline preparation.

1st BG Meeting *:* 23 January 2019
2nd BG Meeting : 28 February 2019
3rd BG Meeting : 23 April 2019
4th BG Meeting : 15 July 2019

Dr. Meenakshi Dhote was engaged as the Sector Advisor to provide expert and technical guidance for the preparation of the bassline.

b) ***Focused Group Discussions****:*

Topic : Managing the Delhi ridge
Date : 06 May 2019
Modality : Focussed Group Discussions
Experts : Mr. Pradeep Krishnan; Mr. Ishwar Singh; Dr. P.K. Joshi
Description : Delhi's most prominent geographical features—the ridge which forms an extension of the Aravalli ranges, and the Yamuna—creates a wide range of ecological variations in the region. Its strategic location as a transition zone between arid and semi-arid desert in the West and the fertile Gangetic plains on the East makes it a conservation zone of paramount significance. Although efforts to preserve the ridge date back to the colonial era, subsequent urbanisation and the constant pressure on land resources, both pre and post-independence resulted in the blasting of major portions of the ridge to pave way for more residential and institutional development. What is left of the ridge today constitutes only about 5.2% of NCT's area. This FGD discussed Delhi's existing forest resources and the variety of flora and fauna it supports. It also provided an avenue for discussions on (a) Conservation and maintenance of the existing ridge to support a diverse ecosystem, (b) Preventing development activities that may cause its depletion/ degradation, and (c) Revitalising/ reviving depleting greens through strategic area-based projects.

Table A1: Composition of the Environment Baseline group

Sl No.	*Agency*	**Details**		
		Nodal Officer	***Designation***	***Email***
1	Delhi Development Authority	Ms. Manju Paul	Addl. Commissioner (plg)	manjupaul16@gmail.com
		Ms. Poonam Diwan	Addl. Com Landscape	poonamruby@gmail.com
		Shri Ashok Kumar	Director (Hort) S/E	dirhortsouth@dda.org.in
		Shri Shiv Pal	DD (Horticulture)	ddashivpal@gmail.com
		Shri Indraj Meena	DD (Horticulture)	Dy.directorhd9@gmail.com
2	Directorate of Environment, GNCTD	Dr. Anil Kumar	Director	direnv.delhi@nic.in
3	Delhi Forest Department, GNCTD	Shri Saurabh Sharma	DCF (South)	dcfsouth.delhi@gov.in
		Sh. Bharat Maheshwari	DCF (Headquarters)	dcfhqgnctd@gmail.com
4	Irrigation and Flood Control Department, GNCTD	Shri Mukesh Kumar	SE FI(III)	ifcfciii@gmail.com
		Sh. Sanjay Saxena	CE	ceifcd@gmail.com
		Shri Shiv Kumar	EECD-XIV	ifccdxiv@gmail.com
5	Delhi Parks and Garden Society, GNCTD	Shri Nisheeth Saxena	CEO Dept. of Forest, GNTCD	ceodpgsenv.delhi@nic.in
6	Delhi Pollution Control Committee, GNCTD	Dr. Chandra Prakash	SEE	cpgogia@yahoo.co.in
7	Central Pollution Control Board (CPCB)	Shri Pankaj Agarwal	Sc. E	pankaj.cpcb@nic.in
		Shri Kedarnath Dash	Scientist C	
		Shri Palash Mar	Research Associate	palash85envs@yahoo.co.in
8	North Delhi Municipal Corporation	Shri A.D. Biswas	Chief Town Planner	stp-ndmc@mcd.gov.in
		Ms. Reeta Meena	ATP -NDMC	reeta.info@gmail.com
9	East Delhi Municipal Corporation	Shri Bharat Bhushan	Sr. Town Planner	bhushanb571@gmail.com
10	South Delhi Municipal Corporation			
		Shri Alok Singh	Director Horticulture	alok67singh@gmail.com
12	New Delhi Municipal Council	Dr. Namrita Kalsi	Chief Architect	chief.architect@ndmc.gov.in
13	Cantonment Board	Shri D S Khatri	Consultant	ceodelhicantt@gmail.com
14	Airport Authority Of India	Shri Satyajit Dutta	Jt. GM (ATM)	sdutta@aai.aero

c) Interaction with subject experts

The following subject experts were engaged in understanding various topics concerning environment-

- Pankaj Vir Gupta (University of Virginia)
- Dr. Robin Russell-Jones (Medical doctor and environmentalist form UK)
- Mr. Sumit Sharma (TERI)
- Mr. Pradip Krishen
- Mr. Ishwar Singh, RMB
- Dr. P. K. Joshi, JNU
- Prof. Somnath Sen, IIT Kharagpur
- Dr. Meenakshi Dhote, SPA, Delhi
- Mr. Mohan Rao, Integrated Design, Bangalore
- Mr. Akshay Kaul, Independent Consultant, Delhi

d) ***Site Visit***: A site visit was carried out to the flood plain areas of Delhi on 27th June 2019 to understand the different characteristics of the Zone O (flood plain area), extending about 22kms from one end to the other in length. In this stretch, the team aimed at ground truthing the extent and nature of existing encroached areas, examine quality of existing greens (both planned and unplanned), take stock of the various development projects and identify potential areas that can be developed in this zone. The areas visited are marked as red dots in the adjacent map.

- The visit started from Palla area moving downwards towards the central and southern parts of Zone O. At Palla, the team met with DJB engineers who elaborated on the planning and monitoring of ground water extraction in the area. Incidentally, this is the only area where DJB abstracts groundwater. The team also visited a Ranney well, shank (which dissipate the floodwater energy), and the site for construction of Master Balancing Reservoir (MBR). The MBR is being constructed to augment the storage of groundwater and increase the reliability of supply.
- The team briefly visited the Yamuna Biodiversity Park (YBP) developed by DDA. The team also drove through unauthorised colonies such as Bagiabad and Sangam Vihar surrounding the YBP falling in zone O, and were able to observe some detrimental developmental aspects (e.g. solid waste dumping) in the vicinity of the park.
- The various socio-economic activities along the river edge were noted. Flow of STPs such as Yamuna Vihar and the confluence of drains such as Barapullah and Najafgarh with the Yamuna were specifically traced. One of the alarming observation in the floodplain area was the dumping of large amount of waste

in close proximity to the river, wetlands or sometimes in the river itself in areas such as Usmanpur, Taimurnagar and Jamia Nagar.

- A critical observation made during the visit was the way infrastructure was planned in Zone O influencing the demarcation of the flood plain. For instance, the roads were developed within the Zone O as embankment removing certain colonies/ areas outside the purview of the floodplain.

Annexure B: Change of land use – Recreation

A - Change of Land use - Recreational to Other Land Use Categories							
S.No.	**S.O. Nos.**	**Date of Issue**	**Planning Zone**	**Subject**	**Area (ha)**	**Land Use (MPD 2021)**	**Land Use Changed to**
1	S.O. No. 272 (E)	07.02.2008	Zone - D	The Change Land Use of the area measuring 12.19 acare in Zone -D Changed from to Recreational to Government office .	4.93	Recreational	Government Office
2	S.O. No. 273 (E)	07.02.2008	Zone - F	The Change Land Use of the area measuring 2.21 Ha (5.25 acare) in Zone -F from Recreational (District Park) to Residential	2.21	Recreational	Residential
3	S.O. No. 1134 (E)	14.05.2008	Zone - D	The Change Land Use of the area measuring 1.70 Ha. Adjacent to Rajnagar & Sarojni Nagar in Zone -D, from Recreational (Districkt Park) to Residential (Student Hostel / Staff Quarters)	1.70	Recreational	Residential
4	S.O. No. 1168 (E)	16.05.2008	Zone - F	The Change Land Use of the area measuring 3.157 Ha of land (7.8 acres) out of 13 acres land in of 5.2 acres as of Zone -F from Recreational (District Park) to Residential for CRRI Campus	3.16	Recreational	Residential
5	S.O. No. 43 (E)	06.01.2009	Zone - F	The Change Land Use of the area measuring 3923 sqmt at Badarpur in Zone-F from Recreational District Park to Public & Semi- Public Facilities (Burial Ground)	0.39	Recreational	Public & Semi Public
6	S.O. No. 1752 (E)	14.07.2009	Zone - M	The Change Land Use of the area measuring 25 acre lands in Rohini in sector 36 Zone - M Recreational (District Park) to Transportation (Heliport)	10.11	Recreational	Transportation
7	S.O. No. 2069 (E)	24.08.2010	Zone - C	The Change Land Use of the area at measuring (3.0 Ha) in Azadpur in Zone-C from Recreational to Transportation. T2 (MRTS Property Development / Composite Development)	3.00	Recreational	Transportation
8	S.O. No. 789 (E)	26.04.2011	Zone - J	Change of Land use of 20 Ha, South of Mehrauli - Mahipal Road in Zone-J from Recreational (P-I, Regional Park to Transportations 8.90 Ha / Recreation to (6.30 Ha, recreation (P-I to Resident) Recreational P- 2 District Park (In Parts))	4.80	Recreational	Transportation
9	S.O. No. 789 (E)	26.04.2011	Zone - J	Change of Land use of 20 Ha, South of Mehrauli - Mahipal Road in Zone-J from Recreational (P-I, Regional Park to Transportations 8.90 Ha / Recreation to (6.30 Ha, recreation (P-I to Resident) Recreational P- 2 District Park (In Parts))	8.90	Recreational	Recreational
10	S.O. No. 789 (E)	26.04.2011	Zone - J	Change of Land use of 20 Ha, South of Mehrauli - Mahipal Road in Zone-J from Recreational (P-I, Regional Park to Transportations 8.90 Ha / Recreation to (6.30 Ha, recreation (P-I to Resident) Recreational P- 2 District Park (In Parts))	6.30	Recreational	Residential
11	S.O. No. 2261 (E)	29.09.2011	Zone - D	and Recreational (District Park) (64686.20 sqmt) to Public & Semi-Public Facilities (Socio- Cultural Activity) at Tyagraj Nagar, in Planning Zone - D	6.46	Recreational	Public & Semi Public
12	S.O. No. 2352 (E)	12.10.2011	Zone - F	Change of Land use measuring 2000 sqmt from Recreational (District Park) to Public & Semi-Public Facilities (Community Hall) at	0.20	Recreational	Public & Semi Public

				Harkesh Nagar, Zone - F			
13	S.O. No. 46 (E)	09.01.2012	Zone - D	Change of Land use measuring 18557.82 sqmt of the Centre of Railway Information System (CRIS) office at Safdarjung in Zone D from Recreational to Govt. Office.	1.85	Recreational	Government Office
14	S.O. No. 1358 (E)	15.06.2012	Zone - F	V) 90 mt. RoW adjoining to Jaitpur Road from Residential, Utilities, Recreational to Transportation	0.60	Recreational	Transportation
15	S.O. No. 1358 (E)	15.06.2012	Zone - F	VI) NSSIC on Ma Ananadamoyee Marg (1.33 Ha) from Recreational Use (District Park) to Industrial	1.33	Recreational	Industrial
16	S.O. No. 1358 (E)	15.06.2012	Zone - F	Pocket A	0.77	Recreational	Residential
17	S.O. No. 1358 (E)	15.06.2012	Zone - F	Pocket B	0.71	Recreational	Public & Semi Public
18	S.O. No. 1358 (E)	15.06.2012	Zone - F	Pocket D to J	0.68	Recreational	Public & Semi Public
19	S.O. No. 1358 (E)	15.06.2012	Zone - F	Pocket L	2.00	Recreational	Public & Semi Public
20	S.O. No. 1358 (E)	15.06.2012	Zone - F	Pocket K	0.90	Recreational	Public & Semi Public
21	S.O. No. 1358 (E)	15.06.2012	Zone - F	Pocket P	0.59	Recreational	Residential
22	S.O. No. 1358 (E)	15.06.2012	Zone - F	Pocket X	0.95	Recreational	Residential
23	S.O. No. 1358 (E)	15.06.2012	Zone - F	VIII) Siri Fort Sports Complex (10.93 Ha) from Recreational (District Park) to Public & Semi- Public Facilities (Sport Complex)	10.93	Recreational	Public & Semi Public
24	S.O. No. 1639 (E)	19.07.2012	Zone - O	Change of Land Use of three areas in Zone-O I. Hospital & OPD Centre Site, near Nigamboth Ghat, for area (0.2836 Ha) from Recreational (P2- District Park) to Public & Semi-Public Facilities	0.28	Recreational	Public & Semi Public
25	S.O. No. 1640 (E)	19.07.2012	Zone - C	III. Sport Facilities and associated infrastructure at North Campus, Delhi University (5.78 Ha) from Recreational (P2: District Park) to Public & Semi-Public Facilities (PS3- Sports Facilities / Complex / Stadium/ Sports Centre)	5.78	Recreational	Public & Semi Public
26	S.O. No. 2533 (E)	19.10.2012	Zone - H	Change of Land use measuring 4.0 Ha at Jailorwala Bagh changed from Recreational (District Park) to Residential in Planning Zone-H.	4.00	Recreational	Residential
27	S.O. No. 416 (E)	20.02.2013	Zone - C	Change of Land use area measuring 1.065 Ha changed from Recreational (District Park) to Transportations T-2 (MRTS Property development) in Parmeshwal Bagh at Model Town	1.07	Recreational	Transportation
28	S.O. No. 1455 (E)	29.05.2013	Zone - C	Change of Land use in Dheerpu Ph-II area measuring 16.63 acre (6.74 Ha) changed from Residential (District Park) to Residential	6.74	Recreational	Residential
29	S.O. No. 1857 (E)	26.06.2013	Zone - D	Change of Land use area measuring 49.98 Ha (123.51 acres)of Pragti Maidan from Recreational (District Park) to Public & Semi- Public Facilities (International Convention Centre) in Planning Zone -D	49.98	Recreational	Public & Semi Public
30	S.O. No. 2198 (E)	18.07.2013	Zone - N	Change of Land use Eight Nos. of Changes in Zone - N I. 2.0 Ha Recreational to Industrial	2.00	Recreational	Industrial
31	S.O. No. 2198 (E)	18.07.2013	Zone - N	VIII. 0.1 Recreational to Transportation (Circulation Road)	0.10	Recreational	Transportation
32	S.O. No. 2653 (E)	26.08.2013	Zone - M	VI. Sector 36 near 100.0 Mt R/W Road (area 2.8 Ha) from Recreational to Commercial (Wholesale / Warehousing)	2.80	Recreational	Commercial
33	S.O. No. 2653 (E)	26.08.2013	Zone - M	VII. Sector 37 near 100 Mt R/W road	4.90	Recreational	Transportation

				(area 4.9 Ha) from Recreational to Transportation (Terminal Bus)			
34	S.O. No. 2653 (E)	26.08.2013	Zone - M	VIII. Sector 34 (area 2.96 Ha) from Recreational to Utility (Electricity - 220 Kv Sub- Station).	2.96	Recreational	Utility
35	S.O. No. 2653 (E)	26.08.2013	Zone - M	XI. Sector 34 near Western Yamuna Canal (area 22.25 Ha) from Recreational to Public & Semi-Public Facilities.	22.25	Recreational	Public & Semi Public
36	S.O. No. 2963 (E)	30.09.2013	Zone - F	Change of Land use area measuring 4000 Sqmt. Harkesh Nagar near Okhla Metro Station from Recreational (District Park) to Public & Semi-Public Facilities (Cremation Ground) in Zone -F	0.40	Recreational	Public & Semi Public
37	S.O. No. 3690 (E)	17.12.2013	Zone - K-II	Change of Land Use of land in Zone - K-Ii 8.48 ha in Sector 24, Dwarka facing 100 m wide road	8.48	Recreational	Commercial
38	S.O. No. 3761 (E)	20.12.2013	Zone - K-I	Modification / Change of Land Use in Zonal Development Plan of of Zone - K-I related to development to knowledge based Industrial Park at Baprola by DSIIDC	2.62	Recreational	Recreational
39	S.O. No. 18 (E)	01.01.2015	Zone - E	Notification regarding Change of land use of an area measuring 3900 sqm land from 'Recreational (Community Park) to Utility (U-3) (RSS)." (Under section 11 (A) of DD Act, 1957)	0.39	Recreational	Utility
40	S.O. No. 501 (E)	12.02.2015	Zone - D	"Proposed Change of Land Use regarding: (i) Area measuring 11.71 Ha (117091 sqm) from 'Recreational (District Park)' to 'Transportation (ISBT)' in respect of the 2nd Inter- State Bus Terminal at Sarai Kale Khan, Delhi.	11.71	Recreational	Transportation
41	S.O. No. 627 (E)	27.02.2015	Zone - G	Proposed Change of Land Use of an area measuring 0.9 Ha from 'Recreational' - City Park, District Park, Community Park (Reserve Forest)' to Utility (Relay / Receiving substation) at Dhaula Kuan for construction of RSS for Mukundpur – Yamuna Vihar Corridor (Line-7) of DMRC. F20(13)2012/MP	0.90	Recreational	Utility
42	S.O. No. 628 (E)	27.02.2015	Zone - F	The change of land use of land measuring 3753 sqmt from 'Recreational' (Reserve Forests) to 'Transportation' at Hauz Khas, R.K. Puram for construction of Janakpuri (West) – Botanical Garden-Kalindi Kunj Corridor of Delhi MRTS Project, Phase-III (Line-8) in Zone F. F21(13)2011/MP	0.37	Recreational	Transportation
43	S.O. No. 629 (E)	27.02.2015	Zone - F	Change of land use of land measuring 3522 sqmt from ' Recreational' use Zone (Protected Forests) to 'Transportation' at sport complex, Hauz Khas, R.K. Puram for construction of Janakpuri (West) – Botanical Garden- Kalindi Kunj Corridor of Delhi MRTS Project, Phase-III (Line-8). F21(02)2013/MP	0.35	Recreational	Transportation
44	S.O. No. 650 (E)	27.02.2015	Zone - G	Change of Land Use of Pocket – I (5215.51 sqm) and Pocket – 2 (2541.89 sqm) at C-2, Janakpuri (Dabri Mor), from 'Recreational (P2- District Park) to "Transportation (T3- MRTS Circulation) for C/o Line 8 of Delhi MRTS, Phase II, Janakpuri (West) – Botanical	0.77	Recreational	Transportation

				Garden Corridor. F20(02)2013/MP/			
45	S.O. No. 941 (E)	07.04.2015	Zone - E	Change of Land Use of an area measuring “3447 sqmt from ‘Recreational’ use to ‘Public & Semi Public facilities (Burial Ground)’ in Layout Plan of facility Centre No. 8 at Wazirabad Road and Loni Road. F3(125)98/MP	0.34	Recreational	Public & Semi Public
46	S.O. No. 982 (E)	09.04.2015	Zone - A	Change of land use of Dangal maidan in Zone Á’(Walled City) from “Recreational (Park/Open)”to “Transportation (multi-Level Parking)” F3.(02)2006/MP/Pt-II/50-G	0.72	Recreational	Transportation
47	S.O. No. 983 (E)	09.04.2015	Zone - E		1.08	Recreational	Residential
48	S.O. No. 983 (E)	09.04.2015	Zone - E	Change of land use of land measuring 3.0 Ha. at Mandoli	3.00	Recreational	Public & Semi Public
49	S.O. No. 983 (E)	09.04.2015	Zone - E	Change of land use of land measuring 3.96 Ha at Wazirabad Road	2.70	Recreational	Transportation
50	S.O. No. 983 (E)	09.04.2015	Zone - E	Change of land use of land measuring 0.42 Ha at Sunder Nagari	0.42	Recreational	Transportation
51	S.O. No. 983 (E)	09.04.2015	Zone - E	Change of land use of land measuring 0.25 Ha at Seemapuri	0.25	Recreational	Public & Semi Public
52	S.O. No. 983 (E)	09.04.2015	Zone - E	Change of land use of land measuring 1.62 Ha at Sunder Nagari	1.62	Recreational	Public & Semi Public
53	S.O. No. 983 (E)	09.04.2015	Zone - E	Change of land use of land measuring 0.86 Ha at Ganesh Nagar/Pandav Nagar	0.86	Recreational	Public & Semi Public
54	S.O.No 1073(E)	23.04.2015	Zone - F	Change of land use of an area measuring 6.05Ha. For expansion of AIIMS T rauma Centre and 0.75Ha. For Police Station in Planning Zone-F from"Recreational"(District Park) to Public &Semi Public (Hospital PS-I and Police Station). F20(2)/2010.M.P.	6.05	Recreational	Public & Semi Public
55	S.O. No. 2743(E)	07.10.2015	Zone - F	Change of land use of an area measuring 25.23 Ha. (62.35Acres) from 'Residential', Útility'and 'Recreational'to 'Public and Semi- Public Facilities (Educational & Research University/university Centre, College) PS-1' in Jamia Millia Isalamia University, Zone-F).	10.51	Recreational	Public & Semi Public
56	S.O. No. 3120(E)	18.11.2015	Zone - G	Change of land use of Pocket-I (6560.10 m2) and Pocket-2 (680.70 m2) at Mayapuri, Zone- G from Recreational (P2-District Park) to Transport (T-3 MRTS Ciruclation) for construction of line 7 of Delhi MRTS, Phase-III, Mukundpur Yamuna Vihar Corridor.	0.72	Recreational	Transportation
57	S.O.175(E)	20.01.2016	Zone - G	Change of land use of land measuring 8367.10 sq.m. from (6560.10 Sq.m) from Recreational (P2-District Park) to Transportation(T3- MRTS Circulation)in Shiva ji Park at Basai Darapur, Ring Road for construction of Metro Station for Mukund Pur Yamuna Vihar Corridor of Delhi MRTS Project, Phase-III	0.83	Recreational	Transportation
58	S.O.176(E)	20.01.2016	Zone - E	Regarding proposed Change of Land Use (CLU) of:- (i) Area measuring 1,99,005.10 sqmt in Planning Zone E from Partly Recreational and Partly Residential to Transportation (Depot and Fuel station / Petrol Pump) for construction of Car Maintenance Depot and relocation of Petrol Pump at Vinod Nagar (East) for MRTS, Phase- III. Area measuring 18,396.96 sqm from Recreational to Transportation (Bus Depot).	17.11	Recreational	Transportation
59	S.O.176(E)	20.01.2016	Zone - E	(iii) Area measuring 11635.34 sqm from	1.16	Recreational	Utility

				Recreational to Utility for allotment to EDMC for Solid Waste C&D Processing Plant.			
60	S.O.No.1494(E)	25.04.2016	Zone - G	Extraordinary Gazette Notification Regarding Change of land use of land measuring 1.14ha form 'Recreational' use (P-2 District Park) to 'Utility' (U-3 Electricity, Sub Station) along 24 m RoW road in Janakpuri, adjacent to Institutional Area, Pankha Road for allotment of land to Delhi Transco Ltd. for setting up 220 KV Grid Station.	1.10	Recreational	Utility
61	S.O.1715(E)	12.05.2016	Zone - A	Extraordinary Gazette Notification Regarding Change of landuse of Parda Bagh in Zone 'A' (Walled City) from 'Recreational' (Park/open space) to 'Residential, Commercial and Public & Semi-Public'.	0.91	Recreational	Residential
62	S.O.1715(E)	12.05.2016	Zone - A	Extraordinary Gazette Notification Regarding Change of landuse of Parda Bagh in Zone 'A' (Walled City) from 'Recreational' (Park/open space) to 'Residential, Commercial and Public & Semi-Public'.	0.06	Recreational	Commercial
63	S.O.1715(E)	12.05.2016	Zone - A	Extraordinary Gazette Notification Regarding Change of landuse of Parda Bagh in Zone 'A' (Walled City) from 'Recreational' (Park/open space) to 'Residential, Commercial and Public & Semi-Public'.	0.54	Recreational	Public & Semi Public
64	S.O.1598(E)	29.04.2016	Zone - J	Change of landuse for an area measuring 2.51 ha from "Recreational Use" (Regional Park) to "Utility" (U-3) 400 KV Grid Sub Station for Delhi Transco Ltd.(DTL) at Tughlakabad in Zone-J, South Delhi-II F.20 (33)/2014-MP	2.51	Recreational	Utility
65	S.O.2085(E)	13.06.2016	Zone - D	Extraordinary Gazette Notification Regarding Change of land use of an area measuring 2.63 ha. from 'Recreational (District Park)' to 'Public & Semi-Public Facilities' for construction of a building for the National Museum of Natural History, behind PuranaQuila at Bhairon Mandir Road, opposite PragatiMaidan, New Delhi, Zone-D F20(5)2015/MP	2.63	Recreational	Public & Semi Public
66	S.O.2435	15.07.2016	Zone - G	Extraordinary Gazette Notification Regarding DDA's proposal for change of land use of 9 cases falling in Zone-G (West Delhi-I) of area measuring 3.96 ha. at G-17, Paschim Vihar from 'Recreational (District Park)' to 'Public & Semi-Public (Sports Complex); (Serial No. 6 of Public Notice Dt. 24.12.10). F.20 (63)2010-MP	3.96	Recreational	Public & Semi Public
67	S.O.2436	15.07.2016	Zone - G	Extraordinary Gazette Notification Regarding change of land use in respect of the DDA's proposal for change of land use of 9 cases falling in Zone-G (West Delhi-I) - of an area measuring 3.237 ha. at G-8, for college in Rajouri Garden and adjacent to Hari Nagar Sports Complex from 'Recreational (P-2 District Park) and Partly Residential to 'Public & Semi Public facilities (PSI) (College) F.3 (59)/2010/MP	3.24	Recreational Residential	Public & Semi Public
68	S.O.2437	15.07.2016	Zone - G	Extraordinary Gazette Notification Regarding change of land use in respect of the DDA's proposal for change of land use of 9 cases falling in Zone-G (West Delhi-I) - CLU of an area measuring 6.40 ha. at G-8, Hari Nagar Sports Complex from 'Recreational (P-2 District Park)' to 'Public & Semi Public facilities (PS-3 Sports Complex). F.20 (58/2010-MP	6.40	Recreational	Public & Semi Public

69	S.O. No. 2691 (E)	11.08.2016	Zone - K-II	Change of land use in MPD-2021/ Zonal Development Plan of two sites of location 'A' in Sector-24, Dwarka	2.00	District Park/MP Green	Utility
70	S.O. No. 2691 (E)	11.08.2016	Zone - K-II	& Location-B in Sector-29, Dwarka in Planning Zone K-II (Dwarka) from 'District Park/Master Plan Green' (P-2) to 'Utility (U-4) for (Dwarka) solid waste management facilities. F20(17)2014/MP	2.00	District Park/MP Green	Utility
71	S.O. No. 2955 (E)	15.09.2016	Zone - M	Change of land use in respect of an area measuring 8.90 ha. from 'Recreational' to 'Public & Semi-Public Facilities'(PS3), Sports Complex in Rohini Project – Sector 33, Phase IV & V, Zone-M. F.20(18)/2015-MP	8.90	Recreational	Public & Semi Public
72	S.O. No. 2956(E)	15.09.2016	Zone - A	Change of land use of an area measuring 1.852 ha. from 'Recreational' (Neighborhood Park/Open Space) to 'Transportation' (Multi Level Parking) located at Gandhi Maidan falling in Planning Zone- A (Walled City). **F.20(3)2016/MP**	1.85	Recreational	Transportation
73	S.O.3105(E)	22.09.2017	Zone - H	Proposed change of land use of land measuring 18452.0 sq.m. from "Recreational" (District Park) to "Transportation" (T-3 MRTS circulation) near Netaji Subhash Place, Pitampura, Zone-H for construction of Metro Station/Entry/Exit and Traffic circulation for Mukundpur-Yamuna Vihar corridor of MRTS project, Phase-III (Line-7). F.20(8)/2012/MP	1.84	Recreational	Transportation
74	S.O. 3429 (E)	12.07.2018	Zone - F	ii) 15.101 acres (6.11 Ha.) from 'Commercial', 'Residential', 'Recreational',	6.11	Commercial Residential Recreational	Utility
75	S.O. 3429 (E)	12.07.2018	Zone - F	iii) 14.20 acres (5.75 Ha.) from Çommercial (Warehousing & Depot)'& 'Recreational'(Total 61.546 acres (24.91 Ha.) to 'Utility (U 4)' for three pockets of land located at Tehkhand, Okhla in Planning, Zone-F. F3 (60)2005/MP/Pt.I	5.75	Commercial Recreational	Utility
76	S.O. 3947 (E)	09.08.2018	Zone - F	Extraordinary Gazette Notification regarding Change of land use of an area measuring 4240 sq.m from 'Recreational (District Park)' to 'Public & Semi-Public facilities (PS1 Police Station)' for Police Station on DDA Land at Govind Puri falling in Planning, Zone-F. F20 (04)2017/MP	0.42	Recreational	Public & Semi Public
Total area (ha.)					**284.81**		

B - Change of Land Use from Other categories to Recreational		
1	**Agriculture/Green Belt and Water Bodies**	17.30
2	**Transportation (Road/Circulations)**	3.55
3	**Commercial**	13.98
4	**Recreational**	11.52
5	**Government**	0.00
6	**Industrial**	0.00
7	**Public & Semi Public**	39.97
8	**Residential**	56.22
9	**Utility**	0.00
	Total Area (ha)	**142.54**

C= (A-B) - Actual area remaining after Change of Land Use Process- Recreational			
1	**A**	Area (ha.) Changed from Recreational to other Land uses	284.81
2	**B**	Area (ha.) received in Recreational from other Land uses	142.54
3	**C**	Area (ha.) remaining in Recreational (A-B)	**142.27**

Annexure C: List of Natural Conservation Zones (NCZ)

S.NO	FID_NCZ	Area (Ha)	Zone Name	MPD 2021 -LAND USE	ZDP LAND USE	REMARKS
1	58	**14.49**	**B**	SPECIAL AREA TRANSPORTATION	RECREATIONAL TRANSPORTATION RESIDENTIAL	ROAD DISTRICT PARK /MULTIPURPOSE
2	59	**1.68**	**B**	SPECIAL AREA	PUBLIC & SEMI PUBLIC	FACILITY CENTER
3	60	**0.12**	**B**	SPECIAL AREA	RESIDENTIAL	
4	61	**17.5**	**B**	SPECIAL AREA TRANSPORTATION	COMMERCIAL TRANSPORTATION RECREATIONAL RESIDENTIAL	ROAD, DISTRICT PARK/MULTIPURPOSE
5	55	**736.84**	**B & D**	RECREATIONAL TRANSPORTATION PUBLIC & SEMI PUBLIC RESIDENTIAL	RESIDENTIAL, RECREATIONAL	ROAD REGIONAL PARK HOSPITAL SOCIO CULTUAL (SC) RELIGIOUS
6	8	**2.02**	**C**	RECREATIONAL	RECREATIONAL RESIDENTIAL	DISTRICT PARK
7	9	**9.75**	**C**	RESIDENTIAL	RESIDENTIAL, TRANSPORTATION	ROAD
8	10	**3.1**	**C**	RESIDENTIAL	RESIDENTIAL TRANSPORTATION	ROAD
9	11	**7.65**	**C**	PUBLIC & SEMI PUBLIC RECREATIONAL COMMERCIAL TRANSPORTATION	RESIDENTIAL COMMERCIAL TRANSPORTATION	DISTRIC CENTER
10	12	**255.2**	**C**	PUBLIC & SEMI PUBLIC RESIDENTIAL RECREATIONAL WATER BODY UTILITIES TRANSPORTATION COMMERCIAL	RESIDENTIAL PUBLIC & SEMI PUBLIC RECREATIONAL WATER BODY UTILITIES COMMERCIAL	TRANSPORTATION TRANSMISSION CENTER, CITY PARK DISTRICT PARK COMMUNITY PARK

11	62	**155.17**	**C**	RECREATIONAL PUBLIC & SEMI PUBLIC TRANSPORTATION	RECREATIONAL PUBLIC & SEMI PUBLIC TRANSPORTATION	REGIONAL PARK HOSPITAL
12	63	**1.31**	**C**	RESIDENTIAL TRANSPORTATION	RESIDENTIAL TRANSPORTATION	MRTS
13	57	**8.38**	**D**	RECREATIONAL	RECREATIONAL	REGIONAL PARK
14	97	**1.3**	**E**	COMMERCIAL	COMMERCIAL RECREATIONAL	WHOLE SALE
15	98	**3**	**E**	COMMERCIAL INDUSTRIAL	INDUSTRIALCOMMERCIALRECREATIONALTRANSPORTATION UTILITIES	WHOLE SALEELECTRIC SUB STATION
16	99	**0.17**	**E**	TRANSPORTATION	TRANSPORTATION	
17	100	**20.56**	**E**	RECREATIONAL COMMERCIAL TRANSPORTATION RESIDENTIAL	RECREATIONAL WATER BODY RESIDENTIAL TRANSPORTATION COMMERCIAL	
18	126	**0.36**	**E**	RECREATIONAL	RECREATIONAL	CITY PARK DISTRICT PARK
19	133	**1.52**	**E**	AGRICULTURE/GREEN BELT	RECREATIONAL AGRICULTURE/GREEN BELT	
20	134	**0.94**	**E**	AGRICULTURE/GREEN BELT	AGRICULTURE/GREEN BELT	
21	135	**42.14**	**E**	AGRICULTURE/GREEN BELT	AGRICULTURE/GREEN BELT	
22	54	**593.58**	**F**	GOVT. LAND GREEN BELT RESIDENTIAL PUBLIC & SEMI PUBLIC TRANSPORTATION COMMERCIAL	GOVT. LAND RESIDENTIAL RECREATIONAL PUBLIC & SEMI PUBLIC TRANSPORTATION	
23	65	**189.52**	**F**	RECREATIONAL TRANSPORTATION	RECREATIONAL PUBLIC & SEMI PUBLIC	DISTRICT PARK CITY PARK

24	74	**4.44**	**F**	RECREATIONAL	RECREATIONAL	CITY PARK DISTRICT PARK
25	50	**703.83**	**F & J**	URBANISABLE AREA AGRICULTURE/GREEN BELT RESIDENTIAL RECREATIONAL PUBLIC & SEMI PUBLIC	RECREATIONAL, RESIDENTIAL PUBLIC & SEMI PUBLIC GOVT. LAND TRANSPORTATION WATER BODY	
26	66	**44.48**	**F & J**	RECREATIONAL TRANSPORTATION RESIDENTIAL	RECREATIONAL TRANSPORTATION RESIDENTIAL	REGIONAL PARK
27	69	**72.96**	**F & J**	RECREATIONAL TRANSPORTATION	RECREATIONAL TRANSPORTATION	REGIONAL PARK
28	110	**4477.85**	**F & J**	RECREATIONAL URBANISABLE AREA PUBLIC & SEMI PUBLIC	RECREATIONAL RESIDENTIAL WATER BODY	REGIONAL PARK SPORTS UNIVERSITY
29	115	**2.4**	**F & J**	PUBLIC & SEMI PUBLIC TRANSPORTATION	PUBLIC & SEMI PUBLICTRANSPORT ATION	
30	49	**8.99**	**G**	AGRICULTURE/GREEN BELT	AGRICULTURE/GRE EN BELT TRANSPORTATION	
31	56	**6.61**	**G**	GOVT LAND	GOVT LAND	
32	64	**6.54**	**G**	RESIDENTIAL TRANSPORTATION	RESIDENTIAL TRANSPORTATION	
33	149	**13.61**	**G**	DRAIN RECREATIONAL	DRAIN RECREATIONAL	DISTRICT PARK CITY PARK COMMUNITY PARK
34	147	**4.56**	**G & K-I**	DRAIN	DRAIN RECREATIONAL	RIVER BED
35	148	**18.46**	**G & K-I**	DRAIN	DRAIN RECREATIONAL	

36	51	**92.26**	**J**	URBANISABLE AREA	RESIDENTIAL PUBLIC & SEMI PUBLIC TRANSPORTATION	
37	52	**16.16**	**J**	URBANISABLE AREA	RESIDENTIAL PUBLIC & SEMI PUBLIC	
38	53	**1.37**	**J**	AGRICULTURE / GREEN BELT	AGRICULTURE / GREEN BELT	
39	67	**0.77**	**J**	RECREATIONAL	RECREATIONAL RESIDENTIAL	REGIONAL PARK
40	68	**9.5**	**J**	RECREATIONAL	RECREATIONAL	REGIONAL PARK
41	70	**3.24**	**J**	RECREATIONAL	RECREATIONAL	REGIONAL PARK
42	71	**34.57**	**J**	RECREATIONAL URBANISABLE AREA	RECREATIONAL RESIDENTIAL	REGIONAL PARK
43	72	**79.53**	**J**	RECREATIONAL URBANISABLE AREA PUBLIC & SEMI PUBLIC	RECREATIONAL RESIDENTIAL TRANSPORTATION	REGIONAL PARK UNIVERSITY
44	73	**0.08**	**J**	RECREATIONAL	RECREATIONAL	REGIONAL PARK
45	111	**12.02**	**J**	URBANISABLE AREA RECREATIONAL	RESIDENTIAL PUBLIC & SEMI PUBLIC RECREATIONAL TRANSPORTATION	REGIONAL PARK
46	112	**758.44**	**J**	RECREATIONAL URBANISABLE AREA RESIDENTIAL	RESIDENTIAL PUBLIC & SEMI PUBLIC RECREATIONAL AGRICULTURE / GREEN BELT TRANSPORTATION	REGIONAL PARK
47	113	**58.46**	**J**	URBANISABLE AREA	RESIDENTIALPUBLIC & SEMI PUBLICTRANSPORTATION	

48	114	**80.99**	**J**	RECREATIONAL URBANISABLE AREA	RECREATIONAL AGRICULTURE / GREEN BELT WATER BODY	REGIONAL PARK
49	116	**5.08**	**J**	RECREATIONAL	RECREATIONAL	REGIONAL PARK
50	117	**0.44**	**J**	URBANISABLE AREA	RESIDENTIAL	
51	118	**1.07**	**J**	URBANISABLE AREA	RESIDENTIAL	
52	150	**6.39**	**J**	RECREATIONAL	RECREATIONAL	REGIONAL PARK
53	153	**7.67**	**J**	RECREATIONAL PUBLIC & SEMI PUBLIC	RECREATIONAL INDUSTRY TRANSPORTATION	UNIVERSTIY REGIONAL PARK
54	155	**0.95**	**J**	RECREATIONAL	RECREATIONAL	REGIONAL PARK
55	28	**7.19**	**K-I**	URBANISABLE AREA	RESIDENTIAL	
56	29	**3.67**	**K-I**	URBANISABLE AREA	PUBLIC & SEMI PUBLIC	
57	30	**1.28**	**K-I**	URBANISABLE AREA	RESIDENTIAL	
58	140	**6.85**	**K-I**	DRAIN	RESIDENTIAL, DRAIN	RIVER BED
59	141	**1.35**	**K-I**	DRAIN	DRAIN	RIVER BED
60	142	**7.58**	**K-I**	DRAIN	DRAIN	RIVER BED
61	143	**3.59**	**K-I**	DRAIN	DRAIN	RIVER BED
62	144	**22.98**	**K-I**	DRAIN	DRAIN	RIVER BED
63	145	**1.21**	**K-I**	DRAIN	DRAIN	
64	146	**1.96**	**K-I**	DRAIN	DRAIN	
65	152	**1.04**	**K-I**	DRAIN	DRAIN	RIVER BED
66	46	**38.24**	**K-I & L**	DRAIN	DRAIN	
67	47	**5.44**	**K-II**	AGRICULTURE / GREEN BELT	AGRICULTURE / GREEN BELT	
68	48	**11.88**	**K-II**	AGRICULTURE / GREEN BELT TRANSPORTATION COMMERCIAL	AGRICULTURE / GREEN BELT COMMERCIAL TRANSPORTATION	

69	31	**37.99**	**L**	URBANISABLE AREA	RESIDENTIAL, TRANSPORTATION PUBLIC & SEMI PUBLIC, RECREATIONAL	DISTRICT PARK CITY PARK COMMUNITY PARK
70	32	**39.82**	**L**	AGRICULTURE / GREEN BELT	AGRICULTURE/GRE EN BELT FOREST RESIDENTIAL	
71	33	**19.85**	**L**	AGRICULTURE / GREEN BELT	AGRICULTURE/GRE EN BELT	
72	34	**32.32**	**L**	AGRI./GREEN BELT , WATER BODY	AGRICULTURE/GRE EN BELTWATER BODYRECREATIONAL	DISTRICT PARKCITY PARK COMMMUNITY PARK
73	35	**17.86**	**L**	AGRICULTURE / GREEN BELT	AGRICULTURE/GRE EN BELT	
74	36	**25.55**	**L**	URBANISABLE AREA	TRANSPORTATION PUBLIC & SEMI PUBLIC RESIDENTIAL RECREATIONAL	DISTRICT PARK CITY PARK COMMUNITY PARK
75	37	**4.3**	**L**	URBANISABLE AREA	PUBLIC & SEMI PUBLIC TRANSPORTATION	
76	38	**63.54**	**L**	URBANISABLE AREA	RECREATIONAL RIVER RESIDENTIAL TRANSPORTATION PUBLIC & SEMI PUBLIC	
77	39	**4.11**	**L**	AGRICULTURE / GREEN BELT	AGRICULTURE/GRE EN BELT	
78	41	**31.1**	**L**	AGRI./GREEN BELT, WATERBODY	AGRICULTURE/GRE EN BELT WATER BODY	
79	42	**12.06**	**L**	AGRICULTURE / GREEN BELT	AGRICULTURE/GRE EN BELT	

80	43	**7.81**	**L**	AGRICULTURE / GREEN BELT	AGRICULTURE/GRE EN BELT TRANSPORTATION	
81	44	**59.13**	**L**	AGRICULTURE / GREEN BELT	FOREST RESIDENTIAL AGRICULTURE/GRE EN BELT WATER BODY	
82	45	**8.89**	**L**	URBANISABLE AREA	TRANSPORTATION, RESIDENTIAL, PUBLIC & SEMI PUBLIC	
83	27	**58.76**	**M & H**	UTILITY,RECREATIONAL,RESIDENTIAL	UTILITIES, RECREATIONAL	
84	22	**9.02**	**N**	URBANISABLE AREA	RESIDENTIAL	
85	23	**12.23**	**N**	AGRICULTURE / GREEN BELT	GREEN BELT	
86	24	**9.43**	**N**	AGRICULTURE / GREEN BELT	GREEN BELT	
87	25	**78.68**	**N**	URBANISABLE AREA	RECREATIONAL	
88	26	**6.95**	**N**	AGRICULTURE / GREEN BELT	GREEN BELT	
89	40	**72.61**	**N**	URBANISABLE AREA	COMMERCIAL TRANSPORTATIONP UBLIC & SEMI PUBLIC RESIDENTIAL RECREATIONAL	
90	19	**73.76**	**N & M & P-I**	UTILITY RECREATIONAL COMMERCIAL TRANSPORTATION	UTILITIES COMMERCIAL AGRICULTURE/GRE EN BELT TRANSPORTATION	ELECTRICAL SUB STATION WATER TREATMENT PLANT
91	75	**24.72**	**O**	TRANSPORTATION RIVER	RIVER TRANSPORTATION RECREATIONAL	WATER BODY
92	76	**0.38**	**O**	RIVER	RIVER UTILITY	RIVER BED
93	77	**17.5**	**O**	RIVER	RIVER	RIVER BED

94	78	**1.43**	**O**	RIVER	RIVER	RIVER BED
95	79	**7.92**	**O**	RIVER TRANSPORTATION	RIVER RECREATIONAL TRNSPORTATION	RIVER BED
96	80	**29.44**	**O**	RIVER	RIVER	RIVER BED
97	81	**4.55**	**O**	RIVER	RIVER	RIVER BED
98	82	**9.89**	**O**	RIVER	RIVER RECREATIONAL	RIVER BED
99	83	**9.94**	**O**	RIVER	RIVER	RIVER BED
100	84	**53.01**	**O**	RIVER	RIVER	RIVER BED
101	85	**50.37**	**O**	RIVER	RIVER	RIVER BED
102	86	**18.48**	**O**	RIVER	RIVER	RIVER BED
103	87	**40.36**	**O**	RIVER	RIVER	RIVER BED
104	88	**22.37**	**O**	RIVER	RIVER	RIVER BED
105	89	**4.1**	**O**	RIVER	RIVER	
106	90	**4.43**	**O**	URBANISABLE AREA RECREATIONAL	RIVER RECREATIONAL UTILITIES	DISTRICT PARK CITY PARK COMMUNITY PARK
107	91	**4.45**	**O**	URBANISABLE AREA RECREATIONAL	RIVER RECREATIONAL	DISTRICT PARK CITY PARK COMMUNITY PARK
108	92	**3.3**	**O**	RIVER TRANSPORTATION	RIVER	RIVER BED
109	93	**338.12**	**O**	RIVER UTILITY TRANSPORTATION	UTILITIES RECREATIONAL RIVER TRANSPORTATION	RIVER BED WATER TREATMENT PLANT
110	94	**3.62**	**O**	RIVER	RIVER	
111	95	**5.01**	**O**	RIVER	RIVER	RIVER BED
112	96	**1.65**	**O**	RIVER TRANSPORTATION	RIVER RECREATIONAL	RIVER BED
113	101	**64.67**	**O**	RIVERTRANSPORTATION	RIVER	RIVER BED
114	102	**31**	**O**	RIVER	RIVER	RIVER BED
115	103	**6.47**	**O**	RIVER	RIVER	RIVER BED
116	105	**16.53**	**O**	RIVER	RIVER	RIVER BED
117	107	**5.43**	**O**	RIVER	RIVER	RIVER BED

118	108	**12.47**	**O**	RIVER	RIVER	RIVER BED
119	109	**1.66**	**O**	RIVER	RIVER	RIVER BED
120	119	**10.58**	**O**	RIVER	RIVER	RIVER BED
121	120	**1.42**	**O**	RIVER	RIVER	RIVER BED
122	121	**0.8**	**O**	RIVER	RIVER	RIVER BED
123	122	**1.57**	**O**	RIVER TRANSPORTATION	RIVER	
124	123	**1.5**	**O**	RIVER	RIVER RECREATIONAL	RIVER BED
125	124	**6.7**	**O**	RIVER	RIVER RECREATIONAL	
126	128	**1.51**	**O**	RIVER	RIVER RECREATIONAL	RIVER BED
127	129	**0.51**	**O**	RIVER	RIVER RECREATIONAL	RIVER BED
128	130	**0.65**	**O**	RIVER	RIVER RECREATIONAL	RIVER BED
129	131	**0.48**	**O**	RIVER	RIVER RECREATIONAL	RIVER BED
130	132	**1.15**	**O**	RIVER	RIVER TRANSPORTATION	RIVER BED
131	136	**12.41**	**O**	RECREATIONAL PUBLIC & SEMI PUBLIC	PUBLIC & SEMI PUBLIC RECREATIONAL	DISTRICT PARK CITY PARK, COMMUNITY PARK
132	137	**1.16**	**O**	RECREATIONAL	RECREATIONAL	DISTRICT PARK CITY PARK COMMUNITY PARK
133	138	**19.95**	**O**	RIVER	RIVER	RIVER BED
134	139	**74.99**	**O**	RIVER	RIVER	RIVER BED
135	154	**0.58**	**O**	RIVER	RIVER	RIVER BED
136	125	**6.23**	**O & E**	RIVER TRANSPORTATION	RIVER	DISTRICT PARK CITY PARK COMMUNITY PARK
137	127	**2.1**	**O & E**	RIVER	RIVER	RIVER BED

138	104	**15.54**	**O & F**	RIVER RESIDENTIAL TRANSPORTATION	RIVER TRANSPORTATION	RIVER BED
139	106	**6.15**	**O & F**	RIVER	RIVER	RIVER BED
140	13	**50.23**	**P-I**	RECREATIONALREATIONAL	RECREATIONAL,	CITY FOREST
141	14	**10.44**	**P-I**	AGRICULTURE/GREEN BELT UTILITY	AGRICULTURE/GRE EN BELT UTILITY	ELECTRICAL SUB STATION
142	15	**16.58**	**P-I**	INDUSTRIAL RECREATIONAL TRANSPORTATION	INDUSTRIAL COMMERCIAL RECREATIONAL TRANSPORTATION	
143	16	**39.54**	**P-I**	AGRICULTURE/GREEN BELT	AGRICULTURE/GRE EN BELT	
144	17	**47.46**	**P-I**	AGRICULTURE/GREEN BELT	AGRICULTURE/GRE EN BELT	
145	18	**27.11**	**P-I**	RESIDENTIAL PUBLIC & SEMI PUBLIC TRANSPORTATION	RESIDENTIAL PUBLIC & SEMI PUBLIC COMMERCIAL TRANSPORTATION	
146	20	**3.8**	**P-I**	PUBLIC & SEMI PUBLIC	PUBLIC & SEMI PUBLIC	
147	21	**23.79**	**P-I**	AGRICULTURE / GREEN BELT	AGRICULTURE / GREEN BELT	
148	151	**3.89**	**P-I**	RESIDENTIAL	RESIDENTIAL	WATER BODY
149	0	**1.23**	**P-II**	URBANISABLE AREA	RESIDENTIAL	
150	1	**9.3**	**P-II**	URBANISABLE AREA	RECREATIONAL	FOREST AREA
151	2	**25.38**	**P-II**	UTILITY	RECREATIONAL UTILITIES TRANSPORTATION	SEWERAGE TREATMENT PLANT
152	3	**11.54**	**P-II**	URBANISABLE AREA	RESIDENTIAL	
153	4	**15.25**	**P-II**	RESIDENTIALIDENTIAL	RESIDENTIAL TRANSPORTATION	
154	5	**1.62**	**P-II**	URBANISABLE AREA	RESIDENTIAL	
155	6	**0.72**	**P-II**	URBANISABLE AREA	RESIDENTIAL	
156	7	**21.19**	**P-II**	DRAIN RECREATIONAL TRANSPORTATION	DRAIN RECREATIONAL TRANSPORTATION	WATER BODY