

PREFACE

Mumbai, the largest metropolis of India and the third largest in the world, is a unique city. It enjoys both, a dense and multi cultural demographic diversity as well as a varied range of environmental features. There are rivers, natural drains, lakes, hills, forests and coastal features like beaches, rocky outcrops, mangroves and creeks. However, growth in population and changes in the State policies, in the past few decades has resulted in phenomenal construction activity adversely affecting all the environmental features. While the natural water bodies are fast disappearing through negligence, and uncontrolled development, the open spaces meant for recreation and sports are grossly inadequate, both in their numbers and in their areas, to address the bare minimum needs of Mumbai's growing population.

The Open Spaces, marked as Reservations on the Development Plan of Greater Mumbai, as Recreational Grounds, Play Grounds, Gardens etc, account for only 6% of the land area. On the other hand the locations of the existing water bodies are not even indicated on the Development Plan. This Development Plan was prepared in the 1980s, for which the survey was undertaken in 1980. Needless to say, that the ground reality of these reservations, after 30 years, is enormously different. The current reality therefore needs to be thoroughly examined on two levels: a) with respect to their deficiency and b) with respect to their current status and conditions. Only after such an assessment that an appropriate strategy can be devised; a strategy which will ensure the provision of Open Spaces that are both, adequate and accessible to all. With this background, the Mumbai Metropolitan Region – Environment Improvement Society (MMR – EIS) has undertaken a project to study the Environmental Features in the entire Mumbai Metropolitan Region (MMR). The first phase of this project covers the city of Greater Mumbai. This is the first time ever that such a thorough study of all the Environmental Features has been undertaken in India by physically visiting each feature. M/s Adarkar Associates were entrusted with the task of “Inventorisation of Open Spaces & Water Bodies in Greater Mumbai” and M/s HCP-DPM, Ahmedabad with Water Courses, Coastline Features and Large Urban Greens. This Executive Summary Report in particular is the result of such a study of all the Open Spaces that are reserved on the 1991 Development Plan and of all the Water Bodies that currently exist in Greater Mumbai.

Although in recent times, studies have been conducted by various individuals and organizations, to understand the current status of Open Spaces in Mumbai, this is probably the only study wherein each and every one of the 3000 plus open spaces shown on the Development Plan and 100 plus Water Bodies actually existing on ground have been physically visited and documented. The entire study of both the reserved Open Spaces and the existing Water Bodies was conducted and completed over a period of two years by Adarkar Associates and involved architects, planners, environmental planners, ecologists, geographers and several teams of surveyors, comprising more than 50 persons.

Informed by the ground data, the study highlights the findings by innovatively addressing ways to analyse such findings. For example the study does not see Per Capita Index in isolation; it shows how the index varies when correlated with significant parameters like accessibility, usability and ecology. The Action Plan derived out of the study, proposes strategies a) for conserving the existing and b) for planning for new environmental features.

It is hoped that this study would lead to a Comprehensive Policy for the Open Spaces and Water Bodies in Greater Mumbai as an important component of the Revised Development Plan for Greater Mumbai (2014 to 2034). Concurrently, as the study is placed in the public domain it would empower the communities and their elected representatives to protect and retrieve these vital Environmental Features.

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SECTION 1: INTRODUCTION

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5. Findings & Analysis of empirical data & emerging issues.
6. Formulation of Action Plan.
7. Formulation of Design Guidelines

1.1. Project Background:

The Mumbai Metropolitan Region – Environment Improvement Society (MMR – EIS) has undertaken a project to prepare an inventory of various environmental features in the Mumbai Metropolitan Region (MMR). The first phase of this project involved preparing an inventory of open spaces, water bodies, water courses, coastline features and large urban greens for Greater Mumbai. Other regions shall be taken up in subsequent phases. M/s Adarkar Associates were entrusted with the task of “Inventorisation of Open Spaces & Water Bodies in Greater Mumbai” and M/s HCPDPM, Ahmedabad with Water Courses, Coastline Features and Large Urban Greens.

1.2 Objective of the Project:

1. To create a comprehensive database which can aid future planning decisions, environment improvement programmes and can help formulate a strategy for conserving the existing and planning for new environmental features.
2. To provide useful inputs for the preparation of the Revised Development Plan for Greater Mumbai (2014-2034), the work for which is currently in progress.
3. To place the study in the public domain and make it accessible to the users and policymakers in order to empower them to retrieve and protect these vital environmental features.

1.3 Scope of Work:

This Study includes the Open Spaces and Water Bodies in Greater Mumbai. For the purpose of this study, only the Open Spaces, marked as reserved Open Spaces on the Development Plan, 1991, viz Playgrounds, Recreation Grounds, Gardens, Parks etc. are considered. Large open spaces such as Aarey Milk Colony, National Park, hillocks etc. are not under the purview of this study. During the progress of the study, it was decided to include Open Spaces in areas which are under MMRDA as Special Planning Authority in the survey. Thus Open Spaces in Backbay, Wadala Truck Terminus, Bandra-Kurla Complex and Oshiwara are covered in this study. Thus, altogether 3246 numbers of Open Spaces were documented. Identification of Water Bodies was done physically with references from various sources. The 1991 Development Plan shows very few Water Bodies; none of these are protected under Water Body reservation. Thus 103 numbers of water bodies were located and documented.

1.4 Deliverables

The entire study is presented in 26 volumes:

- I) Executive Summary Report of Open Spaces and Water Bodies combined in 1 concise volume.
- II) Reports on Open Spaces in individual Municipal Wards in 24 respective volumes.
- III) Report on Water Bodies in Greater Mumbai in one comprehensive volume.

i) Executive Summary Report

This volume is the Executive Summary Report of the project which includes:

- Background, Objectives and Scope of the project
- Various Stages in which the project was carried out and the Methodology adopted for each stage.
- Findings, Analysis and Inferences from the documentation.
- Recommended Strategies for protection of Open Spaces and Water Bodies
- Guidelines for Development and Maintenance of Open Spaces and Water Bodies
- Possible ways to Generate new Open Spaces

All the above has been detailed under separate Sections –‘Open Spaces’ and ‘Water Bodies’ - in this Executive Summary.

In this volume, no data on individual Open Space sites or on individual Water Bodies is included. Detailed data on each of the Open Space sites is given in respective Ward Reports and that on each Water Body is given in the ‘Report on Water Bodies’.

ii) Individual Ward Reports On Open Spaces

The entire documentation on Open Spaces has been presented in 24 Reports, one for each of the 24 Municipal Wards. Each Ward Report consists of:

- a) A brief overview of the ward comprising its basic data (area, population, population density) and its geographical context (extent of the ward in terms of its boundaries, major roads, railway stations, landmarks, any significant natural features etc.)
- b) A brief note highlighting any significant city level or ward level open spaces within the ward, history of the ward / any areas within it, current situation and any projections for the future, any striking features with respect to population distribution, distribution of spaces, any significant observations, etc.
- c) A statistical summary of the Open Space reservations, as per the DP and their status as per this survey.
- d) A map of the Ward showing the DP and AutoCAD drawing layers, superimposed with Satellite Image showing the Open Space reservations highlighted and identified by the assigned numbers. (Refer Map in Annexure 2)
- e) Data Sheets for each of the sites in the ward documenting the site condition and its immediate surroundings
- f) Tabular Sheets giving detailed technical data for each of the sites under significant Parameters
- g) List of sites which are identified as those requiring Immediate Attention with respect to their protection, development and maintenance.
- h) List of sites which are deleted (de-reserved) and list of sites which are relocated by MCGM after 1991 i.e. after the DP was published

iii) Report On Water Bodies

The Report on Water Bodies comprises:

- a) Various stages of the project and the methodology adopted for each of the stages
- b) Findings, Analysis and Inferences from the documentation
- c) A map of Greater Mumbai showing the DP and AutoCAD drawing layers, superimposed with Satellite Image showing the existing Water Bodies highlighted and identified by the assigned numbers. (Refer Map in Annexure 2)
- d) Data Sheets for each Water Body.
- e) Tabular Sheet giving detailed technical data for each Water Body.

1.5 Stages Of The Project

This project was executed in six stages:

1. Preparation of the Base Map in three layers:
 - A. AutoCAD Plan with reserved Open Spaces & Water Bodies
 - B. Scanned image of 1991 DP and
 - C. Satellite Image
2. Identification and Inventorisation of Open Spaces & Water Bodies by allotting a unique identification number to each site.
3. Collection of data on the current condition of all the sites and their immediate surroundings by physical visits and documenting all relevant data in a pre-designed proforma.
4. Grading & Classification of Open Spaces & Water Bodies to identify those requiring immediate attention.
5. Findings & Analysis of empirical data & emerging issues.
6. Formulation of Action Plan.
7. Formulation of Design Guidelines for Open Spaces.

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Definition, Categories and Significance of Open Spaces

Definition and Categories:

Open Space, can be broadly defined as: the land which is open to sky, which allows free access to the public at large with adequate proximity, and which is developed for recreation, sports; as well as the land which is protected for its natural and environmental importance.

Of all the environmental features, open spaces are a crucial component of the urban infrastructure. In the context of this study, Open Spaces are plots of land reserved in the 1991 Development Plan as Recreation Grounds (RG), Playgrounds (PG), Gardens (G), Parks, and Green Belts etc. Apart from being areas of recreation and sport, the Open Spaces are important environmentally, by virtue of their openness. Therefore the Open Spaces are categorised as Active and Passive Open Spaces. Both these types, because of their 'open to sky' nature, act as a) 'lungs' of the city, b) as 'sponges', absorbing excess rain water and preventing flooding and c) as 'carbon sinks', counterbalancing the ill effects of pollution due to their green cover. In this study, these are defined as:

Active Open Space: The Open Spaces which are used for activities like recreation, leisure, relaxation, walking/jogging, interacting etc.

Passive Open Space: The natural Open Spaces which are of environmental importance like mangroves, salt pans, water bodies like ponds, lakes etc.

Per Capita Index:

The Index or Standards of Per Capita Open Space is computed either as acreage per 1000 persons or as square metres per person. The study has shown that before these figures are presented, it is extremely important to know the context in which such figures are quoted. Especially when the international per capita standards are quoted, it remains just a figure in isolation, unless it is correlated with the definition of Open Space and parameters considered for the computation. The per capita goal in Greater Mumbai's Development Plans and the efforts to achieve it are not very clear. The DP of 1967, set up a goal of attaining at least 1/2 acre of open space per 1000 population in the next 20 years and to increase to 1 acre per 1000 population in the next 30 years or so. It did not include the National Park but contemplated to add some 'foreshores' to attain the index of 1 acre/1000 persons. (*The report admits the impossibility of achieving the target of 4 acres per 1000 population because it would result in earmarking 66% of city's area as recreational open spaces for the then existing population of 27.7 lacs*).

In the current study therefore, the per capita figure is not seen as an abstract or a static figure. It changes as per its correlation to significant parameters. For example the per capita open space when correlated with the 'free accessibility' parameter will be less than the figure for all the available open spaces.

This is shown graphically later in the section 'Stage 5: Findings & Analysis'.

Significance of Open Space study is the context of the last two Development Plans:

The survey for the currently used Development Plan (1991-2010) was done around 1981. Since then, especially after the economic policies of the Government of India underwent structural changes to usher in Globalization, the image of large cities appears to be defined by the one projected by Real Estate development. Consequently, the built environment has taken a priority over the existing natural environmental features. Increase in the existing FSI (Floor Space Index) and introducing TDR (Transfer of Development Rights) has amplified the buildable potential of the city. However there has been no corresponding policy to enhance the Open Spaces (and other amenities). As the current DP expires, and the Revised Development Plan (2014-2034) is already in the making, our Open Space provisions would have to be ready to meet the additional demands over the next twenty years.

Many of the Open Space reservations defined on the 1991 DP are built upon. In fact, the green areas appearing on the DP are misleading. During the making of the DP, in order to increase the ratio of per capita

open space, Open Space reservations were marked on plots which already had existing buildings which were supposed to have a short life expectancy. Some reservations were marked on plots which were occupied by slums. Most of these plots are still occupied by the same structures. Besides, some vacant land reserved for Open Spaces was not developed into Recreation and Playgrounds. This subsequently got occupied by slums or other uses. Since the ground reality thus, varies considerably from what appears 'green' on the DP sheets, it is of utmost importance to undertake a comprehensive survey before a comprehensive policy is made. Physical site visits were therefore found to be absolutely inevitable. There are totally 3246 Open Space sites reservations.

The existing Open spaces have not been accorded high priority by the city administration in its planning decisions. This has led to their negligence and misuse. A lack of political will to acquire lands for Open Space amenity has had an adverse effect on the future of open spaces of the city. At certain times, the government policies (such as the decision on sale of Mill lands) have led to losing an opportunity to add to the existing Open Spaces (this could be upto 200 Acres in the Island City). Occupation of Open Spaces for infrastructure projects and public utilities by the local authorities has further contributed to the reduction and sometimes destruction of the existing developed Open Spaces in the city. There is therefore an urgent need, to protect existing Open Spaces of all types, appropriately develop them and also to look for ways to increase their number and areas. On this background MMRDA's initiative to survey the various environmental features in Greater Mumbai is a crucial step in the right direction and at the right time.

The study is broadly divided into three major Stages:

- I Documentation and Assessment of the conditions of the total 3246 sites physically visited.
- II Presentation of Findings & Analysis of data on the basis of important parameters like Accessibility, Usage, Threats etc.
- III Proposing an Action Plan which addresses
 - a) State Policies, b) Generating new Open Spaces c) Guidelines for Development of Open Spaces

Seven Detailed Stages:

- 1. Preparation of the Base Map in three layers: AutoCAD Plan with reserved Open Spaces, Scanned image of 1991 DP and Satellite Image.
- 2. Identification and Inventorisation of Open Spaces by allotting a unique identification number to each site.
- 3. Collection of data on the current condition of all the Open Spaces and their immediate surroundings by physical site visits and documenting all relevant data in a pre-designed proforma.
- 4. Grading & Classification of Open Spaces to identify those requiring immediate attention.
- 5. Findings & Analysis of empirical data & emerging issues.
- 6. Formulation of Action Plan.
- 7. Formulation of Design and Development of Open Spaces.

Limitations of the Study

- Open Spaces outside the reservations shown on the 1991 DP, do not form a part of the study.
- The study does not include any formal quantification of the various parameters studied, either for Open Spaces or for Water Bodies. It is conducted on a visual assessment of the condition of the site based on pre-defined guidelines. In case of Water Bodies, no qualitative analysis of water samples has been done to study the ecology /natural ecosystems within the water bodies.
- The Satellite Image may not exactly match the DP image in some areas. Although corrections and adjustments have been made while superimposing the two on the Base Map, some of the sites may appear slightly displaced with respect to the Satellite Image.
- Entry and photography was not possible for inaccessible Open Space sites. In the sites owned by Govt. Agencies like Defense, Airport Authority, etc. entry was denied and photography disallowed due to security reasons. In such cases, the status of the site was established with the help of the Satellite Image.
- Entry to certain privately owned sites was disallowed. Effort was made to photograph such sites from outside wherever possible and therefore may appear inadequate as visual documentation.

- The entire survey has been conducted over a period of two years. Hence it is possible that the current status of some sites may vary from the data documented.
- Data on ownership of Open Space sites was updated and corrected to the extent possible, by interaction with MCGM officers and with data received from the offices of the Garden Department of MCGM.
- Water levels of lakes / ponds have not been monitored or measured under this study. The findings regarding reductions in water levels are based on local inquiry.
- Environmental features like the catchment characteristics have been determined by the use of secondary data only, after visiting the sites.
- The physical development, i.e. activities and usage, near the water body has been studied only with respect to its impact on the water body.
- The study does not include actual demarcation/delineation of the water body on site as per city survey records to determine the extent of encroachment etc.
- Although all efforts have been made to ensure correctness of the data for Open Spaces as well as Water Bodies, in view of the vastness of the data, certain discrepancies may have crept in due to oversight.

2.1 STAGE 1: PREPARATION OF BASE MAP

A Base Map showing all open space reservations (existing and proposed) in the 1991 Development Plan of Greater Mumbai was prepared in AutoCAD format. This also includes Open Space sites in areas where MMRDA is the Special Planning Authority: viz, Backbay, Wadala Truck Terminus, Bandra-Kurla Complex and Oshiwara.

The Base Map was prepared as follows:

1. All scanned images of the 1991 D.P (Development Plan) sheets were joined together to form a map of Greater Mumbai. This forms one layer of the Map.
2. Then an Auto CAD drawing was prepared by digitizing all major roads, railway lines, railway stations, ward boundaries, major landmarks etc. and superimposed on the D.P. map image of Greater Mumbai. This is the second layer of the Map.
3. The Development Plan is 20 years old and several new roads etc. have come into existence after the preparation of the D.P. Hence a satellite (Google) image of Greater Mumbai, depicting the current scenario, was superimposed as a third layer on the earlier two layers of the Map.

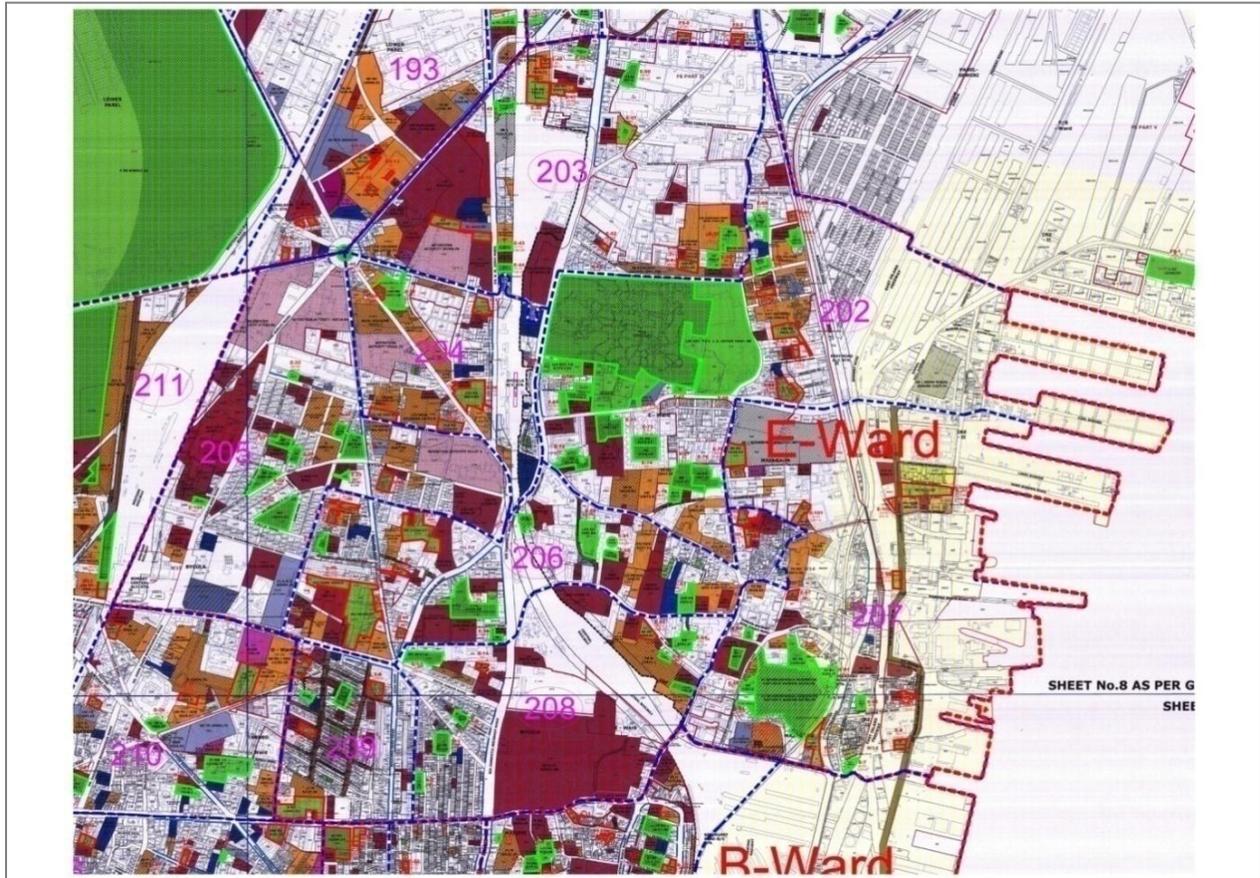
The necessary corrections and adjustments were made to match the DP and satellite image layers with the AutoCAD drawing.

The following was further incorporated on this Map:

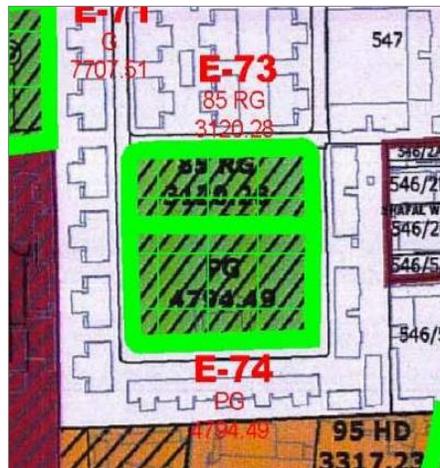
1. All DP reserved Open Spaces, segregated with separate hatch patterns and different green colour shades, to indicate 'Existing' and 'Proposed' Open Spaces. Open Space sites in areas where MMRDA is the Special Planning Authority were also included. Altogether 3246 sites were shown.
2. Water Bodies which were found to be existing at the time of survey.
3. Boundary of Greater Mumbai and boundaries of each of the 24 Administrative (Municipal) Wards.
4. Boundaries of each of the 227 Councilors Electoral Wards in Greater Mumbai.
5. Open Space / Water Body number, corresponding with the reference numbers in the data sheets.
6. Name, C.S. No., area and DP classification of each Open Space.
7. Name, landmark and area of each Water Body.
8. Western, Central, Harbour Railway Lines.
9. . Railway Stations.
10. Major Roads
11. Other existing roads.
12. The sea wherever it abuts the boundary of Greater Mumbai.

Map of entire Greater Mumbai is not attached to this report but the individual Ward Maps are attached in the respective Ward books of 24 Wards. The Greater Mumbai map is available as a soft copy.

Individual Ward Maps: Maps of individual Municipal Wards are included in the respective Ward Reports. These are A3 size Maps for ready reference. (Refer Annexure 2). For larger wards, these Maps are in more than one A3 size sheet. In such cases, a key plan has been included to indicate the areas covered in the different sheets. These Ward Maps are AutoCAD format drawings with DP background only. Since the purpose of these Maps is merely identification of the sites with respect to their location, the satellite image background has been omitted. This offers greater clarity and readability. The individual sites are highlighted by a dark border and the site number.



Typical Ward Map (Part) with boundaries of each Open Space highlighted.



Cropping of Ward Map showing the highlighted site border, Site no., Area, DP Classification

2.2 STAGE 2: IDENTIFICATION & INVENTORISATION

Greater Mumbai comprises of 3 Zones, namely Island City, Western Suburb and Eastern Suburbs. The 24 Administrative Wards are distributed in these 3 Zones as shown below. Further, each ward is divided into Electoral Councilor's wards, total 227 in Greater Mumbai.

Table 1 : Zones, Wards, Open Space Sites in Greater Mumbai

Zones	No. of Wards	Wards	Reserved Open Space sites as per 1991 DP	
			Nos.	Area (Ha)
ISLAND CITY	9	A, B, C, D, E, F-South, F-North, G-South, G-North	766	658
WESTERN SUBURBS	9	H-East, H-West, K-East, K-West, P-North, P-South, R-South, R-Central, R-North	1489	1243
EASTERN SUBURBS	6	L, M-East, M-West, N, S, T	991	1067
Total	24	-----	3246	2968

In order to identify each Open Space site in the city, it was necessary to give a unique identification number to it. The D.P. sheets for every ward of Greater Mumbai were studied and each open space site marked therein was given a serial number, prefixed by an alphabet / alphabets indicating the respective ward.

Thus sites in Ward C have numbers C-1, C-2 ...etc. and sites in Ward G-North have numbers GN-1, GN-2, GN-3,.....etc. The same serial numbers appear on the Base Map as well as everywhere in the Condition Documentation. Open Space sites, in areas where MMRDA is the Special Planning Authority; have been documented in their respective Municipal and Councilor's wards.

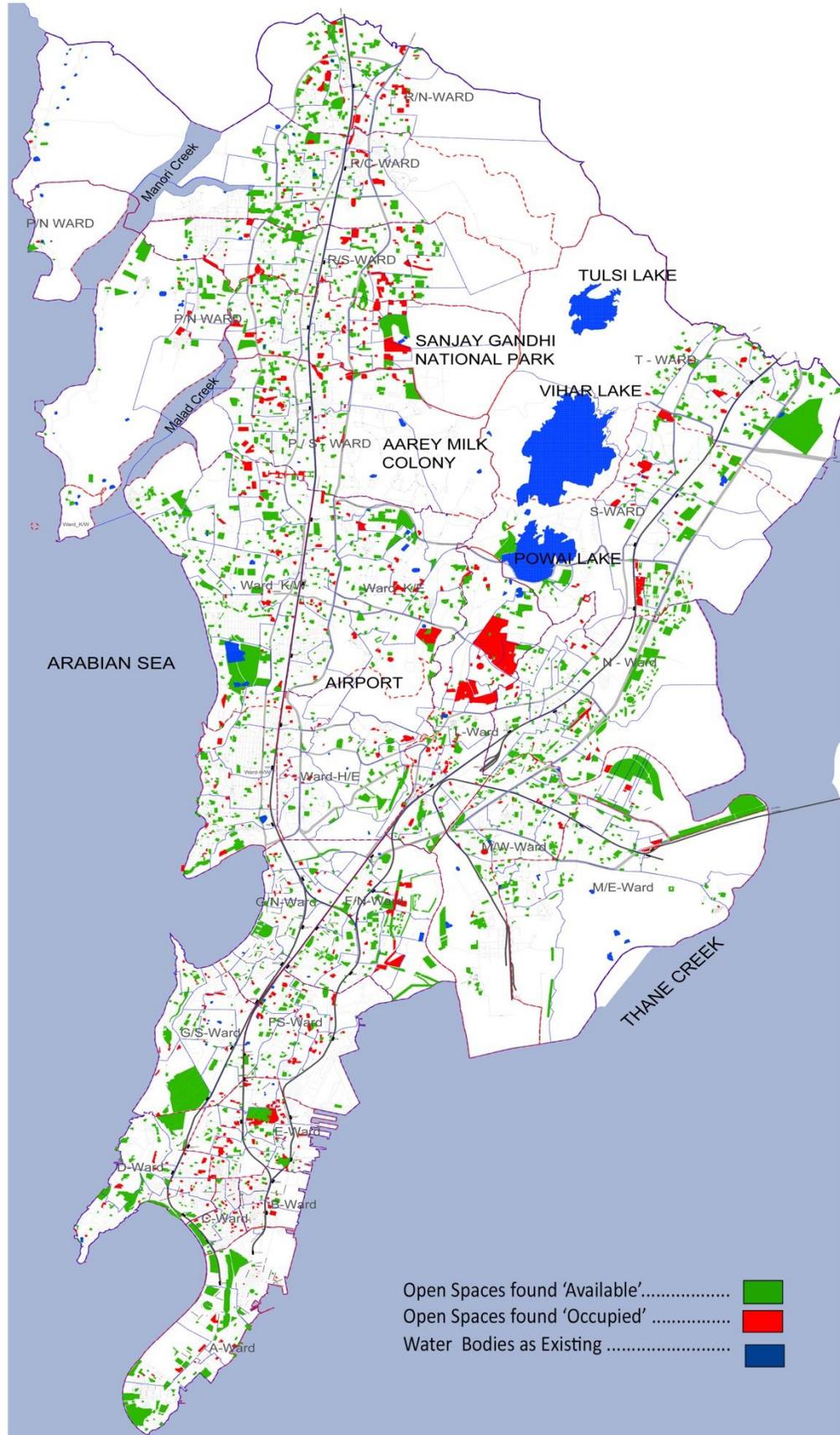
A ward-wise inventory of all the open space sites in Greater Mumbai was made.

The inventory includes:

- Site Serial No.
- Name of the open space. Wherever the Open Space does not have a name, the name of the abutting road or the nearest landmark has been mentioned.
- The DP sheet number in which the site is marked.
- DP classification i.e. whether it is reserved as an RG (recreation ground), PG (playground), G (garden), etc.
- Area of the site as mentioned on the DP.
- C.S. (City Survey) No.
- Owner / Occupier / User

Open Spaces & Water Bodies in Greater Mumbai

Map 1



2.3 STAGE 3: DOCUMENTATION OF SITE CONDITION

The 1991 Development Plan, which forms the basis of this documentation, has 3246 reserved Open Spaces, including the sites in areas under MMRDA as Special Planning Authority (viz. Backbay, Wadala Truck Terminus, Bandra-Kurla Complex and Oshiwara). These sites are spread over nearly 500 sqkm. of land and cover 3 Zones (Island City, Western Suburbs, Eastern Suburbs), 24 administrative Wards and 227 Electoral Wards of Greater Mumbai.

As stated earlier, each and every one of these 3246 sites was physically visited and data collected for the purpose of this study. The survey was conducted and completed over a period of two years, by several teams, together comprising nearly 50 persons.

Since the survey was to be conducted for a large number of sites and over a long span of time, it was necessary to have a number of teams for field visits. Maintaining uniformity in data collection as well as in recording was crucial.

For this purpose, a detailed methodology was formulated. This is discussed in detail below in 3 components:

- Site Visits and Data Collection
- Documentation in two page format of Data Sheets and technical chart form or Tabular Sheet
- Ward wise Summary

2.3.1 SITE VISITS AND DATA COLLECTION

a) For the purpose of ensuring uniformity in collecting information / recording observations in the field, a site proforma was formulated. This was finalized after a series of discussions within the Project Team & with MMR-EIS. (Refer Annexure 3)

b) To achieve uniformity and clarity in understanding the issues and in the method of filling in information on the site proforma, workshops were conducted for the benefit of field surveyors, prior to site visits. The various parameters for documentation were clearly defined. Since the data does not involve any formal quantification of the parameters, the guidelines for their visual assessment were explained. This is especially pertinent for parameters 'maintenance' and 'infrastructure and facilities'. Since the data for the parameter 'predominant users' was to be collected by oral inquiry, the questions to be asked by the survey team were discussed.

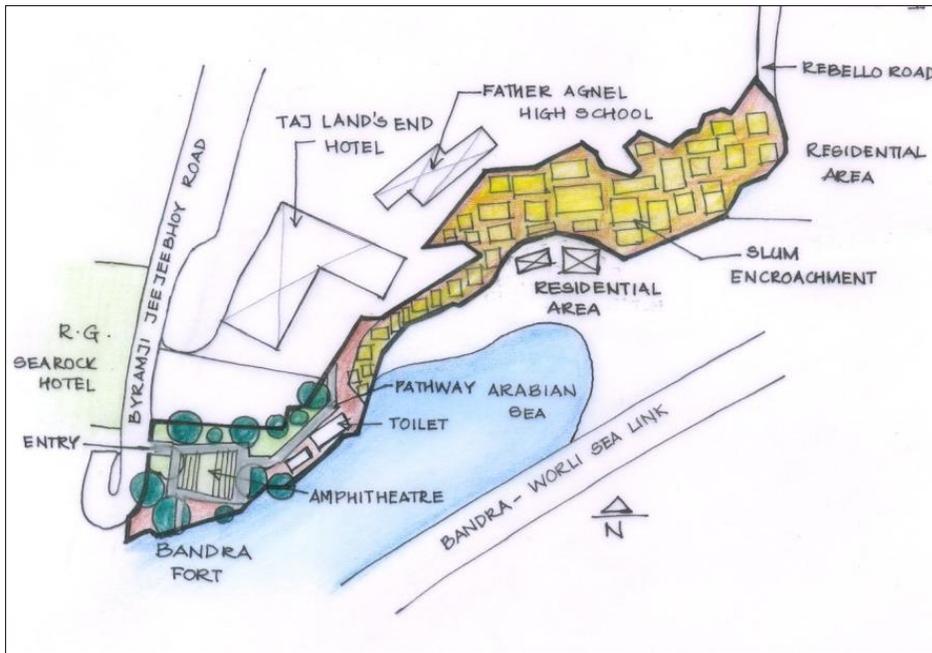
c) Each site visit involved the following:

i) Making observations, talking to any security guard or gardener present at the site and / or people in the vicinity and filling up the information in the allotted columns of the site proforma.

ii) Making a sketch- location plan- (see sample sketch below) on the site, showing the entrance, pathways, trees, any structures, sitting or play areas etc. and noting features in the vicinity (within 50m) of the site, such as buildings, roads etc.

These sketches were later neatly redrawn annotated and coloured and incorporated in the Data Sheets. In order to attain uniformity in preparation of sketches, guidelines were prepared. (Refer Annexure 4) Line thicknesses, symbols and colour codes to denote site boundary, built forms, pathways, trees, bund walls and other details within the site as well as for all details within 50 m radius of the site, were defined.

iii) Taking photographs to show the condition of the site and the surrounding area. The photographs show approach roads, access to the site (any gates, name boards, etc.), edge condition i.e. fence or compound wall, vegetation on the site, facilities like benches, play equipment, paved walkway, etc. In case the site is built upon, the building or slums on site have been photographed.



Sample Final Sketch

2.3.2 DOCUMENTATION:

All the data collected during field visits was documented in:

1. Data Sheets (one sheet for each site).
2. Tabular Sheet (one sheet for all 3246 sites)

1. Documentation in Data Sheet

Data Sheet is a concise format for ready reference (Refer Annexure 5). The data for each site is given in a 2-page format comprising:

- 1) **Basic data** such as name of the site, adjacent roads, City Survey (CS) No., DP classification, its area, scale, ownership, current user etc.
- 2) **A brief description** of the site giving the current usage, its accessibility, details about predominant users such as age group, socio – economic group, gender, numbers visiting daily etc., the status of infrastructure and facilities available on the site, whether there is an edge definition, usage and salient features of the surrounding area, etc.
- 3) **A cropping from the DP sheet** showing the site under reference, adjacent roads and area within 50 m radius of the site. The site under reference is highlighted with a bold out line in green colour. This is done in order to identify it, from any other open spaces in the immediate vicinity.
- 4) **An annotated sketch plan** showing details such as entry, landscaped & paved areas, trees, benches, any structure/s on site and abutting roads, buildings and other details within 50 m radius of the site.
In order to attain uniformity in preparation of sketches, guidelines were prepared. Line thicknesses, symbols and colour codes to denote site boundary, built forms, pathways, trees, bund walls and other details within the site as well as for all details within 50 m radius of the site, were defined.
This sketch has the same orientation as the DP cropping. Hence a comparison of the DP reservation with the current status can be done easily.
- 5) **Photographs** showing the condition of the site and surrounding area. The approach to the site, its edge condition (fence, compound wall, gates, etc.), any paved pathways on the site, vegetation, facilities like benches, play equipment, special features like fountains or statues have been photographed wherever possible. In case there are any built structures on the site, these too have been recorded.

2. Documentation in Tabular Sheet

Tabular Sheet is a detailed and technical format which includes ward-wise compilation of all data collected for each open space in tabular form.

As per the Terms of Reference, the following details were to be listed

Sr. No.	Name of Open Space	DP Classification	Ward	Area (Sqm)	C.S. No.	Existing Use	Owner /Occupier/ User	Land uses along edges	Threats
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However, as the survey progressed, it was felt necessary to modify & expand these heads to finally include:

1. **Scale**
2. **Classification & Status**
3. **Current Land utilization within the open space**
4. **Any additional usage of the site**
5. **Ownership**
6. **Maintenance**
7. **Predominant users of the site**
8. **Infrastructure and facilities available in the site**
9. **Accessibility of the site**
10. **Externalities i.e. the conditions within 50 m radius of the site such as land use, density, other open spaces, etc.**
11. **Threats to the site**
12. **Environmental Parameters such as vegetation, presence of mangroves, salt pans, etc. as well as any significant topographical conditions.**

Parameters, Sub-parameters and Attributes:

The data is thus compiled under these **12 parameters**.

Each parameter is further divided into several **sub-parameters**.

The various 'options' possible under each sub- parameters are called **attributes** of that particular sub-parameter.

For e.g. the **parameter 'accessibility'** has four sub-parameters viz.

- a) Knowledge about the site
- b) Visibility
- c) Edge condition
- d) Entry

The sub-parameter 'Entry' has the following attributes (options):

- i) Free ii) Fee charge iii) Restricted and iv) Inaccessible

The data in the Tabular Sheet is represented under 74 columns and 3246 rows.

Each column in the table represents a particular sub-parameter and the particular Attribute relevant to the open space in noted therein. Each row of the table is dedicated to one site.

The explanation / definitions for all the 12 parameters, their sub divisions into sub-parameters and the various attributes of the sub-parameters is given below. The significance of each parameter and the perceived potentials of or threats to an Open Space with respect to the parameter is also discussed.

SCALE - PARAMETER (I)	
Explanation: This pertains to the size (area) of the site. It has been given on the 1991 DP. Where the area is not available on the DP, it has been computed from the AutoCAD Map.	
SUB- PARAMETERS	ATTRIBUTES
None	<ul style="list-style-type: none"> • Small- Area upto 2,000 Sqm • Medium- Area more than 2,000 Sqm but not more than 10,000 Sqm • Large- Area more than 10,000 Sqm
<p>Significance: This parameter is not highly significant and is more a physical data</p> <p>Potential / Threat: A small or medium scale open space can be a neighbourhood level space. A large open space has the potential to be a ward level or a city level space</p>	

CLASSIFICATION & STATUS - PARAMETER (II)	
Explanation: This has reference to the 1991 Development Plan	
SUB- PARAMETERS	ATTRIBUTES
1. DP classification: This explains what the site is reserved for	<ul style="list-style-type: none"> • RG- Recreation Ground • PG- Playground • G- Garden • Green Belt • Other- Other than any of the above, such as Stadium, Golf Course, Park etc.
2. DP condition: This explains the condition or status of the site as per 1991 DP	<ul style="list-style-type: none"> • Existing-This means the sites which have been shown as 'existing' in the 1991 DP. They are indicated with green colour and are hatched (have inclined black lines) • Proposed-This means the sites which were 'proposed' as new open space sites when the DP was made. They are indicated with plain green colour only.
3. % of Built Area: In case there is any structure (built form) on the site, the percentage of site area covered by it.	<ul style="list-style-type: none"> • 0%, 10%, 20%,100%
4. Existing Condition: Based on the percentage of site area that is built upon (i.e. covered by a structure), sites have been categorized	<ul style="list-style-type: none"> • Open: A site which is 100% open (i.e. no structure built on it) or one which is built upon but the plinth area of the structure thereon does not exceed 30% of total site area. • Semi-occupied: A site which is built upon and the plinth area of the structure thereon is more than 30% but not more than 70% of the total site area. • Occupied: A site which is built upon and the plinth area of the structure thereon is more than 70% of the total site area
<p>Significance:</p> <ul style="list-style-type: none"> ❖ Sub-parameters 1 & 2 are only a part of the information available in the 1991 DP. They are not significant to the condition or quality of the open space and hence not considered for grading purpose ❖ Sub-parameter 4 is very significant. Site which are 'open' or 'semi – occupied' qualify to be called 'available' spaces – whether developed or not developed. Sites which are 'occupied' have practically no open area left (less than 30%) which can be used by the public and hence do not qualify to be called 'available' <p>Potential / Threat: A semi-occupied space may be considered under threat. If there is already some construction on the site, the balance open area is likely to be encroached in future</p>	

USAGE - PARAMETER (III)	
Explanation: This parameter explains what the site is primarily used for	
SUB- PARAMETERS	ATTRIBUTES
1. Stadium: Whether the site is functional as a stadium with a playing field, covered or uncovered seating at the sides etc.	The Attributes for all these Sub-Parameters are: <ul style="list-style-type: none"> • Yes • No
2. Garden: Whether the site is used as a garden with play equipment, walking or jogging track, facilities for sitting, good vegetation etc.	
3. Club: Whether there is a sports club on the site and hence the open space used for sports	
4. Playground: Whether the site is an outdoor playing field	
5. Parking: Whether the entire site or any part of it is used for parking	
6. Hawking / temporary shops: Whether the site is (either partially or wholly) used by hawkers or has temporary shops.	
7. Public utilities: Whether there are utilities such as pylons, pipelines, sewage pumping stations etc.	
8. Defecation / Sewage dumping: Whether the site is misused for these activities	
9. Garbage / debris dumping: Whether there is garbage dumping and burning done on site and / or debris dumping	
10. Slums: Whether the site or any part of it is encroached by slums	
11. Land not in use: A site may be open (i.e. not encroached by built forms) but not developed and not used by people for recreational purposes. As a result it may have wild vegetation or have garbage and / or debris dumped on it or it may be used for defecation	
12. Construction on the site: A public or a privately owned building may be occupying the entire or part of the site	
Significance: Usage of the site is a highly significant parameter. Uses like Stadium, Garden, Playground are positive to the quality of an open space whereas parking, hawking, garbage / debris dumping are negative to the quality of an open space since they do not encourage people to use these spaces	
Potential / Threat: Uses like slums or building construction are threats to open spaces. The sub-parameter 'Land not in use' is considered as a potential, since such a space can be cleared of unwanted elements like wild vegetation, garbage, debris etc. and developed for public use.	

OCCASIONAL USAGE - PARAMETER (IV)	
Explanation: Apart from the everyday use of the site, it may be used periodically for a specific purpose such as for political meetings, for social and religious gatherings during festivals. Such uses have been noted here	
SUB- PARAMETERS	ATTRIBUTES
1. Recreational	The Attributes for all these Sub-Parameters are: <ul style="list-style-type: none"> • Yes • No
2. Religious / Cultural / Social	
3. Sports / Educational	
4. Political	

OWNERSHIP - PARAMETER (V)	
<p>Explanation: Ownership has been noted on the basis of</p> <p>a) boards put up at the site b) inquiries conducted in the local ward office c) data available in 'know your ward' booklet available in the ward office</p> <p>Lists of MCGM owned Open Space sites were procured from the respective ward offices. They were co-related to the documentation and the data updated wherever necessary</p>	
SUB- PARAMETERS	ATTRIBUTES
1. Owner	MCGM, MMRDA, MHADA, Defense, BPT, Private party etc.
2. Maintained by	<ul style="list-style-type: none"> • Owner • Current User • Any other (Sponsor/s) • None
<p>Potential / Threat: A site owned by the Government or a Government Agency, Planning Authority etc. but encroached upon has the potential to be retrieved as an open space</p>	

MAINTENANCE - PARAMETER (VI)	
<p>Explanation: This is data on the present condition of the site. The assessment is based on the cleanliness of the site (i.e. whether properly swept, garbage and litter cleared & accumulation prevented), appearance of the trees & shrubs (whether they are watered, trimmed etc., grass mowed), appearance of play equipment (whether in working order) etc.</p>	
SUB- PARAMETERS	ATTRIBUTES
1. Extent of Maintenance	<ul style="list-style-type: none"> • Good • Fair • Poor • None
2. Staff employed	<ul style="list-style-type: none"> • Security Guard • Gardener • Both • None <p>This has been judged by the presence of the staff or a cabin or by enquiries with people visiting the site</p>
<p>Significance: This is of moderate significance to the open space. Better the maintenance, better would be its usability</p>	

PREDOMINANT USER - PARAMETER (VII)	
<p>Explanation: This data is based on the surveyor's observations and inquiries with any staff on the site and / or with people visiting the site or in the vicinity</p>	
SUB- PARAMETERS	ATTRIBUTES
1. Age group- predominant age group using the site	<ul style="list-style-type: none"> • Children • Youth • Adults • Senior Citizens • All
2. No. of people visiting the site daily- estimation based on field observations &/or by local inquiries as well as by judgement based on the size, location & nature of the space	<ul style="list-style-type: none"> • Upto 200 • 200-500 • Above 500.....etc.

3. Socio-Economic group	<ul style="list-style-type: none"> • Poor • Middle class • Rich • All
4. Gender	<ul style="list-style-type: none"> • Male • Female • Both
5. Catchment Area	<ul style="list-style-type: none"> • Upto 2 km • 2-5 km • Above 5 km
6. Time of the day the site is used	<ul style="list-style-type: none"> • Morning • Afternoon • Evening • Morning & Evening • Whole day
<p>Significance: This parameter has a relatively low significance. As long as an open space is developed and in use, the gender, socio-economic class etc. will not impact its quality or usability significantly.</p> <p>Potential / Threat: If it has a catchment area of more than 5 km, it has the potential to be a city level space. An open space used at night may potentially be a threat due to unwanted activities & nuisance.</p>	

INFRASTRUCTURE & FACILITIES - PARAMETER (VIII)	
<p>Explanation: The data for this parameter has been collected by field observations, based on pre-defined guidelines.</p>	
SUB- PARAMETERS	ATTRIBUTES
A. INFRASTRUCTURE	
1. Water Supply: Ascertained on the basis of whether the site has a water point. The supply of water whether good, fair etc. has been judged by inquiries as well as by the appearance of the vegetation.	<p>The Attributes for all these Sub-Parameters are:</p> <ul style="list-style-type: none"> • Good • Fair • Poor • None
2. Drainage: This refers to storm water drainage. The status has been assessed on the basis of actual drain channels seen on the site and on the condition of the site (whether water – logged during monsoon). For sites visited during dry season, inquiries were conducted among the local people.	
3. Lights: Estimation of status of lights has been based on the number of lights with respect to the area of the site as also their condition– whether working or not operational.	
4. Toilets: Their status has been noted with respect to the cleanliness or the lack of it observed on site.	
5. Garbage collection bins: Whether there are adequate number of bins on the site as well as presence or absence of litter has been observed.	
B. FACILITIES	
1. Jogging track	<p>The Attributes for all these Sub-Parameters are:</p> <p>Yes No</p>
2. Play area / equipment	
3. Sitting area	
4. Nursery	
5. Caretaker's Room	
<p>Significance: This parameter is of significance because better the quality of infrastructure and better the facilities provided, greater is its usability.</p> <p>Potential / Threats: An open space with poor or no infrastructure has less chance of being used for recreational purpose. It can then be a threat as it can lead to unwanted activities like garbage or debris dumping, defecation etc.</p>	

ACCESSIBILITY - PARAMETER (IX)	
Explanation: Data for this parameter is based predominantly on field observations & some on local inquiry	
SUB- PARAMETERS	ATTRIBUTES
1. Knowledge about the site- This data is based on local inquiry	<ul style="list-style-type: none"> • Known to many (people) • Not known to many (people)
2. Visibility of the site from a distance	<ul style="list-style-type: none"> • Visible from 50 m • Not visible
3. Edge condition: whether there is a fence / compound wall, etc.	<ul style="list-style-type: none"> • Defined • Not defined
4. Entry to the site	<ul style="list-style-type: none"> • Free: Open to public without payment of any fees • Fee charged: can be entered only on the payment of an entry fee • Restricted: entry is restricted to a particular category or group of persons only. e.g. When an open space forms part of a club or a gymkhana, entry is granted only to its members • Inaccessible: not possible to reach a site either because there is no road leading to it or because it is surrounded by structures and / or by other obstacles.
<p>Significance: It is one of the most important parameters. Knowledge about the presence of the site and its visibility from 50 m implies that it is more likely to be used. An open space accessible by road and free to public would also have better usability.</p> <p>Potential / Threats: An open space with no proper defined edge has greater threat of encroachment. An open space not accessible by road has the potential to be developed as an open space if a proper access is created.</p>	

SURROUNDING LAND USE - PARAMETER (X)	
Explanation: The area within 50 m radius of the site was surveyed. The observations have been documented under several sub-parameters	
SUB- PARAMETERS	ATTRIBUTES
1. Predominant land use / activity in the vicinity	<ul style="list-style-type: none"> • Residential • Commercial • Industrial • Institutional • Religious • Slums • Mixed
2 Population density	<ul style="list-style-type: none"> • Low • Fair • High
3. Whether surrounding area is susceptible to flooding during monsoon. For sites surveyed in dry season, inquiries were instituted among locals. The condition of storm water drains in the vicinity was also observed.	Yes No
4. Whether surrounding area is susceptible to landslides	The Attributes for all these Sub-Parameters are: <ul style="list-style-type: none"> • Yes • No
5. Whether surrounding area is susceptible to dumping and / or burning of garbage	
6. Whether surrounding area is susceptible to defecation	
7. Whether surrounding area is susceptible to sewage disposal	
8. Whether surrounding area is susceptible to debris dumping	
9. The number of open spaces within 1 km. radius of the site	0,1,2,3,.....
10. Predominant nature of open spaces in the vicinity whether RG, PG, G etc.	<ul style="list-style-type: none"> • RG- Recreation Ground • PG- Playground • G- Garden • Green Belt • Other- Other than any of the above, such as Stadium, Golf Course, Park etc.

<p>Significance: The land use immediately around the open space site will have a direct impact on the quality and usability of that space. A high density residential land use in the vicinity would mean that the open space would be better used. An industrial land use may deter the people from using the open space due to air pollution, noise pollution etc. Similarly flooding, landslides etc. in the neighbourhood would not attract the people to use the open space.</p> <p>Potential / Threats: Garbage and / or debris dumping, sewage disposal, defecation in the vicinity of the site are threats to the open spaces. Presence of other open spaces is potentially good for an open space site.</p>
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THREATS - PARAMETER (XI)	
Explanation: Perceived threats' is one of the most important parameters and has been qualified by several sub-parameters	
SUB- PARAMETERS	ATTRIBUTES
1. Private appropriation of space: An open space which is used exclusively by private parties or groups of people and the public is prevented or deterred from using it is considered as privately appropriated	The Attributes for all these Sub-Parameters are: <ul style="list-style-type: none"> • Yes • No
2. Ongoing construction activity on the site	
3. Acquired for Infrastructure projects: This refers to an open space which is taken over by MCGM / MMRDA / State Govt. or any authority because it is in the path of any of its infrastructure projects such as flyover, Monorail etc.	
4. Unwanted activities: An open space is perceived to be threatened if it is used for activities such as drinking, drug consumption and peddling etc. In such a case, people avoid visiting such sites and gradually it ceases to be used as a recreational space.	
Significance: Threat as a parameter is very important since it directly affects the usability. Any of the above mentioned sub-parameters, if applicable to the site, means the site is in danger and would cease to qualify as an open space.	

ENVIRONMENTAL PARAMETERS - PARAMETER (XII)	
Explanation: Data about this parameter includes information about type of vegetation on the site and presence, if any, of important environmental features such as mangroves, salt pans. etc.	
SUB- PARAMETERS	ATTRIBUTES
1. Type of vegetation: Primarily, the density of trees has decided whether the vegetation is dense, fair, sparse etc. Shrubs are considered only to define 'open scrub' and ground cover has not been considered at all since it is transient – varying with the season. For instance, during monsoon, some ground cover is to be seen on most of the sites.	<ul style="list-style-type: none"> • Dense: plenty of trees well distributed throughout the site, especially in clusters • Fair: Where there are trees only along the periphery of the site and / or in a few small clusters on the site • Sparse: Where there are very few trees on the site • Barren: Absence of any vegetation on the site • Open scrub: Only unkempt wild shrubs on the site
2. Whether the site is low lying and hence prone to water logging	Yes No
3. Whether there are any salt pans or mangroves extensively on the site	Yes No
4. Presence of any particular features such as a rocky outcrop, hills, steep slope etc. on the site	Yes No
Significance: Apart from being available to public for recreation, an open space with its green cover is important to the city environmentally, as a 'lung' or as a 'carbon sink' to counter balance the ill effects of air pollution, as a 'sponge' to absorb rain water and thus prevent flooding. Salt pans, mangroves are very important features which need to be preserved. Proximity of a site to other environmental features may signify that it is part of a particular eco system supporting particular species of flora or fauna.	
Potential / Threats: An open space extensively covered by mangroves has the potential to be developed as a Mangrove Wetland Centre.	

2.3.3 WARD WISE SUMMARY

After documenting all data, a summary was prepared for each ward. This comprises:

- A. Statistical Summary
- B. Qualitative Summary

A. Statistical Summary:

Table 2 : Sample Ward Summary-'H-WEST' WARD

I	Basic Data			
a)	Area of Ward (Ha)			1155
b)	Population (as per 2001 Census)			337391
c)	Population density = (b / a)			292

	Open Spaces	No. of Sites	Area (Sqm.)	% w.r.t. 1991 DP
II	Open Space Reservations as per 1991 DP	112	589944.47	100
1)	Open Spaces Not Available as per 2010 Survey	29	95148.85	16.1
2)	Open Spaces Available as per 2010 Survey = (II-1)	83	494795.62	83.9
2A)	Available Open Spaces which are not 'In Use'	19	177518.38	30.1
2B)	Available Open Spaces which are 'In Use' = (2-2A)	64	317277.24	53.8
	i) Available & 'In Use' Spaces which are not developed	0	0.00	0.0
	ii) Available & 'In Use' Spaces which are developed = (2B-2Bi)	64	317277.24	53.8
	a) Available, 'In Use', & Developed Spaces which have Restricted Entry	25	95705.36	16.2
	b) Available, 'In Use', & Developed Spaces which are open to public = (2Bii-2Bii a)	39	221571.88	37.6
III	Per Capita Open Space			
a)	Per Capita Open Space as per 1991 DP = (II) / (I b)		1.75	
b)	Per Capita Open Space Available as per 2010 Survey = (2) / (I b)		1.47	

Table 3: SUMMARY- GREATER MUMBAI

	BASIC DATA			OPEN SPACES			PER CAPITA OPEN SPACE		
	AREA OF WARD (Hectares)	POPULATION (as per 2001 Census)	POPULATION DENSITY (persons per Hectare)	AREA OF OPEN SPACES AS PER 1991 DP (Ha)	AREA OF OPEN SPACES AVAILABLE AS PER 2010 SURVEY (Ha)	AREA OF OPEN SPACES AVAILABLE, IN USE, DEVELOPED & OPEN TO PUBLIC AS PER 2010 SURVEY (Ha)	PER CAPITA OPEN SPACE AS PER 1991 DP (Sq.m.)	PER CAPITA OPEN SPACE AVAILABLE AS PER 2010 SURVEY (Sq.m.)	PER CAPITA OPEN SPACE AVAILABLE, IN USE, DEVELOPED & OPEN TO PUBLIC AS PER 2010 SURVEY (Ha)
A	1250	210847	169	135.43	127.52	74.73	6.42	6.05	3.54
B	247	140633	569	8.25	3.53	3.29	0.59	0.25	0.23
C	178	202922	1140	16.40	13.09	3.32	0.81	0.65	0.16
D	663	382841	577	86.12	75.77	37.54	2.25	1.98	0.98
E	740	440335	595	71.11	40.84	34.06	1.61	0.93	0.77
F-S	1400	396122	283	47.54	30.96	14.33	1.20	0.78	0.36
F-N	1298	524393	404	123.65	93.84	40.72	2.36	1.79	0.78
G-S	1000	457931	458	130.35	123.25	116.70	2.85	2.69	2.55
G-N	907	582007	642	38.91	33.72	25.28	0.67	0.58	0.43
H-E	1353	580835	429	64.20	51.16	8.74	1.11	0.88	0.15
H-W	1155	337391	292	58.99	49.48	22.16	1.75	1.47	0.66
K-E	2350	810002	345	149.09	104.99	61.54	1.84	1.30	0.76
K-W	2329	700680	301	278.09	239.58	60.76	3.97	3.42	0.87
P-S	2956	437849	148	107.09	73.36	43.82	2.45	1.68	1.00
P-N	1913	798775	418	221.40	165.26	72.40	2.77	2.07	0.91
R-S	1778	589887	332	145.99	99.34	71.59	2.47	1.68	1.21
R-C	5000	513077	103	106.71	87.91	47.03	2.08	1.71	0.92
R-N	1800	363827	202	111.77	78.32	36.19	3.07	2.15	0.99
L	1346	778218	578	263.11	73.07	30.31	3.38	0.94	0.39
M-E	3250	674850	208	49.95	46.29	14.70	0.74	0.69	0.22
M-W	1950	414050	212	235.68	223.48	62.33	5.69	5.40	1.51
N	3900	619556	159	133.33	118.29	32.34	2.15	1.91	0.52
S	6400	691227	108	165.61	124.95	51.86	2.40	1.81	0.75
T	4541	330195	73	219.54	205.88	36.86	6.65	6.24	1.12
TOTAL	49704	11978450	241	2968.30	2283.90	1002.59	2.48	1.91	0.84

This Statistical Summary has been compiled for the entire city of Greater Mumbai.

These summaries are directly derived from the empirical data and give the following details:

I) Basic data i.e. a) Area of ward, b) Population, c) Population density

II) Open space Area & Numbers: As per 1991 DP reservations.

This data has been further qualified as follows:

- i) Number and Area of sites Available as per Survey i.e. sum of areas of all the sites which are not occupied. This is the area which is actually available currently which can be used as 'Open Space'.
- ii) Out of the Available , sites are
- iii) 'In Use' or 'Not in Use'
- iv) Out of Available & In Use, sites are
- v) Developed or Not developed
- vi) Out of Available, In Use & Developed, sites are restricted to the general public or have free access III)
Per Capita open space: a) As per 1991 DP, b) As per our Survey (all Available spaces)

B. Qualitative Summary: Statistical Summary does not throw light on the qualitative aspects of the open spaces. Hence in addition, an overview of each ward has been taken with respect to the

- a) distribution of spaces within the ward
- b) distribution of population
- c) any very large open space/s not accessible to public
- d) large scale encroachments by slums, private buildings etc.
- e) reservations on salt pans, mangroves and hence not usable as RG/ PG/ G
- f) any problems peculiar to the ward

2.4 STAGE 4: GRADING AND CLASSIFICATION OF OPEN SPACES

In order to analyze the data and determine which sites are critical and require immediate attention, the sites had to be '**graded**' i.e. assigned some values or 'marks'. The process of grading of open spaces involved:

- a) Identification of parameters and Sub-parameters for grading purpose.
- b) Evolution of a grading system which in turn involved:
 - i) Assigning weights to various parameters
 - ii) Assigning scores to various attributes
 - iii) Calculating the total score or value of a site
- c) Application of grading criteria to all open spaces

2.4.1 IDENTIFICATION OF PARAMETERS AND SUB-PARAMETERS FOR GRADING PURPOSE

All 12 parameters documented for condition assessment have been considered for the purpose of grading. However, some sub-parameters have not been assigned any score and hence do not contribute to the total score of the open space. They are:

1. DP Classification i.e. whether the reservation is for an RG, PG, G etc.
2. DP Condition i.e. Existing or Proposed with respect to 1991 DP
3. Usage – Public Utilities
4. User / Occupier of the site
5. Site maintained by-whether owner, occupier, etc.
6. No. of non-occupied open spaces in the vicinity
7. Kind of open spaces in the vicinity

2.4.2 EVOLUTION OF GRADING SYSTEM

i) Assigning weights to various parameters

In order to evolve a system to assign weights to various parameters, 3 rounds of discussions were held.

Round 1: Our in-house team of 8 members comprising field surveyors, architects and planning consultants.

Round 2: Our panel of experts comprising:

- a) Dr. Suresh Jog - Geographer with special expertise in environmental issues and statistical analysis
- b) Dr. Smita Gandhi - Geographer, Head of the Department of Geography, University of Mumbai
- c) Ms. Pallavi Latkar - Environmental Planner
- d) Mr. Arvind Katdare – ex Executive Engineer, Development Plan, MCGM
- e) Mr. Dinesh Naik - Asst. Engineer, Development Plan, MCGM

Round 3: Team of planners from MMRDA

Round 1: With In-House Team

Two systems based on SWOT Analysis were worked out. But the 2 methods were found to be complicated. Distributing the various attributes under all sub-parameters in SWOT criteria (Strengths, Weakness, Opportunity, Threat), comparison of their relative importance within the particular criterion and rating the attribute accordingly proved to be a tedious process. Further, the comparison of attributes to judge their relative importance within a particular criterion appeared more subjective than objective.

Round 2: With Panel Of Experts

Later, a simpler method based on logic rather than on a statistical model was evolved. The objective of the grading process is to reach the next stage of the Action Plan which is to identify spaces which require immediate attention, those which require attention (though not immediate) and those which require only maintenance. With the above objective in mind, each parameter was assigned a weight based on the degree of impact it has on the open space. For this, all parameters were first classified as 'high', 'medium' and 'low', signifying the degree of impact. e.g. The current status of the site whether it is 'open', 'semi – occupied' or 'occupied' is of great importance and hence assigned a high weight. The data collected under 'Predominant User' is based on inquiries with people visiting the site, the staff and people in the vicinity and is therefore more subjective. Moreover, as long as a site is in use, whether it is used by children or senior citizens or all age groups or whether it is used by the poor, rich or all classes, is not of great significance. Hence it was assigned a low weight.

The basis of assigning weights was as follows:

- a) All high impact parameters together - 50% weight.
- b) All medium impact parameters together- 30% weight.
- c) All low impact parameters together- 20% weight.

However, this meant that each of the parameters under 'high' impact has equal weight. Same is the case with the other two categories of 'medium' and 'low' impact.

Round 3: With MMRDA Planners

After discussion with MMRDA planners, it was agreed upon that a simple statistical tool be used to finalize the weights for the parameters. Hence, a statistical method known as **Pairwise Comparison Technique** was adopted. It is a tool to rank a set of decision-making criteria (in this case the various parameters) and rate them on a relative scale of importance. It can be very difficult to rank and weight criteria. It may be insurmountable in complex problems because every criterion must be weighted with respect to every other criterion; this is a problem that grows arithmetically. (For example, given 5 criteria, there are $4+3+2+1=10$ relationships to consider, and for 10 criteria there are 45 relationships to consider). *Pairwise Comparison* is one way to determine how to evaluate alternatives by providing an easy and reliable means to rate and rank decision-making criteria.

Pairwise Comparison is implemented in two stages: Stage 1: determine qualitatively which criteria (parameters) are more important – i.e. rank the criteria in their order of importance, and Stage 2: assign to each criterion (parameter) a quantitative weight or value such that the qualitative ranking is satisfied.

Stage 1: Create Ranking: In this method, each parameter is compared with every other parameter, one at a time, i.e. in 'pairs'. For instance, the first parameter 'scale' is compared with each of the balance 11 parameters. For this, the parameters are arranged in an XxY Matrix. That is to say, a table is prepared with all the parameters listed along both 'X' and 'Y' axes. (Refer Annexure 6).

Now consider the parameter in the first row of the table-'Scale'. This is to be compared with the parameters listed in each of the columns. Thus 'scale' is compared with the parameter in the first column 'Status' i.e. the existing status of the site-whether it is available or not as an open space. It is represented in the intersecting cell. For instance, if status is more important of the two, (*in this case, towards a site being a good publicly usable open space*) 'ST' is written in the relevant cell-the cell in row 'scale', under column 'status'. 'Scale' is then compared with 'Usage', the parameter in the next column. The process is repeated for all the rows. In this stage, one assesses qualitatively which parameter is more important in a given pair. Duplication of comparison is avoided. For example, once 'scale' is compared with 'status' in the first row, 'status' in row 2 is not compared again with 'scale'. Thus, only the cells shown white in the table are to be filled. This completes the first stage.

Stage 2: Assign Weights: The parameters are listed and the number of cells representing each parameter as per stage 1 are counted and written down alongside. These numbers are then converted into percentages. In our case, the total number of comparisons (represented by the filled in cells) is 66. Hence, if 66 corresponds to 100, then each cell represents approx. 1.5%. This gives the percentage importance, known as 'weight' of each parameter within all the parameters put together. (Refer Annexure 7) showing distribution of weights). The weights are rounded off. Sometimes, a parameter may get a weight of zero. But this does not mean that it can be completely ignored. So, if there is a parameter that appears to have zero importance, a fractional amount from other parameters is borrowed and given to that last-ranked parameter. Hence it is assigned 1% weight.

In order to avoid personal biases in ranking the parameters, another widely used method, the '**Delphi Method**' was adopted. This method is based on the assumption that group judgements are more valid than individual judgments and that decisions from a structured group of individuals are more accurate than those from unstructured groups. This has been indicated with the term "collective intelligence". The technique when adopted for use in face-to-face meetings is called **Mini-Delphi**. For this method to succeed, it is necessary to have well informed, intelligent people.

Eleven persons with varied backgrounds, but pertinent to the project, were called upon to use the **Pairwise Comparison Technique** to rank the various parameters. Some were associated with the project, while some were entirely new to it. The project, its objective, scope, and the methodology adopted were outlined to those not associated with the project. The various parameters were explained in detail and some of the documentation was shown to them.

1. Ms. Shivani Singh- Architect and Urban Planner, Head of Dept., Institute of Urban and Regional Planning, Rachana Sansad, Mumbai
2. Mr. Bhaskar Sawant- Founder & Head, Maidan Bachao Samiti, an activist group involved in motivating people to save the playgrounds of Mumbai.
3. Mr. Arun Kale- Architect, visiting faculty, Rizvi College of Architecture, Mumbai, Project Team Leader
4. Ms. Parul Kumtha -Architect and Co-ordinator, Citispace, an NGO fighting to save public open spaces
5. Ms. Tanya Mahajan- Architect, working with NGO Karmayog
6. Mr. Isaac Mathew- Architect, Urban Researcher
7. Ms. Ranjana Mistry- Landscape Contractor
8. Ms. Amita Sardesai- Architect & Project Team Leader
9. Mr. Swapnil Bhole- Architect & Project Team Member
10. Ms. Trupti Amritwar- Architect and Planner, Head of Rachana Sansad Urban Design Cell
11. Ms. Radhika Mathur- Architect and Planner, Project Team Member, Member of Rachana Sansad Urban Design Cell

The results of the Pairwise Comparison Technique obtained from the above 11 members were averaged and the parameter weights were finalized (Refer Annexures 8 & 9).

ii) Assigning scores to various attributes

Scores were assigned to all the attributes of each sub-parameter considered for grading. The possible scores for any attribute are 5,10 ,15. The attribute contributing positively towards a site being a good open space scores 5. That which contributes negatively towards a site being a good open space scores 10. The attribute 'NA' scores 15. 'NA' indicates that the particular sub-parameter is not applicable. This is predominantly in case of sites which are more than 70% built upon and hence no longer available as open spaces. The attribute 'NA' therefore, indicates the worst situation. The system of scores is illustrated by the following example:

The parameter 'Maintenance' has 2 sub-parameters viz. Extent of maintenance & Staff employed on site. The attributes for Extent of Maintenance are: good, fair, poor, none, NA. Thus good & fair score 5, poor & none score 10 and NA scores 15. The attributes for Staff employed at site are: security guard, gardener, both, none and NA. Of these, 'both' scores 5, security guard & gardener (i.e. only one person employed) score 10, none and NA score 15.

Table 4: Sample- Assigning scores to attributes

WEIGHT (W)	PARAMETER	SUB PARAMETERS	Attribute Score = 5/15	Attribute Score = 10/15	Attribute Score = 15/15
5.0	OCCASIONAL USAGE	Religious, Socio-cultural, Sports, Political	Yes	No	NA
5.0	OWNERSHIP	State Govt., Central Govt., Private	Private	Central Govt.	State Govt.
5.0	PREDOMINANT USERS	Age group, Socio-economic group, Gender	Good, Fair	Poor, None	NA
		No. of People	Above 2500	501- 2500	Upto 500
		Catchment Area	Above 5 km	2- 5 km	Upto 2 km
		Time of use	Whole day, Morning & Evening	Any one particular time	NA
5.0	SURROUNDING CONDITION	Predominant land use	Comm., Inst., Indust.	Resd., Stn., Market	NA
		Density	Fair	High	NA
		Susceptible to Floods, Landslides, Garbage/ Debris dumping, Defecation	No	Yes	NA

Site Score= \sum [Parameter Weight / No. of Sub-Parameters x (Attribute Score/Max. Score)]

iii) Calculating the total score of a site

Discussions were held with members of MMR-EIS as well as with MMRDA Planners to finalize the system of score calculation. Following are the stages of calculation of score for a site:

- score of an attribute: the attribute score is 5, 10, 15 as already explained above.
- score of a sub-parameter: this is calculated as attribute score/ maximum score. The maximum score in all cases is 15. Hence, a sub-parameter may score 5/15 i.e. 0.3333 or 10/15 i.e. 0.6666 or 15/15 i.e. 1.
- score of a parameter: this is generally the sum of the scores of all the sub-parameters of that parameter multiplied by the parameter weight. However, the number of sub-parameters under each parameter is not the same. Hence the parameter weight is divided by the number of sub-parameters.
- score of a site: this is the sum of the scores of all the parameters.

This can be summarized as:

$$\begin{aligned} \text{Score of a site} &= \sum \text{Parameter scores} \\ &= \sum (\text{Parameter weight/ No. of sub-parameters}) \times (\text{Sub-parameter scores}) \\ &= \sum [(\text{Parameter weight/ No. of sub-parameters}) \times (\text{Attribute score/ Maximum score})] \end{aligned}$$

This leads us to the final equation:

$$\text{Score of a site} = \sum [(\text{Parameter weight/ No. of sub-parameters}) \times (\text{Attribute score/ Maximum score})]$$

2.4.3 APPLICATION OF GRADING CRITERIA TO ALL OPEN SPACES

After assigning weights, scores and finalizing the system of score calculation, scores were calculated for each of the 3246 open space sites in the 24 Municipal wards of Greater Mumbai.

2.4.4 CLASSIFICATION OF OPEN SPACES

After applying the grading system and calculating the scores for each open space, the sites were divided into 3 categories.

They were designated as C1, C2 and C3, with the highest scoring sites as C1 and the lowest as C3.

C1- High scores - Need Immediate Attention

C2- Medium scores - Need Attention

C3- Low scores - Need Maintenance

It may be noted that sites with more than 70% built area are not included in these categories since they do not qualify to be considered as 'available' open spaces. Out of 3246 open space sites in Greater Mumbai, 2412 are still 'available' as open spaces. In order to decide the range of scores for the various categories, the following method was used.

Range of Scores:

1. A hypothetical 'best' site was worked out by taking all the attributes which would contribute towards it being 'best'. The score for such a site was computed. This score is 38.91.
2. ii) A hypothetical 'worst' site was worked out by taking all the attributes which would contribute towards it being 'worst'. The score for such a site was computed. This score is 68.60.
3. iii) A hypothetical site which is good otherwise but very poor in maintenance was worked out by choosing the relevant attributes. This signifies a site which badly requires maintenance. The score for such a site was computed. This score is 52.01.

Thus the approximate ranges of scores of the 3 categories are:

C1- 60 to 68

C2- between 50 & 60

C3- 35 to 50

Sites which need Immediate Attention: There are 47 sites in C1 category (Refer Annexure 12). These sites have several critical issues which need to be addressed urgently.

The issues and the methodology for dealing with them have been discussed in the Action Plan.

2.5: STAGE 5: FINDINGS & ANALYSIS

In order to formulate an Action Plan for these Open Spaces, it was necessary to know:

- various issues and problems involved
- Open Spaces which are most threatened and those which need to be protected and developed on a priority basis
- provisions in the current rules and regulations for their protection
- current policies and practices for their development and maintenance.

Findings:

- Statistical Findings such as Areas of Open Spaces, Per Capita Index, Proximity of open space
- Findings with respect to of Open Space Reservations as shown in 1991 DP
- Issues emerged out of the study, with respect to important parameters such as accessibility, visibility, safety, security and usability.

Analysis:

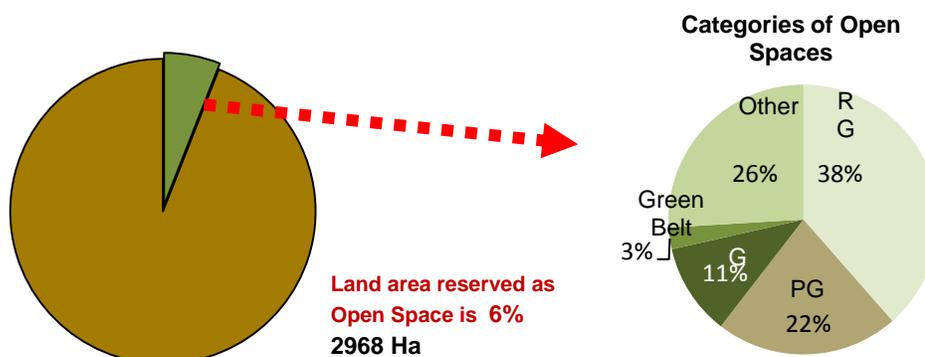
- Analysis of Existing Regulatory framework
- Analysis of current Management Practices and Implementation Mechanisms

2.5.1. STATISTICAL FINDINGS

1. Areas and Percentages of various categories of Open Space reservations .

Table 5: Main Categories of Open Space Reservations in 1991 DP and their Percentages

	NOS.	AREA (Ha)
AREA OF GREATER MUMBAI		49704
OPEN SPACES AS PER 1991 DP	3246	2968
Playgrounds (PG)	1275	651
Recreation Grounds (RG)	1258	1144
Garden (G)	514	326
Green Belt	44	77
Other (Park, Stadium, Open Space, Hill Slope, Tank & PG)	155	770



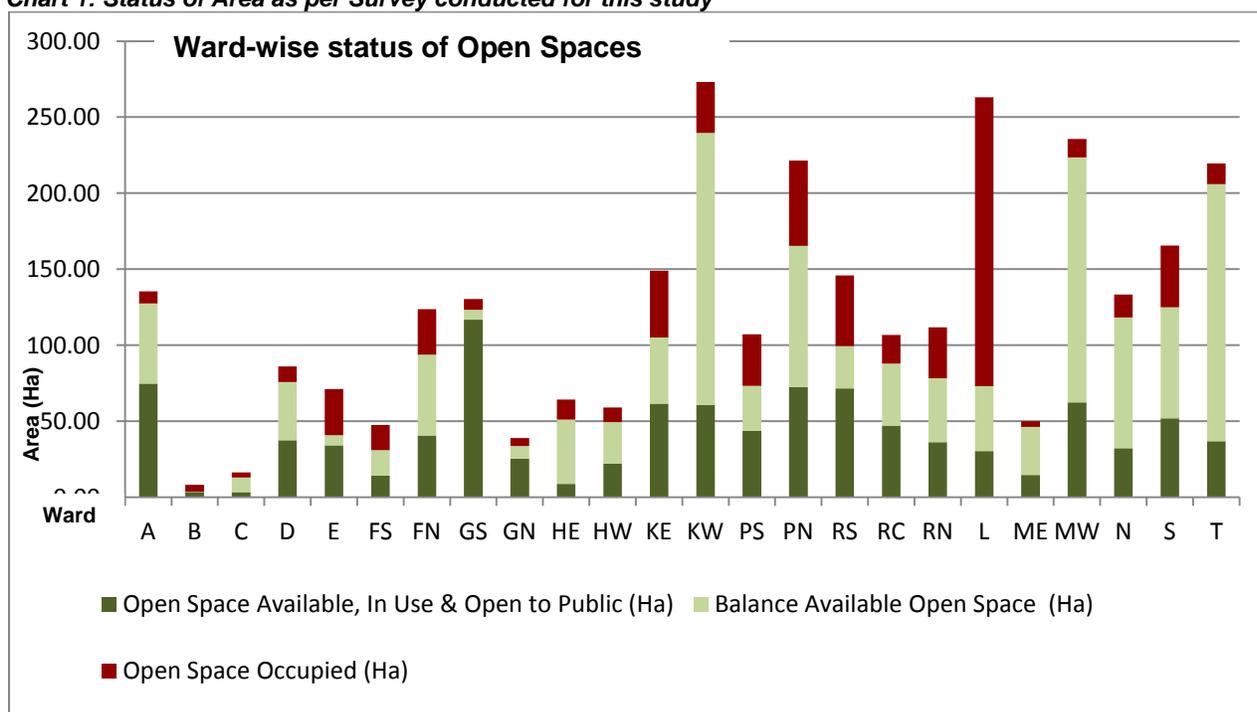
2. Ward Wise Status of Occupied and Available areas of Open Spaces

For the purpose of this study, every Open space has been categorized as ‘Occupied’ or ‘Available’. An ‘**Occupied**’ site implies that more than 70% area of the reservation is occupied by built structures. An ‘**Available**’ site implies that between 30% and 100% of the area of the reservation is open, i.e. less than 30% is occupied by built structures.

The Bar Chart below shows Ward-Wise Status for each municipal ward of Greater Mumbai

- The entire bar (green and red together) represents the area reserved as Open Space as per 1991 DP.
- Open Space area currently ‘**Available**’ are shown in green colour.
- Open Space area ‘**Occupied**’ are shown in red colour.

Chart 1: Status of Area as per Survey conducted for this study



Some of the interesting findings from the analysis of the data:

- Five of the wards have more than 90% of the reserved Open Space currently ‘Available’:
 1. **Ward A:** This ward has a number of city level Open Spaces such as Azad, Cross and Oval Maidans, Brabourne and Kohli Stadia, Cooperage Garden, U.S. Club Golf Course, etc.
 2. **Ward G-South:** Mahalaxmi Race Course with an area of nearly 9 lakh sqm and the second largest Open Space reservation in Greater Mumbai, falls in this ward.
 3. **Ward M-East:** Since this ward has very few ‘Occupied’ spaces- only 6 out of the 92 reserved spaces, it has a high percentage of ‘Available’ Open Space area.
 4. **Ward M-West:** There are 7 very large Open Spaces in the ward, each with an area more than 90,000 sqm i.e. each larger than Oval Maidan. All are currently ‘Available’.
 5. **Ward T:** T Ward has the largest Open Space reservation in entire Greater Mumbai. This accounts for 12.5 lakh sqm out of the total ‘Available’ Open Space area of 20.6 lakh sqm in the ward.
- Two wards of Greater Mumbai have more than 50% of the reserved Open Space ‘Occupied’ by built structures::
 - Ward B:** 20 out of 31 reserved Open Spaces in B ward are ‘Occupied’-all by buildings.
 - Ward L:** 19.5% of the total area of L ward is reserved in the 1991 DP as Open Space. This is the highest for any ward in Greater Mumbai. But more than 25% of all slum occupied Open Space sites in Greater Mumbai are in L ward.

3. Ward Wise Status of Per Capita Index of Open Spaces

Per Capita Open Space Index is computed either as Acres per 1000 persons or as Square metres per person. However the Per capita figure cannot be seen in isolation. The study has shown that before these figures are presented, it is extremely important to know the context in which such figures are quoted.

To check if the population is well served by Open Spaces, a number of parameters are equally important:

- Numbers and Distribution (proximity to residents) of Open Spaces within the city
- Various purposes for which Open spaces are used
- Accessibility of Open Spaces to public
- Development & maintenance of Open Spaces

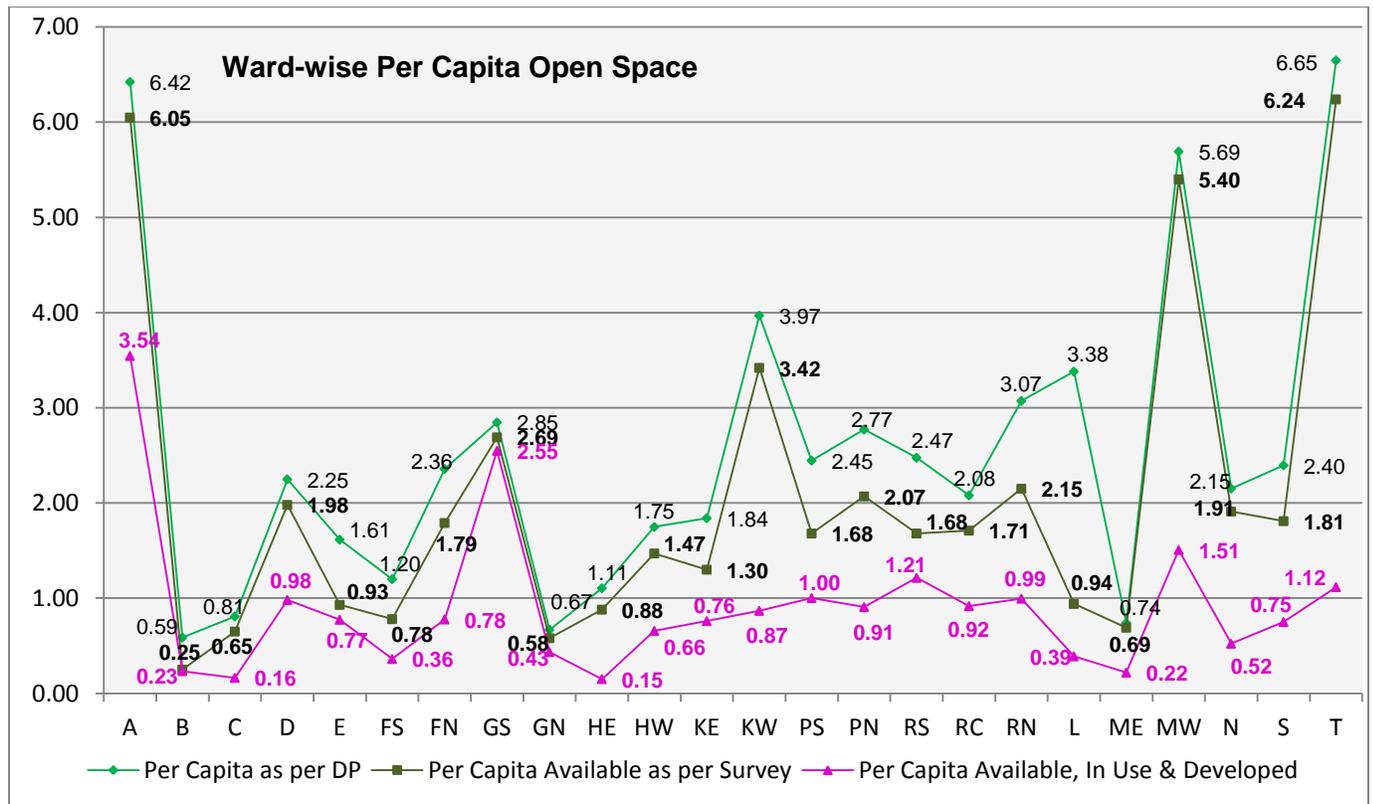
The graph below gives the ward-wise Per Capita Open Space in Sqm

a) As provided for in the 1991 DP

b) Actually Available as per the field data collected

c) Actually 'Available and also In Use as Open Space and Accessible to public' as per the field data collected for this study.

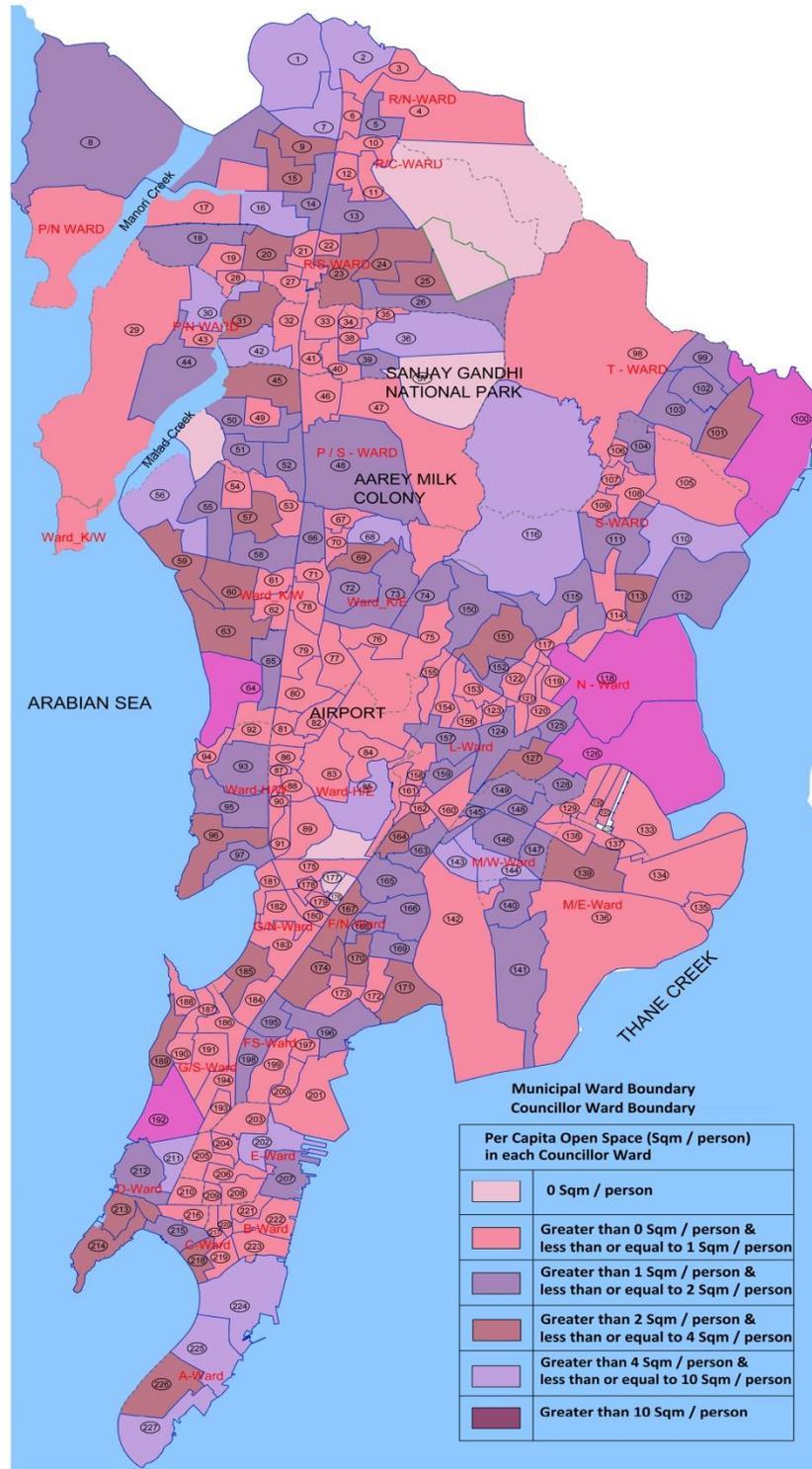
Chart 2: Status of Per Capita Open Space as per Survey conducted for this study



4. Per Capita Open Spaces in 227 Councillors' (Electoral) Wards

Per Capita Open Space in
227 Councillor Wards

Map 2



Per capita Open Space figures for each of the 227 Councillor Wards of Greater Mumbai

It reveals some interesting facts:

- Most Councillor Wards have between 0 & 2 Sqm Open Space per person
- 3 Councillor Wards – nos. 37, 176, 177 do not have any Reserved Open Spaces
- 3 Councillor Wards- nos. 118,133, 192 have between 10 & 20 Sqm Open Space per person
- 2 Councillor Wards- nos. 64, 100 have between 10 & 20 Sqm Open Space per person

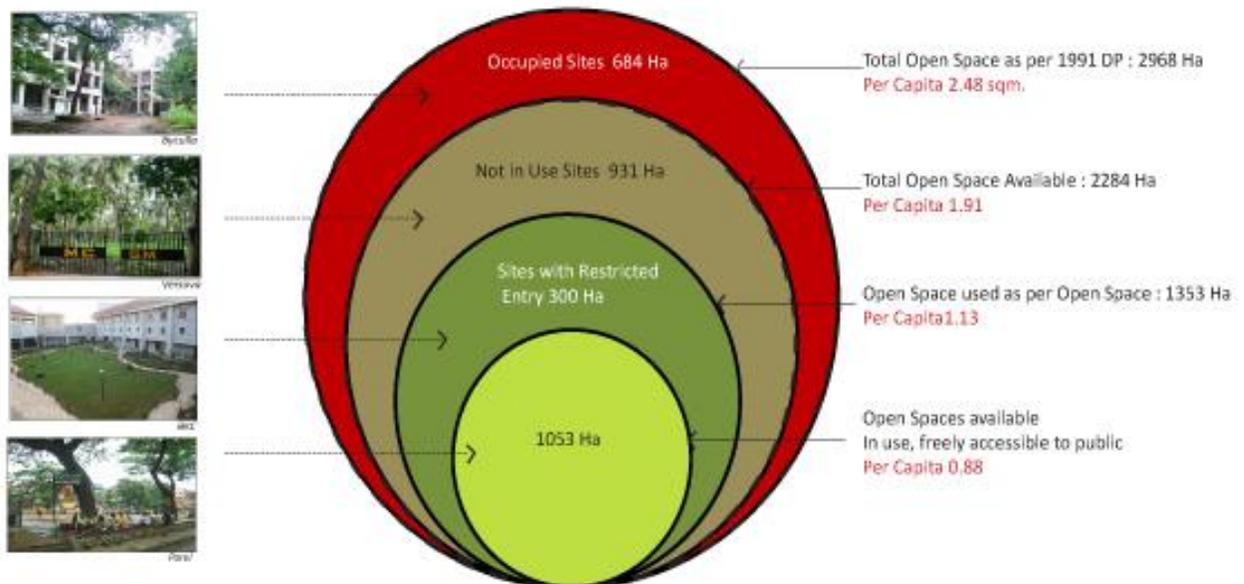
5. Variation of Per Capita Index as per various Parameters

It is observed that many of the Available Open Spaces are either not developed or properly maintained or are not accessible or have entry restrictions, etc. Hence the Findings in this study do not focus on a generalized per capita index. The circular chart below shows how the per capita Open Space of Greater Mumbai varies with different parameters. It gives:

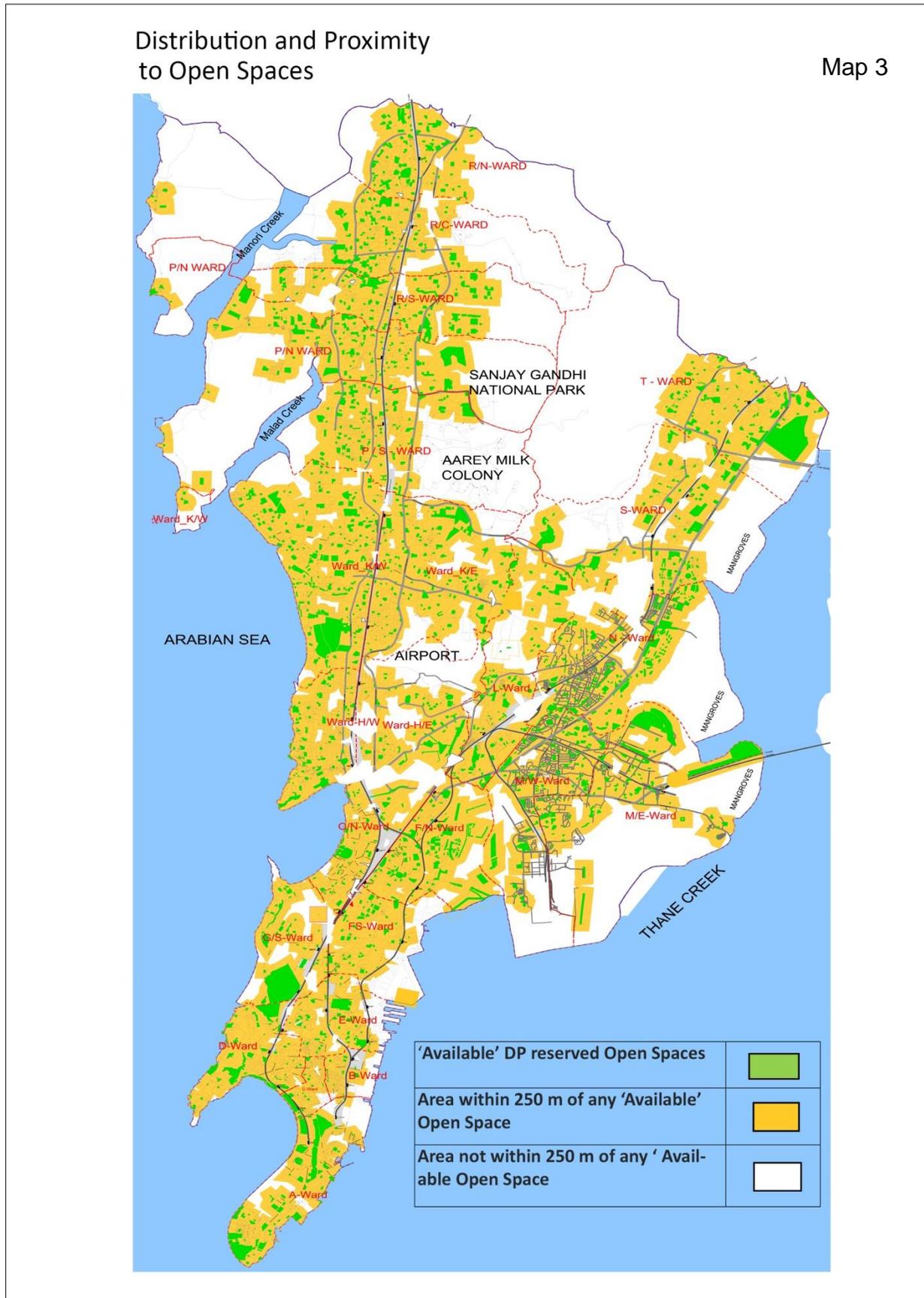
- Per Capita Open Space of all the reservations in the DP
- Per Capita Open Space of all the 'Available' Open Spaces (excluding the occupied open spaces shown red)
- Per Capita of Open Spaces which are 'in use' for play, leisure etc (excluding the available/lying vacant but not in use for any recreational activities)
- Per Capita Open Space of those which are developed as Gardens, Recreational Gardens, Playgrounds, Parks etc as per the reservations on DP
- Per Capita Open Space of those which have 'Restricted Entry'
- Per Capita Open Space of those which are developed and freely accessible to public.

Chart 3: Variation in Per Capita Index as per Parameters

Following Diagram shows how Per Capita Area Index changes as per the above status



6. Distribution of Open Spaces showing their Proximity to Residential Areas



Proximity and distribution of Open Spaces: As stated above, apart from the area, the number of Open Spaces and their distribution is equally important. In Map 3 above, a band of 250 m has been shown around each 'Available' Open Space. This indicates that for people residing within the band, that particular Open Space is easily accessible. 250 m is assumed to be comfortable walking distance even for small children and senior citizens. Where there are two or more Open Spaces in close proximity of each other, these bands overlap.

It is interesting to note that although the area of Open Spaces in the city is extremely inadequate, their proximity to the residents is quite satisfactory. In fact, as seen from the map, most of the residents of Mumbai have at least one 'Available' Open Space within 5 minutes' walking distance of their homes. The large pockets which appear not to have any playgrounds / gardens etc. in their vicinity are in fact Aarey Milk Colony, Sanjay Gandhi National Park and Airport and some mangrove areas on the eastern waterfront.

2.5.2. FINDINGS WITH RESPECT TO THE RESERVATIONS IN THE 1991 DP:

- 1. Land Uses under Open Space reservations**
- 2. Existing & Proposed Reservations**
- 3. Sizes and shapes of Open Space Reservations**
- 4. Distribution of Open Space Reservations**
- 5. Access to Open Spaces**
- 6. Open Space Reservations on Environmentally Sensitive Areas**

1. Land Uses under Open Space reservations:

The DP shows reservation categories of RG, PG, G, etc. but in reality different land uses exist on these sites.

(A) Built Structures.... on 23% of Total Reserved Open Space Area



(B) Environmental Features.... on 11% of Total Reserved Open Space Area



(C) Vacant and Not in Use.... 31% of Total Reserved Open Space Area



(D) Recreational..... only 35% of Total Reserved Open Space Area



2. Existing & Proposed Reservations:

The Report on Development Plan for Greater Bombay 1964, states that the then Existing open space (excluding National Park) was about 1550 acres (794 in the City and 756 in the suburbs) i.e. 620 Ha and the Proposed reservations were on around 3975 acres (i.e. 1590 Ha) The major policy decision while preparing the 1991 DP was that, as far as possible, no reservations of the old Development Plan be deleted, except those which are obsolete. Around 60% to 70% of the total reservations proposed in the earlier DP consist of open space amenities of the various categories mentioned above.

The 1991 DP shows that the percentage of Existing reservations (out of total reservations) in the suburbs is much lower than in the Island City. This, in the Island City, is 40%, as seen in Table 1 below. Although the percentage in the Eastern Suburbs is comparable viz. 35%, that in the Western Suburbs is a meager 15%.

Table 6: Existing and Proposed Open Spaces- Nos. & Areas

Zone	No. of Sites			Area of Sites (Ha)		
	Existing	Proposed	Total	Existing	Proposed	Total
Island City	308	458	766	402.35	255.40	657.75
Western Suburbs	224	1265	1489	137.58	1105.74	1243.32
Eastern Suburbs	356	635	991	151.71	915.51	1067.21
GreaterMumbai	888	2358	3246	691.64	2276.65	2968.29

Table 7: Existing and Proposed Open Spaces- Percentages

Zone	% No. of Sites		% Area of Sites (Ha)	
	Existing	Proposed	Existing	Proposed
Island City	40	60	61	39
Western Suburbs	15	85	11	89
Eastern Suburbs	36	64	14	86
Greater Mumbai	27	73	23	77

It is observed that most of the Existing reservations are owned and developed by MCGM. The Proposed reservations are not necessarily demarcated on open plots of land. Many of the proposed reservations were overlaid on the existing buildings which were then in a dilapidated state or on semi permanent constructions like warehouses, sheds etc, which were estimated to have a life of less than 20 years. (On the basis of the surveys carried out for the 1964 DP, the future life of the buildings in the different wards of the Island City, was used to determine the priority of the clearance areas. The buildings which had a smaller future life (5 to 25 years) were given high priority to proposed reservations. (Refer Annexure 1: Background of Development Plans). Many such structures are found to still exist on the reservations. Similarly, many lands reserved as Open Spaces are occupied by informal settlements at present. These might have been encroached upon during the last two decades or the settlements might have already existed before the reservation of the land. While most of the structures existing then have not been demolished and continue with the same functions, some of them, especially in the prime areas are renovated (without demolition) into rented commercial outlets. Jyoti Studio in Nana Chowk and Shapoorje Pallonji Centre at Colaba sea front near Radio Club are such examples. The SP Centre / The Courtyard is an up-market fashion hub.



SP Centre existing at Colaba and further renovated as an up market office complex.

3. Sizes and shapes of Open Space Reservations:

The sizes of Open Space reservations in the DP range from 50 sqm (Site no. L-79 or A-70) to 12,50,000 sqm (Site no. T-9). As also stated in the Report on DP 1964, there appear to be no particular norms of area for RG, PG, G, etc.

Table 8: Minimum & Maximum plot sizes for various categories of Open Spaces

Reservation	RG	PG	G	Green Belt	Other
Min. Plot size (sqm)	50	70	50	180	175
Max. Plot size (sqm)	9,00,000	1,10,000	1,90,000	1,14,400	12,50,000

In a number of cases, the Proposed' reservations are marked as extensions to 'Existing' reservations. They are often occupied and are too small and of irregular shapes that they appear to be appendages of the main reservation to which they are attached. Extensions to Joseph Bapista Garden and Veer Jijamata Udyan

(Rani Baug) in 'E' ward have 4 to 6 small RGs proposed as extensions to the existing Garden reservation. Most of them are occupied by slums and by warehouses expected then to have a short life. Most of the irregular shaped sites difficult to be developed and used are 'Proposed' or Relocated sites (sites whose locations and shapes are altered without altering the area, within the land under the same ownership, at the owner's request).

4. Distribution of Open Space Reservations:

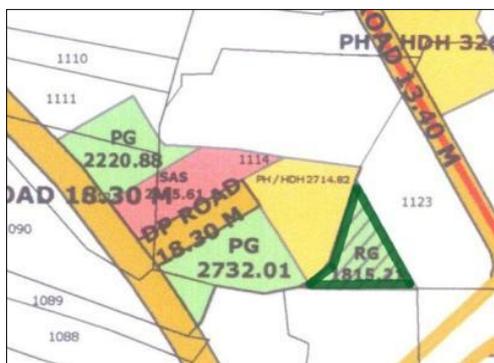
As regards distribution of the reservations, the DP does not follow any norms, as seen on the Plan and in the DP report. In some cases, a number of reservations are set very close together. At other times they are scattered and far apart. But the overall picture of Greater Mumbai shows that there is at least one Open space within 5 minutes' walking distance (250 m) for most residents of Mumbai. (Refer Map 3)



4 RGs proposed as extensions to an existing Garden reservation in E ward

5. Access to Open Spaces:

Some sites are proposed without any abutting road in the DP. This is especially observed in 'T' ward. At times, the abutting road, as shown in the DP, is not constructed. These sites are more prone to slum encroachment. Once encroached, it is difficult to carve out a DP road. Sometimes, such spaces are



appropriated by occupants of the surrounding buildings for their private use like gardens, parking and in the industrial locations for storage of materials.

Open Space site shown in green border is not accessible by any road

6. Open Space Reservations on Environmentally Sensitive Areas:

Table 9: Reservations on Environmentally Sensitive Areas

	Total Open Space Area as per DP (Ha)	Area of Mangroves (Ha)	Area of Salt Pans (Ha)	Total Area of Reservations on Environmentally Sensitive Areas
Island City	657.76	3.25	19.40	22.65
Western Suburbs	1243.32	67.25	0.00	67.25
Eastern Suburbs	1067.21	113.31	125.38	238.69
Greater Mumbai	2968.29	183.81	144.78	328.59

A number of reservations, as RG/PG/Parks (especially the 'Proposed' ones) are environmentally sensitive areas such as mangroves (101 nos.-most of them in 'N' ward), salt pans (10 nos.- most of them in F-North

ward) and nallahs (in F-North ward). In the absence of any specific guidelines for such ecological sites, they remain extremely vulnerable as can be seen in the condition of the nallahs under the Green Belt reservations, stretching from Anik Nagar to Wadala Truck terminus. They are either covered by RCC slabs or left to get filled up by construction debris and domestic waste as can be seen in the images below.



Site FN-14: Near Pratiksha Nagar & Anik Bus Depot, Wadala is a Reservation on Nalah



Site PS-16: Goregaon-Mulund Link Road is a Reservation on Mangroves

2.5.3. ISSUES EMERGED OUT OF FINDINGS

Findings based on the empirical data obtained from documentation of the field data, and from the statistics generated with respect to their accessibility, visibility, availability and safety to the public at large, usability, infrastructure and maintenance are given in detail.

1. **Accessibility**
2. **Visibility**
3. **Public Safety and Security:**
4. **Usage:**
5. **'Not in Use' Open sites**
6. **Occupation on sites**

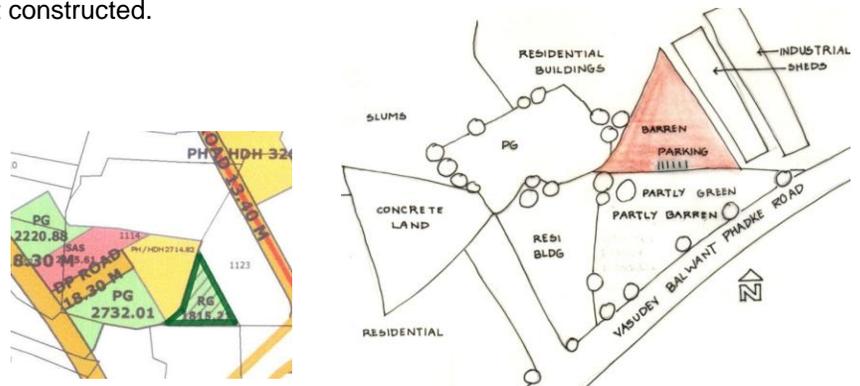
1. Accessibility:

Easy accessibility to an Open Space reservation, developed or otherwise, is negatively affected by many factors:

a) **Absence of a direct approach road:** A number of sites, especially in 'T' ward, are not accessible since the access road as shown in the DP is not yet constructed.



PG in educational institution not accessible to public



Site at Mithagar, Mulund (E): No direct access road

b) Due to the reservation getting land locked: This happens within informal slum settlement within formal educational institutions and in Mill lands. It is MCGM's policy that playgrounds attached to educational institutions should be made accessible to the public outside the institution's working hours. But it is observed that there are many which are accessible only through the institution's premises and not directly from the road. Hence entry to them is restricted to the members of the institution only.

c) Absence of any information in public domain regarding Open Space reservations and their status: People are often not aware which plots in their neighbourhoods are in fact reserved public Open Spaces.

d) Restricted entry due to 'security' reasons, and due to exclusive memberships: Under the Caretaker Policy of the MCGM, Recreation Grounds are given to sports organizations for development and/or maintenance. In return, the sites are allowed to be partially built upon and used for commercial purposes. The balance site area is to be made available as recreation area open to public. However, public is often denied access even to these areas.

e) Entry tickets: These often prevent children, men and women from a low income group from using the Open Space on a regular basis.

f) Restricted timings. The stipulated timings mostly disallow use of the Open Space in the afternoons and at nights. This results in denial of access for recreation and rest to many significant categories of the society like senior citizens, workers in shift timings, students, domestic helps, etc.



Access denied due to restricted timings



Table 10: Accessibility of Open Spaces

Zone	No. of Sites			Area (Ha)		
	Free	Entry Fee charged	Entry Restricted	Free	Entry Fee charged	Entry Restricted
Island City	378	5	125	266.62	121.30	147.37
Western Suburbs	687	31	323	555.07	50.24	293.53
Eastern Suburbs	484	1	230	382.48	0.63	371.22
Greater Mumbai	1549	37	678	1204.17	172.17	812.12

2. Visibility:

Visibility is negatively affected by

a) Lack of proper signage to direct the public to an Open Space

c) Improper edge definition like high metal fencing, High boundary walls or high metal fencing helps in providing support to the structures erected by slums and hawkers along the periphery of Open Spaces. As against this, low boundaries create a safer environment and enhance recreation.



High fence reduces visibility



Misuse of high metal fencing

3. Public Safety and Security:

a) Due to the high boundary walls, the vulnerable sections of the society like the physically challenged, senior citizens and children have no immediate access to outside help in an emergency. Women have specifically expressed their insecurity perceived while walking/jogging on the tracks located along the internal edges of Open Spaces defined by solid boundary walls.



Open edges are preferred to solid walls, especially by women

b) Absence of footpaths. In several cases, especially in the suburbs, there are no footpaths between Open Spaces and their access roads. This creates problems to senior citizens, children and the physically challenged when alighting from/boarding vehicles.

c) Inappropriate materials for Children's play equipment is sometimes made of metal which heats up in the sun. Often it is poorly maintained and even broken and is therefore unsafe for use.



Broken and rusted children's play equipment

4. Usage:

a) Congruous usage: like sports, recreation, relaxation, walking, jogging, playing and



b) Incongruous usage both by the users as well as by the authorities: The public at large are known to dump garbage and debris, litter, urinate etc. on the Open Spaces.



Parking



Garbage / debris dumping

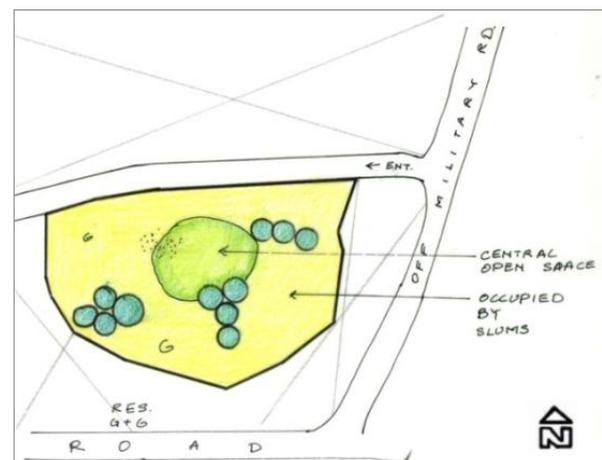


Cultivation

Public Authorities are seen to use the Open Spaces to park their small and heavy vehicles, store garbage containers, use the reservations as dumping grounds. It is observed that pockets of open spaces in dense settlements are generally protected by the local youth groups. These sites may not have any infrastructure, but are well used by the community children. Site KE-164 on Marol-Maroshi Road is an interesting example of this.



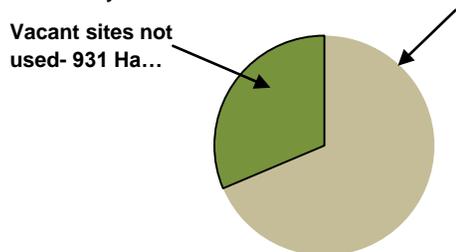
Open Space used as dumping ground by Public Authorities



Open space as a pocket within Slum encroached site

5. 'Not in Use' Open sites reserved for RGs/PGs/Gs:

There is a large number of these sites under Open Space reservations. These sites are open but are neither put to use for any of the congruous usages mentioned above nor are they accessible to the public for any recreational purposes. The data reveals that 31% of the total land under reservation is lying vacant and unused. Often these sites are threatened by encroachment and misuse. Most of such lands are under private ownership. A few are under litigations. They are in need of acquisition by the MCGM for development as per the designated usage like RG, PG etc. If acquired, it would add substantially to the Open Space ratio of the city.



Reserved Open Space in Greater Mumbai (2968 Ha)



Table 11: Usage of Open Spaces

Zone	No. of Sites		Area (Ha)	
	In Use as Recreational Spaces	Not in Use	In Use as Recreational Spaces	Not in Use
Island City	402	111	471.93	70.60
Western Suburbs	745	365	546.50	402.92
Eastern Suburbs	508	280	334.34	457.62
Greater Mumbai	1655	756	1352.77	931.14

6. Occupation on sites:

Some Open Space sites are occupied by large settlements of slums, especially in the suburbs and by newly constructed buildings.

Table12: Occupation of built form on Open Spaces

Zone	No. of Sites				Area (Ha)			
	Slums	Bldgs	Slums & Bldgs	Total	Slums	Bldgs	Slums & Bldgs	Total
Island City	76	142	36	254	50.60	48.71	21.17	120.48
Western Suburbs	218	169	34	421	203.70	84.86	35.50	324.06
Eastern Suburbs	163	50	11	224	270.72	18.50	5.71	294.93
Greater Mumbai	457	361	81	899	525.02	152.07	62.38	739.47

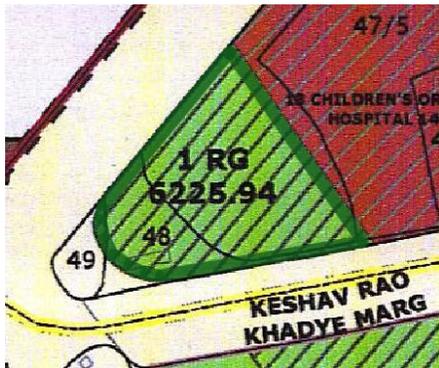


Occupation by buildings



Occupation by slums

Government Authorities too take over large parts of developed RGs for new Infrastructural projects. Two of the developed RGs, crucial in terms of their location, have had to sacrifice upto 75% of their developed garden portions. S.K Patil Garden, very crucial to the congested C Ward and Lala Lajpat Rai Garden at Haji Ali are two of such examples under BRIMSTOWARD. S.K. Patil Udyan is the only publicly accessible large recreational space in the highly dense C ward; the other Gymkhanas along Marine Drive not being accessible to public. The Haji Ali site is crucially located across the Haji Ali Darga and was once well used by the devotees.



RG Reservation at Haji Ali taken over for Infrastructure

2.5.4 ANALYSIS OF EXISTING REGULATORY FRAMEWORK

In order to understand the current provisions for protection of existing Open Spaces and generation of new ones, the following regulations were studied. The DC Regulations and various Acts were studied with respect to their scope and relevance to Open Spaces, their positive and negative aspects, etc.

Various MCGM policies on their development and Maintenance have been discussed in detail later.

1. Development Control Regulations (DCR)

- i) DC Regulation 67 for Transfer of Development Rights
- ii) DC Regulation 33(7), 33(5) for Redevelopment Schemes
- iii) DC Regulation 33(10) for SRA Schemes on Open Space Reservations. This provision is at present stayed by the High Court.
- iv) DCR 58(10) for Open Spaces on Mill Lands
- v) DC Regulation 33(9) for Cluster Development

2. Land Acquisition (LA) Act, 1894

3. Sec 90 of BMC Act 1988

4. MRTP ACT, 1966

5. Proposed Caretakers' Policy for permitting Development of plots reserved for public purposes such as Gymnasium / Gymkhana, Club, Stadium, Swimming Pool, Recreation Ground, Playground, Gardens and Parks, Brihanmumbai Mahanagarpalika.

Table 13: Land Acquisition Act

Name	Brief Scope with respect to Open Spaces	Authority	Positive Aspects	Negative Aspects	Suggestions/Remarks
Land Acquisition, 1894, modified MRTP 1966	Acquiring land for public purposes and amenities from private owners.	L.A. Officer	Instrument to acquire land for public purposes	If the land is encroached, the re-housing responsibility is on ULB	Only 10% acquired so far during the entire tenure of plan
	Market value to be paid as compensation for compulsory acquisition		Purchase notice by owner compels MCGM to acquire within stipulated time period	High cost of acquisition and low priority for acquisition for open spaces	Reluctance on part of MCGM to acquire land
				Prolonged litigation if compensation amount is challenged	
				Owners resist acquisition	

Table 14: BMC Act, 1888 (Sec 90)

Name	Brief Scope with respect to Open Spaces	Authority	Positive Aspects	Negative Aspects	Suggestions/Remarks
Section 90 of BMC Act, 1888	Requisition by negotiation with the land owner like an outright market purchase	Municipal administration with approval of corporation	Process of acquiring land for public purpose can be faster than L.A. Act.	Purchase amount could be high	This act should be used to buy vacant land under DP reservations for open spaces. This could be useful for increasing open spaces in crucial locations

Table 15: Transfer of Development Rights (DCR 67)

Name	Brief Scope with respect to Open Spaces	Authority	Positive Aspects	Negative Aspects	Suggestions/Remarks
Transfer of Developmental Rights TDR DCR 67	Handing over the vacant land under reservation to MCGM free of cost. In return the owner gets to transfer the buildable potential (FSI) in the same ward or in the northern direction through a Development Right Certificate (DRC)		MCGM gets the land for public purpose free of cost.	Owner has to make the offer. Handing over land, free of encumbrance is a pre condition. This excludes many spaces which MCGM could have taken over	MCGM should get the power to initiate and operate TDR for open space reservation. This act could be used to convince the owner to surrender the vacant land under open space reservation

Table 16: SRA Schemes (DCR 33(10))

Name	Brief Scope with respect to Open Spaces	Authority	Positive Aspects	Negative Aspects	Suggestions/Remarks
SRA Schemes SRA 33(10)	Pertains to Slum Settlement occupying the land reserved under open space reservations	SRA MCGM	On redevelopment of Slum settlement, 33% of the encroached area or 500 sqm (whichever is more) is to be left as open space. This area is in addition to the existing vacant land if any	There is no mechanism to take over such land by MCGM's Garden department unless it is handed over by SRA	Mechanism to convert the open space into a usable RG should be formulated. No concessions to be given in marginal open spaces. This act is challenged in the court resulting in the status quo

2.5.5 ANALYSIS OF CURRENT MANAGEMENT PRACTICES & IMPLEMENTATION MECHANISMS

In order to understand the current management practices and implementation mechanisms, several case studies were conducted. Officers of the Garden Department of MCGM as well as many individuals belonging to organizations involved in the protection, retrieval and maintenance of Open Spaces were interviewed. It is found that Open Space sites are maintained and managed by 2 categories of organizations:

1. MCGM: The Garden Department of MCGM is responsible for the development and upkeep of the sites under them.
2. Private parties: Sites belonging to private parties are managed by the respective owners. Some MCGM sites are also maintained and managed by private parties. These are of two types:
 - a) Sites managed by informal local groups
 - b) Sites managed by formal citizens' organizations / trusts

1. Management of Open Spaces by MCGM: As already stated, the Garden Department of MCGM is responsible for all Open Space sites under them. It is headed by the Garden Superintendent, under whom there are 3 officers- Deputy Garden Superintendents (representing the 3 zones of Greater Mumbai) and a Chief Tree Officer. The department in each ward of a particular zone comprises a Tree Officer, a Horticulturist and two Malis (gardeners). The maintenance of Open Spaces is carried out in 2 ways:

- a) by Malis employed at ward level, within the garden department
- b) by contractors shortlisted by MCGM through a tendering process. The contracts are given for maintenance of Open Spaces and for provision of security at the sites.



It is observed that MCGM is making a commendable effort to develop and maintain the Open Spaces. In spite of the deplorable habits of the public to litter and create a nuisance, these spaces are well managed.

However, there are several which have very poor maintenance. The children's play equipment is in poor condition. The high boundary walls are misused.



2. Management of Open Spaces by private parties: Interaction with local users during site visits as well as while conducting case studies, revealed that some MCGM sites are also maintained and managed by private parties. The sites chosen for Case studies had issues of protection and / or maintenance. These issues were resolved through intervention of local Citizens' Groups and Associations. The methodology adopted in each of the cases was different, ranging from negotiations with the local Ward officials and the Corporators to confrontations in the form of protests and *dharnas*. These sites belong to different wards and represent all three zones of the city- Island City, Western Suburbs and Eastern Suburbs. The sites are:

1. Dharamveer Sambhaji Maidan, Kannamwar Nagar, Vikhroli East.
2. Bhagwan Gautam Buddha Udyan, Worli.
3. Ishwarlal Park, Vile Parle West.
4. Pestom Sagar Citizens' Ground, Chembur.
5. Kaifi Azmi Park, Juhu.

The sites managed by private parties are of two types:

a) Sites managed by informal local groups: Informal groups primarily include local 'Krida Mandals' and local Residents' Groups. These groups negotiate with the local Councillor for funding and co-ordinate with MCGM officials like the Ward officer, Tree Officer and Horticulturist, for initiating development of the Open Spaces in their locality. Periodic follow-ups are done for ensuring proper maintenance by MCGM. Ishwarlal Park in Vile Parle West. which was taken up as a case study, is an example of management by local Residents' Group. Another case study, Dharamveer Sambhaji Maidan, Kannamwar Nagar, Vikhroli East is an example of the involvement of local 'Krida Mandals' social organizations etc. in the retrieval of Open Space by confrontation with the local authorities- MCGM, State Government, etc. (Refer Annexure 13).

b) Sites managed by formal citizens' organizations / trusts: Formal organizations include Corporate houses, Trusts, Advance Locality Management Groups, Sports Organizations, etc. The MCGM has an '**Adoption Policy**' whereby Open Space sites are given for maintenance to such organizations. The funding is provided by the organizations. Corporate houses take up the maintenance of Open Spaces as Corporate Social Responsibility (CSR), ALMs and formal Walkers' Associations raise funds through contribution by members, etc. Bhagwan Gautam Buddha Udyan, Worli, and Pestom Sagar Citizens' Ground in Chembur are such examples. (Refer Annexure 13). Under the Adoption Policy, the organizations are permitted to charge a small entry fee, as per MCGM's fee structure, to the public. No structure other than a 3 m x 3 m watchman's or gardener's cabin is permitted to be built.

MCGM also allows Sports Organizations to maintain Open Spaces on '**Caretaker Policy**'. As per the new revised policy, only sites with an area greater than 5000 sqm can be given. Even then, preference is to be given for giving them on 'Adoption' basis. If no organization comes forward for Adoption, the site can be given on 'Caretaker' basis. The drawback of this policy is that construction of structures for sports and allied activities is permissible over 25% of the site area. The balance 75% site area is to be developed and maintained by the caretaking organization and be kept open to the public. However, restrictions of timings for entry to the public are allowed to be imposed. Most often, this rule is used to dissuade the public from using the Open Space, which is then open to only the members of the caretaking sports organization.

2.6 STAGE 6: ACTION PLAN

All the sites are also environmentally important, by virtue of their 'open to sky' nature, and need to be protected, from the threats of encroachment, appropriation and incongruous uses. The prime objective of this Action Plan is to see that all the reserved Open Spaces (except those which are ecologically sensitive sites like mangroves) are made Accessible and Actively Usable to all sections of society at all times.

The sites which are environmentally sensitive, like mangroves, need to be specially conserved by protecting them from any kind of human usage.

The Action Plan includes 3 important components:

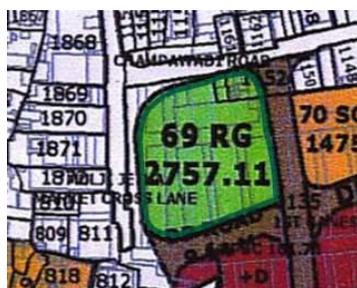
1. Recommendations for Policies with respect to Protection of existing and Generation of new Open Space
2. Guidelines for Design & Development of Open Spaces of various categories
3. Recommendations for Management and Maintenance

2.6.1 RECOMMENDATIONS FOR PROTECTION OF OPEN SPACES

1. **Review of criteria for Open Space Reservations:**
2. **Protection of Reservations in Ecologically Sensitive Areas:**
3. **Acquisition of and Accessibility to Unused Open Space Reservations:**
4. **Sites occupied by Slum settlements:**

1. Review of criteria for Open Space Reservations:

A) Issue: During the making of 1964 and 1981 DPs, many of the proposed reservations were overlaid on the existing buildings which were then in a dilapidated state or on semi permanent constructions. Many such reserved sites are not yet vacant for public usage as the structures still exist on the reservations.



RG reservation in DP shows structures marked on it

Recommendation: It is recommended that the criteria for the reservations of lands proposed for Open Spaces be reviewed during the process of making the Revised Development Plan of 2014 - 2034.

B) Issue: Study of the two Reports on the preparation of the 1964 and 1991 DPs, shows that although there are broad guidelines for the usages of RG, PG, G, etc. there are no specific definitions and specific norms for the categorisations, minimum sizes and development of RG, PG, G. The data shows that the reservations are on lands varies from 50 sq mts to 12 lac sq mt.

Recommendation: It is suggested that the minimum areas of the various classifications be specific and clearly defined. Suggested guidelines for development of the above categories are given later in this report under 'Guidelines for Design & Development of Open Spaces'.

2. Protection of Reservations in Ecologically Sensitive Areas:

Issue: The classification of Open Spaces in the DP does not address the crucial difference between Open Spaces that are 'Active' for sports and recreation and the Open Spaces that are 'Passive' as Ecologically sensitive locations like Salt pans, Mangroves, Nallahs, Water Bodies. The reservations on such ecologically sensitive sites constitute approximately 408 Ha i.e. 14% area of the total reserved Open Spaces in Greater Mumbai. These are under the potential threat from the provisions under DC Regulations, (DCR 23(1)g(ii)), which allows the RGs with an area more than 1000 sqm to be built upon to the extent of 10% of the plot area by structures. Out of the 100 Open Space reservations on Mangroves, 54 are under RGs and therefore vulnerable under the above rule.

Thus the ecologically sensitive spaces if reserved under RG categories, face double threats: being developed as 'active' recreational spaces accessible to public and as 'developed' RGs. Similarly, reservations of RG, PG etc. on Water Bodies or Nallahs, may lead to indiscriminate filling up of these features and consequently, a partial or total loss of Water Bodies and Nallahs.

Recommendation: All Ecologically sensitive areas like Salt Pans, Mangroves, Nallahs and Water Bodies should be out of the categories of 'reserved' Open Spaces and should be clearly demarcated as No Development or Restricted Areas. The planning standards for per capita open spaces should be computed independent of such ecologically sensitive areas. Further these need to be appropriately defined as 'Salt Pans', 'Mangroves', 'Nallahs' and 'Water Bodies' on the Development Plan.

(There is a High Court Order of 2005 which requires mangroves to be treated as forests. A similar policy could be made applicable to Water Bodies and Nallahs).

Implementation Mechanism: The recommendations can be considered during the process of making the Revised Development Plan of 2014-2034.

3. Acquisition of and Accessibility to Unused Open Space Reservations:

Issues: Out of 3246 DP reserved Open Spaces, 2347 are actually available currently as Open Spaces (others are built upon). Of these, 102 sites are in ecologically sensitive areas. Out of the balance 2245 sites which can be developed for active recreational use, 839 are lying vacant and 'not in use'. These sites together have an area of 650 Ha, i.e. about 22% of the total area of reserved Open Spaces in Greater Mumbai. Such sites need to be protected from threats of various kinds and need to be brought in the public domain for active recreational usage.

Recommendation:

A. The above 'not in use' sites which are under MCGM/ other Govt Agency owned, should be taken over on high priority by MCGM (Garden Department) for development as per the reserved public use like RG/PG/G etc.

The 'not in use' sites which are under Private ownership, need to be under the control of MCGM in order to protect and appropriately developed. In order to achieve this, the sites need to be acquired by MCGM under the following existing policies on high priority basis:

- i) Land Acquisition (LA) Act 1894
- ii) Transfer of Development Rights (TDR), DCR 67. (Details of the above two Acts are given under 'Study of Existing Regulatory Framework')
- iii) Modifications in the Provision of 'Advance Possession' of vital infrastructure under the Town Planning Act to be explored for application to the unused Open Spaces in order to bring the 'not in use' category of open spaces under MCGM for public use.
- iv) Possibilities for evolving a short term 'lease' provision for 'not in use' reservations to be brought in the public domain by MCGM.

Implementation Mechanism:

- i) Through the appointment of a special LA officer for the acquisition of Open Space reservations under LA Act and TDR Act.
- ii) Activating Ward Committees and Area Sabhas under the 74th Constitutional Amendment.
- iii) Activating Local stake holders like Citizens' Associations / Krida Mandals and the local Corporators as facilitators and negotiators for bringing the sites under public domain.

B. Partially 'not in use' sites: The open parts of the sites which are partially occupied by slums, in the above category could be taken over by MCGM to develop as a public open space and the slum residents could be rehabilitated as PAPs (Project Affected Persons) on a priority basis to clear the reservation. The tenements generated through various redevelopment schemes under 33(7), and 33(5) could be used for rehabilitation.

4. Sites occupied by Slum settlements:

Issue: 538 nos. of sites under Open Space reservations, together having an area of 587.4 Ha, are occupied by slums. Under the existing provision under SRA, one third of the total occupied area (in addition to the existing open area if any) is to be reserved as public open space and remaining land to be used for rehabilitating the existing slums. However the provision is challenged in the High Court to demand the entire land as open space (as against only one third). This has led to a legal deadlock of the large tracks of reservations, at present occupied by slum settlements.

Recommendation:

In order to bring the maximum number of existing reserved sites occupied fully or partially by slum settlements under the existing provision of SRA (DCR 33(10)), MHADA can undertake, on priority basis, the development of such sites to replace the private developer. The incentive FSI can be computed on the basis of minimum profit, so as to release maximum area of land under slums for Open Space reservation. Negotiations with the Civil Society groups contesting in the HC could lead to resolving the present legal deadlock.

2.6.2 RECOMMENDATIONS FOR GENERATION OF NEW OPEN SPACES

1. Acquisition of Water Bodies from Mill Lands

2. Enhancing the Open Space in Cluster Development Schemes

1. Mill Lands:

Issue: After the 'Minor Modification' provision under MRTP Act, was applied to the 1991 DCR 58(10), in 2001, the provision of upto 200 acres of land reservation for public Open Spaces was brought down to less than 15 acres. Further these lands were not accessible for the visits during the survey and it was found that only 3 mills have handed over the mandatory gardens to MCGM.

Recommendation: The handing over of the mandatory open space component to MCGM, as per DCR 58(10), may be included as one of the IOD conditions so that No Commencement Certificate is issued without fulfillment of this condition. The provision under the MRTP Act wherein the definition of 'Development' includes the 'Demolition' prior to the development, can be applied to acquire the open spaces even before the construction is completed.

2. Cluster Development Schemes:

Issue: Under DCR 33 (9), the redevelopment of the Cessed Buildings mainly in the Island City can be undertaken jointly by the land owners as Cluster development. The Cluster development, although meant to generate better public open spaces and amenities, in reality are offered concessions in the marginal open spaces and in the layout open spaces reservations similar to the development of individual Cessed structures (DCR 33 (7)).

Recommendation: The concessions extended (in some cases on payment of a premium) in the regulations for i) marginal open spaces and ii) provision of RGs in the cluster layouts, need to be reviewed by the policy makers in order to upgrade the ratio of per capita open space within the neighbourhood, within the Wards and in the city at large.

2.7 STAGE 7: GUIDELINES FOR DESIGN AND DEVELOPMENT OF OPEN SPACES

Objective of The Guidelines: The objective of these Guidelines is to make all currently available DP reserved Open Spaces accessible to the public at large and actively usable for recreation and sport.

Basis For Formulation of Guidelines for Design Interventions:

The formulation of guidelines for design interventions are derived from the empirical data and interactions with stakeholders.

a) Data from respective sites. The documentation has highlighted the issues affecting Open Spaces viz. usage, accessibility, visibility, infrastructure, facilities, management & maintenance. These issues have already been discussed. The Urban Design Guidelines have been formulated with a view to addressing these issues.

b) Interactions with different stakeholders like local citizens' groups, representatives of local 'Krida Mandals' as well as with agencies involved in development and maintenance including various MCGM personnel; in order to understand the requirements of various categories of Open Spaces and also the current practices adopted for their development and maintenance

Guidelines For Design Interventions Have Been Proposed at 3 Levels:

A) General Guidelines which are applicable to all Open Spaces in Greater Mumbai

B) Guidelines based on the use of the Open Space i.e. guidelines applicable to all playgrounds, all gardens, etc. These are to be followed along with the general guidelines.

C) Special Guidelines for Open Spaces at significant representative locations such as for Open Spaces near Transport Hubs or for Open Spaces adjoining educational institutions, etc.

2.7.1 GENERAL GUIDELINES FOR DESIGN AND DEVELOPMENT

1. Board on Site: All reserved Open Space sites, whether with MCGM or 'to be acquired', shall have a board erected at the site, stating that the following:

THIS SITE IS RESERVED AS A PUBLIC OPEN SPACE

2. Road signage systems: Locations of all Open Spaces shall be included in the road signage systems currently in operation. This is to facilitate easy information about and access to the Open Spaces. The signage shall have: a) name of the Open Space b) an easily recognizable Graphic representing the Open Space c) an arrow to indicate the direction.



Signage on roads

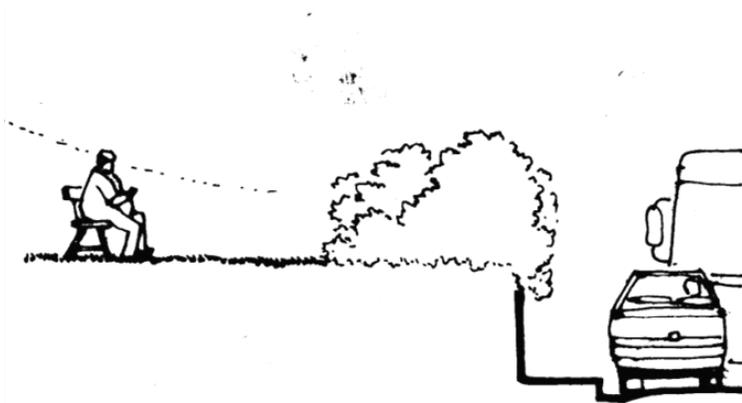
3.The edges of all Open Spaces shall be defined either by a low parapet wall, by shrubs or by a combination of a parapet wall and shrubs. There shall be no high walls or high grills / fences. High walls or grills are often misused and form a ready support for erecting a stall or a hut.



High fencing is misused by hawkers or slum dwellers & reduces visibility



Low parapet wall is used as seating & allows good visibility



Shrubs define the boundary. They also help control sound and air pollution and cut off unwanted views

4. Trees along periphery: All Open Spaces, whether playgrounds (PGs), gardens (Gs), recreation grounds (RGs) or parks (Ps), shall have trees along the periphery.

5. Full Day Timings: All Open Spaces shall be open to public throughout the day and this shall be mentioned on the board erected at the site.

6. Safe Equipment: Children’s play equipment shall be of material which is safe for the users, does not heat up, and is durable and maintenance-free.



Play equipment should be safe, durable & attractive

2.7.2 GUIDELINES BASED ON COMPONENTS AND CATEGORIES OF OPEN SPACES

Four main categories of Open Spaces: a) Playgrounds, which are primarily used by youth for field games and for jogging / walking by all age groups. b) Gardens, which are used for leisure and relaxation by all, especially senior citizens, for walking / jogging by all age groups and for playing by small children. c) Recreation Grounds, which are used both as playgrounds and gardens and also for community activities by all age groups. d) Parks, which are used for leisure and relaxation by all age groups, for aesthetic purpose and to enhance the ecology.

A. Guidelines for Components of Open Spaces: The important components of Open Spaces are: Edge, Surface, Vegetation, Infrastructure and Facilities. Further, it is necessary to understand the objectives of these components to be able to suggest the design guidelines. These are listed below.

Table 17: Objectives of Components of Open Spaces

Component of Open Space	Objectives
EDGE	<ol style="list-style-type: none"> 1 Ensure easy accessibility 2 Ensure good visual connectivity 3 Allow interaction between inside and outside 4 Ensure protection of the open space 5 Ensure safety of the users
SURFACE	<ol style="list-style-type: none"> 1 Establish and demarcate various activity areas e.g. play areas, movement areas, leisurely activity areas etc. 2 Provide surfaces suitable for various activity areas. 3 Minimize hard cover
VEGETATION	<ol style="list-style-type: none"> 1 Enhance environmental conditions and improve ecology. 2 Provide shade 3 Improve the aesthetics
INFRASTRUCTURE	<ol style="list-style-type: none"> 1 Improve usability of the space
FACILITIES	<ol style="list-style-type: none"> 1 Improve usability of the space

2. Individual Guidelines for Reservation Categories:

Playgrounds, Gardens, Recreational Grounds and Parks with respect to above Components are given below.

1.Guidelines For Playgrounds:

Edge: Low parapet wall shall be provided on all sides

Surface: Paving only along the peripheral path and levelled earth cover in the rest of the area

Vegetation: Trees to be planted along the periphery, shrubs may be planted along the edge of the paved area

Infrastructure: Lights, storm water drain, drinking water, toilets, garbage bins to be provided

Facilities: Benches to be provided along the periphery, play equipment to be provided for sites over 5000 sm.



Low stepped parapet wall at the edge as seating. Also allows interaction between inside & outside. It is ideal for a playground.

2.Guidelines For Gardens:

Edge: Low parapet wall shall be provided on all sides

Surface: Hard surface to be limited to maximum 30%, earth cover to be retained minimum 70% out of which green cover to be provided in parts

Vegetation: Trees to be planted along the periphery as well as distributed over the site, shrubs to be provided at suitable locations

Infrastructure: Provide lights, storm water drain, drinking water, toilets, garbage bins

Facilities: Benches to be distributed over the site, 3m X 3 m caretaker's room to be provided.



Soft landscape, plenty of shade & provision of seating



Low parapet walls with a walkway in between allow visual connection between inside & outside. They are suitable for gardens too.

3.Guidelines for Recreation Grounds:

Edge: Low parapet wall shall be provided on all sides

Surface: Hard surface to be limited to maximum 30%, earth cover to be retained minimum 70% out of which green cover to be provided in parts

Vegetation: Trees to be planted along the periphery as well as distributed over the site, shrubs to be provided at suitable locations

Infrastructure: Provide lights, storm water drain, drinking water, toilets, garbage bins

Facilities: Benches to be distributed over the site, 3m X 3 m caretaker's room to be provided. Built structures (of the 10% permissible) to include study areas which shall be covered, semi enclosed (Study areas shall be provided especially in RGs near slums and they shall have fans and lights)

4.Guidelines for Parks:

Edge: Low parapet wall shall be provided on all sides

Surface: Hard surface to be limited to maximum 30%, earth cover to be retained minimum 70% out of which green cover to be provided in parts

Vegetation: Bio-diverse plantation of indigenous species to be done. Plenty of vegetation in the form of large, medium and small trees, shrubs and green cover to be provided

Infrastructure: Lights, storm water drain, drinking water, toilets, garbage bins to be provided

Facilities: Benches to be distributed over the site, 3m X 3 m caretaker's room to be provided



2.7.3 SPECIAL GUIDELINES FOR SIGNIFICANT REPRESENTATIVE LOCATIONS

Open Spaces have been divided into various categories, based on their locations:

1. **Open Spaces abutting roads of width 90 feet or more**
2. **Open Spaces as islands at junction of a number of roads**
3. **Traffic Islands**
4. **Open Spaces adjoining educational institutions**
5. **Open Spaces near Transport Hubs**
6. **Open Spaces under electrical High Tension transmission lines**
7. **Green Belts (buffers) between industrial and other zones**
8. **Open Spaces on nallas**
9. **Open Spaces which are abandoned dumping grounds**
10. **Open Spaces on Mangroves**

1. Open Spaces abutting roads of width 90 feet or more: For Open Spaces on such roads where there are no footpaths, a setback shall be provided at the entry. This shall be done for Open spaces having an area more than 2000 sqm. The setback serves two purposes: it enhances the entry and affords safety to the users from the running traffic on the abutting road.

2. Open Spaces as islands at junction of a number of roads: For such islands without any footpaths along their periphery, a setback shall be provided at the entry. A parapet wall 750 mm high shall be provided along the boundary. This height of wall ensures the safety of the users from the traffic without obstructing the visibility of the Open Space from the surrounding area. This height of the wall also ensures that there is no visual obstruction to those driving on the road. Fly-overs passing over islands often ruin the aesthetics of these Open Spaces. Creepers should be trained along the edges of the flyovers and their supporting columns to make the spaces attractive.



3. Traffic Islands: These shall essentially be developed for aesthetics and enhancing the ecology and not for use as RGs or Gardens. There shall be cluster plantation of indigenous species on them.

4. Open Spaces adjoining educational institutions: Open Spaces adjoining Educational Institutions are generally PGs i.e. playgrounds. They are either accessible from a public road or accessible from the institutions only. Those accessible only through the institutions are maintained by them and used only by the students belonging to the institution.

Open Spaces near Educational Institutions which are accessible from a public road are allowed for use by the general public, outside school hours. In such cases, the board at the site shall mention the entry hours for the public and the rule shall be strictly implemented. Sometimes they are near defunct Educational Institutions, accessible from a public road. As stated earlier in this Report, they are prone to be used for parking. They shall be developed and maintained as playgrounds as per the guidelines for playgrounds and be made accessible to the public. They shall have a board stating that they are Public Playgrounds.

5. Open Spaces near Transport Hubs: These Open Spaces shall be developed into gardens as per the guidelines for gardens. Plenty of seating and plenty of shade-giving trees shall be planted so that these spaces can also act as waiting spaces for the people coming to the transport hub. There shall be a hedge along the periphery of these spaces, instead of a parapet wall. This will retain the visual connectivity of the site with the surrounding, add to the greenery, afford some privacy to the users and help reduce the noise and dust from the hectic activity in the vicinity. Paved areas shall be provided for easy movement of the users.



Plenty of shade and seating, hedge along periphery for visual connectivity and greenery to reduce

6. Open Spaces under electrical High Tension transmission lines: These Open Spaces are potentially dangerous for any active use, due to the high voltage of the transmission lines. These spaces shall have dense dwarf cluster plantation.

7. Green Belts (buffers) between industrial and other zones: These Open Spaces shall be developed as playgrounds or as gardens. For larger spaces, dense plantation shall also be done in some parts. In case of linear shapes, the spaces shall be developed for walking / jogging by providing a paved pathway.



Vegetation on green belts and under High Tension lines



8. Open Spaces on Nallahs: Nallas are ecologically sensitive areas and should not be developed as RGs, PGs, etc. This has already been discussed under recommendations for policies. Apart from cleaning the nallas themselves, the areas in the immediate vicinity could be developed as buffers, with plantations, walkways, benches, etc. This will help protect the nallah from misuse like garbage and other dumping, defecation and from encroachments by built forms.



Area in the immediate vicinity of nallas to be developed for passive recreation

9. Open Spaces which are abandoned dumping grounds: These Open Spaces, though not retrievable as active Open Spaces, can be converted into green sites by covering them with vegetation.



Dumping Ground converted into a green site- Off Link Road, Goregaon west

10. Open Spaces on Mangroves: As ecologically sensitive areas, they shall not be developed as active Open Spaces. In fact, they shall be left as no development zones. However, a few of the mangrove sites may be developed as Mangrove Wetland Centres on the lines seen in Singapore. Simple board walks may be provided for people to walk near the mangroves and enjoy bird watching and other nature related activities.



Simple board walks can be provided in Mangrove

2.7.4 RECOMMENDATIONS FOR MANAGEMENT AND MAINTENANCE

As stated earlier, the Open Spaces available in the city today should be available and accessible to all sections of society, throughout the day for relaxation/ recreation /sports. It is observed that apart from the organizations which 'adopt' the Open Spaces, there is a great deal of involvement of various informal user groups in the protection, development and maintenance of the spaces. These groups co-ordinate with the authorities (i.e. MCGM) on the one hand and with the Ward Councillors and other elected representatives on the other, for management and funding respectively.

It is necessary to formalize this collaboration between Civil Society Groups, the MCGM and the people's representatives. Under the 74 th Amendment to the Constitution, there already exists such a mechanism for interaction and negotiations. This is the PPP i.e. the Public Private Partnership model in the form of Ward Committees. It is recommended that this existing mechanism is activated and extended in the form of Area Sabhas also. This study is expected to be put in the public domain and accessible to all citizens. Access to the data, which tells the citizens about the current status (availability and condition) of Open Spaces in their localities, will help empower and encourage them to take the initiative to retrieve and protect these environmental features.

SECTION 3: WATER BODIES

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INTRODUCTION

Water Bodies, as different from linear and flowing water courses, are contained water holdings. It is very important that all the Water Bodies are conserved and wherever necessary are rejuvenated. Regrettably Water bodies in Greater Mumbai are not identified on the current Development Plan (1991) and therefore not protected. The Water bodies neither should be seen as 'active' open spaces like gardens, nor as 'passive' open spaces like Mangroves. They can be placed between the two categories. The Water Bodies have a high value of psychological recreation for the people. Environmentally, they conserve the monsoon waters depressions, wells, tanks and talaos. Besides they support a rich and varied type of ecosystem, and provide an opportunity for nature awareness and education.

While a direct human (mis) use could be discouraged, the water bodies should be within the visual reach of people, unless located in the ecologically sensitive areas like the mangroves or dense forests. The psychological recreational aspect of the water bodies is extremely important for the citizens as the sight of water itself gives a cooling effect and helps in distressing a person. In this sense, they are of special importance in the urban context.

Over the last few decades the built environment has taken a priority over the natural environmental features in Greater Mumbai. The importance of Water Bodies has been completely ignored. They are not demarcated and reserved on the Development Plan. As a result, they are susceptible to be neglected and are in grave danger of being filled in and even built upon.

Prior to this study, no single comprehensive list of the existing Water Bodies in Greater Mumbai was available. On this background MMRDA's initiative to document various kinds of Water Bodies in addition to the Open Spaces in Greater Mumbai, by physically visiting them is a crucial step in the right direction.

For the purpose of this study, water bodies can be broadly categorised as:

- Ponds: small natural water bodies mostly without defined and built edges.
- Lakes (or Talaos): monsoon holdings assisted by embankment that combines the forces of surface run off and fresh water aquifers to keep away the saline water.
- Tanks: holdings of monsoon waters on a surface either with an earthen embankment on its lower side or within a bowl where steps are often constructed to reach a shifting water line. Lakes and tanks can be excavated or can be dammed to restrict the flow of water.
- Wells: provide access to fresh water aquifers that avoid saline strata; a link between a monsoon surface and aquifers; a way of harnessing the ground water to keep the saline waters at bay. (Mathur, da Cunha, SOAK Mumbai in an Estuary, 2009).

Reservoirs: mostly built to store water brought in from the supply lakes to distribute it to predetermined locations though the network of main and subsidiary pipes.

3.1 Brief history of Water Bodies in Mumbai

The Island City and the Salsette (Suburbs) boasted of a large number of natural ponds and talaos as well as tanks. The maps prepared during the turn of the 19th century shows about 52 water bodies in the Island city. The Gazetteer of the Bombay Presidency comments that like most other Eastern cities, Bombay was the possessor of many tanks and wells constructed by 'pious citizens for public good'. The public use included bathing, washing as well as drinking. While the wells were located within the residential compounds, most of the tanks were built in the crowded inner city areas called the Native Town characterized with the mixed usage of residential, commercial and religious activities. Some of the constructed tanks or natural ponds were located near the temples and were considered holy to be used for a ritual bathing as well as for drinking. For example the tanks of Banganga at Walkeshwar, Mumbadevi and Bhatia Bhagirathi at Bhuleshwar, and Mahalaxmi located near the temples were considered holy. Some of the well known tanks that existed in the Island city till the turn of the 19th century and which still lend their name to the locality are as follows:

1. **Cowasjee Framjee Tank:** Popularly known as the Dhobi Talao, was a natural depression, but later was defined by walls in 1831 by Cowasjee Framjee at the northern end of the esplanade for public use in the locality. In place of the tank, an imposing building - Cowasjee Framjee Institute was built.
2. **Babula Tank:** Located in Byculla near the Old Sailor's Home and in the vicinity of Sir J J Hospital and Grand medical College was built in 1849. Several springs of salt water seeped into the tank subsequently.
3. **Two Tanks:** Popularly known as Do Tanki, was in the Duncan road area built before 1823. This was later connected to C.P. tank through aquaduct.
4. **Banganga Tank:** Located within the historic temple precinct of Walkeshwar, received natural flow of water from Malabar hill. Considered very holy, this still existing tank has a mythological and historical significance, dating back to Shilahaar period 9th to 12th century AD. The steps along the periphery were constructed in the late 19th century.
5. **Gowalia Tank:** Located under the existing August Kranti Maidan, had a natural flow of water from Cumballa hill. It served as fresh water feed stock for both, humans and cattle.
6. **Mumbadevi Tank:** Located near the Mumbadevi Temple in Bhuleshwar, it was a natural water body before the masonry steps were constructed defining its edges.
7. **Cowasji Patel Tank:** More known as C.P. Tank, was a natural water body located near Kalbadevi/Girgaon area. It was rejuvenated by Cowasji Patel in 1775. In 1846 when it was very short of water, Framjee Cowasjee purchased the Mughhat oarts and constructed three large wells from which the earlier tank was replenished with the help of steam machines.
8. **Mahalaxmi Tank:** Located near the low level entrance to the temple, built by Dadaji Dhakjee, it had very elegant design of steps to enter the tank. It is reclaimed to be used for multipurpose activities like fairs and marriages.
9. **Bhatia Bhagirathi Tank:** Located in a temple complex in Bhuleshwar, it was used for ablution by the mourners. Today there is an RCC slab above it and has a restricted entry.
10. **Guilder Tank:** Located near the Grant Road railway station near the Municipal school is a play ground at present.
11. **Nardulla Tank:** Located in Prabhadevi and Siddhivinayak Mandir, is a designated recreational garden at present.

(Sources for the above information: The Gazetteer of Bombay City and Island vol III, 1909. Jagdish Gandhi, A Tale of Native Towns of Mumbai, Bhuleshwar, Girgaum, Malabar Hill, 1910, Mumbaicha Vruttanta, Acarya & Shingne, 1889)

Except for Banganga Tank, all the above water bodies were reclaimed by 1910. Most of these lands however are not built upon being used as public open maidans. The areas therefore are still recognized by the name of the tanks. The water in the tanks was highly prone to pollution because of both, the mixed use by the public and by the seepage from the 'liquid sewage' (Gazetteer) in most of the tanks. However the inadequacy to meet the needs of the city coupled with frequent water famines compelled the British authorities to explore the catchment areas in the Salsette to create lakes by impounding the water courses. Thus in 1850 it was proposed to draw water from the 'Vehar nalla' and the construction of the Vihar lake was completed in 1858. Within two years the water supply was found inadequate, resulting in the construction of Tulsi lake in 1879. Meanwhile the waters from the Tulsi catchments were diverted to Vihar to augment the water supply. The Tulsi lake was connected to Malabar Hill reservoir while the Vihar lake was connected to Bhandarwada reservoir in Mazgaon. When the city's requirements further increased, the Tansa lake was constructed in 1892. Meanwhile Powai lake project was undertaken as an emergency measure to cope with the threat of another water famine. As per the Gazetteer, in 1909, Tulsi, Vihar and Tansa had a total storage capacity of 30000 million gallons above the lowest outlet and this supply was hoped to be adequate to fulfill the total requirement of Mumbai.

As a result, the smaller natural lakes and tanks in the city were neglected and continue to be so since then.

Significance of Water Bodies' Study: The environmental importance of Water Bodies has already been stated. They are not demarcated and reserved on the Development Plan. As a result, they are susceptible to be neglected, filled in and even built upon. Currently, no single comprehensive list of the existing Water Bodies in Greater Mumbai is available.

The lakes of Mumbai region are under threats, for the susceptibility of freshwater bodies in urban areas to

extensive and accelerated deterioration (eutrophication), especially in watersheds undergoing intense development. Inland bodies of water have attracted little or no attention. Far from being protected or restored to their original capacity and attractiveness, many old ponds and tanks are now embarrassing and avoidable eyesores – filled with debris and silt, choked with weeds and covered with unsightly and smelly blooms of blue green algae. Hence it is imperative to revive and rejuvenate all the existing water bodies within the city. The most important step is to include them as appropriate reservations of water bodies only in the Revised Development Plan.

In light of this, the initiative of MMR-EIS to undertake a project to inventorise the Water Bodies of Mumbai, is seen as an extremely necessary step. For this project, all probable sites of water Bodies were physically visited to ascertain their existence and to assess their condition. The lakes of Mumbai region are under threats, for the susceptibility of freshwater bodies in urban areas to extensive and accelerated deterioration (eutrophication), especially in watersheds undergoing intense development. Inland bodies of water have attracted little or no attention. Far from being protected or restored to their original capacity and attractiveness, many old ponds and tanks are now embarrassing and avoidable eyesores – filled with debris and silt, choked with weeds and covered with unsightly and smelly blooms of blue green algae. Hence it is imperative to revive and rejuvenate all the water bodies within the city.

3.2 Stages of the Project

This project was executed in four stages:

1. Preparation of the Base Map
2. Identification and Inventorisation of Open Spaces
3. Condition documentation
4. Grading and Classification
5. Findings
6. Formulation of Action Plan
7. Formulation of Development and Design Guidelines

Limitations of the study

- The water bodies under consideration have been studied and mapped primarily with the purpose of Inventorisation. The study is based only on a visual assessment of the pollution levels of the water body based on pre-defined guidelines. No qualitative analysis of water samples has been done to study the ecology /natural ecosystems within the water bodies.
- Water levels have not been monitored or measured under this study. The findings regarding reductions in water levels, if any, is based on local inquiry.
- Environmental features like the catchment characteristics have been determined by the use of secondary data only.
- The physical development, i.e. activities and usage, near the water body has been studied only with respect to its impact on the water body.
- The study does not include actual demarcation/delineation of the water body on site as per city survey records to determine the extent of encroachment etc.
- For Water Bodies in areas owned by Govt. Agencies (Defense, Airport Authority, etc.), and Institutions, entry was denied and photography disallowed due to security reasons. In such cases, the status of the water body was established with the help of Satellite Image.
- The survey has been conducted over a period of about one year. Hence it is possible that some of the Water Bodies existing at the time of the survey may now have dried up or have been encroached or filled in.

3.3: STAGE 1: BASE MAP

A consolidated list of Water Bodies was prepared, based on available lists from MCGM, Govt. departments, earlier studies, etc. (see Stage 3 for details) The existing Water Bodies were identified by physical site visits. These were then shown on the Base Map of Greater Mumbai.

Methodology

The Base Map was prepared as follows:

1. All scanned images of the 1991 D.P (Development Plan) sheets were joined together to form a map of Greater Mumbai. This forms one layer of the Map.
2. Then an Auto CAD drawing was prepared by digitizing all major roads, railway lines, railway stations, ward boundaries, major landmarks etc. and superimposed on the D.P. map image of Greater Mumbai. This is the second layer of the Map.
3. The Development Plan is 20 years old and several new roads etc. have come into existence after the preparation of the D.P. Hence a satellite (Google) image of Greater Mumbai, depicting the current scenario, was superimposed as a third layer on the earlier two layers of the Map.

The necessary corrections and adjustments were made to match the DP and satellite image layers with the Autocad drawing. As per the Terms of Reference, this Base Map was prepared by M/s HCP-DPM, Ahmedabad, the consultants for Water Courses, Coastline Features And Large Urban Greens.

On this Base Map, the following was incorporated during the study by M/s Adarkar Associates:

1. All DP reserved Open Spaces, segregated with separate hatch patterns and different green colour shades, to indicate 'Existing' and 'Proposed' Open Spaces. Open Space sites in areas where MMRDA is the Special Planning Authority were also included. Altogether 3246 sites were shown.
2. Water Bodies which were found to be existing at the time of survey.
3. Boundary of Greater Mumbai and boundaries of each of the 24 Administrative (Municipal) Wards.
4. Boundaries of each of the 227 Electoral Wards in Greater Mumbai.
5. Open Space / Water Body number, corresponding with the reference numbers in the data sheets.
6. Name, C.S. No., area and DP classification of each Open Space.
7. Name, landmark and area of each Water Body.
8. Western, Central, Harbour Railway Lines.
9. Railway Stations.
10. Major Roads.
11. Other existing roads.
12. The sea wherever it abuts the boundary of Greater Mumbai.

This Map of Greater Mumbai thus shows all the 103 Water Bodies found to exist at the time of the survey.

3.4 STAGE 2: IDENTIFICATION & INVENTORISATION

Unlike Open Spaces, Water Bodies in Greater Mumbai are not reserved features on the 1991 DP. Besides, there was no single document available to state the number of existing Water Bodies.

Methodology for IDENTIFICATION

Six sources were used to identify the possible sites of Water Bodies in Greater Mumbai.

- a) Development plan of 1991.
- b) EICHER Maps
- c) Study of Lakes in Mumbai, a Report by World Wildlife Fund
- d) Collector's list
- e) List prepared by Public Health Department, Insecticide branch, MCGM
- f) Satellite Image

Water bodies were identified from the above mentioned sources and a consolidated list was prepared.

Methodology for INVENTORISATION

Total 143 water bodies were identified from the various sources mentioned above. All these 143 sites of probable water bodies were physically visited in order to verify their actual existence on ground.

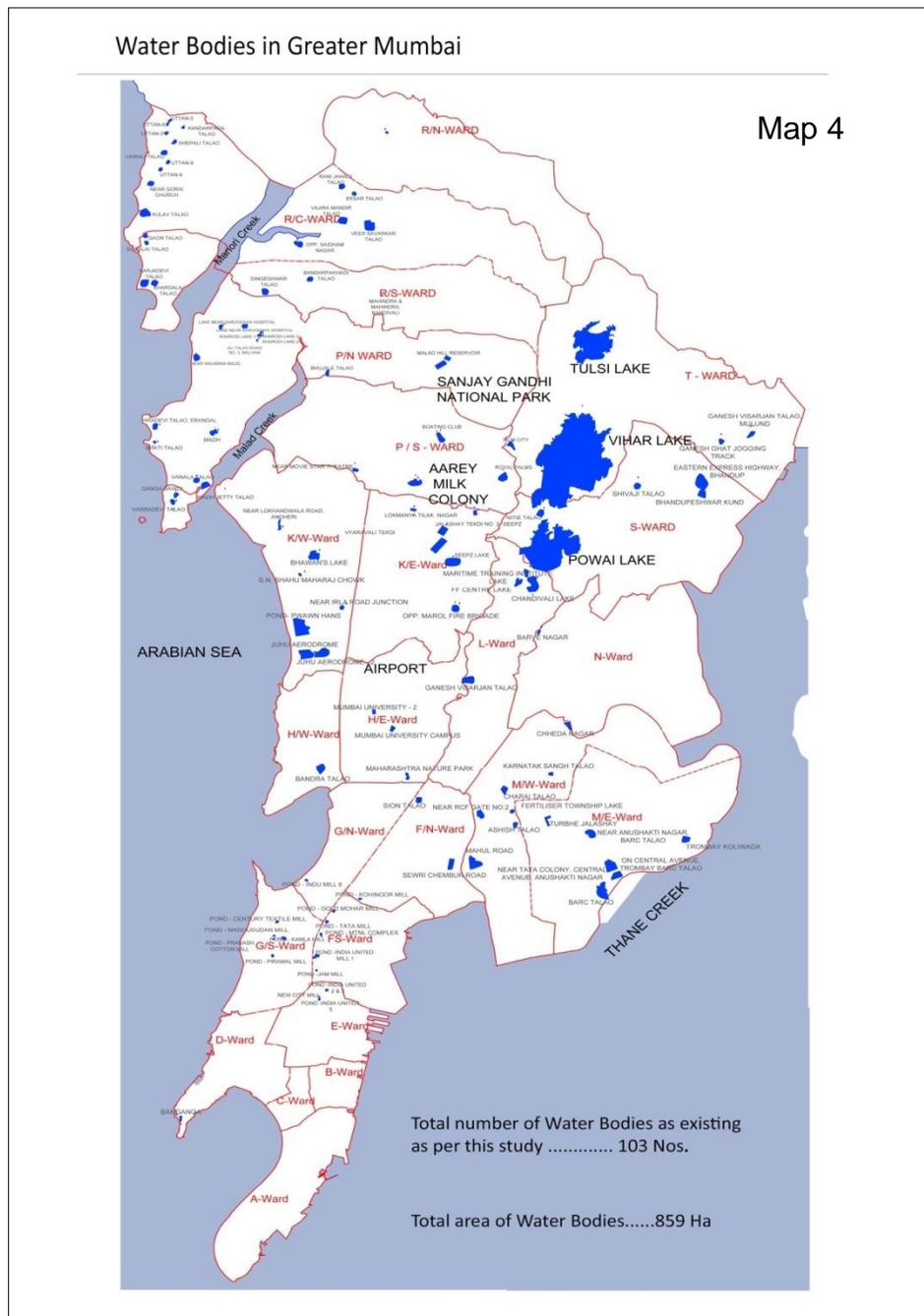
Out of 143, only 107 exist in reality.

On the remaining 36 locations water bodies do not exist.

These sites are occupied either by some built forms- chawls, slums, buildings etc, or are open grounds.

Of the 107 existing ones, 4 are MCGM Water Reservoirs. A final list of existing 103 Water Bodies is given in Annexure 14.

These were studied in detail, with respect to various parameters.



3.5 STAGE 3: DOCUMENTATION OF SITE CONDITIONS

As stated earlier, the 1991 DP does not demarcate all the Water Bodies in Greater Mumbai. Locations of some Water Bodies show reservations of Garden, Playground, etc and some are mentioned as Tank/Reservoirs and many are under various amenity reservations. In this study only the Water Bodies actually existing at the time of survey were documented. Thus, 107 Water Bodies were documented.

Since the survey was to be conducted for a large number of sites and over a long span of time, it was necessary to have a number of persons for field visits. Maintaining uniformity in data collection as well as in recording was crucial. For this purpose, a detailed methodology was formulated. This is discussed in detail below.

Condition Documentation constitutes:

1. Site Visit and Data Collection and Environmental Aspects Of Water Bodies
2. Documentation of data in
 - a) Tabular Sheets under significant parameters and b) in Data Sheets with Sketches and Photographs

3.5.1 SITE VISITS AND DATA COLLECTION

a) For the purpose of ensuring uniformity in collecting information / recording observations in the field, a site proforma was formulated. This was finalized after a series of discussions within the Project Team & with MMR-EIS.

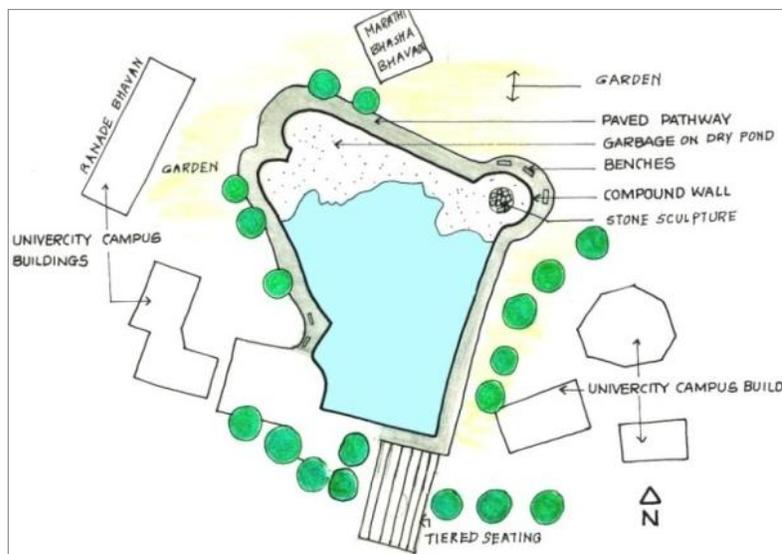
b) To achieve uniformity and clarity in understanding the issues and in the method of filling in information on the site proforma, workshops were conducted for the benefit of field surveyors, prior to site visits. The various parameters for documentation were clearly defined. Since the data does not involve any formal quantification of the parameters, the guidelines for their visual assessment were explained.

c) Each site visit involved the following:

i) Making observations, talking to any security guard or person/s present at the site and / or people in the vicinity and filling up the information in the allotted columns of the site proforma.

ii) Making a sketch (location plan) on the site, showing the access and abutting roads leading to the Water Body and noting features in the vicinity (within 50m) of the site, such as buildings, roads, pathways, trees, etc. as also any encroachment evident on the Water Body, any vegetation and / or garbage or solid waste dumping inside it.

These sketches were later neatly redrawn, annotated and coloured and incorporated in the Data Sheets. In order to attain uniformity in preparation of sketches, guidelines were prepared. Line thicknesses, symbols and colour codes to denote site boundary, built forms, pathways, trees, bund walls and other details within the site as well as for all details within 50 m radius of the site, were defined.



Sample Sketch

iii) Taking photographs to show the condition of the Water Body and the surrounding area. The photographs show approach roads, access to the site (any gateways, name boards, etc.), edge condition i.e. natural edge, wall, etc., vegetation inside and around the Water Body, any facilities like benches, paved walkway, etc. in the immediate surrounding area. The area within 50 m of the Water Body was also documented to show the land use in the vicinity.

3.5.2 ENVIRONMENTAL ASPECTS OF WATER BODIES

As stated earlier, it is essential to study the various environmental aspects of a water body in order to be able to understand the need for its conservation and to formulate an action plan for its protection and rejuvenation. Hence the study involved understanding the intrinsic connectivity of the lakes, physiographic determinism, physiographic features of the city. Certain environmental aspects, such as catchment characteristics, were studied from secondary data.

Intrinsic Connectivity:

Besides the water bodies, their wetlands (marshes, swamps and other areas between dry land and lake edges or river banks) are vital for the survival of biodiversity and the eco-system of the lake. The wetlands around the lakes also function as natural tubs or sponges, storing flood water and slowly releasing it. This combined action of storage and slow release, can lower flood heights and reduce the erosive potential of water. This in turn helps control increase in the rate and volume of runoff from urban areas.

Any region, which is hilly and undulating with a few strips of plain lands, also plays an important role in water and soil conservation. The heavy precipitation of about 260 cm per year (in Mumbai) is absorbed by the forest during the monsoons and released gradually for the next few months through springs and streams, many of them eventually reaching the lakes, which are still important sources of water to parts of Mumbai. The forest also holds back the precious soil, which is highly vulnerable to erosion and which leads to siltation of the lakes.

Physiographic Determinism:

Physiographic determinism is a useful tool to classify any natural environmental resource. The initial surveys through the areas around the lakes revealed an ecologically incongruous pattern of land use. Hence developing a tool to evaluate the impact of these land uses in relation to the existing natural resources of the region was the prime concern. For this it was essential to first examine the land for its various physiographical features. The geographical conditions of the different lakes of Mumbai are varied. The information required for their analysis was acquired from the following:

- Topographical maps from the Survey of India
- Geological information
- Geomorphological information
- Hydro-geological information
- Landform characteristics
- Vegetation pattern
- Other Environmental maps related to Mumbai region
- Landuse maps (old and current)
- Development plans
- Google satellite maps
- On site surveys

Physiographic Features of the city:

The geological evolution and the physiography of the Island City of Mumbai has been documented and studied. South Mumbai region of today or what was known as 'Mumbai' earlier, was originally a cluster of seven islands which were reclaimed to form the Island City of Mumbai ending up north at the Mahim creek. Earlier old maps reveal that the topography of Mumbai is such that the hills lie mainly onto the eastern edge and the western edge. Starting down south and moving northwards along the western edge, there lays the Malabar hill, then the Cumbala hill, the Sambhav pakhadi and the Mahim hillock. Then on the eastern edge, starting from up north, lies the Rawli hill and the Antop hill along with the Brae hill and the Navroji hill range.

These hill ranges house various forts at strategic positions, which guarded the city earlier. The perennial lakes and other water bodies which are seen in this area are a result of this peculiar landform.

The reclaimed areas of the Salsette islands are the suburbs of today. They too are a part of Greater Mumbai and come under the MCGM. Mumbai has a very unique position as an island, with the surface of the sea all around it soaking in the polluting air and moderating the temperature. Equally vital in importance is the carbon sink formed by the single stretch of continuous green cover of the Sanjay Gandhi National Park, the Aarey Milk Colony and the Film City. This green zone has an extremely undulating topography with heights varying from 450 to 500 metres above mean sea level. This gives rise to several springs, streams and rivers. There are four rivers originating from the national park hill, viz the Dahisar river, Poisar river, Oshiwara river and the Mithi river from north to south. All these rivers drain out into the western side, either into the Malad creek or the Arabian Sea. Hence there are several lakes found in the western suburbs. They are also deep compared to their eastern counterparts. On the eastern side of the mountain, the Thane creek is just 1.5km from the ridge along Vihar lake. Hence there are few water bodies as compared to the western side and they are also shallower in characteristics.

The vegetation which is found within the MCGM limits is varied in nature. There are three different types viz, estuaries near the Bassein creek, mangrove vegetation along the Malad and Manori creeks and along the Eastern waterfronts and the hill slope type of vegetation of the tropical deciduous type in the Sanjay Gandhi National Park.

Lake Classification based on environmental parameters:

From detailed analysis of the available environmental data, the water bodies have been broadly classified under the following categories –

- Lakes with Alluvium soil base
- Lakes with Basaltic features like Trachyte, Rhyolite, Agglomerates, Unclassified flows, Simple and Compound flows
- Lakes in mud flats zone and
- Lakes showing multiple characteristics

The lakes in Mumbai region are broadly classified under the above categories. This classification has revealed the surface and surface hydrological conditions of the lake catchments. This information has been used to understand the future sustenance of the quantity of water in the lakes. For instance the lakes with alluvium soil base do not show substantial drop in water levels during the dry seasons due to the water levels of the surrounding alluvium soil base which hold the water for longer durations.

These predominant characteristics of each water body have been seen in the context of the current landuse. Each of the parameters generated for study is useful to understand the current ecological condition of the water body. The various interventions required for further revival and rejuvenation of the water bodies, which have been discussed later, are based on this study.

3.5.3 DOCUMENTATION OF SITE CONDITIONS

All the data collected during field visits was documented in :

1. Tabular Sheet (one sheet for all 107 sites)
2. Data Sheets (one sheet for each site).

1. Condition Documentation in Tabular Sheet

Tabular Sheet is a detailed and technical format which includes compilation of all data collected for each Water Body in tabular form.

As per the Terms of Reference, the following details were to be listed

Table 18: Parameters for Water Bodies									
Sr. No.	Name of Water Body	DP Classification	Ward	Area (Sqm)	C.S. No.	Existing Use	Owner /Occupier/ User	Land uses along edges	Threats

However, as the survey progressed, it was felt necessary to modify & expand these heads to finally include:

1. General statistical and Morpho-metric data

- Name
- Location
- Area
- Depth
- Ownership
- Current usage
- Number of people visiting
- Physical connectivity
- Visual connectivity and
- Facilities provided in the immediate surroundings and the general maintenance

2. Environmental characteristics

- Hydrogeology: like geology and mineral, geomorphology and geohydrology
- Edge characteristics: like Natural and Manmade
- Immediate lake surrounds
- Lake ecosystem: like water quality and water ecology

3. Threats

- Solid waste/ garbage dumping
- Idol immersion
- Siltation
- Disturbance in catchment
- Complete embankment of edges
- Evaporation loss
- New construction in the immediate vicinity
- Encroachment
- Eutrophication
- Algal bloom
- Growth of aquatic weeds
- Saline water ingress

2. Condition Documentation in Data Sheets: This is a two or three page concise format for ready reference. This includes:

1) **Basic data** such as name of the Water Body, adjacent roads, City Survey (CS) No., its area, ownership, etc.

2) **A brief description** of the Water Body, giving the current usage, its accessibility, edge characteristics, facilities in the immediate vicinity and land use in the surrounding area, etc.

3) **A reference from the satellite image** showing the site under reference, adjacent roads and area within 50 m radius of the site. The site under reference is highlighted with a bold out line in blue colour. This is done in order to identify it, from any other features in the immediate vicinity.

4) **An annotated sketch plan** showing details such as access, landscaped & paved areas, trees, benches, etc. in the immediate vicinity and abutting roads, buildings and other details within 50 m radius of the site. Any encroachments / built forms close to the Water Body have been shown.

In order to attain uniformity in preparation of sketches, guidelines were prepared. Line thicknesses, symbols and colour codes to denote the boundary, built forms, pathways, trees, bund walls and other details within 50 m radius of the site, were defined.

5) **Photographs** showing the condition of the Water Body and surrounding area. The approach to the lake, its edge condition (natural, partially natural, artificial), any facilities like paved pathways, benches, etc. in the

immediate vicinity and vegetation inside the Water Body or in the immediate surrounding area has been photographed wherever possible.

After documenting all the data, summaries were made based on a) Entry conditions b) the current usage of the Water Bodies c) Water ecology (Eutrophication). The various issues emerging from the documentation were listed and an action plan was prepared to address these issues.

3.6 STAGE 4: GRADING AND CLASSIFICATION

The documentation has revealed certain threats to the quality and quantity of water in the lakes, which in turn have a direct bearing on the very existence of any Water Body. As per the Terms of Reference, it was required to classify all the existing Water Bodies of Mumbai into 3 categories: a) those which are in danger and require immediate attention, b) those which require attention, though not immediate and c) those which are not in danger but require only maintenance. For this categorization, it was necessary to evolve a system of grading by assigning some value or 'marks' to each of the Water Bodies. The process of grading of Water Bodies involved:

- a) Identification of parameters for grading purpose.
- b) Evolution of a grading system which in turn involved:
 - i) assigning scores to each of the selected parameters
 - ii) calculating the total score or value of a site
- c) Application of grading criteria to all open spaces

3.6.1 IDENTIFICATION OF PARAMETERS FOR GRADING PURPOSE

Of the various parameters used for documentation, threats directly affect the existence of the Water Body. These threats have been summarized under 5 heads and they form the parameters for grading of all Water Bodies:

1. **Deterioration of water quality**
2. **Embankment of edges**
3. **Encroachment**
4. **Solid waste dumping**
5. **Evaporation loss due to loss of green cover**

1. Deterioration of water quality: This was assessed from the extent of eutrophication of the Water Body. Since no qualitative analysis of water samples was done, eutrophication levels were determined from visual observations of the quantity and quality of algae in the water bodies and from the colour of the water in the lakes. Heavily eutrophied lakes appear green in colour and are a hazard not only to the environment, but also to human beings and their surroundings.

2. Embankment of edges: Complete embankment of the lake edge has been observed in some cases. This obstructs the natural inflow of water into the lake. This leads to drying up of the lake.

3. Encroachment: Encroachment is a major concern for the Water Body, because it directly and indirectly affects the lake and its surroundings. It is assumed that every water body is required to have a minimum of 6 m open space around it, which is unencumbered. Wherever any construction or informal settlement has been observed within 6 m, it has been considered as an encroachment. This encroachment has been graded according to the visual density of the built form and its closeness to the water body.

4. Solid waste dumping: Solid waste dumping on a large scale leads to filling up of the Water Body and in extreme case; the very existence of the Water Body is in danger. Disposal of debris, garbage, wet garbage, religious waste, etc. has been observed in the immediate vicinity /along the edges of the lakes. This has been assessed on the basis of the extent of dumping.

5. Evaporation loss due to loss of green cover: An alarming reduction in water levels of many lakes has been noted on the basis of local inquiry and observations. These levels, however, have not been monitored or measured under this study. A major cause of reduction in water levels is the high rate of evaporation of water in the lake. Loss of green cover in the immediate surrounding area of the Water Body is one of the contributing factors for significant evaporation losses.

3.6.2 EVOLUTION OF GRADING SYSTEM

i) assigning scores to each of the selected parameters

A numerical value or a score was assigned for each parameter selected for grading. The scores assigned are 1, 2, or 3, depending upon the levels/extent of the particular threat to the water body. Where the level or degree of threat is “alarming” or severe, a score of 3 has been assigned. Where the particular threat is currently of moderate intensity, but can become severe if not attended to, it has a score of 2. Low intensity threat has been given a score of 1. The criteria for deciding the extent or level of threat have been explained below:

1. Deterioration of water quality: As stated earlier, this has been established from the level or percentage of eutrophication of the Water Body. The colour of the Water Body indicates this level. The deeper the shade of green colour of the water, the greater is the eutrophication. The extent of the lake surface area which appears to be eutrophied has also been considered. On the basis of this visual assessment, the scores assigned are:

Score 1: 0% to 20% eutrophication

Score 2: >20% to 50% eutrophication

Score 3: >50% to 100% eutrophication

2. Embankment of edges: Since complete embankment of the edge leads to drying up of the Water Body, the scores assigned are:

Score 1: No embankment

Score 2: Partial embankment

Score 3: Complete embankment

3. Encroachment: The extent of this threat has been established from the density of built form and its proximity to the edge of the Water Body. The scores assigned are:

Score 1: No built form exists in the vicinity

Score 2: Built form exists in the vicinity

Score 3: Built form exists in the immediate surrounding / abuts the edge of the Water Body

4. Solid waste dumping: For this parameter too, a visual assessment of the percentage of the area of the Water Body which shows dumping, has been considered.

Score 1: 0% to 20% dumping

Score 2: 20% to 50% dumping

Score 3: 50% to 100% dumping

5. Evaporation loss due to loss of green cover: The presence of a fair number of trees in the vicinity helps reduce evaporation losses. Similarly, soft ground cover helps control evaporation. Hence the presence or absence of vegetation (mainly trees) and the type of surface in the immediate surrounding area forms the basis of assigning scores:

Score 1: Fair vegetation (mainly trees), soft ground cover in vicinity

Score 2: No vegetation and soft ground cover in vicinity OR Vegetation and hard ground cover in the immediate surrounding area

Score 3: No vegetation and hard ground cover in the vicinity

ii) Calculating the total score of a site

The summation of all values or scores assigned for every parameter selected for grading, evolved one score which decided the priority level for that lake. Thus the final equation is:

Score of a site = \sum Parameter scores

3.6.3 APPLICATION OF GRADING CRITERIA TO ALL WATER BODIES

After assigning scores and finalizing the system of score calculation, scores were calculated for each of the 143 Water Bodies in the 24 Municipal wards of Greater Mumbai.

Classification of Water Bodies:

After applying the grading system and calculating the scores for each Water Body, the lakes were divided into 3 categories. They were designated as C1, C2 and C3, with the highest scoring sites as C1 and the lowest as C3.

C1- High scores - Need Immediate Attention

C2- Medium scores - Need Attention

C3- Low scores - Need Maintenance

Three ranges of scores were decided out of the maximum range of 1 – 15 for the categories. These ranges are:

1. Score 9 and above – needs immediate attention
2. Score 5 to 8 – needs attention
3. Score 0 to 4 – needs only maintenance

1. The first range of scores i.e. 9 and above is of water bodies which are critically in need of interventions and hence need to be accorded topmost priority. They are in the category “need urgent attention”.

2. The second range of scores i.e. 5 to 8 is for lakes which fall in the middle priority range, which need attention as of now. They are not severely threatened, but could be so if not attended to now. These lakes could benefit from the immediate remedial measures outlined in this study.

3. The third range of scores i.e. 0 to 4 is for lakes with the lowest priority and are categorized as the ones which currently need only maintenance. These lakes are the ones wherein some primary measures have already been undertaken, such as delineation of the water body, edge wall protection. In some cases, development of the surrounding green area has also been observed.

3.6.4 Water Bodies which need Immediate Attention

There are 36 water bodies in the topmost category- C1 i.e. those which require immediate attention. (Refer Annexure 15). The issues and the recommendations for dealing with them have been discussed under ‘Recommendations’.

3.7 STAGE 5: FINDINGS AND ANALYSIS

The findings & observations are noted under various heads:

- 1. D.P. Classification of Water Bodies**
- 2. Location of Water Bodies:**
- 3. Usage of Water Bodies**
- 4. Immediate surroundings**
- 5. Visibility of Water Bodies**
- 6. Accessibility to Water Bodies**
- 7. Ecological conditions**

1. D.P. Classification of Water Bodies:

Of the 107 existing water bodies, only 10 nos. are mentioned in the DP as either 'tank' or 'lake'. Other water bodies existing on ground do not have any specific DP Classification to indicate their status as a water body. Some have classifications like RG, PG, etc. while some of the water bodies are on other reservations.

Table No. 19: Specific D.P. Classification

Category	No.
Tank	6
Tank, PG	1
Lake	3



Harba Devi Mandir Talao

2. Locations of Water Bodies:

a) The water bodies are located in different areas like the urban formal residential areas, the informal residential areas and Gaothan areas on the outskirts of the city. There are certain water bodies which are also located near the highway or major roads.



Water body near the Eastern Express Highway

- b) The main issues for the water bodies near the slums are of excessive garbage dumping, sewage inflow and of deterioration of edges due to encroachment of built form on the water body.
- c) A majority of water bodies in Gaothan areas like Manori, Gorai and Uttan are not within the vicinity of residential areas and are therefore protected from excessive garbage dumping.
- d) 14 nos. water bodies belong to Textile Mills. Although mainly used for fire-fighting when the mills were operational, most of them are threatened due to the Real Estate development policies specifically applicable to the mill lands.

3. Usages of Water Bodies:

- i) Drinking : 2 lakes in Greater Mumbai are used for drinking water- Tulsi Lake and Vihar Lake.
- ii) Reservoirs: 4 reservoirs owned by MCGM used for water supply. These are listed as follows:
 1. Jalashay Tekdi, Andheri
 2. Water Reservoir, Malad Hill
 3. Vyarvali Tekdi, Andheri
 4. Turbhe Jalashay
- iii) Domestic Purpose: Water bodies in the gaothan areas like Manori, Gorai and Uttan are used for domestic purposes like washing clothes, utensils and also cattle.

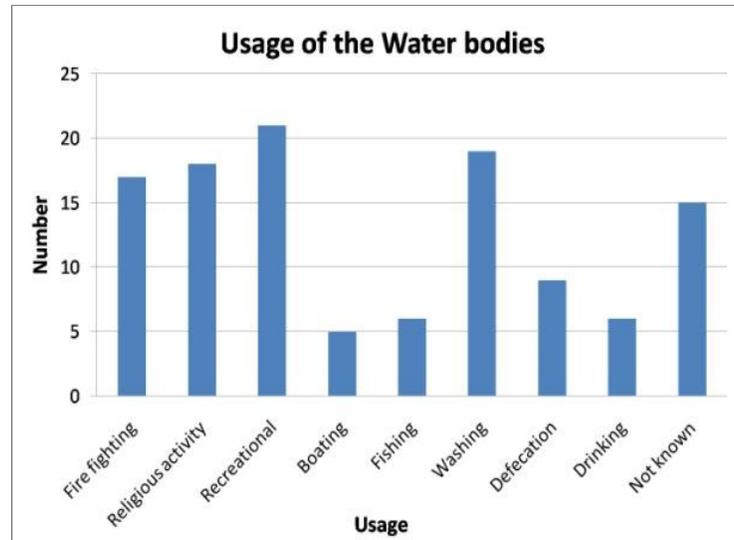
The balance 91 lakes do not have any single specific use. Most of them have multiple uses, both congruent and incongruent. Out of the 91 lakes, 20 lakes have restricted entry e.g. Bhavans College Lake, Pawan Hans Lake, etc. while one lake (Ganga Baudi in K-West ward) is inaccessible.

The table and graph given below is a summarized account of the various uses observed in the surveyed water bodies:

Table 20: Usage of Water Bodies

Name	Nos.
Fire fighting	16
Religious activity	18
Recreational	21
Boating	5
Fishing	6
Washing	19
Defecation	9
Drinking	6
Not known	15

Chart 4: Usages of Water Bodies



4. Immediate surroundings:

- a) Water bodies in the urban areas (formal & informal residential areas), have very less vegetation near them, whereas water bodies in the gaathan areas have a good amount of vegetation surrounding them.
- b) Water bodies located in the vicinity of urban informal residential settlements have problems like garbage dumping and sewage flow.
- c) Parking is done near the water bodies located close to urban informal settlements.



Garbage on the edge of water body



Parking along Ali talao, Malvani

5. Visibility of Water Bodies:

It is observed that many water bodies which have been developed as recreational sites, have a high fencing around it which does not allow the viewer to experience the view completely.



Fenced gate: Gaondevi Lotus Talao



Fencing around the talao: Charai Talao

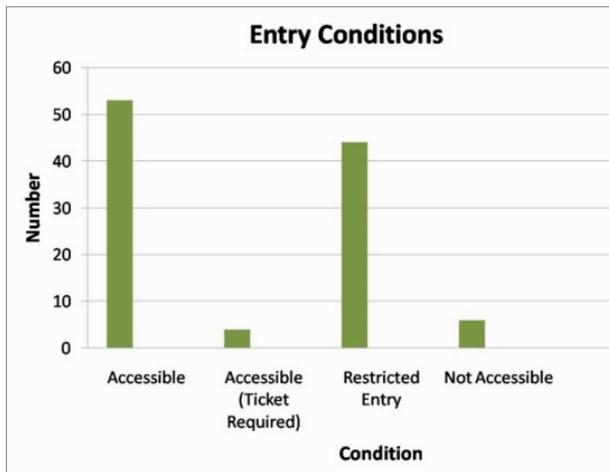
6 Accessibility to Water Bodies

a) Entry conditions to the water bodies are given in the table below.

- 53 out of the total surveyed water bodies are accessible to the public, free.
- 49 have restricted entry (mills, Institutions etc)
- 4 are accessible after buying a ticket,
- 1 is not accessible to the public at all.

b) In several cases, water bodies are not known to the public as there are neither access roads nor signage to give information about them.

Chart 5: Entry Conditions to Water bodies



7. Ecological conditions:

a) All the surveyed water bodies show that the quality of water is continuously deteriorating.

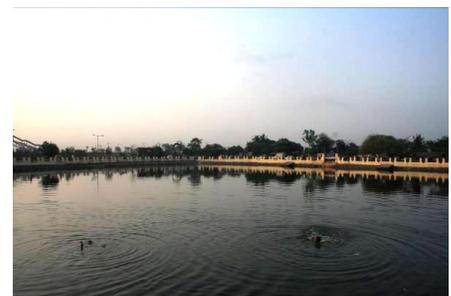
b) Three different types of ecological conditions of water in the water bodies are found. 58 water bodies have mesotrophic water conditions, 28 water bodies have eutrophied water, 6 water bodies are oligotrophic.



Eutrophic water- Hiradevi Talao, Erangal

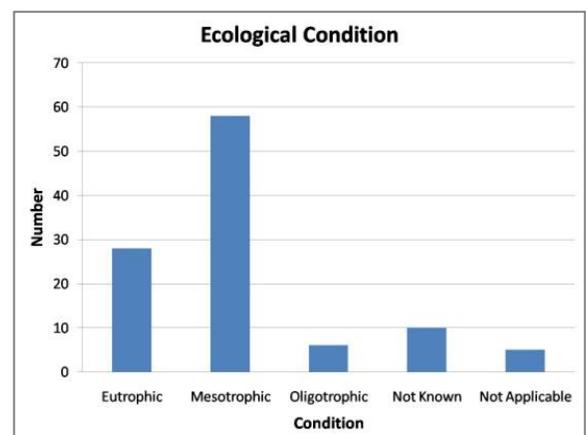


Mesotrophic water- Madh Talao



Oligotrophic water- Bhandupeshwar kund

Chart 6: Ecological Conditions to Water bodies



3.8 STAGE 6: ACTION PLAN : Recommendations and Development Guidelines

Objectives of Action Plan

Like Open Spaces water too has recreational value since it creates a healing and soothing effect on the human mind. The proximity of any water body and a visual connection with it has a very definite psychological value, enhanced by the mobile character of water. Water bodies help in creating this soothing atmosphere in the surrounding merely by their sheer presence. This value is further enhanced by having a barrier free water body and accessible and conducive surroundings.

Water bodies in Greater Mumbai neither should be seen as 'active' open spaces like Gardens, nor as 'passive' open spaces like Mangroves. They can be placed between the two categories in the sense that while a direct human use is discouraged, they should not necessarily be out of visual reach unless located in the ecologically sensitive areas like the mangroves or dense forests. The psychological recreational aspect of the water bodies is extremely important for the citizens as the sight of water itself helps in distressing a person. Hence the objective is to organize a clean water body with good viewing facilities from relaxed positions, and a barrier free immediate environment.

In order to formulate an Action Plan for Water Bodies, it was necessary to know

- i) Various issues and problems involved,
- ii) Water Bodies which are most threatened and those which need to be protected and developed on a priority basis,
- iii) provisions in the current rules and regulations for their protection,
- iv) the current policies and practices for their development and maintenance.

Recommendations

Since every lake is a precious water resource, the ecological sustainability of the lake however small or big, can be neglected, or just filled in to create land for development. Some of the threats need to be addressed on an immediate basis and some can be addressed on in the long term.

Of the various threats listed above, some are of utmost concern and hence need to be addressed on an immediate basis and some can be addressed on a long term basis.

From the point of view of restoration and conservation and also to maintain the eco-sustainability of the lakes, certain measures are recommended, of which some are short term and some are long term. All the measures recommended are essential for the sustenance of the particular water body.

Recommended for Protection, Restoration and Maintenance of the Water Bodies are of two kinds:

- a) Recommendations for Regulatory Framework
- b) Physical Interventions and Development Guidelines for Buffer Zones and for Specific Locations

3.8.1 RECOMMENDATIONS FOR REGULATORY FRAMEWORK

IN order to protect and conserve the Water Bodies, following recommendations need to be part of the DCR of Greater Mumbai. They pertain to the important requirement of the Buffer Zone, Plantations, Idol Immersion etc.

1. All water bodies must be marked and reserved only as Water Bodies on the DP, with their areas and ownership mentioned. This will help in prevention of indiscriminate filling up of lakes and using the land for development.

2. Stringent regulations must be put in place regarding development of the land in the immediate vicinity of a Water Body.

- a) A minimum of 6 to 10 meters open space all around the Water Body must be kept free of any construction.
- b) A limitation on the extent of hard surfaces along the periphery of the Water Body must be stated.
- c) Vegetation and other important environmental features like mangroves, etc. in the immediate surrounding area, congenial to the water body, should not be destroyed.
- d) Improper edge treatment, such as that which may block any feeder channels, must be disallowed.
- e) No land use in its vicinity, which is detrimental to the existence and sustenance of the Water Body, should be allowed.

3. An Environment Protection Cell or a similar regulatory body should be formed under MCGM in order to protect, conserve and maintain the Water Bodies. Although most of the water bodies belong to the MCGM, their catchments or the immediate surrounding land is not within MCGM limit or jurisdiction. This either lies with the forest department or a trust etc. Hence any project to be implemented for the lake, involves several departments or agencies. Within the hierarchy of the MCGM, a proper organizational structure exists for development and maintenance of gardens and parks. A similar body should be formulated for Water Bodies.

4. Water bodies within mills or industrial compounds should be acquired by MCGM and handed over to the Garden department for its development and maintenance.

5. In case of water bodies where there are existent practices of idol immersion, MCGM should build an artificial tank near the main water body for the purpose of idol immersion. An artificial immersion tank erected in the mayor's bungalow compound at Shivaji Park, Dadar during the Ganesh festival should be taken as an example to be followed.

3.8.2 DESIGN /DEVELOPMENT GUIDELINES FOR BUFFER ZONES

Development of recreational buffer zone around the water body:

Issue: Absence of a buffer zone has led to problems like garbage dumping and encroachment at the periphery of the water bodies. The buffer zone is expected for both, protecting the water body as well as creating a recreational zone. It is assumed that protection of the water body should be linked to the recreational value of the water body.



Development of a recreational buffer zone around the Water Body



Recommended measures:

1. As mentioned earlier a buffer area of 6 -10 meters in width to be provided around all the water bodies irrespective of their locations.
2. This buffer is to be developed to enhance and enjoy the recreational value of the water bodies by providing walking tracks, pathways, seating, green zones and plantation. The surfaces designed in the buffer to be of a judicial combination of hard and soft landscape.
3. Provision of infrastructure facilities like extra (more than the regular norms) garbage bins placed at closer intervals, provision of adequate lights, and judiciously placed seating arrangements.
4. Security concerns of the area can be dealt with by providing a low fencing, not more than 1.2 mts around the water body. Alternative ways of fencing are to be explored.
5. Proper Signage is to be provided at the periphery of the water body to give information about the importance and protection of the water body.
6. The edge condition of the water body to be designed so that it discourages any entry inside the water. In case of boating facilities, the edge can be in the form of a low height parapet wall having specific entry points.
7. Plantation in the area is to be done in such a way that it further increases the visual quality of the water body. Plantation should be shade giving for the seating.

3.8.3 DEVELOPMENT RECOMMENDATIONS FOR SPECIFIC LOCATIONS OF WATER BODIES:

1. Development Recommendations for Water Bodies near urban formal residential area:

Issue: A major issue is garbage dumping and concretizing in this category.

Recommended measures:

1. Cleaning of the water bodies to be carried out following the general guidelines.
2. A buffer to be developed as per the general guidelines.
3. A special immersion trough to be constructed for the idol immersion.
4. Concretisation, especially in the buffer zone, to be prevented
5. Engagement of the Housing Societies in protecting the water bodies to be initiated by MCGM

2. Development Recommendations Water Bodies near informal settlements like Slums:

Issue: There are a number of issues relating to encroachment, garbage dumping, discharge of hazardous affluent and sewage in the slums and in the manufacturing units near the water bodies.

Recommended measures:

1. Structures located within the buffer zone area (of minimum 6 to 10 metres) need to be cleared, by treating the occupants as PAPs and relocating them in tenements, generated through various development schemes, on a priority basis.
2. In order to discourage garbage dumping and discharging sewage and waste water into the water body, MCGM to make sanitary provisions like additional toilets, bathrooms and drinking water taps, as well as garbage disposal and clearance facilities till such time that the entire settlement is rehabilitated.
3. Desilting and cleaning the garbage and other solid waste from the water body by means of natural and /or chemical treatments.
4. A part of the buffer zone could be developed by making a sloping edge with pitching. Pitching is to be done to prevent the soil erosion along the edges. Trees are to be planted in the buffer area.
5. As an immediate and interim measure, the immediate edge of the water body to be provided with 6 ft high netting erected between metal frames. This will give complete transparency for visual connectivity and at the same time act as a barrier and prevent garbage dumping.

3. Development Recommendations for Water Bodies near temples or other religious places:

Issue: A good deal of religious waste is generated and dumped into the water body.

Recommended measures:

1. Recreational buffer zone to be created as per the guidelines already stated. This buffer zone should be made accessible to public even if it is near a religious structure
2. Idol immersion in the main water body to be strictly disallowed. An artificial water body to be created for the purpose of immersion
3. Only eco-friendly idols to be immersed in the area allocated for immersion
4. Sufficient number of containers to be provided along the periphery of the Water Body, for collection of religious waste such as flowers and other bio-degradable material. No floral waste to be permitted to be thrown in the lake water.

4. Development Recommendations for Water Bodies in Gaothan area:

Issue: A predominant issue is the use of water for washing utensils and clothes, leading to aggravating the deterioration of the quality of water.

Recommended measures:

1. The use of lake water for washing clothes, utensils and cleaning of cattle to be allowed since these water bodies are probably the only sources of water in these areas. But the lake water should not be allowed to be used for drinking. Instead, municipal supply of water for this purpose should be done on a priority basis.
2. Segregation of water for washing, drinking, cattle can be made through specialized recycling of the water through systems like the 'Root Zone Cleaning System'.
3. Pitching/dredging to be done to prevent soil erosion.
4. Recreational buffer area to be created as per the general guidelines.

5. Development Recommendations for Water Bodies within Institutional areas/ campuses:

A majority of water bodies in Institutional areas are not accessible to the public. They are maintained by the respective institutes. However, MCGM should negotiate with the management of these institutes for application of the above guidelines to improve the condition and the immediate surrounding area of these water bodies.

6. Recommendations for general cleaning

A detailed DPR is necessary to carry out a detailed analysis of the lake ecology. The various remedial measures required to be carried out regarding the improvement of the water quality, are mentioned in the Tabular Sheet against the respective Water Body. They include:

- Dredging/ Desilting
- Catchment management
- Bio-remediation
- Bio raft filters/ Bio technologies
- Provision for disposal of religious waste
- Filters for surface water and feeder channels
- Lake edge protection
- Inflow and outflow gutters
- Plantation in the immediate surrounding area

3.8.5 RECOMMENDATIONS FOR MANAGEMENT AND MAINTENANCE OF WATER BODIES

The Water Bodies existing in the city today should be available and accessible to all sections of society, for recreation and relaxation. As stated earlier, the recommended buffer zone of 6 to 10 m around the water body should be developed and maintained for recreational use. It is observed that, sometimes, there is enthusiasm and willingness of various informal user groups to be involved in the protection, development and maintenance of the lakes and their buffer areas. Mumbai's Water Bodies can be rejuvenated if more local groups, such as Rankala Bachao Andolan Samiti' in Kolhapur (Refer Case Studies in Annexure 17), come forward and collaborate with the authorities. It is necessary to formalize this collaboration between Civil Society Groups, the MCGM & other authorities as well as the people's elected representatives. Under the 74 th Amendment to the Constitution, there already exists such a mechanism for interaction and negotiations. This is the PPP i.e. the Public Private Partnership model in the form of Ward Committees. It is recommended that this existing mechanism is activated.

This study is expected to be put in the public domain and accessible to all citizens. Access to the data, will give the citizens information about the existence and the present condition of Water Bodies in their localities for them to take initiative to retrieve and protect these vital environmental features.

SECTION 4:

GLOSSARY, BIBLIOGRAPHY and ANNEXURES

GLOSSARY

OPEN SPACES

- **DP:** Development Plan
- **Reserved Open Spaces:** All sites reserved as Open Space Amenity in the Development Plan 1991.
- **Available Sites:** Sites which are completely open or those which are built upon but the plinth area of the structure/s thereon is not more than 70% of the total site area.
- **Non-available Sites:** Sites which are built upon and the plinth area of the structure/s thereon is more than 70% of the total site area.
- **Sites In Use:** Sites which are being used as recreational spaces i.e. as a garden, playground, stadium, gymkhana etc. This does not include incongruent uses like parking, hawking, garbage / debris dumping, defecation, etc.
- **Sites Not In Use:** Sites which are open but not used by people for recreational purposes i.e. their intended purpose. It may be used for any incongruous use such as parking, hawking, garbage and / or debris dumping, defecation, etc.
- **Inaccessible Sites:** Sites which are not possible to reach either because there is no road leading to them or because they are surrounded by structures and / or by other obstacles.
- **Developed Sites:** Sites which have at least one of the following facilities:
Lights, Water supply, Drainage, Toilets, Garbage bins, Play equipment, Seating, Walking/ Jogging track, Caretaker's room.
- **Not Developed Sites:** Sites which do not have even one of the above-mentioned facilities. No attempt has been made to develop them.
- **Sites with Restricted Entry:** Sites which are not accessible to the general public- entry is restricted to a certain group only e.g. clubs, gymkhanas which permit entry to members only.

WATER BODIES

- **Eutrophic Water Bodies:** Eutrophication is a process whereby water bodies, such as lakes, estuaries, or slow-moving streams receive excess nutrients that stimulate excessive plant growth (algae, periphyton attached algae, and nuisance plants weeds). This enhanced plant growth, often called an algal bloom, reduces dissolved oxygen in the water when dead plant material decomposes and can cause other organisms to die. Nutrients can come from many sources, such as fertilizers applied to agricultural fields, golf courses, and suburban lawns; deposition of nitrogen from the atmosphere; erosion of soil containing nutrients; and sewage treatment plant discharges.
- **Mesotrophic Water Bodies :** Water Bodies that have clear water with beds of submerged aquatic plants and medium levels of nutrients are said to be Mesotrophic.
- **Oligotrophic Water Bodies :** Water Bodies that have a high level of oxygen, poor nutrient supply, low algal production, very clear waters, scarce rooted vegetation and plankton are said to be Oligotrophic.
- **Hydrogeology :** Study that deals with the distribution and movement of groundwater in the soil and rocks of the Earth's crust, (commonly in aquifers).
- **Geomorphology:** Scientific study of landforms and the processes that shape them. Geo-morphologists seek to understand why landscapes look the way they do, to understand landform history and dynamics, and to predict future changes through a combination of field observation, physical experiment, and numerical modeling.

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