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Urban Planning and Development: A Case Study of Sustainable Zonal Development and Infrastructure Design for Hindaun City (North Zone)

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Abstract - This dissertation examines the urban planning and development strategies for Hindaun City's North Zone through the creation of a Zonal Development Plan (ZDP) for 2036. Hindaun City, a significant urban center in Rajasthan, is experiencing rapid population growth and urbanization, necessitating a comprehensive and sustainable development plan. The Master Plan for Hindaun City 2036 provides a broad framework, and this dissertation delves into the specific proposals for the North Zone, known as Zone A.

The research employs a multi-method approach, including Geographic Information System (GIS) mapping, analysis of existing conditions, stakeholder consultations, and policy reviews. The study identifies critical areas for intervention in residential, commercial, industrial, and recreational sectors, proposing detailed land use plans and infrastructure improvements. Special attention is given to enhancing social and physical infrastructure, addressing environmental sustainability, andensuring equitable development.

Key findings reveal that while Hindaun City has made significant strides in urban development, challenges such as inadequate infrastructure, unplanned growth, and environmental degradation persist. The proposed ZDP aims to address these issues through targeted policies and strategic interventions. The dissertation concludes with recommendations for implementing the ZDP effectively, emphasizing the need for continuous monitoring, stakeholder engagement, and adaptive management to ensure the plan's success.

By providing a detailed case study of Hindaun City's North Zone, this dissertation contributes to the broader discourse on urban planning and development in rapidly growing cities. The findings and recommendations offer valuable insights for policymakers, urban planners, and researchers focused on sustainable urban development

***Key Words*:** urbanization , GIS , ZDP , policymakers

1.INTRODUCTION

The name Hindaun City originates from the forest called 'Hindmi.' Over time, 'Hindmi' evolved into Hindaun City. Historically, this city served as the capital of the kingdom ruled by Hiranyakashipu.

Hindaun City is situated 156 km from Jaipur, the state capital, and 29 km from Karauli, the district headquarters. It functions as the sub-divisional headquarters for Karauli district. The city is well-connected by road, specifically by State Highway No. 22, which runs from Mandalrai to Pahari via Karauli, Hindaun City, Mahwa, Khedli, and Nagar (including the Hindaun City Bypass), and State Highway No. 1, which stretches from Jhalawar to Mathura via Gangapur, Hindaun, Bayana, and Bharatpur to the Uttar Pradesh border. Additionally, Hindaun City is served by a broad-gauge railway line under Central Western Railway.

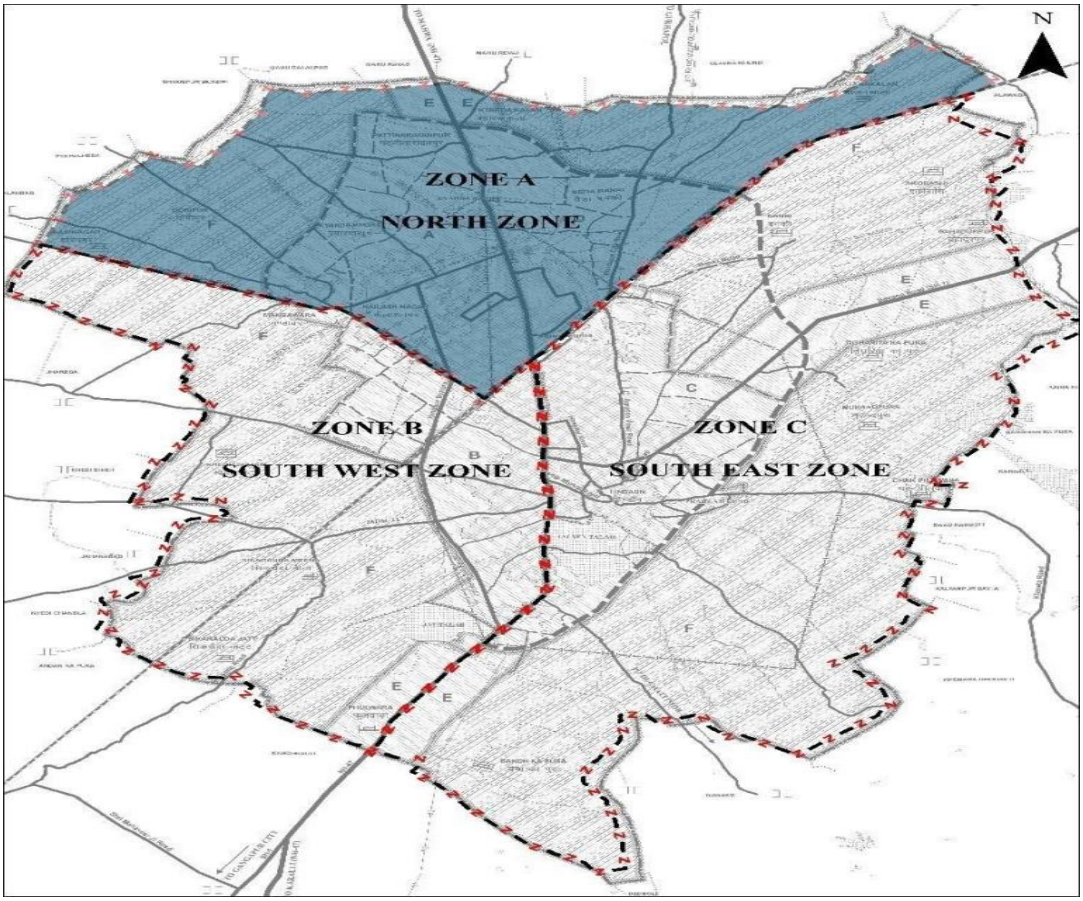
Study Area:

According to the 2011 Census of India, Hindaun City had a population of 105,452, with 55,834 males and 49,618 females. This population is projected to reach 211,204 by 2036. In response to the growing urban population, the Department of Urban Development and Housing, Government of Rajasthan, continues to develop various plans and schemes through its Town Planning Department.

HINDAUN CITY

ZONAL DEVELOPMENT PLAN (2036)

ZONE A (NORTH ZONE)



MUNICIPAL COUNCIL
HINDAUN CITY

Physiography

Hindaun City is located at an elevation of 235 meters above mean sea level (MSL), positioned at 26˚ 74’ north latitude and 77˚ 03’ east longitude. The city's climate is predominantly dry throughout the year, with the exception of the rainy season, which spans from June to September.

Functional Character

The surface area of Hindaun City is rich in resources, it is rich in many agricultural producers and stone business. Under the transport means, it is connected to important cities of Delhi-Mumbai by the West-Central Broad Gauge Railway and due to its location on National Highway-47 and State Highway 22, economic and commercial activities here have their own place.

The participation ratio of Hindaun City is about 28 percent under the 1991 census, about 27 percent under the 2001 census and about 31 percent in the year 2011. The business structure for the year 1991, the year 2001 and the year 2011 is shown in Table-1:

S N	Busine	19		20		20	
		N	Percenta	N	Percenta	N	Percenta
1	Cultivator	2667	16.14	1878	8.22	2669	8.19
2	Agricultural labor	1121	6.78	1123	4.91	2012	6.17
3	Domestic industry	2522	15.26	1248	5.46	1368	4.2
4	Other	10216	61.82	18611	81.41	26549	81.44
Total	Contribution	16526	100	22860	100	32598	100
	Participation ratio		**28**		**27**		**31**

Master Plan of Hidnaun 2036

The Town Planning Department of the Government of Rajasthan formulated the Master Plan for Hindaun 2036 in compliance with Section 7 of the Rajasthan Urban Improvement Act of 1959. This master plan received official notification on December 3, 2019.

Land use	Area (Hectare)	Developa ble area (%)	Percentage ofUrbanizable Area (%)
Residential	1438.69	50.51	48.8
Commercial	149.57	5.24	5.06
Mixed Land use	76.89	2.7	2.62
Industrial	92.85	3.26	3.15

Government &Semi-Government	31.88	1.12	1.08
Recreational	358.76	12.6	12.17
Public & Semi-public	228.9	8.04	7.75
Circulation	470.79	16.53	15.97
Total Developable area	**2848.33**	**100**	--
Planation Belt /Forest	4.09	--	0.14
Water bodies &Other lands	96	--	3.26
Urbanizable area	**2948.42**		**100**

Zonal Development Plan

A master plan for a city or town serves as a visionary document that outlines the future development of the settlement. While it provides a broad framework for achieving this vision, the implementation of the plan requires detailed zoning at the local level. Not only does zonal plans help in creating detailed infrastructural plans, but also would help in preparing/dealing

various schemes of Private/Public Sector and would be more connected to the ground realities.Hence, planning at zonal level is an important step in sustainable development of a city.

Analyzing the city at a more granular level ensures that every locality within the city is adequately linked to essential social and physical infrastructure such as education, healthcare, utilities like power and water, and an efficient road network. With this purpose in mind, the zonal development plan has been formulated.

Some of the features of this zonal development plan preparation exercise include,

- GIS based property level (plot/revenue khasra) base map and existing land use map – to provide property level data which would help urban local body in processing applications for regularization, conversion of agricultural to nonagricultural land, compounding, land use authorization, property tax land title and various other municipal functions.
- Identification of deviations in land use contrary to the master plan and their subsequent

compatibility with the master plan – this will ensure that compatible and non-compatible land use are clearly demarcated and to help in taking further actions accordingly.

- Reserving land for future circulations (road network) – haphazard development often cropsup due to non-reservation of road network in the periphery. Zonal plan will ensure that major road network (up to 12 meters wide road) is proposed such that development takes place in a defined manner.
- Fulfilling the deficiencies in social and physical infrastructure – at master plan level such facilities are demarcated at a broad level for the city, however, many of these facilities haveto be planned based on the concepts of neighborhood planning. Therefore, zonal plans would also help in identifying the deficiencies in social and physical infrastructure and thereby proposing facilities to fulfil the deficiencies.
- Identifying vacant government land for future development – in order to ensure that the government creates new infrastructure facility, the facility should also be financially viable. Acquisition of land is lengthy and sometimes unviable also, therefore it is always better tohave Government land set apart for creation of facilities.
- Ensuring minimum open space per capita requirement – it is often seen in various cities/towns that open spaces are either not developed or non-existent. It has been widely established that good open spaces are essential for better quality of life and hence such

Open spaces which may be developed should be identified and conveniently located for residents to access.

- Determination of Roads' Right of Way and Building Lines: While the master plan broadly outlines the right of way for major roads, the actual dimensions of these rights of way vary in developed and undeveloped areas. Additionally, the master plan does not specify the right of way for other roads, nor does it establish building lines. Therefore, the zonal development plan aims to precisely define the right of way and building lines for all roads.

The zonal development plan has been formulated based on the aforementioned considerations and guided by certain planning principles outlined in Chapter 2. The Urban Area Limit of the Hindaun City Master Plan has been divided into three zones, delineated according to physical boundaries such as State Highway 22 from the center, State Highway 218 to the west, and the railway line running from northeast to southwest within the town.

Demography & Growth

According to the Census of India, 2011, Hindaun City had a total population of 1,05,452, comprising 55,834 males and 49,618 females. In 1951, the population of the city stood at 14,673,marking a tenfold increase over a span of 60 years. The sex ratio of the district is 889 females per 1000 males, compared to the state average of 928. The literacy rate of the city is 75.31%, surpassing the state average of 66.11%. The main city area is divided into 60 wards.

1.5.1 Population Projection

Population projection utilizes the incremental increase method. This approach assumes a progressively increasing or decreasing growth rate, based on whether the average of incremental increases in the past is positive or negative. Future population estimates are derived by adding the arithmetic mean increase to the last known population figure, and subsequently incorporating the average of incremental increases to this sum (once for the first decade, twice for the second, and so forth).

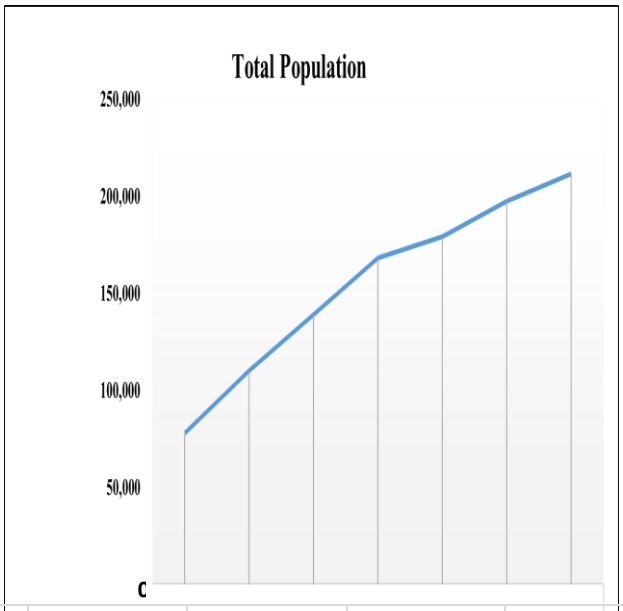
Town/Villag	*19*	*200*	*201*	*2021*	*2026*	*2031*	*2036*
Akorashi							
Bahadurpur	78	1,24	1,41	1,72	1,87	2,04	2,19
Bandh KaPura							
Banki			2,28	2,81	3,07	3,34	3,60
Beda Banki			1,43	1,64	1,75	1,86	1,96
Chak Piluwala							
Gopipur	63	1,60	2,50	3,44	3,88	4,38	4,83
Hari Nagar							
Hindaun	6078	84,86	1,05,5	1,27,7	1,38,0	1,50,2	1,60,0
Kailash Nagar		1,00	1,66	2,32	2,62	2,97	3,28
Kedi Ghatar	35	93	1,12	1,51	1,69	1,90	2,08
Kyarda Kalan	83	1,08	1,47	1,78	1,93	2,10	2,25
Kyarda Khurd	2,8	3,53	4,99	6,25	6,85	7,51	8,12
Mandwara	2,6	3,06	3,74	4,18	1,39	4,61	4,83
Mukandpur	1,5	1,99	1,96	2,21	2,34	2,47	2,59
Pattinarayan pur	83	1,20	1,55	1,91	2,09	2,27	2,45
Phulwara	2,8	3,99	3,60	4,06	4,28	4,52	4,74
Sikarauda Meena	1,6	2,33	2,73	3,21	3,44	3,69	3,93

Tighariya K Pura							
Vajana Kalan	2,7	2,97	2,71	2,98	3,11	3,25	3,38
Total	**764**	**1,09,3**	**1,38,6**	**1,67,8**	**1,78,9**	**1,97,0**	**2,11,0**

*Projected

As it can be seen from the above table, absolute population figures point out that growth rate has been steady and will continue to remain steady, similarly, the relative growth shows that the population is continuously rising.

With steady increase in population of Hindaun City Urban Area, it is expected to become a major city in upcoming decade, which necessitates regulation of urban development at this stage. To control the areas outside municipal limit, Government of Rajasthan had formed Municipal Councilfor the city.



	1991	2001	2011	2021*	2026*	2031*	203
Total Population	**77,645**	**109,833**	**138,661**	**167,888**	**178,895**	**197,106**	**211,2**

Infrastructure Design for Climate Resilience :

Evaluation of Climate-Related Risks
Flood Protection and Stormwater Management
Climate-Resilient Building Design
Green Infrastructure for Resilience:
Energy Infrastructure Resilience

2. Body of Paper

Regulatory Compliance and Monitoring

1. **Adherence to Environmental Regulations and Standards**:

The report stresses that regulatory compliance is fundamental to the success of any development project. It ensures that environmental protection laws are followed to minimize negative impacts on ecosystems and human health. The EIA highlights the importance of aligning the project with:

National Environmental Laws: The development must comply with all relevant national environmental legislation, such as laws governing air quality, water pollution, waste management, and biodiversity protection. The EIA ensures that the project meets these legal requirements before it proceeds.

International Environmental Protocols: For projects with cross-border environmental impacts or those that might affect globally significant ecosystems, the EIA emphasizes compliance with international agreements, such as the Paris Agreement on climate change and the Convention on Biological Diversity.

2. **Environmental Permitting and Approvals**:

One of the core regulatory compliance requirements detailed in the report is obtaining the necessary environmental permits and approvals before beginning any development activities. These permits ensure that the project's environmental impacts have been adequately assessed and mitigated. The report outlines:

- **Permit Application Process**: The report provides a step-by-step guide for securing environmental permits, which may include detailed assessments of potential impacts on water bodies, forests, wetlands, and wildlife.
- **Conditions of Approval**: The EIA highlights that these permits often come with specific conditions that the project must adhere to, such as limiting emissions, protecting endangered species, and restoring natural habitats post-construction. Failure to meet these conditions could result in penalties or project suspension.

3. **Environmental Impact Assessment (EIA) Compliance**:

The EIA itself serves as a crucial tool for regulatory compliance. The report emphasizes that the EIA process ensures that the development is thoroughly evaluated for its environmental impacts, and that necessary mitigation measures are identified and implemented. The EIA process involves:

- **Screening and Scoping**: Determining whether the proposed project requires a full environmental assessment based on its size, location, and potential impacts.
- **Public Consultation**: Ensuring that local communities and stakeholders are involved in the EIA process, as required by regulatory frameworks. This consultation ensures that the project addresses the concerns of affected parties and complies with laws regarding community engagement and social impact.

4. **Compliance with Environmental Management Plans (EMP)**:

The report recommends the preparation of an **Environmental Management Plan (EMP)** that outlines the

specific measures the project will take to mitigate environmental impacts and ensure regulatory compliance. The EMP includes:

- **Mitigation Strategies**: Detailed strategies for reducing air and water pollution, managing waste, and protecting local biodiversity. These strategies must be monitored and adjusted as necessary to remain compliant with environmental regulations.
- **Emergency Response Plans**: The report stresses the importance of having plans in place for managing environmental emergencies, such as chemical spills or accidental wildlife disturbances, to mitigate damage and ensure quick recovery.

5. **Continuous Environmental Monitoring**:

Regulatory compliance is not limited to the planning and approval stages of the project. The report highlights the need for continuous monitoring to ensure that the development remains in compliance with environmental standards throughout its lifecycle. This includes:

- **Air and Water Quality Monitoring**: The report recommends installing monitoring systems to track air emissions and water discharges during construction and operation phases. These systems ensure that pollutant levels remain below legally permitted thresholds.
- **Biodiversity Monitoring**: The EIA suggests regular monitoring of local wildlife populations and ecosystems to assess whether the development has any unforeseen impacts. If necessary, adaptive management practices can be implemented to protect biodiversity and maintain compliance with conservation regulations.

6. **Compliance Audits and Inspections**:

The EIA report recommends periodic environmental audits and inspections by regulatory authorities to verify compliance with laws and project-specific conditions. These audits provide accountability and ensure that mitigation measures are effectively implemented. The report outlines:

- **Internal Compliance Audits**: The development should conduct regular internal audits to identify any potential compliance issues early and correct them before they escalate. This proactive approach ensures ongoing alignment with regulatory requirements.
- **Government Inspections**: In addition to internal audits, the project must be prepared for inspections by government agencies responsible for enforcing environmental laws. These inspections often focus on areas such as pollution control, waste management, and adherence to biodiversity protection regulations.

7. **Reporting and Documentation**:

The report stresses the importance of maintaining accurate and up-to-date documentation related to regulatory compliance. This includes records of permits, environmental assessments, monitoring data, and audit reports. Proper documentation is essential for:

- **Regulatory Reporting**: Regularly submitting reports to regulatory bodies, detailing the project's environmental performance and compliance with applicable laws. These reports ensure transparency and help build trust with both regulators and the public.

- **Public Transparency**: The EIA encourages making certain documents, such as environmental monitoring results, publicly available. This ensures transparency with stakeholders and demonstrates a commitment to environmental responsibility.

8. **Penalties for Non-Compliance**:

The report warns that failure to comply with environmental regulations can result in significant penalties, including fines, project delays, or shutdowns. To avoid these penalties, the EIA advises that the development should:

Implement Robust Compliance Systems: The development should establish a compliance management team responsible for ensuring that all regulatory requirements are met and that corrective actions are taken promptly if issues arise.

9. **Adaptation to Changing Regulations**:

Environmental regulations are subject to change as new laws are passed or as climate policies evolve. The EIA report recommends that the project remain adaptable to new regulatory frameworks. This involves:

- **Monitoring Legislative Changes**: Staying informed about updates to environmental regulations and ensuring that the project adapts to meet new compliance standards. This includes being aware of future policies related to climate change, emissions reduction, and sustainable development.
- **Proactive Engagement with Regulators**: The report suggests maintaining an open line of communication with regulatory agencies to stay ahead of potential compliance issues and to foster cooperation in addressing environmental concerns.

The **Regulatory Compliance and Monitoring** perspective in the report highlights the critical importance of ensuring that all aspects of the development comply with environmental laws and standards. By adhering to national and international regulations, obtaining necessary permits, conducting regular monitoring, and maintaining transparency with regulators and the public, the project ensures that its environmental impact is minimized. Continuous monitoring, auditing, and reporting further ensure that the development remains compliant throughout its lifecycle, safeguarding both the environment and the project's long-term success.

The body of the paper consists of numbered sections that present the main findings. These sections should be organized to best present the material.

It is often important to refer back (or forward) to specific sections. Such references are made by indicating the section number, for example, "In Sec. 2 we showed…" or "Section 2.1 contained a description…." If the word Section, Reference, Equation, or Figure starts a sentence, it is spelled out. When occurring in the middle of a sentence, these words are abbreviated Sec., Ref., Eq., and Fig.
At the first occurrence of an acronym, spell it out followed by the acronym in parentheses, e.g., charge-coupled diode (CCD).

3.Conclusion:

Environmental engineering plays a fundamental role in the planning, execution, and monitoring of **Zonal Development Plans**. These professionals ensure that infrastructure development aligns with sustainable practices, reduces environmental impacts, and provides long-term benefits to both the community and the natural environment. By incorporating environmental engineering principles into zonal development, regions can achieve balanced growth that is economically viable, socially equitable, and environmentally responsible.

EXISTING ANALYSIS (ZONE A)

The analysis of Zone A (North Zone) is conducted in accordance with established urban planning principles, wherein the existing situation is examined to determine the adequacy of local facilities for residents. Beyond assessing the sufficiency of facilities, utilities, parks, open spaces, and residential and non-residential uses, the layout of roads is scrutinized to ensure consistency in maintaining road hierarchy.

North Zone

Zone A (North Zone) is situated on the northern side, delimited by MDR-218 and the Kota-Delhi railway line. It encompasses partial portions of Harinagar, Mandawara, Gopipur, Kyadra Khurd, Kyadra Kalan, Patti Narayanpur, Veda Banki, Banki, Vajna Kalan, and Hindaun City. The total area of the zone is 2513 hectares, with 1313 hectares designated as urbanizable. The zone is bordered by MDR-218 to the west, SH-22 in the center, and the Kota-Delhi railway line to theeast. The developed residential area lies between MDR-218 and the Kota-Delhi Broad-gauge railway line. On the eastern side, industrial areas, the railway station, and railway container depot are included in this zone. Additionally, the zone encompasses a 220 KV Grid Substation and several government offices such as the Forest Department and PHED along the Karauli-Jaipur road. Land is also allocated for the court, hospital, and police station near Kyadra Dam. Commercial activities, including hotels, petrol pumps, and retail shops, are concentrated along the Jaipur road.

Land Use

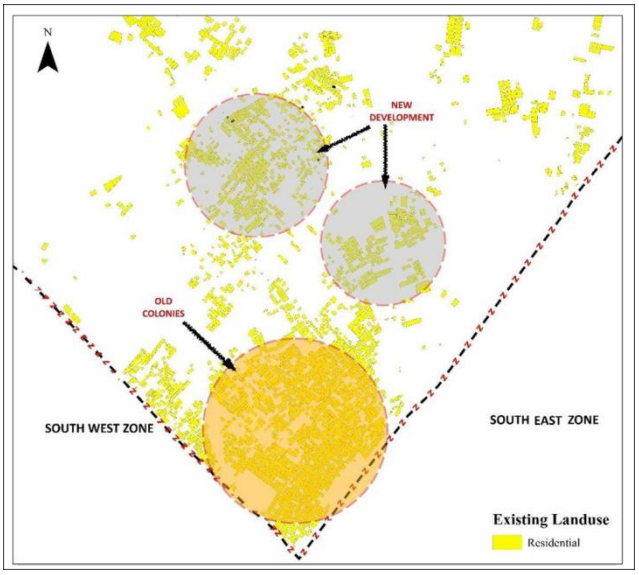
Land use in the North Zone is categorized as developed and undeveloped areas, which include open areas, agricultural land, and water bodies. Only 20.22% of the total zone area is developed, while the majority consists of agricultural land. Table 6 provides details of the existing land use and their respective areas in this zone.

Land use (existing) distribution in North Zone

Landuse	Category		No	Area (existing)	Total area (existing)	% of developed area	% of total zone area
Residentia	Residential		595	186.68	186.68	36.70%	7.43%
Commercial	Retail business and general commercial / commercial cente		51	7.559	42.665	8.39%	1.70%
	Wholesale busines / warehousesand godowns		78	35.10			
Mixed landuse	Mixed landuse		56	1.137	1.137	0.22%	0.05%
Industria			23	25.21	25.214	4.96%	0.01%
Governmental			44	10.85	10.852	2.13%	0.43%
Recreational	Park / Open space Stadium		2	1.353	1.353	0.27%	0.05%
Public & semipublic	Educational	Primary / U. Primary	29	10.258	10.258	2.02%	0.41%
		Secondary / S.Secondar	13				
		College	6				
	Health		8	5.99	5.99	1.18%	0.24%
	Cremation ground burial ground		4	1.297	16.383	3.22%	0.65%
	Religious		57	2.835			
	Other community facilities		11	1.301			
	Other community requirements		7	0.172			
	Public utility		10	10.77			
Circulatio				208.11	208.11	40.91%	8.29%
Total developed area					**507.93**	**100.0 %**	**20.2 %**
Water bod			5	10.01	10.01		0.40%
Other	Ag land / compound wall / vacantland		656	1993.42	1993.42		79.3 %
Total					**2511.47**		**100.0 %**

Area	No. of Plot	Percentage Composition
Below 50 Sq. m	258	43.29 %
50 to 100 Sq. m	114	19.13 %
100 to 200 Sq. m	94	15.77%
Above 200 Sq. m	130	21.81%
Total	596	100.00%

The residential zone constitutes 36.75% of the total developed area of the zone and 7.43% of thetotal zone area, encompassing various types of residences. In Hindaun City, only plotted development is prevalent, although the layout of the residential area is mixed. New developments are underway in approved residential colonies within this zone.



Urban grain and texture of residential units in North zone Area distribution and types of residential plots in North Zone

2. Commercial

The master plan delineates commercial areas as zones where retail businesses, warehousing, wholesale activities, and similar endeavors take place. Within the realm of retail businesses, there are various categories such as general stores, medical outlets, stationery shops, and so forth. The classification of businesses within the retail sector reflects the distribution of the workforce and the predominant activities within the town.

Area Distribution and Number of Commercial Plots in North Zone

1 Industrial

Industrial activity in this zone is primarily situated on the outskirts of the developed area. Currently, there are 235 units operational within this zone, with the stone industry and pipe factory being the predominant industrial sectors.

The Rajasthan State Industrial Development and Investment Corporation Ltd. (RIICO) has established industrial areas within Zone A. Additionally, 77.50 hectares of land have been earmarked by the District Collector on June 5, 2021, for the allocation of a new

industrial area inChamarpura village, situated outside the urban area boundary near the South East Zone. As per the existing land use of Zone A, industrial land comprises 25.214 hectares.

2 Government and Semi-Government Use

Hindaun City is the sub-divisional headquarters of district Karauli that is why many city level government offices are established in this city, several government offices and properties are developed in zone A, there are many government and semi government properties are in this zonelike RIICO office, PHED office and Railway Container depot etc.

3 Recreational

Public parks and open spaces are generally considered as the lungs of a town because to some extent they represent the social and physical health of the people. Zone A mostly has a residential area, RIICO industrial area and commercial along to the main road and but it is very bad to say that there is not a single garden in this zone. There isn't any play ground or stadium is developed in this zone. As per Master plan, there is proposal of recreational facilities in Zone – A. So, it is fulfilling requirement of the future need

2 Public and Semi-Public

- ### Education facilities

Educational facilities contribute to an area of 14.741 hectare, which includes facilities of primary schools, secondary schools both govt. and private such as Shree Krishna Vidhya Mandir upper primary school, Shanti Niketan sen. secondary bal vidhya mandir school, Uttam public secondary school, Bal Vidhya Mandir senior secondary school, Akhil Bhartiya senior secondary school, Sarvodaya senior secondary bal vidya mandir etc. There are 29 nos. of primary and upper primary school in this zone, 13 Nos. of secondary and senior secondary school and 6 nos. of colleges/Professional Institute such as ITI Colleges and Nursing College.

- ### Health Facilities

There are only 2 government Sub Health Centre, 1 Primary health center 2 veterinary hospitals in this zone. There is one large hospital proposed in this zone.

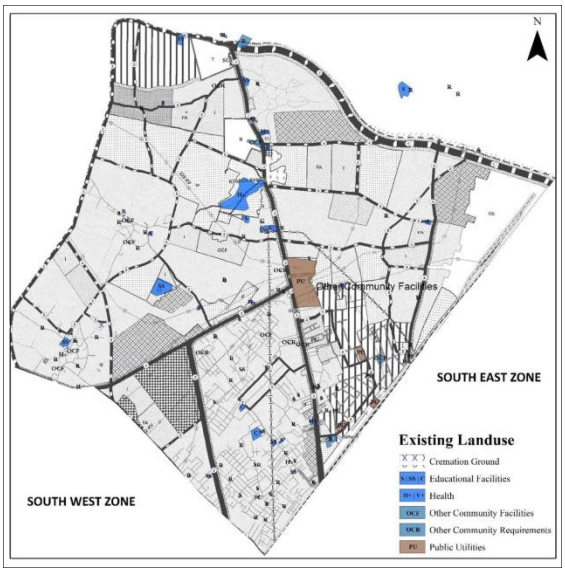
Public Utilities

Water Supply

Water is currently supplied in the zone using tube wells and overhead tanks, with groundwater being the sole source of water supply in Hindaun City. There is one clear water reservoir with a capacity of 100 KL and one overhead tank with a capacity of 900 KL. A distribution of 135 liters per capita per day (lpcd) of water is maintained for 24 hours through this overhead reservoir.

Sewerage, Drainage, and Solid Waste Management

The sewerage system in this zone is a part of phase-2 of the sewerage scheme. Construction of the sewerage system is yet to be completed for the North Zone. However, there is currently no proper drainage system in place; open drains are still prevalent on either side of the roads and streets, through which household wastewater flows. The Hindaun City municipality has identified land in Charampura village, located on the south side of the city, for the execution of solid waste management.



Map Showing Existing Public & Semi-Public Land Use on the Master Plan

Water Bodies and Forest Land

There are a total of five water bodies located in this zone, with Kyadra Bandh being the largest pond within this area. Additionally, there is approximately 7.338 hectares of forest land present in this zone.

Circulation

Circulation, a crucial component falling under major land use categories, is primarily dominated by roads, followed by railway lines/railway premises and bus stands. This zone facilitates easy accessibility within its boundaries, as it is adjacent to major roads such as SH-22 and MDR-218. It also boasts connectivity to other major urban centers such as Karauli and Mahwa. The railway station and railway container depot within this zone ensure convenient public transportation

Road

Zone A is positioned at the intersection point of MDR-218 and the Kota-Delhi Broad-gauge railway line. SH-22 is a significant two-lane highway, experiencing heavy traffic flow as it connects Mandalrai to Pahadi (via Karauli – Hindaun City – Mahwa – Khedli – Nagar), with Karauli being a key transit point for Jaipur and Bharatpur. The segment of SH-22 passing through the city is 30 meters wide, while the bypass road for SH-22 is 45 meters wide. MDR-218to Garhi Panbheda is also 30 meters wide and links with SH-22. Most internal roads within this zone are concrete.

Railway

The railway station is situated on the eastern side of the zone, with the main approach road leading directly to it, ensuring easy accessibility for public transportation

Terminal Facilities - Bus Stand, etc.

There is one bus stand and one bus depot located along the State Highway in the South West zone, covering a total area of 1.11 hectares. Both facilities are situated amidst other land uses such as commercial and residential areas, serving the entire city. Rajasthan State Road Transport Corporation Ltd. operates the bus stand, providing platform facilities and toilets for passengers. Numerous buses commute daily from Hindaun City to Jaipur, Bharatpur, Alwar, Delhi, Agra, and Gangapur, in addition to services to various villages within the Karauli district by private bus operators.

Parking

There is a shortage of designated parking space within the zone. Currently, the majority of vehicles are parked along roads, including various types such as two-wheelers, cars, and trucks. This situation reduces effective carriageway width, leading to bottlenecks at certain locations and hindering traffic flow

Infrastructure Gap

Infrastructure is a vital component of development, encompassing social and physical aspects. At the Zonal Development Plan level, conducting an infrastructure gap analysis is crucial to identify disparities between service delivery/reach and intended service levels. Guidelines issued by the state government serve as a basis for this analysis.

Social Infrastructure

Social infrastructure comprises facilities and amenities essential for societal betterment and development, including educational institutions, healthcare facilities, recreational areas, and law enforcement facilities. As per state government guidelines, the number and area of all facilities must be assessed to ensure alignment with projected population needs and minimum area requirements per facility. Educational, medical, socio-cultural, and recreational facilities are among those considered, while other services such as police and fire services are not addressed at the zonal level.

Table highlights significant gaps in several social infrastructure facilities, particularly in educational, medical, and recreational amenities. An estimated 8.896 hectares of land are required in this zone to address these basic social infrastructure gaps, with guidelines recommending the establishment of four parks and four playgrounds within the area.

Availability of Government Land

Ownership of land is the most important parameter for societal development. In presence of so many complex laws surrounding land acquisition and land management, authorities' resort to maximum utilization of government lands. While such lands are often in the outskirts of the town and in villages, if there are vacant lands available in the close vicinity or in the neighbourhood of town their potential rises manifold.

Before using government land for any development purpose, it is essential to create a list of such lands available and viable uses for each such identified parcel. This section details out theavailable vacant government land in North zone.

An estimated 8.896 hectares of land is deemed necessary to address the identified gap in social infrastructure facilities. The process of identifying and listing government-owned land parcels is crucial for determining the suitability of each parcel for accommodating the required social infrastructure facilities.

Revenue records indicate information about two attributes, ownership and classification ofland. The ownership indicates who owns the land, whether government department or state government or local municipality, and the classification indicates the type of land whether irrigated, non-irrigated, dry, etc.

In North zone, following ownership and classification details have been recorded,

Ownership:-

- Education Department
- Government Primary School
- Nagar Palika
- Public Works Department
- PHED
- JVVNL
- Railway Department
- State Government

lassification:-

- Barani – Rain-fed land
- Chahi – Irrigated land
- Mandir – Temple land
- Aabadi – Settlement
- Raasta/Sadak – Roads
- Gair Mumkin/Banjar – Dry uncultivable
- Sivaychak – Irrigated land
- Nadi/Nahar/Pokhar – Water body/depression
- Railway
- Shamshan – Cremation land
- Charagah – Cultivated land for herds

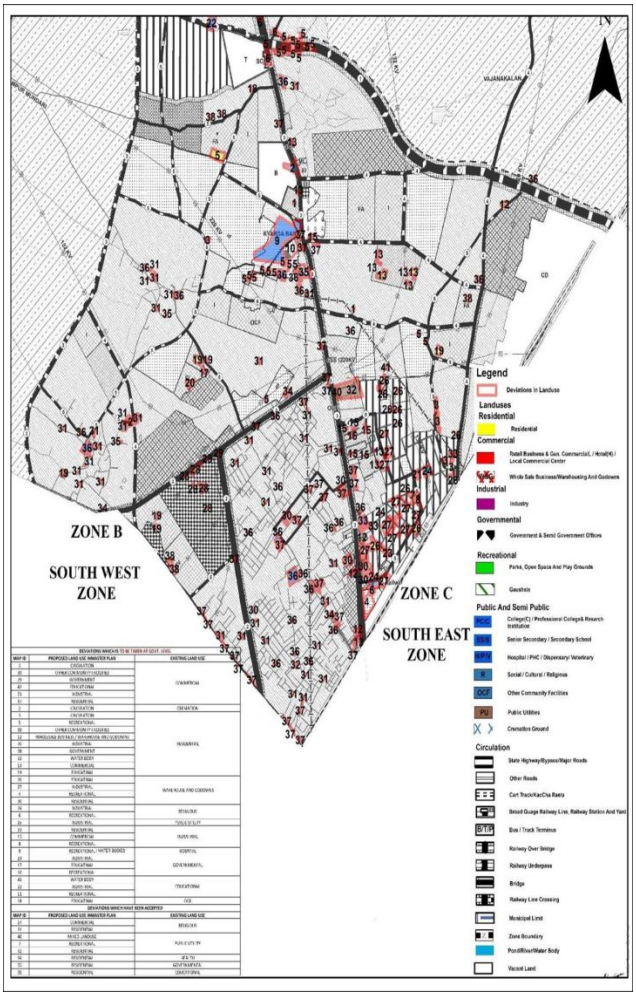
The land which can be used should preferably belong to state government or Nagar Palika, and they must be classified as Sivaychak, Charagah (only for recreational use), Banjar, Chahi and Barani. Based on this criterion, few land parcels have been identified for development of social infrastructure and physical infrastructure facilities in North zone which have been demarcated on Zonal Development Plan maps.

Availability of vacant Government land in North Zone

Sr. No.	Village	KhasraNumber	Land Classification	Area(HA)	Vacant
1	Gopipura	563/624	Chahi (चाही)	0.021604	N
2	Gopipura	547	Barani (बारानी)	0.046218	N
3	Gopipura	445	Gair Mumkin Chah (गै.मु.चाह)	0.001519	N
4	Gopipura	424	Barani (बारानी)	0.11348	N
5	Gopipura	406/629	Chahi (चाही)	0.033398	Y
6	Kayarda	1200	Gair Mumkin Chah (गै.मु.चाह)	0.026016	Y
7	Kayarda	1477/1210	Chahi (चाही)	0.105372	Y
8	Kayarda	1118/1416	Barani (बारानी)	0.26457	Y
9	Kayarda	1475/1126	Barani (बारानी)	0.160042	Y
10	Kayarda	632	Barani (बारानी)	0.042575	Y

Deviations & Variations

Deviations and variations in the existing land use from those that of proposed master plan land use are illegal activities carried out by the residents. One of the important issues in urban planning is enforcement, and with the help of this analysis planners can know the spread of illegal activities and their pattern. The only solution to mitigate these from happening further is by penalizing the miscreants if the deviation is non-compatible. Further sections list out the deviations and variations.



Map showing Deviation in Existing Land use with Master Plan

Compatibility table of Deviations (North Zone)

Sr. No.	Master PlanLanduse	Existing Landuse	Village	Khasra No.	Area (Sq. M)	Compatibility
1	Proposed Road	Commercial	Patti Narayanpur	645/1006	296.950295	N
	Proposed Road	Commercial	Kyadra	1365	208.426468	N
2	Proposed Road	Cremation	Gopipura	460, 462, 463, 464, 465/661, 478	2008.070171	N
	Bus Stand	Ocf	Patti Narayanpur	709, 710, 711/1, 712, 713, 713/995	5897.854672	
	Proposed Road	Religious	Kyadra Kalan	396	1700.856186	N
3	Proposed Road	Residential	Kyadra Kalan	400, 401, 402, 403, 404, 415, 416, 417	9757.574114	N
	Proposed Road	Residential	Kyadra	665	450.972543	N
	Proposed Road	Residential	Hindaun	329, 373, 375, 376	1508.919816	N
	Proposed Road	Residential	Hindaun	329, 385, 386	2154.696809	N
	Proposed Road	Residential	Hindaun	329, 390	792.498	N

					352	
	Proposed Road	Residential	Hindaun	390, 391	485.742337	N
4	Recreational	Wholesale Business Warehouse And Godowns	Hindaun	2137, 2138, 2139	11917.47471	
5	Recreational	Residential	Patti Narayanpur	566,572	6893.371907	N
	Recreational	Residential	Hindon	349	484.32408	N
	Recreational	Residential	Kyadra	12,351,239	203.177977	N
	Recreational	Residential	Kyadra	1514/1495	282.37152	N
	Recreational	Residential	Kyadra	1514/1495	1203.406596	N
	Recreational	Residential	Kyadra	743	729.987843	N
	Recreational	Residential	Kyadra	744	278.097614	N
	Recreational	Residential	Kyadra	752	465.734599	N
	Recreational	Residential	Kyadra	744	527.122026	N
	Recreational	Residential	Hindaun	2139	202.386628	N
	Plantation Belt	Residential	Kyadra Kalan	397, 401, 415, 416, 417	3553.870292	N
	Plantation Belt	Residential	Kyadra Kalan	414, 422, 423, 424, 425	1162.295909	N

Variations

Variations refer to technical errors resulting from unintended human interference. These errors typically involve changes in the shape of water bodies, deviations in the actual position of roads compared to their intended placement, and alterations in boundaries. While these variations are generally acceptable, as they do not significantly impact the proposed land use outlined in the master plan for the area, they may have occurred due to the absence of GIS software utilization in earlier master plan preparations.

In North zone, there are few variations which are listed in table 15 along with their causes(or identified mistakes).

Sr. No.	Variated feature	Identified Mistake
1	Urban areaboundary	Upon Ortho-rectification and superimposition of Khasrasheet on ground, new urban area boundary has been demarcated
2	Municipalboundary	Municipal boundary is the outer boundary of wards However, earlier town boundary was marked as municipal boundary

3	Water body	Water bodies are dynamic features which change over aperiod of time. Only variation is because of this naturalchange
4	Roads	Ortho rectification of Khasra sheet on ground has helpedin identifying minor errors in road layout

Planning Policies and Parameters

Hindaun City holds significance as a pivotal urban center in the Karauli district. The Master Plan crafted for the town, set for the horizon year 2036, embodies a vision where the unplanned development of the town is curbed, and organized development ensues, ultimately benefiting its residents. It endeavors to ensure that by 2036, the town adequately meets the requirements for community facilities, retail and commercial establishments, as well as industrial and employment needs, thereby enhancing living and working conditions for its inhabitants.

The Zonal Development Plan for Hindaun City has been devised based on population projectionsand the ensuing land requisites. The proposed land use plan is meticulously crafted, considering land suitability, with efforts directed towards achieving a harmonious balance between available developable land and the land required for diverse purposes. Additionally, conscientious endeavors have been made to integrate all prior government commitments into the Proposed Land Use Plan 2036.

Outlined below are the overarching guidelines and policies essential for formulating the Zonal Development Plan. Specific local-area policies will be delineated during the formulation of schemes and layouts.

Residential

Residential areas are meticulously planned to foster a conducive community environment while simultaneously minimizing trip generation and travel time to workplaces, educational institutions, shopping centers, and recreational facilities.

Commercial, Wholesale, Warehousing

In addition to the propositions set forth in the Master Plan, a novel concept of land use, extending upto 1.5 times the road width or the depth of a single plot, whichever is lesser, is introduced for commercial development along major roads.

The Zonal Development Plan governing commercial activities shall adhere to the norms outlined inthe table below

Plannin Un	Category	Are (Ha	Populatior	No. of Shopes
Housin Are	Convenience Shopping	0.15	5000	1-110 persons

Neighbor oo	Local Shopping Centre	0.4€	15,000	1-200 persons
Communi y	Weekly Market	0.4	1 or 2 Plac per 1 lakh	As per requirem nt
	Informal Spaces/ Vending Zone	As pe requi emer	On the basis ofSurvey	1 per 10 plots
	Milk distribution center / Dairy Boot	As pe requi emer	As per requirement	As per requirem nt

Urban Street Vendors

The informal and unorganized sector serves as a significant source of employment within the city's economic framework, warranting the following approach in the zonal plan. Development agencies are urged to incorporate such activities into their implementation of the zonal plan through various land schemes and layout plans.

- Identification of 'Hawking' and 'No Hawking' Zones at the neighborhood and cluster levels.
- Development of new areas for informal retail shops integrated with housing, commercial, institutional, and industrial areas.
- Provision of common basic amenities such as toilets and water points.
- Allocation of space for essential retail outlets such as Milk Booths, Fair Price Shops, BankATMs, and Restaurants.
- Establishment of informal retail units and weekly markets, where necessary, by the local bodyor development authority.
- Designation of vegetable markets at the neighborhood level by the local body or developmentauthority.

Norms for Informal Commercial Activities

Incorporating informal sector retail commercial activities into planned development across various use zones is essential. Provision of informal sector trade units should be ensured duringscheme framing and approval of layout plans, adhering to the norms outlined in the table below:

Sr. No.	Use Zone/Use Premises	No. of Informal Shops /Units
1	District Centre, Community Centre, Convenience ShoppingCentre	2 to 3 units per 10 formal shops (to be provided ininforma bazaar/service market components)
2	Government and CommercialOffices	5 to 6 units per 1000 employees

3	Wholesale trade and FreightComplexes	3 to 4 units per 10 formal shops
4	Hospital	3 to 4 units per 100 beds
5	Bus Terminal	1 unit for two bus bays
6	Secondary/Senior Secondary	2-3 units
7	Community Park	2 to 3 units
	District Park	3 to 4units at each major entry
8	Residential	1 unit/10 plots
9	Industrial	4 to 6 units per 1000 employees

Norms for Informal Shops/Units for Urban Street Vendors

Transport and Circulation

The hierarchical road network is designed considering existing and proposed development, future circulation requirements, and city-wide traffic. Right of Way (ROW) norms for various categories of roads must be adhered to, as outlined in the table below

Sr. No.	Type of Road	Minimum ROW (in m)
1	National Highway and StateHighway	60 m ROW and 30m Plantationon both side of Road
2	Arterial Roads	30-36
3	Sub-Arterial Road	24-30
4	Main Roads	18-24
5	Collector Roads	12 --18
6	Internal Roads	09--12

PROPOSALS

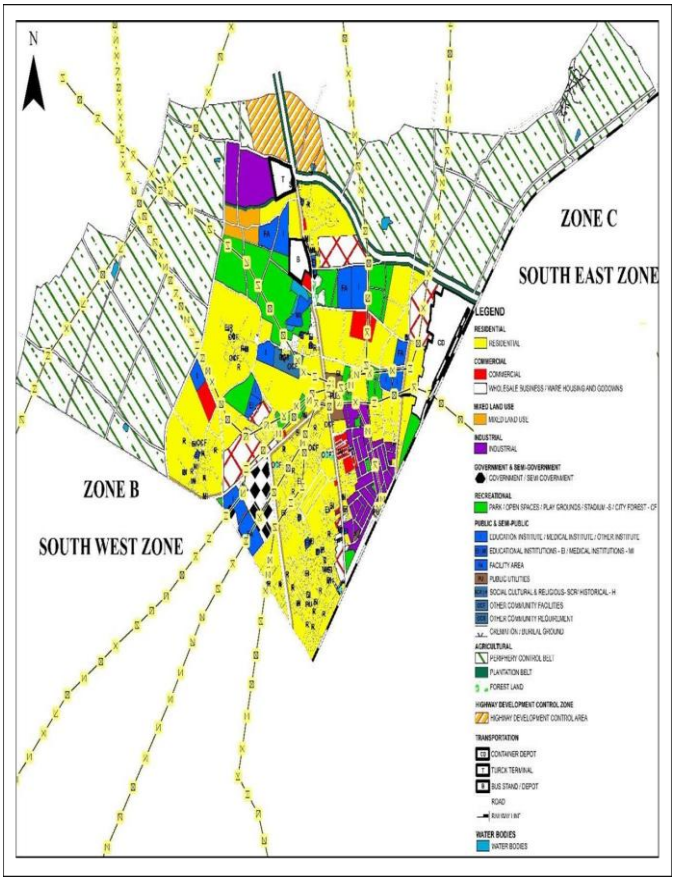
Zonal Development Plan ensures that the Master Plan proposals are examined with respectto deviations and variations and revised in order to control the haphazard development and regulate further development. The major focus areas for Zonal Development Plan proposal are,

- Land use
- Circulation / Transportation

In previous sections, we observed the existing characteristics and the status of developmentin and around North Zone, wherein it was found that there is requirement of providing more social infrastructure facilities and reserve ROWs for transportation networks to control future development. Accordingly, the draft Zonal Development Plan so prepared has the following land use distribution as shown in table

Land Use (Proposed) distribution in North Zone

Land uses	Area(HA)	Percentage of total developedarea	Percentage oftotal Zonal Area
Residential	524.958	39.46%	20.87%
Commercial	98.555	7.41%	3.92%
Mixed use	31.286	2.35%	1.24%
Industrial	82.819	6.23%	3.29%
Government & Semi-Government	27.906	2.10%	1.11%
Recreational	133.145	10.01%	5.29%
Public & Semi-Public	104.424	7.85%	4.15%
Circulation	327.264	24.60%	13.01%
Total Developed Area	**1330.357**	**100.00%**	**52.90%**
Water Bodies	8.534		0.34%
Peripheral Control Belt	1085.917		43.18%
Green Buffer	31.952		1.27%
Highway Corridor Zone	58.024		2.31%
Total Proposed Area of North Zone	**2514.784**		**100.00%**



Zone A Proposed Land use of Zonal Development Plan

Land Use

The land utilization pattern is poised to undergo significant changes in the future, reflecting a substantial increase in residential areas, public and semi-public facilities, and proposed amenities. Currently, the total developed area of the North zone stands at 507.935 hectares (20.22% of the total area), which is projected to increase to 1330.357 hectares (50.92%).

Residential:

The proposed area for residential purposes in the North zone is 524.958 hectares, constituting 39.46% of the total developed area. This allocation accommodates the town's expanding population while preserving traditional cultural practices. Extension limits for abadi areas of various villages have been delineated, with provisions for health, education, and recreational facilities.

Commercial:

Covering 98.55 hectares (7.41% of the total developed area), the proposed commercial area aligns with the requirements outlined in the Master Plan, obviating the need for separate demarcation in the zonal plan.

Government/Semi-Government:

Spanning 27.906 hectares (2.10% of the total developed area), provisions for government/semi-government facilities are deemed adequate, precluding the need for additional demarcations

Transportation/Circulation:

A comprehensive road network, balancing new proposals with existing infrastructure, occupies
327.264 hectares (24.60% of the total developed area), enhancing connectivity and mobility

Recreational:

Allocated 133.145 hectares (10.01% of the total developed area), recreational spaces are in line with Master Plan provisions, catering to the populace's leisure needs.

Green Buffer/Plantation Belt:

Encompassing 26.561 hectares, these belts along state highways, bypass roads, and railway lines enhance aesthetics and environmental sustainability

Other Proposals:

Reserved facility areas on government land may not meet minimum norms, prompting consideration of private sector proposals to bridge infrastructure gaps. Rationalization of land uses aligns with new population estimates, ensuring functional and liveable urban spaces.

Efforts are directed towards crafting a Zonal Development Plan that optimally addresses residents' needs while fostering functional and liveable environments. The draft plan is open forpublic feedback, with received objections and suggestions subject to thorough examination for plan finalization.

ZONING REGULATIONS

The purpose of the Zoning Regulations is to facilitate and govern development controls for buildings within designated use premises, aligning with the land use proposals outlined in the preceding sections. These regulations are applicable to the Developed Area, Urbanisable Area, andPeripheral Control Belt of the Zonal Development Plan for Hindaun City – 2036. They serve both promotional and regulatory functions, guiding development to achieve planned growth for the city. Approval for land use must be obtained from the competent authority in accordance with these regulations.

The regulations govern two main aspects

1. Conversion of use zones into use premises (layout)

2. Permission of use activities on use premises

They draw a distinction between use zones and use premises.

Use Zones refer to areas designated for specific dominant urban functions. These zones are categorized as Residential, Commercial, Industrial, Government and Semi-Government, Public and Semi-Public, Transportation, Recreational, Agriculture/Water Bodies, and Highway Corridor Zone.

These zoning regulations adhere to the "Land Use Compatibility Guide" issued by the Town Planning Department, Rajasthan, under letter number TPR: 8283/2011/Sector Plan (ZDP)/Part – V/3139-57 dated 9th June 2020. They outline the compatibility, permissibility, and non- compatibility of use premises within specific land use categories, as detailed in the table below

Sr. No.	Landuse	Compatible Land Uses to be Permitted	Permissible Land Uses withcertain parameters or approval	Non-Compatible Land Uses

1	**Residential**	1. Residential – Plot or Flat c Group Housing or Service Apartmer or Housing Under CMJAY/PMJAY 2. Hostel / Dharamshala 3. Farm House / Boarding Lodging Houses / Guest Houses 4. Retail Shopping / Convenienc Shopping Centre / Informal Spaces Vending Zone / Restaurant 5. Professional Office	1. Hotel / Motel / Reso to be permitted only on N /SH /Bypass / MDR with othe parameters 2. Bank / Financi Institutions / 3. Convention Centre Auditorium / Art Exhibition Centre /	1. Heavy, large, an extensive industrie Industries categorized a noxious, obnoxious, an hazardous 2. Warehousing an storage facilities fo perishable, hazardous, 3. Workshops for buse and similar vehicles are allowed.

This dissertation provides a comprehensive analysis of the Zonal Development Plan (ZDP) for the North Zone of Hindaun City, projecting its vision until 2036. As a crucial urban center in Rajasthan, Hindaun City is on the cusp of significant growth and transformation. The development of a meticulous ZDP for Zone A is imperative to steer this growth in a sustainable and organized direction.

Key Findings Summary

The research uncovers critical insights into the current state and future requirements of the North Zone. Present urban infrastructure, while showing improvement, grapples with challenges like inadequate road networks, deficient water and sewage systems, and unreliable electricity supply. Land use in the North Zone displays a blend of residential, commercial, industrial, and recreational areas, yet unregulated expansion has led to space inefficiency and environmental issues.

Proposed Interventions

To tackle these challenges, the dissertation proposes targeted interventions:

Infrastructure Development:

- Enhancing roads, expanding water and sewage systems, and upgrading electricity and telecommunications infrastructure.

Sustainable Land Use:

- Enforcing zoning regulations, promoting green spaces, and encouraging mixed-usedevelopment.

Social Infrastructure Enhancement:

- Increasing educational and healthcare facilities, advocating for affordable housing, andexpanding community services.

Environmental Sustainability:

- Conducting regular environmental assessments, promoting renewable energy, andestablishing efficient waste management systems.

Effective Implementation and Monitoring:

- Ensuring stakeholder participation, building local authority capacity, and regularlymonitoring and evaluating the development plan.

Economic Development:

- Creating business and job opportunities, establishing Special Economic Zones (SEZs),and boosting tourism.

Recommendations

1. Strengthen Infrastructure Development

- **Road Network Improvement**: Upgrade and expand the existing road network to ensure better connectivity and reduce traffic congestion. Implement dedicated lanes for public transportation and non-motorized traffic.
- **Water Supply and Sewage Systems:** It's imperative to bolster the capacity and coverage of water supply and sewage systems to accommodate the escalating demands of the burgeoning population. Embracing sustainable water managementpractices, such as rainwater harvesting and wastewater recycling, is essential to ensure the efficient utilization of water resources and mitigate the strain on existing infrastructure.
- **Electricity and Telecommunications**: Upgrade the electricity grid to ensure reliable and uninterrupted power supply. Expand telecommunication infrastructure to support smart city initiatives and improve internet connectivity.

2. Promote Sustainable Land Use

Zoning Regulations: It's crucial to enact and uphold zoning regulations aimed at managing land use and curbing the sprawl of unplanned urban development. By delineating specific zones for residential, commercial, industrial, and recreational purposes, we can ensure orderly growth and sustainable urbanization.

Green Spaces: Prioritize the creation and upkeep of green spaces, parks, and recreationalareas to enrich the urban environment and foster community well-being. Introducing green belts and buffer zones can safeguard natural habitats, mitigate pollution, and enhance the overall ecological balance.

1. Enhance Social Infrastructure

- **Educational and Healthcare Facilities**: Increase the number and quality of educational institutions and healthcare facilities to cater to the growing population. Ensure these facilities are evenly distributed across the North Zone.
- **Affordable Housing**: Promote the development of affordable housing projects to accommodate different income groups, including the Economically Weaker Sections (EWS). Implement policies to prevent slum formation and ensure adequate housing standards.
- **Community Services**: Expand community services such as libraries, community centers, and sports facilities to support social cohesion and community engagement.

2. Adopt Environmental Sustainability Practices

- **Environmental Impact Assessments**: Conduct regular environmental impactassessments for all major development projects to minimize adverse effects on the environment. Implement mitigation measures to address identified impacts.
- **Renewable Energy:** Advocate for the adoption of renewable energy sources like solar and wind power to diminish reliance on non-renewable energy and decrease carbon emissions. By encouraging the implementation of sustainable energy solutions, we can contribute to a greener and more environmentally friendly urbanlandscape.
- **Waste Management**: Develop an efficient waste management system that includes segregation at source, recycling, and proper disposal. Encourage community participation in waste reduction initiatives.

3. Ensure Effective Implementation and Monitoring

- **Stakeholder Engagement:** Ensure the active participation of all pertinent stakeholders, encompassing local communities, governmental entities, and private sector collaborators, throughout the planning and execution phases. Establish channels for ongoing feedback and engagement to foster inclusive decision-making processes.

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