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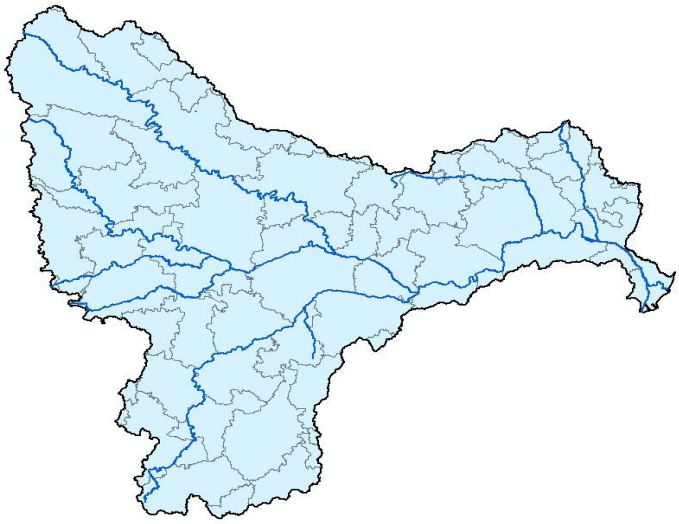
**National River Conservation Directorate**
Ministry of Jal Shakti,
Department of Water Resources,
River Development & Ganga Rejuvenation
Government of India

# Industrial Profile Report

# Krishna River Basin



## March 2026
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# Industrial Profile Report- Krishna River Basin



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## National River Conservation Directorate (NRCD)

The National River Conservation Directorate, functioning under the Department of Water Resources, River Development & Ganga Rejuvenation, and Ministry of Jal Shakti providing financial assistance to the State Government for conservation of rivers under the Centrally Sponsored Schemes of 'National River Conservation Plan (NRCP)'. National River Conservation Plan to the State Governments/ local bodies to set up infrastructure for pollution abatement of rivers in identified polluted river stretches based on proposals received from the State Governments/ local bodies.

**www.nrcd.nic.in**

## Centres for Krishna River Basin Management Studies (cKrishna)

The Centres for Krishna River Basin Management Studies (cKrishna) is a Brain Trust dedicated to River Science and River Basin Management. Established in 2024 by NIT Warangal and NITK Surathkal, under the supervision of cGanga at IIT Kanpur, the center serves as a knowledge wing of the National River Conservation Directorate (NRCD). cKrishna is committed to restoring and conserving the Krishna River and its resources through the collation of information and knowledge, research and development, planning, monitoring, education, advocacy, and stakeholder engagement.

**www.ckrishna.org**

## Centre for Ganga River Basin Management and Studies (cGanga)

cGanga is a think tank formed under the aegis of NMCG, and one of its stated objectives is to make India a world leader in river and water science. The Centre is headquartered at IIT Kanpur and has representation from most leading science and technological institutes of the country. cGanga's mandate is to serve as think-tank in implementation and dynamic evolution of Ganga River Basin Management Plan (GRBMP) prepared by the Consortium of 7 IITs. In addition to this, it is also responsible for introducing new technologies, innovations, and solutions into India.

**www.cganga.org**


## Acknowledgment

This report is a comprehensive outcome of the project jointly executed by NIT Warangal (Lead Institute) and NITK Surathkal (Fellow Institute) under the supervision of cGanga at IIT Kanpur. It was submitted to the National River Conservation Directorate (NRCD) in 2025. We gratefully acknowledge the individuals who provided information and photographs for this report.


## Disclaimer

This report is a preliminary version prepared as part of the ongoing Condition Assessment and Management Plan (CAMP) project. The analyses, interpretations and data presented in the report are subject to further validation and revision. Certain datasets or assessments may contain provisional or incomplete information, which will be updated and refined in the final version of the report after comprehensive review and verification.

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## PREFACE

In an era of unprecedented environmental change, understanding our rivers and their ecosystems has never been more critical. This report aims to provide a comprehensive overview of our rivers, highlighting their importance, current health, and the challenges they face. As we explore the various facets of river systems, we aim to equip readers with the knowledge necessary to appreciate and protect these vital waterways.

Throughout the following pages, you will find an in-depth analysis of the principles and practices that support healthy river ecosystems. Our team of experts has meticulously compiled data, case studies, and testimonials to illustrate the significant impact of rivers on both natural environments and human communities. By sharing these insights, we hope to inspire and empower our readers to engage in river conservation efforts.

This report is not merely a collection of statistics and theories; it is a call to action. We urge all stakeholders to recognize the value of our rivers and to take proactive steps to ensure their preservation. Whether you are an environmental professional, a policy maker, or simply someone who cares about our planet, this guide is designed to support you in your efforts to protect our rivers.

We extend our heartfelt gratitude to the numerous contributors who have generously shared their stories and expertise. Their invaluable input has enriched this report, making it a beacon of knowledge and a practical resource for all who read it. It is our hope that this report will serve as a catalyst for positive environmental action, fostering a culture of stewardship that benefits both current and future generations.

As you delve into this overview of our rivers, we invite you to embrace the opportunities and challenges that lie ahead. Together, we can ensure that our rivers continue to thrive and sustain life for generations to come.

**Centers for Krishna River Basin Management Studies (cKrishna)**

**NIT Warangal and NITK, Surathkal**
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CONTENTS

List of figures

List of tables

1. Introduction

The Krishna River Basin is one of the major river basins in India, supporting a wide range of socio-economic activities across the states of Maharashtra, Karnataka, Telangana, and Andhra Pradesh. Over the years, rapid industrialization within the basin has contributed significantly to regional economic growth, employment generation, and infrastructure development. However, this growth has also led to increased pressure on water resources, both in terms of quantity and quality.

Industries within the basin depend heavily on water for various processes such as cooling, processing, and cleaning, resulting in substantial water consumption and wastewater generation. In many cases, the discharge of untreated or partially treated industrial effluents has emerged as a major concern, contributing to the deterioration of river water quality and posing risks to ecosystems and human health. The presence of pollution-intensive industries, particularly in certain districts and industrial clusters, further amplifies these challenges.

In this context, it is essential to develop a comprehensive understanding of the industrial profile of the Krishna River Basin, including the spatial distribution of industries, their classification, water usage patterns, and pollution potential. Such an assessment is crucial for identifying pollution hotspots, evaluating the impact of industrial activities on water resources, and supporting sustainable river basin management.

This report aims to systematically analyse the industrial landscape of the Krishna River Basin by integrating geo-spatial mapping, sectoral classification, water footprint assessment, and quantitative evaluation of effluent generation and pollutant loads. The findings of this study are expected to provide valuable insights for policymakers, regulatory authorities, and stakeholders to design effective strategies for industrial water management, pollution control, and sustainable development within the basin.

2. Methodology

The methodology adopted for the preparation of the Industrial Profile of the Krishna River Basin involves systematic collection, compilation, processing, and analysis of data from multiple sources to understand the spatial distribution, classification, water usage, and pollution potential of industries across the basin.

The study primarily relies on secondary data obtained from various government agencies and reports, including the Central Pollution Control Board (CPCB), State Pollution Control Boards (Maharashtra Pollution Control Board, Karnataka State Pollution Control Board, Telangana State Pollution Control Board, and Andhra Pradesh Pollution Control Board), District Industrial Profile Reports from the Development Commissioner of MSMEs (DCMSME), and other relevant publications. The collected data includes information on

industrial classification, water consumption, wastewater generation, and pollution categories.

The geo-tagged database of industries was developed by compiling district-wise industrial data and integrating it into a Geographic Information System (GIS) environment to map the spatial distribution of industries across its sub-basins. Industries were further categorized into Micro, Small, and medium enterprises to understand the scale of industrial activities. Sector-wise classification was carried out based on DCMSME reports to identify dominant industrial sectors such as agro-based, textile, chemical, and engineering industries.

Industries were also classified into Red, Orange, Green, and White categories based on their pollution potential as per CPCB guidelines, enabling assessment of pollution intensity and identification of potential hotspots. Water footprint analysis was carried out using available data on industrial water consumption and wastewater generation. For Maharashtra, Telangana, and Andhra Pradesh, water consumption data was obtained directly from respective State Pollution Control Boards and aggregated at the district level. In the case of Karnataka, where direct data was not available, water consumption was estimated using wastewater generation data by applying a return flow factor of 0.9.

Quantitative assessment of effluent generation was performed using available wastewater data, expressed in terms of Million Litres per Day (MLD). Due to limitations in data availability, detailed analysis of flow characteristics, pollutant concentrations, and chemical load estimation could not be carried out for all regions.

The compiled data was analyzed at district and sub-basin levels to identify spatial patterns, industrial clusters, water demand, and potential environmental impacts. Maps, tables, and graphical representations were prepared to support the analysis and facilitate better understanding of industrial distribution and its implications on water resources in the Krishna River Basin.

3. Industry Profile Inventory

3.1 Geo – tagged Database of Industries in the Krishna River Basin

The geo-tagged database of industries in the Krishna River Basin provides a comprehensive understanding of the spatial distribution of industries across districts and sub-basins. This section presents the mapping of industries based on their geographic locations, enabling the identification of industrial clusters and regional concentration patterns. In addition to spatial representation, the industries have been further classified into Micro, Small, and medium categories to understand the scale of industrial activities within different regions. The district-wise and sub-basin-wise aggregation of these categories helps in analysing the distribution of industrial intensity and identifying areas with higher concentration of

industrial units. This integrated approach supports better visualization and assessment of industrial presence across the Krishna River basin.

Upper Bhima Basin: In the Upper Bhima sub-basin, the database of industries highlights a significant spatial variation in the distribution of Micro, Small, and medium enterprises across districts. The analysis indicates that micro industries form the dominant share in all districts, reflecting the prevalence of small-scale industrial activities in the region. Pune district emerges as a major industrial hub with the highest concentration of micro, small, and medium industries, followed by Solapur and Ahmednagar, indicating high industrial intensity in these areas. Districts such as Satara and Sangli show moderate industrial presence, while Beed and Dharashiv exhibit relatively lower industrial concentration. The distribution pattern suggests that industrial activities are largely clustered around urban and economically developed regions within the sub-basin. This geo-spatial representation of MSME industries provides valuable insights into industrial density, regional disparities, and potential zones of economic activity, forming a basis for further analysis of water demand and environmental impacts in the Upper Bhima sub-basin. The number of Micro, Small and Medium Industries in districts of Upper Bhima Basin are represented in Figure 1 below

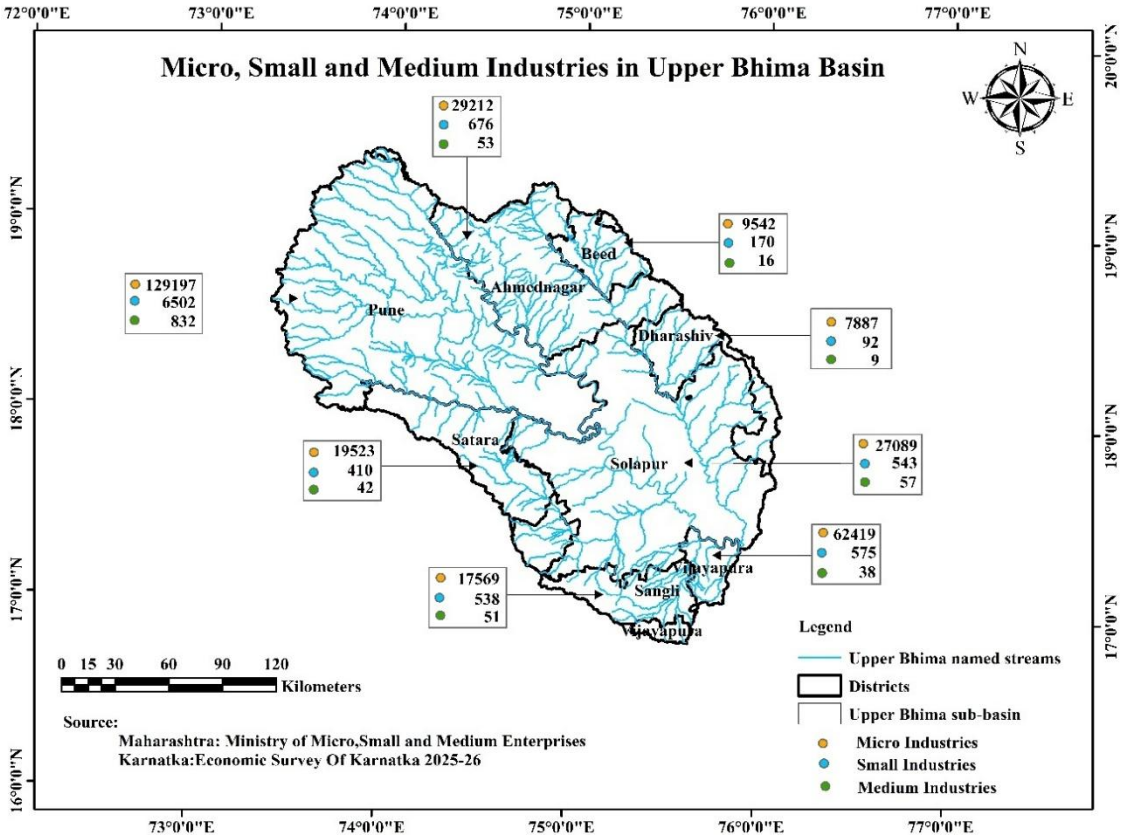

Figure 1: Micro, Small, Medium Industries in Districts of Upper Bhima Sub basin

Lower Bhima Basin: In the Lower Bhima sub-basin, the database of industries highlights a significant spatial variation in the distribution of Micro, Small, and medium enterprises across districts. The analysis indicates that micro industries form the dominant share in all districts, reflecting the prevalence of small-scale industrial activities in the region. Vijayapura and Kalaburgi districts emerge as a major industrial hub with the highest concentration of micro, small, and medium industries, followed by Solapur, Yadgir, Bidar indicating high industrial intensity in these areas. District such as Dharashiv exhibit relatively lower industrial concentration. The distribution pattern suggests that industrial activities are largely clustered around urban and economically developed regions within the lower Bhima sub-basin. The number of Micro, Small and Medium Industries in districts of Lower Bhima Basin are represented in Figure 2 below

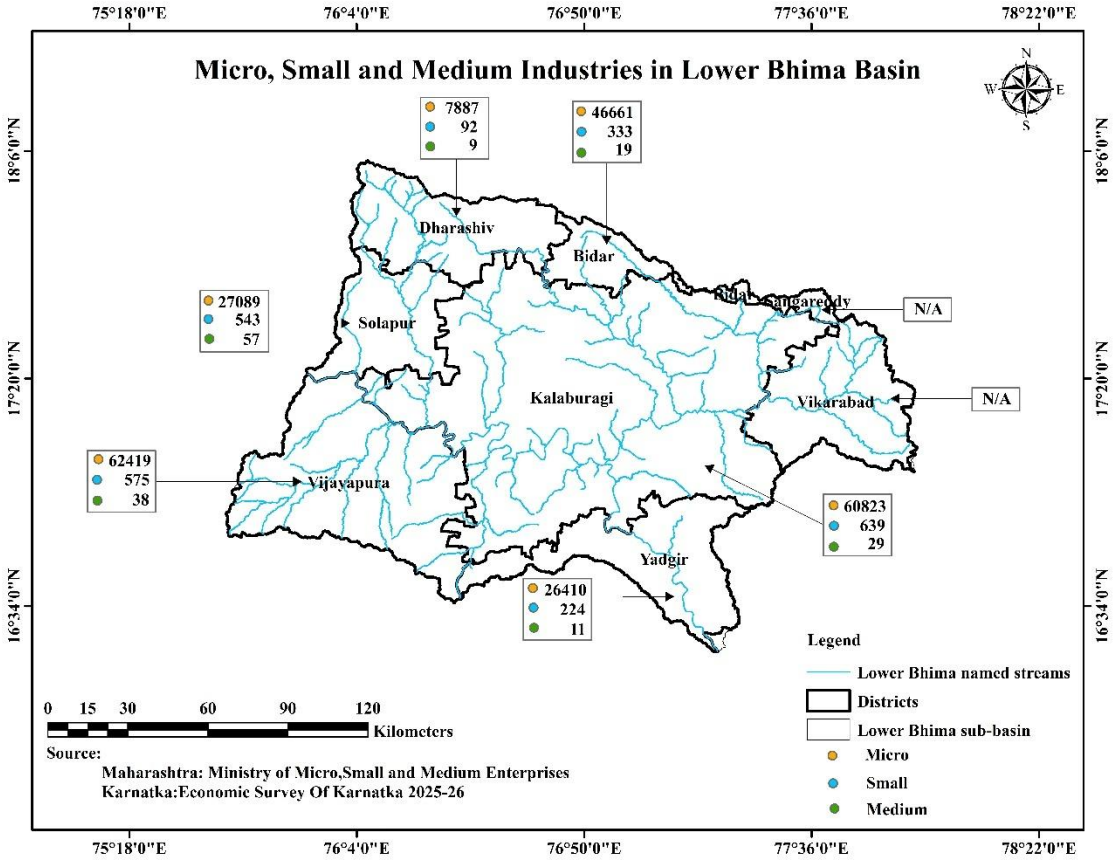

Figure 2: Micro, Small, Medium Industries in Districts of Lower Bhima Sub basin

Upper Krishna Basin: In the Upper Krishna sub-basin, the database of industries indicates a wide spatial distribution of Micro, Small, and medium enterprises across districts, with a clear dominance of micro industries throughout the region. Districts such as Belagavi and Dharwad emerge as major industrial hubs with a significantly higher concentration of industries across all three categories, reflecting strong industrial development. Other

districts including Vijayapura, Raichur, and Bagalkot, Kholapur, Gadag also show considerable industrial presence, particularly in micro and small-scale industries. In contrast, districts such as Sindhudurg and Yadgir exhibit relatively lower industrial concentration, indicating limited industrial activity. The distribution pattern highlights that industrial activities are largely concentrated in economically developed and well-connected regions of the Upper Krishna sub-basin. The number of Micro, Small and Medium Industries in districts of Upper Krishna Basin are represented in Figure 3 below

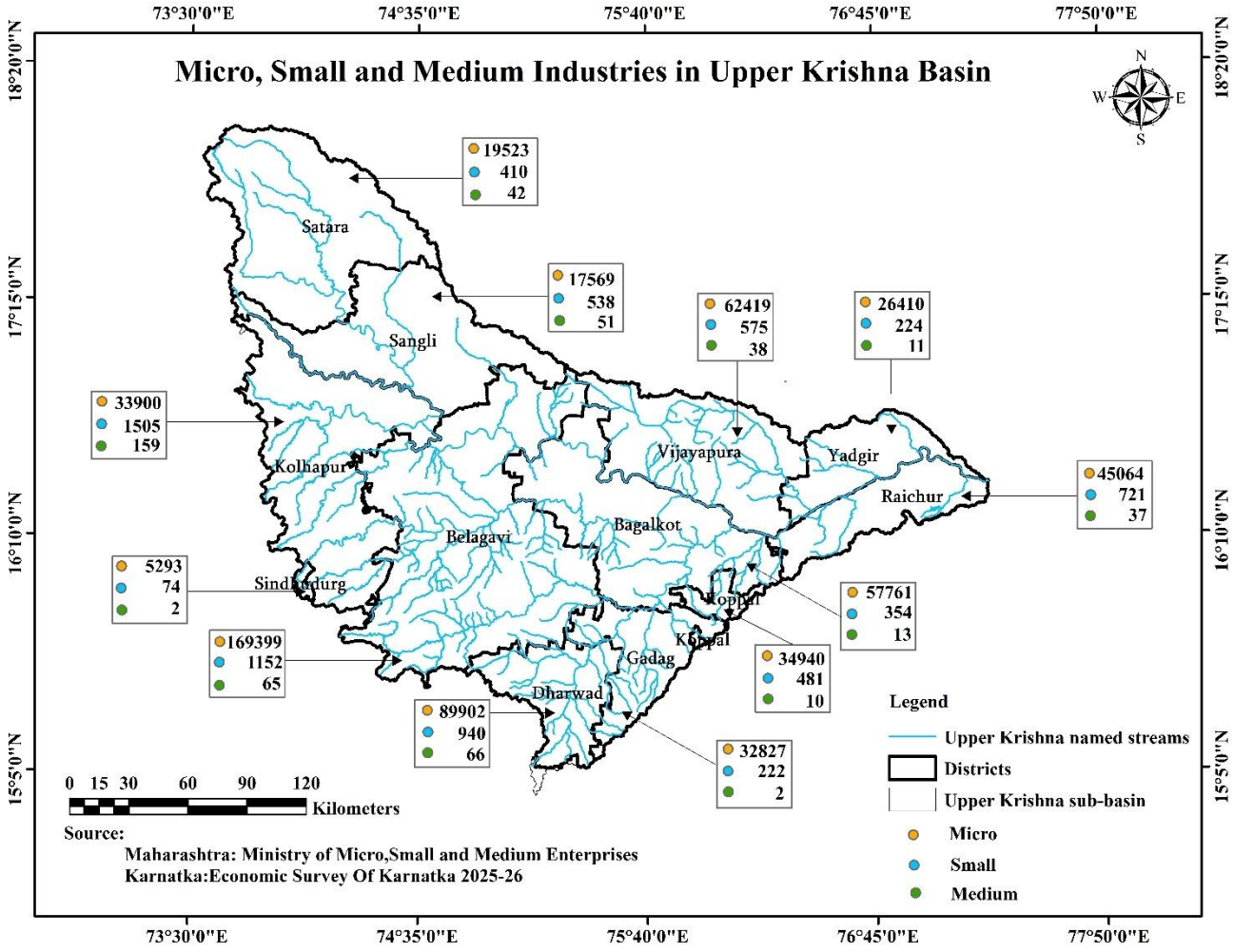

Figure 3: Micro, Small, Medium Industries in Districts of Upper Krishna Sub basin

Middle Krishna Basin: In the Middle Krishna sub-basin, the database of industries highlights a significant spatial variation in the distribution of Micro, Small, and medium enterprises across districts. Prakasam and Nandyal districts emerge as a major industrial hub with the highest concentration of micro, small, and medium industries, apart from these two districts other districts like Narayanpet, Mahabubnagar, Raichur, Jogulamba Gadwal, Nagarkurnool, Nalgonda is not available. The number of Micro, Small and Medium Industries in districts of Middle Krishna Basin are represented in Figure 4 below

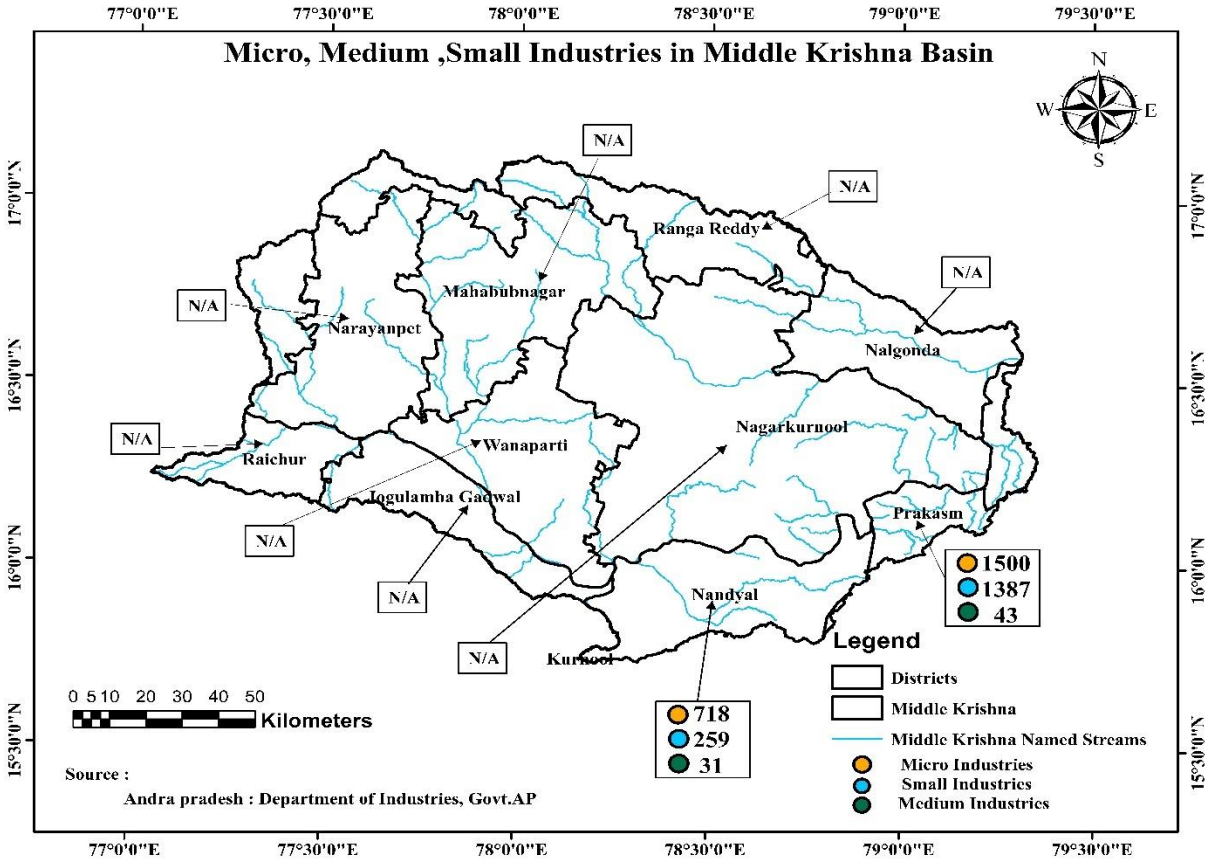

Figure 4: Micro, Small, Medium Industries in Districts of Middle Krishna Sub basin

Lower Krishna Basin: In the Lower Krishna sub-basin, the database of industries highlights a significant spatial variation in the distribution of Micro, Small, and medium enterprises across districts. Palnadu, Guntur, Bapatla, Krishna and NTR districts emerge as a major industrial hub with the highest concentration of micro, small, and medium industries, apart from these districts other districts like Malkajgiri, Ranga reddy, Nalgonda, Suryapet, Khamam, Mahabubabad, Warangal, Hanumakonda, Jangoan and Bhuvanagiri are not available. The number of Micro, Small and Medium Industries in districts of Lower Krishna Basin are represented in Figure 5 below

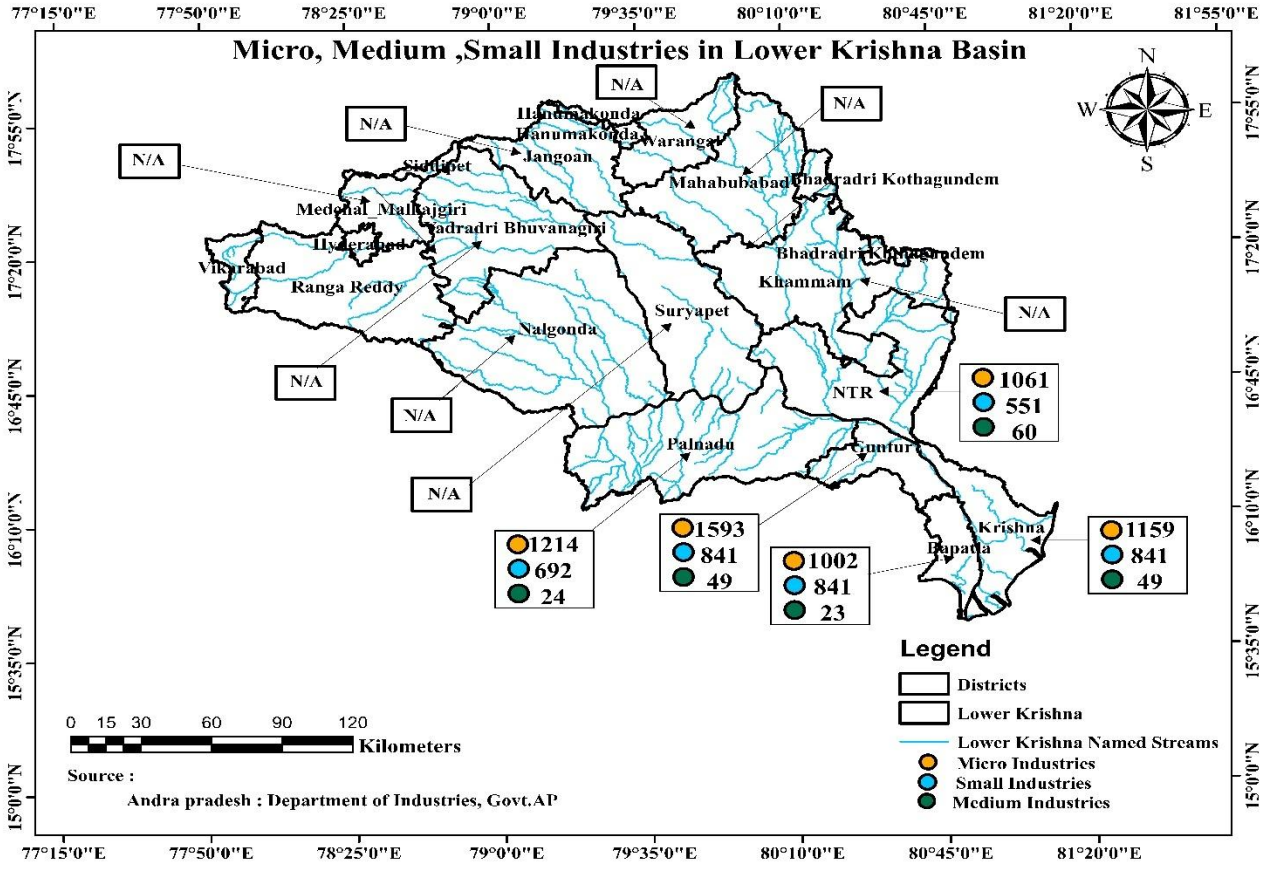

Figure 5: Micro, Small, Medium Industries in Districts of Lower Krishna Sub basin

Upper Tungabhadra Basin: In the Upper Tungabhadra basin, the distribution of industries shows that Shivamogga and Davangere have the highest concentration of micro industries, followed by Haveri and Uttara Kannada, indicating strong dominance of small-scale economic activity in these regions. In contrast, Vijayanagara and Gadag show relatively lower numbers of micro enterprises. For small industries, Shivamogga and Davangere again rank highest, while Vijayanagara and Gadag remain at the lower end. Medium industries are very limited across the basin, with slightly higher presence in Shivamogga, Davangere, and Chitradurga, whereas districts like Gadag and Vijayanagara record the lowest figures. Overall, the Upper Tungabhadra basin reflects a pattern of micro-industry dominance with moderate small-scale development and minimal medium-scale industrialization. The number of Micro, Small and Medium Industries in districts of Upper Tungabhadra Basin are represented in Figure 6 below

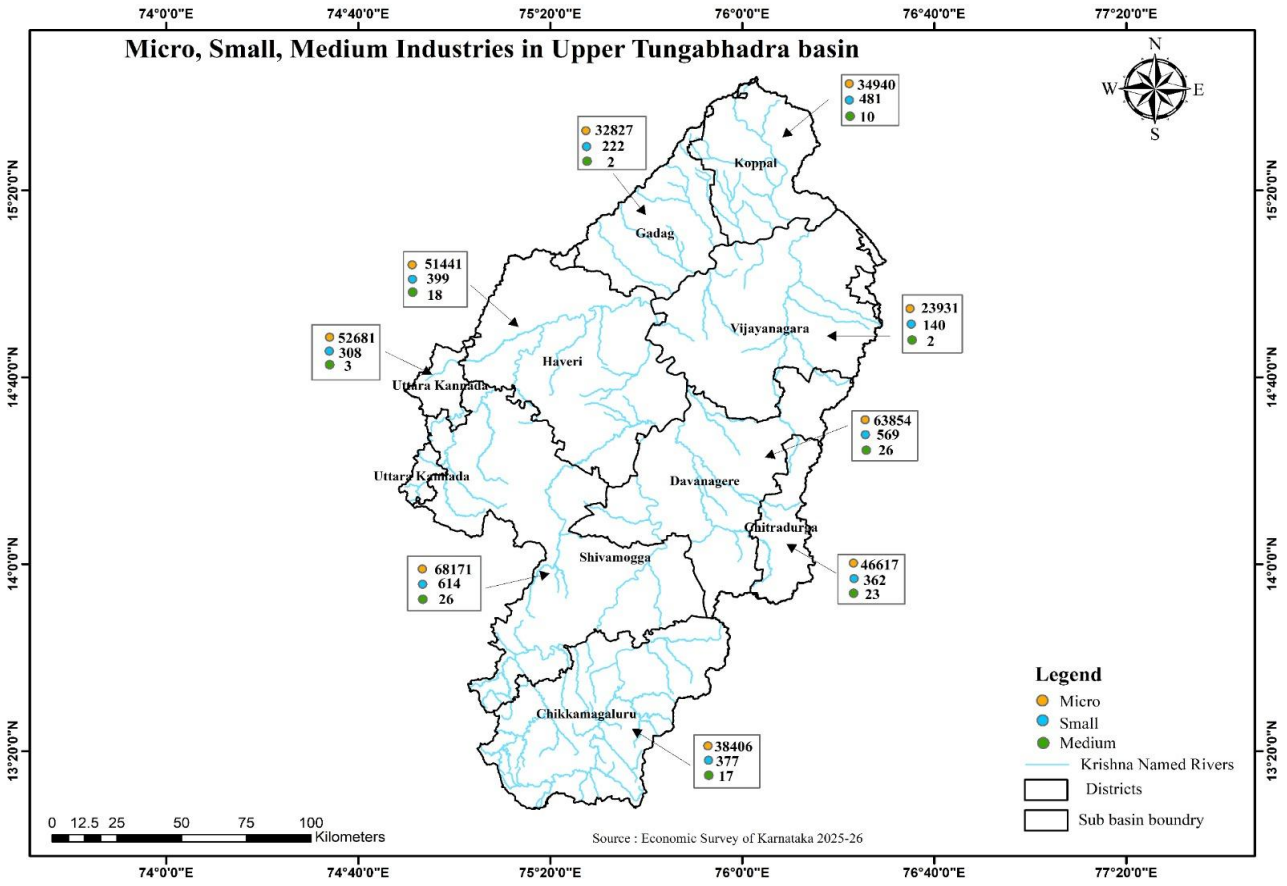

Figure 6: Micro, Small, Medium Industries in Districts of Upper Tungabhadra Sub basin

Lower Tungabhadra Basin: The map of the Lower Tungabhadra basin shows the distribution of micro, small, and medium industries across different districts, highlighting a strong dominance of micro-scale industries throughout the region. Districts such as Ballari, Tumakuru, and Raichur exhibit particularly high concentrations of micro enterprises, indicating widespread small-scale economic activity driven by low investment requirements and local resource use. Small industries are present in moderate numbers, while medium industries are very limited, suggesting constraints in capital, infrastructure, and industrial advancement. The spatial pattern also reflects the influence of river networks and district connectivity, as industrial clusters tend to develop in areas with better access to water, transport, and markets. Overall, the Lower Tungabhadra basin represents a region with a predominantly small-scale industrial base and uneven industrial development across districts. The number of Micro, Small and Medium Industries in districts of Lower Tungabhadra Basin are represented in Figure 7 below

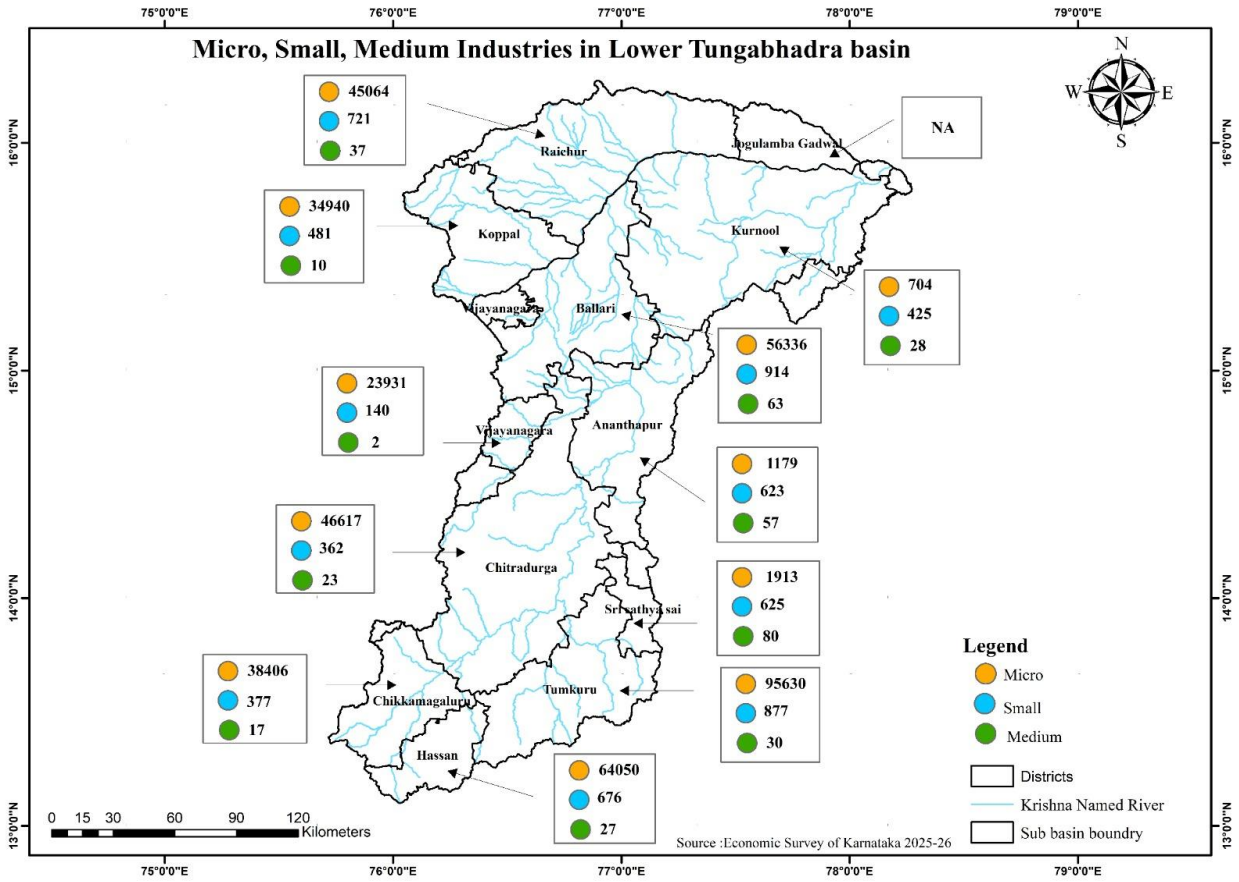

Figure 7: Micro, Small, Medium Industries in Districts of Lower Tungabhadra Sub basin

3.2 Sector – wise Categorization

The sector-wise categorization of industries in the Krishna River Basin has been carried out using data obtained from District Industrial Profile Reports of the DCMSME. The available district-level data has been systematically compiled and aggregated at the sub-basin level to understand the distribution of different industrial sectors across the basin. Among the various sectors reported, key sectors such as agro-based industries, soda water, cotton textiles, jute, paper and paper products, leather-based industries, engineering products, wooden furniture, ready-made garments and embroidery, and woolen industries have been considered for detailed analysis, as they represent the major industrial activities in the region. Although a wide range of sectors exists, the selected sectors were identified based on their relative importance, prevalence, and potential impact on water resources. This categorization helps in understanding the dominant industrial sectors within each sub-basin and provides a basis for assessing sector-specific water demand and pollution characteristics.

3.2.1 Agro – Based Industries

The agro-based industries form the foundational industrial segment within the Krishna River Basin, closely aligned with the region's extensive agricultural landscape and agrarian livelihoods. These industries, comprising general agro-processing units, cotton textiles, wool/silk/artificial thread-based products, jute and jute-derived units, and ready-made garments and embroidery, collectively contribute to value addition, rural employment, and local entrepreneurship. Their distribution reflects the agricultural diversity of the Krishna River basin, where cotton-growing regions support textile units, and urban-agro linkages foster garment and embroidery clusters. As a result, the agro-based sector acts as a major driver of small-scale industrial development, socio-economic upliftment, and market integration across both rural and semi-urban districts of the Krishna Basin.

Agro – Based Industries in Upper Krishna Basin

There is a clear variation in values across districts, with a few areas contributing much more than others. Belagavi has the highest figures, particularly in the readymade garments and embroidery, indicating a strong concentration. Vijayapura and Gadag also record relatively higher numbers, while Yadgir and Koppal remain very low in most categories. Some missing entries point to incomplete data availability. Overall, the pattern highlights an uneven distribution among districts. The agro-based industries in districts of Upper Krishna basin shown in table 1 below.

Table 1: The agro-based industries in districts of Upper Krishna basin

Sl.No	Districts	Agro based/Food based	Cotton Textile	Woolen, Silk	Jute	Readymade garments and embroidery
1	Satara	181	27	-	-	-
2	Sangli	480	874	-	-	-
3	Sindhudurg	22	-	-	-	90
4	Kolhapur	8507	8632	0	0	460
5	Vijayapur	2140	1096	-	-	-
6	Yadgir	6	-	-		3
7	Bagalkot	954	-	-	-	626
8	Koppal	46	9	9	-	21
9	Gadag	998	530	48	-	356
10	Dharwad	40	60	30	0	32
11	Belagavi	3437	-	143	193	4825

Agro – Based Industries in Upper Bhima Basin

In the districts of Upper Bhima BasinSolapur dominates the region with the highest number of agro/food-based industries (4,388 units) and an exceptionally large cotton textile sector (6,763 units). Vijayapura and Pune follow with significant agro-based and cotton textile figures. Most districts show negligible or no activity in Woolen/Silk and Jute industries, indicating these sectors are largely underdeveloped across the basin. Ready-made garments and embroidery are present only in Dharashiv, Beed, and Pune, with Pune leading at 487 units, suggesting concentration of value-added textile industries in selected districts. The agro-based industries in districts of Upper Bhima basin shown in table 2 below.

Table 2: The agro-based industries in districts of Upper Bhima basin

Sl.No	Districts	Agro based/Food based	Cotton Textile	Woolen,Silk	Jute	Readymade garments and embroidery
1	Dharashiv	83	7	0	0	46
2	Solapur	4388	6763	-	-	-
3	Ahmedanagar	481	17	-	-	-
4	Beed	284	113	-	-	57
5	Sangli	480	874	-	-	-
6	Satara	181	27	-	-	-
7	Pune	1409(Including Soda water)	62		Nil	487
8	Vijayapura	2140	1096	-	-	-

Agro – Based Industries in Lower Bhima Basin

Solapur dominates the Lower Bhima Basin with the highest agro/food-based and cotton textile activity, making it the most industrially significant district in the region. Vijayapura follows with a strong presence in both agro-based and cotton textile sectors, while Sangareddy and Vikarabad have no available data, making it difficult to assess their industrial standing. Dharashiv has a limited agro-based presence but uniquely records data for Woolen/Silk and Jute, both showing negligible activity, along with a moderate ready-made garments sector. Bidar shows a small but diverse industrial presence across agro-based, cotton textile, Woolen/Silk, and ready-made garments, whereas Kalaburagi and Yadgir remain the least industrialized, with very minimal activity across all sectors. Overall, Woolen/Silk, Jute, and ready-made garments industries are largely underdeveloped throughout the Lower Bhima Basin. The agro-based industries in districts of lower Bhima basin shown in table 3 below.

Table 3: The agro-based industries in districts of Lower Bhima basin

Sl.No	Districts	Agro based/Food based	Cotton Textile	Woolen,Silk	Jute	Readymade garments and embroidery
1	Dharashiv	83	7	0	0	46
2	Solapur	4388	6763	-	-	-
3	Sangareddy	NA				
4	Vikarabad					
5	Vijayapura	2140	1096	-	-	-
6	Yadgir	6	-	-		3
7	Bidar	26	36	44	-	8
8	Kalaburagi	31	13	-		11

Agro – Based Industries in Middle Krishna Basin

Agro-based industries in the Middle Krishna Sub-Basin, with activity concentrated in a few districts. Cotton textile industries are mainly present in Nalgonda, along with woolen, silk, and artificial thread-based clothes and ready-made garments. Warangal district shows a more diversified agro-industrial base with food-based industries, cotton textiles, woolen/silk products, jute and tobacco products, and ready-made garments. All other districts such as Krishna, Bapatla, Guntur, NTR, Palnadu, Khammam, Suryapet, Mahabubabad, Jangaon, Yadadri Bhuvanagiri, and Medchal Malkajgiri show no recorded units in these categories. This indicates that agro-based industries in the region are highly concentrated in Nalgonda and Warangal districts. The agro-based industries in districts of Middle Krishna basin are shown in table 4 below.

Table 4: The agro-based industries in districts of Middle Krishna basin

S/No	Districts	Food Based	Cotton Textile	Woolen, silk & artificial Thread based clothes.	Jute & jute based/Tobacco Products	Ready-made garments & embroidery
1	Nalgonda	-	1054	118	-	127
2	Krishna	-	-	-	-	-
3	Bapatla	-	-	-	-	-
4	Guntur	-	-	-	-	-
5	NTR	-	-	-	-	-

6	Palnadu	-	-	-	-	-
7	Khammam	-	-	-	-	-
8	Suyrapet	-	-	-	-	-
9	Mahabubabad	-	-	-	-	-
10	Warangal	1058	13	11	8	75
11	Jangoan	-	-	-	-	-
12	Yadadri Bhuvanagiri	-	-	-	-	-
13	Medchal Malkajgiri	-	-	-	-	-

Agro – Based Industries in Lower Krishna Basin

Agro-based industries across districts in the Lower Krishna Sub-Basin, with clear dominance in food processing and cotton textiles. Food-based industries are highly concentrated in Raichur and Prakasam, followed by Mahabub Nagar, while other districts show no presence. Cotton textile industries are also significant, particularly in Raichur, Ranga Reddy, Prakasam, and Mahabub Nagar. The remaining categories such as woolen, silk, jute, tobacco products, and ready-made garments show no recorded units across all districts. This indicates that agro-based industrial activity in the region is heavily focused on food processing and cotton textiles. The agro-based industries in districts of Lower Krishna basin is shown in table 5 below.

Table 5: The agro-based industries in districts of Lower Krishna basin

S/No	Districts	Food Based	Cotton Textile	Woolen, silk & artificial Thread based clothes.	Jute & jute based/Tobacco Products	Ready-made garments & embroidery
1	Ranga Reddy	-	218	-	-	-
2	Nagara kurnool	-	-	-	-	-
3	Mahabub Nagar	8	13	-	-	-
4	Wanaparti	-	-	-	-	-
5	Narayanpet	-	-	-	-	-
6	Prakasam	665	55	-	-	-
7	Nandyal	-	-	-	-	-
8	Raichur	1050	1626	-	-	-
9	Jogulamba Gadwal	-	-	-	-	-

Agro – Based Industries in Upper Tungabhadra Basin

In the Upper Tungabhadra sub-basin, agro-based industries constitute a significant share of the industrial sector, reflecting the strong linkage between agriculture and industrial activities in the region. Districts such as Hassan, Chikkamagaluru, and Ananthapur show a high concentration of agro-based industries, indicating their dominance in the local economy. Raichur and Ballari also contribute notably, though at a comparatively moderate level. The presence of related sectors such as cotton textiles and ready-made garments further supports the agro-industrial base of the region. However, spatial variations exist, with districts like Koppal and Kurnool exhibiting relatively lower industrial intensity. Overall, the distribution highlights the importance of agro-based industries as a key driver of regional economic activity in the Upper Tungabhadra Basin. The agro-based industries in districts of Upper Tungabhadra basin shown in table 6 below.

Table 6: The agro-based industries in districts of Upper Tungabhadra basin

Sl.No	Districts	Agro -based	Cotton textile	Woolen, Silk & Arificial thread-based clothes	Jute	Readymade garments & embroidery
1	Chikamagalur	1224(Including Soda water)	_	1578(Including Cotton textile,Jute, Readymade garments & Embroidary	_	_
2	Shivamogga	2505	_	_	_	1500
3	Davangere	2523	5	0	0	510
4	Haveri	1	23	0	0	189
5	Gadag	998	530	48	_	356
6	Koppal	46	9	9	_	21
7	Uttara kannada	1102	_	40	2	455
8	Chithradurga	250	20	600	20	2200
9	Vijayanagara	N/A				

Agro – Based Industries in Lower Tungabhadra Basin

The overall industrial scenario of agro-based and textile sectors districts of lower Tungabhadra basin region reflects a selective concentration, where only a few districts show strong industrial presence while several others remain less active. Districts like Hassan, Raichur, Ananthapur, and Chikkamagalur play a significant role in supporting agro-based industries, indicating better linkage between agriculture and industrial activities, whereas areas such as Koppal, Ballari and Kurnool have comparatively weaker development. The

textile sector, including cotton, silk, woolen, and garment-related industries, is also not uniformly spread, with districts like Chitradurga, Hassan and Raichur showing notable activity, while many regions have limited or no representation. This pattern suggests the importance of promoting industrial diversification and strengthening infrastructure in underdeveloped districts to achieve more balanced regional progress. The agro-based industries in districts of Lower Tungabhadra basin shown in table 7 below.

Table 7: The agro-based industries in districts of Lower Tungabhadra basin

Sl.No	Districts	Agro -based	Cotton textile	Woolen, Silk & Arificial thread-based clothes	Jute	Readymade garments & embroidery
1	Raichur	1050	1626	_	_	_
2	Ballari	199	165	0	0	82
3	Hassan	2013	192	1792	_	_
4	Koppal	46	9	9	_	21
5	Chithradurga	250	20	600	20	2200
6	Kurnool	186	4	_	_	_
7	Ananthapur	1926	902	_	_	_
8	Vijayanagara	N/A				
9	Jogulamba Gadwal	N/A				
11	Sri satya sai	N/A				

3.2.2 Forest/ Wood – Based Industries

The forest and wood-based industries represent a significant component of the Krishna River Basin's industrial profile, drawing strength from the basin's rich forest cover and natural resource base. This sector encompasses wood furniture manufacturing and the paper and paper product industries, which are deeply connected to local forestry resources, artisanal skills, and small-scale entrepreneurial networks. These industries support livelihood creation, supply local construction and carpentry needs, and contribute to industrial diversification in both forest-dominated and urban-adjacent districts. Their distribution reflects variations in forest resource availability, transportation linkages, and local market dynamics, making them integral to sustainable resource utilization and forest-linked economic activities within the Krishna River basin.

Forest/Wood – Based Industries in Upper Krishna Basin

Forest and wood-based industries in the Upper Krishna Basin are highly concentrated in a few districts, with Belagavi leading significantly, followed by Vijayapura. Moderate presence is observed in districts like Gadag and Bagalkot (315), while others such as Dharwad and Koppal have relatively low numbers. Paper and paper product industries are more evenly distributed, with Belagavi again having the highest count, and notable contributions from Sangli and Bagalkot. Some districts like Yadgir and Koppal show minimal or no presence in paper-related industries. Overall, Belagavi emerges as the dominant industrial hub in both categories. The Forest/Wood-based industries in districts of Upper Krishna basin shown in table 8 below.

Table 8: The forest/wood - based industries in districts of Upper Krishna basin

Sl.No	Districts	Wood/Wooden based	Paper and paper products
1	Satara	-	19
2	Sangli	-	163
3	Sindhudurg	60	2
4	Kolhapur	0	98
5	Vijayapur	1253	132
6	Yadgir	1	-
7	Bagalkot	315	141
8	Koppal	56	-
9	Gadag	418	127
10	Dharwad	59	6
11	Belagavi	4295	604

Forest/Wood – Based Industries in Upper Bhima Basin

Vijayapura leads the Upper Bhima Basin in wood/wooden-based industries by a dominant margin, while also maintaining a strong paper and paper products presence. Pune follows as the second most active district, showing considerable strength in both wood/wooden-based and paper products sectors. Beed has a moderate wood/wooden-based presence along with a small paper products activity, while Sangli records no wood/wooden-based industry but has a notably strong paper products sector. Dharashiv maintains a small but balanced presence across both categories, whereas Ahmedanagar and Solapur show no wood/wooden-based activity, with only a limited paper products presence. Satara remains the least active district overall, with minimal presence in both sectors. The forest/wood - based industries in districts of Upper Bhima basin is shown in table 9 below.

Table 9: The forest/wood - based industries in districts of Upper Bhima basin

Sl.No	Districts	Wood/Wooden based	Paper and paper products
1	Dharashiv	48	74
2	Solapur	-	5
3	Ahmedanagar	-	32
4	Beed	101	36
5	Sangli	-	163
6	Satara	-	19
7	Pune	357	332
8	Vijayapura	1253	132

Forest/Wood – Based Industries in Lower Bhima Basin

Vijayapura dominates the Lower Bhima Basin in both wood/wooden-based and paper and paper products industries, standing far ahead of all other districts by a significant margin. Dharashiv holds a moderate presence in both sectors, making it the second most active district overall, while Kalaburagi shows a small but balanced activity across both categories. Bidar has a minimal yet consistent presence in both wood/wooden and paper products sectors, whereas Yadgir records barely any activity, limited only to wood/wooden-based industries. Solapur has no wood/wooden-based activity and only a negligible paper products presence, while Sangareddy and Vikarabad have no available data, leaving their industrial standing uncertain. Overall, forest and wood-based industries are highly concentrated in Vijayapura, with most other districts showing very limited development in this sector. The Forest/Wood-based industries in districts of Lower Bhima basin shown in table 10 below.

Table 10: The forest/wood - based industries in districts of Lower Bhima basin

Sl.No	Districts	Wood/Wooden based	Paper and paper products
1	Dharashiv	48	74
2	Solapur	-	5
3	Sangareddy	NA	
4	Vikarabad		
5	Vijayapura	1253	132
6	Yadgir	1	-
7	Bidar	9	9
8	Kalaburagi	31	6

Forest/Wood – Based Industries in Middle Krishna Basin

Forest/wood-based industries in the Middle Krishna Sub-Basin, showing a strong concentration in a few districts. Wood/wooden-based industries are mainly found in Warangal and Nalgonda, while all other districts report no presence. Paper and paper product industries are highly concentrated in Warangal, with a smaller contribution from Nalgonda. The remaining districts, including Krishna, Bapatla, Guntur, NTR, Palnadu, Khammam, Suryapet, Mahabubabad, Jangaon, Yadadri Bhuvanagiri, and Medchal Malkajgiri, show no recorded units in this sector. The forest/wood - based industries in districts of Middle Krishna basin is shown in table 11 below

Table 11: The forest/wood - based industries in districts of Middle Krishna basin

Sl No	Districts	Wood/Wooden Based	Paper and Paper Products
1	Nalgonda	74	124
2	Krishna	-	-
3	Bapatla	-	-
4	Guntur	-	-
5	NTR	-	-
6	Palnadu	-	-
7	Khammam	-	-
8	Suyrapet	-	-
9	Mahabubabad	-	-
10	Warangal	338	967
11	Jangoan	-	-
12	Yadadri Bhuvanagiri	-	-
13	Medchal Malkajgiri	-	-

Forest/Wood – Based Industries in Lower Krishna Basin

Forest/wood-based industries in the Lower Krishna Sub-Basin, showing a highly uneven pattern across districts. Wood/wooden-based industries are predominantly concentrated in Raichur, while no other district reports any such units. Similarly, paper and paper product industries are mainly found in Raichur (330 units) and to a smaller extent in Ranga Reddy, with all other districts showing no presence. This indicates that forest-based industrial activities are largely localized in a few districts with access to raw materials and infrastructure. The forest/wood - based industries in districts of Lower Krishna basin is represented in table 12 below.

Table 12: The forest/wood - based industries in districts of Lower Krishna basin

S/No	Districts	Wood/Wooden Based	Paper and Paper Products
1	Ranga Reddy	-	105
2	Nagara kurnool	-	-
3	Mahabub Nagar	-	-
4	Wanaparti	-	-
5	Narayanpet	-	-
6	Prakasam	-	-
7	Nandyal	-	-
8	Raichur	1015	330
9	Jogulamba Gadwal	-	-

Forest/Wood – Based Industries in Upper Tungabhadra Basin

The distribution of wood-based and paper industries in the Upper Tungabhadra Basin highlights a clear dominance of a few districts, while others show limited development. Districts like Chikkamagalur, Davangere, and Shivamogga emerge as major centers for wood-based industries, supported by Uttara Kannada, whereas districts such as Haveri, Koppal, and Chitradurga have very minimal presence in this sector. In contrast, paper and paper-based industries are more concentrated in Shivamogga, with moderate presence in Chikkamagalur and Uttara Kannada, while some districts show little to no activity. Overall, wood-based industries are more widely developed across the basin, whereas paper industries remain restricted to a few key locations, indicating an uneven industrial distribution. The Forest/ Wood industries in districts of Upper Tungabhadra basin shown in table 13 below.

Table 13: The forest/wood - based industries in districts of Upper Tungabhadra basin

Sl.No	Districts	Wood/wooden based furniture	Paper & paper products
1	Chikamagalur	2415	236
2	Shivamogga	1650	410
3	Davangere	2010	0
4	Haveri	78	0
5	Gadag	418	127
6	Koppal	56	_

7	Uttara kannada	1235	208
8	Chithradurga	30	150
9	Vijayanagara	N/A	

Forest/Wood – Based Industries in Lower Tungabhadra Basin

The pattern of wood-based and paper industries in the region indicates that industrial growth is more prominent in certain districts, while many others have only a marginal presence. Districts such as Hassan, Raichur stand out as key contributors to wood and furniture-related industries, suggesting better utilization of forest resources and industrial support, whereas districts like Ballari, Koppal, and Kurnool reflect relatively low industrial activity.

In the case of paper industries, a moderate level of development is seen in a few districts like Raichur, Hassan, while several regions show very limited or almost no presence. This overall distribution points to a need for improved industrial planning and support in less-developed areas to achieve a more even and sustainable growth pattern. The Forest/ Wood industries in districts of Lower Tungabhadra basin shown in table 14 below.

Table 14: The forest/wood - based industries in districts of Lower Tungabhadra basin

Sl.No	Districts	Wood/wooden based furniture	Paper & paper products
1	Raichur	1015	330
2	Ballari	22	21
3	Hassan	2020	234
4	Koppal	56	_
5	Chithradurga	30	150
6	Kurnool	_	1
7	Ananthapur	480	50
8	Vijayanagara	N/A	
9	Jogulamba Gadwal	N/A	
10	Sri satya sai	N/A	

3.2.3 Chemical and Allied Industries

The chemical and allied industries constitute a diverse and evolving industrial segment in the Krishna River Basin, encompassing chemical-based manufacturing, rubber/plastic/petro-derived units, as well as leather-based enterprises. These industries

range from fertilizer, detergent, paint, and adhesive producers to plastic goods, rubber items, and leather processing units, reflecting the basin's gradual transition toward modern manufacturing sectors. Their growth is influenced by urban demand, availability of raw materials, increasing industrial infrastructure, and employment-generating capacities. The sector forms an essential link between agriculture, urban markets, and industrial supply chains, contributing to both economic diversification and regional industrial modernization.

Chemical and Allied Industries in Upper Krishna Basin

Belagavi stands out as the most industrially dominant district, leading in leather-based industries and maintaining a strong presence in chemical and rubber/plastic/petro-based sectors as well. Vijayapura ranks second in leather-based activity, while Sangli leads in chemical and chemical-based industries and also shows strong rubber/plastic/petro-based presence. Gadag and Dharwad are the only districts with any soda water activity, though it remains minimal, while Kolhapur records zero soda water presence despite being moderately active in leather-based and rubber/plastic/petro-based sectors. Bagalkot shows a notable chemical-based presence and Satara maintains a balanced moderate activity across leather, chemical and rubber sectors. Sindhudurg, Koppal and Yadgir remain the least industrialized, with very limited or negligible activity across most categories. Chemical and Allied industries in districts of Upper Krishna Basin is shown in table 15 below.

Table 15: Chemical and Allied industries in districts of Upper Krishna Basin

Sl.No	Districts	Soda water	Leather based	Chemical and chemical based	Rubber, plastic and petro based
1	Satara	-	50	73	123
2	Sangli	-	101	391	286
3	Sindhudurg	-	-	6	42
4	Kolhapur	0	244	44	95
5	Vijayapur	-	505	86	76
6	Yadgir	-	-	-	2
7	Bagalkot	-	64	216	25
8	Koppal	-	12	6	10
9	Gadag	67	342	146	65
10	Dharwad	3	63	22	8
11	Belagavi	-	2813	209	256

Chemical and Allied Industries in Upper Bhima Basin

Pune stands out as the most industrially dominant district, leading across all sectors including soda water, leather-based, chemical, and rubber/plastic/petro-based industries by a considerable margin. Vijayapura ranks highest in leather-based industries among the remaining districts, while Sangli leads in chemical and chemical-based activity.

Ahmedanagar shows strong performance in both chemical and rubber/plastic/petro-based sectors, making it notably active overall. Beed and Satara maintain moderate industrial presence, whereas Solapur and Dharashiv remain the least developed, with very limited activity across all categories. Soda water as an industry is virtually absent throughout the region, with only Pune recording any presence in this sector. The Chemical and allied Industries in Districts of Upper Bhima basin is shown in table 16 below.

Table 16: Chemical and Allied industries in districts of Upper Bhima Basin

Sl.No	Districts	Soda water	Leather based	Chemical and chemical based	Rubber,plastic and petro based
1	Dharashiv	0	0	46	32
2	Solapur	-	0	69	55
3	Ahmedanagar	-	30	210	235
4	Beed	-	38	44	47
5	Sangli	-	101	391	286
6	Satara	-	50	73	123
7	Pune	1409(Including Agro based)	454	835	1398
8	Vijayapura	-	505	86	76

Chemical and Allied Industries in Lower Bhima Basin

Vijayapura leads the Lower Bhima Basin in leather-based industries by a dominant margin, while also maintaining a moderate presence in chemical and rubber/plastic/petro-based sectors. Solapur shows activity only in chemical and rubber/plastic/petro-based sectors, with no leather-based presence, while Dharashiv records zero activity in both soda water and leather-based industries but has a modest chemical and rubber/plastic/petro-based presence. Bidar and Kalaburagi have very limited and scattered industrial activity across a few sectors, whereas Yadgir is nearly absent from all categories except a negligible rubber/plastic/petro-based presence. Sangareddy and Vikarabad have no available data, making their industrial assessment incomplete. The Chemical and allied Industries in Districts of Lower Bhima basin is shown in table 17 below.

Table 17: Chemical and Allied industries in districts of Lower Bhima Basin

Sl.No	Districts	Soda water	Leather based	Chemical and chemical based	Rubber,plastic and petro based
1	Dharashiv	0	0	46	32
2	Solapur	-	0	69	55

3	Sangareddy	NA			
4	Vikarabad				
5	Vijayapura	-	505	86	76
6	Yadgir	-	-	-	2
7	Bidar	-	1	32	15
8	Kalaburagi	-	4	4	3

Chemical and Allied Industries in Middle Krishna Basin

Chemical and allied industries in the Middle Krishna Sub-Basin, with activity concentrated mainly in Nalgonda and Warangal districts. In Nalgonda, leather-based industries account for 92 units, chemical-based industries for 198 units, and rubber, plastic, and petro-based industries for 212 units. Warangal also shows a moderate presence with 96 leather-based units, 22 chemical-based units, and 64 rubber and plastic units. No soda water industries are recorded in any of the districts. The remaining districts, including Krishna, Bapatla, Guntur, NTR, Palnadu, Khammam, Suryapet, Mahabubabad, Jangaon, Yadadri Bhuvanagiri, and Medchal Malkajgiri, show no presence in this sector. Chemical and Allied industries in districts of Middle Krishna Basin is shown in the table 18 below.

Table 18: Chemical and Allied industries in districts of Middle Krishna Basin

S/No	Districts	Soda Water	Lather Based	Chemical/Chemical based	Rubber, Plastic & petro based
1	Nalgonda	-	92	198	212
2	Krishna	-	-	-	-
3	Bapatla	-	-	-	-
4	Guntur	-	-	-	-
5	NTR	-	-	-	-
6	Palnadu	-	-	-	-
7	Khammam	-	-	-	-
8	Suyrapet	-	-	-	-
9	Mahabubabad	-	-	-	-
10	Warangal	-	96	22	64
11	Jangoan	-	-	-	-
12	Yadadri Bhuvanagiri	-	-	-	-
13	Medchal Malkajgiri	-	-	-	-

Chemical and Allied Industries in Lower Krishna Basin

Chemical and allied industries in the Lower Krishna Sub-Basin, indicating a concentration in a few key districts. Chemical-based industries are mainly found in Prakasam and Ranga Reddy, with a smaller presence in Raichur. Rubber, plastic, and petro-based industries are concentrated in Ranga Reddy, followed by Raichur and Mahabub Nagar. Leather-based industries are present only in Raichur, while soda water industries are absent across all districts. Most other districts such as Nagara Kurnool, Wanaparti, Narayanpet, Nandyal, and Jogulamba Gadwal show no presence in this sector. Chemical and Allied industries in districts of Lower Krishna Basin is shown in table 19 below.

Table 19: Chemical and Allied industries in districts of Lower Krishna Basin

S/No	Districts	Soda Water	Lather Based	Chemical/Chemical based	Rubber, Plastic & petro based
1	Ranga Reddy	-	-	276	298
2	Nagara kurnool	-	-	-	-
3	Mahabub Nagar	-	-	-	3
4	Wanaparti	-	-	-	-
5	Narayanpet	-	-	-	-
6	Prakasam	-	-	495	-
7	Nandyal	-	-	-	-
8	Raichur	-	258	33	33
9	Jogulamba Gadwal	-	-	-	-

Chemical and Allied Industries in Upper Tungabhadra Basin

The distribution of soda water, leather, chemical, and petro-based industries in the Upper Tungabhadra Basin clearly reflects a diverse yet uneven industrial landscape, where development is strongly concentrated in a few prominent districts while others remain comparatively underdeveloped. Districts such as Shivamogga, Chitradurga, and Davangere emerge as key industrial centers, particularly in leather and related sectors, whereas districts like Haveri and Koppal show relatively limited industrial activity.

Chemical and chemical-based industries are well established in districts like Chikkamagalur and Uttara Kannada, indicating a gradual shift towards industrial diversification and value-added production. Rubber, plastic, and petro-based industries show a moderate presence, with noticeable concentration in Shivamogga and Uttara Kannada. Overall, this pattern highlights an imbalanced yet evolving industrial structure, emphasizing the need for strategic planning and inclusive development to achieve more balanced regional growth. The Chemical and Allied industries in districts of Upper Tungabhadra basin shown in table 20 below

Table 20: Chemical and Allied industries in districts of Upper Tungabhadra Basin

Sl.No	Districts	Soda water	Leather based	Chemical/chemical based	Rubber, plastic & petro based
1	Chikamagalur	_	171	375	118
2	Shivamogga	50	740	190	281
3	Davangere	25	350	50	40
4	Haveri	1	11	11	0
5	Gadag	67	342	146	65
6	Koppal	_	12	6	10
7	Uttara kannada	106	120	303	106
8	Chithradurga	35	700	30	40
9	Vijayanagara	N/A			

Chemical and Allied Industries in Lower Tungabhadra Basin

The overall distribution of soda water, leather, chemical, and petro-based industries shows a diverse yet uneven pattern of industrial development across the region. Districts such as Hassan, Chitradurga, and Chikkamagalur stand out for their stronger presence, especially in leather and chemical-related sectors, reflecting better industrial growth and resource use. Raichur and Ananthapur also show notable activity in selected industries, indicating gradual expansion.

In contrast, districts like Ballari, Koppals, and Kurnool have relatively limited industrial representation, pointing to slower development in these sectors. The emergence of chemical and petro-based industries in a few districts suggests a shift towards modernization, but the overall distribution highlights the need for more inclusive and regionally balanced industrial development. The Chemical and Allied industries in districts of Lower Tungabhadra basin shown in table 21 below.

Table 21: Chemical and Allied industries in districts of Lower Tungabhadra Basin

Sl.No	Districts	Soda water	Leather based	Chemical/chemical based	Rubber, plastic & petro based
1	Raichur	_	258	33	33
2	Ballari	0	2	14	9
3	Hassan	_	333	360	223

4	Koppal	_	12	6	10
5	Chithradurga	35	700	30	40
6	Kurnool	_	1	18	41
7	Ananthapur	_	_	288	200
8	Vijayanagara	N/A			
9	Jogulamba Gadwal	N/A			
10	Sri satya sai	N/A			

3.2.4 Mineral and Metal - Based Industries

Mineral and metal-based industries form the backbone of the basin's resource-driven industrial economy, leveraging abundant deposits of limestone, dolomite, marble, clay, and other minerals. These industries, comprising mineral processing units and metal-based enterprises (such as steel fabrication), play a pivotal role in supplying critical materials for construction, infrastructure, and engineering. Mineral-based units support operations involving the production of cement, lime, and stone, while metal fabrication units manufacture structural steel, machinery components, tools, and engineering goods essential for industrial and agricultural activities. The spatial distribution of this sector highlights strong resource industry linkages, particularly in districts where geological advantages and industrial corridors converge, supporting rapid manufacturing growth.

Mineral and Metal - Based Industries in Upper Krishna Basin

Belagavi records extremely high values compared to the other districts, indicating a strong concentration of mineral based and metal based industrial activity. Gadag has moderate figures, reflecting a developing industrial presence. Dharwad has limited data availability but shows some contribution in one category. The variation across districts highlights uneven industrial distribution. Overall, a few districts dominate while others contribute at a much lower level. The Mineral and metal – based industries in districts of Upper Krishna basin is shown in table 22 below.

Table 22: Mineral and Metal - Based industries in districts of Upper Krishna Basin

Sl.No	Districts	Mineral based	Metal based
1	Satara	-	197
2	Sangli	-	306
3	Sindhudurg	60	225
4	Kolhapur	41	2708
5	Vijayapur	153	-
6	Yadgir	-	1

7	Bagalkot	-	-
8	Koppal	42	5
9	Gadag	53	42
10	Dharwad	NA	80
11	Belagavi	2802	1029

Mineral and Metal - Based Industries in Upper Bhima Basin

In the districts of Upper Bhima basin, Pune dominates both mineral-based and metal-based industries across the Upper Bhima Basin, standing far ahead of all other districts in both categories. Beed ranks second in mineral-based industries and also shows strong metal-based activity, while Vijayapura holds a moderate mineral-based presence but records no metal-based industry. Ahmedanagar and Solapur show no mineral-based activity but maintain a decent metal-based industrial presence, with Ahmedanagar leading among the two. Sangli and Satara are limited to metal-based industries alone with moderate figures, whereas Dharashiv records no mineral-based activity and has the lowest metal-based industrial presence in the region. The Mineral and metal – based industries in districts of Upper Bhima basin is shown in table 23 below.

Table 23: Mineral and Metal - Based Industries in districts of Upper Bhima Basin

Sl.No	Districts	Mineral based	Metal based
1	Dharashiv	0	115
2	Solapur	-	170
3	Ahmedanagar	-	215
4	Beed	215	408
5	Sangli	-	306
6	Satara	-	197
7	Pune	802	1867
8	Vijayapura	153	-

Mineral and Metal - Based Industries in Lower Bhima Basin

Mineral and metal-based industries are largely underdeveloped across the Lower Bhima Basin, with very limited activity recorded in most districts. Vijayapura is the only district with a notable mineral-based industrial presence, while recording no metal-based activity at all. Solapur and Dharashiv show no mineral-based activity but maintain a relatively stronger metal-based industrial presence compared to other districts. Kalaburagi and Yadgir have extremely minimal metal-based activity and no mineral-based industry, while Bidar records no activity in either sector. Sangareddy and Vikarabad have no available data, leaving their

industrial standing uncertain. The Mineral and metal – based industries in districts of Lower Bhima basin is shown in table 24 below.

Table 24: Mineral and Metal - Based Industries in districts of Lower Bhima Basin

Sl.No	Districts	Mineral based	Metal based
1	Dharashiv	0	115
2	Solapur	-	170
3	Sangareddy	NA	
4	Vikarabad		
5	Vijayapura	153	-
6	Yadgir	-	1
7	Bidar	-	-
8	Kalaburagi	-	9

Mineral and Metal - Based Industries in Middle Krishna Basin

Mineral and metal-based industries in the Middle Krishna Sub-Basin, showing a strong concentration in Nalgonda and Warangal districts. In Nalgonda, mineral-based industries account for 296 units, metal-based (steel fabrication) for 174 units, indicating a well-developed industrial base. Warangal also shows significant activity with 250 mineral-based units, 240 metal-based units. All other districts, including Krishna, Bapatla, Guntur, NTR, Palnadu, Khammam, Suryapet, Mahabubabad, Jangaon, Yadadri Bhuvanagiri, and Medchal Malkajgiri, show no presence in this sector. Mineral and Metal - Based Industries in districts of Middle Krishna Basin is shown in table 25 below.

Table 25: Mineral and Metal - Based Industries in districts of Middle Krishna Basin

S/No	Districts	Mineral based	Metal based (Steel Fab.)
1	Nalgonda	296	174
2	Krishna	-	-
3	Bapatla	-	-
4	Guntur	-	-
5	NTR	-	-
6	Palnadu	-	-
7	Khammam	-	-
8	Suyrapet	-	-
9	Mahabubabad	-	-
10	Warangal	250	240
11	Jangoan	-	-
12	Yadadri Bhuvanagiri	-	-
13	Medchal Malkajgiri	-	-

Mineral and Metal - Based Industries in Lower Krishna Basin

Mineral and metal-based industries in the Lower Krishna Sub-Basin, showing concentration in a few key districts. Mineral-based industries are mainly found in Prakasam (951 units) and Ranga Reddy (221 units), industries are minimal, recorded only in Mahabub Nagar with 4 units. Other districts such as Nagara Kurnool, Wanaparti, Narayanpet, Nandyal, and Jogulamba Gadwal show no industrial presence in this category. Mineral and Metal - Based Industries in districts of Lower Krishna Basin is shown in table 26 below.

Table 26: Mineral and Metal - Based Industries in districts of Lower Krishna Basin

S/No	Districts	Mineral based	Metal based (Steel Fab.)
1	Ranga Reddy	221	-
2	Nagara kurnool	-	-
3	Mahabub Nagar	4	4
4	Wanaparti	-	-
5	Narayanpet	-	-
6	Prakasam	951	-
7	Nandyal	-	-
8	Raichur	-	-
9	Jogulamba Gadwal	-	-

Mineral and Metal - Based Industries in Upper Tungabhadra Basin

The pattern of mineral-based and metal-based industries in the Upper Tungabhadra Basin shows that industrial development is concentrated in a few key districts, while others remain less developed. Districts such as Davangere and Uttara Kannada stand out as important centers, especially in metal-based industries, reflecting strong industrial potential and effective use of available resources. Shivamogga and Chikkamagalur also show a noticeable presence, contributing to both sectors. However, districts like Haveri and Koppal exhibit only a marginal presence in these industries, pointing to limited industrial expansion. The Mineral and Metal – Based industries in districts of Upper Tungabhadra basin shown in table 27 below.

Table 27: Mineral and Metal - Based Industries in districts of Upper Tungabhadra Basin

Sl.No	Districts	Mineral based	Metal based
1	Chikamagalur	57	127
2	Shivamogga	47	240

3	Davangere	95	1510
4	Haveri	0	9
5	Gadag	53	42
6	Koppal	42	5
7	Uttara kannada	118	578
8	Chithradurga	18	120
9	Vijayanagara	N/A	

Mineral and Metal - Based Industries in Lower Tungabhadra Basin

The distribution of mineral-based and metal-based industries across the region indicates that industrial development is concentrated in a few key districts, while several others show very limited or no presence. Districts such as Ananthapur, Kurnool, and Hassan emerge as prominent centers for mineral-based activities, reflecting strong resource availability and utilization, while Chitradurga and Chikkamagalur also contribute to both sectors to some extent. Metal-based industries are comparatively more developed in selected districts like Ananthapur and Chitradurga, whereas districts such as Ballari and Koppal show only minimal activity. Some regions have little to no representation in these industries, highlighting gaps in industrial growth. Overall, the pattern suggests a resource-driven but uneven industrial structure, emphasizing the importance of promoting balanced and region-specific development strategies. The Mineral and Metal – Based industries in districts of Lower Tungabhadra basin shown in table 28 below.

Table 28: Mineral and Metal - Based Industries in districts of Lower Tungabhadra Basin

Sl.No	Districts	Mineral based	Metal based
1	Raichur	_	_
2	Ballari	4	0
3	Hassan	214	86
4	Koppal	42	5
5	Chithradurga	18	120
6	Kurnool	433	6
7	Ananthapur	802	700
8	Vijayanagara	N/A	
9	Jogulamba Gadwal	N/A	
10	Sri satya sai	N/A	

3.3 Polluting and Non – Polluting Industries

Industries play a significant role in the economic development of the Krishna River Basin, but they also contribute to environmental pollution, particularly affecting water resources. Based on the pollution potential as classified by the Central Pollution Control Board (CPCB), industries are categorized into Red, Orange, Green, and White categories. Red category industries are highly polluting and generate substantial quantities of effluents and hazardous wastes, while orange category industries have moderate pollution potential. Green category industries are less polluting with relatively lower environmental impact, whereas White category industries are considered non-polluting and do not generate significant emissions or effluents. The analysis of industrial data across the four states of the basin indicates that a considerable number of industries fall under the red and orange categories, especially in major industrial districts, highlighting potential pollution risks. In contrast, Green and White category industries have comparatively minimal impact on water quality. This classification helps in identifying pollution hotspots and emphasizes the need for effective monitoring, regulation, and adoption of cleaner technologies to protect the river ecosystem.

Upper Krishna Sub – basin: The distribution of polluting and non-polluting industries in the Upper Krishna Basin indicates a significant presence of industries across all CPCB categories, including Red, Orange, Green, and White. The analysis shows that orange and green category industries dominate the basin, reflecting a predominance of moderate to low pollution-generating activities. However, a considerable number of Red category industries, particularly in districts such as Kolhapur, Satara, and Belagavi, indicate the presence of highly polluting industrial units that may contribute significantly to water quality degradation. Kolhapur district stands out with a notably high concentration of industries across all categories, making it a major industrial hub as well as a potential pollution hotspot within the basin. Similarly, districts like Sangli and Dharwad also show substantial numbers of orange and green industries, indicating moderate industrial activity with associated environmental impacts. In contrast, districts such as Vijayapura and Bagalkot exhibit relatively lower industrial intensity. Overall, the spatial distribution highlights that while non-polluting and less polluting industries (Green and White categories) form the majority, the concentration of red and orange category industries in key districts necessitates stringent monitoring and effective pollution control measures to protect the river ecosystem

in the Upper Krishna Sub -Basin. The polluting and non-polluting industries in Upper Krishna Sub basin has been represented through Figure 8 below.

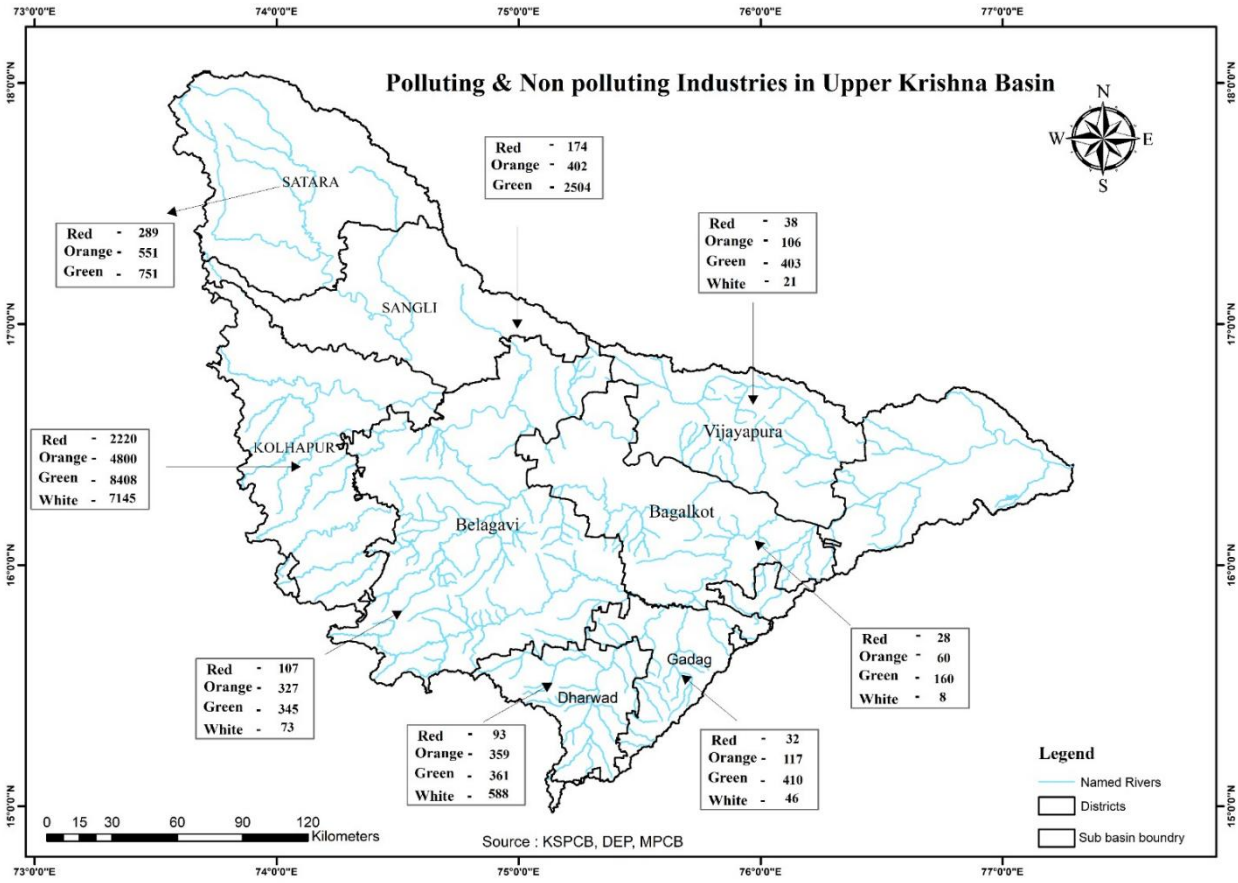

Figure 8: Polluting and Non – Polluting Industries in Districts of Upper Krishna Sub basin

Upper Bhima Sub – basin: The distribution of polluting and non-polluting industries in the Upper Bhima Basin indicates a strong industrial presence across all CPCB categories, the analysis reveals that orange and green category industries dominate the basin, suggesting a prevalence of moderate to low pollution-generating activities. However, a substantial number of red category industries are also present, particularly in districts such as Pune and Solapur, indicating significant potential for environmental pollution. Pune district emerges as a major industrial hub with the highest concentration of industries across all categories, making it a key pollution hotspot within the basin. Solapur also shows considerable industrial activity, especially in the orange and green categories, contributing to cumulative pollution loads. Other districts such as Ahmednagar and Satara exhibit moderate industrial presence, while regions like Beed and Dharashiv have comparatively lower industrial intensity. Overall, while non-polluting and less polluting industries (Green and White categories) form the majority, the concentration of red and orange category industries in major districts highlights the need for stringent monitoring, effective effluent treatment, and sustainable industrial practices to safeguard water quality in the Upper Bhima Basin. The

polluting and non-polluting industries in Upper Bhima Sub basin has been represented through Figure 9 below.

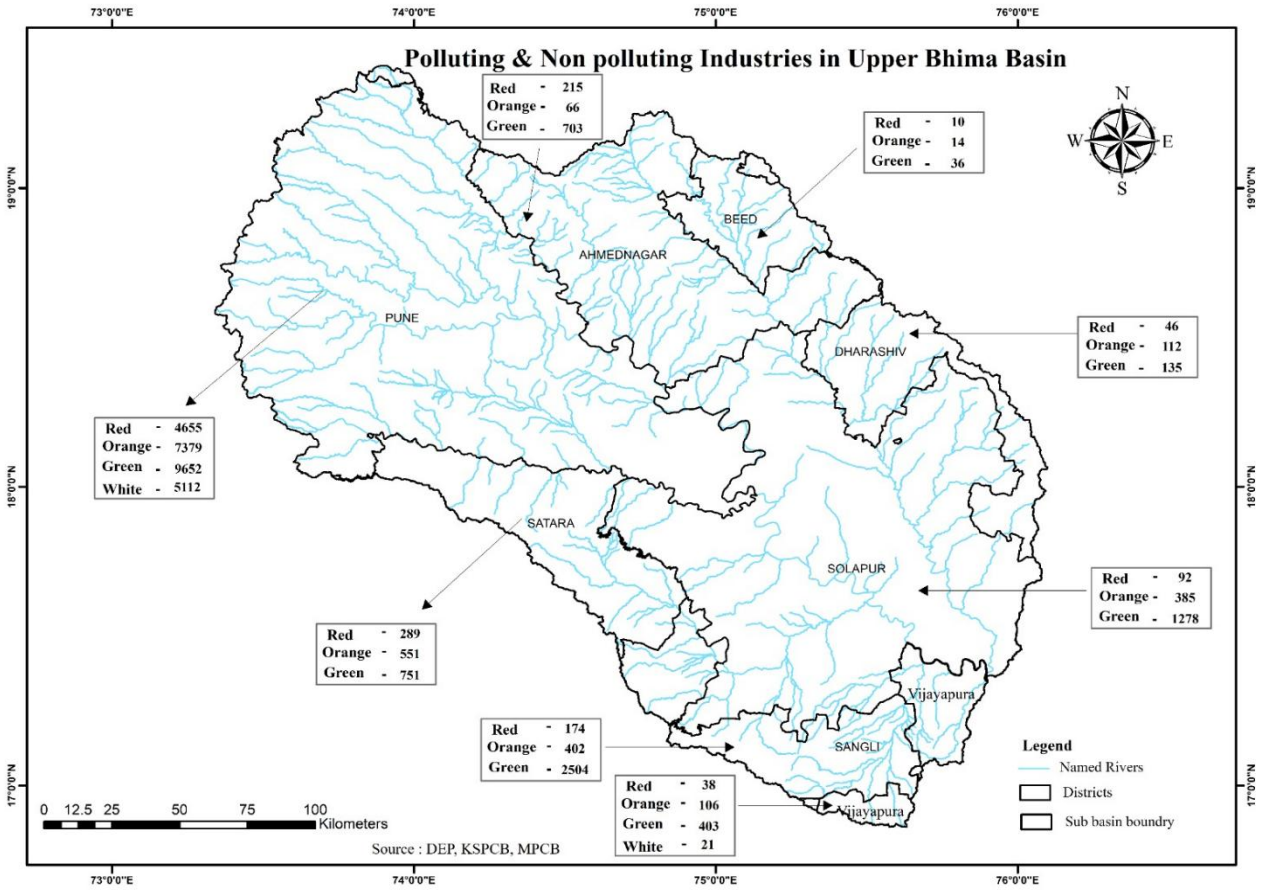

Figure 9: Polluting and Non – Polluting Industries in Districts of Upper Bhima Sub basin

Lower Bhima Sub – basin: The distribution of polluting and non-polluting industries in the Basin reflects a moderate level of industrial activity across districts. The analysis indicates that orange and green category industries dominate the basin, suggesting the prevalence of moderate to low pollution-generating activities. However, a notable presence of red category industries is observed in districts such as Solapur and Ranga Reddy, indicating potential environmental stress due to higher pollution loads. Solapur emerges as a key industrial district with a significant number of industries, particularly in the orange and green categories, making it an important contributor to cumulative pollution within the basin. Similarly, Ranga Reddy district shows a considerable concentration of red and orange category industries, highlighting it as a potential pollution hotspot. Other districts such as Bidar, Kalaburagi, and Yadgir exhibit moderate industrial presence, while areas like Vikarabad show relatively lower industrial intensity. The polluting and non-polluting industries in Lower Bhima Sub basin has been represented in figure 10 below.

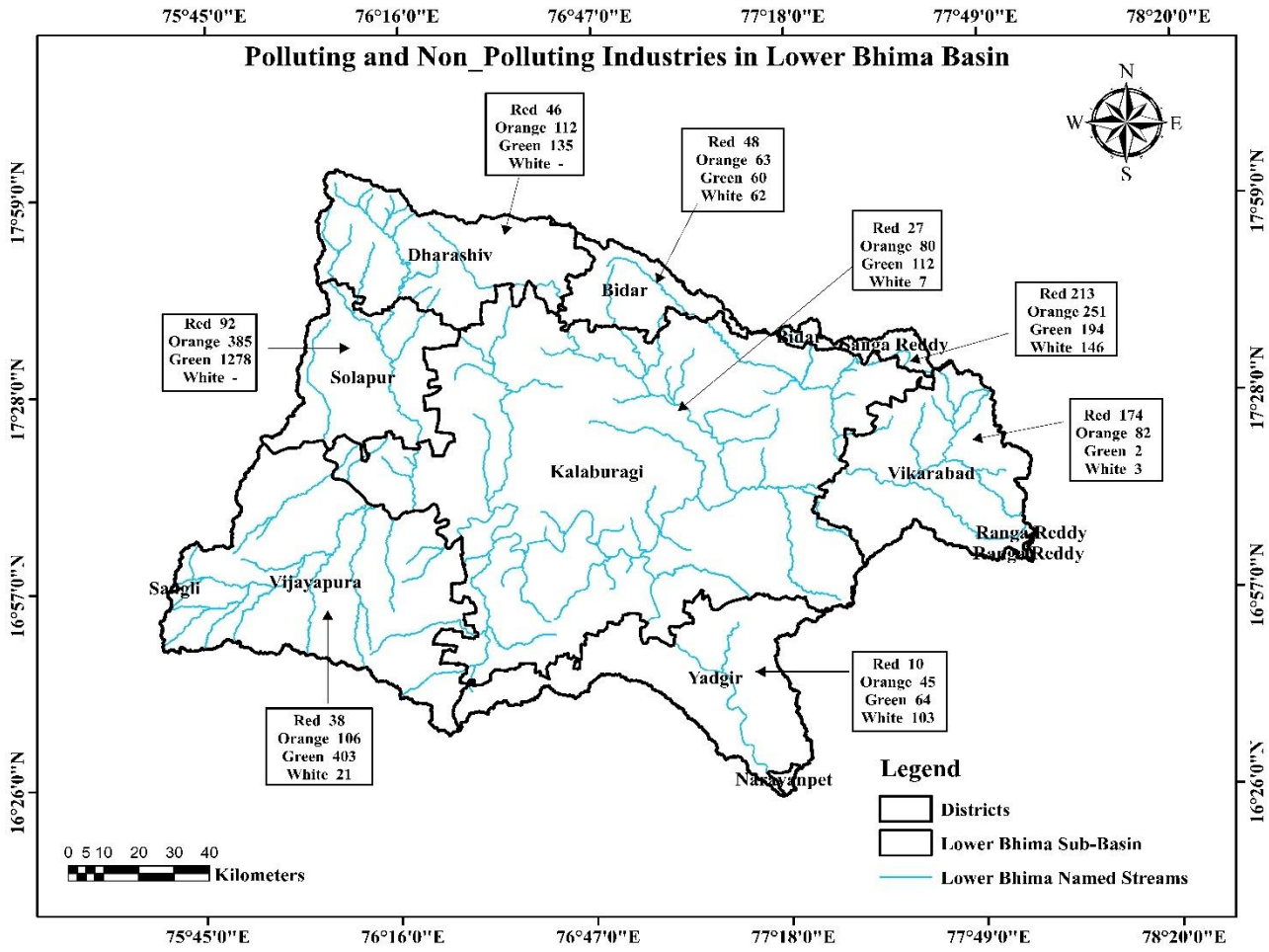

Figure 10: Polluting and Non – Polluting Industries in Districts of lower Bhima Sub basin

Lower Krishna Sub – basin: The map of the Lower Krishna Basin shows an uneven distribution of polluting (Red, Orange) and non-polluting (Green, White) industries across districts. Very high industrial concentration is seen in Guntur and Krishna indicating major pollution loads. Khammam and Bhadradri Kothagudem shows contrasting patterns, with the latter having more green industries. Warangal and Hanumakonda also differ significantly in industrial composition. Moderate levels are observed in Nalgonda, Siddipet and Yadadri Bhuvanagiri. Lower industrial presence is seen in Hyderabad, Medchal–Malkajgiri.Some areas like Palnadu, Bapatla and NTR have no available data. Overall, Red and Orange industries dominate most districts, highlighting uneven industrial growth and potential environmental stress in the basin. The polluting and non-polluting industries in Lower Krishna Sub basin has been represented in figure 11 below.

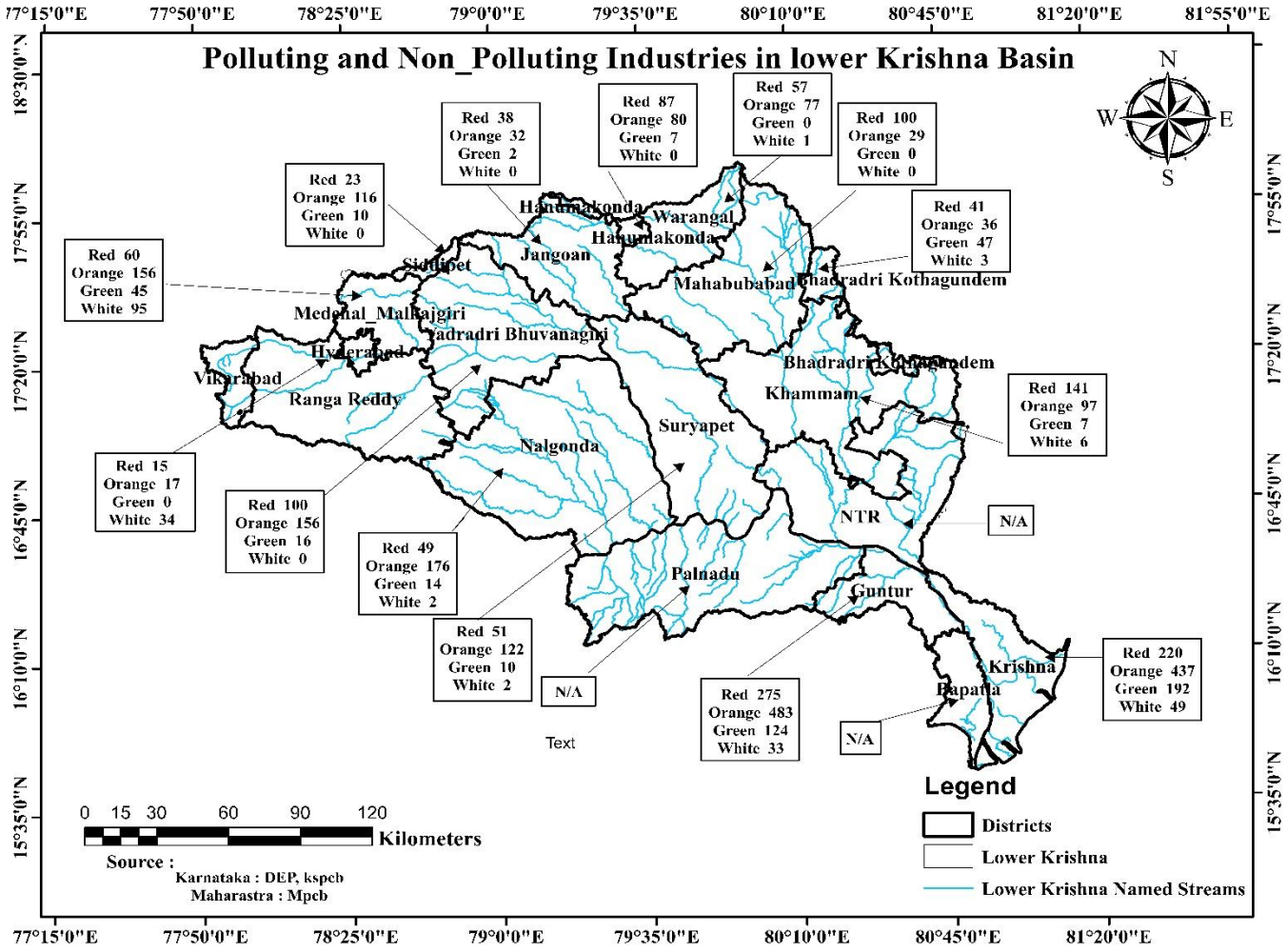

Figure 11: Polluting and Non – Polluting Industries in Districts of lower Krishna Sub basin

Middle Krishan Sub- basin: The Middle Krishna Basin shows a varied distribution of industries across red, orange, green and white categories, with a noticeable dominance of orange category industries, indicating moderate pollution levels across the region. Prakasam district stands out with the highest industrial concentration reflecting significant heavy industrial activity. Ranga Reddy also shows a strong presence. While, Nalgonda records moderate to high industrialization. Mahabubnagar shows a dominance of red and orange categories. Importantly, Nagarkurnool district has comparatively low industrial presence indicating limited industrial development. Northern parts like Raichur display a more balanced and environmentally favorable distribution indicating a higher presence of less-polluting sectors. Other districts such as Narayanpet, Jogulamba Gadwal and Wanaparthy also show relatively low industrial activity. Some areas like Kurnool and Nandyal have no available data. The polluting and non-polluting industries in Middle Krishna Sub basin has been represented in figure 12 below.

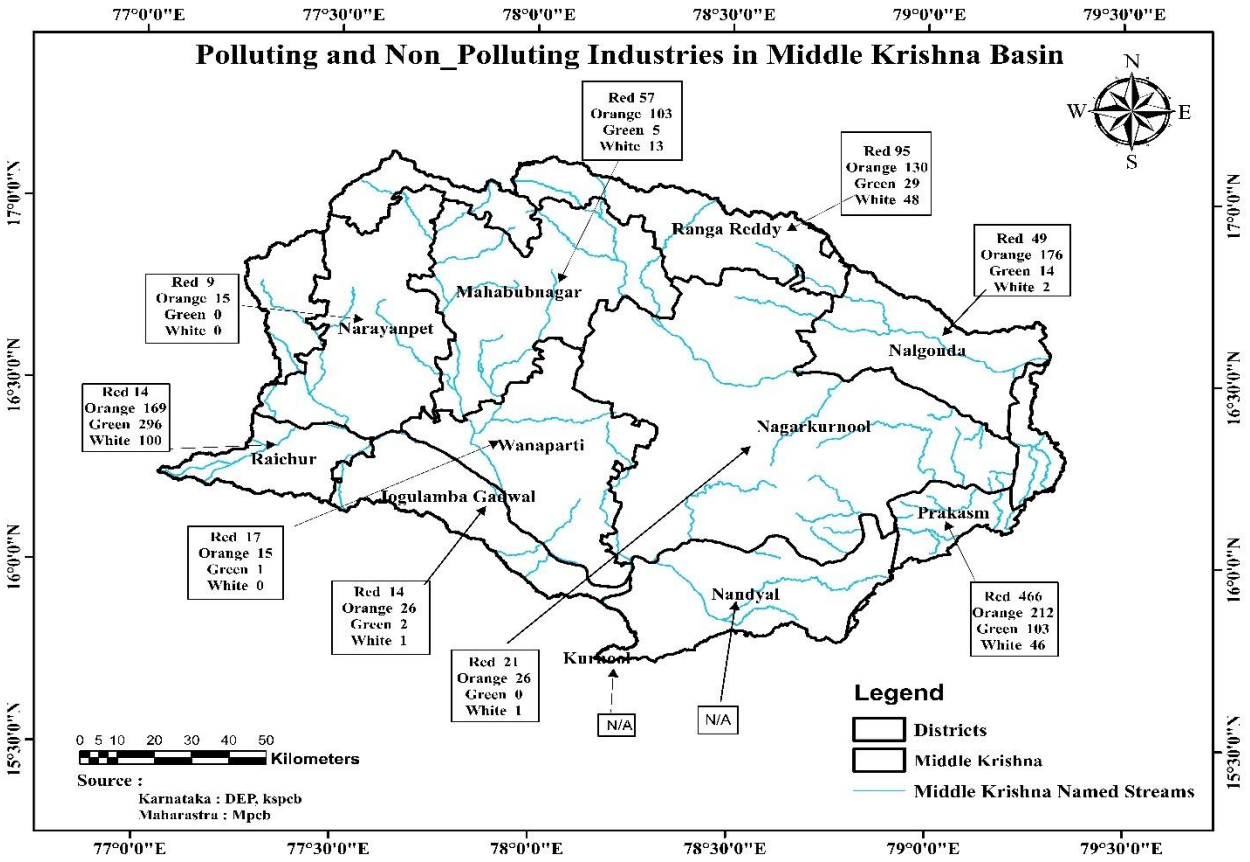

Figure 12: Polluting and Non – Polluting Industries in Districts of Middle Krishna Sub basin

Upper Tungabhadra Sub – basin: The Upper Tungabhadra Basin shows a diverse distribution of industries across different pollution categories, with a dominance of green and orange industries, indicating a prevalence of less to moderately polluting activities. Districts such as Dharwad and Gadag exhibits a strong presence of green and white category industries, Shivamogga also demonstrates a notable inclination toward eco-friendly industrial development. In contrast, Ballari and Koppal show relatively higher concentrations of red and orange category industries, indicating the presence of more pollution-intensive activities. Davangere and Chitradurga display a balanced mix of all industry categories, suggesting moderate industrial development. Uttara Kannada and Haveri have comparatively lower industrial presence with a greater share of less-polluting industries. Chikkamagaluru has minimal industrial activity overall, while Vijayanagara has partly unavailable data. The polluting and non-polluting industries in Upper Tungabhadra Sub basin has been represented in figure 13 below.

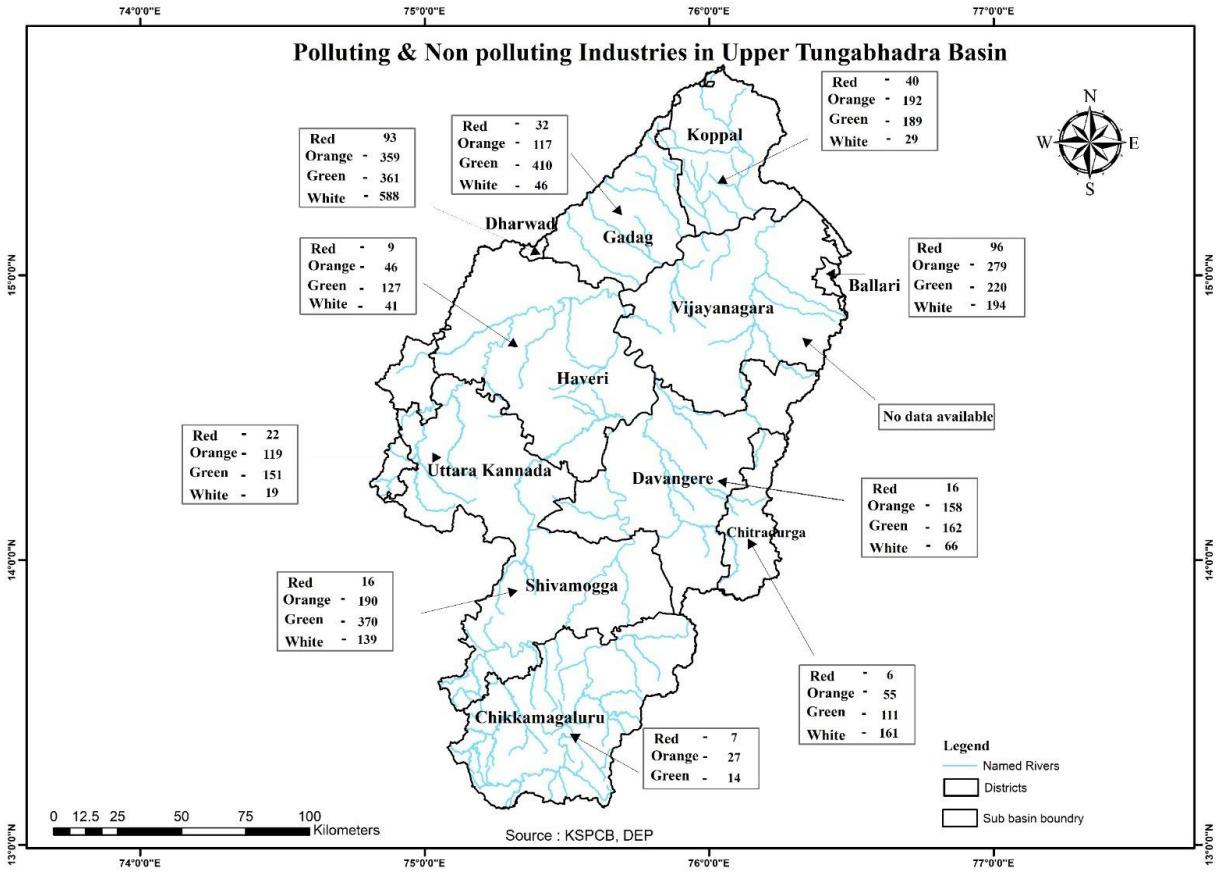

Figure 13: Polluting and Non – Polluting Industries in Districts of Upper Tungabhadra Sub basin

Lower Tungabhadra Sub – basin: The Lower Tungabhadra Basin exhibits a diverse distribution of industries categorized into red, orange, green, and white groups based on their pollution levels. Overall, orange and green category industries dominate the region, indicating a prevalence of moderate to low-pollution activities. However, certain districts such as Ananthapur and Kurnool show a high concentration of red category industries, reflecting significant heavy industrial activity and potential environmental concerns. In contrast, districts like Hassan and Tumakuru have a large number of green and white category industries, suggesting a shift toward more environmentally sustainable sectors. Bellari also shows a balanced industrial distribution across categories. Northern districts such as Raichur, Bagalkot, and Koppal display a balanced mix of all industry types, while districts like Chitradurga, Chikkamagaluru, Jogulamba Gadwal and Davangere indicates moderate industrial presence. Nandyal, Vijayanagara, and Sri Sathya Sai, where industrial data is partly unavailable or limited. The polluting and non-polluting industries in Lower Tungabhadra Sub basin has been represented in figure 14 below.

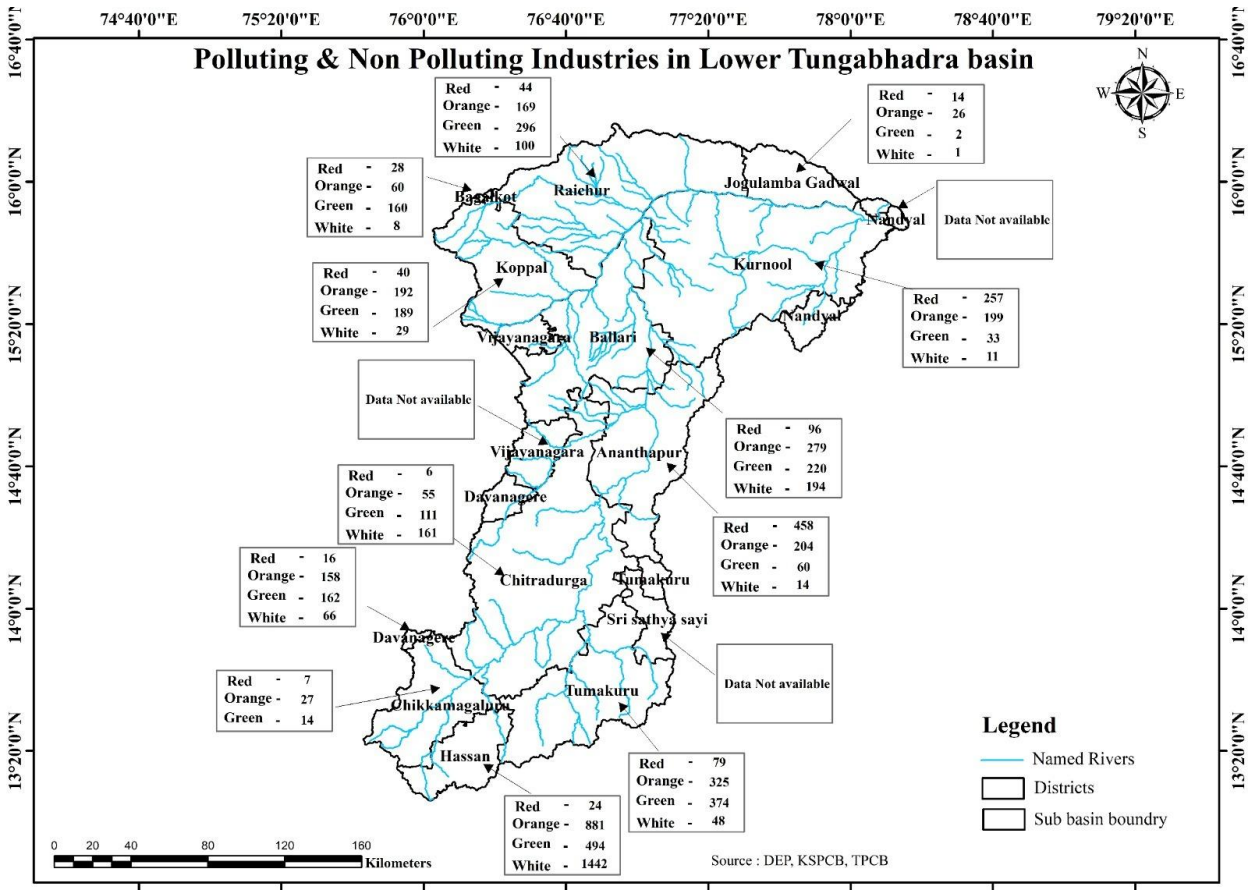

Figure 14: Polluting and Non – Polluting Industries in Districts of lower Tungabhadra Sub basin

4. Water Footprint

The water footprint of the industrial sector in the Krishna River Basin represents the total volume of freshwater utilized by industries for various processes, including production, cooling, cleaning, and other operational activities. It provides a comprehensive understanding of the extent of water use and its impact on available water resources within the basin. Assessing the industrial water footprint is essential to evaluate resource efficiency, identify high water-consuming sectors, and understand the pressure exerted on both surface water and groundwater systems. The water footprint also reflects the potential environmental implications associated with water withdrawal and wastewater generation. In this study, the industrial water footprint is assessed based on district-wise water consumption data and estimated values, enabling spatial analysis of water use patterns across the basin.

4.1 Daily Consumption and Source

The assessment of daily water consumption and its sources provides insight into the dependency of industries on surface water and groundwater resources. In this study, water consumption data for districts in Maharashtra, Telangana, and Andhra Pradesh has been obtained from the respective State Pollution Control Boards, namely MPCB, Telangana State Pollution Control Board, and Andhra Pradesh Pollution Control Board. The available industry-level data has been aggregated to derive total district-wise industrial water consumption, which is further represented spatially. However, in the case of Karnataka, direct data on industrial water consumption was not available, and therefore, water consumption has been estimated using wastewater generation data. A return flow factor of 0.9 (i.e., 90% of water used is assumed to be converted into wastewater) has been considered for this estimation. Accordingly, industrial water consumption has been calculated using the following relationship: **(Water Consumption = Wastewater Generation / 0.9)**

Upper Krishna Sub – Basin: The spatial distribution of industrial water consumption in the Upper Krishna Basin shows significant variation across districts, reflecting differences in industrial concentration and economic activity. Kolhapur district records the highest daily industrial water consumption at approximately 147.5 MLD, followed by Satara (around 71 MLD) and Sangli (65.2 MLD), indicating a strong industrial base in these upstream regions. In the Karnataka part of the basin, districts such as Yadgir (64 MLD) and Belagavi–Dharwad region (around 9.111 MLD) also exhibit notable consumption, whereas districts like Vijayapura (5.011 MLD), Koppal (16.089 MLD), Gadag (1.611 MLD), and Raichur (0.533 MLD) show relatively lower industrial water demand. Overall, the pattern suggests that industrial water use is concentrated in a few key districts, with declining consumption towards downstream and less industrialized areas. This uneven distribution highlights the influence of industrial clusters, availability of infrastructure, and regional development on

water demand within the basin. The daily consumption and source of water in Lower Bhima Sub basin districts has been represented in figure 15 below.

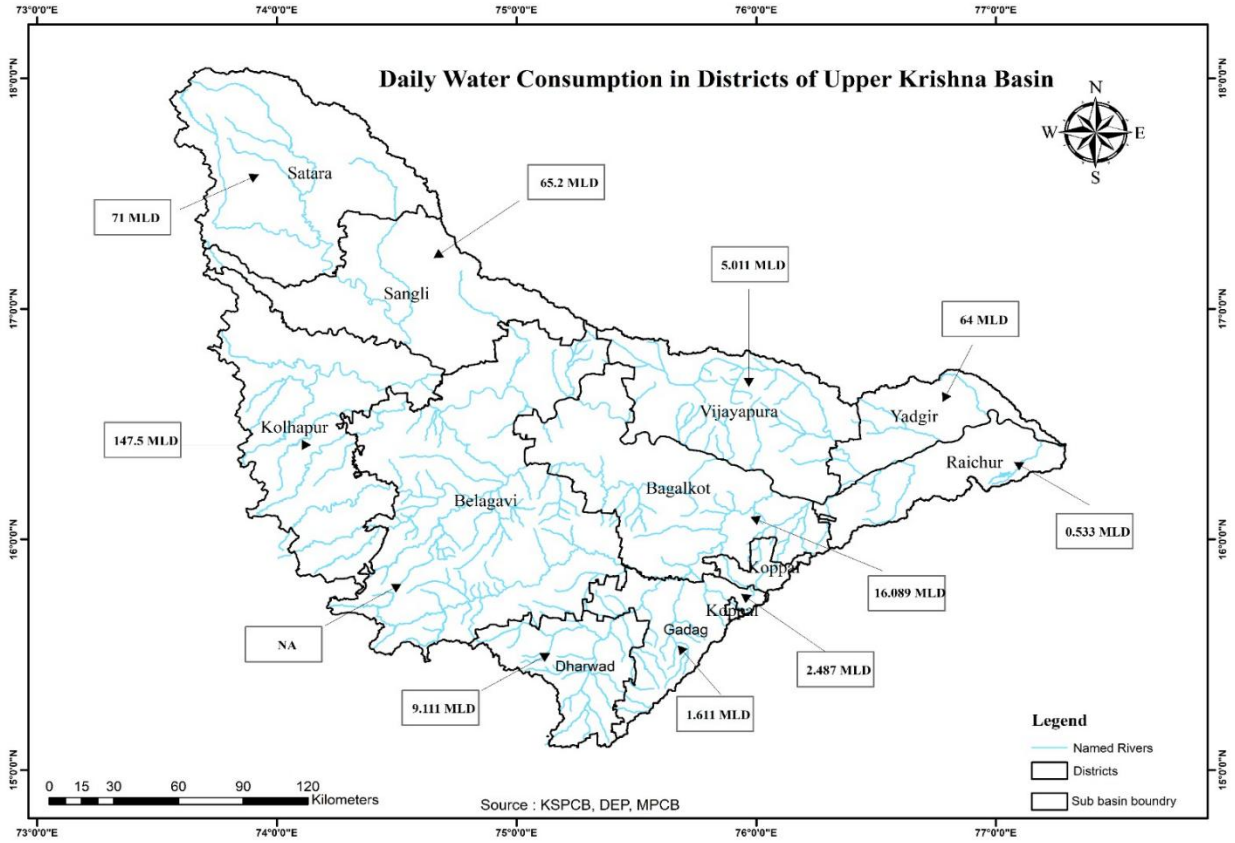

Figure 15: Daily Water Consumption in Districts of Upper Krishna Sub basin

Upper Tungabhadra Sub – basin: The pattern of industrial water consumption in the Upper Tungabhadra Basin shows considerable spatial variation, largely influenced by the level of industrialization and urban development across districts. Dakshina Kannada records the highest daily industrial water consumption at about 1740.889 MLD, indicating a highly intensive industrial and port-based economic activity in the coastal region. This is followed by Chitradurga (296.667 MLD), which also shows significantly high demand, likely due to industrial clusters and mineral-based activities. Moderate levels of consumption are observed in districts such as Davanagere (68.035 MLD), Uttara Kannada (59.171 MLD), and reflecting a mix of agro-based and manufacturing industries. In contrast, districts like Dharwad (9.111 MLD), Shivamogga (11.35 MLD), Haveri (3.911 MLD), Gadag (1.611 MLD), Koppal (2.487 MLD), and Chikkamagaluru (0.644 MLD) exhibit relatively lower industrial water usage. The daily consumption and source of water in Upper Tungabhadra Sub basin districts has been represented in figure 16 below.

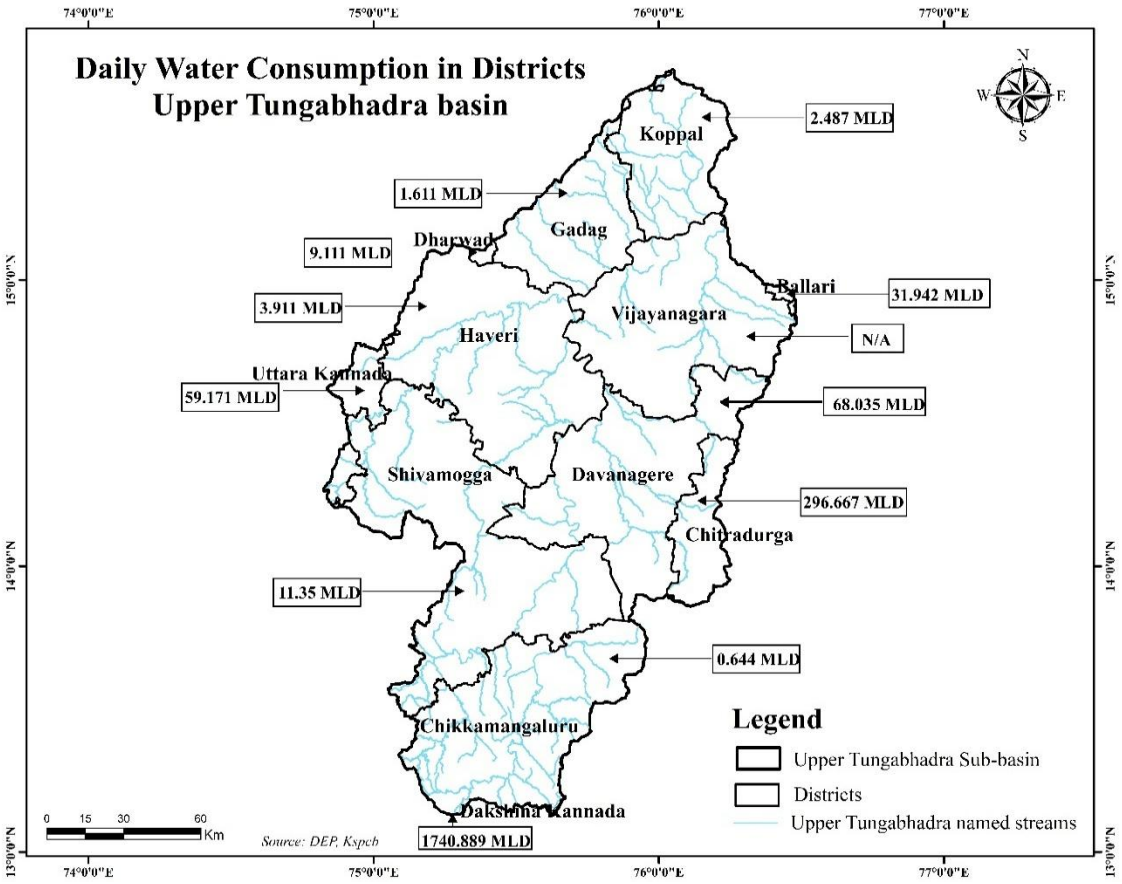

Figure 16 : Daily Water Consumption in Districts of Upper Tungabhadra Sub basin

Lower Tungabhadra Sub – basin: The distribution of industrial water consumption in the Lower Tungabhadra Basin reveals a mixed pattern with a few districts accounting for relatively higher demand while others show minimal or no recorded usage. Ballari (31.942 MLD), indicating the presence of significant industrial activities in these regions. Moderate consumption levels are observed in districts such as Koppal (2.487 MLD), Tumakuru (4.278 MLD), and Hassan (4.389 MLD). In contrast, districts like Raichur (0.533 MLD) and Chikkamagaluru (0.644 MLD) show relatively low industrial water demand. Some districts, including Jogulamba Gadwal, Wanaparthy, Sri Satya Sai, and parts of Vijayanagara, have no available data (N/A), suggesting either negligible industrial presence or lack of reported information. Additionally, districts such as Kurnool (4516 KLD), Nandyal (954 KLD), and Anantapur (1191 KLD) indicate comparatively lower consumption when expressed in KLD units. Overall, the pattern highlights that industrial water use in the Lower Tungabhadra Basin is unevenly distributed, concentrated in select industrial districts, and influenced by regional industrial development and data availability. The daily consumption and source of water in Lower Tungabhadra Sub basin districts has been represented in figure 17 below.

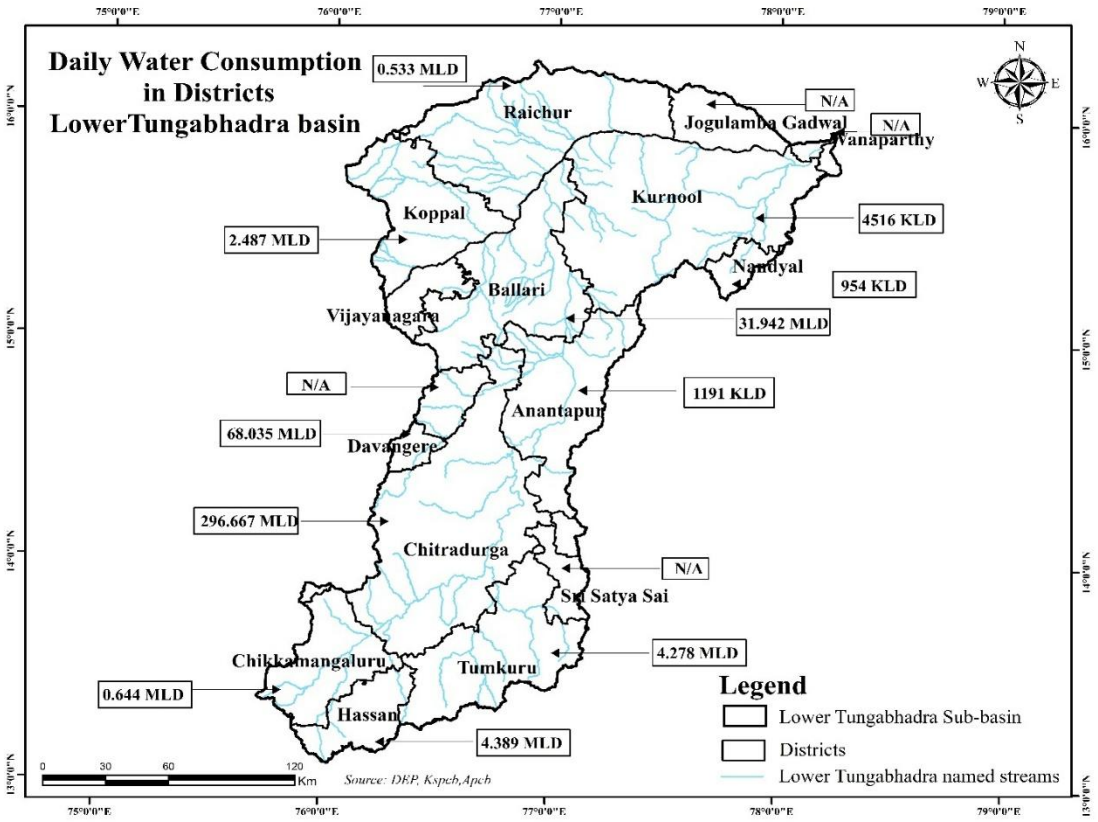

Figure 17: Daily Water Consumption in Districts of Lower Tungabhadra Sub basin

Upper Bhima Sub – basin: The industrial water consumption pattern in the Upper Bhima Basin indicates a concentration of demand in a few districts, with notable spatial variation across the region. Pune district records the highest daily industrial water consumption at approximately 266 MLD, reflecting its strong industrial and urban base. This is followed by Satara (71 MLD), Solapur (69.9 MLD), and Sangli (65.2 MLD), which also show substantial levels of industrial activity and water use. Vijayapura, located towards the downstream part of the basin, has relatively lower consumption at around 5.011 MLD. Several districts such as Ahmednagar, Beed, and Dharashiv are marked with no available data (N/A), indicating either limited industrial presence or gaps in reporting. Overall, the distribution suggests that industrial water demand in the Upper Bhima Basin is uneven, with higher consumption concentrated in major industrial hubs, while other districts exhibit comparatively low or unreported usage. The daily consumption and source of water in Lower Bhima Sub basin districts has been represented in figure 18 below.

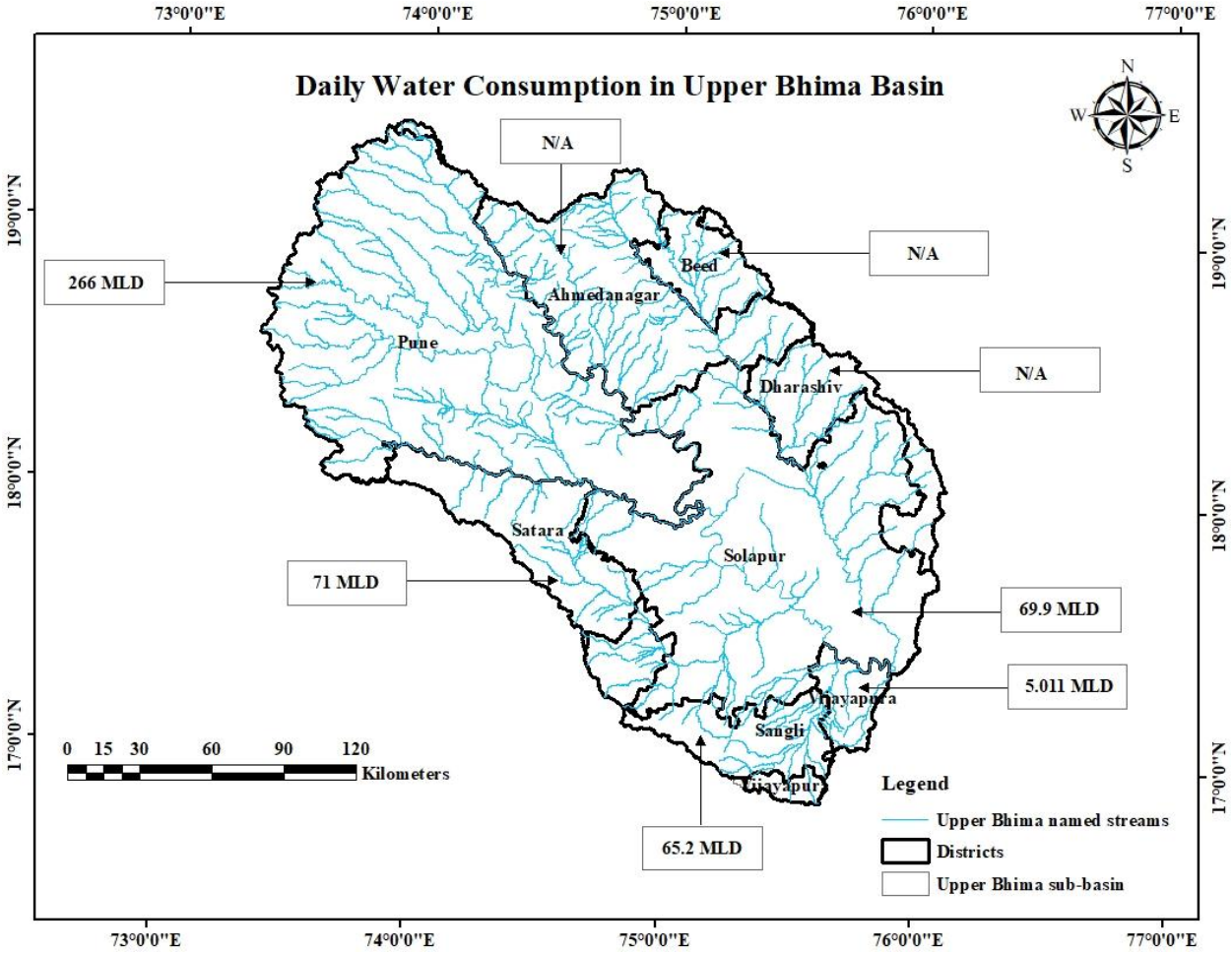

Figure 18: Daily Water Consumption in Districts of Upper Bhima Sub basin

Lower Bhima Sub – basin: In the lower Bhima basin yadgir district records a significant daily industrial water consumption with 64 MLD, indicating notable industrial activity in these regions. Bidar also shows moderate consumption at around 11.111 MLD, while Vijayapura and Kalaburagi register lower values of approximately 5.011 MLD and 2.632 MLD, respectively. Sangareddy district reflects comparatively smaller demand when expressed in KLD (5247 KLD). Some districts such as Dharashiv and Vikarabad are marked as having no available data (N/A), suggesting either limited industrial presence or gaps in reporting. Overall, the distribution indicates that industrial water use in the Lower Bhima Basin is uneven, with higher consumption concentrated in select districts, while other areas exhibit relatively low or unreported industrial demand. The daily consumption and source of water in Lower Bhima Sub basin districts has been represented in figure 19 below.

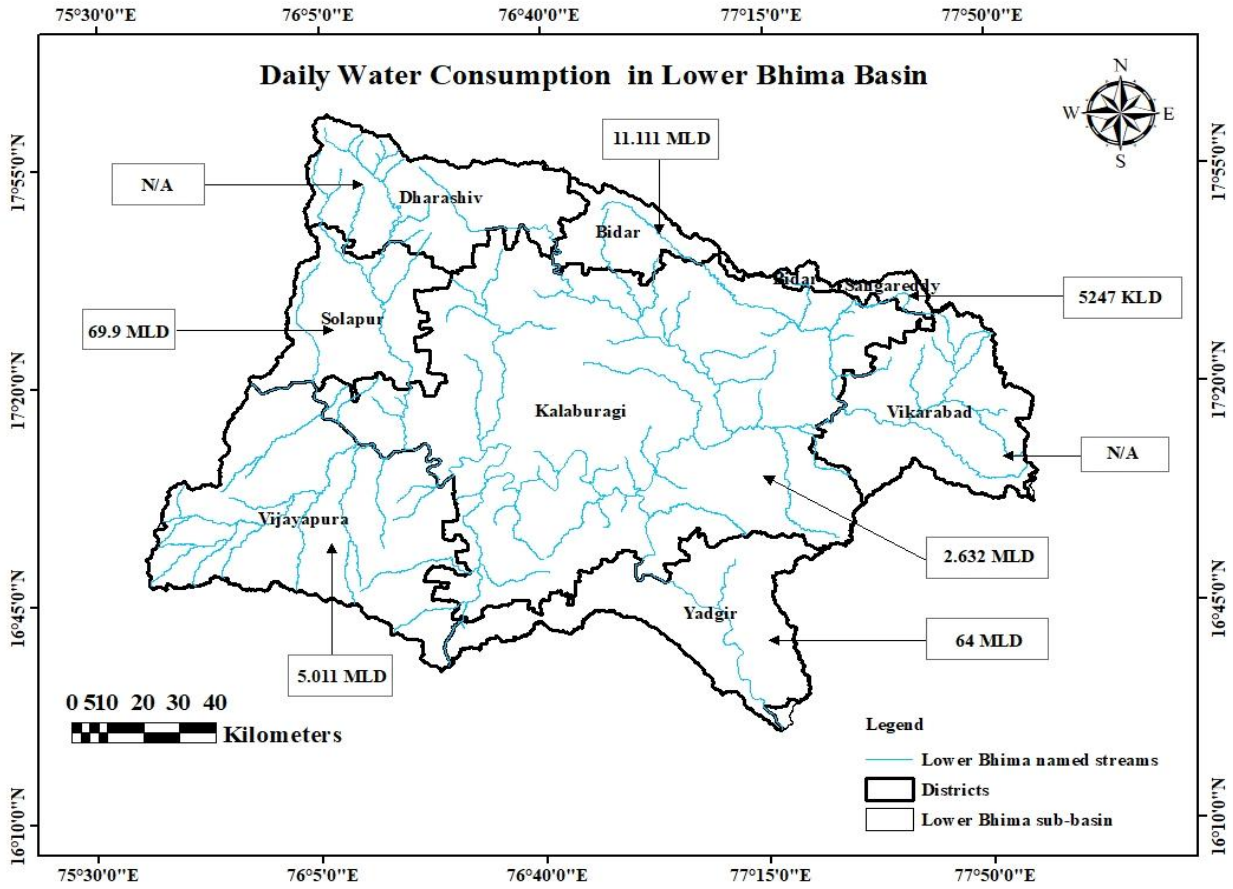

Figure 19: Daily Water Consumption in Districts of Lower Bhima Sub basin

Middle Krishna Sub – basin: The industrial water consumption pattern in the Middle Krishna Basin indicates a concentration of demand in a few districts, with notable spatial variation across the region. Kurnool district records the highest daily industrial water consumption at approximately 4516 KLD, reflecting its strong industrial and urban base. This is followed by Nalagonda (1154.83 KLD), Palnadu (138 KLD), Yadgir (64 MLD), Nandyal (954 KLD) and Raichur (0.533 MLD), which also show substantial levels of industrial activity and water use. Several districts such as Vikarabad, Mahabubnagar, Ranga reddy, Narayanpet, Jogulamba Gadwal, Wanaparti, prakasam and Nagarkurnool are marked with no available data (N/A), indicating either limited industrial presence or gaps in reporting. Overall, the distribution suggests that industrial water demand in the Middle Krishna Basin is uneven, with higher consumption concentrated in major industrial hubs, while other districts exhibit comparatively low or unreported usage. The daily consumption and source of water in Middle Krishna Sub basin districts has been represented in figure 20 below.

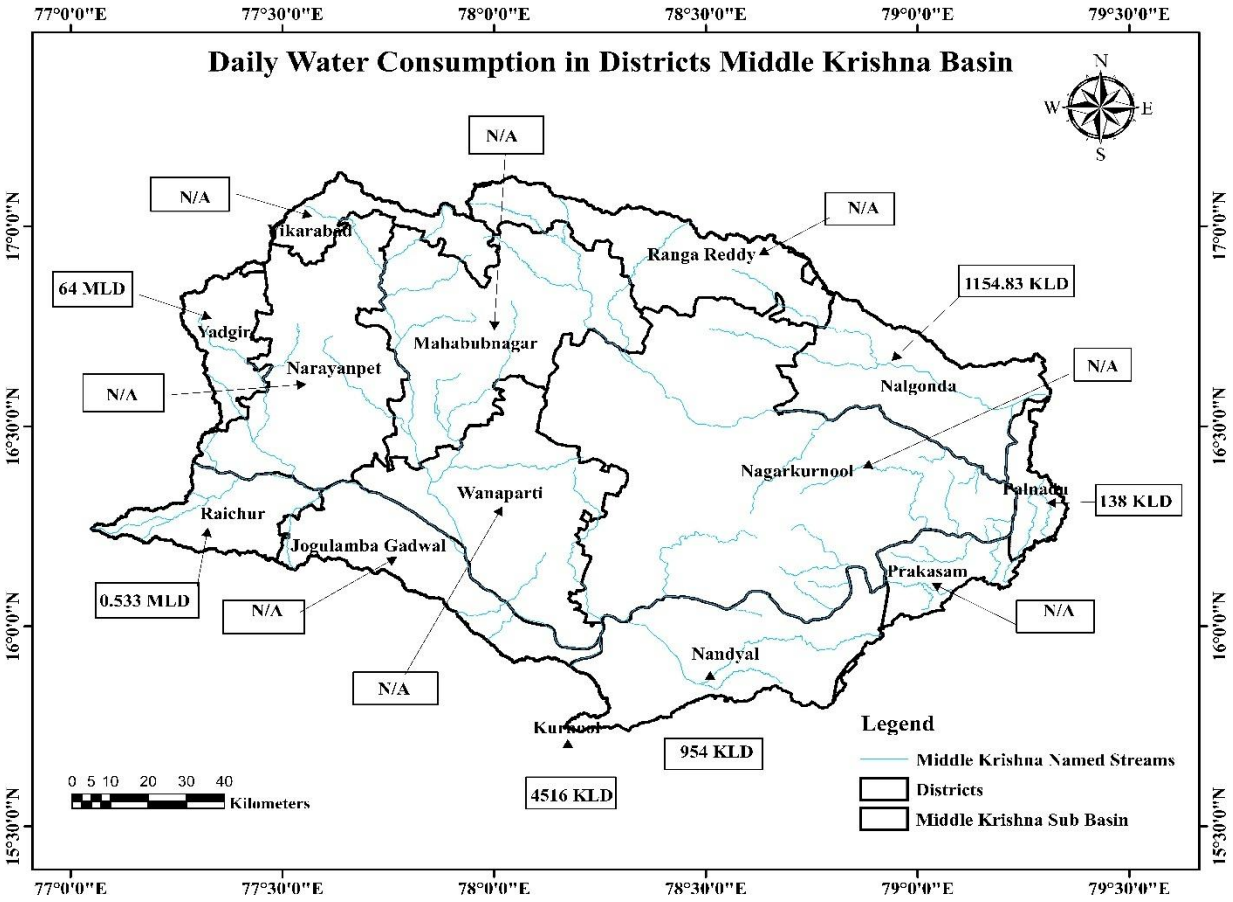

Figure 20: Daily Water Consumption in Districts of Middle Krishna Sub basin

Lower Krishna Sub – basin: The industrial water consumption pattern in the Lower Krishna Basin indicates a concentration of demand in a few districts, with notable spatial variation across the region. Krishna district records the highest daily industrial water consumption at approximately 8352 KLD, reflecting its strong industrial and urban base. This is followed by Yadadadri Bhuvanagiri (6736), Suryapet (6565 KLD), Malkajgiri (5247 KLD), Nalgonda (1154 KLD), Guntur (2028 KLD) and Palnadu (138 KLD), which also show substantial levels of industrial activity and water use. Several districts such as Hyderabad, Vikarabad, NTR, Bapatla, Hanumakonda, Jangoan, Warangal, Siidipet and Khamam marked with no available data (N/A), indicating either limited industrial presence or gaps in reporting. Overall, the distribution suggests that industrial water demand in the Lower Krishna Basin is uneven, with higher consumption concentrated in major industrial hubs, while other districts exhibit comparatively low or unreported usage. The daily consumption and source of water in Lower Krishna Sub basin districts has been represented in figure 21 below.

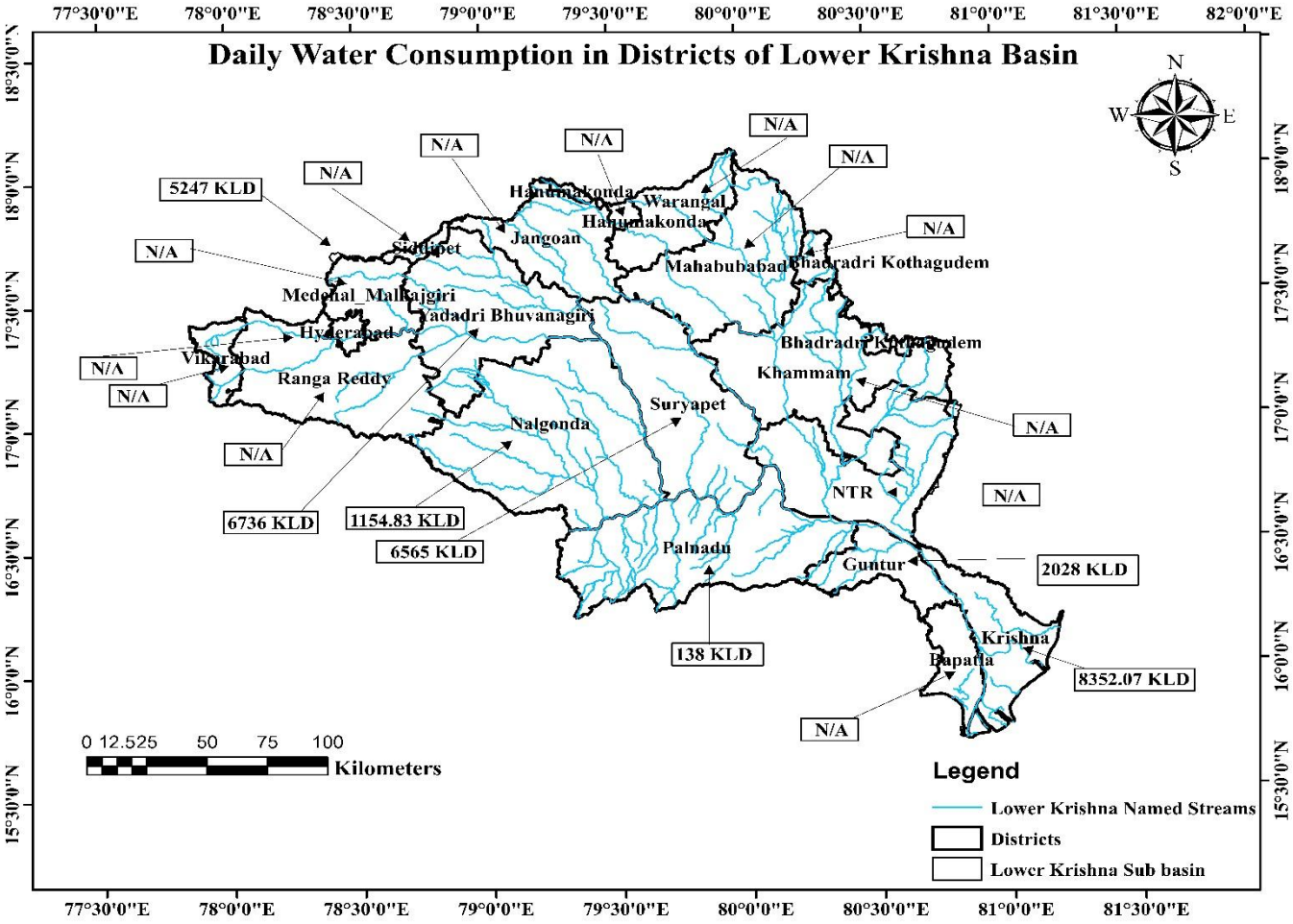

Figure 21: Daily Water Consumption in Districts of Lower Krishna Sub basin

4.2 Industrial Water Demand

Industrial water demand constitutes a substantial share of the overall water requirement within the Krishna River Basin, as water serves as an essential input across a wide spectrum of industrial activities including manufacturing, mineral processing, thermal power generation, cooling operations, construction, mining, metallurgy, textiles, food processing, and other agro-based industries. In addition to process water, significant quantities are required for washing, material handling, dust suppression, boiler feed, and auxiliary services within industrial premises.

With accelerating industrialization, the development of industrial corridors and estates, the expansion of MSMEs, and the growth of large-scale manufacturing and energy production units across urban and peri-urban centres, the demand for assured, high-quality, and uninterrupted water supply has increased markedly.

For the present assessment, district-wise industrial water demand data have been compiled from the respective District Irrigation Plan (DIP) reports of all districts within the Krishna River Basin. The analysis is based on DIP reports published in 2015, which provide baseline industrial water demand estimates for the year 2015 along with projected demand values for 2020. Accordingly, the current report has been prepared using this standardized dataset for the two reference years—2015 (base year) and 2020 (projected year)—as documented in the official DIP reports.

Furthermore, economic diversification, technological advancement, and policy-driven industrial growth have intensified pressure on both surface and groundwater resources. Consequently, industrial water demand is emerging as a critical planning component within the Krishna River basin, necessitating efficient allocation, recycling and reuse strategies, and adoption of water-efficient technologies to ensure long-term sustainability and balanced sectoral distribution.

Karnataka: The overall analysis of industrial water demand across all districts indicates varying growth trends between 2015 (present stage) and the projected year 2020, with significant increases in a few districts and stable demand in others. Belagavi maintains a constant demand of 0.0382 BCM in both 2015 and 2020, while Bagalkote also remains unchanged at 0.0039 BCM. In contrast, Bidar shows a substantial rise from 0.376252 BCM to 0.513 BCM, requiring an additional 0.3525 BCM beyond its existing 0.1605 BCM potential. Chitradurga increases from 0.00200664 BCM to 0.0100332 BCM, mainly driven by small-scale industries. Dakshina Kannada grows from 0.0605 BCM to 0.1110 BCM, needing an additional 0.0431 BCM over its existing 0.0679 BCM supply. Davanagere records a marginal increase from 0.00134117 BCM to 0.0013849 BCM, while Haveri nearly doubles from 0.00595 BCM to 0.0119 BCM, creating a significant additional requirement. Kalaburagi rises from 0.0342 BCM to 0.0433 BCM, and Raichur increases from 0.06430 BCM to 0.08202 BCM. Shivamogga remains almost stable, changing slightly from 0.0260278 BCM to 0.0260299 BCM. Tumakuru shows moderate growth from 0.03968 BCM to 0.04418 BCM.Among other districts, Uttara Kannada increases from 0.0037595 BCM to 0.00563925 BCM, Gadag from 0.01234715 BCM to 0.012567975 BCM, Vijayapura (Bijapur) from 0.004144 BCM to 0.005684 BCM, and Yadgir records one of the sharpest proportional increases from 0.001168 BCM to 0.010293 BCM. Koppal remains constant at 0.0116 BCM, and Ballari also remains unchanged at 0.00004961 BCM. Dharwad reaches 0.084 BCM by 2020, while Hassan has an allocated industrial supply of 0.00829 BCM from Hemavathi reservoir. Overall, by 2020, districts such as Bidar, Dakshina Kannada, Raichur, Tumakuru, Kalaburagi, Dharwad, and Yadgir show notable increases in industrial water demand, while Belagavi, Bagalkote, Koppal, Ballari, and Shivamogga remain largely stable. The data clearly indicates that industrial growth is uneven across districts, with certain regions requiring significant additional water potential creation to meet projected 2020 demands. The industrial water

demand in districts of Karnataka state Krishna River basin portion is presented in below Table 29.

Table 29: Industrial Water Demand in Districts of Karnataka.

Sl.No	Districts	Water Demand in 2015 (BCM)	Water Demand in 2020 (BCM)	Existing water Potential (BCM)	Water Potential to be Created
1	Bagalkote	0.011145	0.011145	0.011145	0
2	Belagaum	0.0382	0.0382	0.0382	0
3	Bellary	0.00004961	0.00004961	–	–
4	Bidar	0.376252	0.513	0.1605	0.3525
5	Bijapur	0.001036	0.001624	–	–
6	Chikkamagaluru	–	–	–	–
7	Chitradurga	0.00200664	0.0100332	0.0011985	0.002444
8	Dakshina Kannada	0.0605	0.111	0.0679	0.0431
9	Dharwad	0.084	0.084	–	–
10	Davangere	0.0013417	0.0013849	0.0013417	0.000437
11	Gadag	0.01234715	0.012567975	–	–
12	Haveri	0.00595	0.0119	0.0068	0.0143
13	Kalaburgi	0.0342	0.0433	–	0.0091
14	Koppal	0.0116	0.0116	–	–
15	Raichur	0.0643	0.08202	0.0643	0.0188
16	Shivamogga	0.0260278	0.0260299	0.0260293	1.1E-06
17	Tumakur	0.039681567	0.044182097	0.0002808	0.000135
18	Uttarakannada	0.0037595	0.00563925	0.0037595	0.00188
19	Hassan	0.00859	–	–	–
20	Yadgiri	0.001168	0.010293	–	–
21	Vijayanagara	–	–	–	–

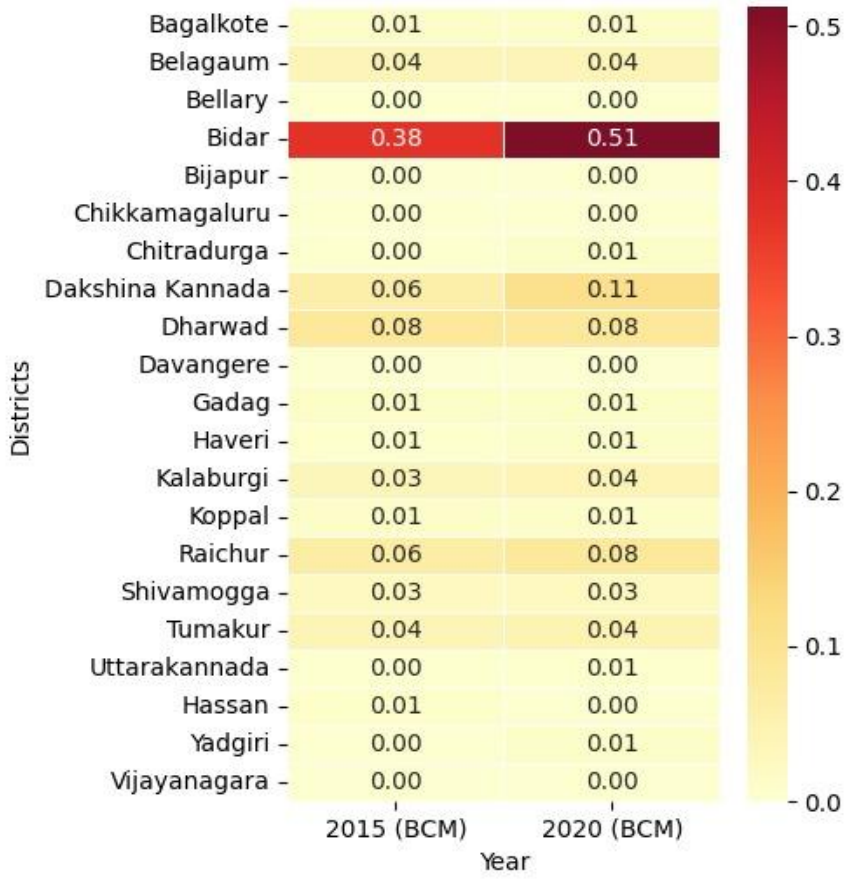

Figure 22: Graphical representation of Industrial Water Demand in Districts of Karnataka.

Telangana: The overall industrial water demand assessment for Telangana districts indicates a significant rise in requirements between 2011/2015 and 2020. In Malkajgiri, demand increases from 241.54 MCM to 304.96 MCM by 2020, with an existing potential of 219.59 MCM, creating a deficit of 85.39 MCM. Rangareddy shows growth from 100.80 MCM to 123.89 MCM by 2020, against an available 91.75 MCM, requiring an additional 32.11 MCM. Substantial increases are also observed in Warangal, where demand rises from 64.37 MCM in 2015 to 120.81 MCM in 2020, and in Jangaon, which grows sharply from 43.11 MCM to 115.89 MCM by 2020. Bhadradri Kothagudem records one of the steepest increases, from 19.76 MCM in 2015 to 183.16 MCM in 2020, reflecting rapid industrial expansion. Moderate growth is seen in Mahabubabad (from 65.37 MCM in 2015 to 98.07 MCM in 2020) and Nalagonda (from 78.110 MCM to 94.512 MCM). Vikarabad rises from 15.75 MCM to 19.34 MCM by 2020, requiring 5.03 MCM additional capacity. Smaller districts such as Wanaparthy and Nagarkurnool remain constant at 0.003 MCM between 2015 and 2020, showing minimal growth. Overall, the analysis highlights that by 2020, most major industrial districts face widening gaps between projected demand and existing water potential, necessitating substantial augmentation, improved allocation, and sustainable water management

strategies to support continued industrial development. The industrial water demand in districts of Telangana state Krishna River basin portion is presented in below Table 30.

Table 30: Industrial Water Demand in Districts of Telangana.

Sl.No	Districts	Water Demand in 2015 (MCM)	Water Demand 2020 (MCM)	Existing Water Potential (MCM)	Water Potential to be Created (MCM)
1	Vikarabad	15.75	19.34	14.32	5.03
2	Mehabubaba	–	98.07	–	–
3	Malkajgiri	241.54	304.96	219.59	85.39
4	Suryapet	5.748	6.955	5.748	7.651
5	Siddipet	–	–	–	–
6	Sangareddy	–	–	–	–
7	Rangareddy	100.8	123.89	91.75	32.11
8	Nalagonda	78.11	94.512	78.11	103.965
9	Khammam	190.73	–	–	–
10	Warangal	64.37	120.81	–	–
11	YadadriBhuvanagiri	30.906	37.397	30.906	41.137
12	Wanaparthy	0.031	0.039	0.031	0.008
13	Nagarkurnool	0.003	0.003	0.004	0.0004
14	Mahabubnagar	1.092	1.336	0.222	1.114
15	Jogulamba Gadwal	0.008	0.01	0.009	0.0017
16	Jangoan	43.11	115.89	–	–
17	Hanumakonda	25.32	27.32	–	–
18	BhadradriKothagudem	19.76	183.16	–	–

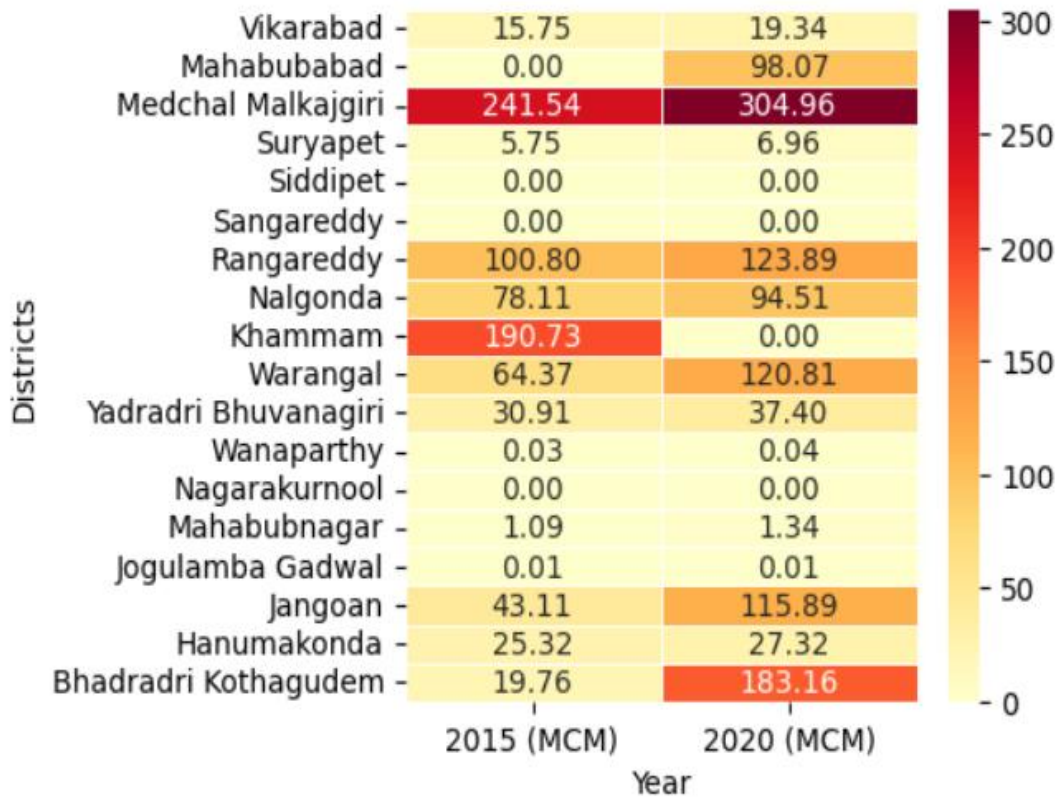

Figure 23: Graphical representation of Industrial Water Demand in Districts of Telangana.

Maharashtra: The overall industrial water demand assessment for districts of Maharashtra—including Solapur, Osmanabad, Ahmednagar, Sindhudurg, Satara, Pune, Sangli, Beed, and Kolhapur—shows a sharp increase in water requirements by the year 2020. Satara has one of the highest demands, rising from 1.521 BCM at present to 2.345 BCM by 2020, with an additional 0.759 BCM needed. Solapur also records very high usage, where 3,741 industries require about 1.47920 BCM, supported by an existing capacity of 2.77350 BCM, with 7.0107 BCM planned for future creation. In Pune, demand increases from 0.0753 BCM to 0.1215 BCM by 2020, requiring about 0.046173 BCM of additional water. Moderate growth is seen in Ahmednagar, where demand rises from 0.12666 BCM to 0.13933 BCM by 2020, needing 0.01267 BCM more. Beed shows a doubling trend from 0.0047377 BCM to 0.0097377 BCM, with nearly 0.005 BCM additional requirement. Smaller but rapidly increasing needs occur in Sindhudurg, where demand grows from 0.000508454 BCM to 0.002758174 BCM by 2020, and in Osmanabad, from 0.00032833 BCM to 0.00057984 BCM, both facing severe shortages due to very low existing potential. In contrast, Sangli has relatively adequate availability, with demand increasing slightly from 0.005515 BCM to 0.006248 BCM by 2020, supported by 0.00946445 BCM of existing resources. Kolhapur shows localized industrial clusters with varying future requirements, such as Shirol rising to

about 0.0177 BCM by 2020. Overall, the analysis indicates that by 2020, most districts will experience a widening gap between industrial water demand and available supply, making augmentation, recycling, and efficient water management essential for sustainable industrial growth. The industrial water demand in districts of Maharashtra state Krishna River basin portion is presented in below Table 31.

Table 31: Industrial Water Demand in Districts of Maharashtra.

Sl. No.	Districts	Water Demand in 2015 (BCM)	Water Demand in 2020 (BCM)	Existing Water Potential (BCM)	Water Potential to be Created (BCM)
1	Pune	0.0753	0.1215	0.07529	0.04617
2	Beed	0.0047377	0.0097377	0.0047377	0.005
3	sangli	0.005515	0.006248	0.00946445	0.00022
4	Satara	1.52124579	2.3452795	1.58595999	0.75931951
5	Sindhudurga	0.00050845	0.00275817	0.000508454	0.00224972
6	Solapur	0.0251	0.0288	0.0251	0.0037
7	Osmanabad	0.00032833	0.00057984	0.00000056	0.00057928
8	Ahmedanagar	0.12666	0.13933	0.12666	0.01267
9	Kohlapur	–	–	–	–

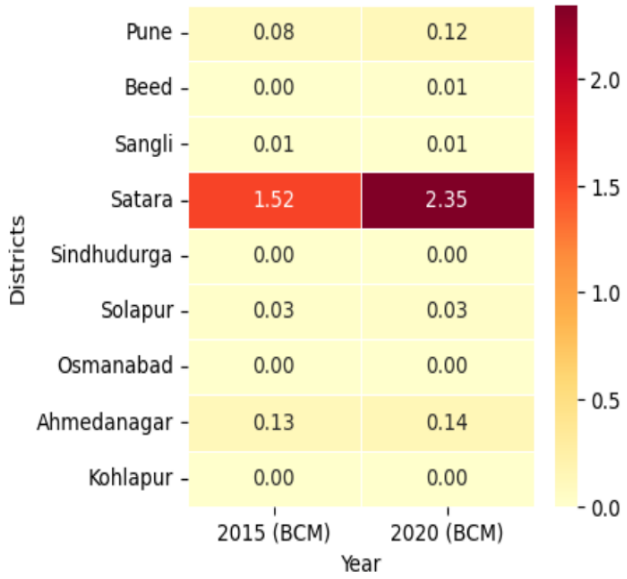

Figure 24: Graphical representation of Industrial Water Demand in Districts of Maharashtra.

Andhra Pradesh: The industrial water demand in the districts of Krishna River Basin of Andhra Pradesh shows a substantial increase between the present period and the year 2020, driven by rapid industrial expansion in select regions. Prakasam records the highest demand, rising from 374.63 MCM to 526.97 MCM by 2020, mainly due to growth in Kandukur. Ananthapur also shows a major increase from 130.26 MCM to 312.62 MCM, largely influenced by future requirements in Penukonda. Similarly, Kurnool experiences a sharp rise from 158.57 MCM to 300.44 MCM by 2020, requiring an additional 141.87 MCM of water potential to support industrial growth. In contrast, Krishna district maintains a constant demand of 167.35 MCM in both the years of 2016-2017 and 2020, indicating stable industrial activity with adequate existing supply. Lower but steady growth is observed in Guntur, where demand increases slightly from 0.13 MCM to 0.16 MCM by 2020, requiring only 0.03 MCM of additional water. Overall, the data indicates that by 2020, industrial water demand in Andhra Pradesh is highly uneven across districts, with a few high-growth areas driving most of the increase. Strategic planning, infrastructure development, and efficient water management will be essential to address the significant future requirements while ensuring sustainable industrial development. The industrial water demand in districts of Andhra Pradesh state Krishna River basin portion is presented in below Table 32.

Table 32: Industrial Water Demand in Districts of Andhra Pradesh.

Sl.No	Districts	Water Demand in 2015 (MCM)	Water Demand 2020 (MCM)	Water Potential to be Created (MCM)
1	Anantapur	130.26	312.62	182.36
2	Kurnool	158.57	300.44	141.87
3	Guntur	0.13	0.16	0.03
4	Krishna	167.35	167.35	–
5	Prakasam	374.63	526.97	–

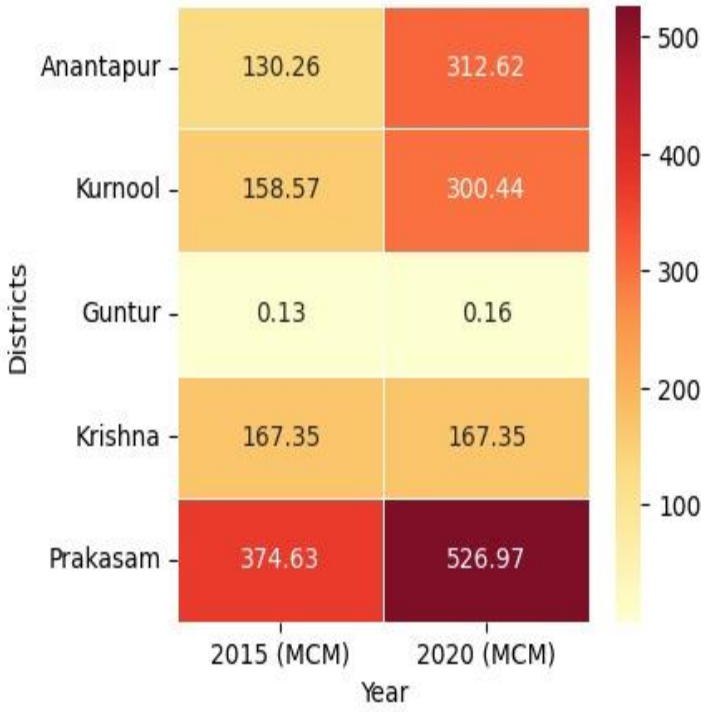

Figure 25: Graphical representation of Industrial Water Demand in Districts of Andhra Pradesh.

5. Quantitative Assessment

5.1 Waste Water Generation

Wastewater generation is a key indicator for assessing the pressure exerted on water resources and the potential pollution load within the Krishna River Basin. It is primarily influenced by domestic, industrial, and commercial activities across urban and rural regions. In the present study, district-wise wastewater generation data has been compiled and further aggregated at the sub-basin level to understand the spatial distribution of wastewater across the basin. This approach helps in identifying critical regions contributing higher wastewater volumes and supports effective planning for treatment and management strategies.

Upper Krishna Sub – basin: The analysis of wastewater generation by Industries in the Upper Krishna sub-basin indicates a significant spatial variation across districts. Higher wastewater generation is observed in districts such as Pune (296 MLD) and Satara (275.97 MLD), reflecting the influence of urbanization and population density. Moderate contributions are noted from districts like Kolhapur (52.5 MLD) and Yadgiri (57.6 MLD), while districts such as Vijayapura (4.51 MLD), Sangli (9.3 MLD), and Dharwad (8.2 MLD) show comparatively lower wastewater generation. In Karnataka districts within the sub-basin, wastewater generation varies, with Bagalkot, Belagavi, and Gadag contributing moderate amounts, whereas Haveri and Koppal exhibit relatively lower values. Overall, the

Upper Krishna sub-basin demonstrates a concentration of higher wastewater generation in upstream urbanized districts, indicating potential stress on river water quality and highlighting the need for efficient wastewater treatment infrastructure in these regions. The Wastewater generation in districts of Upper Krishna Sub basin has been represented through Figure 26 below.

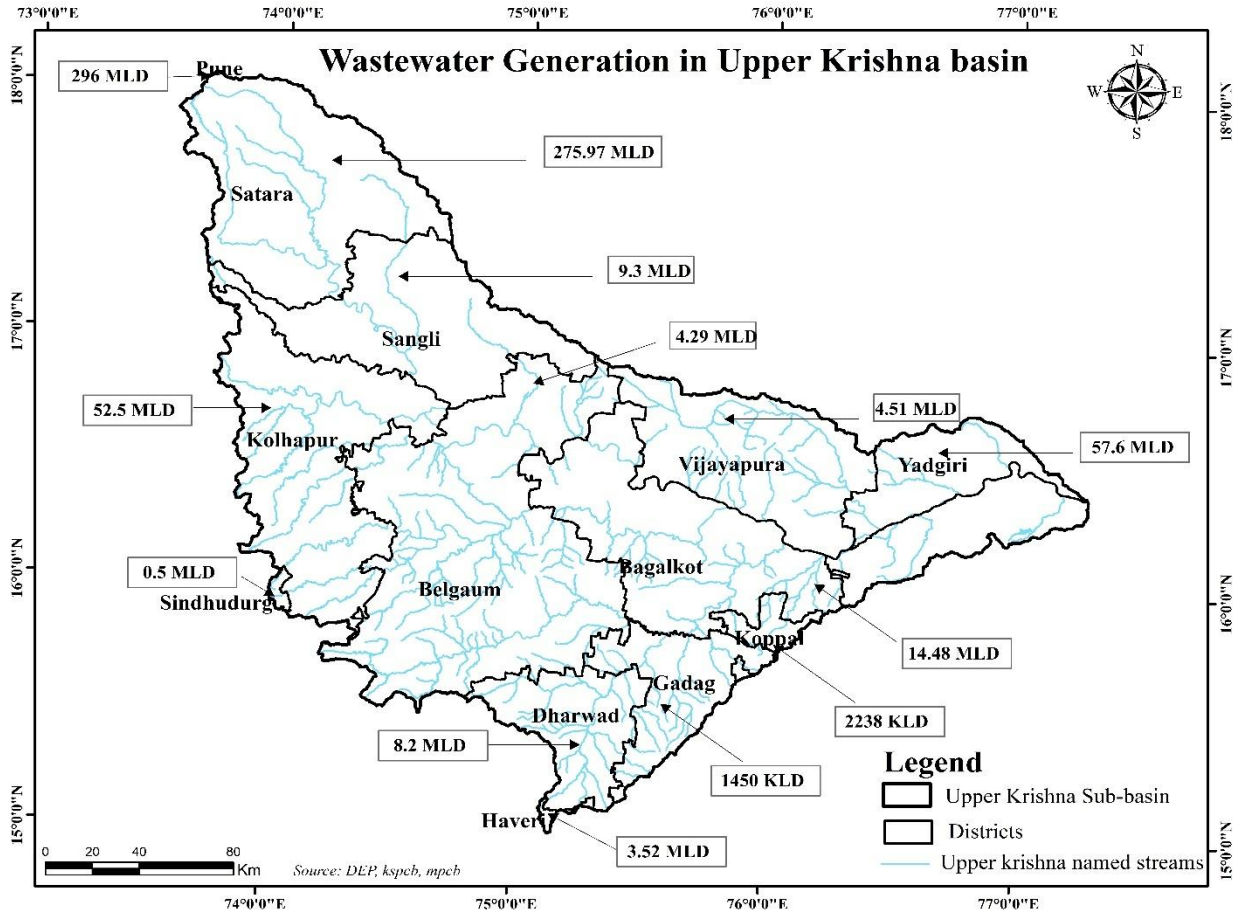

Figure 26: Waste Water Generation in Districts of Upper Krishna Sub basin

Upper Tungabhadra Sub – basin: The spatial distribution of wastewater generation in the Upper Tungabhadra basin across different district illustrates how the quantity of wastewater produced varies significantly from one district to another, reflecting differences in population density, level of urbanization, industrial activities, and water consumption patterns. Districts such as Dakshina Kannada and Chitradurga show comparatively higher wastewater generation, indicating more intensive domestic or industrial water use, while districts like Chikkamagaluru generate much lower amounts, suggesting either lower population density or limited industrialization. The presence of "no data available" in some areas highlights gaps in monitoring and data collection. Overall, the map emphasizes the uneven distribution of wastewater production within the basin and underscores the need for region-specific wastewater management strategies to ensure sustainable water resource planning and environmental protection. The Waste Water Generation in Districts of Upper Tungabhadra Sub basin is represented in figure below 27

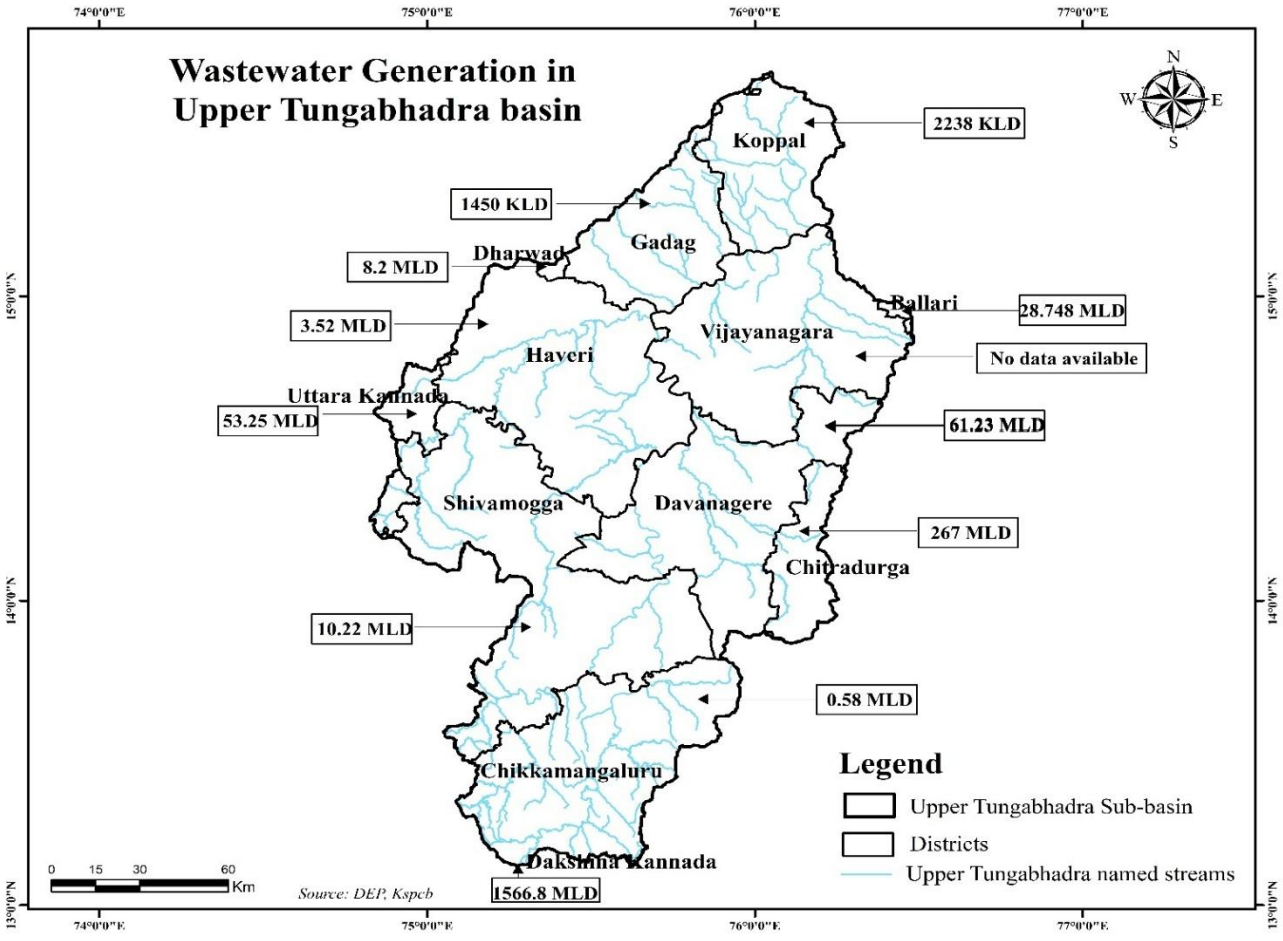

Figure 27: Waste Water Generation in Districts of Upper Tungabhadra Sub basin

Upper Bhima Sub – basin: Wastewater generation across the Upper Bhima basin shows considerable variation among districts, influenced by differences in population size, urbanization, and economic activities. Highly urbanized districts such as Pune and Satara contribute significantly higher volumes of wastewater due to intensive domestic, commercial, and industrial water usage. In contrast, districts like Solapur, Osmanabad, and Vijayapura generate comparatively lower amounts, reflecting lower urban concentration and limited industrial development. Intermediate levels in districts such as Ahmednagar and Beed indicate moderate water consumption patterns. The Waste Water Generation in Districts of Upper Bhima Sub basin is represented in figure below 28

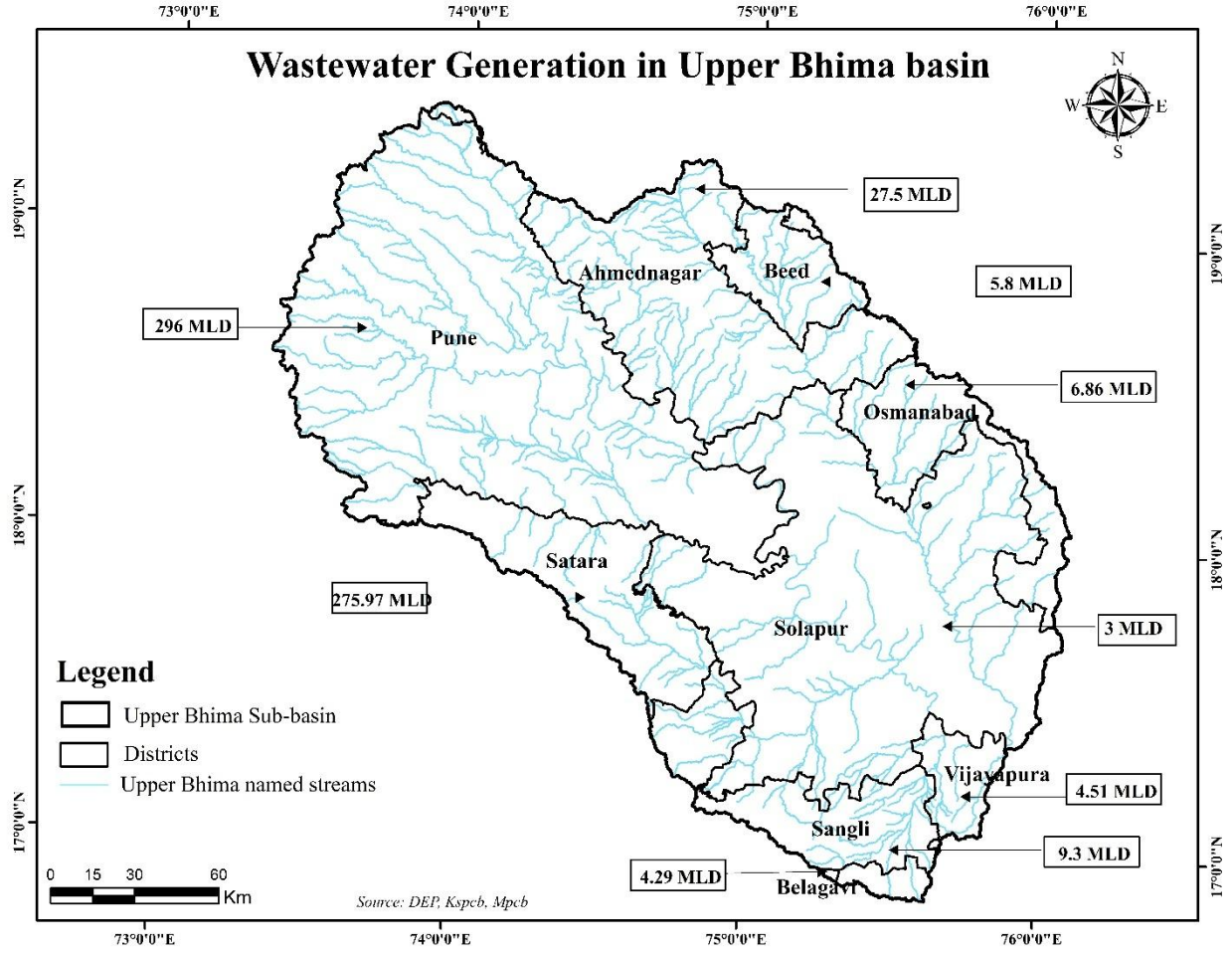

Figure 28: Waste Water Generation in Districts of Upper Bhima Sub basin

Lower Bhima Sub – basin: The image depicts the variation in wastewater generation across different districts of the Lower Bhima basin. Some districts, like Yadgir and Bidar, record relatively higher wastewater volumes, which may be associated with greater domestic and industrial water use, while others such as Solapur and Vijayapura have lower outputs, possibly due to lower urbanization or fewer industrial operations. The presence of "N/A" in certain locations indicates a lack of available data, pointing to limitations in data collection and monitoring. The Waste Water Generation in Districts of Lower Bhima Sub basin is represented in figure below 29

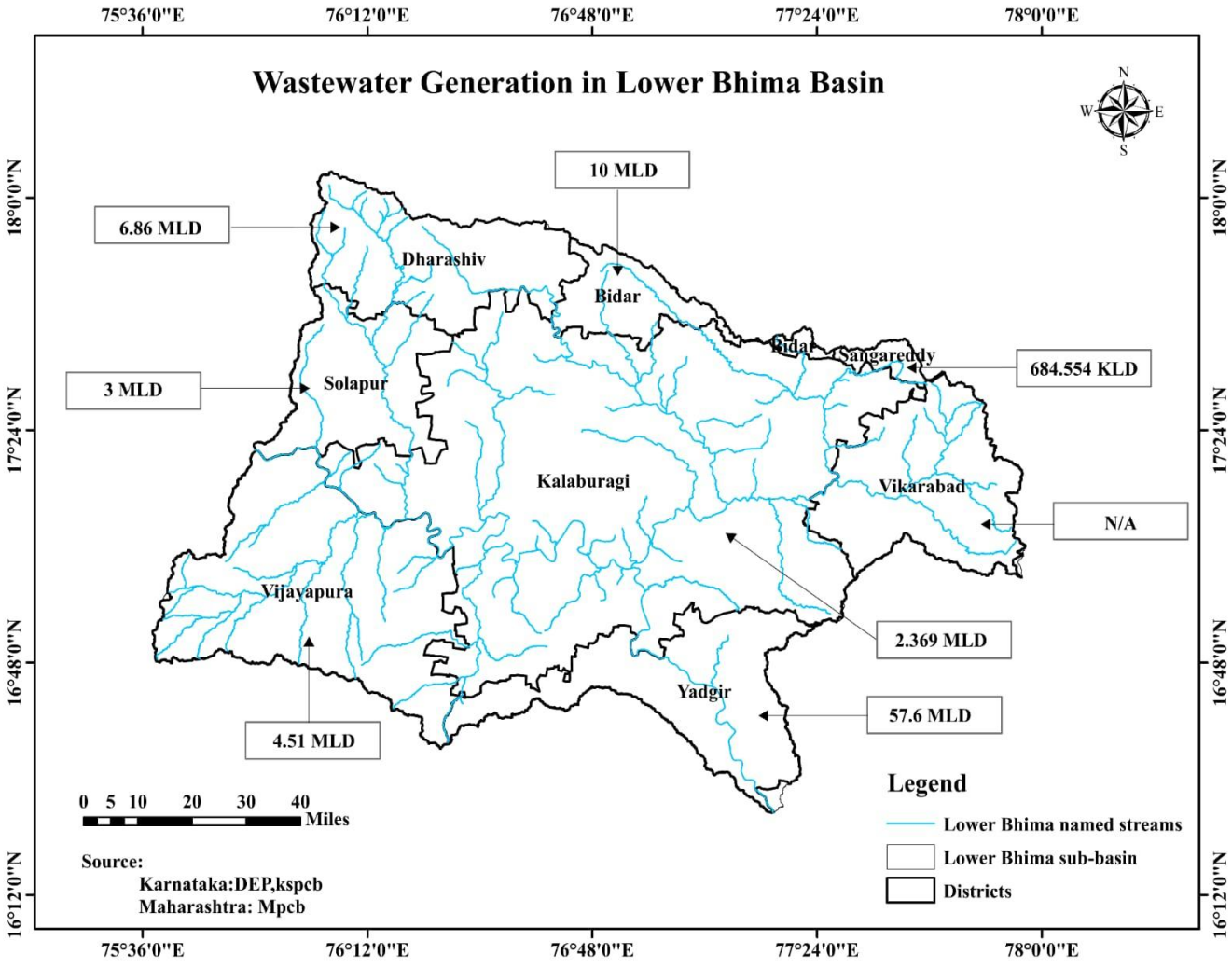

Figure 29: Waste Water Generation in Districts of Lower Bhima Sub basin

Middle Krishna Sub – basin: The map illustrating wastewater generation in the Middle Krishna Basin reveals noticeable spatial variation among different districts. Areas such as Nalgonda, Kurnool, and parts of the eastern region show relatively higher wastewater generation, which can be linked to increased urban settlements, agricultural activities, and local industrial influence. On the other hand, districts like Narayanpet, Wanaparthy, and Jogulamba Gadwal exhibit comparatively lower levels, reflecting limited urban and industrial development. Several parts of the basin, including Rangareddy, Mahabubnagar, and Prakasam, lack sufficient information, pointing to gaps in data availability and coverage. The Waste Water Generation in Districts of Lower Bhima Sub basin is represented in figure below 30

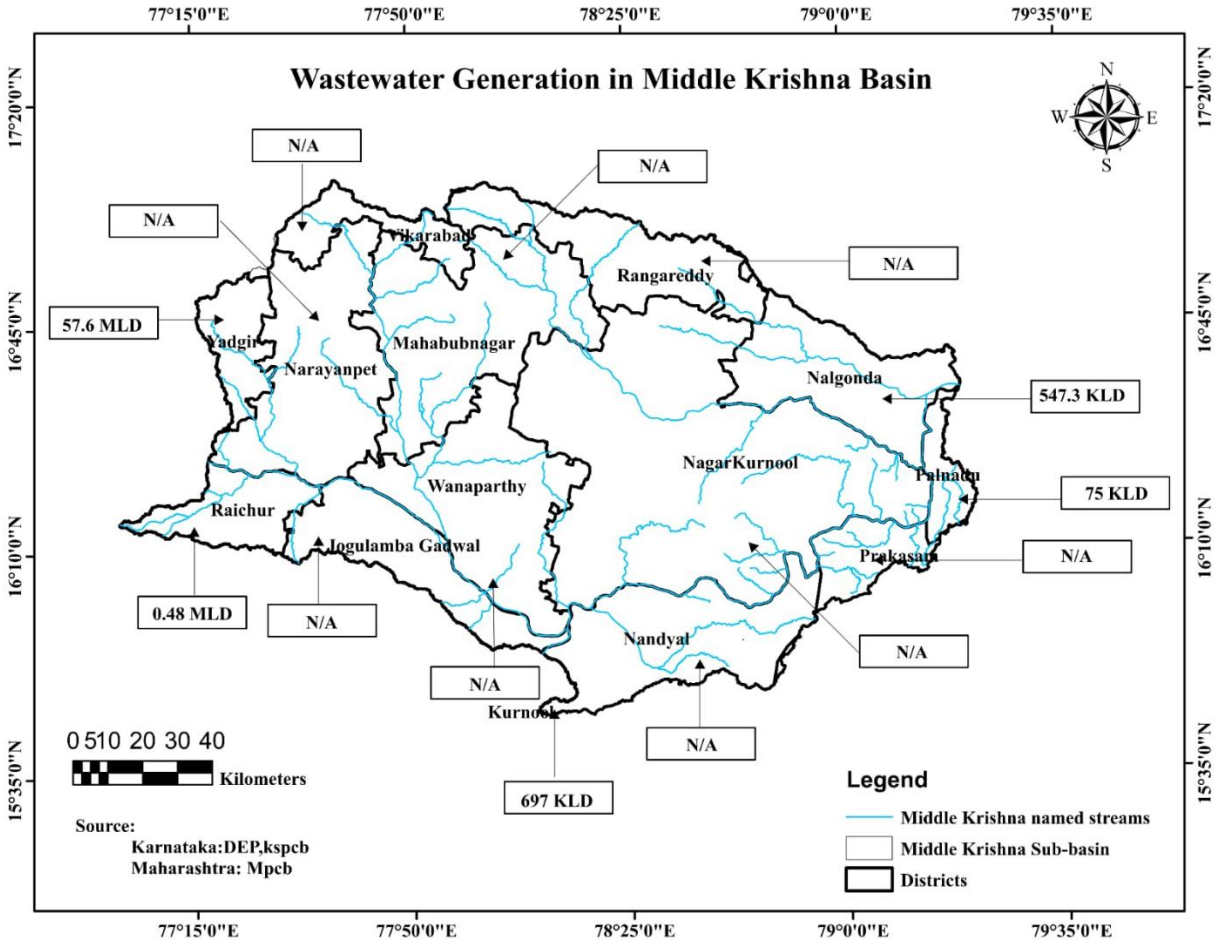

Figure 30: Waste Water Generation in Districts of Middle Krishna Sub basin

Lower Tungabhadra Sub – basin: The map of wastewater generation in the Lower Tungabhadra Basin shows a varied spatial distribution across different districts. Certain districts such as Ballari, Kurnool, and Davanagere exhibit comparatively higher wastewater generation, indicating the influence of urbanization, industrial activities, and population concentration. In contrast, districts like Chikkamagaluru, Hassan, and Tumakuru show relatively lower levels, which may be due to lesser industrial development and lower population density. In some areas, including parts of Anantapur, Nandyal, and Sri Sathya Sai, information is not available, indicating inconsistencies in data coverage across the basin. The Waste Water Generation in Districts of Lower Tungabhadra Sub basin is represented in figure below 31

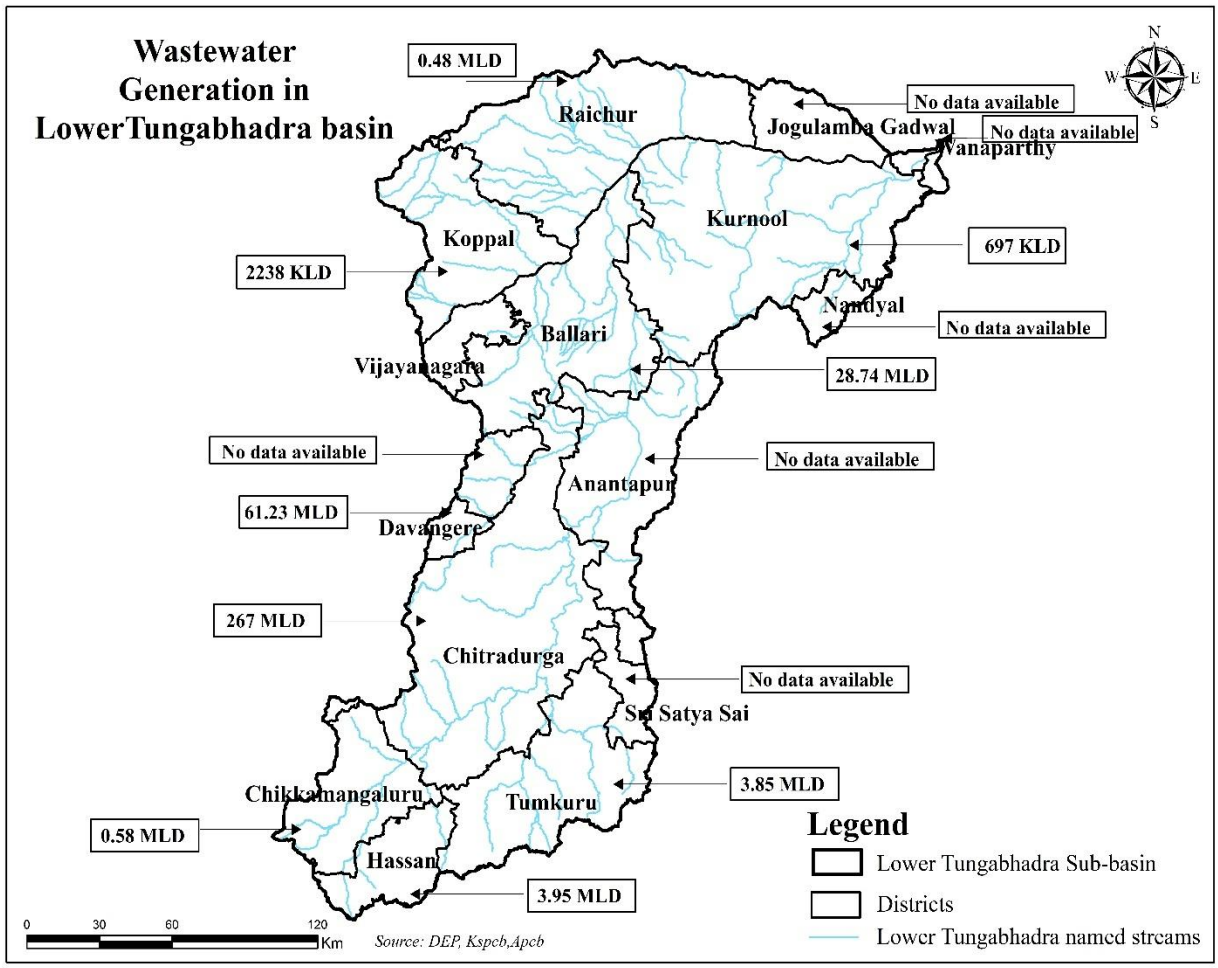

Figure 31: Waste Water Generation in Districts of Lower Tungabhadra Sub basin

Lower Krishna Sub – basin: The map of wastewater generation in the Lower Krishna Basin covers several districts across Telangana and Andhra Pradesh, showing clear spatial variation. In Telangana, districts such as Vikarabad, Rangareddy, Medchal–Malkajgiri, Hyderabad, Yadadri Bhuvanagiri, Siddipet, Jangaon, Hanumakonda, Warangal, Mahabubabad, Bhadradri Kothagudem, Khammam, Suryapet and Nalgonda are included, many of which show either low generation or unavailable data, especially in the northern and western regions. In Andhra Pradesh, districts like Palnadu, NTR, Guntur, Bapatla and Krishna are part of the basin, with comparatively higher and more consistent wastewater generation observed toward the downstream coastal areas. Central districts such as Nalgonda and Suryapet show moderate contributions, acting as transition zones between low and high generation regions. The Waste Water Generation in Districts of Lower Krishna Sub basin is represented in figure below 32

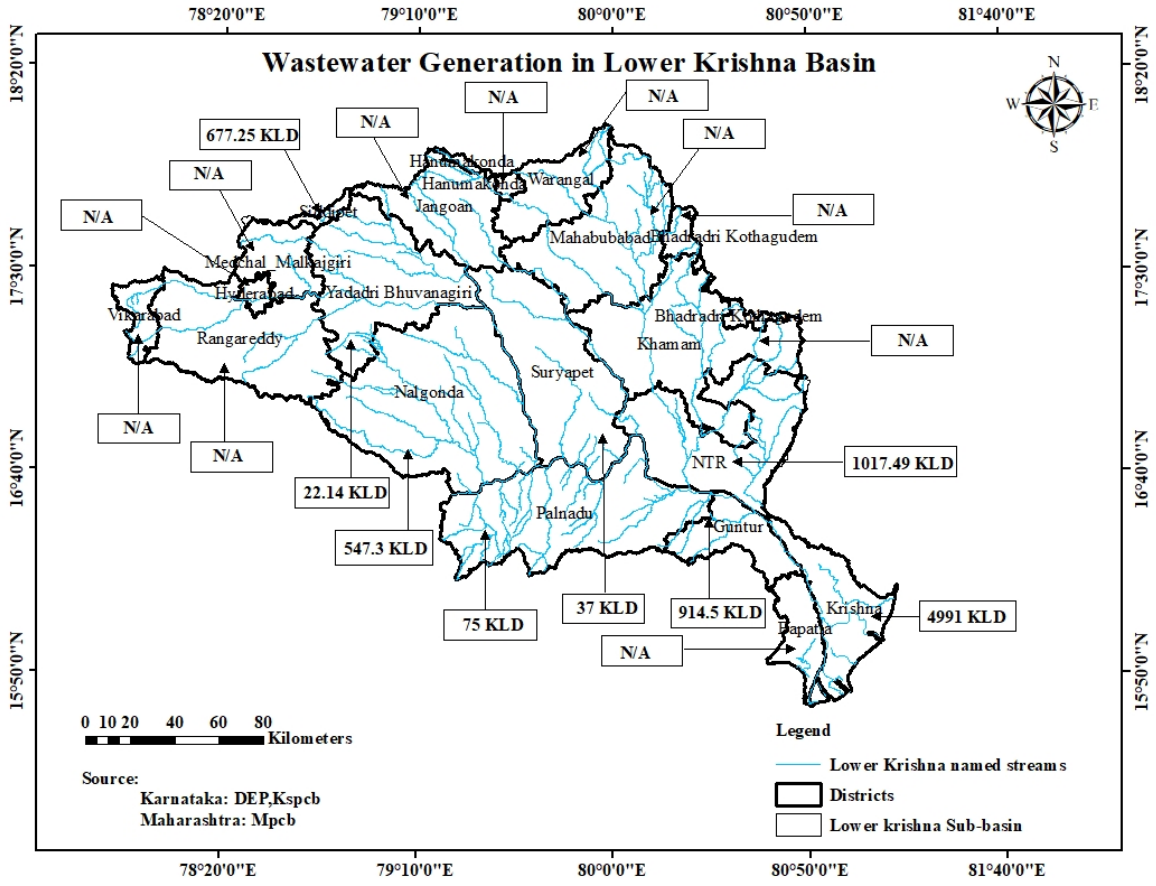

Figure 32: Waste Water Generation in Districts of Lower Krishna Sub basin

6. Data Gaps and Uncertainties

Despite efforts to compile a comprehensive industrial profile of the Krishna River Basin, the analysis is subject to certain data gaps and uncertainties. Limitations primarily arise due to the unavailability of consistent and up-to-date data on industrial water consumption, wastewater generation, and effluent characteristics across all districts and states. In several cases, data has been derived from secondary sources, reports, and assumptions, which may not fully capture the current ground conditions. Additionally, variations in reporting standards and data collection methods among different states further contribute to inconsistencies in the dataset. The absence of real-time monitoring data and limited access to industry-specific information also introduce uncertainties in estimating industrial pollution loads and water demand.

The data gaps and uncertainties persist across the states of Maharashtra, Karnataka, Telangana, and Andhra Pradesh, affecting the overall reliability of the analysis. In Maharashtra, available data on water consumption is limited and largely aggregated, with incomplete information on flow volumes and pollution characteristics, particularly for the Krishna and Koyna sub-basins. In Karnataka, the extent of data gaps is more pronounced, with the absence of critical information on wastewater flow volumes, pollution characteristics, and estimated loads of chemicals and heavy metals, limiting environmental assessment. In Telangana, district-wise and industry-level data is incomplete, with missing information on MSME sectors, wastewater quality parameters, and detailed pollutant characteristics. Similarly, in Andhra Pradesh, the lack of comprehensive district-wise and unit-level data, absence of time-series and seasonal variations, and unavailability of wastewater quality and pollutant concentration data restrict detailed analysis. Across all states, there is a common limitation in the absence of data on estimated pollutant loads, including chemicals and heavy metals, as well as insufficient information on industry-wise contributions and concentration levels. These limitations hinder accurate assessment of pollution levels, identification of critical hotspots, and effective comparison across regions, thereby posing challenges for informed decision-making and sustainable river basin management.

Furthermore, it is important to note that critical data required for detailed assessment of industrial impacts is largely unavailable across the basin. Information on wastewater flow volumes at the industry or unit level, along with seasonal variations, is not adequately reported. Similarly, essential data on wastewater characteristics, including parameters such as BOD, COD, pH, and specific pollutant concentrations, is missing for most regions. In addition, there is a complete absence of information on the estimated loads of chemicals and heavy metals entering the river system, as well as their concentration levels and industry-wise contributions. The lack of such crucial data significantly limits the ability to carry out quantitative assessment of pollution loads, evaluate environmental impacts, and design effective mitigation and management strategies.

7. Conclusion

The Industrial Profile of the Krishna River Basin highlights the significant role of industries in driving regional economic development across the states of Maharashtra, Karnataka, Telangana, and Andhra Pradesh. The spatial analysis of industries indicates that industrial activities are unevenly distributed, with certain districts emerging as major industrial hubs due to better infrastructure, resource availability, and urbanization. The geo-tagged database and sector-wise categorization reveal that micro, small, and medium enterprises form a substantial portion of the industrial base, with key sectors such as agro-based, textile, engineering, and related industries dominating across sub-basins.

The assessment of water footprint indicates that industries exert considerable pressure on water resources, with varying levels of water consumption observed across districts. The dependence on both surface water and groundwater sources highlights the need for sustainable water management practices. The estimation of water consumption, particularly in data-deficient regions such as Karnataka, further emphasizes the importance of reliable and consistent data for accurate assessment.

The analysis of polluting and non-polluting industries shows that while a majority of industries fall under Green and White categories, a significant presence of red and orange category industries exists in key districts, contributing to potential environmental stress and water quality degradation. The quantitative assessment of wastewater generation indicates considerable effluent discharge, especially in industrially developed regions, posing risks to river health.

However, the study is constrained by several data gaps and uncertainties, including the lack of detailed information on wastewater characteristics, pollutant concentrations, and chemical load estimation. These limitations restrict comprehensive evaluation of pollution impacts and highlight the need for improved data availability, standardization, and monitoring systems.

Overall, the study underscores the necessity for integrated industrial and water resource management in the Krishna River Basin. Strengthening regulatory frameworks, promoting sustainable industrial practices, improving wastewater treatment infrastructure, and enhancing data collection mechanisms are essential for minimizing environmental impacts and ensuring long-term sustainability of the Krishna river basin.

8. Recommendations and Role of Stakeholders

Recommendations: To ensure sustainable management of water resources in the Krishna River Basin, several measures need to be implemented to reduce industrial water consumption and pollution. Industries should adopt water-efficient technologies and promote recycling and reuse practices to minimize freshwater demand. Installation and proper operation of Effluent Treatment Plants (ETPs) should be made mandatory, especially for red and orange category industries, along with the adoption of advanced systems such as Zero Liquid Discharge (ZLD) wherever feasible. Regular monitoring of effluent quality and quantity should be carried out to ensure compliance with environmental standards. Development of Common Effluent Treatment Plants (CETPs) in industrial clusters can help manage wastewater effectively. In addition, strict enforcement of environmental regulations, promotion of cleaner production technologies, and awareness programs for industries are essential to reduce pollution loads and protect river water quality.

Role of Stakeholders: The effective management of industrial water use and pollution control in the Krishna River Basin requires the active involvement of multiple stakeholders. Government agencies are responsible for policy formulation, infrastructure development, and enforcement of regulations. The Central and State Pollution Control Boards (CPCB/SPCBs) play a crucial role in monitoring industrial compliance, conducting inspections, and ensuring adherence to discharge standards. Industries themselves are key stakeholders and must take responsibility for reducing water consumption, treating effluents, and adopting sustainable practices. Local bodies and urban authorities are responsible for managing wastewater infrastructure and preventing untreated discharge into water bodies. Research institutions and academic organizations contribute through data analysis, technological innovations, and policy support. Public participation and community awareness are also important to ensure accountability and promote environmentally responsible industrial development.

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