THOOTHUKUDI
MASTER PLAN
2045

GIS BASED PLAN



VOLUME
1

Directorate of Town and Country Planning
Government of Tamil Nadu

THOOTHUKUDI MASTER PLAN - 2045

THOOTHUKUDI
LOCAL PLANNING AUTHORITY

VOLUME – 1

DIRECTORATE OF TOWN AND COUNTRY PLANNING
GOVERNMENT OF TAMIL NADU

MASTER PLAN–2045
FOR
THOOTHUKUDI LOCAL PLANNING AREA

Name of the Local Planning Authority : Thoothukudi Local Planning Authority

Thoothukudi Local Planning Authority Reference No. : Roc No: 341/2018 தூமாஅ–1

Directorate of Town and Country Planning Reference No.: Roc No: 1535/2012/MP/TCP6

Consent : Consented in G.O.(Ms). No. 44, Housing and Urban Development (UD4(2)) Department, Dated 13.03.2025

Approved Under Section 28 of Tamil Nadu Town and Country Planning Act, 1971 in G.O. (Ms) No: 67 Housing and Urban Development (UD4(2)) Department dated: 04.03.2026

11/02/26

Assistant Director / Member Secretary (I/C)
Thoothukudi Local Planning Authority
District Town and Country Planning Office,
Thoothukudi

18/2/26

Assistant Director,
Directorate of Town and Country Planning.
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K. Usha

ADDITIONAL CHIEF SECRETARY TO THE GOVERNMENT
Housing and Urban Development Department
Government of Tamil Nadu

PERFORMA

Name of the Office	:	District Town and Country Planning Office, Thoothukudi District
Name of the LPA	:	Thoothukudi Local Planning Authority
I. PROPOSAL		
1. Letter No. and date on which proposals submitted by the Local Planning Authority	:	Letter No: 341/2018 தூமாஅ–1, Dt. 11.02.2026
II. NOTIFICATION		
2. The G.O details of Notification Under Section 10(1) (For Town)	:	G.O. (Ms) No. 629 RD&LA Dt. 04.04.1975
3. The G.O. details which confirmation was ordered under section 10(4) (For Town)	:	G.O. (Ms) No.1340 H&UD, Dt. 06.08.1975
4. The G.O. details which confirmation was ordered under section 10(1)(b) (For Added Villages)		G.O. (Ms) No.853 H&UD, Dt. 01.06.1983
5. The G.O. details which confirmation was ordered under section 10(4) (For Added Villages)		G.O. (Ms) No.1620 H&UD, Dt. 16.10.1986
6. The G.O. details of Notification Under section 10(1)(b)	:	G.O. (Ms) 149 H&UD Dt. 20.06.2013
7. The G.O. details which confirmation was ordered under section 10(4)	:	G.O. (Ms) 116 H&UD Dt. 16.06.2022
III. CONSITUTION		
8. The G.O details in which Thoothukudi appointment of Members	:	G.O. (Ms)No. 134, H&UD Dt. 14.06.2013
IV CONSENT		
9. The G.O details in which the Government Accorded consent Under Section 24(2)	:	G.O.(Ms). No. 54, H&UD Dt. 11.01.1991 (For Town) G.O.(Ms). No. 71, H&UD Dt. 10.02.2000 (For Villages)

V. PUBLICATION		
10. Notification in form No.1 in the Tamil Nadu Government Gazette Under Section 26	:	Tamil Nadu Government Gazette No. 18 Part VI–Section 1, Dt. 07.05.2025 (Pg No: 224 and 225)
11. Resolution No. and date in which the Thoothukudi LPA recommended the Draft Master Plan	:	Thoothukudi Local Planning Authority Resolution No. 72, Dt. 19.11.2024
VI. APPROVAL		
12. Submission of Master Plan to Government for final approval Under Section 28	:	Letter No. 1535/2012/MP/TCP6 Dt. 18.02.2026
13. The G.O. details in which Government accorded its Approval under Section 28	:	G.O.(Ms). No. 67, H&UD Dt. 04.03.2026
VII. PUBLICATION DETAILS OF APPROVAL IN		
14. The Tamil Nadu Government Gazette under Section 30	:	Tamil Nadu Government Gazette No. 145 Part II–Section 2, Dt 04.03.2026
15. The notice board of the Local Body One or more leading daily Newspaper	:	
16. Circulation in the Thoothukudi Local Planning Area	:	

4/02/26

Assistant Director /
Member Secretary (i/c)
Thoothukudi Local Planning Authority

THOOTHUKUDI MASTER PLAN – 2045

CERTIFICATE

It is certified that,

➤ All the procedures prescribed in the Master Plan are prepared, published and sanctioned.

➤ The boundary of Thoothukudi Local Planning Area is reframed.

➤ Reports with the Master Plan are annexed and authenticated.

➤ The categorization in zoning map and the categorization in zoning regulation are tallied and found correct.

11/02/26

Assistant Director /
Member Secretary (i/c)
Thoothukudi Local Planning Authority

ACKNOWLEDGEMENT

The Thoothukudi Local Planning Authority expresses its deep sense of gratitude to all individuals and institutions whose guidance, support, and collaboration have been instrumental in the preparation of the "GIS–Based Master Plan for Thoothukudi Local Planning Area–2045". The successful completion of this comprehensive planning document has been made possible through the collective efforts of numerous stakeholders.

We convey our sincere thanks to Tmt Kakarla Usha, I.A.S., Additional Chief Secretary to Government, Housing and Urban Development Department (HUDD), Tamil Nadu, for her invaluable guidance and direction throughout the planning process.

We express our gratitude to Thiru B. Ganesan, I.A.S., Director of Town and Country Planning, for his strategic recommendations, leadership and continued mentorship, which greatly contributed to the successful completion of the Master Plan.

We also acknowledge the dedicated support of Thiru K. Elambahavath, I.A.S., District Collector, Thoothukudi District for their assistance in facilitating stakeholder consultations and community engagement activities, critical to the development of this Master Plan.

Our sincere regards are also extended to Thiru Murugan C.S., Advisor, HUDD, and Dr. Kanchanamala S., Additional Secretary (Technical), HUDD, Government of Tamil Nadu, for their expert guidance and continuous support in shaping the document.

We gratefully acknowledge the significant contributions of the Chennai Unified Metropolitan Transport Authority (CUMTA) for its valuable inputs to the Mobility Sector, the Tamil Nadu Electricity Board (TNEB) for its inputs to the Energy Sector, Datacorp Traffic for its contribution to traffic surveys and Guidance Tamil Nadu for its inputs to the Economic Sector of the Master Plan.

We acknowledge the dedicated contribution of Thiru Rama Krishna Rao, Team Leader – Project Monitoring Unit, DTCP, Tmt. Vaidehi E. P. Deputy Team Leader – Master Plan Unit, Thiru Sreevatsa G R, Chief Executive Tapasya Design Studio, Auroville, Dr. Astha Agarwalla (Economist) and Tmt. Shanthakumari P, Assistant Director, DTCP for their technical guidance, consistent review and coordination throughout the project period.

We express our appreciation to all stakeholders, Urban Local Bodies, and participating government departments for their co–operation and commitment to this collaborative effort. Finally, we extend our sincere thanks to all officers and staff of the District Town and Country Planning Office, whose commitment, hard work, and consistent support ensured the timely completion of the Master Plan.

CORE TEAM:

Ms. Ashmi A | Mr. Balaji Jothikumar | Ms. Bavithra K | Ms. Chandavi C N | Ms. Gayathri | Ms. Guru Prasath A | Mr. J. Naveen Sampriyan | Ms. K.S. Ananya | Ms. Kokku Sai Pratika | Mr. Manoj Kumar S | Ms. Monisha P | Ms. Nikki Yadav | Mr. R Prabhu | Mr. R. Shanmuga Priyan | Mr. Sesha Bharathy M | Ms. Shivani K | Mr. Sivamani P | Ms. Vaasli T | Mr. K Vallarasu | Mr. Venkat Ramanan A.

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Mr. Manikandan V | Ms. Padma Priya G | Mr. Mughil M B.

11/02/26

Assistant Director,
Member Secretary (i/c)
Thoothukudi Local Planning Authority

ABSTRACT

Urban Development – Master Plan 2045 for Thoothukudi local planning area – Approval under section 28 of the Tamil Nadu Town and Country Planning Act, 1971 (Tamil Nadu Act 35 of 1972) - Accorded – Orders – Issued.

==========

HOUSING AND URBAN DEVELOPMENT [UD4(2)] DEPARTMENT

G.O.(Ms).No.67 **Dated:04.03.2026**

விசுவாவசு வருடம், மாசி 20

திருவள்ளுவர் ஆண்டு 2057.

Read:

1. G.O.(Ms).No.149, Housing and Urban Development (UD4(2)) Department, dated 20.06.2013.
2. G.O.(Ms).No.116, Housing and Urban Development (UD4(2)) Department, dated 16.06.2022.
3. G.O.(Ms).No.44, Housing and Urban Development (UD4(2)) Department, dated 13.03.2025.
4. From the Director of Town and Country Planning, letter Na.Ka.No.1535/2012/முதி/TCP-6, dated 18.02.2026.

======

ORDER:

In the Government order second read above, orders were issued for declaring the revenue villages specified therein to be a local planning area, namely, Thoothukudi local planning area under sub-section (4) of section 10 of the Tamil Nadu Town and Country Planning Act, 1971 (Tamil Nadu Act 35 of 1972).

2. In the Government order third read above, orders have been issued giving consent under sub-section (2) of section 24 of the said Act to the Thoothukudi local planning authority for the publication of a notice under section 26 of the said Act for inviting objections and suggestions in the preparation of the Master Plan for Thoothukudi local planning area.

3. The Director of Town and Country Planning, in his letter fourth read above, has forwarded the draft Master Plan 2045 for the Thoothukudi local planning area as approved by the Thoothukudi local planning authority and requested the Government to accord approval under section 28 of the said Act.

..2..

4. The Government, after careful consideration, have decided to accept the draft Master Plan 2045 for Thoothukudi local planning area, as approved by the Thoothukudi local planning authority submitted through the Director of Town and Country Planning in para 3 above.

5. Accordingly, in exercise of the powers conferred by section 28 of the Tamil Nadu Town and Country Planning Act, 1971 (Tamil Nadu Act 35 of 1972), the Governor of Tamil Nadu, after consultation with the Director of Town and Country Planning, hereby approves the draft Master Plan 2045 for the Thoothukudi local planning area submitted by the Thoothukudi local planning authority.

6. The copies of the said Master Plan 2045 for the Thoothukudi local planning area as approved by the Government are communicated to the Director of Town and Country Planning, subject to condition that the master plan shall be reviewed every five years as per clause (b) of sub-section (2) of section 32 of the said Act.

7. The following Notification shall be published in the Tamil Nadu Government Gazette. Thoothukudi local planning authority is directed to ensure that the Notification is republished in the manner as prescribed in rules 12 and 15 of the Master Plan (Preparation, Publication and Sanction) Rules.

NOTIFICATION

In exercise of the powers conferred by sub-section (1) of section 30 of the Tamil Nadu Town and Country Planning Act, 1971 (Tamil Nadu Act 35 of 1972), the Governor of Tamil Nadu hereby publishes the approval of the Government under section 28 of the said Act for the Master Plan 2045 for the Thoothukudi local planning area submitted by the Thoothukudi local planning authority.

2. The approved Master Plan 2045 for the Thoothukudi local planning area with all its enclosures shall be kept open for the inspection of the public during working days in the office of the Thoothukudi Municipal Corporation during office hours.

(BY ORDER OF THE GOVERNOR)

KAKARLA USHA
ADDITIONAL CHIEF SECRETARY TO GOVERNMENT

To
The Works Manager,
Government Central Press,
Chennai - 600 001. (for publication of notification in the
Extra-ordinary issue of Tamil Nadu Government Gazette)

The Director of Town and Country Planning,
Chennai-600107.
The Collector, Thoothukudi District.
The Assistant Director of Town and Country Planning,
Thoothukudi. (Through Director of Town and Country
Planning, Chennai-600 107).
Copy to
The Special Personal Assistant to Hon'ble Minister,
(Housing and Prohibition & Excise), Chennai-600009.
The Private Secretary to Additional Chief Secretary to Government,
Housing and Urban Development Department, Chennai-600009.
The Law (Hg&UD)Department, Chennai-600009.
The Housing and Urban Development (OP-1) Department,
Chennai-600 009.
Stock File/Spare Copy.

//FORWARDED BY ORDER//

04/03/26
SECTION OFFICER.
04/03/2026

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GOVERNMENT OF TAMIL NADU
2026

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EXTRAORDINARY PUBLISHED BY AUTHORITY

No. 145] CHENNAI, WEDNESDAY, MARCH 4, 2026
Maasi 20, Visuvaavasu, Thiruvalluvar Aandu–2057

Part II—Section 2

Notifications or Orders of interest to a Section of the public issued by Secretariat Departments.

NOTIFICATIONS BY GOVERNMENT

HOUSING AND URBAN DEVELOPMENT DEPARTMENT

APPROVAL OF MASTER PLAN 2045 FOR THOOTHUKUDI LOCAL PLANNING AREA UNDER THE TAMIL NADU TOWN AND COUNTRY PLANNING ACT, 1971.

[G.O.Ms. No.67, Housing and Urban Development [UD4 (2)], 4th March 2026, மாசி 20, விசுவாவசு, திருவள்ளுவர் ஆண்டு–2057.]

No. II(2)/HOU/166(c)/2026.

In exercise of the powers conferred by sub-section (1) of section 30 of the Tamil Nadu Town and Country Planning Act, 1971 (Tamil Nadu Act 35 of 1972), the Governor of Tamil Nadu hereby publishes the approval of the Government under section 28 of the said Act for the Master Plan 2045 for the Thoothukudi local planning area submitted by the Thoothukudi local planning authority.

2. The approved Master Plan 2045 for the Thoothukudi local planning area with all its enclosures shall be kept open for the inspection of the public during working days in the office of the Thoothukudi Municipal Corporation during office hours.

KAKARLA USHA,
Additional Chief Secretary to Government.

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List of Acronyms and Abbreviations

AAI	-	Airport Authority of India
A.D.	-	Anno Domini
ACP	-	Annual Credit Plan
ADB	-	Asian Development Bank
ADS	-	Area Development Scheme
AMASR	-	Ancient Monuments and Archaeological Sites and Remains Act
AMRUT	-	Atal Mission for Rejuvenation and Urban Transformation
ASI	-	Archaeological Survey of India
AWC	-	Anganwadi Centres
AWPS	-	All-Women Police Stations
BC	-	Before Christ
BCE	-	Before Common Era
BGL	-	Below Ground Level
BIS	-	Bureau of Indian Standards
BRTS	-	Bus Rapid Transit System
C&D	-	Construction and Demolition.
CA	-	Competent Authority
CE	-	Common Era
CEPI	-	Comprehensive Environmental Pollution Index
CERC	-	Consultancy Evaluation and Review Committee
CETPs	-	Common Effluent Treatment Plants
CEU	-	Coastal Employment Unit
CKIC	-	Chennai–Kanyakumari Industrial Corridor
CLPA	-	Composite Local Planning Area
CMFRI	-	Central Marine Fisheries Research Institute
CPCB	-	Central Pollution Control Board
CPHEEO	-	Central Public Health and Environmental Engineering Organisation
CRZ	-	Coastal Regulation Zone
CSI	-	Churches of South India
CSL	-	Cochin Shipyard Limited
CSR	-	Child Sex Ratio
CT	-	Census Town
CVC	-	Classified Volume Counts
CVCA	-	Critically Vulnerable Coastal Area

CWSN	-	Children With Special Needs
CWSS	-	Combined Water Supply Schemes
DAY	-	NULM Deen dayal Antyodaya Yojana- National Urban Livelihoods Mission
DDP	-	Detailed Development Plan
DEWATS	-	Decentralised Wastewater Treatment System
DGPS	-	Differential Global Positioning System
DGR	-	Decadal Growth Rate
DH	-	District Hospital
DIC	-	District Industries Centre
DISH	-	Directorate of Industrial Safety and Health
DPD	-	Direct Port Delivery
DPE	-	Direct Port Entry
DRDA	-	District Rural Development Agency
DTCP	-	Directorate of Town and Country Planning
DTWL	-	Depth to Water Level
DWT	-	Deadweight Tonnage
ECEC	-	East Coast Economic Corridor
ECS	-	Equivalent Car Space
ELU	-	Existing Land Use
ESD	-	Electrostatic Discharge
ESI	-	Employees’ State Insurance
ESZ	-	Eco-Sensitive Zone
EV	-	Electric Vehicle
EWS	-	Early Warning System
EWS	-	Economically Weaker Section
EXIM	-	Export - Import
FAR	-	Floor Area Ratio
FSI	-	Floor Space Index
FSTP	-	Faecal Sludge Treatment Plant
FTA	-	Free Trade Agreement
G.O	-	Government Order
GCP	-	Ground Control Point
GCR	-	Great Cotton Road
GDDP	-	Gross District Development Product
GH	-	Government Hospital
GI	-	Geographical Indication

GII	-	Gender Inequality Index
GIS	-	Geographic Information Systems
GOM	-	Gulf of Mannar
GoMBR	-	Gulf of Mannar Biosphere Reserve
GoMBRT	-	Gulf of Mannar Marine Biosphere Reserve Trust
GPS	-	Global Positioning System
GR	-	Growth Rate
GSDP	-	Gross State Domestic Product
H&UD	-	Housing and Urban Development Department
Ha	-	Hectare
HCC	-	Heritage Conservation Committee
HDI	-	Human Development Index
HDR	-	Human Development Report
HFA	-	Housing For All
HIG	-	Higher Income Group
HR&CE	-	Hindu Religious and Charitable Endowments
HSC	-	Health Sub-Centre
ICCC	-	Integrated Control and Command Centre
ICD	-	Inland Container Depot
ICH	-	Intangible Cultural Heritage
IGC	-	Indian Geo-informatics Centre
IMD	-	India Meteorological Department
IPHS	-	Indian Public Health Standards
IPL	-	Indian Potash Limited
IRC	-	Indian Road Congress
IRFC	-	Indian Railway Finance Corporation
ISRO	-	Indian Space Research Organisation
IT	-	Information Technology
ITeS	-	Information Technology Enabled Service
ITS	-	Intelligent Transportation Systems
IWM	-	Integrated Water Management
JJM	-	Jal Jeevan Mission
JNNURM	-	Jawaharlal Nehru National Urban Renewal Mission
KKI	-	Kalaignarin Kanavu Illam
KL	-	Kilo Litres
KRIBHCO	-	Krishak Bharati Cooperative Limited

LAP	-	Local Area Plan
LCV	-	Light Commercial Vehicles
LIG	-	Lower Income Group
LL	-	Lakh Litres
LOS	-	Level of service
LPA	-	Local Planning Area
LPADS	-	Land Pooling Area Development Scheme
LPCD	-	Liters per capita per day
LST	-	Land Surface Temperature
MAR	-	Managed Aquifer Recharge
MAV	-	Multi-Axle Vehicles
MCC	-	Micro Compost Centres
MDL	-	Mazagon Dock Shipbuilders Limited
MEA	-	Millennium Ecosystem Assessment
MEMU	-	Mainline Electric Multiple Unit
MICE	-	Meetings, Incentives, Conferences, and Exhibitions
MIG	-	Middle Income Group
MLD	-	Million Litres per Day
MLP	-	Multi-Layered Plastics
MMI	-	Multi-Modal Integration
MMLP	-	Multi-Modal Logistics Park
MoHUA	-	Ministry of Housing and Urban Affairs
MoUD	-	Ministry of Urban Development
MPI	-	Multidimensional Poverty Index
MRF	-	Material Recovery Facilities.
MSME	-	Micro, Small, and Medium Enterprises
MT	-	Metric Ton
NBC	-	National Building Code
NDMA	-	National Disaster Management Authority
NDVI	-	Normalised Difference Vegetation Index
NDWI	-	Normalised Difference Wetness Index
NFHS	-	National Family Health Survey
NH	-	National Highway
NMT	-	Non-Motorized Transport
NRSC	-	National Remote Sensing Centre
NRW	-	Non-Revenue Water

NSG	-	Non Suburban Grade
NSHIP	-	The National Shipbuilding & Heavy Industries Park
NTDA	-	New Town Development Authority
NULM	-	National Urban Livelihood Mission
NUTP	-	National Urban Transport Policy
O& M	-	Operation and Maintenance
OD	-	Origin and Destination
OHTs	-	Over Head Tanks
OSR	-	Open Space Reservation
PCI	-	Per Capita Income
PHC	-	Primary Health Centre
PLU	-	Proposed Land Use
PMAY	-	Pradhan Mantri Awas Yojana
PM_{10} / $PM_{2.5}$	-	Particulate Matter (≤10 µm / ≤2.5 µm)
POI	-	Places of Interest
PPH	-	Persons per Hectare
PPP	-	Public Private Partnership
PSTP	-	Packaged Sewage Treatment Plants
PSUs	-	Public Sector Undertaking
PwD	-	Person with Disabilities
PWD	-	Public Works Department
RAY	-	Rajiv Awas Yojana
RCF	-	Rashtriya Chemicals & Fertilizers
RDF	-	Refuse Derived Fuel
RMSA	-	Rashtriya Madhyamik Shiksha Abhiyan
ROB	-	Road Over Bridges
ROW	-	Right-of-Way
RRC	-	Resource Recovery Centres.
RTE	-	Right to Education
RUB	-	Road Under Bridges
SBR	-	Sequential Batch Reactor
SCADA	-	Supervisory Control and Data Acquisition
SDAT	-	Sports Development Authority
SDG	-	Sustainable Development Goals
SDH	-	Sub-District Hospital
SDRF	-	Supplemental Disaster Recovery Fund

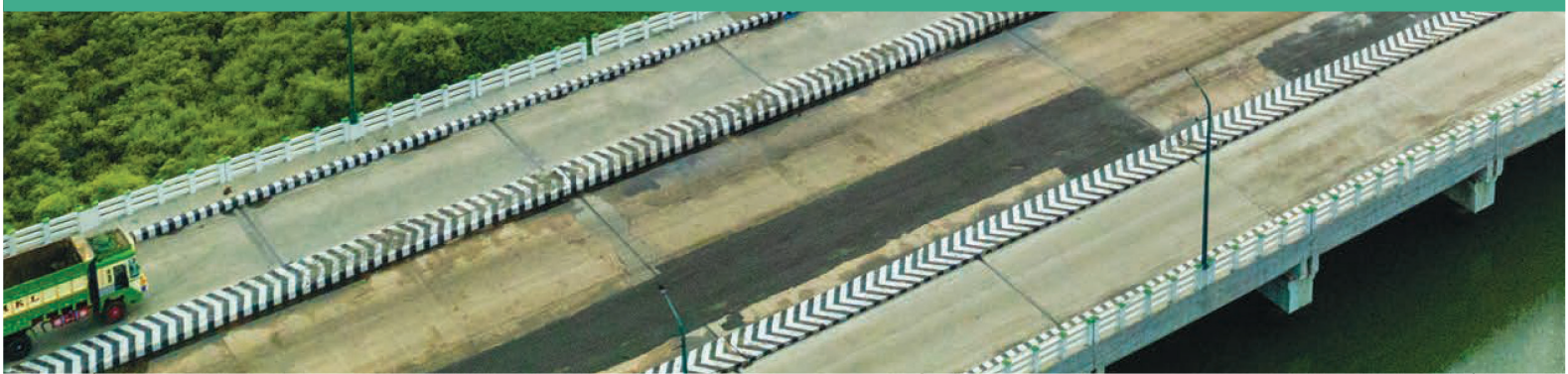
SETC	-	State Express Transport Corporation
SFS	-	Self-Financing Scheme
SH	-	State Highways
SHG	-	Self-Help Groups.
SIDCO	-	Small Industries Development Corporations
SIPCOT	-	State Industries Promotion Corporation of Tamil Nadu
SLPA	-	Single Local Planning Area
SPI	-	Standardised Precipitation Index
SPIC	-	Southern Petrochemical Industries Corporation
SPV	-	Special Purpose Vehicle
SSS	-	Site and Service Scheme
STEM	-	Science, Technology, Engineering, and Mathematics
STP	-	Sewage Treatment Plant
STR	-	Student-Teacher Ratio
SVCTFC	-	Space Vehicle Common Technical Facility Centre
SWD	-	Storm Water Drains
SWM	-	Solid Waste Management
SWWED	-	Social Welfare and Women Empowerment Department
TDR	-	Transferable Development Rights
TEU	-	Twenty-foot Equivalent Unit
THUDITSSIA	-	Tuticorin District Tiny and Small-Scale Industries Association
TIDCO	-	The Tamil Nadu Industrial Development Corporation
TMC	-	Turning Movement Count
TNCCM	-	Tamil Nadu Climate Change Mission
TNCDBR	-	Tamil Nadu Combined Development and Building Rules
TNHB	-	Tamil Nadu Housing Board
TNHC	-	Tamil Nadu Heritage Commission
TNPCB	-	Tamil Nadu Pollution Control Board
TNSAPCC	-	Tamil Nadu State Action Plan on Climate Change
TNSCCC	-	Tamil Nadu State Climate Change Cell
TNSDA	-	Tamil Nadu State Department of Archaeology
TNSTC	-	Tamil Nadu State Transport Corporation
TNTCP	-	Tamil Nadu Town and Country Planning Act
TNUDP	-	Tamil Nadu Urban Development Project
TNUHDB	-	Tamil Nadu Urban Habitat Development Board
TNULM	-	Tamil Nadu Urban Livelihood Mission

TNWWHCL	-	Tamil Nadu Working Women Hostels Corporation Limited
TOD	-	Transit-Oriented Development
TP	-	Town Panchayat
TPD	-	Tons Per Day
TPP	-	Thermal Power Plant
TWAD	-	Tamil Nadu Water supply and Drainage Board
UHWC	-	Urban Health Wellness Center
UGSS	-	Under Ground Sewerage Scheme
UHII	-	Urban Heat Island Index
ULB	-	Urban Local Body
ULIP	-	Unified Logistics Interface Platform
UPHC	-	Urban Primary Health Centre
URDPFI	-	Urban and Regional Development Plans Formulation and Implementation
V.O.C	-	Vallinayagam Olaganathan Chidambaram Pillai
VE Road	-	Victoria Extension Road
VOC Market	-	Vallinayagam Olaganathan Chidambaram Pillai Market
VOC Port	-	Vallinayagam Olaganathan Chidambaram Pillai Port
VOCPA	-	V.O. Chidambaranar Port Authority
WPR	-	Workforce Participation Ratio
WSUD	-	Water Sensitive Urban Design
WTP	-	Water Treatment Plant



Preamble







1

1.1 Background

The Master Plan is a statutory planning instrument with a twenty-year planning horizon, providing a comprehensive spatial and policy framework for regulating and guiding the growth and development of the planning area. It functions as a foundational urban planning and policy tool, integrating multiple components such as the built environment, socio-economic dynamics, ecological systems, infrastructure and cultural assets with the objective of enabling organized, inclusive and sustainable urban development.

In the context of Thoothukudi LPA, one of the key port-based industrial cities in Tamil Nadu, a Master Plan is essential due to its unique combination of maritime history, coastal location, port-based industrial activities and economic significance. The city developed around its strategic coastal position and has served as a major trade centre since ancient times. Its origins date back to Korkai, renowned for pearl fishing and trade with Roman and Chinese merchants, as documented in Sangam literature. Over the years, Thoothukudi fell under Portuguese, Dutch and British influence, which shaped its urban development, port facilities and civic institutions. The city has transformed from a traditional maritime settlement into a modern industrial and port-oriented hub with large-scale industries, commercial zones and residential neighbourhoods. The Master Plan will direct the city's future growth by balancing industrial and port development with urban expansion, improved connectivity, coastal ecosystem protection and better infrastructure. It also emphasises preserving cultural and historical heritage, including religious sites, markets and maritime traditions. Thoothukudi's evolution from an ancient trade centre to a modern industrial city has moulded its urban form and public life, highlighting the importance of effective planning for sustainable development.

1.1.1 Key Areas Addressed

The following are the key areas addressed by the Master Plan 2045:

- **Land Use Planning:** Ensuring optimal allocation of land for residential, commercial, industrial and green uses by proposing a zoning strategy.
- **Promote balanced industrial growth** while ensuring integration with urban development and land-use planning and encourage investment in diverse industrial sectors to generate employment and strengthen the local economy
- **Transportation and Mobility**: Enhancing connectivity and promoting public and non-motorised transport.
- **Infrastructure and Utilities:** Upgrading water supply, sanitation, power and waste management systems.
- **Housing and Livelihoods:** Promoting inclusive housing and supporting economic development.
- **Environmental Sustainability:** Protecting natural assets and promoting climate-responsive development.
- **Social Sector:** Identifying key benchmarks and parameters and ensuring the LPA achieves its goals for community support, inclusion and sustainable development.
- **Heritage and Urban Identity:** Preserving built heritage and reinforcing local character.

- **Phasing and Implementation** of projects and recommendations along with abstract costing.

1.2 Purpose Of Master Plan

1.2.1 AMRUT Scheme

The GIS-based Master Plan is prepared under the AMRUT (**Atal Mission for Rejuvenation and Urban Transformation**) Program. The scheme aims to transform cities into efficient living spaces by targeting the transformation of 500 cities and towns in India into efficient urban living spaces, with special focus on:

i. Water supply,

ii. Sewerage,

iii. Storm water drains

iv. Green spaces and parks.

The Atal Mission for Rejuvenation and Urban Transformation (AMRUT) mandates the implementation of 11 key reforms by all States and 500 Mission cities, with the objective of ensuring planned and sustainable urban development across India. Under AMRUT, the Master Plan serves as a core planning instrument to guide the orderly growth of cities and towns, with a strong emphasis on the provision of essential urban services such as water supply, sewerage, urban transport and green spaces, thereby enhancing the overall quality for its life of citizens.

In this context, the adoption of Geographic Information Systems (GIS) has become integral to Master Plan preparation under AMRUT. GIS enables the creation, management, analysis and visualisation of spatial and geographic data, significantly improving the efficiency and accuracy of map-making and planning processes. Its ability to support systematic data storage, updating, retrieval and analysis allows plans to be prepared in a faster and more cost-effective manner.

Building on this technology-driven planning approach, AMRUT promotes sustainable and inclusive urban development by encouraging the use of green and energy-efficient technologies, fostering citizen participation in urban planning and strengthening urban governance through capacity building and institutional reforms. The Master Plan under AMRUT further seeks to develop infrastructure that responds to the growing demands of urbanisation, including provisions for affordable housing and slum rehabilitation, while also supporting economic growth and employment generation. Collectively, these efforts aim to create liveable, resilient and well-governed cities and towns capable of delivering a high quality of life to their residents.

In this context, the Department of Town and Country Planning, Government of Tamil Nadu, with the assistance of the local authority, has undertaken the preparation of the GIS-based Master Plan for Thoothukudi. The Master Plan is formulated for a planning horizon of 20 years, considering projected population growth and the corresponding demand for infrastructure and services. The planning process involves the collection and review of available data, assessment of demand–supply gaps in service delivery, evaluation of environmental conditions, analysis of traffic and mobility patterns, preparation of the existing land use map and identification of key development issues.

The primary objective of the Master Plan under AMRUT is to establish a comprehensive and sustainable urban planning framework that supports balanced growth and efficient service provision. In line with this objective, the Plan focuses on:

- **Identify infrastructure gaps and prioritise investments** in areas such as water supply, sewerage, drainage, urban transport, parks and green spaces and other social facilites.
- **Promote compact and mixed land-use development** that reduces urban sprawl and supports the efficient use of resources.
- **Foster sustainable and inclusive urban development** that considers the needs of all segments of society, including the poor and vulnerable.
- **Strengthen urban governance and institutional capacities** to enable effective implementation of the Master Plan.

1.2.2 Statutory Framework

The Tamil Nadu Town and Country Planning Act, 1971, provides a comprehensive statutory framework for the systematic development and optimal utilisation of rural and urban land across the State. The Act enables the preparation, approval and implementation of Master Plans to facilitate planned growth and sustainable development.

The Master Plan encompasses various aspects of land use planning, infrastructure development, environmental conservation and socio-economic advancement. The Master Plan may provide any or all of the following requirements:

- To determine how land in the planning area is used.
- To allocate or reserve land for residential, commercial, industrial and agricultural purposes, as well as for parks, playgrounds and open spaces.
- To allocate or reserve land for public buildings, institutions and civic amenities.
- To make provisions for national highways, arterial roads, ring roads, major streets, railways, airports, canals and other transportation links.

- To outline traffic and transportation patterns, including road improvements and circulation systems.
- To reserve for future development, expansion and new housing projects.
- To address improvements for poorly designed areas, outdated developments, slums and population relocation wherever necessary.

Further to the above and in compliance with applicable Acts, regulations, guidelines such as URDPFI and other statutory norms, the Master Plan seeks to achieve the following objestives:

- To ensure the provision of essential amenities, services and utilities.
- To make detailed development plans for specific zones, including housing, shopping centres, industries, civic facilities, educational and cultural institutions.
- To define the stages for implementing the Master Plan and any other necessary matters, as required to be included.
- To incorporate provisions for disaster management, including flood mitigation, cyclone-resistant infrastructure, earthquake-prone zone regulations and emergency evacuation routes.
- To allocate and protect water resources, including rivers, lakes, groundwater recharge zones and watershed areas, ensuring sustainable usage and prevent pollution.
- To include provisions for critical social infrastructure such as hospitals, community centres and welfare institutions to cater to the needs of the population.
- To address the development and maintenance of physical infrastructure, including water supply and sewage systems, storm water drainage, solid waste management and power supply networks.

The Urban and Regional Development Plans Formulation and Implementation (URDPFI) Guidelines 2015, formulated by the Town and Country Planning Organisation, Government of India, provide the guiding framework for the preparation of Master Plans across the country. Accordingly:

- The Master Plan (Development Plan) shall aim to provide detailed strategies and recommendations to implement policies from the Perspective Plan and Regional Plan, based on economic and social needs, public aspirations, available resources and priorities.
- To ensure affordable housing provisions and slum rehabilitation, as equitable access to shelter ensures inclusive urban growth.
- The Master Plan also identifies areas that need preservation, conservation and development, particularly those with ecological value, natural scenery and significant landscapes.

- It includes the protection of historical, architectural and scientifically important structures, as well as environmentally sensitive areas.
- The Master Plan will be prepared using Geographic Information System (GIS)- based mapping and spatial analysis to ensure accurate land-use planning, infrastructure management and data-driven decision-making. The typical timeframe for these plans is 20-30 years, with phased planning in 5-year intervals for periodic reviews.

1.3 Need Of Master Plan

Thoothukudi Local Planning Area (LPA) is a strategically significant, port-based urban region with a strong economic base supported by maritime trade, industries, logistics, fisheries and allied services, alongside sensitive coastal and ecological systems. The city's development is closely interlinked with its fragile coastal and marine ecosystems, making environmental considerations critical to its long-term growth and resilience. However, the existing Master Plan for Thoothukudi LPA, prepared several decades ago, is no longer adequate to address the city's evolving urban dynamics, including rapid industrialisation, port-led development, population growth, spatial expansion and increasing pressures on infrastructure, natural resources and environmental systems.

In response to these emerging challenges and to accommodate future development requirements, the Government of Tamil Nadu expanded the Thoothukudi LPA boundary from 354.7 sq. km to 463.62 sq. km through G.O. (Ms) No. 116, H&UD, dated 16.06.2022. This expansion reflects the growing spatial influence of the city and the need for a more comprehensive and integrated planning framework.

There is a pressing need for a revised strategic vision that balances economic growth driven by port activities, industries and logistics with environmental protection, coastal regulation and inclusive urban development. The revised Master Plan is therefore essential to guide orderly urban development in a manner that enhances liveability by improving access to basic services, affordable housing, efficient mobility, public open spaces and social infrastructure, while reducing environmental pollution and exposure to hazards. It aims to address land-use conflicts, infrastructure deficits, traffic congestion and housing demand, while ensuring the protection of water bodies, coastal stretches, green buffers and ecologically fragile areas that are vital for environmental balance and quality of life

To respond effectively to these challenges, the new Master Plan will adopt a technology-driven planning approach through GIS-based spatial analysis, updated base maps, growth projections and evidence-based decision-making. The Plan will align with national and global sustainability frameworks, including

the United Nations Sustainable Development Goals (SDGs), particularly SDG 6 (clean water and sanitation), SDG 11 (inclusive, safe, resilient and liveable cities) and SDG 15 (life on land and coastal ecosystem protection). Overall, the revised Master Plan seeks to ensure that Thoothukudi's future growth is economically robust, environmentally responsible, climate-resilient and enhances liveability.

1.4 Local Planning Area

The Thoothukudi Composite Local Planning Area (CLPA) represents the present statutory planning jurisdiction constituted through successive extensions, with the most recent notification forming the current planning boundary. In this regard, nine additional revenue villages were added to the Thoothukudi CLPA and notified under Section 10(1)(b) of the Tamil Nadu Town and Country Planning Act, 1971, vide G.O.Ms. No.149, Housing and Urban Development Department, dated 20th June 2013. Of these, five villages—Koothudankadu, Mudivaithanendal, Varthagareddipatti, Kattalankulam and Servaikaranmadam—fall within Thoothukudi Taluk, while the remaining four villages—Melamarudhur, Valasamutharam, Sinthalakattai and Pattinamarudhur—are located in Ottapidaram Taluk. This notification defines the existing extent of the Thoothukudi Composite Local Planning Area and forms the statutory basis for the preparation and implementation of the present Master Plan.

Table 1.1 shows the administrative details of the Thoothukudi Local Planning Area LPA.

Table 1.1 Administrative Summary of Thoothukudi LPA

S.No	Administrative Category	No of local bodies	Area in Sq.km
1.	Corporation	1	90.66
2.	Village Panchayats	34	372.96
Total LPA Area			**463.62**

Source : DTCP, Thoothukudi.

1.5 Master Plan Preparation 2025 – 2045

The preparation of Thoothukudi's Revised Master Plan 2045 follows a systematic, multi-stage planning process that integrates technical analysis, comprehensive baseline assessments, structured feedback mechanisms and comparisons with relevant national and international benchmarks. The

approach is supported by GIS-enabled spatial mapping and progresses through detailed gap analysis, vision formulation and extensive stakeholder consultations. This methodology combines established urban planning tools with ground-level insights to develop a balanced, inclusive and sustainable development framework.

1.5.1 Baseline Study For Thoothukudi Master Plan 2045

As part of the preparation of the Thoothukudi Master Plan, a comprehensive baseline study was undertaken to establish a clear and accurate understanding of the planning area's demographic characteristics, socio-economic profile, environmental conditions and physical attributes. This process involved the formulation of a detailed methodology, work plan and action schedule with clearly defined timelines and milestones.

The baseline assessment encompassed structured approaches for secondary data collection, identification of survey locations and the design of an effective stakeholder engagement framework. A detailed review of existing master plans, development plans, sectoral studies and statutory documents relevant to the Thoothukudi planning area was carried out to identify gaps and ensure that the revised Master Plan is robust, context-specific and forward-looking. The available data was evaluated for its quantity, quality and adequacy to ensure its suitability for meeting the intended planning objectives.

A stakeholder engagement and citizen participation strategy was developed as part of a broader Communication Plan, outlining the methods, tools and timelines for engaging stakeholders throughout the planning process. This approach ensured inclusive, transparent and meaningful participation from relevant government departments, port and industrial authorities, institutional stakeholders and the general public.

However, it is important to note that the **Census of India,** which constitutes a critical component of the baseline dataset, is currently based on the 2011 Census. Many subsequent data sources, including the District Census Handbook and other official databases, rely on this Census as a benchmark. Accordingly, the revised Master Plan must incorporate a provision to revisit and update the baseline analysis once the latest Census data becomes available, to ensure continued relevance and accuracy.

To ensure spatial accuracy and up-to-date mapping, a dedicated action plan for spatial data generation and validation was implemented.

1.5.2 Base Map Preparation

The Existing Land Use Map was prepared to understand the current development scenario, identify growth trends and analyse how land is being

utilised across different sectors. It serves as a crucial reference for planning future infrastructure, regulating development and preserving environmental resources. The base map was prepared by integrating multiple layers of spatial and attribute data. The cadastral framework was digitised from geo-referenced village maps, with boundaries and survey numbers clearly marked. Government lands, water bodies and approved layouts were mapped using official datasets and verified through field surveys. Additional thematic layers, such as transport networks, public facilities and environmental zones, were incorporated to ensure a comprehensive database.

Layers integrated into the base map include:

- Cadastral maps with survey numbers
- Government lands
- Water bodies (rivers, lakes, tanks and canals)
- Land approval data provided by government agencies
- Transport and road networks
- Public and community facilities
- Existing land use classification based on the usage and classified as per
- TN Master Plan rules
- Environmental and ecological features

1.5.3 Process of base map preparation

GIS Survey & Geo-Referencing – Cadastral maps were generated from village survey records, with DGPS-derived Ground Control Points (GCPs) enabling precise geo-referencing. Administrative and planning boundaries were digitised as GIS polygons and ward maps of the Thoothukudi LPA were spatially aligned and linked with corresponding town survey numbers within the GIS database. GIS-based Master Plan formulation is one of the important reforms under AMRUT Mission, in which NRSC and ISRO have played a major role. The Urban Studies team at NRSC has contributed to the preparation of AMRUT Design & Standards, which are published on the MoHUA website and are adopted as a national guideline for the preparation of a large-scale urban GIS database using Very High-Resolution satellite (VHRS) data. In addition, NRSC is carrying out a major activity under the Mission creation of a large-scale (1:4,000 scale) Urban GIS database for AMRUT Cities. This project involves GIS-based map preparation by NRSC and handing over the data to ULBs for ground verification and attribute data collection. The ULBs conduct field verification of the base maps, after which NRSC incorporates the field information and finalises the geospatial database. So far, NRSC has finalised and delivered GIS databases of cities to ULBs for the formulation of GIS-based

Master Plans. The diagram illustrates the process sequence adopted for GIS database creation. Figure 1.1 illustrates the methodology adopted for the preparation of the GIS-based Master Plan

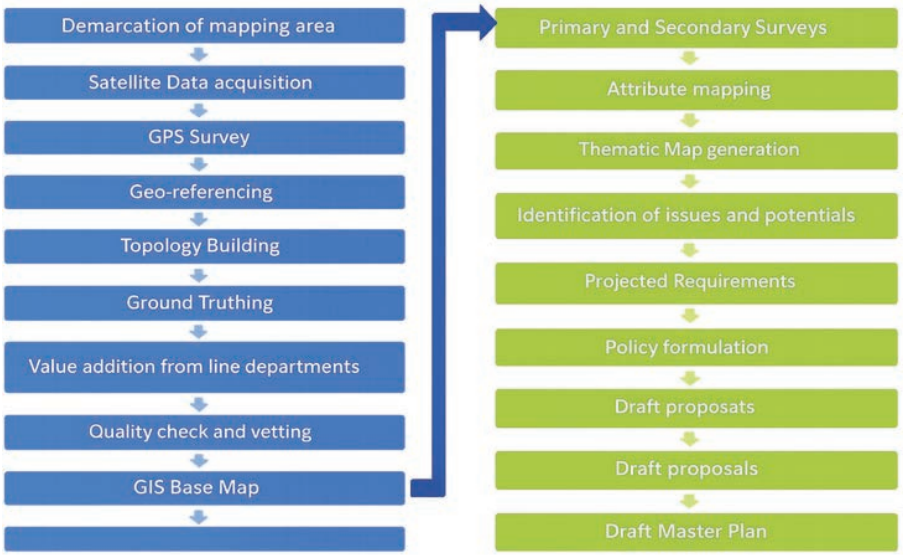


Figure 1.1 Formulation of AMRUT GIS-based Master Plan Methodology

1. **Satellite data acquisition & Ground truthing -** Following the AMRUT guidelines, high-resolution satellite images were obtained from the National Remote Sensing Centre (NRSC) of ISRO. NRSC initially generated a preliminary land use map based on these satellite images. Subsequently, the Indian Geo-informatics Centre (IGC) conducted ground truthing to verify the accuracy of the land use map on behalf of the Department of Town and Country Planning (DTCP).

2. **GIS survey & Geo Referencing –** The cadastral framework was established using village maps containing survey numbers obtained from the Survey and Land Records department. To enhance Geo-referencing accuracy, Differential Global Positioning System (DGPS) surveys were conducted to collect Ground Control Points (GCPs) for scanned paper maps. Subsequently, the survey boundaries were digitised and incorporated as polygon features in the GIS database, including details such as the village name and survey number.

3. **Quality Checking and Vetting** – The Indian Geo-informatics Centre (IGC) conducts a thorough quality assessment and verification process for the GIS data, focusing on both topological integrity and attribute accuracy. Given the diverse origins, timeframes and scales of the map data, it is crucial to individually examine each layer and conduct cross-comparisons.

4. **Preparation of Base Map** - For the creation of the Base map, the Digital Terrain Model (DTM of SRTM) is utilised by IGC to delineate terrain features and

contours. This map highlights the physical characteristics of the Local Planning Area (LPA), including topography, rivers, streams and tanks, providing a comprehensive view of the area's natural landscape in the Thoothukudi Planning Area.

1.6 Stakeholder Engagement

Stakeholder engagement formed a crucial pillar in the preparation of the Master Plan for additional area of Thoothukudi LPA. The consultative process was initiated with a stakeholder meeting held on 03.06.2025 at the District Collectorate, chaired by the District Collector, Thoothukudi City Corporation Commissioner, LPA representatives and public stakeholders, who provided inputs on the draft plan. Through the O&S initiative, numerous public suggestions were received and after careful examination of revenue records, field verification and planning parameters, the relevant inputs were incorporated into the proposed land use and proposals.



Figure 1.2: Images from the Stakeholder Meeting and O&S process

Key Takeaways from Stakeholder Consultations

During the Consultancy Evaluation and Review Committee (CERC) meetings held on 04.03.2022 and 12.02.2024, chaired by the Director of Town and Country Planning, several important points were highlighted by stakeholders for consideration in the preparation of the Master Plan for Thoothukudi.

- Environmental safeguards need stronger emphasis, given the industrial character of Thoothukudi, with environmental protection integrated as a core planning priority.
- Core city road widths and connectivity require attention, as several narrow roads constrain traffic movement and overall urban mobility.
- Traditional pearl industry decline should be explicitly analysed in the Plan, including underlying causes, to inform future revival or diversification strategies.
- Salt production enhancement was recommended, recognising that salt pans account for about 11.11% of the LPA land area and remain critical to the local economy.
- Healthcare infrastructure requires strengthening alongside environmental considerations to support the growing population and industrial activity.
- Strengthening the SIPCOT industrial node near Allikulam and Therku Veerappandiapuram was highlighted, with suggestions to reclassify suitable agricultural land for industrial use to support manufacturing, logistics and allied services.
- Truck terminals to be proposed at Milavitan and Pudhur Pandiyapuram to improve freight movement and reduce heavy vehicle congestion within urban areas.
- A new regional link road between Thoothukudi and Tirunelveli via Manjalneerkayal–Maramangalam–Kattalankulam–Mudivaithanendal was emphasised to enhance regional connectivity and industrial logistics.
- Proactive land use planning around proposed shipyard areas at Mullakkadu and Palayakayal was recommended to support shipbuilding, repair and ancillary industries.
- Increased provision for industrial and residential land uses was urged, based on growth potential and land suitability, supported by a balanced spatial development strategy.

Subsequently, a stakeholder meeting was conducted on 30.01.2026 to discuss the draft Master Plan proposals.



Figure 1.3: Stakeholder Discussion Meeting

During this meeting, key observations, concerns and recommendations from stakeholders were deliberated and the following major points were highlighted:

- The **proposed Ring Road alignment** was agreed upon, with stakeholders noting that it would significantly improve regional and intra-city connectivity.
- The **proposed industrial clusters** were also considered adequate to meet the projected industrial and employment requirements over the next 20 years.
- Overall, stakeholders underscored the need to **increase provisions for general industrial and residential developments** based on the growth potential and land suitability within the planning area. A balanced spatial strategy was emphasised to ensure future sustainable development.

1.7 Vision

Thoothukudi 2045 – India's Gateway to Sustainable Industry, Innovation and Global Trade

A key step in the formulation of the Master Plan is the development of a Vision through a participatory and consultative process. This ensures that the Master Plan reflects the collective aspirations of the people, the character of the land and the institutional framework governing the Local Planning Area (LPA). The collective outcome of these discussions was a vision to reposition Thoothukudi as "Global Trade Gateway" where by its strategic geographical advantages, progressing towards becoming an economically dynamic, globally competitive and a clean energy city by 2045. Stakeholders emphasized the need to transform the LPA through sustainable urban development, smart infrastructure and the integration of Port and its interlinked activities, while preserving the city's coastline and its blue-green ecological systems

Accordingly, "Thoothukudi – Gateway to Sustainable Global Trade" representing the consolidated inputs of diverse stakeholders, has been formally adopted as the Vision of the Master Plan. The vision is to transform Thoothukudi from its crossroads to being a catalyst to sustainable growth through strategic planning for prosperity and resilience.

V.O. Chidambaranar (VOC) Port, is a major maritime gateway on India's southeastern coast, serving as a key node for international trade and regional economic growth. Given the port's pivotal role in connecting hinterland industries and facilitating import-export activities, the Master Plan 2045 aims to strategically expand and optimally utilise the VOC Port's infrastructure and its operations to indulge in the economic development.

"By 2045, Thoothukudi will emerge as a world-class maritime, industrial and sustainable urban hub, leveraging its strategic port, diversified industries and renewable energy resources to drive inclusive growth, innovation and global trade connectivity."

By 2045, Thoothukudi aims to be:

- A global maritime and industrial hub
- A centre for renewable energy and green manufacturing
- A smart, sustainable and liveable city
- A knowledge-driven, inclusive economy with strong rural-urban integration



Figure 1.4 Vision for Thoothukudi 2045

Key Pillars of the Vision:



Figure 1.5: Key Pillars of the Vision

1. Industrial and Economic Transformation

- **Mega shipbuilding & maritime hub:** Host one of India's largest shipbuilding clusters with integrated supply chains and global export links.
- **EV and advanced manufacturing cluster:** Become a leader in electric vehicles, battery systems and auto-components.
- **Defence, aerospace and space tech centre:** Manufacture propulsion systems, aerospace components and defence equipment.
- **Chemical and renewable energy industries:** Green hydrogen, renewable energy and speciality chemicals become growth engines.
- **MSME ecosystem:** Thriving ancillary industries supporting large-scale manufacturing.

2. Port and Logistics Directives

- **VOC Port as a global trade gateway:** Efficient cargo handling, cold chains and value-added logistics services.

- **Multi-modal transport hub:** Seamless connectivity with rail, road and coastal shipping networks.
- **Export-oriented economy:** Strong linkages between agriculture, seafood and industrial exports.

3. Smart and Sustainable Urbanism

- **Smart and resilient city:** Integrated urban planning, smart infrastructure and climate-resilient architecture.
- **Clean energy adoption:** Solar, wind and green hydrogen powering industries and urban needs.
- **Water management:** Advanced rainwater harvesting, desalination and wastewater recycling to overcome arid climate challenges.

4. Aqua Sector Innovation

- **High-value and climate-smart crops:** Onion, chilli, banana and floriculture using precision irrigation.
- **Advanced aquaculture:** Sustainable shrimp, prawn and fish farming with export-quality processing.
- **Agro-processing & port export linkages:** Strengthening farmer income and rural livelihoods.

5. Inclusive Growth and Knowledge-Driven Economy

- **World-class education and skill centres:** Engineering, maritime, defence and renewable energy training institutes.
- **Innovation & research hubs:** Collaboration between universities, industries and government for R&D.
- **Human Capital Inclusive employment:** 100,000+ jobs in industrial, services and allied sectors by 2045.

6. Sustainable Infrastructure and Ecology

- **Coastal and marine ecosystem protection:** Responsible industrialisation to preserve fisheries and biodiversity.
- **Renewable energy targets:** Port and industrial clusters powered largely by solar, wind and hydrogen.
- **Low-carbon, circular economy:** Waste-to-energy and industrial symbiosis for sustainability.

1.8 Report Structure

The Thoothukudi Master Plan 2045 is presented in three volumes, along with a set of existing and proposed land use plans. Volumes I and II comprise the main planning report, while Volume III contains the detailed schedule specifying the proposed land use for each survey number within the LPA. Tabel 1.2 shows the chapter schema of Thoothukudi Master Plan 2045.

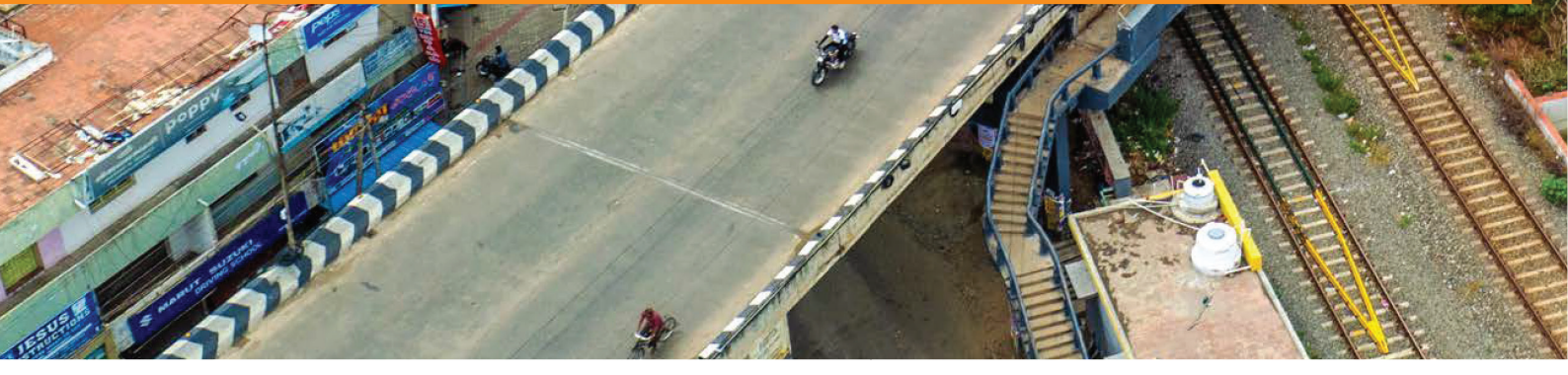
Table 1.2 Chapter Schema of Thoothukudi Master Plan 2045

1	PREAMBLE
2	REGIONAL SETTING
3	PROFILE OF LPA
4	ADMINISTRATION AND GOVERNANCE
5	PREVIOUS PLANNING EFFORTS
6	ECOLOGY & ENVIRONMENT
7	DEMOGRAPHIC PROFILE
8	ECONOMY
9	MOBILITY
10	HOUSING
11	SOCIAL INFRASTRUCTURE
12	WATER INFRASTRUCTURE
13	SOLID WASTE MANAGEMENT
14	ENERGY
15	HERITAGE & CULTURE
16	TOURISM
17	SPATIAL TRENDS AND EXISTING LAND USE
18	PROPOSED LAND USE AND ZONING STRATEGY
19	BLOCK COSTING, PHASING AND IMPLEMENTATION



Regional Setting







2

2.1 Overview

The Thoothukudi Local Planning Area (LPA) covers an extent of 463.62 sq.km, accounting for approximately 9.85% of the district's geographical area and accommodating about 29.39% of the district's population. The LPA concentrates a significant share of the district's urban population, economic activities, and critical infrastructure. Thoothukudi District, located in the southern coastal region of Tamil Nadu, spans around 4,707 sq.km and occupies a strategic position along the Gulf of Mannar at approximately 8.7642° N latitude and 78.1348° E longitude.

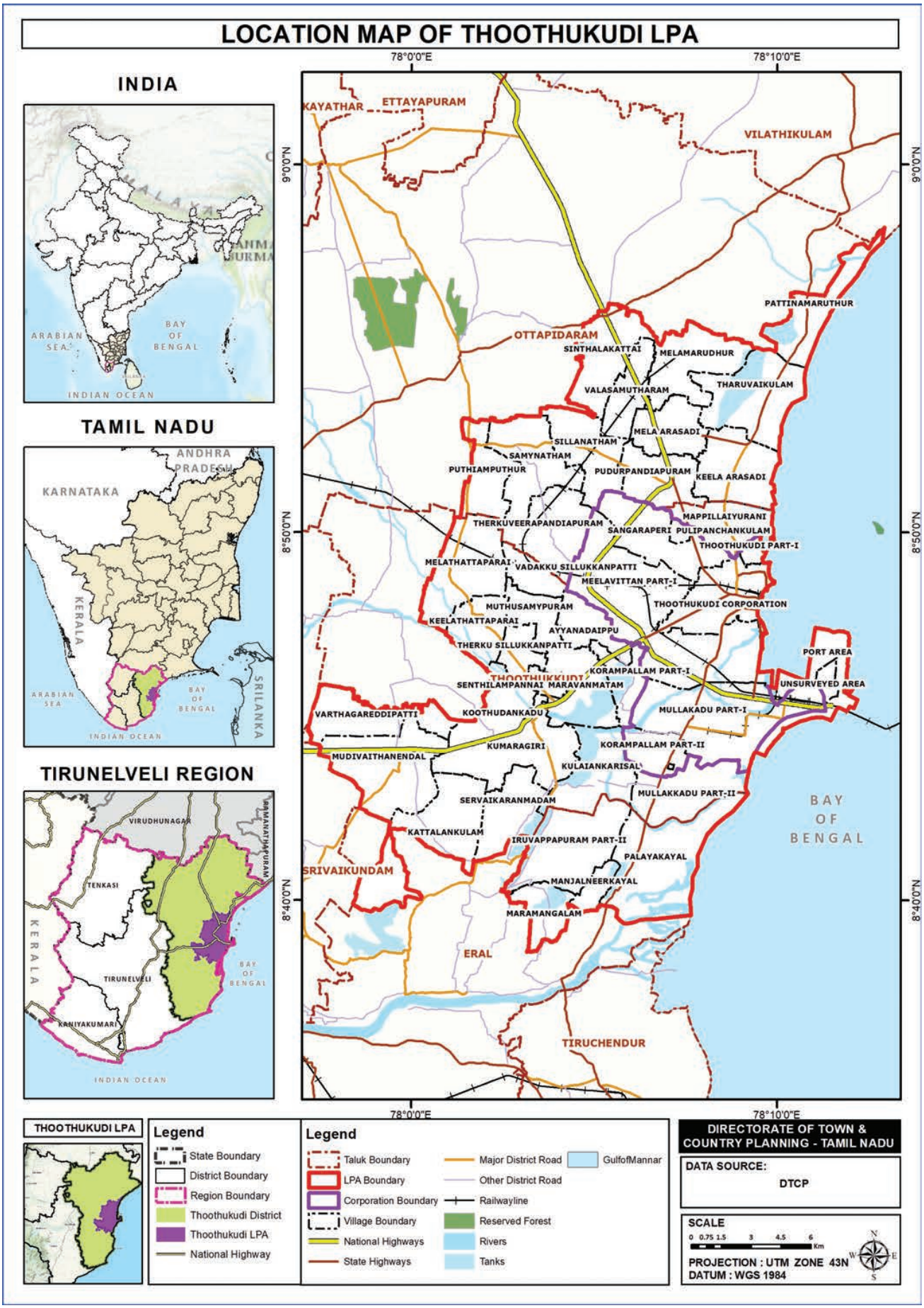
Regional Setting

Administratively, the district is bounded by Virudhunagar District to the north, Ramanathapuram District to the northeast, and Tirunelveli District to the west and south, while the Bay of Bengal forms its eastern boundary. Geographically, the district is characterised by flat coastal plains, inland dry tracts, and extensive salt pans and marine ecosystems, with the coastline and proximity to the Gulf of Mannar significantly shaping settlement patterns and livelihoods.

At the core of the LPA lies Thoothukudi City, also known as the Pearl City, which functions as the district headquarters and a prominent port-based urban centre. The city's growth is anchored by the V.O. Chidambaranar Port, one of India's major seaports, supporting maritime trade, industrial development, and regional connectivity. Port-led industries, thermal power, chemicals, salt production, fisheries, and allied manufacturing activities form the backbone of the local economy.

Beyond the urban core, the district comprises a network of municipalities, town panchayats, and coastal and inland villages, integrated through road and rail corridors linking the hinterland to the port. This combination of strategic coastal location, port-driven economic activity, and an evolving urban–rural structure reinforces Thoothukudi's role as an important regional hub in southern Tamil Nadu.





Map 2.1 Location Map of Thoothukudi LPA

2.2 Historical Significance of Thoothukudi District

2.2.1 Historical Background

Thoothukudi District, historically celebrated as the "Pearl City," occupies a prominent position in the maritime and cultural history of Tamil Nadu. The region's origins are closely associated with the ancient Pandya kingdom, under whose rule it flourished between the 7th and 9th centuries CE as a coastal trading and pearl-fishing centre. Literary references from Sangam and post-Sangam Tamil texts, along with accounts by foreign travellers such as Megasthenes and Marco Polo, attest to the prosperity of the Pandya ports along this coastline, particularly Korkai—an early port capital located south of present-day Thoothukudi.

Over successive centuries, the region experienced layered political transitions. Following Pandya dominance, it came intermittently under Chola control during the 10th to 12th centuries, benefiting from expanded maritime linkages and administrative consolidation. Thereafter, the territory witnessed shifts between Pandya resurgence, Vijayanagara influence, and Nayak administration from Madurai. During the Nayak period, local chieftains (Poligars) emerged as powerful intermediaries, shaping both the agrarian landscape and regional power structures.

Thoothukudi's coastal location and natural anchorage drew early European interest. The Portuguese established a presence in the early 16th century (1532 CE), followed by the Dutch in the mid-17th century (1658 CE), who intensified pearl fisheries and maritime trade. Control later passed to the British East India Company towards the end of the 18th century (1782 CE), following prolonged conflicts involving the Dutch, the Carnatic Nawab, and local Poligar resistance. British administration integrated Thoothukudi into the Madras Presidency, marking a decisive shift towards colonial governance.

The colonial phase strengthened Thoothukudi's role as a port-based economy. The commissioning of the first wooden jetty in 1864 and the development of anchorage and lighterage facilities enabled sustained export of salt, cotton, palmyrah products, dry fish, and medicinal plants, while facilitating imports of coal, grains, and pulses. By the late 19th and early 20th centuries, the port had emerged as one of the busiest minor ports on the eastern coast.

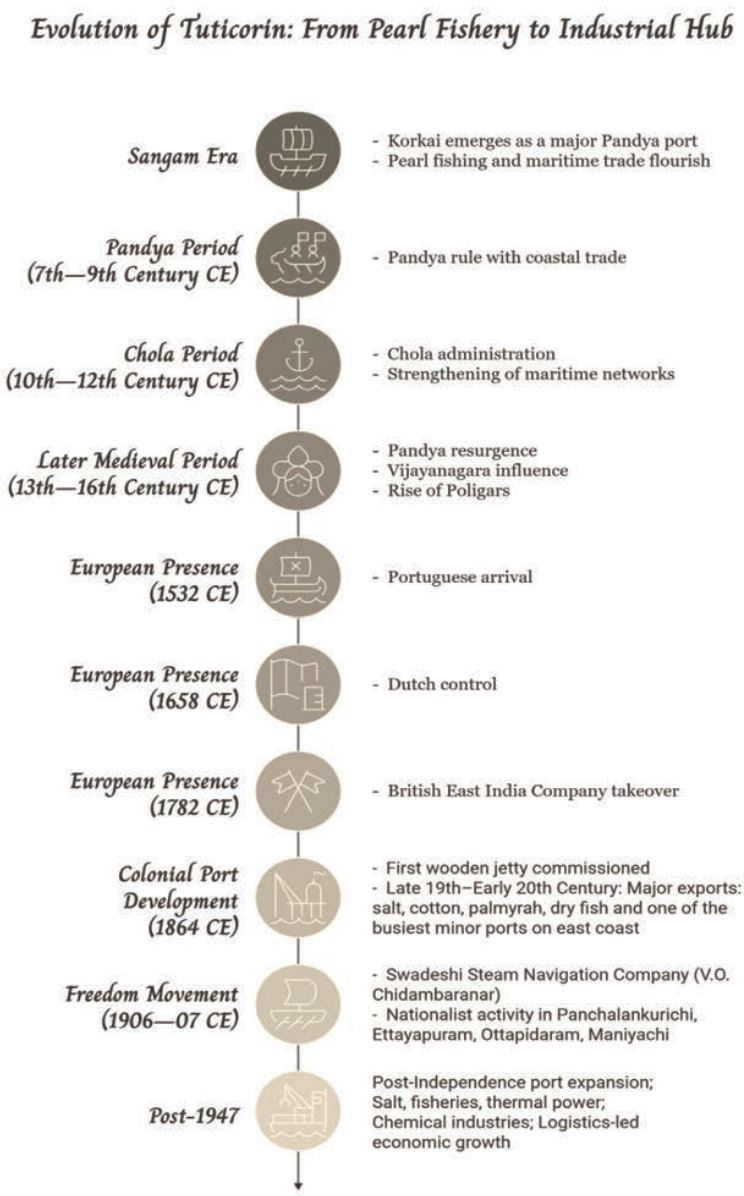


Figure 2.1 Historical Background of Thoothukudi District

The district also played a pivotal role in India's freedom movement. Thoothukudi became a nucleus of nationalist activity under the leadership of V.O. Chidambaranar, who launched the Swadeshi Steam Navigation Company in 1906–07 to challenge British maritime monopoly. The freedom movement extended beyond the port town and found expression across key centres such as Panchalankurichi, Ettayapuram, Ottapidaram, and Maniyachi, embedding the district firmly within the broader narrative of resistance and reform.

In the post-independence period, Thoothukudi's historical trading foundations evolved into a diversified economic base. Port expansion, salt manufacturing, fisheries, thermal power generation, chemical industries, and logistics-driven activities reshaped the district's spatial and economic character. The continuity from ancient maritime exchange to modern industrial infrastructure reflects the district's enduring relationship with the sea and trade-led growth.

2.2.2 Administrative Background and Chronological Change

Administratively, Thoothukudi District represents a relatively recent but strategically significant reorganization within Tamil Nadu's territorial framework. Until the late 20th century, the present district formed part of the larger Tirunelveli District, functioning primarily as its eastern coastal and port-oriented extension. Governance during the colonial and early post-independence periods was thus shaped by Tirunelveli's agrarian-administrative priorities, with Thoothukudi serving as a maritime and commercial sub-region.

A major administrative milestone occurred on 20th October 1986, when Thoothukudi District was carved out of Tirunelveli District to enhance governance efficiency and support region-specific development. The newly formed district was initially named V.O. Chidambaranar District, commemorating the freedom fighter whose contributions were deeply rooted in the region's maritime and nationalist history. In line with state-wide administrative practice, the district was renamed Thoothukudi District in 1997, adopting the name of its headquarters town.

This reorganization marked a decisive shift in administrative focus—from agrarian hinterland management to port-led industrial and coastal development. The formation of a separate district enabled targeted investments in port infrastructure, industrial estates, fisheries harbours, and coastal settlements. Administrative decentralization also facilitated improved delivery of civic services across diverse landscapes, including coastal belts, arid interiors, industrial zones, and historically significant rural settlements.

Over time, Thoothukudi District evolved as a specialized coastal-industrial node within southern Tamil Nadu. Its administrative consolidation strengthened linkages with neighbouring districts such as Tirunelveli, Tenkasi, and Virudhunagar, fostering complementary economic relationships between agriculture, industry, power generation, and logistics. Rather than diminishing its regional role, the district's administrative redefinition enhanced its strategic importance as a gateway for maritime trade, energy infrastructure, and export-oriented industries.

Thus, the chronological evolution of Thoothukudi District—from an ancient port region under imperial dynasties to a modern administrative unit—underscores how governance restructuring, when aligned with geographic and economic realities, can reinforce regional identity and development trajectories.

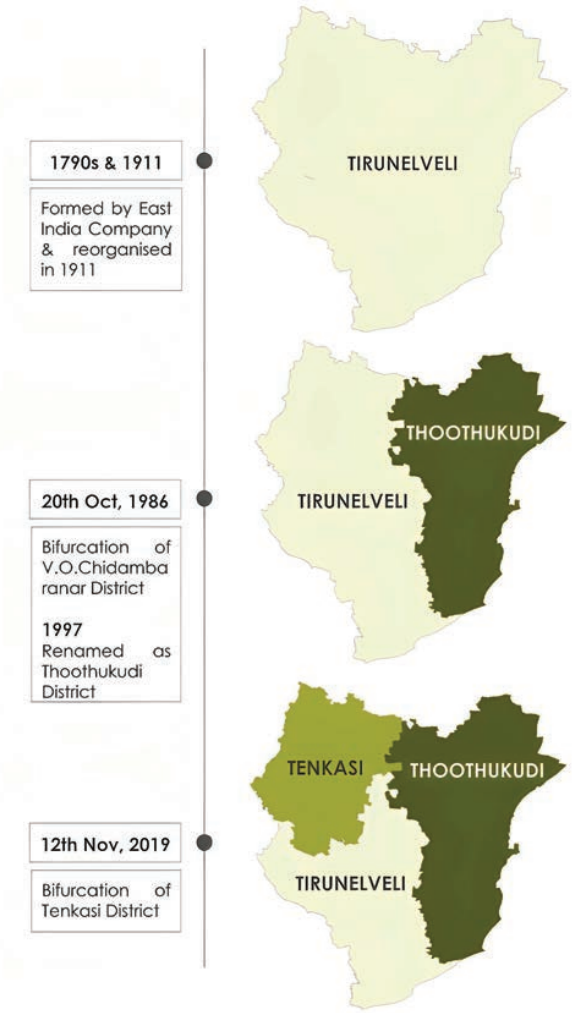


Figure 2.2 Administrative Chronological Change of Thoothukudi District

2.3 Natural Setting of Thoothukudi

Thoothukudi district is characterized by a complex and well-evolved geological and physiographic setting. The region comprises a meta-sedimentary lithopackage interbanded with charnockite group rocks belonging to the Eastern Ghats Supergroup of Archaean age. The interior areas are dominated by Precambrian crystalline formations, including quartzite, calc-granulite, and high-grade gneisses such as garnet–biotite–sillimanite and garnet–biotite–cordierite, while the coastal and offshore zones are overlain by Mesozoic to Recent sedimentary sequences. These crystalline complexes are unconformably capped by Tertiary and Quaternary deposits comprising alluvium, red soil, coastal sand, and extensive salt pan sediments. Structurally, the district is

influenced by fault systems exhibiting neo-tectonic activity, particularly in the Palk Bay–Gulf of Mannar sector, indicating potential seismic sensitivity associated with high heat flow and gravity anomalies. The district also holds considerable economic importance due to the presence of crystalline limestone, multi-color dimension stone, gypsum, and heavy mineral sands such as ilmenite.

Hydrologically and geomorphologically, Thoothukudi exhibits an eastward-sloping undulating terrain draining toward the Bay of Bengal through a predominantly co-linear drainage pattern. The Tamiraparani River is the only perennial river system, while the Vaippar and Karamaniyar function as ephemeral channels activated during intense rainfall events. The Buckle Canal remains a critical urban drainage corridor within Thoothukudi city, facilitating stormwater discharge to the sea. Geomorphological features reflect the combined influence of fluvial, marine, aeolian, and erosional processes, resulting in landforms such as beach ridges, sand dunes, back swamps, and coastal plains. A distinctive regional feature is the development of "teri" red sandy tracts, forming extensive coastal belts approximately 6–8 km inland. Geographically located in the south-eastern extremity of Tamil Nadu, the district is bounded by Virudhunagar and Ramanathapuram to the north, Tirunelveli to the west and south-west, and the Bay of Bengal to the east, reinforcing its strategic coastal, ecological, and economic significance.

2.4 Connectivity and Regional Linkages

The Thoothukudi Local Planning Area (LPA) occupies a strategically superior position within the southern peninsular transport and logistics network, emerging as a dominant maritime–industrial gateway that integrates Tamil Nadu's hinterland with global trade corridors. Situated along the Gulf of Mannar and in close proximity to the East–West international shipping routes, Thoothukudi functions as the primary sea gateway of Tamil Nadu, complementing and competing with emerging transhipment nodes such as Vizhinjam International Transhipment Deepwater Multipurpose Seaport (Kerala) and the proposed Colachel Port near the Tamil Nadu–Kerala border.

While Vizhinjam is being developed primarily as a container transshipment port with limited hinterland industrial integration, Thoothukudi distinguishes itself through its deep multi-modal connectivity, extensive industrial base, and direct access to the southern Tamil Nadu manufacturing and mineral belts. The port's transformation into a global logistics and transshipment hub is anchored by the Rs.7,056 crore Outer Harbour Project (PPP mode), envisaged to position the V.O. Chidambaranar Port Authority (VOCPA) as a Mother Vessel–handling port, thereby reducing India's reliance on Colombo, Singapore, and foreign transshipment hubs.

This evolving connectivity framework is further reinforced by regionally significant economic drivers such as the $2 billion VinFast Electric Vehicle manufacturing complex and the ISRO Spaceport at Kulasekarapattinam, both of which elevate Thoothukudi's role from a regional transport hub to a strategic national logistics and industrial node. Through seamless integration of road, rail, air, and maritime systems, the LPA anchors the movement of goods and people across southern Tamil Nadu, linking districts such as Tirunelveli, Tenkasi, Madurai, Virudhunagar, Ramanathapuram, and Theni to international markets in Europe, the Middle East, Southeast Asia, and East Asia.

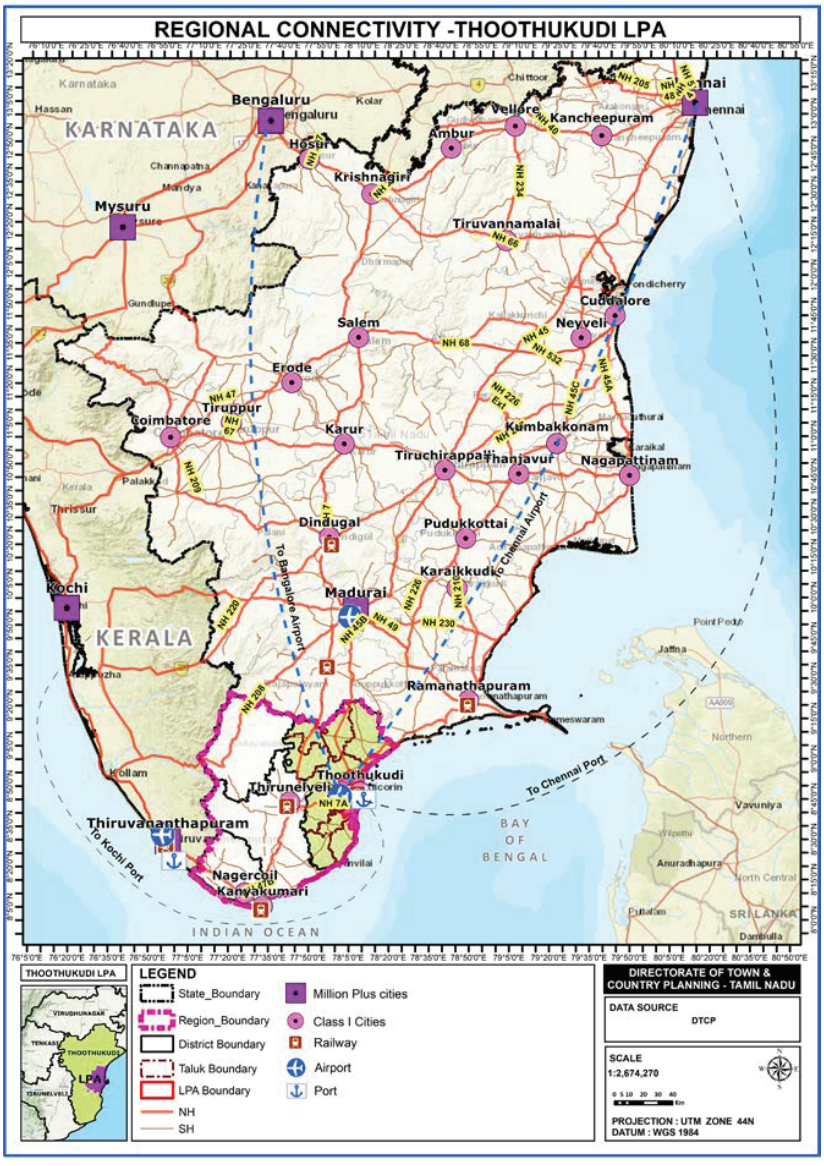
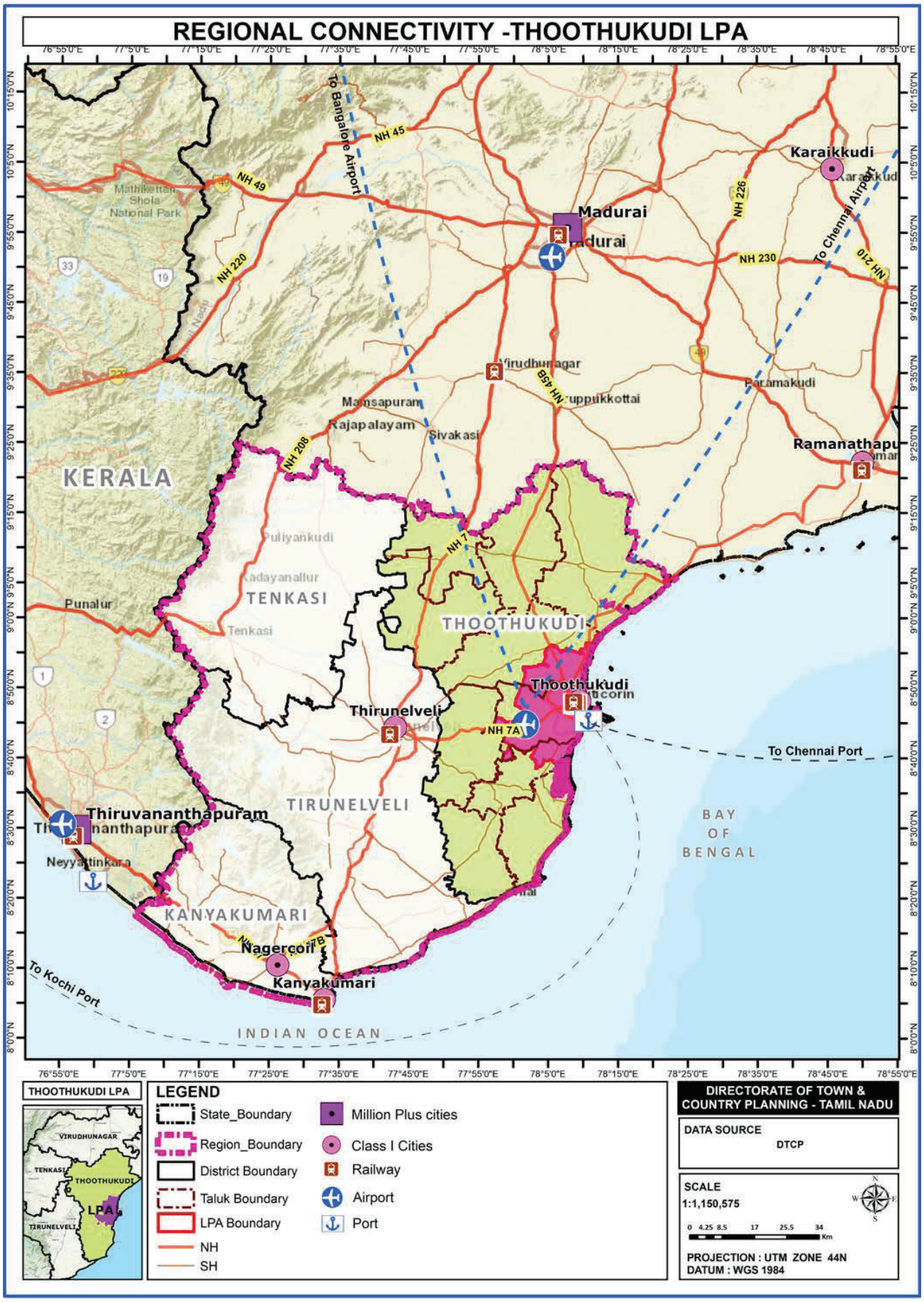


Figure 2.3 Regional Connectivity



Map 2.2 Regional Connectivity of Thoothukudi LPA

2.4.1 Road Connectivity

Road connectivity forms the foundational layer of regional integration for the Thoothukudi LPA, linking the coastal industrial economy with the interior districts of Tamil Nadu and the inter-state corridors toward Kerala and Karnataka. The LPA is served by a network of three National Highways, positioning it as a key junction between coastal corridors and inland economic belts.

NH-32 (East Coast Corridor) connects Thoothukudi northward to Chennai, running parallel to the Coromandel Coast and facilitating the large-scale movement of port-led commodities such as salt, chemicals, fertilizers, seafood, and containerized cargo. This corridor also acts as a complementary coastal alternative to the interior NH-44 spine, strengthening redundancy and resilience in the state's logistics network.

NH-138, extending approximately 54 km, links Thoothukudi to Tirunelveli and onward to NH-44 (North–South Corridor), India's longest highway. This linkage is critical for interstate freight movement toward Bengaluru, Hyderabad, Nagpur, and northern consumption centers. The corridor also supports passenger mobility between Thoothukudi and the Tirunelveli–Tenkasi urban region, which functions as a secondary growth pole.

NH-38 provides a direct east–west axis connecting Thoothukudi with Madurai and Tiruchirappalli, integrating the LPA with central Tamil Nadu's industrial, educational, and healthcare hubs. This route strengthens Thoothukudi's hinterland reach in comparison to ports like Colachel, which lack strong multi-directional road penetration.

At the regional scale, State Highways SH-49 and SH-176 play a pivotal role in linking Thoothukudi to Ramanathapuram, Tiruchendur, and the upcoming ISRO Spaceport at Kulasekarapattinam. The SH-176 corridor, in particular, has acquired strategic national importance, necessitating geometric upgrades and capacity enhancement to handle high-precision aerospace logistics and heavy equipment movement.

Beyond Tamil Nadu, the Senkottai–Tenkasi–Aryankavu road corridor establishes an important inter-state gateway to Kerala, connecting Thoothukudi's port and industrial outputs to Kollam, Thiruvananthapuram, and the southern Kerala markets. This corridor complements the maritime competition posed by Vizhinjam by ensuring that Tamil Nadu retains strong surface connectivity into Kerala's consumer regions.

Within the LPA, the road-based public transport system is structured around the Thoothukudi New Bus Stand (Anna Bus Stand) and the Old Bus Stand, which together form a dual-node transit system. While the New Bus Stand handles inter-district and inter-regional services to Madurai, Tirunelveli, Coimbatore,

Trichy, and Chennai, the Old Bus Stand anchors intensive town bus operations serving industrial estates, port zones, and residential neighborhoods.

Operations by Tamil Nadu State Transport Corporation (TNSTC – Tirunelveli Division) and State Express Transport Corporation (SETC) ensure high-frequency connectivity across southern Tamil Nadu and neighboring states including Kerala and Karnataka. This robust bus network plays a crucial role in supporting the daily workforce employed in the port, SIPCOT industrial complexes, thermal power plants, and emerging green energy clusters, reinforcing Thoothukudi's socio-economic integration with its regional hinterland.

2.4.2 Rail Connectivity

Rail connectivity places Thoothukudi within the core framework of southern India's freight and passenger rail system, offering a strategic advantage over emerging ports such as Vizhinjam, which currently lack comparable rail penetration. The LPA falls under the Madurai Division of Southern Railway, with a hierarchy of stations catering to passenger movement, industrial freight, and port-linked logistics.

Thoothukudi Railway Station (TN), a Grade-A terminal, functions as the principal passenger gateway, providing direct express connectivity to Chennai and regular services to Madurai, Tirunelveli, Coimbatore, Mysuru, and Palakkad. Supporting stations such as Tuticorin Melur (TME) serve northern residential and institutional areas, while Milavittan and Kailasapuram cater to freight handling and industrial workforce movement near SIPCOT and port-related industries.

A critical regional asset is Vanchi Maniyachchi Junction (MEJ), located approximately 30 km from Thoothukudi. This junction acts as the principal rail bifurcation point for south Tamil Nadu, splitting Chennai-bound traffic toward Thoothukudi and Tirunelveli–Kanyakumari. This configuration enables efficient routing of both passengers and freight and enhances Thoothukudi's accessibility relative to ports lacking junction-level integration.

Inter-state and long-distance connectivity are strengthened by services such as the Tuticorin–Mysuru Express, Vivek Express to Okha (Gujarat), and bi-weekly services to Coimbatore and Mettupalayam, linking the LPA to national tourism, industrial, and pilgrimage circuits.

The ongoing Madurai–Maniyachchi–Thoothukudi Doubling Project, which achieved major milestones by late 2025, is a transformative capacity enhancement initiative aimed at eliminating single-line constraints and improving schedule reliability. Additionally, the 17.6 KM dedicated port rail line connecting VOC Port to the national rail network is being upgraded for

long-haul freight operations, supporting Direct Port Delivery (DPD) and Direct Port Entry (DPE) systems. These rail upgrades firmly position Thoothukudi as the most rail-integrated port in southern Tamil Nadu, surpassing both Colachel and Vizhinjam in hinterland rail access. These enhancements are critical for the "Direct Port Delivery" and "Direct Port Entry" initiatives, reducing the dwell time of cargo and lowering the overall logistics cost for exporters in the southern districts.

2.4.3 Air Connectivity

Air connectivity for the Thoothukudi LPA is anchored by Tuticorin Airport (Vagaikulam), located approximately 26–30 KM from the city along NH-138. The airport provides vital regional and business travel connectivity, complementing surface and maritime transport systems.

The airport maintains strong domestic linkages, with Chennai as the primary node through frequent daily flights operated by IndiGo and SpiceJet, ensuring seamless access to administrative, financial, and international gateways. Bengaluru serves as the secondary hub, supporting the technology, automotive, and engineering ecosystem linked to EV manufacturing and green hydrogen projects.

While international air travel is currently dependent on Madurai International Airport and Chennai, the planned expansion of Tuticorin Airport—including the proposed Air Cargo Complex—is expected to significantly enhance the LPA's logistics capabilities. This facility will cater to high-value, time-sensitive cargo from electronics, EV components, and advanced manufacturing sectors, providing critical just-in-time connectivity that aligns with global supply chain requirements.

2.4.4 Cargo and Logistics

The V.O. Chidambaranar Port (V.O.C Port) stands at the core of Thoothukudi's regional and international connectivity framework. Strategically located along the Coromandel Coast and within close proximity to the East–West international shipping route, the port enjoys a locational advantage over competing ports such as Vizhinjam and the proposed Colachel Port.

VOC Port is currently the only port in South India offering direct weekly mainline services to the United States and Europe, significantly reducing transit time and logistics costs by bypassing intermediate transshipment hubs. Regular direct connectivity to China, Colombo, and Red Sea ports further reinforces its global maritime integration. The berthing of the M.V. MSC Michaela (6,724 TEUs) in December 2025 marks a defining milestone, demonstrating the port's readiness to handle large mainline vessels.

The Outer Harbour Container Terminal Project (Rs.7,056 crore) is a cornerstone initiative aimed at increasing draft depth to 16–18 meters, enabling the accommodation of mother vessels and positioning Thoothukudi as a true transshipment alternative to Colombo and Vizhinjam. In parallel, the allocation of 501 acres for a Green Hydrogen Hub, with proposed investments exceeding Rs.41,860 crore, underscores the port's evolution into a future-oriented energy and logistics hub.

By combining deep-sea access, robust rail and road connectivity, and proximity to key industrial and cultural nodes such as Adichanallur, Thoothukudi LPA emerges as the most comprehensive and resilient logistics gateway in southern Tamil Nadu, anchoring regional development while integrating seamlessly with national and global transport networks.

2.5 Thoothukudi District Profile

2.5.1 Administrative Boundaries and Jurisdiction

Thoothukudi District is administratively organized to manage a diverse landscape comprising coastal belts, industrial zones, inland agrarian regions, and port-oriented settlements. For effective revenue administration, the district is divided into three revenue divisions, which are further subdivided into ten taluks, ensuring decentralized governance and service delivery.

- Thoothukudi Revenue Division includes the taluks of Thoothukudi and Srivaikundam.
- Tiruchendur Revenue Division covers Tiruchendur, Sattankulam and Eral taluks.
- Kovilpatti Revenue Division comprises Kovilpatti, Ettayapuram, Vilathikulam, Ottapidaram and Kayathar taluks.

Urban governance within the district is anchored by Thoothukudi Municipal Corporation, which functions as the principal civic authority for the district headquarters and the core urban area. In addition, the district has 3 Municipalities – Kovilpatti, Thiruchendur, Kayalpattinam and 18 town panchayats such as Ettayapuram (TP), Kayathar (TP), which administer secondary urban centres, addressing localized infrastructure, housing, and service needs.

This multi-tier administrative framework supports balanced governance across urban, peri-urban, and rural areas, enabling the district to respond effectively to its dual role as a port-driven industrial hub and an agrarian hinterland while facilitating coordinated regional development and service delivery.

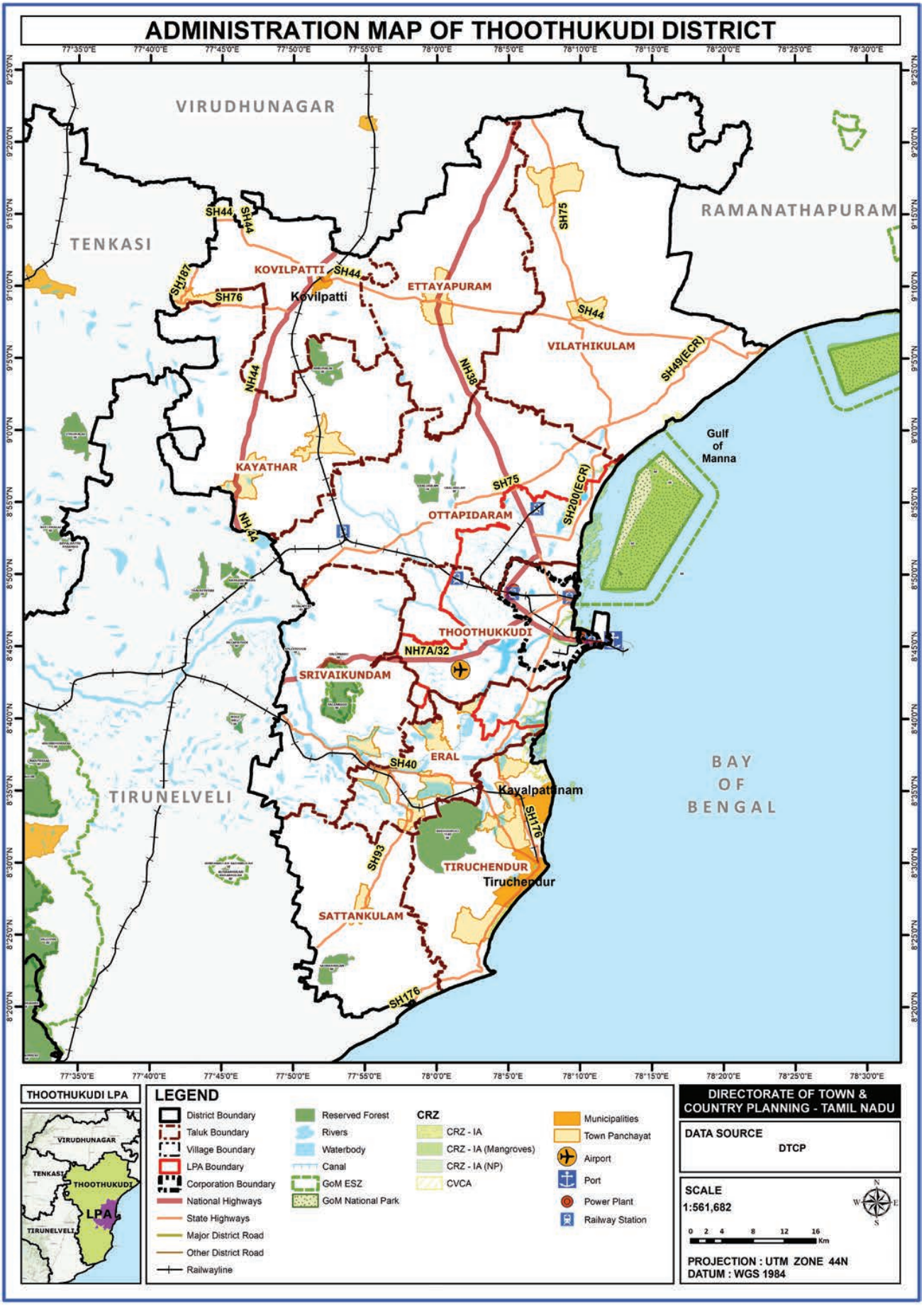
2.5.2 Urban and Rural Profile

Thoothukudi District exhibits a moderate level of urbanisation, shaped by its coastal location, port-led industrial activities, and the presence of established commercial and service centres. As per the 2011 Census, 50.1% of the district's population resides in urban areas, indicating a balanced distribution between urban and rural settlements. The spatial pattern of urbanisation varies significantly across the ten taluks, reflecting differences in economic structure, settlement hierarchy, and functional roles.

- Among the taluks, Thoothukudi Taluk records the highest level of urbanisation, with 86.1% of its population residing in urban areas, attributable to its role as a major port city and industrial centre.
- Kovilpatti Taluk also exhibits a high degree of urbanisation, with 59.4% of its population classified as urban, supported by manufacturing activities, trade, and regional connectivity.
- Tiruchendur Taluk, characterised by religious tourism and allied service functions, shows a comparatively high urban share of 54.6%.

While taluks such as Vilathikulam (17.3%), Ettayapuram (17.0%), and Sathankulam (14.4%) remain predominantly rural, with settlement patterns largely dependent on agriculture, livestock rearing and allied primary-sector activities. Srivaikuntam Taluk, with an urban population share of 22.3%, exhibits a semi-rural character, supported by irrigation-based agriculture sustained by the Tamiraparani river system. The remaining taluks display mixed rural–urban characteristics, reflecting gradual transitions influenced by accessibility, economic diversification, and proximity to major urban centres.

Overall, the urban structure of Thoothukudi District reflects a well-defined functional hierarchy, wherein highly urbanised taluks serve as centres for industry, trade, services, and employment generation. These urban centres provide critical market linkages, industrial demand, and institutional support, while the surrounding rural areas contribute agricultural produce, marine resources, and labour supply. This interdependent relationship between urban and rural areas reinforces economic complementarities and supports balanced regional development, forming an integrated spatial system that underpins the district's socio-economic structure and long-term development trajectory.



Map 2.3 Administration Map of Thoothukudi District

2.5.3 Economic Significance of Thoothukudi

Thoothukudi District holds substantial economic importance within southern Tamil Nadu due to its strategic coastal location and port-based industrial ecosystem. The district's economy is anchored by V.O. Chidambaranar Port, one of India's major ports, which facilitates bulk cargo handling, container traffic, and energy-related imports, positioning Thoothukudi as a key maritime gateway for the southern region.

Industrial activity in the district is diversified, encompassing thermal power generation, petrochemicals, fertilizers, salt-based industries, cement, and heavy manufacturing. The presence of large industrial estates and port-linked logistics infrastructure has strengthened the district's role in energy security and export-oriented production. Reflecting this economic base, Thoothukudi accounted for approximately 1.8% of Tamil Nadu's per capita income in 2022–23, indicating its measurable contribution to the state economy.

Agriculture and allied sectors continue to play a vital role in the district's economy. Thoothukudi is a leading producer of salt, contributes significantly to cotton and pulse cultivation, and supports a robust fisheries sector, providing livelihoods to a substantial coastal population. These primary-sector activities also feed into downstream processing and trade.

The tertiary sector has been expanding steadily, supported by port services, transport and warehousing, education, healthcare, and pilgrimage tourism, particularly centered around Tiruchendur. Improved road and rail connectivity have further integrated the district with regional markets across southern Tamil Nadu.

Overall, Thoothukudi District's economic significance lies in its ability to integrate maritime trade, industrial production, and resource-based livelihoods, reinforcing its role as a critical growth pole within the state's coastal and industrial development framework.





Profile of LPA



3.1 Introduction

The Thoothukudi Local Planning Area (LPA) encompasses a well-defined administrative and settlement structure that supports balanced regional development. The LPA consists of one Municipal Corporation—the Thoothukudi Corporation—which functions as the primary urban centre and the core of economic, industrial, and service-based activities in the region.

Beyond the corporation limits, the rural fabric of the Thoothukudi LPA comprises 34 Revenue Villages, distributed across three major Blocks namely Thoothukudi, Srivaikundam, and Ottapidaram. These blocks form the essential administrative units that facilitate local governance, developmental schemes, and land management activities within the planning area.

The Revenue Villages within the Thoothukudi, Srivaikundam and Ottapitadaram blocks represent the diverse socio-economic and geographical characteristics of the LPA, contributing significantly to agriculture, fisheries, small-scale industries, and traditional livelihoods. Their inclusion within the LPA boundary ensures an integrated approach to urban–rural development, infrastructure provision, and land-use regulation.

The presence of a single Corporation surrounded by strategically located rural settlements enables a coherent planning framework that supports growth corridors, connectivity improvements, and sustainable land utilisation. A detailed delineation of the Corporation and the Revenue Villages are provided in the Table 3.1, Map 3.1.

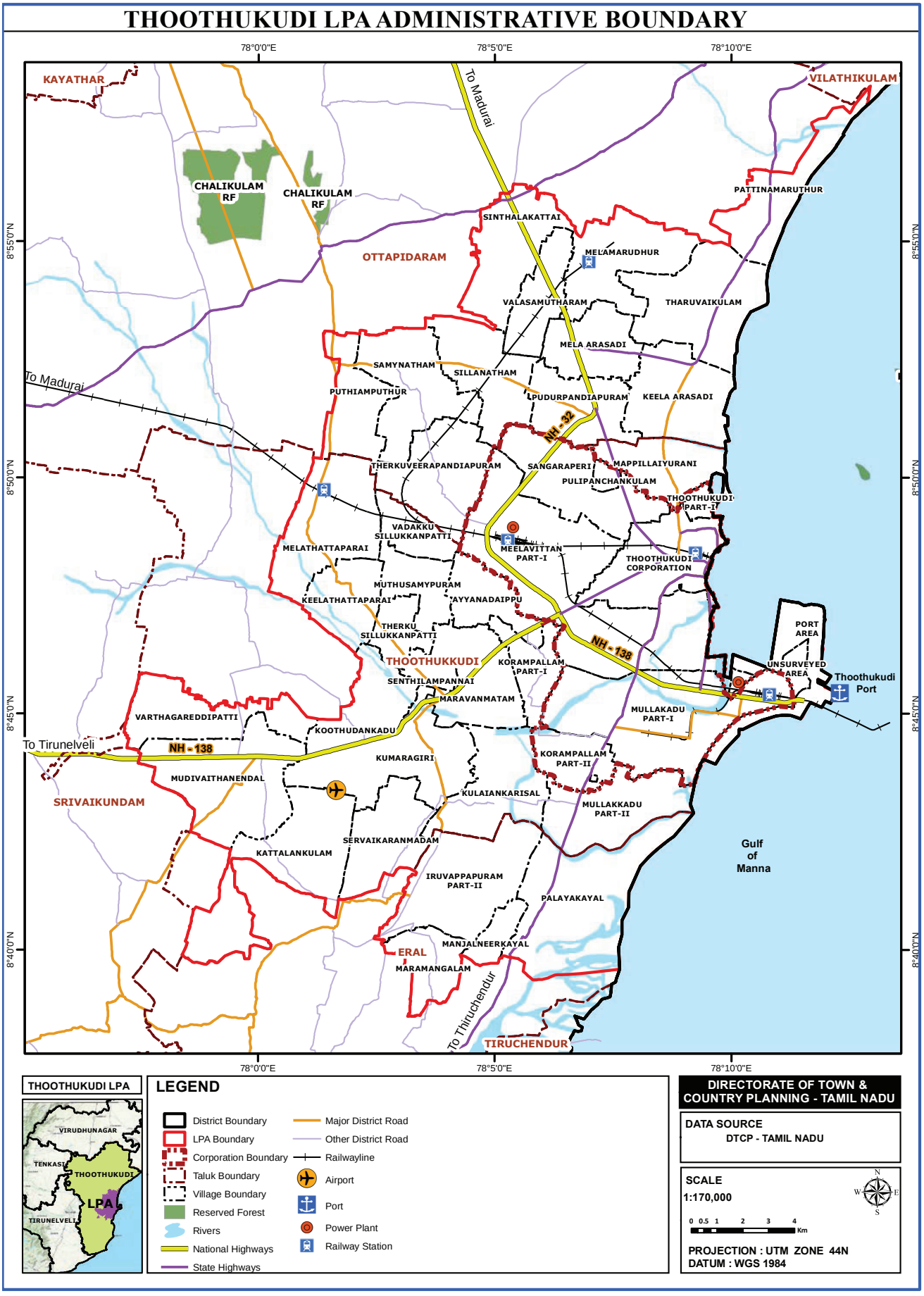
Table 3-1: Administrative Summary of Thoothukudi Local Planning Area

S. No.	Administrative Category	No. of Local Bodies		Area (in Sq.km)
1	Municipal Corporation	1		**90.66**
2	Revenue Villages	34		**372.96**
Thoothukudi		18	**183.6**	
Srivaikundam		4	**49.36**	
Ottapidaram		12	**140**	
Total				**463.62**

3.2 Thoothukudi LPA – Urban Morphology

Thoothukudi's urban morphology has evolved primarily in response to its strategic coastal location and long-standing role as a maritime port. The city's earliest spatial structure developed along the shoreline around the natural harbour, where fishing hamlets, pearl-diving communities, salt pans, and indigenous trading activities formed a compact and organically grown settlement pattern. This historic core is characterised by narrow streets, high plot coverage, mixed land use, and strong functional linkage to the waterfront.

The establishment and gradual expansion of port infrastructure significantly influenced the city's physical form. The construction of the wooden jetty in



Map 3.1: LPA Boundary

1864 and subsequent port-related facilities led to the consolidation of port-oriented land uses such as warehouses, godowns, customs areas, and workers' housing. These developments introduced more organised street patterns and created distinct port–town interfaces, shaping linear growth along the coast and transport corridors.

Colonial administration further contributed to morphological differentiation within the city. Areas accommodating administrative buildings, railway infrastructure, and institutional uses displayed relatively planned layouts, while adjoining native residential areas continued to grow incrementally. The railway line and major arterial roads emerged as strong structuring elements, directing urban expansion inland and reinforcing a ribbon-like development pattern.

In the post-independence period, industrialisation became a major driver of urban form. Large industrial units, thermal power stations, port-based industries, and logistics facilities were located predominantly on the urban periphery and coastal stretches, resulting in functional zoning and spatial segregation. Residential neighbourhoods expanded around these employment nodes, leading to a mix of planned housing layouts and unplanned extensions.

The present-day urban morphology of Thoothukudi reflects a poly-nuclear structure, with the port, industrial estates, commercial spines, and residential clusters operating as interconnected urban nodes. Traditional fishing settlements, salt manufacturing areas, palmyra groves, and sand dune formations (Teris) continue to influence land-use patterns and impose natural constraints on urban expansion.

Overall, Thoothukudi's city form represents a layered morphological evolution shaped by maritime activity, port-led development, industrial growth, and transport infrastructure, resulting in a coastal-oriented, functionally zoned, and corridor-based urban structure.

3.3 LPA Notification

Thoothukudi Composite Local Planning Area (CLPA) comprises Thoothukudi Single Local Planning area was originally notified vide G.O.No.629, Rural Development and Local Administration, dated 4th April, 1975 under section 10(1) of Town and Country Planning Act, 1971 and was published in Part II section 2 of Tamil Nadu Government Gazette dated 30th April, 1975. The same was confirmed vide G.O. No.1340, Rural Development Local Administration dated 6th August, 1975 under section 10(4) of Town and Country Planning Act, 1971. Subsequently, it was consented under sub-section 2 of section 24 of Town and Country Planning Act, 1971 vide G.O.Ms.No. No.54, Housing and Urban Development Department, dated 11th January, 1991.

Single Local Planning Area (SLPA) of Thoothukudi was extended by adding 29 villages to form CLPA. The same was notified under section of 10 (1)(b) of the said Act vide G.O.Ms.No. No.853, Housing and Urban Development Department, dated 1st June 1983. It was confirmed under section of 10(4) of the said Act vide G.O.Ms.No.1620, Housing and Urban Development Department, dated 16th October, 1986. The Master Plan for rural area was consented under section 24(2) of Town and Country Planning Act, 1971 vide G.O.Ms.No.71, Housing and Urban Development Department, dated 10th February, 2000. Additionally, 9 more revenue villages were added to the planning area and notified under section 10(1)(b) of Town and Country Planning Act, 1971 vide G.O.Ms. No.149, Housing and Urban Development Department, dated 20th June 2013. Out of those 9 villages, 5 villages namely, Koothudankadu, Mudivaithanendal, Varthagareddipatti, Kattalankulam and Servaikaranmadam falls in Thoothukudi Taluk and 4 villages namely Melamarudhur, Valasamutharam, Sinthalakattai and Pattinamarudhur falls in Ottapidaram Taluk.

Table 3-2: LPA Notifications

Sl. No.	Government Order (G.O.)	Section of TCP Act, 1971	Description / Planning Area Status
1	G.O. No. 629, dated 04.04.1975	Section 10(1)	Notification of Thoothukudi Single Local Planning Area (SLPA)
2	G.O. No. 1340, dated 06.08.1975	Section 10(4)	Confirmation of SLPA notification
3	G.O.Ms. No. 54, dated 11.01.1991	Section 24(2)	Consent accorded to SLPA
4	G.O.Ms. No. 853, dated 01.06.1983	Section 10(1)(b)	Extension of SLPA by adding 29 villages, forming Composite Local Planning Area (CLPA)
5	G.O.Ms. No. 1620, dated 16.10.1986	Section 10(4)	Confirmation of CLPA extension
6	G.O.Ms. No. 71, dated 10.02.2000	Section 24(2)	Consent of Master Plan for Rural Areas
7	G.O.Ms. No. 149, dated 20.06.2013	Section 10(1)(b)	Addition of 9 more revenue villages to CLPA

3.4 Thoothukudi Corporation Administrative Evolution

Thoothukudi's urban governance framework has undergone a steady and structured evolution over more than a century. The town first attained municipality status in 1866, marking its formal entry into organized local administration under the colonial system. With continued urban growth and increasing administrative responsibilities, Thoothukudi was elevated to

a Second-Grade Municipality in 1986, signifying its rising demographic and economic prominence within the region.

A major milestone in Thoothukudi's civic development occurred in 2008, when it was upgraded and officially declared as the Thoothukudi Municipal Corporation. At the time of its formation in 2008, the newly constituted Corporation comprised 51 wards with the area of 15 Sq km, marking its initial organizational structure as an urban local body with enhanced administrative powers and responsibilities.

Further spatial expansion took place in 2011, when the Corporation boundaries were extended through the inclusion of five Village Panchayath from Thoothukudi District. These areas

- Korampallam Part-II (Athimarapatti)
- Meelavittan
- Sankaraperi
- Thoothukudi Part-II
- Mullakadu Part-I (Muthaiyapuram)

were incorporated to accommodate the city's outward growth and ensure comprehensive urban management. Following this expansion, the Thoothukudi Municipal Corporation attained a total jurisdictional area of 90.66 sq. km.

The Corporation is presently divided into 60 electoral wards, systematically grouped into four administrative zones to facilitate decentralized governance, improved service delivery, and effective local representation. The distribution of wards across these zones is as follows:

- North Zone: Wards 1–13 and 17–18
- East Zone: Wards 14–16 and 19–33
- West Zone: Wards 34–47
- South Zone: Wards 48–60

This zonal division supports structured municipal administration, enabling efficient management of civic functions such as solid waste management, urban infrastructure development, water supply, and public health services across the expanding urban landscape.

The key institutional and spatial characteristics of the Thoothukudi Municipal Corporation are presented in (Table 3.3-), providing a concise overview of its administrative profile within the broader Local Planning Area framework.

Table 3-3: Corporation VIllages

S.No	Villages	Administration Boundary	Area in SQ.Km
1	Korampallam Part-II	Corporation	**90.66**
2	Meelavittan Part-I		
3	Mullakadu Part-I		
4	Pulipanchankulam		
5	Sangaraperi		
6	Thoothukudi Corporation		
7	Thoothukudi Part-I		

Table 3-4: Profile of Thoothukudi Municipal Corporation

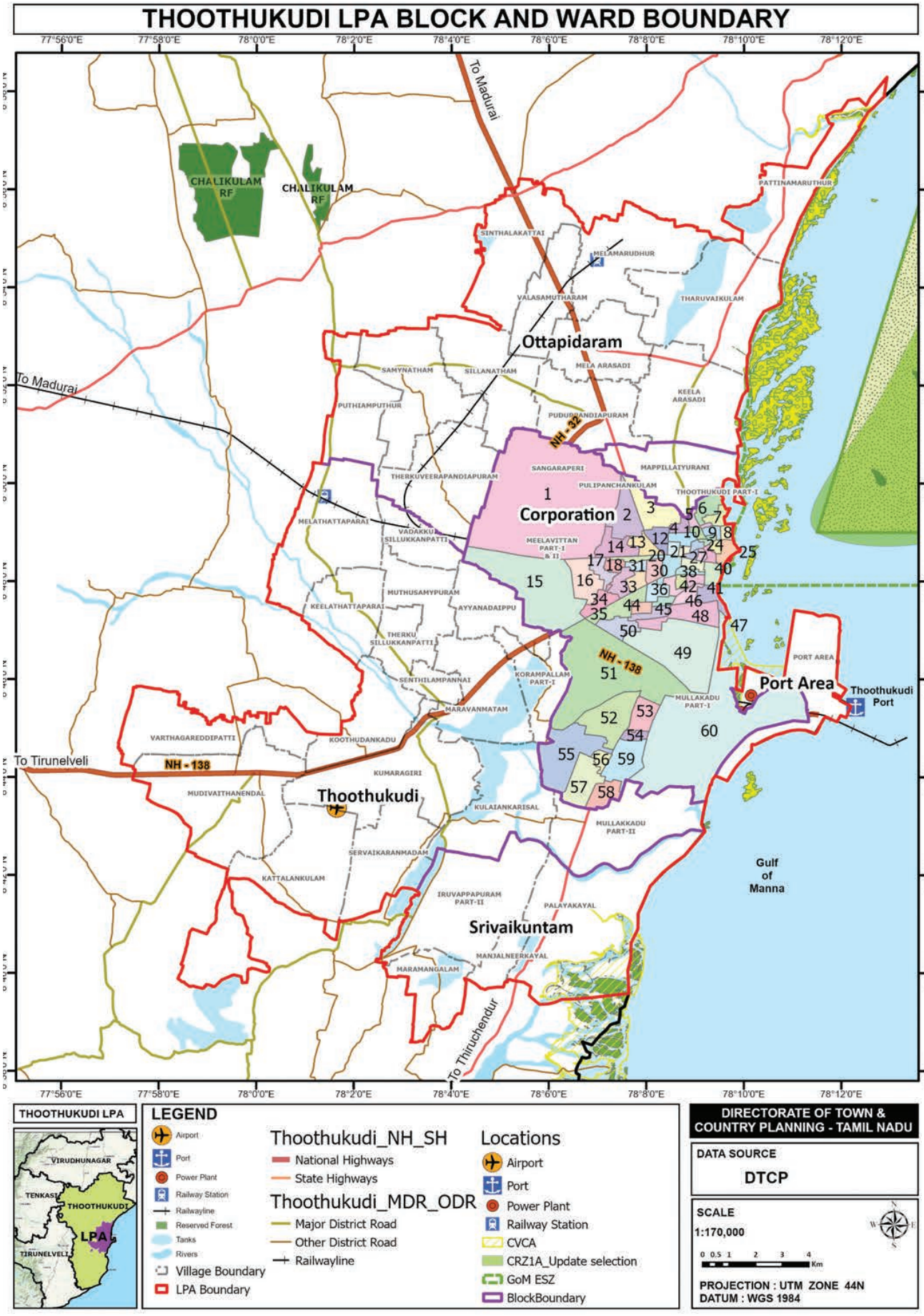
S.No	Description	2011	2025
1	Population	372408	533372
2	Population Density	41 persons/ha	59 persons/ha
3	Growth Rate	16.21 %	43.22 %

3.5 Village Panchayats

The Thoothukudi Local Planning Area (LPA) encompasses a total of 34 Village Panchayats, excluding the Thoothukudi Municipal Corporation area. The planning area is designed to manage the rapid industrial growth and urban spillover from the port city while preserving the rural and agricultural fabric of the surrounding regions. The block-wise distribution and characteristics are as follows

Table 3-5: Profile of Thoothukudi LPA VIllages

S.No	Description	2011	2025
1	Population	141905	230192
2	Population Density	4 persons/ha	6 persons/ha
3	Growth Rate	21.10 %	62.22 %



Map 3.2: Villages and Ward Boundary

3.1.1 Thoothukudi Block

The Thoothukudi block consists of 18 Village Panchayats. As the primary gateway to the district, this block is characterized by its maritime and industrial profile. It serves as a vital hub for port-related activities, salt production, and thermal power logistics. The inclusion of these panchayats in the LPA is crucial for managing urban expansion, ensuring seamless connectivity to the VO Chidambaranar Port, and providing the necessary infrastructure to support the workforce residing in these peripheral coastal and inland settlements.

Table 3-6: Thoothukudi Block Villages

S.No	Villages	Area in SQ.Km	Block	Area in SQ.Km
1	Ayyanadaippu	6.81	Thoothukudi Block	183.6
2	Kattalankulam	19.17		
3	Keelathattaparai	7.93		
4	Koothudankadu	8.91		
5	Korampallam Part-I	5.67		
6	Kulaiankarisal	12.70		
7	Kumaragiri	16.54		
8	Mappillaiyurani	8.79		
9	Maravanmatam	11.34		
10	Melathattaparai	15.58		
11	Mudivaithanendal	19.50		
12	Mullakkadu Part-II	12.67		
13	Senthilampannai	2.29		
14	Servaikaranmadam	10.35		
15	Therku sillukkanpatti	4.46		
16	Muthusamypuram	6.11		
17	Vadakku Sillukkanpatti	4.72		
18	Varthagareddipatti	11.49		

3.1.2 Srivaikundam Block

The Srivaikundam block includes 4 Village Panchayats within the LPA boundary. This block is defined by its rich agricultural and its location along the fertile banks of the Thamirabarani River. Known for its traditional irrigation systems and historic temple settlements, the block maintains a distinctively green and rural character. The LPA's focus here is on preserving fertile agricultural lands and managing the transition of these villages to ensure that development does not infringe upon the ecological and cultural significance of the river basin.

Table 3-7: Srivaikundam Block Villages

S.No	Villages	Area in SQ.Km	Block	Area in SQ.Km
1	Maramangalam	6.41	Srivaikuntam Block	49.36
2	Iruvappapuram Part-II	17.24		
3	Manjalneerkayal	3.01		
4	Maramangalam	6.41		
5	Palayakayal	22.81		

3.1.3 Ottapidaram Block

In the Ottapidaram block, 12 Village Panchayats fall under the LPA jurisdiction. This block holds significant historical importance and is characterized by its vast stretches of open land and semi-arid landscape. Currently serving as a rural-industrial transition zone, Ottapidaram is increasingly becoming a focus for large-scale infrastructure projects and industrial corridors. Its inclusion in the LPA ensures that the historical legacy of the region is protected while guiding the conversion of land for future industrial and residential growth in a planned and sustainable manner.



Table 3-8: Ottapidaram Block Villages

S.No	Villages	Area in SQ.Km	Block	Area in SQ.Km
1	Keela Arasadi	13.36	Ottapidaram Block	140
2	Sinthalakattai	12.54		
3	Mela Arasadi	8.89		
4	Melamarudhur	13.30		
5	Pattinamaruthur	10.80		
6	Pudurpandiapuram	9.81		
7	Puthiamputhur	8.74		
8	Samynatham	13.48		
9	Sillanatham	11.58		
10	Tharuvaikulam	17.58		
11	Therkuveerapandiapuram	12.87		
12	Valasamutharam	7.37		





Administration and Governance



4.1 Introduction

Administrative governance forms the backbone of effective urban planning and implementation. In the context of the Master Plan, it refers to the institutional framework, decision-making processes, and inter-agency coordination mechanisms that ensure policies and proposals are translated into tangible outcomes. It is important to understand the existing administrative setup, including urban local body administration, development administration, and electoral constituencies, while also focusing on strengthening institutional capacity.

It is equally important to examine the statutory functions, powers, and responsibilities of various administrative units, with emphasis on their role in implementing the Master Plan. Special attention is given to the governance mechanisms of urban local bodies, highlighting their obligatory and discretionary functions as outlined in the 74th Constitutional Amendment Act, 1992. In addition, key stakeholders such as municipal corporations, town panchayats, and line departments must be identified.

4.2 Administration Setup

The Thoothukudi district covers **4,707 sq.km.** it is led by the District Collector, which acts as the main authority to coordinate between departments and implement policies. Under it, there are three main parts:

- Revenue Administration,
- Local Bodies Administration, and
- Development Administration.

The Revenue Administration handles land records, taxes, and rules; the Local Bodies Administration, which includes the Thoothukudi Corporation, Municipalities, and Town Panchayats, manages public services, civic facilities, and community needs and the Development Administration focuses on building infrastructure, improving city areas, housing projects, and economic growth. These three parts work together to form the main support for Thoothukudi district urban governance.

4.3 Revenue Administration

The revenue administration of Thoothukudi district is organised into three revenue divisions, all of which fall within the Thoothukudi Local Planning Area (LPA). The district's 10 taluks, 3 are included in the LPA, reflecting its wide coverage of the district's administrative framework. Similarly, the LPA comprises 8 of the 41 firkas and 480 of the 42 revenue villages in the district. This distribution highlights that the LPA encompasses the majority of the district's revenue administration units, particularly at the divisional and taluk levels. The revenue administration of Thoothukudi district and its coverage under the LPA is presented in Table 4.1.

Table 4.1 Revenue Administration in Thoothukudi District and Local Planning Area

Parameters	Thoothukudi District	Thoothukudi LPA
Revenue Administration		
Revenue Divisions	3	3
Taluks	10	3
Firkas	41	8
Revenue Villages	403	32

Source : Thoothukudi District

Within the Thoothukudi Local Planning Area (LPA), the revenue divisions of Thoothukudi, Thoothukudi, Tiruchendur and Kovilpatti fall under its jurisdiction. Of the 10 taluks in the district, 3 taluks—namely Ottapidaram, Thoothukudi and Eral Taluks are encompassed within the planning area.

In terms of sub-divisions, 8 out of the 41 firkas are situated within the LPA. Similarly, out of the total 480 revenue villages in the district, 42 villages fall within the boundaries of the Thoothukudi Local Planning Area. This distribution underscores significant administrative coverage of the LPA in relation to the overall district framework.

District Collector as the head of administration and revenue in Thoothukudi District, plays a central role in governance and development. He ensures effective coordination across all line departments, integrating their functions with the district's overall growth objectives and District collector as the Chairman of the Thoothukudi Local Planning Authority. The District Collector has a pivotal role in land administration, infrastructure development, and public service delivery, while also regulating land acquisition, resettlement, and maintaining law and order in development activities. By bridging state-level directives with local-level execution, the Collector guides Thoothukudi's growth in line with its development vision, ensuring sustainability and resilience.

District Revenue Officer supports the District Collector in strengthening revenue administration, which is vital for implementing the Thoothukudi Master Plan. The DRO is responsible for overseeing land records, revenue collection, and the resolution of land disputes, ensuring that land earmarked for residential, commercial, and infrastructure projects is managed legally and efficiently. In the absence of the Collector, the DRO functions as the head of the revenue staff, thereby maintaining continuity in governance and administrative control. This role is particularly crucial in facilitating land acquisition and conversion processes required for planned urban expansion.

The Revenue Divisional Officer oversees land acquisition, revenue appeals, and law and order at the divisional level, supervising Tahsildars across taluks. Their role is crucial in ensuring that development projects align with land use zoning and master plan objectives while resolving local issues.

Tahsildar as the head of taluk administration, plays a key role in revenue collection, maintaining land records, and managing law and order at the taluk level. They are responsible for services like patta transfers, land mutations, and issuing community, nativity, and income certificates. In the context of urban governance and master plan implementation, the Tahsildar ensures that land-related processes support planned development and equitable service delivery

Village Administrative Officer (VAO) is the primary revenue functionary at the village level, maintaining land records and village accounts. They handle tax collection and assist citizens in obtaining essential revenue-related certificates. In the context of governance, the VAO supports grassroots-level implementation of land management and development provisions aligned with the master plan.

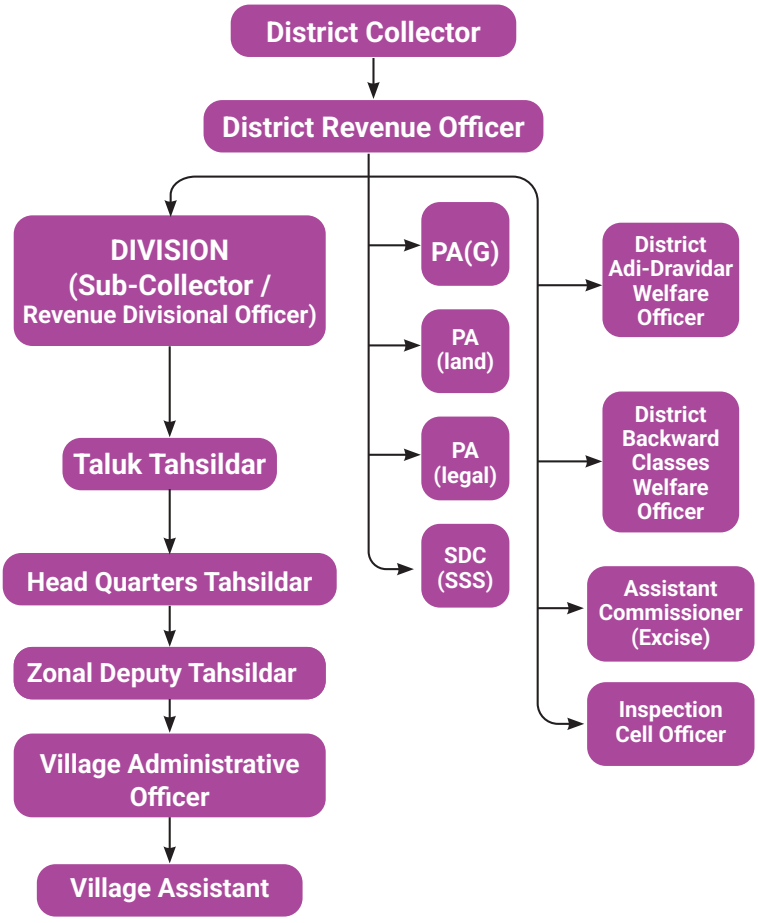
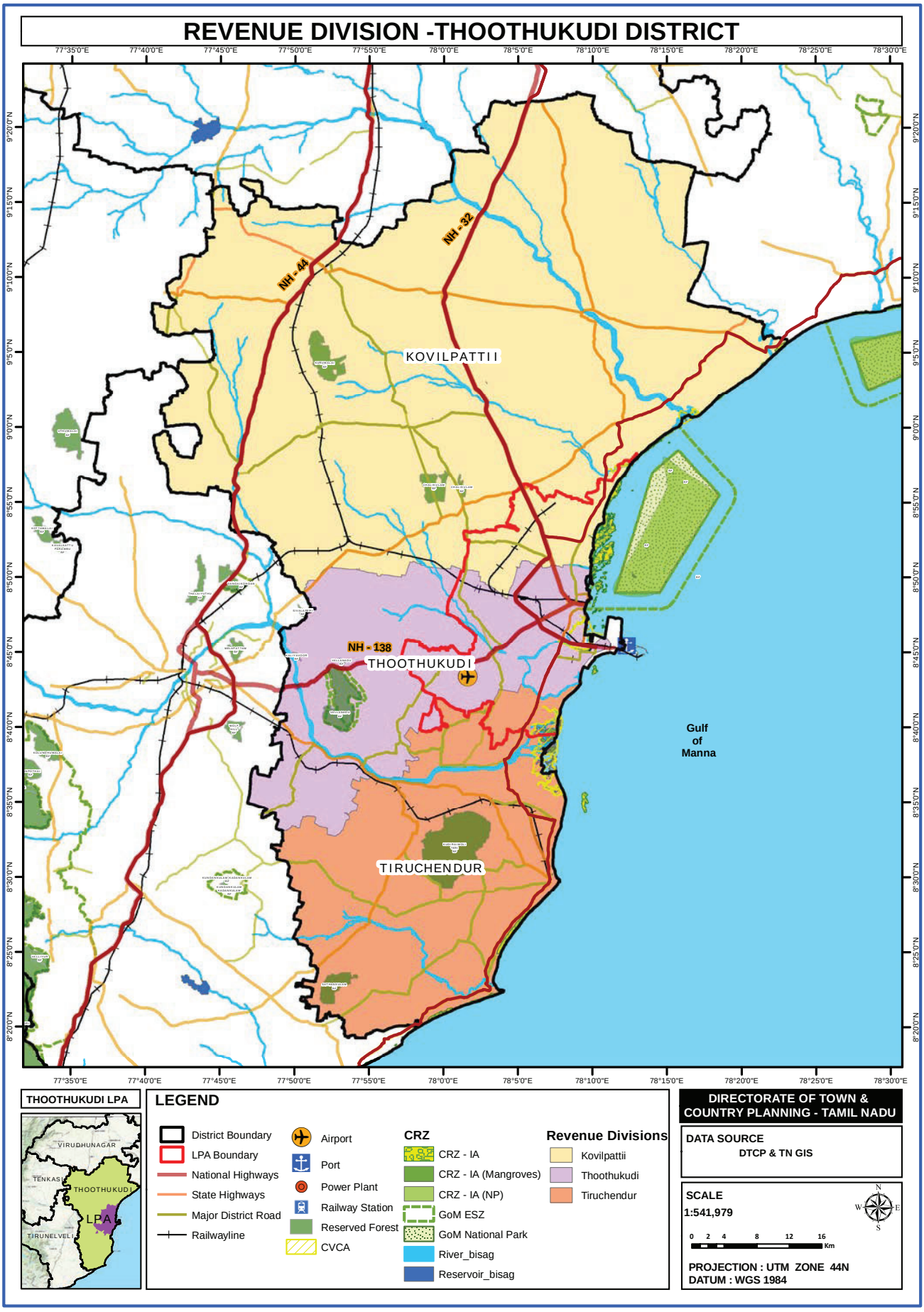
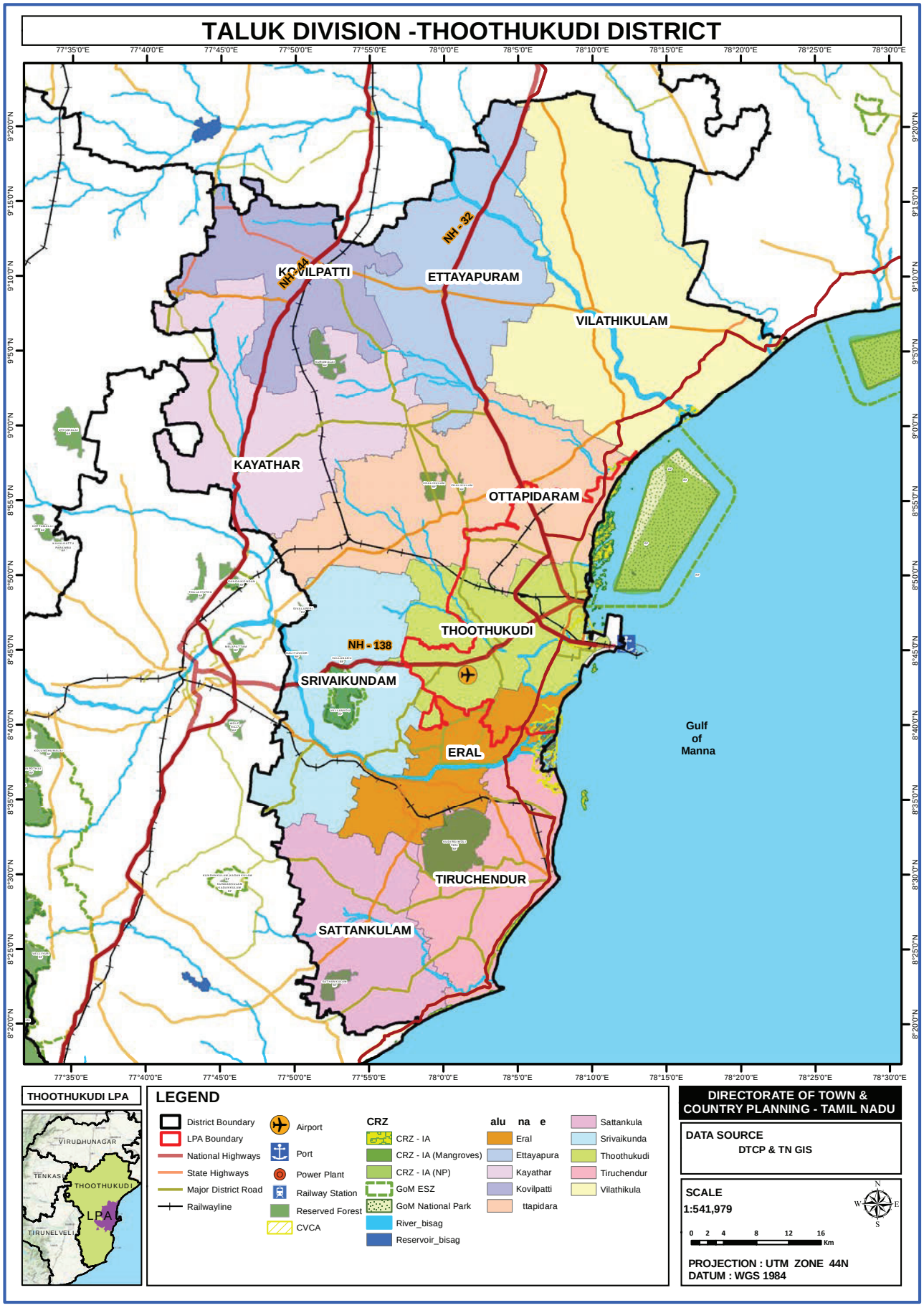


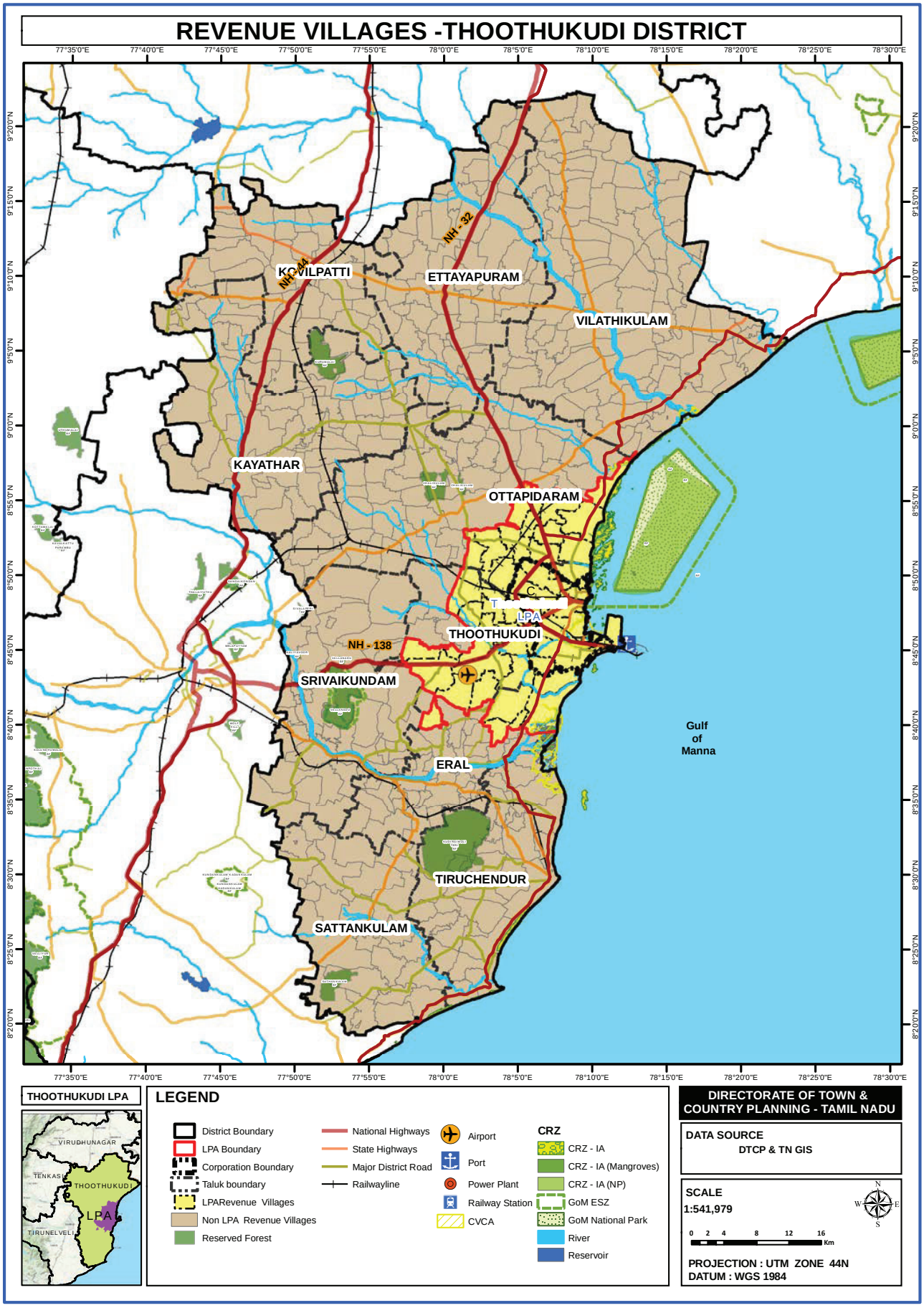
Figure 4.1 Institutional setup Revenue Administration in Thoothukudi District



Map 4.1 Revenue Administration in Thoothukudi District and Local Planning Area



Map 4.2 Taluk in Thoothukudi District and Local Planning Area



Map 4.3 Revenue Villages in Thoothukudi District and Local Planning Area

4.4 Local Body Administration

Thoothukudi district has one Municipal Corporation, which is fully included within the Local Planning Area (LPA), three municipalities in the district such as Kovilpatti, Kayalpattinam and Tiruchendur do not fall within the LPA. Similarly, out of the 18 town panchayats, none are covered by the LPA. This distribution highlights that the LPA encompasses the core urban administrative units of the district, while certain smaller towns remain outside its jurisdiction. Overall, the LPA plays a central role in regional planning and governance by capturing the district's most significant urban centers. Table 4.2 presents a comparative overview of the local bodies' administration within the Thoothukudi district and the Local Planning Area (LPA).

Table 4.2 Local Bodies Administration in Thoothukudi District and Local Planning Area

Parameters	Thoothukudi District	Thoothukudi LPA
Local Administration		
Corporation	1	1
Municipalities	3	0
Town Panchayats	18	0

Thoothukudi Corporation

The Thoothukudi Corporation serves as the primary implementing agency of the Thoothukudi Master Plan, translating policy directions into on-ground development. Headed by the Mayor and supported by the Corporation Commissioner, it oversees urban planning, public health, sanitation, roads, and other essential civic services. With 60 wards represented by elected councillors, the Corporation ensures grassroots participation and inclusive governance. It plays a crucial role in regulating land use, providing infrastructure, and delivering services in line with the objectives of the Master Plan. Through ward committees and standing committees, the Corporation integrates citizen feedback, enhances accountability, and steers development initiatives towards sustainable and equitable urban growth.

Village Panchayats

The Thoothukudi LPA also encompasses 32 Village Panchayats, each headed by a directly elected President and supported by a Vice-President and executive staff. Functioning through the Grama Sabha, these bodies deliberate on local issues, pass resolutions, and prioritize community needs, thus strengthening grassroots democracy and decentralized governance. Village Panchayats

are pivotal in delivering basic infrastructure and services, including the maintenance of rural roads, management of water resources, provision of sanitation facilities, and support for livelihood activities. They also serve as direct channels for implementing state and central government schemes, ensuring that developmental benefits reach rural populations effectively.

4.5 Development Administration

Development Administration in Thoothukudi district is primarily responsible for the implementation of various state and centrally sponsored welfare schemes and development programmes across multiple sectors, including health, education, housing, rural development, and infrastructure. This administrative domain focuses on planning, execution, monitoring, and evaluation of developmental initiatives aimed at enhancing the quality of life. Development Administration plays a crucial role in bridging policy and practice, ensuring that government interventions reach the intended beneficiaries efficiently and effectively. Table 4.3 shows the comparative overview of the development administration within Thoothukudi district and the Local Planning Area (LPA).

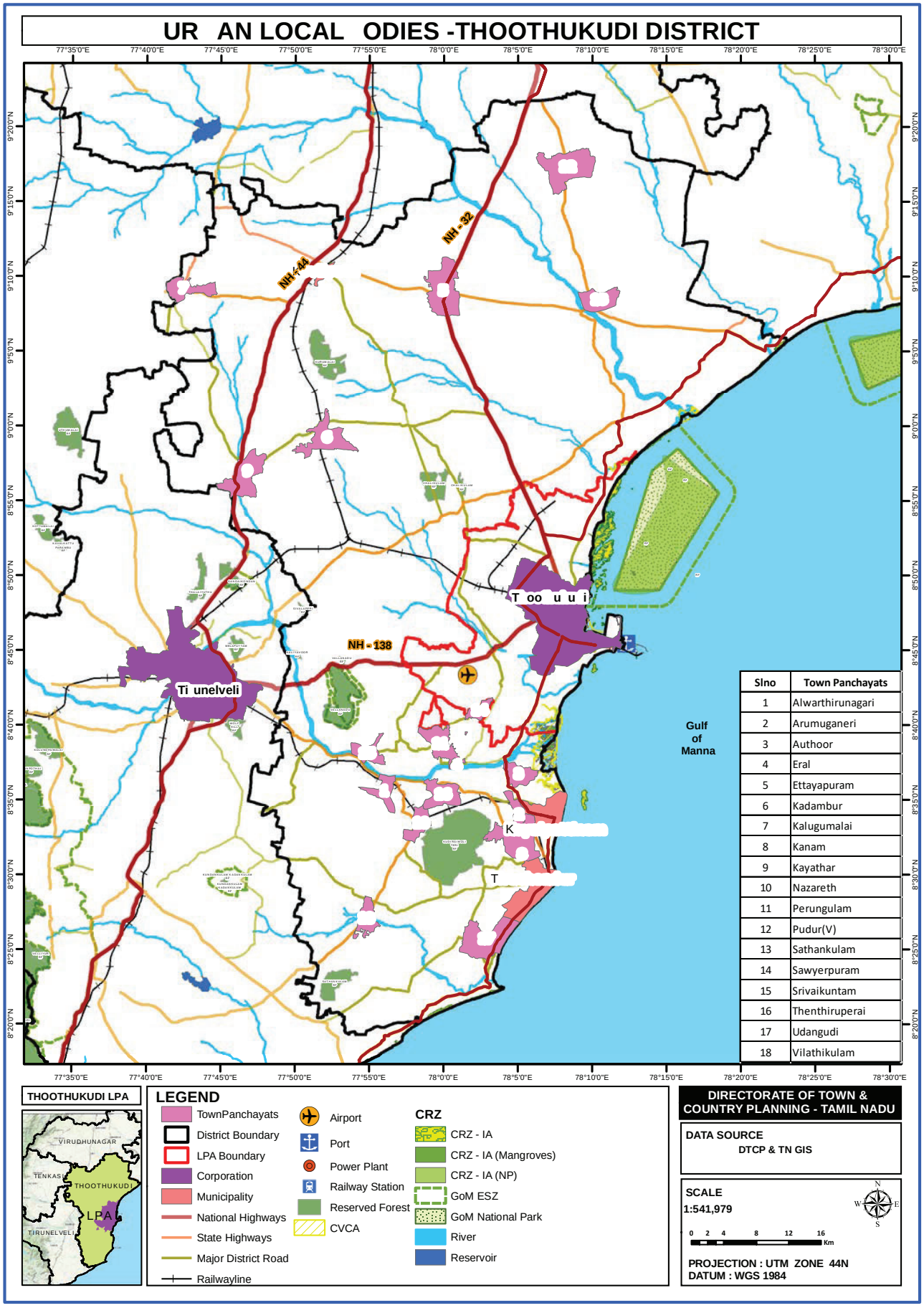
Table 4.3 Development Administration in Thoothukudi District and Local Planning Area LPA

Parameters	Thoothukudi District	Thoothukudi LPA
Development Administration		
Panchayat Union	12	3
Village Panchayats	403	32

The Development Administration in Thoothukudi District comprises 12 Panchayat Unions (Blocks), of which 3 namely Ottapidram, Thoothukudi and Eral—fall within the jurisdiction of the Thoothukudi Local Planning Area (LPA). The district has 403 Village Panchayats, which form the grassroots level of rural governance. Of these, 32 Village Panchayats are located within the boundaries of the LPA.

District Collector / Chairman, District Rural Development Agency (DRDA): The Collector serves as the overall head of rural development in the district and chairs the DRDA. They coordinate implementation of state and central rural development schemes, oversee fund allocation, monitor progress, and ensure convergence with other departments.

Project Director, DRDA: A senior officer (usually from the Rural Development service) who manages the day-to-day functioning of DRDA. The PD ensures



Slno	Town Panchayats
1	Alwarthirunagari
2	Arumuganeri
3	Authoor
4	Eral
5	Ettayapuram
6	Kadambur
7	Kalugumalai
8	Kanam
9	Kayathar
10	Nazareth
11	Perungulam
12	Pudur(V)
13	Sathankulam
14	Sawyerpuram
15	Srivaikuntam
16	Thenthiruperai
17	Udangudi
18	Vilathikulam

Map 4.4 Local Bodies Administration in Thoothukudi District and Local Planning Area

effective implementation of schemes such as MGNREGS, PMAY (Gramin), sanitation programs, and livelihood initiatives across blocks and villages.

Project Director, Tamil Nadu State Rural Livelihood Mission (TNSRLM) – Mission Management Unit: This officer is responsible for strengthening Self-Help Groups (SHGs), promoting women's empowerment, livelihood generation, and poverty alleviation programs. They coordinate with block-level and village-level SHG federations.

Personal Assistant to Collector (Panchayat Development) Advises and assists the Collector in matters related to Panchayat governance and development. This officer supervises Panchayat Union activities, ensures compliance with Panchayat Raj Act provisions, and monitors scheme execution.

Assistant Director (Panchayats) Provides technical and administrative support in the functioning of Panchayats. They guide Panchayat Presidents, Secretaries, and BDOs in governance, planning, and execution of works. They also play a key role in capacity building and compliance monitoring. Section 112 of the Tamil Nadu Panchayats Act, 1994 prescribes various powers and functions of Panchayat Union Councils. Some of the important functions of a Panchayat Union Council are

a) Construction, repair and maintenance of all Panchayat union roads.

b) Construction of water works for the supply of water for drinking, washing and bathing purposes.

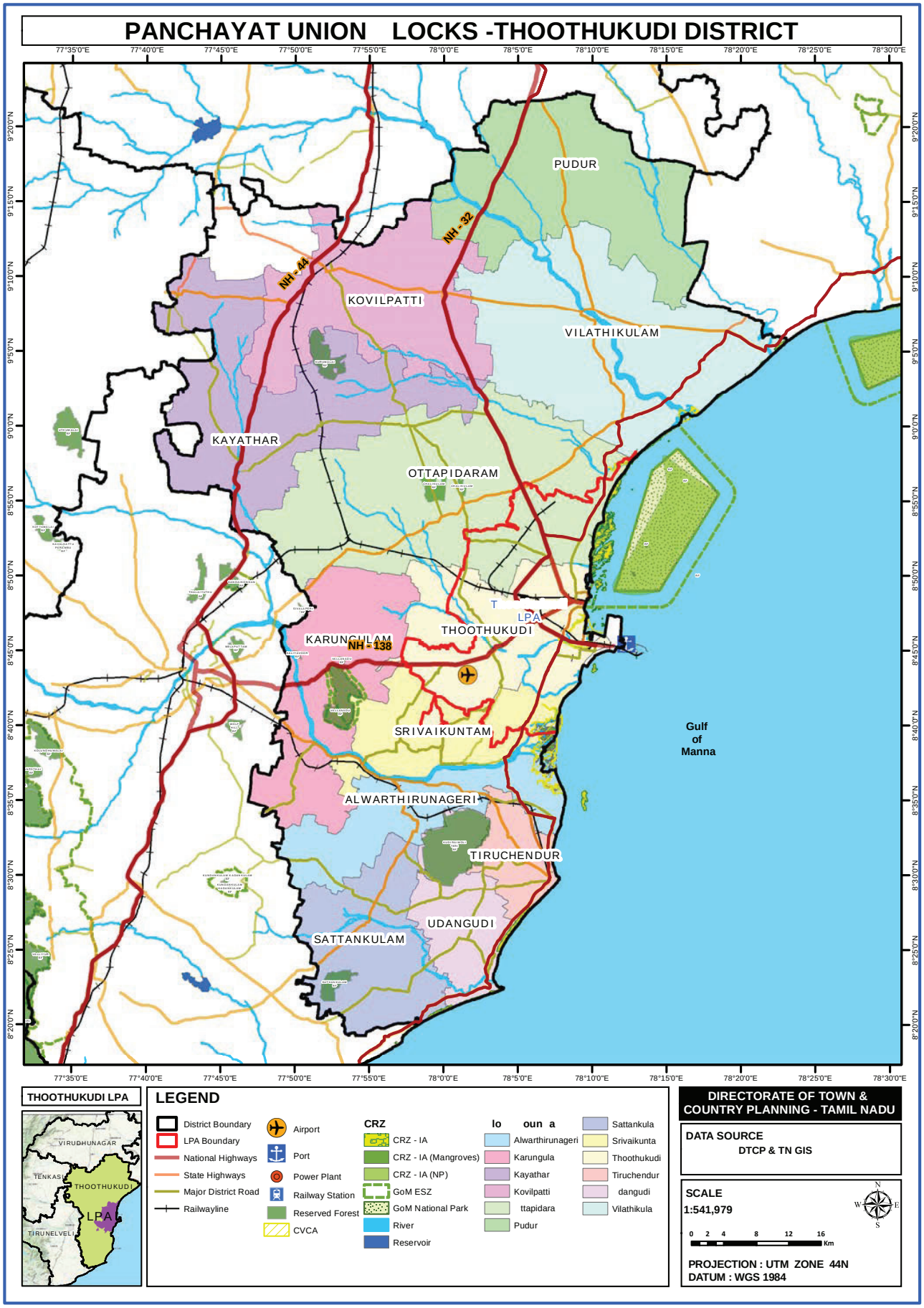
c) Construction and maintenance of elementary and middle schools.

d) Control of fairs and festivals under the control of the Panchayat Union.

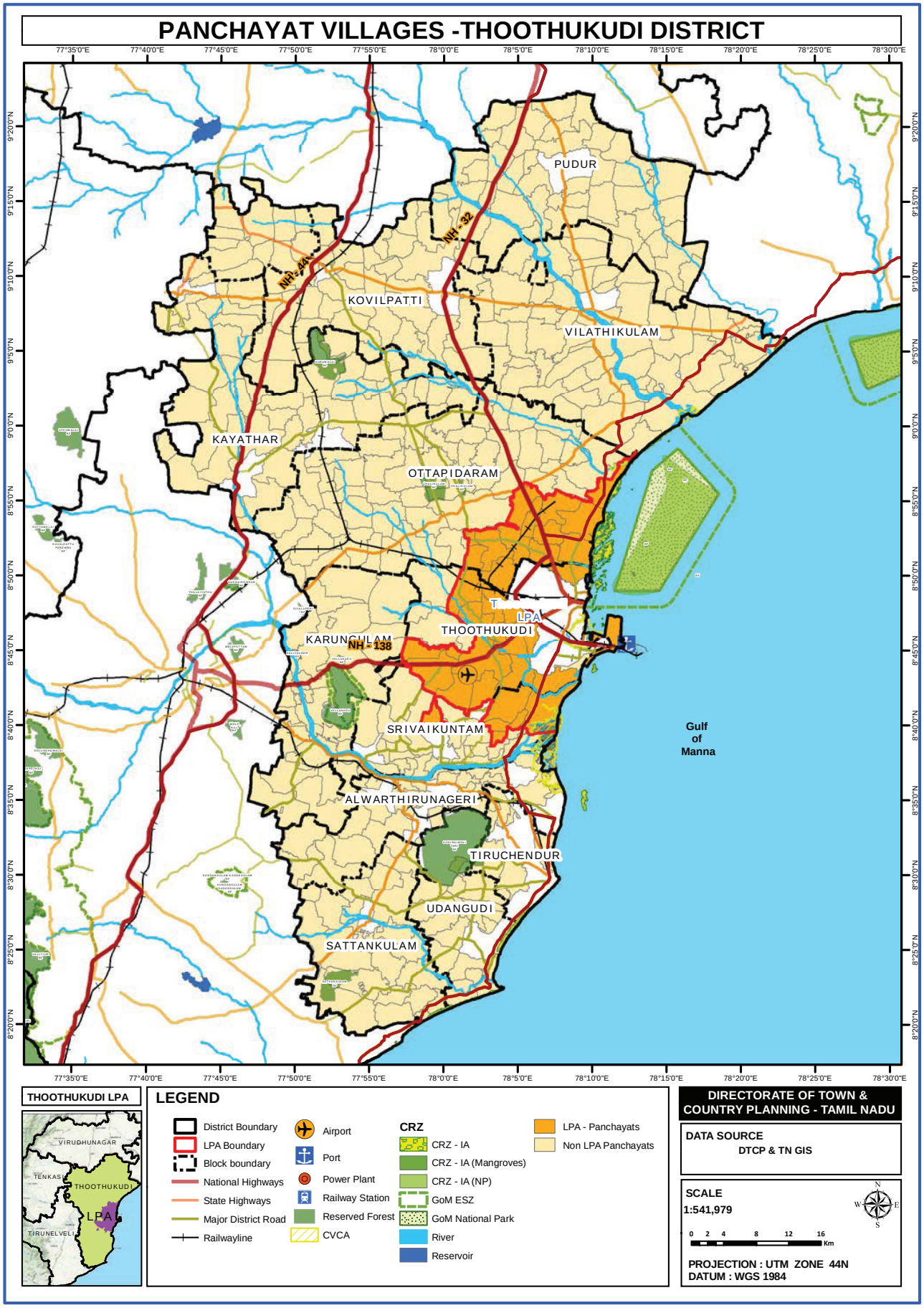
e) Opening and maintenance of Panchayat Union public markets.

f) Implementing various Centrally sponsored and State schemes.

g) Preventive and remedial measures connected with any epidemic or with malaria.



Map 4.5 Panchayat Union in Thoothukudi District and Local Planning Area



Map 4.6: Village Panchayat in Thoothukudi District and Local Planning Area

4.6 Electoral Constuitencies

Thoothukudi district falls under multiple Parliamentary and Assembly Constituencies, ensuring representation at both the state and national levels. The Thoothukudi Parliamentary Constituency covers the Assembly segments of Vilathikulam, Thoothukudi, Tiruchendur, Srivaikundam, Ottapidaram, Kovilpatti providing a direct link between the citizens of Thoothukudi city and surrounding areas with the Lok Sabha. The Parliamentary constituencies and their respective assembly constituencies within Thoothukudi LPA is given in the Table 4.4.

Table 4.4 Parliamentary Constituencies and their Respective Assembly Constituencies within Thoothukudi LPA

Parliamentary Consistency	Assembly Consistency
Thoothukudi	Vilathikulam Thoothukudi Tiruchendur Srivaikundam Ottapidaram Kovilpatti

4.6.1 Thoothukudi Corporation

Thoothukudi Corporation is divided into 60 electoral wards, each serving as the basic unit of urban representation in local governance. In the electoral context, every ward elects one councilor through direct elections, who becomes the voice of the people in the Corporation Council. These councilors collectively deliberate on urban policies, development works, and resource allocation across the city. The Mayor, elected indirectly by the councilors, leads the council, while the Deputy Mayor supports governance functions. This ward-based electoral structure ensures decentralized democracy, enabling citizens to directly influence decision-making at the grassroots level and linking governance priorities with local needs in line with Thoothukudi's Master Plan.

4.6.2 Panchayat Union and Village Panchayat

In Village Panchayats, the people directly elect the President, while ward members are chosen from each ward, forming the base of grassroots democracy. The President leads Grama Sabha meetings, manages local infrastructure, and implements government schemes to reflect community needs in development plans. At the Panchayat Union level, members are elected from constituent Village Panchayats, and from among them, a Chairperson and Vice-Chairperson are chosen. The Union focuses on inter-village development such as roads, schools, and health services

4.7 E-Governance

The Community Service Centre (CSC) Project is part of the National e-Governance Plan, designed to provide government services to people in rural and remote areas in a transparent, reliable, and affordable way. These centres act as technology-enabled service delivery points where citizens can access facilities related to agriculture, education, banking, utility payments, and other essential services.

A Village Level Entrepreneur who serves as the local operator, while implementation at the state level is carried out by the Tamil Nadu e-Governance Agency (TNeGA) manages each centre. The state has adopted multiple delivery channels to expand access, including Tamil Nadu Arasu Cable TV Corporation (TACTV), Electronics Corporation of Tamil Nadu Limited (ELCOT), Primary Agriculture Cooperative Credit Societies, Village Poverty Reduction Committees, and other public institutions. These agencies have been permitted to set up service centres at different levels—district headquarters, taluk offices, municipalities, and village panchayats—ensuring that both urban and rural populations benefit.In Tamil Nadu, CSCs have become an important link in bridging the digital divide by supporting government-to-citizen service delivery. In Thoothukudi Local Planning Area, 88 centers are currently operational, providing services that connect local citizens with government schemes and facilities.

Table 4.5 Community Service Centers (CSC) in Thoothukudi District

S.No.	Service Center Agency	No. of Centers	No. of Counters
1.	TamilNadu Arasu Cable TV	16	26
2.	Primary Agricultural Credit Co-Operative Society	152	152
3.	Magalir Thittam	249	249
4.	Village Level Entrepreneurs	12	12
	Total	**429**	**439**

4.8 Departments And Implementations Agency

The State Government's line departments play a crucial role in basic service delivery within the Thoothukudi Local Planning Area (LPA). The following are the key government bodies responsible for governance and administration.

4.8.1 Thoothukudi Corporation

The Municipal Corporation serves as the primary implementing agency of the Master Plan, translating policy directions into development works. The Municipal Commissioner provides leadership and coordinates inter-departmental functions, supporting SDG 11 - Sustainable Cities and Communities. The City Engineer manages roads, drains, and water supply projects, addressing SDG 6 - Clean Water and Sanitation and SDG 9 - Industry, Innovation, and Infrastructure. The Town Planning Officer ensures land use compliance, zoning enforcement, and layout approvals, contributing to SDG 11 - Sustainable Cities and Communities. The Public Health Officer oversees sanitation, waste management, and health-related infrastructure, fulfilling SDG 3 - Good Health and Well-Being and SDG 6 - Clean Water and Sanitation. The Finance Officer handles budgeting, resource mobilization, and fund allocation, ensuring progress towards SDG 8 - Decent Work and Economic Growth and SDG 17 - Partnerships for the Goals. At the ward level, Assistant Engineers, Sanitary Inspectors, and Ward Committees support implementation. Together, these functions ensure the Master Plan delivers tangible improvements in urban life while advancing multiple SDGs

4.8.2 Village Panchayats

Village Panchayats function as the grassroots level of governance, delivering basic services like water supply, sanitation, and rural roads. Presidents, with support from Vice-Presidents and executive staff, lead the implementation of government schemes. Grama Sabhas encourage democratic participation and community-led planning. Local health and sanitation initiatives strengthen rural resilience. By addressing livelihood and service needs, Village Panchayats ensure rural development remains integrated with the Master Plan.

4.8.3 Regional Directorate of Municipal Administration

The Regional Director of Municipal Administration (RDMA) is the head of RDMA and functions under the Directorate of Municipal Administration. Tamil Nadu has seven RDMAs, and Thoothukudi is one among them. The RDMA supervises municipalities and town panchayats, ensuring implementation of government schemes, financial discipline, and compliance with municipal laws. It also provides administrative and technical guidance on planning, infrastructure, and service delivery. Acting as a link between the state government and local bodies, the RDMA strengthens urban governance in its jurisdiction.

4.8.4 Rural Development & Panchayat Raj Department

Rural Development & Panchayat Raj Department is responsible for rural infrastructure, poverty alleviation, livelihood programmes, and strengthening

Panchayati Raj Institutions. It is headed by the Minister for Rural Development & Panchayat Raj and the Principal Secretary/Commissioner of Rural Development at the state level, while at the district level the District Collector and the Project Director – DRDA oversee implementation, supported by Block Development Officers (BDOs) at the block level. Rural Development & Panchayat Raj Department implements several flagship schemes to improve rural infrastructure and livelihoods, with a focus on good governance and sustainability. The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) provides wage employment through Gram Panchayats and ensures transparency through social audits, contributing to poverty reduction and decent work. The Swachh Bharat Mission (Rural) promotes sanitation and hygiene in villages by encouraging community participation and behaviour change. The National Rural Drinking Water Programme (NRDWP) works to supply safe drinking water through decentralised management at the village level. The Pradhan Mantri Awaas Yojana (Rural) provides pucca houses with financial assistance directly transferred to beneficiaries, ensuring secure housing for the poor. These programmes are closely linked with the Sustainable Development Goals (SDGs), including poverty reduction, clean water and sanitation, good health, decent work, and sustainable communities. The Department also emphasises decentralisation and inclusivity, giving Gram Panchayats and local institutions a central role in implementation. Together, these efforts ensure that rural development is transparent, participatory, and sustainable.

4.8.5 Adi Dravidar and Tribal Welfare Department

The Project Officer heads the District Adi Dravidar and Tribal Welfare Department. The Project Officer is responsible for implementing welfare programmes for Scheduled Castes and Scheduled Tribes at the district level. The Department promotes the welfare of SCs, STs, and other vulnerable groups through targeted schemes ensuring social justice and equity. Pre- and Post-Matric Scholarships support students by removing financial barriers to education and are implemented through Direct Benefit Transfer for transparency. The Special Central Assistance to Tribal Sub-Scheme provides financial aid and livelihood opportunities for tribal households. The Umbrella Scheme for Development of Scheduled Castes and other Vulnerable Groups focuses on education, skill training, entrepreneurship, and housing. These schemes are carried out through decentralized mechanisms involving Gram Panchayats, district agencies, and direct beneficiary participation. By integrating good governance principles, the Department enables inclusive growth and sustainable development for disadvantaged communities.

4.8.6 BC, MBC & Minorities Welfare Department

The Project Officer at the district level heads the BC, MBC & Minorities

Welfare Department. The Department implements various welfare schemes to promote education, skill development, and social inclusion among minority communities. The Merit-cum-Means Scholarship supports minority students pursuing professional and technical courses at undergraduate and postgraduate levels through transparent beneficiary selection and Direct Benefit Transfer. The Free Coaching and Allied Scheme provides structured coaching for competitive examinations, ensuring fair opportunities in public employment. The Multi-Sectoral Development Programme addresses development gaps in minority-concentrated areas by investing in education, health, skills, and infrastructure. Special support is also extended to minority students who clear competitive examinations. These schemes are implemented in coordination with district and local levels to ensure decentralization and inclusivity. By embedding transparency, accountability, and good governance, the Department promotes equitable growth and empowerment of minority communities.

4.8.7 District Differently Abled Welfare Department

The District Differently Abled Welfare Department, headed by the Deputy Director and supported by the Assistant Director, implements schemes aimed at the welfare and empowerment of persons with disabilities. Key initiatives focus on providing assistive devices, rehabilitation services, and opportunities for education and skill development. Support is extended through scholarships, fellowships, and special institutions to ensure equal access and inclusion. Programmes are delivered through decentralised mechanisms, direct benefit transfers, and collaboration with local agencies to maintain transparency and accountability. By addressing accessibility, education, and livelihood needs, the Department promotes inclusive growth and social equity.

4.8.8 Water supply and sewerage

The Tamil Nadu Water Supply and Drainage (TWAD) Board, in coordination with the Thoothukudi Municipal Corporation, serves as the primary authority for managing water supply and sewer infrastructure within the Local Planning Area (LPA). Specifically, the TWAD Board oversees the extraction and transmission of water from the Tamirabharani River via the Vallanadu Headworks, supported by a network of Divisional and Sub-Divisional offices, training centers, and a Material Quality Control Laboratory, while the Corporation assumes responsibility for localized storage and distribution within city limits. Sewerage services are managed through a decentralized framework involving the Corporation and rural administrative units, ensuring localized service delivery. This governance model emphasizes seamless coordination between state technical agencies and local institutions, upholding the core values of accountability, inclusivity, and transparency. By providing reliable access to potable water and sanitation, these bodies drive sustainable urban development and directly align with Sustainable Development Goals 6 and 11, fostering healthier and more resilient urban environments.

4.8.9 Tamil Nadu Electricity Board

The electrical distribution system in the Thoothukudi Local Planning Area (LPA) functions within Tamil Nadu's restructured power sector framework, which separates generation, transmission and distribution for improved efficiency and governance. Power transmission is managed by TANTRANSCO, while electricity distribution is undertaken by Tamil Nadu Power Distribution Corporation Limited (TNPDCL). Renewable energy development is supported by Tamil Nadu Green Energy Corporation Limited (TNGECL), which facilitates rooftop solar and grid-connected renewable projects within the LPA. Electricity distribution in the Thoothukudi LPA falls under the Tirunelveli Region and is administered through the Thoothukudi Circle. The Circle is divided into Urban Tuticorin and Rural Tuticorin divisions, with the Urban Tuticorin Division covering the Thoothukudi Corporation area and adjoining zones, and the Rural Tuticorin Division serving the surrounding rural and semi-urban areas.

At the operational level, power supply is managed through a network of five sub-divisions—Urban North, Urban South, Ottapidaram, Rural Tuticorin and Srivaikundam—and 18 sections covering major residential, commercial, industrial and institutional areas. Within this administrative structure, electricity distribution is organised to respond to differing spatial demand characteristics across the LPA. High-capacity strengthening is prioritised in urban and industrial nodes, while incremental network expansion and extension-oriented infrastructure are planned across peripheral and rural areas. This tiered and spatially differentiated approach enables balanced power distribution, improves service responsiveness, and supports phased network strengthening in line with Thoothukudi's urban expansion, industrial development and long-term growth patterns envisaged under the Master Plan 2045, while maintaining system reliability and scope for renewable energy integration.

4.8.10 Revenue Department

Revenue Department—is the administrative backbone responsible for land governance in Thoothukudi district. It maintains land records, oversees issuance of titles such as Patta and Chitta, manages land revenue, stamp duties, and property taxes, and operates at local level through a structure of Revenue Divisions, Taluks, Firkas, and Revenue Villages—with Revenue Divisional Officers (RDOs) overseeing each division. Administrative penetration, the department also delivers a wide range of social welfare services issuing certificates (e.g., income, nativity, legal-heirship, community) and implementing welfare schemes—while playing the lead role in disaster response, coordinating rescue, relief, and rehabilitation efforts during natural calamities. At the district level, the District Collector, supported by the RDOs and the State Relief Commissioner (who also serves as Commissioner of Revenue Administration), directs both the administrative and disaster-related responsibilities. Additionally, the department supports urban planning, grievance redressal, and legal enforcement on land

matters, working as the custodian of government land and facilitating land reforms and issuance of government property-related orders.

4.8.11 Housing and Urban Habitat board

Tamil Nadu Housing Board (TNHB) and the Tamil Nadu Urban Habitat Development Board (TNUHDB) manage housing provision and slum redevelopment projects in Thoothukudi, functioning under their respective district heads. While TNHB focuses on developing plotted schemes, apartments, and integrated townships for middle- and higher-income groups, TNUHDB implements affordable housing and in-situ slum rehabilitation for low-income communities. Ongoing central and state schemes such as the Pradhan Mantri Awas Yojana–Urban (PMAY-U), Tamil Nadu Affordable Urban Housing Programme, and various Slum-Free City initiatives are implemented through these agencies in coordination with the Thoothukudi City Corporation. The governance mechanism emphasizes transparent beneficiary selection, direct financial transfers, and community participation to ensure inclusivity. By integrating housing delivery with livelihood support, infrastructure provision, and social amenities, these initiatives contribute to good governance and align with Sustainable Development Goals by promoting adequate shelter, reducing urban poverty, and fostering equitable urban growth

4.8.12 Economic and Employment Sector

i) Thoothukudi District Information Centre

The District Industries Centre (DIC), headed by the General Manager, functions under the Department of Industries and Commerce. It plays a key role in promoting Micro, Small, and Medium Enterprises (MSMEs), cottage industries, and handicrafts at the district level. MSMEs contribute to innovation, employment generation, and inclusive economic growth. As of 2023, Thoothukudi district has 33,926 registered MSME units under the Udyam Scheme. The DIC supports entrepreneurs through credit linkages, subsidies, and technical guidance. Skill training and capacity-building programmes are provided to strengthen small businesses and artisans. The Centre also promotes traditional industries and handicrafts to preserve cultural identity while enhancing livelihoods. Through these initiatives, the DIC contributes to industrial growth, self-reliance, and sustainable development in the district.

ii) TIDCO

The Tamil Nadu Industrial Development Corporation Limited (TIDCO), established in 1965, is the premier industrial development agency of the Government of Tamil Nadu. The Chairman and Managing Director (CMD) head it. TIDCO promotes medium and large industries in the State through Joint Ventures to ensure balanced industrial growth. It also acts as the Nodal Agency for developing industrial corridor projects across Tamil Nadu. By

facilitating investments and partnerships, TIDCO contributes to sustainable economic and industrial development.

iii) SIDCO

The Tamil Nadu Small Industries Development Corporation (SIDCO) supports and promotes Micro, Small, and Medium Enterprises (MSMEs) across the State. At the district level, it is headed by the Senior Regional Manager or Regional Manager. SIDCO plays a major role in developing industrial estates and providing infrastructure facilities for MSMEs. In Thoothukudi, it manages the Kappalur Industrial Estate and the K. Pudur Industrial Estate. Through these initiatives, SIDCO fosters entrepreneurship, industrial growth, and local employment opportunities.

4.8.13 Agriculture and Horticulture

Department of Agriculture.

The Agricultural Department in Thoothukudi functions under the Department of Agriculture, Government of Tamil Nadu. At the district level, the Joint Director of Agriculture (JDA) heads it. The department implements state and central government policies, schemes, and regulations related to agriculture. It prepares and executes district-level agricultural development plans and coordinates with allied departments for effective governance. Training and awareness programmes are regularly conducted to support farmers with updated practices. Irrigation planning is carried out in coordination with the Public Works Department to improve water management. Market linkages are facilitated to help farmer's secure fair prices for their produce. Through these measures, the department promotes sustainable agriculture, improves productivity, and strengthens rural livelihoods in Thoothukudi.

4.8.14 Department of Environment and Forest.

The Department of Environment in Tamil Nadu functions under the Environment, Climate Change and Forests Department. At the district level, the Superintending Engineer of the Tamil Nadu Pollution Control Board (TNPCB) heads its activities. The department monitors and enforces environmental regulations, focusing on industrial pollution control, solid and liquid waste management, and air and water quality. It works in coordination with Urban Local Bodies and allied departments for effective implementation. Key initiatives include compliance with National Green Tribunal directives, climate change adaptation projects, and programmes under the National Clean Air Programme. The department promotes participatory environmental governance by involving local bodies and communities in decision-making. Transparency is ensured through continuous monitoring and public reporting. By integrating sustainability principles, the department safeguards ecosystems and fosters resilient urban and rural environments.

4.8.15 Transportation

National and State Highway

The National Highways Authority of India (NHAI) manages national Highways in Thoothukudi. At the district level, the General Manager of the NHAI Project Implementation Unit (PIU) heads them. Major highways such as NH-138, NH-32 and NH-38 pass through the district, ensuring strong regional and national connectivity. State Highways including SH-49 and SH-176 are maintained by the State Highways Department, linking Thoothukudi to neighbouring districts and major cities. The Thoothukudi Corporation, supporting intra-city mobility and access, manages urban roads. Panchayat Unions oversee rural and local roads, enabling connectivity to villages and small settlements. Coordination between NHAI, the State Highways Department, and local bodies ensures integrated planning and road maintenance. Together, these networks contribute to trade, mobility, and the overall economic growth of Thoothukudi district.

Public Transport

The Tamil Nadu State Transport Corporation (TNSTC) regulates and operates public transport services in Thoothukudi, supported by the Regional Transport Office (RTO) for vehicle registration, permits, and enforcement. The city has a dense bus network connecting urban and rural areas, ensuring accessibility for daily commuters, students, and workers. In addition, plans for a metro rail system and improvements to road infrastructure under state and central schemes aim to enhance mobility, reduce congestion, and support sustainable urban growth. Implementation mechanisms include coordination between TNSTC, the Thoothukudi City Corporation, the Highways Department, and the State Transport Department for route planning, fleet modernization, road maintenance, and integration of multi-modal transport systems. Smart transport initiatives, such as digital ticketing and real-time passenger information, are also being introduced to improve service efficiency. These initiatives contribute to the Sustainable Development Goals by enabling affordable and accessible transport for all (SDG on inclusive infrastructure), reducing reliance on private vehicles to cut emissions (SDG on climate action), and strengthening urban mobility systems that support economic growth and social inclusion (SDG on sustainable cities and communities)

Indian Railway Thoothukudi Division

Thoothukudi Railway Junction holds significance as a crucial railway junction in southern Tamil Nadu and operates as a distinct division within the Southern Railway. Serving as the headquarters of the Thoothukudi Railway division, it stands as the second largest revenue division in Southern Railway, following the Chennai division. Direct trains from Thoothukudi connect to Chennai, Madurai, Tirunelveli, and Mysuru.

Airport Authority of India

Air connectivity is provided by Thoothukudi Domestic Airport, located just outside the Corporation limits, offering domestic services. Tuticorin Airport is spread across 17,340 square meters, the terminal is equipped to handle 1,350 passengers during peak hours and 20 lakh passengers annually, with a future expansion capacity of up to 1,800 peak-hour passengers and 25 lakh passengers annually. Operated by Airport Authority of India under the Ministry of Civil Aviation.

4.8.16 Social Infrastructure and amenities

Thoothukudi has historically been a centre of Tamil culture and learning, with a strong network of educational institutions that shape its identity as a hub of knowledge. At the district level, the Chief Educational Officer (CEO) under the School Education Department heads the education system. The district has 369 primary, secondary, and higher secondary schools managed under government and private administration. Thoothukudi also hosts major higher education institutions such as Thoothukudi Kamaraj University with its affiliated colleges, The American College, Lady Doak College, Fatima College, and Thiagarajar College of Engineering. Other institutions include law, agricultural, paramedical, teacher training, music, polytechnic, and industrial training institutes. The Departments of School Education, Higher Education, and Technical Education to ensure compliance and quality standards regulate these. Governance is implemented through accreditation, curriculum development, funding schemes, and inclusivity programmes for women, marginalized groups, and first-generation learners. This framework enhances human capital, ensures equitable access to quality education, and empowers youth with skills for inclusive and sustainable development.

Medical and Health services

The Joint Director of Medical and Rural Health Services, Thoothukudi, oversees the district's healthcare delivery system, which integrates urban and rural health institutions. This includes medical college hospitals, district hospitals, taluk hospitals, and Primary Health Centers (PHCs), along with sub-centers in rural areas. In addition, Thoothukudi is home to premier medical colleges and teaching hospitals that provide both advanced healthcare and medical education, strengthening service delivery and capacity-building in the health sector. Implementation mechanisms involve coordination between the Directorate of Medical Education, Directorate of Medical and Rural Health Services, and the local bodies to ensure preventive, promotive, and curative healthcare. Public health programs such as immunization drives, maternal and child health services, disease surveillance, and the National Health Mission (NHM) play a key role in strengthening grassroots access. These governance structures and schemes directly contribute to the Sustainable Development Goals

by advancing SDG 3 (Good Health and Well-being), ensuring universal health coverage, reducing maternal and child mortality, controlling communicable and non-communicable diseases, and building a resilient healthcare system that addresses both urban and rural needs.

4.8.17 Hindu Religious & Charitable Endowments Department (HR&CE)

Hindu Religious and Charitable Endowments (HR&CE) Department is entrusted by law (under the Tamil Nadu Hindu Religious and Charitable Endowments Act of 1959) with the administration, financial oversight, and property management of Hindu temples and endowments, ensuring that rituals, revenues, and upkeep are maintained in accordance with both tradition and statutory norms. Commissioner of HR&CE—manages the department's day-to-day operations and execution of its responsibilities, supported by a hierarchical structure of Joint, Deputy, and Assistant Commissioners and Executive Officers. In Thoothukudi, several prominent temples fall under the administrative oversight of the HR&CE Department of Tamil Nadu. The most prominent temples under the department's purview are the iconic Arulmigu Bagampriyal udanyurai Sankararameswarar Temple, Arulmigu Vaikuntapathi Temple, Arulmigu Ayirathen Vinayagar Temple within the LPA and significant pilgrimage sites (outside LPA but located in the District) of Navathirupathi, NavaKailayam, Tiruchendur Murugan Temple, Mutharamman temple of Kulasekarapattinam. The department also oversees the proper conduct of daily rituals, month long festivals such as the famous Muthaaramman Kovil Festival, Skanda Sashti at Tiruchendur, and Vaikasi Vishakam. Appointed Executive Officers and fall under the governance framework of HR&CE, ensuring rituals, financial affairs, property maintenance, manage these temples and community services are carried out under departmental guidelines.

4.8.18 Tourism Department

Tourism Department in Thoothukudi, led by the District Tourism Officer and supported by the Assistant Tourism Officer, plays a pivotal role in preserving and promoting the city's cultural and natural heritage. It manages iconic destinations such as the Ayyanarsunai, Ettayapuram, Kazhugumalai, Kulasekaranpattinam, Panimaya Matha Church, Adichanallur, Kayalpattinam, Kayathar, Korkai, Manapad, Meignanapuram, Navakailayam, Navathirupathi, Panchalankurichi and Thiruchendur. Implementation mechanisms include the development of tourism infrastructure (roads, amenities, signage, and digital information systems), partnerships with the Thoothukudi City Corporation and Archaeological Department for heritage site upkeep, and coordination with private stakeholders for hospitality services. The department organizes cultural festivals, temple tourism programs, and awareness campaigns to strengthen Thoothukudi's tourism. These initiatives align with the Sustainable Development Goals by fostering inclusive economic growth through job creation in tourism and hospitality (SDG 8: Decent Work and Economic

Growth), safeguarding cultural and natural heritage (SDG 11: Sustainable Cities and Communities), and promoting responsible and sustainable tourism practices that protect the environment and support local communities (SDG 12: Responsible Consumption and Production).

4.8.19 Police Department

The Commissioner of Police, Thoothukudi City, and the Superintendent of Police for the district are responsible for maintaining law and order, crime prevention, traffic management, and public safety. Multiple police stations across urban and rural areas ensure local-level policing and quick response mechanisms. Specialized units such as the traffic wing, crime branch, cybercrime cell, and all-women police stations address sector-specific needs, ensuring inclusive and responsive law enforcement. Implementation mechanisms include coordination with local bodies for urban safety measures (such as CCTV surveillance under Smart City initiatives), community policing programs, women's safety helplines, and digital platforms for citizen grievance redressal. Capacity building through regular training, modernization of equipment, and integration with disaster management systems further strengthen policing efficiency. These efforts contribute to the Sustainable Development Goals by ensuring safe, resilient, and inclusive urban spaces (SDG 11: Sustainable Cities and Communities), promoting justice and strong institutions (SDG 16: Peace, Justice, and Strong Institutions), and enhancing trust between citizens and governance system

4.8.20 Fire Safety Department

The Deputy Director heads the Fire and Rescue Services Department, which is responsible for fire safety, disaster response, and emergency rescue operations across the Thoothukudi Local Planning Area (LPA). Fire stations are strategically located to ensure timely response, supported by trained personnel and modern firefighting equipment. The department's functions extend beyond fire suppression to include fire prevention, public awareness programs, industrial safety inspections, and training institutions that build community preparedness for emergencies. Implementation mechanisms include coordination with the District Collector, Police, Health Department, and local bodies during disaster management, strict enforcement of the Tamil Nadu Fire Service Rules in building approvals, and regular mock drills in public spaces, schools, and industries. The department also collaborates with the State Disaster Management Authority to strengthen resilience against natural and man-made disasters. These initiatives directly contribute to the Sustainable Development Goals by reducing risks to life and property (SDG 3: Good Health and Well-being), ensuring safe and sustainable urban infrastructure (SDG 11: Sustainable Cities and Communities), and strengthening institutional capacity for disaster risk reduction (SDG 13: Climate Action)

4.8.21 Pollution Control Board (TNPCB)

The Tamil Nadu Pollution Control Board (TNPCB) District Office in Thoothukudi functions as the key regulatory authority for environmental protection and pollution management. It monitors air and water quality, issues consents and environmental clearances, and ensures industrial compliance with state and national standards. The office works in coordination with local bodies, industries, and other government departments to implement waste management rules, control effluent discharges, and promote cleaner production practices. Implementation mechanisms include regular inspections, enforcement of statutory norms, public grievance redressal, and awareness campaigns on sustainable practices. These efforts align with the Sustainable Development Goals by addressing SDG 6 (Clean Water and Sanitation), SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action), thereby fostering healthier ecosystems and resilient urban environments in Thoothukudi.

4.8.22 District Coastal Zone Management Authority (DCZMA)

The Tamil Nadu District Coastal Zone Management Authority (DCZMA) is a statutory authority constituted under the Coastal Regulation Zone (CRZ) Notification, issued under the Environment (Protection) Act, 1986, to ensure effective implementation of coastal regulation measures at the district level across the coastal districts of Tamil Nadu. It functions as the district-level arm of the Tamil Nadu State Coastal Zone Management Authority (TNSCZMA). The primary objective of the Tamil Nadu DCZMA is to protect and conserve the State's extensive and ecologically sensitive coastline while enabling regulated and sustainable development. The Authority plays a critical role in balancing environmental protection, disaster risk reduction, and the socio-economic needs of coastal communities. DCZMA operates in each coastal district of Tamil Nadu, covering areas notified under the CRZ, including coastal stretches along the Bay of Bengal, Palk Bay, and the Gulf of Mannar. Its jurisdiction extends over CRZ-I to CRZ-IV areas, as defined in the CRZ Notification, including ecologically sensitive zones, coastal waters, intertidal areas, and regulated development zones. In Tamil Nadu, where the coastline is highly vulnerable to cyclones, storm surges, sea-level rise, and erosion, the DCZMA plays a vital role in integrating coastal regulation with disaster risk reduction and climate resilience. Its functioning supports environmentally responsible urbanisation, port-led development, fisheries livelihoods, and conservation of coastal ecosystems.

4.8.23 Tamil Nadu Salt Corporation Limited

Tamil Nadu Salt Corporation Limited herein referred to as (TNSC) was registered under the Companies Act 1956 with the Registrar of Companies, Tamil Nadu on the 22nd July of 1974 as a Company and the entire shareholding is

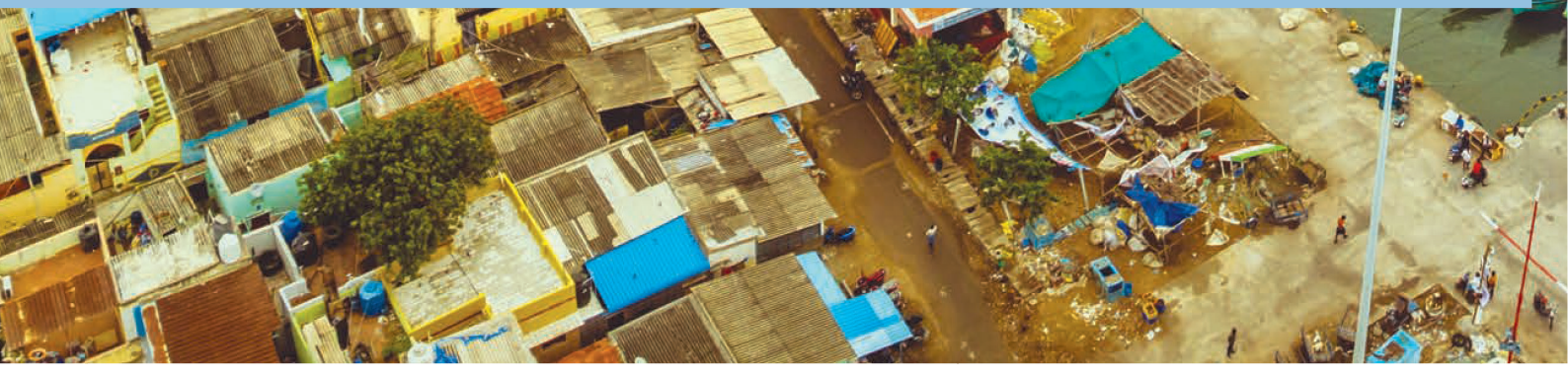
held by the Government of Tamil Nadu. TNSC is a wholly owned Government of Tamil Nadu undertaking i.e. State Public Sector Undertaking (SPSU). TNSCplays an important role in the salt economy of Thoothukudi district, which is one of the largest salt-producing regions in India. While TNSC's major production units are located in other coastal districts of Tamil Nadu, its operations are closely linked to Thoothukudi's extensive salt pans, skilled workforce, and well-established salt trade ecosystem. The district's favourable coastal climate and vast saline lands support large-scale solar salt production, making Thoothukudi a critical supply and market hub that influences statewide salt availability and pricing. Through its involvement in procurement, processing, and distribution of iodised and industrial salt, TNSC complements the predominantly private salt industry of Thoothukudi, contributes to stabilising supply for public distribution and welfare schemes, and supports the broader economic activity associated with salt production, transport, and trade in the district.

4.8.24 V.O. Chidambaranar (VOC) Port Authority

V.O. Chidambaranar (VOC) Port, is a major maritime gateway on India's southeastern coast, serving as a key node for international trade and regional economic growth. Named after the freedom fighter V.O. Chidambaranar, the port plays a vital role in facilitating international and coastal trade, particularly serving Tamil Nadu and neighbouring states. V.O. Chidambaranar Port Authority is an autonomous body constituted under Chapter II, Section 3(1) of the Major Port Authorities Act 2021 by the Central Government. The Board members appointed by Ministry of Ports, Shipping and Waterways, Government of India consists of Chairperson, Deputy Chairperson and 7 Board Members. It functions under the administrative control of the Ministry of Ports, Shipping and Waterways, Government of India. It handles a diverse range of cargo including coal, petroleum products, fertilizers, containers, salt, and general cargo, and is well connected by rail and road networks to major industrial and hinterland centres. With dedicated container terminals, mechanised berths, and proximity to the East–West international shipping route, VOC Port supports regional industrial growth, export-import activities, and employment generation, while also contributing significantly to the economic development of Thoothukudi district and the state as a whole.



Previous Planning Efforts





5.1 Background

The review of earlier statutory plans is undertaken to assess their effectiveness in guiding the spatial, economic, and environmental development of the Thoothukudi Local Planning Area (LPA). This assessment is intended not merely to document past planning initiatives, but to critically evaluate their outcomes and to identify systematic limitations that have shaped present development patterns. The insights derived from this review are essential for ensuring that the Thoothukudi Master Plan 2045 is based on realistic growth assumptions, integrated spatial strategies, and implementable policy frameworks.

Previous Planning Efforts

The planning and development of the Thoothukudi Local Planning Area (LPA) have been regulated by two distinct Master Plans. The first Master Plan was prepared specifically for Thoothukudi Town, which at the time functioned as an independent Local Planning Area, covering an extent of 13.47 sq. km. Subsequently, the jurisdiction of the Local Planning Area was expanded to include 29 adjoining revenue villages. Following this expansion, a separate master plan was formulated to address the planning and development requirements of these 29 villages.

The Master Plan for Thoothukudi Single Local Planning Area was formulated for an area of 13.47 sq. km. The planning area was declared under Section 10(1) of the Tamil Nadu Town and Country Planning Act, 1971, through G.O. (Ms) No. 629, RD & LA Department, dated 04.04.1975. It was subsequently confirmed under Section 10(4) through G.O. (Ms) No. 1748, RD & LA Department, dated 06.08.1975.

The Local Planning Authority for the municipal area was constituted under Section 11(1) of the Act through G.O. (Ms) No. 1748, RD & LA Department. The Master Plan was notified under Section 24(2) through G.O. (Ms) No. 54, Housing and Urban Development (H&UD) Department, dated 11.01.1991, with a plan period extending up to the year 2001.

Subsequently, a separate master plan was formulated for the peripheral areas surrounding Thoothukudi Municipality. This plan covered 29 adjoining revenue villages with a total extent of 341.23 sq. km.

The planning area for the added region was declared under Section 10(1)(b) of the Tamil Nadu Town and Country Planning Act, 1971, through G.O. (Ms) No. 853, H&UD Department, dated 16.10.1983, and later confirmed under Section 10(4) through G.O. (Ms) No. 1620, RD & LA Department, dated 16.10.1986. The Local Planning Authority was constituted under Section 11(1) through G.O. (Ms) No. 1748, RD & LA Department, dated 17.10.1975.

The master plan for the added area was notified under Section 24(2) through G.O. (Ms) No. 71, H&UD Department, dated 10.02.2000, with a plan period extending up to the year 2015.

Subsequently, the municipal planning area and the added peripheral planning area were merged and constituted as a single local planning area as represented in Map 5.1. The present Thoothukudi Local Planning Area comprises one municipal corporation and 34 revenue villages, covering a total extent of 463.62 sq. km.

The integrated Local Planning Area was declared under Section 10(1)(b) of the Tamil Nadu Town and Country Planning Act, 1971, through G.O. (Ms) No. 149, H&UD Department, dated 20.06.2013, and was later confirmed

under Section 10(4) through G.O. (Ms) No. 116, H&UD Department, dated 16.06.2022. The Master Plan for the unified Local Planning Area was consented under Section 24(2) through G.O. (Ms) No. 44, H&UD Department, dated 13.03.2025. The Figure 5.1 shows the Administrative Expansion of Thoothukudi Local Planning Area.

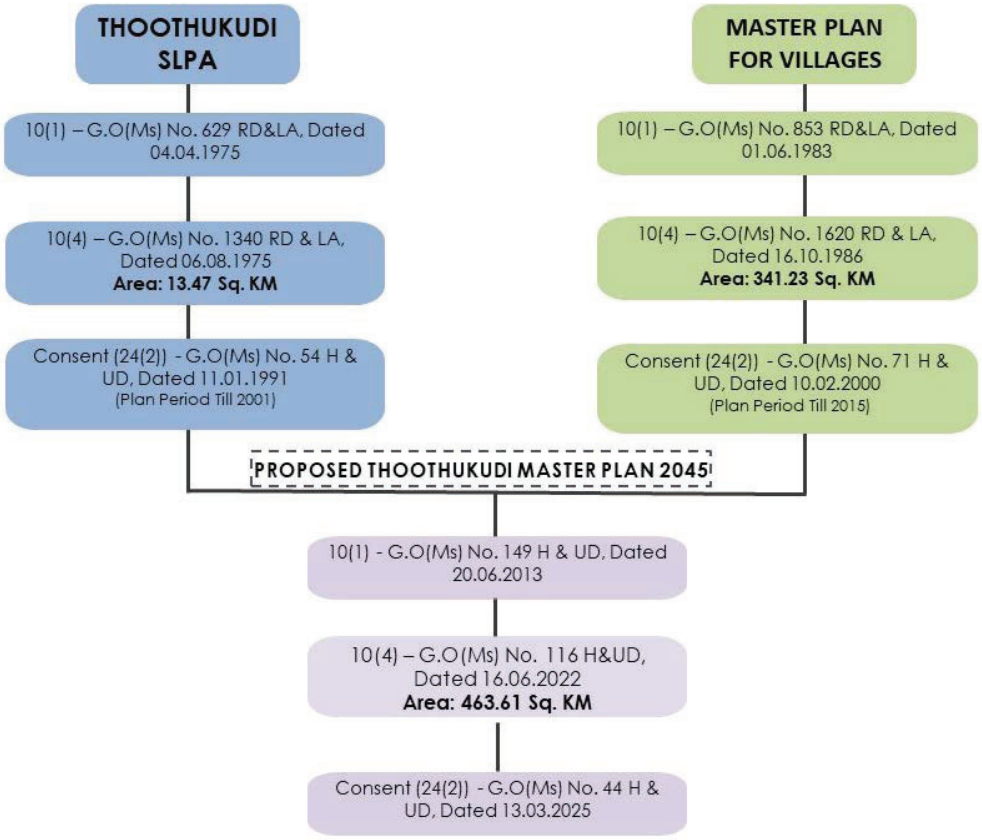
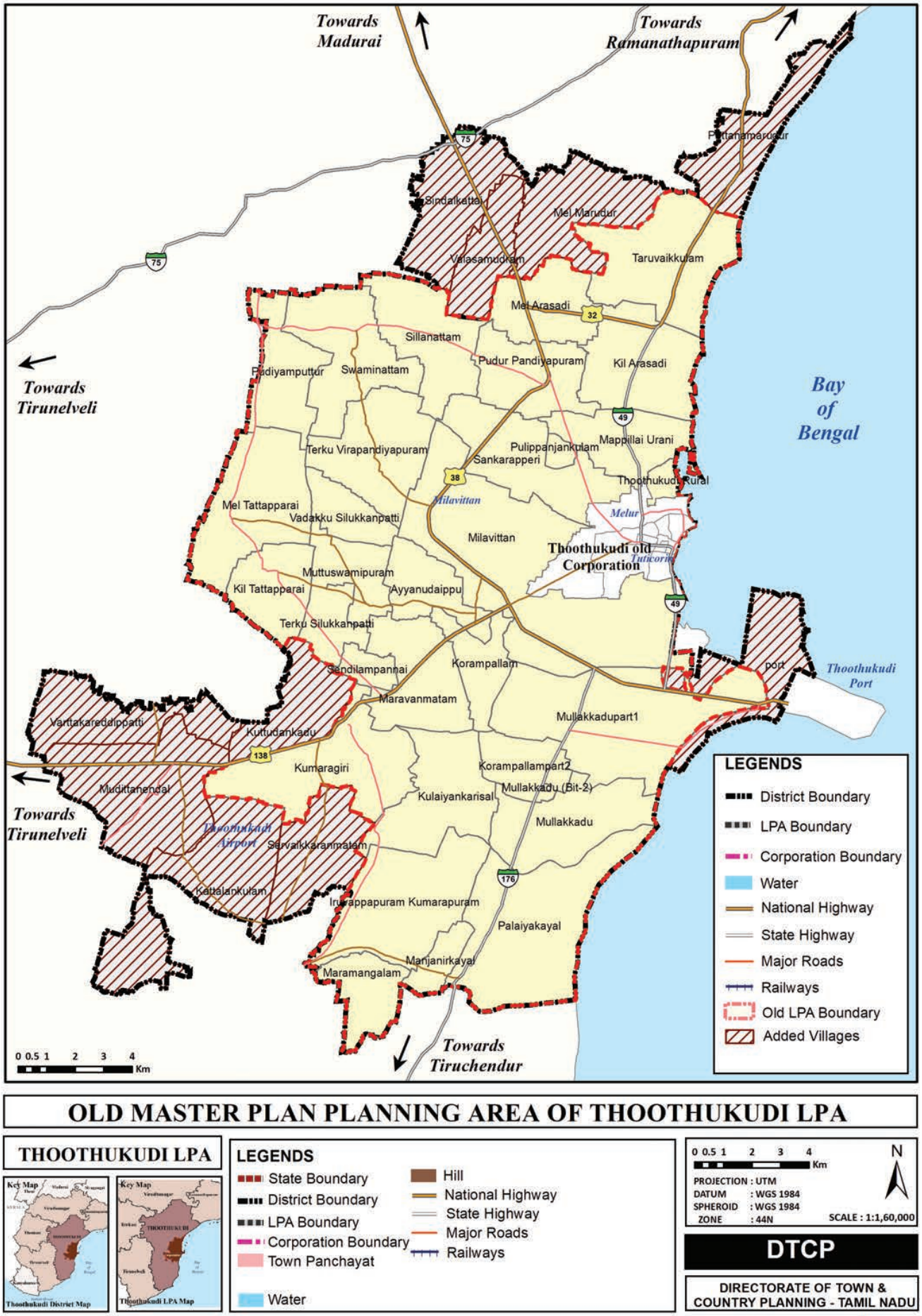


Figure 5.1 Planning Area Administrative Expansion



OLD MASTER PLAN PLANNING AREA OF THOOTHUKUDI LPA

THOOTHUKUDI LPA

LEGENDS

- State Boundary
- District Boundary
- LPA Boundary
- Corporation Boundary
- Town Panchayat
- Water
- Hill
- National Highway
- State Highway
- Major Roads
- Railways

0 0.5 1 2 3 4 Km

N

PROJECTION : UTM
DATUM : WGS 1984
SPHEROID : WGS 1984
ZONE : 44N

SCALE : 1:1,60,000

DTCP

DIRECTORATE OF TOWN & COUNTRY PLANNING - TAMIL NADU

Map 5.1 Evolution Planning Area Boundary of Thoothukudi LPA

5.2 Master Plan for Thoothukudi Single Local Planning Area 2001

5.2.1 Objective of the Master Plan

The planning framework for Thoothukudi focuses on managing development within the urban core to ensure orderly growth, efficient land use, and adequate infrastructure and services. It seeks to utilise the strategic importance of the port by encouraging port-based industries and allied economic activities to strengthen the regional economy. The plan also promotes salt production and related activities, recognising their role in local livelihoods, while protecting ecologically sensitive coastal areas through regulation under Coastal Regulation Zone.

5.2.2 Distribution of Land Use

An analysis of the existing land use pattern within the Local Planning Area (LPA) was undertaken to understand the prevailing distribution of land uses and the overall development characteristics of the planning area. This assessment provides a baseline for evaluating changes in land use and measuring variations in the proportion of different land use categories over time.

The Thoothukudi LPA Master Plan was prepared with the year 1985 as the base year and 2001 as the ultimate year. According to the 1981 Census, Thoothukudi Town had a population of 192,949. Table 5.1 presents the existing land use distribution within the LPA. Residential land use constitutes 52.71% of the total planning area, with a notable concentration around the Thoothukudi Old Port Trust area. Commercial activities are predominantly located along major arterial corridors such as Victoria Road, George Road, and Beach Road. Industrial land use occupies a relatively small share of the area, accounting for only 2.82% of the total extent.

Table 5.1 Existing Land Use of Thoothkudi Town 1985

Land Use	Area (In Sq. Km)	Percentage to Total Area
Residential	7.1	**52.71**
Commercial	0.64	**4.75**
Industrial	0.38	**2.82**
Educational	0.90	**6.68**
Public and Semi-Public	0.58	**4.31**

Land Use	Area (In Sq. Km)	Percentage to Total Area
Agriculture (Includes Parks, Playgrounds, Water Bodies, and Burial)	2.27	**16.85**
Transportation	1.6	**11.88**
Total	**13.47**	**100**

Source: Thoothukudi Master Plan 2001

5.2.3 Review of Thoothukudi Town Master Plan 2001

A comparative analysis of the proposed land use for the year 2001 and the existing land use pattern in 2025 was undertaken to assess the extent of realisation of the Master Plan proposals and to understand the prevailing land use trends within the planning area. The analysis aims to evaluate the level of achievement of the proposed land use structure and to identify deviations resulting from subsequent urban development processes.

Under the Thoothukudi Town Master Plan, residential land use was proposed to cover an extent of 8.50 sq. km, constituting 63.10% of the total planning area. In the existing land use scenario of 2025, residential use accounts for 5.93 sq. km (44.02%). Although a substantial portion of the proposed residential land has been developed, a significant share of the designated residential areas has transitioned to commercial and institutional uses in response to changing urban demands.

Commercial land use was originally proposed to occupy 0.72 sq. km (5.35%) of the planning area. However, in 2025, commercial land use has expanded to 1.43 sq. km (10.62%), considerably exceeding the proposed allocation. This increase is primarily attributed to the transformation of the urban core into a major commercial zone, with existing residential properties along key corridors being converted into commercial establishments. While George Road was envisaged as a principal commercial corridor in the Master Plan, commercial development has instead intensified along Palayamkottai Road and Ettayapuram Road, which function as important regional connectivity corridors.

Industrial land use was proposed at 0.42 sq. km (3.12%), whereas in the existing land use pattern of 2025, industrial areas occupy only 0.15 sq. km (1.11%). The reduction in industrial land use is mainly due to the relocation of industries from within the planning area to the Milavittan region, with the vacated industrial sites subsequently being converted to commercial uses.

Institutional land use was proposed to cover 1.72 sq. km (12.77%) of the planning area. In contrast, the existing institutional land use in 2025 has

increased to 3.03 sq. km (22.49%). This substantial growth is largely driven by the development of new public infrastructure and facilities, including a new bus stand, private educational institutions, and a veterinary hospital.

Transportation land use was proposed to occupy 1.70 sq. km (12.62%) under the 2001 Master Plan. In the existing land use pattern of 2025, transportation-related uses account for 2.60 sq. km (19.30%). The increase in transportation land use can be attributed to the expansion of residential layouts, which necessitated the development of additional road networks and supporting transport infrastructure. Table 5.2 shows the comparison of Proposed Land Use 2001 with Existing Land Use of 2025 for Thoothukudi town.

Table 5.2 Comparison of Proposed Land Use 2001 with Existing Land Use of 2025

Description	Proposed Land Use 2001		Existing Land Use 2025	
	Area (Sq. Km)	Percentage of Area	Area (Sq. Km)	Percentage of Area
Residential	8.5	63.10	5.93	44.02
Commercial	0.72	5.35	1.43	10.62
Industrial	0.42	3.12	0.15	1.11
Institutional	1.72	12.77	3.03	22.49
Agricultural	0.41	3.04	0.11	0.82
Transportation	1.7	12.62	2.6	19.30
Waterbody	-		0.22	1.63
Total	**13.47**	**100**	**13.47**	**100**

Source: Thoothukudi Master Plan 2001

5.2.4 Projected Population

The projected population for Thoothukudi Town for the year 2001 was estimated at 4,30,000. However, as per the Census of 2011, the actual population was 2,37,830, indicating a shortfall of 1,92,170 persons. This reflects a population achievement of only 55.30% of the projected population when compared with the 2011 Census.

5.2.5 Master Plan Proposals

The Master Plan include only two major development proposals, namely the improvement of the Buckle Channel and the construction of a new bus stand. Both of these proposals have been successfully implemented. Apart from these interventions, the Master Plans do not identify any sector-specific proposals addressing areas such as land use planning, housing, transportation, infrastructure, environment, or economic development.

5.2.6 Way Forward

The Thoothukudi Town Master Plan was originally envisaged as a residential-oriented town supporting port-based activities, with limited commercial development and small industrial pockets along Palayamkottai Road and Ettayapuram Road. Over time, the urban core has evolved into a predominantly commercial zone, with increased commercial activity along major regional corridors. The municipal area has now reached near saturation, with limited land available for future development. Areas near the Thoothukudi Port Trust, such as Cruz Puram, Lions Town, and Matha Kovil, are highly congested and require focused interventions through Local Area Plans. The Thoovipuram area offers potential for planned commercial expansion to strengthen the local economy.

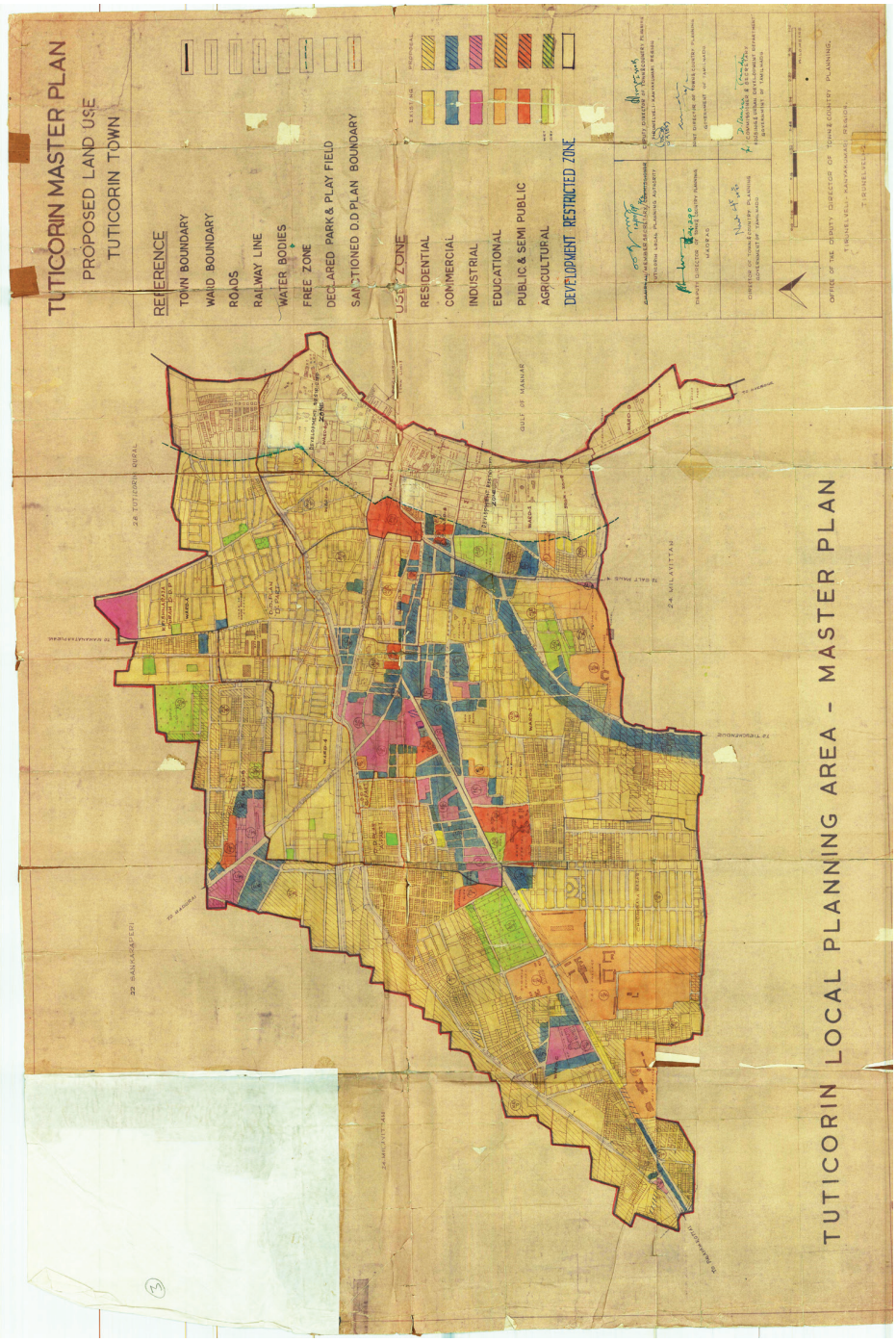
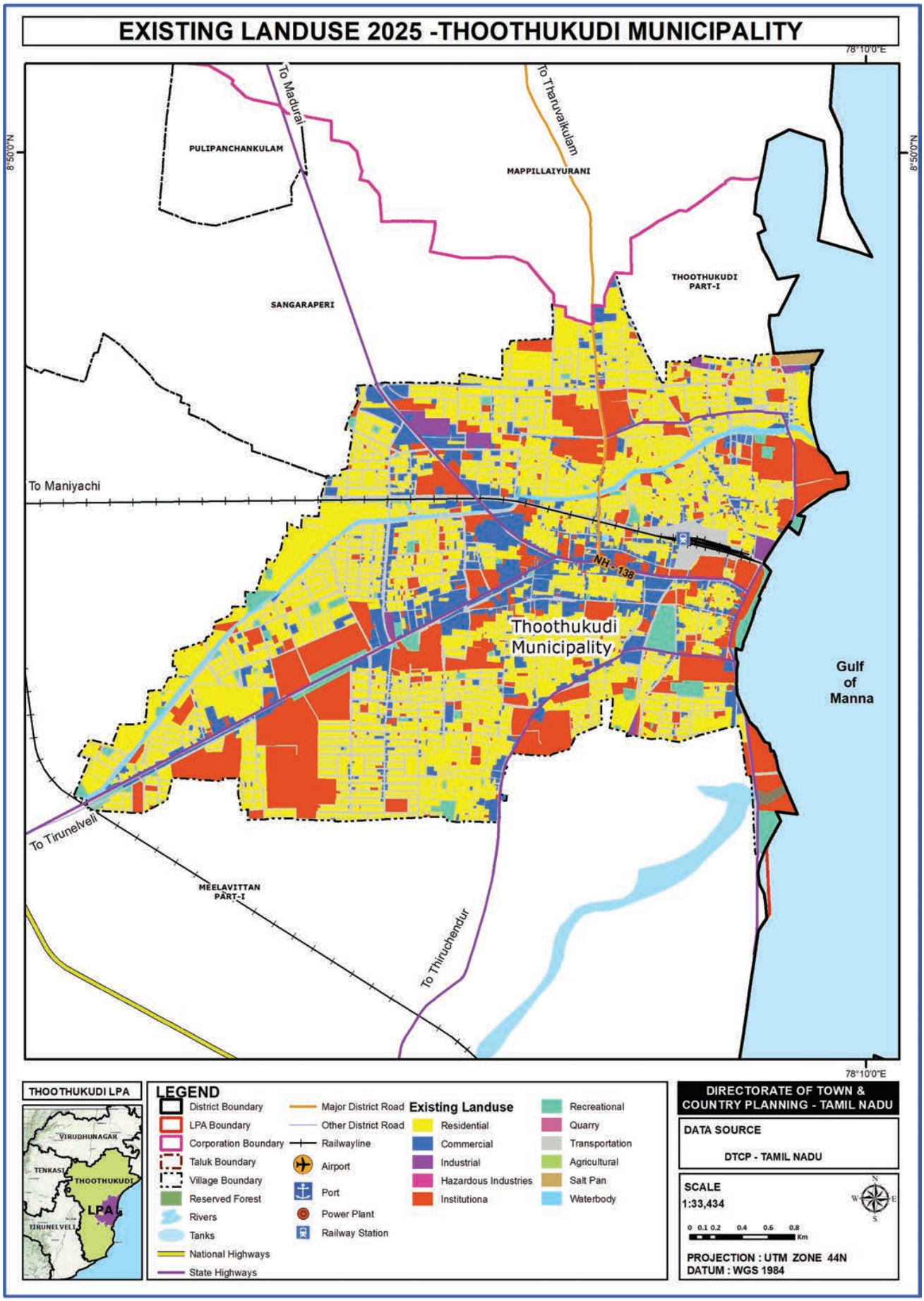


Figure 5.2 Proposed Land Use 2001 of Thoothukudi Town



Map 5.2 Existing Land Use 2025 – Thoothukudi Municipality

5.3 Thoothukudi Master Plan for Added Villages

5.3.1 Objective of the Master Plan

The Thoothukudi Master Plan for the villages has been prepared to promote planned industrial development by utilising the region's strategic advantages. The primary objective is to accommodate heavy manufacturing industries supported by the Thoothukudi Port, which functions as a key logistics and trade hub. In addition, the Local Planning Area benefits from air connectivity, enhancing regional accessibility. Recognising these advantages, the Master Plan aims to guide the orderly development of surrounding villages through appropriate land use allocation, infrastructure provision, and sustainable growth strategies.

5.3.2 Jurisdiction of Thoothukudi Added Villages

The Thoothukudi Master Plan for villages encompasses 29 villages around the Thoothukudi Municipality. Of these, 17 villages fall within the jurisdiction of the Thoothukudi Panchayat Union, 8 villages are part of the Ottapidaram Panchayat Union, and the remaining 4 villages are situated within the Srivaikundam Panchayat Union. Collectively, these villages cover a total geographical area of 341.23 sq. km.

5.3.3 Distribution of Land Use

An analysis of the existing land use pattern within the Thoothukudi Local Planning Area (LPA) was undertaken to understand the current distribution of land uses and the overall development characteristics of the region. The Master Plan for the added villages was prepared with 1995 as the base year and 2015 as the horizon year. According to the 1991 Census, the population of Thoothukudi Town was 131,755. Table 5.3 presents the existing land use distribution of the added villages in percentage terms. The analysis indicates that agricultural land use dominates the planning area, accounting for 79.61% of the total area. Residential land use constitutes approximately 6.46% of the total area. Given Thoothukudi's coastal setting, salt production is a significant activity, with salt pans occupying about 6.82% of the total area. Industrial land use accounts for 3.70% of the total area, primarily due to the concentration of industries in Milavittan Village.

Table 5.3 Existing Land Use for Thoothukudi Added Villages 1995

Land Use	Area (In Sq. Km)	Percentage to Total Area
Residential	22.05	6.46
Commercial	0.92	0.27
Industrial	12.64	3.70
Educational	0.95	0.28
Public and Semi-public	9.74	2.85
Agriculture	271.67	79.61
Salt Pan	23.26	6.82
Total	**341.23**	**100**

Source: Thoothukudi Master Plan 2015

5.3.4 Review of Master Plan for Thoothukudi Added Villages

A comparative analysis was undertaken between the proposed land use for the year 2015 under the Thoothukudi Villages Master Plan and the existing land use in 2025. The primary objective of this analysis is to assess the extent to which the proposed land use allocations have been realised under current conditions and to identify the factors influencing deviations from the plan.

Residential land use was proposed to cover an extent of 151.90 sq. km, accounting for 44.52% of the total planning area. However, in the existing land use pattern of 2025, residential use occupies only 29.75 sq. km (8.72%). A significant shortfall is observed in the western part of the Local Planning Area, particularly in villages such as Vadakku Silukkanpatti, Muthusamypuram, Ayyanadaippu, Maravanmadam, and Sentilampannai, where the proposed residential development has not materialised. The primary reason for this underachievement is the unfavourable geomorphological conditions in these villages, characterised by rocky substrata that are unsuitable for large-scale residential development.

Commercial land use for the horizon year 2015 was proposed at 10.95 sq. km (3.21%), whereas only 4.85 sq. km (1.42%) has been realised by 2025. Commercial development was proposed along major transport corridors, including NH-32 towards Madurai and NH-138 towards Tirunelveli, with additional commercial nodes envisaged at Puthurpandiyapuram and Maravanmadam. However, these proposed commercial areas have largely remained unrealised.

Industrial land use was proposed to cover 74.75 sq. km (21.91%) of the planning area, but only 18.43 sq. km (5.40%) has been developed. A large proportion of the designated industrial land remains vacant, indicating an over-estimation of industrial land requirements within the Local Planning Area.

Agricultural land use was proposed to be retained at 86.06 sq. km (25.22%). In contrast, the existing land use pattern in 2025 shows that agricultural activities occupy 190.94 sq. km (55.96%) of the total area, indicating that a substantial portion of the land continues to remain under agriculture despite urban and industrial development proposals. Table 5.4 shows the comparison of Proposed Land Use 2015 with Existing Land Use of 2025 for Thoothukudi added villages.

Table 5.4 Comparison of Proposed Land Use 2015 and Existing Land Use 2025

Description	Proposed Land Use 2015		Existing Land Use 2025	
	Area (Sq. Km)	Percentage of Land Use	Area (Sq.km)	Percentage of Land Use
Residential	151.9	44.52	29.75	8.72
Commercial	10.95	3.21	4.85	1.42
Industrial	74.75	21.91	18.43	5.40
Institutional	17.57	5.15	9.77	2.86
Agricultural	86.06	25.22	190.94	55.96
Salt Pan	-	-	32.74	9.59
Transportation	-	-	10.13	2.97
Waterbody	-	-	44.62	13.08
Total	**341.23**	**100**	**341.23**	**100**

Source: Thoothukudi Master Plan 2015

5.3.5 Projected Population

The projected population for the added villages within the Thoothukudi Local Planning Area was estimated at 3,00,000 for the year 2015. However, as per the Census of India 2011, the recorded population of these villages was 2,51,498.

5.3.6 Master Plan Proposal

The Master Plan does not provide sector-wise specific proposals to address the development needs of the planning area. Although key issues and challenges have been identified in the Plan, corresponding proposals and actionable strategies to resolve these issues have not been clearly defined.

5.3.7 Way Forward

The Village Master Plan was envisioned to accommodate Special Hazardous Industries and General Industries within the Local Planning Area, with the Thoothukudi Port identified as the primary strategic anchor for industrial development. Residential land use was also proposed on the western side of the planning area to meet the housing needs of the industrial workforce.

However, a significant portion of the industrial land proposed in the previous Master Plan remains vacant, largely due to the absence of a well-defined grid road network to support industrial access and logistics. Under existing conditions, major industries have instead concentrated along established arterial corridors that offer better connectivity.

Similarly, the proposed residential development in the western villages has not been realised to the expected extent. The primary constraint is the unfavourable geomorphological conditions in these areas, characterised by rocky substrata that are unsuitable for large-scale residential development.

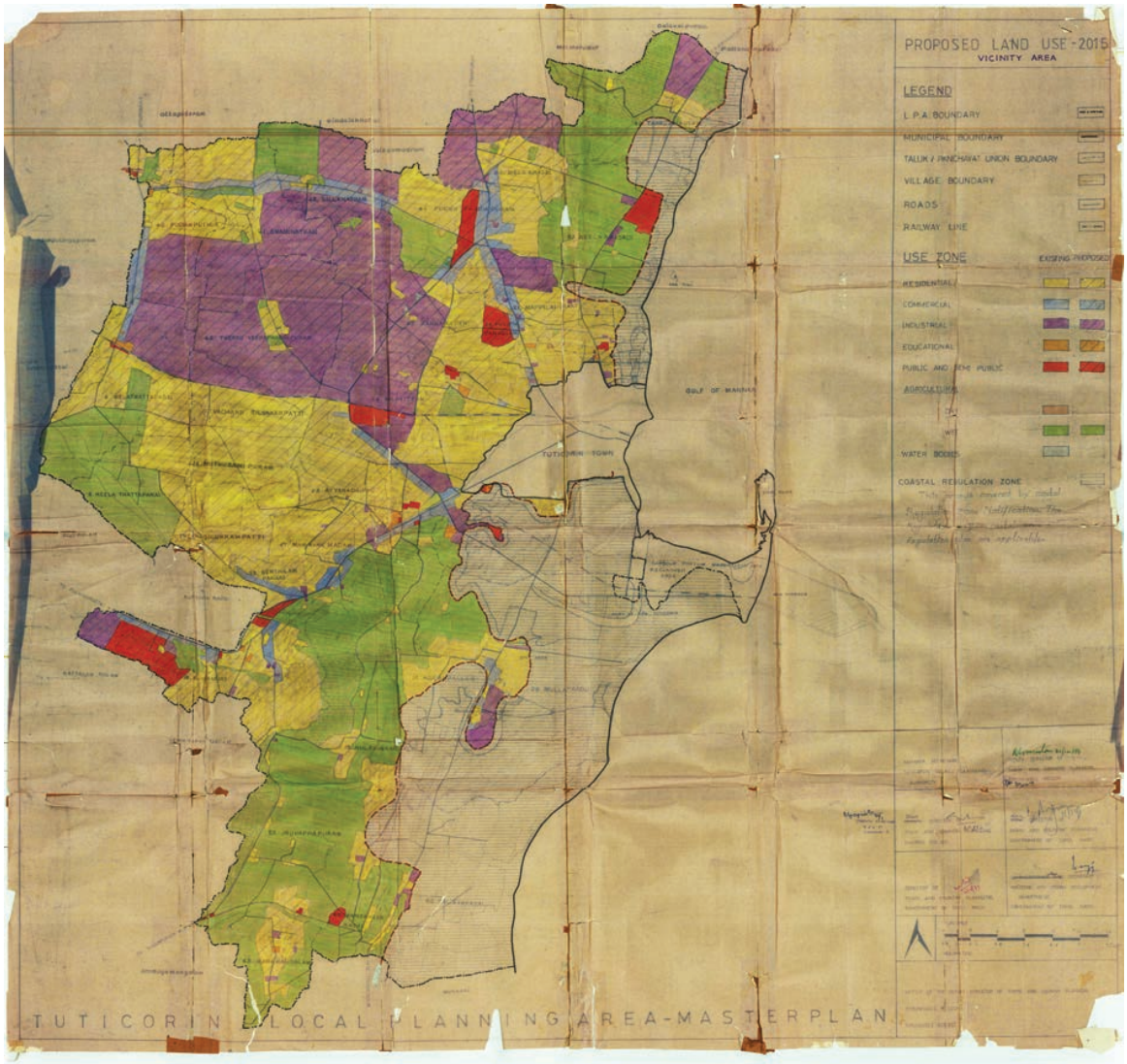
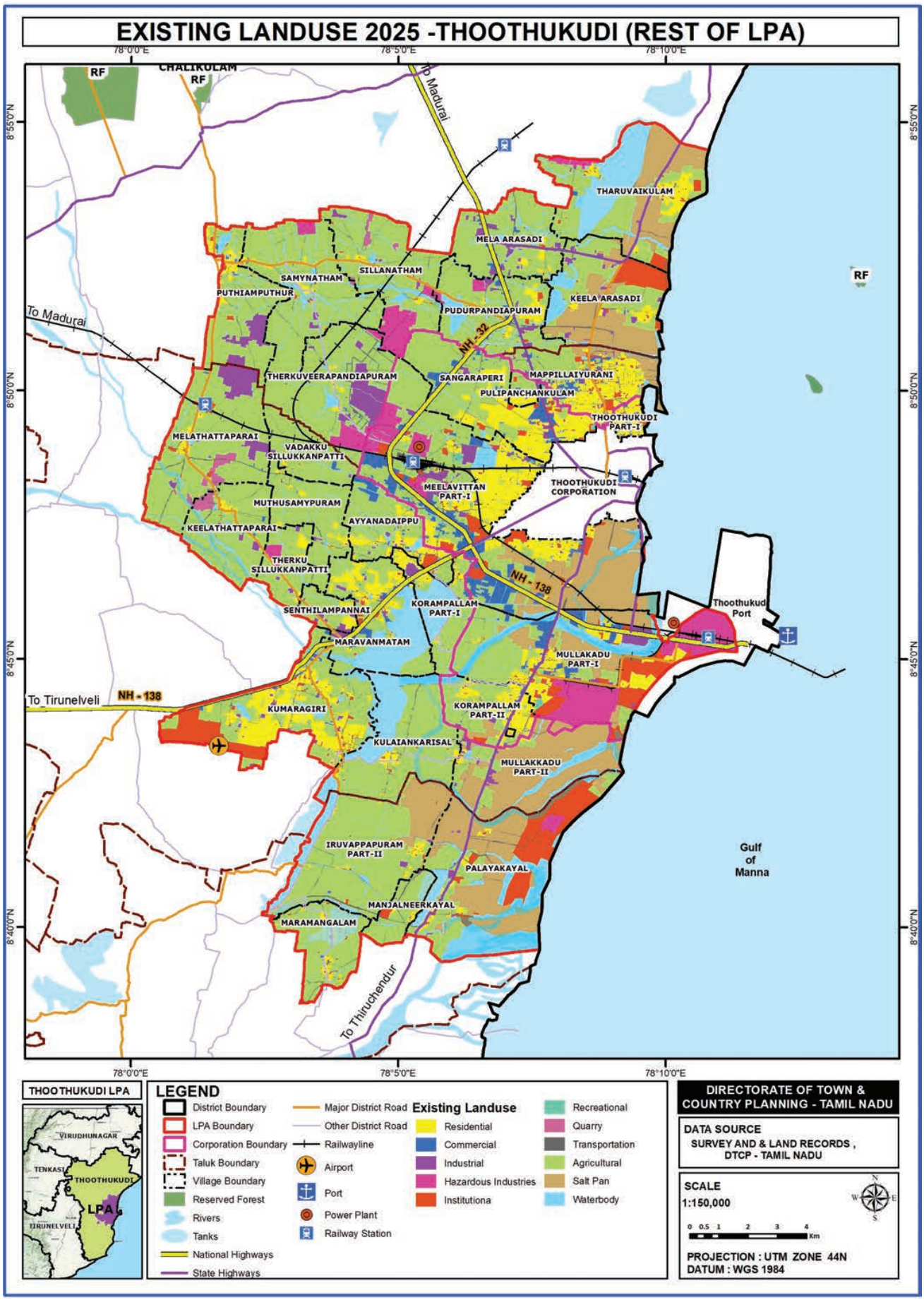


Figure 5.3 Proposed Land Use 2015 – Added Villages



Map 5.3 Existing Land Use 2025 for Added Villages

5.4 Detailed Development Plans

Section 19 of the Town and Country Planning Act envisages the preparation and implementation of Detailed Development Plans (DDPs) for any land within the Local Planning Area. At present, there are 35 Detailed Development Plans within the Local Planning Area. Table 5.5 presents the status of the Detailed Development Plans in the Thoothukudi Local Planning Area. The status indicates that a total of 31 plans have been approved, while 2 plans have received consent. In addition, 2 plans have been notified.

A total of 161 new roads have been proposed within the Thoothukudi Local Planning Area through 31 approved Detailed Development Plans (DDPs) to improve connectivity and support planned urban growth. The implementation status indicates varying levels of progress across different DDP areas. Krishnarajapuram DDP–05 and Milavittan DDP–01 have achieved significant progress, with approximately 80% of the proposed road network completed. Similarly, Sankaraperi DDP–05 and Maravanmatam DDP–01 and DDP–02 have recorded moderate progress, with nearly 60% of the proposed roads completed. The completion of these road networks has contributed to strengthening intra-area connectivity, facilitating access to developing residential and industrial zones, and supporting overall infrastructure development within the Local Planning Area. All the feasible roads proposed in the previous Detailed Development Plan are retained for future development.

Table 5.5 Stages of Detailed Development Plan in Thoothukudi LPA

Sl. No	Stage of Plan	No. of Plan
1	Approved	31
2	Consent	2
3	Notified & drafted	2
	Total	**35**

Source: Detailed Development Plan, Thoothukudi

5.5 Conclusion

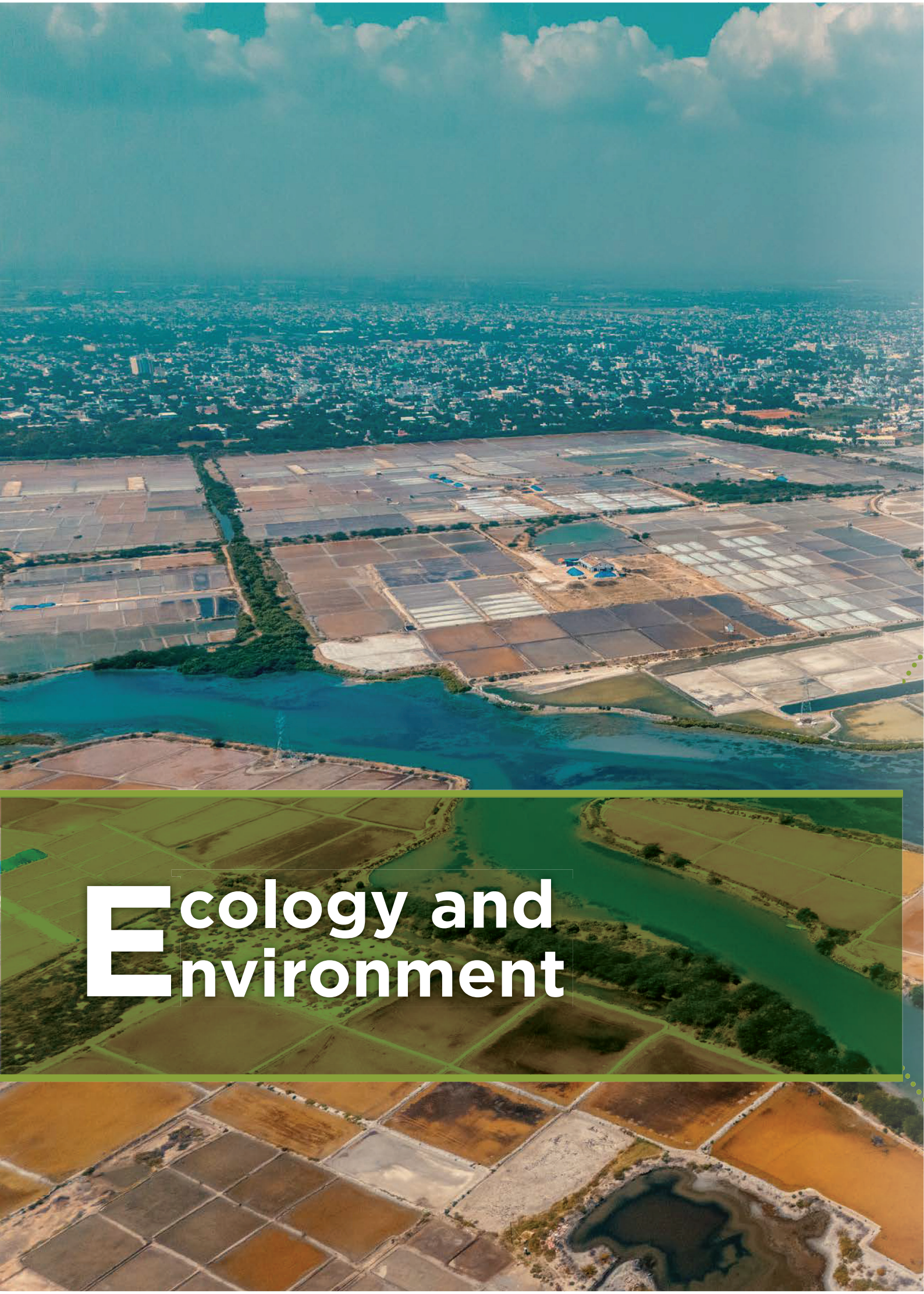
The review of previous Master Plans for the Thoothukudi Local Planning Area highlights significant gaps between planned proposals and actual development outcomes. The Thoothukudi Town Master Plan (2001) shows a considerable shortfall in achieving projected population, residential land use, and industrial development, reflecting overestimation of growth and limited implementation mechanisms. In contrast, the added villages witnessed relatively higher population growth, although large portions of proposed residential, commercial, and industrial lands remain underutilised, with agriculture continuing as the predominant land use.



Both plans lack sector-wise development strategies, clear land use policies, and integrated infrastructure planning. Key urban challenges—such as mixed land use in the town core, traffic congestion, parking shortages, heritage conservation, and disaster management—were inadequately addressed. The absence of provisions for disaster mitigation, climate resilience, and phased development further reduces the effectiveness of the plans.

Overall, the review underscores the need for a comprehensive and implementation-oriented Master Plan 2045, emphasising focused land use regulation, integrated infrastructure, disaster resilience, and sustainable urban growth.





Ecology and Environment



6.1 Introduction

The Thoothukudi Local Planning Area (LPA) is located in south-eastern Tamil Nadu along the ecologically sensitive Gulf of Mannar coast and forms part of the Deccan Peninsula physiographic region.

The natural setting of the LPA is defined by its low-lying coastal morphology and strong land–sea interface. The landscape comprises coastal plains, sandy beaches, tidal flats, estuaries, salt pans and extensive pediment-pedi-plain complexes, with gentle inland gradients and limited elevation towards the western hinterland.

The planning area is underlain predominantly by ancient Precambrian crystalline formations of the Charnockite and Migmatite Gneissic Complexes of the Southern Granulite Terrain, which are overlain in the coastal and low-lying zones by younger fluvial, aeolian and marine sediments. These deposits reflect long-term riverine, coastal and marine depositional processes and form the physical base governing landforms, soils, drainage systems, groundwater behaviour and ecological processes within the LPA. A significant portion of the planning area lies within low elevation bands, making it inherently sensitive to flooding, waterlogging, saline ingress and coastal processes. The proximity to the Gulf of Mannar-one of India's most ecologically significant marine regions-further enhances the ecological sensitivity of the LPA and influences coastal hydrodynamics, sediment movement, fisheries, wetlands and biodiversity.

Water systems form a critical component of the natural environment of the Thoothukudi LPA. The area is drained by monsoon-dependent river systems, seasonal odais, inland tanks and estuarine channels that ultimately discharge into the Gulf of Mannar. These surface water systems play a vital role in flood moderation, sediment transport, groundwater recharge and maintenance of coastal and estuarine ecosystems. Groundwater occurs within a mix of hard rock and coastal alluvial aquifers, with availability and quality strongly influenced by coastal processes, salinity ingress and recharge conditions. In this predominantly semi-arid and coastal setting, the interdependence between surface water, groundwater and coastal waters is a defining environmental characteristic.

Building upon this physical and hydrological context, the Ecology and Environment chapter presents a comprehensive assessment of the Thoothukudi Planning Area's natural systems and environmental resources, which form the foundation for sustainable and climate-resilient urban development. Thoothukudi's role as a coastal city and a major port-led industrial hub presents both opportunities and environmental challenges, with increasing pressure on coastal and marine ecosystems, wetlands, salt pans, river systems and groundwater aquifers. These pressures are further intensified by climate-related risks such as rising temperatures, sea-level rise, coastal erosion, saline intrusion and extreme rainfall events

The environmental assessment is structured in a hierarchical sequence beginning with the climate (air environment), followed by land, water, biotic systems, and finally disaster profile. This order reflects the natural dependency of environmental systems, where climate establishes boundary conditions, landforms translate climatic forces into spatial constraints, water systems respond to both climate and terrain, and biotic systems emerge from the interaction of these physical components. Disaster risks are treated as cumulative outcomes of stresses across these systems rather than isolated events. This sequencing ensures that subsequent sectoral proposals are grounded in fundamental physical realities.

The chapter aligns with national and state policy frameworks, including Coastal Regulation Zone (CRZ) norms, environmental protection legislation and climate resilience guidelines. By integrating physical features with ecological processes, it provides a robust basis for land-use planning, infrastructure development and environmental management strategies proposed under the Master Plan.

6.2 Climate

The climatic characteristics of the planning area are primarily governed by temperature patterns, rainfall distribution, and prevailing wind regimes. An assessment of temperature, rainfall quantity, and wind direction and speed provide insight into climatic extremes, and overall environmental dynamics. This section presents an overview of these key climatic parameters using Indian Metrological Department's data, to establish the climatic baseline of the planning area studied for a period of 30 years – 1995 to 2024 and to understand the climate change scenario in the Thoothukudi Planning Area

The Thoothukudi Planning Area has a tropical climate with hot and humid summer and dry winter seasons, characterised by high temperatures, moderate to high rainfall and high humidity influenced by the proximity to Bay of Bengal and the Gulf of Mannar. The city's climate plays a crucial role in shaping the settlement pattern, water availability, ecological systems and overall liveability.

6.2.1 Temperature

The temperature record shows year-to-year variability with an overall increasing trend over the study period. The average temperature over 3 decades (1995 to 2024) is 27.83°C The maximum temperature ranges between 33.60°C and 36.91°C, while the minimum temperature ranges between 21.44°C and 23.52°C as depicted in figure 6.1

Annual mean maximum and Annual Mean Minimum for the year 2024 is recorded as 35.99°C and 23.48°C as show in figure 6.1. April remain the hottest month with an average temperature of 30.31°C and December is the coldest month with an average temperature of 25.17°C, as observed over the 3 decades.

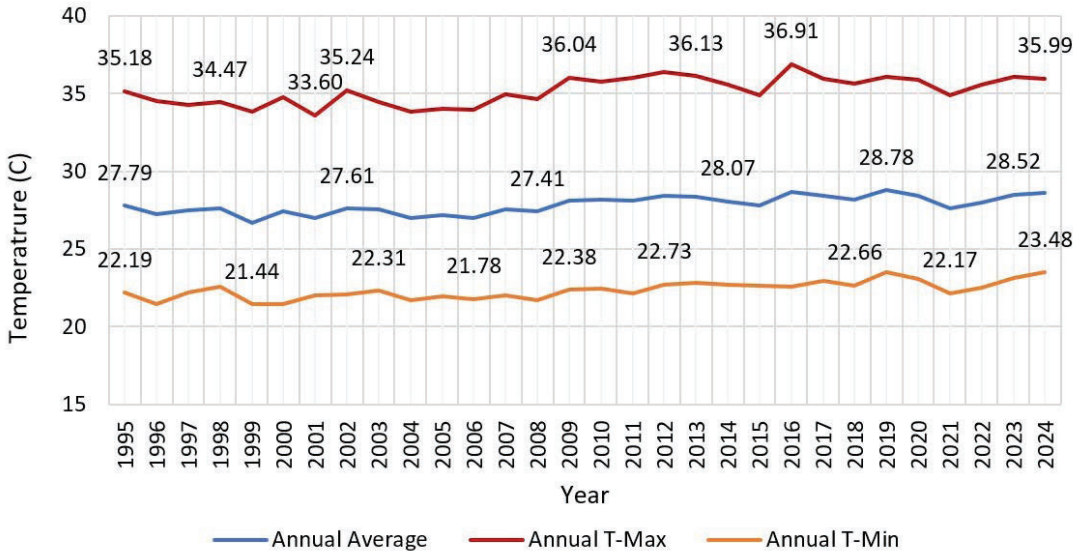


Figure 6.1 Temperature over 30 years period (1995 to 2024)

Source IMD Data

Seasonal temperature variation

Summer maximums range between 35.22°C & 39.15°C, with the highest recorded temperature of 39.15°C observed in 2019. While summer minimums range between 22.51 & 25.34 as depicted in figure 6.2.

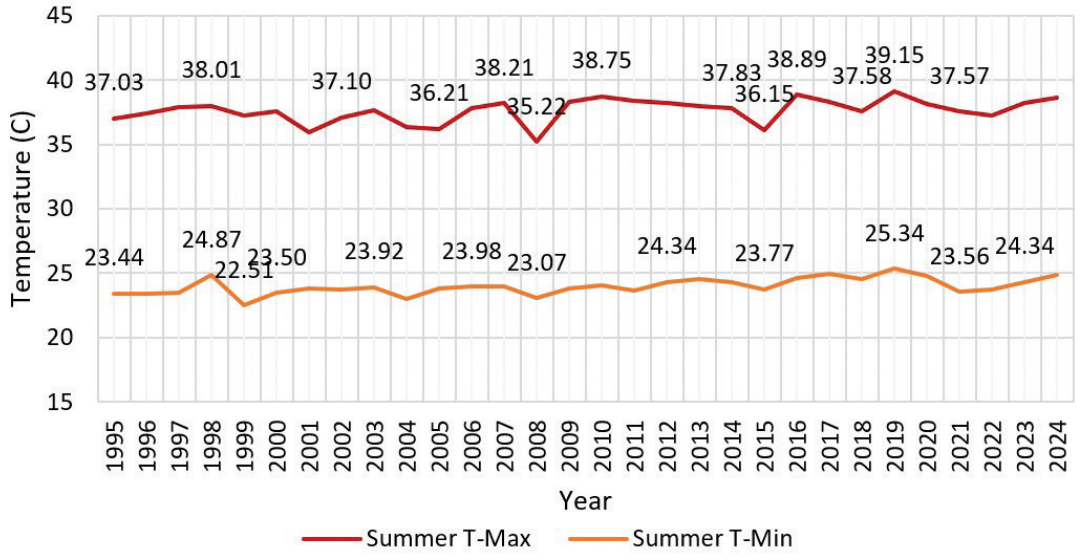


Figure 6.2 Summer Temperature Variation

Source IMD Data

The lowest temperature recorded is 18.05°C, observed in 2006. Winter minimums ranges between 18.05°C & 20.68°C, while winter maximums fall between 31.37°C & 34.47°C as show in figure 6.3.

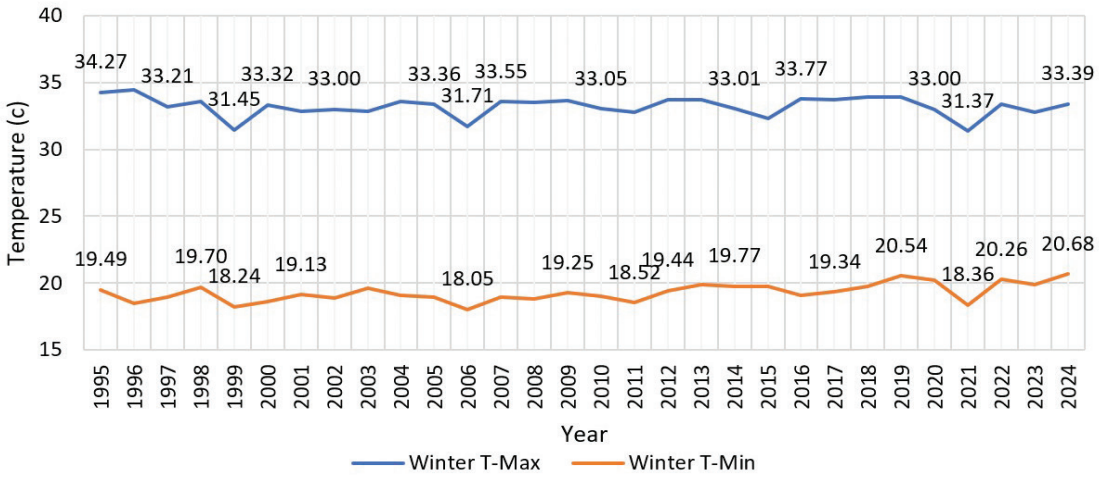


Figure 6.3 Winter Temperature Variation

Source IMD Data

Temperature deviations

T-Max - 1995 to 2004: Predominantly negative T-Max deviation with higher inter-annual variability. Majority of the year's show below-normal T-Max. Several pronounced cool years can be noticed between -2% and -4% (1997, 1999, 2001 & 2004). The only isolated positive deviation is +0.14 observed in 2002, not sustained. No clear warming trend can be notice in this decade as presented in figure 6.4. This decade represents a relatively stable, cooler climatic baseline against which later warming trends become more apparent.

T-Max – 2005 to 2014: There is a noticeable shift from negative to positive deviations. Negative deviation continues up to 2007, while consistently positive deviations occur 2008 onwards. There is a gradual increase reaching ~+3–3.5% by 2012–13, followed by a short dip around 2014, but overall positive dominance can be observed in this decade. This decade marks the onset of systemic warming, indicating a transition phase rather than short term variability.

T-Max – 2015 to 2024: Consistently positive and elevated deviations can be noticed in this decade. All year's show above-normal T-Max. Extreme peaks is observed in 2016 with +4.88% deviation. Even the relatively cooler years within this decade remain positive. There are minor fluctuations, but no return to historical baseline. This decade reflects fully established warming conditions, with T-Max deviations becoming the new normal, not anomalies.

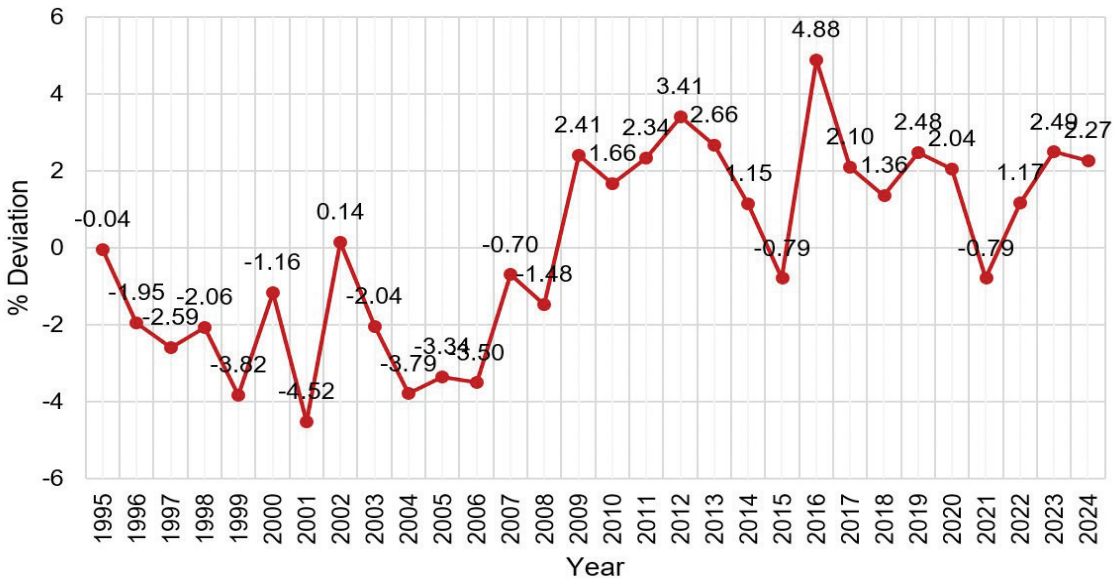


Figure 6.4 T-Max deviation %

Source IMD Data

T-Min – 1995 to 2004: Predominantly negative T-Min deviations observed, sharper than T-Max. Most years show below-normal minimum temperatures. Several deep negative departures, (~-4%), especially in the late 1990's. One brief positive spike can be seen in 1998, but it is not sustained. Highly variable, yet cool nights dominate this decade as shown in figure 6.5. This period represents a cool nocturnal baseline, with efficient night-time cooling and limited heat retention.

T-Min – 2005 to 2014: This decade marks a gradual shift from negative to positive T-Min deviations remaining largely below normal. From 2009 onwards, T-Min deviations turn consistently positive, with sustained values around +1 to +2%. There is a reduced amplitude of negative extremes compared to previous decade. This decade signals the weakening of night time cooling, marking the onset of nocturnal warming, often associated with increasing urbanisation and heat retention.

T-Min – 2015 to 2024: A strong and persistent positive T-Min deviations can be observed. Almost all years are well above normal. Extreme peaks occur in 2019 (~+5.2%) and 2024 (~+5.0%). The negative deviations are also closer to normal. Overall rise is sharper than T-Max, indicating night warming dominance. This decade reflects pronounced night-time heat accumulation, a classic signature of urban heat island effect and climate warming.

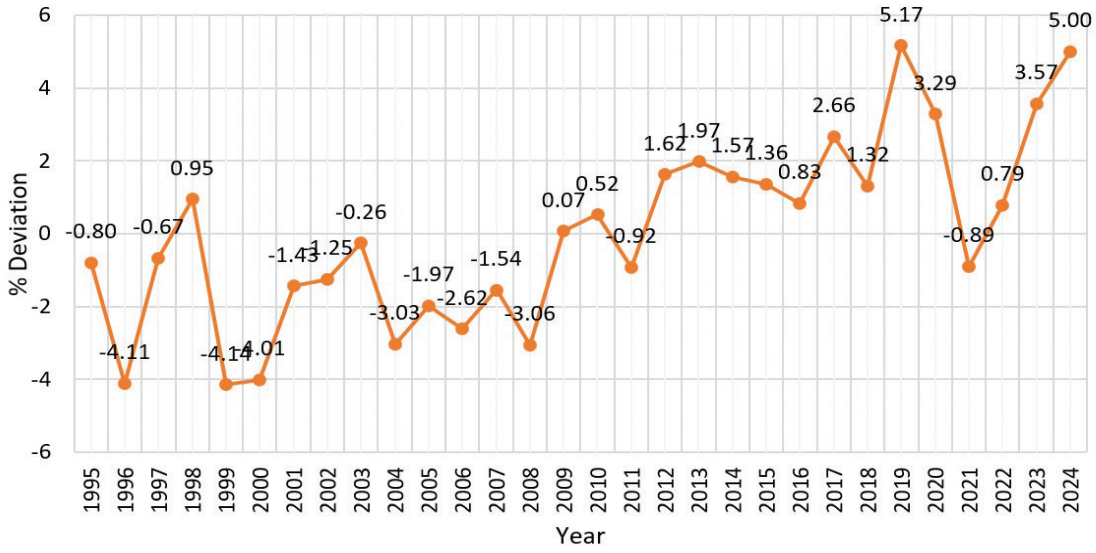


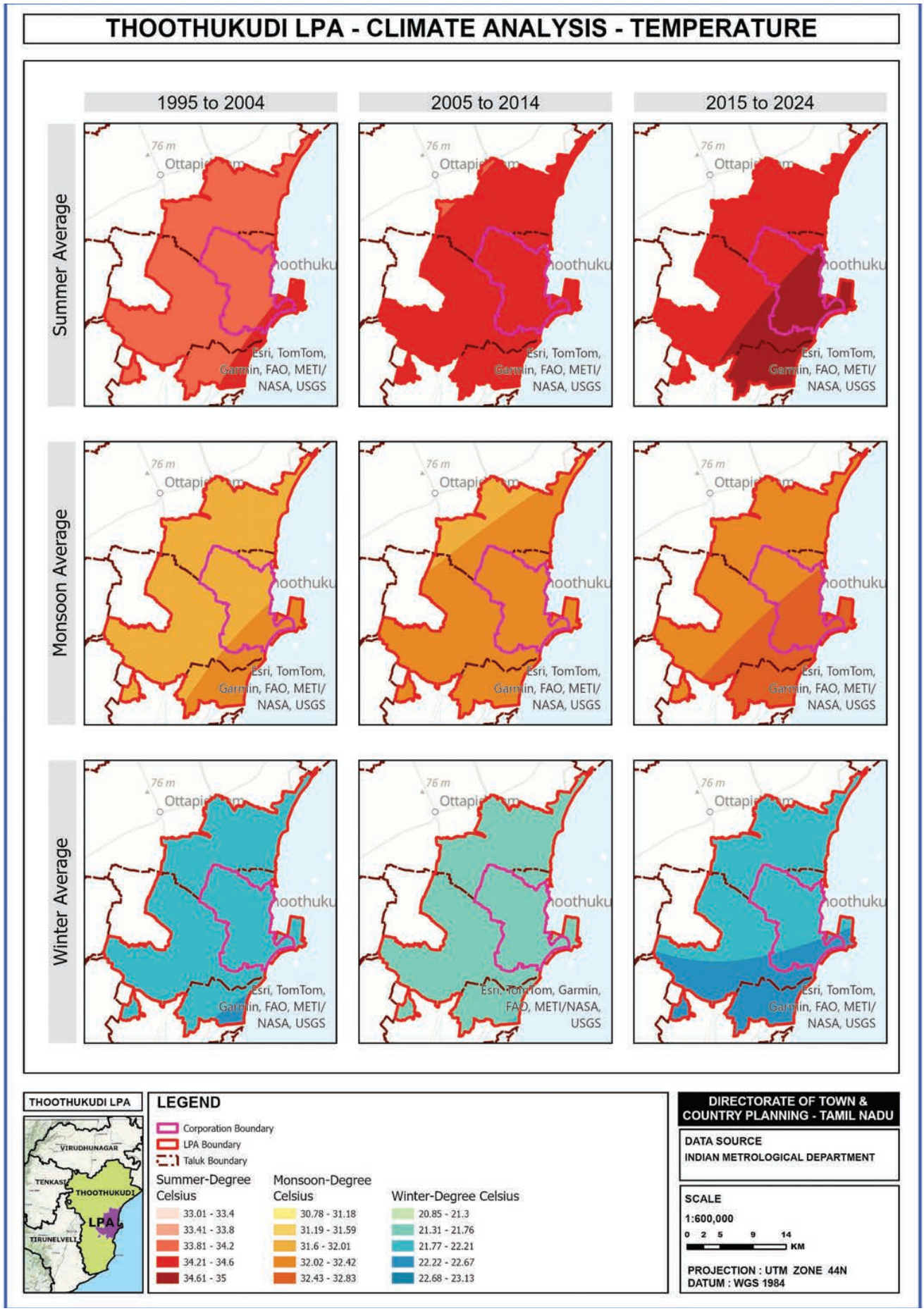
Figure 6.5 T-Min deviation %

Source IMD Data

The T-Max deviation analysis indicates a clear transition from cooler baseline (1995-2004) to a warming phase (2005-2014), culminating in consistently elevated maximum temperatures post 2015, suggesting long-term thermal stress rather than episodic anomalies.

The T-min deviations shows a stronger and rapid warning signal than T-Max, particularly post 2015, indicating reduced night-time cooling and increasing heat retention, a characteristic of urban heat stress.

To spatially corroborate the observed decadal trends in temperature, seasonal isotherms are analysed for the time period: 1995 to 2004, 2005 to 2014 and 2015 to 2024. The evolution of isotherm patterns reflects the progressive warming observed in the temperature deviation study as presented in Map 6.1.



Map 6.1 Isotherms for Thoothukudi Planning Area - 1995 to 2024

Source IMD Data

6.2.2 Temperature Projections

As per Tamil Nadu State Action Plan on Climate Change (TNSAPCC), the Thoothukudi district is expected to experience an increase of 2.8°C in Maximum temperature and 3.1°C with respect to minimum temperature by the end of this century as show in Table 6.1. This indicates a warming climate, leading to higher heat index, increased frequency of heat waves, affecting agriculture and public health as well as increased water demand possibly resulting in water stress highlighting the need for proactive and integrated water resource management. However, the Thoothukudi LPA is observed to have an increase in maximum temperature by 2.16°C and minimum temperature to increase by 2.32°C by 2050's as per Anna University and Tamil Nadu State Climate Change Cell (TNSCCC). Figure 6.6. and 6.7 depicts the projected rise in maximum and minimum temperatures within the Thoothukudi district.

Table 6.1 Change in maximum and minimum temperature in °C with reference to 1970-2000 for Thoothukudi District

Change in maximum temperature in °C with reference to 1970-2000		Change in minimum temperature in °C with reference to 1970-2000	
2010-2040	2040-2070	2010-2040	2040-2070
1.0	1.8	1.1	2.2

Source Tamil Nadu State Action Plan for Climate Change

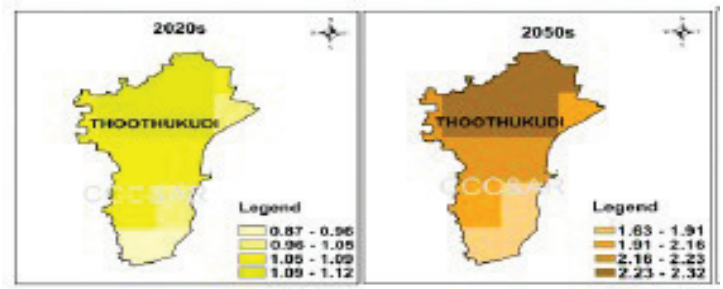


Figure 6.6 Changes in Max. Temperature for 2020s, 2050s

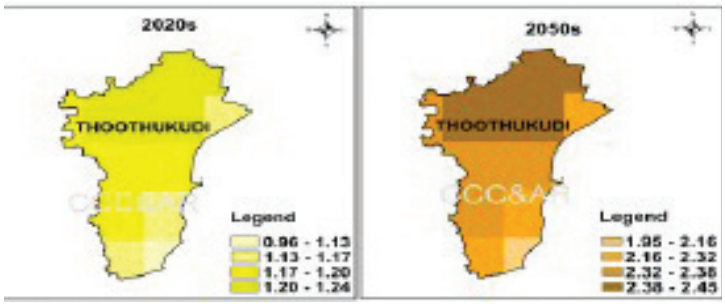


Figure 6.7 Changes in Max. Temperature for 2020s, 2050s

Source Anna University and Tamil Nadu State Climate Change Cell (TNSCCC)

6.2.3 Rainfall

The district receives rainfall from both the South **West and North East** monsoons, with the latter dominating the rainfall regime. Cyclonic storms, often originating from the depressions in the Bay of Bengal, result in high amounts of rainfall, which is observed in the months of October to December. Kayalpattinam, a locality within the district, experienced an extraordinary event when it received a remarkable **96 cm** of rain in a single day.

Thoothukudi receives an average annual rainfall of 790.116 mm as observed in the past decade (2015 – 2024) which is lower than the state average of 960 mm. Annual rainfall in 2024 is 931.78 as presented in figure 6.8.

The month of November receive the highest rainfall with an average rainfall of 264.45 mm across the past decade, with the highest rainfall of 483.86 mm recorded in November 2021, and **262.41 mm** of rainfall observed in **one single day** at a location within Korampallam sub-watershed of the Thoothukudi Planning Area. Overall, North East monsoon has received an average rainfall 571.77 mm observed for the past decade (2015-2024).

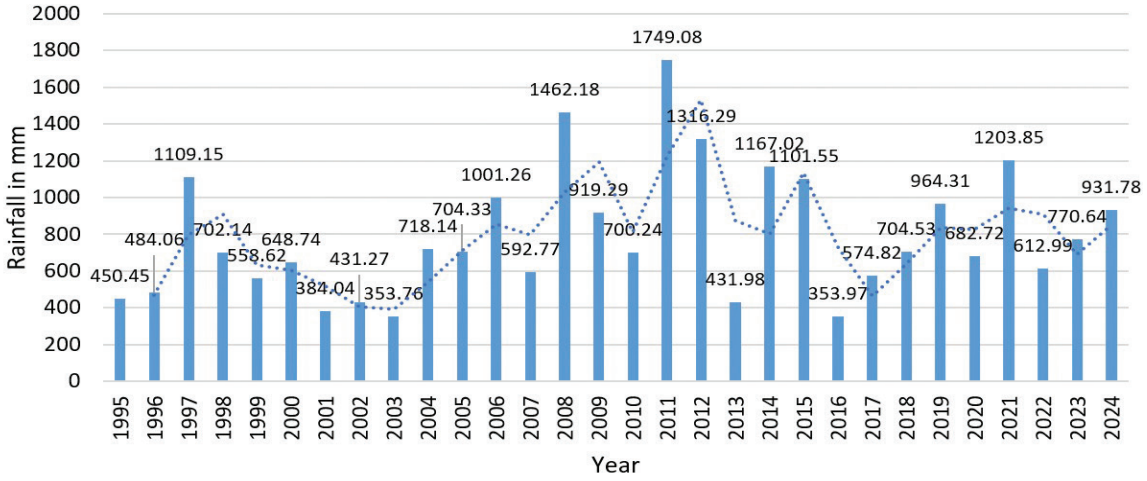


Figure 6.8 Annual Rainfall for 30 years (1995 to 2024)

Source IMD Data

Monsoon Trend

The monsoon trend shows that 1995 to 2004 had moderate rainfall with NE monsoon dominating occasional peak years. In 2004 to 2014, both SW and NE monsoons become highly variable, with strong NE monsoon years (2008, 2011, 2012) driving major annual rainfall spikes. 2015 to 2024 reflects fluctuating but more balanced contributions from both monsoons, with NE monsoon still influencing key wet years like 2015 and 2021. Overall, monsoon variability has increased across the decades, with the NE monsoon growing more influential over time, as presented in figure 6.9.

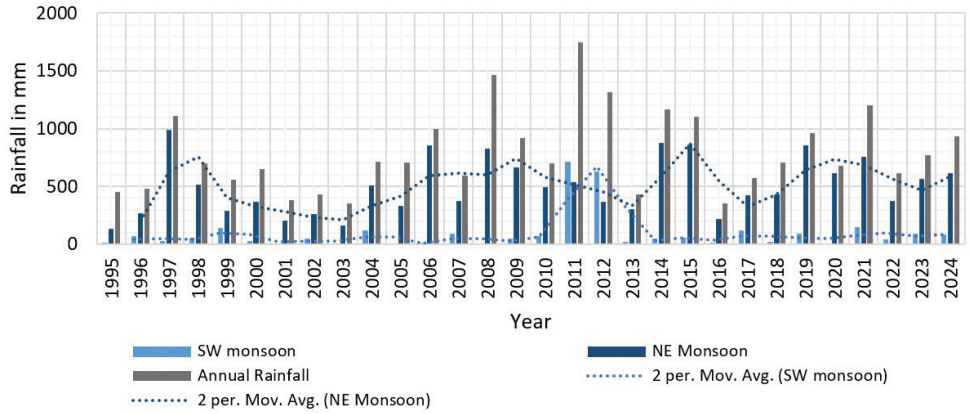


Figure 6.9 Trend in monsoon months over 30 years (1995 to 2024)

Source IMD Data

Rainfall Variability

The rainfall variability plot presented in figure 6.10 shows clear decadal contrasts in the frequency of excess (> +20%) and deficit (< -20%) rainfall years. 1995 to 2004 is dominated by deficit years, with several extreme negative deviations (1995, 1992 to 2002), indicating a generally drier phase. In 2005 to 2014, variability becomes much sharper, marked by major excess rainfall years like 2007, 2008, 2010, and an extreme peak in 2011 (+120%) alongside notable deficit years like 2012 and 2015, reflecting heightened climatic instability.

The period 2015 to 2024 shows a mix of moderate deficit and occasional excess years (2018,2021), but with fewer extreme swings than the previous decade. Overall, the data illustrates a shift from persistent deficits in the early decade to high volatility in the mid-decade, followed by a more balanced yet still variable pattern in recent years.

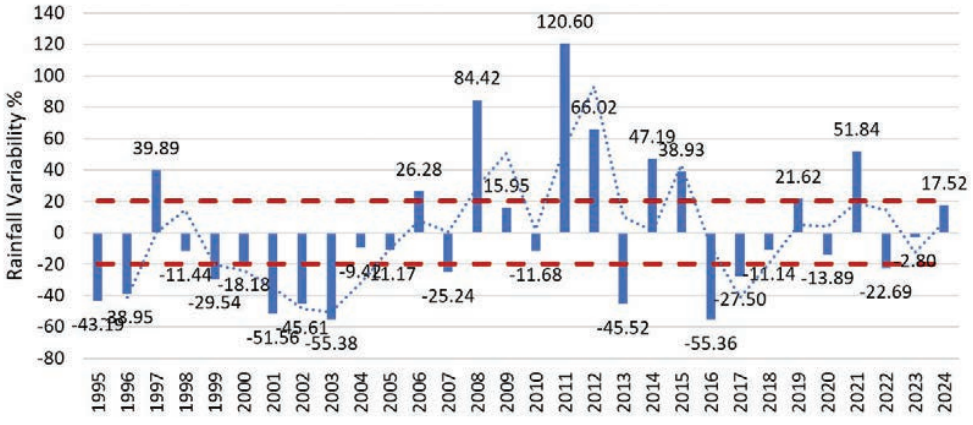


Figure 6.10 Rainfall variability over 30 years (1995 to 2024)

Source IMD Data

Standardised Precipitation Index

The Standardised Precipitation Index (SPI) is a widely used to measure and monitor drought by quantifying precipitation deficits or surpluses over a specific time period as presented in Table 6.2. It provides a numerical value that represents how much precipitation deviates from the historical average for a given location. Negative values indicate drier-than-average conditions, and positive values indicate wetter than average conditions.

Table 6.2 Standardised Precipitation Index

Description	Criterion
2 or more	Extremely wet
1.5 to 1.99	Severely wet
1.0 to 1.49	Moderately wet
-0.99 to 0.99	Near Normal
-1.0 to -1.49	Moderately dry
-1.5 to -1.99	Severely dry
-2 or less	Extremely dry

Source World Meteorological Organization (2012). Standardized Precipitation Index User Guide.

The SPI from 1995 to 2024 shown in figure 6.11 indicates the first decade – 1995 to 2004 experienced drier years dominated by negative SPI values including moderate drought (-1.0 to -1.49) years around 2001 to 2003, while other years in the decade stayed in the near normal range (-0.99 to +0.99).

The second decade, 2005 to 2014, shows a drastic shift towards positive SPI values, with multiple wet years – 2006, 2008, 2009, 2011, 2012 and 2014 largely ranging between moderately wet (1.0 to 1.49) and very wet (1.5 to 1.99) except 2011 which falls in the extremely wet (2 and above) SPI.

The period 2015 to 2024 shows mixed but milder conditions, with a few wet years (2015 slightly wet, 2021 moderately wet) and scattered drought years (2016 moderately wet, being most severe), reflecting a more balanced but still variable hydroclimatic regime. Overall the SPI trend moves from a decade of sustained drought to one of strong wet extremes, and finally to a more moderate but fluctuating recent periods.

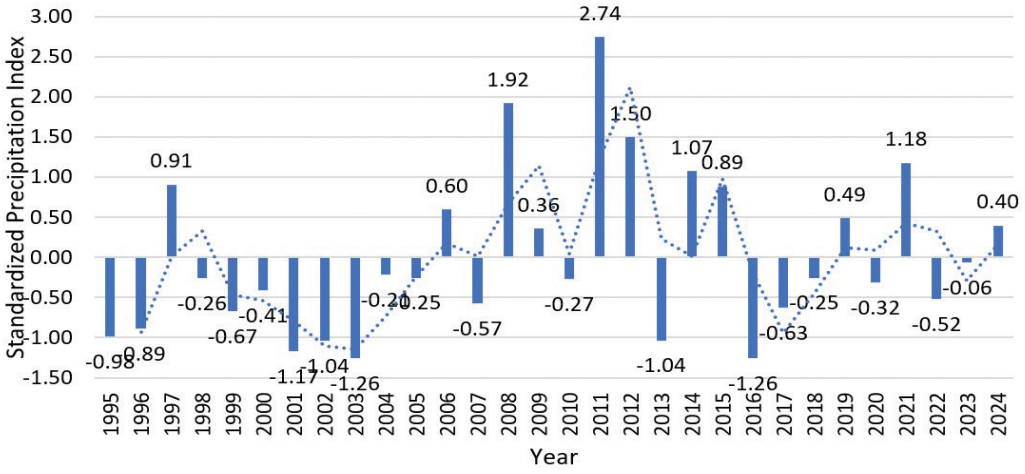


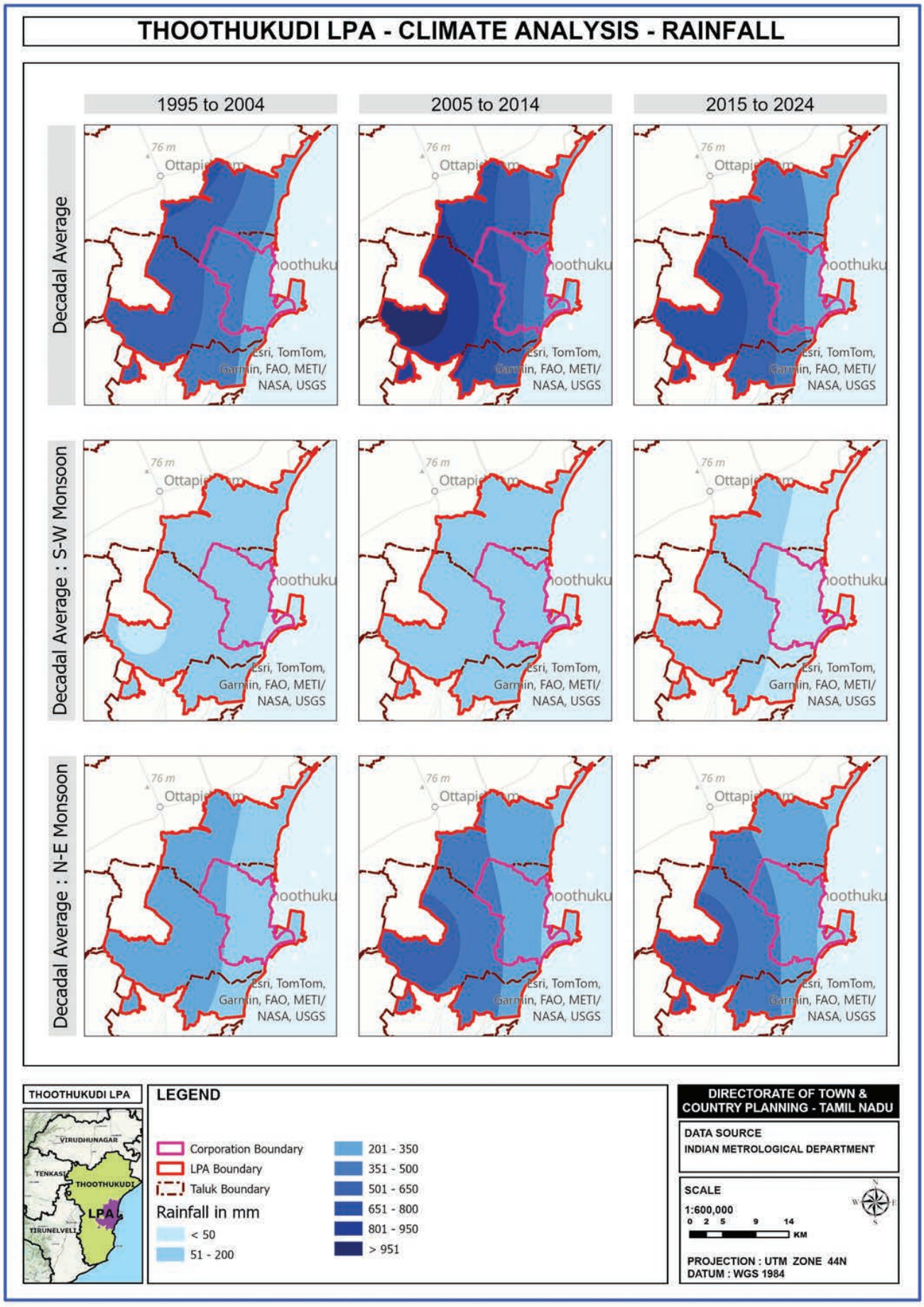
Figure 6.11 Standardised Precipitation Index over 30 years (1995 to 2024)

Source IMD Data

To spatially corroborate the observed rainfall trend, isohyets have been developed for each of the decades that show a clear decadal shift in rainfall distribution across the Thoothukudi LPA as shows in Map 6.2. From 199 to 2004, rainfall is relatively moderate and spatially uniform, with most of the LPA falling under 351 to 650mm rainfall.

During 2005 to 2014, the region experiences a noticeable intensification, with closely spaced and higher value isohyets beyond 951mm rainfall. The third decade, 2015 to 2024, shows the stabilised but higher rainfall. Overall, the rainfall pattern shows a transition from a moderate to a distinctly wetter middle decade followed by a stabilised but still a higher rainfall regime.

The observed increase in inter-annual rainfall variability, with alternating excess and deficit years, indicates higher hydro-climatic uncertainty, raising the risk of both short-duration flooding and droughts. The growing dominance and variability of the NE monsoon makes rainfall more event-based and concentrated, stressing urban drainage, coastal infrastructure, and water-harvesting systems. Periods of deficit rainfall, reflected in SPI and variability trends, can reduce groundwater recharge and heighten dependence on external water sources, while excess rainfall years demand improved stormwater management and flood-resilient planning. Overall, the rainfall trends underline the need for climate-responsive land-use planning, decentralized water storage, and adaptive urban infrastructure in Thoothukudi LPA.



Map 6.2 Isohyets for Thoothukudi Planning Area - 1995 to 2024

Source IMD Data

6.2.4 Rainfall Projections

As per Tamil Nadu State Climate Action Plan, the rainfall is projected to decline in the near future (-1% by 2040) and increase by 8% by the end of 2070's as shown in Table 6.3

Table 6.3 Change in annual rainfall % with reference to 1970-2000 for Thoothukudi District

2010-2040	2040-2070
-1	8

Source Tamil Nadu State Action Plan for Climate Change

In the short term, reduced rainfall may intensify water stress corresponding to increasing temperature, necessitating efficient water-use planning, demand management, and strengthening of drought preparedness measures. Over the long term, increased annual rainfall, calls for climate-resilient planning approaches, including augmentation of drainage infrastructure, flood risk management, protection and restoration of natural drainage systems, adaptive water and land management strategy to address both deficit and excess rainfall conditions under changing climatic scenario. Climatic conditions and seasonal variability directly influence surface drainage behaviour, groundwater recharge cycles, coastal processes and the performance of natural and built systems across the planning area.

6.2.5 Wind Speed and Direction

Wind Speed

The annual mean wind speed at **50m height**, a level considered important for dispersion of industrial emissions, stack height planning, and renewable energy (wind potential) assessment, over the 30-year period is **6.08 m/s.** The maximum wind speed is between 12.51 and 17.48, with the maximum recorded in the year 2000 as shown in figure 6.12.

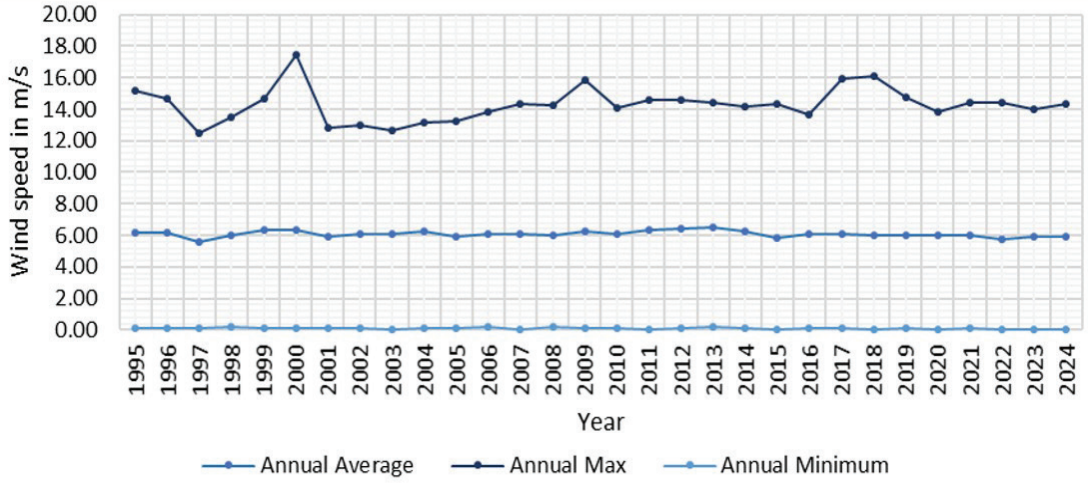


Figure 6.12 Wind speed at 50 m height -Thoothukudi LPA over 30 years (1995 to 2024)

Source IMD Data

The annual mean wind speed at **10m height,** a level considered to assess thermal comfort, dust resuspension, air pollution dispersion, and pedestrian-level microclimate, remains largely stable over the 30-year period, fluctuating within a narrow band of **4.03 to 4.92 m/s** as shown in figure 6.13, indicating no major long-term increasing or decreasing trend. The annual maximum wind speed consistently lies between 8.0 to 9.5 m/s, with occasional peaks in around 2000, 2009 and 2017, reflecting short term variability but overall stability. The annual minimum wind speed stays between 0.5 to 1.2 m/s, showing small year-to -year fluctuations with no observable long-term shift. Overall, the dataset suggests stable wind regime with minor interannual variations but no significant climate trend in either mean, maximum or minimum wind speeds.

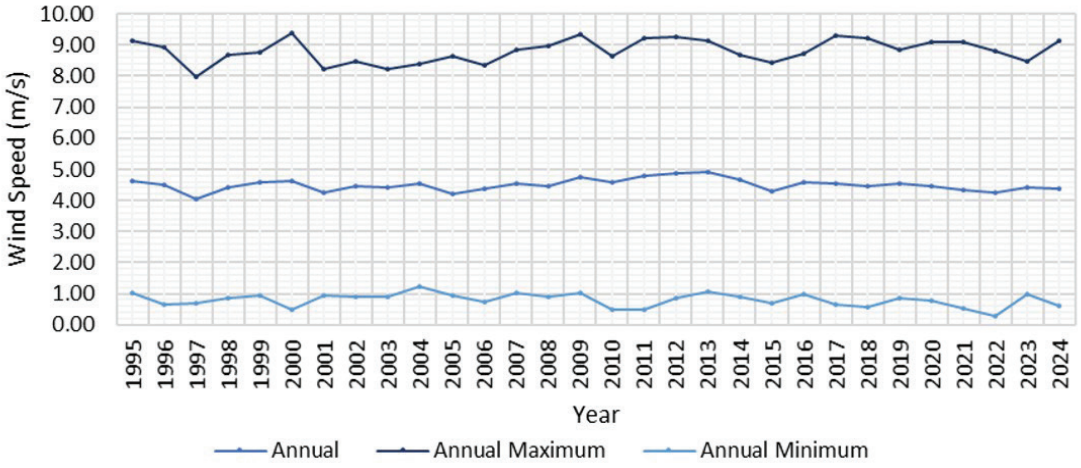
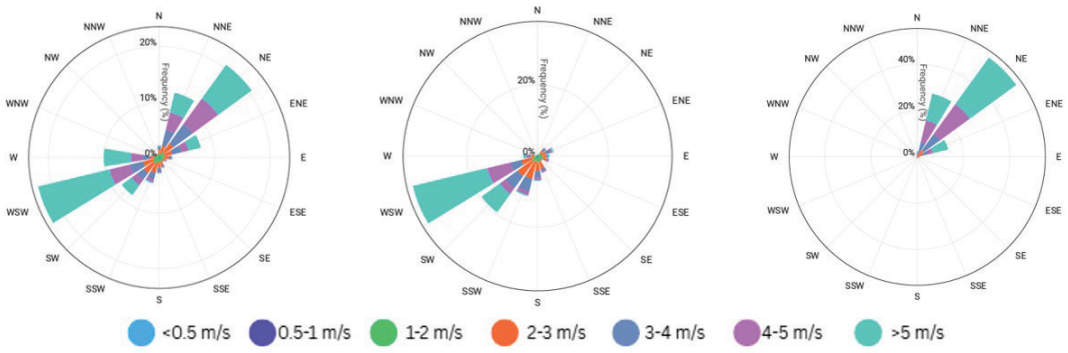


Figure 6.13 Wind speed at 10 m height -Thoothukudi LPA over 30 years (1995 to 2024)

Source IMD Data

Wind Direction

The wind rose diagrams for Thoothukudi LPA annual wind direction shows a bimodal pattern dominated by two seasonal systems with North-East and South-West sectors contributing the highest frequencies across the years. The summer winds predominantly blow from the South-West showing a strong maritime influence, while the winter winds are strongly concentrating from the North-East, corresponding to the North-East monsoon as shown in figure 6.14. The prevailing wind direction in Thoothukudi is **WSW** dominated by wind speed greater than 5 m/s accounting for 13.15% of wind from all directions.



Annual Wind Direction *Summer Wind Direction* *Winter Wind Direction*

Figure 6.14 Wind Directions

Source Envitrans

6.2.6 Relative Humidity

The relative humidity trends show a clear decadal shift. 1995 to 2004 records consistently high humidity, between 72 and 80%, reflecting wetter and more moisture rich conditions. During 2005-2014, humidity begins to decline, with noticeable drops after 2007 and values frequently falling near or below 72%. In 2015 to 2024, humidity stabilises at a lower range (around 70 to 74%), with only occasional short-lived increase. Overall, the pattern indicates a gradual long-term decrease in atmospheric moisture, aligning with rising temperatures and shifting rainfall behaviour in recent decades as shown in figure 6.15.

Monsoon RH as shown in figure 6.16 remains the highest but shows a mild decline, summer RH drops more noticeably after 2007, and winter RH also trends downward after 2010.

Across all seasons, humidity is gradually decreasing, indicating a shift toward a drier atmosphere, exacerbating thermal discomfort and heat stress, particularly in summer, increase evapotranspiration losses and elevate irrigation and domestic water demand.

This may also affect crop productivity, soil moisture retention, and urban microclimates, while increasing the risk of dust generation and air-quality

deterioration, which is a concern here, as Thoothukudi is a non-attainment city having repeatedly recorded particulate matter levels exceeding the national ambient air quality standards for key pollutants such as PM10 and PM2.5.



Figure 6.15 Relative Humidity % over 30 years (1995 to 2024)

Source IMD Data

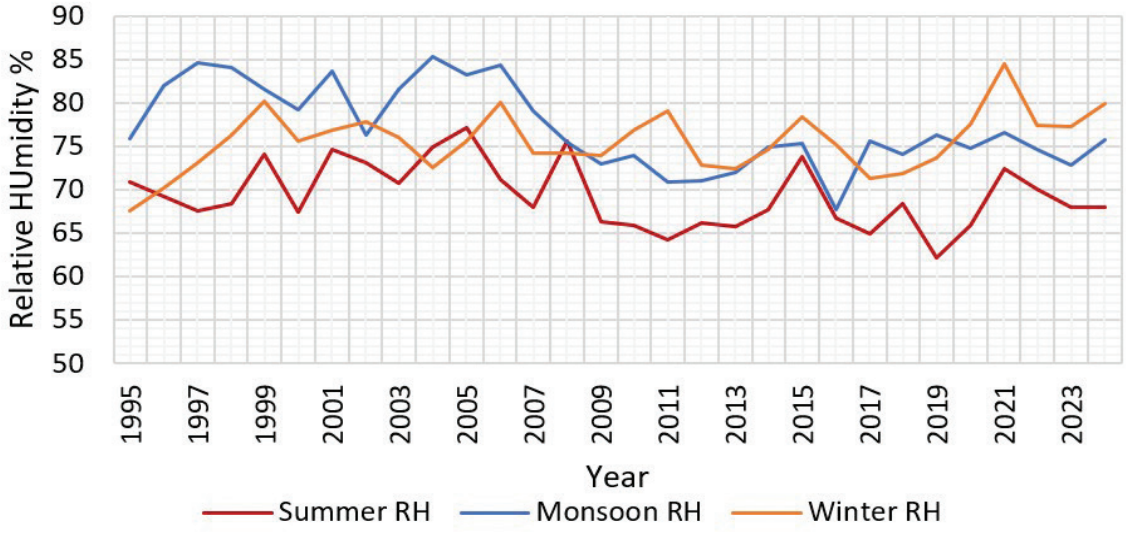


Figure 6.16 Seasonal relative humidity % over 30 years (1995 to 2024)

Source IMD Data

The steady decrease in relative humidity over the decades suggests a shift toward **drier atmospheric conditions**, which may intensify heat stress, increase

evapotranspiration, and reduce soil moisture, making the region more prone to dry spells and agricultural stress.

Lower humidity also affects human comfort, amplifying warming impacts in urban areas, while potentially influencing monsoon behaviour, as reduced moisture availability can weaken or delay rainfall events.

In coastal cities like Thoothukudi, declining humidity may also indicate broader climatic shifts driven by warming temperatures and changing wind-sea interactions.

6.2.7 Solar Radiation

The average solar radiation across the 30-year period is 272.73 W/m2, and has typically ranged between 268 to 276 W/m2 A rising trend can be seen in the initial decade, around 1998 to 2004, and a gradual decline can be observed post 2008 followed by sharper dips in the recent decade specifically in 2018 and 2022 as shown in figure 6.17. The recent decline suggests increased cloud cover and increase in atmospheric aerosols which may limit the solar energy potential.

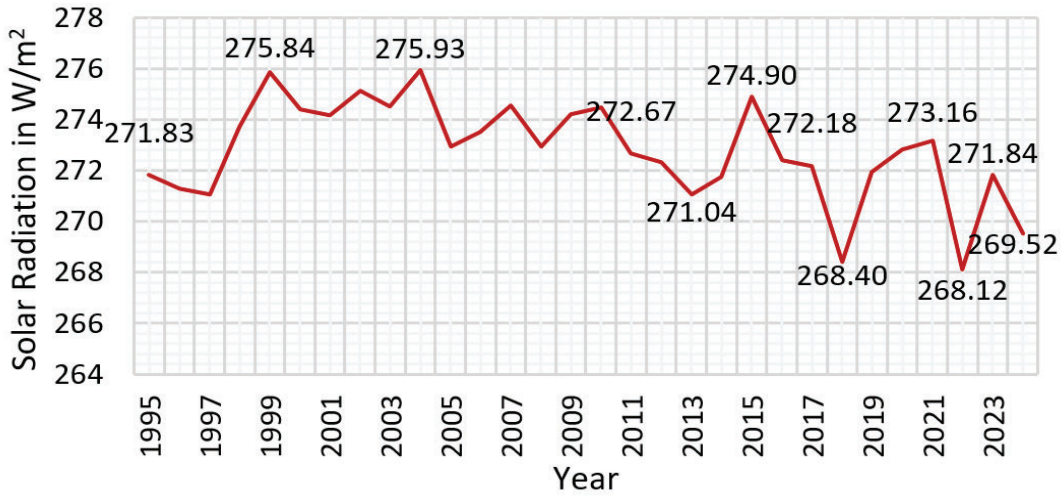


Figure 6.17 Solar radiation in Thoothukudi LPA over 30 years (1995 to 2024)

Source IMD Data

The observed trends of rising temperatures, declining humidity, and increasing rainfall variability have direct implications on land systems in Thoothukudi, influencing soil moisture, runoff behaviour, salinity dynamics, and flood susceptibility. These climatic drivers form the basis for assessing the land environment as an active mediator between climate processes and hydrological response.

6.3 Land Environment

6.3.1 Elevation

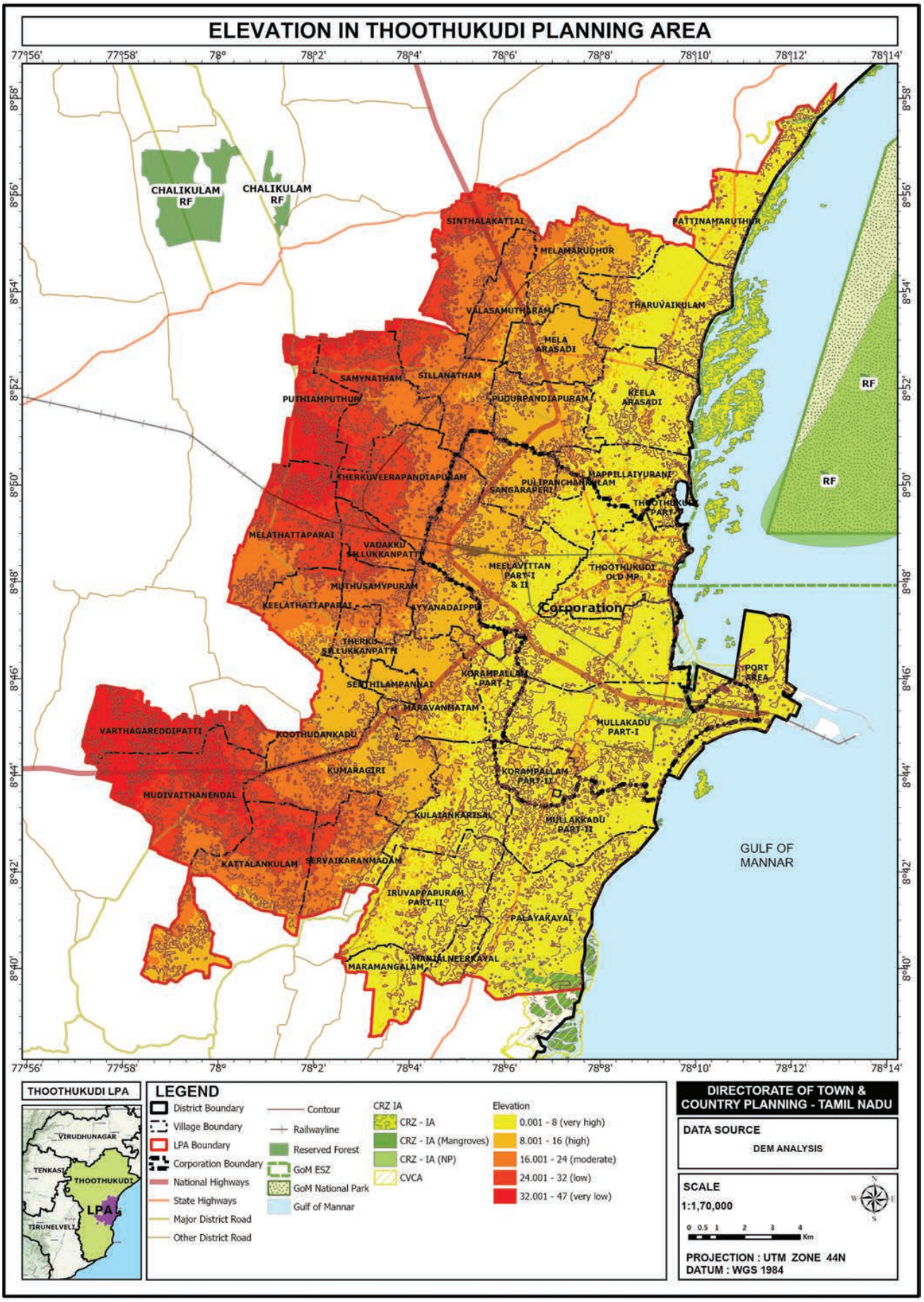
The elevation characteristics of the Thoothukudi LPA, indicate a predominantly low-lying coastal landscape, with elevations gradually increasing from the coastal edge towards the interior parts of the LPA. Within the Thoothukudi Corporation boundary, the terrain ranges from 0 to 30 metres ASL, reflecting flat coastal plains with minimal variation.

Beyond the corporation limits, the elevation gradually increases, falling between 30 and 47 metres ASL across the remaining LPA extent. This overall pattern shows a smooth transition from coastal lowlands to slightly elevated inland areas, forming a consistent and gently rising terrain across the region.

The contour profile of the Thoothukudi Local Planning Area reflects a predominantly flat coastal landscape with limited topographic variation. Elevations within the LPA as shown in Map 6.3 ranges from 0.1 m ASL, observed along the coastal stretch and in low-lying areas such as salt pans and the port precinct, to a maximum of approximately 125 m ASL in the Vallanadu Reserve Forest located in the western hinterland.

A significant portion of the LPA lies within the 0-40 m elevation band, characterising the region as a low-lying coastal plain. This zone encompasses key landscape features including salt pan extents, port and industrial areas, sandy beaches, tidal creeks, and estuarine systems that drain eastwards into the Gulf of Mannar.

Beyond the coastal belt, the terrain exhibits a gradual inland rise, culminating in the elevated landforms of the Vallanadu Reserve Forest. Hence, the contour distribution highlights a gently sloping topography transitioning from flat coastal plains to moderately elevated inland areas, defining the physical structure of the Thoothukudi LPA.



Map 6.3 Elevation of Thoothukudi Planning Area

Source Landsat series

6.3.2 Slope

The lower elevation in the eastern part of the LPA features slope up to 6% which is high suitable areas for coastal plains especially salt pans to deal with high and low tides as shown in Map 6.4

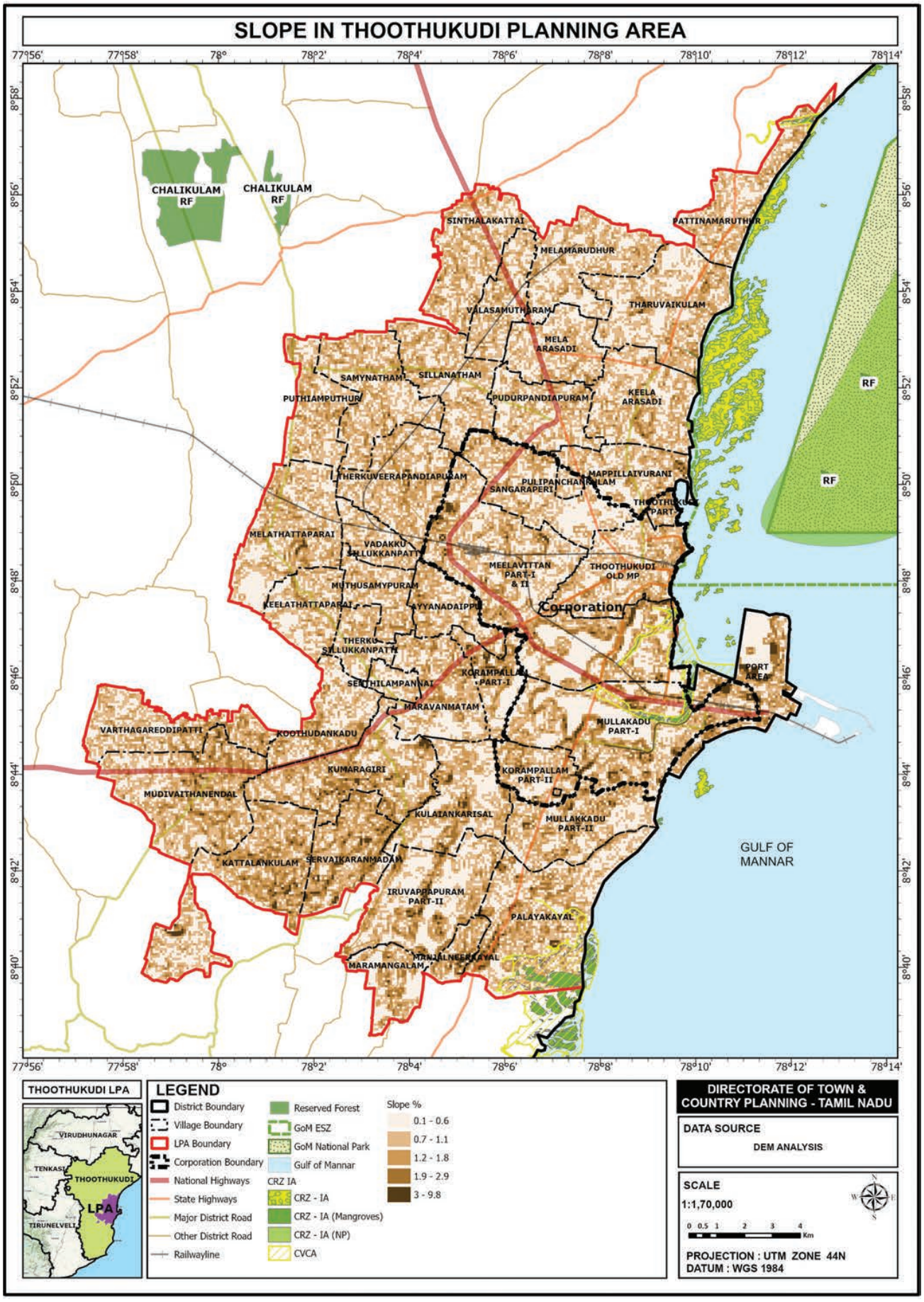
6.3.3 Geology

The role of geology is prominent through the influence of lithology in the production of parent material and tectonics in the geoform of structural origin. As presented in Map 6.5, the LPA is dominated by hard crystalline formations of the Charnockite Gneissic Complex and Migmatite Gneissic Complex, representing ancient Precambrian basement rocks of the Southern Granulite Terrain, which influence structural landforms and limited groundwater potential.

Along the coastal and low-lying zones, younger sedimentary formations such as the Cuddalore Formation (Miocene–Pliocene) and extensive undifferentiated fluvial, aeolian, and coastal sediments are observed, indicating depositional environments shaped by river action, wind processes, and marine influence. These softer sediments contribute to fertile soils, groundwater recharge, and relatively gentle landforms.

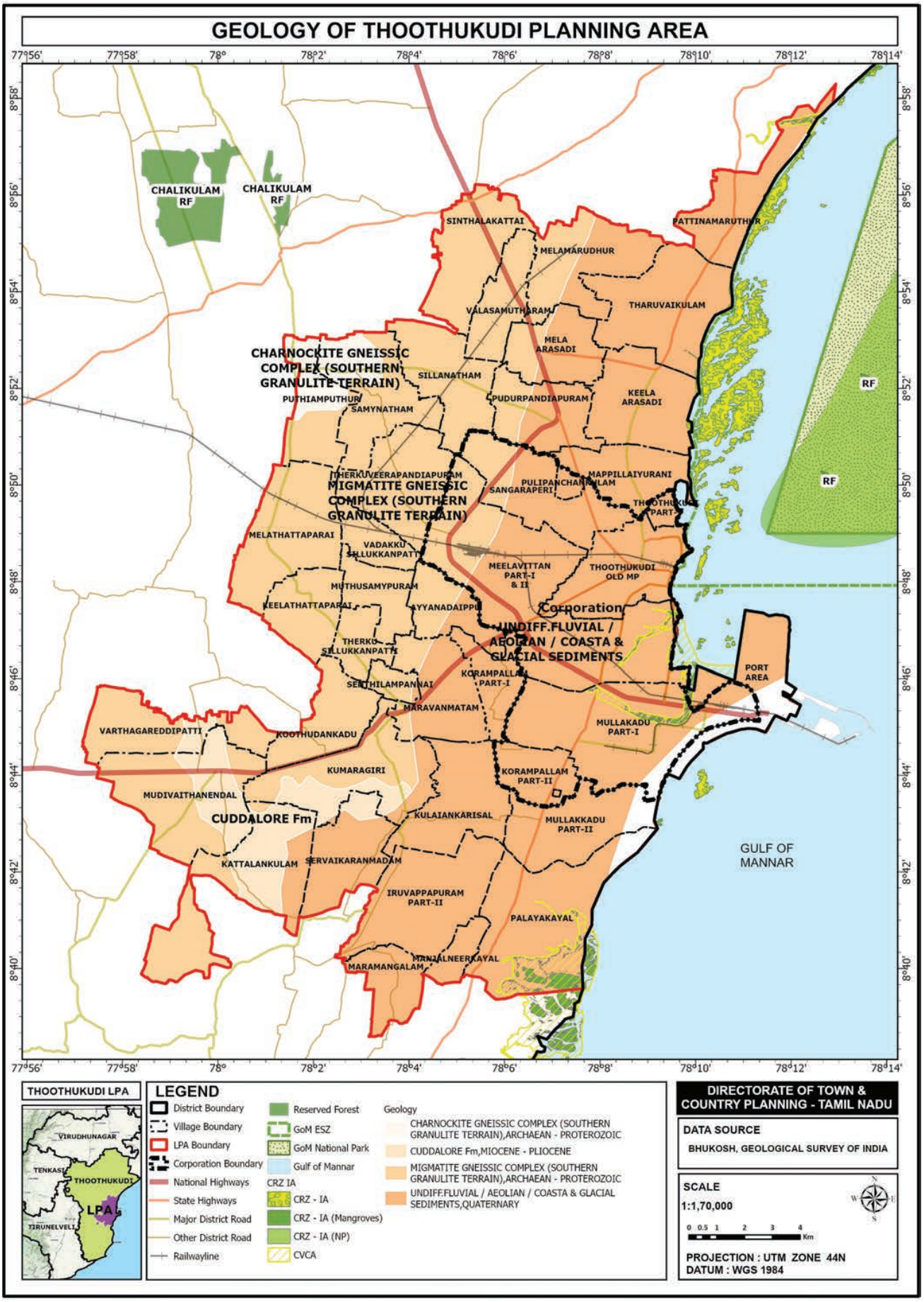
6.3.4 Geomorphology

Geomorphology studies the landforms resulting from geological structures interacting with surface processes. As presented in Map 6.6, the Pediment-Pediplain Complex constitutes the largest share of the Thoothukudi Local Planning Area, covering an extent of approximately 205.25 sq.km, which reflects the dominance of gently undulating inland terrain. The Coastal Plain occupies about 163.46 sq.km, indicating the presence of an extensive low-lying coastal stretch shaped by marine and depositional processes. The Salt Pan areas, largely concentrated along the coastal belt, cover nearly 57.74 sq.km, highlighting their notable spatial presence within the overall coastal landscape of the LPA. The villages comprising the major landforms are listed in Table 6.4.



Map 6.4 Slope in Thoothukudi Planning Area

Source Landsat series



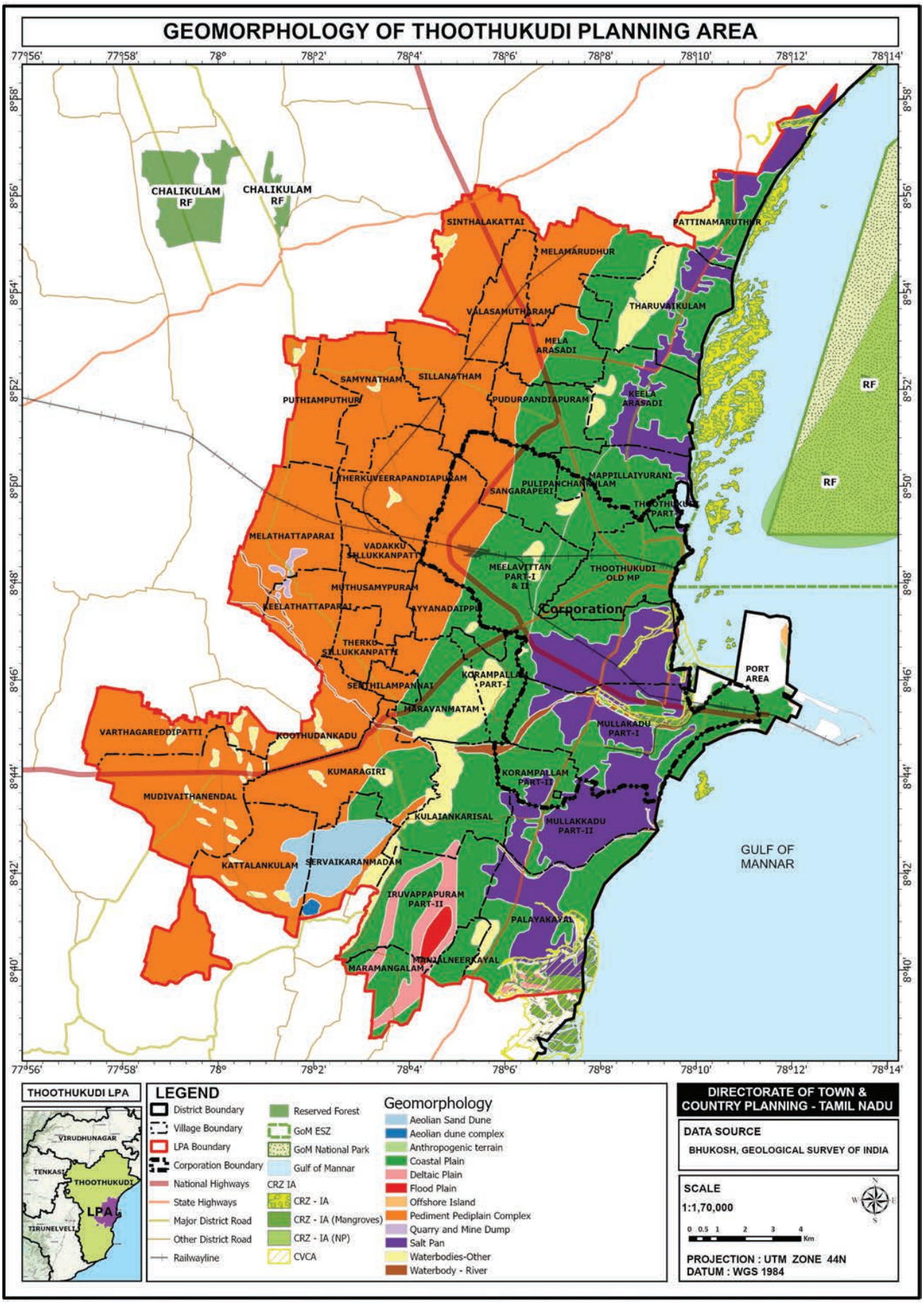
Map 6.5 Geology of Thoothukudi Planning Area

Source Bhukosh, Geological Survey of India

Table 6.4 Observation of Landforms in Thoothukudi LPA

Sl No	Landforms	Village Names
1.	Salt Pan	Palayakayal (parts of Tamiraparani estuary, Mullakkadu part 1&2, Korampallam part 2, Meelavittan part 1, along the shorelines of Thoothukudi part 1, Keela Arasadi, Tharuvaikulam, Pattinamaruthur.
2.	Coastal Plain	Palayakayal, Mullakkadu part 1 & 2, Port Area, Thoothukudi corporation, Mappillaiyurani, Keela Arasadi, Tharuvaikulam, Pattinamaruthur, Melamarudhur, Mela Arasadi, Pudurpandiapuram, Pulipanchankulam, Sangaraperi, Meelavittan Part 1, Ayyanadaippu, Korampallam part 1&2, Maravanmatam, Kumaragiri, Kulaiankarisal, Servaikaranmadam, Iruvappapuram part 2, Manjalneerkayal and Maramangalam.
3.	Pediment Pediplain Complex	Kattalankulam, Mudivaithanendal, Varthagareddipatti, Kumaragiri, Koothudankadu, Servaikaranmadam, Senthilampannai, Therku Sillukkanpatti, Maravanmatam, Ayyanadaippu, Muthusamypuram, Keelathattaparai, Therkuveerapandiapuram, Melathattaparai, Puthiamputhur, Samynatham, sillanatham, Valasamutharam, Sinthalakattai, Melamarudhur.

Predominantly flat terrain and geomorphic structure govern natural drainage paths, flood susceptibility and settlement distribution, forming a key physical basis for spatial organisation and infrastructure placement.



Map 6.6 Geomorphology of Thoothukudi Planning Area

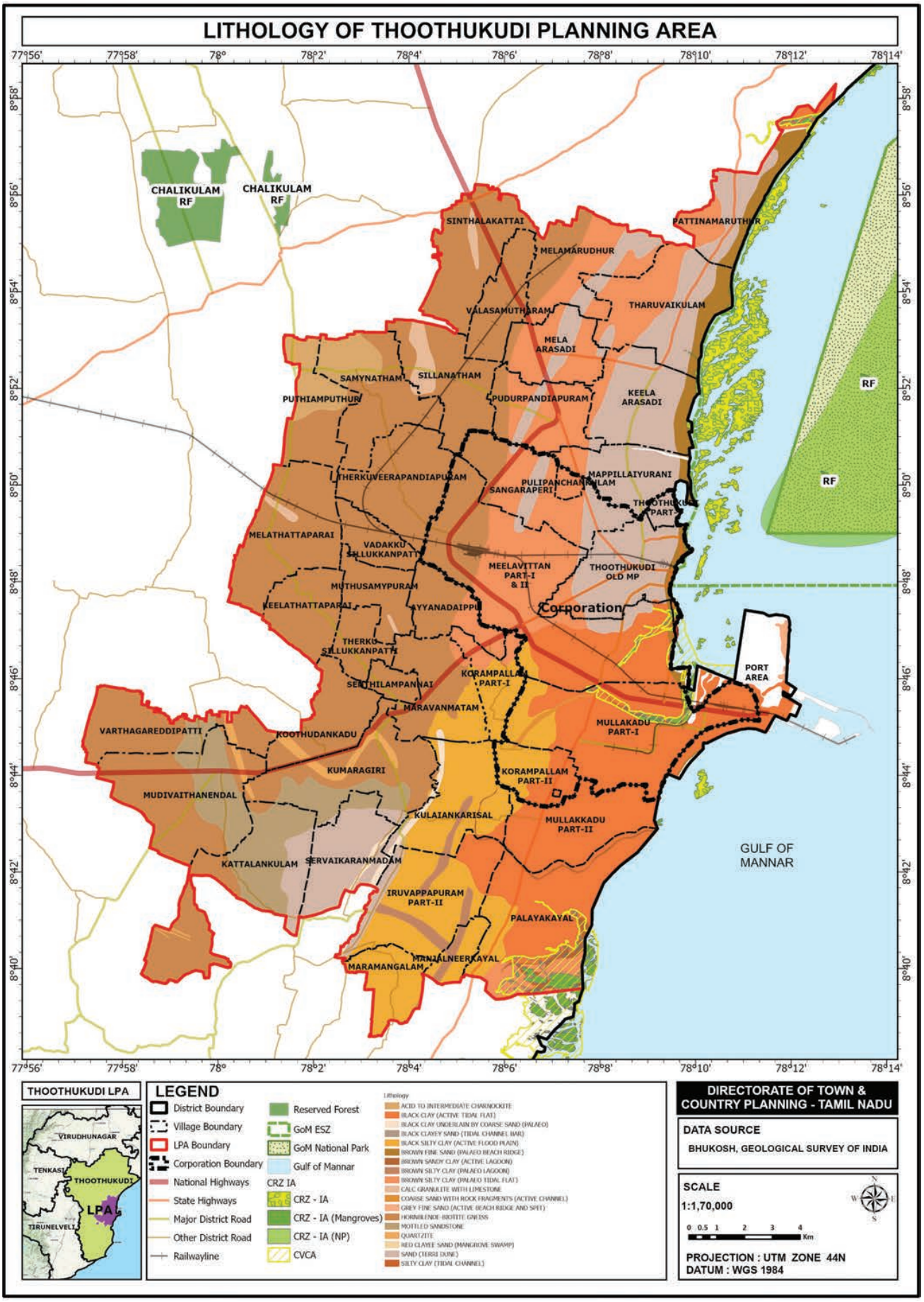
Source Bhukosh, Geological Survey of India

Table 6.5 Observation of Lithologic condition in Thoothukudi LPA

Sl. No	Lithology	Village Name
1.	Black Clay (Active Tidal Flat)	Mullakkadu part 1&2, Meelavittan part 1, Port Area, Palayakayal, Kallar
2.	Black Silty Clay (Active Flood Plain)	Maramangalam, Manjalneerkayal, Iruvappapuram part -2, Kulaiankarisal, Korampallam part 1&2.
3.	Coarse Sand with Rock Fragments (Active Channel)	Along the Korampallam Odai of the Mullakkadu part 1 and Korampallam part 2.
4.	Sand (Terri Dune)	Servaikaranmadam, Thoothukudi corporation, Mappillaiyurani, Keela Arasadi, and part of Iruvappapuram part 2, Sangaraperi, Pudurpandiapuram, Mela Arasadi, Kattalankulam, Tharuvaikulam, Meelavittan part 1, Melamarudhur, and Pattinamaruthur.
5.	Silty Clay (Tidal Channel)	Along the Korampallam Odai of Mullakkadu Part 1
6.	Hornblende-Biotite Gneiss	Melathattaparai, Keelathattaparai, Therku Sillukkanpatti, Koothudankadu, Senthilampannai, Kumaragiri, Varthagareddipatti, Maravanmatam, Muthusamypuram, Ayyanadaippu, Vadakku Sillukkanpatti, Therkuveerapandiapuram, Puthiamputhur, Samynatham, Meelavittan part1, Sangaraperi, Sillanatham, Sinthalakattai, Valasamutharam, Melam Arudhur Varthagareddipatti, Mudivaithanendal and part of Mela Arasadi, Pudurpandiapuram, Kattalankulam.
7.	Calc Granulite with Limestone	Part of Sillanatham, Samynatham, Melathattaparai, Sinthalakattai, Muthusamypuram, Maravanmatam,
8.	Red Clayey Sand (Mangrove Swamp)	Along the Korampallam Odai of the port area (flows into the Gulf of Mannar)

Sl. No	Lithology	Village Name
9.	Brown Silty Clay (Paleo Tidal Flat)	Tamiraparani river estuary, parts of Pattinamaruthur, Tharuvaikulam, Melamarudhur, Mela Arasadi, Keela Arasadi, Pudurpandiapuram, Sangaraperi, Pulipanchankulam, Meelavittan part 1, Thoothukudi corporation, Ayyanadaippu, Korampallam part 1 and Maravanmatam
10.	Brown Silty Clay (Paleo Lagoon)	Parts of Manjalneerkayal, Iruvappapuram part 2 and Kulaiankarisal
11.	Brown Sandy Clay (Active Lagoon)	Tamiraparani river estuary, along the Madiketan Odai of Palayakayal, Iruvappapuram part 2, Kulaiankarisal villages
12	Brown Fine Sand (Paleo Beach Ridge)	Along the coastal line of Thoothukudi starts from Kallar to Mullakkadu part 1 village
13.	Mottled Sandstone	Kattalankulam, Mudivaithanendal, Varthagareddipatti, Kumaragiri and Servaikaranmadam.
14.	Grey Fine Sand (Active Beach Ridge and Spit)	Port Area along the shore line
15.	Quartzite	Parts of Kattalankulam, Kumaragiri, Koothudankadu, Varthagareddipatti, Mudivaithanendal and Puthiamputhur.





Map 6.7 Lithology of Thoothukudi Planning Area

Source Bhukosh, Geological Survey of India

6.3.5 Soil Texture

The soil texture of the Local Planning Area (LPA) as shown in Map 6.8 exhibits distinct spatial variation shaped by coastal processes, fluvial influences, and inland agricultural practices. This variation plays a critical role in determining land-use suitability, agricultural productivity, drainage behaviour, and environmental sensitivity across the region. Based on GIS-based soil texture classification, the LPA is broadly characterized by **sand**, **clay**, and **sandy clay loam** soils. Sandy soils are predominantly associated with the coastal and salt pan stretches, clay soils dominate the western and interior agricultural tracts, while sandy clay loam soils occur in transitional zones between these two extremes. Understanding this distribution is essential for informed planning decisions, particularly in relation to flood management, agricultural zoning, and sustainable urban development. Table 6.6 shows the soil texture type and the associated revenue villages within Thoothukudi Planning Area.

Table 6.6 Soil Texture Distribution and Associated Revenue Villages within the LPA

Soil Texture Type	Spatial Distribution	Associated Revenue Villages	Area (sq.km)
Sand	Coastal belt and salt pan regions, including areas along the Korampallam Channel	Mullakkadu (Part I & II), Korampallam (Part II), Meelavittan (Part I), Palayakayal	218.23
Clay	Western and interior agricultural zones of the LPA	Therku Veerapandiapuram; Vadakku & Therku Sillukkanpatti; Melathattaparai; Keelathattaparai; Muthusamypuram; Ayyanadaippu; Senthilampannai; Kumaragiri; Koothudankadu; Servaikaranmadam; Kattalankulam; Mudivathanendal; Varthagareddipatti; Iruvappapuram (Part II); Maramangalam; Manjalneerkayal; Kulaiankarisal; Korampallam (Part I & II); Puthiamputhur; Silanatham; Valasamutharam; Melamarudhur; Keela Arasadi; Tharuvaikulam; Pattinamaruthur; Mullakkadu (Part II)	739.23
Sandy Clay Loam	Central and western transitional zones of the LPA	Predominantly distributed across central and western villages forming transitional land-use zones	292.14

6.3.6 Soil Depth

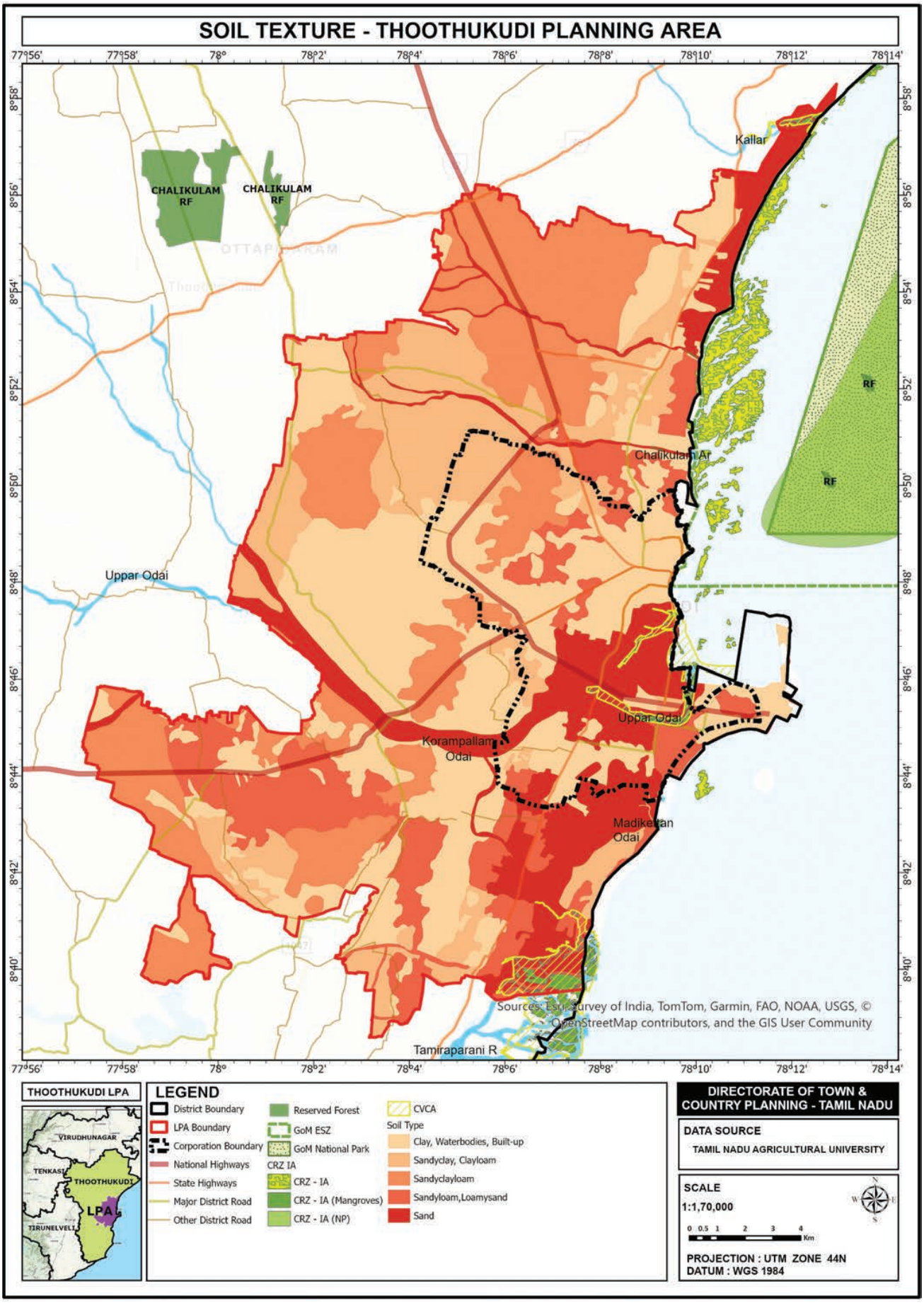
The soil depth across the Thoothukudi Local Planning Area (LPA) as shown in Map 6.9 varies significantly, ranging from 8 m to 170 m, reflecting differences in coastal depositional processes and inland soil formation conditions. This variation influences groundwater potential, land-use suitability, and construction feasibility within the region.

The maximum soil depth range of 124–170 m is primarily observed along the coastal belt, salt pan areas, and the Thoothukudi Airport region. This zone includes the revenue villages of Mullakkadu (Part I & II), Servaikaranmadam, Kumaragiri, Vadakku Sillukkanpatti, Mappillaiyurani, Keela Arasadi, Pattinamaruthur, and Tharuvaikulam, covering an area of 256.25 sq.km. These deeper soil zones indicate extensive sediment deposition and require careful consideration for coastal regulation, groundwater management, and infrastructure planning.

6.3.7 Soil Productivity

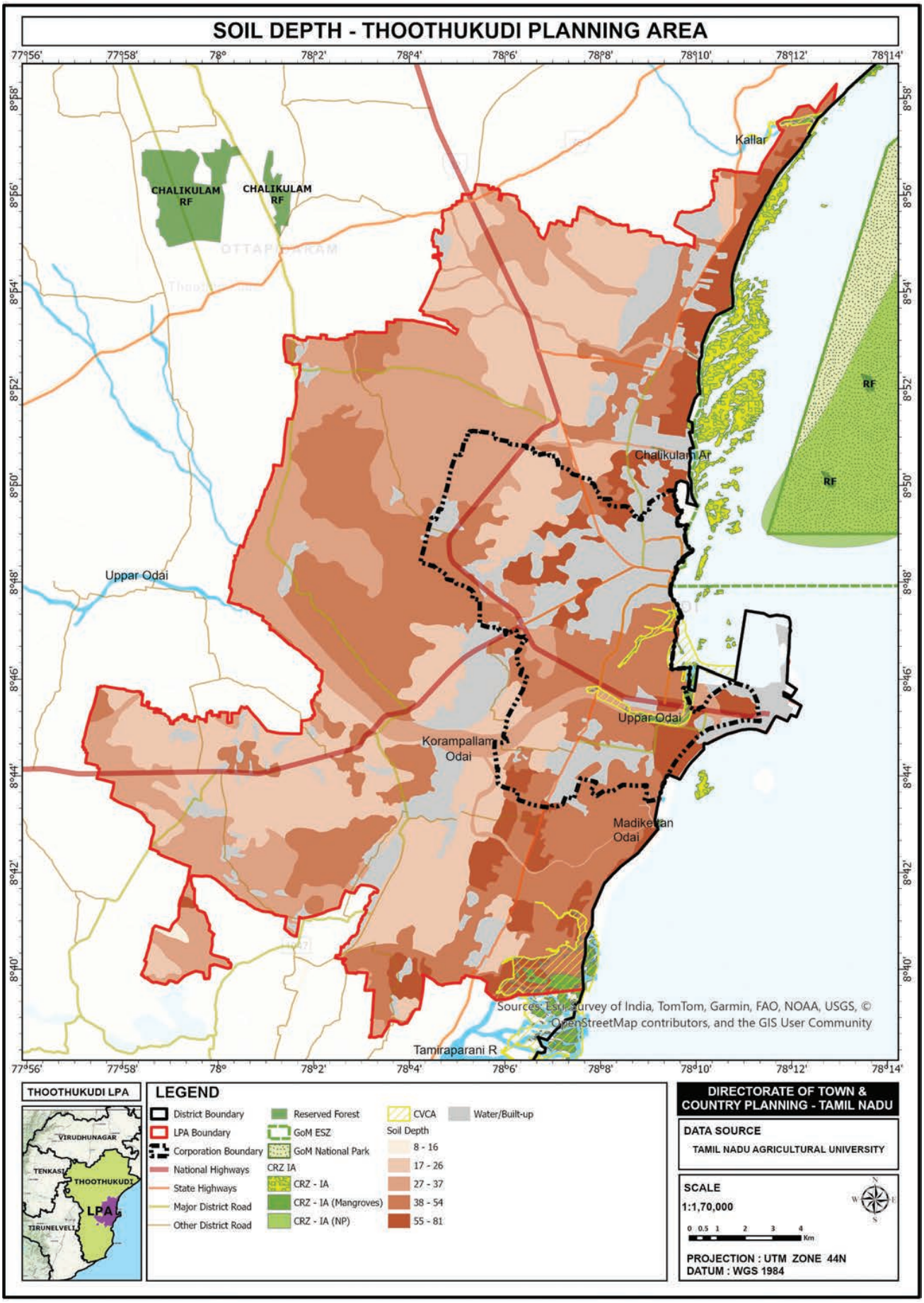
The soil productivity pattern within the Thoothukudi Local Planning Area as shown in Map 6.10 is largely governed by its coastal setting and associated land-use characteristics. A significant extent of the area, measuring about 124.50 sq.km, falls under the extremely poor soil productivity category, predominantly comprising water bodies, salt pan regions, the immediate coastal belt, and the Thoothukudi airport zone. These areas are constrained by high salinity levels, poor drainage, and minimal nutrient availability, making them unsuitable for agricultural or intensive developmental uses. In addition, nearly 191.15 sq.km of the LPA is classified as poor soil productivity, where sandy clay loam and clay soils dominate.

Although these soils have relatively better moisture-holding capacity, their productivity is limited due to textural constraints, salinity influence, and compaction issues. Comparatively, a smaller extent of about 79.62 sq.km exhibits average soil productivity, mainly in inland pockets where soil texture and drainage conditions are more favourable.



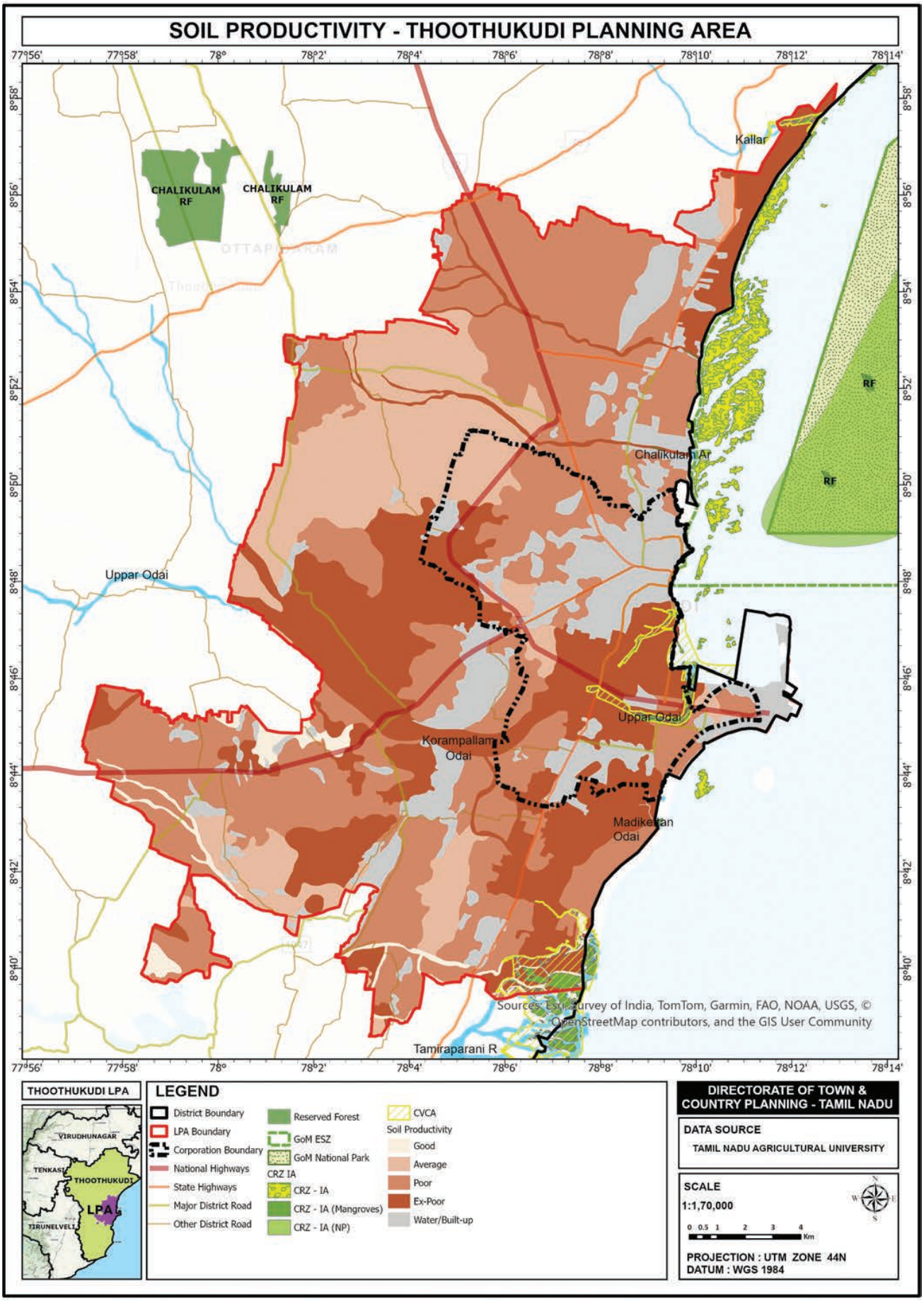
Map 6.8 Soil Texture in Thoothukudi Planning Area

Source Tamil Nadu Agricultural University



Map 6.9 Soil Depth in Thoothukudi Planning Area

Source Tamil Nadu Agricultural University



Map 6.10 Soil Productivity in Thoothukudi Planning Area

Source : Tamil Nadu Agricultural University

6.4 Water environment

6.4.1 Surface Water

River basin and Sub-River basin

Thoothukudi district falls within the Vaippar and other sub-basins, which is a part of the east-flowing river basin between Pennar and Kanyakumari. These river systems drain eastwards and ultimately discharge into the Bay of Bengal, as depicted in Map 6.11 and Map 6.12



Map 6.11 River Basin: East Flowing Rivers between Pennar and Kanyakumari Basin



Map 6.12 Sub-basin: Vaippar and others sub-basin

Source India WRIS Basin Report - EFR between Pennar and Kanyakumari

Watersheds

The Thoothukudi Planning Area is primarily drained by the Kallar and Tamiraparani watersheds, as illustrated in Map 6.13. A substantial portion of the Planning Area, accounting for approximately **80.76%,** lies within the **Kallar watershed,** indicating its dominant role in surface runoff, drainage patterns, and hydrological processes in the region.

The remaining **19.24%** of the Planning Area falls within the **Tamiraparani watershed,** which contributes to localized drainage and ultimately discharges into the Bay of Bengal. Together, these watersheds govern the spatial distribution of surface water flow, influence groundwater recharge potential, and play a crucial role in water resource availability and management within the Planning Area.

Micro-watersheds

The Planning Area is hydrologically organised into three watersheds coded as 4A1B1, 4A1C1 and 4A1C2, further sub-divided into micro-watersheds as presented in Map 6.14. Each of these micro-watersheds integrates upland runoff zones, local drainage channels (odais), tanks, wetlands, and downstream discharge points, ultimately connecting to estuarine or coastal systems.

Micro-watersheds of the Kallar Basin

The Kallar watershed, which encompasses the majority of the Planning Area, is divided into a number of 4A1C2 micro-watersheds, mainly concentrated in the northern and mid-area of the LPA. The Ottapidaram and Peri-urban North areas are also included.

Ecological characteristics of these micro-watersheds is that it is predominantly rain-fed runoff, with peak discharge during North-East monsoon, Dense first and second-order stream networks that come together in seasonal odais, Presence of tanks, as well as depressions acting as seasonal wetlands and gradual downstream transition to the coastal plains and the effects of Kallar estuaries near the top edge of the coast. Ecologically speaking, the micro-watersheds are extremely important for flood reduction and the transportation of sediments during heavy rains.

Micro-Watersheds of the Upparu / Korampallam System

The 4A1C1 micro-watersheds constitute the primary urban and peri-urban hydrological basins of the Thoothukudi LPA. The micro-watersheds drain to the Upparu River (Korampallam Odai) and its associated tanks and channels

Some of the main ecological characteristics include coupled natural and engineered canal (Korampallam Odai, and buckle canal) that flows in the urban areas, high proportion of impervious surfaces (built areas), leading to a rapid runoff response, Tanks and odais acting as flood buffers for urban areas, downstream linkage to mangrove patches and tidal creeks along the coastline.

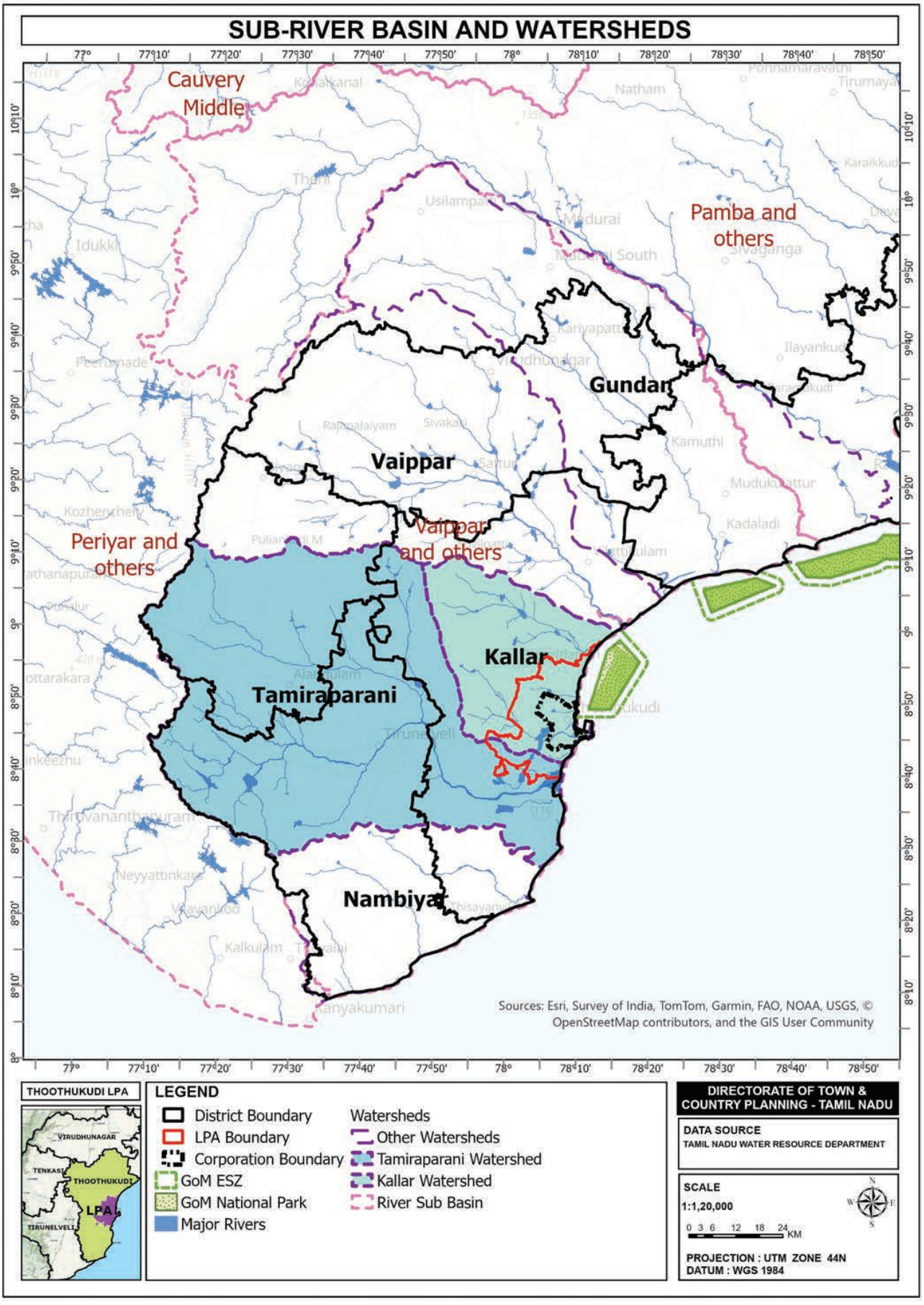
These micro-watersheds are environmentally sensitive due to their presence in the urban area. Pollution, encroachments, and constrictions in these channels could affect these ecological bodies significantly. However, these micro-watersheds remain extremely important for making cities flood-resistant because any disruption in these micro-watersheds immediately leads to coastal zone degradation.

Micro-Watersheds of the Tamiraparani Influenced Zone

The 4A1B1 micro-watersheds are present in the southern portion of the Planning Area where surface water systems are affected by the estuarine characteristics of the Tamiraparani River. The 4A1B1 micro-watersheds are distinctly different in terms of their hydrological behaviour because of their close association with the perennial river system.

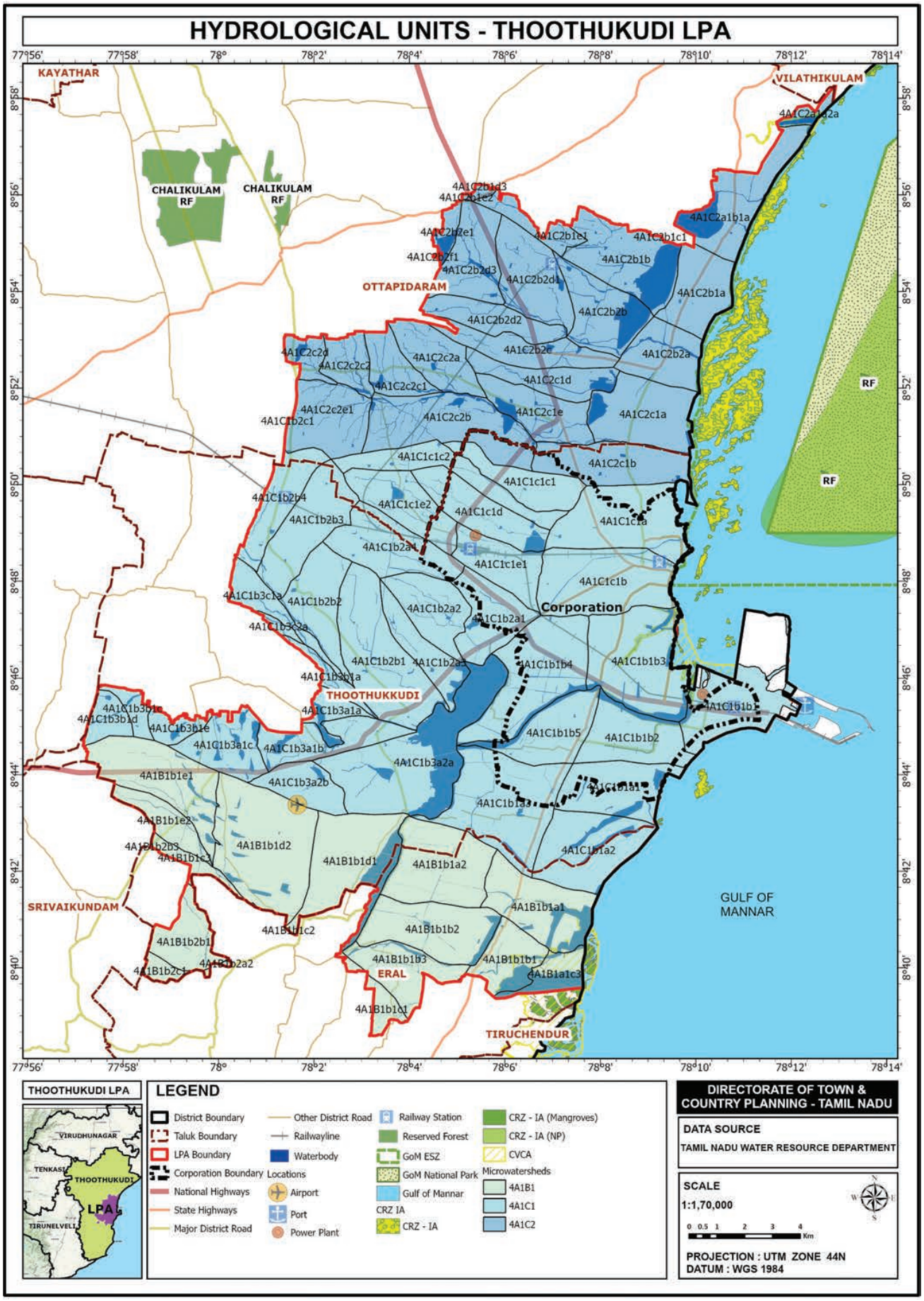
Ecological significance for such micro-watersheds is include, interaction of freshwater flow with the tidal-induced backwaters to form brackish environments, characterised by presence of mangroves, mudflats, and/or salt marshes, especially around Palayakayal area, high productivity supporting fisheries, and bird species. This area is extremely sensitivity to changes in upstream land-use and water quality and is classified as Critically Vulnerable Coastal Area (CVCA) under CRZ regulation.





Map 6.13 Watersheds that drain the Thoothukudi Planning Area

Source Tamil Nadu Water Resource Department



Map 6.14 Watersheds and Micro-waters of Thoothukudi Planning Area

Source Tamil Nadu Water Resource Department

River Systems and Waterbodies

The river systems influencing the Thoothukudi Planning Area originate from the eastern slopes of the Western Ghats and adjoining upland regions of southern Tamil Nadu. These rivers are predominantly seasonal in nature, with flows largely dependent on monsoonal rainfall. The drainage pattern is generally dendritic, reflecting the regional topography and geological structure. The Planning Area has **10.12%** of its area under waterbodies, which includes all the river systems, tanks and ponds.

The **Tamiraparani River,** a major perennial river system of southern Tamil Nadu, originates in the Agasthyamalai range of the Western Ghats at an elevation of about 1,725 m AMSL. influences the southern parts of the Planning Area through its associated distributaries and drainage channels forming an estuary along the coast in the Palayakayal which is the southern-most village of the planning area.

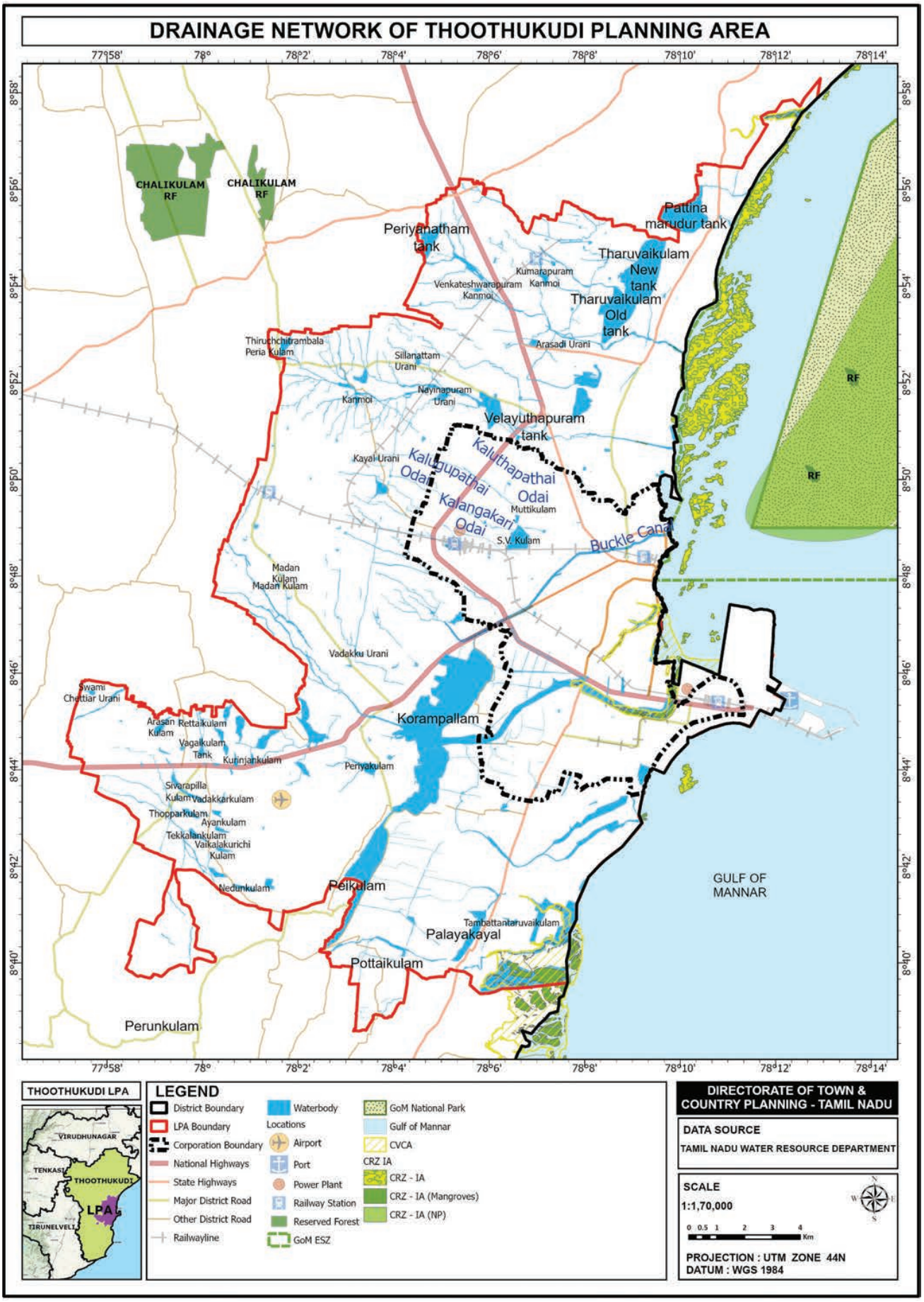
The **Kallar river** is an ephemeral stream (Rain-fed seasonal stream) originating in the local plain terrain and internal hillocks near western parts of Ottapidaram Taluk of the Thoothukudi district. As per ADB and TNUIFSL's 2019 study, there will be a future deficit in water availability in Kallar basin, contrasting with the Tamiraparani basin with surplus water availability.

The **Upparu River, Korampallam** Odai being the local name as it flows into the **Korampallam Kulam/Tank** of the Kallar River watershed, which flows through the Planning Area, is a seasonal stream originating from the low-elevation uplands and pedi-plain areas to the west and northwest of Thoothukudi, from Muramban area in western parts of Ottapidaram Taluk. The Odai is primarily rainfed, with flows occurring during the northeast monsoon. It serves as the principal surface drainage channel within the Planning Area as shown in Map 6.15. and is crucial for local irrigation and flood management, known for seasonal water flow and sometimes causing floods into Thoothukudi city.

To manage drainage in the developed part of the city, a natural drain was channelized in the recent past by the TCMC, known as **Buckle Canal.** Despite its channelization, Buckle Canal has a limited carrying capacity of about 30 cu.m/sec. In the northern part of the city, three Odai (smaller rivers) flow. but one of them, Kaluthapathai, lacks a water course after the Shankaraperi area. Another Odai, Kalugupathai, which passes through the **S.V. Kulam** area, also lacks a water course after approximately 150 m from the S.V. Kulam spillway. The third. Kalangakari Odai, follows the rail track leading to the Chidambaram port and ultimately discharges into Buckle Canal.

The Korampallam Tank now has a perennial characteristic as it receives water from Tamiraparani through a network of tanks including Peikulam and the Buckle canal system represents the primary inland and urban surface water network within the planning area. Beyond their hydraulic function, these features collectively moderate the monsoon run-offs, reducing the flood peaks, and facilitating the movement of freshwater and sediments towards coastal and estuarine environments. Inland tanks such as Tharuvaikulam Tank, Pattinamarudur Tank and S.V Kulam further strengthen this network by acting as seasonal wetlands that provide localised flood buffering, ground water recharge, and habitats for aquatic and avian species within urban and peri-urban landscapes.





Map 6.15 Drainage Network of Thoothukudi Planning Area

Source Tamil Nadu Water Resource Department

Ecosystem Service of Surface water systems

Understanding the ecosystem services provided by these surface water bodies and their classification under the **Millennium Ecosystem Assessment (MEA) framework** is essential for informed land-use planning, climate resilience, and environmental management. These services extend beyond water storage and drainage to include flood regulation, biodiversity support, micro-climate moderation, and protection of downstream coastal ecosystems. The following Table 6.7 summarises the key surface water bodies within the LPA and highlights the ecosystem services they deliver, providing basis for integrating ecological considerations into the master plan's zoning and development controls.

Table 6.7 Surface Water Bodies and Millennium Ecosystem Services in Thoothukudi LPA

Waterbody/System	Type	Key Ecosystem Services	MEA Service category
Tamiraparani River (Estuarine stretch)	Perennial river estuary	Fisheries support, water supply security, biodiversity conservation	Provisioning, Supporting, Regulating
Korampallam Tank	Inland tank	Flood buffering, limited recharge, avifaunal habitat	Regulating, Supporting
Korampallam Odai (Upparu)	Seasonal drainage channel	Flood conveyance, sediment transport, estuarine freshwater input	Regulating, Supporting
Buckle Canal	Engineered urban canal	Urban flood mitigation, drainage continuity	Regulating
Tharuvaikulam Tank	Inland tank	Flood attenuation, recharge support, bird habitat	Regulating, Supporting
Pattinamarudur Tank	Inland tank / wetland	Stormwater regulation, biodiversity support	Regulating, Supporting
S.V. Kulam	Urban tank	Flood mitigation, micro-climate regulation	Regulating

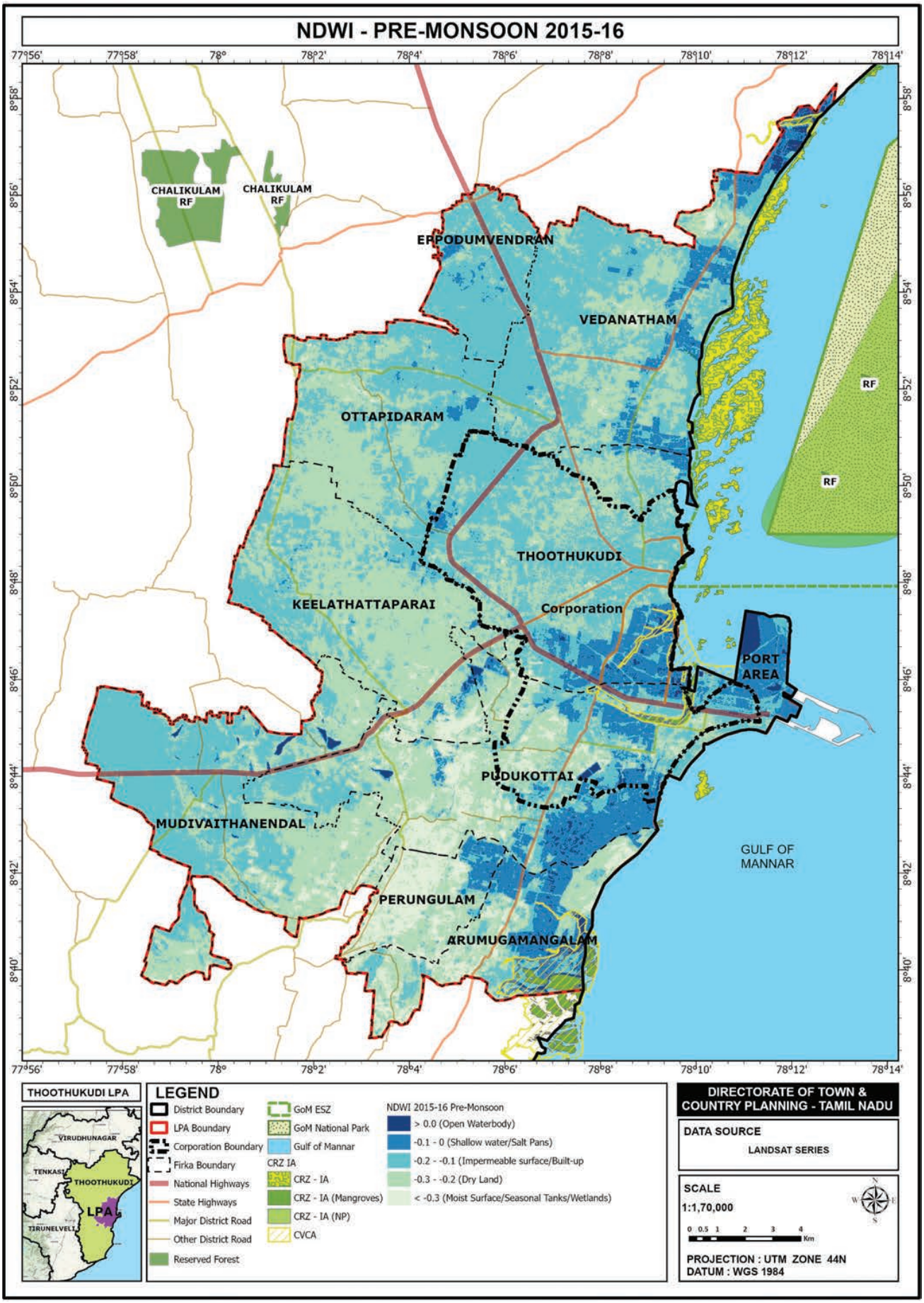
6.4.2 Normalised Difference Wetness Index (NDWI)

After having established the watershed dynamics, surface water systems, and the ecosystem services provided by major waterbodies, NDWI is used as a supporting spatial indicator to assess the actual extent and seasonal behaviour of surface water within LPA. The NDWI enables comparison of pre and post monsoon surface water conditions for 2015 and 2024, and validates the persistence, seasonality and functional role of key surface water bodies. Table 6.8 captures the change in Area (Ha) for Pre and post monsoon seasons under various surface characteristics considered for NDWI in the context of Thoothukudi LPA

Table 6.8 NDWI Change analysis

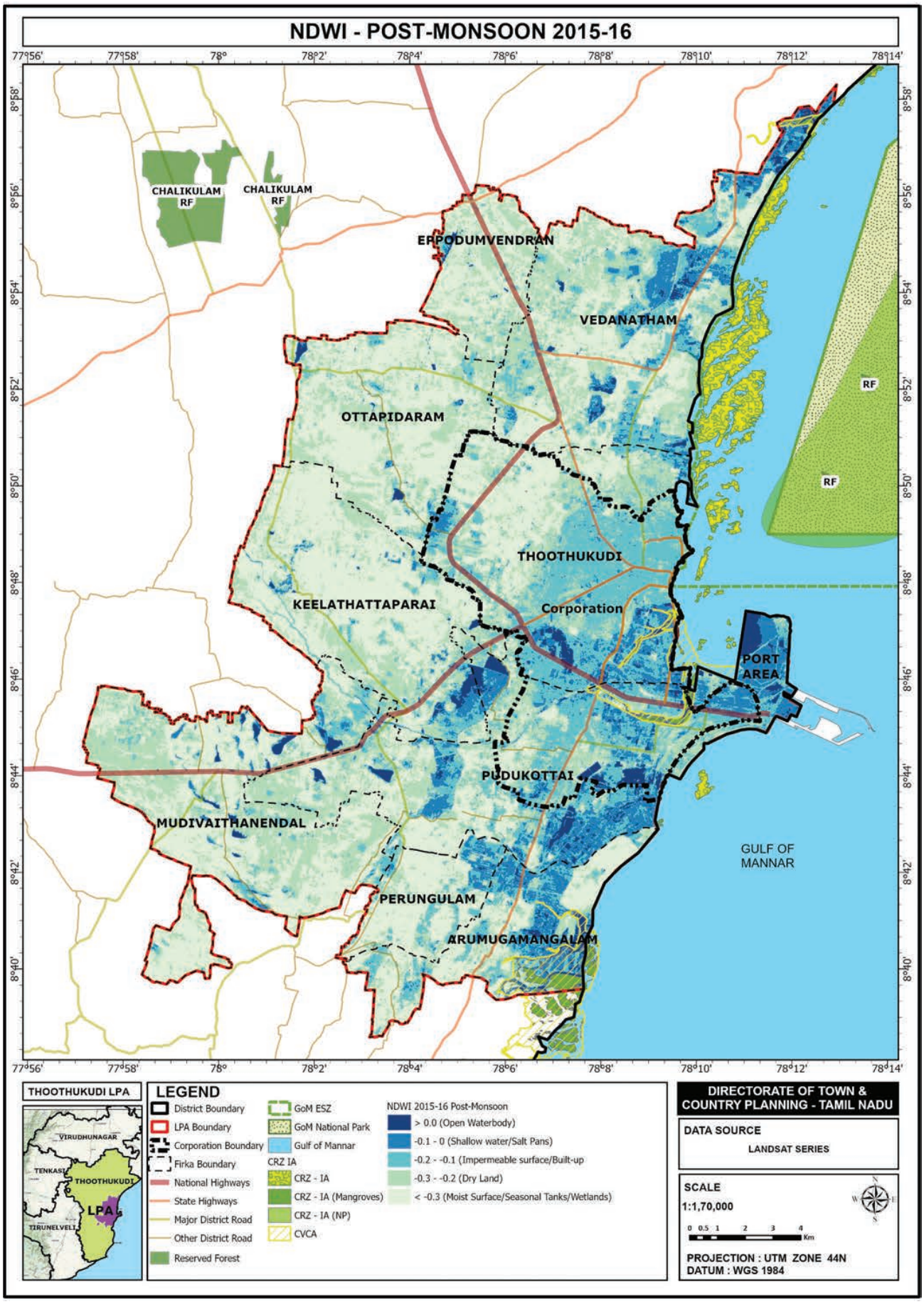
NDWI Value	Characteristic	Pre-Monsoon 2015	% Area of LPA	Post-Monsoon 2015	% Area of LPA	Pre-Monsoon 2024	% Area of LPA	Post-Monsoon 2024	% Area of LPA	% Change Pre-Monsoon 2015 - 2024	% Change Post-Monsoon 2015 - 2024
> 0.0	Open Waterbody	513.76	1.07	1084.94	2.25	1,732.06	3.59	1530.20	3.17	**2.53**	**0.92**
-0.1 - 0.0	Shallow Saline Water/ Salt Pans	5063.81	10.50	4321.57	8.96	5142.89	10.66	4948.47	10.26	**0.16**	**1.30**
-0.2 - -0.1	Impermeable Surface/ Built-up	21144.85	43.84	9667.13	20.05	15572.38	32.29	10085.88	20.91	**-11.55**	**0.87**
-0.3 - -0.2	Dry Land	18416.40	38.19	13886.59	28.79	20645.63	42.81	22131.19	45.89	**4.62**	**17.10**
< -0.3	Moist Surface/Seasonal Tanks/Wetlands	3088.17	6.40	19266.76	39.95	5134.02	10.65	9531.25	19.76	**4.24**	**-20.19**
Total		48226.99		48,226.99		48,226.99		48,226.99			

There is a consistent increase in permanent/open water extent across seasons. This indicates a positive hydrological change likely due to expansion of tanks rather than monsoon dependence. Very minor increase observed for areas under shallow saline water reflecting persistence of salt pans crucial for buffer flood in the planning area. The decline in impervious surface/built up is not to be interpreted as urban de-growth. This decrease indicates a change in NDWI response likely due to increased surrounding moisture or adjacency effects. The dry land area has increased, especially post-monsoon indicating reduced moisture retention after monsoon, expansion of exposed dry surfaces and possible drying or conversion of moist/seasonal areas. The most critical finding would be the pre-monsoon increase in Moist / Seasonal surfaces suggests residual moisture and the sharp post-monsoon decline indicates loss of seasonal tanks/wetlands and reduced monsoon water storage capacity. This increases vulnerability to run-off and flooding downstream necessitating the need to enhance the capacity of these downstream tanks and expansion of seasonal tanks/wetlands along with proposing green open land uses around them. Overall, the results point towards increasing post-monsoon dryness and degradation of seasonal hydrological features. Maps 6.16 to 6.19 present this changing condition in NDWI spatially for the Thoothukudi Planning Area.



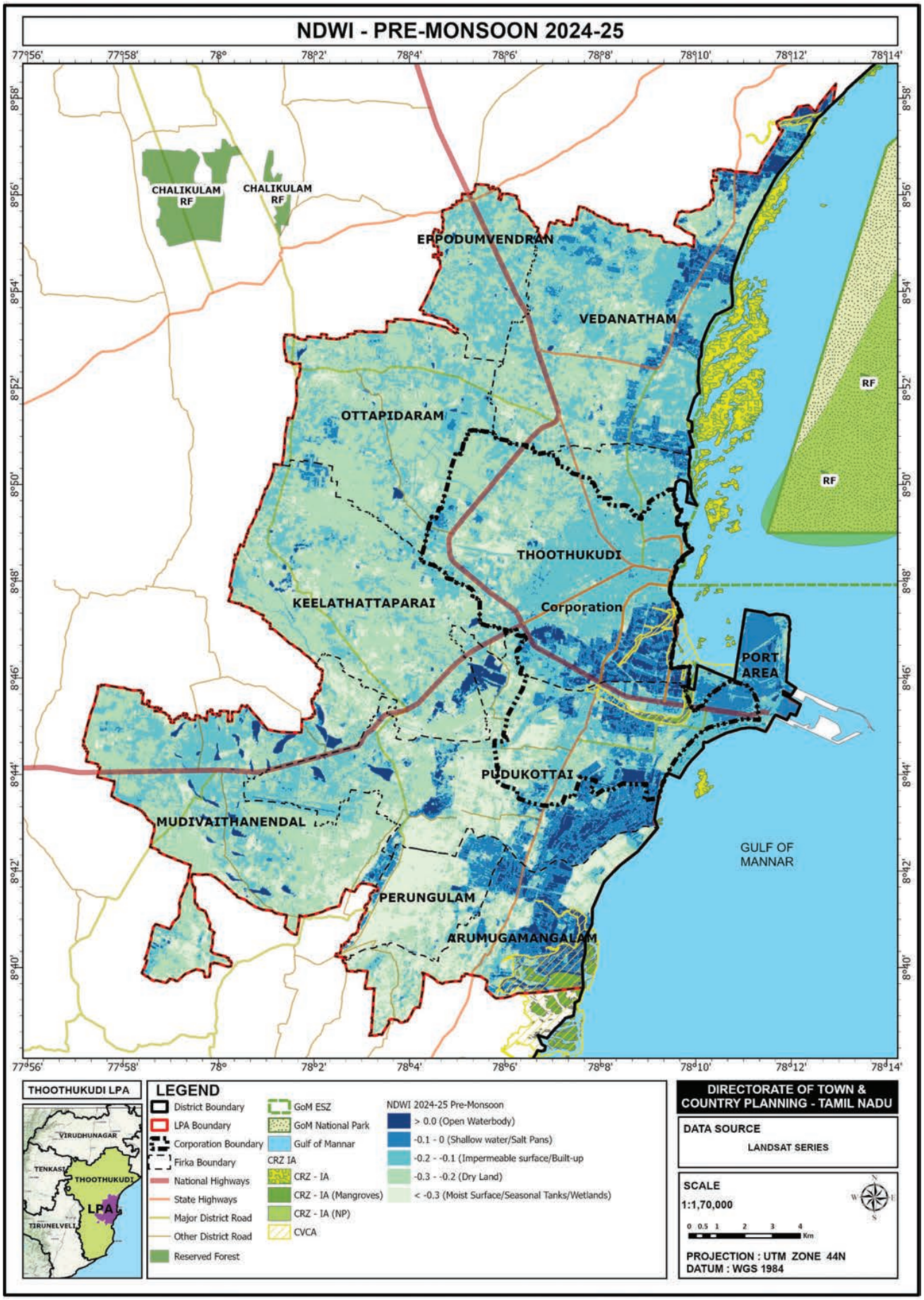
Map 6.16 Normalised Difference Wetness Index - Pre-Monsoon 2015-2016

Source Analysis using Landsat imagery



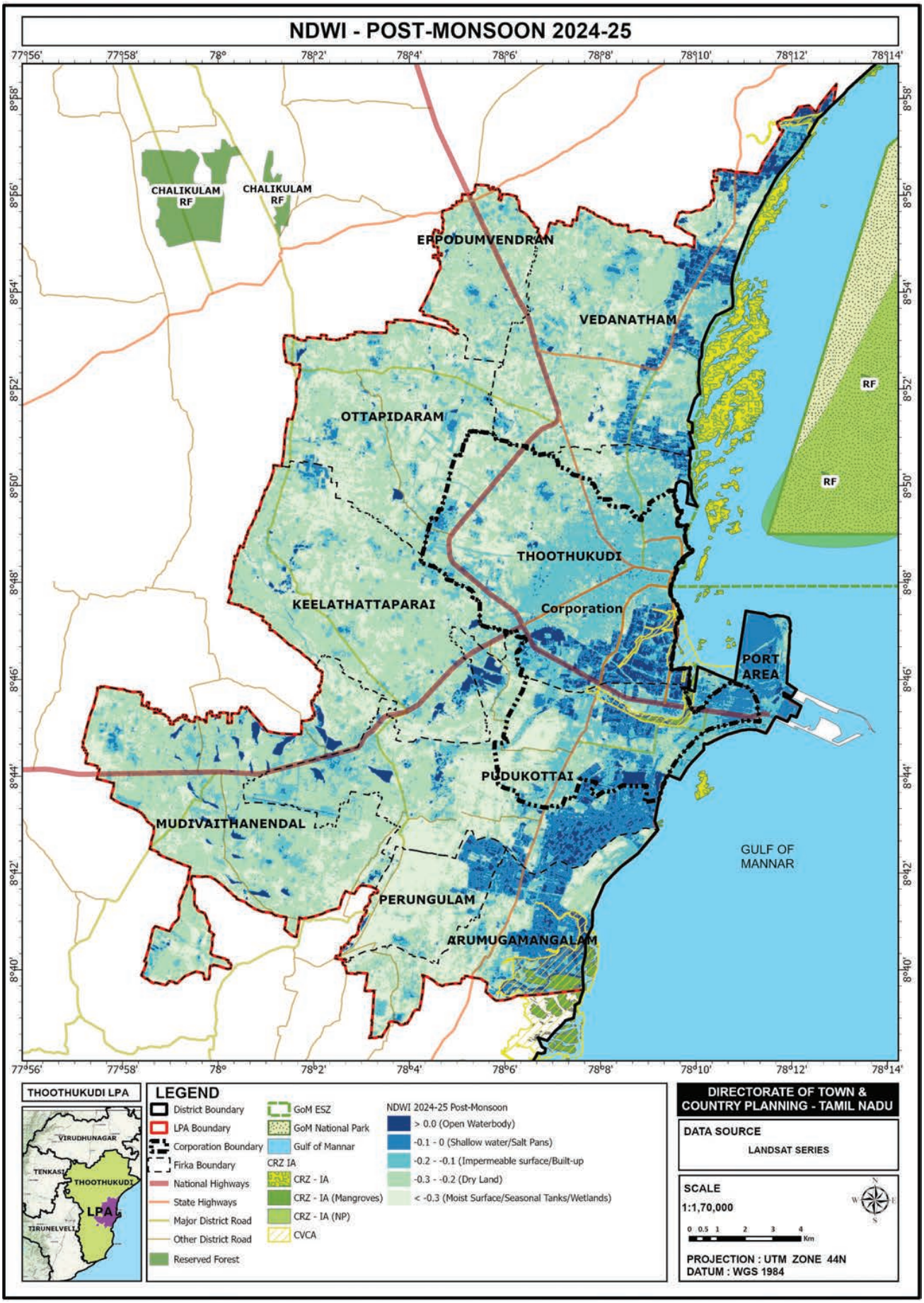
Map 6.17 Normalised Difference Wetness Index - Post-Monsoon 2015-2016

Source Analysis using Landsat imagery



Map 6.18 Normalised Difference Wetness Index - Pre-Monsoon 2024-2025

Source Analysis using Landsat imagery



Map 6.19 Normalised Difference Wetness Index - Post-Monsoon 2024-2025

Source Analysis using Landsat imagery

6.4.3 Ground Water

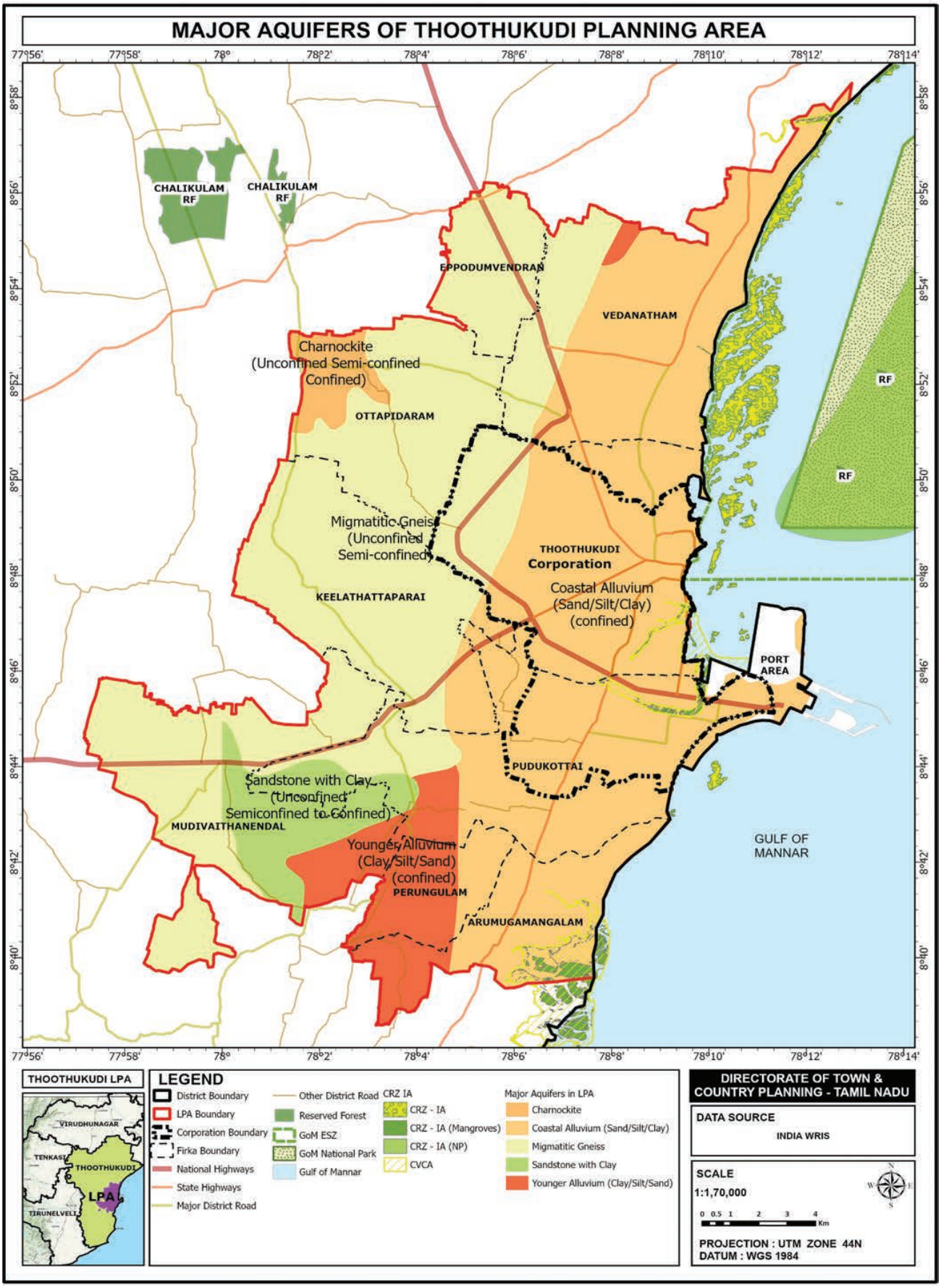
Ground water is a critical source of freshwater resources that supports domestic water supply, agricultural and industrial activities, particularly in regions with erratic rainfall, seasonal surface water streams and high temperatures. Being stored in a subsurface geological formation known as aquifers, ground water sustains the water availability in dry periods.

In Thoothukudi Planning Area, ground water is a significant freshwater resource due to the semi-arid climate, erratic rainfall, and limited perennial surface water sources. The planning area is underlain with a mix of hard rock and coastal sedimentary aquifers with varying storage capacities and recharge potential. Being a coastal city, Thoothukudi also faces saline water intrusion which may further limit the freshwater availability, necessitating suitable planning for recharge and extraction.

The coexistence of low-yield unconfined and semi-confined hard-rock aquifers inland and high yield confined coastal alluvial aquifers as shown in Map 6.20, highlights the need for aquifer specific ground water management. This includes measures to regulate the extraction of ground water in the coastal zones, protection and enhancement of inland recharge areas and the integration of aquifer characteristics in infrastructure planning to ensure sustainable and climate-resilient ground water use. Table 6.9 presents the firka-wise aquifer systems, depth to 1st aquifer and the aquifer thickness for the Thoothukudi Planning Area.

Table 6.9 Details of aquifers in Thoothukudi Planning Area

Firka name	Aquifer type	Aquifer System	1st Aquifer depth	Aquifer thickness
Vedanatham	Coastal alluvium	Confined	25 – 35m	10 - 20m
Thoothukudi	Coastal alluvium	Confined	< 25 - 35m	10 - 34m
Pudukottai	Coastal alluvium	Confined	< 25 - 45 m	1.6 - 34m
Perungulam	Younger Alluvium	Confined	< 25 - 35m	10 - 25m
Mudivaithanendal	Magmatitic Gneiss	Unconfined to semi-confined	<25 - >55m	1.6 - 15m
Keelathattaparai	Magmatitic Gneiss	Unconfined to semi-confined	25 - > 55m	1.6 - 20m
Ottapidaram	Magmatitic Gneiss	Unconfined to semi-confined	25 - > 55m	1.6 - 15m
Eppodumvenran	Magmatitic Gneiss	Unconfined to semi-confined	25 - 45 m	1.6 - 15m



Map 6.20 Major Aquifers in Thoothukudi Planning Area

Source India WRIS

Aquifer Depth and Thickness

The depth to 1st aquifer ranges from <25 to > 55 meters below ground level (mbgl), with deeper aquifers in the western and south-western parts. Shallow aquifers in the costal and central areas as shown in Map 6.21 are more vulnerable to contamination and saline intrusion.

Aquifer thickness increases towards the coastal and southern parts, particularly within alluvial formations. Inland rock regions have thinner aquifers as shown in Map 6.22 which will limit the sustainable yield and storage capacity.

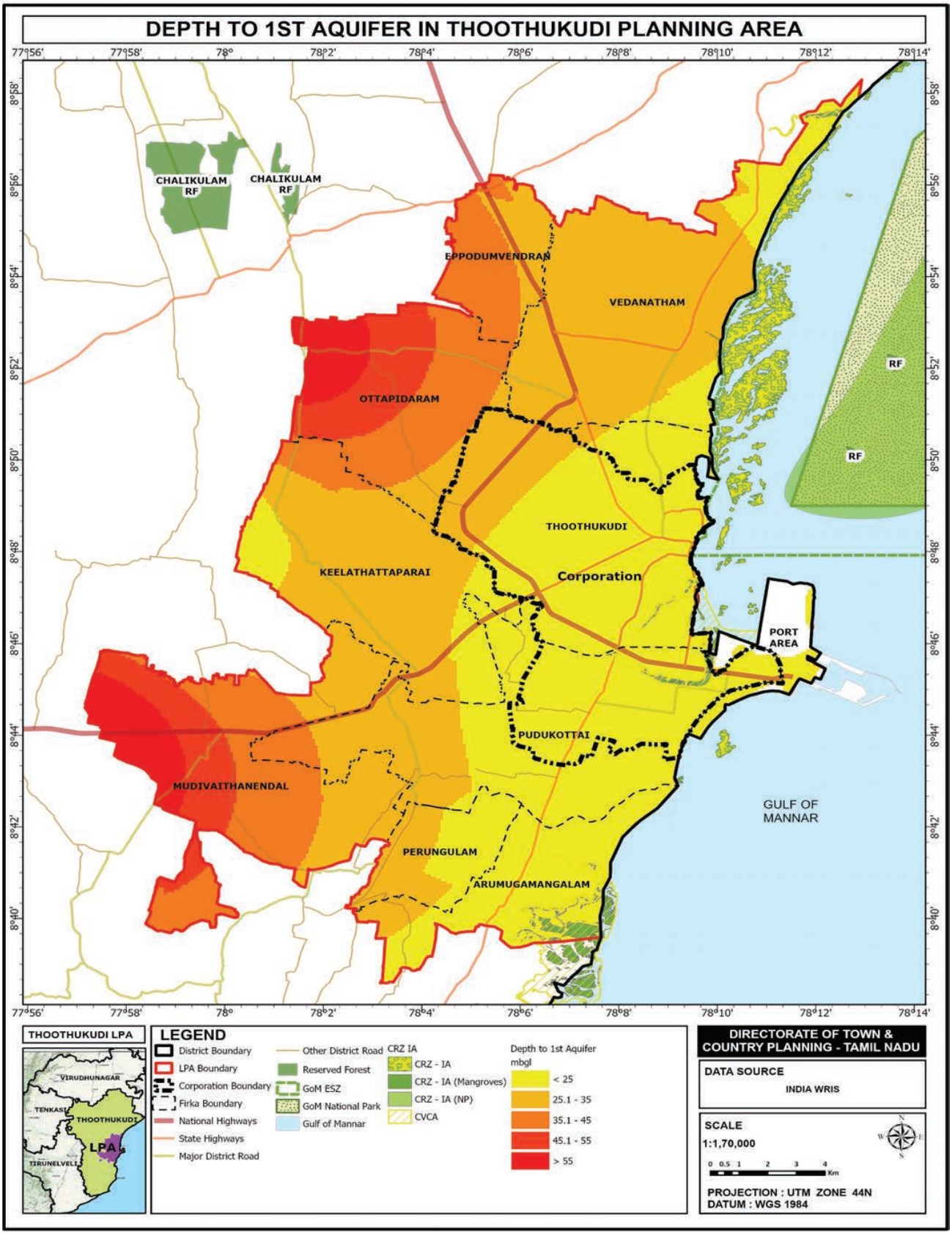
6.4.4 Groundwater Levels And Quality

From an ecological and environmental perspective, groundwater assessment therefore focuses in understanding the long-term trends in water levels and quality. To capture these trends, decadal average ground water levels from 1995-2004 (Map 6.23 and 6.24), 2005-2014 (Map 6.25 and 6.26) and 2015-2024 (Map 6.27 and 6.28) have been analysed for both pre and post monsoon scenarios, and interpreted at firka level. This shows the changes in groundwater behaviour over time and provides a planning relevant basis for resource management.

Groundwater levels: Decadal and Firka-wise trends

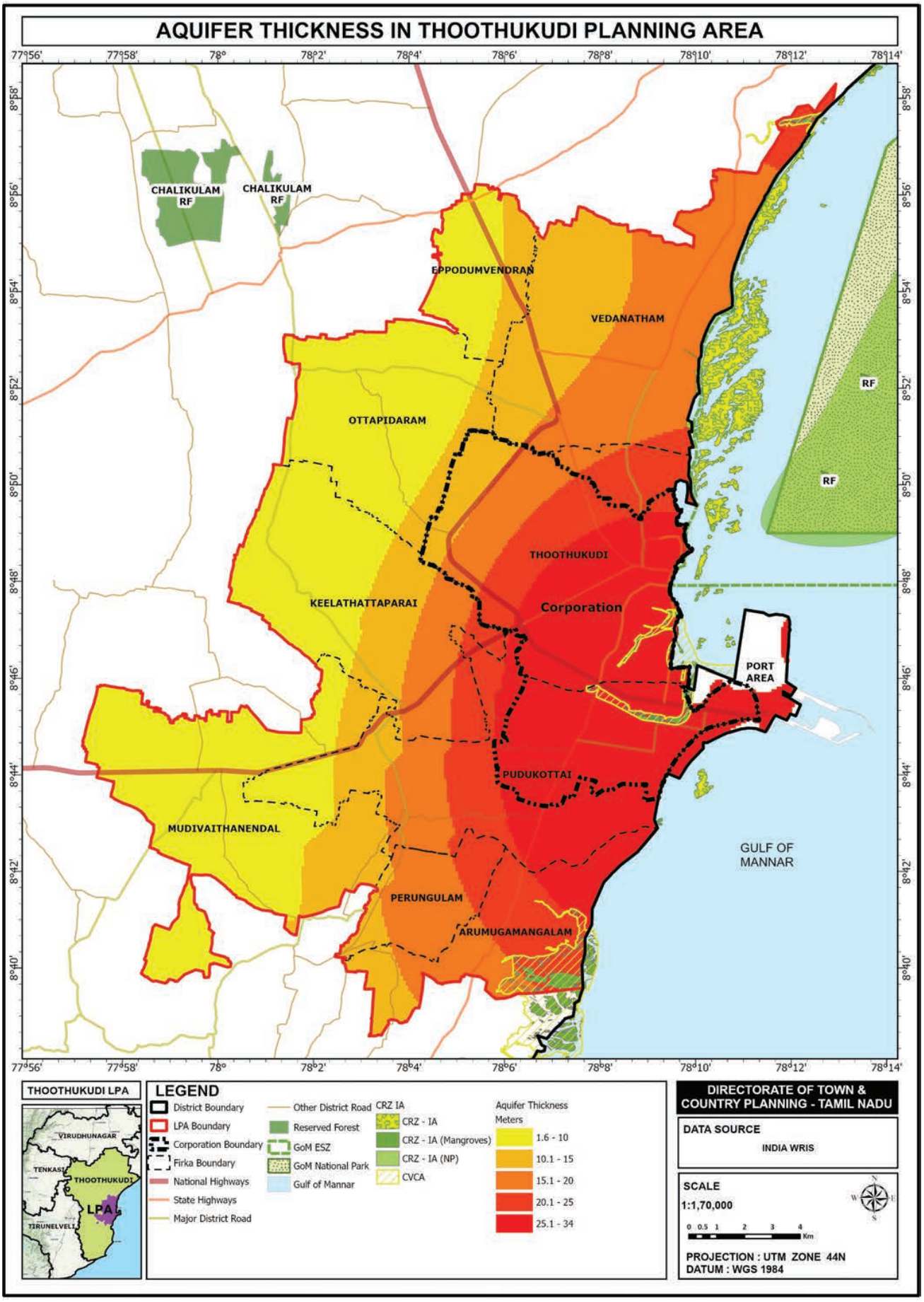
Analysis of depth to water level (DTWL) maps indicate an overall improvement in groundwater levels across the planning area over the past three decades. The improvement is reflected by a progressive spatial shift from deeper DTWL towards shallower depth ranges, observed consistently in both pre and post monsoon periods.

During the 1995–2004-decade, inland firkas such as Ottapidaram, Eppodumvendran, Keelathattaparai, Mudivaithanendal, and Perungulam largely had depths in the 6-8 and >8 m below ground level (bgl) ranges. Post-monsoon recovery is evident but spatially limited. Coastal and urban firkas including Thoothukudi, Pudukkottai, Arumugamangalam, and Vedanatham recorded persistently shallow groundwater levels with levels ranging < 2 m and 24 m bgl range.



Map 6.21 Depth to 1st Aquifer in Thoothukudi Planning Area

Source India WRIS



Map 6.22 Aquifer Thickness in Thoothukudi Planning Area

Source India WRIS

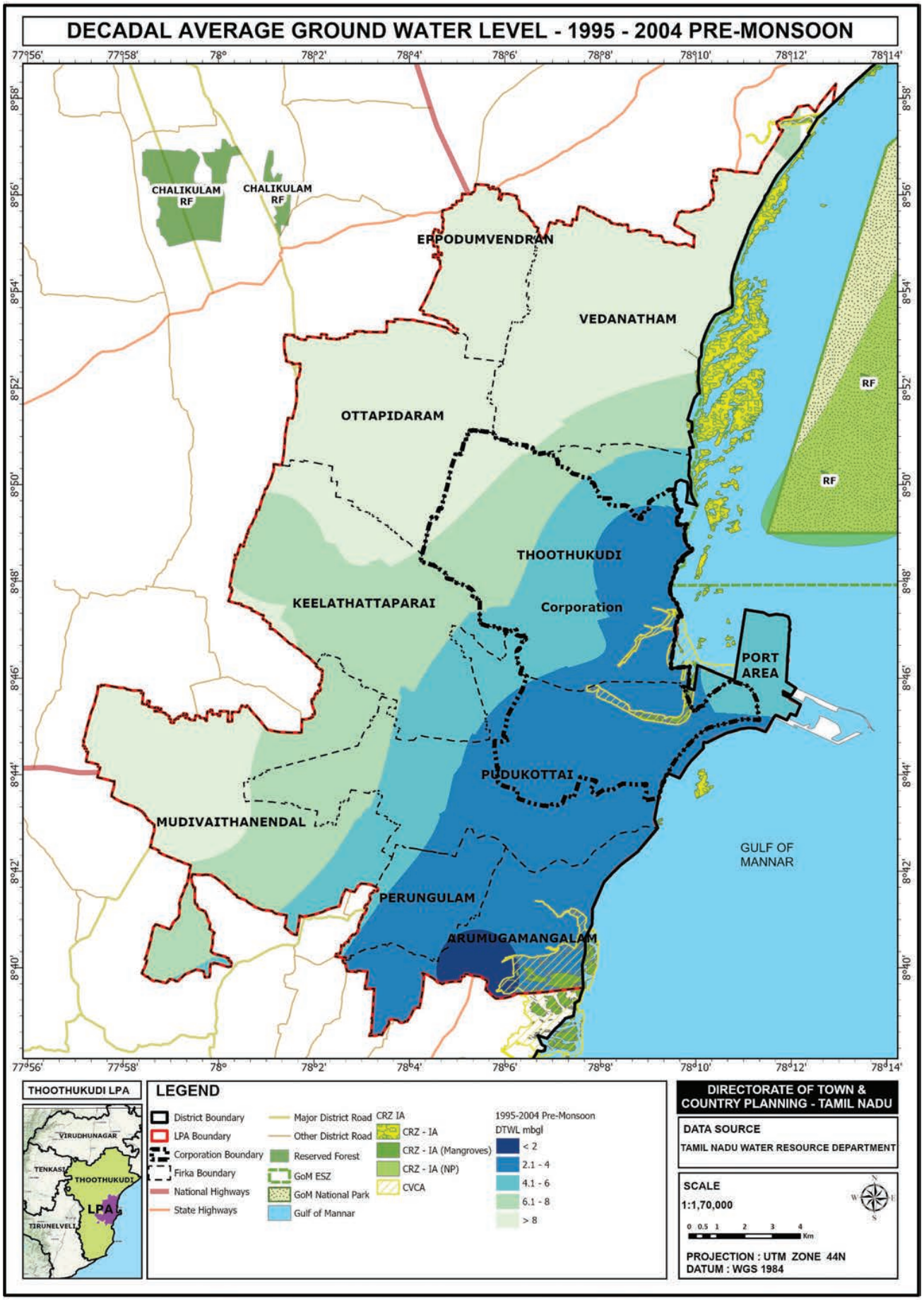
In the 2005-2014-decade, several inland and southern firkas show a noticeable rise in groundwater levels, with large areas transitioning into the 4-6 m and 2-4 m bgl categories. Seasonal recharge becomes more spatially continuous, indicating improved infiltration and recharge conditions.

The 2015-2024 decade shows the most widespread improvement, with inland firkas such as Ottapidaram, Keelathattaparai, Mudivaithanendal, and Perungulam recording levels in the 2-4 m bgl range. Coastal and urban firkas continue to exhibit shallow groundwater levels across all decades, however these are largely governed by marine and tidal influences rather than freshwater availability.

Table 6.10 captures the firka-wise groundwater levels across the three decades to help distinguish areas where rising groundwater levels reflect effective recharge from those where shallow levels are influenced by coastal and marine environments.

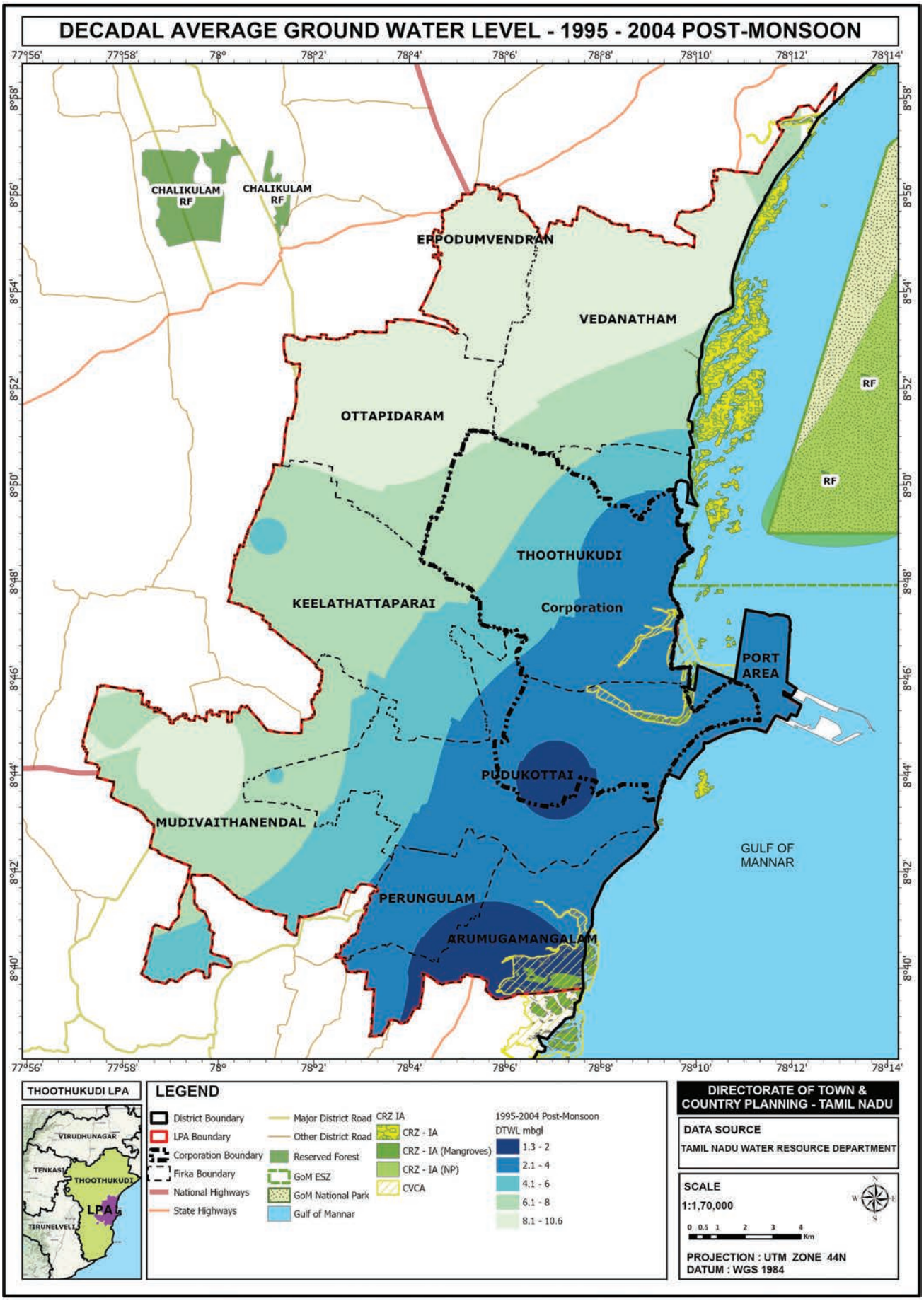
Table 6.10 Firka-wise decadal average groundwater levels (DTWL in m bgl)

Firka	1995–2004	2005–2014	2015–2024	Decadal Trend
Thoothukudi (Corporation)	<2	<2	<2	Stable, marine influenced
Pudukkottai	<2	<2	<2	Stable, marine influenced
Arumugamangalam	<2	<2	<2	Stable, marine influenced
Vedanatham	2–4	<2–2–4	<2–2–4	Slight rise
Ottapidaram	6–8	4–6	2–4	Clear improvement
Eppodumvendran	6–8	4–6	2–4 / 4–6	Improving
Keelathattaparai	6–8	4–6	2–4	Improving
Mudivaithanendal	4–6	2–4	2–4	Moderate improvement
Perungulam	4–6	2–4	2–4	Moderate improvement



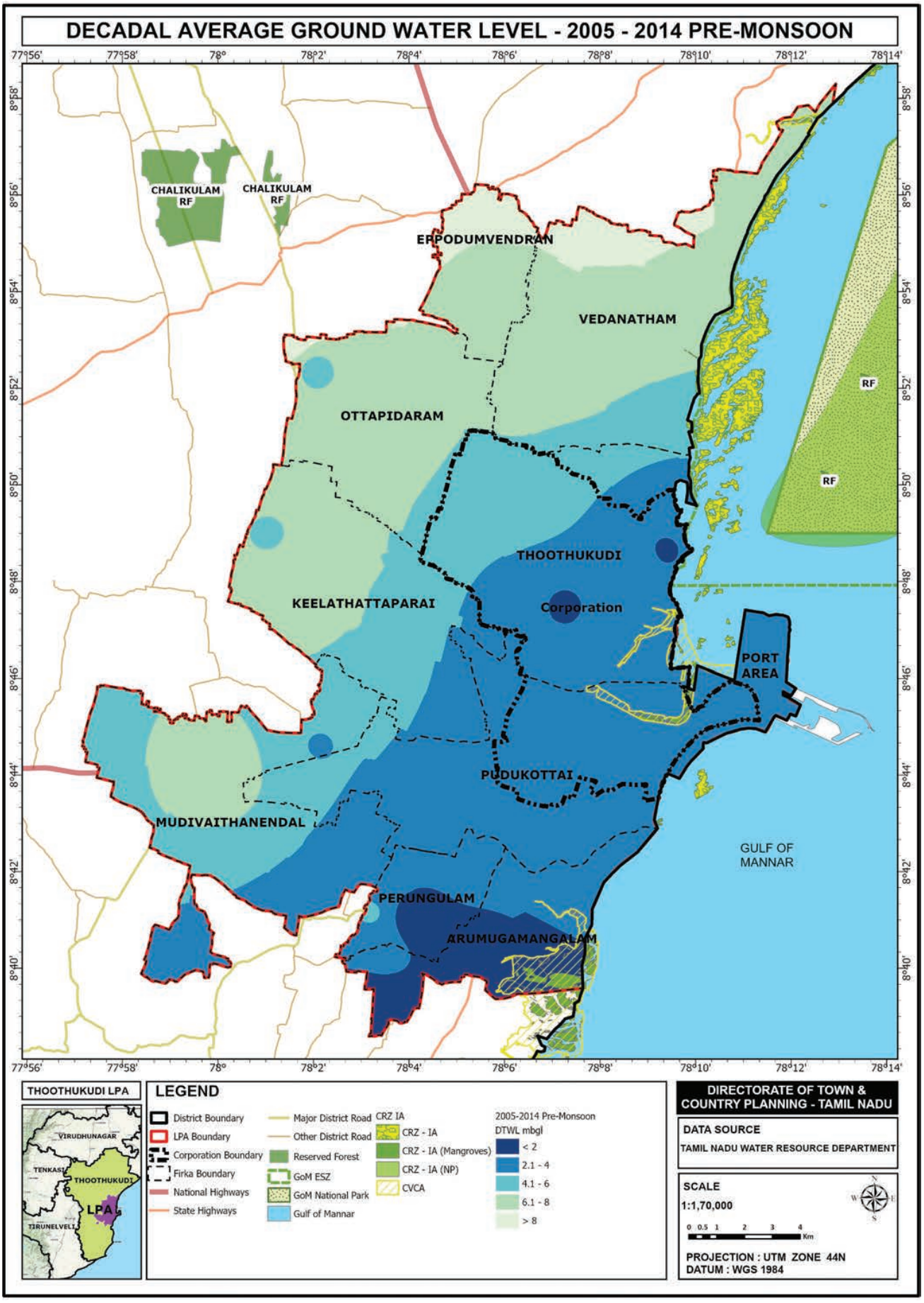
Map 6.23 DTWL 1995-2004 pre-monsoon

Source Tamil Nadu Water Resource Department

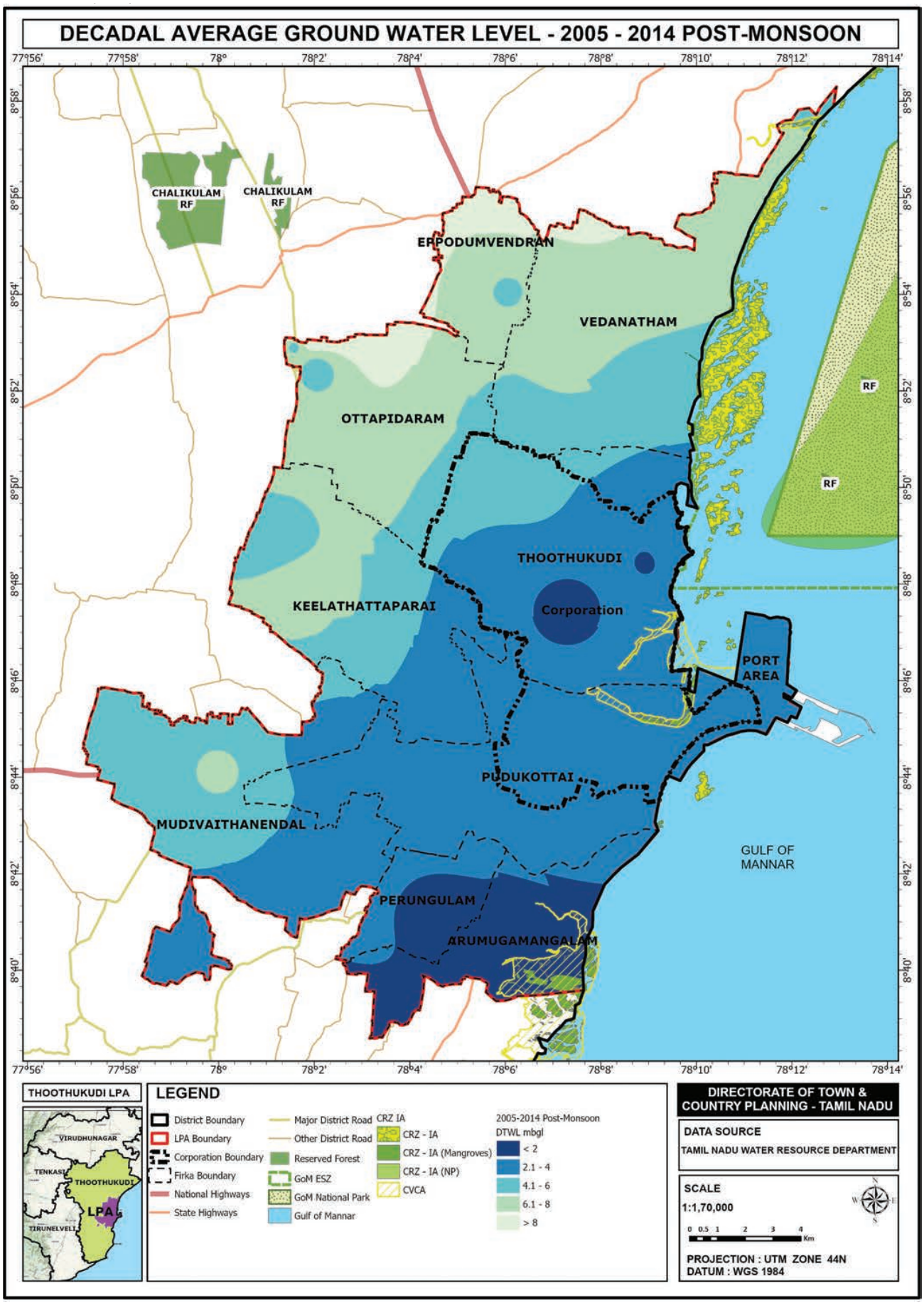


Map 6.24 DTWL 1995-2004 post-monsoon

Source Tamil Nadu Water Resource Department

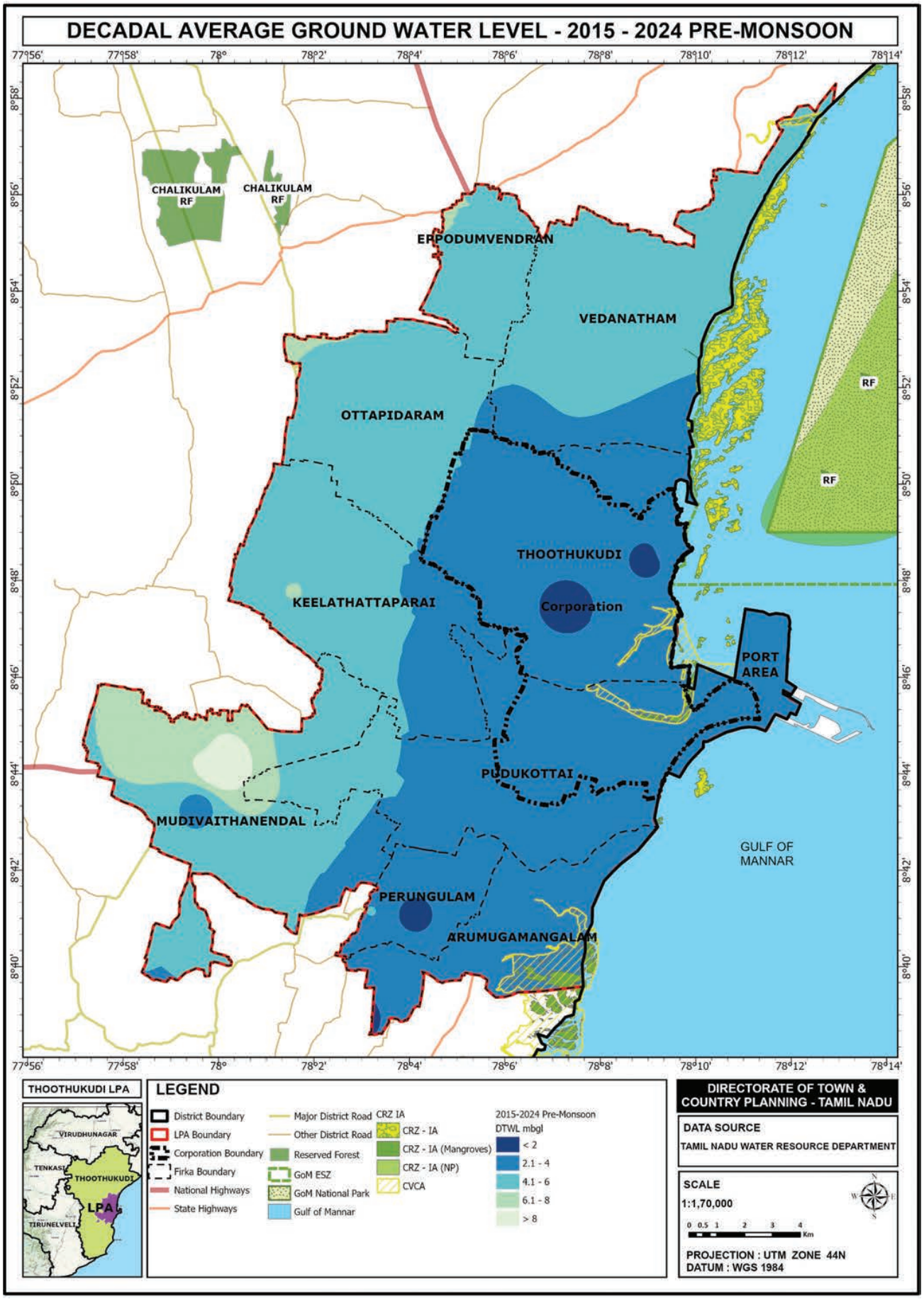


Map 6.25 DTWL 2005-2014 pre-monsoon



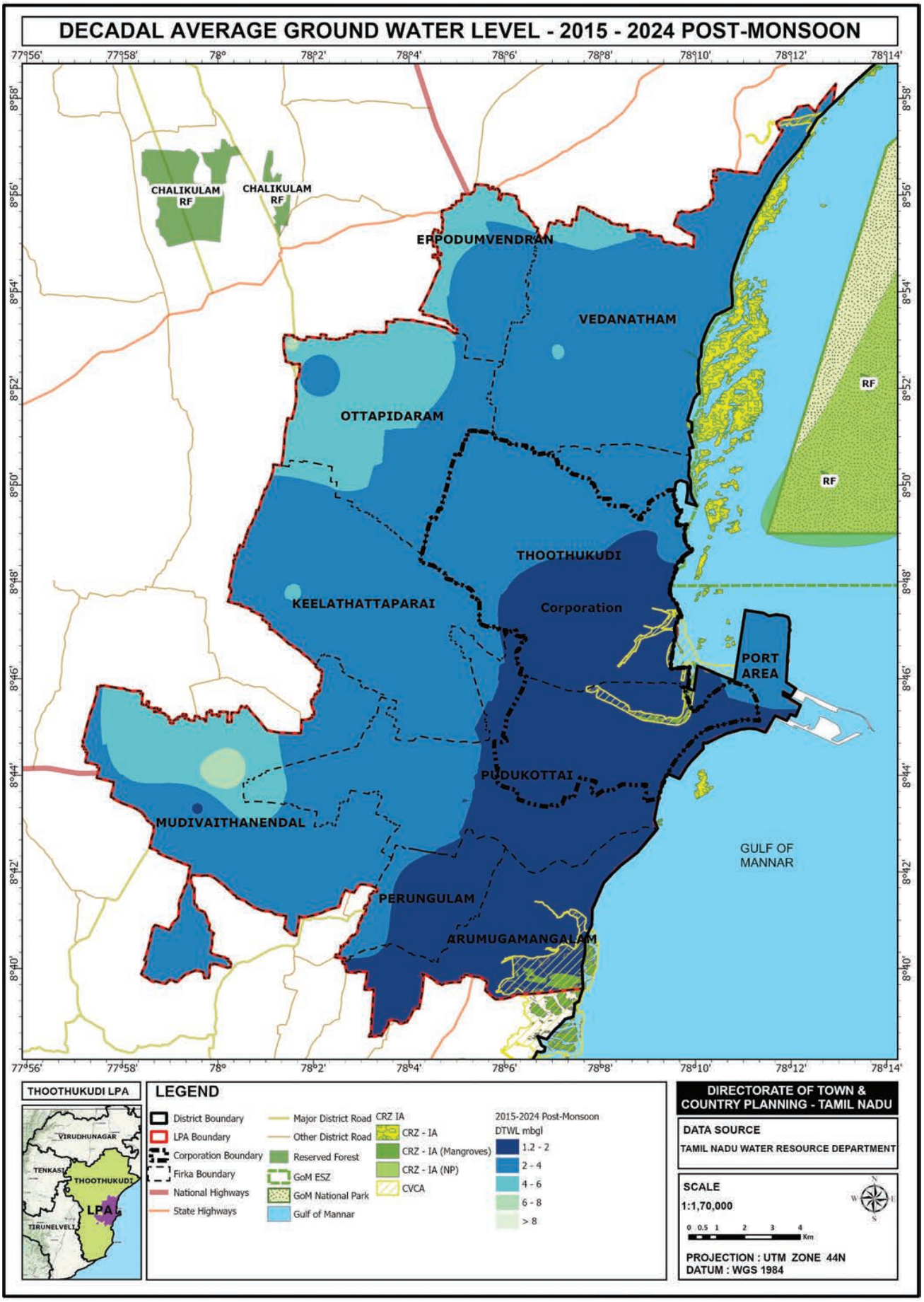
Map 6.26 DTWL 2005-2014 post-monsoon

Source Tamil Nadu Water Resource Department



Map 6.27 DTWL 2015-2024 pre-monsoon

Source Tamil Nadu Water Resource Department



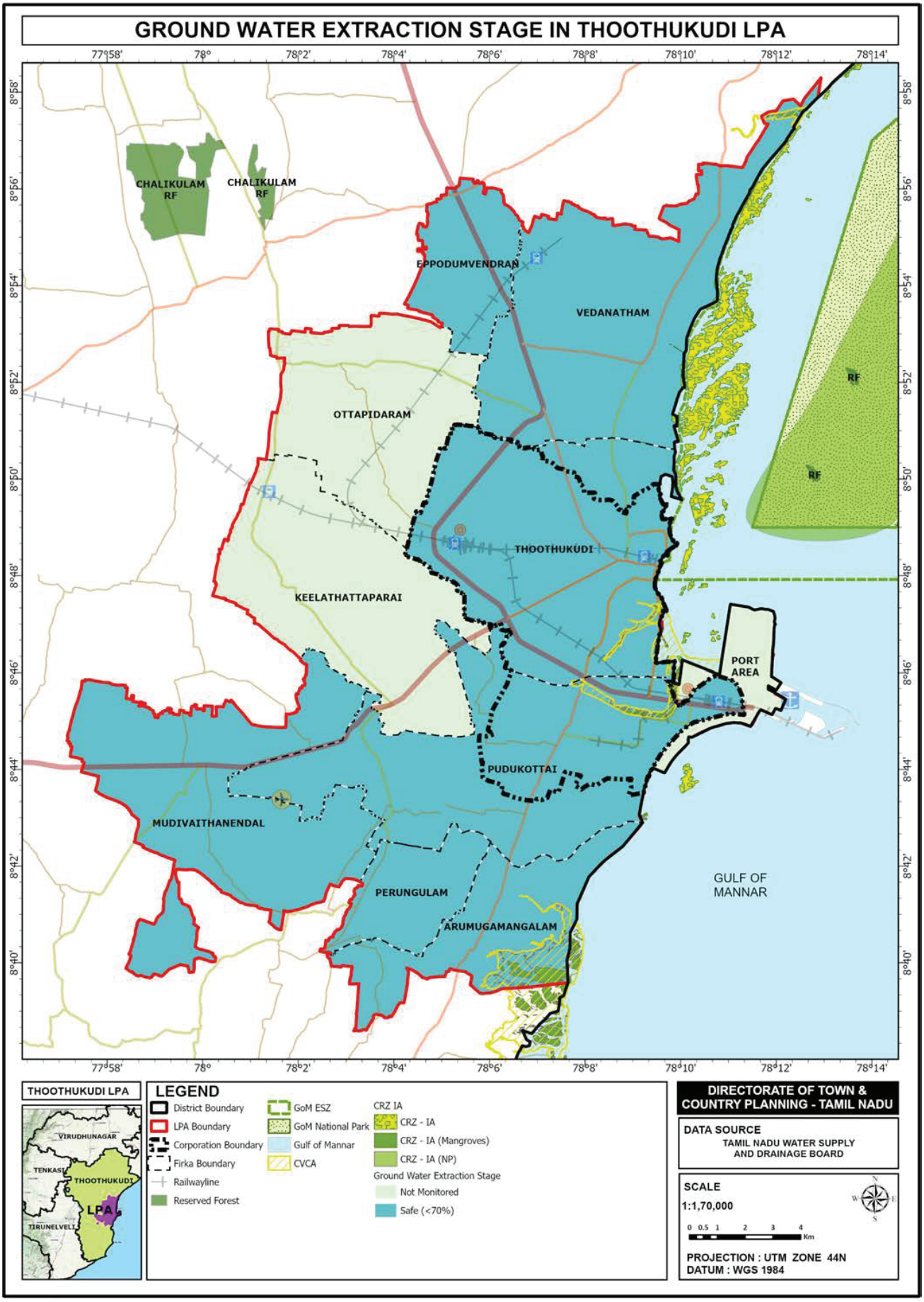
Map 6.28 DTWL 2015-2024 post-monsoon

Source Tamil Nadu Water Resource Department

6.4.5 Stage of Extraction of Ground Water

Firka-wise assessment of Ground water extraction in the Thoothukudi Planning Area as depicted in Map 6.29 suggests it is within the safe category with less than 70% use of the extractable ground water resource. This status must be consistently maintained given that the underlying aquifers are low-yield hard rock and confined coastal alluvial aquifers which are vulnerable to over-exploitation and are prone to saline water intrusion if posed with intensive pumping.





Map 6.29 Firka-wise ground water extraction in Thoothukudi Planning Area

Source Tamil Nadu Water Supply and Drainage Board (TWAD)

6.4.6 Groundwater quality: pH, Electrical Conductivity and Total Dissolved Solids

After having established the stage of extraction, understanding the ground water quality parameters, especially those indicating the dissolved salt content becomes important given the coastal setting of the planning area. While ground water levels show improvement, the quality parameters exhibit persistent spatial constraints. Decadal average maps of pH, Electrical conductivity (EC), and Total Dissolved Solids (TDS) show a long-term chemical characteristic that directly influence groundwater usability. Understanding these parameters at the firka level is essential for distinguishing areas where shallow groundwater is usable from those where quality limits its usability.

Ph (Potential of Hydrogen)

pH in water is the measure of its acidity or alkalinity on a scale of 0-14, with 7 being neutral (pure water), below 7 acidic, and above 7 alkaline (basic). For drinking water, the pH typically varies between 6.5 and 8.5 which is the acceptable limits as per BIS Standards.

Groundwater in coastal areas commonly shows a neutral to slightly alkaline pH, typically ranging between 7 and 8.6, often indicating a mild alkalinity due to **saline water intrusion.**

The Table 6.11 presents firka-wise decadal groundwater pH conditions for the Thoothukudi LPA, derived from the decadal average pH maps for 1995-2004, 2005-2014, and 2015-2024 shown in Map 6.30 to Map 6.32. The values shown represent the dominant condition within each firka. This assessment highlights the spatial persistence and gradual intensification of alkaline groundwater conditions across decades, and evaluates compliance against BIS drinking water standards of pH between 6.5 and 8.5.

Table 6.11 Firka-wise pH levels in Thoothukudi Planning Area

Firka	1995–2004	2005–2014	2015–2024
Thoothukudi (Corp.)	8.0–8.25	8.0–8.25	8.0–8.25
Pudukkottai	7.75–8.25	8.0–8.25	>8.25
Arumugamangalam	<7.75	<7.75	7.75–8.0
Vedanatham	7.75–8.25	8.0–8.25	>8.25
Ottapidaram	8.0–8.25	>8.25	>8.25
Eppodumvendran	7.75–8.0	8.0–8.25	8.0–8.25
Keelathattaparai	7.75–8.25	>8.25	>8.25
Mudivaithanendal	<7.75	<7.75	7.75–8.0
Perungulam	7.75–8.0	7.75–8.0	7.75–8.0

Electrical conductivity

Electrical Conductivity represents total number of cations and anions present in ground water, indicating mobility of different ions, total dissolved solids and saline nature of water. In general water having EC < 1500 µS/cm at 25 °C, is considered as fresh water, EC 1500 to 15000 µS/cm as brackish water and > 15000 µS/cm as saline water. Table 6.12 presents the BIS and CPCB standards for EC.

Table 6.12 Electrical Conductivity Standards as per BIS and acceptable limits as per CPBC

Class	Range (µS/cm)	Acceptable limits as per CBCP Designated best use
Low	< 1500	Max 2250 µS/cm (Class E - Irrigation, Industrial Cooling, Controlled Waste disposal)
Medium	1500-3000	
High	3000-6000	
Very High	600	

Source BIS 11624 1986

The Table 6.13 summarises firka-wise and decadal Electrical Conductivity (EC) classes of groundwater, based on interpretation of the EC distribution maps for the three decades (Map 6.33 to Map 6.35). The EC ranges reflect long-term salinity conditions rather than short-term fluctuations. Majority of the planning area – Pudukkottai, Vedanatham, Ottapidaram, Eppodumvendran, Keelathattaparai has EC exceeding 1500 µS/cm but within 15000 µS/cm indicating brackish water which is often the direct result of saline intrusion in coastal groundwater.

Table 6.13 Firka-wise electrical conductivity in Thoothukudi Planning Area

Firka	1995–2004	2005–2014	2015–2024
Thoothukudi (Corp.)	<1500	<1500	<1500
Pudukkottai	2000–2500	2000–2500	>2500
Arumugamangalam	<1500	<1500	<1500
Vedanatham	2000–2500	2000–2500	2000–2500
Ottapidaram	>2500	>2500	>2500
Erpodumvendran	2000–2500	2000–2500	2000–2500
Keelathattaparai	>2500	>2500	>2500
Mudivaithanendal	1500–2000	1500–2000	1500–2000
Perungulam	<1500	<1500	<1500

Total Dissolved Solids (TDS)

TDS is a measure of dissolved minerals, salts and organic matter, usually in parts per million or mg/L. As per BIS: 10500, 2012, the acceptable limits of TDS for drinking water is up to 500 mg/L. TDS in coastal ground water ranges from fresh (<1000 mg/L) to brackish (>1000 mg/L), primarily due to natural seawater intrusion, which can intensify due to over-extraction.

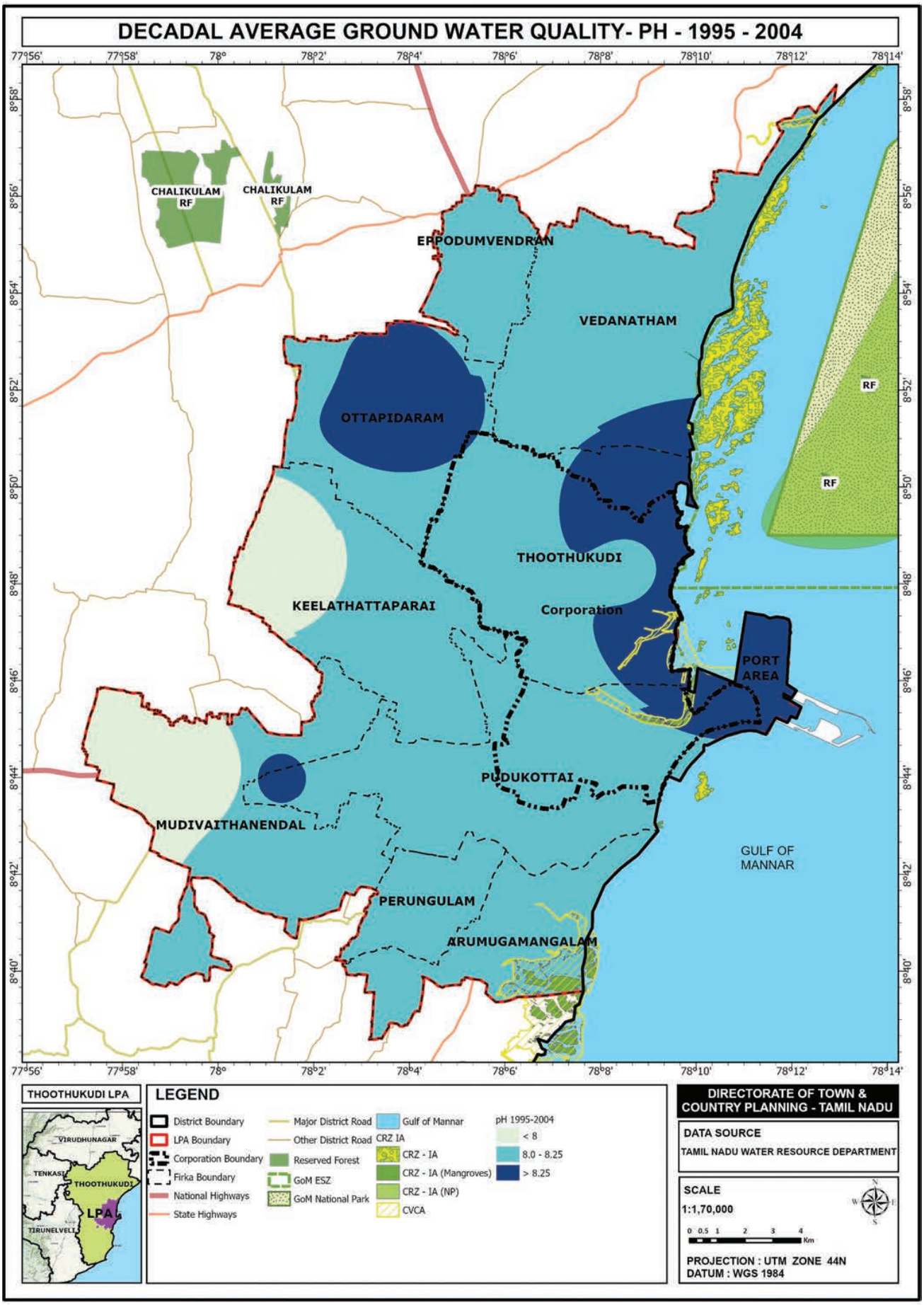
The Table 6.14 provides a decadal, firka-wise representation of Total Dissolved Solids (TDS) in groundwater, compiled from the TDS maps for 1995-2004 (Map 6.36), 2005-2014 (Map 6.37), and 2015-2024 (Map 6.38). The TDS ranges indicate the dominant groundwater quality class within each firka. This assessment is used to evaluate long-term drinking water suitability in relation to BIS 5TDS standards for drinking water with 500 mg/L being the acceptable limit, and 2,000 mg/L being the permissible limits in the absence of alternate sources.

Table 6.14 Firka-wise Total Dissolved Solids in groundwater for Thoothukudi Planning Area

Firka	1995–2004	2005–2014	2015–2024
Thoothukudi (Corp.)	500–1000	500–1000	500–1000
Pudukkottai	1500–2000	1000–1500	>2000
Arumugamangalam	<500	<500	500–1000
Vedanatham	1000–1500	1000–1500	1500–2000
Ottapidaram	>2000	>2000	>2000
Erpodumvendran	1000–1500	1000–1500	1000–1500
Keelathattaparai	>2000	>2000	>2000
Mudivaithanendal	500–1000	500–1000	500–1000
Perungulam	500–1000	500–1000	500–1000

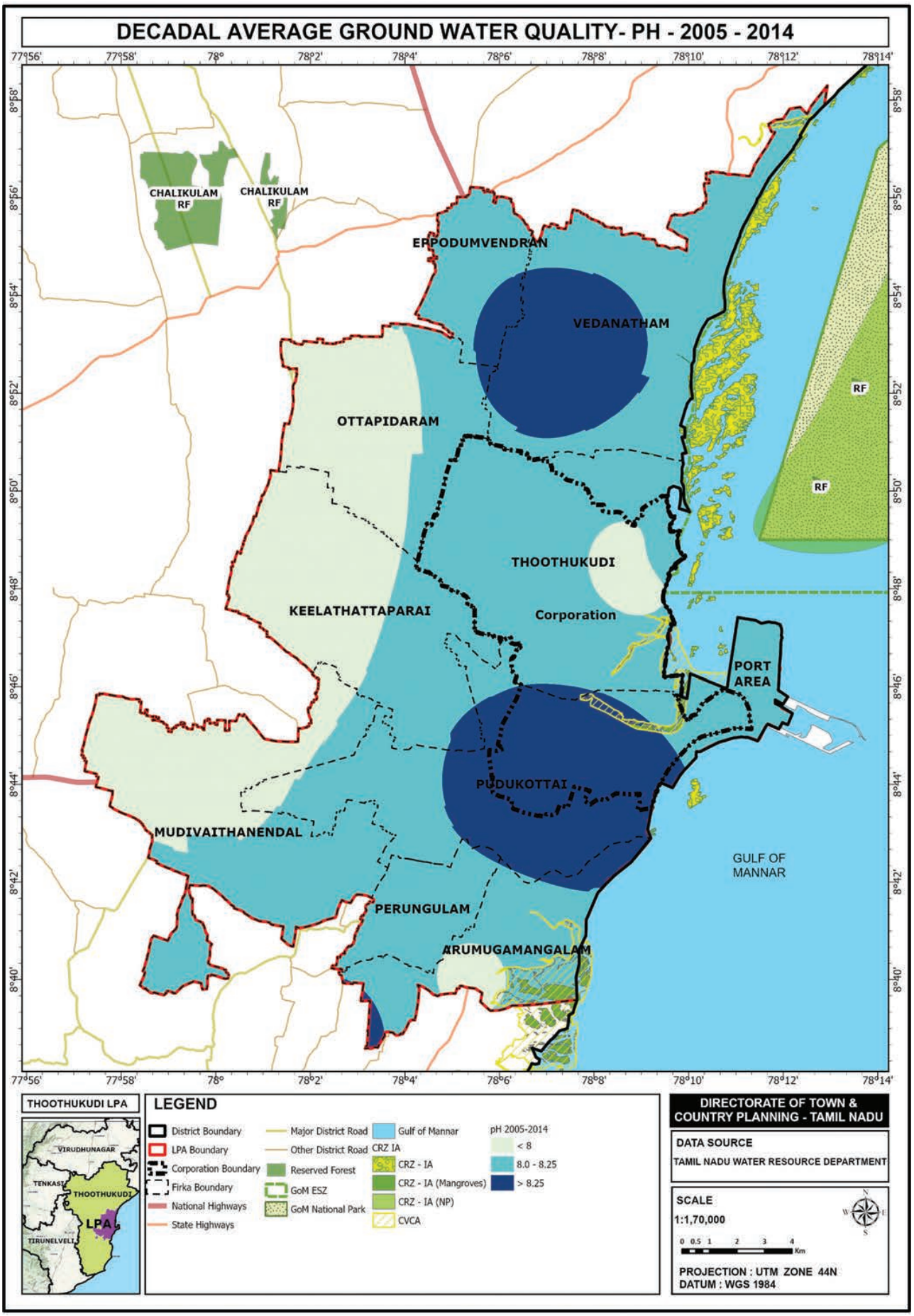
Although coastal firkas of the Thoothukudi LPA are inherently susceptible to salinity ingress, the relatively better groundwater quality observed in these areas can be attributed to their hydrogeological setting. As described in the Physical Features chapter, the coastal belt is underlain by thicker sedimentary formations with multi-layered aquifer systems, where deeper confined aquifers are separated from shallow unconfined aquifers by clayey aquitards. These confining layers restrict direct saline intrusion and contribute to greater chemical stability in the deeper groundwater zones that are typically accessed for water supply.

In contrast, inland firkas such as Ottapidaram and Keelathattaparai are dominated by shallow, unconfined hard rock aquifers with limited storage and flushing capacity. These aquifers are more vulnerable to salt accumulation, resulting in persistently high EC and TDS levels despite improved groundwater levels. Additionally, reduced groundwater dependence along the coast, owing to surface water supply, further limits quality deterioration. Consequently, groundwater quality stress in the Planning Area is driven more by aquifer vulnerability than proximity to the sea.



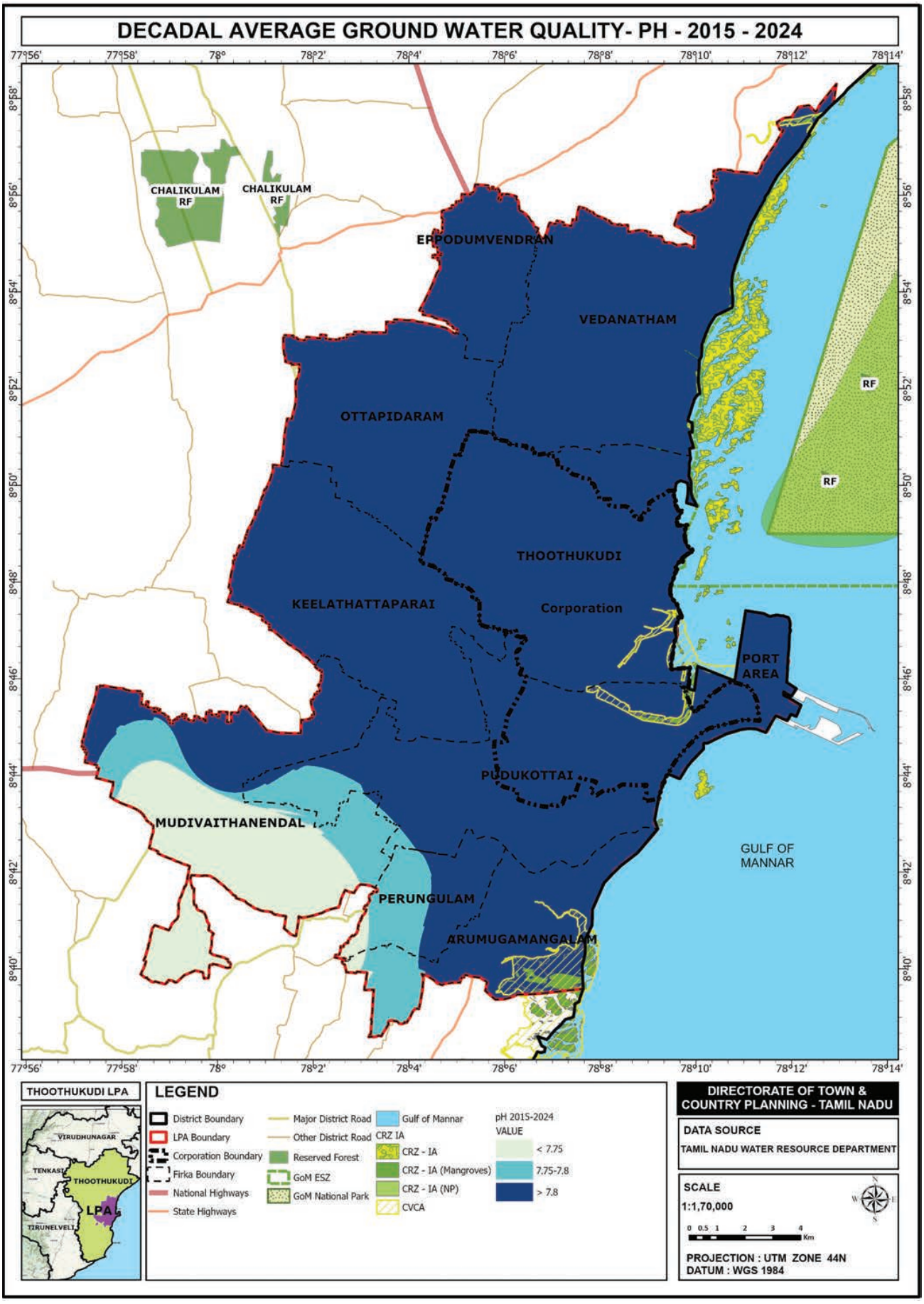
Map 6.30 Decadal Average Ground Water Quality -PH – 1995-2004

Source: Tamil Nadu Water Resource Department



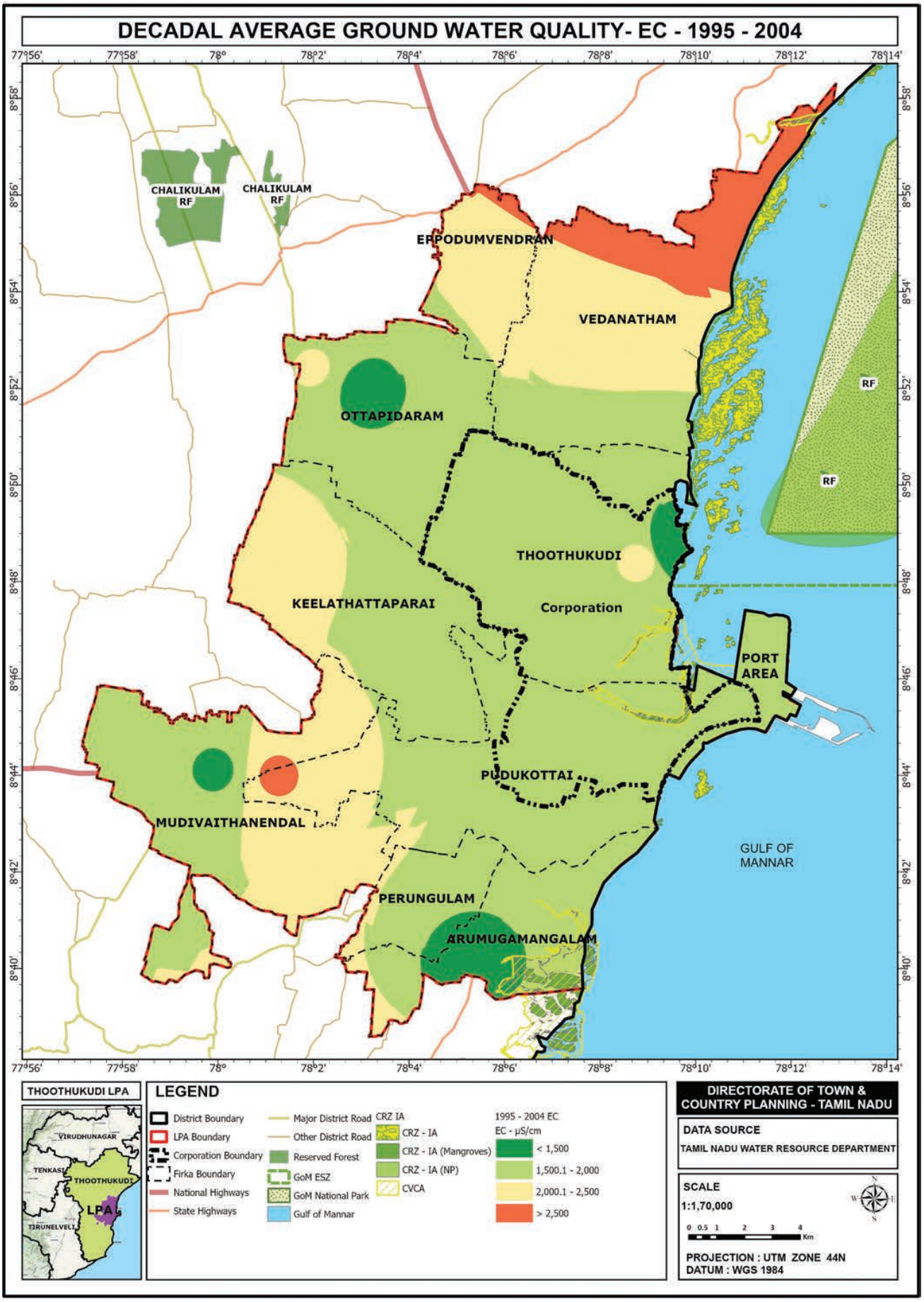
Map 6.31 Decadal Average Ground Water Quality -PH – 1995-2004

Source: Tamil Nadu Water Resource Department



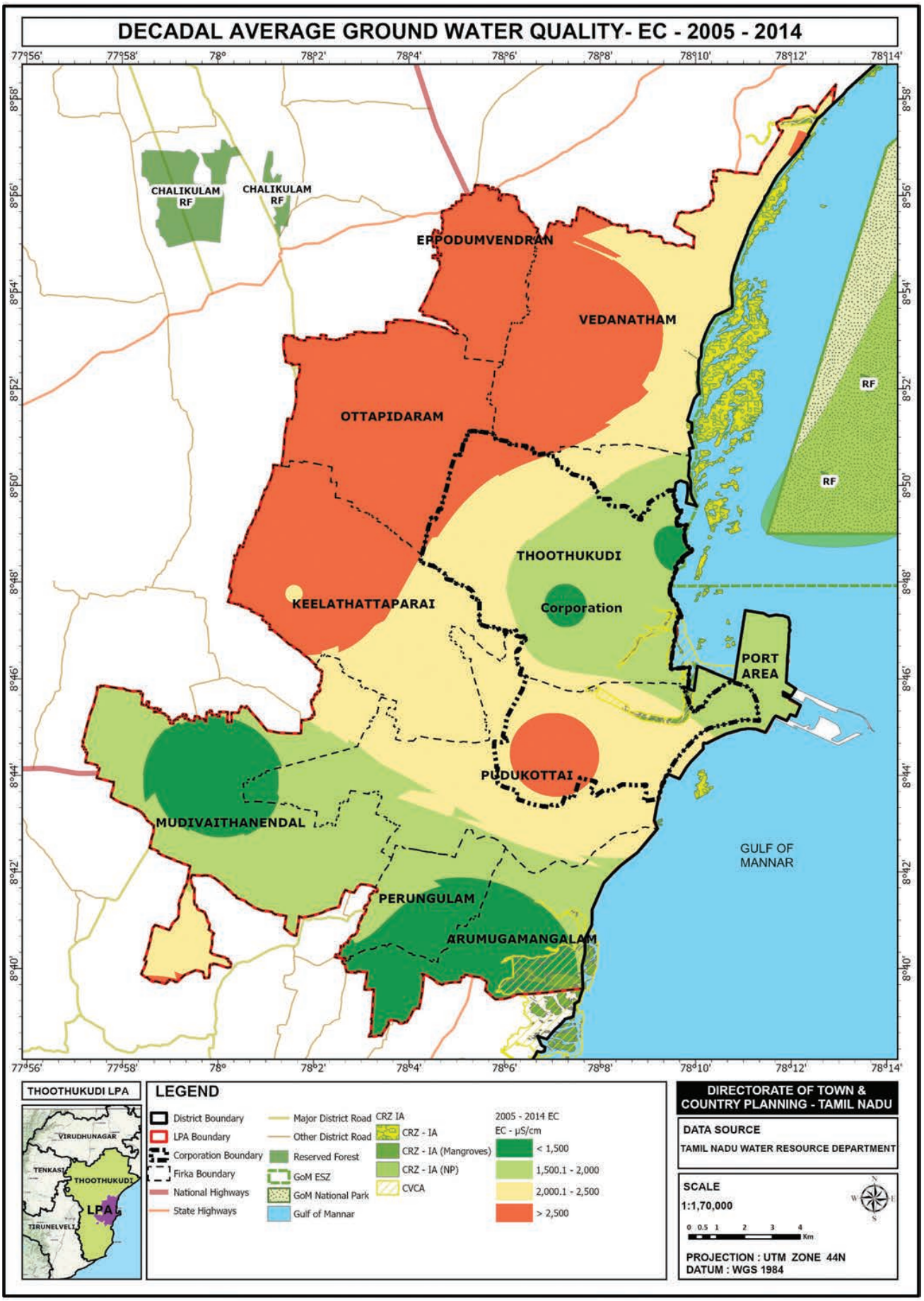
Map 6.32 Decadal Average Ground Water Quality -PH – 2015-2024

Source: Tamil Nadu Water Resource Department



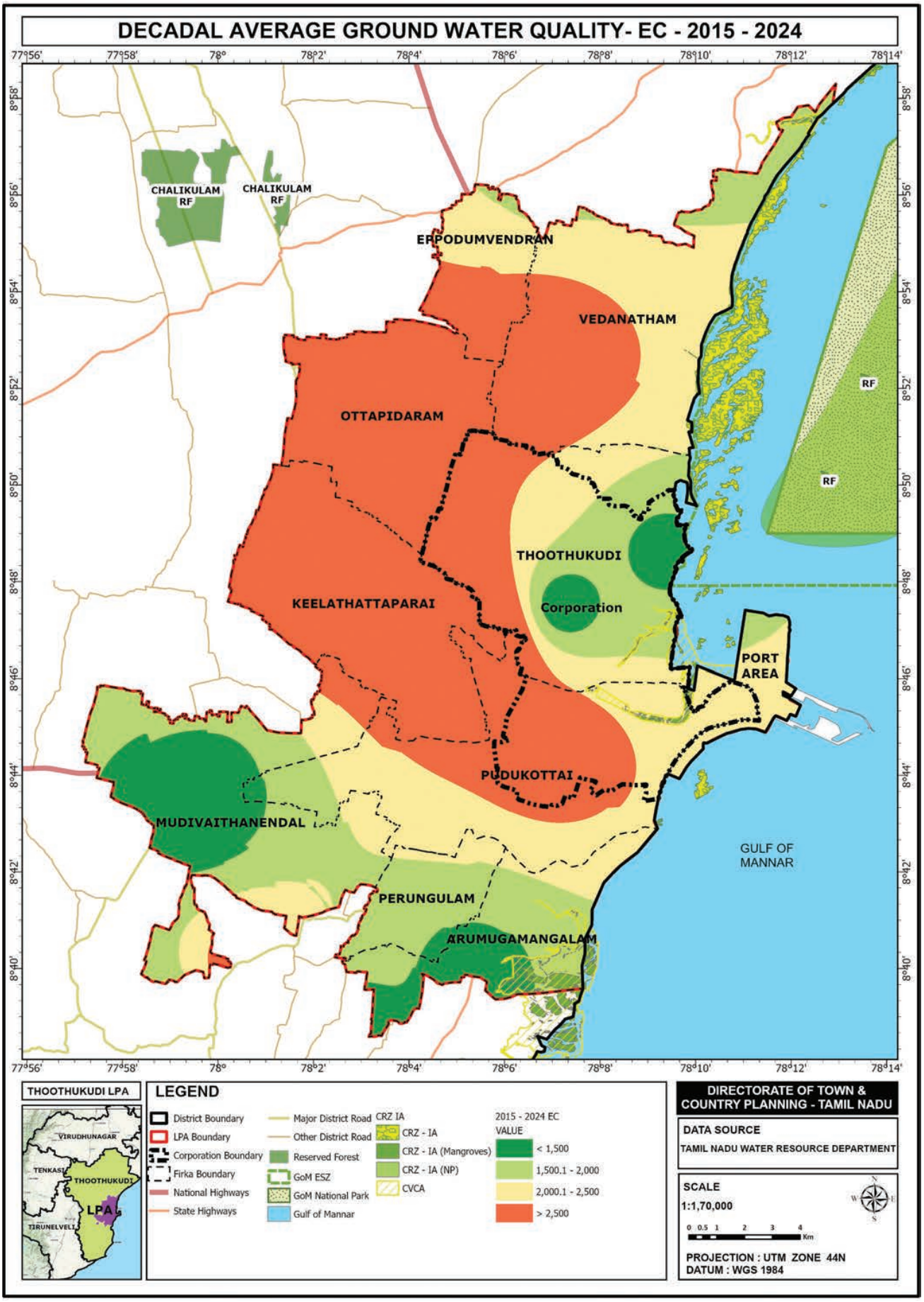
Map 6.33 Decadal Average Ground Water Quality -EC – 1995-2004

Source: Tamil Nadu Water Resource Department



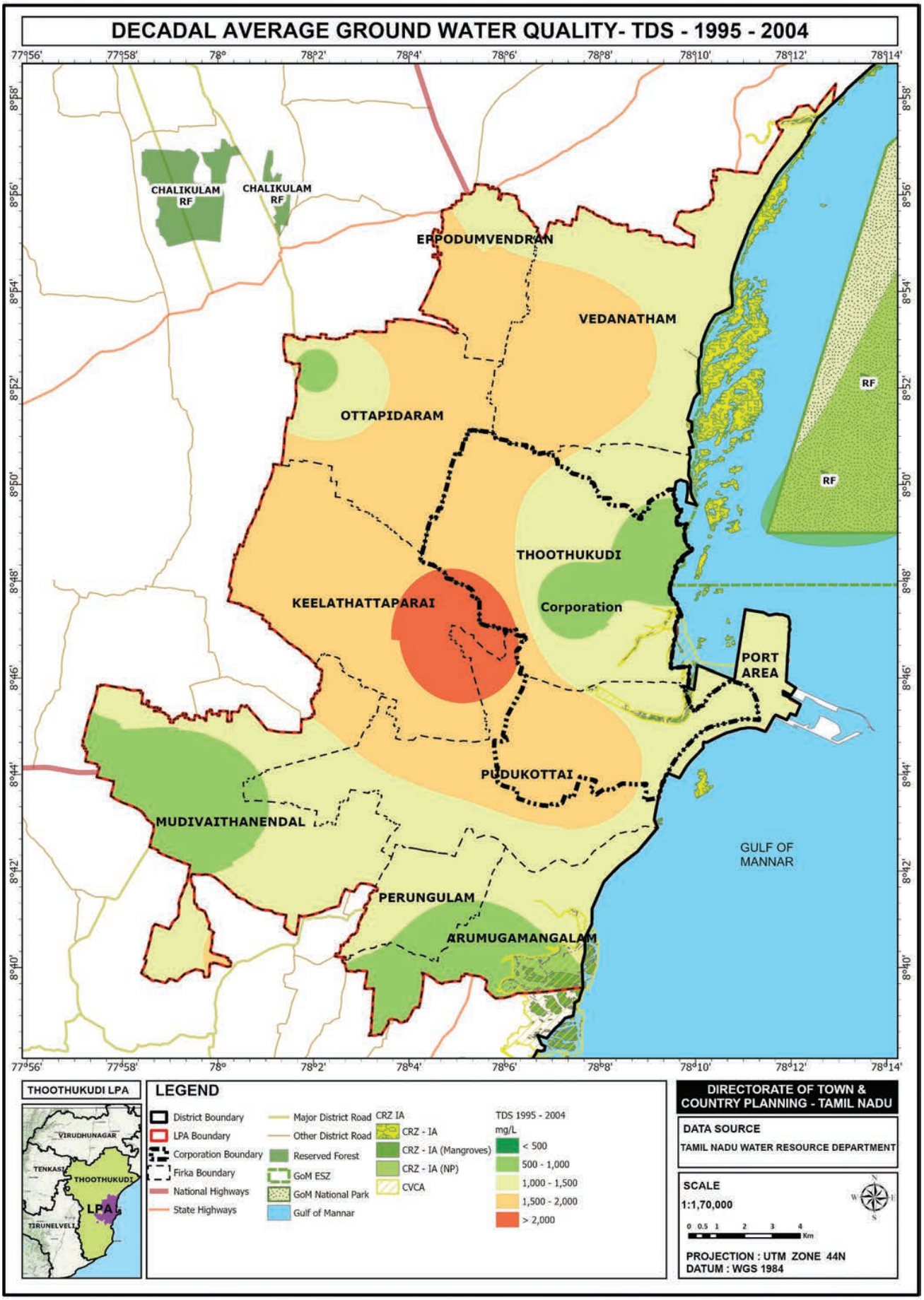
Map 6.34 Decadal Average Ground Water Quality -EC – 2005-2014

Source: Tamil Nadu Water Resource Department



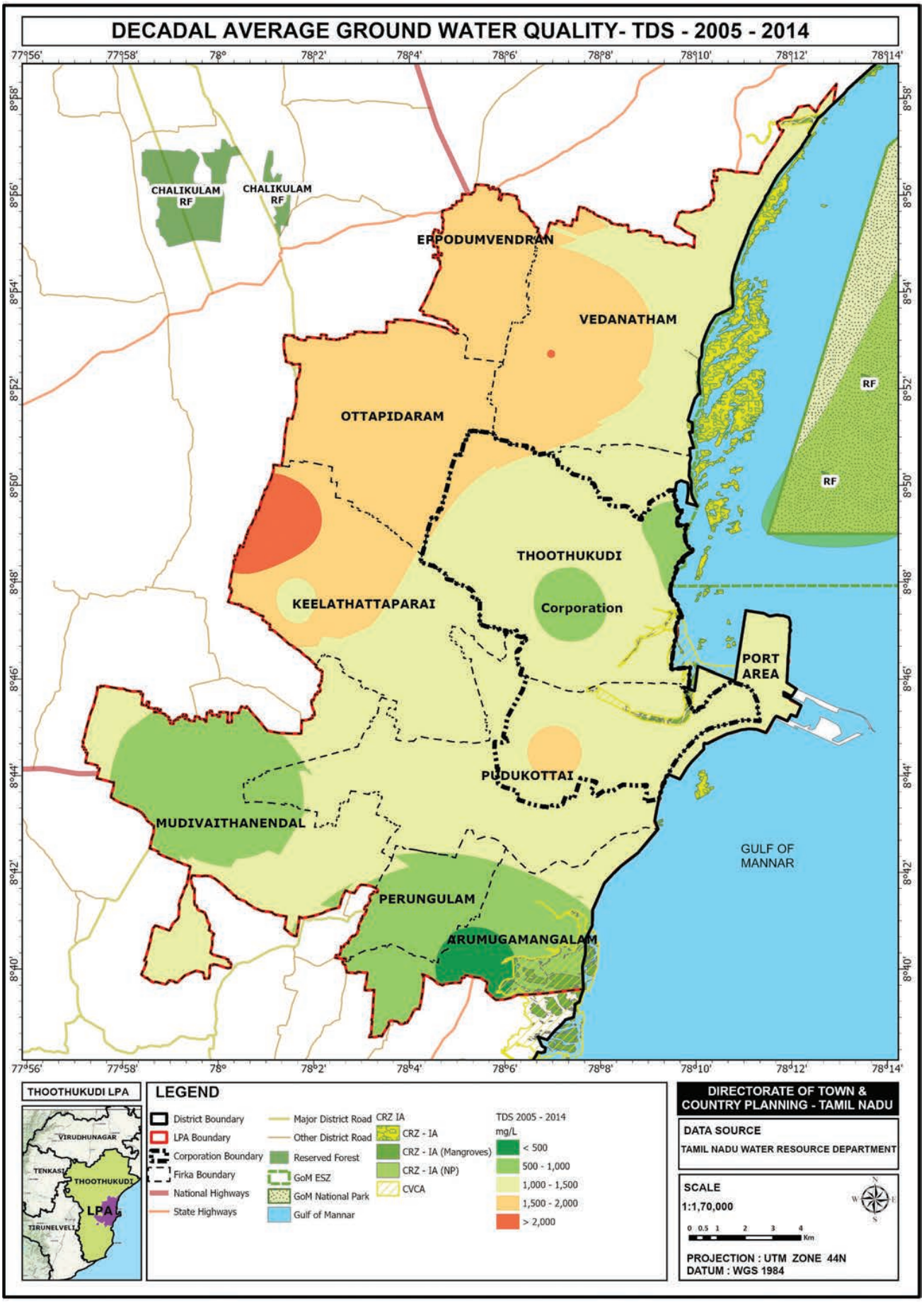
Map 6.35 Decadal Average Ground Water Quality -EC – 2015-2024

Source: Tamil Nadu Water Resource Department



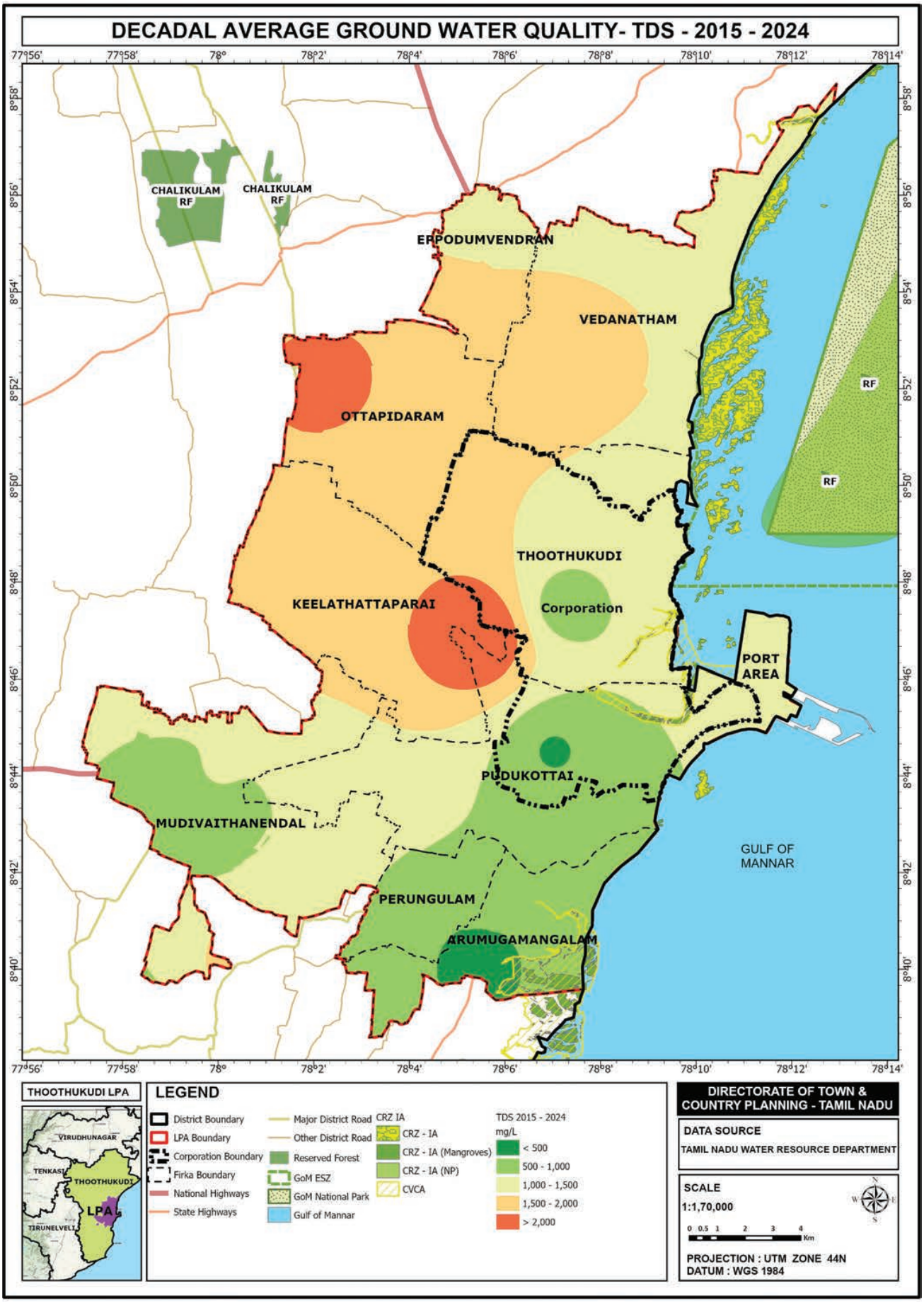
Map 6.36 Decadal Average Ground Water Quality -TDS – 1995-2004

Source: Tamil Nadu Water Resource Department



Map 6.37 Decadal Average Ground Water Quality -TDS – 2005-2014

Source: Tamil Nadu Water Resource Department



Map 6.38 Decadal Average Ground Water Quality -TDS – 2015-2024

Source: Tamil Nadu Water Resource Department

The groundwater assessment highlights that chemical suitability, rather than availability alone, limits groundwater uses across the planning area. This further necessitates examining groundwater development and aquifer context at the basin scale to understand the practical role of groundwater within the planning areas water resource framework.

Groundwater Development and Aquifer Context

Basin-level assessments by the Central Ground Water Board under the NAQUIM programme classify the Kallar Basin, within which the Thoothukudi LPA lies, as **"Safe"** in terms of stage of groundwater development. Groundwater extraction is dominated by irrigation use, with domestic and industrial demand forming a relatively smaller share of the total draft.

However, within the Thoothukudi LPA, groundwater usability is governed more by aquifer disposition and quality constraints than by extraction pressure. As outlined in the Physical Features chapter, coastal areas are underlain by **deeper confined aquifers** protected by clayey layers, resulting in comparatively stable groundwater quality. In contrast, inland firkas are characterised by **shallow, unconfined hard-rock aquifers**, which are more vulnerable to salinity build-up and alkalinity, despite observed improvements in groundwater levels.

Accordingly, groundwater within the Planning Area functions as a supplementary and spatially constrained resource, reinforcing the reliance on surface water systems for long-term water security.

The groundwater assessment indicates that, while groundwater conditions vary across firkas, its role within the Thoothukudi LPA remains constrained by quality and aquifer characteristics. In this context, long-term water security for the Planning Area is best achieved through prioritisation of surface water sources, with groundwater serving a complementary role supported by careful monitoring and regulation. Integrating this approach into land-use planning will be essential for environmentally sustainable development.

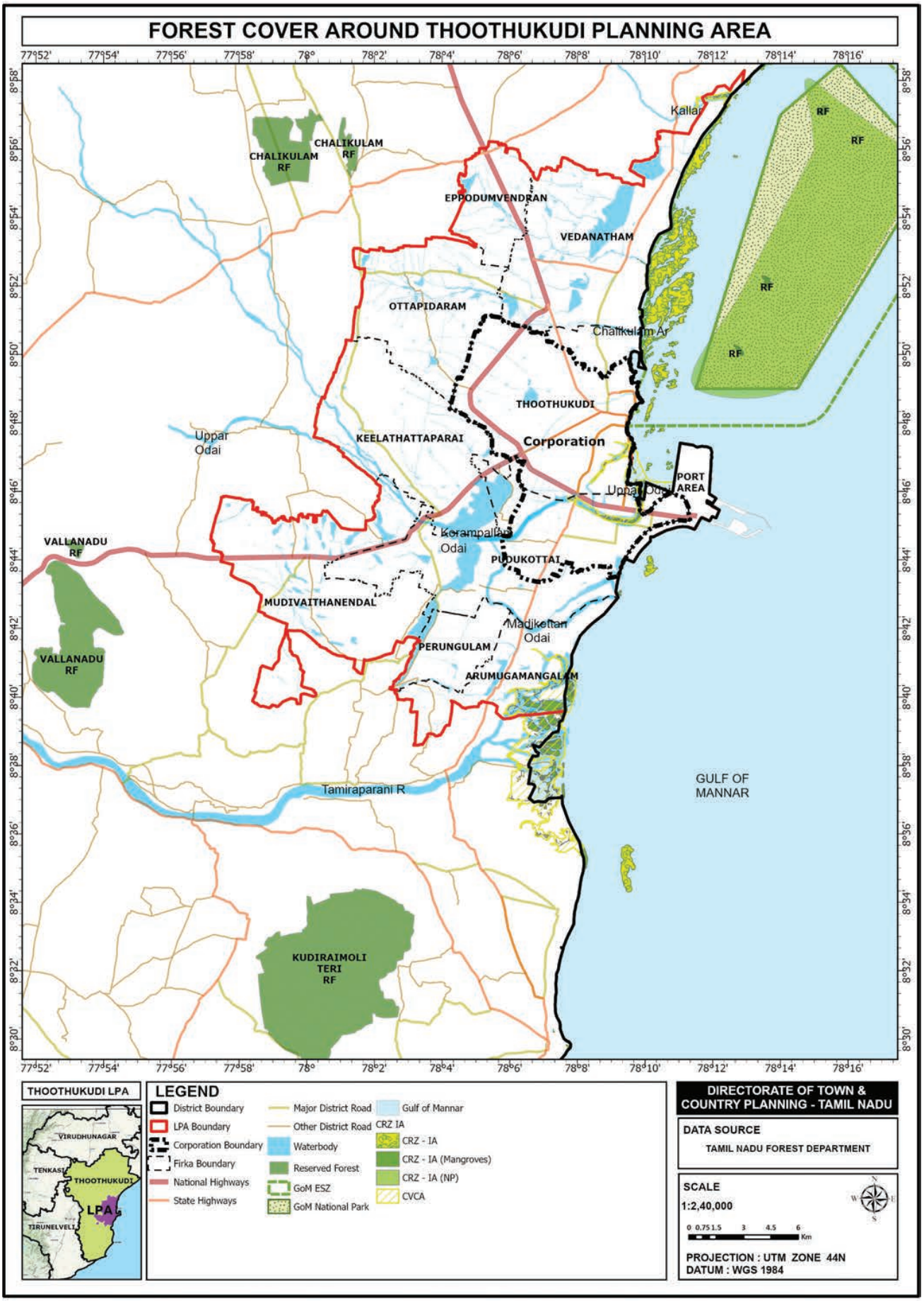


6.5 Biotic Environment

The Thoothukudi Planning Area is located within a complex coastal-estuarine ecological setting shaped by the interaction of terrestrial, riverine, estuarine, and marine systems. The Planning Area does not contain any notified or contiguous forest areas. The larger Thoothukudi district itself is characterised by low forest cover in comparison to the state average, reflecting its arid climate, coastal setting, and long history of human habitation and land use. As per the Indian State Forest Report (ISFR) 2023, the total forest cover in Thoothukudi district approximately 261 km2, consisting about 5.5% of the district's geographical area and is largely dominated by Open forest and Scrub forest category.

The Planning Area is predominantly urban, peri-urban, industrial, coastal and wetland in character. Consequently, ecological value within the Planning Area is not derived from forest ecosystems but from a diverse assemblage of non-forest natural and modified habitats. However, in the immediate outer context of the Thoothukudi Planning Area, forest is present in scattered patches as shown in Map 6.39. Chalikulam Reserve Forest in the North-West, Vallanadu Reserve Forest in the South West and the Kudiramoli Teri Reserve Forest, locally referred to as Theri Kaadu which is a red sand forest situated south of the Tamiraparani River. Despite the absence of forest cover within the Planning Area limits, the region supports rich and diverse biodiversity, owing to the presence of coastal wetlands, estuaries, salt pans, mangroves, river channels, tanks, mudflats, scrublands, and nearshore marine ecosystems. These habitats collectively sustain a wide range of avian, terrestrial, riverine, estuarine, and marine species, including resident, migratory, endemic and threatened taxa.





Map 6.39 Forest cover around Thoothukudi Planning Area

Source Tamil Nadu Forest Department

The biotic environment of the planning area has been assessed by documenting the existing flora and fauna under terrestrial, avian, marine, and riverine categories. The recorded species have been cross-referenced with the **schedules of the Wildlife Protection Act (WPA), 1972, and the conservation status as per the IUCN Red List** to establish their legal protection status and conservation priority. Incorporation of WPA schedules ensures statutory compliance by identifying species that are legally protected and sensitive to habitat alteration, while the IUCN classification provides a globally recognised framework to assess extinction risk and ecological vulnerability. This integrated approach supports informed land-use planning, aids in identifying ecologically sensitive zones, and guides appropriate mitigation and conservation measures to balance development with biodiversity protection.

6.5.1 Avian Biodiversity

The Thoothukudi Planning Area is part of an important coastal avian landscape along the Central Asian Flyway, supporting large populations of resident and migratory birds. Coastal wetlands, salt pans, estuaries, and tanks are the critical feeding, roosting and wintering habitats. Salt pans and industrial backwaters act as surrogate wetlands, that support the congregation of shorebirds and water birds such as Greater Flamingo (Phoenicopterus roseus), Spot-billed Pelican (Pelecanus philippensis), Black-headed Ibis (Threskiornis melanocephalus), Painted Stork (Mycteria leucocephala), Little Egret (Egretta garzetta), and various species of sandpipers and terns, including species of conservation concern. Some of these species are shown in figure 6.18.



Figure 6.18 On the salt pans and coastal wetlands spotted the Greater Flamingo, Painted Stork and Little Egret

6.5.2 Migratory Flyways and visits to Tamil Nadu

Tamil Nadu is indispensable for long-distance migrants as mentioned in Table 6.15, because it offers diverse wetlands that provide essential food and shelter. Key sites in the state include Pulicat Lake, Pallikaranai Marsh, Vedanthangal, Point Calimere, and Koonthankulam. While the Central Asian Flyway is the primary route to Tamil Nadu, India as a whole is also influenced by the East Asian-Australasian Flyway (EAAF) and the Asian-East African Flyway (AEAF) as shown in figure 6.19.

Table 6.15 List of selected migratory bird species and their conservation status

Sl. No.	Common Name	Scientific Name	IUCN Status	WP(A)A, 2022
1	Ruddy Turnstone	*Arenaria interpres*	Near Threatened	Schedule-II
2	Eurasian Curlew	*Numenius arquata*	Near Threatened	Schedule-II
3	Common Pochard	*Aythya ferina*	Vulnerable	Schedule-I
4	Curlew Sandpiper	*Calidris ferruginea*	Vulnerable	Schedule-II
5	Bar-headed Goose	*Anser indicus*	Least Concern	Schedule-II

Source: Distribution of selected migratory bird species of Tamil Nadu and their conservation challenges, TBGPC-CR-2025, AIWC (R, T & E), TNFD, Vandalur

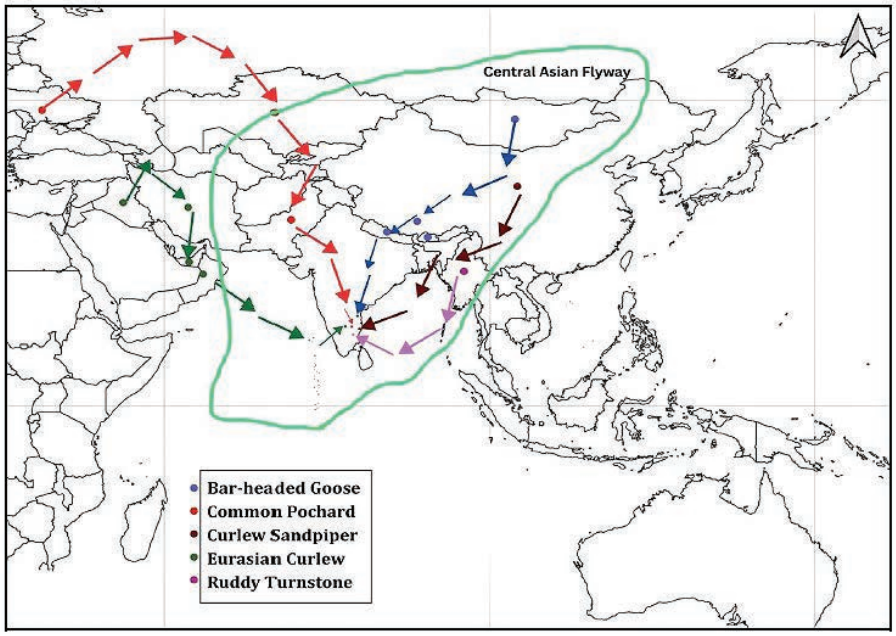


Figure 6.19 Illustrated Migratory route map of Ruddy Turnstone, Eurasian Curlew, Common Pochard, Curlew Sandpiper & Bar-headed Goose

Source: Distribution of selected migratory bird species of Tamil Nadu and their conservation challenges, TBGPCCR-2025, AIWC (R, T & E), TNFD, Vandalur

Specific Observations in Thoothukudi

Thoothukudi is an essential district for various migratory species, appearing in the distribution data for various migratory birds shown in figure 6.20.

- **Ruddy Turnstone:** Thoothukudi ranks as the fourth most significant district for this species in Tamil Nadu, recording approximately 75 sightings over the last decade.
- **Eurasian Curlew:** This district is among the top recorded locations for

the species in the state, documenting roughly 110 sightings.

- **Common Pochard:** Thoothukudi is one of the few districts in Tamil Nadu where this diving duck has been observed, with 5 total sightings recorded in the data.
- **Curlew Sandpiper:** Geographical distribution maps in the sources show consistent sighting points along the coastal mudflats and marshes of Thoothukudi.
- **Bar-headed Goose:** While primarily recorded in Tirunelveli, the distribution map indicates that Thoothukudi also hosts wintering populations of these geese.



Figure 6.20 Ruddy Turnstone, Eurasian Curlew, Common Pochard, Curlew Sandpiper & Bar-headed Goose

Source: Distribution of selected migratory bird species of Tamil Nadu and their conservation challenges, TBGPC-CR-2025, AIWC (R, T & E), TNFD, Vandalur

The following species are recorded across the study areas. The **WPA Schedule and IUCN Status** are provided as specified in the source documentation, particularly the biodiversity assessments for the Thoothukudi Local Planning Area (LPA). The Table 6.16 presents flora species that serve as the primary nesting, resting, and roosting sites for bird populations within the mangrove and wetland ecosystems.

Table 6.16 List of Flora in the Avian Habitat and their conservation status

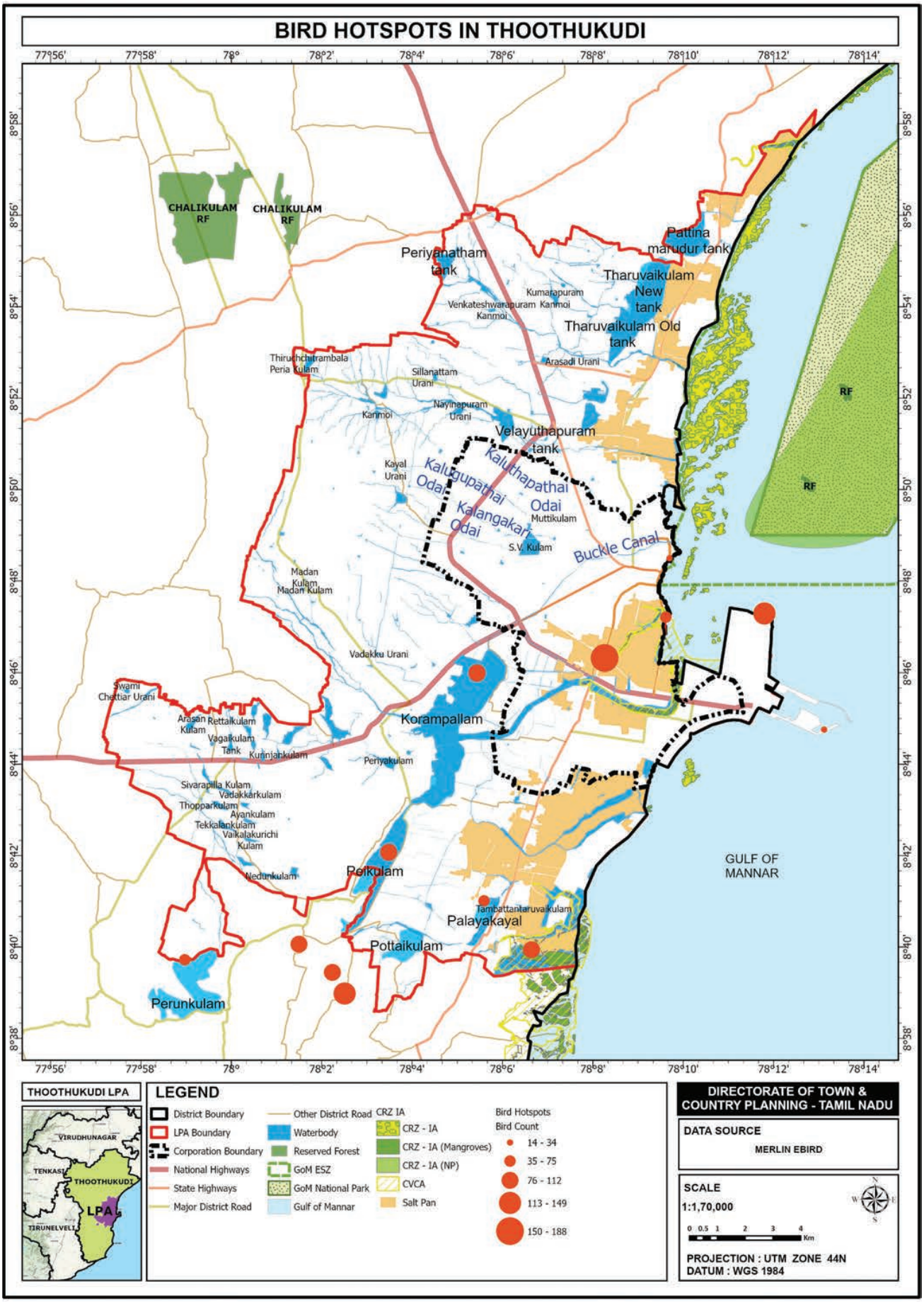
Scientific Name of the Species	Common Name	IUCN Status	WPA Schedule
Tree			
Avicennia marina	Gray Mangrove	Least Concern (LC)	Not Specified
Borassus flabellifer	Asian Palmyra Palm	Not Evaluated (NE)	Not Specified
Cocos nucifera	Coconut Tree	Not Evaluated (NE)	Not Specified
Tamarindus indica	Tamarind / Chinch	Not Evaluated (NE)	Not Specified
Rhizophora mucronata	True Mangrove	Least Concern (LC)	Not Specified
Thespesia populnea	Portia Tree	Not Specified	Not Specified
Pemphis acidula	Small-leaved Mangrove	Least Concern (LC)	Not Specified
Shrub			
Suaeda monoica	South-Indian Seepweed	Endangered (EN)	Not Specified
Ipomoea carnea	Pink Morning Glory	Invasive	Not Specified
Herb			
Eichhornia crassipes	Water Hyacinth	Invasive	Not Specified

While the biodiversity is dominated by Aves (Birds), these ecosystems also support specialized Mammals and Reptiles listed in Table 6.17 that interact within the same wetland and mangrove corridors.

Table 6.17 List of Fauna in the Avian Habitat and their conservation status

Scientific Name of the Species	Common Name	IUCN Status	WPA Schedule
Bird			
Pelecanus philippensis	Spot-billed Pelican	Near Threatened (NT)	Not Specified
Mycteria leucocephala	Painted Stork	Near Threatened (NT)	Not Specified
Aquila nipalensis	Steppe Eagle	Endangered (EN)	Schedule II
Calidris pygmaea	Spoon-billed Sandpiper	Critically Endangered (CR)	Not Specified
Phoenicopterus roseus	Greater Flamingo	Least Concern (LC)	Not Specified
Pava cristatus	Indian Peafowl	Least Concern (LC)	Schedule I
Accipiter badius	Shikra	Least Concern (LC)	Schedule IV
Eudynamys scolopaceus	Asian Koel	Least Concern (LC)	Schedule IV
Bubulcus ibis	Cattle Egret	Least Concern (LC)	Schedule IV
Threskiornis melanocephalus	Black-headed Ibis	Near Threatened (NT)	Not Specified
Reptile			
Varanus bengalensis	Indian Monitor Lizard	Near Threatened (NT)	Schedule I
Calotes versicolor	Garden Lizard	Least Concern (LC)	Not Specified
Naja naja	Indian Cobra	Least Concern (LC)	Schedule II
Mammal			
Herpestes javanicus	Asian Small Mongoose	Least Concern (LC)	Schedule II
Funambulus palmarum	Striped Squirrel	Not Listed (NL)	Schedule IV
Lepus nigricollis	Indian Hare	Not Listed (NL)	Schedule IV

The Map 6.40 captures the bird hotspots within the Thoothukudi Planning Area. The hotspots include major tanks such as Korampallam tank, Peikulam, the Tamiraparani estuary in Palayakayal, the coastal areas and the salt pans.



Map 6.40 Bird hotspot in Thoothukudi Planning Area

Source Merlin eBird

6.5.3 Terrestrial Biodiversity

Terrestrial biodiversity within the Planning Area is primarily associated with Scrub vegetation, coastal plantations, agricultural lands, shelterbelts and mangrove in the estuary and creeks. These habitats support fauna that thrive in the saline and dry coastal conditions, including reptiles such as the Indian Monitor Lizard (Varanus bengalensis) and Garden Lizard (Calotes versicolor), small mammals such as Indian Palm Squirrel (Funambulus palmarum), amphibians like Common Indian Toad (Duttaphrynus melanostictus), and diverse invertebrate communities. Despite being fragmented, these habitats are critical to sustain the local ecological stability and buffering between urban areas and sensitive coastal ecosystems.

Faunal species are categorized by their protection status under the Indian Wildlife (Protection) Act (WPA), 1972, and IUCN status as listed in Table 6.18. The terrestrial fauna includes species that have adapted to semi-arid and saline conditions. Most of the mammals and reptiles recorded are common to the Deccan Peninsula, though several receive specific legal protection under the Indian Wildlife (Protection) Act, 1972.

Table 6.18: List of Fauna in Terrestrial Habitat and their conservation status

Scientific Name of the Species	Common Name	IUCN Status	WPA Schedule
Mammal			
Herpestes javanicus	Asian Small Mongoose	Least Concern (LC)	Schedule II
Funambulus palmarum	Striped Squirrel	Not Listed (NL)	Schedule IV
Lepus nigricollis	Indian Hare	Not Listed (NL)	Schedule IV
Mus booduga	Indian Field Mouse	Not Listed (NL)	Schedule IV
Reptile			
Varanus bengalensis	Indian Monitor Lizard	Near Threatened (NT)	Schedule II
Naja naja	Indian Cobra	Least Concern (LC)	Schedule II (Part II)
Vipera russeli	Russell's Viper	Least Concern (LC)	Schedule II (Part II)
Ptyas mucosa	Rat Snake	Least Concern (LC)	Schedule IV (Part II)
Ahaetulla nasuta	Green Vine Snake	Not Listed (NL)	Schedule IV
Bungarus caeruleus	Common Krait	Not Listed (NL)	Schedule IV
Calotes versicolor	Garden Lizard	Least Concern (LC)	Not Listed

Scientific Name of the Species	Common Name	IUCN Status	WPA Schedule
Mabuya carinata	Keeled Grass Skink	Least Concern (LC)	Schedule IV
Hemidactylus maculatus	Spotted House Gecko	Not Listed (NL)	Schedule IV

The vegetation in the region consists of littoral and swamp forests, scrublands, and coastal plantations. While the core urban and industrial areas have sparse vegetation, the surrounding landscape contains a mix of endangered halophytes and common native species as listed in Table 6.19.

Table 6.19 List of Flora in Terrestrial Habitat and their conservation status

Scientific Name of the Species	Common Name	IUCN Status	WPA Schedule
Tree			
Salvadora persica	Toothbrush Tree	Endangered (EN)	Not Listed
Azadirachta indica	Neem	Least Concern (LC)	Not Listed
Borassus flabellifer	Asian Palmyra Palm	Not Evaluated (NE)	Not Listed
Thespesia populnea	Portia Tree	Not Specified	Not Listed
Albizia amara	Bitter Albizia	Not Specified	Not Listed
Ziziphus mauritiana	Indian Plum	Not Specified	Not Listed
Shrub			
Suaeda monoica	South-Indian Seepweed	Endangered (EN)	Not Listed
Suaeda maritima	Annual Sea-Blite	Endangered (EN)	Not Listed
Tamarix indica	Tamarisk	Endangered (EN)	Not Listed
Calotropis gigantea	Milk Weed	Not Evaluated (NE)	Not Listed
Senna auriculata	Avaram	Not Evaluated (NE)	Not Listed
Herb			
Aloe vera	Aloe barbadensis	Not Evaluated (NE)	Not Listed
Salicornia brachiata	Glasswort	Least Concern (LC)	Not Listed
Grass			
Aeluropus lagopoides	Mangrove Grass	Endangered (EN)	Not Listed
Climber			
Cissus quadrangularis	Stemmed Vine	Not Evaluated (NE)	Not Listed

6.5.4 Riverine and Estuarine Biodiversity

Tamiraparani and Upparu River systems along with the associated estuaries, tanks, odais, and creeks, support diverse aquatic biodiversity, particularly fish, crustaceans, molluscs, and plankton. These are the breeding and nursery grounds, especially in the estuarine stretches. The commonly found fish species include Catla (Catla catla), Rohu (Labeo rohita), Tilapia (Oreochromis mossambicus), mullets (Mugil spp.), prawns (Penaeus spp.), and crabs (Scylla spp.). The presence of these freshwater and marine/brackish water species means Thoothukudi's fishing sector has diverse production sources, including inland aquaculture, riverine and marine fishing along the Gulf of Mannar Coast. While many fish species are not explicitly listed in the WPA schedules within the sources, specialized marine mammals and reptiles that frequent these interfaces receive high protection, listed in Table 6.20

Table 6.20 List of Fauna in Riverine Habitat and their conservation status

Scientific Name of the Species	Common Name	IUCN Status	WPA Schedule
Mammal			
Dugong dugon	Dugong / Sea Cow	Vulnerable (VU)	Schedule I
Sousa chinensis	Chinese White Dolphin	Vulnerable (VU)	Schedule I
Reptile			
Chelonia mydas	Green Sea Turtle	Endangered (EN)	Schedule I
Lepidochelys olivacea	Olive Ridley Turtle	Vulnerable (VU)	Schedule I
Hydrophis spiralis	Yellow Sea Snake	Not Specified	Schedule IV
Crocodylus porosus	Saltwater Crocodile	Not Specified	Schedule I
Fish			
Dawkinsia tambraparniei	Tamiraparani Barb	Endangered (EN)	Not Specified
Hypselobarbus dubius	Nilgiri Barb	Endangered (EN)	Not Specified
Garra kalakadensis	Kalakad Garra	Endangered (EN)	Not Specified
Hippocampus kuda	Common Seahorse	Vulnerable (VU)	Schedule I
Cyprinus carpio	Common Carp	Vulnerable (VU)	Not Specified
Cirrhinus cirrhosis	Mrigal	Vulnerable (VU)	Not Specified
Anguilla bengalensis	Indian Mottled Eel	Near Threatened (NT)	Not Specified

Scientific Name of the Species	Common Name	IUCN Status	WPA Schedule
Oreochromis mossambicus	Mozambique Tilapia	Near Threatened (NT)	Not Specified
Mugil cephalus	Flathead Grey Mullet	Least Concern (LC)	Not Specified
Invertebrate			
Scylla serrata	Mud Crab	Not Evaluated	Not Specified

The vegetation in these zones primarily belongs to the Littoral and Swamp forests group, characterized by specialized mangrove species and halophytes that stabilize the coastline and act as flood inhibitors, listed in Table 6.21.

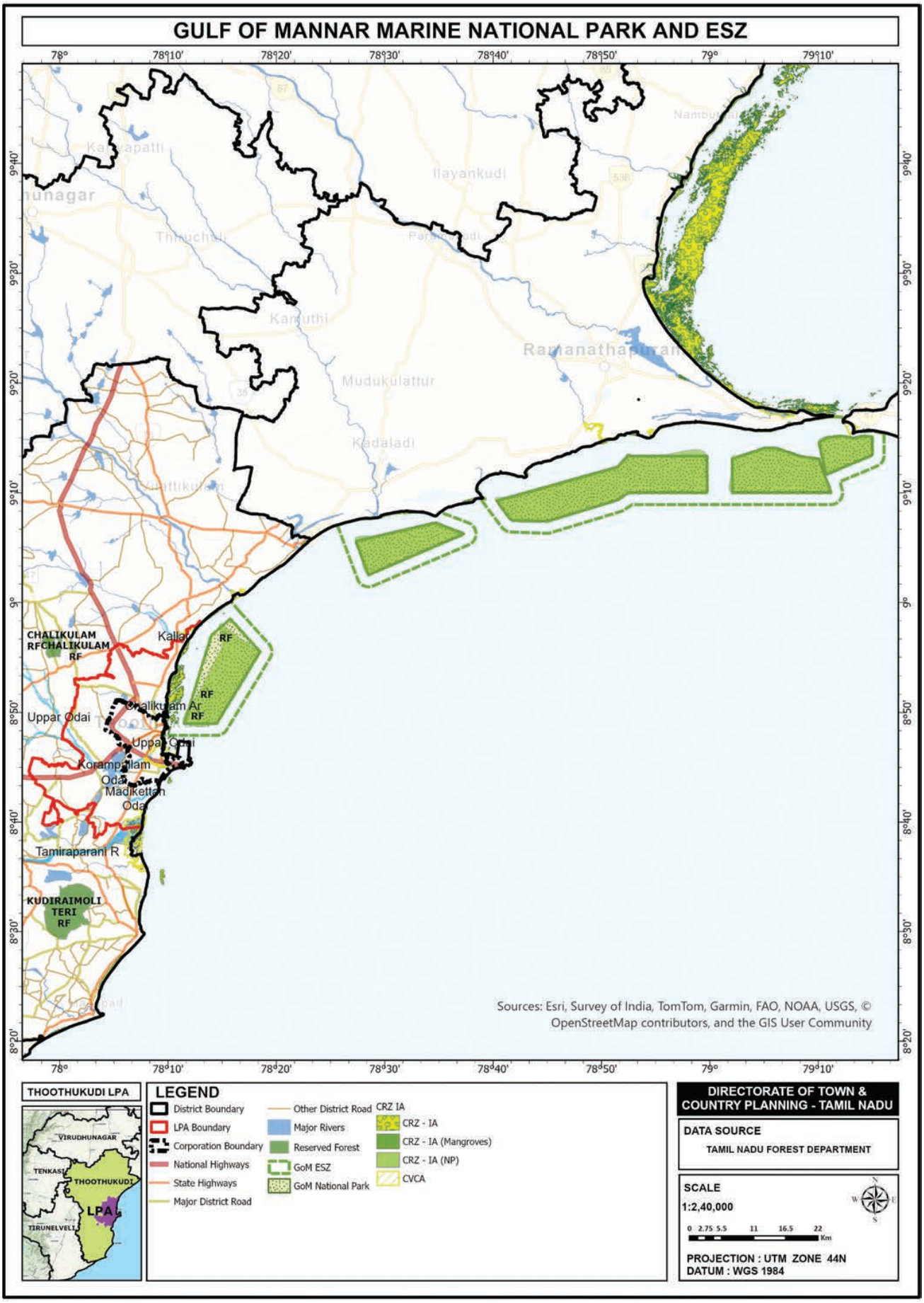
Table 6.21 List of Flora in Riverine Habitat and their conservation status

Scientific Name of the Species	Common Name	IUCN Status	WPA Schedule
Tree			
Avicennia marina	Gray Mangrove	Least Concern (LC)	Not Specified
Rhizophora mucronata	True Mangrove	Least Concern (LC)	Not Specified
Excoecaria agallocha	Blinding Tree	Not Specified	Not Specified
Ceriops tagal	Tagal Mangrove	Not Specified	Not Specified
Shrub			
Lumnitzera racemosa	Black Mangrove	Not Specified	Not Specified
Pemphis acidula	Small-leaved Mangrove	Least Concern (LC)	Not Specified
Suaeda monoica	South-Indian Seepweed	Endangered (EN)	Not Specified
Suaeda maritima	Annual Sea-Blite	Endangered (EN)	Not Specified
Tamarix indica	Tamarisk	Endangered (EN)	Not Specified
Herb			
Salicornia brachiata	Glasswort	Least Concern (LC)	Not Specified
Grass			
Aeluropus lagopoides	Mangrove Grass	Endangered (EN)	Not Specified

6.5.5 Marine Biodiversity and Gulf of Mannar

The coastal waters adjoining the Planning Area form part of the Gulf of Mannar Marine National Park, as shown in Map 6.41, covering an area of 560 sq. km. The Gulf of Mannar was declared India's first Marine Biosphere Reserve in 1989 and is recognized under UNESCO's Man and the Biosphere (MAB) Programme. Owing to its global ecological significance, it has also been designated as a Ramsar Wetland of International Importance. The reserve encompasses 21 offshore islands along the coasts of Ramanathapuram and Thoothukudi districts, making it one of the most biologically diverse coastal regions in India. Its marine biodiversity includes coral reefs, seagrass meadows, finfish, marine mammals, sea turtles, and diverse invertebrate communities. Ecological processes originating in the Gulf extend inland through estuaries and creeks supporting mangroves, which function as natural flood regulators and critical nursery habitats for juvenile fish. The Tamiraparani estuary, forming a small part of the southern edge of the Thoothukudi Planning Area, is ecologically linked to this biosphere reserve. Collectively, the Gulf of Mannar provides vital ecosystem services, including fisheries productivity, shoreline protection, and climate regulation, and is widely regarded as a "Biologists' Paradise", supporting over 4,200 species of flora and fauna, including endemic, rare, endangered, and threatened species.

The Eco-Sensitive Zone (ESZ) around the Gulf of Mannar Biosphere Reserve (GoMBR) was officially notified by the MoEFCC on 1 January 2020 to minimize adverse impacts of developmental activities on sensitive marine and coastal ecosystems. While the Thoothukudi Planning Area does not fall within the core zone of the Marine National Park, it lies within the zone of ecological influence of the biosphere reserve, and land use within this influence area has been examined under the ESZ Notification. The ESZ extends from 0.73 km to 5.57 km around the National Park, covering a total area of 720.89 sq. km, and clearly specifies prohibited, regulated, and promoted activities. The estuaries, rivers, canals, and coastal wetlands within the Planning Area maintain strong land–sea ecological linkages, directly influencing the health of coral reefs, seagrass beds, and overall marine biodiversity of the Gulf of Mannar.



Map 6.41 Gulf of Mannar National park and its ESZ

Source Tamil Nadu Forest Department

The endemic species recorded in the Gulf of Mannar include Balanoglossus, Enhalus acaroides, and Pempis acidula. Endangered species present within the sanctuary comprise Sea Cucumbers (Holothurians), Green Turtle (Chelonia mydas), Hawksbill Turtle (Eretmochelys imbricata), Olive Ridley Turtle (Lepidochelys olivacea), Loggerhead Turtle (Caretta caretta), Leatherback Turtle (Dermochelys coriacea), and Sea Horses (family Syngnathidae). Rare species include the Short-finned Pilot Whale (Globicephala macrorhynchus), Risso's Dolphin (Grampus griseus), Bottlenose Dolphin (Tursiops truncatus), Chinese White Dolphin (Sousa chinensis), False Killer Whale (Pseudorca crassidens), and Bryde's Whale (Balaenoptera edeni). The Dugong (Dugong dugon), commonly known as the Sea Cow, is a threatened flagship species recorded within the sanctuary, underscoring the conservation importance of the Gulf of Mannar.

6.5.6 The Gulf of Mannar: Integrated Management and Eco-Development Strategies

The Gulf of Mannar Biosphere Reserve (GoMBR), notified in 1989, represents a nationally significant marine conservation landscape integrating biodiversity protection with sustainable livelihood management. The reserve incorporates the Gulf of Mannar Marine National Park (GoMMNP) as its core zone, supported by surrounding buffer and transition areas. The Integrated Management Plan (2018–2027) provides a structured framework to balance ecosystem conservation with the socio-economic needs of approximately 1.1 lakh coastal households dependent on marine and coastal resources.

6.5.7 Eco-Development Zone (Terrestrial Buffer)

The Eco-Development Zone encompasses a 10 km-wide terrestrial coastal strip extending inland from the shoreline and functions as a socio-economic buffer to reduce direct dependence on marine ecosystems. The primary strategy in this zone is livelihood diversification through community-led planning and implementation mechanisms.

Eco-Development Committees have been established in project villages to facilitate vocational training, micro-credit access, and basic infrastructure development. Village Marine Conservation Plans, prepared through Participatory Rural Appraisal processes, institutionalize community participation in conservation decision-making and sustainable resource management, fostering shared responsibility for ecosystem protection.

6.5.8 Livelihood Generation and Resource Substitution

The Integrated Management Plan emphasizes income-generation activities that align with local socio-cultural practices while minimizing ecological impacts. These include the promotion of native seaweed cultivation to replace destructive wild harvesting practices, utilization of invasive Prosopis juliflora for charcoal production as a combined livelihood and habitat restoration measure, and the development of value-added enterprises such as fish processing, palm leaf handicrafts, and halophyte-based products. Community-based eco-tourism initiatives support local employment through training of youth as scuba divers, nature guides, and boat operators, ensuring that tourism-related benefits accrue directly to host communities. Climate-resilient agricultural practices, including the cultivation of drought-tolerant crops within the terrestrial buffer, are encouraged to enhance livelihood stability during periods of monsoon variability.



6.5.9 Normalised Difference Vegetation Index (NDVI)

Although the species inventory establishes the ecological richness and conservation significance of the planning area, it provides a static snapshot of biodiversity. To evaluate spatial patterns, seasonal variability, and vegetation response to changing hydrological and climatic conditions, NDVI analysis is used as a complementary indicator of biotic health.

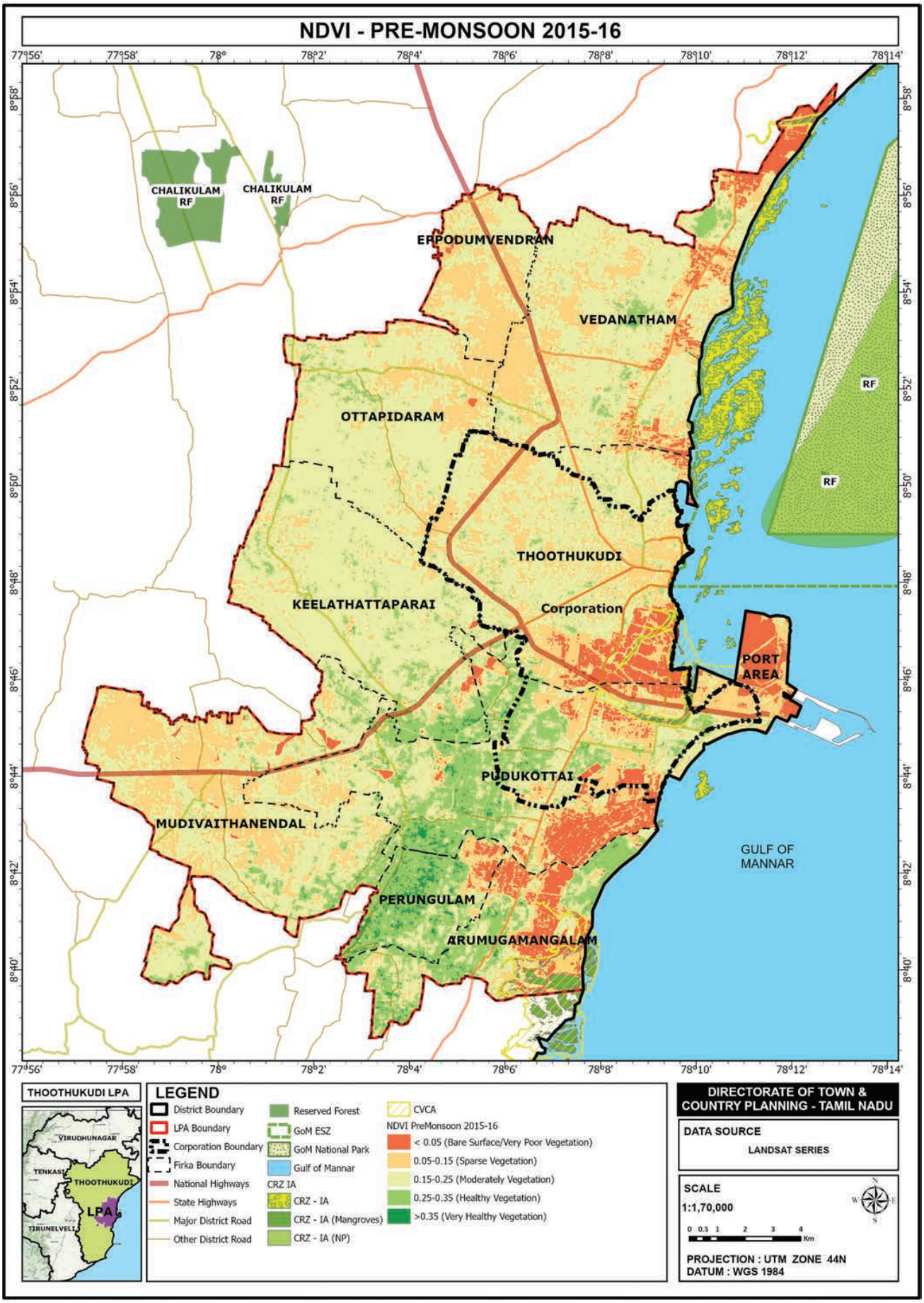
NDVI assesses the response of vegetation to the hydrological conditions, thereby providing a functional linkage between abiotic and biotic systems. It also plays a crucial role in in influencing land surface thermal behaviour, forming a critical link with Land Surface Temperature (LST) and Urban Heat Island Intensity which will further be discussed in the following section of Hazard within the Planning Area. Table 6.22 presents the changes in NDVI observed in Thoothukudi.

Table 6.22 NDVI Change Analysis

NDVI Value	Characteristic	Pre-Monsoon 2015	% Area of LPA	Post-Monsoon 2015	% Area of LPA	Pre-Monsoon 2024	% Area of LPA	Post-Monsoon 2024	% Area of LPA	% Change Pre-Monsoon 2015 - 2024	% Change Post-Monsoon 2015 - 2024
<0.05	Bare surface/very poor vegetation	3384.91	7.02	2643.90	5.48	4,614.85	9.57	4668.43	9.68	**2.55**	**4.20**
0.05-0.15	Sparse vegetation	12744.18	26.43	7885.44	16.35	10693.53	22.17	8499.99	17.62	**-4.25**	**1.27**
0.15-0.25	Moderate vegetation	25670.58	53.23	10177.16	21.10	23173.99	48.05	18684.40	38.74	**-5.18**	**17.64**
0.25-0.35	Healthy vegetation	6063.49	12.57	21036.21	43.62	8137.27	16.87	14418.46	29.90	**4.30**	**-13.72**
>0.35	Very healthy vegetation	363.83	0.75	6484.28	13.45	1607.35	3.33	1955.70	4.06	**2.58**	**-9.39**
Total		48226.99		48,226.99		48,226.99		48,226.99			

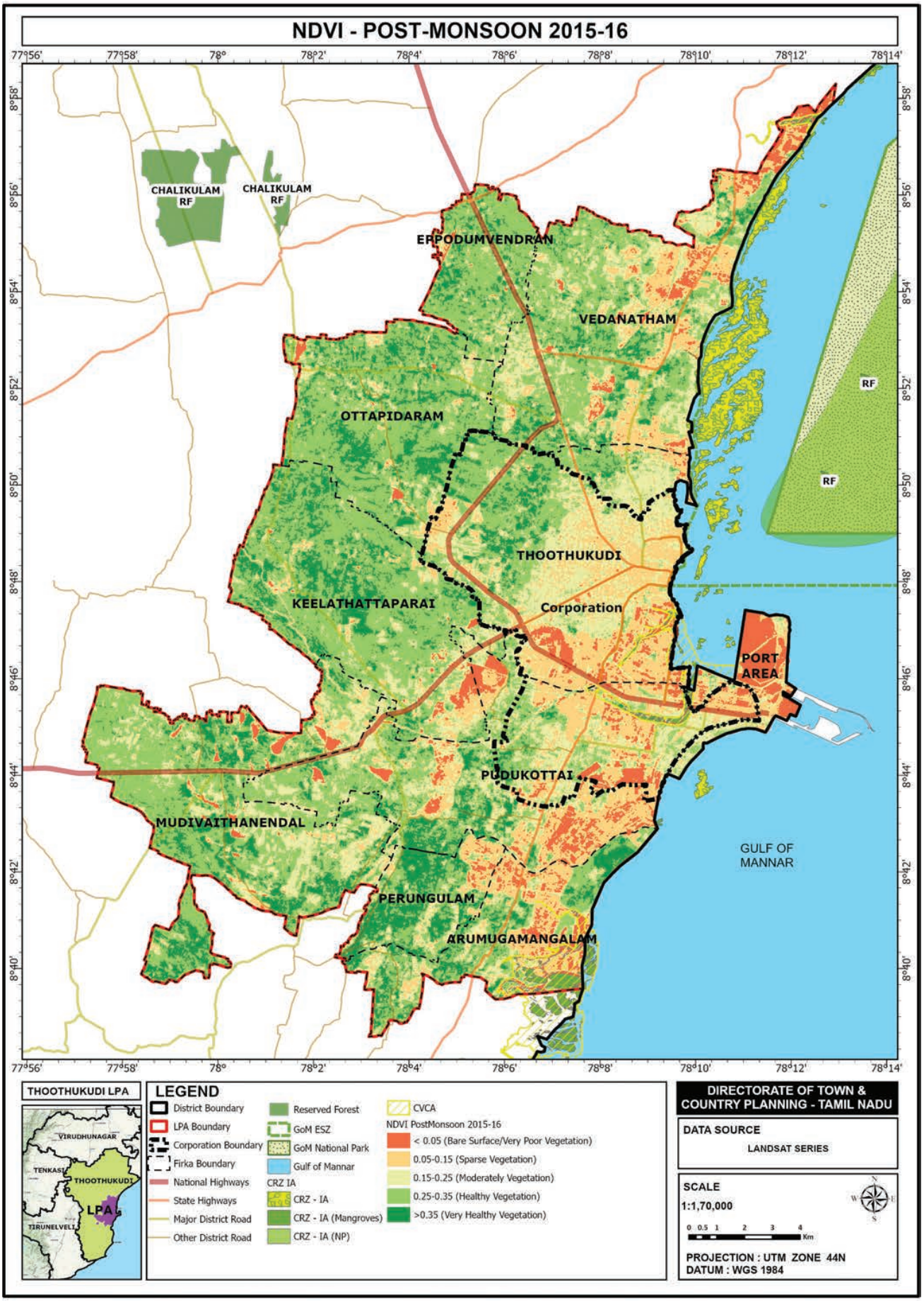
NDVI analysis indicates an expansion of bare and sparsely vegetated surfaces across both seasons between 2015 and 2024. While moderate vegetation shows strong post-monsoon greening, healthy and very healthy vegetation exhibit notable declines during the same period, pointing towards increasing vegetation stress and seasonal dependence. Overall, the results suggest a shift from stable perennial vegetation to short-lived, monsoon-dependent vegetative cover.

The integrated NDVI-NDWI analysis indicates increasing seasonal dependence of land surface conditions within the LPA between 2015 and 2024. NDVI results show expansion of bare and sparsely vegetated areas and a decline in healthy vegetation during the post-monsoon period, while NDWI reveals a reduction in post-monsoon moist surfaces and seasonal water bodies alongside an increase in dry land. These trends suggest reduced monsoon water retention, higher surface runoff, and increased flood susceptibility. Maps 6.42 to 6.45 spatially represent the change in NDVI across the planning area.



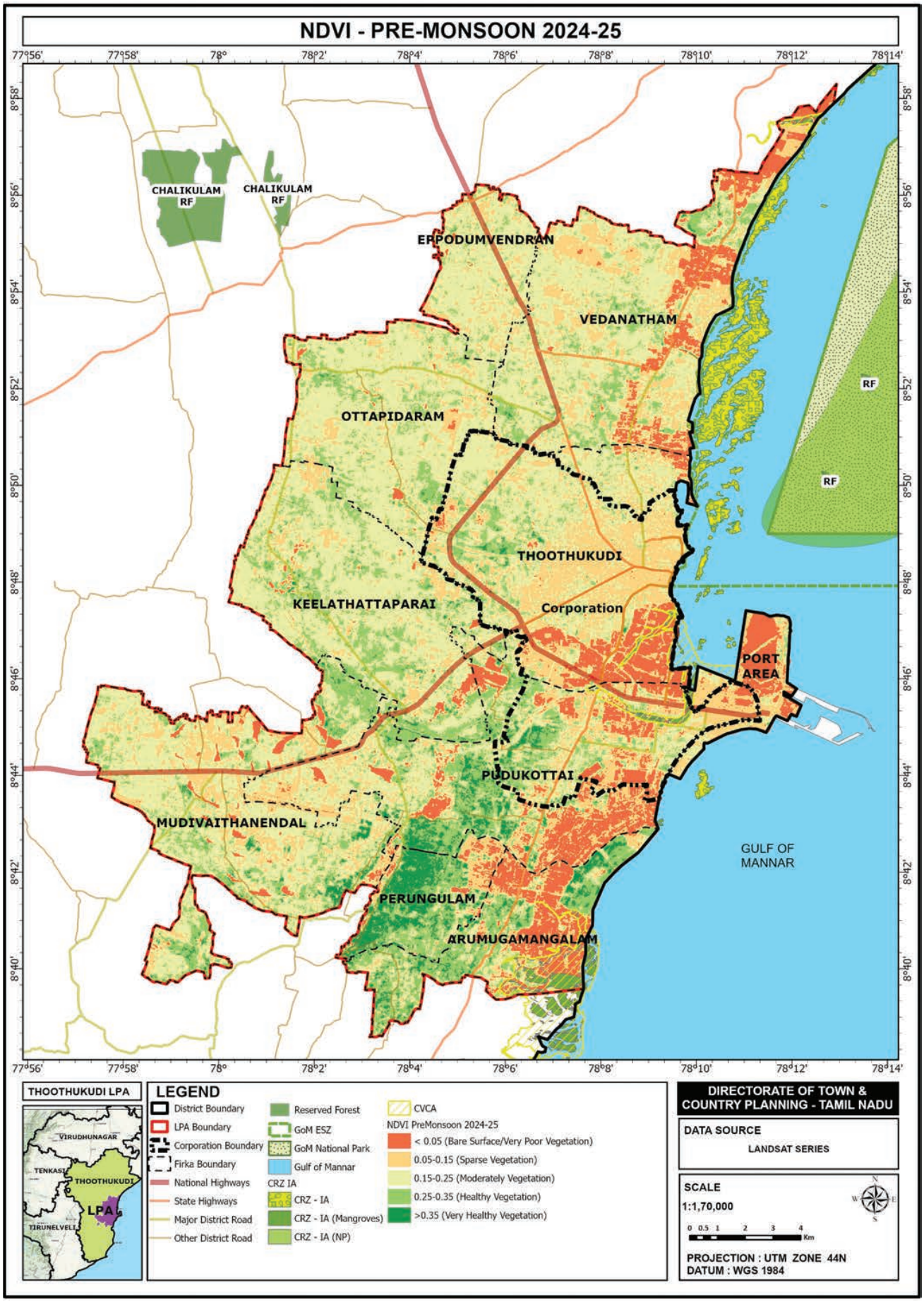
Map 6.42 Normalised Difference Vegetation Index - Pre-Monsoon 2015-16

Source Analysis using Landsat Imagery



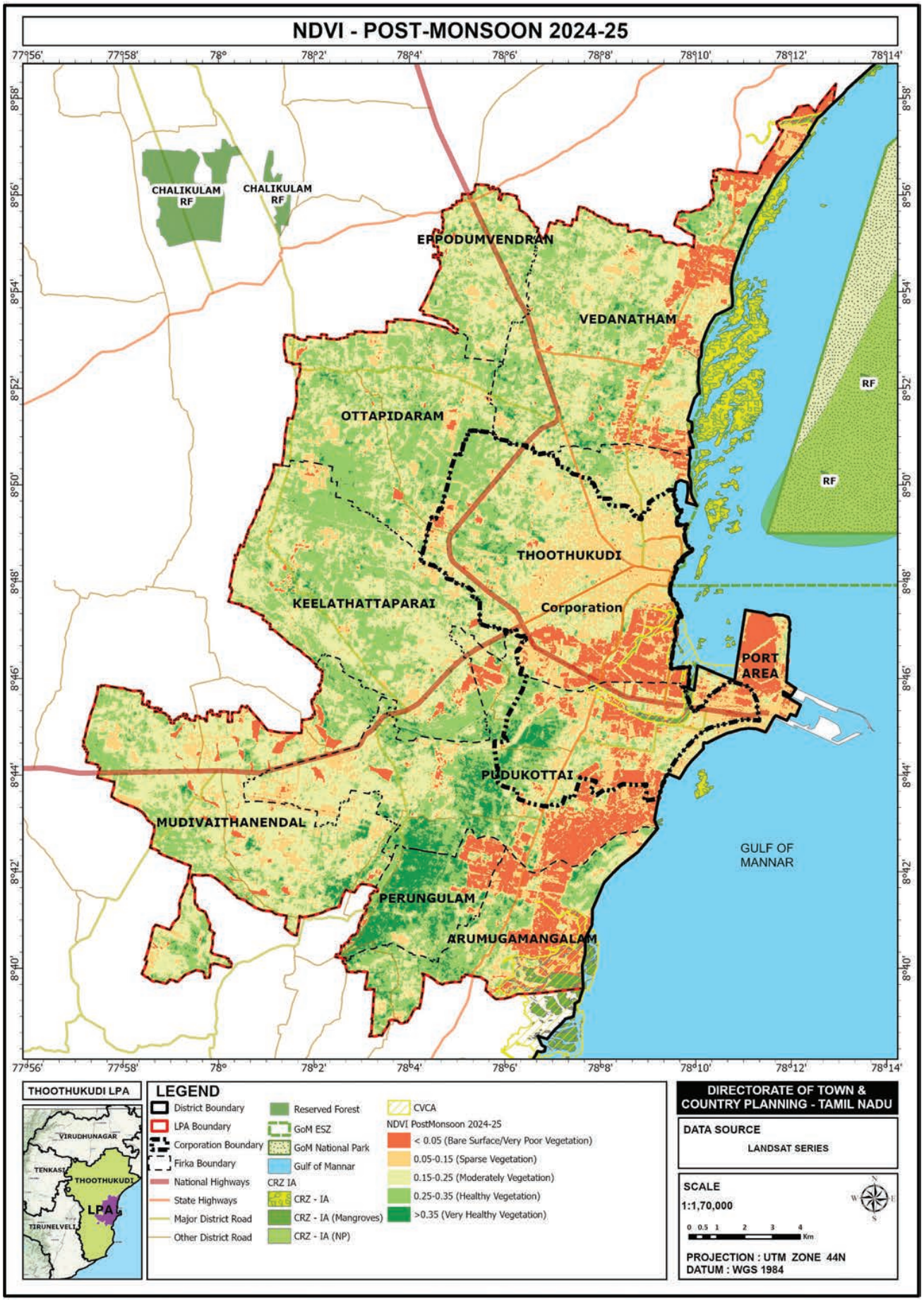
Map 6.43 Normalised Difference Vegetation Index - Post-Monsoon 2015-16

Source Analysis using Landsat Imagery



Map 6.44 Normalised Difference Vegetation Index - Pre-Monsoon 2024-25

Source Analysis using Landsat Imagery



Map 6.45 Normalised Difference Vegetation Index - Post-Monsoon 2024-25

Source Analysis using Landsat Imagery

6.6 Coastal Regulation zone (CRZ)

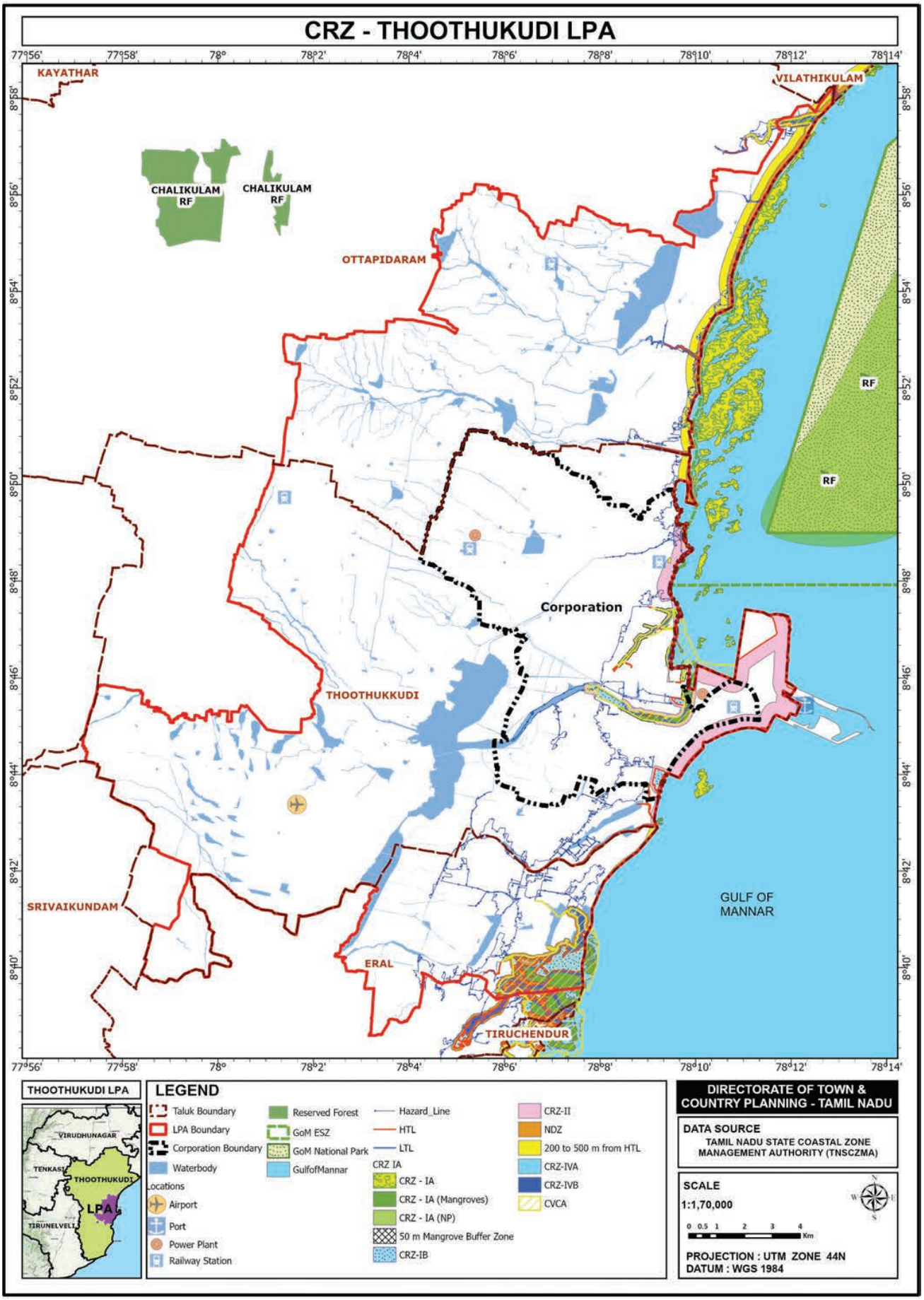
Thoothukudi Planning Area lies along the Gulf of Mannar coast, a region of high ecological sensitivity and economic importance. The coastal stretch is characterised by sandy beaches, tidal flats, estuaries, backwaters, salt pans, fishing harbours, and port-related infrastructure. Land use and development within the coastal stretch of the Planning Area are regulated as per the provisions of the Coastal Regulation Zone (CRZ) Notification notified the Environment (Protection) Act, 1986.

As per the prevailing CRZ Notification (2011), areas up to 500m from the High Tide Line (HTL) on the landward side, and the intertidal area between the High Tide Line (HTL) and Low Tide Line (LTL), are regulated. For tidal influenced water bodies such as rivers, creeks, and estuaries, CRZ provisions apply on both banks, with the regulated distance measured from HTL as shown for Thoothukudi Planning Area in Map 6.46.

Ecologically Sensitive Areas within CRZ

The CRZ Notification 2011 identifies certain ecologically sensitive areas as CRZ – 1A, where development is subject to the highest level of regulation. Apart from mangroves associated with estuaries and tidal water bodies, CRZ – IA also includes coral reefs, seagrass beds, turtle nesting sites, salt marshes, mudflats and notifies protected areas such as National Parks, Marine Parks, and Sanctuaries.

The coast of Thoothukudi is characterised by the presence of Coral reefs and sea grass beds along its immediate nearshore waters, which form a part of the larger and ecologically significant Gulf of Mannar Marine Biosphere. The Gulf of Mannar National Park, which lies offshore and in close proximity to the Planning Area, represents a nationally important protected area and falls under CRZ-IA. These ecosystems provide critical ecological functions, including shoreline protection, fisheries support and biodiversity conservation, and therefore requires stringent protection in the Master Plan framework.



Map 6.46 Coastal Regulation Zone of Thoothukudi Planning Area

Source Tamil Nadu State Coastal Zone Management Authority

Critically Vulnerable Coastal Areas

Critically Vulnerable Areas Coastal (CVCA) form part of the Coastal Regulations Zone framework and represent stretches of the coast that require special consideration to protect the environment while supporting local communities, such as fisherfolk, who depend on these resources.

Within the Thoothukudi Planning Area, **three CVCAs** have been identified. These comprise environmentally sensitive coastal stretches that include mangroves, salt marshes, and inter-tidal zones. The salt pans are developed along these vulnerable zones, reflecting the close interaction between coastal ecosystem and the traditional livelihood activities. The three CVCAs include:

- **Tamiraparani River Estuary** – Located in the southernmost portion of the planning area, this estuarine zone represents a critical interface between freshwater inflows and the marine environment. The area plays an important role in coastal ecology, fisheries, and sediment dynamics, and is sensitive to upstream land use changes and pollution. This CVCA includes mangroves and salt marshes which are part of CRZ IA
- **Korampallam Channel Mouth** – The Korampallam Channel meets the Bay of Bengal near the Thoothukudi Port. This area is influenced by tidal action, urban drainage, and port related activities, and is vulnerable to flooding and water quality degradation. Careful regulation of land use and development is required in this zone. Mangroves are present, which are ecologically sensitive areas under CRZ IA
- **Kallar River Estuary** – Situated at the northern tip of the planning area, this estuarine system contributes to coastal drainage and fisheries. The area is environmentally sensitive and susceptible to salinity ingress and inundation during extreme rainfall and storm surge events. This estuary has mangroves as well.

The total area under CVCA is 740.08 Ha. The CVA locations largely fall within the ecologically sensitive and water influenced portions of CRZ, where development controls are stringent. The Master Plan recognises these areas as conservation-oriented area with limited scope for development.

A summary of the extent of land falling under various CRZ Categories within the Thoothukudi Planning Area is presented in the Table 6.23. This provides the basis for aligning proposed land uses and developed controls with statutory coastal management requirements. 6.62% of Thoothukudi Planning Area is governed by CRZ accounting to 3070.08 Ha. Table 6.24 captures the activities within each category as per CRZ Notification 2011.

Table 6.23 Area under CRZ within Thoothukudi Planning Area

CRZ Categories within Thoothukudi LPA							
Category	**CRZ IA**	**50M Mangrove Buffer**	**CRZ IB (Inter-tidal zone)**	**CRZ 2A (Developed area within municipal limits)**	**NDZ**	**200-500m from HTL**	**CRZ IVB (Area between LTL and both sides of tidal influenced water bodies)**
Area (Ha)	236.47	381.07	376.24	972.12	454.22	487.92	162.05

Table 6.24 Activities in CRZ Zones as per CRZ Notification 2011

CRZ Category	Permissible Activities	Restricted / Regulated Activities (Subject to CRZ Clearance / Conditions)	Prohibited Activities
CRZ–I (Ecologically Sensitive Areas + Intertidal Zone HTL–LTL)	• Projects of Dept. of Atomic Energy • Pipelines, transmission lines • Weather radar installations • Essential foreshore facilities (ports, jetties, wharves etc.) • Exploration & extraction of natural gas (LTL–HTL, non-eco sensitive) • Salt harvesting by solar evaporation • Desalination plants (non-CRZ-I(A)) • Storage of non-hazardous cargo in notified ports • Public utilities for traditional inhabitants (schools, toilets, roads, bridges etc., in non-eco sensitive intertidal areas)	• Any construction allowed only if it is essential and requires waterfront/foreshore • Activities in hazard line areas subject to safety measures • Exploration of oil & gas subject to MoEF clearance • Erosion control measures based on scientific study • Port-related facilities subject to EIA & CZMA approval	• No new construction in CRZ-I(A) (ecologically sensitive areas) • New industries (except waterfront-dependent) • Land reclamation except for permitted foreshore facilities • Bunding/disturbance of natural seawater flow • Sand mining (except rare minerals, oil & gas) • Hazardous substance handling (except listed petroleum products in non-CRZ-I(A)) • Disposal of untreated effluents, solid waste dumping • Groundwater extraction within 200m of HTL (except local use) • Alteration of sand dunes/natural features • Commercial reclamation (housing, hotels, malls)

CRZ Category	Permissible Activities	Restricted / Regulated Activities (Subject to CRZ Clearance / Conditions)	Prohibited Activities
CRZ–II (Developed Urban Areas up to Shoreline)	• Buildings on landward side of existing road/ authorized structures • Reconstruction of authorized buildings (same FSI/FAR & use) • Desalination plants • Storage of non-hazardous cargo in ports • LNG terminals & petroleum storage (Annexure-II products) • Non-conventional energy projects	• Construction subject to existing Town & Country Planning norms (as on 19.02.1991) • Construction >20,000 sq.m under EIA Notification • Foreshore facilities requiring MoEF clearance • Pipelines & transmission systems • Oil & gas exploration • Buildings only on landward side of existing road • No benefit of new seaward road construction	• New industries not requiring waterfront • Hazardous industries (except specified petroleum storage) • Reclamation for commercial housing/ hotels • Dumping of waste/ debris • Untreated effluent discharge • Groundwater extraction within 200m HTL (except local use)
CRZ–III (Relatively Undisturbed / Rural Areas) A. 0–200m (NDZ)	• Agriculture, horticulture, forestry • Salt manufacture • Mining of rare minerals • Non-conventional energy • Fishing community facilities (drying yards, net mending, boat yards, ice plants etc.) • Public utilities for local inhabitants (schools, toilets, roads, drainage) • Sewage treatment units • Repair/reconstruction of authorized structures (no increase in FSI/density) \ • Traditional dwelling units (100–200m as per approved plan)	• Construction of traditional dwelling units (100–200m) with CZMA & MoEF approval • Petroleum & LNG facilities (as per Annexure-II) • Desalination foreshore facilities • Subject to height limit (max 9m, G+1) for traditional dwellings	• No new construction in NDZ except listed permissible activities • Commercial buildings • Hotels/resorts within 200m • Hazardous industries • Land reclamation • Sand mining (except rare minerals) • Untreated waste discharge

CRZ Category	Permissible Activities	Restricted / Regulated Activities (Subject to CRZ Clearance / Conditions)	Prohibited Activities
CRZ–III B. 200–500m	• Hotels/beach resorts (as per Annexure-III guidelines) • Traditional dwelling units (G+1, max 9m height) • Public utilities (schools, toilets, roads, bridges) • Petroleum & LNG storage • Desalination plants • Non-conventional energy projects	• Hotels subject to: FSI ≤0.33; min plot 0.4 ha; no construction within 200m; height ≤9m; environmental safeguards • Groundwater extraction only with approval (200–500m zone) • All projects subject to CZMA & MoEF clearance where applicable	• Reclamation for commercial complexes • Hazardous industries (other than permitted storage) • Dumping of waste/ debris • Untreated sewage discharge • Altering sand dunes
CRZ–IV (Water Area: LTL to 12 NM + Tidal Water Bodies)	• Traditional fishing and allied activities • Navigation, shipping • Oil & gas exploration (with clearance)	• Pollution control compliance mandatory • Aquaculture subject to regulations • Sewage treatment plan for coastal towns mandatory • Regulated ballast discharge & ship waste	• Discharge of untreated sewage/effluents • Dumping of solid waste/ fly ash • Pollution from oil drilling • Activities harming marine ecology
CVCA	• Activities as per Integrated Management Plan (IMP) • Traditional livelihood activities • Public utilities for local communities (case-by-case basis)	• All development subject to Integrated Management Plan (IMP) • Mandatory consultation with coastal communities • Stricter conservation norms • CRZ-I norms generally applicable unless IMP specifies otherwise	• Any activity inconsistent with conservation objectives of CVCA • Large-scale commercial/ industrial expansion • Ecologically damaging activities • Habitat destruction (mangroves, coral reefs, seagrass, turtle nesting areas etc.)

Source CRZ Notification 2011

6.7 Pollution

Following the CRZ framework and the ecological sensitivity of the Gulf of Mannar, this section reviews pollution pressures in the planning area with a focus on air quality under the Non-Attainment City Action Plan and multi-media environmental stress reflected through the CEPI assessment of the SIPCOT-Meelavittan industrial cluster. Thoothukudi's port-led industrial economy-comprising thermal power plants, fertiliser and chemical industries, port activities and logistics-exerts combined pressures on air, water and land environments.

While regulatory actions over the past decade have led to measurable improvements, including a lower composite CEPI score in recent assessments, legacy groundwater impacts and localised air and surface water risks continue to shape development constraints. The Master Plan therefore treats pollution management as a spatial planning concern, guiding land use controls, buffers and infrastructure investments to align future growth with environmental capacity and public health objectives.

6.7.1 Air Pollution with respect to non-attainment city status

Ambient air quality monitoring by TNPCB under the NAAQM programme indicates that particulate matter, particularly PM_{10}, has been the dominant air quality concern in Thoothukudi. During 2011–2018, annual average PM_{10} concentrations at monitored locations consistently exceeded the prescribed standard of 60 µg/m³, leading CPCB to classify the city as a **Non-Attainment City.** Major sources include road dust, vehicular emissions, industrial and port-related activities, construction and material handling. A high vehicle population, dominated by two-wheelers, further contributes to emissions along major corridors.

Air quality trends (2013–2023) show that SO_2 and NO_2 have consistently remained within standards, with a declining trend after 2018. $PM_{2.5}$ levels during 2021–2023 are also compliant. PM_{10}, though high until 2017, shows a sustained decline from 2018 onwards, with recent levels nearing compliance as depicted in the figure 6.21, reflecting the impact of dust control and emission management measures.

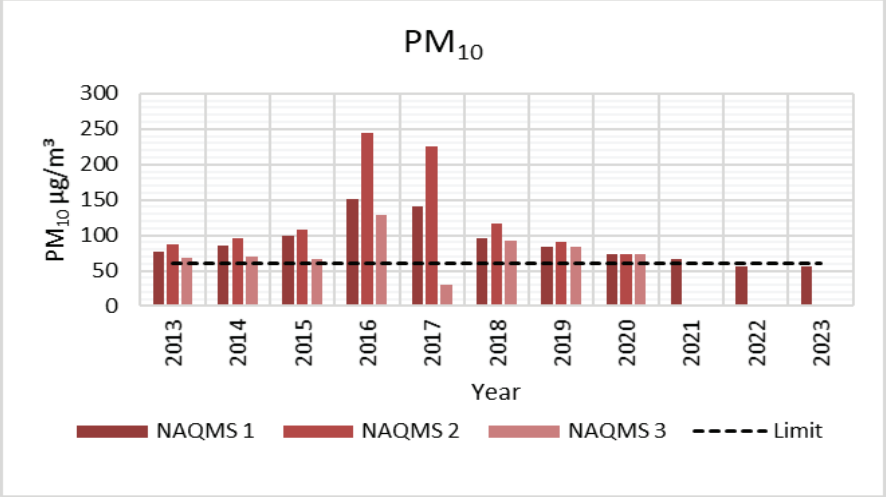


Figure 6.21 PM10 levels in Thoothukudi

Source Air quality monitoring data, Central Pollution Control Board

Key actions include implementation of the Non-Attainment City Action Plan, expanded monitoring, mechanised sweeping, construction dust control and stricter enforcement of emission norms. The Master Plan reinforces these through transport planning, land-use controls, buffer zones and green infrastructure. Figure 6.22 explains the evolution of air pollution management in Thoothukudi.

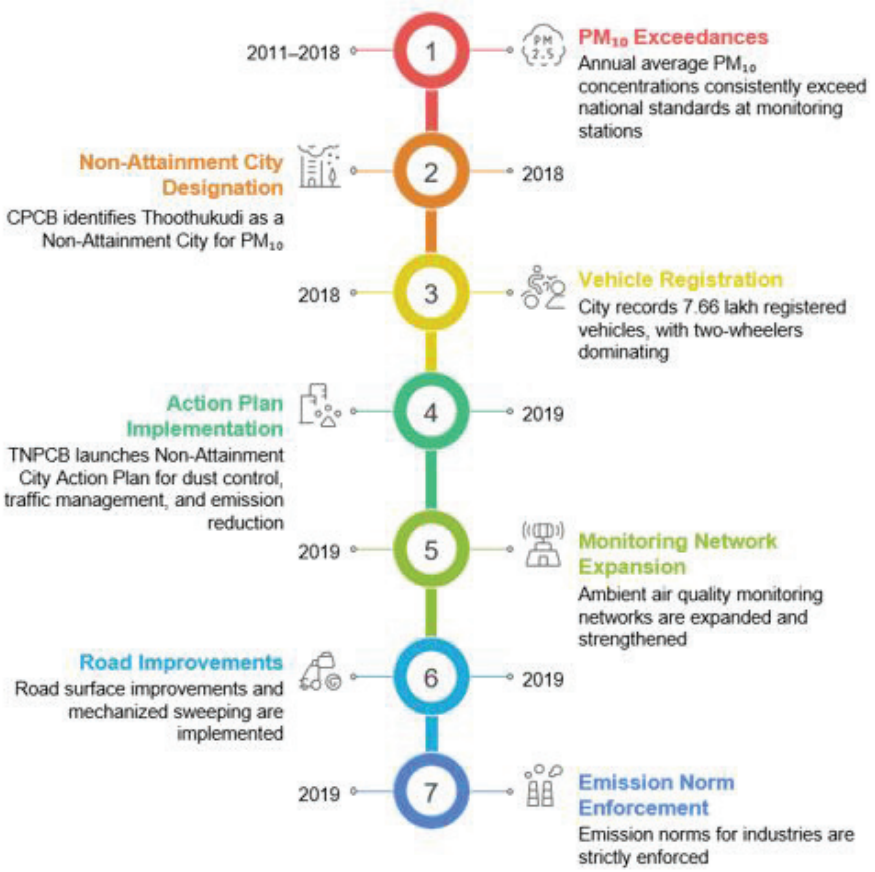


Figure 6.22 Air Quality Management: Key Developments in Thoothukudi

6.7.2 Industrial Pollution, CEPI Status and Management Measures

Given the cumulative nature of impacts from clustered industrial activities, the area has been periodically assessed under the Comprehensive Environmental Pollution Index (CEPI) framework, which integrates pollution loads across air, water and land pathways. The CEPI assessment for Thoothukudi pertains to the SIPCOT Industrial Complex, Meelavittan and its influence zone. In 2018, the industrial area recorded a **CEPI score of 66.3**, classifying it as a **"Severely Polluted Area,"** largely due to land and groundwater impacts. As per the latest update. Subsequent pollution control measures, such as upgraded

Effluent Treatment Plants and Zero Liquid Discharge systems, improved waste management, green belt development and strengthened compliance, have led to significant improvement. The pre-monsoon 2024 CEPI score has reduced to 27.34, placing the area well below pollution category thresholds. A summary of the environment-wise CEPI/EPI scores is presented in Table 6.25. From a planning perspective, this improving CEPI trend underscores the need to consolidate environmental safeguards, guide future industrial development through zoning and buffers, and ensure alignment with environmental carrying capacity.

Table 6.25 CEPI Scores for Thoothukudi (SIPCOT Influence Zone)

Environmental Component	CEPI Score	Interpretation
Air Environment	29.75	Moderate impact; localised hotspots earlier
Water (Surface Water) Environment	46.00	Moderate stress; seasonal sensitivity
Land (Groundwater) Environment	61.00	Critical due to TDS and hardness
Composite CEPI Score (2018)	66.34	Severely Polluted Area (historical)
Composite CEPI Score (2024)	27.34	Significantly improved status

Source Tamil Nadu State Pollution Control Board

Air Environment

Affected areas: SIPCOT surroundings, port corridors and downwind residential pockets. Earlier monitoring recorded PM10 up to ~105.7 µg/m³ (std: 60 µg/m³) and arsenic ~42 ng/m³ (std: 6 ng/m³) near VOC Port School, mainly from thermal power and industrial emissions; later monitoring shows improvement.

Implication: Overall air quality has improved, but **localised hotspots** still require buffer zoning, strict stack controls and monitoring-linked land use regulation.

Water Environment (Surface Water)

Affected areas: Kormapallam Tank and its catchment and nearshore influence zones. In 2018, Total Phosphorus (TP) reached ~0.38 mg/L (std: 0.3 mg/L) and TKN exceeded limits during low-flow periods, post-monsoon samples were below detectable limits. This pattern indicates primarily non-point source inputs (bathing/washing, urban runoff, seasonal stagnation) rather than a continuous point-source discharge.

Implication: Surface waters are seasonally vulnerable, requiring catchment protection, runoff control and enforced buffers around tanks and channels.

Land Environment (Groundwater)

Affected areas: Meelavittan, Silverpuram, Pandarampatti, Sankaraperi and nearby villages in the SIPCOT influence zone. Groundwater shows severe salinity and hardness, with TDS up to ~17,632 mg/L (std: ~2,000 mg/L) and Total Hardness up to ~6,860 mg/L (std: ~600 mg/L) at some locations, commonly exceeding 2,000–6,000+ mg/L across multiple wells. This is linked to legacy industrial contamination, especially gypsum handling and chemical process residues.

Implication: This remains the most critical long-term constraint, demanding site remediation, recharge protection, regulated extraction and cautious land-use zoning.

Biotic Environment (Contextual Sensitivity)

Affected areas: Coastal belt and Gulf of Mannar influence zone, including wetlands and salt pans. Though not directly scored under CEPI, these ecosystems receive cumulative pollution loads via surface water and groundwater pathways.

Implication: Even with improved CEPI scores, ecologically sensitive areas require stricter land-use control, buffers and pollution load management to protect fisheries and biodiversity.

While Table 6.25 shows a major improvement culminating in a CEPI score of 27.34 (2024), groundwater with TDS often >2,000–17,000 mg/L and hardness up to ~6,800 mg/L remains the key spatial risk, alongside seasonally sensitive, non-point source–driven surface water stress at Korampallam. Therefore, a shift from crisis response to area-specific risk management is necessary, focusing on groundwater recovery, surface water catchment protection, sustained air quality control.

6.8 Disaster

Thoothukudi is identified as one of the 14 coastal districts in Tamil Nadu that are highly vulnerable to tropical cyclones, floods, and earthquake-induced tsunamis.

6.8.1 Seismic and Tsunami Vulnerability

The Seismic Damage Risk Zonation as shown in figure 6.23 of Tamil Nadu illustrates the spatial distribution of earthquake-related damage potential across the state, classified primarily into Zone II (Low Damage Risk) and Zone III (Moderate Damage Risk) based on expected seismic intensity levels. The map indicates that a significant portion of Tamil Nadu falls within Zone II, which is a low risk zone, including Thoothukudi. Coastal, inland, and plateau regions

are clearly delineated through district and state boundaries, enabling region-specific interpretation of seismic vulnerability. The zonation is prepared using guidelines from the Building Materials and Technology Promotion Council (BMTPC), Government of India.

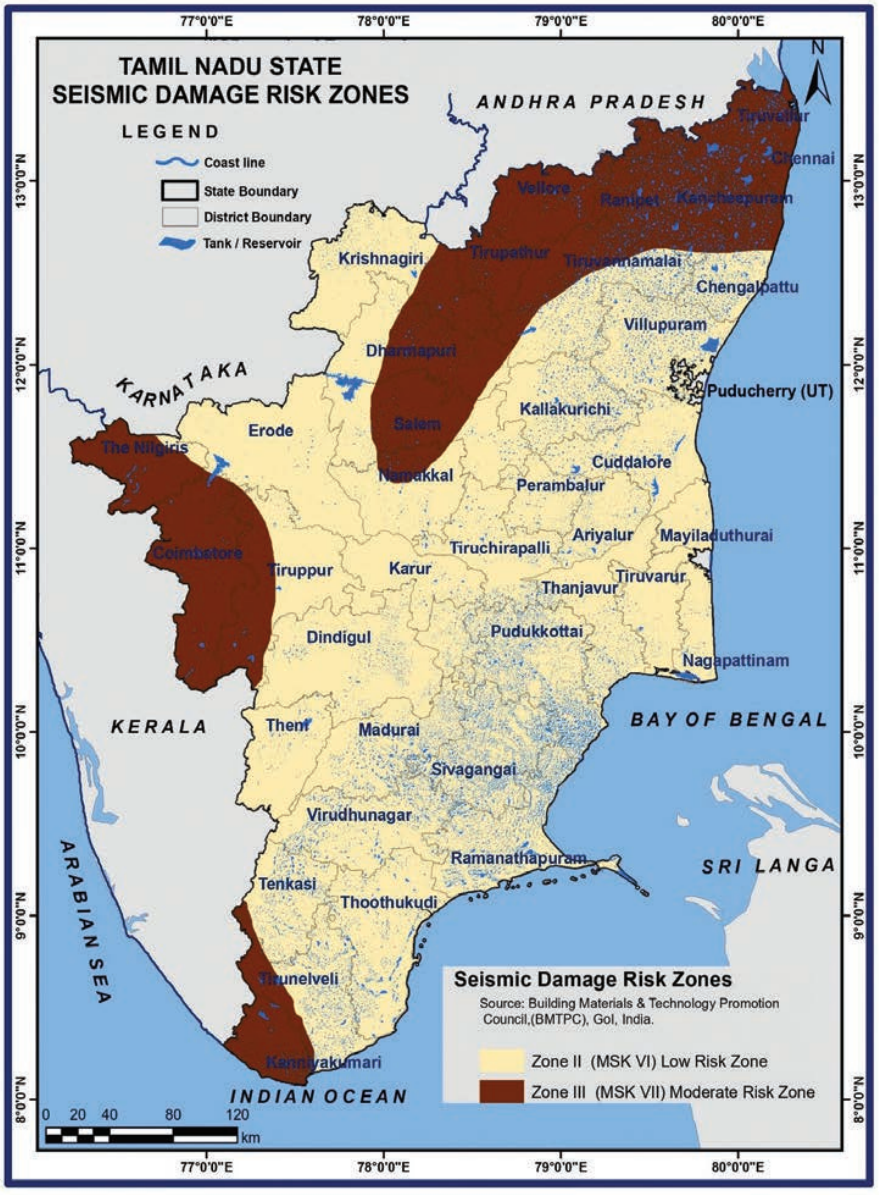


Figure 6.23 Tamil Nadu State Seismic damage risk zones

Source TN Disaster Management plan

6.8.2 Cyclone and Wind Hazard Profile

The Wind and Cyclone Hazard Zonation as shown in figure 6.24 of Tamil Nadu depicts the spatial distribution of cyclone-induced damage risk across the state based on historical cyclone data and wind vulnerability assessment. The map delineates Tamil Nadu into Low, Moderate, High, and Very High Damage Risk Zones, reflecting the varying intensity and frequency of cyclonic impacts along the coastline and inland regions. Coastal districts along the Bay of Bengal and the Indian Ocean, including Thoothukudi, Nagapattinam, Chennai, Cuddalore, and Kanyakumari, are prominently classified under High to Very High Damage Risk Zones, indicating their heightened exposure to strong winds, cyclonic storms, and associated storm surges. In contrast, interior districts located farther from the coastline are predominantly categorized under Moderate to Low Damage Risk Zones, highlighting the decreasing influence of cyclonic systems with increasing inland distance.

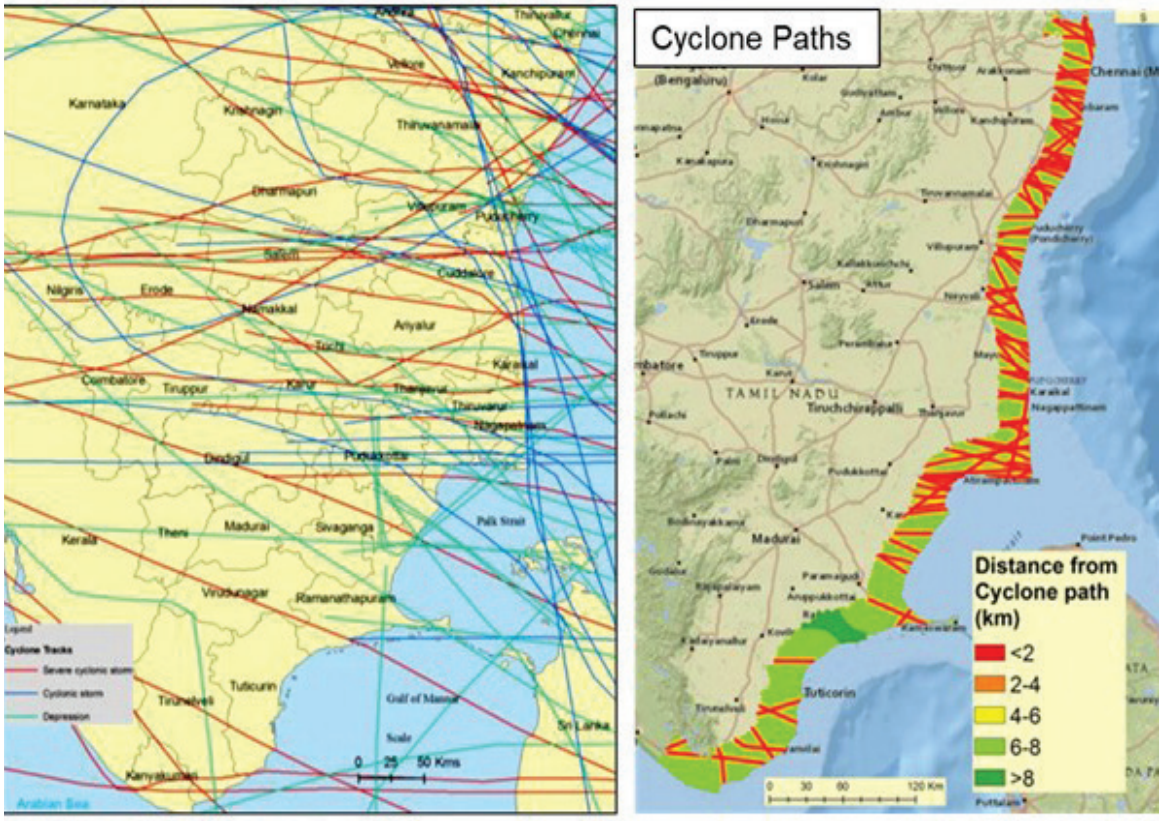


Figure 6.24 100-year Historical cyclone map and its affected path

Source TN Disaster Management plan

The figure 6.25 clearly demarcates state boundaries, district boundaries, and the coastline, enabling district-level interpretation of hazard exposure. Thoothukudi district is distinctly marked within the High Damage Risk Zone,

underscoring its susceptibility to cyclonic wind damage and extreme weather events due to its coastal location. The hazard classification presented in the map is derived from the BMTPC Vulnerability Atlas (Second Edition) and historical cyclone records compiled by the India Meteorological Department (IMD) for the period 1877–2017, thereby providing a reliable and long-term perspective on cyclone risk patterns across the state.

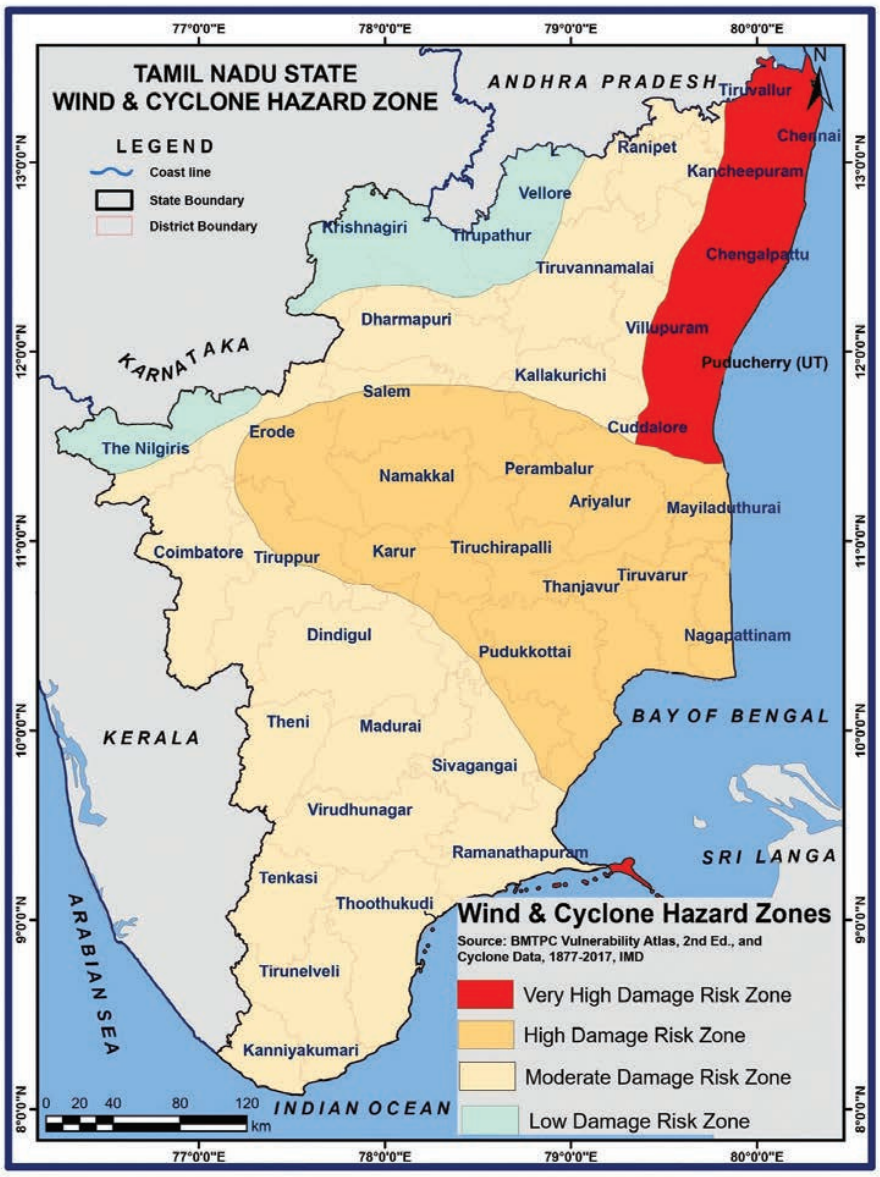


Figure 6.25 Tamil Nadu State Cyclone Hazard zones

Source TN Disaster Management plan

6.8.3 Sea Level Rise

In this coastal setting, long-term interactions between ocean dynamics, land subsidence, and climate-driven changes in mean sea level increasingly influence the spatial stability of the urban edge, making Thoothukudi particularly sensitive to incremental increases in sea level. Historical sea-level records for the period 1992–2021 show a very slow, and at times marginally negative, relative sea-level trend along the Thoothukudi coast compared to other Indian coastal locations. This behaviour is attributed to short-term local geomorphological and oceanographic influences rather than an actual reduction in sea levels, and therefore does not imply reduced long-term vulnerability. Table 6.26 presents the Seal level rise and inundation impacts in Thoothukudi. Figure 6.26 presents the historical and projected scenarios of sea level rise. The figures 6.27 and 6.28 spatially show the inundation areas as per projected scenarios.

Table 6.26 Sea Level Rise and Inundation Impacts – Thoothukudi

Parameter	Value / Range
Historical sea-level trend (1992–2021)	Very slow / marginally negative
Projected SLR by 2040	18.2 – 19.3 cm
Projected land subsidence by 2040	> 10%
Projected SLR by 2100 (SSP5-8.5)	~92.2 cm
Total area potentially inundated by 2100	81.64 sq. km
Share of total town area inundated	23.12%
Wetlands affected	> 27 sq. km
Urban & residential land affected	14.75 – 20.91 sq. km
Industrial land affected	> 12 sq. km
Agricultural land affected	7.18 – 9.85 sq. km

Source Centre for Study of Science, Technology and Policy (CSTEP)

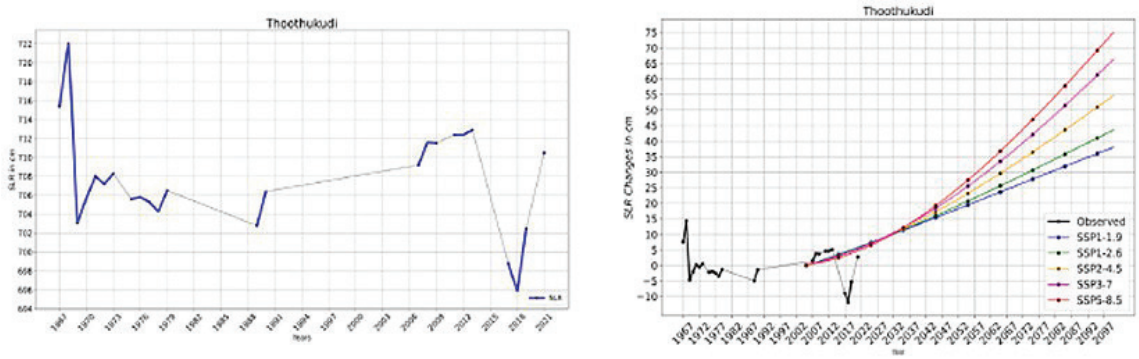


Figure 6.26 (a)Sea level rise during the historical period from the Thoothukudi tide gauge station; (b) SLR projected under the future SSP scenarios for Thoothukudi, Tamil Nadu

Source Centre for Study of Science, Technology and Policy (CSTEP)

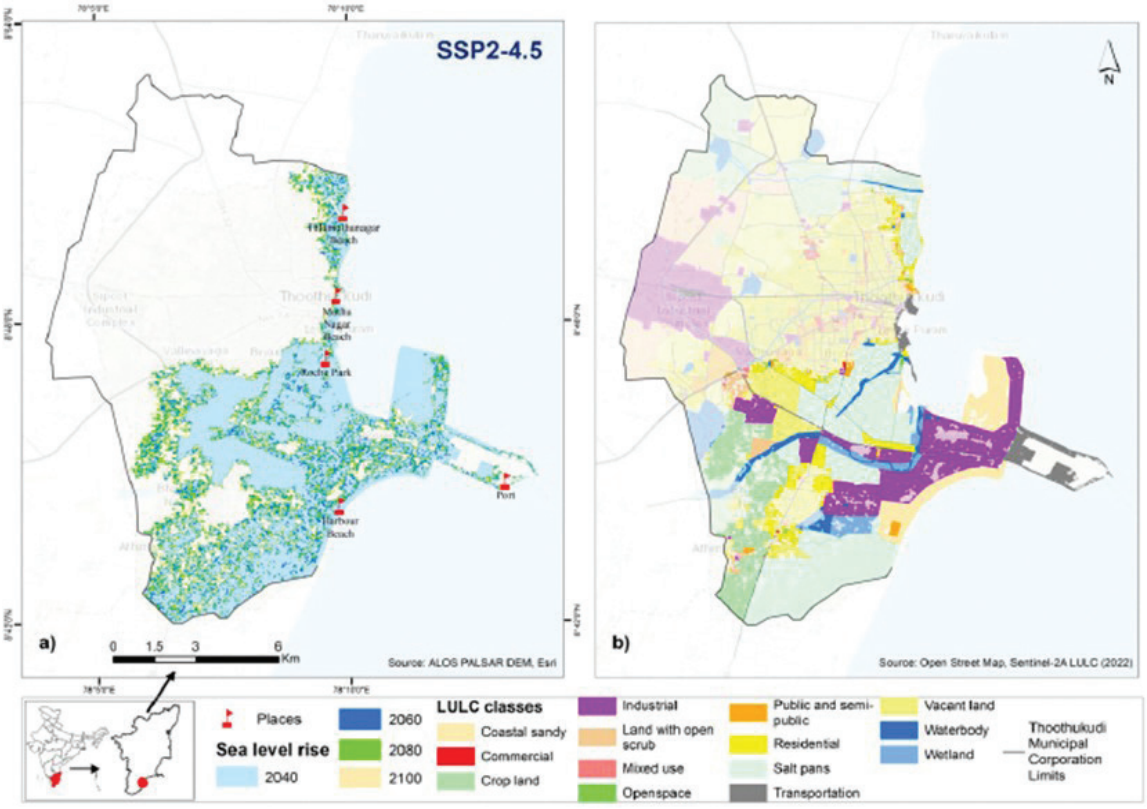


Figure 6.27 (a) Inundation area for projected SLR in Thoothukudi, Tamil Nadu; (b) LULC-wise inundation for projected SLR by 2100 under the SSP2-4.5 scenario in Thoothukudi, Tamil Nadu

Source Centre for Study of Science, Technology and Policy (CSTEP)

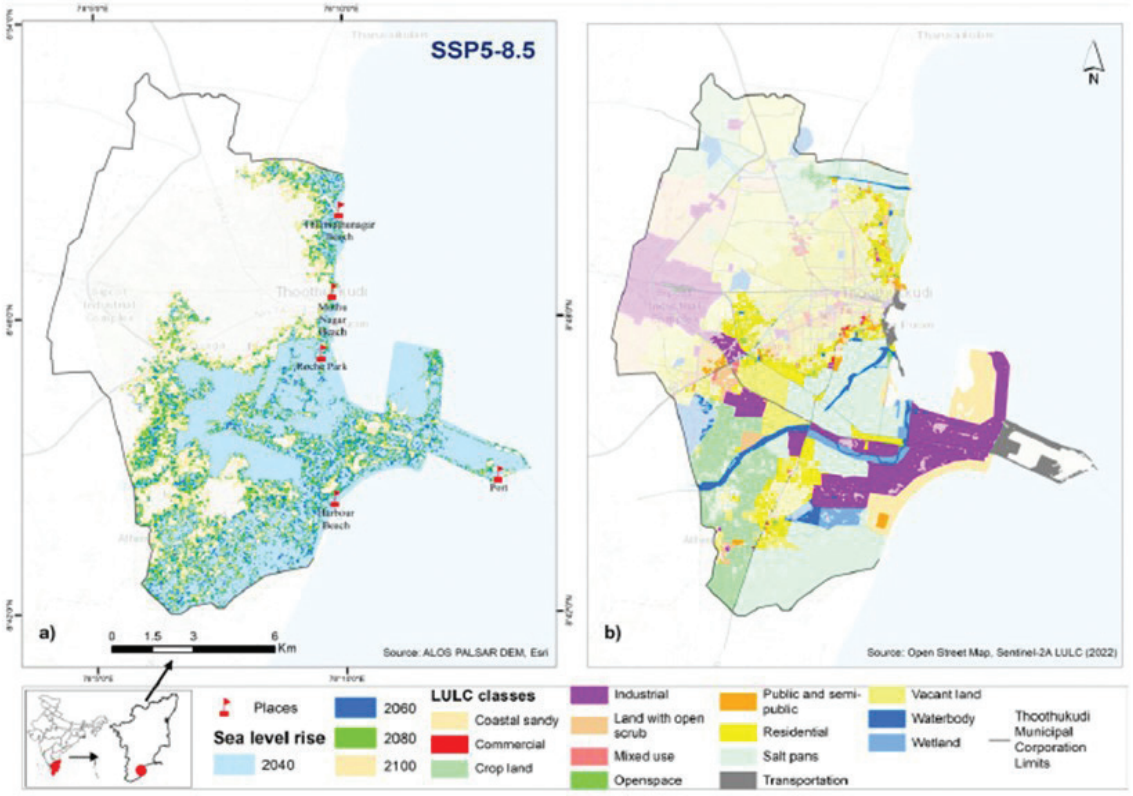


Figure 6.28 Inundation area for projected SLR in Thoothukudi, Tamil Nadu; (b) LULC-wise inundation for projected SLR by 2100 under the SSP2-4.5 scenario in Thoothukudi, Tamil Nadu

Source Centre for Study of Science, Technology and Policy (CSTEP)

Under IPCC AR6-aligned climate scenarios, sea levels along the Thoothukudi coast are projected to rise by 18.2–19.3 cm by 2040, coinciding with land subsidence exceeding 10%, significantly amplifying exposure in this low-lying coastal setting. By 2100, under the SSP5-8.5 high-emission scenario, relative sea levels are expected to rise by approximately 92.2 cm, potentially inundating 81.64 sq. km, or 23.12% of the town's total area. The impacts are unevenly distributed, with wetlands, urban areas, industrial zones, and agricultural land facing substantial losses. Hence, the projected proportional inundation in Thoothukudi exceeds that of several Tier-I cities, underscoring its heightened long-term coastal vulnerability.

6.9 Vulnerability Analysis

The combined effects of climatic variability, altered land cover, constrained drainage systems, ecological degradation, and pollution pressures manifest as recurrent disaster risks, particularly flooding and heat stress, within the Thoothukudi Planning Area. The Thoothukudi Planning Area is increasingly exposed to Natural and climate-induced hazards due to its coastal setting, low

lying terrain, and rapid land-use transformation. Among these, flooding and heat-related hazards pose significant risks to human settlements, infrastructure, and ecological systems. Seasonal monsoon rainfall, tidal influence, surface drainage constraints, and extensive impervious and built land cover contribute to recurring flood events in several parts of the planning area, largely falling within the corporation limits in areas along Buckle canal and the Korampallam tank and canal.

This section builds upon the baseline conditions established in the Climate, land, water and biotic environment sections to assess disaster vulnerability in an integrated manner. The analysis focuses on existing flooding issues and identifying areas prone to flooding through flood susceptibility analysis, while also examining Land Surface Temperature (LST) and Urban Heat Island Intensity (UHII) as emerging **thermal hazards** associated with land-use change and vegetation loss. By integrating hydrological, ecological and thermal indicators, this chapter provides a spatial understanding of hazard-prone areas and supports informed planning and mitigation strategies for the Thoothukudi Planning Area.

6.9.1 Existing flood issues

The Thoothukudi Planning Area experiences recurrent flooding and waterlogging, particularly during the northeast monsoon, owning to its natural low-lying coastal setting, constrained drainage infrastructure, and altered natural hydrological systems. Flooding is predominantly pluvial, with fluvial influence of tanks, odais and channels, and is further attenuated by limited gradient towards the coast and tidal backflow from the sea.

The flooding incidents and impacts discussed in this section are compiled from secondary sources, including Asian Development Bank (ADB) supported Tamil Nadu Urban Infrastructure Financial Services (TNUIFSL) report titled City Resilience and Drainage Assessment for Thoothukudi (2018), along with subsequent secondary literature and media reports. A consolidated summary of recorded flood events is presented in Table 6.27.

Historical flooding events and frequency

As per ADB-TNUIFSL (2018) report, Thoothukudi has historically experienced major flooding events at intervals of approximately 5 to 8 years, notably in 1992, 2004, and 2025. The 2015 flood event, affected nearly 160locations across the city, highlighting systemic drainage limitations. Subsequent flood incidents reported during 2023, 2024 and 2025 indicate a shift towards near-annual flooding and recurrent waterlogging, particularly in the low-lying areas, institutional campuses, and along major transport corridors. These findings suggest an increasing frequency of flooding events, even during rainfall episodes of shorter duration. Details of affected locations, causes and impacts compiled from various sources are presented in Table 6.27.

Table 6.27 Major Flooding Events in Thoothukudi City

Year	Period	Major Affected Areas	Key Triggers	Nature of Impact
1992	NE Monsoon	Core town areas, Buckle Canal-adjacent wards	Intense rainfall, inadequate drainage	Prolonged urban flooding
2004	NE Monsoon	Low-lying residential areas within old municipal limits	Heavy rainfall, drainage congestion	Inundation of residential streets
2015	Nov–Dec	Athimarapatti, Mullakkadu, Meelavittan Road corridor, Buckle Canal and Upparu River zones	Extreme rainfall, blocked drains, reduced canal capacity	~160 locations flooded
2023	Dec	Korampallam tank catchment, Upparu Odai corridor, northern and southern zones	Extreme rainfall, tank surplus release	Inundation lasting over 10 days
2024	Dec	Collectorate campus and surrounding areas	Incessant rainfall and odai overflow	Disruption of public services
2025	Nov	Government Hospital campus, residential localities, arterial roads	Continuous rainfall and surplus inflow	Recurrent waterlogging
2026	Dec, NE Monsoon	Muthammal colony, Kurinjinagar, Dhanasekaran Nagar, and Nataraja Nagar	Breach of Korampallam tank and Uppar Odai, Buckle Canal	Inundation lasting over 10 days

Source Compiled from ADB–TNUIFSL, 2018; secondary literature; and media reports

Korampallam tank catchment and flood dynamics

As documented in ADB-TNUIFSL (2018) report, the Korampallam tank as shown in figure 6.29 is a critical hydrological feature influencing flood behaviour in Thoothukudi. It receives surface run-off from the up-stream area and discharges surplus into the Korampallam channel, forming a part of city's natural drain network.

The ADB report identifies encroachment, siltation and reduced channel cross-sections along the Korampallam channel as major contributors to downstream flooding. During periods of intense rainfall, the overflow from the tank inundates the surrounding areas resulting in prolonged inundation of residential zones.



Figure 6.29 Breach in Korampallam Tank

Source Dinamalar

Buckle canal and Urban Flooding

The Buckle canal, is the primary urban stormwater conveyance system and plays a central role in flood dynamics of Thoothukudi. According to the ADB-TNUIFSL (2018) report RCC wall construction to protect its bank has narrowed the canal, while siltation, solid waste accumulation as shown in figure 6.30 and encroachments has further reduced the designed carrying capacity of Buckle Canal.

During heavy rainfall events, run-off from large portion of the urban area drains into the Buckle canal. Exceeding inflows beyond the drains carrying capacity results as backflow in the upstream drains and water-logging in the adjacent low-lying areas. Recurrent flooding along canal-adjacent areas reported in recent news articles reinforces the structural limitations identified in the ADB study.



Figure 6.30 Desilting of Buckle Canal

Source the Hindu

As per the Environmental Assessment Report of Storm Water Drains Phase-I for Thoothukudi Corporation prepared by TNUIFSL, the Buckle Canal originates just north of the railway flyover on Palayamkottai (Tirunelveli) Road, where flows from the Chengulam Tank channel and runoff conveyed along the railway alignment from parts of the erstwhile Meelavittan Panchayat are admitted into the canal. From this point, the canal traverses through P&T Colony, Ashok Nagar, Anna Nagar and Rathanapuram, flowing through the heart of the city and finally out falling into the sea near Therespuram. Structurally, the canal is constructed as an RCC channel with RCC bottom slab and side walls and remains open without a top slab for most of its length, with several bridges and culverts across it within the city limits.

The canal receives runoff from multiple sources. Of the three odais draining the northern part of the city, Kaluthapathai Odai does not have a defined watercourse beyond the Shankaraperi area, while Kalugupathai Odai, across which S.V. Kulam is constructed, loses its watercourse about 150 m downstream of the spillway. Only the Kalangakari Odai maintains a continuous alignment, running along the railway track towards Chidambaram Port and ultimately

discharging into the Buckle Canal. The Environmental Assessment Report of Storm Water Drains Phase-I for Thoothukudi Corporation prepared by TNUIFSL records the presence of three to four small creeks within the city limits, contributing local runoff.

Issues

- The Buckle Canal has been reduced from a natural width of 16–58 m to an RCC channel of about 7.0 m, over a length of approximately 7,170 m, significantly constraining its hydraulic capacity.
- For most stretches, the clear internal width is only about 6.40 m, with widening occurring only in the final 265 m near the sea outfall (19–29 m).
- The canal has a limited carrying capacity of about 15–30 m^3/s, designed for a catchment of about 5.50 km^2.
- The actual catchment draining into the canal is about 70.42 km^2, resulting in a 5-year return period critical flow of approximately 165 m^3/s as shown in figure 6.31.
- Silt deposition occurs along most reaches, with greater silting near downstream stretches, reducing effective flow capacity.
- Bridges and culverts within city limits create localised constrictions and backwater effects.
- Tidal backflow at the sea outfall affects discharge during high tide and storm surge conditions.
- Flooding is aggravated by clogging of storm water drains, solid waste dumping, and intense rainfall events.
- The canal also conveys wastewater, sullage and untreated effluents, leading to environmental degradation and public health concerns.

Action points (TNUIFSL 2019 Storm Water Assessment Report)

- Reduce discharge into the Buckle Canal by diverting contributing catchments to adjoining watersheds as shown in figure 6.32.
- Divert flows of Kalangakari, Kalugupathai and Kaluthapathai Odais to the Periapallam Odai watershed, which drains independently to the sea.
- Divert Chengulam Odai flows from the Buckle Canal to the Upparu River, which has adequate carrying capacity.
- Use S.V. Kulam and Mullikulam as holding ponds to regulate and attenuate peak flows.
- Undertake de-silting, deepening, bund strengthening and outlet improvements for effective detention and controlled release.
- Reduce peak inflows into the Buckle Canal through combined diversion and upstream detention measures.

In conclusion, the Buckle Canal remains the backbone of the existing storm water drainage system in Thoothukudi. Long-term flood mitigation depends on catchment-level diversion, upstream detention and integrated storm water management, rather than further modification of the Buckle Canal alone.

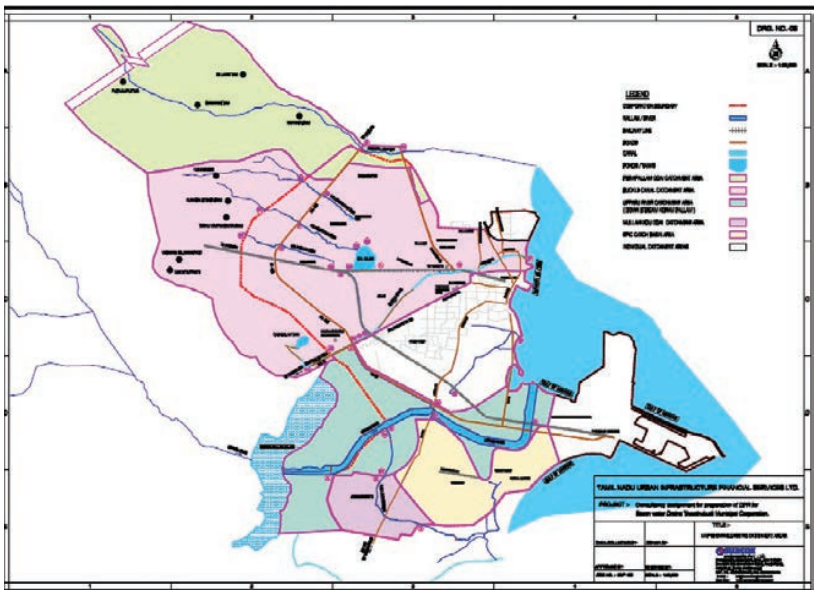


Figure 6.31 Existing Storm water drain network with catchment areas

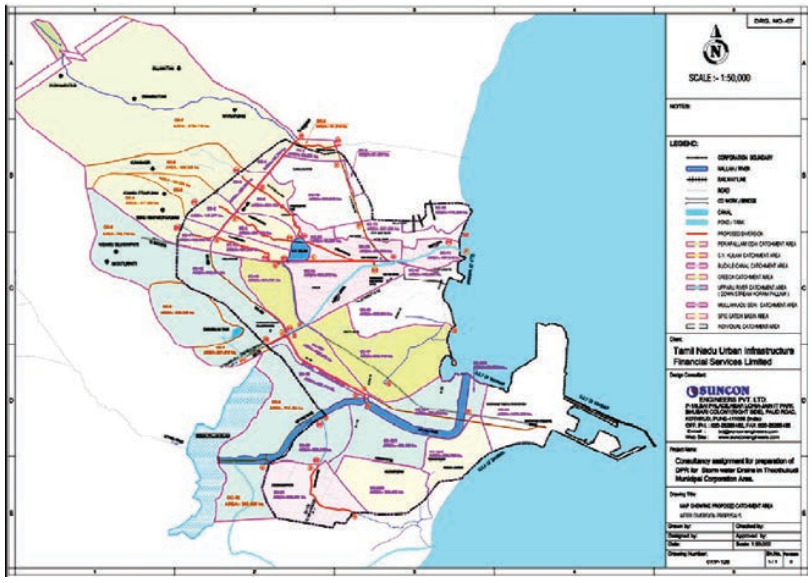


Figure 6.32 Proposed Sub-catchment and diversions to address flooding of Buckle Canal

Source: Environmental Assessment Report of Storm Water Drains Phase-I for Thoothukudi Corporation, Executive Summary prepared by TNUIFSL

6.9.2 Flood Susecptibility

The recurring flooding observed within the Thoothukudi Planning Area highlights the need to move beyond documentation of past flood events towards a spatial assessment of flood-prone areas. While historical flood records indicate locations that have been affected in the past, they do not fully capture areas that are inherently vulnerable due to terrain, hydrological setting, land cover, and drainage characteristics, particularly in the context of ongoing land-use change and climate variability.

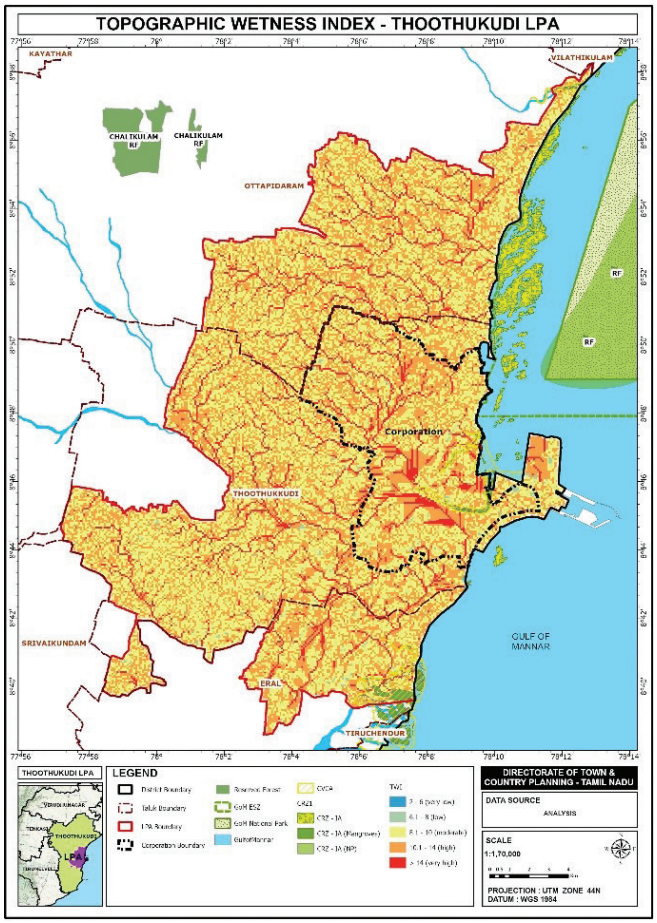
Flood susceptibility analysis provides a proactive framework to identify areas with a higher likelihood of flooding under similar or intensified rainfall conditions. By integrating multiple physical, hydrological, and land-cover parameters, the analysis helps to delineate zones that are structurally prone to inundation, even in the absence of recent flood records. This approach is particularly relevant for the Thoothukudi Planning Area, where constrained drainage systems, low-lying coastal terrain, seasonal water storage landscapes, and expanding impervious surfaces interact to influence flood behaviour.

The susceptibility assessment thus complements the existing flood inventory by offering a spatially continuous and predictive understanding of flood risk. The parameters considered in the assessment and their relative influence are presented in Table 6.28, while the corresponding thematic maps and flood susceptibility classification maps are presented in Maps 6.47 to 6.56. The results support proactive decision-making for land-use regulation, infrastructure planning, and disaster risk reduction within the planning area.



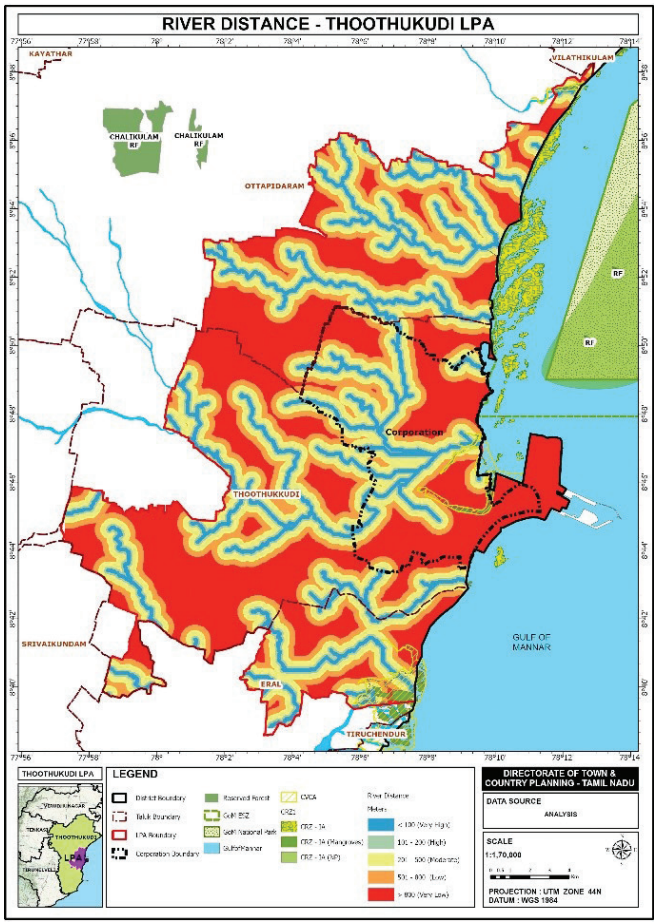
Table 6.28 Parameters considered for Flood Susceptibility Assessment

Parameter	Units	Class	Susceptibility class range	Susceptibility class rating	AHP Weightage
Topographic Wetness Index	Meters	2-6	Very Low	1	28
		6-8	Low	2	
		8-10	Moderate	3	
		10-14	High	4	
		>14	Very High	5	
River Distance	Meters	<100	Very High	5	20
		100-200	High	4	
		200-500	Moderate	3	
		500-800	Low	2	
		>800	Very Low	1	
Waterbody Distance	Meters	<50	Very High	5	15
		50-100	High	4	
		100-200	Moderate	3	
		200-300	Low	2	
		>300	Very Low	1	
Drainage Density	%	<0.1	Very Low	1	11
		0.1-0.5	Low	2	
		0.5-1.0	Moderate	3	
		1.0-1.5	High	4	
		>1.5	Very High	5	
Rainfall	mm	<800	Very Low	1	9
		800-1000	Low	2	
		1000-1200	Moderate	3	
		1200-1400	High	4	
		>1400	Very High	5	
Elevation	Meters	<8	Very High	5	6
		8-16	High	4	
		16-24	Moderate	3	
		24-32	Low	2	
		>32	Very Low	1	
Soil Type	Type	Clay and Waterbodies, Built-up	Very High	5	5
		Sandy Clay, Clay Loam	High	4	
		Sandy Clay Loam	Moderate	3	
		Sandy Loam, Loamy Sand	Low	2	
		Sand	Very Low	1	
NDWI	Value	> 0.0	Very High	5	3
		-0.1 - 0.0	High	4	
		-0.2 - -0.1	Moderate	3	
		-0.3 - -0.2	Low	2	
		< -0.3	Very Low	1	
NDVI	Value	< 0.05	Very High	5	2
		0.05-0.15	High	4	
		0.15-0.25	Moderate	3	
		0.25-0.35	Low	2	
		>0.35	Very Low	1	
LULC	Value	Waterbody	Very High	5	1
		Bare Land	High	4	
		Built	Moderate	3	
		Vegetation and Agriculture	Low	2	



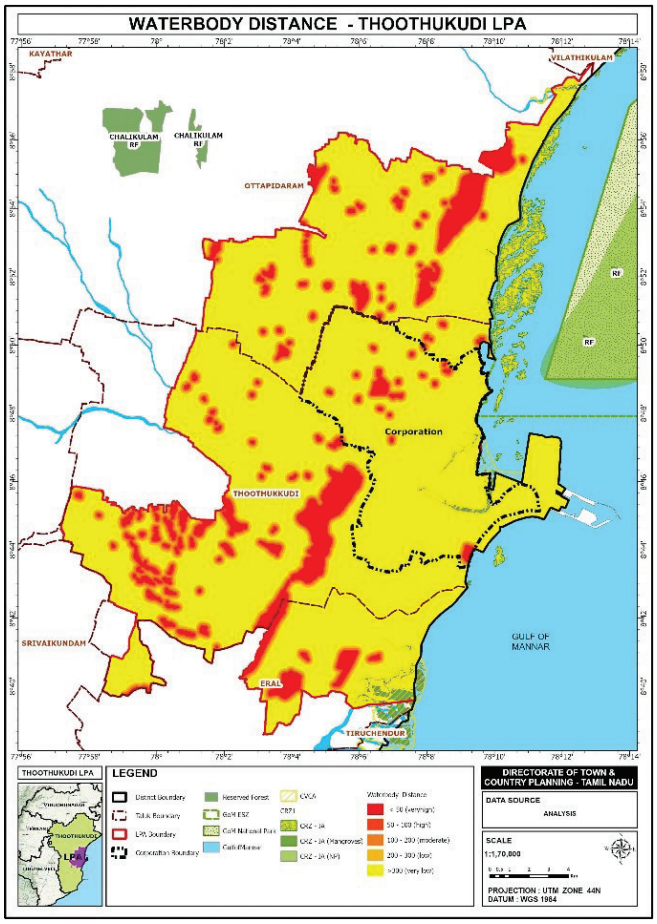
Map 6.47 Topographic Wetness Index (TWI)

Source: DTCP



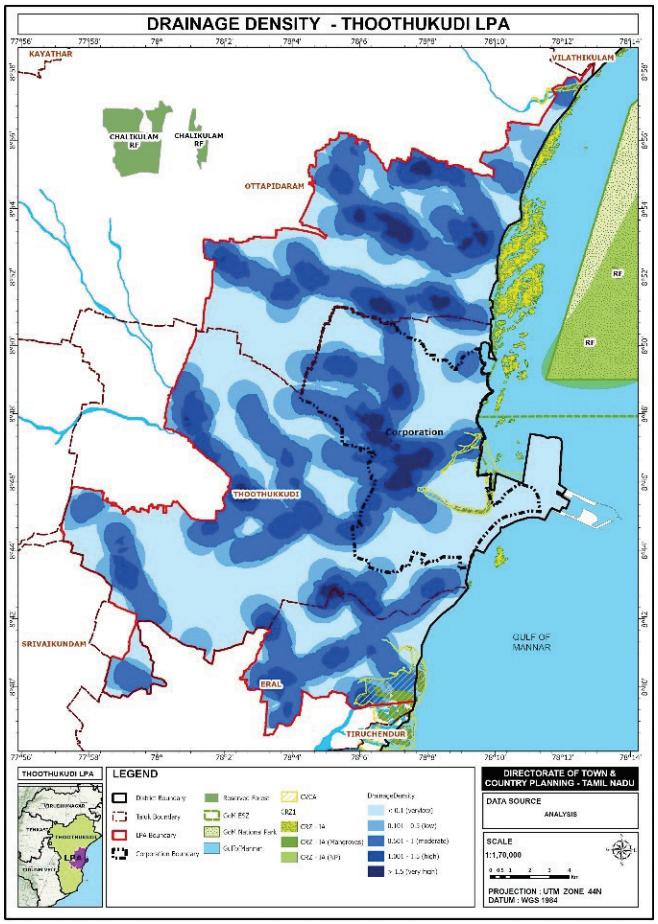
Map 6.48 Distance from rivers and streams

Source: DTCP



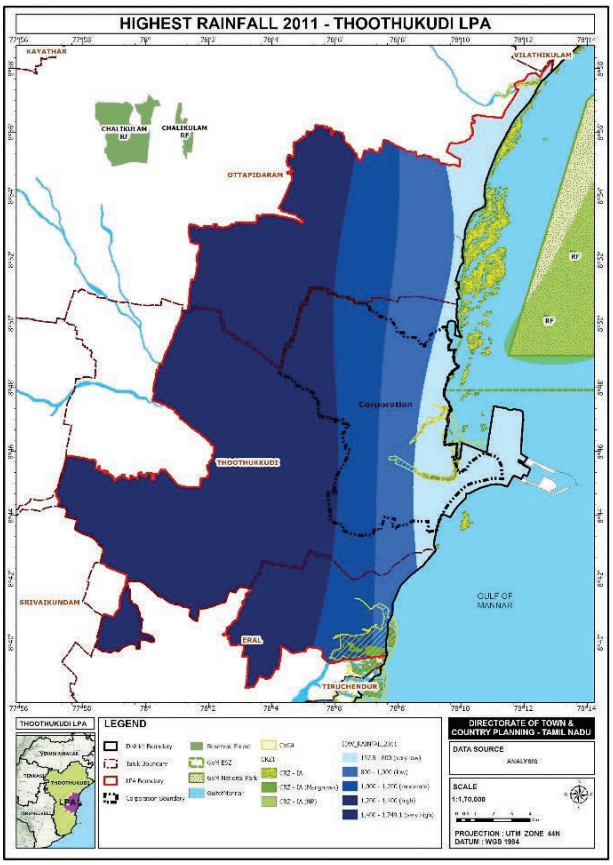
Map 6.49 Distance from water body

Source: DTCP



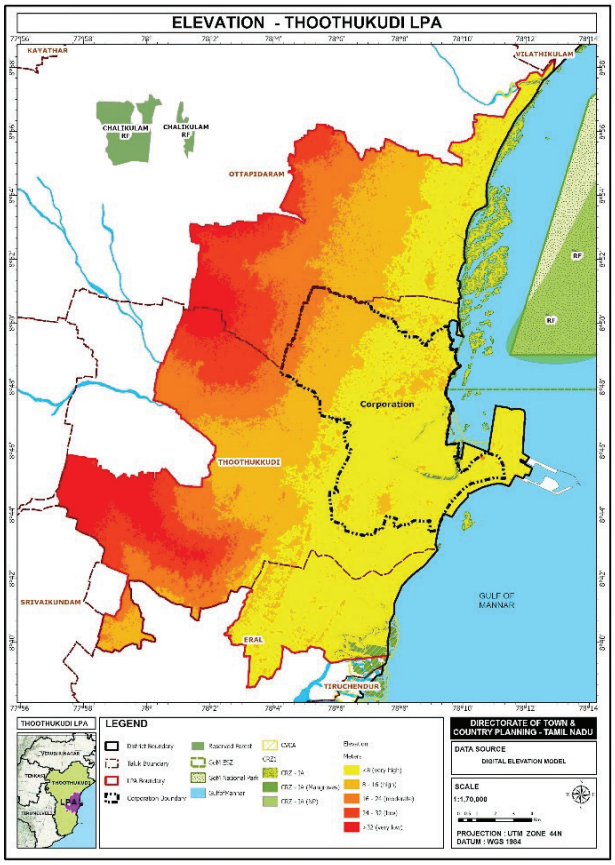
Map 6.50 Drainage Density

Source: DTCP



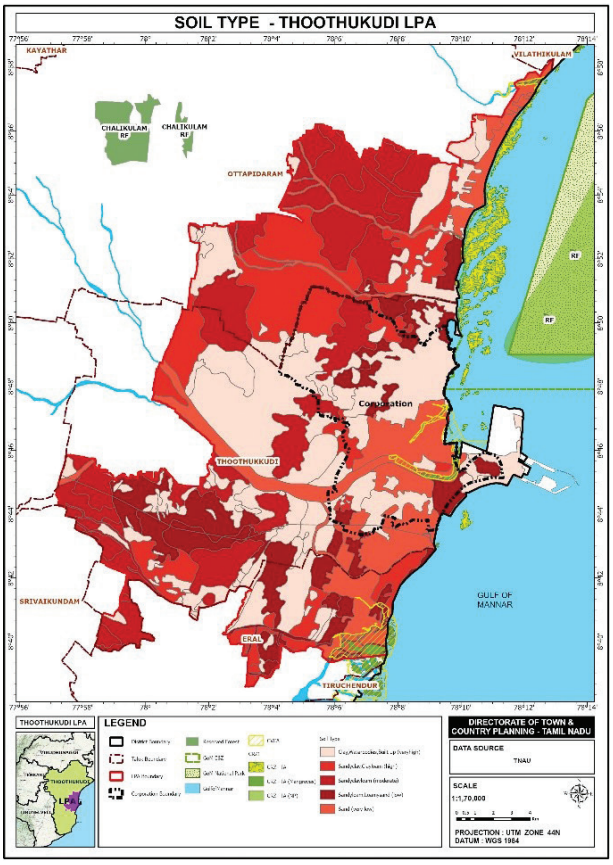
Map 6.51 Highest observed rainfall

Source: DTCP



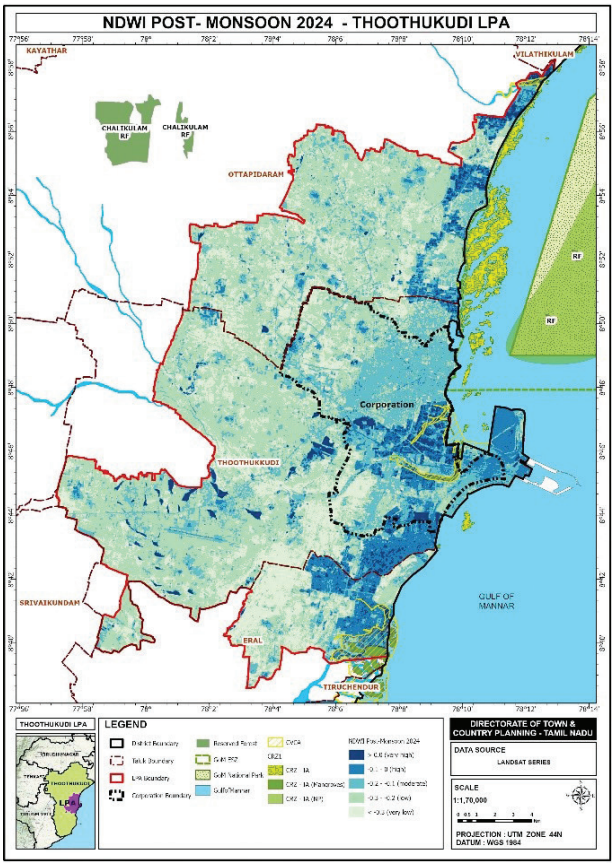
Map 6.52 Elevation

Source: DTCP



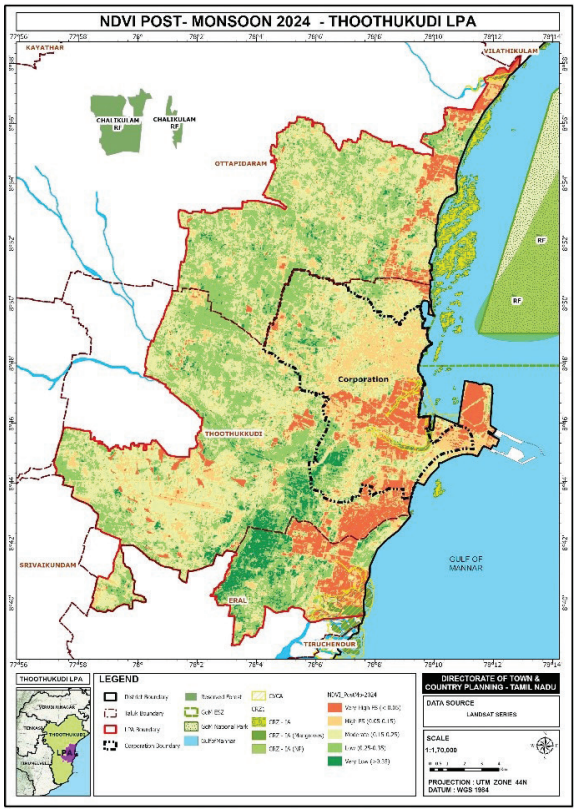
Map 6.53 Soil type

Source: DTCP

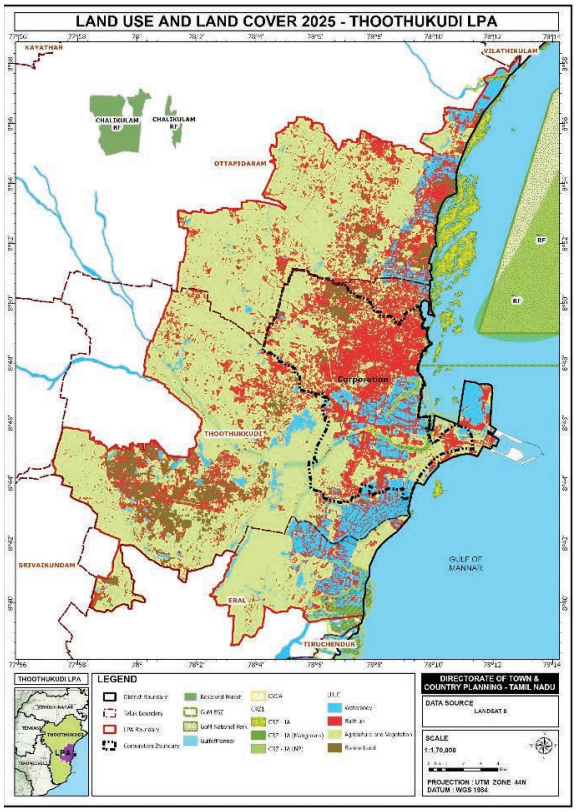


Map 6.54 NDWI - Post-Monsoon 2024

Source: DTCP



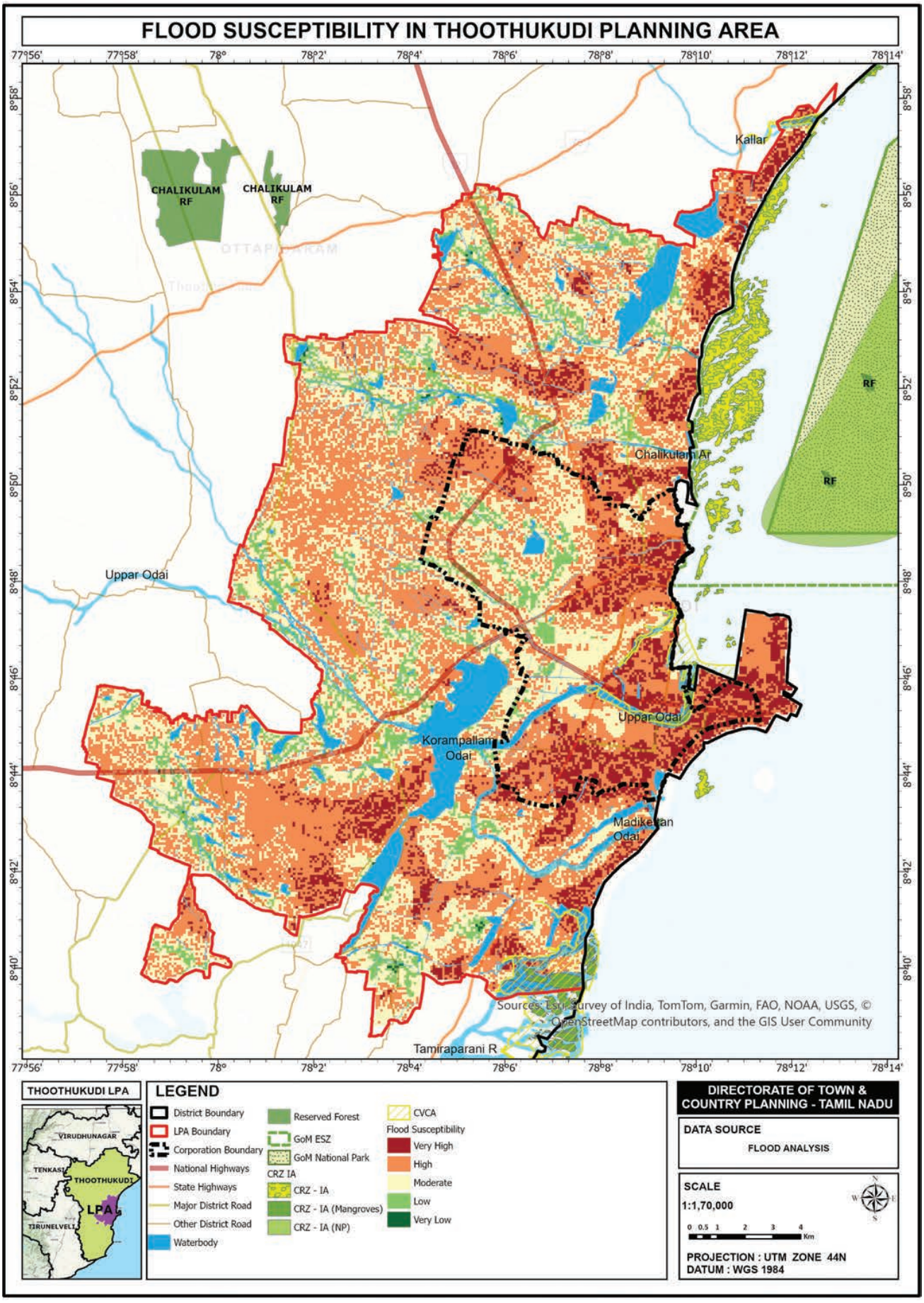
Map 6.55 NDVI - Post-Monsoon 2024
Source: DTCP



Map 6.56 Land Use Land Cover (LULC) 2025
Source: DTCP

The flood susceptibility Map 6.57 shows that much of the Thoothukudi Planning Area falls under moderate to high flood susceptibility, with very high susceptibility zones concentrated along the coastal belt, major drainage corridors, and low-lying urban areas. Elevated susceptibility is particularly evident along the eastern coastal stretch, including the Thoothukudi Corporation area and port-adjacent zones, reflecting low elevation, proximity to waterbodies, and constrained drainage outfalls.

High to very high susceptibility is also observed along the Korampallam tank catchment, channels, and associated odais, where surplus flows and backwater effects contribute to recurrent inundation. Moderate susceptibility areas dominate agricultural tracts and seasonal wetlands, which experience temporary flooding but also function as flood storage and attenuation zones. Low to very low susceptibility zones are limited and generally correspond to relatively higher ground and better-drained areas. Overall, the map highlights the strong influence of terrain, drainage connectivity, and land use on flood risk within the planning area.



Map 6.57 Flood Susceptibility map for Thoothukudi Planning Area

6.9.3 Salt Pans: Flood Regulation And Environmental Significance

The flood susceptibility analysis indicates that several low-lying coastal areas within the Thoothukudi Planning Area function as flood-receiving and storage zones during intense and prolonger rainfall events. Among these landscapes, salt pans play a major role in the flood dynamics and coastal hydrology.

Salt production in Thoothukudi has a long historical association with the region, dating back to colonial period, supported by flat coastal terrain, high evaporation rates, and easy access to seawater. Over time, extensive salt pan systems developed along the eastern and southeaster coastal tracts, shaping both livelihood patterns and drainage characteristics. The spatial distribution of salt pan areas within the planning area is shown in Map 6.58, which also depicts their location within the **10 km buffer** from the high tide mark to landward side, designated as an **Eco-Development Zone** under the Integrated Management Plan for the Gulf of Mannar (2018–2027). Buffer zone can be declared as **Multipurpose use zone** but in sustainable manner so that there is **no harm to biological integrity of the region.** This spatial context highlights the ecological sensitivity of these coastal landscapes.

Traditionally, salt pans have been operated under controlled regimes with public sector bodies and licensed operators. In the last couple of decades, economic circumstances and other development pressures have resulted in consideration of a range of alternative uses for some areas of salt pans. According to the **Salt Department guidelines, Clause 2(ii), 2(iv), 2(vii), and 2(xii)** allow use of salt lands for **public purpose,** subject to determination of operational status, protection of active salt pans, and adherence to relevant environmental and planning legislation. Such amendments need to be carefully thought out since modifications to salt pan landscapes may alter local connectivity of drainage and flood storage capacity.



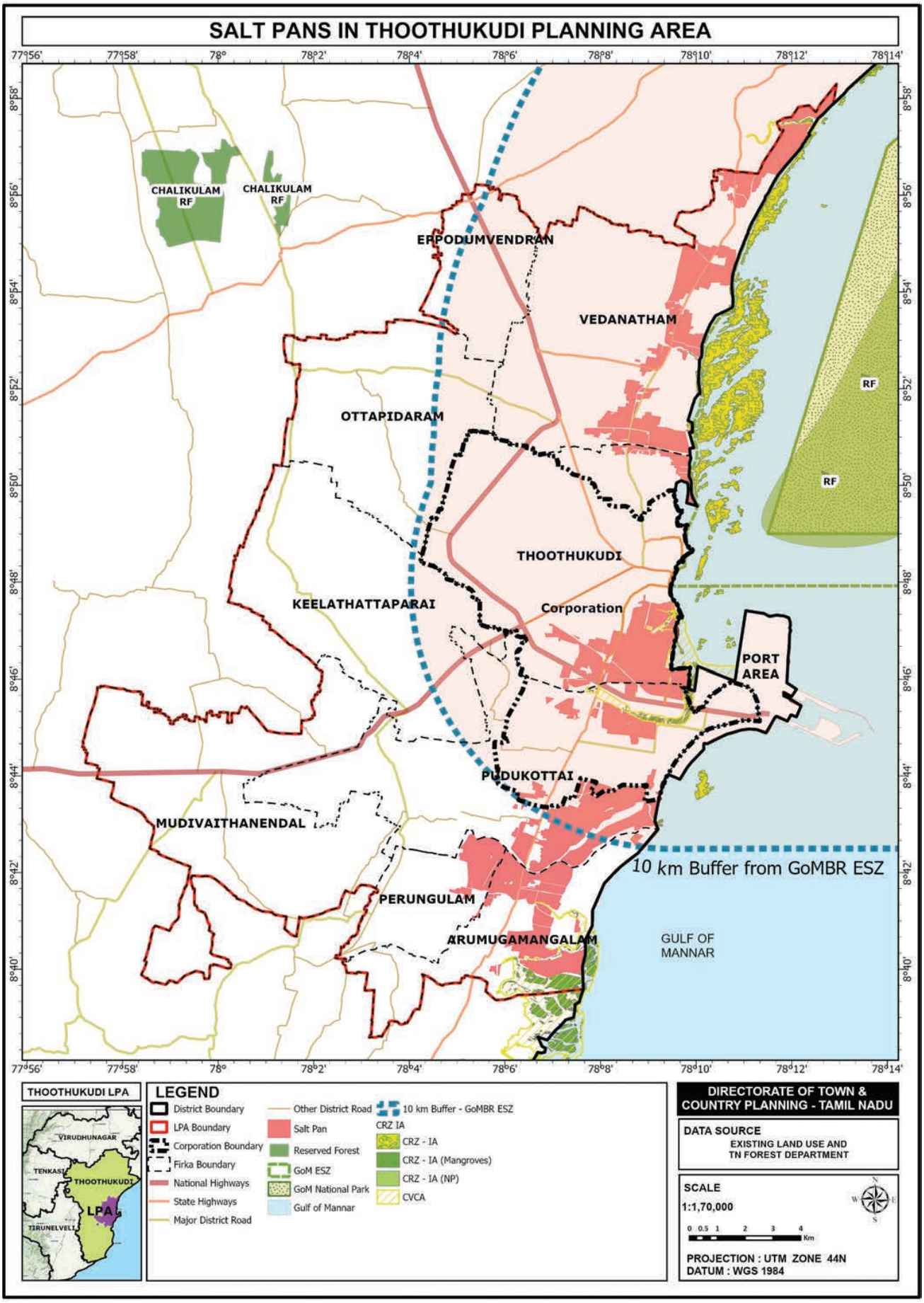
Figure 6.33 Salt pans of Thoothukudi

Source Stock Images



Figure 6.34 Greater flamingoes in Thoothukudi Salt Pans

Source Rangan Datta/Wordpress



Map 6.58 Salt pans of Thoothukudi within the GoMBR Eco-Development (Terrestrial) Zone (10 km buffer from ESZ)

Source Existing Land Use and TN Forest Department

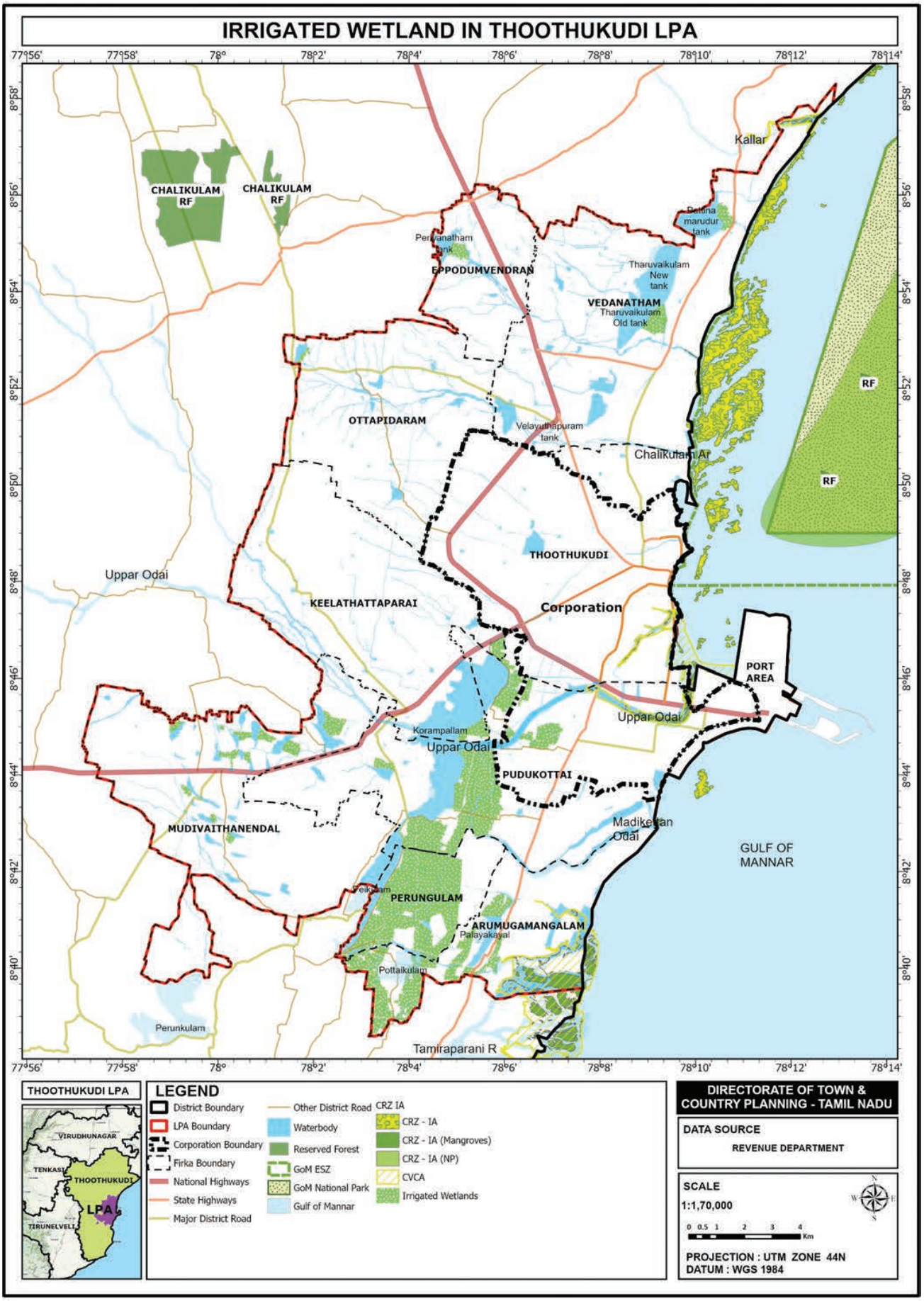
Apart from the economic role, salt pans render vital ecosystem services. During the monsoons, it allows the shallow and bund structure to temporarily store excess rainwater and attenuate it, hence reducing surface runoff and flood peaks. Seasonally inundated and abandoned salt pans also act as surrogate wetlands that support migratory and resident water birds, as recorded through secondary literature ecological studies, and media reports.

Salt pan landscapes, characterised by open, low-built, and seasonally inundated surfaces, also exhibit surface thermal characteristics distinct from dense built-up and industrial areas. In this context, the following sections on Land Surface Temperature (LST) and Urban Heat Island Intensity (UHII) present an assessment of the existing thermal environment of the Thoothukudi Planning Area, providing a baseline understanding of present-day surface temperature patterns across different land-use types, including coastal salt pan areas.

6.9.4 Irrigated Wetlands: Flood Regulation and Ecosystem Services

In addition to salt pans, irrigated wetlands associated with tanks such as Korampaalm, Peikulam and Velayuthapuram and other interconnected systems crucial for irrigation play a significant role in flood moderation within the planning area as shown in Map 6.59. These irrigated land act as seasonal wetlands in the low-lying areas, receiving overflow during heavy rainfall and act as temporary storage and conveyance zones, thereby reducing flood peaks towards the downstream urban areas.

Ecologically, the seasonal presence of shallow water and cropped fields provides habitat for aquatic fauna and wetland-dependent birds. In addition, evapotranspiration from these landscapes helps moderate local microclimate. Given their role in flood buffering, ecological support and livelihoods, the continuity and hydrological connectivity of irrigated wetlands need to be conserved and integrated into land-use planning decisions.



Map 6.59 Irrigated Wetlands in Thoothukudi Planning Area

Source Adangal Register, Revenue Department

6.9.5 Land Surface Temperature

Thoothukudi, has emerged as one of the most critical heat hotspots in the state. While its coastal geography traditionally offers some climate moderation, the city is now defined by extreme surface temperatures and an intensifying Urban Heat Island (UHI) effect driven by the reasons mentioned in figure 6.35.



Figure 6.35 Primary reasons for urban heat stress

6.9.6 Future Heat Risk In Tamil Nadu

Future heat risk in Tamil Nadu is defined by a persistent rise in both daytime and night-time temperatures, resulting in escalating physiological stress, economic losses, and systemic pressure on urban and natural systems. Under the RCP 4.5 scenario (baseline: 1975–2005) shown in Table 6.29, maximum air temperatures are projected to increase by 0.5-1°C by 2040, reaching up to 2°C by 2095, with some assessments indicating potential increases of up to 3.30°C by the end of the century. Minimum (night-time) temperatures show a steeper warming trend, rising by more than 1°C by 2040 and exceeding 1.5°C-up to 3.55°C in certain models-by 2095, indicating reduced nocturnal cooling and cumulative heat stress.

Table 6.29 Projected Air Temperature Changes in Tamil Nadu under RCP 4.5 Scenario (Baseline: 1975–2005)

Parameter	Near Term (By 2040)	Mid–Late Century (By 2095)
Maximum Air Temperature Increase	+0.5°C to +1.0°C	Up to +2.0°C
Population Exposed to Above-Average Maximum Temperatures	~71% of total population	~80% of total population
Minimum Air Temperature Increase	> +1.0°C	> +1.5°C
Climate Model Basis	-	21 NEX-GDDP (CMIP5) models
Overall Climate Signal	Clear warming trend	Sustained and intensified warming

Source: Tamil Nadu State Planning Commission – Urban Heat Island Hotspot Analysis & Mitigation Strategies for Tamil Nadu

Impact on Salt Pan Workers

The combination of existing extreme heat stress and projected future risks has created a "grave occupational health risk" for salt pan workers in Thoothukudi. As the city consistently records some of the state's highest daytime temperatures, these outdoor laborers face severe physiological and economic consequences. Workers experience pronounced heat strain, with observed core body temperature increases of ≥ 1°C and sweat rates exceeding 1 litre per hour, indicating acute thermal overload. The extreme environment heightens susceptibility to heat exhaustion, heatstroke, and exacerbation of cardiovascular and respiratory conditions. Persistent exposure leads to physical fatigue, reduced work capacity, and increased absenteeism, directly affecting livelihood security.

6.9.7 Mean Land Surface Temperature

The Mean Land Surface Temperature (Mean LST) analysis of Thoothukudi LPA shown in Map 6.60 represents the average thermal behaviour of land surfaces over the observed period, thereby reducing short-term variability and highlighting persistent heat patterns, presented in Table 6.30.

Table 6.30 Thermal and UHI Indicators – Thoothukudi

Indicator	Observed Trend / Value
Mean Daytime LST	> 42°C (peaks of 42–44°C in 2023)
Night-time LST	25–26°C during extreme summer nights
Rise in Summer Night Temperature (2013–2023)	+0.68°C
UHI Intensity (2023)	~ 2.5°C
Built-up Area Change	+12 km² built-up; −7 km² open spaces
Built-up–LST Correlation (NDBI)	+0.635
Vegetation Influence (NDVI)	Weak negative correlation
Discomfort Days	76 (2014) → 152 (2021)

Source: Tamil Nadu State Planning Commission – Urban Heat Island Hotspot Analysis & Mitigation Strategies for Tamil Nadu

Higher mean LST values are predominantly concentrated in the inland portions of the LPA, particularly across Ottapidaram blocks, salt pan landscapes, industrial estates, and dense built-up zones within the Thoothukudi Corporation boundary. These areas exhibit consistently elevated surface temperatures due to the impervious materials, exposed soil, low albedo surfaces, and limited vegetation, indicating chronic heat accumulation rather than episodic warming.

Lower mean LST values are distinctly observed along the coastal belt adjoining the Gulf of Mannar, in proximity to waterbodies, river courses, tanks, mangroves, and reserved forest patches such as Chalikulam RF. The thermal moderation in these areas is attributable to evapotranspiration, higher soil moisture content, vegetative shading, and maritime influence, which collectively suppress long-term surface heating. Environmentally, these zones function as stable cooling corridors, maintaining microclimatic balance and supporting ecological resilience.

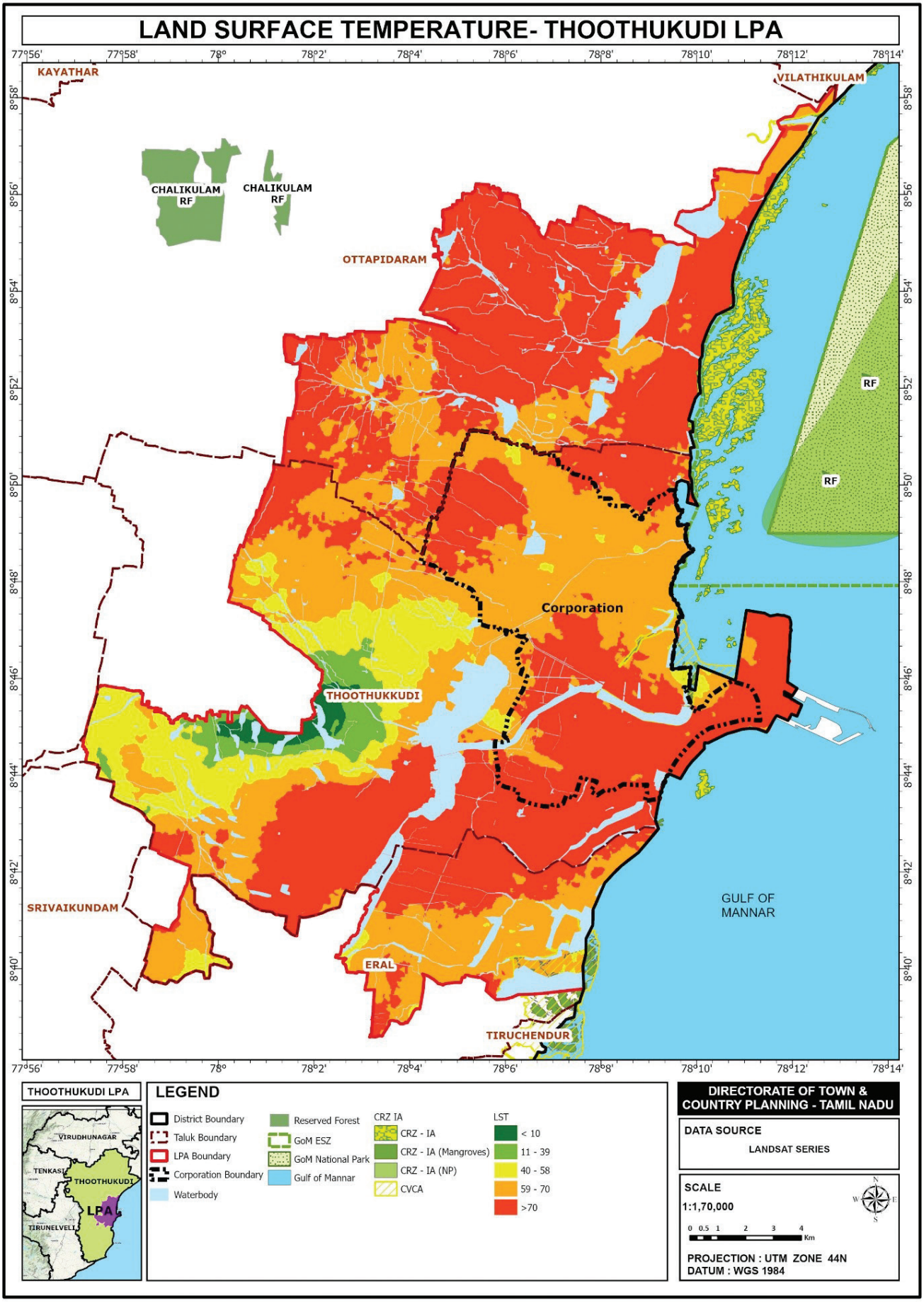
6.9.8 Urban Heat Island (UHI) Index

The Urban Heat Island Index (UHII) map for Thoothukudi LPA was generated using a multi-parameter remote sensing approach to assess spatial variations in surface heat intensity influenced by land use and land cover characteristics. The analysis integrates spectral and thermal data from the Landsat satellite series, specifically Band 4 (Red), Band 5 (Near Infrared), and Band 10 (Thermal Infrared), along with the Built-up Index and Modified Land Surface Temperature (MLST).

Band 4 was used to identify built-up and bare soil surfaces, Band 5 to assess vegetation density, and Band 10 to derive land surface temperature. The Built-up Index quantified impervious surface concentration, while MLST normalized temperature values to account for surface emissivity variations, enabling consistent thermal comparison across diverse land covers. Figure 6.36 explains the urban heat island conceptually.

The Thoothukudi Corporation area, port zone, and inland settlements register positive UHII values, confirming the presence of a sustained urban heat island effect driven by long-term land cover transformation. In contrast, coastal CRZ areas, wetlands, agricultural tracts, and forested landscapes exhibit low or negative UHII values as shown in Map 6.61, reflecting their role as thermal sinks that mitigate average surface warming across the LPA.





Map 6.60 Land surface temperature in Thoothukudi LPA

Source Landsat series

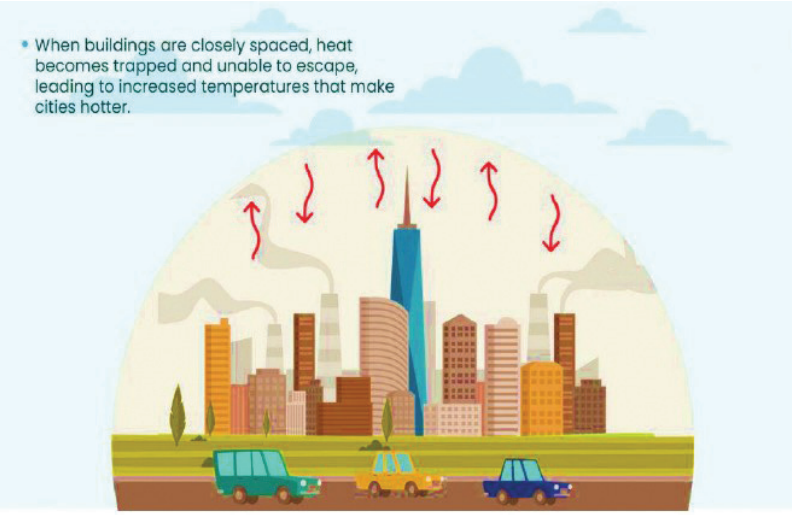


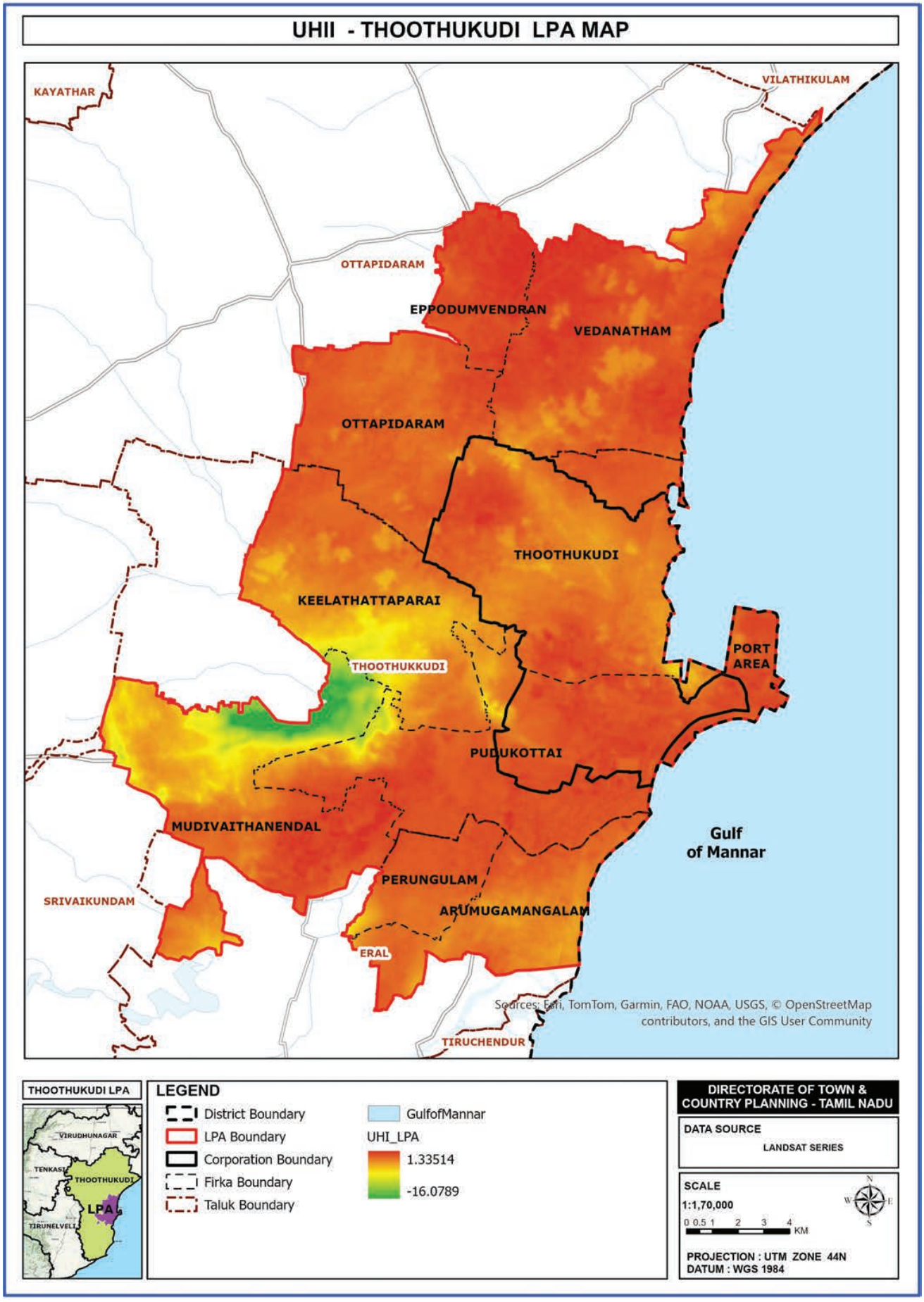
Figure 6.36 Urban Heat Island

Source: AQI

From an environmental perspective, the mean LST–UHII relationship clearly demonstrates that land cover type and surface characteristics govern long-term thermal behaviour in Thoothukudi LPA. Areas with consistently high mean LST are associated with increased environmental stress, reduced surface moisture retention, and higher heat exposure, while zones with low mean LST contribute significantly to thermal regulation, climatic stability, and heat mitigation at the regional scale. These findings are presented in Table 6.31.

Table 6.31 UHII Deviation Range Analysis

UHII Value Range	Thermal Intensity Level	Dominant Land Cover Characteristics	Spatial Occurrence
−16.08 to −10.00	Very Low (Cooling Zones)	Water bodies, wetlands, mangroves, dense vegetation	Gulf of Mannar, CRZ IA, canals, reserved forest areas
−10.00 to −5.00	Low	Vegetated land, agricultural fields, open land with moisture content	Peri-urban and rural fringes
−5.00 to −2.00	Moderate–Low	Mixed land cover with partial built-up and vegetation	Transitional zones around corporation limits
−2.00 to −1.00	Moderate	Low to medium density built-up areas	Suburban residential pockets
−1.00 to +1.33	High (Urban Heat Zones)	Dense built-up areas, industrial zones, transport infrastructure	Thoothukudi Corporation, port and industrial corridors



Map 6.61 Urban Heat Island in Thoothukudi LPA

Source Landsat series

6.10 State-Led Environmental Initiatives and Policy Alignment

Environmental management in Thoothukudi is supported by a range of State-led programmes and city-level initiatives addressing coastal resilience, biodiversity conservation, water management, flood mitigation and urban environmental quality. These initiatives provide an enabling framework for environmentally responsible development and inform the Master Plan's planning approach. The figure 6.37 comprehensively captures the state initiatives in Thoothukudi

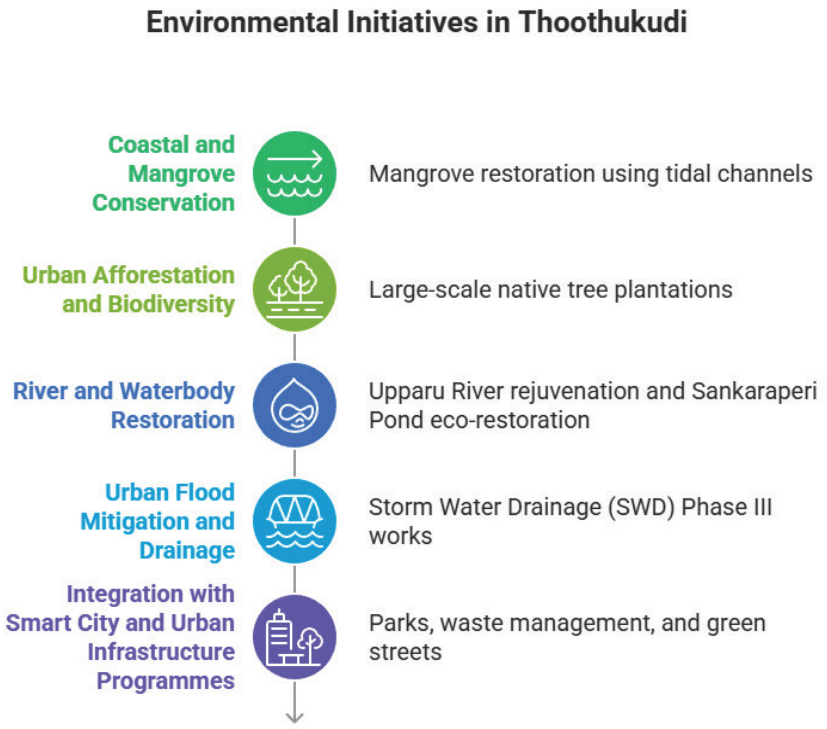


Figure 6.37 Environment Initiatives in Thoothukudi

Coastal and Mangrove Conservation

Mangrove conservation and restoration initiatives are being undertaken by the Forest Department using scientific techniques such as **fish-bone designed tidal channels to improve tidal exchange and mangrove health.** These mangrove systems function as natural buffers against coastal erosion and storm surges, while supporting marine biodiversity and fisheries. The initiatives align with the Tamil Nadu Coastal Zone Management Plan (CZMP) and climate adaptation objectives.

Urban Afforestation and Biodiversity

Urban and peri-urban afforestation programmes, including large-scale native tree plantations in areas such as Tharuvaikulam, aim to enhance green cover, reclaim degraded land and improve urban micro-climate. These efforts are aligned with the Green Tamil Nadu Mission and contribute to biodiversity enhancement and improved liveability.

River and Waterbody Restoration

Restoration initiatives such as the Upparu River rejuvenation and eco-restoration of Sankaraperi Pond focus on desilting, removal of invasive species, bund strengthening and groundwater recharge. These interventions improve flood moderation, water storage capacity and ecological health, and align with the Tamil Nadu Wetlands Mission.

Urban Flood Mitigation and Drainage

Urban flood mitigation is being addressed through infrastructure investments such as Storm Water Drainage (SWD) Phase III works undertaken by the Thoothukudi City Municipal Corporation. These measures enhance drainage efficiency, reduce waterlogging and improve climate resilience, consistent with State flood mitigation guidelines.

Integration with Smart City and Urban Infrastructure Programmes

Environmental considerations are increasingly integrated with Smart City initiatives in Thoothukudi. Projects related to creation of parks and open spaces, improved waste management infrastructure, resource recovery facilities and green streets contribute to enhanced urban environmental quality and liveability.

These initiatives demonstrate alignment between environmental sustainability and urban infrastructure development, providing a model for integrated planning approaches.

6.10.1 Supporting Tamil Nadu State Policies

The following State-level policies and missions provide a strong policy foundation for environmental planning in Thoothukudi:

1. **Tamil Nadu State Action Plan on Climate Change (TNSAPCC):** supports coastal resilience, water security, urban flood management and climate-resilient infrastructure
2. **Green Tamil Nadu Mission:** promotes afforestation, urban forestry and native species plantation
3. **Tamil Nadu Coastal Zone Management Plan (CZMP) and CRZ Framework:** guides coastal protection, mangrove conservation and regulated development
4. **Tamil Nadu Wetlands Mission:** supports restoration and protection of wetlands, tanks and ponds
5. **Urban Flood Mitigation and Storm Water Drainage Guidelines:** promote flood-resilient urban infrastructure
6. **Tamil Nadu Biodiversity Strategy and Action Plan:** encourages biodiversity conservation and ecological integration in planning
7. **TNPCB Industrial Environmental Guidelines:** support pollution prevention, green buffers and environmentally responsible industrial development.

6.10.2 SWOT Analysis

This section provides an insight into the Strength, Weakness, Opportunities and Threats considering the ecological and environmental aspects in Thoothukudi.

S

- Strategic coastal location along the GoMBR with high marine, coastal and wetland biodiversity value.
- Presence of salt pans, irrigation tanks, Odais and wetlands that contribute to flood moderation, drainage regulation, livelihoods and ecological balance.
- Well-established tank-based irrigation and wetland systems supporting agriculture, groundwater recharge and peri-urban ecosystems.
- Demonstrated improvement in industrial environmental performance, reflected in recent reductions in CEPI scores.
- Availability of statutory and programmatic frameworks such as CRZ regulations and the GoMBR Integrated Management Plan (2018–2027) to guide environmentally informed development.

W

- High concentration of industrial, port and logistics activities requires continuous environmental management to address cumulative pressures across air, water and land systems.
- Increasing complexity of urban drainage and surface water systems due to expanding built-up areas, necessitating coordinated planning and maintenance across multiple agencies.
- Exposure to urban heat stress linked to climatic warming trends and land-use intensification, particularly in dense urban and industrial zones.
- Dependence on conventional engineered infrastructure, with limited integration of landscape-based approaches in certain locations.

O

- Scope to strengthen integration between ecological systems and urban development, particularly in managing floods, heat and microclimate through land-use planning.
- Potential to enhance the functional role of existing waterbodies, wetlands and salt pan landscapes within the broader urban and regional infrastructure framework.
- Increasing alignment between industrial growth and environmental performance, supported by regulatory mechanisms and technological advancements.
- Growing policy emphasis on climate resilience, coastal management and ecosystem-based planning, providing an enabling context for future interventions.

T

- Climate change impacts, including increased rainfall variability, extreme events and sea-level rise, posing long-term risks to low-lying coastal and urban areas.
- Ongoing land-use transitions in peri-urban and coastal areas, including salt pans, wetlands and tank command regions, requiring careful planning to balance development needs and environmental functions.
- Cumulative pressures on coastal and marine ecosystems associated with urbanisation, infrastructure expansion and economic activities, particularly in proximity to the GoMBR.
- Long-term sustainability of ecosystem services may be affected if environmental considerations are not consistently integrated into spatial planning and implementation processes.

6.11 Recommendations

The recommendations presented in this chapter are derived from the baseline environmental study, existing situation analysis, and also draws from the SWOT analysis of ecological and environmental resources within the planning area. It attempts to address identified vulnerabilities and build upon the strengths and ongoing initiatives undertaken by the state government and urban local bodies with the objective of guiding sustainable land use, environmental protection and climate resilience. The recommended measures are intended to balance the ecological sensitivity with development needs, and provides a strategic, implementable framework for informed decision-making in the master plan period.

6.11.1 Overview of the Recommendation

The overview of the key recommendations formulated to strengthen ecological resilience, mitigate environmental vulnerabilities and support sustainable development in the planning area is categorised as under:

1. Resilience based strategies: Addresses climate change challenges such as Heat stress, flooding, sea level rise and cyclones

a. Cool roofs and rooftop solar panels are proposed to reduce Urban Heat Island effects in continuous built-up areas.

b. Multi-cropping in Agricultural area to build drought resilience

c. Lake and waterbody restoration

d. Blue-green network for Mitigation of urban heat stress through green and open spaces and stabilising the riverbanks ensuring no encroachment on the natural drainage patter

e. Water Sensitive Urban Design for Buckle Canal

f. Flood warning systems

g. Sea wall: Strategic coastal protection measure for long-term resilience

2. Pollution reduction strategies

a. Green belts around the industrial area as per CPCB guidelines

b. Pollution trapping plantation

c. Managed aquifer recharge

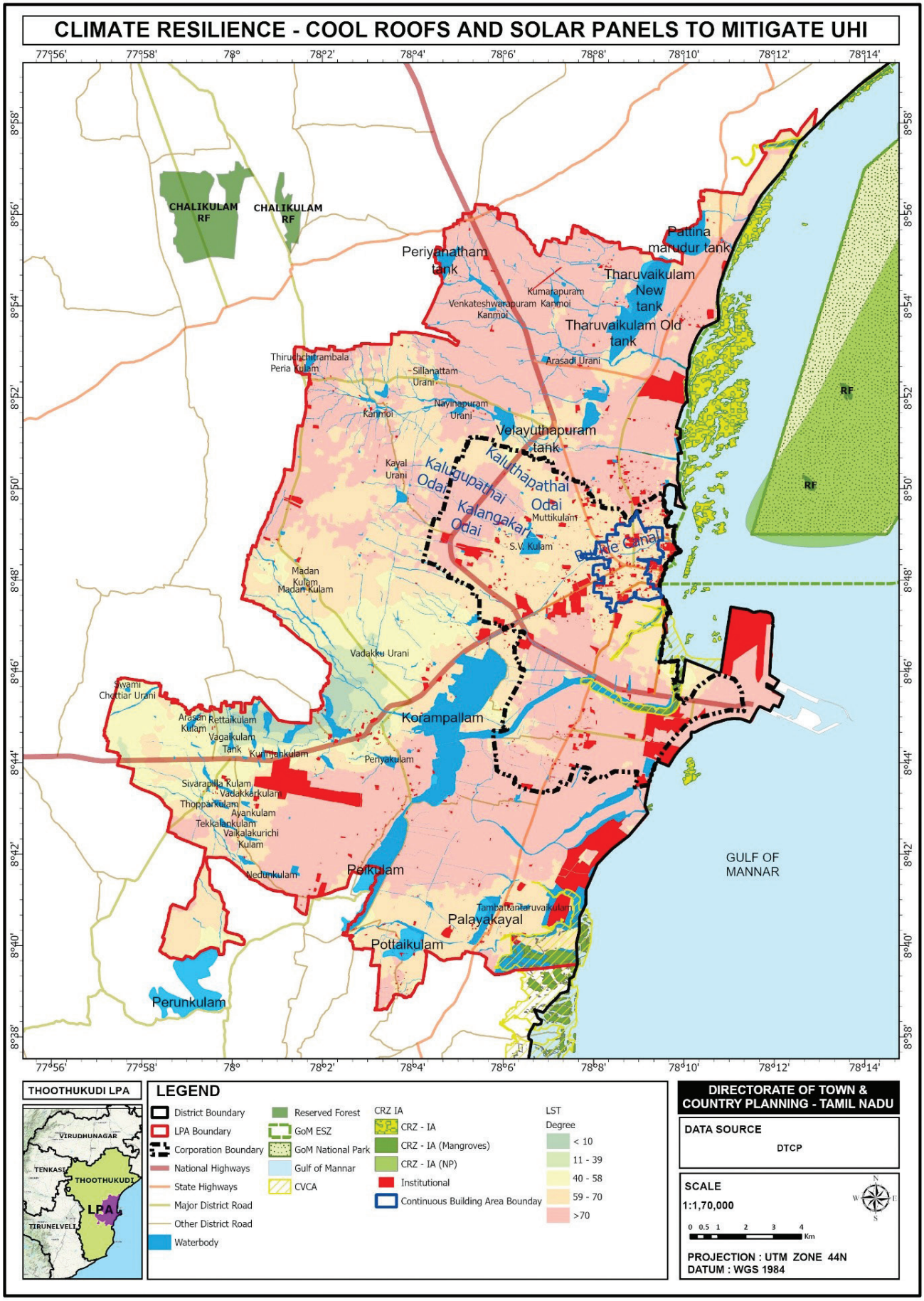
6.11.2 Cool roofs and Solar roof tops to shade the built areas

Based on the Land Surface Temperature (LST) analysis at Thoothukudi LPA scale, compact built-up zones within the Corporation boundary-particularly Continuous Building Areas (CBAs)-emerge as critical heat-stressed pockets due to high building density, and limited vegetation cover, and extensive impervious roof surfaces, as shown in Map 6.62. In response, roof-based interventions are prioritised as scalable and implementable Urban Heat Island (UHI) mitigation measures across the LPA, with differentiated focus for institutional and residential typologies.

At the LPA level, institutional areas identified in Map 6.62 are recommended for rooftop solar installations covering a **minimum of 30% of roof area,** in line with the Tamil Nadu Rooftop Solar Policy. Institutional buildings are structurally suitable for such deployment due to large contiguous roof plates, single ownership, higher load-bearing capacity, and consistent daytime energy demand. In addition to renewable energy generation, solar panels function as passive shading elements, reducing direct solar heat gain on roofs and contributing to local thermal moderation, as illustrated in figure 6.38.



Figure 6.38 Solar roof tops as passive shading and renewable energy technique on Institutional buildings



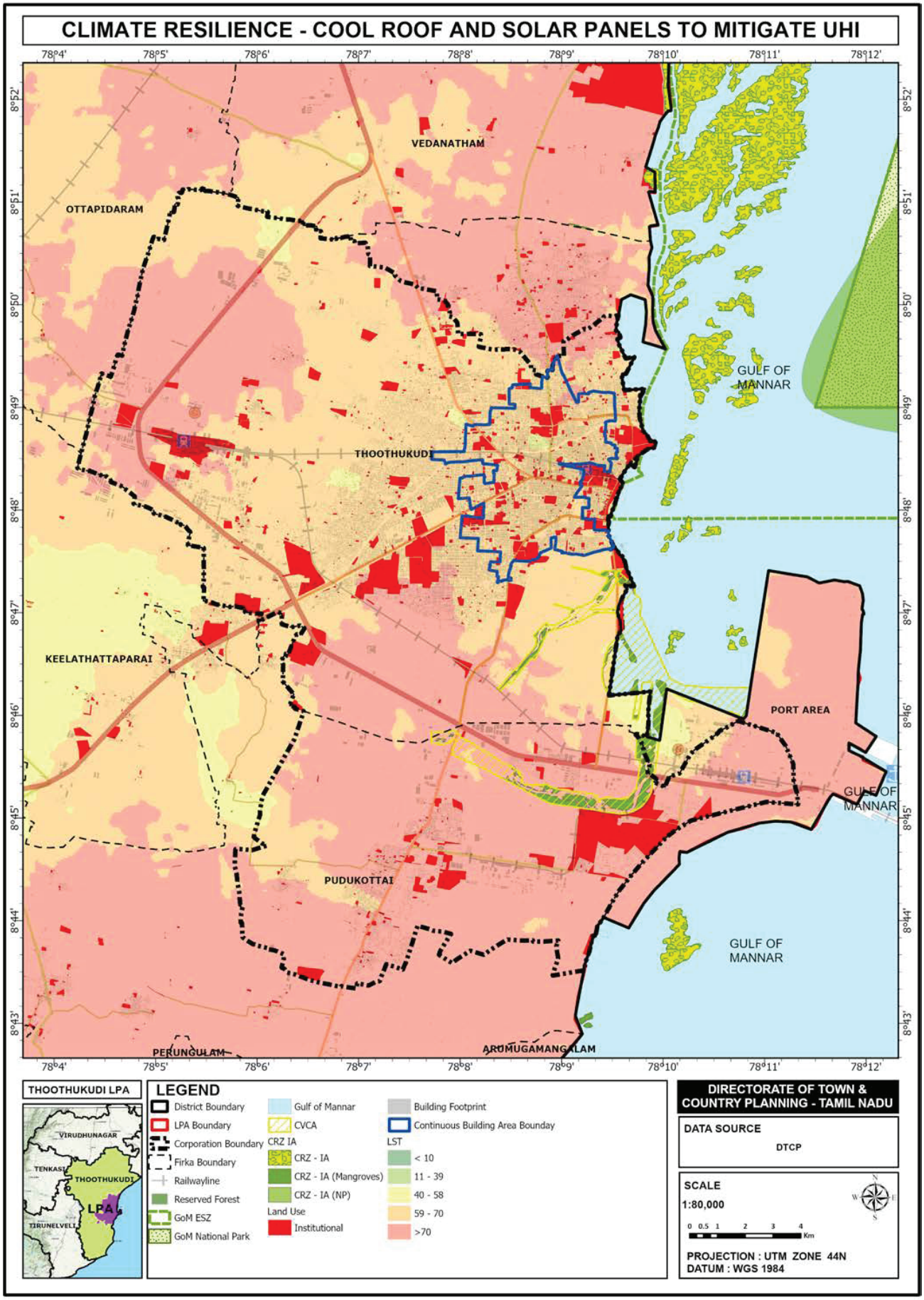
Map 6.62 Cool roof intervention in the CBA and Institutional Area in Thoothukudi

In the CBA, where high LST zones overlap with dense residential fabrics, cool roofs are recommended as a priority intervention, as shown in Map 6.63. In accordance with the Tamil Nadu Cool Roof Policy (2021) and Thoothukudi's hot-humid coastal climate, locally appropriate techniques such as white lime-based coatings, reflective acrylic paints, clay tiles, terracotta filler slabs, and lime-surkhi finishes are recommended, as indicated in figure 6.39.



Figure 6.39 White lime-based coating, terracotta filler and clay tiles as cool roof techniques in Thoothukudi

Across both CBAs and institutional buildings within the LPA, the integration of rooftop Rainwater harvesting systems for non-potable use is recommended. These systems support secondary water requirements such as flushing, cleaning, and landscaping, while also contributing to roof surface cooling through reduced runoff and short-term moisture retention. The combined application of cool roofs, rooftop solar shading, and rainwater harvesting establishes a coordinated roof-level strategy to mitigate urban heat stress, reduce cooling energy demand, and enhance climate resilience in Thoothukudi's most vulnerable urban zones.



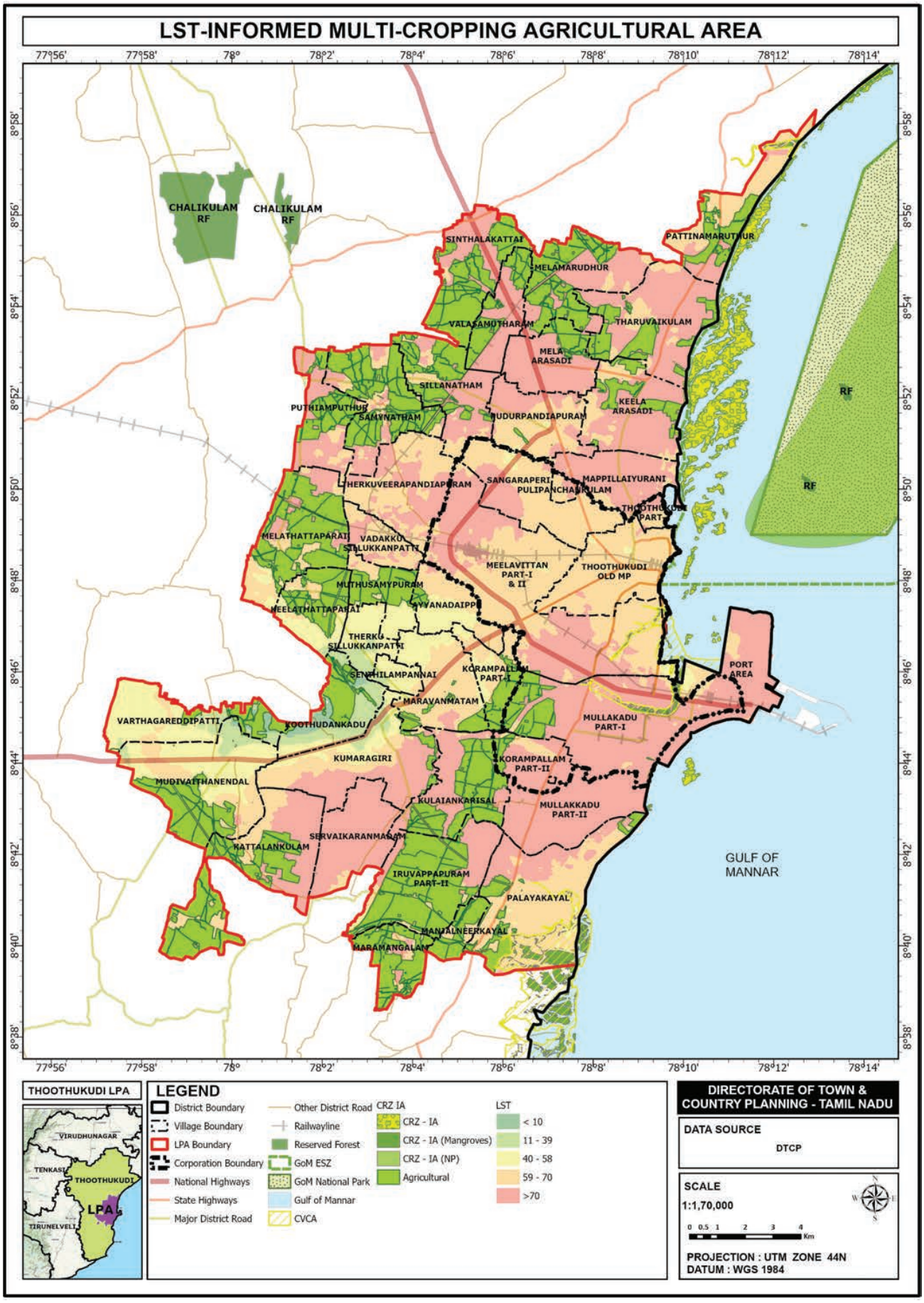
Map 6.63 Cool roof intervention in the CBA and Institutional Area in Thoothukudi

6.11.3 Multi-cropping in Agricultural area to build drought resilience

Bringing the primary sector, particularly agriculture, into the climate resilience framework of the Thoothukudi LPA is recommended as a strategic, land-based intervention to mitigate rising heat stress across the region. Spatial assessment of Land Surface Temperature (LST) indicates that several interior and peri-urban areas experience moderate to high surface temperatures (40–58°C, 59–70°C, and localized pockets exceeding 70°C). These elevated thermal conditions are primarily driven by limited vegetative cover, seasonal fallow agricultural lands, and increasing built-up influence, collectively intensifying Urban Heat Island Intensity (UHII). The observed spatial patterns highlight the need for interventions that extend beyond conventional urban greening and infrastructure-centric measures.

Within this context, agricultural lands are repositioned as active climate-regulating assets rather than passive land-use zones. A GIS-based overlay analysis of LST and agricultural land-use layers was undertaken to identify priority areas where agricultural interventions can deliver maximum thermal mitigation benefits. The analysis confirms that substantial extents of agricultural land coincide with elevated LST zones, establishing a strong technical basis for LST-informed multi-cropping as a resilience strategy. This approach provides a clear institutional pathway for the Agricultural Department to integrate crop diversification and climate-resilient farming practices into the broader heat mitigation agenda of the LPA.

The LST-Informed multi-cropping agricultural area shown in Map 6.64 highlights thermal stress concentrations in villages such as Melarasadi, Keela Arasadi, Tharuvaikulam, Mappillaiyurani, Sangarapettai, Herkuveerpandiyapuram, Vadakku Silukkanpatti, Meelavittan Part I & II, Thoothukudi Old Municipality area, Mullakkadu Part I & II, and Korampallam Part I & II, where exposed soils during fallow periods and reduced vegetative cover contribute to higher surface temperatures. Simultaneously, significant agricultural extents are observed in Sinthalakattai, Melamarudur, Valasamuthram, Sithanatham, Puthiyamputhur, Mela Thattaparai, Muthusamyapuram, Therku Silukkanpatti, Maravanmadam, Kumaragiri, Kulangarisal, Iruvappapuram Part I & II, Manjan Eerkkai, Palayakayal, and Varathagaredipatti, many of which lie within or adjacent to high-LST zones. The spatial overlap of thermal stress and agricultural land availability strengthens the suitability of these villages for targeted multi-cropping interventions.



Map 6.64 LST informed Multi-Cropping Agriculture area in Thoothukudi LPA

The north-western agricultural belt assumes additional strategic importance due to its upstream hydrological function within the LPA. These lands align with natural drainage paths where surface runoff and seasonal inflows accumulate in village-level tanks and water bodies. Enhancing agricultural intensity and crop diversity in these upstream zones improves soil moisture retention, groundwater recharge, and surface water sustainability, while simultaneously increasing vegetative cover. This integrated role reinforces both thermal regulation and water resilience, particularly during peak summer conditions.

As an environmental resilience recommendation, the promotion of multi-cropping in high-LST agricultural zones delivers multiple co-benefits. Continuous vegetative cover reduces exposed soil surfaces, enhances evapotranspiration, and contributes to measurable reductions in land surface temperature.

In addition, the strategy recommends the integration of agroforestry systems along the periphery and within agricultural landscapes, creating canopy cover buffers around cultivated lands. The introduction of native and drought-tolerant tree species enhances shade, reduces surface heat accumulation, and strengthens evapotranspirative cooling across agricultural zones. This measure also contributes to soil moisture conservation, wind protection, and long-term carbon sequestration. The agroforestry component to be coordinated with the Forest Department, aligning with afforestation and landscape restoration initiatives, and reinforcing cross-sectoral collaboration between agriculture and forestry. Together, multi-cropping and agroforestry form a complementary resilience-based strategy that strengthens thermal regulation, ecological stability, and climate adaptability across the Thoothukudi LPA.

6.11.4 Lake and Waterbody Restoration

The waterbodies identified for restoration

1. Pattinamarudur Tank
2. Tharuvaikulam tank
3. Seasonal tank in Arasadi
4. S.V Kulam
5. Chengulam tank
6. Korampallam tank
7. Peikulam

These waterbodies form a connected upstream drainage system within the Thoothukudi LPA as depicted in Map 6.65. These tanks receive monsoon runoff from their respective catchments through natural odais, minor streams, and overflow from upstream tanks. Functioning as a cascading system, excess water is progressively transferred from one tank to another before reaching downstream urban areas and coastal discharge zones. Their location along primary drainage paths make them critical control points in the regional hydrological network.

Restoration of these tanks primarily enhances their temporary storage capacity by reinstating original depths and effective water spread areas. During high-intensity rainfall events, the restored tanks function as **hydrological buffers**, retaining peak runoff volumes and releasing water in a regulated manner. This process reduces the immediate load on downstream drainage networks and urban low-lying areas, thereby lowering flood peaks and delaying the arrival of floodwaters within the city. In the case of **Korampallam Tank**, the integration of a **reed bed-based treatment system** is recommended as part of the restoration strategy to intercept surface inflows, filter sediments, and remove pollutants before water enters the main tank body. This nature-based intervention enhances water quality while maintaining hydraulic connectivity, ensuring that flood mitigation and pollution control objectives are achieved simultaneously without disrupting natural flow regimes.

The Environmental Foundation of India (E.F.I.) implements a comprehensive ecological restoration approach as shown in figure 6.40 across Thoothukudi waterbodies, including Sankaraperi Pond and other district ponds, as documented in their reports. The interventions focus on removing invasive vegetation to restore native ecological balance, desilting waterbodies to enhance storage and hydrological function, and strengthening or constructing bunds to stabilize banks. Additionally, groundwater recharge structures are installed to improve infiltration, and protective fencing is provided to prevent encroachment and maintain site integrity. To support biodiversity, E.F.I. has also introduced nesting islands for birds, creating safe habitats that encourage avifaunal activity. This integrated approach combines engineering, ecological, and habitat-enhancement strategies to rehabilitate waterbodies, improve water retention, and promote long-term ecological and community stewardship.

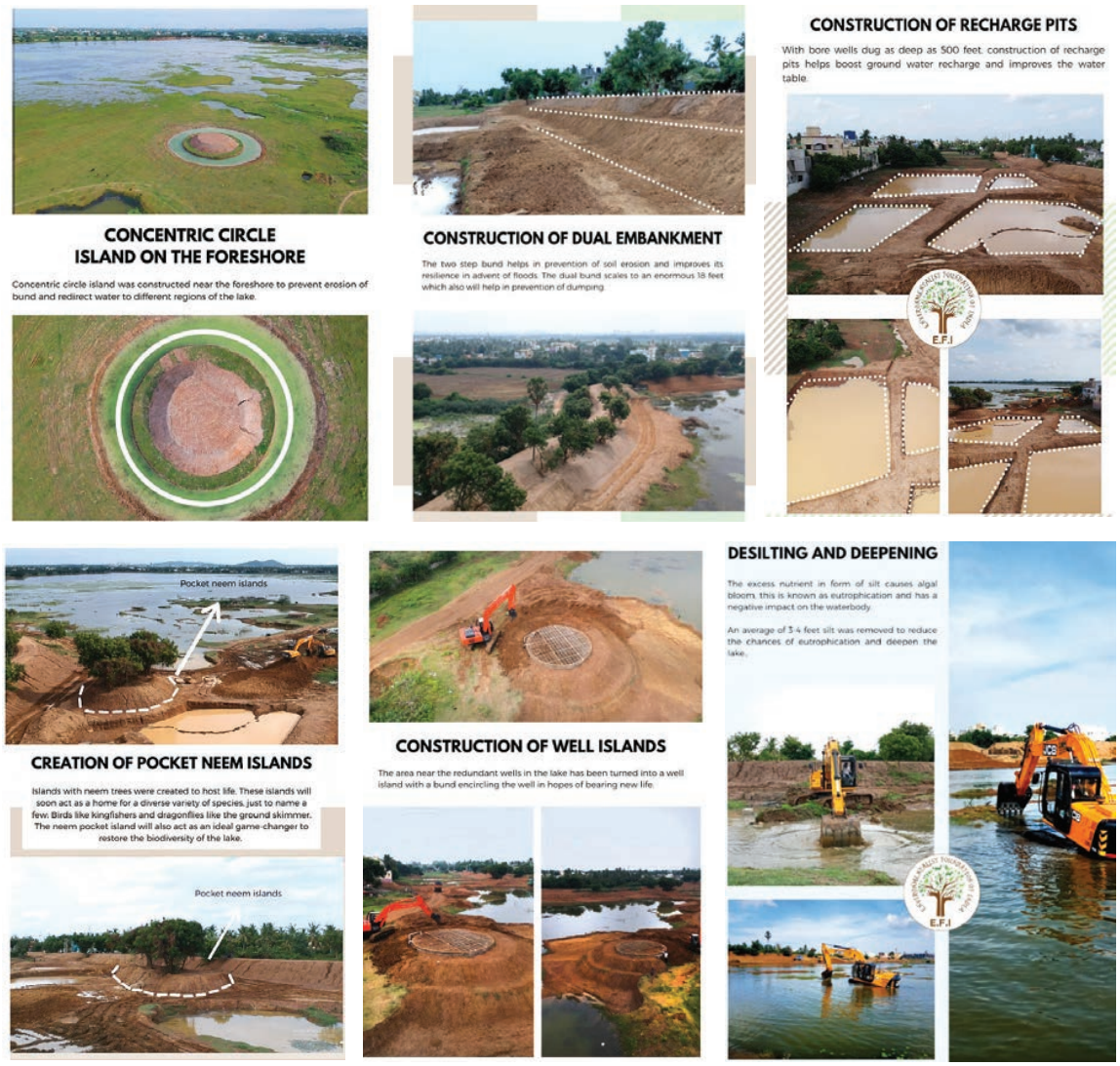
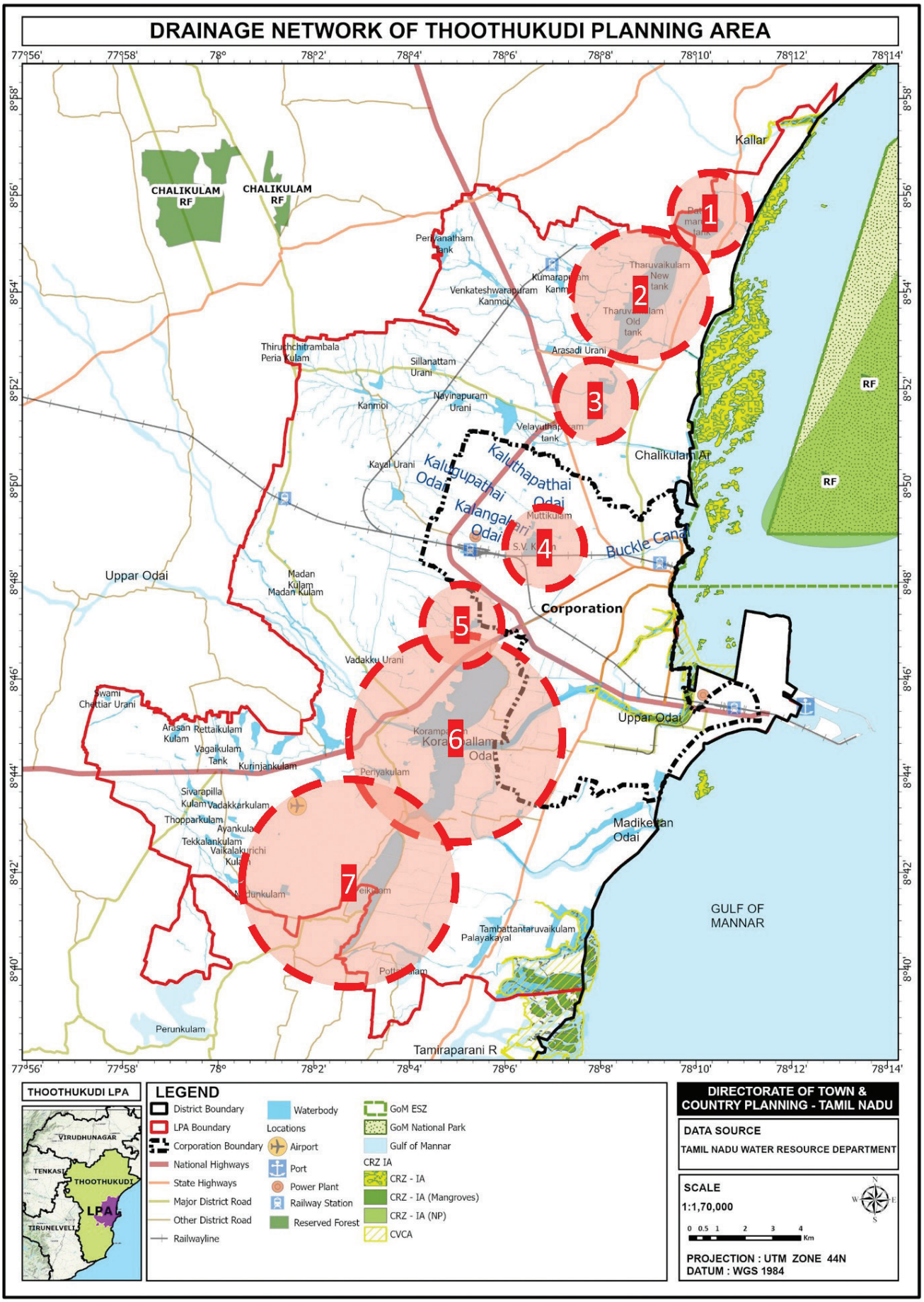


Figure 6.40 Describing E.F.I.'s interventions



Map 6.65 Identified potential lake and waterbody for Restoration in Thoothukudi LPA

6.11.5 Blue-Green Network

The Blue-Green Network for the Thoothukudi Planning Area comprises an interconnected system of water bodies, rivers, tanks, natural drains, drainage corridors, agricultural lands, irrigated wetlands, industrial green belts, recreational open spaces and coastal ecosystems, collectively supporting flood regulation, ecological stability and climate resilience.

In accordance with Tamil Nadu Government Orders [G.O. Ms. No.133, Housing and Urban Development [UD4(1)], 18th July 2024, riparian green belts are provided along natural drainage systems to stabilise banks and maintain natural drainage patterns:

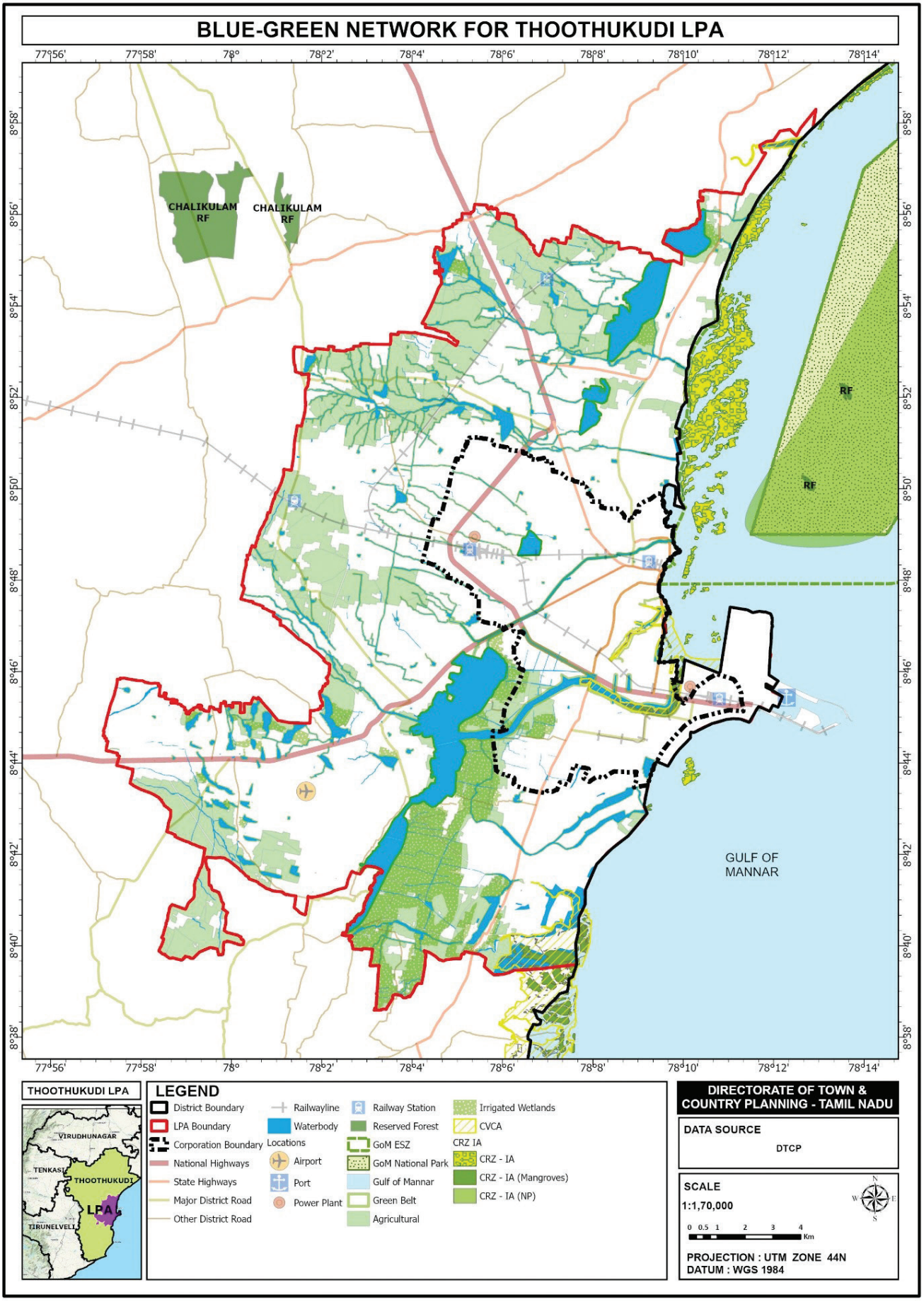
- 1 metre riparian green belt along drains of less than 1 metre width,
- 3 metre riparian green belt along drains wider than 3 metres,
- 15 metre riparian green belt along rivers and major watercourses.

For major tank systems such as Korampallam, Peikulam and other cascading downstream tanks located within flood-prone areas, a minimum 15 **metre riparian green belt** is proposed, exceeding standard norms in view of high flood susceptibility and downstream hydraulic interdependence. These green belts are intended to strengthen embankments, accommodate flood flows and preserve inter-tank connectivity.

Buffer areas (**total 3.72 sq.km, 0.80% of LPA):**

- Major tank buffers: 1.04 sq.km
- Streams: 1.75 sq.km
- Canals (Buckle/micro): 0.11 sq.km
- Waterbodies: 0.40 sq.km
- Canals (Korampallam): 0.42 sq.km

Agricultural lands, irrigated wetlands, industrial green belts and designated recreational spaces form the terrestrial components of the blue–green network, enabling groundwater recharge, surface runoff moderation and ecological continuity from inland catchments to the Gulf of Mannar. Together, these elements establish a city-wide blue-green infrastructure framework guiding resilient and environmentally responsive development in Thoothukudi. The suggested blue-green network is shown in Map 6.66.



Map 6.66 Blue Green Network for Thoothukudi Planning Area

6.11.6 Water Sensitive Urban Design (WSUD) for Buckle Canal

The Buckle Canal as shown in Map 6.67 functions as a critical urban drainage and flood conveyance system in Thoothukudi, where the current edge conditions are dominated by hard engineering, limited pedestrian integration, poor water quality, and weak ecological performance.

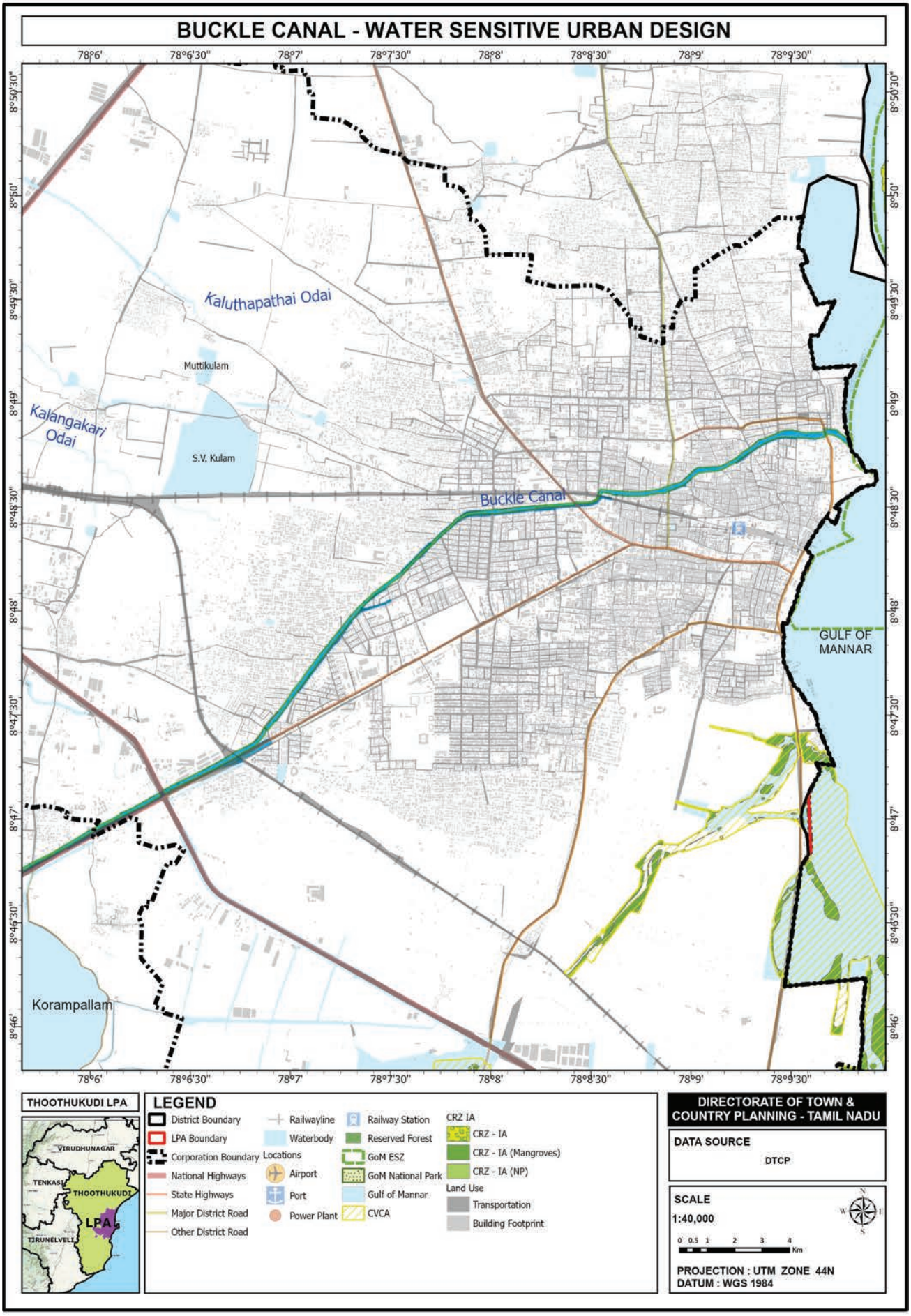
Adopting Water Sensitive Urban Design (WSUD) allows the canal to transition from a mere drainage corridor into a multi-functional blue-green urban spine that enhances flood resilience, walkability, microclimate moderation, and urban ecology. Figure 6.41 depicts an example of WSUD.



Figure 6.41 An Example of WSUD

Principles of WSUD

- Protect and enhance natural water systems within urban environments.
- Integrate stormwater treatment into the landscape, maximizing the visual and recreational amenity of developments.
- Improve the quality of water draining from urban developments into receiving catchment environments.
- Reduce runoff and peak flows from urban developments by increasing local detention times and minimising impervious areas.
- Minimise drainage infrastructure costs of development due to reduced runoff and peak flows.



Map 6.67 Buckle canal – Water Sensitive Urban design

Proposed WSUD-Based Cross-Section Strategy

The proposed WSUD-based cross-section as shown in figure 6.42 strategy for the corridor integrates stormwater management, urban biodiversity, and pedestrian comfort while maintaining the existing urban footprint.

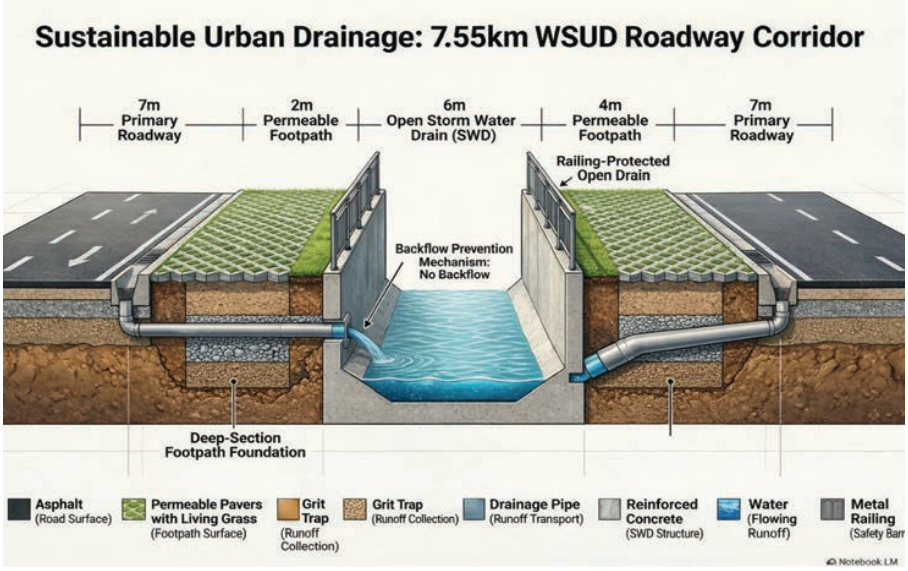


Figure 6.42 Recommended section as per site condition, based on WSUD for Buckle canal

The 7-meter carriageway on either side is retained to avoid land acquisition, with permeable paving introduced at parking bays and shoulders to reduce surface runoff. Cambered road profiles are designed to direct runoff toward vegetated footpath edges, enabling first-flush pollutant control and reducing the overall runoff volume entering the canal.

The 2 and 4-meter footpath functions as a dual-purpose pedestrian and bio-retention corridor, incorporating permeable pavement, linear bio-swales, and native salt-tolerant vegetation suitable for Thoothukudi's coastal and arid conditions. Slight cross falls channel runoff into the swales, facilitating stormwater filtration, groundwater recharge, and enhanced walkability with improved thermal comfort. Controlled inlet points from the bio-swales ensure regulated discharge, contributing to flood attenuation and ecological enhancement along the canal corridor.

6.11.7 Flood Early Warning Systems (EWS)

An integrated Early Warning System (EWS) is proposed for the Thoothukudi Planning Area to enhance preparedness against flooding and extreme rainfall events. The system shall be anchored to the identified floodprone areas delineated through the flood susceptibility shown in Map 6.68 ensuring focused monitoring, timely alerts and coordinated response in highrisk zones. The EWS will support riskinformed decisionmaking, reduce potential loss to life and property, and complement structural and nonstructural flood mitigation measures proposed in the Master Plan. The figure 6.43 illustrates the working mechanism of an Early Warning System (EWS), from realtime monitoring and forecasting to warning dissemination and coordinated response

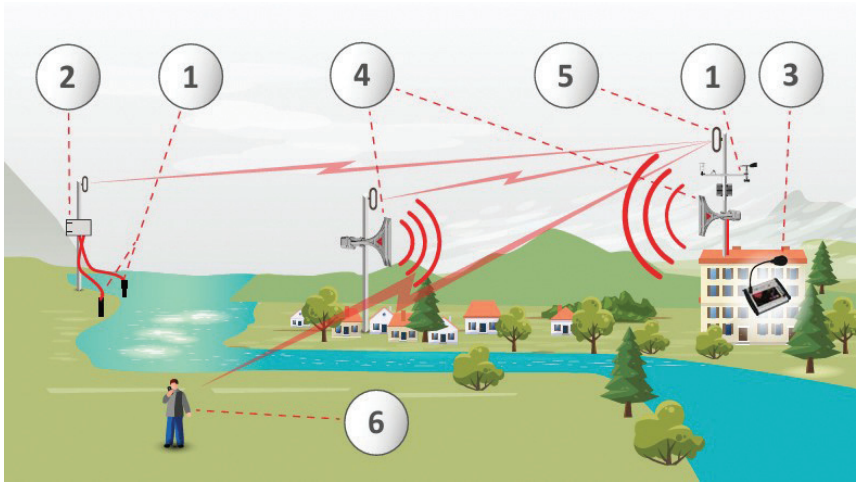
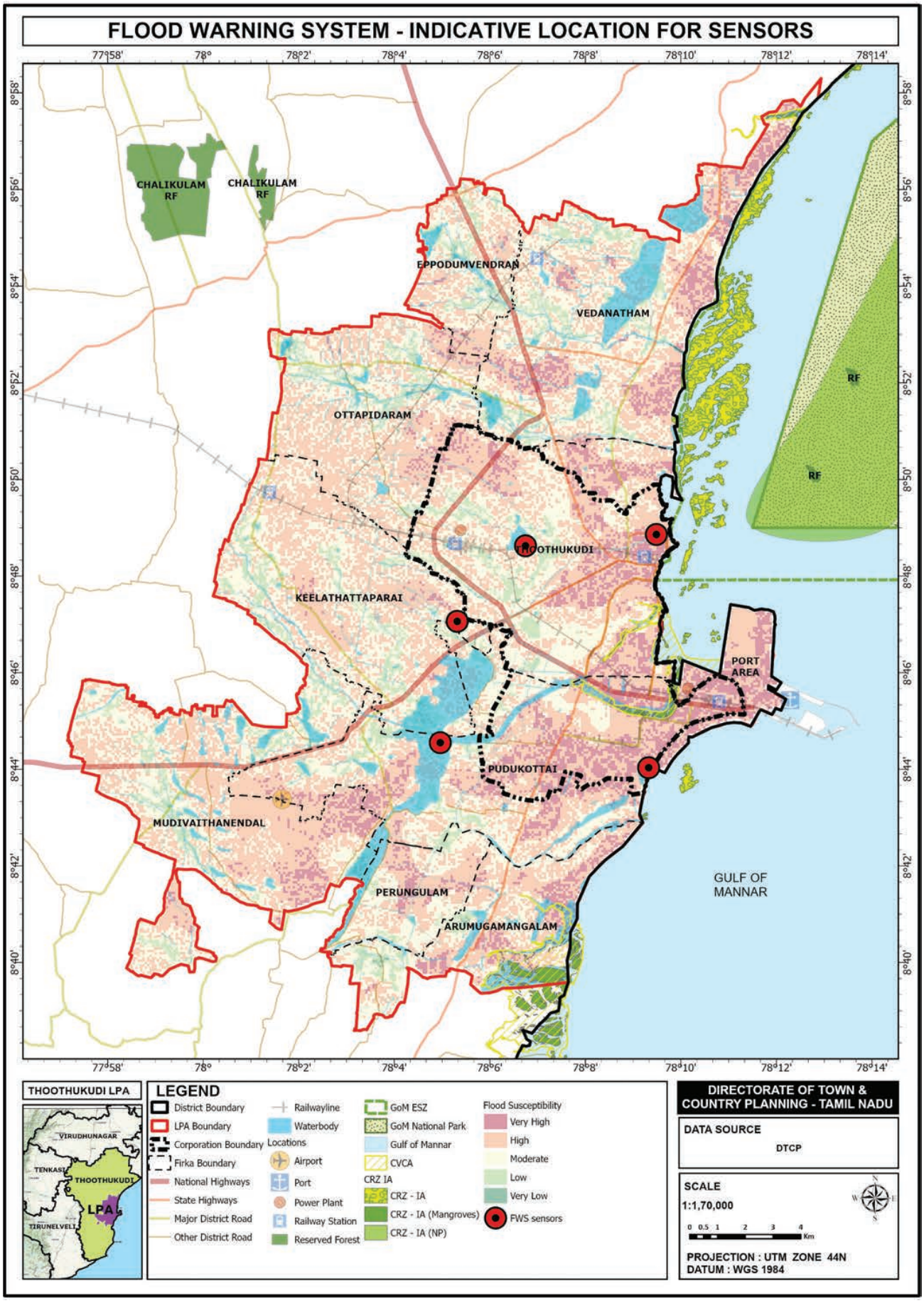


Figure 6.43 Working of an early warning system

Source Early Flood Warning Systems, Telegrafia

Working of the Early Warning System (EWS)

1. **Monitoring and Detection:** Realtime monitoring of rainfall, river/water levels and weather parameters through fieldbased sensors.
2. **Data Transmission:** Collected data is transmitted from monitoring stations to the central processing and control system.
3. **Forecasting and Analysis:** Integrated analysis of sensor data and meteorological forecasts to assess flood risk and event likelihood.
4. **Warning Generation:** Alerts are generated when predefined thresholds are exceeded, based on risk levels.
5. **Warning Dissemination:** Early warnings are communicated through sirens, communication towers, mobile alerts and official channels.
6. **Response and Preparedness:** Communities, authorities and stakeholders receive alerts and initiate timely preparedness and response actions.



Map 6.68 Potential location for Flood Warning System in Thoothukudi LPA

The Flood Warning System (FWS) sensors, marked as red dots, are strategically placed within key water bodies and along major canal junctions and outfalls, including Korampallam Tank, Velayuthapuram Tank, Periyatham Tank, Tharuvaikulam Old Tank, Tharuvaikulam New Tank, and along the Buckle Canal and its connected reaches of Kaluppanai Odai and Kalangarai Odai. These locations correspond to flood-prone zones, hydraulic choke points, and areas of rapid water level fluctuation, enabling real-time monitoring and early flood alerts.

Methodology for Adoption

1. **Use of Flood Susceptibility Mapping**: Floodprone areas identified through the flood susceptibility map shall form the primary basis for prioritising monitoring locations, alert thresholds and response planning.
2. **Targeted Monitoring Infrastructure**: Install realtime rainfall and waterlevel sensors in identified high and moderaterisk zones, including critical drains, tanks, canals and lowlying urban areas.
3. **Threshold Definition and Alert Levels**: Define rainfall and waterlevel thresholds specific to floodsusceptible zones to trigger graded alerts (watch, warning, emergency).
4. **Centralized Data Integration**: Integrate sensor data with meteorological forecasts through a centralized monitoring platform at city or district level.
5. **Warning Dissemination and Response Linkage**: Disseminate alerts through multiple channels (SMS, sirens, public address systems, coordination with authorities), linked to predefined response actions in floodprone areas.
6. **Institutional Coordination and Review**: Align the EWS with district disaster management systems and periodically review performance based on observed flood events.

6.11.8 Sea-Wall

The flood susceptibility assessment indicates that, in addition to inland flooding driven by rainfall and drainage constraints, parts of the Thoothukudi LPA are increasingly exposed to coastal flooding due to sea level rise, storm surge, and tidal backflow. While the Blue-Green Network forms the primary framework for flood mitigation and ecological buffering, certain low-lying urban coastal stretches and storm water outfall zones remain vulnerable to direct marine influence under extreme events and long-term sea level rise scenarios.

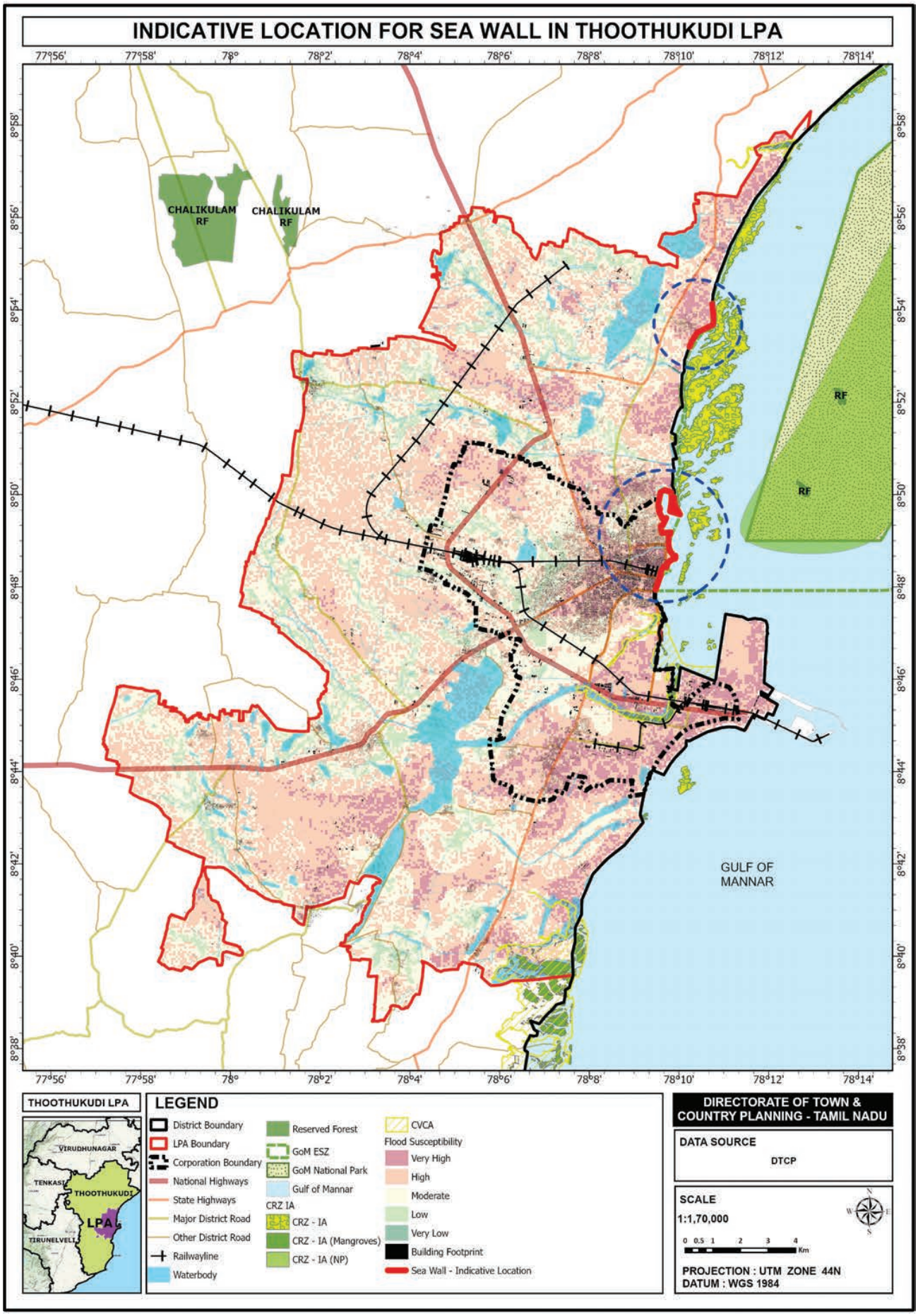
In this context, sloped or stepped revetment-type sea walls, as shown in figure 6.44 may be considered as a long-term resilience intervention in locations where coastal inundation poses direct risk to existing built-up areas, critical

infrastructure, port-related assets, and major storm water discharge points. Key planning considerations for sea wall interventions include:

- Construct phased sloped or stepped revetment-type sea walls at selective, highly vulnerable urban coastal stretches along the **Tharuvaikulam beach and Thlamuthunagar** as shown in Map 6.69, with a total length of 10.09 km
- Priority consideration may be given to **urban coastal edges and storm water outfalls** where tidal backflow, storm surge, and monsoon runoff coincide to aggravate flood risk.
- The alignment, extent, and form of any sea wall shall be determined through site-specific coastal vulnerability assessments, shoreline change analysis, hydrodynamic and wave modelling, and geotechnical investigations, to be undertaken by competent State or District agencies.
- All coastal protection measures shall comply with the Coastal Regulation Zone (CRZ) Notification and shall require approval from the Tamil Nadu State Coastal Zone Management Authority (TNSCZMA).
- Sea wall interventions shall be integrated with the overall storm water drainage and flood management system, ensuring that protection at one location does not transfer erosion or flood risk to adjacent coastal stretches.
- Sea walls are recommended as a phased, resilience-based coastal defence option, to be considered only where structural protection is unavoidable for safeguarding vulnerable urban areas and essential infrastructure, and to be guided by detailed technical evaluation and statutory clearances.



Figure 6.44 Stepped and Sloped revetment-type sea walls



Map 6.69 Indicative location of sea walls

6.11.9 Green belts around the industrial areas

Industrial green buffers are recommended as an environmental safeguard measure for industrial areas, industrial parks and individual industrial units within the Thoothukudi Planning Area. These buffers are intended to mitigate air and noise pollution, enhance ambient environmental quality, moderate microclimatic conditions, and serve as transitional zones between industrial activities and adjoining residential areas, waterbodies, agricultural lands and ecologically sensitive zones.

Green buffers are recommended to be planned in alignment with CPCB industrial pollution categorisation, MoEFCC green belt and buffer guidelines, and applicable environmental regulations. The extent of green belt provision may be determined based on pollution category, pollution index and locational context presented in Table 6.32 to 6.34.

Table 6.32 Minimum Green Belt Requirement - Industrial Areas and Industrial Parks

Pollution Category	Minimum Green Belt Requirement
Red	Minimum 15% of total plot area
Orange	Minimum 10% of total plot area
Green	Optional – no mandatory requirement
White	Optional – no mandatory requirement

Source MoEFCC, 2025

Table 6.33 Minimum Green Belt Requirement- Individual Industrial Units outside Industrial Areas – Predominantly Air-Polluting Sectors

Pollution Category	Pollution Index (PI)	Minimum Green Belt Requirement
Red	PI ≥ 280	25% of total plot area
Orange	PI ≥ 55	20% of total plot area
Green	PI ≥ 25	10% of total plot area
White	–	Optional – no mandatory requirement

Source MoEFCC, 2025

Table 6.34 Minimum Green Belt Requirement - Individual Industrial Units outside Industrial Areas – Other Sectors

Pollution Category	Minimum Green Belt Requirement
Red	20% of total plot area
Orange	15% of total plot area
Green	Optional – no mandatory requirement
White	Optional – no mandatory requirement

Source MoEFCC, 2025

6.11.10 Pollution trapping plantation

Plantation along the medians of major urban transport corridors and high traffic rights of way is recommended to be developed using native and/or site-appropriate and climate-resilient species, with preference to species having high Air Pollution Tolerance Index (APTI). A recommended species list with APTI values and functional characteristics is included in Table 6.35.

Table 6.35 Indicative Plant Species for Industrial Green Belts (High APTI)

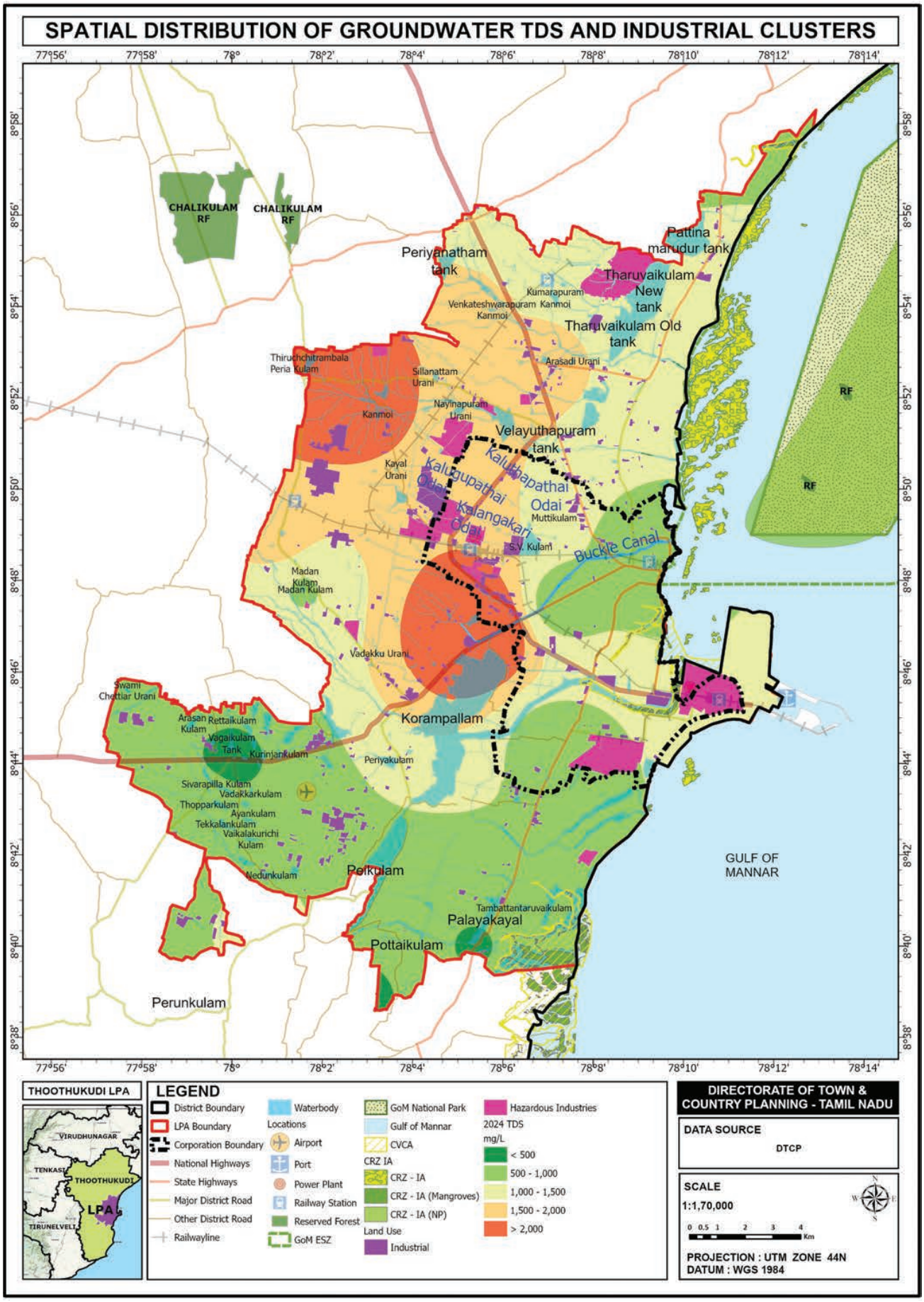
Scientific Name	Type	Average Height (m)	Crown Shape	Indicative APTI Index
Azadirachta indica	Tree	12–18	Broad, spreading	30–35
Tamarindus indica	Tree	15–20	Wide, dense canopy	28–32
Pongamia pinnata	Tree	12–15	Rounded, dense	27–31
Ficus benghalensis	Tree	20–25	Very wide, spreading	30–34
Ficus religiosa	Tree	18–22	Broad, open	29–33
Terminalia catappa	Tree	12–15	Horizontal, layered	26–30
Polyalthia longifolia	Tree	12–18	Columnar	22–26
Albizia lebbeck	Tree	15–20	Umbrella shaped	25–29
Pithecellobium dulce	Tree	10–15	Irregular, spreading	24–28
Casuarina equisetifolia	Tree	15–25	Columnar	21–25
Moringa oleifera	Tree	8–12	Open, spreading	24–27
Calotropis gigantea	Shrub	3–5	Irregular	20–23

Scientific Name	Type	Average Height (m)	Crown Shape	Indicative APTI Index
Vitex negundo	Shrub	3–6	Bushy	21–24
Dodonaea viscosa	Shrub	2–4	Dense, rounded	20–22
Clerodendrum inerme	Shrub	2–3	Spreading	19–22
Bougainvillea spectabilis	Shrub/ Climber	4–6	Spreading	18–22
Cenchrus ciliaris	Grass	1–1.5	Tufted	15–18
Vetiveria zizanioides	Grass	1–1.5	Clumping	16–20

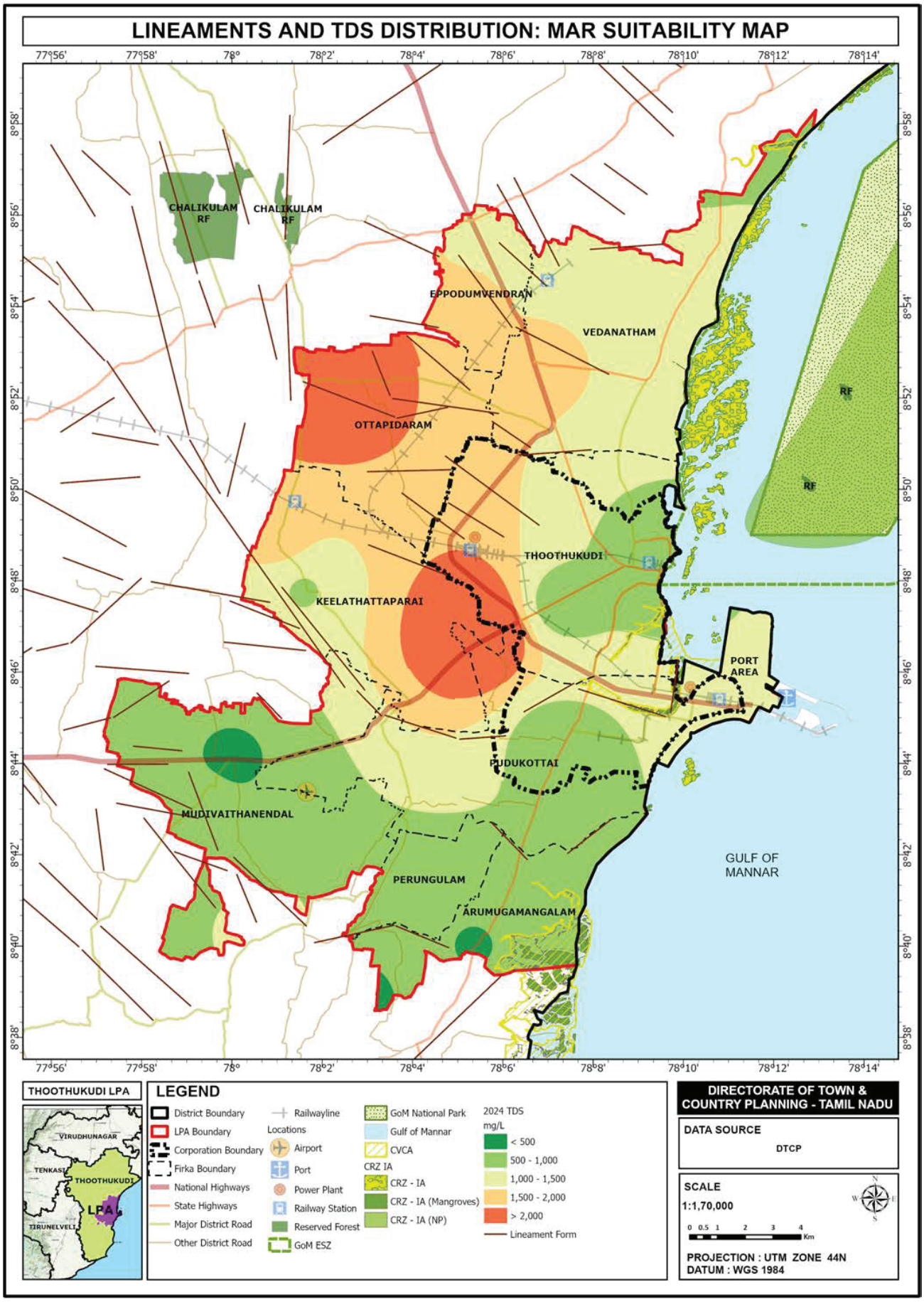
6.11.11 Managed aquifer recharge

It is recommended to implement Managed Aquifer Recharge (MAR) across the LPA with the primary objective of reducing persistently high groundwater TDS levels resulting from legacy contamination from past industrial influence, salinity ingress. The LPA's hard rock geology, coastal setting, and modified drainage systems limit natural recharge and promote the accumulation of dissolved salts, as reflected in 2024 groundwater quality, particularly in industrial, as shown in Map 6.70. Continued groundwater extraction further increases the risk of saline intrusion from the Gulf of Mannar.

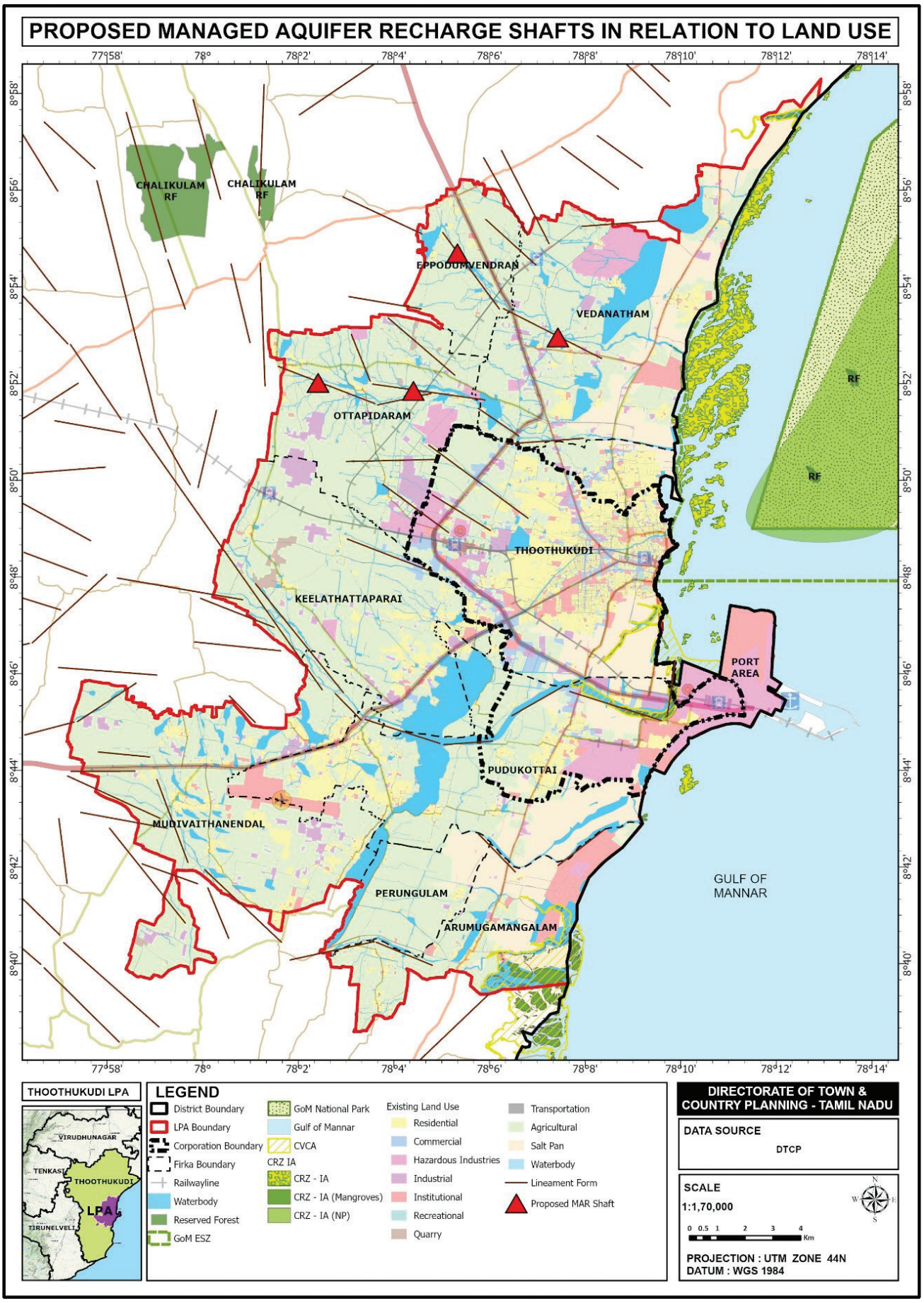
The proposed MAR interventions shall focus on controlled recharge through injection wells and suitable recharge structures to dilute and flush accumulated salts, restore groundwater levels, and strengthen freshwater heads. MAR structures are proposed along mapped lineaments and aligned with natural drainage paths, primarily in agricultural areas, so that these areas can progressively benefit from improved groundwater quality. Suitable locations have been identified based on groundwater quality and structural controls as shown in Map 6.71 and integrated with land use planning as depicted in Map 6.72. Overall, MAR is recommended as a targeted, climate-resilient intervention to improve groundwater quality and support long-term water security within the LPA.



Map 6.70 Spatial Distribution of groundwater TDS and Industrial clusters



Map 6.71 Lineaments and TDS distribution: MAR suitability Map



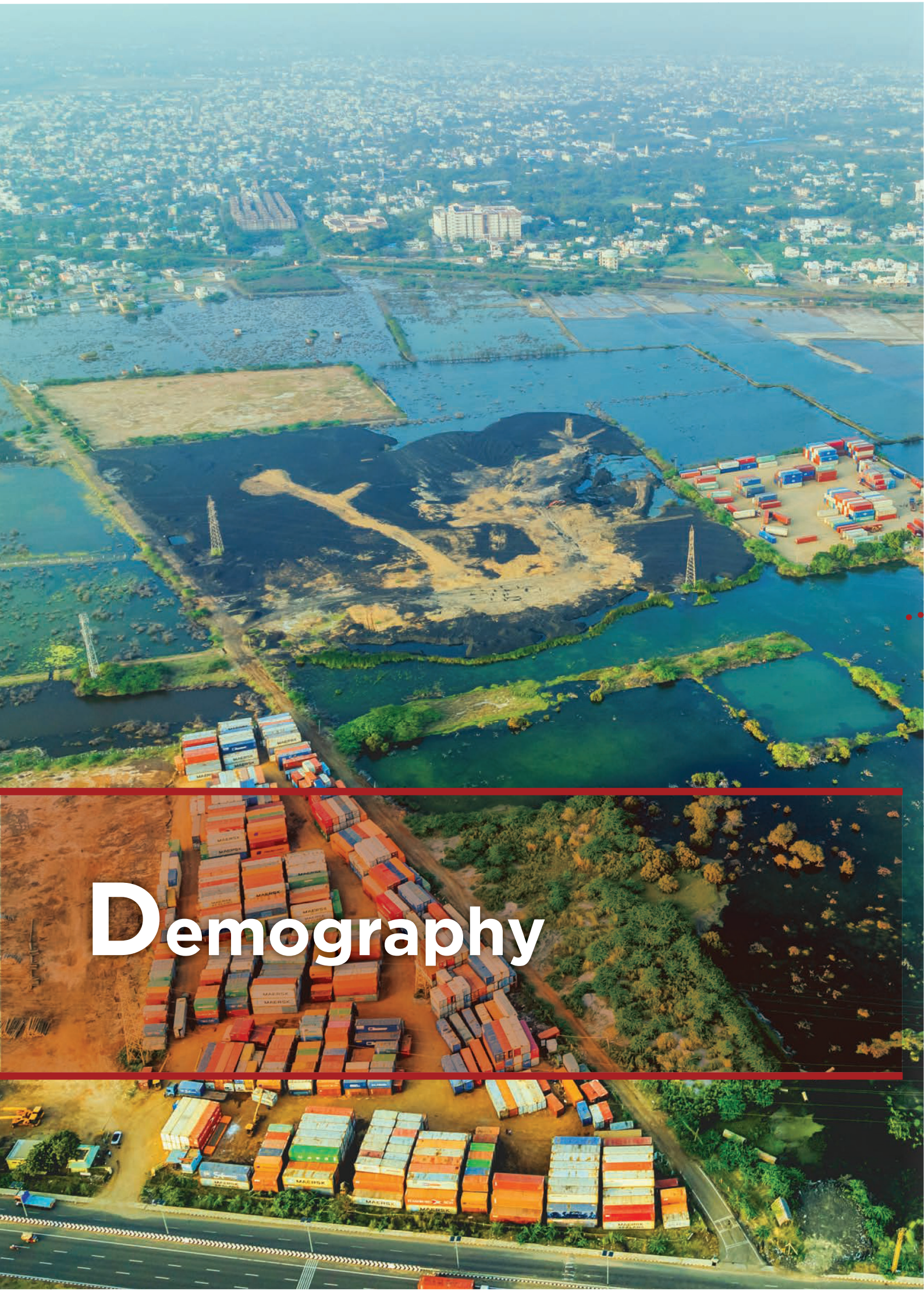
Map 6.72 Potential location for injection wells

6.11.12 Conclusion

The Ecology and Environment section establishes that Thoothukudi's development trajectory is fundamentally shaped by its coastal setting, low-lying terrain, climate trends, sensitive water systems, diverse biotic assets, and exposure to multi-hazard risks. The analysis indicates a clear intensification of heat stress, rainfall variability, flood susceptibility, and pressure on surface and groundwater systems, alongside the ecological significance of the Gulf of Mannar, wetlands, salt pans, and inland tanks. While recent regulatory and management measures have improved environmental performance, particularly in air quality and industrial pollution control legacy groundwater quality issues, hydrological vulnerabilities, and ecosystem sensitivity remain key spatial constraints.

Taken together, these findings underline that environmental considerations must form the structural basis for land-use planning, infrastructure placement, and growth management in the Thoothukudi LPA. The chapter therefore provides the scientific and spatial rationale for strategies that emphasise climate-responsive urban form, protection and restoration of water systems, safeguarding of coastal and ecological buffers, risk-informed disaster management, and pollution prevention. This integrated approach ensures that future development is not only economically and spatially efficient, but also environmentally resilient.





Demography



7.1 Overview of Thoothukudi LPA

Thoothukudi Local Planning Area (LPA) accommodates a population of about 5.14 lakh within an area of 463.62 sq. km, resulting in a moderate population density of 11 persons per hectare. This density is significantly higher than the district average, indicating the LPA's role as a major core area concentration and peri-urban sprawl, while remaining substantially lower than the municipal corporation core.

Table 7.1: State, District, LPA and Corporation level comparison of demographic factors

Demographic Factor	Tamil Nadu State	Thoothukudi District	Thoothukudi LPA	Thoothukudi Corporation
Population (2011)	7,21,47,030	17,50,176	5,14,313	3,72,408
Area (in Ha.)	1,30,05,800	4,74,500	46,362	9,066
Population Density (Persons / Ha.)	6	4	11	41
Literacy Rate - 2011 (%)	80	86	90	92
Sex Ratio – 2011 (no. of females for 1000 males)	996	1023	997	997

Source: Census of India - 2011

The Thoothukudi LPA demonstrates a high literacy rate of 90%, exceeding both district and state averages, indicating a strong human resource base suitable for skill development, service-sector growth, and advanced social infrastructure. With a balanced sex ratio of 997 females per 1,000 males, closely matching the state average, the area reflects stable social conditions, supporting inclusive urban development and equitable access to housing, employment, and social amenities. A comparison of key demographic details at the State, District, LPA and Corporation levels is given in Table 7.1.

Overall, Thoothukudi LPA demonstrates a transitional demographic character, bridging the high-density urban core of the Corporation and the lower-density rural hinterland. These characteristics underline the need for balanced spatial planning, emphasizing compact growth in identified nodes, efficient infrastructure provision, and protection of peri-urban areas from unplanned sprawl, in line with long-term master plan objectives.

7.2 Urbanisation Trend in Tamil Nadu And Thoothukudi

As per Census 2011, Tamil Nadu has a population of 7.21 crore, accounting for 5.96% of India's total population, and is among the most urbanised states in the country. Nearly 48.45% of its population resides in urban areas, which is significantly higher than the national average of 31.16%, reflecting the state's sustained industrialisation, economic diversification, and urban-centric development.

Thoothukudi District, with a population of 17.50 lakh, constitutes about 2.42% of the state's population and exhibits a relatively high urbanisation level of 42%. This elevated urban share is largely driven by the district's strong industrial base, port-related activities, and its role as a commercial, and service hub for the surrounding rural regions. Within the district, Thoothukudi city and

its Local Planning Area (LPA) play a pivotal role in shaping the urbanisation pattern, functioning as a key centre for economic activity, employment generation, and service delivery.

7.3 Source Of Baseline Data

The demographic analysis of the Thoothukudi Local Planning Area is primarily based on Census of India data (1981, 1991, 2001, and 2011) and also the population data from the Tamil Nadu Water Supply and Drainage Board, Jal Jeevan Mission of the Ministry of Jal Shakti, representing conditions up to 2025, has been used and cross-verified with data from the Tamil Nadu Civil Supplies and Public Distribution Department and updated records of Urban Local Bodies. Based on this validated dataset, population projections for the Thoothukudi Local Planning Area (LPA) have been prepared for the horizon years 2035 and 2045 to support long-term planning and development decisions.

7.4 Classification Of Towns

The classification of towns based on population size is outlined in the URDPFI Guidelines. In the case of Thoothukudi Local Planning Area (LPA), this classification helps understand the demographic changes and urban growth trends observed over the past decade. Using the data, Census 2011 and population data from the Tamil Nadu Water Supply and Drainage Board, towns within the LPA are grouped into five categories based on their population size, as shown in Table 7.2 and Map 7.1.

Table 7.2: Classification of Towns in 2011 and 2025 (Based on Population Size)

Classification of town	Number of towns (Census - 2011)	Local Bodies	Number of towns (TWAD - 2025)	Local Bodies
CLASS I (More than 1,00,000)	1	Thoothukudi MC	1	Thoothukudi MC (Korampallam Part II, Sankaraperi, Thoothukudi Rural and Mullakadu Pat I are merged with corporation)
CLASS II (50,000-99,999)	0	-	0	-

Classification of town	Number of towns (Census - 2011)	Local Bodies	Number of towns (TWAD - 2025)	Local Bodies
CLASS III (20,000-49,999)	4	Athimarapatti CT (Korampallam Part-II), Muttayyapuram CT (Mullakadu Part I), Meelavittan Part I & Mapillaiyurani CT	1	Mapillaiyurani CT
CLASS IV (10,000-19,999)	3	Thoothukudi Rural, Sankaraperi & Kumaragiri CT	3	Kumaragiri CT, Puthiamputhur CT & Pudurpandiyapuram
CLASS V (5000-9999)	5	Koothudankadu, Mudivaithanendal, Palayakayal, Puthiamputhur CT, Tharuvaikulam	4	Ayyanadaippu, Mudivaithanendal, Palayakayal & Tharuvaikulam

Source: Census of India – 2011 and Jal Jeevan Mission - 2025

From the above table, the classification of towns in the Thoothukudi Local Planning Area (LPA) shows noticeable changes between Census 2011 and Tamil nadu Water Supply and Drainage Board 2025. Thoothukudi Municipal Corporation continues to function as the only Class I town, reinforcing its role as the primary urban centre of the LPA. The reduction in the number of Class III towns is mainly due to the merger of adjoining census towns and rural areas into the Corporation, indicating administrative consolidation rather than a decline in population. Variations in Class IV and Class V towns reflect gradual urban growth and reclassification of peripheral settlements. From a planning perspective, these trends highlight the need to manage urban expansion around the Corporation area while strengthening smaller towns to achieve balanced and orderly development within the LPA.

7.5 Population Growth In Thoothukudi Corporation

The population of Thoothukudi Corporation grew from 28,048 in 1901 to over 5.23 Lakhs by 2025, with distinct variations across decades driven by health crises, administrative changes, and migration patterns, is shown in the table 7.3 and Figure 7.1.

Table 7.3: Decadal Growth Rate of Thoothukudi Corporation

Census Year	Population	Variation	Decadal Growth Rate (in %)	Remarks
1901	28,048	-	-	-
1911	40,185	12,137	43.27	-
1921	44,522	4,337	10.79	Due to the 1918 influenza epidemic
1931	60,395	15,873	35.65	-
1941	75,614	15,219	25.20	-
1951	98,866	23,252	30.75	Expansion of the Thoothukudi Municipal Corporation
1961	124,230	25,364	25.65	-
1971	155,310	31,080	25.02	-
1981	192,949	37,639	24.23	-
1991	199,854	6,905	3.58	Decadal growth rate declined due to slowdown in urban expansion and out-migration
2001	216,054	16,200	8.11	Moderate growth resumed
2011	237,830	21,776	10.08	-
2025	5,23,336	2,85,506	120.05	Expansion of the Municipal Corporation boundarie through the inclusion of adjoining villages, namely Korampallam Part II, Sankaraperi, Thoothukudi Rural and Mullakadu Part 1

Source: Census of India

In the above table, the decadal population growth rate of Thoothukudi Municipal Corporation from 1901 to 2011. In the early decades, the city experienced rapid growth, with a peak of 43.27% during 1901–1911, followed by a sharp decline to 10.79% in 1911–1921, likely due to epidemics, famine **and** migration. Between 1921 and 1951, growth rebounded to 25–35%, reflecting gradual urban expansion and industrial development. From 1951 to 1981, the growth rate showed a steady decline to 24.23%, indicating slower but stable urbanisation.

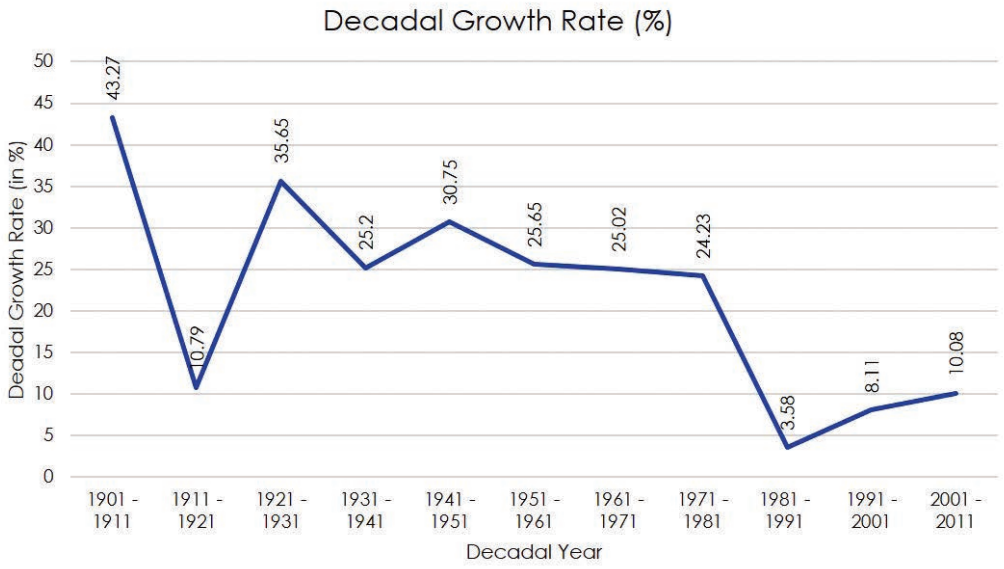


Figure 7.1: Decadal Growth Rate of Thoothukudi Corporation

And also, A significant drop in growth to 3.58% during 1981–1991 highlights a period of population stagnation, possibly caused by industrial restructuring, economic slowdown, or limitations in urban infrastructure. Growth rates recovered moderately in the following decades, reaching 8.11% (1991–2001) and 10.08% (2001–2011), suggesting a return of urban expansion at a controlled pace.

7.6 Population Distribution And Density: Thoothukudi Corporation

Population Distribution:

Thoothukudi Corporation, comprising 60 wards, covers a total area of 9,066 hectares and accommodates a projected population of 5,23,336 persons in 2025, resulting in an average density of 59 persons per hectare.

- Core urban wards with smaller geographical extents exhibit very high to extremely high population densities, often exceeding 250 persons per hectare.
- Ward-level densities range widely from as low as 4 persons/ha (Ward 60) to over 600 persons/ha (Ward 39), indicating pronounced spatial variation in urban development intensity.
- Peripheral and newly added wards (Athiramarapatti, Meelavittan, Muttuyyapuram, Pulipanchankulam and Sankaraperi) occupy large land areas but support relatively smaller populations, resulting in low to very low densities.

Table 7.4: Population Distribution of Thoothukudi Corporation

S. No.	Ward No.	Area (in Ha.)	Population 2025	Population Density - 2025 (Persons / Hectare)
1	Ward 1	2022.78	8204	5
2	Ward 2	180.70	9534	53
3	Ward 3	191.25	12429	65
4	Ward 4	33.19	8838	267
5	Ward 5	25.61	9695	379
6	Ward 6	83.27	8764	120
7	Ward 7	42.71	8176	192
8	Ward 8	26.17	9020	345
9	Ward 9	25.15	8383	334
10	Ward 10	17.59	7172	408
11	Ward 11	42.78	8785	206
12	Ward 12	61.42	6682	109
13	Ward 13	60.91	9132	150
14	Ward 14	109.66	9464	87
15	Ward 15	752.50	12110	18
16	Ward 16	152.93	9807	69
17	Ward 17	55.83	10476	188
18	Ward 18	34.32	8897	260
19	Ward 19	25.73	8680	338
20	Ward 20	22.25	9534	429
21	Ward 21	13.72	6753	493
22	Ward 22	15.98	5886	369
23	Ward 23	15.07	5712	379
24	Ward 24	18.41	6934	377
25	Ward 25	50.82	9107	180

S. No.	Ward No.	Area (in Ha.)	Population 2025	Population Density - 2025 (Persons / Hectare)
26	Ward 26	20.94	6057	290
27	Ward 27	14.64	6282	430
28	Ward 28	14.13	7299	517
29	Ward 29	61.59	12978	211
30	Ward 30	50.44	10880	216
31	Ward 31	26.37	9020	343
32	Ward 32	41.69	7606	183
33	Ward 33	64.40	7952	124
34	Ward 34	70.30	9982	142
35	Ward 35	118.32	10584	90
36	Ward 36	50.74	7667	152
37	Ward 37	30.87	8490	276
38	Ward 38	22.40	9969	446
39	Ward 39	32.21	19751	614
40	Ward 40	53.78	12754	238
41	Ward 41	26.18	9021	346
42	Ward 42	21.98	7998	364
43	Ward 43	24.65	7158	291
44	Ward 44	34.12	8985	264
45	Ward 45	47.26	10847	231
46	Ward 46	46.76	7956	171
47	Ward 47	63.53	8278	131
48	Ward 48	178.17	8029	46
49	Ward 49	589.14	7368	13
50	Ward 50	84.91	7756	92
51	Ward 51	1042.28	8043	10

S. No.	Ward No.	Area (in Ha.)	Population 2025	Population Density - 2025 (Persons / Hectare)
52	Ward 52	269.05	8159	31
53	Ward 53	104.52	7126	69
54	Ward 54	33.25	7784	235
55	Ward 55	371.24	7518	24
56	Ward 56	36.45	8775	241
57	Ward 57	185.92	7494	41
58	Ward 58	97.69	6618	68
59	Ward 59	190.41	7518	40
60	Ward 60	1585.66	5460	4
Total		**9066**	**5,23,336**	**59**

Population Density:

In 2025, the Planning Area records an overall average population density of 58 persons per hectare, with ward-wise densities distributed across defined density categories. Very Low-Density areas (<30 persons/ha) are observed in Ward 1 (5 persons/ha), Ward 15 (18), Ward 49 (13), Ward 51 (10), Ward 55 (24), and Ward 60 (4), covering localities such as Sankaraperi Village, Madathur, Vallinayapuram (Salt Pan), Balathandayutham Nagar, Athiramapatti, and SPIC.

Low Density areas (30–60 persons/ha) include Ward 48 (46), Ward 52 (31), Ward 57 (41), and Ward 59 (40), comprising localities such as Caldwell Colony, Muttayapuram, Mullakadu, and HWP Housing Colony. Moderate Density areas (60–100 persons/ha) are represented by Ward 2 (53), Ward 3 (65), Ward 6 (120), Ward 12 (109), Ward 14 (87), Ward 16 (69), Ward 50 (92), and Ward 53 (69), covering developing residential areas including Korampallam, Om Sakthi Nagar, VMS Nagar, Millerpuram, and Vallinayapuram (wards near the upper threshold).

High Density areas (100–150 persons/ha) include Ward 11 (206), Ward 13 (150), Ward 25 (180), Ward 33 (124), Ward 34 (142), Ward 35 (90), Ward 36 (152), Ward 46 (171), and Ward 47 (131), covering Polepettai, Kurunji Nagar, Teacher's Colony, Sankar Colony, Subbiah Puram, and CEG Colony (wards at transition levels).

Very High Density areas (150–250 persons/ha) are observed in Ward 4 (267),

Ward 7 (192), Ward 17 (188), Ward 18 (260), Ward 19 (338), Ward 29 (211), Ward 30 (216), Ward 32 (183), Ward 37 (276), Ward 38 (446), Ward 40 (238), Ward 44 (264), and Ward 45 (231), including Sundaravelpuram, Krishnarajapuram, Toovipuram, Tuticorin Meler, Bryant Nagar, and Levingipuram.

Extremely High Density areas (>250 persons/ha) are concentrated in Ward 5 (379), Ward 8 (345), Ward 9 (334), Ward 10 (408), Ward 20 (429), Ward 21 (493), Ward 22 (369), Ward 23 (379), Ward 24 (377), Ward 27 (430), Ward 28 (517), Ward 39 (614), Ward 41 (346), and Ward 42 (364), covering compact inner-city localities such as **Aalagashesha** Puram, Kandhasamy Puram, Nataraja Puram, Shanmugapuram, Tuticorin Meler core areas, and railway staff quarters.

Table 7.5: Classification of Population Density of Thoothukudi Corporation – 2025

S. No.	Classification	Density Range (Persons per Hectare)	No. of Wards	Wards
1	Very Low Density	less than 30	6	1, 15, 49, 51, 55, 60
2	Low Density	30 - 60	5	2, 48, 52, 57, 59
3	Moderate Density	60 - 100	7	3, 14, 169, 35, 50, 53, 58
4	High Density	100 - 150	5	6, 12, 33, 34, 47
5	Very High Density	150 - 250	14	7, 11, 13, 17, 25, 29, 30, 32, 36, 40, 45, 46, 54, 56
6	Extremely High Density	More than 250	23	4, 5, 8, 9, 10, 18, 19, 20, 21, 22, 23, 24, 26, 27, 28, 31, 37, 38, 39, 41, 42, 43, 44

7.6.1 Comparison of Population Density with Similar Corporation

The comparative analysis of population, Corporation area and population density across the port cities in India in the following table 7.6.

Table 7.6: Comparison of Population Density with Similar Corporation

Port Cities in India	Population	Area (in Ha.)	Population Density (Persons per Hectare)
Thoothukudi (TN)	3,72,408	9066	42
Kochi (KL)	6,02,046	9488	64
Mangaluru (KA)	4,88,968	13245	37
Kakinada (AP)	3,25,985	3139	104

Source: Urban local bodies from Various Cities

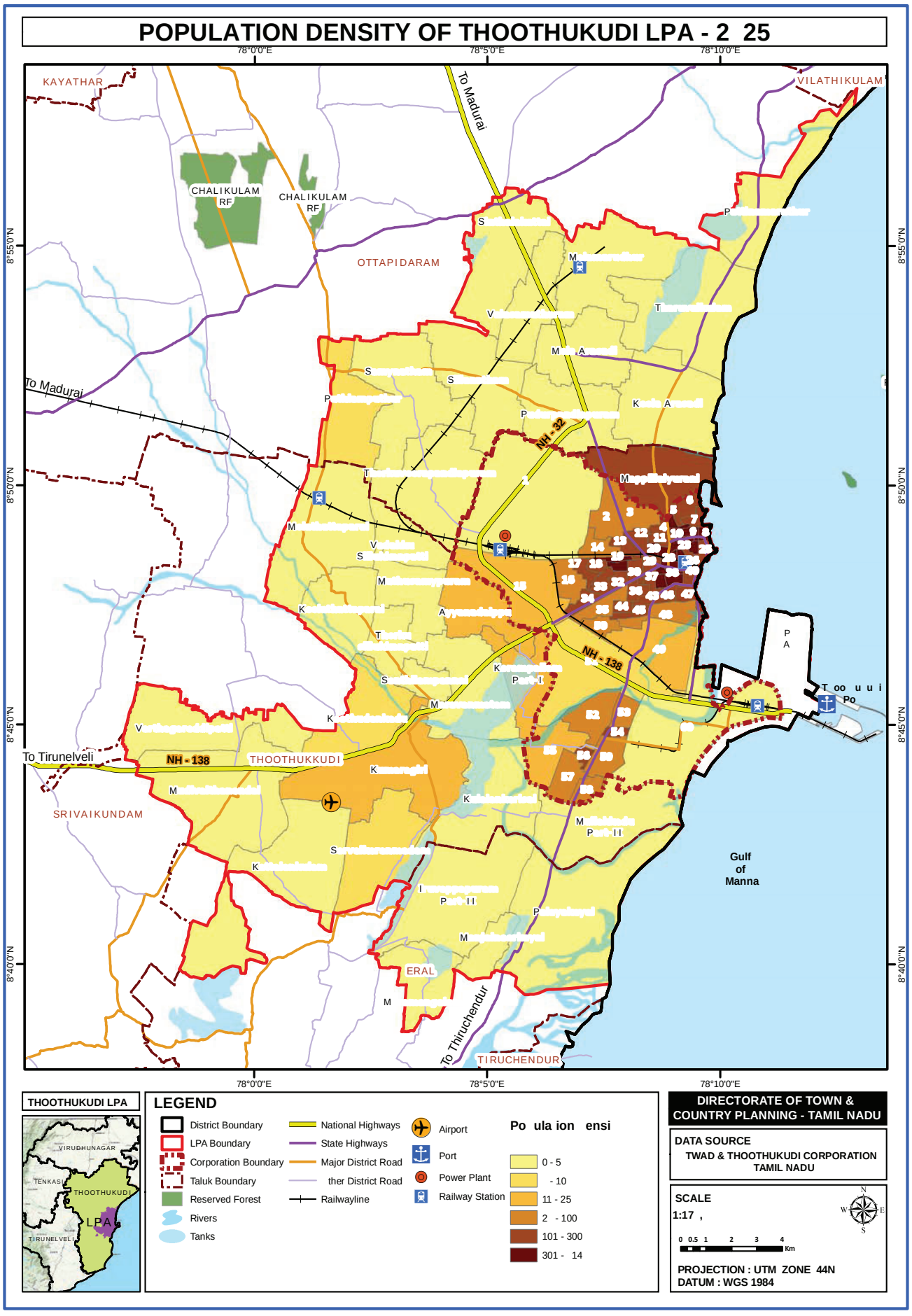
As shown in the table above, Thoothukudi, with a population of 372,408 and a moderate density of 42 persons per hectare, demonstrates a balanced urban structure compared to other major port cities such as Kochi, Mangaluru, and Kakinada. Its population size provides a sufficient labor pool to support maritime trade, logistics, and port-linked industries, while the moderate density ensures that urban services, infrastructure, and public amenities can operate efficiently without severe congestion. Compared to high-density Kakinada (104 per hectare) or more populated cities like Kochi (602,046), Thoothukudi has the advantage of being less crowded while still maintaining economic viability.

7.7 Population Distribution And Density: Rest of LPA

The population distribution within the Thoothukudi LPA demonstrates pronounced spatial variation, with Census Towns such as Mapillaiyurani (CT) and Kumaragiri (CT) exhibiting substantially higher population densities and growth rates compared to the surrounding rural settlements. Mapillaiyurani, in particular, has experienced a marked increase in population density from 15 persons per hectare in 1991 to 54 persons per hectare in 2025, supported by consistently high decadal growth rates, indicating its progressive transformation into an urbanized settlement. In contrast, interior villages including Kattalankulam, Keelathattaparai, Melathattaparai, and Vadakku Silukkanpatti continue to exhibit low and relatively static population densities of 1–2 persons per hectare, reflecting their predominantly rural character and limited urban influence.

From a temporal growth perspective, the LPA recorded a robust population increase during 1991–2001 (28.08%), followed by a moderated yet sustained growth during 2001–2011 (21.10%). Several villages show low or negative

growth rates, indicating localized demographic stagnation, while settlements within the urban influence zone display sustained increases in population and density. Overall, the emerging trend highlights a concentration of population growth in Census Towns and peri-urban areas, alongside comparatively low-density growth in the rural hinterland. This spatial pattern underscores the need for differentiated planning interventions, emphasizing infrastructure strengthening and service provisioning in high-growth nodes, while ensuring basic service accessibility and rural support systems in low-density areas across the Thoothukudi LPA.



Map 7.1: Population Density of Thoothukudi LPA in 2025

Table 7.7: Population Distribution of Rest of LPA

S. No.	Taluk	Block	Revenue Villages No.	Town / Villages	Area (in Ha.)	Population				Decadal Growth Rate (in %)			Average DGR (%)	Population Densities (Population per hectares)			
						1991	2001	2011	2025	1991 - 2001	2001 - 2011	2011 - 2025		1991	2001	2011	2025
1	Thoothukudi	Thoothukudi	18	Kumaragiri (CT)	1,623	8042	11354	13344	31845	41.18	17.53	138.65	65.79	5	7	8	9
2			27	Mapillaiyurani (CT)	873	13327	27361	40035	95992	105.31	46.32	139.77	97.13	15	31	46	54
3			23	Ayyanadaippu	674	2099	2839	4693	9847	35.25	65.30	109.82	70.13	3	4	7	10
4			13	Kattalankulam	1,908	2276	2364	2835	5586	3.87	19.92	97.04	40.28	1	1	1	1
5			5	Keelathattaparai	799	1396	1248	1382	1848	-10.60	10.74	33.72	11.28	2	2	2	2
6			6	Koothudankadu	884	2095	3820	5065	7130	82.34	32.59	40.77	51.90	2	4	6	5
7			16	Korampallam Part I	608	2818	3790	4912	7366	34.49	29.60	49.96	38.02	5	6	8	8
8			15	Kulaiankarisal	1,266	4313	4077	3951	4253	-5.47	-3.09	7.64	-0.31	3	3	3	3
9			17	Maravanmatam	1,134	2222	2625	2664	3397	18.14	1.49	27.52	15.71	2	2	2	2
10			4	Melathattaparai	1,551	2025	2007	2154	2647	-0.89	7.32	22.89	9.77	1	1	1	1
11			12	Mudivaithanendal	1,930	5039	5578	5927	9248	10.70	6.26	56.03	24.33	3	3	3	3
12			31	Mullakadu Part II	1,239	2271	2346	2191	2738	3.30	-6.61	24.97	7.22	2	2	2	2
13			21	Muthusamypuram	612	331	422	886	546	27.49	109.95	-38.37	33.02	1	1	1	3
14			19	Senthilampannai	224	190	178	103	173	-6.32	-42.13	67.96	6.50	1	1	0	6
15			14	Servaikaranmadam	1,035	4159	4490	4473	5535	7.96	-0.38	23.74	10.44	4	4	4	5
16			20	Therku Silukkanpatti	441	649	783	681	856	20.65	-13.03	25.70	11.11	1	2	2	1
17			22	Vadakku Silukkanpatti	469	543	461	473	1152	-15.10	2.60	143.55	43.68	1	1	1	3
18			10	Varthagareddipatti	1,132	1760	2159	1990	3355	22.67	-7.83	68.59	27.81	2	2	2	2

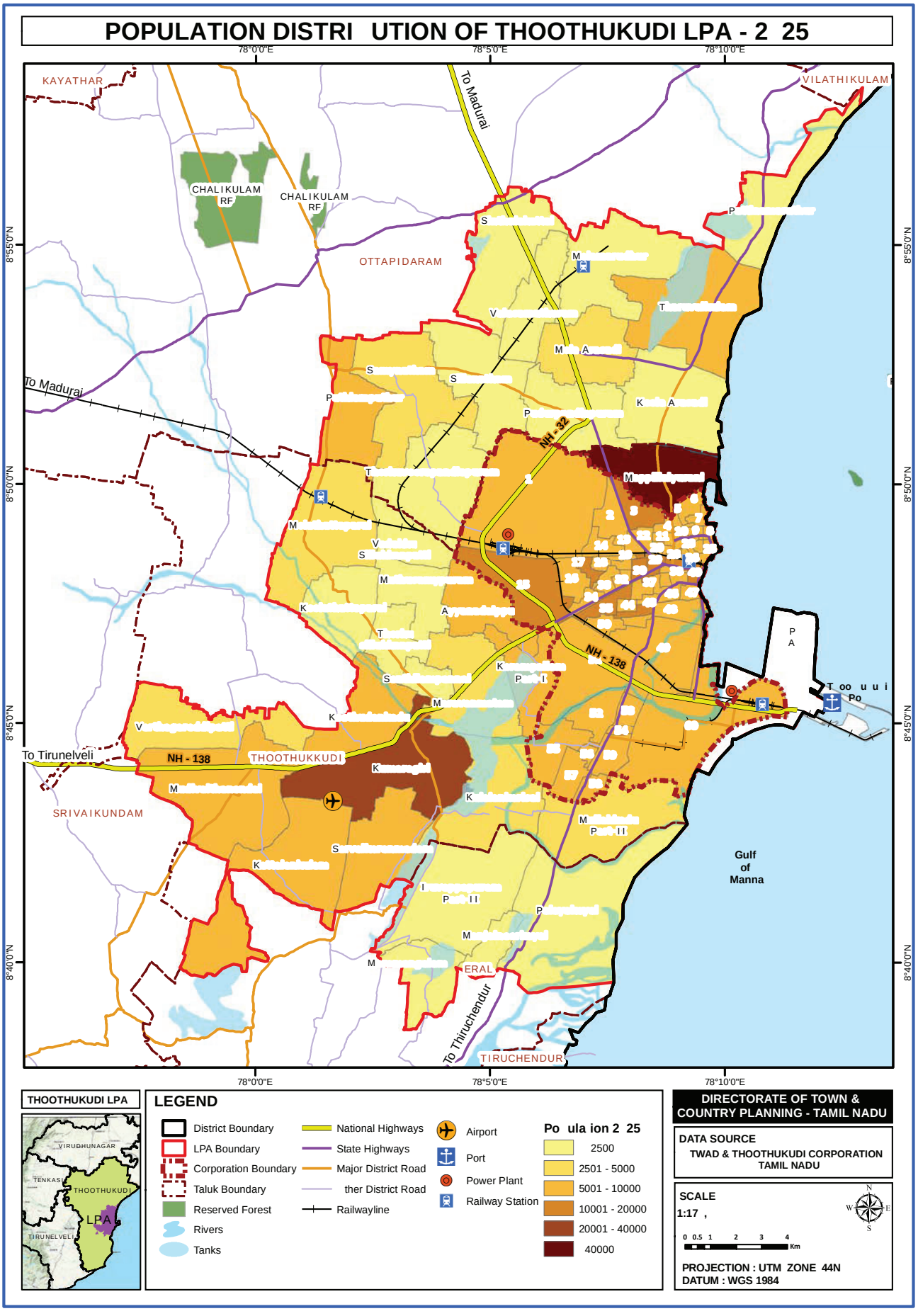
S. No.	Taluk	Block	Revenue Villages No.	Town / Villages	Area (in Ha.)	Population				Decadal Growth Rate (in %)			Average DGR (%)	Population Densities (Population per hectares)			
						1991	2001	2011	2025	1991 - 2001	2001 - 2011	2011 - 2025		1991	2001	2011	2025
19	Eral	Srivaikuntam	16	Iravappapuram Part II	1,704	1928	1872	1753	1371	-2.90	-6.36	-21.79	-10.35	1	1	1	1
20			19	Manjalneerkayal	293	1197	1170	1143	939	-2.26	-2.31	-17.85	-7.47	4	4	4	6
21			17	Maramangalam	649	3886	3882	3819	630	-0.10	-1.62	-83.50	-28.41	6	6	6	6
22			20	Palayakayal	2,260	4925	4691	5024	1616	-4.75	7.10	-67.83	-21.83	2	2	2	2
23	Ottapidaram	Ottapidaram	28	Puthiamputhur (CT) + Puthiamputhur (Part)	870	5316	6836	8837	8012	28.59	29.27	-9.34	16.18	6	8	10	12
24			56	Keela Arasadi	1,341	1368	1740	2186	2448	27.19	25.63	11.99	21.60	1	1	2	2
25			54	Mela Arasadi	887	3097	3029	1841	3597	-2.20	-39.22	95.38	17.99	3	3	2	4
26			52	Melamarudhur	1,324	447	390	1005	493	-12.75	157.69	-50.95	31.33	0	0	1	1
27			49	Pattinamarudhur	1,092	838	842	805	805	0.48	-4.39	0.00	-1.31	1	1	1	1
28			55	Pudurpandiapuram	973	1045	743	1764	1073	-28.90	137.42	-39.17	23.11	1	1	2	10
29			29	Samynatham	1,346	1929	1905	2598	2598	-1.24	36.38	0.00	11.71	1	1	2	2
30			31	Sillanatham	1,156	1515	1669	1594	1785	10.17	-4.49	11.98	5.88	1	1	1	2
31			33	Sinthalakattai	1,248	2021	2206	2430	1030	9.15	10.15	-57.61	-12.77	2	2	2	3
32			53	Tharuvaikulam	1,728	4587	6178	7325	8204	34.68	18.57	12.00	21.75	3	4	4	4
33			30	Therkuveerapandiapuram	1,288	1317	1606	1567	1567	21.94	-2.43	0.00	6.51	1	1	1	1
34			32	Valasamutharam	734	520	523	455	510	0.58	-13.00	12.09	-0.11	1	1	1	1
Rural					**37,295**	**91,491**	**117,184**	**141,905**	**2.30,192**	**28.08**	**21.10**	**62.22**	**37.13**	**2**	**3**	**4**	**5**

Source: Census of India

7.8 Population Characteristics Of Overall Planning Area

The population distribution within the Thoothukudi LPA tabulated in the Table 7.8, indicates a highly urban-concentrated growth pattern, with the Thoothukudi Municipal Corporation emerging as the dominant demographic core. Although the urban area constitutes only about 20% of the total LPA area, it accommodates more than 75% of the total population by 2025, with population density increasing sharply from 29 persons per hectare in 1991 to 59 persons per hectare in 2025. The high decadal growth rate during 2011–2025 (43.22%) highlights accelerated urbanisation driven by port-led economic activities, industrial growth, and improved infrastructure within the municipal limits.

The rural blocks, covering nearly 80% of the LPA area, continue to exhibit low-density and dispersed settlement patterns, with densities increasing modestly from 2 persons per hectare in 1991 to 5 persons per hectare in 2025. While the Thoothukudi rural block shows relatively higher growth due to peri-urban influence, Eral **and** Ottapidaram display moderate and spatially diffused growth.



Map 7.2: Population Distribution of Thoothukudi LPA in 2025

Table 7.8: Population Distribution of Thoothukudi LPA

S. No.	Towns / Villages	Area (in Ha.)	Population				Decadal Growth Rate (in %)			Average Decadal Growth Rates (in %)	Population Density (Persons per Ha.)			
			1991	2001	2011	2025	1991 - 2001	2001 - 2011	2011 – 2025		1991	2001	2011	2025
1	Thoothukudi Corporation	9066	2,60,053	3,20,466	3,72,408	5,33,372	23.23	16.21	43.22	23.28	29	35	41	59
	Urban	**9066**	**2,60,053**	**3,20,466**	**3,72,408**	**5,33,372**	**23.23**	**16.21**	**43.22**	**23.28**	**29**	**35**	**41**	**59**
	Blocks													
1	Thoothukudi	18,402	55,555	77,902	97,759	1,93,514	40.23	25.49	97.95	54.55	3	4	5	6
2	Eral	4,906	11,936	11,615	11,739	4,556	-2.69	1.07	-61.19	-20.94	2	2	2	3
3	Ottapidaram	13,987	24,000	27,667	32,407	32,122	15.28	17.13	-0.88	10.51	2	2	2	3
	Rural	**37,295**	**91,491**	**1,17,184**	**1,41,905**	**2,30,192**	**28.08**	**21.10**	**62.22**	**37.13**	**2**	**3**	**4**	**5**
	Total	**46,361**	**3,51,544**	**4,37,650**	**5,14,313**	**7,63,564**	**24.49**	**17.52**	**48.46**	**30.16**	**8**	**9**	**11**	**15**

Source: Census of India, TWAD & ULB

7.9 Other Demographic Characteristics

The other demographic characteristics of the Thoothukudi Local Planning Area (LPA) encompass notable spatial and socio-economic variations in Scheduled Caste (SC) & Scheduled Tribes (ST), literacy **rates**, sex ratio, age composition, persons with disabilities, and migration patterns, reflecting the diverse demographic structure of the region.

7.9.1 Scheduled Castes And Schedules Tribes Contributions

Scheduled Caste (SC):

The Scheduled Caste (SC) population in the Thoothukudi Local Planning Area (LPA) is significant, numbering 80,143 persons, of which about 57% (45,806) reside in urban areas. Concentrations are observed within the Thoothukudi Municipal Corporation and Census Towns such as Milavittan, Muttayyapuram, and Mappilaiurani, reflecting the historical association of SC communities with port-based activities, salt pan operations, fishing and fish-processing, industries, and urban service-sector employment. The SC population shows a near-balanced gender composition. The rural SC population (34,337 persons) is spread across villages including Ayyanadaippu, Pudur Pandiyapuram, Korampallam (Part), Kuttudankadu, Mudivaithanendal, and Maramangalam, with livelihoods largely linked to agriculture, salt pans, fishing, and allied informal activities.

Scheduled Tribes (ST):

The Scheduled Tribe (ST) population is relatively small at 1,039 persons and is largely urban-based (591 persons), with sparse rural presence in select villages such as **Ayyanadaippu**, Sindalakottai, Kuttudankadu, Mudivaithanendal, and Kuliyankarisal. The limited and dispersed ST distribution indicates that the LPA is not a tribal-dominated region.

7.9.2 Literacy Rate

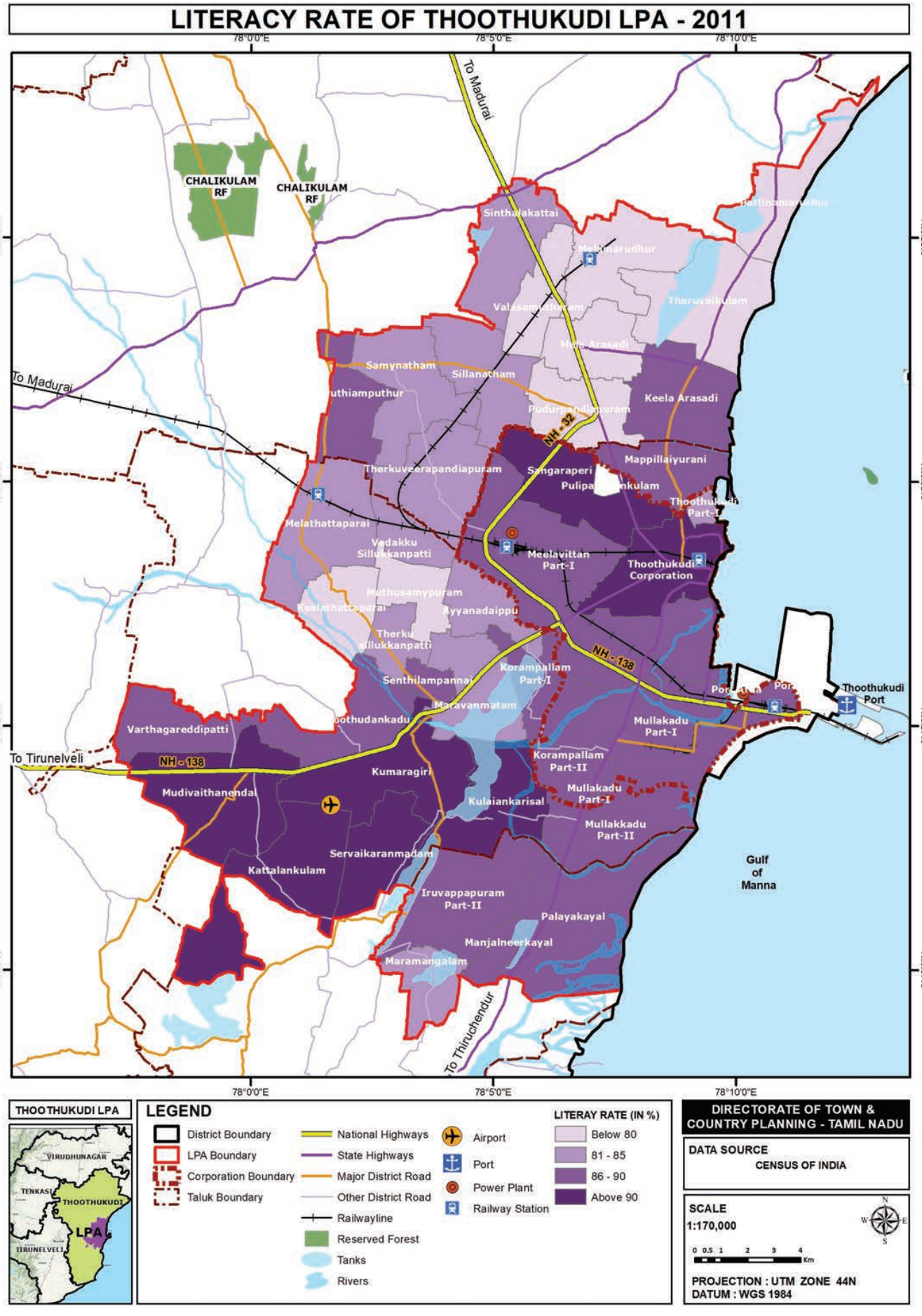
The literacy profile of Thoothukudi LPA, as presented in Table 7.9, indicates that the planning area is predominantly characterized by high literacy levels, with an overall literacy rate of 90%, thereby placing the LPA within the High Literacy category (above 80%). Urban areas, particularly the Thoothukudi Municipal Corporation and the Census Towns, consistently record literacy rates ranging from 86% to 94%, reflecting better access to educational infrastructure, urban amenities, and socio-economic opportunities. Notably, several rural villages such as Mudivaithanendal (95%), Pudiyamputhur (95%), Kattalangulam (93%), and Servaikaranmadam (93%) also exhibit literacy levels exceeding 90%, indicating effective outreach and penetration of basic education beyond the urban core.

Table 7.9: Distribution of Literate Rate in Thoothukudi LPA

S. No.	Classification	Range of Literate Rate	Literacy Rate (in no. of Villages)		
			Overall	Male	Female
1	High Literacy	Above 80%	33	40	22
2	Good Literacy	71% - 80%	7	1	13
3	Transitional	61% - 70%	1	0	5
4	Backward areas	51% - 60%	0	0	1
5	Special Educational Deprivation	Below 50%	0	0	0

Source: Census of India - 2011

At the same time, the classification reveals localized disparities, particularly in female literacy, with certain villages such as Keelathattapparai (63%) falling within the Transitional category (61–70%). Villages categorized under the Good Literacy range (71–80%) point to areas requiring targeted educational interventions, especially focused on improving female enrolment, retention, and educational attainment.



Map 7.3: Literacy Rate of Thoothukudi LPA in 2011

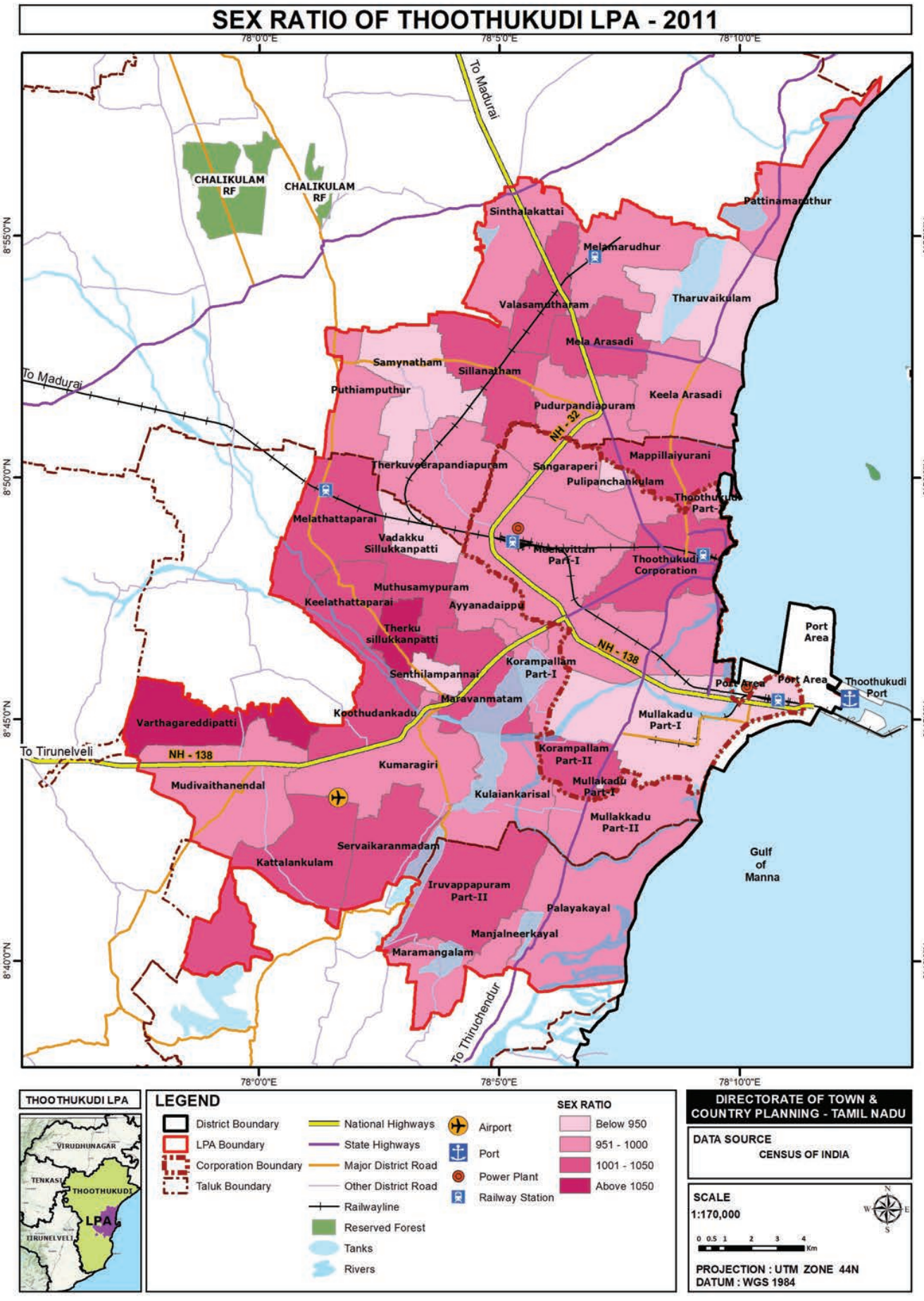
7.9.3 Sex Ratio

The sex ratio across the Thoothukudi Local Planning Area as presented in the table 7.10, is generally healthy and balanced, with an overall sex ratio of 997, indicating near parity between males and females. A large number of rural villages fall under the Highly Healthy category, showing a relatively higher presence of females. This trend is commonly observed in areas with stable livelihoods based on agriculture, fishing, and salt pan activities. Most urban areas and Census Towns fall within the Healthy/Balanced category; however, a few industrial and port-oriented settlements such as Muttayyapuram and Swaminatham exhibit moderate imbalance, which may be attributed to male-dominated in-migration for employment.

Table 7.10: Distribution of Sex Ratio in Thoothukudi LPA

Category	Sex Ratio Range	No. of Villages
Highly Healthy	Above 1050	Muthuswamipuram (1105), Terkusilukkanpatti (1083), Varthakareddipatti (1058),
Healthy / Balanced	1001 - 1050	Iruvappapuram (1032), Maravanmatam (1031), Mela Arasadi (1028), Valasamuthram (1023), Mela Thattaparai (1021), Kattalangulam (1021), Mullakadu (Part) (1018), Thoothukkudi (M Corp.) (1011), Athimarapatti (1006), Urban Avg. (997), Mappilaiurani (1017), Servaikaranmadam (1014), Keelathattapparai (1009), Sillanatham (1006), Kuttudankadu (1004)
Moderately Skewed	951 - 1000	Sindalakottai (1000), Therkuveerapandiyapuram (997), Mudivaithanendal (997), Keela Arasadi (997), Maramangalam (996), Palayakkayal (995), Kuliyankarisal (992), Mela Maruthur (991), Manjanirkayal (988), Sankaraperi (985), Pattanamarudur (983), Kumaragiri (982), Thoothukudi (982), Milavittan (980), Rural Avg. (997), Overall LPA (997), Korampallam (Part) (976), Pudiyamputhur (Part) (969), Pudur Pandiyapuram (960),
Severely Skewed	Below 950	Tharuvaikulam (950), Pudiyamputhur (CT) (947), Sendilampannai (944), Muttayyapuram (932), Swaminatham (926), Vadakkusilukkanpatti (915)

Source: Census of India - 2011



Map 7.4: Sex Ratio of Thoothukudi LPA in 2011

Table 7.11: Distribution of Other Demographic Characteristics in Thoothukudi LPA

S. No.	Administrative Units	SC Population			ST Population			Literacy Rate (jn %)			Sex Ratio
		Total	Male	Female	Total	Male	Female	Total	Male	Female	
1	Thoothukudi Corporation	45,806	23,167	22,639	591	304	287	92	94	89	997
	Urban	**45,806**	**23,167**	**22,639**	**591**	**304**	**287**	**92**	**94**	**89**	**997**
	Blocks										
1	Thoothukudi	21,155	10,608	10,547	408	211	197	89	93	85	1007
2	Eral	3,912	1,962	1,950	0	0	0	86	91	81	1000
3	Ottapidaram	9,270	4,728	4,542	40	17	23	82	88	77	978
	Rural	**34,337**	**17,298**	**17,039**	**448**	**228**	**220**	**87**	**91**	**83**	**1000**
	Total	**80,143**	**40,465**	**39,678**	**1,039**	**532**	**507**	**90**	**94**	**87**	**998**

Source: Census of India - 2011

7.9.4 Age Sex Composition

Based on the Census of India 2011, Thoothukudi District had a total population of 17.50 lakh persons. The age–sex pyramid for thoothukudi district shown in the Figure 7.2, indicates that the working-age population (20–59 years) formed the major share, accounting for about 9.7 lakh persons (around 56%). The highest population concentration was in the 40–49 years age group (2.31 lakh), followed by 25–29 years (1.56 lakh). The child population (0–14 years) stood at about 4.29 lakh (25%), reflecting moderate fertility levels and a gradual movement towards population stabilisation even at the time of the 2011 Census.

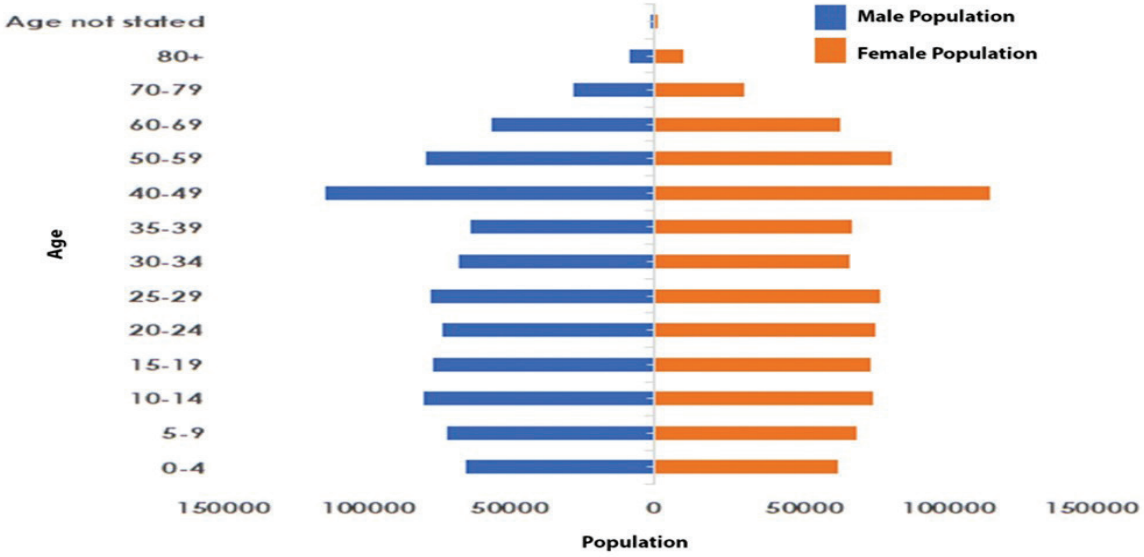


Figure 7.2: Age Sex Pyramid of Thoothukudi District – 2011

The major working-age cohorts recorded in the 2011 Census would have gradually transitioned into the 30–69 years age groups, leading to an increasing share of middle-aged and elderly population. The population aged 60 years and above, which was 1.99 lakh (11%) in 2011, is expected to have increased further over time. The sex composition showed a higher number of females (8.85 lakh) compared to males (8.65 lakh), particularly in the older age groups, indicating better female life expectancy, a trend likely to continue.

7.9.5 Person with Disabilities

The district has a total of 31,370 persons with disabilities (PwDs). Out of this, 18,095 persons (57.7%) live in rural areas, while 13,275 persons (42.3%) live in urban areas. Males account for 16,925 persons (54.0%), and females account for 14,445 persons (46.0%), showing that PwDs are slightly more among males across both urban and rural areas.

The age-wise distribution of persons with disabilities in Thoothukudi District shown in the table 7.12, concentration in the working-age population (20–49 years), which accounts for 15,961 persons (about 51%) of the total. The highest numbers are in the 20–29 age group (5,842; 18.6%) and 30–39 age group (5,689; 18.1%), indicating a significant impact on the productive workforce.

Children and adolescents (0–19 years) form 6,805 persons (21.7%), highlighting the need for early detection and inclusive education. The elderly population (60 years and above) accounts for 9,360 persons (29.8%), reflecting age-related disabilities and increased demand for healthcare and support services. Overall, the data highlights the need for age-specific interventions, focusing on employment support for working-age **PwDs** and healthcare and mobility assistance for the elderly.

Table 7.12: Person with Disabilities of Thoothukudi District in 2011

Administrative Unit	Age group	Total population of persons with disabilities (2011)
Thoothukudi District	0-4	811
	5-9	1641
	10-19	4353
	20-29	5842
	30-39	5689
	40-49	4430
	50-59	3216
	60-69	2848
	70-79	1738
	80-89	643
	90+	131
	Age not stated	28
	Total	**31370**

Source: Census of India - 2011

In terms of type of disability shown in the table 7.13, locomotor disability is the most common, with 8,903 persons (28.4%). This is followed by hearing impairment with 5,360 persons (17.1%), other types of disabilities with 4,588 persons (14.6%), and low vision affecting 3,751 persons (12.0%). Mental

retardation accounts for 2,988 persons (9.5%), multiple disabilities for 2,472 persons (7.9%), speech disabilities for 2,006 persons (6.4%), and mental illness for 1,302 persons (4.2%) of the total PwD **population.**

Table 7.13: Overall Type-wise Distribution of Disabilities (Total Population) - 2011

Disability Type	Total Population		
	Total	Male	Female
Low Vision	3,751	1,884	1,867
Hearing impairment	5,360	2,516	2,844
Speech Disabilities	2,006	1,089	917
Locomotor Disabilities	8,903	5,310	3,593
Mental Retardation	2,988	1,639	1,349
Mental illness	1,302	631	671
Other types	4,588	2,507	2,081
Multiple Disabilities	2,472	1,349	1,123
Total Population	31,370	16,925	14,445

Source: Census of India - 2011

Rural areas show a higher share of PwDs across most disability types. For example, locomotor disability in rural areas accounts for 5,045 persons, nearly 57% of all locomotor-disabled persons, while hearing impairment in rural areas includes 3,286 persons (about 61%) of the total hearing-impaired population.

7.9.6 Migration Population

As per the Census of India 2011, Thoothukudi District has 6.95 lakh migrants as presented in the Table 7.14, indicating considerable population movement within and into the district. A majority of migrants are females (4.11 lakh) compared to males (2.84 lakh). The main reason for migration is marriage, accounting for 2.12 lakh persons, of which 1.94 lakh are females. Migration due to moving with household (1.29 lakh) and other reasons (1.57 lakh) also forms a significant share, showing that family-related and social reasons largely influence migration in the district.

Table 7.14: Migration Population of Thoothukudi District in 2011

Reason for Migration	Total	Male Population	Female Population
Total Migrants	**6,95,370**	**2,84,360**	**4,11,010**
Work / Employment	84,503	66,728	17,775
Business	3,129	2,300	829
Education	10,058	4,699	5,359
Marriage	2,12,410	18,006	1,94,404
Moved after Birth	99,408	54,521	44,887
Moved with Household	1,29,062	57,415	71,647
Other Reasons	1,56,800	80,691	76,109

Source: Census of India - 2011

Migration for work or employment accounts for 84,503 persons, with males forming the major share (66,728 males), reflecting male-dominated labour movement associated with port-related activities, industries, fishing, salt pan work, and services. Migration for education (10,058 persons) shows a nearly balanced gender composition, indicating improved access to education for both males and females. Overall, the migration pattern of Thoothukudi District is mainly socially driven, with employment-related migration playing a supporting role, highlighting the need for adequate housing, basic amenities, employment support, and social infrastructure for migrant populations.

7.10 Workforce Distribution

Between 1991 and 2011, Thoothukudi LPA experienced steady growth in both population and workforce, as shown in the Table 7.15. Urban areas consistently accommodated the majority of the population, accounting for 74.0% in 1991, 73.2% in 2001, and 72.4% in 2011, while rural areas constituted the remaining 26–28%. The workforce distribution closely followed this pattern, with urban areas contributing 73.5% of workers in 1991, 70.2% in 2001, and 70.4% in 2011, and rural areas contributing 26.5–29.6%.

Table 7.15: Population Projection of Thoothukudi LPA using various methods

Type	Category	Census Year		
		1991	2001	2011
Population Distribution	Urban	2,60,053	3,20,466	3,72,408
	Rural	91,491	1,17,184	1,41,905
	Total	**3,51,544**	**4,37,650**	**5,14,313**
Worker Population Distribution	Urban	83,807	1,09,987	1,34,618
	Rural	30,200	46,660	56,611
	Total	**1,14,007**	**1,56,647**	**1,91,229**

The overall workforce participation rate increased from 32.4% in 1991 to 35.8% in 2001 and further to 37.2% in 2011, indicating improved economic engagement. Notably, the rural workforce share was marginally higher than its population share, reflecting continued dependence on agriculture, fishing, salt-pan, and allied activities.

7.11 Population Projection

The population growth of Thoothukudi Local Planning Area (LPA) reflects its transition into a port-led industrial and economic hub in southern Tamil Nadu. Between 1981 and 2011, the population increased from 3.17 lakh to 5.14 lakh, indicating steady and moderate growth. During this period, nearly 75% of the population remained concentrated within Thoothukudi Corporation, supported by established port activities, industrial base, and urban infrastructure, resulting in a compact and centralised urban form with limited outward expansion.

During 2011–2025, the LPA experienced accelerated growth with an additional population of about 1.88 lakh. This growth was driven by the expansion of V.O. Chidambaranar Port, development of SIPCOT and allied industrial clusters, and increased investments in energy, logistics, transport, and port connectivity, leading to substantial employment generation and in-migration. Based on the observed growth trends and planning requirements, population projections for the horizon year 2045 have been prepared using multiple standard projection techniques, namely Arithmetical Increase, Geometrical Increase, Incremental Increase, Least Squares, Exponential Curve, and Average Growth Rate methods. The comparative results of these projection methods are presented in Figure 7.3 and form the basis for assessing future infrastructure, housing, and service requirements within the Thoothukudi LPA.

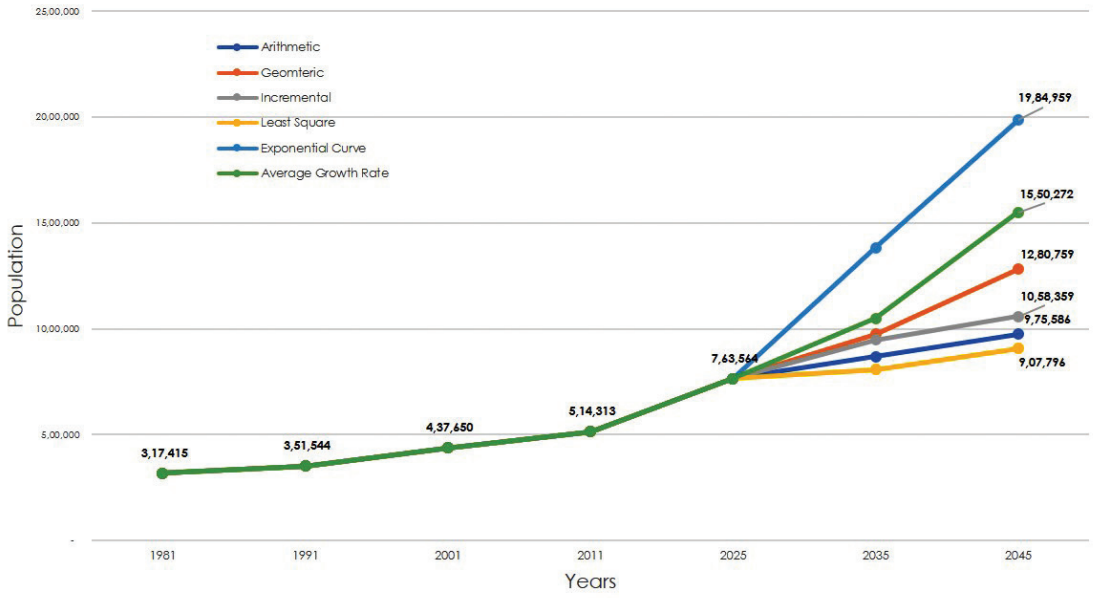


Figure 7.3: Projected Population of Thoothukudi LPA using Various methods

Table 7.16: Population Projection of Thoothukudi LPA using various methods

Year	Arithmetical Increase	Geometrical Increase	Exponential Curve	Least Square	Incremental Increase	Average Growth Rate
1981	3,17,415					
1991	3,51,544					
2001	4,37,650					
2011	5,14,313					
2025	7,02,029					
2035	**8,69,583**	**9,74,111**	**13,84,232**	**8.08.045**	**9,46,824**	**10,48,439**
2045	**9,75,586**	**12,80759**	**19,84,959**	**9,07,796**	**10,58,359**	**15,50,272**

Employment-Driven Population Projection Strategy for Thoothukudi LPA:

- Population projections for Thoothukudi LPA are based on expected employment growth, considering major industrial and infrastructure investments during 2015–2025, which are estimated to create about 2.01 lakh jobs (around 69,047 direct and 1,16,221 indirect).

- Based on the URDPFI Guidelines, the migrant population is assumed that about 30% of these jobs (around 55,580) will be taken by daily commuters from outside the planning area, and about 20% (around 37,054 jobs) will be filled by the existing population.
- The remaining jobs are expected to attract migrant workers, mainly for blue-collar work. Based on a smaller household size for migrants, an additional population of about 2.77 lakh persons is expected, which will require phased provision of housing, infrastructure, and urban services, especially in industrial and peri-urban areas.
- The additional migrant population has been phased evenly, with 50% included in the 2035 population projections and the remaining 50% in the 2045 projections.

Table 7.17: Existing and Projected Population for Thoothukudi LPA

Administrative Units	Existing Population					Projected Population	
	1981	1991	2001	2011	2025	2035	2045
Thoothukudi Corporation	2,35,473	2,60,053	3,20,466	3,72,408	5,33,372	6,67,977	8,28,955
Revenue Villages	81.942	91.491	1,17,184	1,41,905	1,68,657	4,45,085	7,48,155
Thoothukudi LPA	**3,17,415**	**3,51,544**	**4,37,650**	**5,14,313**	**7,02,029**	**11,13,062**	**15,77,110**

Note: 1. The population projection for 2045 shall be reviewed and updated based on the findings of the upcoming Census 2027, ensuring improved accuracy and alignment with the latest demographic trends.

2. The Migrant population added to the projected population of 2045

Table 7.18: Summary of Projected population for Thoothukudi LPA

S. No.	Administrative Units	Area (in Ha.)	Population 2035	Population 2045	Average Decadal Growth Rate (in %)	Population Density – 2045 (Persons per Ha.)
1	Thoothukudi Corporation	9,066	6,67,977	8,28,955	23.74	91
	Urban	**9,066**	**6,67,977**	**8,28,955**	**23.74**	**91**
	Blocks					
1	Thoothukudi	18,402	3,67,173	6,25,427	56.79	34
2	Eral	4,906	13,331	22,113	34.02	5
3	Ottapidaram	13,987	64,581	1,00,615	31.79	7

S. No.	Administrative Units	Area (in Ha.)	Population 2035	Population 2045	Average Decadal Growth Rate (in %)	Population Density – 2045 (Persons per Ha.)
	Rural	37,295	4,45,085	7,48,155	47.42	20
	Total	46,361	11,13,062	15,77,110	31.45	34

7.11.1 Population Growth Trends

The total population of the LPA increased from 3,17,415 in 1981 to 5,14,313 in 2011, registering a steady decadal growth rate ranging between 10.75% and 24.49% during the period 1981–2011. A significant acceleration in growth is observed during the post-2011 period, with the population projected to reach 7,63,564 by 2025, 11,13,062 by 2035, and 15,77,110 by 2045 (shown in the map 7.5 & 7.6).

The projected decadal growth rates for the LPA are 48.46% (2011–2025), 45.77% (2025–2035) and 41.69% (2035–2045). Although the growth rate shows a marginal declining trend over successive decades, the absolute population increase remains substantial, indicating sustained in-migration driven by employment generation, industrial expansion and improved regional connectivity.

Urban Population Growth – Thoothukudi Corporation

The urban population increased from 2,35,473 in 1981 to 3,72,408 in 2011, accounting for nearly 72% of the total LPA population in 2011. During the same period, the decadal growth rate peaked at 23.23% during 1991–2001, reflecting rapid urbanisation.

Post-2011, urban growth has intensified considerably, with the population projected to increase to 5,33,372 by 2025, 6,67,977 by 2035, and 8,28,955 by 2045. The exceptionally high decadal growth rate of 43.22% during 2011–2025 indicates strong in-migration, expansion of port-based industries, and consolidation of urban services. The average decadal growth rate for the urban area stands at 23.74%, confirming its continued dominance within the regional settlement structure.

Rural Population Dynamics and Block-wise Analysis

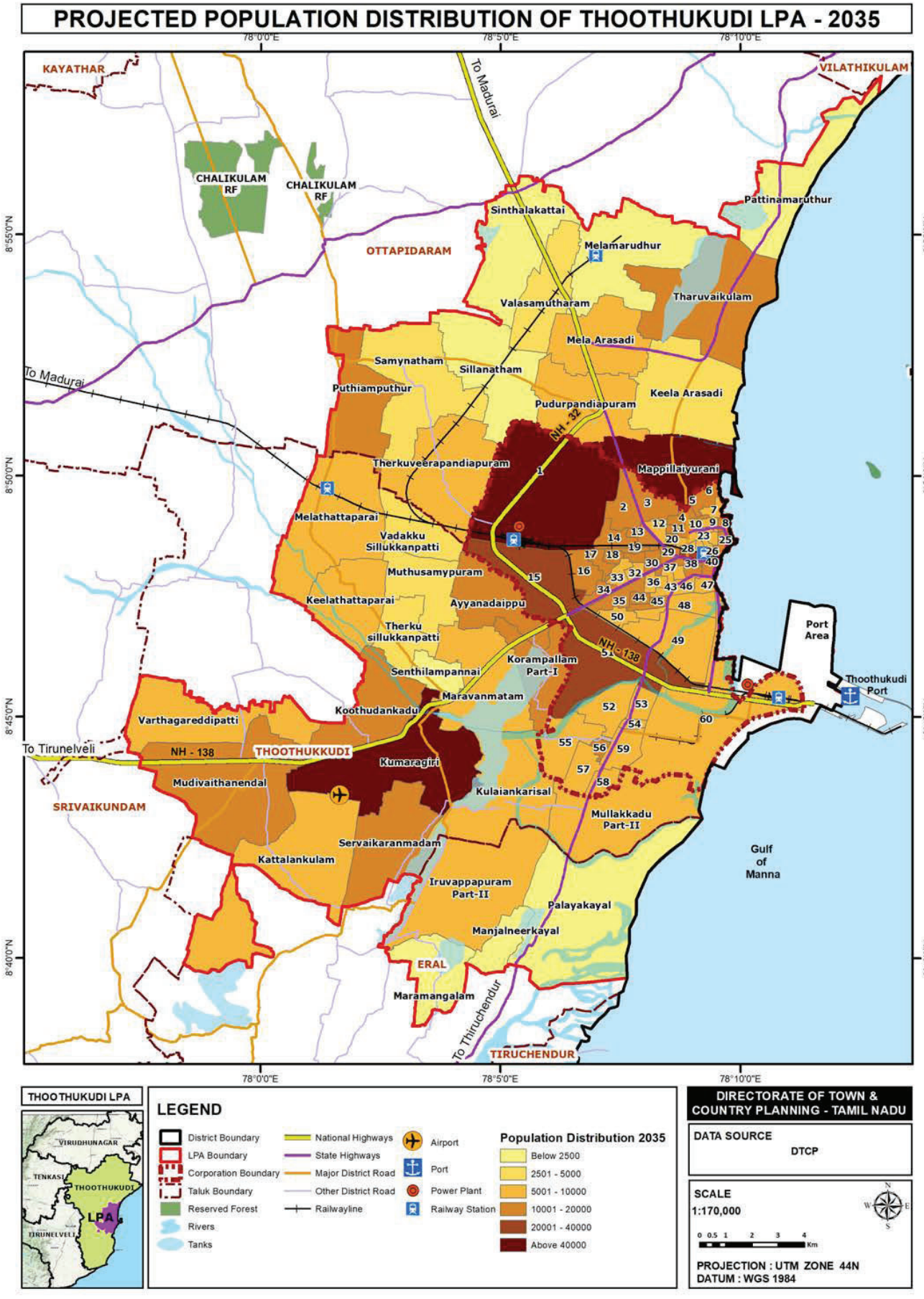
The rural areas of the population increase from 81,942 in 1981 to 1,41,905 in 2011. While rural growth remained moderate up to 2011, a sharp increase is projected thereafter, with the rural population expected to reach 2,30,192 by 2025, 4,45,085 by 2035, and 7,48,155 by 2045. The rural decadal growth

rate during 2011–2025 is notably high at 62.22%, highlighting rapid peri-urbanisation and outward spread of urban influence.

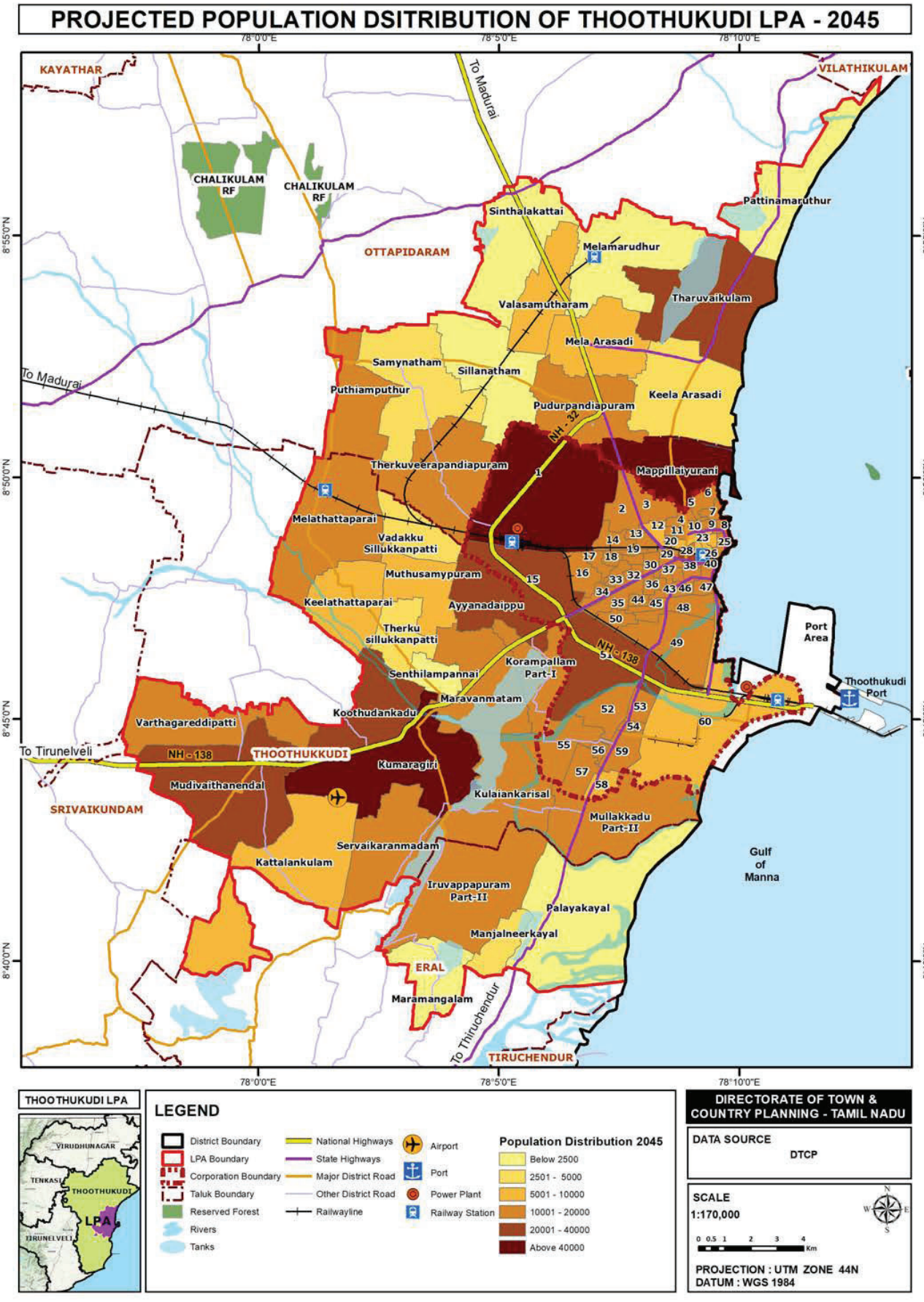
Thoothukudi Block exhibits the highest growth among the blocks, with population increasing from 97,759 in 2011 to 1,93,514 by 2025, and further projected to reach 6,25,427 by 2045. The block records a very high average decadal growth rate of 56.79%, largely due to its proximity to the Corporation, industrial estates and major transport corridors.

Ottapidaram Block demonstrates consistent and stable growth, with population increasing from 32,407 in 2011 to 1,00,615 by 2045. The growth pattern reflects the gradual transformation of rural settlements into employment-supporting nodes influenced by industrial and logistics development.

Eral Block shows comparatively slower growth and periods of stagnation, particularly during 2011–2025, where a decline is observed, because of the larger area of salt pan fields and agricultural fields.



Map 7.5: Projected Population for Thoothukudi LPA – 2035



Map 7.6: Projected Population for Thoothukudi LPA – 2045

7.11.2 Population Density Pattern

Population density of Thoothukudi LPA is shown in the map 7.7, LPA has increased steadily from 7 persons per hectare in 1981 to 11 persons per hectare in 2011, reflecting gradual urban expansion. By 2025, the overall density is projected to increase to 16 persons per hectare, further rising to 24 persons per hectare by 2035 and 34 persons per hectare by 2045. The projected population density map of Thoothukudi LPA for 2035 and 2045 as illustrated in the Map 7.7 and 7.8.

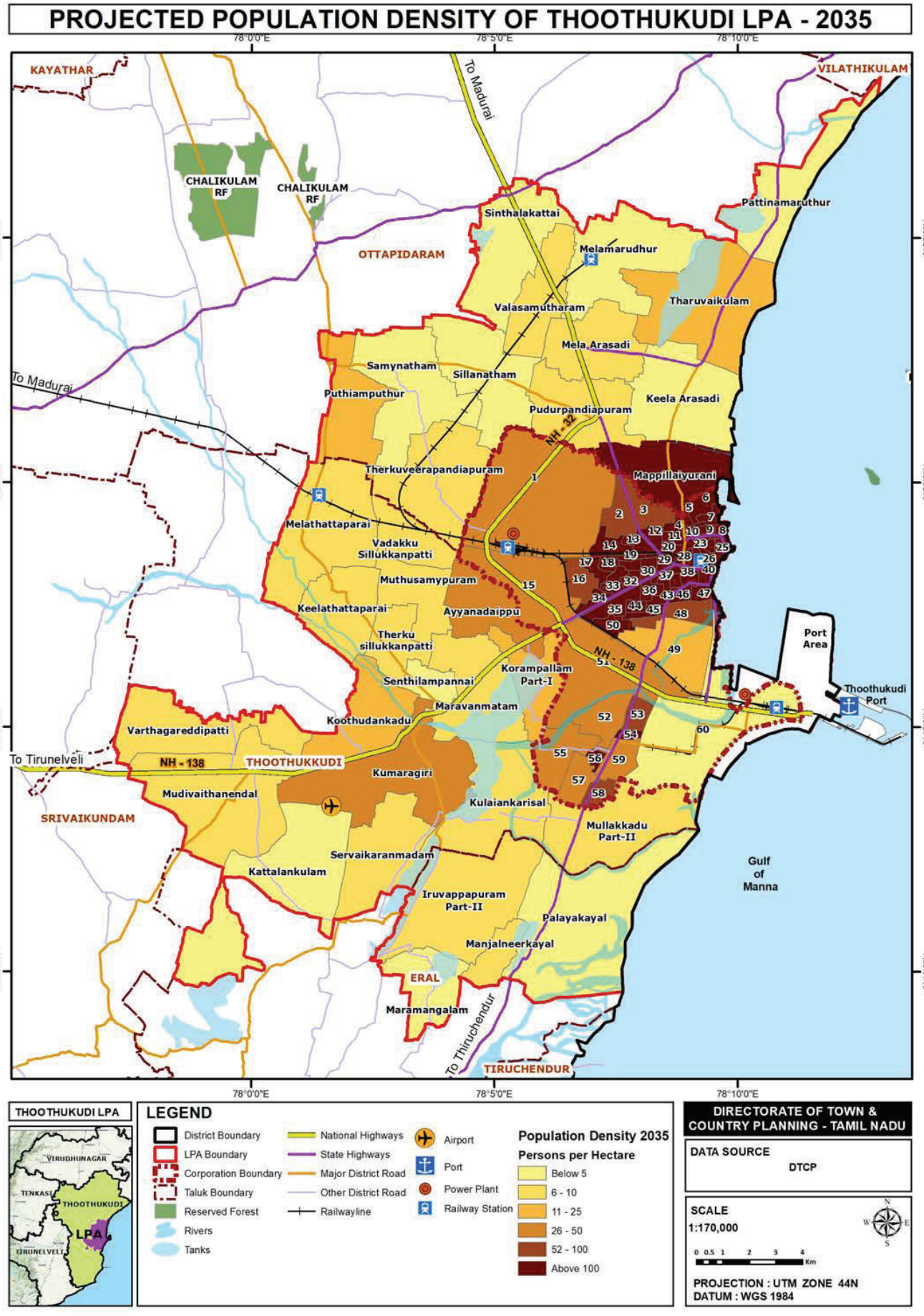
Corporation

The ward-wise population assessment for the Planning Area indicates a total population of 5.23 lakh in 2025, which is projected to increase to 6.68 lakh by 2035 and further to 8.29 lakh by 2045. Correspondingly, the average population density of the Planning Area is expected to increase from 58 persons per hectare in 2025 to 74 persons per hectare in 2035 and 92 persons per hectare in 2045, indicating steady and planned urban growth over the horizon period.

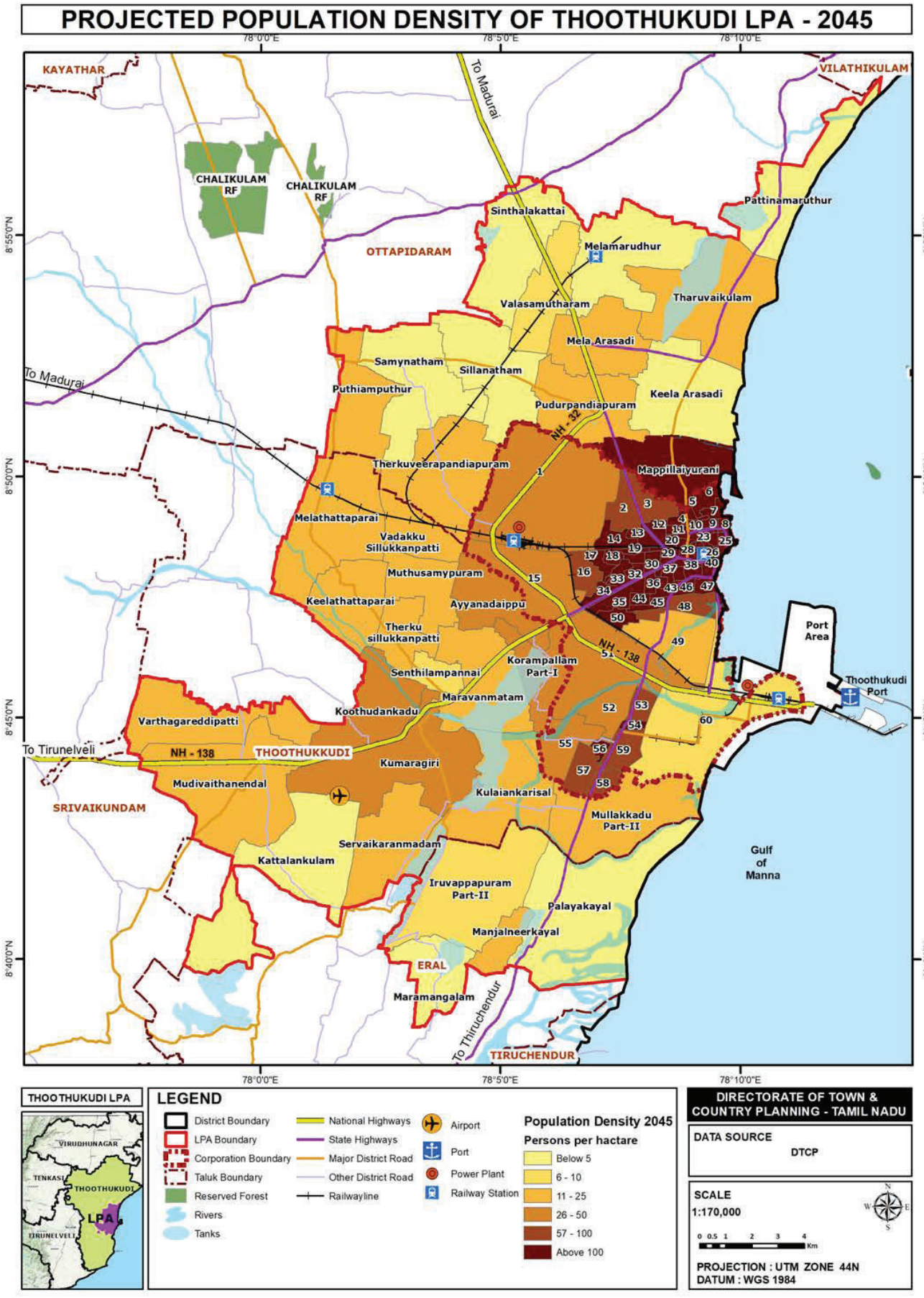
The Core wards, comprising established residential, commercial, institutional, and port-related neighbourhoods such as Sundaravelpuram, Krishnarajapuram, Threspuram, Aalagashesha Puram, Kandhasamy Puram, Polepettai, Kurunji Nagar, VMS Nagar, Anna Nagar, Shanmugapuram, Tuticorin Meler, Bryant Nagar, Levingipuram, CEG Colony, and SPIC, are expected to experience stable and moderate population growth during 2035 and 2045. Growth in these areas will largely be governed by natural increase and limited redevelopment within the existing urban fabric. And, the added villages, including emerging and peripheral localities such as Sankaraperi Village, Milavittan Industrial Area, Korampallam, Millerpuram, Rajiv Nagar, Pushpa Nagar, Vallinayapuram, Balathandayutham Nagar, Muttayapuram, Athiramapatti, VOC Nagar, Mullakadu, Saveriyapuram, and HWP Housing Colony, are projected to accommodate a larger share of future population increase owing to the availability of developable land and planned expansion potential.

Rest of LPA

Rural densities, though relatively low, are expected to increase significantly from 4 persons per hectare in 2011 to 20 persons per hectare by 2045, reflecting the conversion of agricultural and vacant lands into residential, industrial and mixed-use developments.



Map 7.7: Projected Population Densities for Thoothukudi LPA – 2035



Map 7.8: Projected Population Densities for Thoothukudi LPA – 2045

Table 7.19: Population Growth, Density, and Projections for Thoothukudi LPA (1991–2045)

Administrative Units	Population 1991	Population 2001	Population 2011	Population 2025	Growth Rate 1991 - 2001 (in %)	Growth Rate 2001 - 2011 (in %)	Growth Rate 2011 - 2025 (in %)	Population Density 2025 (pph)	Population 2035	Population 2045	Growth Rate 2035 - 2045 (in %)	Population Density 2045 (pph)
Thoothukudi Corporation	**2,60,053**	**3,20,466**	**3,72,408**	**5,33,372**	**23.23**	**16.21**	**43.22**	**59**	**6,67,977**	**8,28,955**	**24.10**	**91**
Blocks												
Thoothukudi	55,555	77,902	97,759	193,514	40.23	25.49	97.95	11	3,67,173	6,25,427	70.34	34
Eral	11,936	11,615	11,739	4,556	-2.69	1.07	-61.19	1	13,331	22,113	65.88	5
Ottapidaram	24,000	27,667	32,407	32,122	15.28	17.13	-0.88	2	64,581	1,00,615	55.80	7
Rural	**91,491**	**1,17,184**	**1,41,905**	**2,30,192**	**28.08**	**21.10**	**62.22**	**6**	**4,45,085**	**7,48,155**	**68.09**	**20**
Overall LPA	**3,51,544**	**4,37,650**	**5,14,313**	**7,63,564**	**24.49**	**17.52**	**48.46**	**16**	**11,13,062**	**15,77,110**	**41.69**	**34**

7.12 Identification Of Growth Centers

Mudivaithanndal, Sinthalakattai, Pudurpandiyapuram, Kumaragiri, and Puthiamputhur have been identified as key areas for future development based on population projections and observed growth trends. These localities are strategically located along existing and proposed transport corridors, providing excellent connectivity for residential, commercial, and industrial activities. The availability of developable land, combined with anticipated population inflows, positions these centers to absorb future urban growth, support economic development, and strengthen the overall urbanisation framework of the planning area.

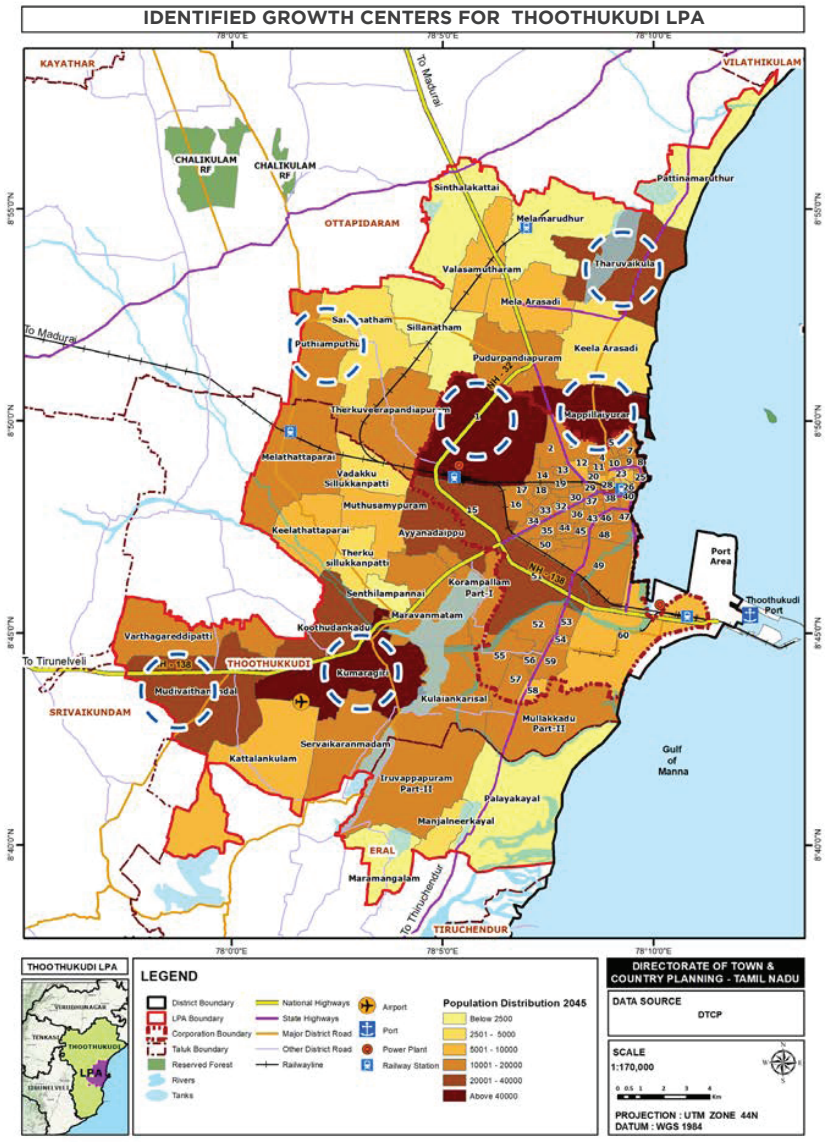


Figure 7.4: Identified Growth Centers for Thoothukudi LPA





Economy

8.1 Introduction

Thoothukudi's economy has historically been shaped by its coastal location and long-standing role as a centre of maritime trade. As early as the Sangam period, the nearby port town of Korkai functioned as a prominent entrepot for pearl fishing and overseas commerce, linking the region with trade networks across the Indian Ocean. This maritime orientation laid the foundation for a settlement economy structured around coastal exchange, navigation, and port-related activities.



In the modern era, the development of organised port infrastructure at Thoothukudi transformed the district into a key maritime and industrial node in southern Tamil Nadu. Port operations, heavy industries, power generation, fertilisers, chemicals, and allied manufacturing emerged as dominant economic activities, supported by transport, logistics, warehousing, and trade-related services. Alongside these formal sectors, traditional activities such as fisheries, salt production, and coastal livelihoods have continued to play an important role in supporting local employment and income generation.

This Chapter of the Master Plan adopts a forward-looking diagnostic approach appropriate to a 20-year planning horizon, aimed at identifying the existing strengths, limitations, and emerging opportunities within Thoothukudi's economy based on its current sectoral composition, investment patterns, employment characteristics, and spatial distribution of economic activities. It further seeks to establish a clear understanding of the district's economic base and vulnerabilities, including the prevailing environmental constraints and resource sensitivities. This assessment provides the analytical foundation necessary to inform strategic planning decisions and to guide the integration of economic development objectives within the overall Master Plan framework.

8.2 Economic Profile of Thoothukudi

8.2.1 Gross District Domestic Product

Thoothukudi district plays a significant role in Tamil Nadu's industrial economy, with its Gross District Domestic Product (GDDP) shaped by port-led activities, energy infrastructure, and a limited set of large industrial establishments.

GDDP: Rs. 17,943.46 crores (2011–12) → Rs. 26,574.50 crores (2022–23)

In 2022–23, the district accounted for approximately 1.8% of the state's Gross State Domestic Product (GSDP), a decline from its contribution of about 2.4% in 2011–12, indicating a relative weakening of its economic share within the state over the past decade (Fig 8.1).

The district's Gross District Domestic Product (GDDP) between 2011–12 and 2022–23 exhibits a pattern of overall growth interspersed with significant sectoral volatility, reflecting the district's dependence on a narrow industrial base. In absolute terms, the district's GDDP has increased over the period, reaching approximately Rs.25,000–26,000 crore by 2022–23. However, this growth trajectory has not been steady, with visible fluctuations indicating sensitivity to industrial disruptions and external economic shocks such as the global COVID-19 pandemic.

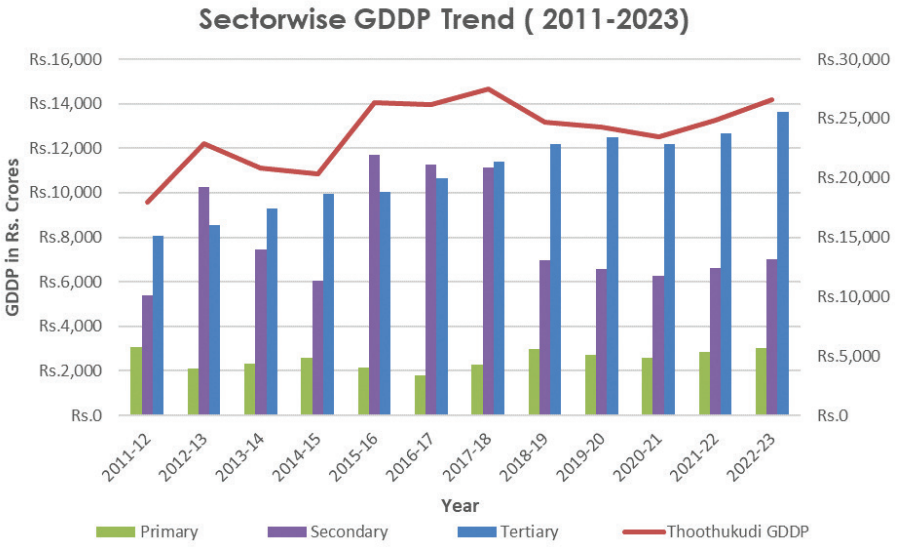


Figure 8.1: GDDP Trend 2011 – 2023

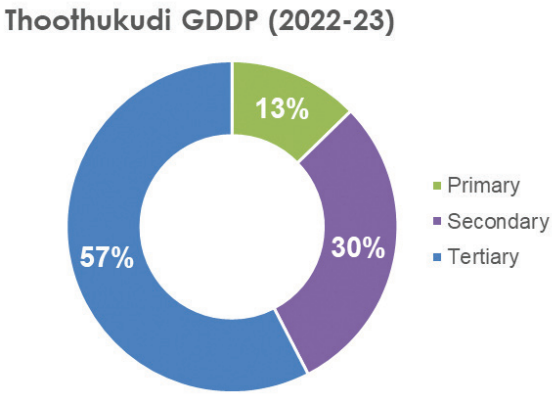


Figure 8.2: GDDP Share in 2022 - 2023

Source: Department of Economics and Statistics

The most prominent structural change observed during this period is the progressive shift in sectoral contribution towards the tertiary sector. Services—including port operations, trade, transport, logistics, and allied activities—have shown relatively consistent growth throughout the decade. By 2022–23, the tertiary sector accounts for the largest share of GDDP, at around 57%, underscoring the district's increasing reliance on service-led economic activity. Even during periods of broader economic stress, such as post-2018 and during the COVID-19 pandemic, the tertiary sector demonstrated comparatively greater resilience than other sectors.

In contrast, the secondary sector displays marked volatility and a clear declining trend in its relative contribution. The secondary sector reached its

peak contribution around 2015–16 and 2016–17, when manufacturing, power generation, and industrial processing were the principal drivers of district output. Following this period, a sharp contraction is evident, particularly after 2018–19. By 2022–23, the secondary sector's share has reduced to 30% of GDDP, significantly lower than its mid-decade peak. This decline reflects the district's exposure to industrial shutdowns, regulatory disruptions, and reduced capacity utilisation in large-scale manufacturing units. The slow and partial recovery observed after 2019–20 suggests structural weaknesses rather than a short-term cyclical downturn.

The primary sector remains the smallest contributor to GDDP throughout the period, accounting for 13% of district output in recent years. While agriculture, fisheries, and allied activities provide livelihood support, their limited scale and modest growth rates mean they have had minimal influence on overall GDDP trends. The relative stability of the primary sector contrasts with the sharp fluctuations observed in the secondary sector, further highlighting the industrial concentration risks within the district economy.

Overall, the GDDP trend indicates that while Thoothukudi's economy has expanded in absolute terms, its growth has increasingly been driven by services, with a weakening industrial base. The declining share and volatility of the secondary sector represent a significant structural characteristic of the district's current economy, shaping both employment patterns and economic resilience. This existing economic profile underscores the district's transition away from manufacturing-led growth towards a service-dominated structure over the last decade.

8.3 Per Capita Income

The per capita income of Thoothukudi district exhibits a long-term upward trend over the period 2011–12 to 2022–23, despite intermittent year-to-year fluctuations (Fig 8.3). While the district outperformed the State average during parts of the mid-decade, its per capita income has remained below the State average in recent years, indicating a widening relative gap and underscoring the need for diversification and higher value-added economic activities.

- Per Capita Income: Rs. 1,03,275 (2011–12) → Rs. 1,42,705 (2022–23)
- Gap with TN PCI: Rs. 468 in 2011–12 (0.45%) → Rs. 46,434 in 2022–23 (25%).

While Thoothukudi's per capita income rises from just over Rs.1.0 lakh in 2011–12 to approximately Rs.1.4–1.45 lakh by 2022–23, the corresponding State per capita income increases at a faster pace, reaching close to Rs.1.9 lakh in the same year (Fig.8-2). The widening gap after 2017–18 suggests that income growth in the district has not kept pace with broader state-level

economic expansion, particularly during periods of structural transition and post-pandemic recovery. This pattern indicates that income growth in the district is less resilient and more sensitive to sector-specific downturns, particularly in industries that historically formed the core of the local economy.

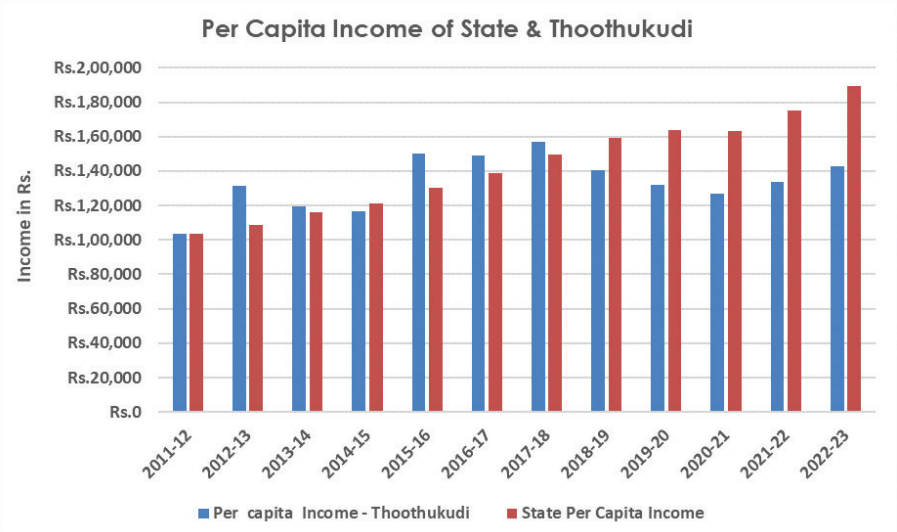


Figure 8.3: Per Capita Income

Source: Department of Economics and Statistics

The persistent gap between district and State per capita income levels indicates underlying structural limitations in value addition and sectoral diversification. Thoothukudi's economy remains largely anchored in port-led activities, with a limited presence of diversified, high-value-added manufacturing and advanced services. The dominance of capital-intensive industries, while contributing significantly to output, has not translated into broad-based income gains across the workforce, resulting in constrained wage progression and limited upward mobility despite employment generation.

Overall, the per capita income trend reflects a pattern of output growth without corresponding income deepening, reinforcing the observations from the GDDP analysis that growth in Thoothukudi has been uneven across sectors.

8.4 Workforce Distribution

The total population of the LPA increased from 3,46,619 in 1991 to 5,14,313 in 2011, while the working population grew from 1,14,007 to 1,91,229 during the same period. The proportion of workers to the total population increased from 32.9% in 1991 to 35.8% in 2001 and further to 37.2% in 2011, indicating a steady improvement in workforce participation (Fig. 8.4). This

rising contribution of workers reflects increased employment opportunities within the LPA.

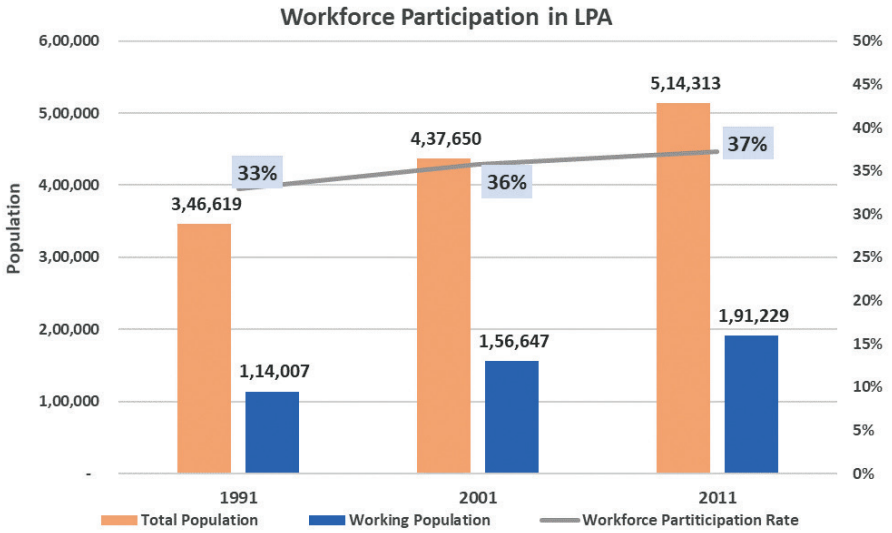


Figure 8.4: LPA Workforce Participation

Source: Census of India

8.4.1 Gender-wise Population and Workforce Composition

Gender-wise Population Structure

In 2011, the LPA recorded a total male population of 2,57,588 (50.1%) and a female population of 2,56,725 (49.9%), indicating a nearly balanced gender composition. This balance has remained consistent over the decades, providing a strong demographic base for inclusive workforce participation and gender-responsive planning.

Gender-wise Workforce Participation

Out of the total workforce in 2011, male workers accounted for 1,48,158 (77.5%), while female workers constituted 43,071 (22.5%). Although female participation has increased from 16.3% in 1991 to 22.5% in 2011, the workforce remains male-dominated (Fig.8-5).

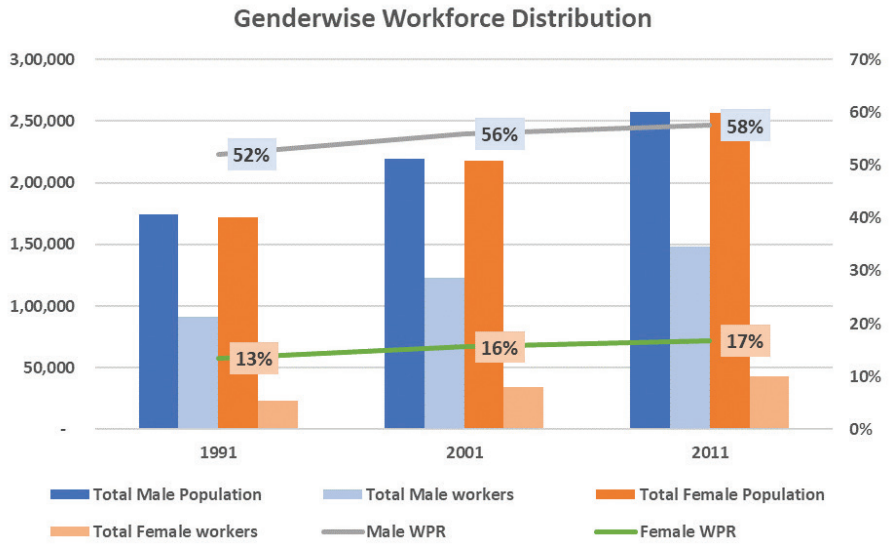


Figure 8.5: Gender Wise Workforce Distribution

Source: Census of India

The male–female worker ratio in 2011 stands at approximately 77:23, highlighting the need for targeted employment generation, skill development, and livelihood programs for women in the LPA's labour structure.

8.4.2 Urban and Rural Distribution of Workers

Total Workers – Urban Vs Rural

In 2011, the LPA had 1,34,618 urban workers, contributing 70.4% of the total workforce, while 56,611 rural workers accounted for 29.6%. The increasing dominance of urban workers over time reflects urbanisation, industrial growth, and the expansion of service-sector employment within the LPA. Rural workforce growth remains moderate, indicating continued dependence on traditional and seasonal occupations.

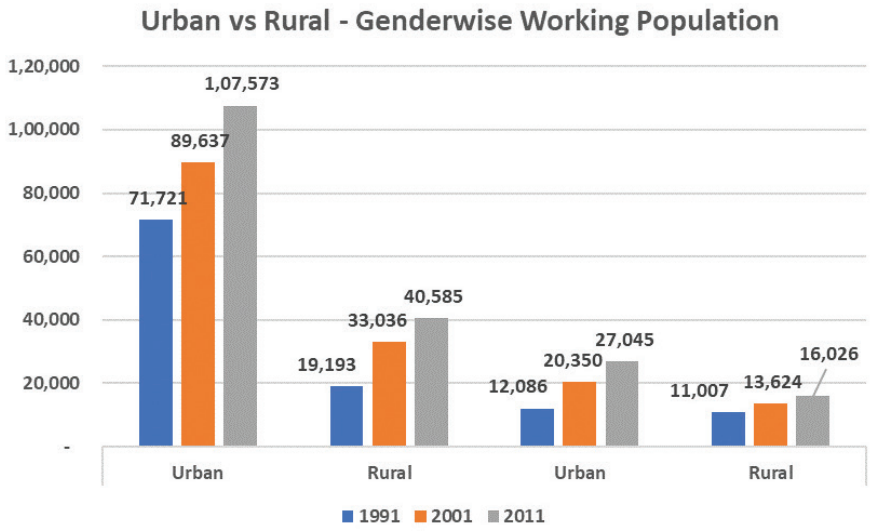


Figure 8.6: Urban & Rural workers Distribution

Source: Census of India

In 2011, the LPA recorded a significantly higher concentration of male workers in urban areas compared to rural areas, reflecting the strong pull of industrial, port-led, and service-sector employment in the urban core. Female workforce participation is also higher in urban areas than in rural areas and shows a steady increase from 1991 to 2011, indicating improved access to education, services, and non-agricultural employment opportunities. While both male and female employment has grown over time, the gender gap remains more pronounced in rural areas, where limited diversification of livelihoods and dependence on traditional activities continue to constrain female participation.

8.4.3 Main and Marginal Workers

The workforce structure in 2011 is heavily skewed towards main workers. Main workers totalled 1,74,735, forming 91.4% of the workforce, while marginal workers numbered 16,494, accounting for only 8.6%. This high share of main workers indicates relatively stable employment conditions and sustained economic activity across the LPA, a positive indicator for long-term urban and regional planning.

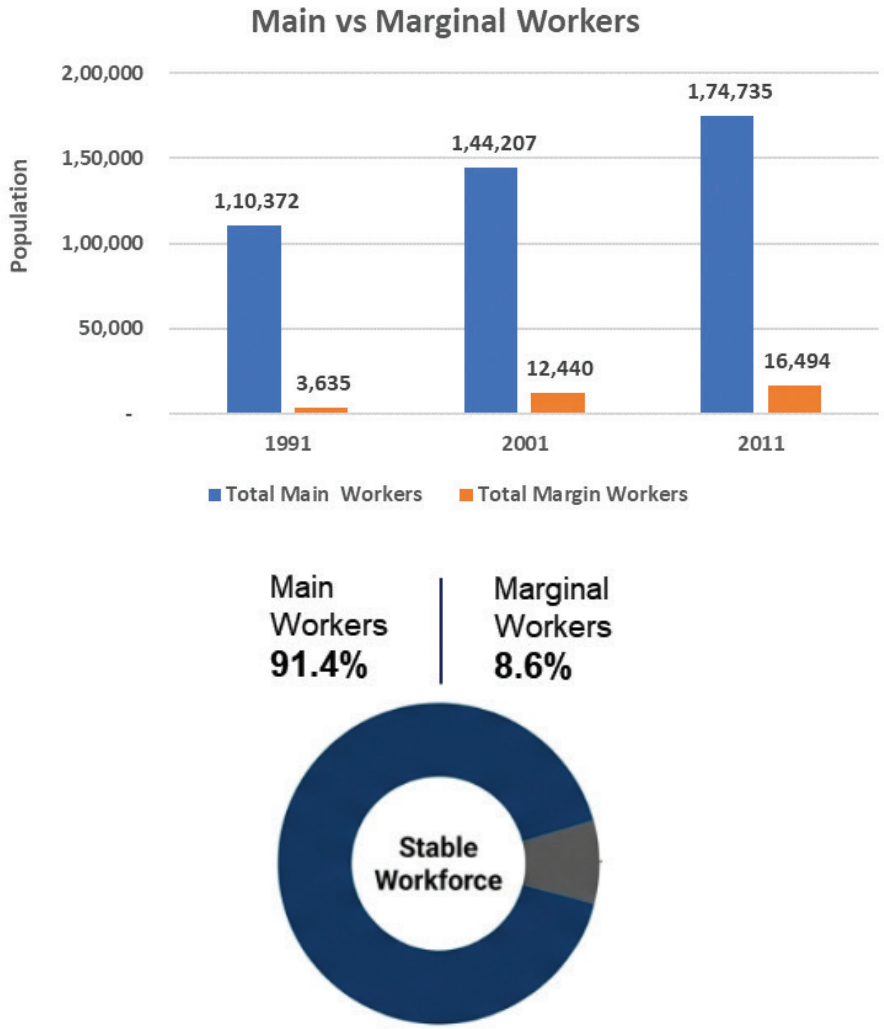


Figure 8.7: Main & Marginal workers Distribution

Source: Census of India

Main Workers – Urban and Rural Contribution

The total number of main workers in 2011, urban main workers numbered 1,25,449, contributing 71.8%, whereas rural main workers accounted for 49,286 (28.2%). This distribution highlights the concentration of stable employment opportunities in urban areas, driven by industries, trade, transport, and services. Rural main workers, though fewer, indicate steady engagement in agriculture, allied activities, and local enterprises.

Marginal Workers – Urban and Rural Contribution

Marginal workers in 2011 were predominantly rural. Rural marginal workers

numbered 7,325 (44.4%), while urban marginal workers accounted for 9,169 (55.6%). Although urban areas host a larger absolute number, marginal employment remains significant in rural areas, reflecting seasonal work patterns, agricultural dependence, and informal livelihoods.

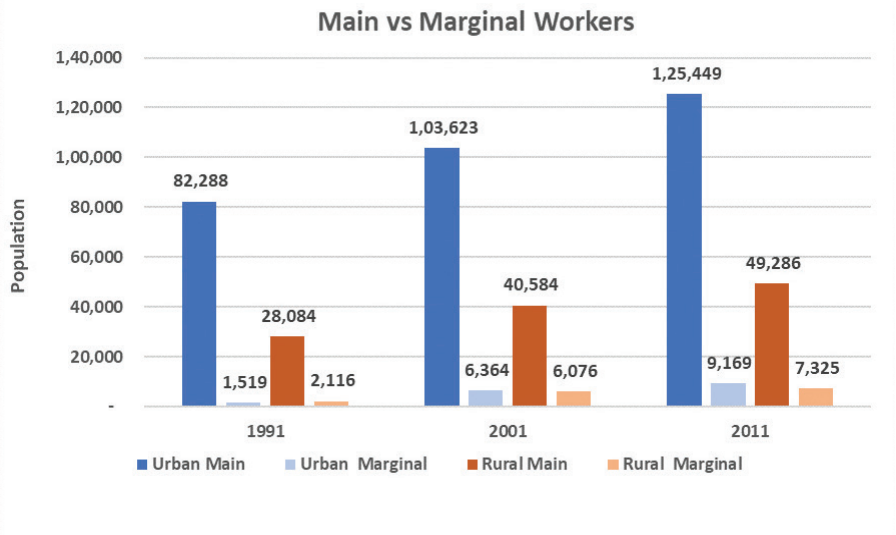


Figure 8.8: Main and Marginal Workers Distribution in Urban and Rural

Source: Census of India

Overall, the LPA exhibits a strong and improving workforce base, with rising workforce participation, dominance of main workers, and increasing urban employment concentration. However, the gender gap in workforce participation and the presence of marginal workers in rural areas highlight the need for inclusive economic planning. Strengthening female workforce participation, enhancing rural employment stability, and diversifying livelihood opportunities will be critical for balanced and sustainable LPA development.

8.5 Sectoral Contribution

8.5.1 Primary Sector

The primary sector in Thoothukudi plays a continuing but gradually diminishing role in the district's economy, with its contribution driven largely by agriculture and allied activities. As seen from the sub-sectoral contribution trend (2011–12 to 2022–23), agriculture remains the dominant component within the primary sector, although its output shows fluctuations over time, reflecting rainfall variability, changing cropping patterns, and increasing non-farm employment shifts. Livestock and fisheries provide important supplementary contributions, with fisheries showing relatively stable performance owing to Thoothukudi's strong coastal and marine base. Forestry, logging, and mining

& quarrying contribute marginally to overall output, indicating the limited scope of extractive activities within the district. Overall, the trend highlights a structurally stable but low-growth primary sector, reinforcing the district's transition towards industry- and service-led economic development rather than primary-sector expansion.

Agriculture remains the backbone of the Thoothukudi primary sector economy, engaging 33% of the population as cultivators and agricultural labourers.

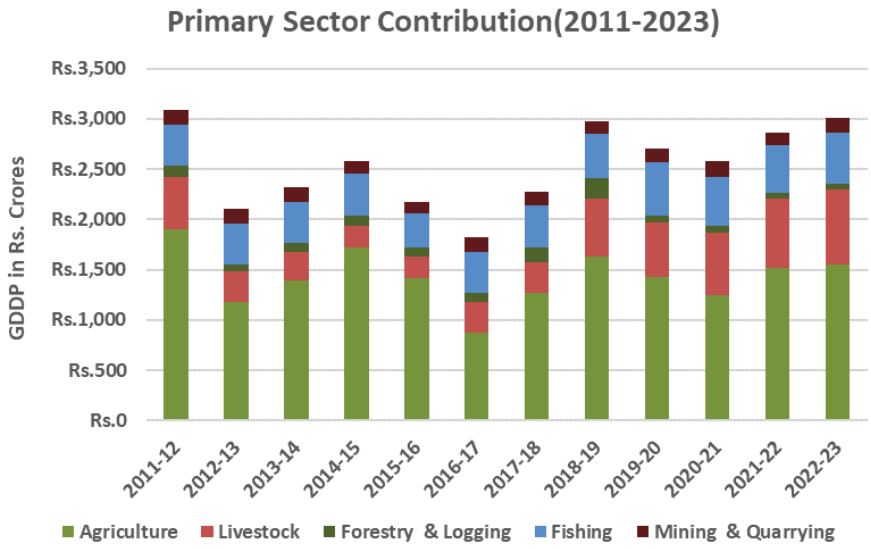


Figure 8.9: Primary Sector Contribution

Source: Department of Economics and Statistics

The primary sector sub-sectoral contribution trend shows clear year-on-year fluctuations shaped by climatic conditions, market demand, and ongoing crop diversification efforts. Throughout the period, Agriculture remains the dominant component, consistently contributing around 60–70% of total primary sector output, with its share rising notably during 2018–19 and peaking in 2019–20 due to favourable monsoons and higher crop productivity. Livestock, contributing 15–20%, displays a steady upward trajectory across the years, reflecting the district's increasing reliance on dairy and small ruminant rearing as stable supplementary income sources. Fishing, supported by the district's extensive coastline, contributes 10–15% and shows pronounced improvements during years of enhanced marine catch, particularly around 2019–20, before stabilizing in the subsequent period.

The smaller sub-sectors—Forestry & Logging and Mining & Quarrying, each contributing between 1–5%—show gradual, incremental increases aligned with resource utilization and coastal ecological activities. Overall, the year-wise trend reveals a strong post-2018 surge, culminating in a 2019–20 peak, followed by

moderate stabilization from 2020–21 to 2022–23, during which agriculture continues to dominate while livestock and fishing maintain consistent, supportive growth. This pattern underscores the district's agricultural strength while highlighting the rising significance of allied activities in sustaining rural economy.

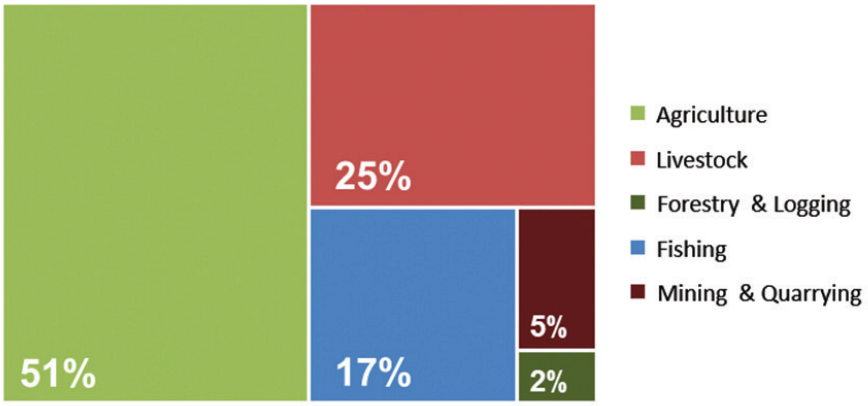


Figure 8.10: Primary Sub- sector Contribution

Source: Department of Economics and Statistics

The 2022–23 sub-sectoral composition of the primary sector clearly highlights the dominance of Agriculture, which accounts for the largest share at approximately 51% of the sectoral output. Livestock follows as the second major contributor with around 25%, reflecting its growing importance as a stable and diversified rural income source. Fishing, benefiting from Thoothukudi's extensive coastline and marine resources, contributes about 17%, forming a vital component of the district's coastal economy. The remaining share is distributed between Mining & Quarrying (5%) and Forestry & Logging (2%), which, though smaller in magnitude, continue to support local employment and resource-based activities. Overall, the structure indicates a strong agricultural backbone complemented by expanding allied activities that strengthen the district's primary sector economy.

8.5.2 Agriculture

Agriculture continues to be an important component of Thoothukudi's primary sector, though its role is increasingly shaped by climatic variability and structural shifts in the district's economy. About 44.77% of the district's geographical area (2.11 lakh hectares) is under net cultivation, supporting a mix of food, dryland, and commercial crops. Paddy cultivation is concentrated in the irrigated taluks of Srivaikundam, Sattankulam, Eral, and Tiruchendur, while dryland crops such as cumbu, cholam, maize, blackgram, and greengram dominate the rain-fed blocks of Kovilpatti, Vilathikulam, Ottapidaram, Kayathar, and Thoothukudi. Commercial crops including cotton and groundnut are grown in limited pockets, reflecting soil and water constraints.

The district also has distinctive livelihood-linked crops such as palmyrah, cultivated across Tiruchendur, Srivaikundam, Sattankulam, and Vilathikulam, supporting jaggery production, palm sugar, and traditional crafts. Banana cultivation, particularly in Srivaikundam and Alwarthirunagiri under the Maasipattam and Chithiraipattam seasons, remains a significant income source but is highly vulnerable to cyclones and monsoon variability, highlighting the need for improved storage, processing, and value-addition infrastructure.

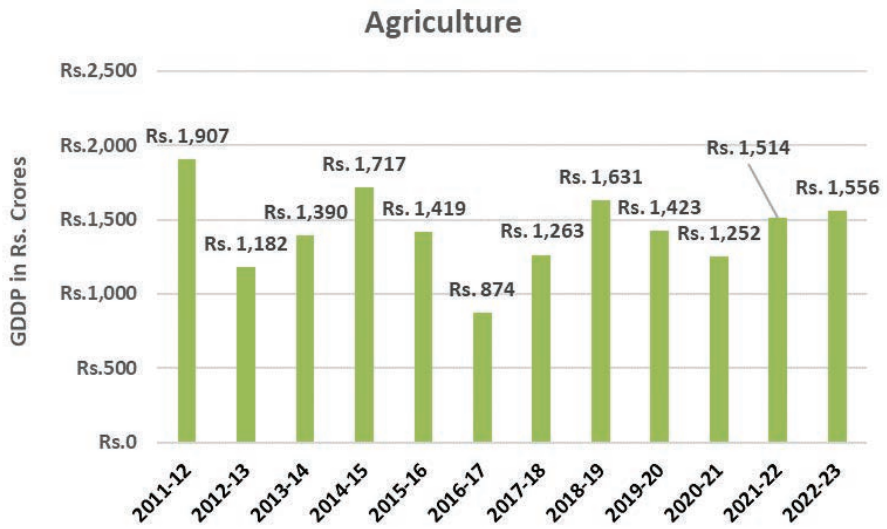


Figure 8.11: Agriculture contribution

Source: Department of Economics and Statistics

Output trends from 2011–12 to 2022–23 indicate considerable year-to-year fluctuation in agricultural performance. After a high base in 2011–12, output declined in 2012–13, followed by a recovery during 2013–14 and 2014–15. A mid-period slowdown occurred in 2015–16 and 2016–17, reflecting weaker production conditions. From 2017–18 onwards, the sector showed a sustained recovery, with 2018–19 and 2019–20 emerging as peak years. Although a marginal dip is observed in 2020–21, output stabilised in 2021–22 and 2022–23, remaining close to the long-term average.

Overall, the trend underscores agriculture's resilience but limited growth potential, reinforcing the need to shift from output expansion to risk mitigation, productivity enhancement, and agro-based value addition

Regulated Market

In the district's agricultural infrastructure, the Thoothukudi Regulated Market, locally known as the VOC Market, stands out as a pivotal economic hub. Among the nine regulated markets listed in the district, the VOC Market is the only one located within the Local Planning Area (LPA).

Its significance is underscored by its dominance in commodity handling. According to the 2022-23 data, the Thoothukudi market recorded a massive quantity arrival of 86,506.864 M.T., while the total quantity arrivals for all nine markets combined was 124,754.250 M.T. This indicates that the VOC Market alone handled approximately 69.34% of the district's total agricultural produce arrivals for that year. Such a high percentage highlights its central role in the region's trade network, far outpacing other markets like Kovilpatti or Ettayapuram, and reinforcing its status as the primary aggregation point for the LPA's agricultural output.

8.5.3 Livestock

The livestock sector in Thoothukudi shows a clear long-term growth trend from 2011–12 to 2022–23, despite early fluctuations. After a brief decline in the mid-2010s, output recovered steadily from 2016–17 onwards, strengthened after 2017–18, and reached its highest level in 2022–23.

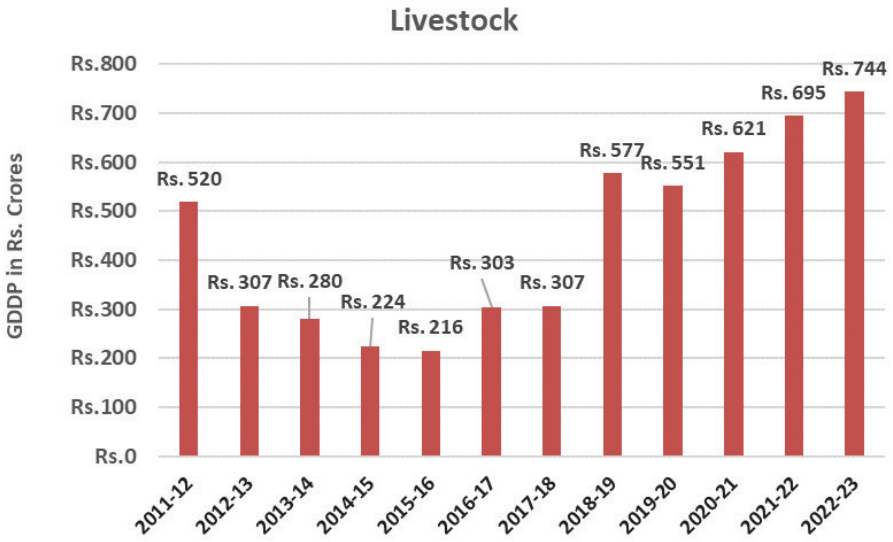


Figure 8.12: Livestock Contribution

Source: Department of Economics and Statistics

This upward trend is reflected in the Gross District Domestic Product (GDDP) data, which indicates a steadily increasing contribution of livestock to the district economy. The expansion of animal husbandry activities has been accompanied by rising dairy production, suggesting a structural shift towards more stable, market-oriented rural livelihoods. Together, these trends highlight livestock as a growing and relatively resilient component of the primary sector, with increasing relevance for income stability and diversification within Thoothukudi's agrarian economy.

Dairy Sector Performance in the LPA

The sustained growth in livestock GDDP—which increased from Rs. 52,000 in 2011-12 to over Rs. 74,000 in 2022-23—is directly substantiated by the robust dairy production within the Local Planning Area (LPA). The blocks of Thoothukudi, Srivaikuntam, and Ottapidaram constitute the district's primary dairy belt, supported by a network of 43 Cooperative Milk Societies. During the 2022-23 period, these three blocks collectively contributed 49,034 litres to the district's milk output. Ottapidaram emerged as the leading producer within the LPA with 33,231 litres supported by 25 societies, followed by Thoothukudi block with 15,728 litres and 17 societies, and Srivaikuntam with 75 litres from 1 society. While the total district output reached 5,39,606 litres, the concentration of these societies within the LPA blocks ensures they remain the critical hub for processing and distributing the increased livestock wealth generated across the region.

8.5.4 Salt pans

Salt production is a defining and historically significant activity in the Thoothukudi Local Planning Area (LPA), reflecting the district's long-standing identity as the "Salt Capital of Tamil Nadu." While the broader LPA economy is diversified and increasingly port- and industry-led, salt farming remains a key primary-sector activity with substantial land, employment, and output significance.

Thoothukudi district accounts for approximately 70% of Tamil Nadu's total salt production, underscoring its strategic importance at the state level. Within the LPA, salt pans cover about 44.34 sq km, representing 9.56% of the total LPA area, and generate an annual output of around 17.12 lakh metric tonnes. The sector supports a large number of enterprises, with about 2,208 operational salt production units, predominantly concentrated in Thoothukudi Taluk, where favourable coastal conditions, evaporation rates, and access to transport infrastructure enable large-scale production.

Land ownership within the salt sector is mixed, with nearly 4,000 acres of government land leased to private operators, while the remaining 8,850 acres are privately owned. The industry is characterised by a high presence of small-scale producers and traders, numbering close to 2,000 units, indicating the sector's role in sustaining local livelihoods alongside larger commercial operations. Salt production is largely seasonal, operating between February and September, in line with climatic conditions, which also makes the sector sensitive to monsoons and extreme weather events.

Salt cultivation in the LPA is a labour-intensive activity, engaging an estimated 12,000–15,000 workers daily during the production season. Owing to the relatively low salinity of surface seawater (about 2–3° Baume), large land parcels

are required for conventional evaporation. To improve efficiency, producers widely adopt the Sub-Soil Brine method, extracting saline groundwater from borewells up to 150 feet deep, where salinity levels range between 5–10° Baume. This method significantly reduces the crystallisation cycle, enabling salt formation within 15–21 days.

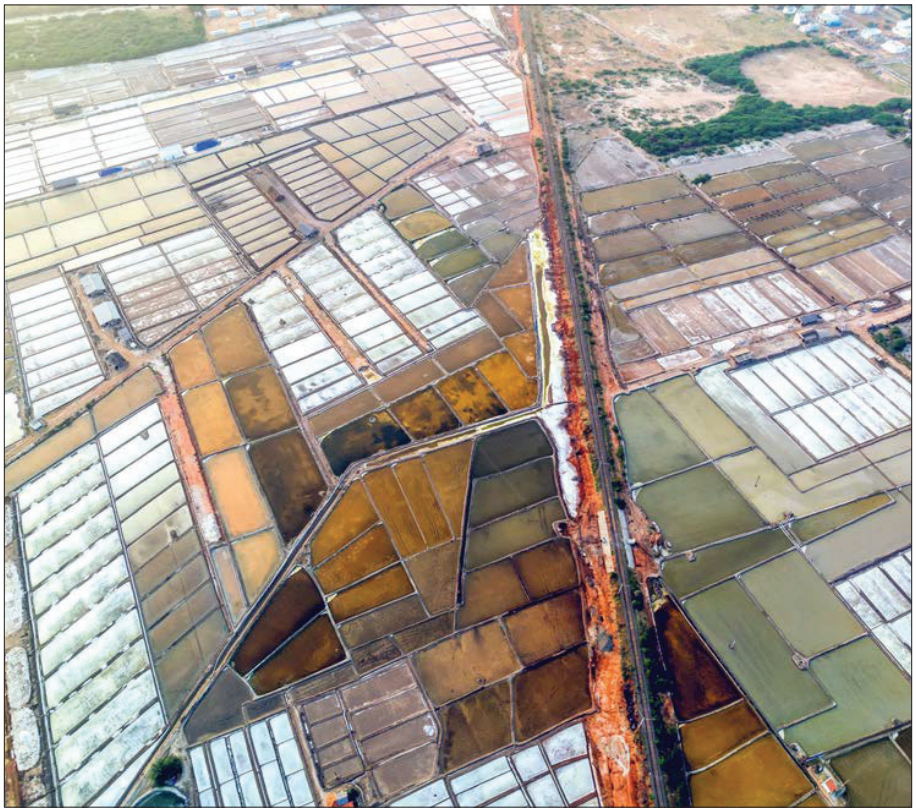


Figure 8.13: Existing Salt plan

Timely movement of brine to crystallisers is critical, as salt retained beyond 21 days in pans loses its consumption quality. The harvested crystal salt is subsequently refined and iodised through an established downstream processing base. The LPA hosts around 40 salt refining units, employing approximately 460 workers directly and about 6,000 indirectly through transport, trading, and ancillary activities. Despite its scale, the sector faces a persistent labour shortage, emerging as a key operational constraint affecting productivity and continuity.

Overall, salt farming constitutes a specialised, land-intensive coastal economic activity that continues to shape land use patterns, employment, and the industrial identity of the LPA, while coexisting with emerging port-led, manufacturing, and logistics-driven economic systems.

8.5.5 Fishing - pearl farming

Thoothukudi is the main centre for deep-sea fishing in the district, which has a lengthy coastline of about 163.5 Km. The coastal area starts in the North at Vembar to the South at Periyathazhai. The sea coast enables the development of deep-sea fishing, marine products, and salt industries in the district. Pearl and chank fishing are the tradition of the district. There are 21 marine fishing villages. Under cooperative societies, 688 fisherman families are directly engaged in fishing. Seafood is being exported to many countries all over the world.

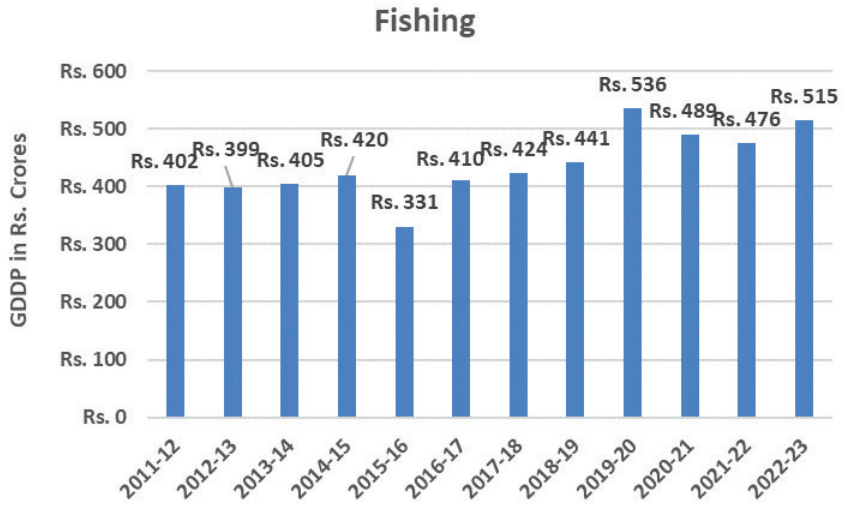


Figure 8.14: Fishing- GDDP Growth Trend

Source: Department of Economics and Statistics

Out of the district's total coastline of about 163.5 km, the LPA accounts for an approximate coastal stretch of 39 km, extending across key fishing zones. This stretch supports 18 coastal villages that are actively involved in marine fishing and allied activities. Fishing within the LPA is predominantly small-scale and traditional in nature, providing direct livelihoods to a large number of fisher households through capture fishing, fish landing, processing, and marketing. The LPA coastline also facilitates related activities such as fish drying, ice plants, boat repair yards, and marine product handling, thereby contributing to local employment and the regional seafood supply chain

Table 8-1: Fishing Villages and Members Involved in Fishing Allied Activities

Sl No	Name of the village	Active Fishermen	No. of members involved in fishing allied activities							
			Marketing	Net Mending	Curing	Peeling	Labourer	Others	Non-Fishing	Total Occupied
1	Pattinamaruthur	110	0	5	0	0	0	0	3	118
2	Tharuvaikulam	1,559	28	98	1	4	5	41	0	1736
3	Vellapatti	328	4	6	19	6	112	14	0	489
4	Alangarathatu	367	97	1	10	60	14	15	39	603
5	Ananda Nagar	157	90	0	42	67	9	15	43	423
6	Inico Nagar	264	29	9	2	2	7	7	6	326
7	Loorthammalpuram	585	196	3	9	176	42	15	14	1040
8	Meenavar Colony	313	28	0	0	21	25	34	13	434
9	Rajapalayam	111	63	1	4	34	10	15	23	261
10	Siluvaipatti	1,143	17	0	1	3	12	0	65	1241
11	Talamuthunagar	322	235	4	81	155	72	52	161	1082
12	Threspuram	3,643	184	3	79	105	12	70	114	4210
13	Tuticorin F.H.	2,881	229	35	52	20	89	112	216	3634
14	VOC Statue (VOC nagar)	22	0	0	0	0	0	0	0	22
Total		**11,805**	**12,00**	**165**	**300**	**653**	**409**	**390**	**697**	**15,619**

Source: Department of Fisheries (JD, Thoothukudi)

8.5.6 Fisheries and Allied Activities within Thoothukudi Local Planning Area (LPA)

Thoothukudi Fishing Harbour is one of the oldest and most important fishery harbours on the east coast of India and serves as the principal hub for marine fishing activities within the Thoothukudi Local Planning Area (LPA). In addition to the main fishing harbour, the LPA is supported by a network of fish landing centres, including centres equipped with fuel facilities at Threspuram and Tharuvaikulam, which play a vital role in daily fishing operations.

Within the LPA, there are ten identified fish landing centres, namely: Threspuram, Sangumal, Inico Nagar, Pattinamaruthur, Vellapatti, V.O.C. Statue Point, Meenavar Colony, Pazhayakayal, Thoothukudi Fisheries Harbour, and Tharuvaikulam. These centres provide essential infrastructure for fish landing, handling, and distribution, thereby supporting the livelihoods of coastal communities and strengthening the marine economy of the planning area.



Figure 8.15: Fishing Harbour at Threspuram

Marine fishing activities in the LPA utilise a mix of mechanised boats, outboard motorised boats, and non-motorised traditional crafts. As per the Marine Fisheries Census, the planning area accommodates 725 mechanised boats, 167 outboard boats, and 298 non-motorised boats, indicating a strong mechanized fishing base. Major fishing hamlets such as Threspuram, Tharuvaikulam, Vellapatti, Meenavar Colony, and Talamuthu Nagar contribute significantly to the overall fishing capacity of the LPA.

Fish production within the planning area is concentrated around key landing centres. Tharuvaikulam records the highest average daily fish landing (approximately 311 tons/day), followed by Thoothukudi Fishing Harbour (150 tons/day), Pazhaya Kayal (95 tons/day), Threspuram (50 tons/day), and Pattinamaruthur (28 tons/day). These figures highlight the spatial distribution of fishing intensity within the LPA.

The LPA also plays an important role in post-harvest infrastructure, with 12 fish cold storage units operating within the planning area. Each unit has a storage capacity ranging between 1,800 and 2,000 metric tons. These facilities support the export-oriented marine economy, with approximately 500 metric tons of seafood exported every month to countries such as Japan and European nations, particularly Spain. During peak festive seasons, these cold storage units operate at full capacity.

The fisheries sector within the LPA provides significant employment opportunities, generating around 350 direct jobs and supporting nearly 12,500 indirect livelihoods across fishing, processing, transport, and export activities. In addition, the presence of fisheries-based training institutions in Thoothukudi supports skill development, value-added fish processing, and entrepreneurship, particularly among fisherwomen and Self-Help Groups (SHGs), thereby enhancing socio-economic sustainability in the coastal planning area.

An annual fishing ban period of 61 days (15 April to 15 June) is observed to ensure conservation of marine resources. The peak fishing season generally occurs during July and August, contributing to regulated and sustainable fisheries management within the LPA.

8.5.7 Pearl Farming

Pearl oyster resources have historically formed one of the most distinctive marine-based identities of Thoothukudi, with the Gulf of Mannar recognised as one of India's oldest and most important pearl-producing regions. Pearls are derived from pearl oysters that inhabit hard seabeds, coral formations, and rocky substrates, generally occurring at depths of 10–12 fathoms (approximately 18–22 metres) and at distances ranging from 10 to 20 kilometres offshore. The traditional pearl fishing grounds in the Gulf of Mannar are locally referred to as "paars," which represent patches of hard seabed with a very low profile. as illustrated below.



Figure 8.16: Pearl Activity Zones

Source: CMFRI, Thoothukudi

Three prime species of pearl oysters—Pinctada fucata, Pinctada margaritifera, and Pinctada maxima—are known for producing superior-quality pearls. Among these, Pinctada fucata, commonly referred to as the Indian pearl oyster, is the most prevalent species in Indian waters. It is typically found in intertidal and shallow subtidal zones up to a depth of 12 fathoms and can grow up to a size of 9 cm. In India, this species is distributed mainly in the Gulf of Kutch along the Gujarat coast and the Gulf of Mannar along the Tamil Nadu coast, with Thoothukudi historically serving as a major centre for pearl oyster fisheries.

According to Hornell (1922), a total of 72 pearl banks (paars) have been identified in the Gulf of Mannar. These paars are arranged in linear formations running parallel to the coastline, located at distances of 10–16 nautical miles from the shore, extending from Pamban Karai Paar in the north to Manapad Periya Paar in the south. Over the centuries, pearl oyster collection in this region has undergone cyclical phases of abundance and decline, influenced by natural regeneration, fishing pressure, and environmental conditions.

In recent decades, however, traditional pearl fishing activities have significantly declined. Factors such as reduced availability of skilled diving labour, high occupational risk, and increased maritime and port-related traffic have adversely impacted pearl oyster habitats and natural stocks. Intensified shipping movements and associated disturbances to seabed conditions have further constrained the recovery of pearl oyster populations in several traditional paars.



Figure 8.17: Oyster Farming

Source: CMFRI, Thoothukudi

To address these challenges and revive pearl resources, the Central Marine Fisheries Research Institute (CMFRI) has introduced scientific pearl oyster management and culture techniques in the Gulf of Mannar. (Fig 8.17) These include pearl culture through the implantation of shell bead nuclei into live oysters, resulting in the production of cultured pearls, as well as breeding and seed production programmes aimed at stock enhancement. Despite these initiatives, large-scale commercial pearl production remains limited, primarily due to ecological sensitivity and operational constraints.

In addition, sea ranching practices have been undertaken periodically to augment natural pearl oyster populations. A recent initiative was carried out on 15 September 2022 near Tharaipaar, close to Tsunami Nagar, Thoothukudi, under the supervision of the District Administration, reflecting renewed institutional efforts to restore pearl oyster habitats and improve long-term resource sustainability.

Apart from pearls, the coastal waters near Threspuram support the collection and trade of conch, chanks, and ornamental sea shells, which continue to contribute to traditional livelihoods. Conch shells from this region are particularly valued for their specific physical and cultural qualities. Together, these activities highlight the continued relevance of marine-based primary sector livelihoods, even as pearl oyster fisheries transition from traditional extraction to scientifically managed and conservation-oriented practices.

8.5.8 Secondary Sector

The secondary sector in Thoothukudi plays a critical role in translating port-led investments and infrastructure development into economic output. It is characterised by a mix of large-scale manufacturing, energy and utility services, and construction activity, reflecting the district's function as an industrial and infrastructure-driven economy rather than a diversified manufacturing hub.

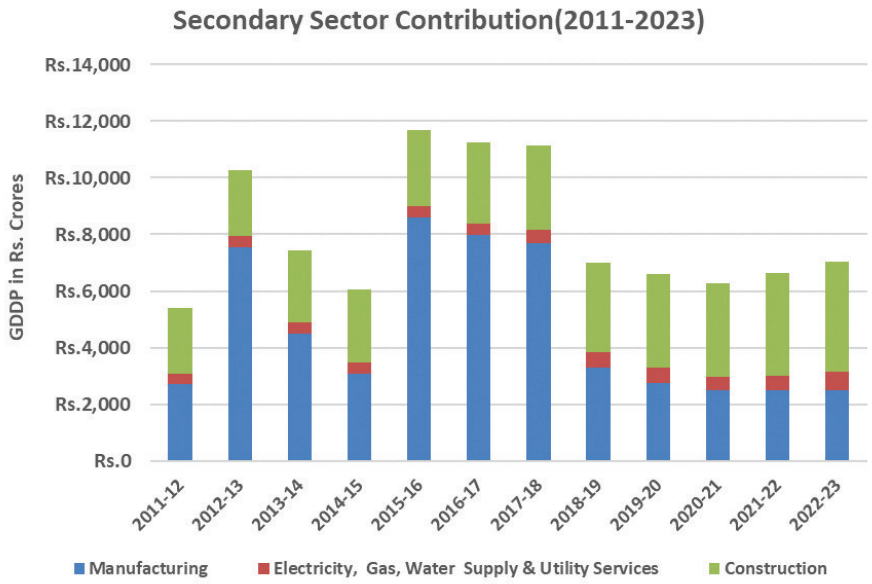


Figure 8.18: Secondary Sector Contribution

Source: Department of Economics and Statistics

Over the period 2011–12 to 2022–23, the secondary sector has exhibited pronounced fluctuations, indicating structural imbalances within industrial activity. Manufacturing has historically been the dominant component, with output peaking during the mid-decade period between 2015–16 and 2017–18 (Fig.8-18). This phase corresponds to higher capacity utilisation and operational activity in large industrial units, supported by port throughput and industrial investments.

From 2018–19 onwards, manufacturing output shows a sustained decline and remains subdued through 2022–23. This downturn reflects the combined impact of regulatory disruptions, environmental compliance issues, operational slowdowns in key industries, and broader economic shocks, including the pandemic period. The prolonged stagnation highlights the vulnerability of the district's manufacturing base to sector-specific and external risks.

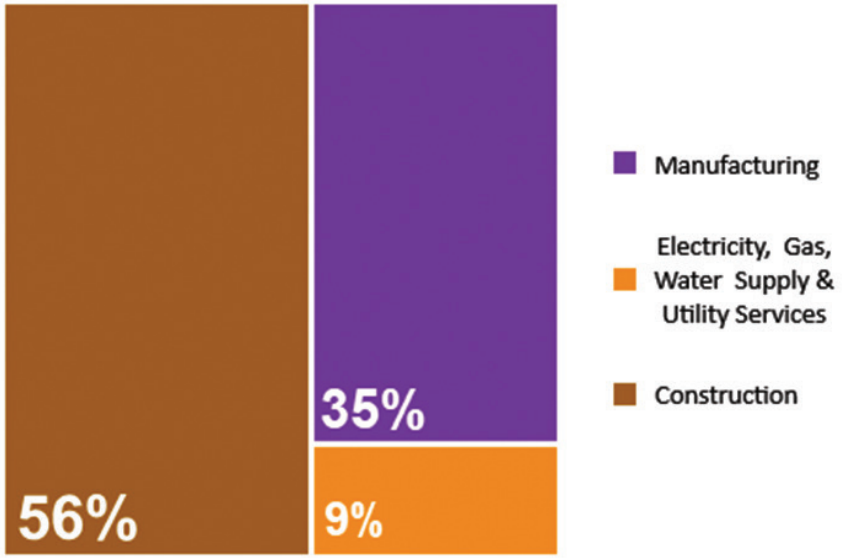


Figure 8.19: Secondary Sector Contribution in Percentage

Source: Department of Economics and Statistics

In contrast, the construction sub-sector has consistently contributed a substantial share of secondary sector output and, in several years, has exceeded manufacturing in value terms. This trend reflects Thoothukudi's investment-driven growth pattern, where output has been supported by large-scale infrastructure projects such as port expansion, industrial estates, power and utility infrastructure, housing development, and public sector capital works. Construction activity has remained relatively resilient even during periods of manufacturing slowdown, as it is driven by project execution rather than continuous industrial production.

The utilities sub-sector (electricity, gas, and water supply) maintains a smaller but stable contribution throughout the period, underpinning industrial and urban functions without exhibiting large cyclical variations.

The sub-sectoral composition for 2022–23 indicates a gradual rebalancing within the secondary sector. Manufacturing continues to anchor the sector, accounting for approximately 70% of output, while construction contributes around 25%, reflecting the sustained emphasis on infrastructure and urban development. Utilities account for the remaining 5%, maintaining a steady support role.

Overall, the dominance of construction alongside fluctuating manufacturing output suggests that secondary sector growth in Thoothukudi has been more project- and investment-led than production-led. While this has supported short- to medium-term output growth, it underscores the need to stabilise

and diversify manufacturing activities to ensure sustained value addition, employment generation, and long-term industrial resilience.

8.5.9 Manufacturing

The manufacturing sub-sector, serving as the primary industrial pillar of the district's secondary economy, has experienced significant fluctuations over the last twelve years. Analysis of the sectoral data shows a period of aggressive growth that peaked in 2015-16, with output reaching approximately Rs. 8.6 Lakhs. This peak was followed by a steady decline, eventually stabilising at a lower threshold of around Rs. 2.5 Lakhs during the 2021-2023 period. Despite this contraction from its mid-decade highs, the 2023 sub-sector share illustrated in the tree map confirms that Manufacturing remains a dominant force, still commanding a major portion of the secondary sector's total contribution. This current trend suggests a shift from rapid expansion to a phase of industrial consolidation within the district.

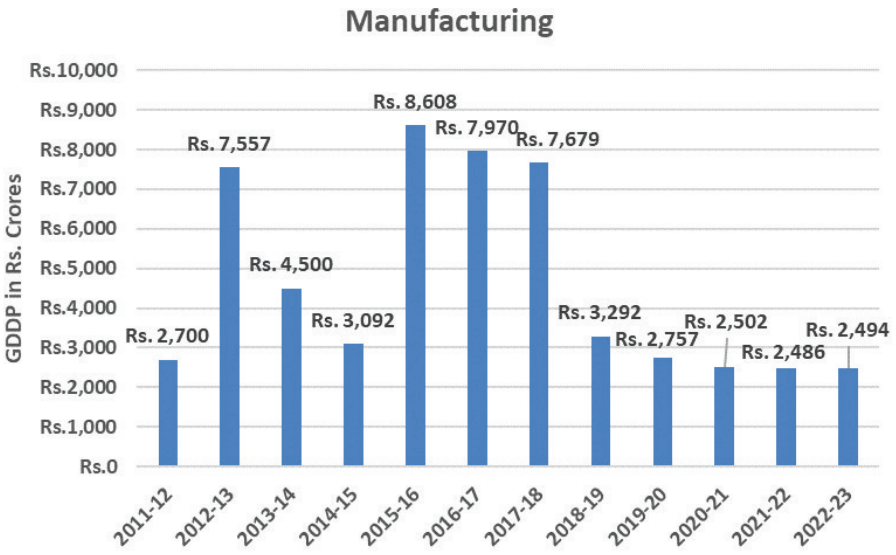
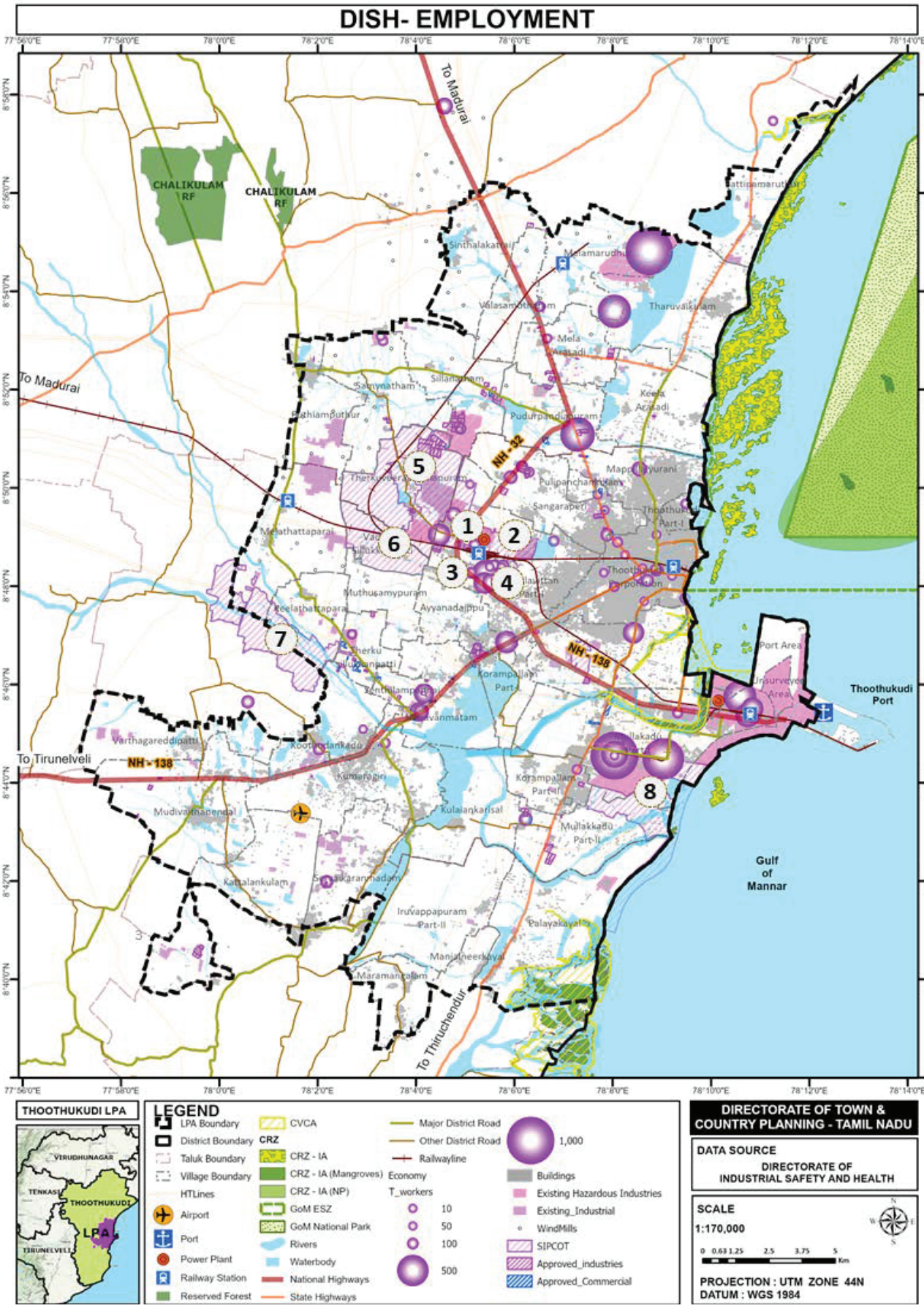


Figure 8.20: Manufacturing Contribution

Source: Department of Economics and Statistics



Map 8.1: Major Industries and SIPCOT location

8.5.10 Industrial Estates - Sipcot And Sidco

The industrial landscape within the Local Planning Authority (LPA) is anchored by a robust network of SIPCOT industrial estates, which serve as the primary drivers of regional economic growth and employment. (Fig: 8.21)

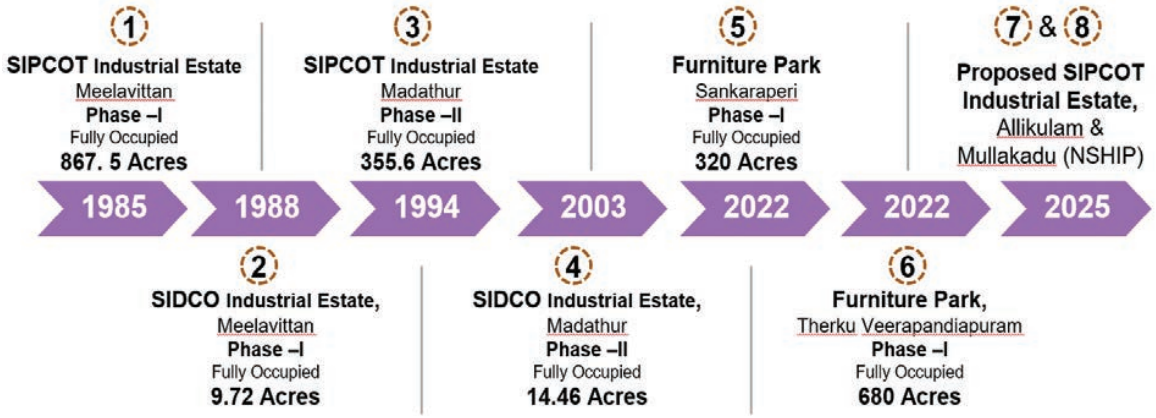


Figure 8.21 Industrial Estates in Thoothukudi

Source: ***SIPCOT and SIDCO***

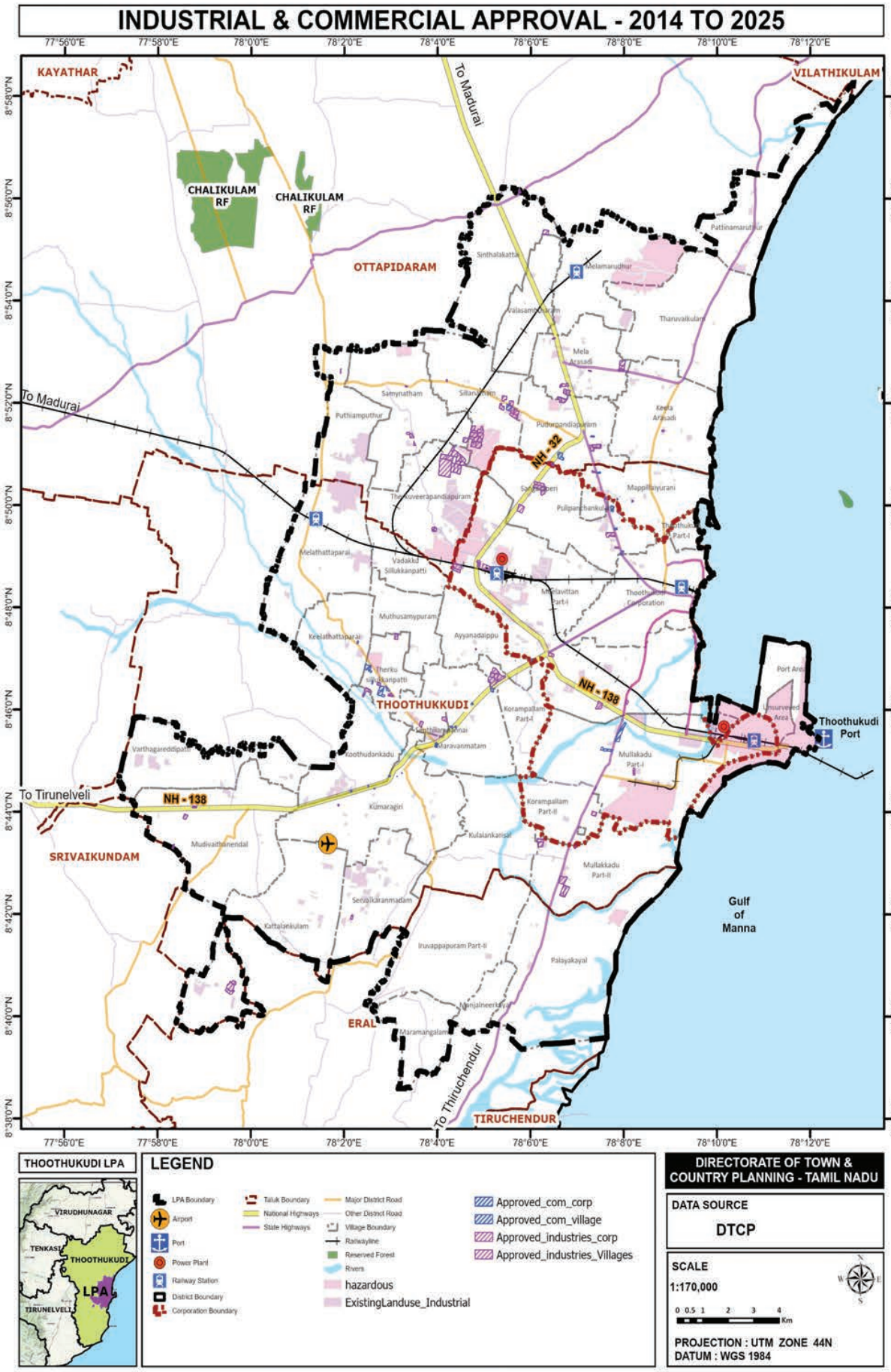
The established industrial parks include the Thoothukudi Phase 1 estate, strategically located in Milavittan over an extent of 867.5 acres. This phase has reached full maturity with 100% of its land occupied by diverse industrial units. Integrated within this campus is the SIDCO Phase 1 estate, which occupies an additional 9.720 acres of allotted land, fostering a synergistic environment for both large-scale and small-scale industries. Similarly, Phase 2 of the SIPCOT industrial park, situated in Madathur, spans 355.64 acres and is also entirely occupied. This campus hosts SIDCO Phase 2, covering an extent of 14.460 acres, further solidifying the region's status as a saturated and highly productive industrial corridor.

Complementing these general industrial zones are specialized parks dedicated to the furniture manufacturing sector. The Furniture Park Phase 1, located in Sankaraperi, covers an area of 320 acres, with approximately 90 percent of the land already occupied by large-scale industries. Building on this success, Furniture Park Phase 2 has been developed in Therku Veerapandiapuram across 680 acres. This second phase is also largely occupied by major industrial players, reflecting the region's emerging dominance as a global hub for furniture production and export-oriented manufacturing.

Regarding future expansion and strategic infrastructure, a significant new SIPCOT industrial park has been proposed in Allikulam, covering a massive extent of 2,232 acres. Since this park is partially situated within the LPA boundaries, it is expected to exert a profound influence on the local planning area,

driving further urbanization and demand for auxiliary services. Additionally, land has been allocated in Mullakadu village for a critical infrastructure project featuring a 60 MLD capacity sea water desalination plant to meet the growing water requirements of the industrial sector. This site is also earmarked for a major shipyard building facility, representing a strategic move to leverage the coastal proximity for maritime industry growth. These proposals underscore a long-term vision to transform the LPA into a high-tech industrial and maritime gateway.





Map 8.2: Industrial Growth trend -2014 to 2025

8.5.11 Construction

The Construction sub-sector has emerged as a resilient and increasingly significant component of the district's secondary economy, demonstrating a more stable trajectory compared to the volatile manufacturing sector. While the overall secondary sector peaked in 2015-16, the data shows that construction (represented in green) has maintained a consistent presence, eventually becoming a primary driver of the district's economic recovery between 2021 and 2023 (Fig: 8.22). This recent growth phase indicates that the sub-sector is playing a vital role in the post-pandemic rebound, with a visible increase in its proportional share of the total secondary output. This trend reflects a steady demand for infrastructure development and building projects, positioning construction as a critical stabilizer for the district's industrial landscape.

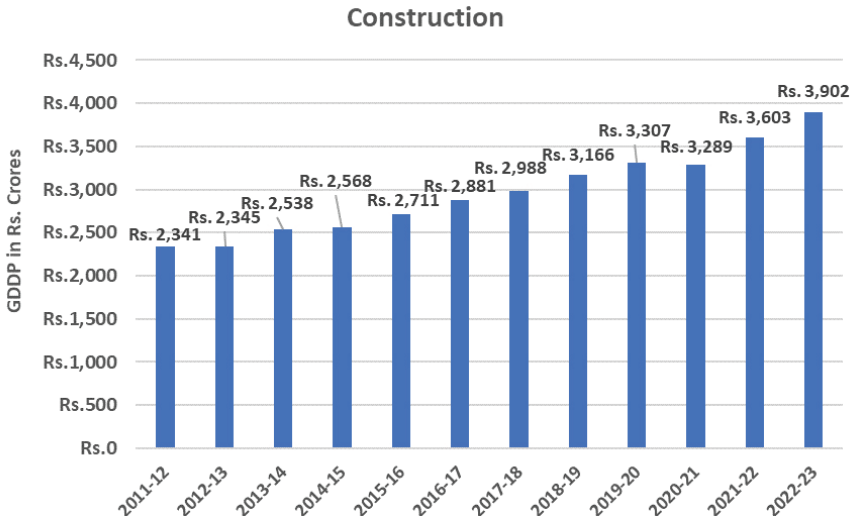


Figure 8.22: Construction Growth 2011 - 2023

Source: Department of Economics and Statistics

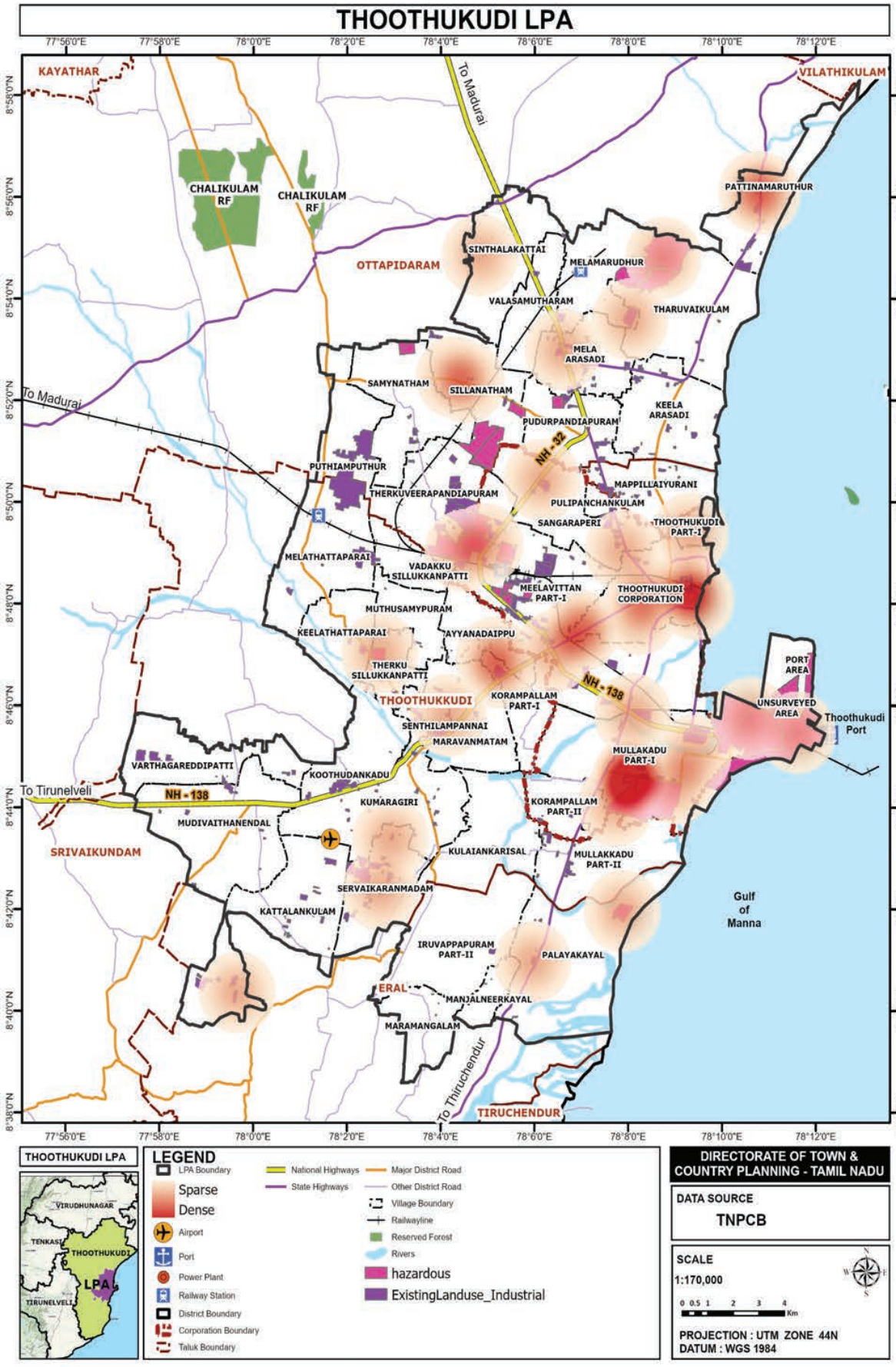
8.5.12 Pollution wise Industrial Classification

The Tamil Nadu Pollution Control Board (TNPCB) utilizes a color-coded classification system to categorize industrial activities based on their environmental impact and Pollution Index (PI) scores. This classification serves as a vital regulatory tool for sustainable urban planning and environmental management within the state. Under this framework, industries are divided into Red, Orange, and Green categories, where the Red category represents industries with the highest pollution potential having a PI score of 60 and above, necessitating stringent monitoring and specific location-based restrictions. The Orange category includes industries with a moderate pollution potential and PI scores ranging from 41 to 59, while the Green category encompasses those with the least environmental impact, typically scoring between 21 and 40.

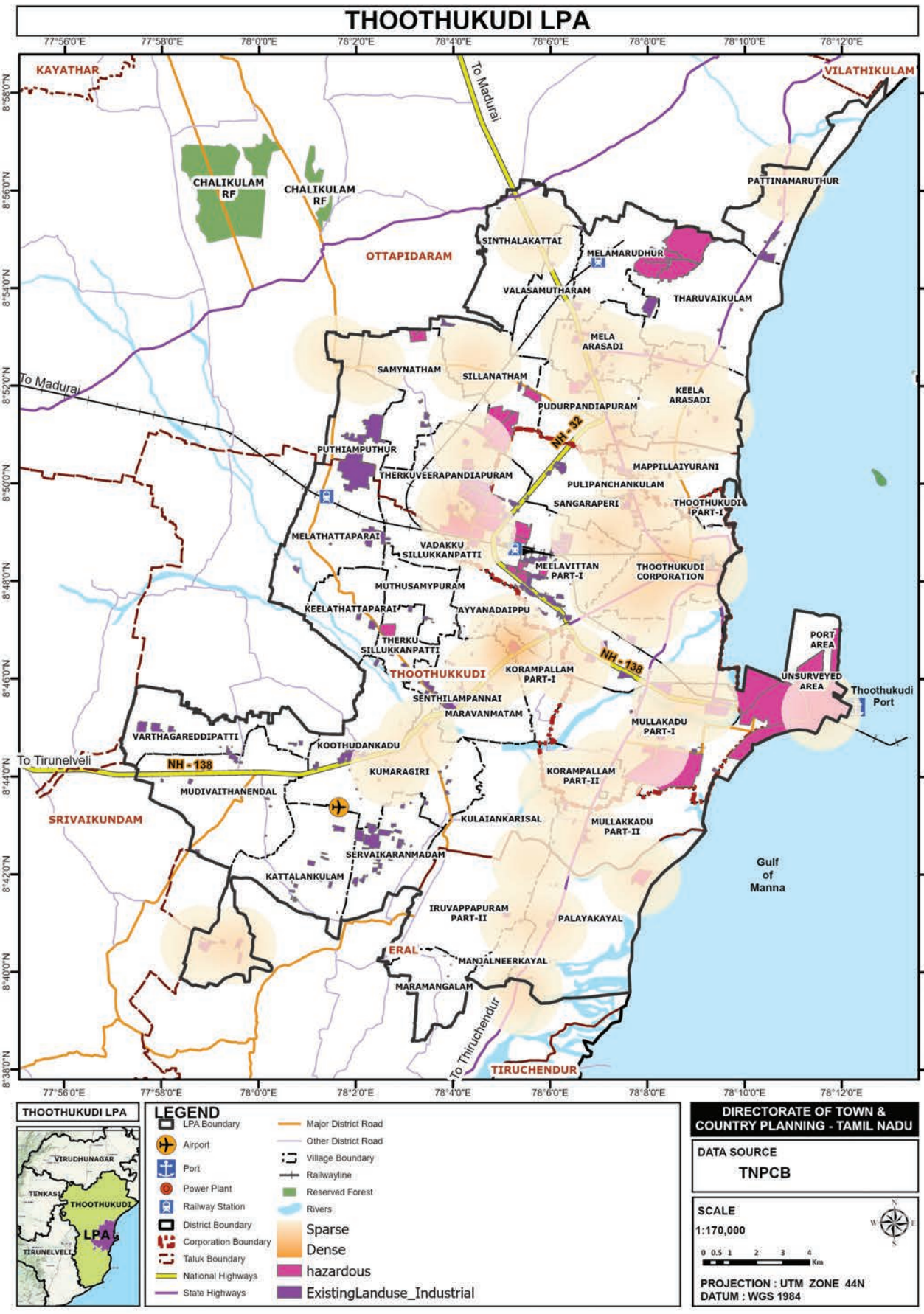
This tiered approach allows for localized planning, ensuring that high-impact industrial zones are properly buffered from sensitive ecological areas and residential settlements.

Based on the spatial data for Red category industries in the Thoothukudi Local Planning Area (Map: 8.3), there is a distinct and heavy concentration of high-impact industrial activity situated primarily along the south-eastern coastal belt and major transit corridors. The most intense density is observed within the Thoothukudi Corporation limits and extending into Meelavittan Part-I and Mullakadu Part-I, which aligns with the proximity to the Thoothukudi Port and essential shipping infrastructure. Significant industrial clusters are also evident in the areas of Therkuveerapandiapuram, Puthiamputhur, and Vadakku Sillukkanpatti, indicating a concentrated industrial spine following the NH-138 and NH-32 routes. Other notable pockets of Red category industries are scattered around Sangaraperi and Korampallam, showcasing a layout where heavy industrial operations are deeply integrated into the suburban periphery of the main corporation area.

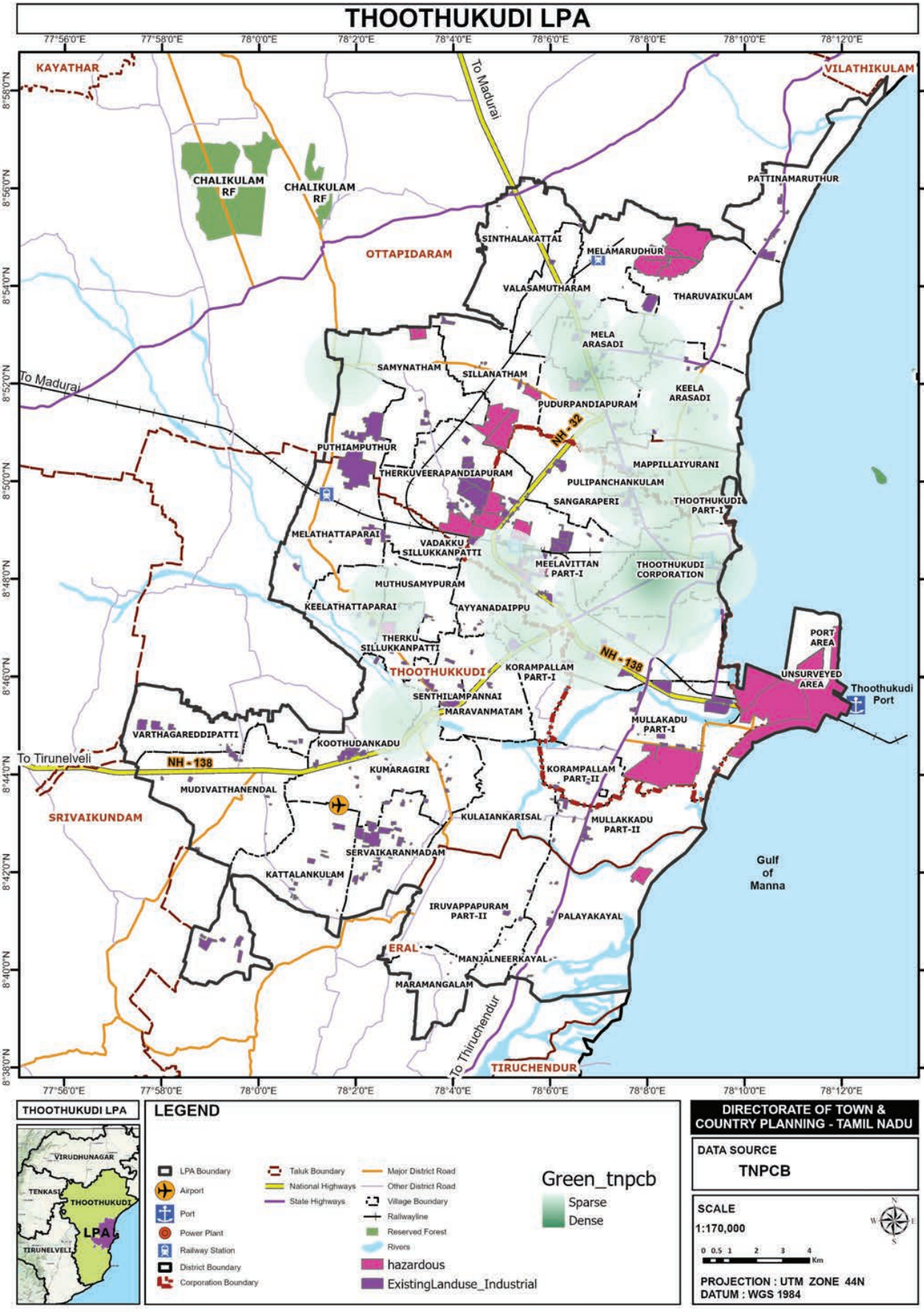
The distribution of Orange category (Map: 8.4) industries shows a more dispersed but still significant footprint across the region, representing a secondary layer of industrial development with moderate environmental impact. These industries are notably concentrated in the northern and central-western parts of the planning area, particularly around villages such as Samynatham, Sillanatham, and Pudurpandiapuram. There is also a visible clustering in the Mappillaiyurani and Pudurpandiapuram areas, which likely serves as a supportive industrial zone for the larger complexes nearby. While these industries follow a similar pattern of being located near major district roads and highways, their presence in areas like Palayakayal and the fringes of the Thoothukudi Corporation suggests a broader spread of medium-scale manufacturing and processing units throughout the mid-section of the Local Planning Area.



Map 8.3: TNPCB Red Category Industries



Map 8.4: TNPCB Orange Category Industries



Map 8.5: TNPCB Green Category Industries

Green category industries, which represent the least polluting sector, exhibit a unique spatial pattern that blends with the coastal and northern rural boundaries of Thoothukudi (Map: 8.5). While there is still a high-density cluster within the Meelavittan and Corporation areas—likely due to service-oriented or light manufacturing units—there is a prominent presence of these industries in the northern coastal village of Tharuvaikulam and the adjacent Melamarudhur. Additional activity is visible in the vicinity of Puthiamputhur and scattered across the southern regions near Eral and Maramangalam. This distribution indicates that Green category industries are more flexible in their location requirements, often situated closer to residential or agricultural interfaces where high-impact industrial activity would otherwise be restricted.

The TNPCB industrial landscape of the Thoothukudi Local Planning Area is characterized by a high degree of specialization and clustering, particularly driven by the presence of the port and the national highway network. The Meelavittan and Mullakadu regions emerge as the primary industrial hubs of the district, hosting a dense overlap of all three industrial classifications, which necessitates integrated environmental management strategies to mitigate cumulative pollution effects. While the Red industries are heavily localized near the port and southern corridors, the Orange and Green industries provide a broader industrial base that extends toward the northern and western hinterlands. Overall, the data suggests a trend of coastal-heavy industrialization, emphasizing the need for balanced land-use planning to protect the Gulf of Mannar's ecological sensitivity while sustaining the region's vital economic growth.

8.5.13 Tertiary Sector

The Tertiary Sector has shown consistent and robust growth over the last decade, establishing itself as a vital component of the district's economic landscape. The sector's total contribution has risen steadily from approximately Rs. 8.0 Lakhs in 2011-12 to a peak of nearly Rs. 13.8 Lakhs in 2022-23, reflecting a maturing economy with an increasing reliance on services (Fig: 8.23). This upward trajectory demonstrates strong resilience, as the sector continued to expand even during periods when the secondary sector faced volatility, indicating that service-based activities are becoming a more stable anchor for the regional economy.

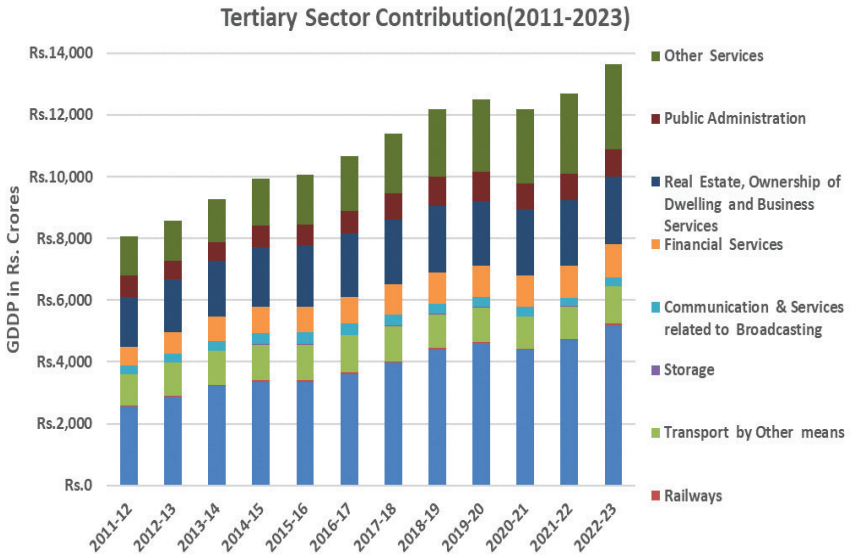


Figure 8.23: Tertiary Sector Contribution

Source: Department of Economics and Statistics

The 2023 sub-sector distribution highlights a well-diversified service economy led by Trade, Repair Services, Hotels & Restaurants, which contributes a dominant Rs. 5,19,722. Other significant contributors include Other Services at Rs. 2,75,583 and Real Estate and Business Services at Rs. 2,17,996, which together account for a large portion of the sector's value. Combined with steady inputs from Transport (Rs. 1,21,193) and Financial Services (Rs. 1,06,424), these sub-chapters illustrate a successful transition toward a service-oriented model. This diversification ensures that the district's Tertiary Sector is not reliant on a single industry but is supported by a broad range of professional, commercial, and public services.

8.5.14 Trade, Repair Services and Hotels

The Trade, Repair Services, Hotels and Restaurants sector shows a steady growth trend from 2011–12 to 2022–23, with output increasing from about Rs.2.5 lakh crore to over Rs.5.2 lakh crore. A temporary decline in 2020–21 reflects the impact of the COVID-19 pandemic (Fig. 8.24), followed by a strong recovery in subsequent years. Overall, the trend indicates resilient and expanding service-sector activity, supporting trade, logistics, and urban economic growth.



Figure 8.24: Tertiary Sub-Sector Contribution

Source: Department of Economics and Statistics

A. Trade (EXIM and Domestic)

Trade remains the backbone of Thoothukudi's economy, primarily driven by the V.O. Chidambaranar Port.

EXIM Growth: The port is transitioning into a transshipment hub, with significant growth in containerized trade (reaching over 1 Million TEUs) and bulk commodities like salt, coal, and fertilizers.

Global Integration: The recent India-UK Free Trade Agreement (FTA) and similar trade pacts are expected to eliminate duties on 99% of Indian exports, significantly boosting the demand for trading houses and export-import firms in the Local Planning Area (LPA).

Commercial Trading: Beyond the port, the city serves as a major wholesale trading center for regional produce and industrial raw materials.

B. Repair Services (The Shipyard Hub)

The repair sector is undergoing a massive transformation from small-scale workshops to heavy industrial ship-repair facilities.

Mega Shipbuilding Hub: The VOC Port has earmarked 49 hectares of land and 7 hectares of waterfront for a dedicated Shipbuilding and Repair Yard.

Strategic Partnerships: Major MoUs worth Rs.30,000 Crores have been signed with Cochin Shipyard (CSL) and Mazagon Dock (MDL). These facilities will handle both commercial cargo vessels and naval warships, positioning Thoothukudi as a vital repair node on the East Coast.

Ancillary Growth: The growth of the shipyard will trigger a "cluster effect," creating a demand for hundreds of small-scale specialized repair units in the surrounding LPA for machinery, electronics, and maritime equipment.

C. Hotels and Hospitality

The hospitality sector is shifting its focus from basic transit accommodation to premium business and leisure categories.

Business Travel Demand: With the influx of global investors (e.g., VinFast, HD Hyundai) and maritime experts, there is a rising demand for Star Category Hotels and serviced apartments.

Tourism Potential: The proximity to Tiruchendur and the "Pearl City" heritage offers a foundation for leisure tourism. Current proposals include the development of beach resorts and entertainment zones to enhance the "livability" of the city.

8.5.15 Import and Export

The Import and Export of cargo at V.O. Chidambaranar (VOC) Port over the decade spanning 2014–15 to 2024–25. By examining trends in imports and exports, commodity compositions, and annual volume fluctuations, the study highlights the port's role as a critical maritime gateway. The analysis focuses on the high volume of bulk imports like coal and the dominance of containerised cargo in the export sector, offering a clear picture of the port's strategic trade dynamics and regional economic impact.

Table 8-2: Import and Export Trend (2014 - 2025)

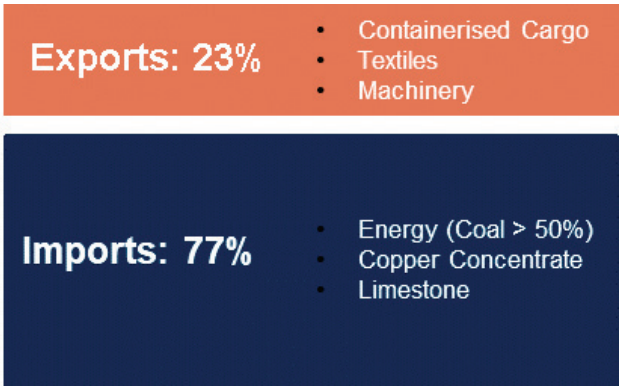
Commodity	2014-15	2017-18	2020-21	2023-24	2024-25
IMPORTS					
Coal	1,38,03,877	1,24,80,366	1,14,35,904	1,84,15,422	1,78,67,651
General Cargo	27,60,778	34,65,504	11,91,793	24,66,368	18,36,025
Liquid Cargo	11,05,276	13,00,976	13,05,603	15,41,730	17,78,010
Total Imports(A)	1,96,03,881	2,05,49,765	1,56,71,790	2,47,54,124	2,39,37,884
EXPORTS					
General Cargo	9,55,513	15,44,954	9,21,268	13,46,746	14,98,317
Liquid Cargo	4,00,690	2,07,871	83,685	86,996	1,01,040
Dry Cargo	3,02,947	38,700	-	5,419	206
Total Export (B)	**17,75,620**	**18,41,738**	**10,20,331**	**15,46,840**	**17,70,110**

(Note: Data for intermediate years 2015-16, 2016-17, 2018-19, 2019-20, 2021-22, and 2022-23 are available in the full dataset provided in the source image.)

- Import Trend: Imports saw a dip during the 2020-21 period (likely due to global supply chain disruptions) but have since surged to record highs, peaking in 2023-24.
- Export Trend: Exports have remained relatively stagnant compared to imports, fluctuating between 10 lakh and 26 lakh tons, indicating a need for stronger export-oriented industrial growth in the port's catchment area.

Overall Trade Composition (2024–2025)

During the 2024–25 period, VOC Port demonstrated a significant leaning toward import activities. The trade balance is heavily skewed, positioning the port as a vital gateway for incoming raw materials and energy resources for the region.



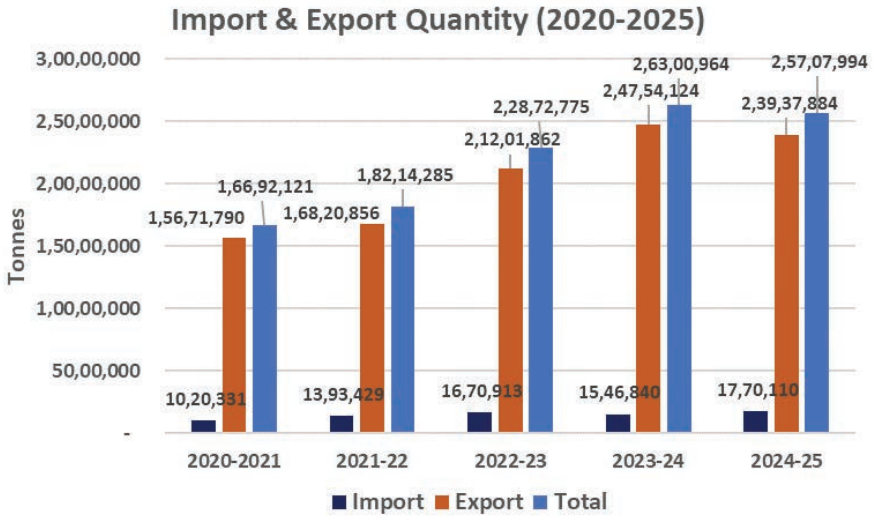


Figure 8.25: Import and Export Profile

Source: VOC Port Master Plan 2047

Import Cargo

Commodity Composition (2024–25)

The import profile is dominated by energy and industrial requirements. Coal remains the single most important commodity handled by the port.

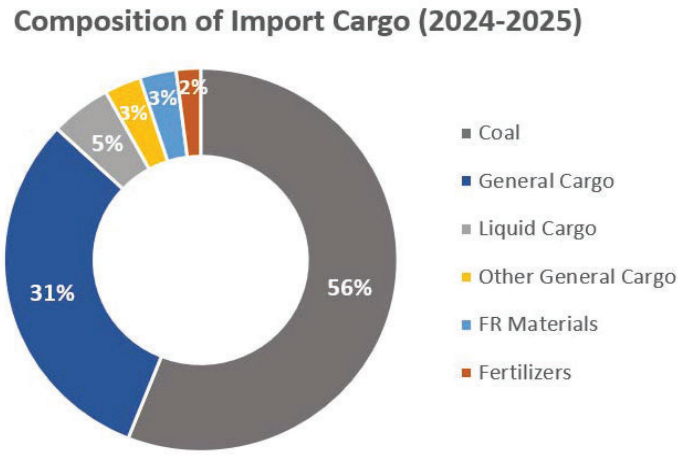


Figure 8-26: Composition of Import Cargo in 2024–25

Source: VOC Port Master Plan 2047

With over half of the imports being Coal, the port's performance is intrinsically linked to the energy sector and thermal power requirements. The 31% share of General Cargo indicates a healthy diversity in manufactured goods and miscellaneous industrial inputs.

Geographical Origins of Imports:

The import supply chain is deeply connected to the Middle East and Southeast Asia. For Liquid Cargo, the Gulf Countries lead with 29%, followed by Korea (15%) and Malaysia (13%). In contrast, General Cargo imports are highly concentrated, with the UAE (50%) and Oman (35%) accounting for a massive 85% of the total volume.

The extreme concentration of general cargo origins in the UAE and Oman suggests a strategic trade corridor for specific materials like limestone or industrial minerals essential for regional construction and cement industries.

Export Cargo

Containerized cargo is the backbone of the port's export economy. The negligible volume of food grains and dry cargoes suggests a shift away from bulk agricultural exports toward processed or containerised goods.

The General Cargo category specifically tracks construction-related materials and industrial outputs. Key components include Construction Materials, Cement, and Granite Stone.

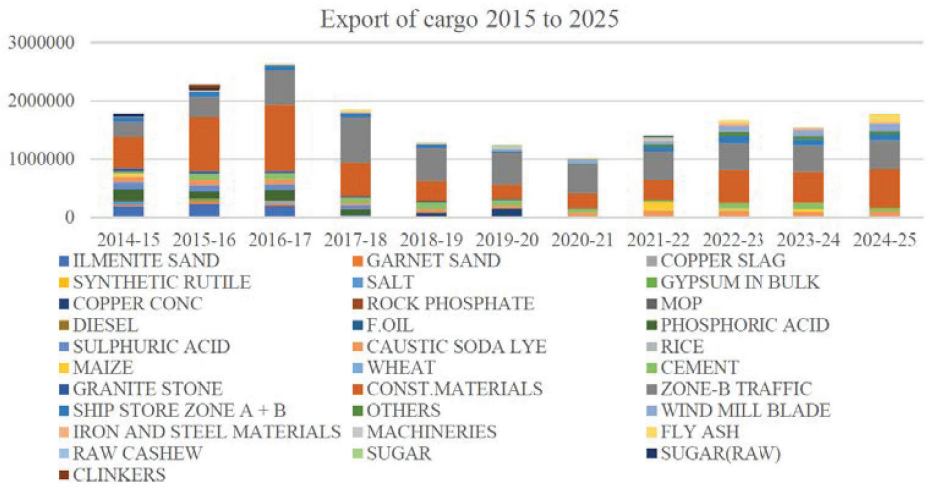


Figure 8.27: General Cargo export trend at VOC Port (2015–25)

Source: VOC Port Master Plan 2047

There was a massive peak in Construction Material exports around 2016-17, followed by a stabilisation period. Recent years show a gradual recovery in construction-related exports, reflecting fluctuations in regional demand and infrastructure projects.

The Port is an import-heavy industrial gateway. While it efficiently handles massive volumes of Coal and Containerized cargo, there is a clear opportunity to bridge the 54% gap between imports and exports by incentivising the export of liquid cargo and diversified general goods.

8.5.16 Information Technology

The tertiary sector in Thoothukudi LPA has historically been dominated by port-related services and logistics. However, there is a strategic shift toward Information Technology (IT) and Knowledge-based Services.

Contribution and Current Status of the IT Sector

The IT sector in Thoothukudi is currently in a "transition phase," moving from a purely industrial/maritime economy to a diversified service economy.

- **Decentralized Growth:** Following the "Work from Home" and "Work from Hometown" trends post-COVID, Thoothukudi has seen a rise in remote-working professionals.

- **Regional Talent Retention:** The sector's growth is primarily designed to prevent "brain drain," allowing the high volume of engineering and science graduates from local institutions (e.g., Anna University Thoothukudi Campus) to find employment within the district.
- **Emerging Start-up Ecosystem:** Small-scale software development firms and BPOs have begun operating in the city, focusing on logistics-tech and fintech solutions for the port and local banking sectors

Table 8-3: Existing Neo TIDEL Park

Feature	Details
Location	Meelavittan, Thoothukudi (Strategically near the Port & Highway)
Project Cost	~Rs.32.50 Crores
Built-up Area	63,000 sq. ft.
Inauguration	December 29, 2024
Building Structure	G+3 Floors
Employment Potential	Approximately 600 – 1,000 direct jobs
Key Facilities	Plug-and-Play office spaces, 24/7 power backup, high-speed fiber connectivity, fitness center, and auditorium.
Occupancy Status	Fully occupied/committed at the time of inauguration, reflecting high demand.



Figure 8.28: Existing NEO TIDEL Park

8.5.17 Tourism

Tourism forms a growing component of Thoothukudi's tertiary sector, complementing its port-led and industrial economy by generating employment

in hospitality, transport, retail, and recreational services. The city's tourism base is anchored in its maritime heritage, religious institutions, coastal assets, and regional pilgrimage circuits, with Thoothukudi functioning as a gateway to major destinations such as Tiruchendur, Navathirupathi, Navakailayam, and Kayalpattinam. Within the Local Planning Area, tourism activity is driven primarily by domestic visitors, supported by religious tourism, leisure visits, eco-tourism, and short-stay business travel linked to port and industrial activities. With major upcoming industrial, energy, and infrastructure investments in the region, there is strong potential for the development of MICE (Meetings, Incentives, Conferences, and Exhibitions) tourism and organised coastal tourism.

8.5.18 Logistics and Storage

Existing Infrastructure and Current Status (Port Level)

VOC Port currently manages a wide range of storage and logistics facilities categorized by cargo type to ensure operational efficiency.

- **Covered Warehousing:** The port features transit sheds (Transit Shed I & II) covering approximately 10,878 sq.m and specialized warehouses for fertilizers and general cargo (IPL, KRIBCO, and RCF warehouses).
- **Container Logistics:** Berth VII serves as a dedicated container terminal with integrated stack yards.
- **Bulk and Liquid Storage:** Dedicated yards are maintained for coal and mineral storage, while an extensive pipeline network supports the transfer of liquid bulk.
- **Space Constraints:** The current infrastructure faces significant space limitations for the intermittent storage of liquid and dry bulk cargo, necessitating immediate expansion of the bonded zones.

Development of the Multi-Modal Logistics Park (MMLP)

- **Proposal for 100-Acre MMLP:** A Multi-Modal Logistics Park is proposed in Tuticorin with an estimated extent of 100 acres.
- **Facility Requirements:** The MMLP should include automated material handling, cold storage facilities, and intermodal transfer hubs for containers and break-bulk cargo.

8.5.19 Financial services

Banking sector activity provides an important reflection of the underlying structure and functioning of a district's economy, as patterns of credit deployment indicate which sectors are active, expanding, or perceived as viable for investment. The scale and composition of bank lending reveal the relative

strength of traditional livelihoods, the depth of enterprise formation, and the extent to which emerging sectors are integrated into the local economic system. In this context, an assessment of sector-wise Annual Credit Plan (ACP) targets, achievement and outstanding credit offers valuable insights into Thoothukudi's economic base, and capacity to absorb investment-led growth.

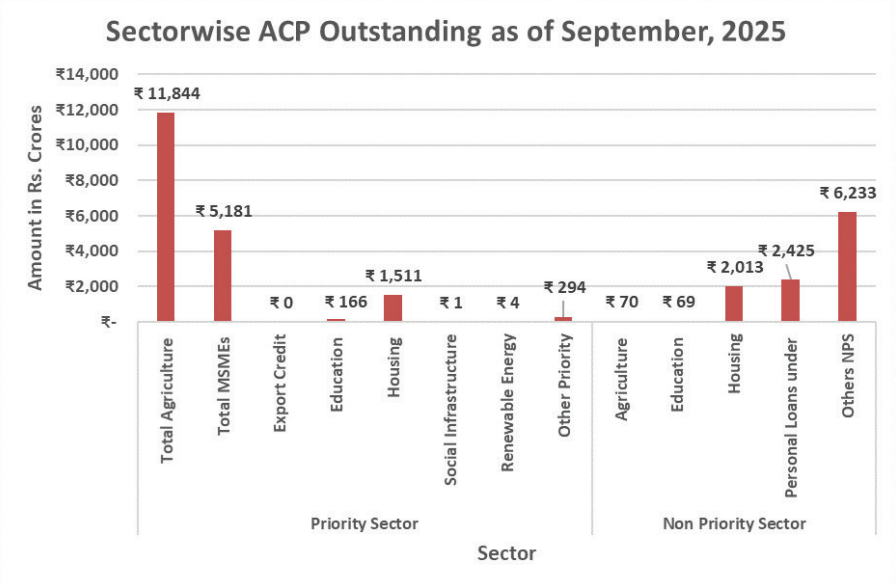


Figure 8.29: Sector wise ACP Outstanding as of September - 2025

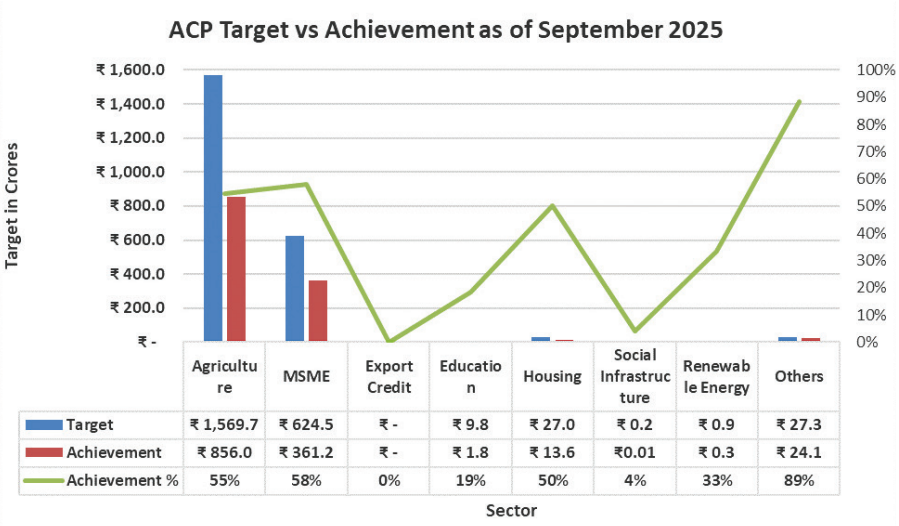


Figure 8.30: Target vs Achievement as of September 2025

Source: Lead Bank, Thoothukudi.

The sector-wise ACP outstanding data highlights the legacy structure of Thoothukudi's credit deployment, with agriculture and MSMEs accounting

for the largest share of cumulative lending, reflecting their long-standing role in the district's economic base. Housing and personal loans also constitute a substantial portion of outstanding credit under the non-priority sector, indicating a consumption- and asset-oriented lending pattern rather than a strong emphasis on productive investment. In contrast, sectors such as export credit, renewable energy, and social infrastructure exhibit very low outstanding values, suggesting that emerging and infrastructure-oriented activities are yet to be fully integrated into the local financial ecosystem. When assessed against annual ACP targets, the target-versus-achievement analysis as of September 2025 shows moderate progress in traditional sectors such as agriculture and MSMEs, with approximately 55–58 per cent of targets achieved by mid-year, indicating steady but not accelerated credit absorption. Housing demonstrates relatively stronger mid-year performance, while renewable energy and social infrastructure display low absolute achievement despite policy emphasis, underscoring limited project-level uptake at the district level. The absence of achievement in export credit further reinforces Thoothukudi's current role as a logistics-oriented port district rather than a locally embedded export-manufacturing hub. Overall, the combined analysis of outstanding and achievement patterns reveals a disconnect between the district's emerging investment ambitions and the structure of local credit deployment, highlighting the need for economic interventions that strengthen value-added activities, export orientation, and integration of new sectors into the local economy.

8.6 Micro, Small And Medium Enterprises

Micro, Small and Medium Enterprises form the backbone of Thoothukudi's local and industrial economy, supporting large-scale industries, port-led activities, and urban services. MSMEs play a critical role in job creation, ancillary production, logistics support, trade, and services, particularly in a port-based industrial region. They provide flexibility and resilience to the economic system by supplying components, services, and labour-intensive activities that complement capital-intensive industries. Strengthening the MSME ecosystem is therefore essential for inclusive growth, value addition, and supply-chain integration.

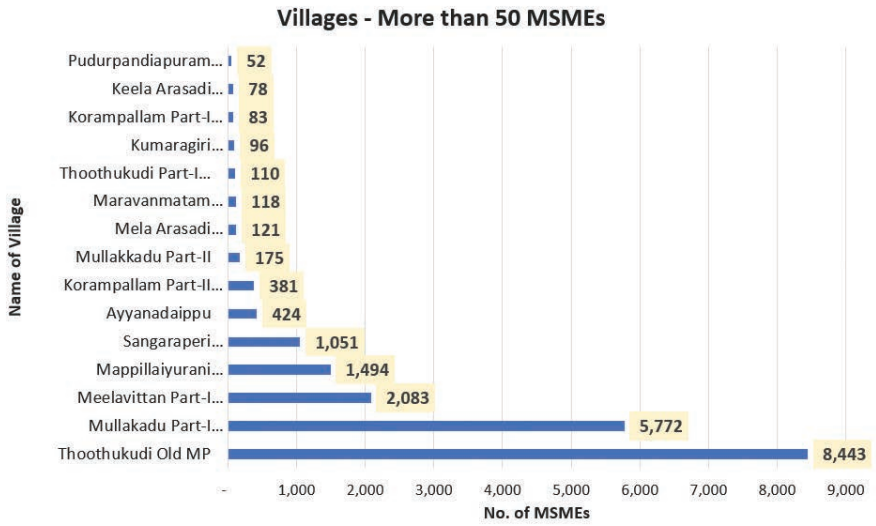


Figure 8-31: Village-wise MSME Distribution

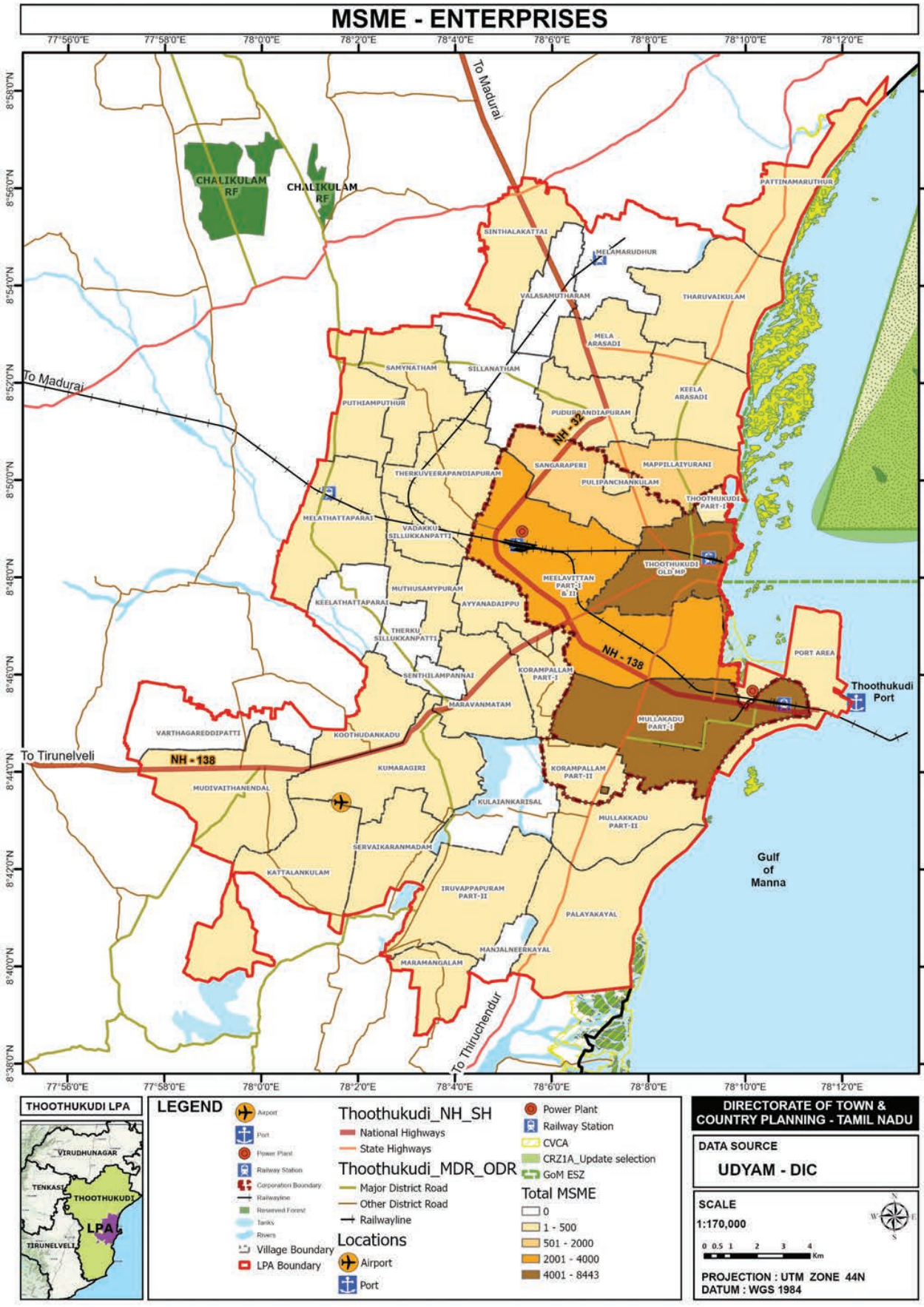
Source: UDYAM - DIC

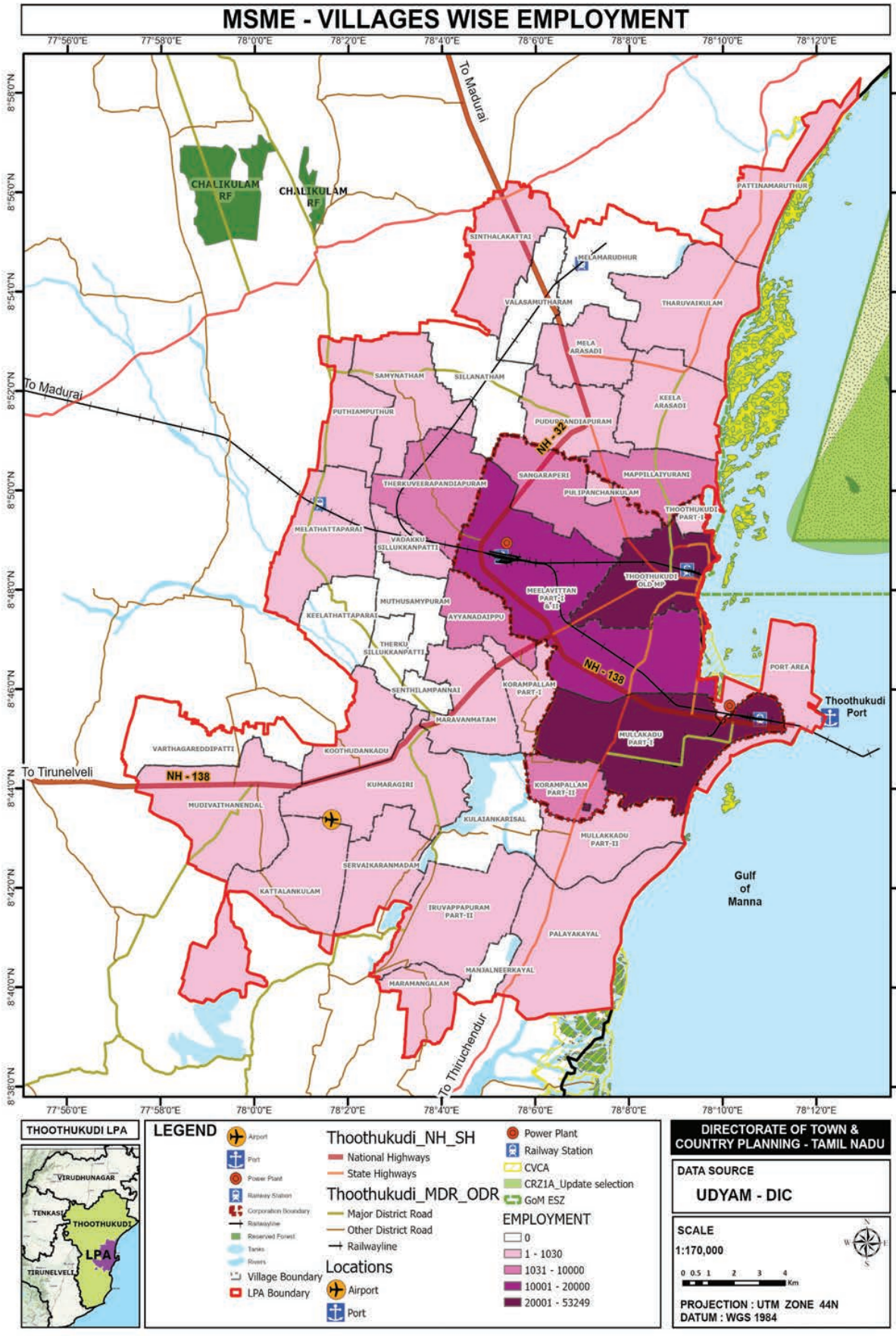
The spatial distribution of MSMEs in the Thoothukudi Local Planning Area (LPA) reveals a heavy concentration within the urban core and port-influenced zones. Areas such as the Thoothukudi Old Municipal Area and Mullakadu Part-I lead in enterprise density, followed by emerging clusters in Meelavittan, Mappillaiyurani, and Sangaraperi. This clustering underscores the dominance of city-centered and port-linked business activities, which serve as the backbone of the local economy.

Spatial Dynamics and Connectivity

The highest MSME density is found within Corporation limits—specifically near the port, industrial estates, and along NH-138 and major arterial roads. In these high-activity zones, enterprise counts range between 4,000 and 8,400 units, driven by:

- Logistics Connectivity: Direct access to the port and national highways.
- Infrastructure: Proximity to large-scale industries and essential services.
- Market Access: Centralized location for trade and distribution


MSME - ENTERPRISES
77°56'0"E
77°58'0"E
78°0'0"E
78°2'0"E
78°4'0"E
78°6'0"E
78°8'0"E
78°10'0"E
78°12'0"E
8°58'0"N
8°56'0"N
8°54'0"N
8°52'0"N
8°50'0"N
8°48'0"N
8°46'0"N
8°44'0"N
8°42'0"N
8°40'0"N
8°38'0"N
To Madurai
To Tirunelveli
To Thiruchendur
NH - 32
NH - 138
CHALIKULAM RF
CHALIKULAM RF
PATTINAMARUTHUR
SINTHALAKATTAI
MELAMARUDHUR
VALASAMUTHARAM
THARUVAIKULAM
MELA ARASADI
KEELA ARASADI
SAMYNATHAM
SILLANATHAM
PUTHIAMPUTHUR
PUDUKANDIAPURAM
SANGARAPERI
MAPPILLAIYURANI
PULIPANCHANKULAM
THERKUVEERAPANDIAPURAM
MELATHATTAPARAI
VADAKKU SILLUKKANPATTI
THOOTHUKUDI PART-I
THOOTHUKUDI OLD MP
MEELAVITTAN PART-I & II
MUTHUSAMYPURAM
KEELATHATTAPARAI
AYYANADAIPPU
THERKU SILLUKKANPATTI
PORT AREA
Thoothukudi Port
KORAMPALLAM PART-I
SENTHILAMPANNAI
MARAVANMATAM
MULLAKADU PART-I
VARTHAGAREDDIPATTI
KOOTHUDANKADU
KUMARAGIRI
KORAMPALLAM PART-II
MUDIVAITHANENDAL
KULAIANKARISAL
MULLAKKADU PART-II
SERVAIKARANMADAM
KATTALANKULAM
IRUVAPPAPURAM PART-II
PALAYAKAYAL
MANJALNEERKAYAL
MARAMANGALAM
Gulf of Manna
THOOTHUKUDI LPA
VIRUDHUNAGAR
TENKASI
THOOTHUKUDI
TIRUNELVELI
LPA
LEGEND
Airport
Port
Power Plant
Railway Station
Corporation Boundary
Railwayline
Reserved Forest
Tanks
Rivers
Village Boundary
LPA Boundary
Thoothukudi_NH_SH
National Highways
State Highways
Thoothukudi_MDR_ODR
Major District Road
Other District Road
Railwayline
Locations
Airport
Port
Power Plant
Railway Station
CVCA
CRZ1A_Update selection
GoM ESZ
Total MSME
0
1 - 500
501 - 2000
2001 - 4000
4001 - 8443
DIRECTORATE OF TOWN & COUNTRY PLANNING - TAMIL NADU
DATA SOURCE
UDYAM - DIC
SCALE
1:170,000
0 0.5 1 2 3 4
Km
PROJECTION : UTM ZONE 44N
DATUM : WGS 1984



Map 8.6: Total MSME Enterprises & Employment

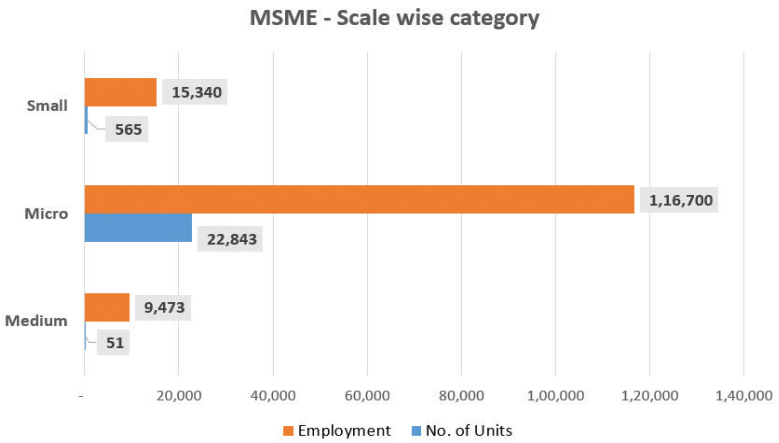


Figure 8-32: MSME - Scale wise Category

Source: UDYAM - DIC

The MSME landscape in the Thoothukudi Local Planning Area (LPA) is characterised by a massive base of Micro-scale enterprises, which function as the primary engine for MSME based employment. According to sectoral data, Micro units account for 22,843 enterprises and provide livelihoods to 1,16,700 individuals, dwarfing the combined employment figures of Small and Medium categories. While Medium-scale units are fewer in number (51 units), they represent the highest employment density per enterprise, supporting 9,473 jobs.

In terms of functional distribution, the Services sector is the most dominant activity, hosting 11,455 units and employing 65,897 people. However, the Manufacturing sector demonstrates significant economic weight; despite having the lowest unit count (4,699), it generates substantial employment for 44,622 individuals, indicating a high labour-to-unit ratio compared to the Trading sector. This data suggests that while the economy is volume-driven by microservice providers, the Manufacturing segment remains a critical pillar for concentrated job creation.

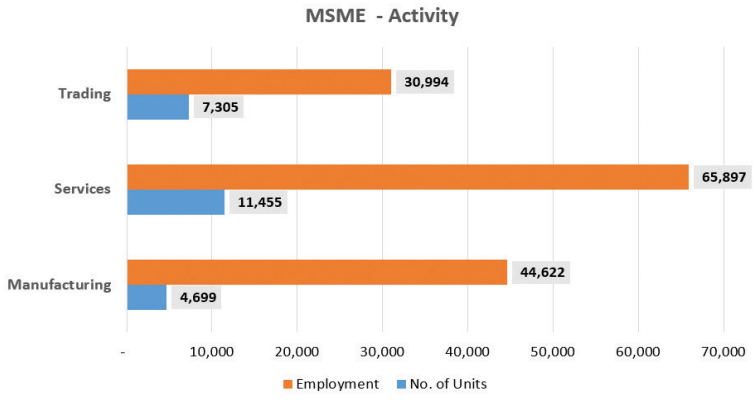


Figure 8-33: MSME - Activity

Source: UDYAM - DIC

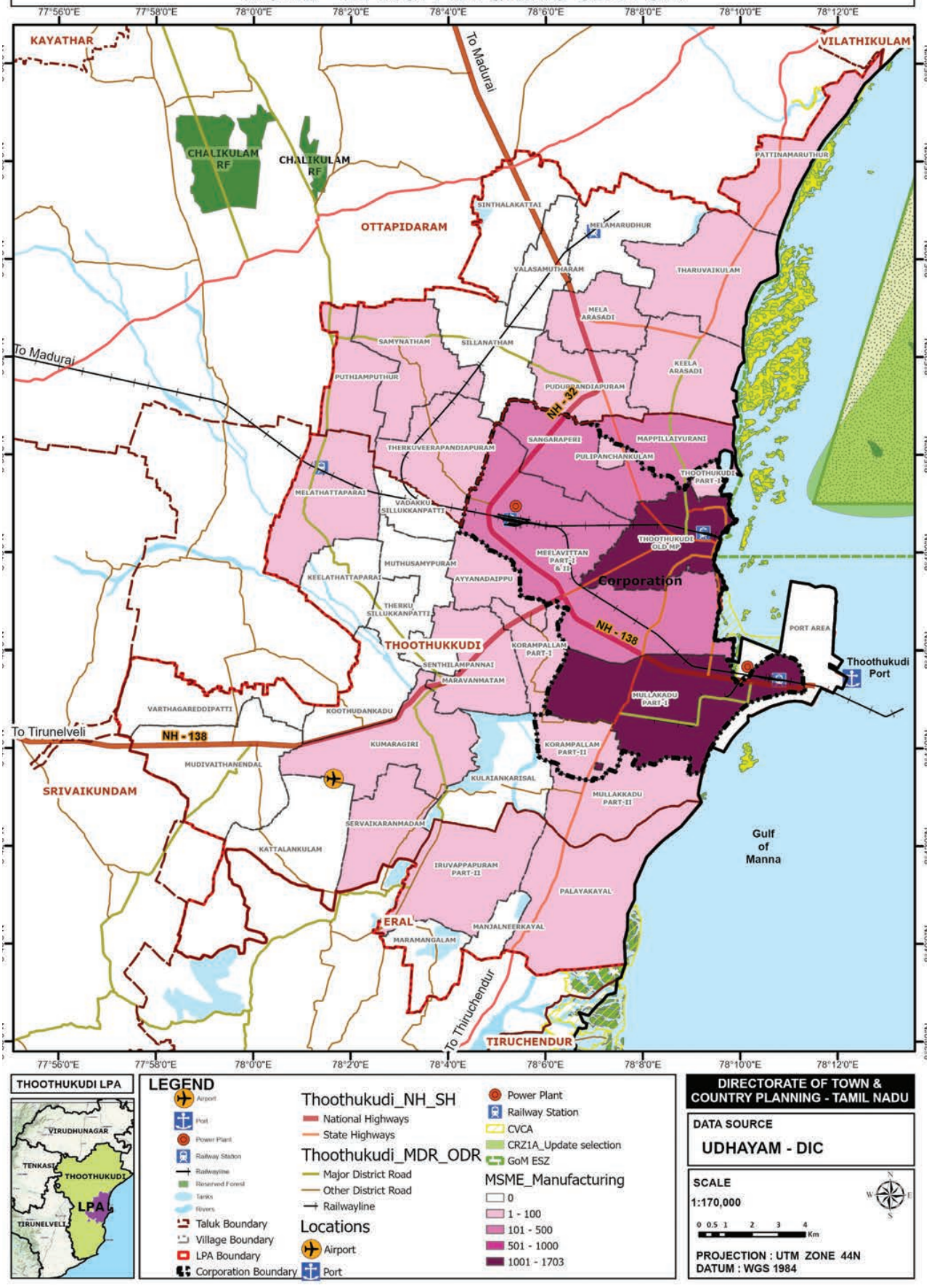
Employment generated by MSMEs follows a similar spatial pattern. The highest MSME employment levels (20,000–53,000 workers) are concentrated in the core urban and port-adjacent villages, indicating a dense clustering of labour-intensive manufacturing, trade, and service activities. Secondary employment clusters (10,000–20,000 workers) are observed along key transport corridors and industrial influence zones, while outer villages largely fall within the lower employment bands (below 1,000–10,000 workers).

Manufacturing Sector

Manufacturing MSMEs are primarily concentrated around the Thoothukudi Corporation area, SIPCOT industrial estates, port-influenced zones, and major transport corridors. These units are engaged in fabrication, engineering works, food processing, textile-related manufacturing, and industrial component production, reflecting strong linkages with large-scale industries and port-based logistics.

The manufacturing employment map indicates that the highest employment concentrations (10,000–17,000 workers) are clustered in the urban core, port area, and SIPCOT-influenced villages, underscoring the labour-absorbing nature of these clusters. Secondary employment bands (5,000–10,000 workers) extend along NH-138 and key industrial corridors, while peripheral villages record lower employment levels (below 1,000–5,000 workers), largely associated with agro-processing and small-scale manufacturing. This spatial and employment pattern highlights the need to reinforce industrial infrastructure, power supply, and logistics within designated manufacturing clusters to support job-intensive MSME growth and more balanced industrial development across the planning area.

MSME - MANUFACTURING SECTOR



THOOTHUKUDI LPA

LEGEND

- Airport
- Port
- Power Plant
- Railway Station
- Railwayline
- Reserved Forest
- Tanks
- Rivers
- Taluk Boundary
- Village Boundary
- LPA Boundary
- Corporation Boundary

Thoothukudi_NH_SH
- National Highways
- State Highways

Thoothukudi_MDR_ODR
- Major District Road
- Other District Road
- Railwayline

Locations
- Airport
- Port
- Power Plant
- Railway Station
- CVCA
- CRZ1A_Update selection
- GoM ESZ

MSME_Manufacturing
- 0
- 1 - 100
- 101 - 500
- 501 - 1000
- 1001 - 1703

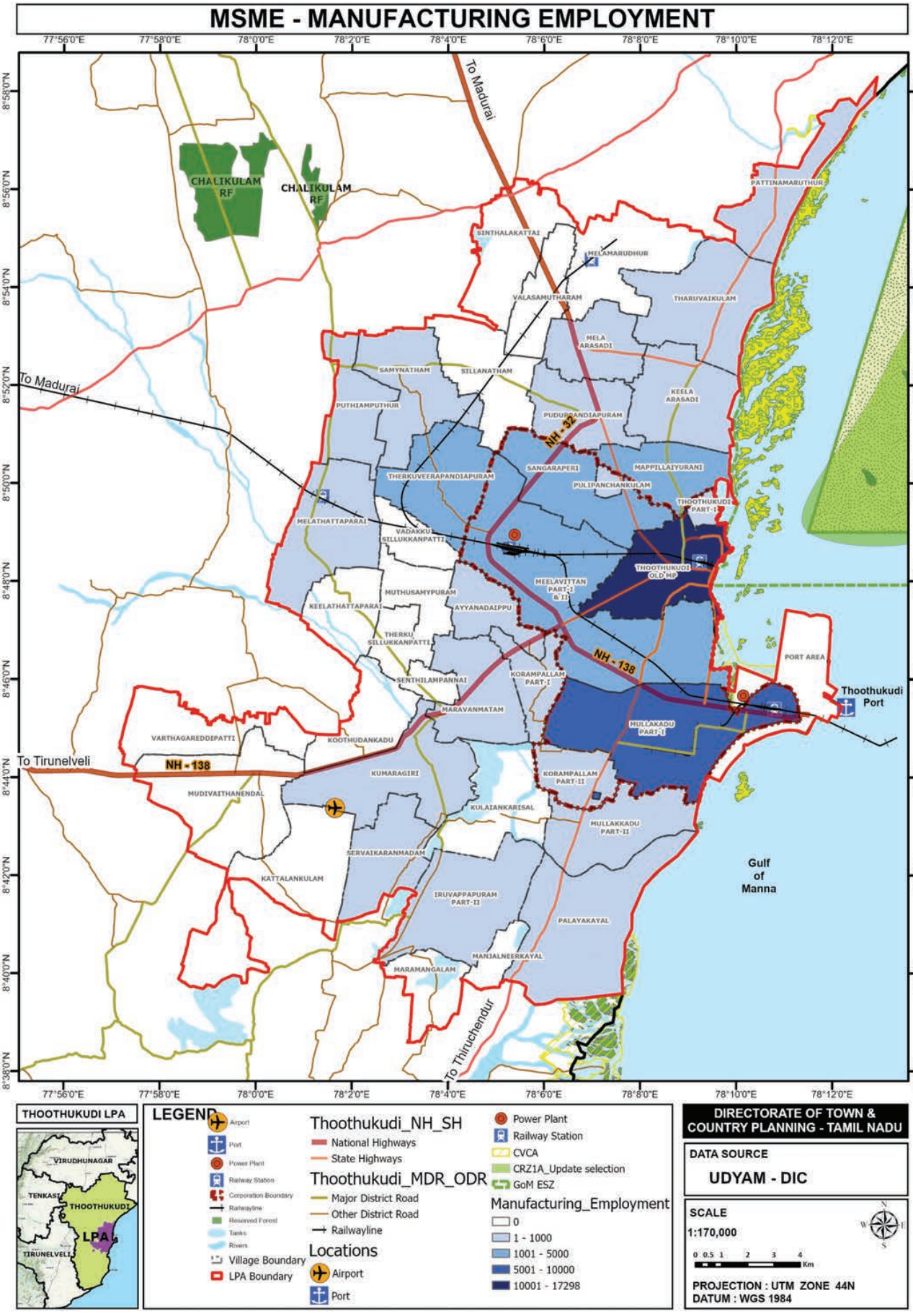
DIRECTORATE OF TOWN & COUNTRY PLANNING - TAMIL NADU

DATA SOURCE
UDHAYAM - DIC

SCALE
1:170,000

0 0.5 1 2 3 4 Km

PROJECTION : UTM ZONE 44N
DATUM : WGS 1984



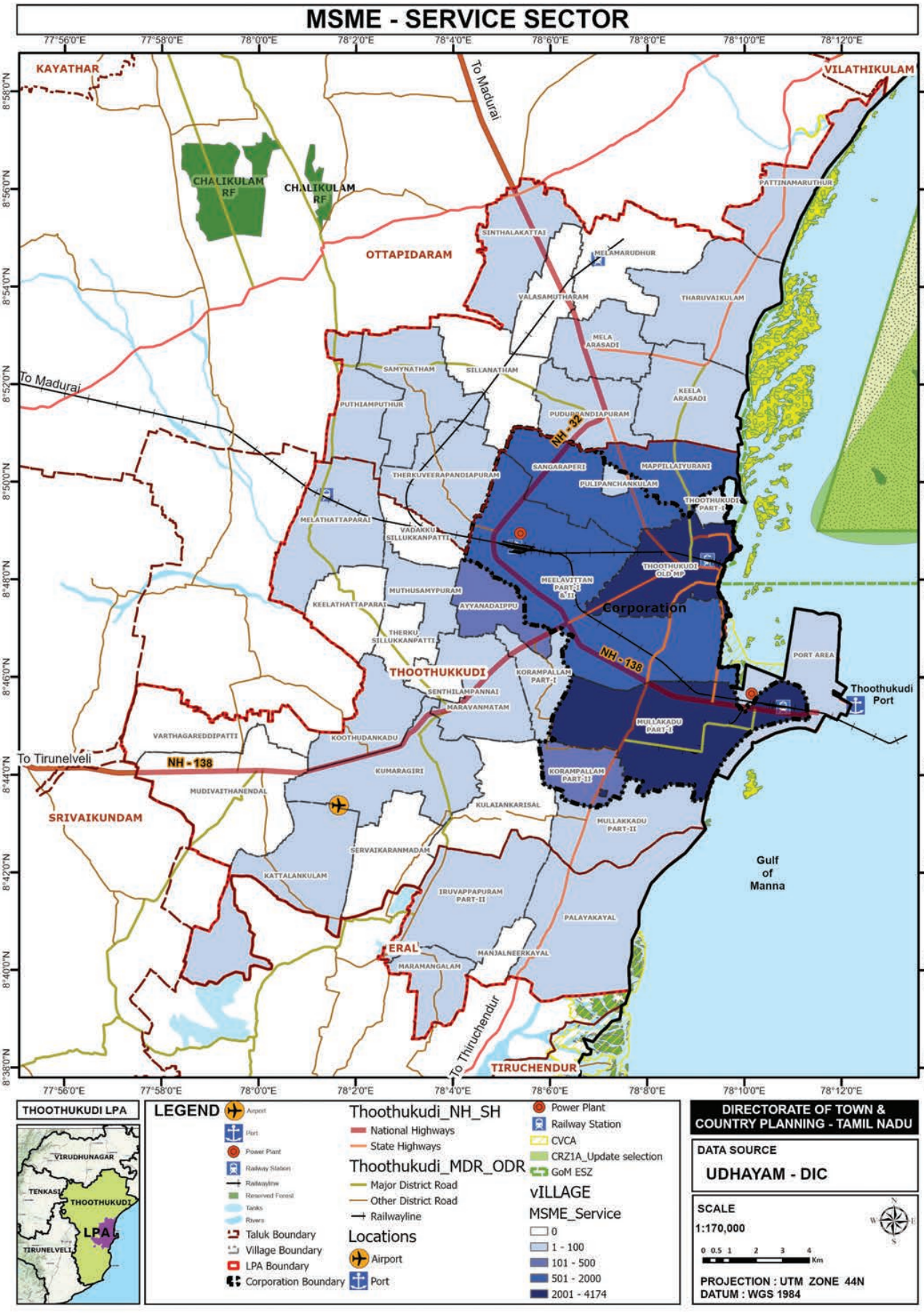
Map 8.7: Manufacturing MSME Industries & Employment

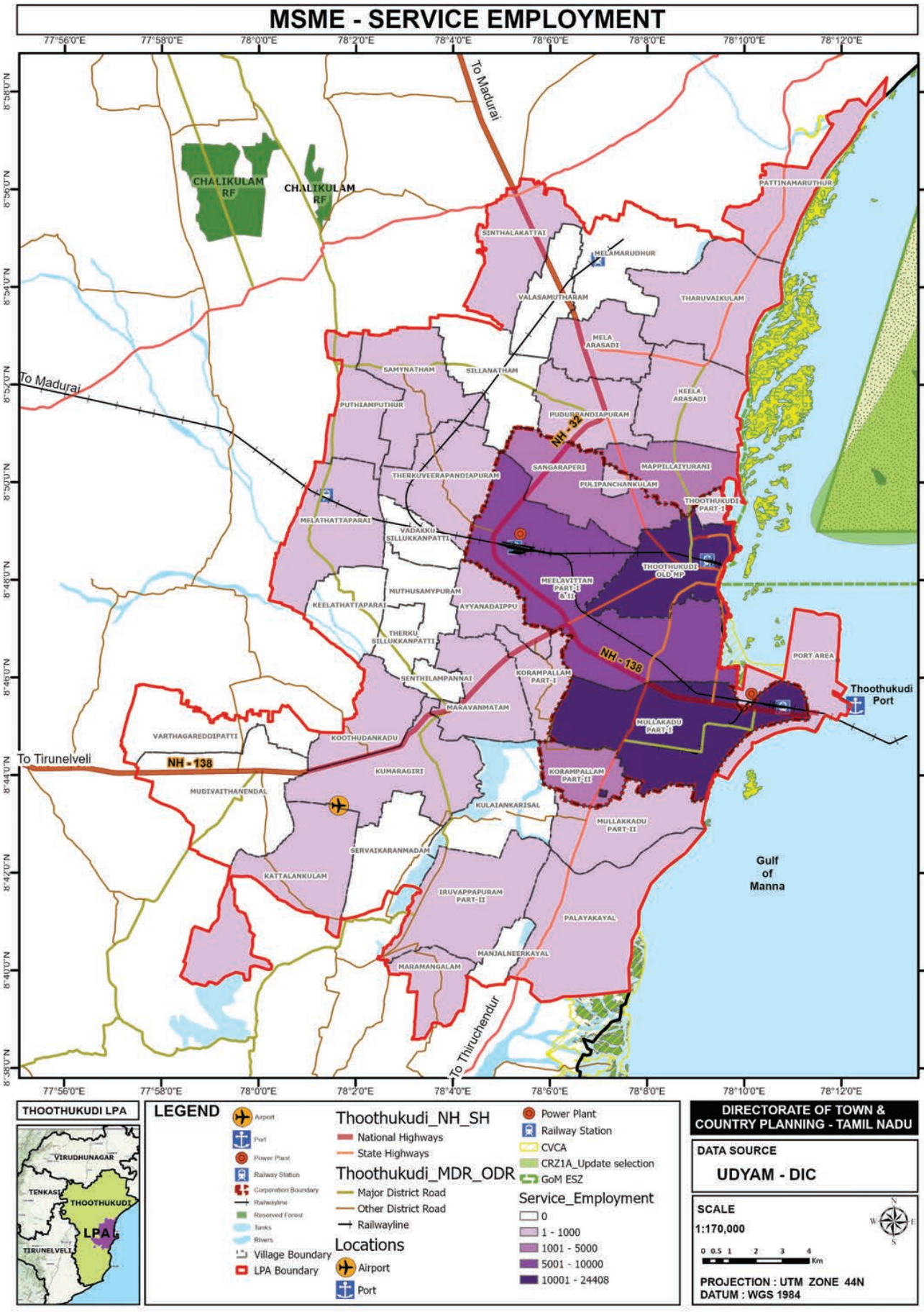
Service Sector

Service-sector MSMEs are widely distributed across the urban core and along major road corridors, with the highest concentration within the Thoothukudi Corporation limits. These enterprises include transport services, repairs, logistics support, professional services, hospitality-related activities, and informal services that directly support port, industrial, and urban functions. The employment map indicates that service-sector employment is most intensive in the city core and port-adjacent areas, where higher population density and industrial activity generate sustained demand for services. Moderate employment levels extend along NH-138 and key arterial roads, reflecting corridor-based commercial and service growth, while peripheral villages show relatively lower service employment linked to local markets and rural demand. This pattern highlights the role of service MSMEs as a critical employment absorber and an essential support system for Thoothukudi's port-led and industrial economy.

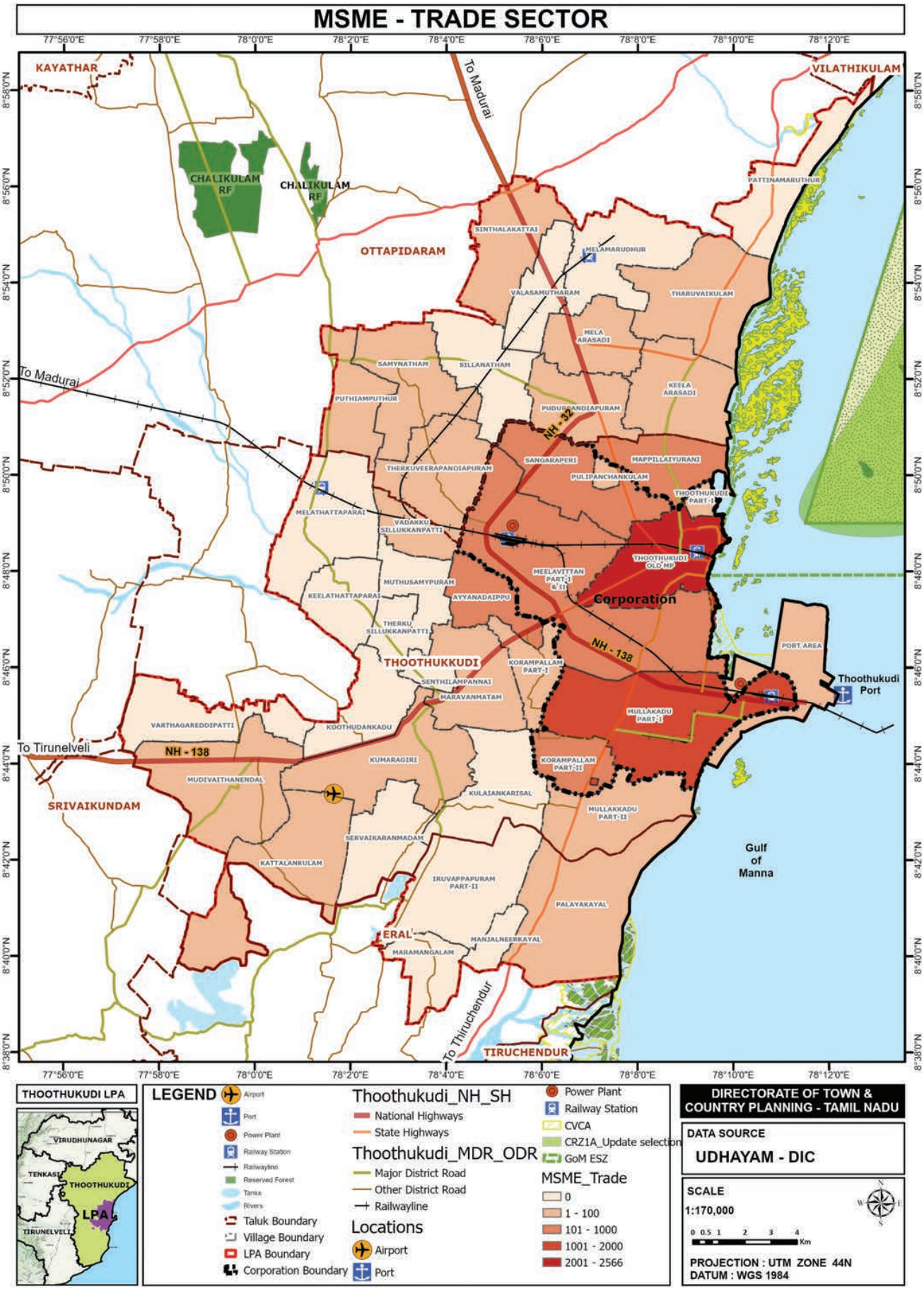
Trade Sector

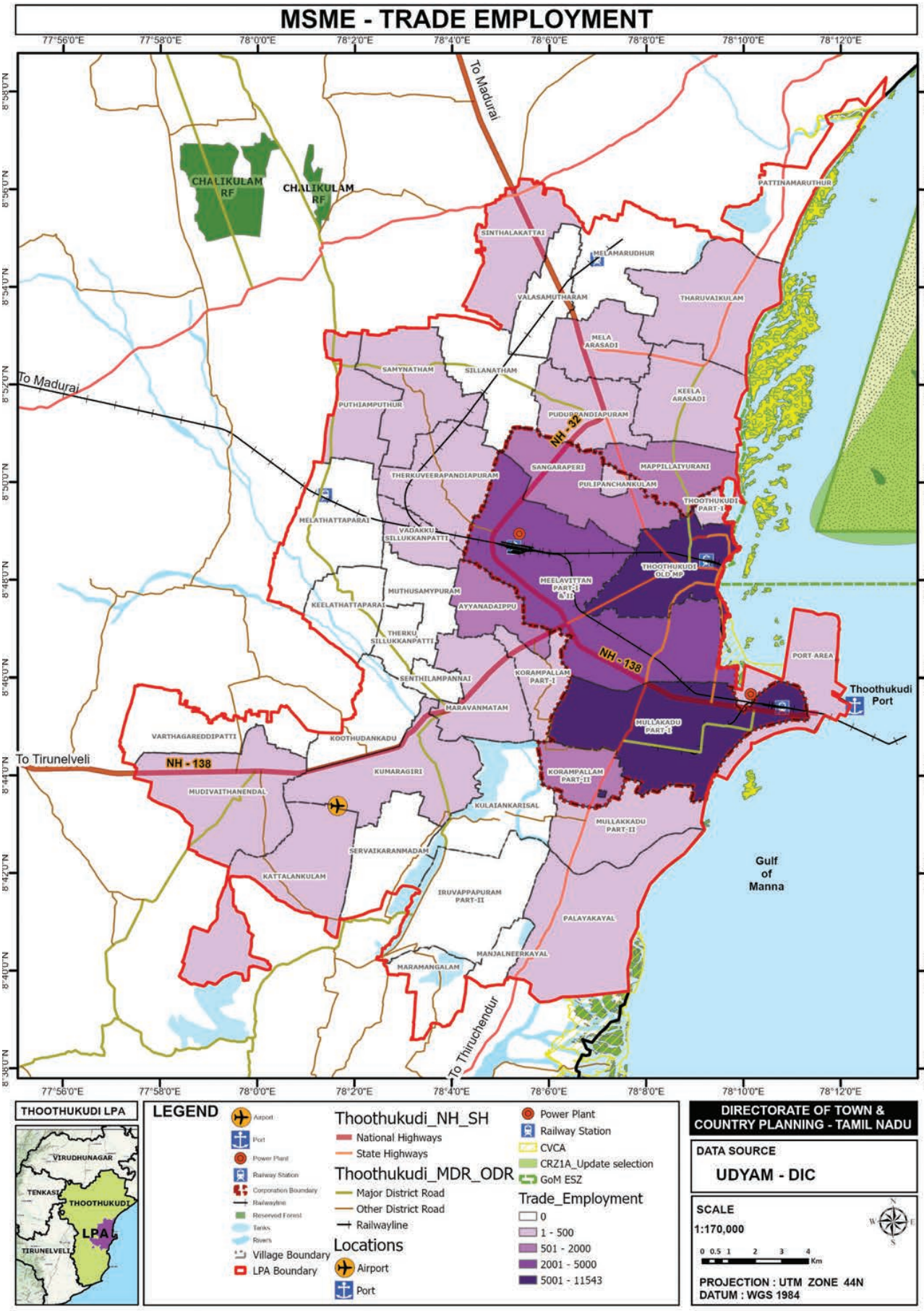
Trade MSMEs show strong concentration within urban commercial areas, port-linked zones, and the highway corridors connecting Madurai, Tirunelveli, and Tiruchendur. These enterprises are engaged in wholesale and retail trade of industrial inputs, consumer goods, construction materials, and port-related commodities. The employment map indicates that trade-related employment is highest within the Thoothukudi Corporation area and port-adjacent localities, reflecting the role of the city as the primary trading and distribution centre for the district. Secondary employment concentrations are visible along NH-138 and other major arterials, where roadside markets, transport-linked trade, and logistics-oriented commerce have developed. This pattern underscores the function of trade MSMEs as critical intermediaries linking manufacturing clusters, port operations, and regional markets, thereby reinforcing Thoothukudi's role as a commercial and logistics hub.


MSME - SERVICE SECTOR
77°56'0"E
77°58'0"E
78°0'0"E
78°2'0"E
78°4'0"E
78°6'0"E
78°8'0"E
78°10'0"E
78°12'0"E
8°58'0"N
8°56'0"N
8°54'0"N
8°52'0"N
8°50'0"N
8°48'0"N
8°46'0"N
8°44'0"N
8°42'0"N
8°40'0"N
8°38'0"N
KAYATHAR
VILATHIKULAM
To Madurai
CHALIKULAM RF
CHALIKULAM RF
OTTAPIDARAM
SINTHALAKATTAI
MELAMARUDHUR
VALASAMUTHARAM
THARUVAIKULAM
PATTINAMARUTHUR
MELA ARASADI
KEELA ARASADI
SAMYNATHAM
SILLANATHAM
PUTHIAMPUTHUR
PUDURPANDIAPURAM
NH - 32
SANGARAPERI
MAPPILLAIYURANI
PULIPANCHANKULAM
THERKUVEERAPANDIAPURAM
THOOTHUKUDI PART-I
MELATHATTAPARAI
VADAKKU SILLUKKANPATTI
THOOTHUKUDI OLD HP
MEELAVITTAN PART-I & II
MUTHUSAMYPURAM
KEELATHATTAPARAI
AYYANADAIPPU
Corporation
THERKU SILLUKKANPATTI
NH - 138
PORT AREA
THOOTHUKKUDI
KORAMPALLAM PART-I
SENTHILAMPANNAI
MARAVANMATAM
Thoothukudi Port
MULLAKADU PART-I
VARTHAGAREDDIPATTI
KOOTHUDANKADU
To Tirunelveli
NH - 138
KUMARAGIRI
KORAMPALLAM PART-II
MUDIVAITHANENDAL
KULAIANKARISAL
SRIVAIKUNDAM
MULLAKKADU PART-II
SERVAIKARANMADAM
Gulf of Manna
KATTALANKULAM
IRUVAPPAPURAM PART-II
PALAYAKAYAL
ERAL
MANJALNEERKAYAL
MARAMANGALAM
To Thiruchendur
TIRUCHENDUR
THOOTHUKUDI LPA
VIRUDHUNAGAR
TENKASI
THOOTHUKUDI
LPA
TIRUNELVELI
LEGEND
Airport
Port
Power Plant
Railway Station
Railwayline
Reserved Forest
Tanks
Rivers
Taluk Boundary
Village Boundary
LPA Boundary
Corporation Boundary
Thoothukudi_NH_SH
National Highways
State Highways
Thoothukudi_MDR_ODR
Major District Road
Other District Road
Railwayline
Locations
Airport
Port
Power Plant
Railway Station
CVCA
CRZ1A_Update selection
GoM ESZ
vILLAGE
MSME_Service
0
1 - 100
101 - 500
501 - 2000
2001 - 4174
DIRECTORATE OF TOWN & COUNTRY PLANNING - TAMIL NADU
DATA SOURCE
UDHAYAM - DIC
SCALE
1:170,000
0 0.5 1 2 3 4 Km
PROJECTION : UTM ZONE 44N
DATUM : WGS 1984



Map 8.8: MSME - Service Enterprises & Employment


MSME - TRADE SECTOR
KAYATHAR
VILATHIKULAM
CHALIKULAM RF
CHALIKULAM RF
To Madurai
OTTAPIDARAM
SINTHALAKATTAI
MELAMARUDHUR
PATTINAMARUTHUR
VALASAMUTHARAM
THARUVAIKULAM
MELA ARASADI
KEELA ARASADI
SAMYNATHAM
SILLANATHAM
PUTHIAMPUTHUR
PUDURPANDIAPURAM
NH - 32
THERKUVEERAPANDIAPURAM
SANGARAPERI
MAPPILLAIYURANI
PULIPANCHANKULAM
THOOTHUKUDI PART-II
MELATHATTAPARAI
VADAKKU SILLUKKANPATTI
THOOTHUKUDI OLD MP
MEELAVITTAN PART-I & II
MUTHUSAMYPURAM
KEELATHATTAPARAI
AYYANADAIPPU
Corporation
THERKU SILLUKKANPATTI
PORT AREA
NH - 138
THOOTHUKKUDI
KORAMPALLAM PART-I
Thoothukudi Port
SENTHILAMPANNAI
MARAVANMATAM
MULLAKADU PART-I
VARTHAGAREDDIPATTI
KOOTHUDANKADU
To Tirunelveli
NH - 138
KUMARAGIRI
KORAMPALLAM PART-II
MUDIVAITHANENDAL
KULAIANKARISAL
SRIVAIKUNDAM
MULLAKKADU PART-II
SERVAIKARANMADAM
Gulf of Manna
KATTALANKULAM
IRUVAPPAPURAM PART-II
PALAYAKAYAL
ERAL
MANJALNEERKAYAL
MARAMANGALAM
To Thiruchendur
TIRUCHENDUR
77°56'0"E
77°58'0"E
78°0'0"E
78°2'0"E
78°4'0"E
78°6'0"E
78°8'0"E
78°10'0"E
78°12'0"E
8°58'0"N
8°56'0"N
8°54'0"N
8°52'0"N
8°50'0"N
8°48'0"N
8°46'0"N
8°44'0"N
8°42'0"N
8°40'0"N
8°38'0"N
THOOTHUKUDI LPA
VIRUDHUNAGAR
TENKASI
THOOTHUKUDI
LPA
TIRUNELVELI
LEGEND
Airport
Port
Power Plant
Railway Station
Railwayline
Reserved Forest
Tanks
Rivers
Taluk Boundary
Village Boundary
LPA Boundary
Corporation Boundary
Thoothukudi_NH_SH
National Highways
State Highways
Thoothukudi_MDR_ODR
Major District Road
Other District Road
Railwayline
Locations
Airport
Port
Power Plant
Railway Station
CVCA
CRZ1A_Update selection
GoM ESZ
MSME_Trade
0
1 - 100
101 - 1000
1001 - 2000
2001 - 2566
DIRECTORATE OF TOWN & COUNTRY PLANNING - TAMIL NADU
DATA SOURCE
UDHAYAM - DIC
SCALE
1:170,000
0 0.5 1 2 3 4 Km
PROJECTION : UTM ZONE 44N
DATUM : WGS 1984



Map 8.9: MSME - Trade Enterprises & Employment

Scale-wise Distribution of MSMEs

Micro Enterprises

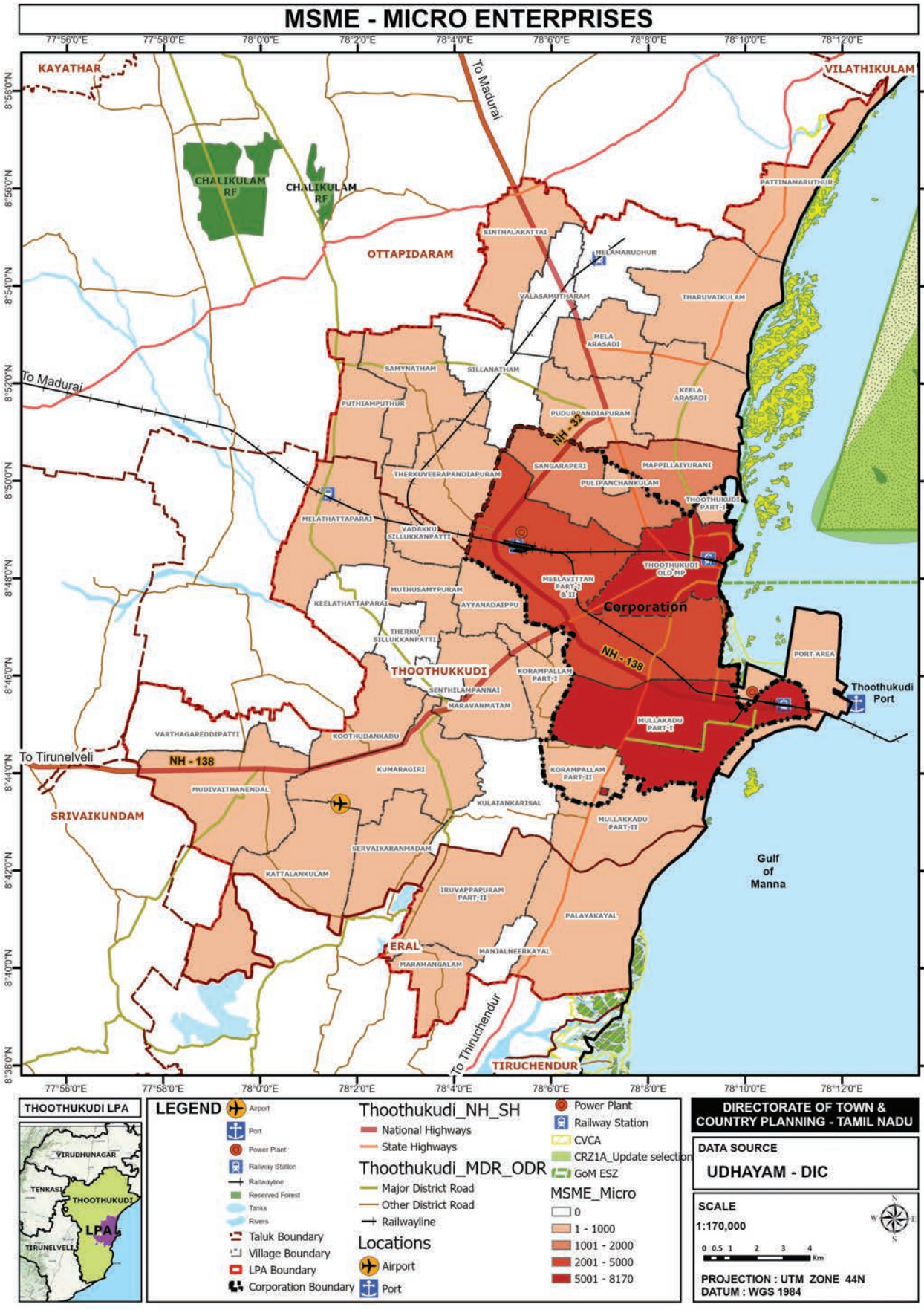
Micro enterprises constitute the largest share of MSMEs and are widely dispersed across urban neighbourhoods and rural settlements. They are typically household-based or small-unit operations involved in retail, services, repairs, transport, and small-scale manufacturing. Their dominance reflects low entry barriers and strong self-employment trends, but also limited access to capital, technology, and formal industrial spaces. While they provide livelihood security, their scale constraints highlight the need for targeted support for formalisation and productivity enhancement.

Small Enterprises

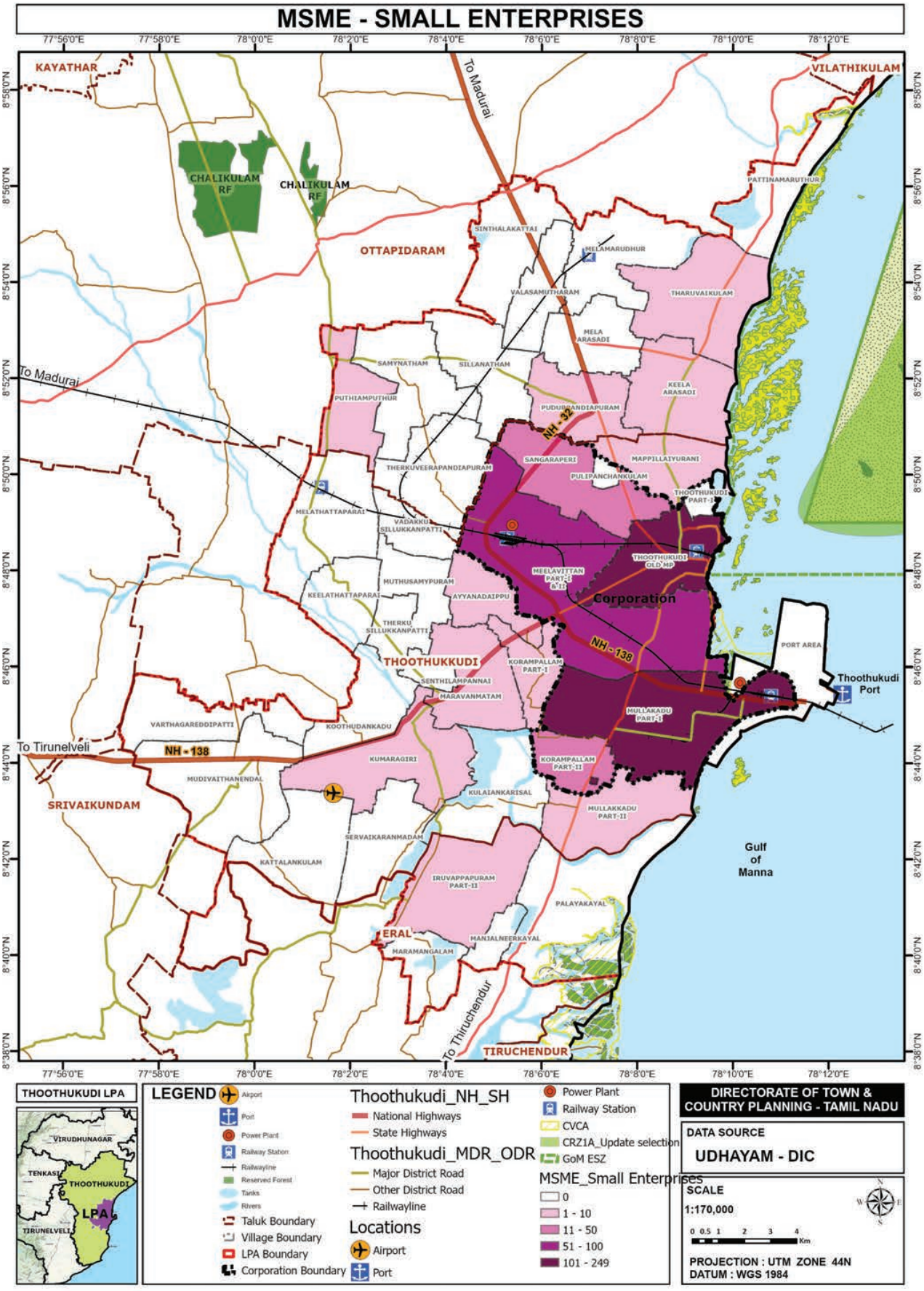
Small enterprises are moderately distributed and tend to cluster around industrial estates, transport corridors, and peri-urban zones. These units often function as ancillary suppliers, subcontractors, and specialised service providers to larger industries. Compared to micro enterprises, they require better infrastructure, larger plots, and formal workspaces. Their relatively lower numbers indicate constraints related to land availability, infrastructure, and investment access, underscoring the importance of planned MSME industrial clusters.

Medium Enterprises

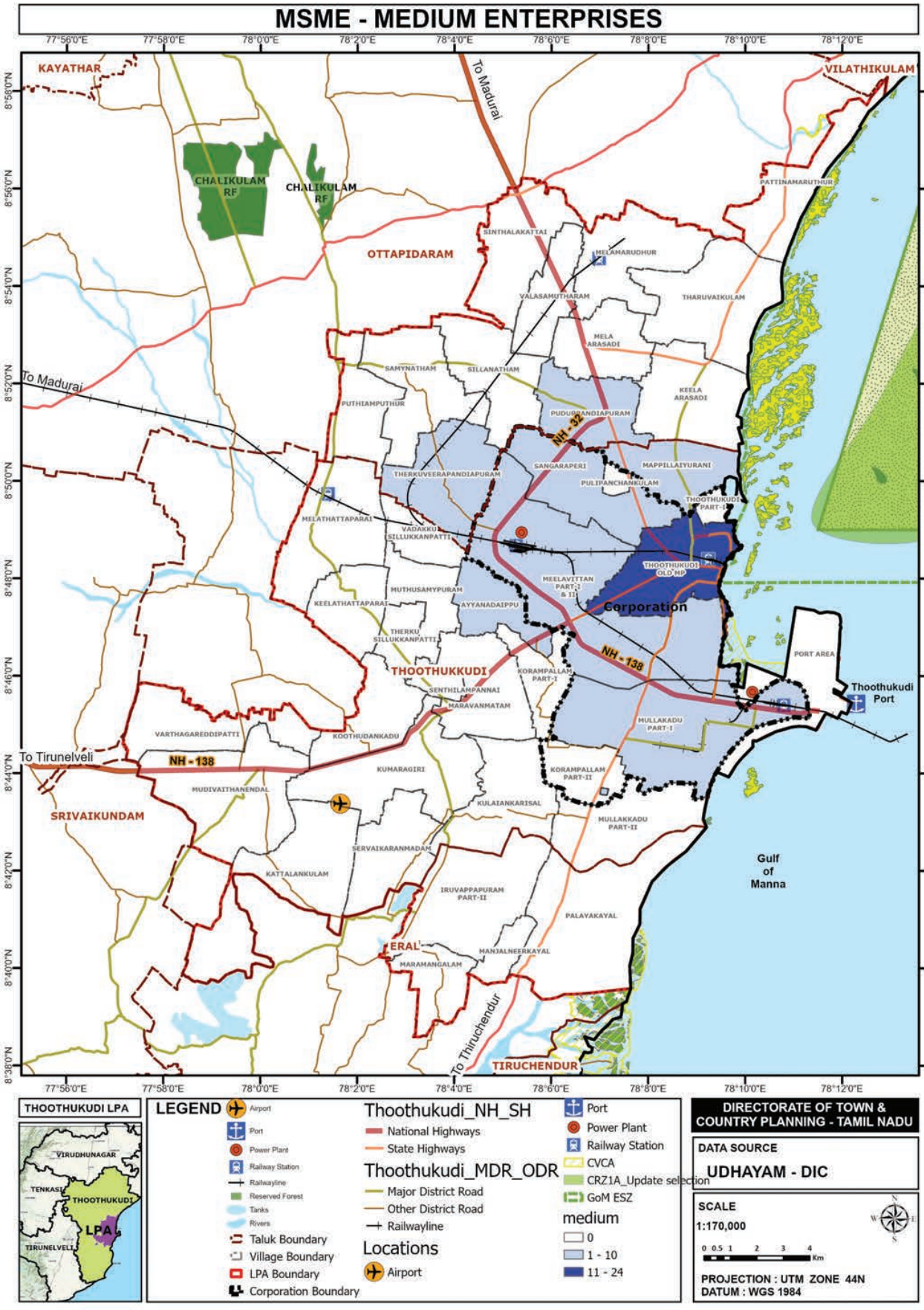
Medium enterprises are limited in number and highly concentrated in well-serviced industrial and port-proximate locations. These units are more capital-intensive and engaged in engineering, processing, fabrication, and export-oriented activities. Their spatial concentration reflects the need for reliable infrastructure, skilled labour, regulatory compliance, and logistics connectivity. The small base of medium enterprises suggests a missing middle in enterprise scaling, highlighting the need to support the transition of small enterprises into higher-value, medium-scale operations.



Map 8.10: MSME - Micro Enterprises



Map 8.11: MSME - Small Enterprises



Map 8.12: MSME - Medium Enterprises

8.7 Industrial and Commercial Growth Trend

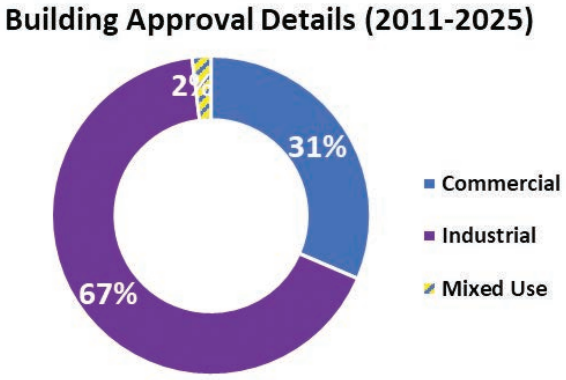


Figure 8.34: Building Approval Data

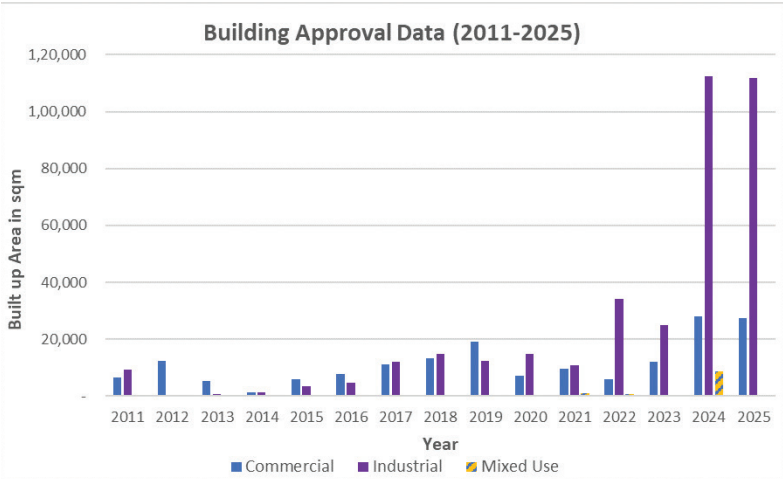


Figure 8.35: Building Approval Trend (2011 – 2025)

Source: DTCP, Thoothukudi.

The analysis of building approval data from 2011 to 2025 highlights a strong industrial-led growth trajectory within the planning area. Industrial developments account for nearly two-thirds of the total approved built-up area, underscoring the region's role as a major industrial and port-influenced economy. Commercial developments, while significant, primarily function as support infrastructure catering to industrial activity, workforce requirements, and urban services.

Temporally, the period between 2011 and 2016 reflects a relatively subdued development phase. This was followed by steady growth during 2017–2019, and a pronounced surge after 2021. The sharp increase in industrial

approvals during 2022–2025 indicates large-scale investments, expansion of industrial estates, and heightened economic activity, possibly linked to port-led development and regional industrial policies. Commercial approvals have also risen in tandem, though at a comparatively moderate scale, reflecting demand for trade, warehousing, offices, and allied services.

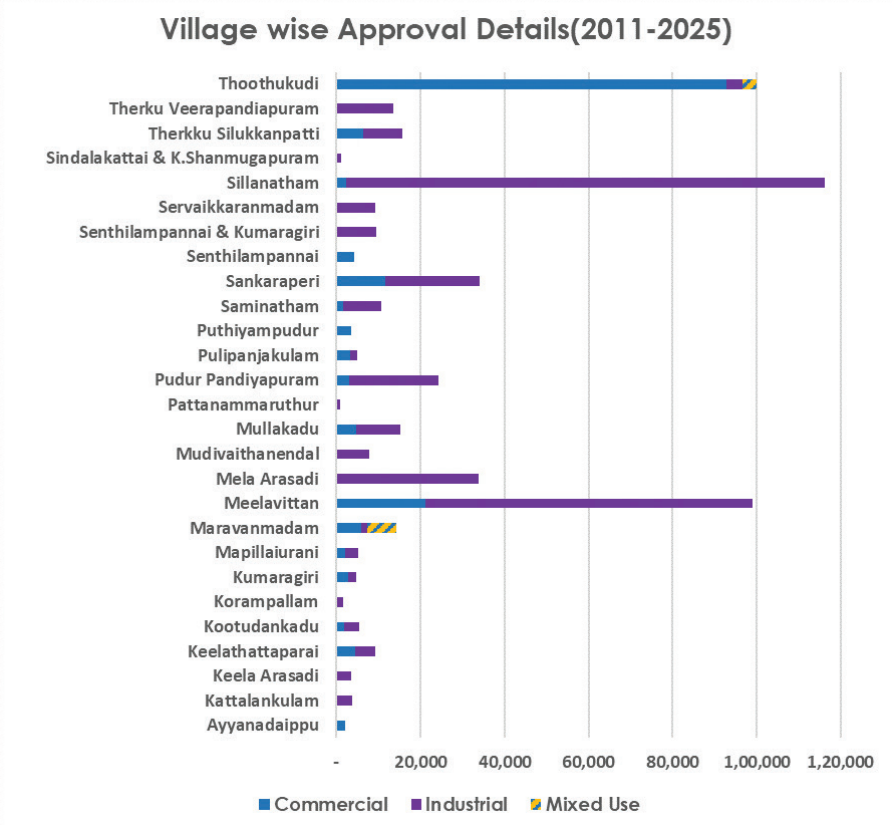


Figure 8.36: Village Wise Building Approvals

Source: DTCP ,Thoothukudi.

Spatially, industrial development is highly concentrated. Villages such as Sillanatham, Meelavittan, Sankaraperi, and Mela Arasadi account for a substantial share of industrial approvals, indicating the presence of established industrial clusters and the availability of large contiguous land parcels. In contrast, Thoothukudi town continues to dominate commercial approvals, reinforcing its role as the primary urban and service hub within the region.

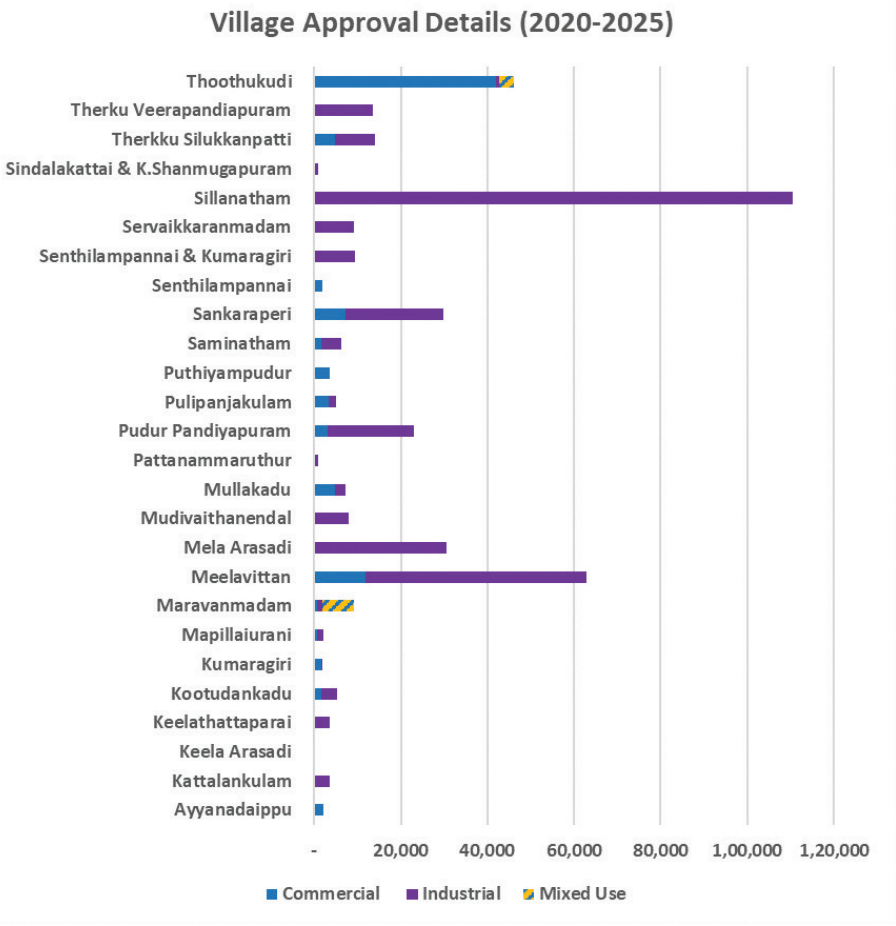


Figure 8.37: Village Wise Building Approval Trend (2020 - 2025)

Source: DTCP , Thoothukudi.

The village-wise analysis for the recent period (2020–2025) reveals a trend of intensification within existing industrial nodes rather than dispersal to new areas. Mixed-use developments remain minimal, suggesting that land-use patterns are still largely segregated, with limited adoption of integrated or compact development models.

Overall, the approval trends point toward an industrial-driven economic structure with spatial concentration, growing commercial support functions, and early but limited signs of diversification. These patterns underline the need for planned industrial zoning, supporting commercial infrastructure, improved connectivity, and a gradual transition toward mixed-use and employment-supportive urban forms in future development proposals.

8.8 VOC Port

V.O. Chidambaranar Port (VOC Port), located in Thoothukudi on India's southeastern coast, is one of the 12 major ports in the country and a vital maritime gateway for regional and international trade. Situated at latitude 08°45' N and longitude 78°13' E, and with an artificial deep-water harbour, VOC Port operates year-round in calm coastal waters. Its strategic position — approximately 129 nautical miles from the Middle East–Far East trade route and 160 km north of Kanyakumari — enhances its accessibility to global shipping networks, while its proximity to the Palk Strait and the Gulf of Mannar supports uninterrupted international connectivity. This location advantage positions VOC Port as a key node not only for cargo handling but also for regional industrial and economic expansion. The port managed over 41.72 million tonnes of cargo in 2024–25, indicating significant handling capacity and continued growth potential.



Figure 8.38: Satellite image of the VOC Port

Source: VOC Port Master Plan -2047

Operational Structure and Cargo Profile

V.O. Chidambaranar Port operates through two distinct operational wings, namely Zone A and Zone B. Zone A, which constitutes the new port area, accommodates the primary commercial and container handling operations, while Zone B comprises the older anchorage port located approximately 9 km from the new port. This dual-zone configuration enables functional segregation of activities and provides operational flexibility for handling diverse cargo streams.



Figure 8.39: VOC Port Zone

Source: VOC Port Master Plan -2047

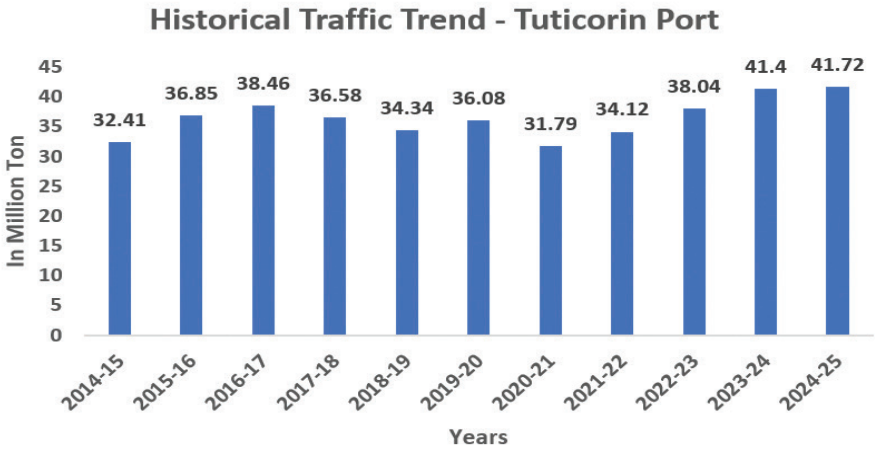


Figure 8.40: Traffic Details of VOC Port (2015-2025)

Source: VOC Port Master Plan -2047

VOC Port handles a wide range of cargo types, reflecting its role as a multi-commodity maritime gateway. Bulk cargo includes coal, salt, fertilisers, limestone, copper concentrate, and other industrial raw materials. Liquid cargo primarily consists of petroleum products, chemicals, and edible oils, while containerised cargo includes export–import goods such as textiles, machinery, and agricultural products. VOC Port has demonstrated a steady long-term

growth trajectory in cargo handling over the past decade. Port traffic increased from approximately 32.4 million tonnes in 2014–15 to 41.7 million tonnes in 2024–25, despite a temporary dip during 2020–21, reflecting resilience to external shocks. The recovery and subsequent growth in cargo volumes highlight the port's operational stability and its capacity to support expanding industrial and trade activities in the region.

The cargo profile of VOC Port continues to be import-dominant, with imports accounting for about 77% and exports for around 23% of total cargo handled in 2024–25. This composition underscores the port's role as a key gateway for industrial raw materials and energy inputs required by the regional economy. At the same time, the export share, though smaller, indicates a stable outward flow of manufactured and processed goods, with scope for expansion through value-added and export-oriented industries.

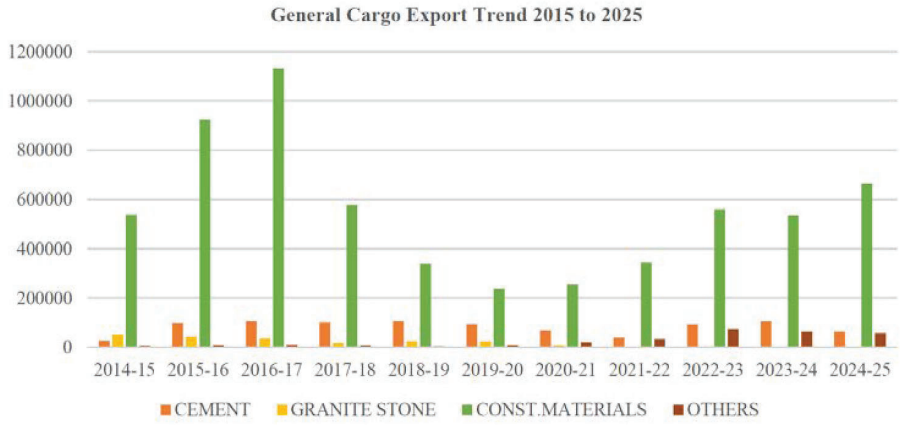


Figure 8.41: General Cargo Export Trend 2015 - 2025

Source: VOC Port Master Plan -2047

General cargo exports through VOC Port have shown sector-specific fluctuations over the period 2015–2025. Construction materials and allied products have historically dominated export volumes, while commodities such as cement, granite stone, and other general cargo have exhibited variable trends influenced by domestic demand cycles and global market conditions. Post-pandemic years show a gradual recovery in export volumes, indicating renewed industrial activity and improved trade momentum.

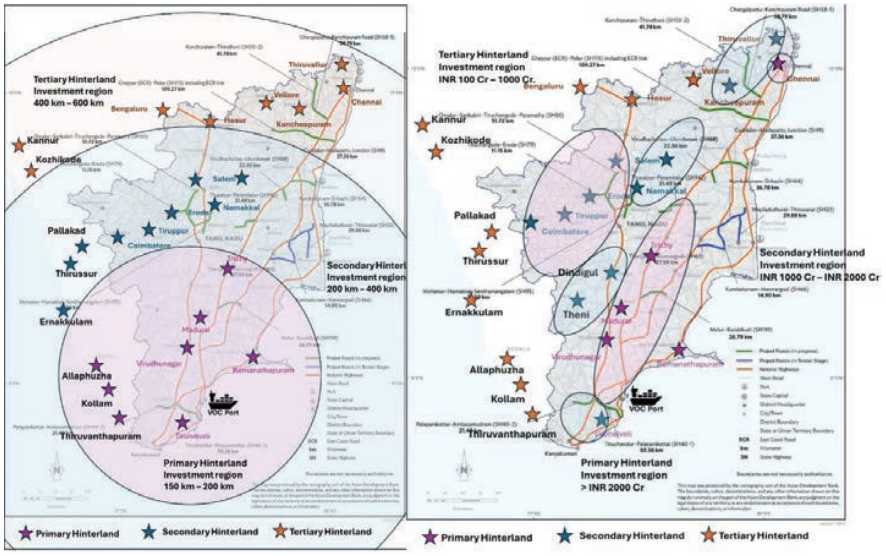


Figure 8.42: Port Hinterland

The hinterland analysis highlights VOC Port's multi-tiered catchment, extending from a primary hinterland within 150–200 km (including Tirunelveli, Madurai, Virudhunagar, and Ramanathapuram), to a secondary hinterland of 200–400 km (Coimbatore, Tiruppur, Erode, Salem, Namakkal), and a tertiary hinterland extending up to 600 km, encompassing major industrial centres such as Chennai, Hosur, Bengaluru, and parts of Kerala. This extensive hinterland enables VOC Port to serve both traditional industrial clusters and emerging manufacturing regions, reinforcing its strategic importance within Tamil Nadu's logistics and industrial ecosystem.



Figure 8.43: Major Districts of Tamil Nadu Contributing Cargo to VOC port

Source: VOC Port Master Plan -2047

District-level cargo flow patterns indicate that VOC Port plays a crucial role in handling exports from textile-dominated districts such as Coimbatore, Tiruppur, and Erode, particularly for cotton yarn, fabrics, and readymade garments. Significant cargo contributions also originate from districts engaged in electric machinery, engineering goods, marine products, and agro-based commodities. This spatial distribution of cargo flows reflects the port's strong linkage with manufacturing clusters across western and southern Tamil Nadu, despite its coastal location in the south.

8.8.1 Strategic Advantages

Connectivity and Hinterland Access

VOC Port benefits from robust road connectivity through a network of national highways, including NH-38, NH-179B, NH-744, NH-966, NH-32, and NH-44, linking the port to major economic centres such as Tirupati, Bangalore, Coimbatore, Kochi, and Kanyakumari. This facilitates efficient freight movement across the hinterland and enhances inter-regional economic integration.

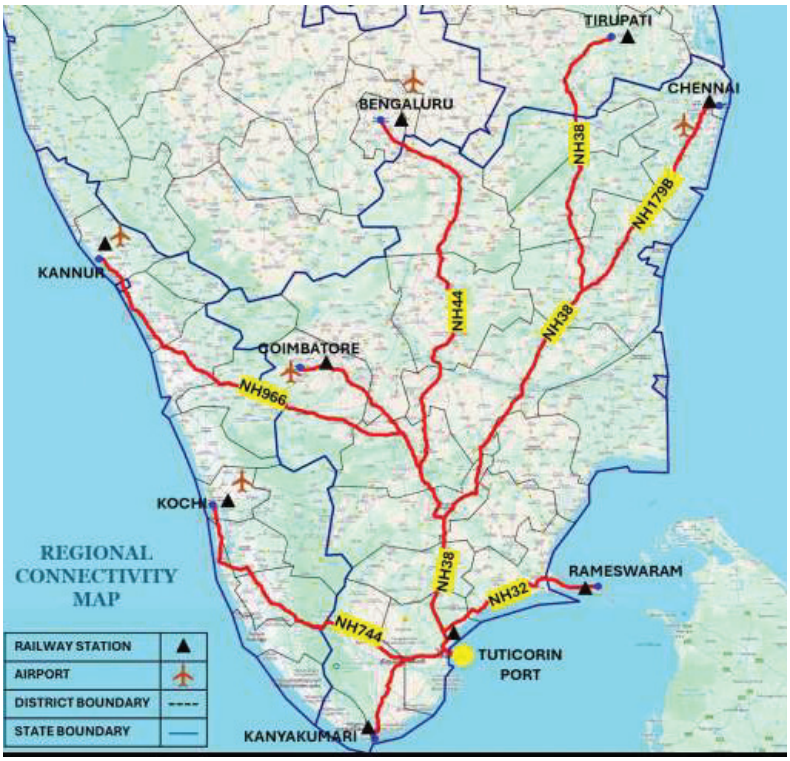


Figure 8.44: Major Hinterland Access

Source: VOC Port Master Plan -2047

Rail connectivity is set to improve with the proposed Madurai–Tuticorin railway line, which will provide a direct link between the port and inland industrial hubs. Planned extensions of the Southern Dedicated Freight Corridor (DFC) towards VOC Port, along with multimodal logistics hubs such as Inland Container Depots (ICDs) at Hosur and Sriperumbudur, would further strengthen VOC Port's role in national freight networks.

These connectivity enhancements are expected to support Thoothukudi's positioning within broader economic corridors such as the Chennai–Kanyakumari Industrial Corridor (CKIC) and the East Coast Economic Corridor (ECEC), catalysing industrial growth, export competitiveness, and diversified cargo flows.

8.8.2 Economic and Industrial Linkages

VOC Port's hinterland economy is increasingly diversified, with opportunities in sectors such as:

- Marine and offshore industries
- Seafood processing and related cold chains
- Agro-processing and nutraceuticals
- Electronics and semiconductor components
- Wind energy and renewable technologies
- Green hydrogen and green ammonia manufacturing

The port's existing cargo mix includes bulk commodities (coal, salt, fertilisers, limestone, copper concentrate), liquid cargo (petroleum products, chemicals, edible oils), and containerised cargo (textiles, machinery, agricultural products). The diversity of cargo handled reflects its role as a multimodal logistics hub and supports value chains across manufacturing, agriculture, and energy sectors.

VOC Port's competitive edge over other regional ports arises from three factors:

1. Lower congestion compared to ports such as Chennai.
2. Proximity to Southeast Asian and Middle East trade routes.
3. Shorter hinterland distances to industrial centres in southern and western Tamil Nadu.

However, competition from developing ports like Vizhinjam (natural draft, deep container hub) and established western ports such as Cochin Port underscores the importance of infrastructure enhancements and service diversification to sustain cargo growth.

8.8.3 Emerging Opportunities

Port-Linked Industrial and Economic Development

VOC Port's strategic coastal location, proximity to global shipping routes, and availability of dry, non-agricultural land in its influence area provide strong foundations for port-linked industrial and infrastructure expansion. An estimated Rs.1.54 lakh crore of investments are expected to be grounded within the port's primary hinterland over the next 2–3 years, underscoring the port's growing role as an anchor for regional industrial development.

The proposed Outer Harbour development represents a major capacity expansion initiative, enabling the port to accommodate larger vessels, enhance container and bulk handling capabilities, and strengthen its role in international trade and transhipment. This development is expected to significantly improve operational efficiency, attract high-volume cargo, and stimulate further industrial and logistics investments in the surrounding region. In parallel, collaboration with the Indian Railway Finance Corporation (IRFC) for port-related rail and infrastructure development will strengthen last-mile connectivity, improve evacuation capacity, and support seamless movement of cargo between the port and its hinterland.

Key emerging opportunities linked to these developments include:

- Offshore wind energy terminals (e.g., a proposed 500 MW offshore wind terminal costing approximately Rs.450 crore), aligned with renewable energy transition goals.
- Multimodal Logistics Parks (MMLP) to integrate road, rail, and maritime logistics.
- Automated cold storage, warehouses, and intermodal transfer facilities to support time-sensitive cargo such as seafood and perishables.
- Sector-specific facilities are proposed for electronics, EV components, wind turbine parts, and clean energy machinery, leveraging VOC Port's strategic location, lower congestion, and strong industrial connectivity. To support the state's EV manufacturing ecosystem, the Ro-Ro yard should be integrated with the SIPCOT Industrial Estate through dedicated access roads, enabling efficient movement of finished vehicles and associated cargo.
- VOC Port's existing role as a gateway for windmill blade exports — including operations by manufacturers such as Nordex, Siemens Gamesa, Vestas, and LM Power — highlights its potential for specialised cargo positioning in high-growth global manufacturing segments.

Integration with Economic Corridors

The Chennai–Kanyakumari Industrial Corridor (CKIC) and the East Coast Economic Corridor (ECEC) are two strategic national and state-level initiatives aimed at strengthening industrial development, logistics efficiency, and export competitiveness along India's eastern seaboard. While CKIC focuses on enhancing manufacturing and industrial linkages within Tamil Nadu by connecting major production centres to ports, the ECEC provides a broader framework for integrating eastern coastal states into national and global trade networks. In this context, linkages with the CKIC and ECEC will be critical in attracting export-oriented industries and facilitating seamless cargo and industrial flows through the VOC Port, enabling Thoothukudi to function as a key maritime and industrial node within these corridors. Developing logistics parks, warehousing, and industrial clusters along these corridors will strengthen VOC Port's competitiveness and regional economic impact.

8.8.4 Land Use and Spatial Implications

VOC Port's total area, including the port and Thoothukudi Thermal Power Plant lands, spans approximately 5,634.35 acres.

Total Area under Port and TPP → 5634.35 Acres

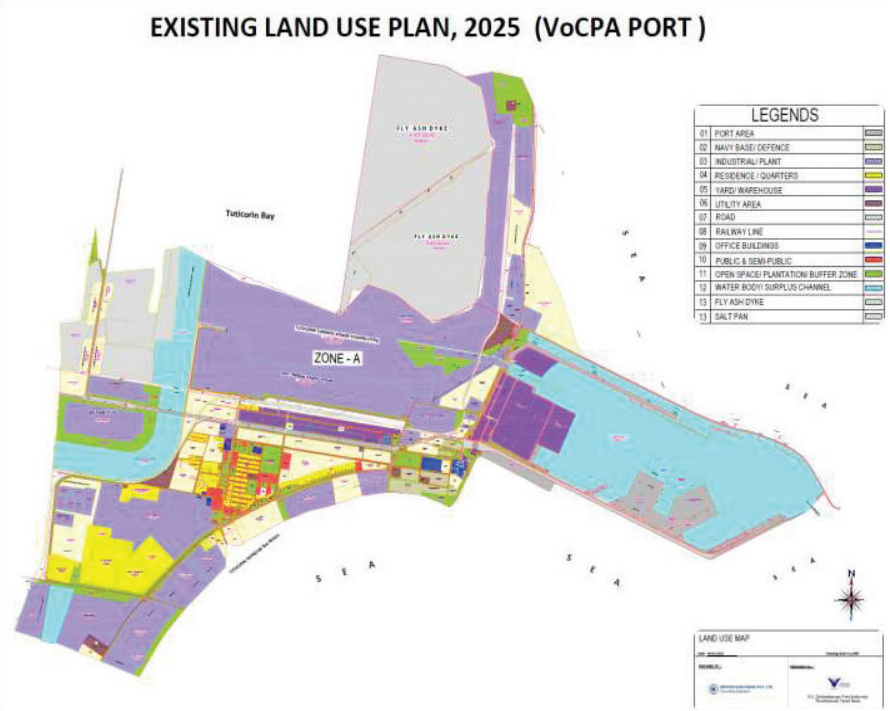


Figure 8.45: Existing Land Use of VOC Port

Source: VOC Port Master Plan -2047

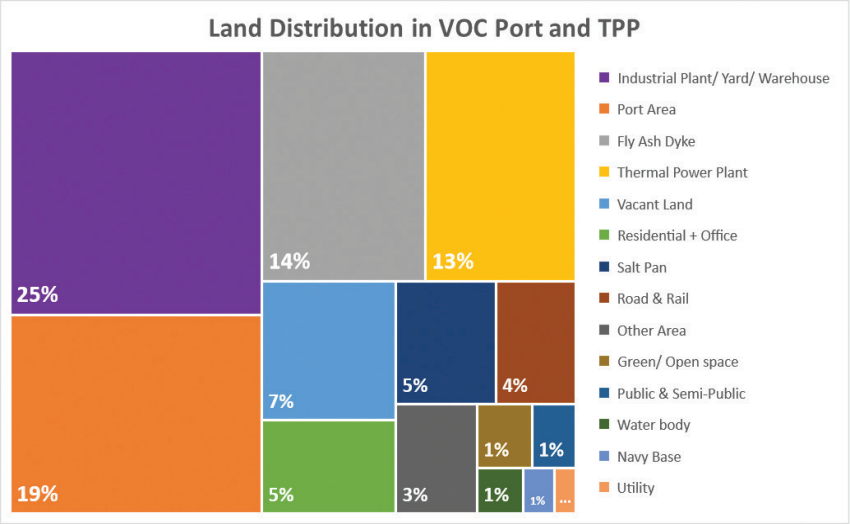


Figure 8.46: Existing Land Use Percentage of VOC

Source: VOC Port Master Plan -2047

Given rising cargo volumes and future investment activity (with an estimated Rs.1,54,485 crore expected in the primary hinterland over the next 2–3 years), it is crucial to plan for efficient land utilisation that balances operational needs with economic expansion.

Regional Challenges

The emergence of Cochin and Vizhinjam ports along India's southwest coast introduces competitive pressures for VOC Port, particularly in container traffic and transshipment potential. Vizhinjam Port, developed as a deep-draft transshipment hub with a natural draft exceeding 20 metres, is positioned close to major East–West shipping routes and is expected to attract mother vessels and transshipment cargo currently routed via Colombo, especially cargo destined for Kerala and parts of southern Tamil Nadu. Cochin Port, supported by the Vallarpadam International Container Transshipment Terminal, continues to serve the Kerala hinterland and western Tamil Nadu with established services and schedule reliability.

Despite this, VOC Port retains a strong competitive advantage for southern and interior Tamil Nadu due to shorter road and rail distances, cost efficiencies, and the presence of growing industrial clusters around Thoothukudi. Its proximity to the Middle East–Far East and Suez trade routes provides strategic relevance for mainliner operations, subject to achieving berth drafts of 15–16 metres. Strengthening rail connectivity, expanding container yard capacity, and targeting emerging cargo segments such as electronics, EVs, and clean energy-related cargo will be critical for sustaining and enhancing VOC Port's container volumes.

Port Sustainability and Future Vision: Proposed Land Use

VOC Port is exploring a transition to clean energy generation, with existing installations of a 5 MW solar plant (approx. Rs.26.70 crore) and a 2 MW wind farm (approx. Rs.18.39 crore). Long-term ambitions include scaling renewable and tidal energy generation to support port operations and contribute surplus power to the local grid — a direction that supports the broader blue–green economic orientation of the Master Plan.

The Proposed Land Use Plan for V.O. Chidambaranar Port (2047) reflects a strategic transition from a predominantly operational port to a diversified, future-ready maritime–industrial ecosystem aligned with sustainability, safety, and emerging economic sectors. The plan rationalises land use within Zone A to support higher cargo throughput, port-based industrialisation, clean energy industries, logistics, and supporting institutional and commercial functions, while strengthening environmental buffers and operational efficiency.

As per the proposed distribution, industrial plants, yards, and warehouses constitute the largest share (about 44%), underscoring the port's evolving role as a hub for port-based manufacturing, container freight stations, and value-added logistics. Core port operations account for around 22%, supported by dedicated road and rail infrastructure (about 10%), ensuring improved multimodal connectivity. Office, public/semi-public uses and utilities are consolidated to enable efficient administration, research, and services, while open spaces, plantations, and buffer zones (about 4%) are retained to enhance environmental performance and resilience.

The proposed land use strategy for VOC Port integrates selective spatial interventions to improve operational efficiency, safety, and long-term sustainability while aligning with emerging economic trends.

- Aging residential quarters located within the port, which are exposed to industrial emissions and have exceeded their functional lifespan, are proposed to be relocated outside the port limits, releasing strategically located land for port-related expansion.
- Port-based industrial expansion and container freight stations.
- Peripheral industrial/warehouse zones utilising under-used residential and TPP lands, while preserving green buffers.
- Salt pan and waterfront areas earmarked for mixed economic uses, such as convention centres, hospitality, business events, offices, and training centres.
- Repurposing fly ash and other industrial tracts for emerging sectors such as green fertilisers, marine processing, and precision manufacturing.

Compared to the existing land use pattern—where residential quarters and legacy utility functions occupy prime port-adjacent land—the proposed plan reduces non-core residential uses within the port and significantly increases land allocated for industrial, logistics, institutional, and green economic activities, while formalising buffers and open spaces. This shift enhances operational efficiency, safety, sustainability, and long-term economic resilience of VOC Port.

VOC Port is not only a major cargo gateway but is poised to be a key driver of economic diversification and regional competitiveness. Its strategic location, connectivity, and hinterland dynamics support expansion into high-growth industrial and export value chains. Strengthening the integration between VOC Port, industrial clusters, logistics corridors, and emerging economic sectors is essential for improving Thoothukudi's long-term economic resilience and advancing its blue–green economy vision. While the current cargo profile reflects a strong reliance on imported raw materials and energy inputs, the wide range of export commodities and the port's extensive hinterland linkages point to significant untapped potential for expanding export-oriented manufacturing, logistics, and value-added activities. These dynamics underscore the importance of a coordinated planning approach that aligns port-linked industrial development, logistics infrastructure, and supporting economic functions within the Thoothukudi Master Plan framework.

8.9 Investment Analysis

Thoothukudi has emerged as one of Tamil Nadu's major investment destinations over the last decade, driven by its port-led industrial base, strategic coastal location, and increasing policy focus on manufacturing, renewable energy, and logistics. Between 2015 and 2025, the district has attracted Rs.2,60.21 crore in cumulative investments, reflecting a strong concentration of capital-intensive, export-oriented, and infrastructure-linked sectors.

Total Investment from 2015-2025 → Rs. 2,60,127.21 Crores

Recent and proposed investments indicate a clear shift in the economic structure—from traditional port-dependent and bulk industries towards renewable energy, shipbuilding, clean manufacturing, defence, and advanced industrial sectors. This transition aligns with both national industrial priorities and the district's emerging role within port-linked industrial corridors.

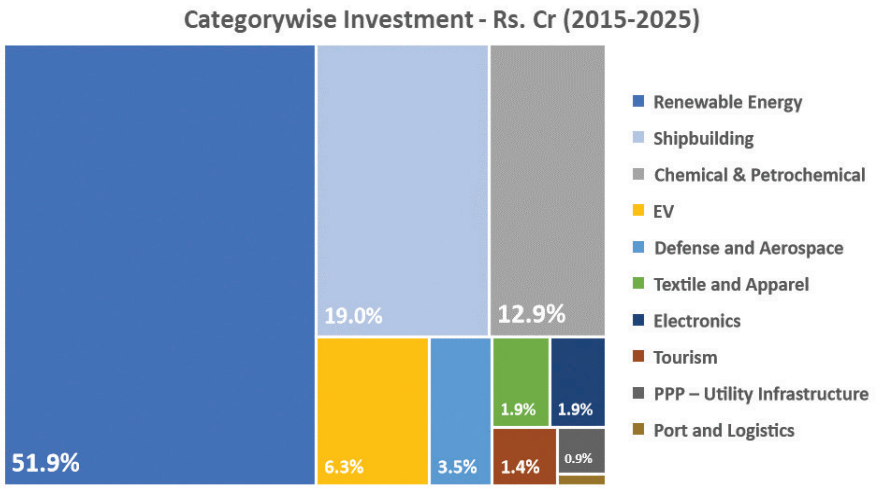


Figure 8.47: Category wise Investments

Source: Guidance, Tamil Nadu

The investment pipeline in Thoothukudi is dominated by proposed projects, which account for the largest share of identified investments, indicating a strong forward-looking growth trajectory rather than reliance on legacy industries. A smaller but significant portion of investments is already operational, reflecting an established industrial base that provides stability and early employment generation. The presence of operational expansions suggests investor confidence in scaling existing facilities, while also highlighting the need for timely land provisioning, infrastructure readiness, and phased implementation strategies to convert proposed investments into operational outcomes over the plan period.

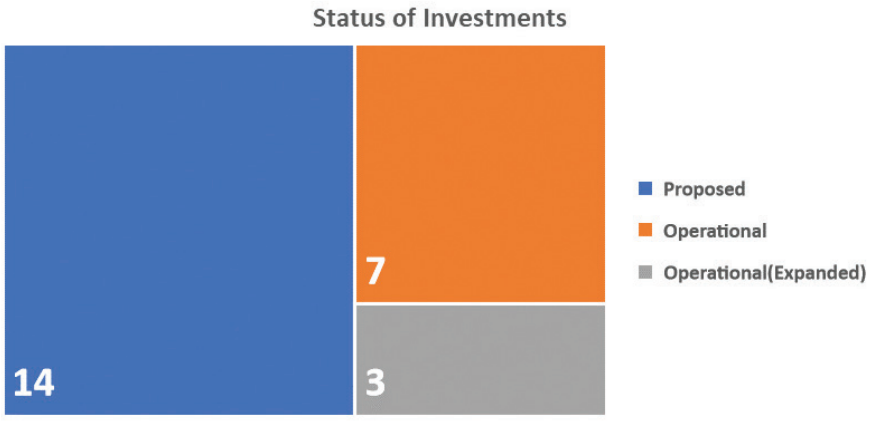


Figure 8.48: Category-wise Investments

Source: Guidance, TamilNadu.

Table 8-4: Category-wise Proposed Investments

Category	Sum of Investment (Rs. Cr)
Renewable Energy	Rs. 1,32,442.00
Shipbuilding	Rs. 49,500.00
Petrochemical	Rs. 30,000.00
Defense and Aerospace	Rs. 8,919.00
Textile and Apparesl	Rs. 5,053.00
Electronics	Rs. 4,995.00
PPP – Utility Infrastructure	Rs. 2,217.00
Total	Rs. 2,33,126.00

The proposed investment pipeline within the planning area amounts to Rs.2,27,684 crore, dominated by a small number of high-impact sectors (refer Figures on category-wise investment distribution).

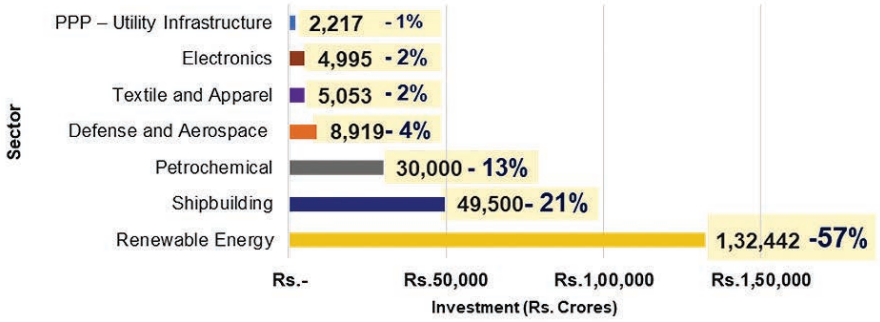


Figure 8.49: Sector-wise Investments

1. Renewable Energy (Rs.1,32,442 crore | ~5%)

   Renewable energy constitutes the single largest share of proposed investments, reflecting Thoothukudi's growing role in wind energy, offshore wind support, green hydrogen, and associated manufacturing and logistics. These investments are capital-intensive but strategically important for positioning the district within India's green energy transition.

2. Shipbuilding and Heavy Manufacturing (Rs.49,500 crore | ~21%)

   Large-scale shipyards and allied fabrication industries form the second-largest investment category. These projects are strongly port-dependent and have significant multiplier effects through vendor networks, MSMEs,

logistics, and specialised services.

3. Petrochemical and Chemical Industries (Rs.30,000 crore | ~13%)

   While petrochemicals remain important due to port proximity and bulk handling advantages, their share is relatively lower compared to renewable and shipbuilding sectors, indicating a gradual move away from pollution-intensive activities.

4. Defence & Aerospace, Electronics, and Textiles (Rs.18,967 crore | ~8%)

   These sectors, though smaller in investment value, are critical for economic diversification, technology intensity, and employment generation, particularly through MSMEs and skilled labour.

5. PPP-based Utility Infrastructure (Rs.2,217 crore | ~%)

   Infrastructure investments such as desalination support industrial growth and urban resilience, though they generate relatively lower direct employment.

Table 8-5: Category-wise Job Estimations

Sector Type	Direct Jobs	Indirect Jobs	Total Jobs Estimated
Heavy Manufacturing / Shipbuilding	42082	75197	1,17,279
Petrochemical & Chemical	5000	7500	12,500
Renewable Energy	15,000	22500	37,500
Textile & Apparel	1,865	3264	5,129
Large Infrastructure (Desalination)	400	240	640
Electronics	4700	7520	12,220
Total	69,047	1,16,221	1,85,268
	Assuming 30% of workers are commuters from outside LPA		55,580
	Assuming 20% of jobs will be from existing population growth of LPA		37,054
	Total Influx of Population with household Size-3(to account for blue collar migrant jobs)		2,77,902

Employment estimates have been derived using sector-specific direct employment norms and standard indirect employment multipliers, consistent with planning practices adopted by NITI port

Aayog, industrial corridor studies, and port-led development assessments.

Key Employment Outcomes

- Total Direct Jobs: ~69,047
- Total Indirect Jobs: ~1,16,221
- Total Employment Generated from Investments: ~1,85,268 jobs

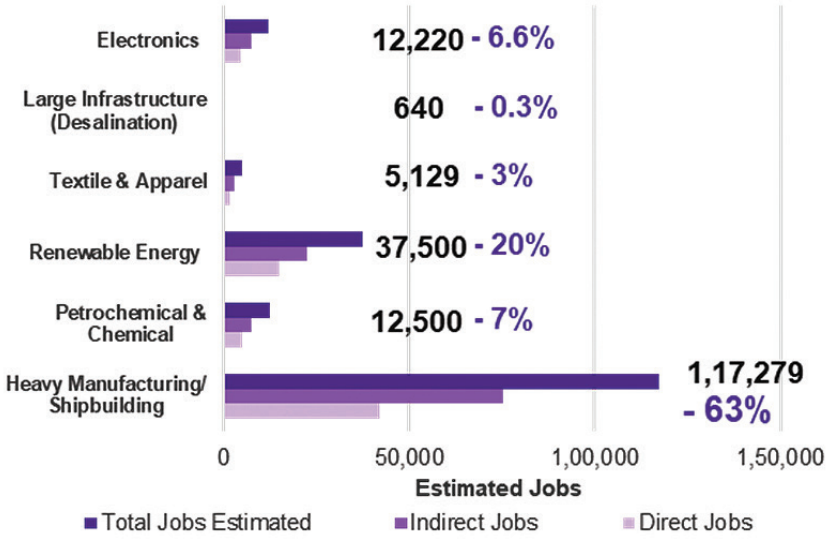


Figure 8.50: Estimated job based on Proposed Investments

The employment structure reflects the nature of investments:

- Shipbuilding and Heavy Manufacturing generates the highest employment, accounting for over 1.17 lakh jobs, due to strong backward linkages with fabrication, MSMEs, logistics, and precision manufacturing.
- Renewable Energy creates a balanced mix of direct and indirect employment through equipment manufacturing, operations & maintenance, transport, and port services.
- Textiles and Apparel, despite lower capital investment, remain relatively labour-intensive, supporting local employment and MSME participation.
- Electronics and Defence Manufacturing show strong indirect employment effects due to component supply chains and ancillary services.
- Large Infrastructure Projects (e.g., Desalination) are capital-intensive with limited but stable O&M employment.

Based on employment estimates and workforce behaviour assumptions:

- 30% of workers are expected to commute from outside the Local Planning Area (LPA)

- 20% of jobs are likely to be absorbed by natural population growth within the LPA

The remaining employment will result in net workforce-induced population influx

Assuming:

Average household size of 3 persons (reflecting a mix of blue-collar and migrant workers)

➡ Estimated population addition due to investment-led employment:

~2,77,900 persons over the plan period

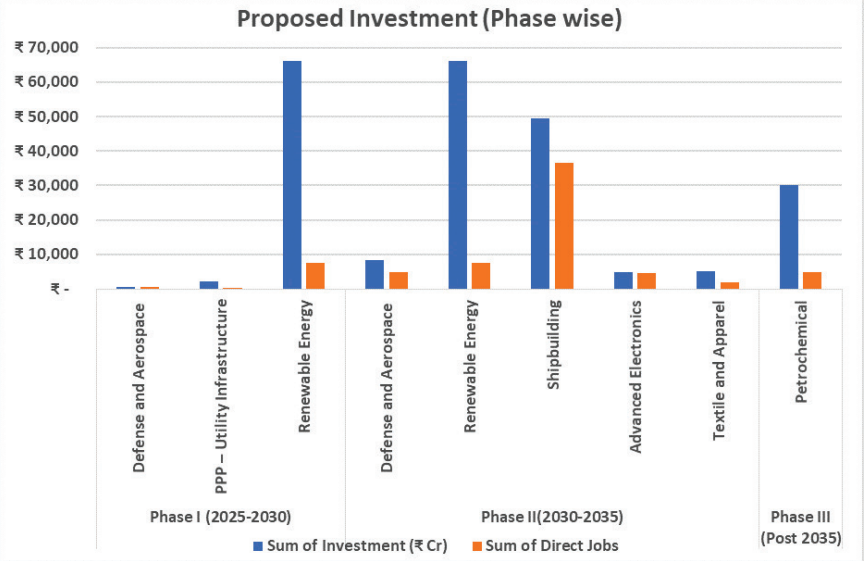


Figure 8.51: Phasing of Proposed Investments and Estimated Jobs

Investment phasing indicates a front-loaded growth trajectory:

Phase I (2025–2030):

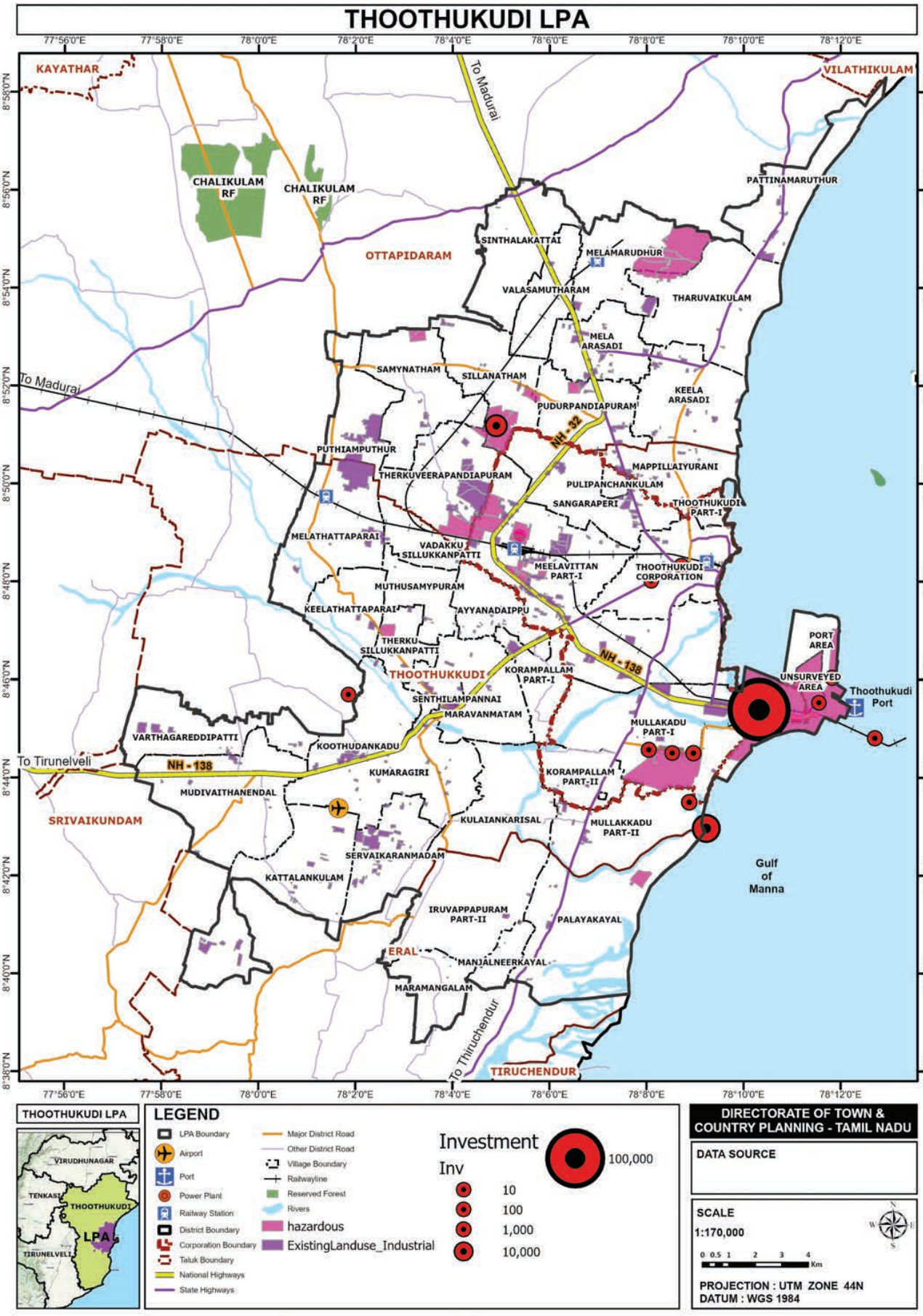
Dominated by renewable energy, defence, and utility infrastructure projects, establishing the foundation for industrial expansion.

Phase II (2030–2035):

Peak investment phase, driven by large shipbuilding projects, renewable energy expansion, and advanced manufacturing.

Phase III (Post-2035):

Consolidation phase with petrochemicals gaining prominence.



Map 8.13: Future Investment in Thoothukudi LPA

The upcoming pattern supports scenario-based land demand assessment and allows infrastructure provisioning to be aligned with realistic absorption capacity.

8.10 Key Organisations – Stakeholder Consultation

a. V.O. Chidambaranar Port Authority (VOCPA)

The V.O. Chidambaranar (VOC) Port is the primary economic engine of the Thoothukudi Local Planning Area (LPA), serving as a "nerve centre" that transforms the region from a traditional maritime town into a global industrial and energy hub. Shifting away from its legacy as a pearl fishery centre, the port now operates as a high-performance maritime gateway with a profound impact on the local and regional economy:

- **Direct Economic Contribution:** The port is a major revenue generator, recording its highest-ever operating income of approximately Rs.1,013.56 crores in 2024–25. It handles over 41 million tonnes of cargo annually, with significant year-on-year growth in container traffic and bulk commodities like coal, limestone, and rock phosphate, which are essential for the region's power and cement industries.
- **Port-Led Industrialization:** The port has earmarked 765 acres of land for a Coastal Employment Unit (CEU). This initiative promotes industrial diversification within the LPA, with hundreds of acres already allotted for Green Hydrogen and Green Ammonia plants, edible oil refineries, and large-scale warehouses. This shift is attracting international investments, such as a Korean footwear manufacturing unit and Singapore-based fiber plants.
- **Green Energy Transition:** The VOC Port has been designated as a national hub for green hydrogen and ammonia. This positioning is expected to catalyze a new "Green Economy" in Thoothukudi, moving the LPA toward sustainable industrial growth and creating high-tech employment opportunities in the renewable energy sector.
- **Strategic Gateway for the Hinterland:** It serves as the vital link for the export-oriented industrial clusters of Tirupur, Coimbatore and Karur. By providing efficient logistics and reducing turnaround times, the port enhances the global competitiveness of South Indian textiles and manufacturing, indirectly supporting millions of jobs across the state.
- **Future Growth – The Outer Harbour Project:** The massive Rs.7,056-crore Outer Harbour Project (foundation stone laid in 2024) is set to be a game-changer. By increasing the draught to 18 meters, it will allow the port to handle the world's largest container vessels. This will transition Thoothukudi into a global transshipment hub, competing directly with

international ports like Colombo and drastically reducing logistics costs for Indian trade.

The port's evolution into a smart, green, and deep-water facility is the key driver of the Thoothukudi LPA's transition into a modern industrial corridor, moving beyond local trade to become a critical node in the global supply chain.

b. Guidance, Tamil Nadu

Guidance Tamil Nadu, the State's nodal investment promotion and facilitation agency, plays a key role in supporting industrial and infrastructure development in the Thoothukudi Local Planning Area (LPA). Leveraging the strategic advantages of Thoothukudi Port, availability of industrial land, and strong power and logistics infrastructure, Guidance Tamil Nadu has facilitated investments in port-based industries, manufacturing, energy, logistics, and allied sectors. Through its single-window facilitation mechanism, the agency has enabled faster approvals, inter-departmental coordination, and improved ease of doing business, thereby strengthening investor confidence in the LPA.

The investments supported by Guidance Tamil Nadu have contributed significantly to employment generation and economic growth in the Thoothukudi LPA. These initiatives have led to an increase in urban employment, a higher share of main workers, and the expansion of industrial and service-sector activities, reinforcing the role of Thoothukudi as a major industrial and port-led growth centre in southern Tamil Nadu.

c. SPIC

Southern Petrochemical Industries Corporation (SPIC), established in 1969, serves as the foundational pillar of industrialization within the Thoothukudi Local Planning Area (LPA). As one of India's premier fertilizer manufacturers, its massive complex in Mullakadu has been a primary economic driver for decades, catalyzing the growth of a specialized chemical and petrochemical ecosystem in the region. Beyond its industrial output, SPIC's legacy is deeply etched into the urban fabric through the development of SPIC Nagar, a self-contained township that set the early standard for organized industrial housing and high-quality social infrastructure within the planning area. By providing large-scale employment and fostering an extensive network of ancillary industries, SPIC transformed Thoothukudi from a traditional coastal town into a major industrial hub, maintaining its status as a vital anchor for the region's ongoing socio-economic development.

d. TIDCO

The Tamil Nadu Industrial Development Corporation (TIDCO) is instrumental in transforming the Thoothukudi Local Planning Area (LPA) into a service-oriented hub. A cornerstone of this shift is the TIDEL Neo Thoothukudi located

in Meelavittan Village, a 63,100-square-foot facility designed to catalyze the IT and ITES sectors within the district. Complementing this is the strategic development of the Space Industrial Park and the Space Vehicle Common Technical Facility Centre (SV-CTFC) within the Allikulam land bank. These facilities serve as vital support nodes for the upcoming international spaceport, positioning the LPA as a specialized center for aerospace integration, precision engineering, and defense-related manufacturing.

In addition to technology and aerospace, TIDCO is spearheading large-scale sustainable infrastructure projects that leverage the region's maritime advantages, particularly in the Mullakadu and VOC Port vicinity. The corporation is a key facilitator of the Green Hydrogen Hub, which involves earmarking expansive coastal land for green ammonia and hydrogen production, aiming to establish the LPA as a global leader in clean energy. Furthermore, TIDCO is collaborating on the development of a Multi-Modal Logistics Park (MMLP) near the port area to enhance freight efficiency and provide value-added services like bonded warehousing and customs clearance. These strategic interventions in renewable energy and port-led logistics ensure that the LPA remains a competitive, future-ready maritime gateway for global trade.

e. TANSIDCO

The Tamil Nadu Small Industries Development Corporation (SIDCO) supports and promotes Micro, Small, and Medium Enterprises (MSMEs) throughout Tamil Nadu. At the district level, SIDCO is headed by the Regional Manager or Senior Regional Manager. In Thoothukudi District, SIDCO plays a key role in developing and managing industrial estates and providing essential infrastructure facilities such as developed plots, roads, power supply, and common amenities for MSMEs. By enabling small-scale industrial units and encouraging entrepreneurship, SIDCO supports employment generation, decentralised industrial growth, and the strengthening of the local economy within the district.

f. THUDITSSIA

Tuticorin District Tiny and Small-Scale Industries Association (THUDITSSIA) is the apex body representing micro, small and medium enterprises (MSMEs) in Thoothukudi District and has been functioning for over 34 years. The Association is a member of various District-level Committees constituted by the Government and acts as an important interface between MSMEs and government agencies. THUDITSSIA supports industrial development within the Thoothukudi Local Planning Area by providing marketing assistance, facilitating access to credit and promoting technology upgradation among small and medium enterprises.

A key focus of THUDITSSIA is the promotion of entrepreneurship, particularly

among new and budding entrepreneurs. In coordination with the District Industries Centre (DIC), the Association assists entrepreneurs in identifying and availing benefits under various MSME schemes through guidance and application support. Through these facilitation activities, THUDITSSIA is estimated to contribute to the creation of nearly 15–20 percent of new enterprises in the district, thereby playing a significant role in strengthening the MSME ecosystem, employment generation and industrial growth within the Thoothukudi LPA.

g. Salt Corporation

The Salt Corporation plays an important role in the development of salt production and related activities along the coastal areas of Thoothukudi District. Salt manufacturing is a traditional industry that provides livelihoods to a significant number of workers and supports allied industries such as chemical processing and export-oriented units. The Corporation facilitates land management, production support, and regulatory oversight of salt pans, influencing coastal land-use patterns. Through the promotion of organised salt production and employment opportunities, the Salt Corporation contributes to industrial activity, economic stability, and sustainable coastal development in the district.

h. District Industries Centre (DIC), Thoothukudi

The District Industries Centre (DIC), Thoothukudi, headed by the General Manager, functions under the Department of Industries and Commerce. It plays a crucial role in promoting Micro, Small, and Medium Enterprises (MSMEs), cottage industries, and traditional sectors at the district level. MSMEs contribute significantly to employment generation, innovation, and inclusive economic growth in the district. The DIC facilitates entrepreneurship by providing support through credit linkages, government subsidies, incentives, and technical guidance. It also implements skill development and capacity-building programmes to strengthen local enterprises and artisans. By promoting small-scale industries and encouraging self-employment, the DIC contributes to industrial growth, economic diversification, and sustainable development within Thoothukudi District.

i. Fisheries Department

The Fisheries Department, Thoothukudi, supporting marine and inland fisheries, which form a key livelihood sector in the district. The department is monitoring the development and maintenance of fisheries infrastructure, including fishing harbours, fish landing centres, cold storage facilities, and auction halls. It implements welfare schemes, capacity-building programmes, and skill training for fishermen and fisherwomen, promoting sustainable fishing practices and value-added fish processing activities. Through these initiatives, the Fisheries Department contributes to employment generation, food security,

coastal community development, and the sustainable utilisation of marine resources within Thoothukudi.

8.11 SWOC Analysis

8.11.1 Strength:

- **Strategic Port Location and Maritime Legacy**

  Thoothukudi Port serves as a major economic anchor, supporting trade, logistics, and industrial activities, with strong backward and forward linkages to regional and global markets.

- **Geographical Advantage and Climate Resilience**

  Compared to other east-coast ports, Thoothukudi has relatively lower exposure to cyclones and extreme weather events, improving long-term investment attractiveness and operational reliability.

- **Established Industrial Base**

  Presence of fertilisers, power, chemicals, port-based industries, and large industrial land parcels provides a foundation for industrial activity and expansion.

- **Emerging Investment Pipeline**

  Significant announced investments in shipbuilding, renewable energy, green hydrogen, defence manufacturing, textiles, and port-linked industries indicate strong future economic potential.

- **Availability of Large Tracts of Industrial Land**

  SIPCOT estates and upcoming industrial areas allow for large-scale, contiguous industrial development with scope for integrated infrastructure.

- **Growing Services and Logistics Sector**

  Expansion of port-related services, transport, warehousing, and trade has strengthened the tertiary sector, providing relative economic resilience.

8.11.2 Weakness:

- **Decline and Volatility in the Secondary Sector**

  Manufacturing output has shown a clear decline since 2018–19, reflecting dependence on a limited number of large industrial units and vulnerability to sector-specific disruptions.

- **Low Income Deepening Despite Economic Activity**

  Per capita income consistently remains below the State average, indicating limited value addition, wage progression, and upward mobility across sectors.

- **Limited Industrial Diversification**

  The economy remains concentrated around port-led and capital-intensive industries, with comparatively low presence of high value-added manufacturing and advanced services.

- **Limited MSME and Ancillary Ecosystem**

  Credit data indicates modest lending to MSMEs, suggesting underdevelopment of local supplier networks and ancillary industries.

- **Financial Ecosystem Not Aligned with Emerging Sectors**

  Banking credit is largely directed towards agriculture and housing, with limited penetration into manufacturing, export credit, and renewable energy at the branch level.

- **Inadequate Urban Amenities for Global Talent**

  Limited nightlife, commercial activity, and lifestyle infrastructure reduces attractiveness for foreign investors and skilled professionals.

8.11.3 Opportunities:

- **Port-Led Blue Economy Expansion**

  Strong potential for shipbuilding, ship repair, logistics, seafood processing, offshore fabrication, and maritime services linked to the port.

- **Green Economy and Energy Transition**

  Renewable energy, green hydrogen, ammonia, and pipeline infrastructure (including IOCL initiatives) present opportunities for clean industrial growth.

- **Non-Hazardous Industrial Development**

  Strategic shift towards environmentally compliant and non-hazardous industries can rebuild investor confidence and reduce socio-environmental conflict.

- **Growth of Commercial Activities and the Night Economy**

  Increasing industrial presence, business travel, and foreign investment create opportunities for retail, dining, entertainment, hospitality, and extended-hours commercial activity, particularly in urban and port-adjacent areas.

- **Growth of Cold Storage and Warehousing**

  Anticipated surge in demand for cold chains and logistics facilities driven by seafood exports, port activity, and industrial supply chains.

8.11.4 Challenges:

- **Environmental Sensitivities and Regulatory Scrutiny**

  Coastal ecology, pollution concerns, and past industrial conflicts necessitate careful environmental management and compliance.

- **Infrastructure Readiness and Phasing Risks**

  Water supply, power evacuation, transport connectivity, and housing must keep pace with industrial development to avoid bottlenecks.

- **Competition from Other Ports and Industrial Nodes**

  Competing port cities and industrial corridors may attract investments unless Thoothukudi differentiates itself clearly.

8.12 Workforce Estimation - 2045

Workforce projections for the planning area were carried out using three standard demographic techniques, namely:

- Simple Linear Regression Method, and
- Linear Trend Method
- Workforce Participation Ratio (WPR)–Based Projection Method

based on historical census data for the years 1991, 2001, and 2011 for both urban and rural areas.

A comparative assessment of the outputs from both methods was undertaken to identify the approach that best reflects long-term structural trends and urbanisation patterns.

8.12.1 Growth of Workers Population (1991–2011)

The urban workers population increased steadily from 83,807 (1991) to 1,34,618 (2011), indicating sustained urban employment generation.

The rural workers population also showed growth from 30,200 (1991) to 56,611 (2011), though at a relatively slower pace.

This period reflects a progressive shift towards urban-based employment, driven by industrial, service-sector, and port-linked economic activities.

Table 8-6: Estimated Workers Population

Method	Existing Workers Population						Estimated Workers Population	
	1991		2001		2011		2045	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Simple Linear Regression Method	83,807	30,200	1,09,987	46,660	1,34,618	56,611	2,21,255	1,02,595
Linear Trend Method							2,21,257	1,02,596
Workforce Participation Ratio (WPR)–Based Projection Method							4,85,750	2,08,178

8.12.2 Projected Workers Population for 2045

Based on the Workforce Participation Ratio (WPR)–Based Projection Method, the projected workers population for 2045 is estimated as:

- Urban Workers: 4,85,750
- Rural Workers: 2,80,178

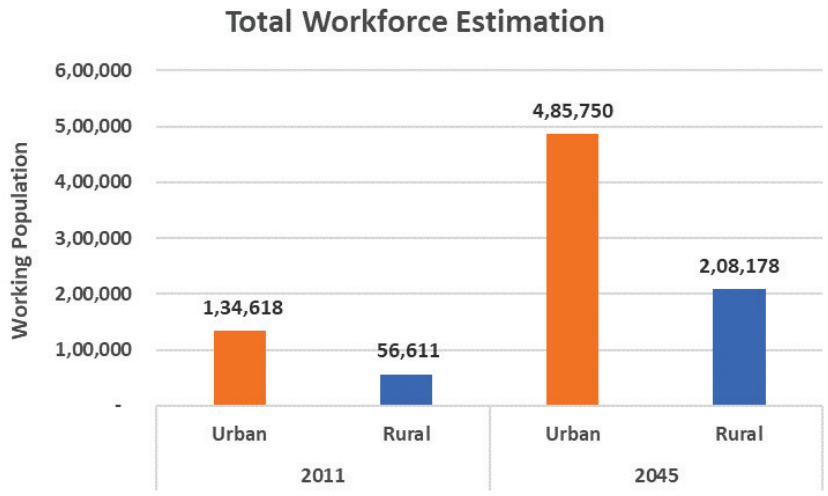


Figure 8.52: Total Workers Estimation

Total Workforce Growth (2011–2045):

The workforce projections indicate a substantial increase in both urban and rural employment within the Local Planning Area between 2011 and the horizon year 2045. The urban workforce is projected to increase from 1,34,618 in 2011 to 4,85,750 in 2045, representing an absolute increase of approximately 3.51 lakh workers. This significant growth reflects the continued expansion of port-led industrial activities, manufacturing, logistics, construction, and service-sector employment concentrated within the urban areas.

During the same period, the rural workforce is projected to increase from 56,611 to 2,08,178, indicating an absolute increase of about 1.52 lakh workers, which is more than a threefold rise. This growth highlights Industrial growth, agriculture, fisheries, salt production, allied rural activities, as well as the increasing role of peri-urban and non-farm employment opportunities in villages surrounding the urban core.

Urban–Rural Workforce Distribution Trend

Despite the growth observed in rural employment, urban areas continue to dominate the workforce structure, accounting for nearly 70% of the total projected workforce in 2045, while rural areas contribute the remaining 30%. This distribution underscores the LPA's evolving character as a predominantly urban employment region, driven by industrialisation and service-sector growth, while still maintaining a strong rural economic base.

Overall, the projected workforce pattern reflects a balanced yet urban-oriented employment structure, where rapid urban job creation is complemented by steady rural workforce expansion. This trend reinforces the need for integrated urban–rural planning, improved connectivity, and targeted infrastructure provision to support employment growth across the Local Planning Area up to 2045.

8.13 Goals And Strategies For 2041

8.13.1 Vision and Goals

"To enable a port-led, environmentally responsible blue and green economy that strengthens Thoothukudi's long-term economic resilience with enhanced liveability and infrastructure to support investment-led growth and talent retention"

Goals:

Goal 1: Strengthen Thoothukudi's Port-Led Economic Role

To reinforce Thoothukudi's position as a port-anchored economic centre,

leveraging maritime trade, logistics, and port-dependent activities as the foundation of long-term economic growth.

Goal 2: Enable a Transition to a Blue and Green Economy

To guide the district's economic transition towards environmentally responsible blue and green sectors, including clean manufacturing, renewable energy, and non-hazardous industries, while building on existing industrial strengths.

Goal 3: Diversify the Economic Base and Improve Value Addition

To reduce dependence on a limited number of large industries by promoting diversification and higher value-added economic activities, thereby strengthening resilience and improving income outcomes.

Goal 4: Support a Vibrant and Investment-Ready Urban Economy

To foster a vibrant urban economic environment, including commercial, business, and service activities that enhance Thoothukudi's attractiveness for investment, skilled workforce, and business visitor

8.14 Scenario Based Land Demand Assessment

To ensure that land use proposals are responsive to investment uncertainty and phased implementation, a scenario-based land demand assessment has been undertaken for Thoothukudi. Rather than relying on a single-point projection, this approach evaluates land requirements under multiple plausible investment and employment realisation scenarios, based on the nature of proposed industries, their employment intensity, and locational dependence on port and urban infrastructure.

Table 8-7: Sector-wise Land Requirement

Sector	Requirement Considered (acres per 1000 jobs)	Rationale
Electronics Manufacturing	20	High employment density, but requires clean rooms, testing labs, ESD-safe layouts- can be multistoreyed
Defence & Aerospace	30	Higher land per job due to security and R&D components
Shipbuilding & Heavy Engg	50	Very large open assembly yards, dry docks, slipways • Waterfront access requirements
Textile & Apparel	25	Labour-intensive layouts
Petrochemical	1.5	Land driven by process units, tank farms, and safety buffers • Employment is not the right metric (capital-intensive)
Renewable Energy (manufacturing)	25	Assembly lines plus large warehousing areas • Logistics-heavy component handling
Tourism & Hospitality	10	High employment density per built-up area
Utilities (Desalination)	Land provided already	Land driven by intake & outfall corridors, RO units, storage, buffers • Employment extremely low relative to land

Table 8-8: Sector Wise Land Requirement

Land Demand Assessment									
Scenario	**Assumption**	**Investment (Cr)**	**Direct Jobs**	**Land (Acres)**	**Land (Sqkm)**	**Land for Ancillary Industries**	**Land for Logistics and Warehousing**	**Land for Sea Based Industries**	**Total Industrial Land Requirement (sqkm) WITH 40% buffer**
Scenario A - Conservative	Only high certainty, employment-oriented investments located inside the LPA AND 50% of renewable energy MOU becomes operational	Rs. 1,55,654	57,200	806.5	3.26	0.98	0.85	0.49	7.81
Scenario B - Balanced	Manufacturing and employment-intensive industries which require proximity to port get implemented inside LPA and 80% of green energy MoU inside LPA	Rs. 1,97,154	62,950	960.25	4.78	1.43	1.24	0.72	10.43
Scenario C - High Growth	Assuming all the investments are inside LPA and will be implemented	Rs. 2,33,126	69,047	1536.46	5.69	1.71	1.48	0.85	12.42

Basis of Industrial Land Norms

Industrial land demand has been estimated using sector-specific land consumption norms, expressed either in acres per 1,000 jobs or project-specific footprints, depending on the capital–labour intensity of each sector. Employment-linked norms have been applied for labour- and manufacturing-intensive sectors such as electronics, textiles, defence manufacturing, renewable energy equipment, and tourism, while process-driven land norms have been used for petrochemicals and utilities, where employment is not a reliable indicator of land requirement.

The adopted norms reflect a synthesis of:

- SIPCOT estate layouts and benchmarks
- URDPFI Guidelines (MoHUA)
- Sectoral DPRs and comparable industrial park layouts
- Established practices in port-linked industrial developments

This ensures that land demand estimates are realistic, conservative, and aligned with implementation experience in Tamil Nadu and comparable port cities.

Industrial Land Demand under Alternative Scenarios

Three development scenarios have been assessed to capture varying degrees of investment realisation within the Local Planning Area (LPA):

Scenario A – Conservative

- This scenario assumes that only high-certainty investments are implemented within the LPA, along with 50% realisation of renewable energy MoUs. It represents a cautious outlook aligned with early-phase development and initial investor conversion.
- This scenario establishes a minimum assured land requirement for industrial planning.

Scenario B – Balanced

- The balanced scenario assumes that manufacturing and employment-intensive industries requiring proximity to the port are implemented within the LPA, along with 80% realisation of green energy investments.
- It represents a probable planning scenario, balancing market feasibility with growth ambition.

Scenario C – High Growth (Selected Planning Scenario)

The high-growth scenario assumes that all identified investments are implemented within the LPA, including large-scale shipbuilding, clean energy, petrochemicals, defence manufacturing, and allied industries.

This scenario has been adopted as the planning reference case in view of:

- Rapidly increasing national and state-level energy demand,
- India's and Tamil Nadu's strategic commitment to renewable energy, green hydrogen, and clean manufacturing,
- The concentration of large anchor investments announced for Thoothukudi and its primary hinterland, and
- VOC Port's emerging role as a key gateway for energy, industrial exports, and green supply chains.

Under this scenario, industrial land demand is highest due to full investment realisation, extensive ancillary ecosystems, logistics infrastructure, and port-dependent activities. It represents a long-term capacity-building condition, ensuring that the Master Plan does not become a constraint on future growth driven by policy priorities and global energy transitions.

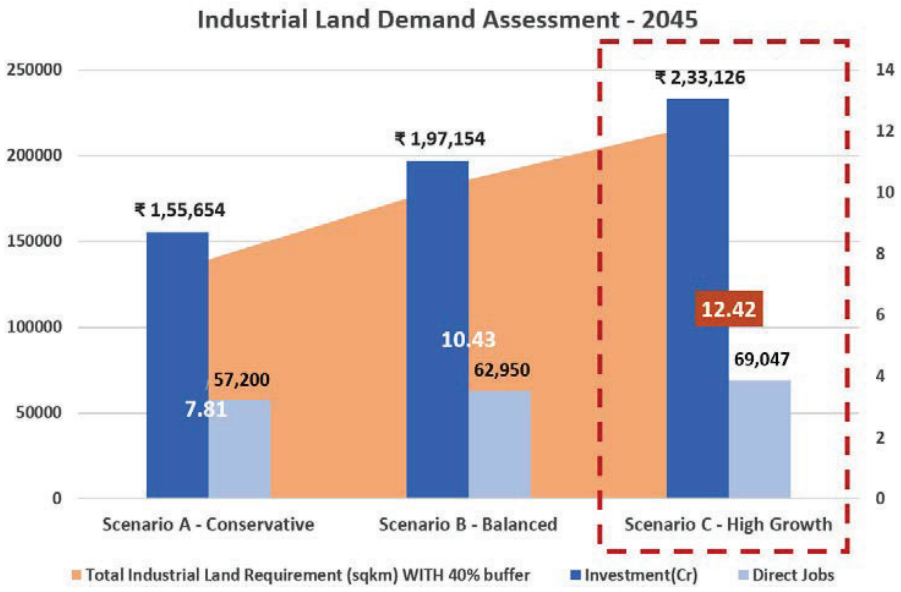


Figure 8.53: Land Demand Assessment

8.14.1 Land Demand Assessment

Commercial land demand has been estimated independently to reflect the service, business, and trade functions required to support an emerging industrial economy. In line with URDPFI guidance for emerging industrial cities and future influx of population, a norm of 1 sq m of commercial floorspace per capita has been adopted.

Table 8-9: Land Demand Assessment - Commercial

Land Demand Assessment - Commercial			
1 sq m / capita of floorspace for emerging industrial cities			
Floorspace Demand in sqm	Considering 1.25 FSI	Land Demand in Sqkm	Total Commercial Land with 40% Buffer
1577110	**1261688.00**	**1.26**	**1.77**

Applying a 1.25 FSI, the resulting land requirement has been derived and further adjusted with a 40% buffer to account for market variation, phased development, and spatial inefficiencies. This commercial demand caters to:

- Offices and business services
- Trade, retail, and hospitality
- Logistics-related commercial uses
- Supporting urban services for a growing workforce

Table 8-10: Industrial + CommercialLand Requirement

Consolidated Industrial + Commercial Land Requirement

Category	Sqkm	Acres
Existing Land Use- Industrial	14.23	3516.88
Existing Land Use- Special and Hazardous	16.54	4087.12
Existing Land Use- Commercial	8.8	2174.52
Proposed Land Use- Industrial	12.42	3069.81
Industrial Land Under Proposed SIPCOT	22.52	5564.80
Total Industrial Land - Proposed	34.94	8634.61
Proposed Land Use- Commercial	1.77	436.48
Total Industrial + Commercial Land Requirement	**36.7**	**9071.09**

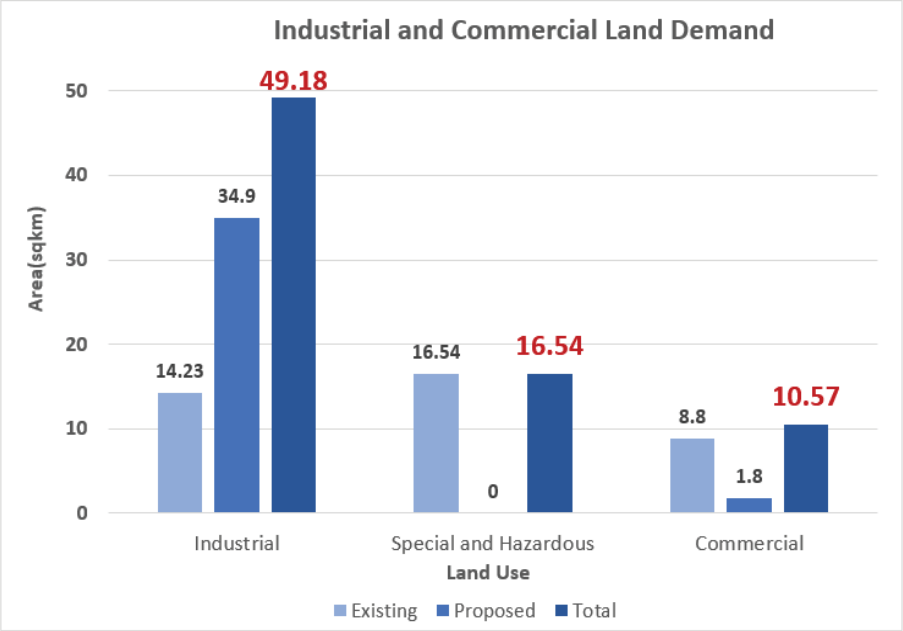


Figure 8.54: Industrial + Commercial Land Requirement

Land Requirement

The scenario-based industrial land demand assessment, when combined with commercial land requirements, indicates a total and requirement of approximately 36.7 sq km, comprising 12.42 sq km of industrial land, 22.52 sq km within proposed SIPCOT estates, and 1.77 sq km of organised commercial land.

This structured provisioning allows sufficient flexibility to absorb investment surges under the high-growth scenario without triggering premature or ad-hoc land conversion.

A clear functional distinction between industrial, logistics, and commercial uses further strengthens implementation clarity, infrastructure provisioning, and long-term land management efficiency within the planning area.

8.15 Strategic Transition Actions

Goal 1: Strengthen Thoothukudi's Port-Led Economic Role

Structure Port-Linked Industrial and Logistics Zones

Designate and earmark land within the VOC Port influence area for port-dependent industries, including shipbuilding, logistics, seafood processing, green energy, and cargo-linked manufacturing, ensuring proximity between production, storage, and maritime gateways.

Prioritise Cargo-Generating Industrial Activities

Encourage industries that directly generate port traffic—such as wind energy equipment, EVs, machinery, chemicals, agro-processing, and marine products—to locate within identified port-linked clusters.

Strengthen Hinterland-Port Integration

Align industrial estates, logistics parks, and export-oriented zones across the primary and secondary hinterland with VOC Port's cargo handling and export capacity to reinforce its role as the main maritime gateway for southern and western Tamil Nadu.

Develop Integrated Logistics Hubs along Key Port Corridors

Madurai Road, Tirunelveli Road and Tiruchendur Road corridors should be developed as integrated logistics hubs comprising ICDs, container yards, cold storage, warehousing, empty container depots, and truck terminals, enabling efficient cargo aggregation, reduced port-gate congestion, and support for export-oriented, seafood, EV, and clean-energy industries.

Goal 2: Enable a Transition to a Blue and Green Economy

Promote Clean and Non-Hazardous Industrial Typologies

Prioritise environmentally compliant manufacturing, green chemicals, clean energy equipment, electronics, and defence-related industries, especially in response to environmental sensitivities following the Sterlite closure.

Establish a Blue Economy Production and Processing Base

Support port-linked marine activities such as seafood processing, cold chains, marine services, ship repair, and coastal manufacturing, ensuring these sectors are spatially integrated with port operations.

Create Land Banks for Green and Future Industries

Reserve land parcels for emerging sectors such as green hydrogen, green ammonia, renewable energy manufacturing, shipbuilding, and clean logistics, allowing phased development as projects mature.

Goal 3: Diversify the Economic Base and Improve Value Addition

Strengthen MSME and Ancillary Ecosystems

Develop vendor parks, plug and play parks, and MSME clusters such as SIDCO estates near large anchor investments (shipyards, electronics, energy projects) to embed local enterprises and ancillary industries within industrial value chains.

Promote Processing and Export-Oriented Manufacturing

Encourage downstream processing in sectors such as timber, textiles, seafood, agro-products, and clean manufacturing to move the economy from raw material handling to value-added exports.

Goal 4: Support a Vibrant and Investment-Ready Urban Economy

Develop Organised Commercial and Business Districts

Identify urban commercial nodes for offices, trade services, hospitality, retail, and professional services to support industrial growth, business travel, and investor presence.

Enable Business, MICE and Knowledge-Based Activities

Promote zones for convention centres, training institutes, R&D facilities, and business services linked to port, industrial, and clean-energy sectors, in order to support skilled manpower development, technology adoption, business networking, and the institutional ecosystem required for large-scale and knowledge-intensive investments.

Integrate Urban Services with Industrial Growth

Ensure that areas of high employment concentration are supported by commercial, social, and service-oriented land uses, enhancing the district's attractiveness to skilled workers and investors.

Enable Redevelopment and Modernisation of the Urban Core

Promote the economic redevelopment of Thoothukudi's core areas to accommodate modern commercial, service, and business functions, enabling older urban fabric to support contemporary investment needs, employment growth, and a more vibrant urban economy while minimising the need for peripheral expansion.

Cross Cutting Strategies

C1. Align Workforce Development with Emerging Economic Sectors

Support the creation of training, skilling, and apprenticeship ecosystems aligned with shipbuilding, clean energy, electronics, EVs, logistics, seafood processing, and defence manufacturing, enabling effective workforce integration and more broadly distributed income growth.

C2. Integrate Environmental Sustainability into Economic Development

Ensure that industrial and commercial growth is guided by environmental performance by prioritising non-hazardous industries, clean manufacturing, renewable energy-based activities, and low-emission logistics within designated economic zones, thereby reducing pollution risks and improving long-term economic viability.

C3. Protect Environmentally Sensitive Zones

It is crucial to safeguard environmentally sensitive zones such as Gulf of Mannar Biosphere Reserve, coastal regulation zones, and wetlands which form the ecological foundation of Thoothukudi's blue economy, by directing economic development away from these sensitive areas and concentrating growth within planned industrial, port-linked, and urban zones.

C4. Strengthen Tourism, Recreation and Lifestyle Economies as Economic Enablers

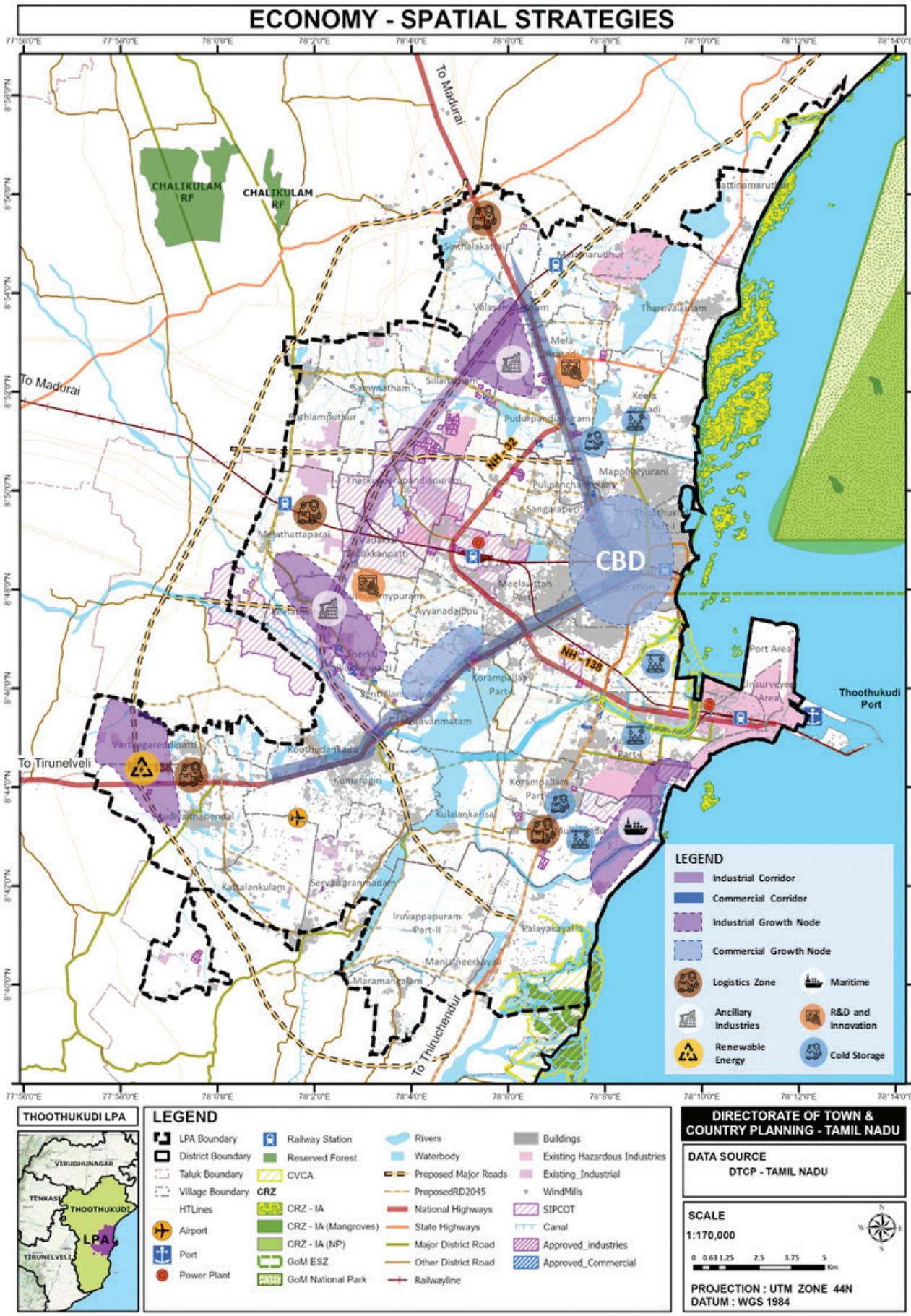
Promote tourism, waterfront recreation, leisure, and cultural activities within the planning area as complementary economic drivers that enhance quality of life, support business travel and workforce retention, and strengthen Thoothukudi's overall investment climate.

8.16 Growth Corridors and Nodes

The spatial strategy for Thoothukudi Planning Area is formulated to support the district's priority economic systems by structuring growth along clearly defined corridors, nodes, and clusters that align infrastructure, industry, logistics, and urban functions.

Economic Focus Areas Guiding the Spatial Proposals

- Port–industrial–logistics economy
- Blue economy and marine value chains
- Green energy and clean manufacturing
- Export-oriented processing and MSMEs
- Urban commercial, business, and tourism economy



Map 8.14: Growth Corridors and Nodes

Spatial Strategies

1. Industrial Growth Corridor

An industrial corridor is proposed along the proposed Inner Ring Road connecting Valasamudhram and Koothudankadu, integrating the SIPCOT industrial estates at Milavittan, Allikulam, and the Furniture Park.

This corridor creates a continuous manufacturing and logistics spine, enabling:

- Efficient movement of raw materials and finished goods between SIPCOT estates and the VOC Port
- Co-location of large industries with ancillary units, vendor parks, and plug-and-play parks
- Economies of scale, reduced transport costs, and stronger industrial clustering

This directly strengthens the Port–Industrial–Logistics System and the Export-Oriented Manufacturing System by spatially aligning production with port access.

2. High-Growth Commercial Corridor

A commercial growth corridor is proposed along Madurai and Tirunelveli road, extending toward the airport along Tirunelveli Road, where:

- Road width, accessibility, and travel demand make the corridors suitable for mass transit

These corridors are designated as high-intensity, mixed-use growth zones, allowing vertical and compact development that supports:

- Business travel and port-linked commerce
- Investment servicing, professional services, and hospitality

By concentrating growth here, the plan enables densification rather than outward sprawl, improving land efficiency and infrastructure viability.

3. Strategic Commercial and Industrial Nodes

A network of commercial and industrial growth nodes has been identified based on land suitability, transport connectivity, and proximity to existing industrial areas and infrastructure.

- Industrial growth nodes are proposed in Keela Thattapattai, Therku Sillukanpatti, Mela Arasadi, Valasamudhram, and Pudur Pandia Puram, located close to the SIPCOT industrial estates and major transport corridors.

- These nodes are planned to accommodate ancillary units, component suppliers, vendor parks, and plug-and-play MSME parks, enabling local enterprises to integrate into the supply chains of large industries such as shipbuilding, clean energy, electronics, and agro-processing.

This spatial clustering will improve industrial efficiency, strengthen MSME participation, and support the district's export-oriented manufacturing base.

- Commercial growth nodes are proposed at Maravanamattam and Senthilampannai, where good highway access and land availability create opportunities for offices, retail, hospitality, logistics services, and business-support functions.
- These nodes will act as secondary urban centres along the growth corridors, supporting workforce needs, business travel, and the expanding industrial economy while reducing pressure on the core city.

Together, these nodes complement the corridor-based development framework by creating well-distributed, investment-ready locations for both industrial expansion and urban commercial activity across the planning area.

4. R&D and Innovation Clusters near Anchor Industries

Dedicated R&D and innovation clusters are proposed near large enterprises in electronics, energy, shipbuilding, and clean manufacturing.



This spatial proximity enables:

- Technology transfer
- Workforce upskilling
- Vendor upgrading
- Product and process innovation

These clusters support the Green Industrial System and help Thoothukudi move from assembly and handling to higher-value manufacturing and engineering.

5. Maritime Industrial Cluster

The National Shipbuilding & Heavy Industries Park, Tamil Nadu (NSHIP, TN) has been established as the country's first Special Purpose Vehicle (SPV) dedicated to developing a mega shipbuilding cluster to position India as a global maritime hub. In alignment with this initiative, a specialised maritime industrial cluster is proposed near the upcoming SIPCOT estate and desalination plant, enabling:

- Shipbuilding
- Marine engineering
- Port-dependent industrial services

This anchors a maritime industrial ecosystem, reinforcing Thoothukudi's position in shipbuilding, offshore wind logistics, and port-based engineering.

6. Renewable Energy Cluster

A dedicated renewable energy cluster is proposed along the Tirunelveli Road corridor in Varathagreddypatti and Mudivaithenendal villages, based on the assessed land demand and the concentration of existing and proposed clean energy investments in the planning area. The cluster is intended to accommodate

- Solar manufacturing units,
- Renewable energy equipment assembly
- Energy storage facilities
- Research and Development Facilities

Its location along a major transport corridor enables efficient movement of components, strong grid connectivity, and logistical integration with VOC Port.

7. Logistics Nodes on Key Port Corridors

To support rising cargo volumes and reduce congestion at VOC Port, logistics nodes are proposed along:

- Madurai Road
- Tirunelveli Road
- Tiruchendur Road

These nodes include:

- ICDs and container yards
- Warehousing and cold chains
- Truck terminals and empty container depots

They act as cargo aggregation and distribution points for the hinterland, directly supporting the Port–Industrial–Logistics System.

8. Food Processing and Cold Chain Clusters

To support Thoothukudi's strong seafood and agro-export base, cold storage and processing facilities are proposed near:

- Existing seafood industries
- Port access routes

This reduces spoilage, improves export quality, and strengthens the Blue Economy System.





Mobility



9.1 Introduction

As a major coastal urban and industrial centre of southern Tamil Nadu, Thoothukudi's transportation infrastructure comprises an integrated system of roads, railways, port facilities, and air connectivity that caters to both urban mobility and regional as well as international trade requirements. The road network within the Thoothukudi Local Planning Area (LPA) consists of National Highways, State Highways, Major District Roads, Other District Roads, and village roads, providing connectivity between the city, its peri-urban areas, and neighbouring taluks and districts. This multi-tier road hierarchy supports passenger movement, industrial freight, and port-related traffic, making transportation a critical component of the city's economic structure.

Located on the southeast coast of Tamil Nadu along the Gulf of Mannar, Thoothukudi functions as the district headquarters and a prominent port city. The urban core of Thoothukudi Corporation acts as the primary commercial and administrative centre, while industrial areas, port activities, power plants, and logistics facilities form key employment nodes within and around the LPA. In addition, the city serves as a regional service centre for surrounding settlements, attracting a considerable daily floating population comprising workers, traders, students, and port-related commuters. This continuous inflow places increasing pressure on the existing transport infrastructure and necessitates improved access, circulation, and intermodal coordination.

A well-planned and efficient transportation system is essential for sustaining the economic growth and spatial development of Thoothukudi LPA, particularly in the context of port-led development and industrial expansion. The LPA currently faces challenges such as traffic congestion on key corridors, conflicts between freight and passenger traffic, inadequate public transport coverage in peripheral areas, unorganised on-street parking, and rising dependence on private vehicles. Addressing these issues requires the provision of an integrated, accessible, and affordable transport system that accommodates both people and goods. Strengthening public transport, improving last-mile and non-motorised transport infrastructure, enhancing road safety, and implementing effective traffic and freight management measures are key priorities for achieving a sustainable and efficient transportation framework for Thoothukudi LPA.

9.2 Regional Linkages

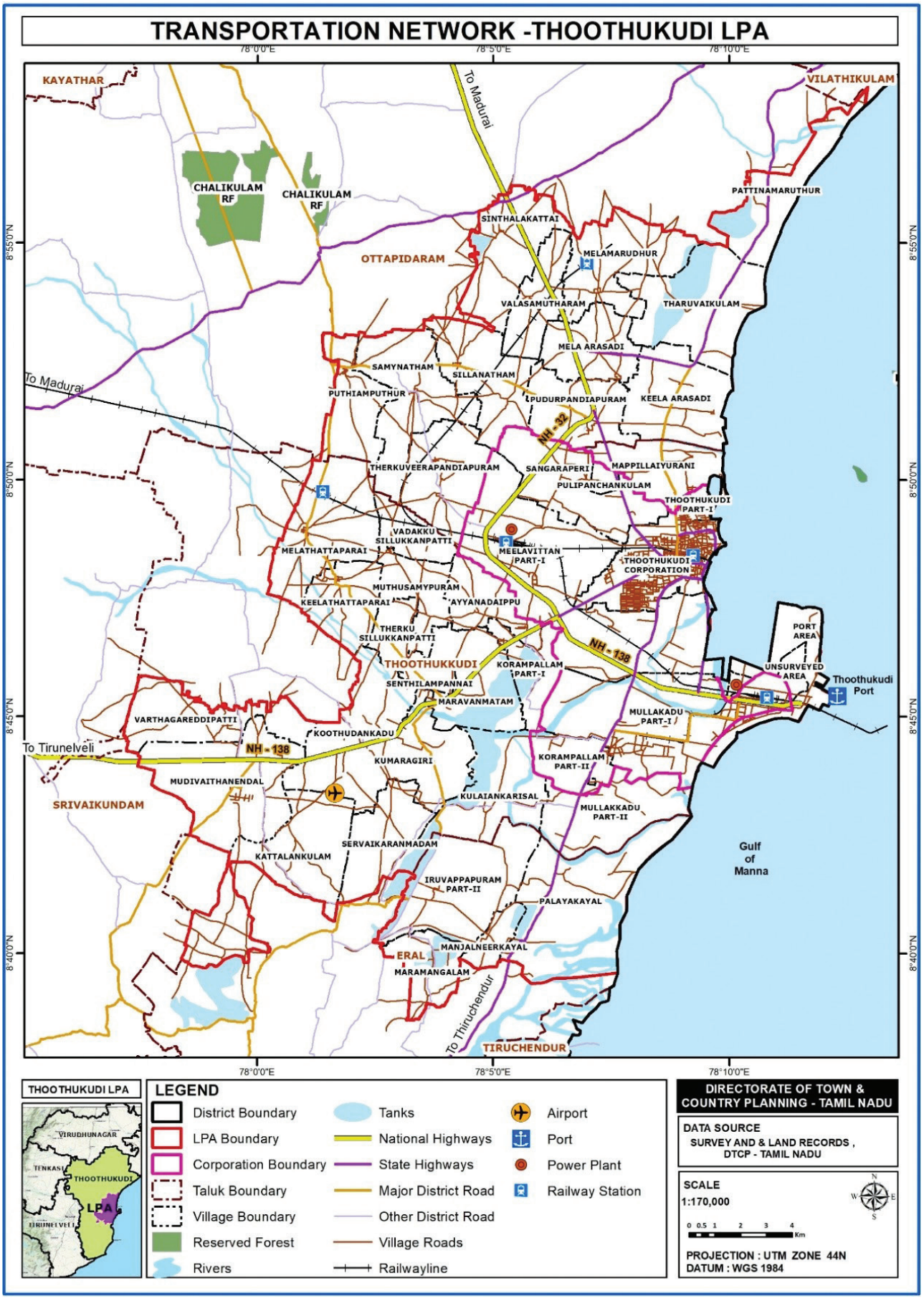
Thoothukudi Local Planning Area (LPA) enjoys strong regional and inter-regional connectivity owing to its strategic coastal location and well-established multimodal transportation network. Thoothukudi's connectivity is supported by several major National and State Highways that facilitate regional and industrial transit. **NH-138** acts as a primary regional connector between Thoothukudi and Tirunelveli, covering 54 km total with approximately 18 km within the Local Planning Area (LPA). The city is further linked by **NH-32**, an expansive 750 km East Coast corridor connecting Chennai to Kanniyakumari, and **NH-38**, which links Thoothukudi to Madurai and Vellore; both of these National Highways have about 8 km of their length within the LPA. In addition to these, two significant State Highways bolster the local network: **SH-49** serves as an important industrial and port-linked connector between Ramanathapuram and Tirunelveli with 14 km inside the LPA, while **SH-176** functions as a major religious and commuter corridor connecting Tiruchendur to Thoothukudi and Palayamkottai, featuring roughly 12 km within the LPA boundaries. In addition, a dense network of Major District Roads, and Other

District Roads radiate from Thoothukudi city and surrounding settlements, ensuring seamless connectivity with neighbouring taluks such as Srivaikundam, Ottapidaram, Vilathikulam, Kayathar, and Tiruchendur. This hierarchical road network supports the movement of goods, commuters, and services, reinforcing Thoothukudi's role as a regional service and industrial hub.

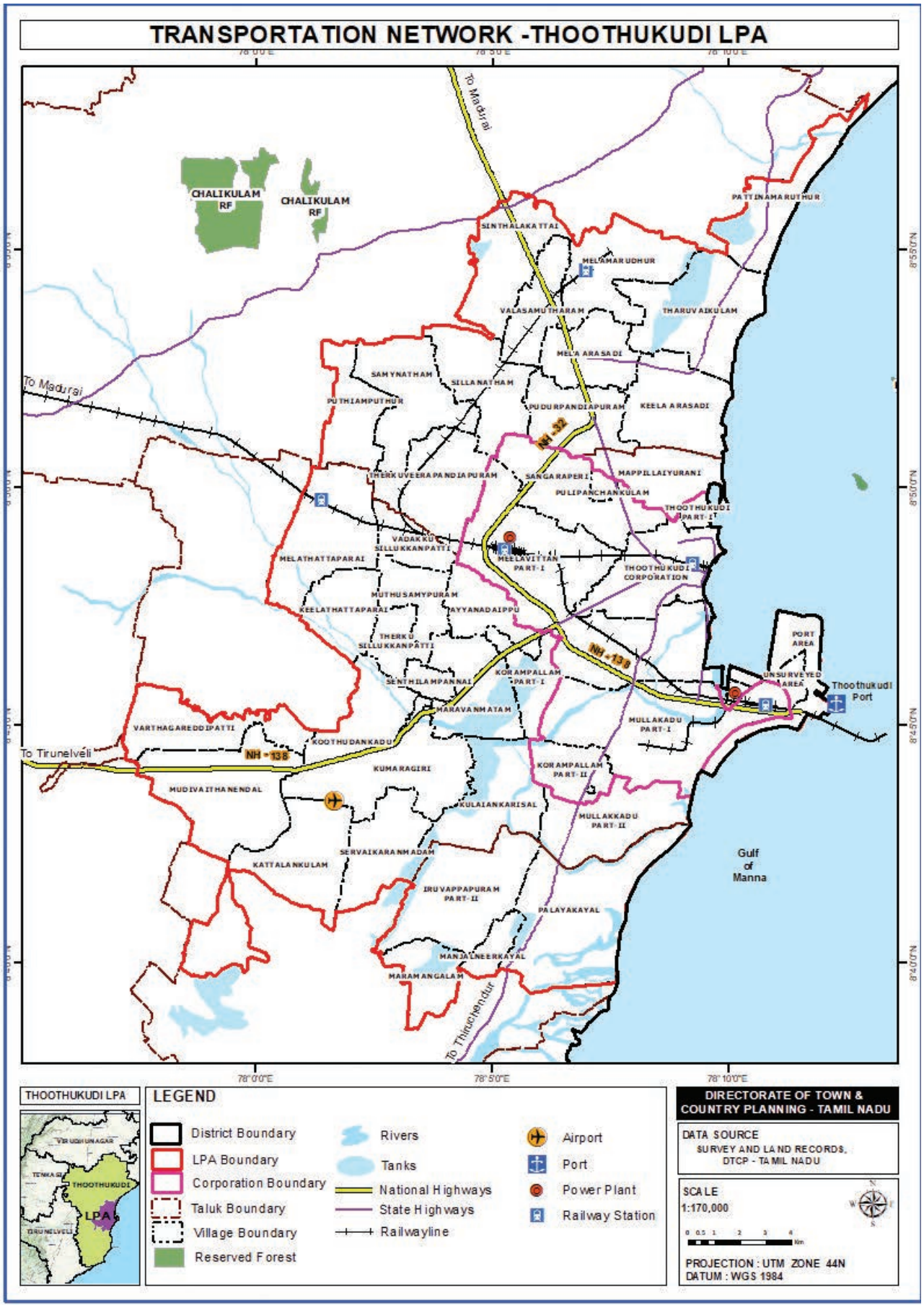
Rail connectivity further strengthens the regional linkages of Thoothukudi LPA. Thoothukudi functions as a major railhead in southern Tamil Nadu, with broad-gauge railway lines connecting it to Tirunelveli, Madurai, Virudhunagar, and onward to Coimbatore, Chennai, and other parts of the country. The presence of Thoothukudi Railway Station and associated freight handling facilities enables efficient movement of bulk cargo, industrial raw materials, and passenger traffic. These rail linkages play a critical role in supporting port-led industrial development, power generation facilities, and regional trade, while also providing reliable passenger connectivity for daily commuters and long-distance travelers, consistent with regional rail integration principles highlighted in other major LPA master plans.

Thoothukudi Airport, located within the planning area, offers regional air connectivity to major cities, enhancing accessibility for business, tourism, and administrative functions. Tuticorin Airport (Vagaikulam) serves as the primary air gateway for Thoothukudi, located 26–30 km from the city via **NH-138**. The airport supports both regional passengers and emerging air freight needs through high-frequency domestic services. Key connections include Chennai, which serves as the main business link with over 28 weekly flights by IndiGo and SpiceJet, and Bengaluru.

Together, the integrated road, rail, air, and port infrastructure positions Thoothukudi LPA as a key regional gateway and growth centre, supporting balanced regional development as envisaged in the Master Plan framework.



Map 9.1: Transportation Network Map of Thoothukudi LPA



Map 9.2: Transport Network Map showing NH and SH of Thoothukudi LPA

9.3 Existing Transportation Scenario

9.3.1 Road Network

Thoothukudi is well connected by road network. National Highway 138 originates at the Thoothukudi Port and terminates at Tirunelveli (Palayamkottai), covering approximately 18 km within the Local Planning Area (LPA) and acting as the primary link to the Tirunelveli District Headquarters. National Highway 38 (formerly part of NH-45B) originates in Vellore and terminates at Thoothukudi Port, running for about 8 km within the LPA; it is a critical trade corridor connecting the city to major industrial hubs like Madurai and Trichy. National Highway 32 originates in Chennai and terminates in Thoothukudi, spanning roughly 10 km within the city's planning limits and providing a scenic coastal connection to Ramanathapuram.

In terms of state-level connectivity, State Highway 176 originates in Thoothukudi and terminates in Tiruchendur, running for about 8 km within the LPA it is essential for the district's salt and agricultural trade, particularly from the southern regions. State Highway 49, providing coastal access for approximately 14 km within the LPA before merging with the national network. These roads ensure that the port is seamlessly linked to the rural hinterlands and major trade centers, allowing for the rapid transit of raw materials like coal and copper to the industrial belts of interior Tamil Nadu. Thoothukudi serves as a vital logistics terminal where several high-capacity highways converge to facilitate the movement of goods from the V.O. Chidambaranar Port. Rural parts of the district are well connected by the district roads.

Table 9.1: Details of Major Highways Passing Through Thoothukudi LPA

Sl. No.	Road No.	Classification	Major Places Connected	Approx. Length (km)	Remarks
1	NH-138	National Highway	Thoothukudi – Tirunelveli	54 km (total)~18 km within LPA	Primary regional connector linking Thoothukudi with Tirunelveli and further to NH-44; major passenger and freight corridor
2	NH-32	National Highway	Chennai – Cuddalore – Nagapattinam – Thoothukudi – Kanniyakumari	~750 km (total)~8 km within LPA	East Coast corridor connecting Thoothukudi with Chennai and southern coastal districts
3	NH-38	National Highway	Vellore - Thoothukudi	604 km - 8 km within LPA	Links Thoothukudi to Madurai

Sl. No.	Road No.	Classification	Major Places Connected	Approx. Length (km)	Remarks
4	SH-49	State Highway	Ramanathapuram – Thoothukudi – Tirunelveli	~160 km (total)~14 km within LPA	Important regional connector supporting industrial and port-linked traffic
5	SH-176	State Highway	Tiruchendur – Thoothukudi – Palayamkottai	~90 km (total)~12 km within LPA	Major religious and commuter corridor connecting Tiruchendur with Thoothukudi city

The modal split of Thoothukudi reveals a transport landscape heavily skewed toward individual motorized mobility, reflecting a common trend in rapidly urbanizing Indian port cities. The data underscores a critical reliance on private transport over organized public systems.

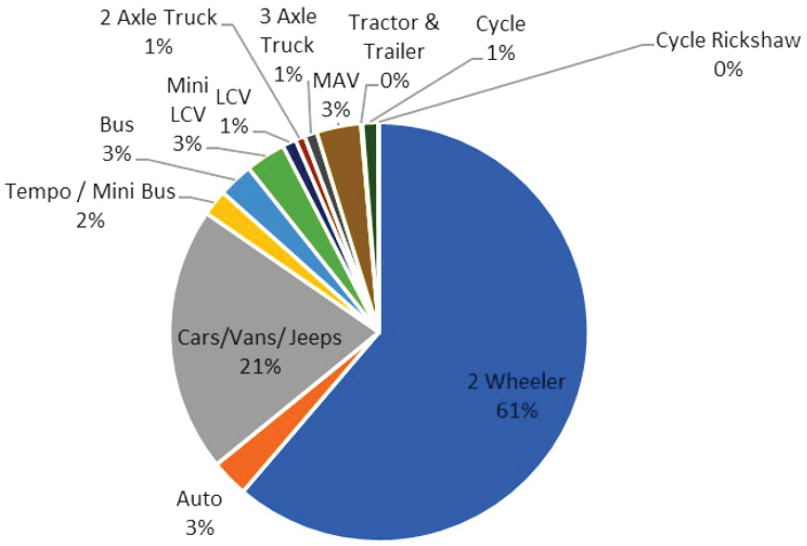


Figure 9.1: Mode Share (%)

The most striking feature of the survey is the overwhelming presence of Two-Wheelers, which command 61% of the total modal share. When combined with Cars/Vans/Jeeps (21%), private motorized transport accounts for a staggering 82% of all road activity. This high level of motorization suggests that personal vehicles are the primary response to gaps in public transport coverage. The sheer volume of two-wheelers, while space-efficient compared to cars, contributes significantly to chaotic traffic flow and safety concerns at major intersections.

Despite the city's scale, Public Transport (Buses) and IPT (Autos, Tempos) maintain a marginal footprint. Buses (3%) and Tempos/Mini-Buses (2%): A combined 5% share for mass transit is notably low for a city of this importance, indicating a potential lack of route frequency or last-mile connectivity. Auto-Rickshaws (3%) serve as the primary flexible transit option, though their limited share suggests they function more as a niche service rather than a backbone of the transit system.

Table 9.2: Existing Modal Share of Transport Modes in Thoothukudi LPA

Category	Transport Modes	Aggregate Share
Private Motorized	2-Wheelers, Cars/Vans/Jeeps	82%
Public/Semi-Public	Bus, Tempo, Auto	8%
Freight/Logistics	MAV, LCVs, Trucks, Tractor	9%
Non-Motorized	Cycles, Cycle Rickshaws	1%

Given Thoothukudi's status as a major port hub, the freight segment is diverse, though it appears fragmented across the general road network Multi-Axle Vehicles (MAV) and Mini LCVs each hold a 3% share, 2-Axle and 3-Axle trucks contribute another 1% each, The presence of heavy freight (MAV) on the same arterial roads as high-volume two-wheeler traffic creates significant friction, leading to the operational inefficiencies and safety risks identified in the LPA (Local Planning Area) hierarchy. The survey highlights a concerning decline in sustainable mobility. Cycles account for only 1%, while Cycle Rickshaws have a negligible 0% share. This suggests that the road environment may be perceived as hostile or unsafe for non-motorized users, likely due to high speeds and the lack of dedicated cycling infrastructure.

Table 9.3: Corporation Roads based on Material Used

Type of Roads	Length in KM
Bitumen Road	342.39
Cement Concrete Road	58.72
Paver Block Road	36.21
WBM Roads	1.35
Earthen Roads	181.59
Total	**620.27**

Source: Thoothukudi Corporation

9.3.2 Rail Transport

Thoothukudi Railway station is one of the oldest railway junctions in Tamil Nadu. Thoothukudi railway station, also known as Tuticorin railway station is an NSG-3 category railway station serving the port city of Thoothukudi in the Thoothukudi district of Tamil Nadu, India. It functions as a terminus on the Thoothukudi–Vanchi Maniyachi line, handling both passenger and freight traffic essential to the region's industrial and maritime economy. The station is operated by the Madurai division of the Southern Railway zone under the Ministry of Railways. Established on 1 January 1876 with the opening of the 158.85 km Madurai–Thoothukudi line by the South Indian Railway Company, the station marked a significant milestone in connecting southern Tamil Nadu to broader rail networks before Indian independence. This development facilitated trade links, including early connections to Ceylon (now Sri Lanka) via boat services from the nearby port.

The rail infrastructure within the Thoothukudi region is anchored by a strategic network of stations, led by the Thoothukudi (TN) primary terminus in the city center and supported by Thoothukudi Melur (TME), which serves as a vital secondary halt for western residential and commercial neighborhoods. For industrial operations, Meelavittan (MVN) acts as a critical freight junction supplying the region's thermal power plants and the V. O. Chidambaranar Port, while the historic Vanchi Maniyachi Junction (MEJ) serves as the ultimate gateway, where the main lines from Chennai and Madurai diverge toward either the port city or the southern districts of Tirunelveli and Kanyakumari.



Figure 9.2: Tuticorin railway station

The Thoothukudi Local Planning Area (LPA) and its immediate surroundings are served by a network of stations that facilitate both suburban movement and heavy industrial freight. Daily express services provide direct connectivity to Chennai (Pearl City Express), Madurai, Tirunelveli, and Mysuru. For the Inter-District connectivity, the ongoing doubling of the Madurai–Thoothukudi line is set to further integrate the Virudhunagar, Madurai, and Thoothukudi

districts, reducing transit times for both commuters and industrial cargo. Over the years, the station has undergone expansions, including track doubling and electrification of the Meelavittan–Thoothukudi section completed by 2023, enhancing efficiency for electric locomotives. Today, it supports key routes to cities like Madurai, Tirunelveli, and Chennai. As a Port City, the railway's role extends far beyond passenger travel. It is the backbone of the region's industrial-maritime economy, facilitating the movement of coal, fertilizers, and containers from the VOC Port to the hinterlands of South India.

Table 9.4: Annual Originating Passenger Traffic, Earnings, and Average Daily Footfall at Tuticorin Railway Station

Annual Originating Passengers & Earnings						
Year	Station Name	Station Code	Category	Originating Passengers 2024-25	Originating Earnings 2024-25	Footfall / day
2020-2021	Tuticorin	TN	NSG 3	241935	113300567	663
2022-2023	Tuticorin	TN	NSG 3	712374	321264970	3623
2024-2025	Tuticorin	TN	NSG 3	832154	353892265	4387

Source: Madurai Division Southern Railway





Map 9.3: Railway Network Map of Thoothukudi LPA

9.3.3 Air Transport

Tuticorin Airport located in the southern part of Tamil Nadu, serves as an important domestic airport for the districts of Thoothukudi and Tirunelveli. The only one Airport in this district at Vagaikulam of Thoothukudi taluk was opened for traffic on April 30, 1992 for Vayudoot Services only. Situated approximately 16.9 km from Thoothukudi city, the airport connects it to the nearby city of Tirunelveli. Thoothukudi Airport is the fifth busiest airport in Tamil Nadu, following the major airports in Chennai, Coimbatore, Tiruchirappalli, and Madurai. It is located 15.6 km west from the city centre on Thoothukudi-Tirunelveli. The airport plays a vital role in enhancing regional connectivity, facilitating both business and tourism in the southern districts of Tamil Nadu. It serves as a key transport hub, especially for industries such as fisheries, shipping, and logistics in the Thoothukudi region. Given its proximity to the industrial areas and ports, the airport also supports the export-oriented economy of the region.

To develop world-class air infrastructure and enhance connectivity, the New Terminal Building at Tuticorin Airport, which was developed at a cost of around Rs.450 crore and was designed to meet the growing aviation demands of the southern region. Spread across 17,340 square meters, the terminal was equipped to handle 1,350 passengers during peak hours and 20 lakh passengers annually, with a future expansion capacity of up to 1,800 peak-hour passengers and 25 lakh passengers annually.

Table 9.5: Tuticorin Airport Passenger and Cargo Statistics

Tuticorin Airport: Passenger Traffic

Year	Embarked	Disembarked	Transit	Total Passengers
2022-2023	104,010	98,632	Nil	202,642
2023-2024	96,060	104,437	Nil	200,497

Tuticorin Airport: Cargo & Revenue

Year	Cargo Out (Kg)	Cargo In (Kg)	Total Cargo	Total Revenue
2022-2023	664	460	1,124	Rs. 399.54 Lakhs
2023-2024	304	5,102	5,406	Rs. 814.25 Lakhs

Source: Airport Authority of India

Table 9.6: Month-wise Passenger Traffic at Tuticorin Airport (2020–2025)

	Passengers (In Number's)					
Month	2020	2021	2022	2023	2024	2025
January	23144	15165	11606	16598	17286	20218
February	20236	14007	10974	15234	16409	17401
March	11712	13632	15124	17335	16336	20206
April	0	8716	17495	17823	19913	24069
May	359	5330	18758	18952	22803	28684
June	3933	5324	17923	17631	20775	24450
July	7514	10010	17901	15194	20707	26807
August	11530	12731	18833	16526	19237	29788
September	13828	12878	15374	17327	16970	26022
October	13526	13227	16088	16287	15691	25355
November	13743	12702	14980	15668	17313	20672
December	14083	16741	16123	14322	18917	20296

Source: Airport Authority of India

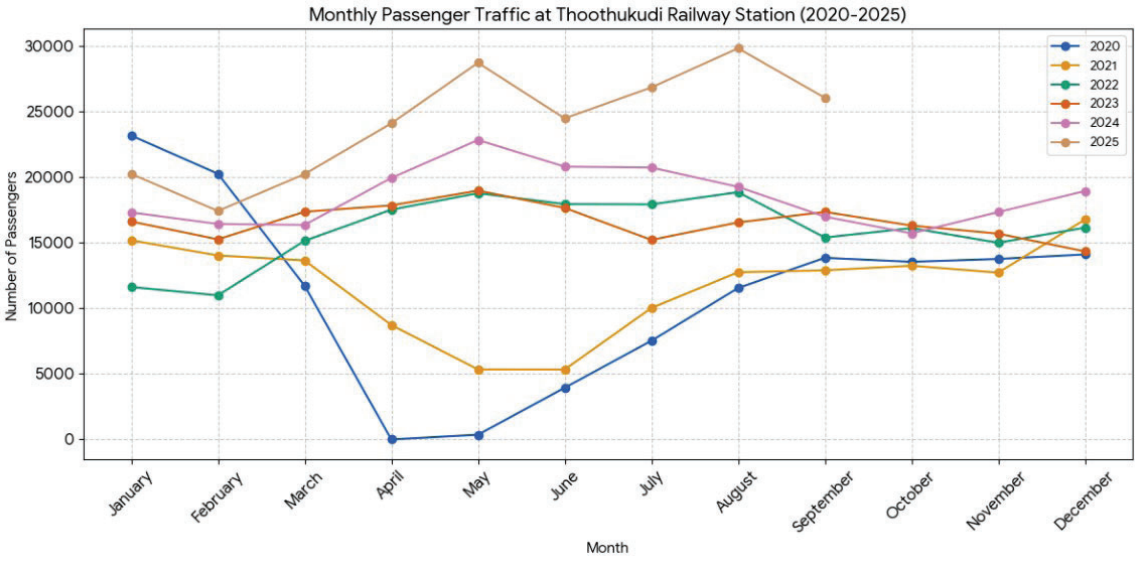


Figure 9.3: Monthly Passenger Traffic at Thoothukudi Railway Station (2020-2025)

The data clearly illustrates the impact of the COVID-19 pandemic, with passenger numbers hitting an absolute low in April 2020 (0 passengers). However, since 2021, there has been a consistent year-on-year increase in footfall as travel restrictions eased and public confidence returned. There is a remarkable surge in passenger volume in 2025. Comparing the first nine months (January–September) of 2024 to 2025, the station experienced a 27.70% growth in traffic. The average monthly passenger count has climbed from roughly 11,134 in 2020 to 24,182 in 2025, more than doubling in five years. Every year shows a significant rise in May (reaching 28,684 in 2025), likely corresponding to summer school vacations and family travel. August 2025 recorded the highest single-month footfall in the dataset with 29,788 passengers, indicating a strong demand during the late-third quarter. The consistent upward trend, underscores Thoothukudi's growing role as a vital transportation hub for both the industrial workforce and the public in Southern Tamil Nadu.

Table 9.7: Month-wise Freight Handling and Aircraft Movements at Tuticorin Airport (2020–2025)

	Freight (In MT)						Aircraft Movements (IN NOS)					
Month	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
January	3	0	0	1	0.8	0.4	359	248	224	276	256	308
February	3	0	1	0	0.3	0.7	314	224	160	236	234	264
March	0	0	0	0	0.8	5.6	228	234	220	278	254	322
April	0	0	1	1	0.4	2.6	0	140	266	274	332	400
May	0	0	0	0	0.6	0.5	6	134	274	274	346	444
June	0	0	0	1	0.7	0.5	92	100	268	268	334	402
July	0	0	0	0	0.6	0.7	124	178	278	220	350	418
August	0	0	0	1	0.9	1	190	202	274	240	300	422
September	0	0	0	0	0.7	0.9	240	198	270	264	252	380
October	0	0	0	0	1.1	1	248	212	276	272	266	374
November	0	0	0	0	0.7	0.6	226	226	266	236	296	292
December	0	0	0	0	0.8	1.1	230	278	270	228	306	310

Source: Airport Authority of India

In months like May and August 2025, aircraft movements reached over 420–440, compared to the 200–300 range seen in previous years. Comparing May 2024 (346 movements) to May 2025 (444 movements) shows a 28% increase

in flight frequency, indicating enhanced connectivity and likely the introduction of new routes or larger flight schedules. Freight hit a peak of 5.6 MT in March 2025. While still modest in absolute terms, this is a massive relative increase compared to the previous four years, where many months saw zero cargo. Unlike previous years where freight was hit or miss, 2025 shows consistent tonnage every month, suggesting that a regular cargo handling process or a specific industrial supply chain has been established. There is a clear positive correlation between aircraft movements and freight in 2025. As flight frequency increased, freight volumes also began to stabilize above 0.5 MT consistently. This suggests that the cargo is likely being carried in the belly hold of passenger aircraft rather than dedicated freighters.

9.3.4 Port

V.O. Chidambaranar Port, formerly Tuticorin Port, is one of the 12 major ports in India. It was declared to be a major port on 11 July 1974. Thoothukudi port that becomes a major port in India in 1974 is now on the average becoming an International Container Transhipment Hub of South East Asia. It is second-largest port in Tamil Nadu and fourth-largest container terminal in India. V.O.Chidambaram Port is an artificial port. In 2010, it is renamed as V.O.C Port in the name of V.O.Chidambaram Pillai, a prominent freedom fighter. The growth of V.O.C port develops the district in the changing economic scenario. This is the third international port in Tamil Nadu and its second all-weather port. The size of V.O. Chidambaranar (VOC) Port refers to its physical area (around 960 acres water spread, 2150+ acres land) and its berth dimensions, with berths ranging up to 1000m long and drafts up to 14.2m currently (planned for 15.5m+), allowing it to handle large container and bulk carriers, with ongoing expansions for bigger ships.

It has services to USA, China, Europe, Sri Lanka and Mediterranean countries. The Station Commander, Coast Guard Station Tuticorin is located at Tuticorin Port, Tamil Nadu under the operational and administrative control of the Commander, Coast Guard Region (East), Chennai. The Coast Guard Station Tuticorin Port was commissioned on 25 Apr 1991 by Vice Admiral SW Lakhar, NM, VSM the then Director General Coast Guard. The Station Commander is responsible for Coast Guard operations in this area of jurisdiction in Gulf of Mannar.

VOC Port Tuticorin is an ISO 9001:2008, ISO 14001:2004 and ISPS compliant Port. V.O.C Port Tuticorin is located strategically close to the East-West International Sea route on South-Eastern coast of India. Port of Tuticorin is also well connected by road and railways to allow fast transit of all the goods and raw materials from the port itself to the desired location. In a major boost to augment port infrastructure and clean energy initiatives, the newly inaugurated North Cargo Berth–III with a cargo-handling capacity of 6.96 MMTPA at V.O. Chidambaranar Port, developed at a cost of around Rs.285 crore. This helped

in meeting the growing demand for handling dry bulk cargo requirements in the region, thereby improving overall port efficiency, and optimizing cargo-handling logistics.



Figure 9.4: Road Connectivity to Port

V.O. Chidambaranar Port relates to major National Highways connecting through three major cities/ urban centres in Tamil Nadu like Tirunelveli, Madurai and Kanyakumari, indicating its strategic position in southern Tamil Nadu's road network. This connectivity supports smooth movement of passengers as well as goods between coastal, inland, and hinterland regions

The direct highway links enhance access to key economic nodes, especially the port and industrial areas of Thoothukudi, facilitating freight transport and trade activities. The convergence of multiple routes toward the city highlights its role as a regional transport hub, improving connectivity for tourism, commerce, and logistics while also strengthening integration with neighboring districts and states.

Rail Connectivity to Port

Presently a Broad-Gauge single line connects the Port area originating from Milavattan Railway station. The total length of this railway line is 17.60 km. The distance from Milavattan Railway station to VOC wharf is 14.0 km and VOC wharf to Marshalling yard is the balance length near coal yard with a loop line with 5 no. lines available in the Marshalling yard



Figure 9.5: Rail Connectivity to Port

Existing Conditions and Baseline Analysis

As of the latest data, V.O. Chidambaranar (VOC) Port features 16 fully operational berths catering to a wide range of cargo-handling requirements. These berths are equipped to manage diverse types of cargo, including bulk, break-bulk, liquid, and containerized goods, reflecting the port's versatility and capacity to handle high traffic volumes.



Figure 9. 6: Berths in VOC Port

Details of Berthing Infrastructure

The terminal infrastructure at VOC Port is highly specialized and capable of handling large-vessel operations, with nearly half of the berths supporting a maximum deadweight tonnage (Dwt) of 80,000 M. These high-capacity berths, including Berth VIII, NCB I, and NCB III, typically feature the deepest permissible drafts of 14.20 M and are dedicated to specialized uses such as container terminals, coal handling, and captive industrial operations. The port also maintains significant capacity for break bulk and dry bulk through Berths I through VI and Berth IX, which offer varying drafts ranging from 8.60 M to 14.20 M. While the facility is primarily geared toward heavy industrial and commercial cargo, it also accommodates smaller-scale operations, such as the Shallow Berth leased to the Indian Coast Guard and Zone B, which is specifically designated for sailing vessels and barges with a draft of only 5.00 M. Overall, the berth configurations indicate a strategically balanced port capable of managing diverse maritime activities ranging from massive energy imports to coastal security and small-vessel traffic.

Outer Harbour Area of 100 Acres is proposed to be developed at VOC port, which is expected to operate as transhipment container terminal. Following figures shows draft plan of outer harbour development. The Outer Harbour shall feature with two terminals with quay length of 1 Km each, draft of 16.5 metres, with a capacity to handle 4 million TEUs of container traffic. Considering construction of outer harbour period of four years, by 2032 is it expected to handle 1 million TEU/year.

It is proposed to deepen the Inner Harbour to a uniform navigational draft of 16.5 metres. This upgrade is intended to support the safe accommodation of larger and more efficient vessel classes, thereby enhancing port productivity, lowering shipping costs per ton, and aligning with cargo growth forecasts.

The port is strategically divided into Zone A (major cargo and container operations) and Zone B (specialized and miscellaneous wharves). As of 2024-25, the port operates 16 fully operational berths with a total annual capacity of 69.30 million tonnes.

Container Terminals

Berth VIII: Operated by DBGT (Dakshin Bharat Gateway Terminal) with a 14.20m draft.

Berth IX: Operated by JM Baxi (since September 2024) with a 14.20m draft.

Berth VII: A 370m quay handled by the Port (formerly PSA Sical), with an 11.70m draft.

Coal Jetties and Berths

CJ I & CJ II: Dedicated thermal coal jetties for TANGEDCO/TTPS with drafts of 14.2m and 14.0m respectively.

NCB I: A captive thermal coal berth for NTPL (80,000 DWT vessels).

NCB II: A 306m wharf previously for coal, currently being returned to port control.

NCB III: A newly operational fully mechanized dry bulk terminal (allotted to JSW) with a 14.20m draft.

General Cargo and Other Berths

Berths I to IV: Multi-purpose berths for general cargo (cement, fertilizer, industrial coal) with drafts of 9.3m to 11.5m.

Berths V & VI: General cargo and container handling with drafts of 8.6m and 9.3m.

Oil Jetty: Dedicated for POL (Petroleum, Oil, and Lubricants), LPG, and chemicals (13.0m draft).

Coastal Cargo Berth (West): Handles coastal cargo with a 9.0m draft.

Shallow Draught Berth: Leased to the Indian Coast Guard.

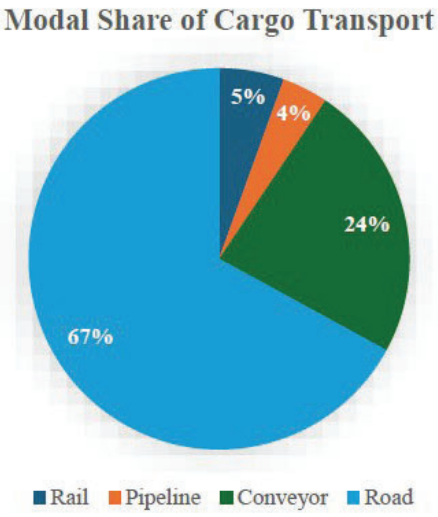


Figure 9. 7: Modal share of Cargo Transport at VOC Port during 2024 – 25

The modal share of cargo transport is overwhelmingly dominated by road transportation at 67%, a figure that aligns with Port's heavy reliance on its

vast road network for the flexible, door-to-door delivery essential for modern commerce and last-mile connectivity. While specialized conveyor systems account for a significant 24%, indicating high efficiency in industrial and port-specific bulk handling, there is a notable underutilization of rail (5%) and pipelines (4%). This skewed mix contributes to higher overall logistics costs and carbon emissions, prompting national policy shifts toward a multimodal approach aimed at increasing the rail share to 45% by 2030 to enhance sustainability and economic efficiency.

Table 9.8: Traffic handled at Major Ports in India

Ports	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	% Variance (vs 2023-24)
SMP – Kolkatta DS	17,303	15,900	15,298	17,052	16,909	16,641	-1.58
SMP – Haldia DC	46,680	45,468	42,877	48,608	49,536	47,310	-4.49
Paradip	112,689	114,549	116,134	135,329	145,379	150,408	3.46
Visakhapatnam	72,722	69,843	69,030	73,750	81,090	82,623	1.89
Kamarajar	31,746	25,889	38,742	43,507	45,277	48,407	6.91
Chennai	46,758	43,553	48,564	48,949	51,598	54,961	6.52
V.O.C Port	36,076	31,790	34,119	38,041	41,402	41,724	0.78
Cochin	34,038	31,503	43,551	35,256	36,315	37,745	3.94
New Mangalore	39,145	36,500	39,296	41,417	45,707	46,014	0.67
Mormugao	16,017	21,988	18,456	17,334	20,628	18,126	-12.13
Mumbai	60,696	53,324	59,891	63,606	67,261	68,625	2.03
JNPT	68,449	64,809	75,996	83,861	85,818	92,115	7.34
Kandla (Deendayal)	122,606	117,566	127,100	137,561	132,374	150,157	13.43
Total	**704,925**	**672,682**	**729,054**	**784,271**	**818,208**	**854,856**	**4.34**

Source: Indian Port Association

The Thoothukudi Master Plan addresses a critical regional economy driven by its status as a premier maritime gateway, where the VOC Port has demonstrated remarkable growth, handling 41.40 million tonnes of cargo in FY 2023-24. Despite the port's success and its record-breaking container traffic exceeding

7.39 lakh TEUs, the local planning area faces significant logistics inefficiencies due to a heavily skewed modal share, with road transport historically accounting for nearly 83% of movement. To align with Maritime India Vision 2030, the master plan emphasizes infrastructure augmentation, such as the ₹7,000 crore Outer Harbour Development and port-led industrialization, to transform Thoothukudi into a high-capacity transshipment hub while integrating digital trading and cold storage systems to optimize rural-urban freight efficiency.

Table 9.9 : Import and Export Cargo at VOC Port (2015 – 2025)

Commodity	2014-15	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25
IMPORTS							
Coal	1,38,03,877	1,32,63,008	1,14,35,904	1,16,64,425	1,55,52,819	1,84,15,422	1,78,67,651
General Cargo	27,60,778	16,70,748	11,91,793	17,73,865	21,37,510	24,66,368	18,36,025
Liquid Cargo	11,05,276	17,46,136	13,05,603	12,40,762	14,11,683	15,41,730	17,78,010
Other Gen. Cargo	2,52,285	7,64,737	3,93,838	10,32,487	6,94,478	7,36,523	10,08,765
F.R. Materials	10,51,716	5,99,109	5,04,407	7,63,159	7,39,472	7,96,848	8,60,855
Fertilizer	4,17,467	2,95,869	8,40,245	3,46,158	6,65,900	7,97,233	5,86,578
Total Imports (A)	**1,96,03,881**	**1,83,93,550**	**1,56,71,790**	**1,68,20,856**	**2,12,01,862**	**2,47,54,124**	**2,39,37,884**
EXPORTS							
General Cargo	9,55,513	9,68,619	9,21,268	10,56,382	14,20,987	13,46,746	14,98,317
Liquid Cargo	4,00,690	43,730	83,685	1,13,148	1,12,284	86,996	1,01,040
Dry Cargo	3,02,947	1,61,320	-	8,658	6,646	5,419	206
Other Gen. Cargo	57,062	63,677	15,378	79,941	95,656	54,419	1,70,547
Food Grains	59,408	-	-	1,35,300	35,340	53,260	-
Total Exports (B)	**17,75,620**	**12,37,346**	**10,20,331**	**13,93,429**	**16,70,913**	**15,46,840**	**17,70,110**

Source: VOC Port Authority

The cargo data for V.O.C. Port highlights its status as an import-dependent gateway, with total imports consistently dwarfing exports by a ratio of approximately 13:1 as of 2024-25. Coal remains the backbone of the port's operations, accounting for over 74% of total import volume in the latest fiscal year, despite a slight dip from its peak in 2023-24. On the export side, General Cargo is the primary driver, showing a steady upward trajectory to reach14,98,317 units in 2024-25, while other categories like Dry Cargo and Food Grains have become nearly negligible or highly intermittent. Notably, after a significant downturn during the 2020-21 period—likely due to global trade disruptions—the port has shown a strong recovery, with total import tonnage growing by over 52% from that low point to its current levels. Overall, the port serves as a critical energy and industrial hub, primarily facilitating the inward flow of raw materials like coal, liquid cargo, and fertilizers to support regional power and agricultural sectors.

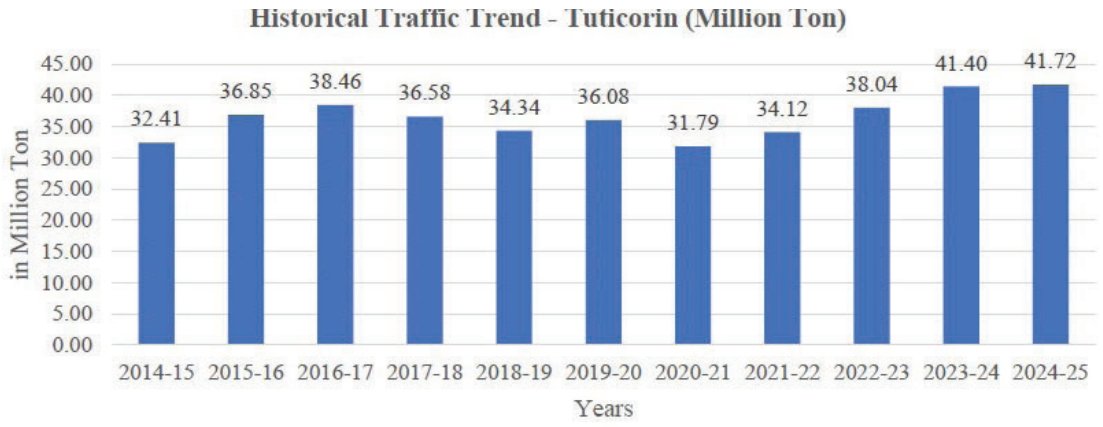
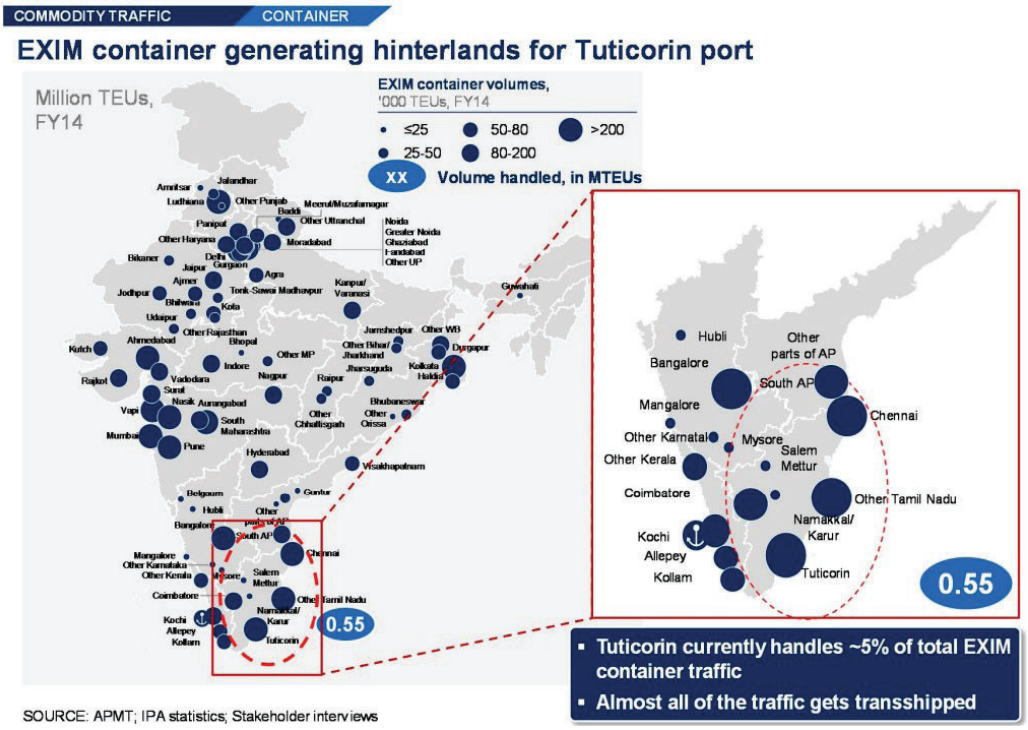


Figure 9. 8: Traffic Details of VOC Port (2015 – 2025)



Map 9.4: EXIM Container Traffic Hinterland of Tuticorin Port

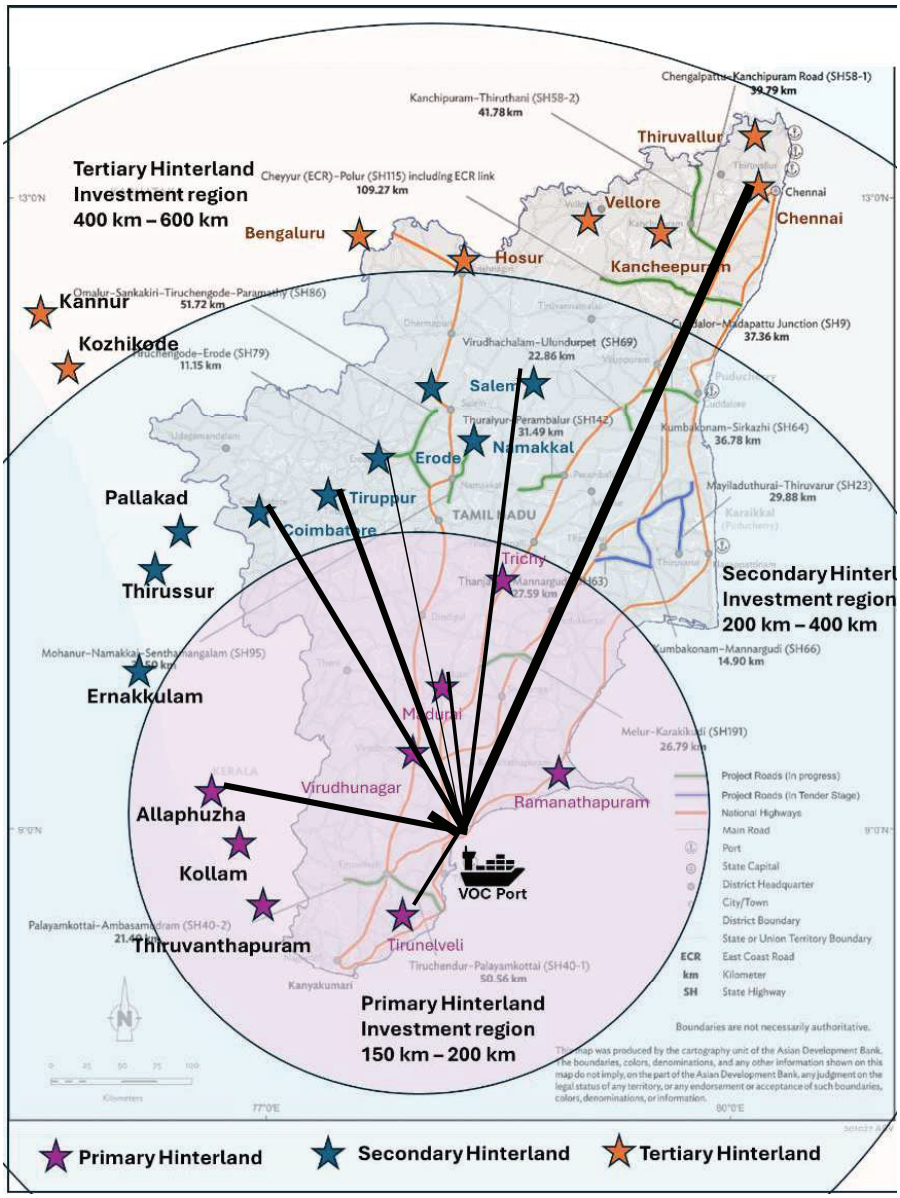
The map shows that Tuticorin Port mainly serves the southern part of India, especially Tamil Nadu, and parts of Kerala, Karnataka, and Andhra Pradesh. Many important cities like Chennai, Coimbatore, Tiruppur, Madurai, Salem, Bengaluru, Kochi, and Mangalore send and receive container cargo through Tuticorin. This means the port has a good industrial and commercial base around it.

Table 9.10: Vessel Traffic and Cargo Handling at V.O. Chidambaranar Port Trust (2021–2024)

Name of the Port	Vessels entered (in Nos)			Cargo handled (in Tonnes)		
V.O. Chidambaranar Port Trust	2021-2022	2022-2023	2023-2024	2021-2022	2022-2023	2023-2024
	1238	1523	1540	3,41,19,226	3,80,40,917	4,14,01,910

Source: VOC Port Authority

However, Tuticorin handles only about 0.55 million TEUs, which is around 5% of India's total EXIM container traffic. Also, almost all containers are transshipped, meaning they are first sent to another major port before going abroad. This shows that Tuticorin has limited direct ship connections. With better connectivity and direct shipping services, the port has strong potential to handle more container traffic in the future.

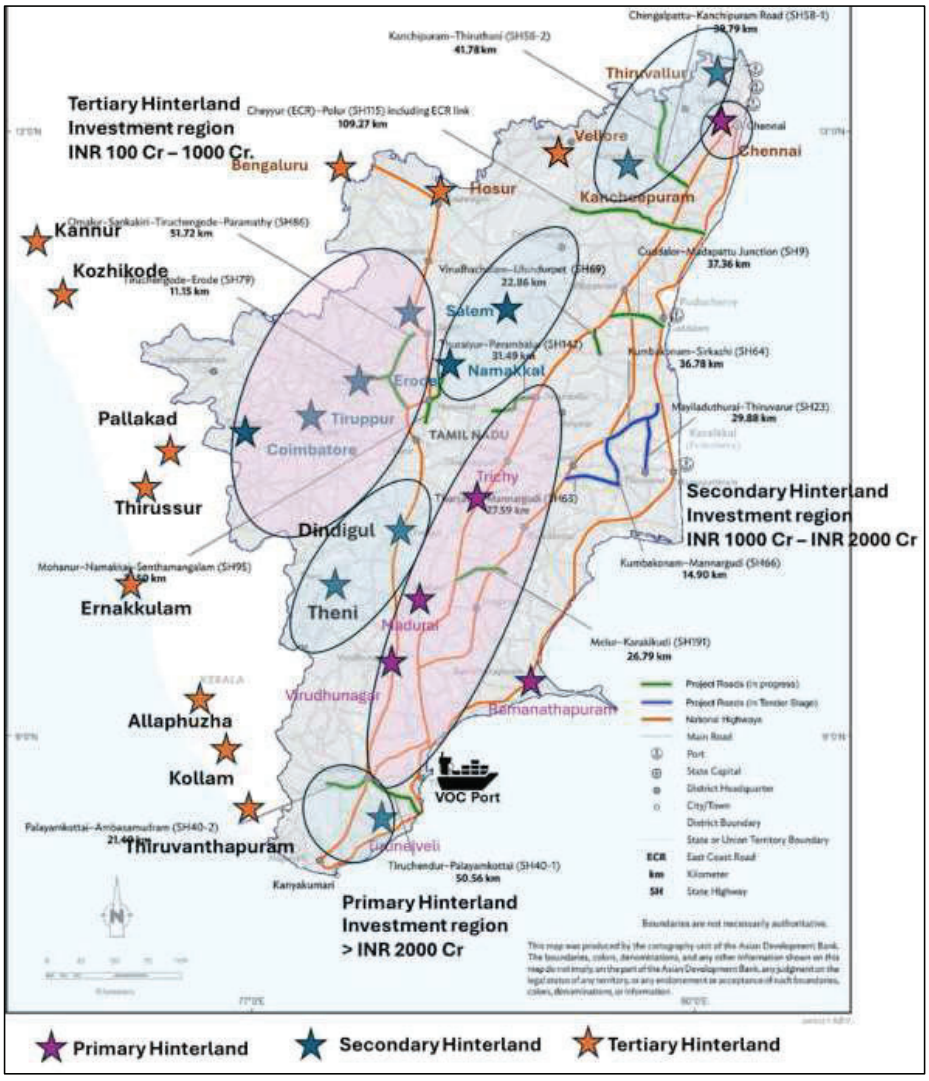


Source: NKI Analysis

Map 9.5: Hinterland Catchment Zones of VOC Port

The map clearly shows that V.O.C Port has three levels of hinterland influence: primary, secondary, and tertiary. The primary hinterland (150–200 km) lies closest to the port and includes areas such as Thoothukudi, Tirunelveli, Ramanathapuram, and Virudhunagar. These areas are the main and most regular cargo-generating regions, as they are well connected and involve lower transport time and cost.

The secondary hinterland (200–400 km) covers major industrial cities like Madurai, Trichy, Salem, Erode, Coimbatore, Tiruppur, and parts of Kerala. These regions contribute significant cargo volumes but also have the option of using other nearby ports such as Chennai and Cochin, leading to competition. The tertiary hinterland (400–600 km) extends to cities such as Chennai, Bengaluru, Vellore, Kancheepuram, Kozhikode, and Kannur, where cargo movement to V.O.C Port is limited and selective due to longer distances. Overall, the map indicates that while V.O.C Port has a strong local base, its cargo share reduces with distance, highlighting the importance of improving connectivity to attract cargo from farther regions.



Source: NKI Analysis

Map 9.6: Hinterland Catchment Zones of Cargo Value (INR)

The map explains how cargo value (in INR) handled through V.O.C Port is spread across different regions based on distance. The primary hinterland, located closest to the port, contributes the highest cargo value (more than INR 2000 crore). This area includes Thoothukudi, Tirunelveli, Ramanathapuram, Virudhunagar, and nearby districts, showing that industries close to the port depend heavily on it for high-value cargo movement.

The secondary hinterland (moderate distance from the port) contributes a medium level of cargo value (INR 1000–2000 crore). Important industrial cities such as Madurai, Trichy, Salem, Erode, Coimbatore, Tiruppur, and parts of Kerala fall in this zone. These areas generate good cargo volumes but also have alternative port choices, which reduces their exclusive dependence on V.O.C Port.

The tertiary hinterland, which is farthest from the port, contributes the lowest cargo value (INR 100–1000 crore). This zone includes cities like Chennai, Bengaluru, Vellore, Kozhikode, Kannur, and Thiruvananthapuram. Due to longer distance, higher transport cost, and competition from nearby major ports, cargo movement to V.O.C Port from these regions is limited. Overall, the map shows that cargo value decreases as distance from the port increases, highlighting the importance of strengthening connectivity and logistics to attract higher-value cargo from distant regions.

Future Proposed Facilities (Master Plan 2047)

The Master Plan proposes massive infrastructure upgrades to handle up to 173 million tonnes by 2046-47.

Outer Harbour Development

Stage I & II: Phased development of an Outer Harbour with four deep-draught container berths (up to 16m+ drafts) and a total capacity of 4 million TEUs.

Outer-Outer Harbour: Long-term planning for additional berths to handle up to 6.5 million TEUs by 2047.

New Berths and Reconfigurations

Proposed Berth X: A new multipurpose berth west of Berth IX with a 15.5m draft.

Offshore Wind Terminal (NCB IV): A dedicated berth with a 15.5m draft to handle over-dimensional cargo like windmill blades and accessories.

Ro-Ro Terminal (Berth V): Reconfiguration of Berth V specifically to handle Automobile exports (e.g., for VinFast) and heavy-duty vehicles.

Cruise Terminal: A dedicated terminal (long-term) to promote maritime tourism, potentially utilizing the backup area of Berths V, VI, or VII.

Infrastructure Upgrades

Draft Deepening: Deepening the Inner Harbour to a uniform 15.5m to 16.5m draft to accommodate fully loaded Panamax and Post-Panamax vessels (up to 120,000 DWT).

Ship Building & Repair Yard: Establishing a dedicated facility in the Inner Harbour (proposed at Berth XI).

Green Port Initiatives: Establishment of Green Hydrogen and Ammonia hubs, desalination plants (5 MLD), and shore power infrastructure (Cold Ironing) for docked ships.

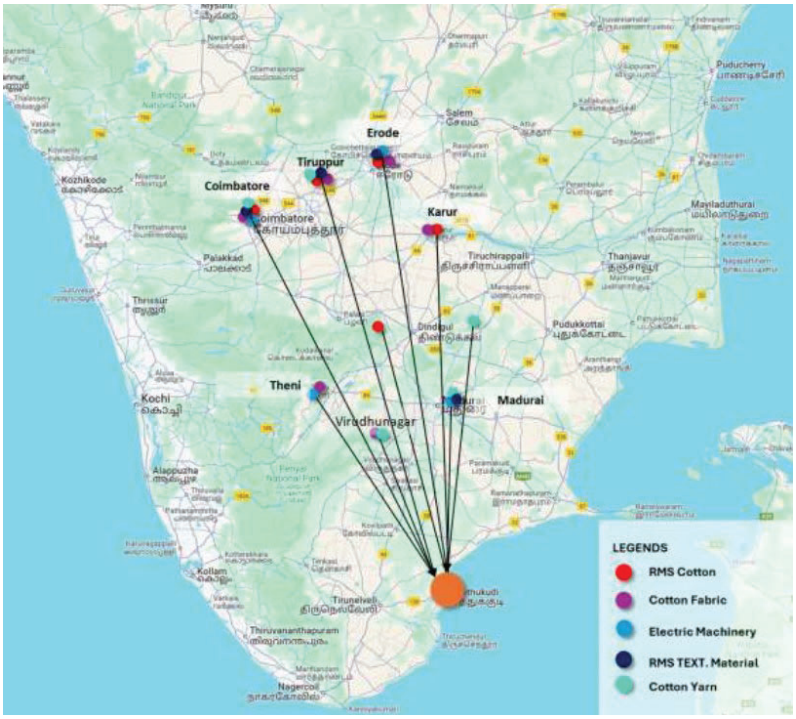


Figure 9.9: Major Districts of Tamil Nadu contributing Cargo to VOC Port

Driven by the National Maritime Vision and Tamil Nadu's economic growth, VOC Port's containerized cargo recently grew by 7%, a trend that is expected to accelerate. By 2028, demand is projected to reach 2 million TEU, significantly outstripping the current 1.2 million TEU capacity and necessitating the development of a new Outer Harbour. This project is designed to handle both containerized and transhipment cargo, with the first phase adding 2 million TEU of capacity by December 2028 and a second phase bringing the total additional capacity to 4 million TEU by 2031. As transhipment demand rises, cargo volumes are expected to hit 3.5 million TEU by 2030, 4.5 million TEU by 2035, and 5.3 million TEU by 2040. To accommodate this long-term growth, which is forecast to reach 6.5 million TEU by 2047, a further Outer to Outer

Harbour expansion is planned for 2040 to ensure the port remains a vital maritime hub. A jump to 6.50 million TEU means thousands of additional truck trips per day. If the road network is not upgraded, the city will face gridlock conditions. This affects not just cargo, but also local commuters and emergency services. To mitigate these impacts, city should consider Separating truck traffic from private cars and also increase the use of rail or coastal shipping to move containers inland, reducing the reliance on trucks.

Table 9.11: Projected Containerized cargo and Transhipment Cargo Demand in VOC Port

Year	Containerized Cargo in million TEU	Transhipment Cargo in million TEU	Total Demand in million TEU
2024 – 2025	0.8	0.01	0.8
2025 – 2026	1.06	0.02	1.08
2026 – 2027	1.4	0.07	1.47
2027 – 2028	1.8	0.27	2.08
2028 – 2029	1.95	0.83	2.78
2029 – 2030	2.1	1.38	3.47
2034 – 2035	2.76	1.76	4.52
2039 – 2040	3.23	2.05	5.27
2046 – 2047	3.98	2.52	6.5

Source: VOC Master plan 2047

9.3.5 Public Transportation

Thoothukudi has a diverse public transportation network that supports both intra-cities commuting and inter-city travel. The city is served by well-established bus services, connecting residential areas, commercial centres, industrial hubs, and regional destinations. Buses form the backbone of public transport, catering to the mobility needs of daily commuters, students, workers, and long-distance travelers. The Tamil Nadu State Transport Corporation (TNSTC), through its Tirunelveli region, is the primary provider of public bus services in Thoothukudi and nearby districts. The corporation operates a mix of city buses, mofussil buses, and express services, facilitating connectivity within the city and to other major towns and cities such as Tirunelveli, Chennai, Bangalore, and other parts of Tamil Nadu and neighbouring states. Government buses run both urban (city) routes and rural/intercity (mofussil) routes, ensuring extensive coverage for passengers.

In addition to government buses, private bus operators complement the public transport system. These include private inter-city services that connect Thoothukudi to distant urban centres, providing alternatives in terms of comfort and scheduling. The presence of private operators helps meet peak demand and reduces pressure on government-operated services. Minibus services form an important component of urban mobility in Thoothukudi, particularly for short-distance travel and neighbourhood-level connectivity. These services operate on designated routes approved by transport authorities and help improve access in areas where full-sized buses are less feasible. Periodic notifications are issued by district transport authorities to expand or modify minibus routes to meet growing travel demand.

Thoothukudi's bus network is supported by two main bus terminals, The Newly developed Perarignar Anna Bus Stand and the Older bus stand on Palayamkottai Road. The Perarignar Anna Bus Stand was recently inaugurated and upgraded to ease congestion and improve passenger amenities for government buses.

Table 9.12: Bus stand and ancillary facilities

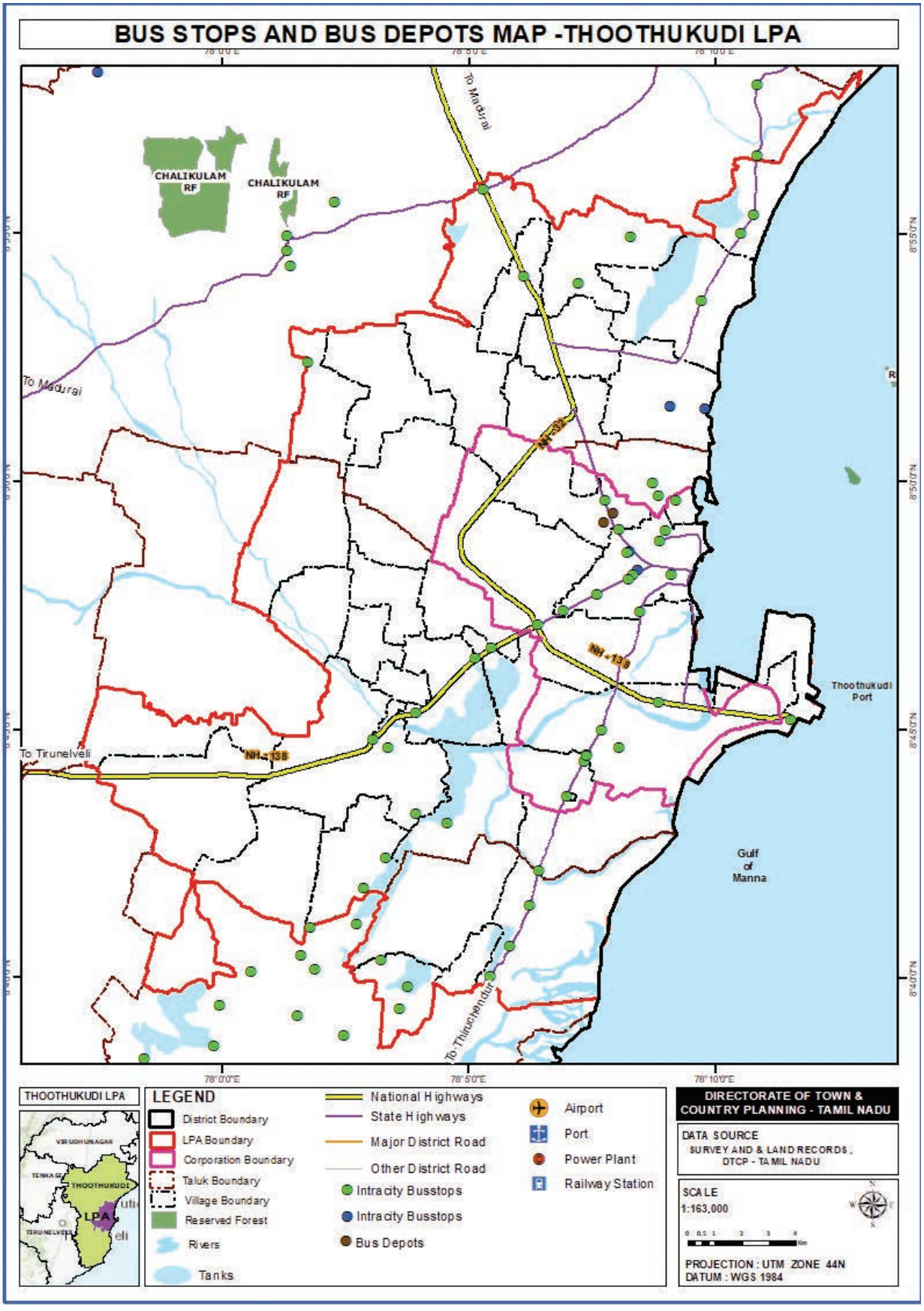
No	Bus Stand	Bus Bays	Extent (Acres)	Bus operation/ Daily	Shop
1	New Bus Stand	51	6.88	600	80
2	Old Bus Stand	19	1.51	250	48

Source: Thoothukudi Corporation

Table 9.13: Bus Service Details at New and Old Bus Stands in Thoothukudi

	Bus Type	Number of Buses	No of trips	Occupancy Ratio	Frequency	Route wise Schedule	Stage wise Pricing details (Cost matrix)
New Bus Stand	AC	5	5	40	54	80%	AC -95
	Super (Exp/Sup Deluxe)	100	117	40	52	80%	Super - 85
	Ordinary	83	155	40	52	80%	Local - 58
Old Bus Stand (City)	Ordinary	57	367	38	40	95%	Ordinary - 58
Old Bus Stand (Moffusil)	Super (Exp/Sup Deluxe)	23	73	42	52	81%	Super - 85
	Ordinary	98	491	42	52	81%	Ordinary - 58

Source: Thoothukudi Corporation



Map 9.7: Bus Depots and Bus Stops Map of Thoothukudi LPA

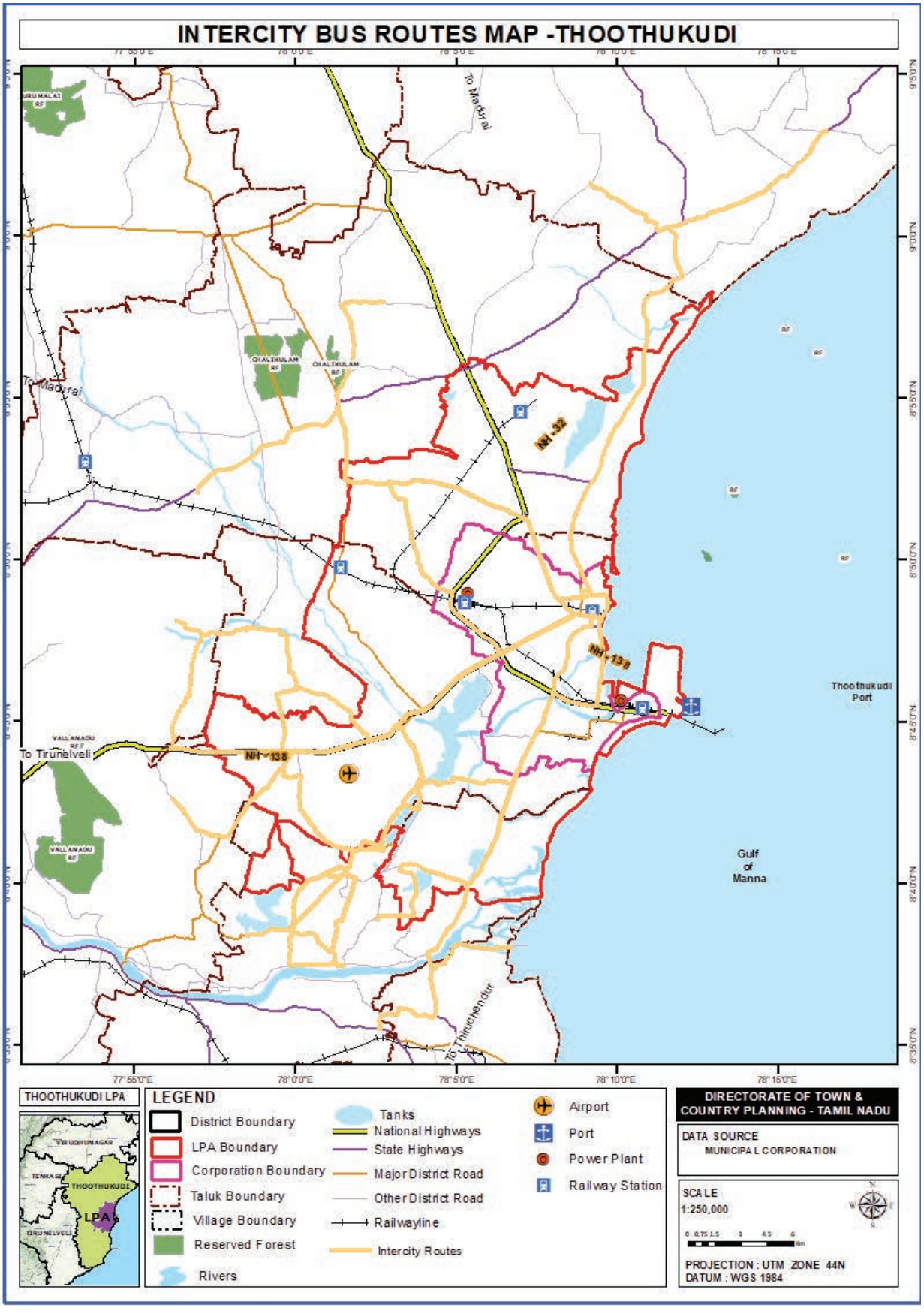
The Bus Depots and Bus Stops map of Thoothukudi indicates a well-organized public transport system with extensive spatial coverage across the corporation and LPA areas. A dense concentration of intracity bus stops is observed within the core city, particularly along major arterial and district roads and near key activity nodes such as commercial areas, railway stations, the port region, and institutional zones. This distribution reflects high travel demand and ensures good accessibility for daily commuters within the urban area.

Intercity bus stops are predominantly located along National Highways and State Highways, especially along corridors connecting Thoothukudi to Tirunelveli, Madurai, and other regional centers. Bus depots are strategically located close to major road networks, supporting efficient fleet operations, route management, and smooth movement of buses across the city and its outskirts.

The bus network is further strengthened by two major bus terminals: the newly developed Perarignar Anna Bus Stand and the older bus stand located on Palayamkottai Road. The Perarignar Anna Bus Stand, recently commissioned, has been upgraded to reduce congestion in the city core and to provide improved facilities and operational efficiency for government bus services. Together, these terminals, along with the widespread distribution of bus stops and depots, form a robust public transport framework that enhances connectivity, mobility, and accessibility throughout Thoothukudi.



Figure 9.10: Bus Stands of Tuticorin



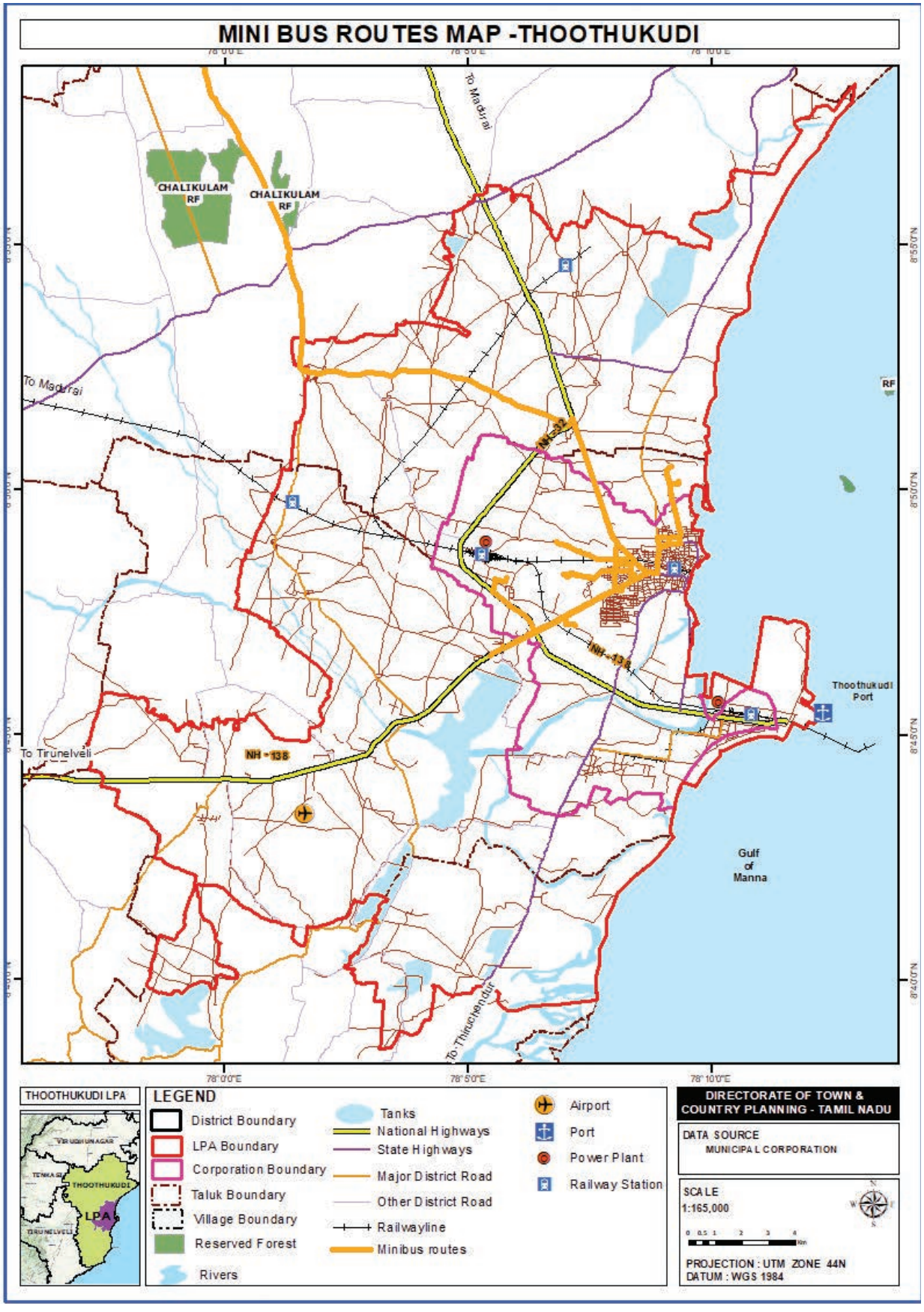
Map 9.8: Intercity Bus Routes Map of Thoothukdi LPA

The Intercity Bus Routes map of Thoothukudi highlights a strong radial and corridor-based public transport network connecting the city with surrounding towns and rural settlements. Most intercity routes originate from Thoothukudi and extend outward along National Highways and major district roads, indicating Thoothukudi's role as a primary regional transport hub for the surrounding region. Key corridors such as Thoothukudi–Eral, Thoothukudi–Subramaniyapuram, Thoothukudi–Keela Vaippar, and Thoothukudi–Ottapidaram show multiple route variations, reflecting high passenger demand along these directions.

Routes such as Thoothukudi to Perungulam / Sivakasi and Thoothukudi to Subramaniyapuram / BS Koil are among the longer routes, suggesting extended regional connectivity beyond the immediate urban influence. Shorter routes like Thoothukudi to TTP Camp and Thoothukudi to Sebathiahpuram / Keela Seithalai cater to nearby settlements and function as frequent commuter services.

Overall, the intercity bus system provides balanced regional connectivity by supporting both frequent short-distance travel and longer intercity movements, thereby strengthening Thoothukudi's linkage with its surrounding region.





Map 9.9: Mini Bus Routes Map of Thoothukudi LPA

The Minibus Route Map of Thoothukudi LPA shows a well-distributed network designed to provide last-mile and intermediate connectivity across the planning area. The routes are largely concentrated within the corporation limits and extend outward to cover peripheral villages, indicating the role of minibuses in linking suburban and semi-rural settlements with the urban core.

The map highlights strong integration of minibus routes with major transportation corridors such as National Highways and State Highways, ensuring smooth feeder connections to primary road networks. Routes are also aligned to serve key activity nodes including the port area, railway stations, airport, power plant, and major residential and commercial pockets, reflecting demand-oriented planning.

From the minibus route data, the GH to Nagampatti route is the longest route as it starts from the Government Hospital and extends up to Nagampatti, covering the maximum distance among all routes. This route passes through several peripheral areas before reaching the town limits, thereby serving a wider region. It plays an important role in connecting outer settlements with major urban facilities such as the Government Hospital, resulting in a longer travel distance compared to other minibus routes. On the other hand, the Bharathi Nagar to Old Bus Stand route is the shortest route, covering the least distance. Although short, this route is likely to have frequent trips due to its location within the urban area and its connection to the Old Bus Stand, which is a major transport hub.

9.3.6 Parking

Parking is a crucial component of urban planning and plays an essential role in creating liveable, functional, and accessible areas in the corporation area. Adequate parking provision is important to support economic development, reduce congestion and traffic, improve safety, and enhance the quality of life. Ease of parking provides better mobility inside the corporation area, whereas irregular parking reduces the carriageway and, as a result, affects traffic flow.

Efficient parking management strategies, such as pricing and zoning, can help cities regulate parking demand and encourage the use of sustainable transportation modes. This can result in reduced traffic congestion, improved air quality, and more equitable access to urban services.



Figure 9.11: Multi-level Parking

In the core commercial streets namely Palayamkottai Road and West Great Cotton Road, on-street parking creates numerous issues such as congestion, lack of pedestrian safety, and negative impacts on the streetscape in the corporation area. The aforementioned roads are already one-way streets to handle traffic. West Great Cotton Road has two-wheeler and truck parking on side, reducing the carriageway. It also lacks pedestrian infrastructure as well as a dedicated cycle track. To facilitate parking, the Thoothukudi Corporation has erected a multilevel parking facility, accommodating 74 four-wheelers and 150 two-wheelers. Additionally, ongoing renovations along Victoria Extension Road aim to create space for on-street parking.

9.3.7 Road Safety

Road accidents remain a serious concern in the Thoothukudi area, reflecting the increasing traffic volume and mixed movement of heavy vehicles, two-wheelers, and pedestrians. The year-wise data shows that the total number of accidents has remained consistently high from 2019 to 2024, with a temporary reduction in 2020 due to restricted movement during the pandemic. However, accident numbers increased again in the following years, along with a high number of fatal cases, deaths, and injuries, indicating the severity of road safety issues in the region.

The data for 2025 (up to June) already shows a significant number of accidents, suggesting that the annual total may remain high if current trends continue. The consistently high proportion of fatal accidents and injured persons highlights the need for improved road safety measures such as better road design, safer junctions, strict enforcement of traffic rules, speed control, and enhanced pedestrian safety facilities. Addressing these issues is essential to reduce accidents and improve overall road safety in Thoothukudi.

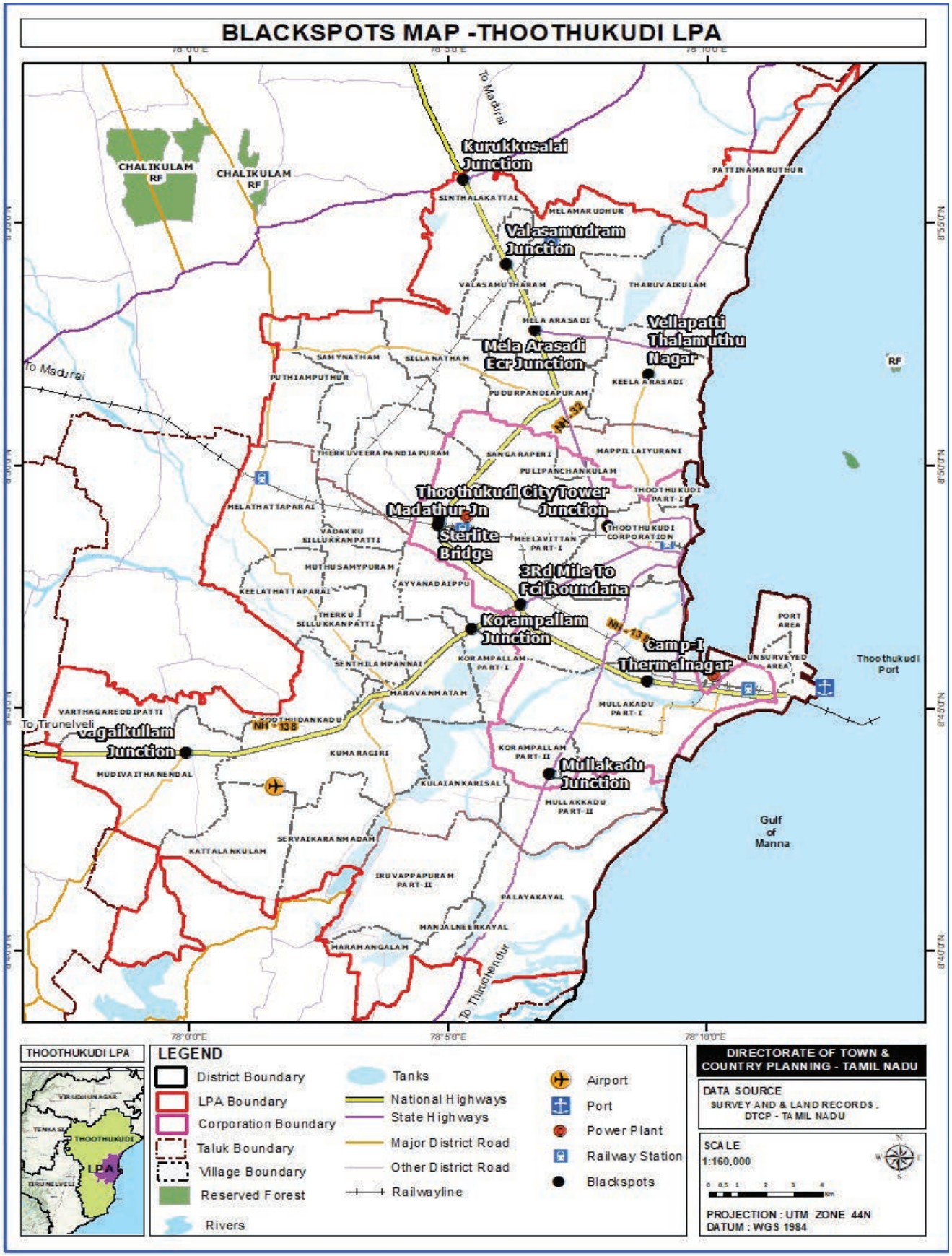
Table 9.14: Year-wise Road Accident Statistics in Thoothukudi

Year	Total Accidents	No. of Fatal Cases	No of Persons Died	No. of Non-Fatal Cases	No. of Person Injured
2019	1234	403	440	831	1381
2020	1019	328	351	691	1014
2021	1253	371	394	882	1448
2022	1249	426	458	823	1450
2023	1435	460	482	975	1701
2024	1379	460	487	919	1557
2025 (upto 30.06.25)	744	231	241	513	1066

Source: Statistical Handbook of Tamilnadu

In 2023, Thoothukudi accounted for 1,435 total accidents and 482 deaths, representing approximately 2.15% of the state's total accidents (66,841) and 2.63% of the state's total fatalities (18,347). While Thoothukudi's absolute numbers are significantly lower than major metropolitan hubs like Chennai City and Coimbatore City—which both topped the state with 3,642 accidents each (5.45% share each)—Thoothukudi has been identified as part of a group of districts showing an increasing trend in total accidents. Furthermore, while Tamil Nadu reported a state-wide reduction in road fatalities in 2024 (dropping to 18,074 deaths), Thoothukudi's provided data shows a slight increase in deaths from 482 in 2023 to 487 in 2024, bucking the overall state trend.

Additionally, Thoothukudi's fatality-to-accident ratio in 2023 was approximately 33.6%, which is notably higher than the state average of roughly 27.4%. This suggests that while accidents are fewer in Thoothukudi compared to industrial corridors like Chengalpattu (912 deaths), Tiruppur (861 deaths), and Salem (787 deaths), the accidents that do occur in Thoothukudi tend to result in higher mortality rates relative to the state's average.



Map 9.10: Blackspots Map of Thoothukudi

9.3.8 Registered Vehicles- Thoothukudi

The number of registered vehicles in Thoothukudi district indicates a steady growth in motorization, reflecting increasing economic activity, mobility needs, and dependence on road-based transport. The registered vehicle data includes both commercial and non-commercial motor vehicles, highlighting the diverse nature of travel demand within the district.

Commercial motor vehicles comprise buses, goods vehicles, taxis, autorickshaws, and other service-related vehicles. These vehicles play a crucial role in supporting public transport, goods movement, port-related logistics, emergency services, and institutional travel. The presence of a significant number of commercial vehicles in Thoothukudi can be attributed to the port operations, industrial establishments, and inter-district connectivity. The data shows a substantial share of buses, goods vehicles, and autorickshaws, indicating high demand for passenger and reight transport services.

Table 9.15: Registered Commercial Motor Vehicles of Thoothukudi District 2022-23

<table>
<tr><th>District</th><th colspan="6">Commercial (01.04.2023)</th></tr>
<tr><td>State Transport Authority</td><td colspan="2">PUBLIC</td><td colspan="2">PRIVATE</td><td>MERGE BUSES</td><td>AUTO RICK-SHAWS</td></tr>
<tr><td rowspan="11">Thoothukudi</td><td colspan="2">232</td><td colspan="2">167</td><td>120</td><td>7187</td></tr>
<tr><td colspan="4">MOTOR CABS</td><td colspan="2">MAXI CAB</td></tr>
<tr><td colspan="2">State Permit</td><td colspan="2">All India Permit</td><td>State Permit</td><td>All India Permit</td></tr>
<tr><td colspan="2">2513</td><td colspan="2">0</td><td>2683</td><td>4</td></tr>
<tr><td colspan="4">OMNI BUSES</td><td rowspan="2">Private Service Vehicle</td><td rowspan="2">School Bus</td></tr>
<tr><td colspan="2">State Permit</td><td colspan="2">All India Permit</td></tr>
<tr><td colspan="2">25</td><td colspan="2">0</td><td>328</td><td>685</td></tr>
<tr><td>College Bus</td><td>Ambulance</td><td>Fire Fighter</td><td>Light Commercial Vehicles</td><td colspan="2">State Permit</td></tr>
<tr><td colspan="3"></td><td></td><td>Lorries</td><td>Articulated Vehicles</td></tr>
<tr><td>0</td><td>225</td><td>35</td><td>4707</td><td>5271</td><td>554</td></tr>
<tr><td colspan="4">NATIONAL PERMIT</td><td rowspan="2">TRACTORS & TRAILERS</td><td rowspan="2">TOTAL COMMERCIAL VEHICLES</td></tr>
<tr><td colspan="2">LORRIES</td><td colspan="2">AV</td></tr>
<tr><td colspan="2">916</td><td colspan="2">538</td><td>1567</td><td>27757</td></tr>
</table>

Source: Statistical Handbook of Tamilnadu

Non-commercial motor vehicles form the major share of registered vehicles in the district. Two-wheelers, including motorcycles and scooters, dominate the vehicle population due to their affordability and suitability for short- and medium-distance travel. Cars and jeeps also constitute a notable portion, reflecting rising household vehicle ownership. The increasing number of private vehicles has resulted in higher traffic volumes on arterial and collector roads, particularly in commercial and residential areas.

Table 9.16: Registered Non- Commercial Motor Vehicles of Thoothukudi District 2022-23

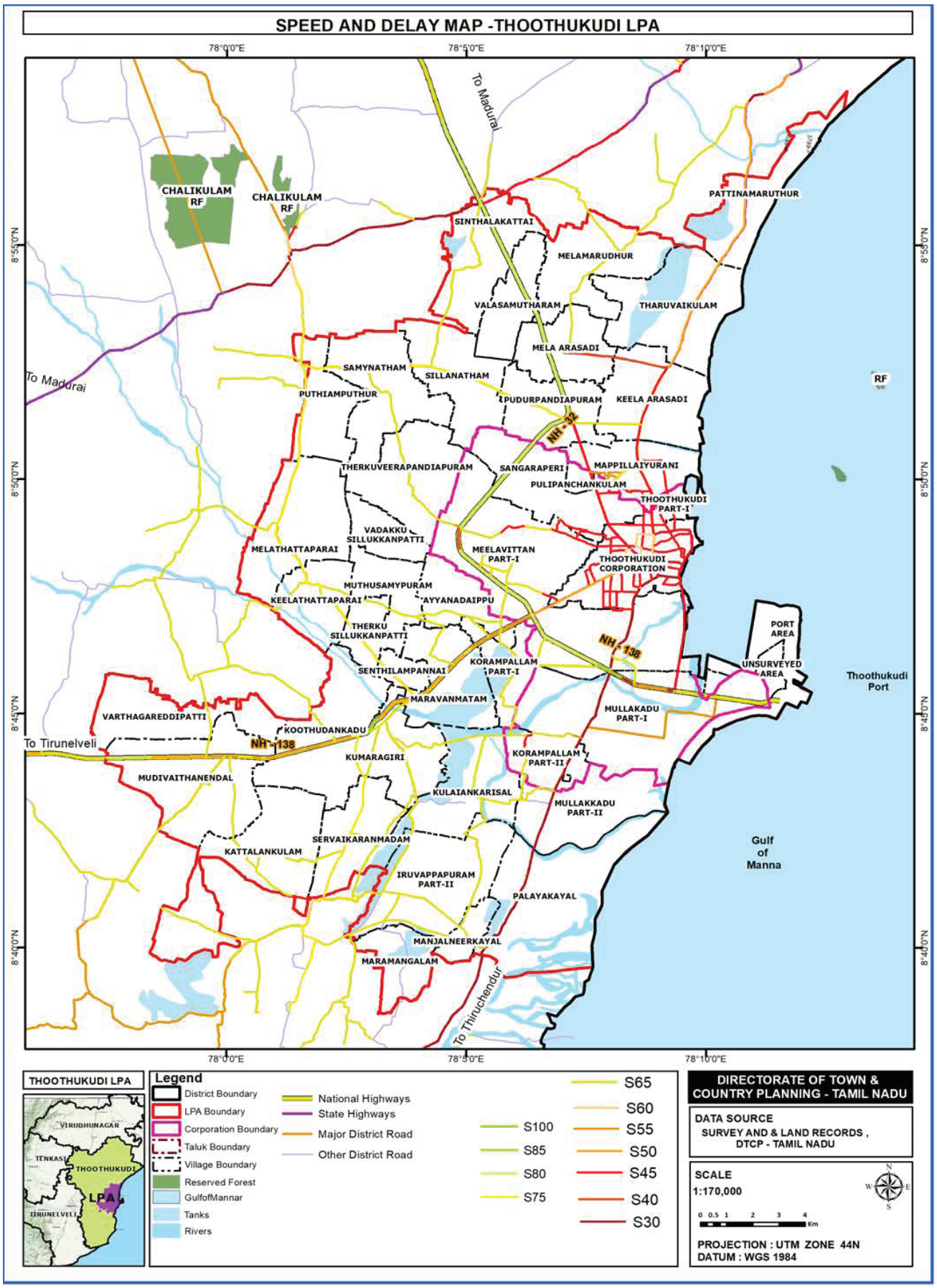
District	Non-Commercial Vehicles			
State Transport Authority	MOTOR CYCLES	SCOOTER	MOPEDS	TRICYCLE AUTO
Thoothukudi	411624	40693	106166	0
	MOTOR CAR	JEEPS	STATION WAGON	TRACTOR
	51537	1203	110	7498
	THREE WHEELERS	FOUR WHEELERS	ROAD ROLLERS	
	641	0	29	
	OTHERS	TOTAL NONCOMMERCIAL VEHICLES	GRAND TOTAL (COMML+ NON COMML)	
	2570	622071	649828	

Source: Statistical Handbook of Tamilnadu

Overall, the growth in registered vehicles has placed additional pressure on the existing road infrastructure, leading to congestion, increased demand for parking, and road safety concerns. The trend highlights the need for strengthening public transport systems, improving traffic management measures, providing adequate parking facilities, and promoting sustainable transport modes to ensure safe and efficient mobility in Thoothukudi.

In 2023-24 the number of registered motor vehicles for commercial purpose is 7650 and Non-commercial purpose is 328845.

9.3.9 Speed and Delay



Map 9.11: Speed and Delay Map of Thoothukudi

S30–S40 (Very Low Speed / High Delay – Red & Dark Orange)

These stretches are mainly concentrated within the Thoothukudi Corporation area, especially around the port, CBD, old town roads, and major junctions. The low speeds indicate heavy congestion, frequent stoppages, high pedestrian activity, on-street parking, and freight movement.

S45–S55 (Low to Moderate Speed – Orange & Yellow)

Found along major district roads and important urban connectors. These roads experience interrupted flow due to signals, intersections, mixed traffic, and roadside activities, particularly during peak hours.

S60–S70 (Moderate Speed – Light Yellow & Yellow-Green)

Mostly observed on outer urban and semi-urban roads. These stretches indicate acceptable traffic flow with occasional delays, generally serving as transition zones between urban core and peripheral areas.

S75–S85 (Good Speed – Light Green & Green)

Predominantly located in peripheral villages and less developed areas of the LPA. These roads have lower traffic volumes, fewer junctions, and limited roadside friction.

S90–S100 (High Speed / Free Flow – Dark Green)

Mainly along National Highways and outer bypass stretch. These indicate free-flow conditions with minimal delay, suitable for long-distance and through traffic movement.

The Speed and Delay Map of Thoothukudi LPA show a clear spatial variation in traffic conditions across the study area. The Thoothukudi Corporation area is predominantly covered by low-speed categories (S30–S45), indicating severe congestion, frequent delays, and high traffic friction due to dense land use, mixed traffic, on-street activities, and major junctions. The port connectivity corridors also fall largely under low-speed bands, reflecting continuous movement of heavy goods vehicles, operational delays, and limited road capacity, which significantly affect travel speeds. In contrast, the peripheral areas of the LPA are mainly characterized by higher speed categories (S75–S100), indicating smoother traffic flow, lower traffic volumes, fewer intersections, and adequate road capacity. Overall, the map highlights a strong urban core–periphery contrast, with congestion concentrated in the city and port areas, while outer regions experience relatively free-flowing traffic conditions.

9.4 Diagnostics – Key Issues And Challenges

The key issues and challenges impacting urban mobility are presented below:

9.4.1 Road Infrastructure

The road network of Thoothukudi LPA is structured around a hierarchy of National Highways, port access roads, urban arterials, and local streets; however, several critical corridors experience operational inefficiencies. NH-138 (Thoothukudi–Tirunelveli Road) functions as the primary regional connector carrying long-distance passenger traffic as well as freight movement linked to industrial and port activities. High traffic volumes, limited access control, and junction bottlenecks along this corridor result in recurrent congestion. VOC Port Road / Harbour Extension Road, which serves as the main approach to V.O. Chidambaranar Port, is heavily dominated by container trucks and bulk cargo vehicles, leading to conflicts with local traffic and reduced level of service. Within the urban core, important arterial roads such as VE Road, Jeyaraj Road, Thamizh Salai (Rajaji Park area), Anna Nagar Main Road, Chidambaranagar Main Road, and Tiruchendur Road (South Police Station to Kamaraj College stretch) experience constrained right-of-way, frequent junction delays, and mixed traffic conditions. In peripheral areas and village roads within the LPA, inadequate pavement condition, drainage issues, and discontinuous connectivity further affect all-weather accessibility.

9.4.2 Rail Network Limitations and Infrastructure Gaps

Thoothukudi serves as an important railhead in southern Tamil Nadu, with Thoothukudi Railway Station functioning as the principal passenger and freight node under the Madurai Division of Southern Railway. While the existing rail network provides regional connectivity to Tirunelveli, Madurai, Virudhunagar, and beyond, its potential for urban and suburban mobility remains underutilised. Limited frequency of commuter-oriented services, capacity constraints at yards, and inadequate last-mile connectivity between the railway station, industrial areas, and the port reduce the effectiveness of rail as an alternative to road-based freight and passenger movement. Additionally, the presence of rail–road level crossings along key urban corridors interrupts traffic flow, creates safety risks, and contributes to peak-hour congestion, particularly on roads leading to the port and industrial zones.

9.4.3 Public Transport & IPT Connectivity

Public transport in Thoothukudi LPA is mainly bus-based, operating from the Perarignar Anna Bus Terminus and serving both intra-city and inter-city routes. However, its effectiveness is limited due to poor coverage in peripheral areas, irregular service frequency, and congestion on major roads. Intermediate Public Transport (IPT) modes such as auto-rickshaws, share autos, and

tempos provide crucial first- and last-mile connectivity, especially along key corridors and market areas. These IPT services are largely unregulated, lacking designated stands, route planning, and fare control, which leads to traffic conflicts, inefficient operations, and inconvenience to passengers near terminals and commercial streets.

9.4.4 Pedestrian Infrastructure, Accessibility and Safety

Recent projects have introduced integrated Smart Roads (such as portions of the ABD area) featuring cement concrete pavements, dedicated footpaths with tactile paving for universal accessibility, and organized parking slots to prevent encroachment. The redevelopment of the Buckle Odai (approx. 7.2 km) has introduced dedicated walkway-cum-bicycle lanes and jogging tracks with LED lighting, creating safe, high-quality pedestrian environments that were previously absent. New infrastructure projects now incorporate geometric improvements at major intersections. Despite these strides, many arterial stretches like VE Road, Thamizh Salai, and Tiruchendur Road still exhibit gaps where infrastructure remains discontinuous. High-density zones – particularly around markets, schools, and the railway station – continue to experience mixed traffic conflicts. In these older sections, pedestrians are often forced onto the carriageway due to residual utility obstructions and temporary vendor encroachments.

9.4.5 Unorganised Parking and Encroachments

Unorganised on-street parking and encroachments significantly reduce effective road width and traffic capacity on key corridors in Thoothukudi LPA. Commercial streets such as VE Road, Jeyaraj Road, Anna Nagar Main Road, Chidambaranagar Main Road, Thamizh Salai (Rajaji Park area), and Tiruchendur Road are heavily affected by indiscriminate parking, IPT operations, and loading and unloading activities. Along VOC Port Road and port access roads, roadside parking and informal freight halting further worsen congestion and safety concerns. The lack of off-street parking facilities, parking management policies, and enforcement has led to persistent vendor encroachments, negatively impacting pedestrian movement.

9.5 Traffic Surveys And Analysis

The following are the primary surveys carried out for preparing the master plan – Thoothukudi LPA Region:

Table 9.17 : Survey Locations

a. Origin–Destination Survey at Outer Cordon Locations

S.No	Location Name
OD 1	Tharuvaikulam - Veppalodai
OD 2	Thoothukudi to Ettaiyapuram
OD 3	Ottapidaram - Kurukkuchalai
OD 4	Tirunelveli to Thoothukudi
OD 5	Mukkani - Thoothukudi
OD 6	Thoothukudi to Harbour Estate

b. Classified Volume Counts at Outer Cordon Locations

S.No	Location Name
CVC 1	Chidambara Nagar - Thiraviapuram
CVC 2	Sindalakottai - Thoothukudi
CVC 3	Tharuvaikulam - Velankanni Nagar
CVC 4	Siluvaipatti - Therepuram
CVC 5	VOC Port Rd - West Great Cotton Road
CVC 6	Levingipuram (NH 138)
CVC 7	Threspuram - Alageshapuram Rd
CVC 8	Tharuvaikulam - Veppalodai
CVC 9	Thoothukudi to Ettaiyapuram

CVC 10	Ottapidaram - Kurukkuchalai
CVC 11	Tirunelveli to Thoothukudi
CVC 12	Mukkani - Thoothukudi
CVC 13	Thoothukudi to Harbour Estate

c. Intersection Turning Movement Survey

S.No	Location Name
TMC 1	VVD Junction
TMC 2	Periyar Statue Junction
TMC 3	Anna Statue Junction
TMC 4	Chidambaranagar Signal
TMC 5	Shanmugapuram Junction

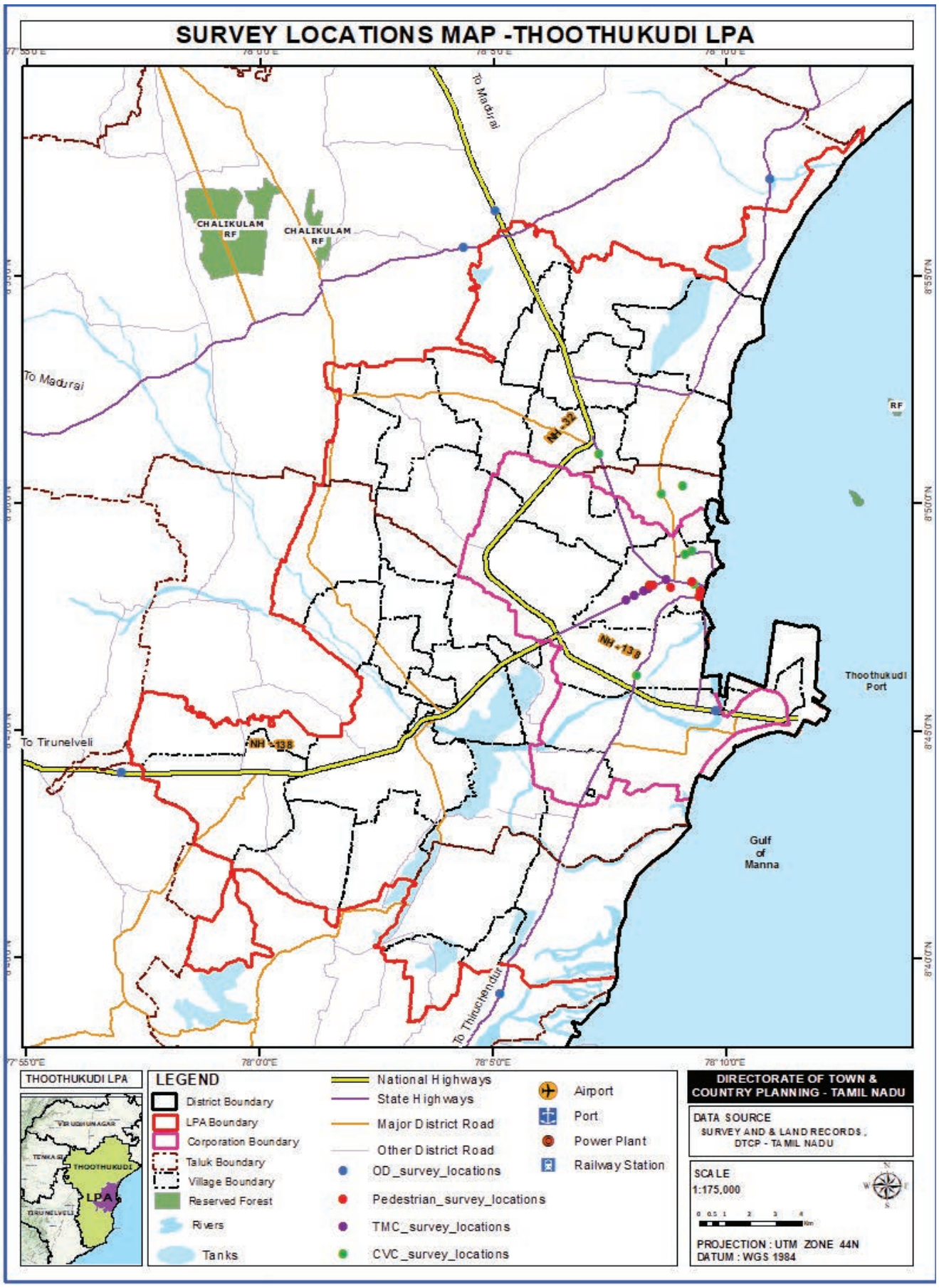
d. Pedestrian Count Survey

S.No	Location Name
Peds 1	Tuticorin Big Market
Peds 2	Old Bus Stand
Peds 3	Old Tuticorin Corporation Building
Peds 4	DSF Grand Plaza
Peds 5	Bank Street
Peds 6	Periya Kovil Street
Peds 7	Railway Street

e. Parking survey

ON – STREET PARKING LOCATIONS	
S.No	**Location Name**
1	Palayamkottai Street
2	Bala Vinayagar Street
3	WGC Road 1
4	WGC Road 2
5	Bank Street
6	Near Holy Cross School
7	Adjacent to Old Bus Stand
8	Keelaratha Street
9	Melaratha Street
10	New South Street
11	North Car Street
12	Sampath Murthy Street
13	Shivan Kovil Street
14	Thanti Office Street
15	Tuti Melur Station
16	VOC Market Road

OFF – STREET PARKING LOCATIONS	
S.No	**Location Name**
1	Jeyraj Road
2	New Bus Stand
3	Old Bus Stand



Map 9.12: Traffic Survey locations of Thoothukudi

9.5.1 Origin and Destination

a) Goods Data

Consolidated Trips by Vehicle Type

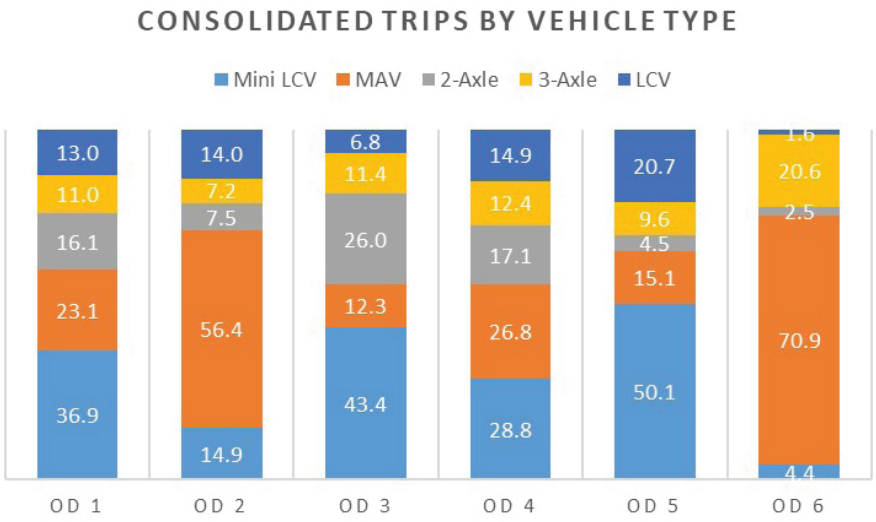


Figure 9.12: Percentage distribution of consolidated goods trips by vehicle type

The chart reveals a diverse distribution of logistics preferences across six distinct origin-destination (OD) pairs, highlighting a clear shift between light and heavy vehicle usage depending on the route. Mini LCVs emerge as a primary choice for several routes, most notably dominating OD 5 at 50.1% and OD 3 at 43.4%, which suggests these corridors are likely characterized by smaller shipment sizes or urban distribution. Conversely, MAVs (Multi-Axle Vehicles) are the preferred choice for heavy-duty transport, commanding a significant majority in OD 6 at 70.9% and OD 2 at 56.4%, indicating these are likely long-haul or bulk-goods corridors. Intermediate vehicles also play specific roles, with 2-Axle trucks reaching their highest utility in OD 3 (26.0%) and 3-Axle trucks contributing significantly to OD 6 (20.6%). While OD 4 shows the most balanced distribution across all vehicle types, the overall data reflects a bimodal logistics landscape where transport is split between high-volume heavy-duty movement and frequent light-commercial trips.

Consolidated Trips by Commodity Type

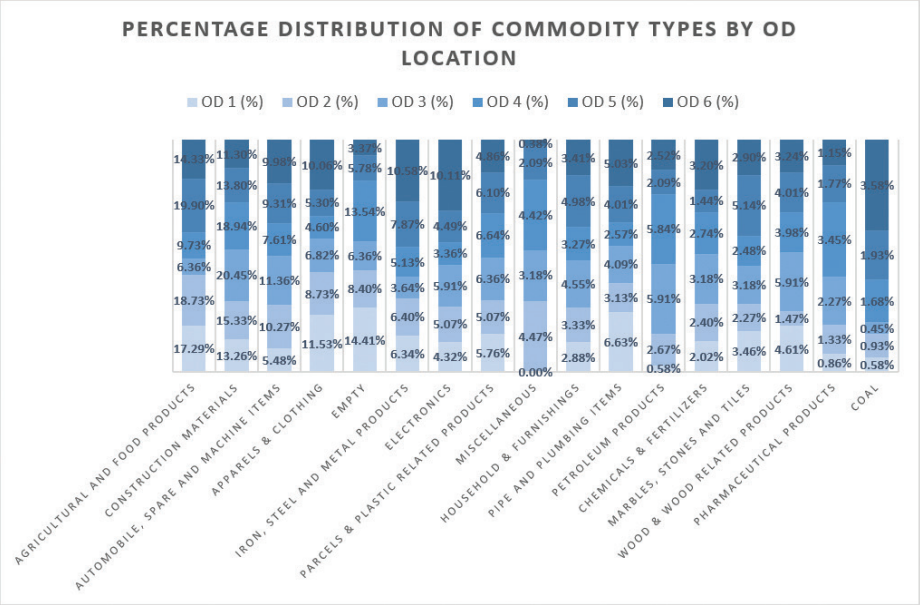


Figure 9.13: Percentage distribution of goods trips by vehicle and commodity types

Based on the data for Consolidated Goods Trips by Commodity Type, the freight landscape is primarily driven by essential industrial and consumption-based goods, though distribution patterns vary significantly across the six origin-destination (OD) pairs. Agriculture and Construction materials emerge as the most consistent high-volume commodities; Agricultural goods reach their highest concentration in OD 5 (19.90%) and OD 2 (18.73%), while Construction materials dominate OD 3 (20.45%) and OD 4 (18.94%). A notable percentage of Empty trips is observed, particularly in OD 1 (14.41%) and OD 4 (13.54%), which may indicate logistical imbalances or the return of specialized vehicles. Heavy industrial goods like Iron and Steel (10.58%) and Electronics (10.11%) show their strongest presence in OD 6, suggesting this route serves a specialized industrial or high-tech manufacturing corridor. Conversely, consumer-facing goods such as Apparels are most prominent in OD 1 (11.53%) and OD 6 (10.06%). Overall, the data illustrates a commodity-specific logistics network where infrastructure and industrial hubs heavily dictate the flow of goods, ranging from raw materials for building to finished consumer products.

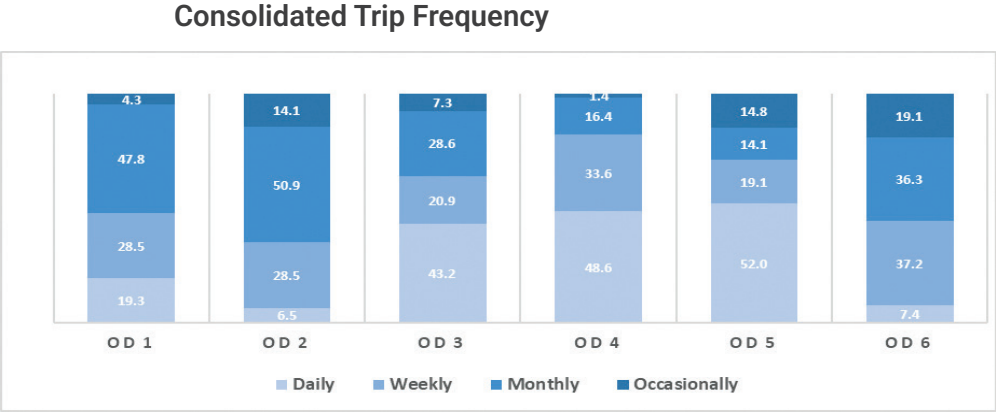


Figure 9.14: Consolidated goods trip data by vehicle type, Commodity distribution, and Frequency

The provided table illustrating the frequency of consolidated goods trips across six origin-destination (OD) pairs reveals distinct operational patterns, ranging from high-velocity daily rotations to infrequent bulk movements. A significant portion of the traffic is characterized by high-frequency service in certain corridors, particularly OD 5 and OD 4, where daily trips account for 52.0% and 48.6% of the total respectively, suggesting these routes serve consistent, high-demand supply chains. Conversely, other routes lean heavily toward a lower-frequency model; for instance, OD 2 sees over half of its trips occurring monthly (50.9%), while OD 1 also shows a strong monthly preference at 47.8%, likely indicating the transport of non-perishable goods or larger, consolidated batches that do not require daily dispatch. Weekly trips maintain a relatively stable presence across most routes, peaking at 37.2% for OD 6, while occasional trips remain the minority across the board, though they reach a high of 19.1% in OD 6. Overall, the data implies a logistics network that bifurcates between highly repetitive, daily urban, or industrial replenishment (OD 4 and 5) and more strategic, monthly consolidated shipping (OD 1 and 2).

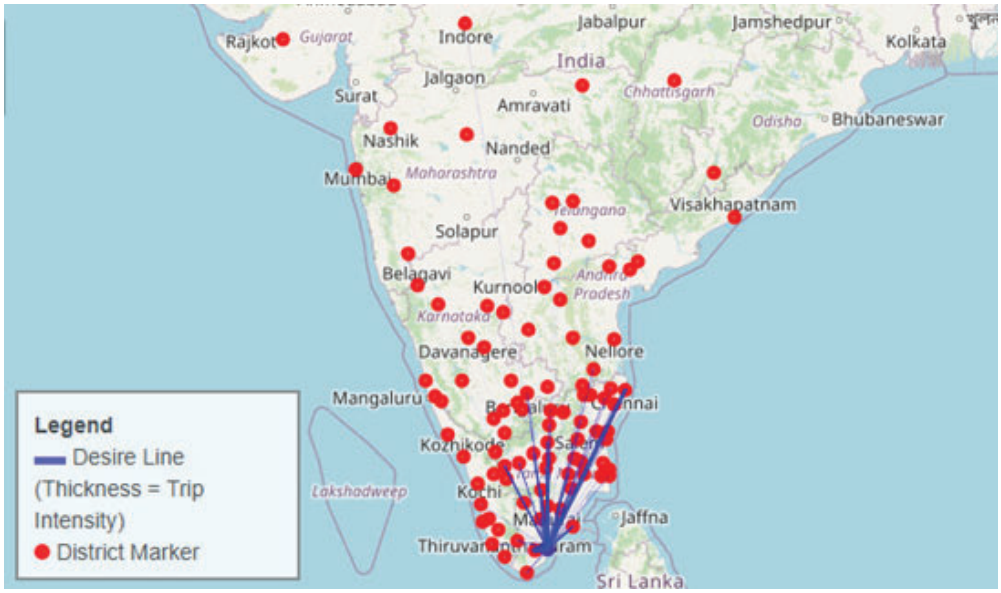
The survey categorized 6,165 trips based on their relationship with the internal study area (Thoothukudi District).

Table 9.18: Inbound-Outbound-Trip-Breakdown of Goods

Trip Type	Pattern	Description	Total Trips	Percentage (%)
Inbound	E-I	Origin is Outside, Destination is Inside	2,540	41.20%
Outbound	I-E	Origin is Inside, Destination is Outside	2,405	39.01%
Internal	I-I	Both Origin & Destination are within Thoothukudi	1,065	17.27%
Through Traffic	E-E	Both Origin & Destination are Outside	155	2.51%

Analysis Insights

Over 80% of all goods movement is either entering or leaving the district, confirming Thoothukudi as a vital gateway (driven by the V.O. Chidambaranar Port and industrial clusters). Inbound and Outbound movements are relatively balanced, indicating high economic activity in both receiving raw materials and exporting finished products. 17.27% of trips are purely local, reflecting intra-district commerce and last-mile connectivity. Only 2.51% is through traffic, suggesting the surveyed corridors are primarily terminal routes rather than transit-heavy corridors for external states.



Map 9.13: Desire Line Map of Goods

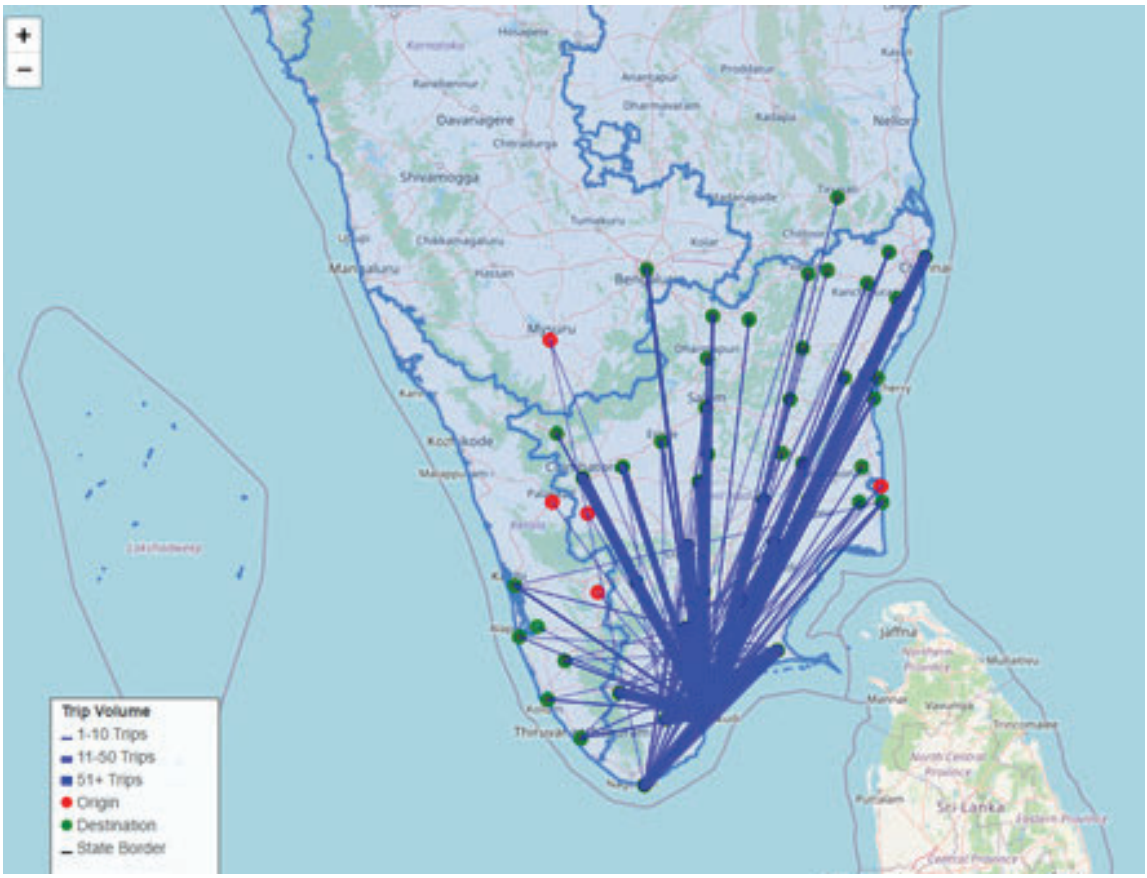
b) Passenger Data

A total of **14,995 passenger trips** were analysed and classified into four categories:

Table 9.19: Inbound-Outbound-Trip-Breakdown of Passengers

Trip Category	Pattern	Description	Total Trips	Percentage (%)
Internal	I-I	Origin and Destination are both within Thoothukudi	6,256	41.72%
Outbound	I-E	Origin is within Thoothukudi, Destination is outside	4,066	27.12%
Inbound	E-I	Origin is outside, Destination is within Thoothukudi	4,009	26.74%
Through	E-E	Both Origin and Destination are outside	664	4.43%

Nearly 42% of all surveyed passenger movement is local within the Thoothukudi district, indicating strong intra-district social and economic ties. Inbound (26.74%) and Outbound (27.12%) trips are almost equal, showing a steady daily exchange of people between Thoothukudi and neighbouring regions. Only 4.43% of the trips are through-traffic (E-E), suggesting that most passengers on these routes have a direct interest in the study area.



Map 9.14: Desire Line Map of Passengers

Vehicle Type Distribution (%)

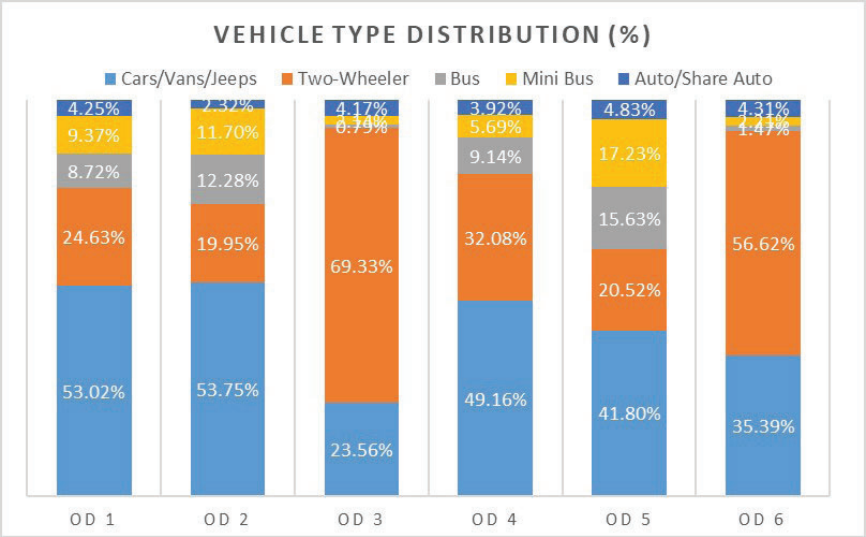


Figure 9.15: Percentage of Vehicle Type Distribution (%)

Based on the chart titled Vehicle Type Distribution (%), the modal split for consolidated passenger trips across the six origin-destination (OD) pairs reveals a significant reliance on private transport, with Cars, Vans, and Jeeps serving as the dominant mode for the majority of routes. Specifically, this category accounts for over half of all trips in OD 1 (53.02%) and OD 2 (53.75%), and remains the primary choice for OD 4 (49.16%) and OD 5 (41.80%). A notable exception occurs in OD 3 and OD 6, where Two-Wheelers surge to become the most utilized vehicle type, representing a substantial 69.33% and 56.62% of trips, respectively. The use of public or high-capacity transport is comparatively low; Buses and Mini Buses combined see their highest utilization in OD 5, contributing roughly 32.86% to the total modal share. Meanwhile, the usage of Auto/Share Autos is consistently the smallest segment across all corridors, peaking at only 4.83% in OD 5. Overall, the data illustrates a passenger landscape bifurcated between car-heavy routes and those heavily dominated by two-wheelers, likely reflecting differences in trip distance, economic factors, or infrastructure suitability between the pairs.

Trip Purpose Distribution (%)



Figure 9.16: Percentage of Trip Purpose Distribution

Based on the data for Consolidated Passenger Trips by Trip Purpose, the movement of people across the six origin-destination (OD) pairs is overwhelmingly driven by economic and subsistence activities, with Work and Business trips forming the largest share of travel demand. Work-related travel is the single most dominant purpose, peaking at 39.35% in OD 3 and remaining above 30% for most other routes, while Business trips consistently contribute another 21% to 30% to the total volume. Notably, Tourism and Personal trips show significant variation, reaching a high of 27.78% in OD 5 but dropping to nearly half that in OD 3 (11.16%), suggesting a shift from leisure-oriented travel to strictly functional commuting in certain corridors. Social and shopping activities represent a smaller, more fragmented portion of the travel landscape, typically hovering between 5% and 15%. Meanwhile, Hospital visits account for the lowest frequency across all pairs, even reaching 0.00% in OD 3, which likely indicates that these routes are specialized industrial or commercial links rather than providing access to essential social services. Overall, the data illustrates a passenger network primarily anchored by employment hubs, where non-discretionary travel (Work/Business) vastly outweighs discretionary leisure or social movement.

Trip Frequency Distribution (%)

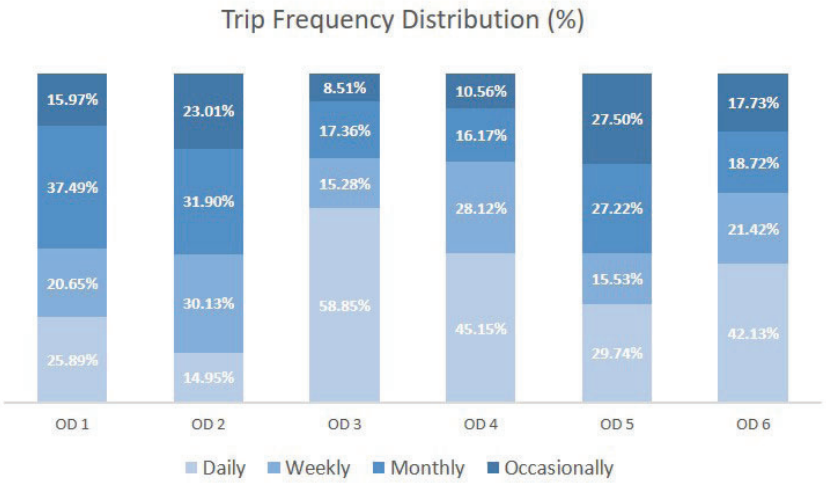


Figure 9.17: Percentage of Trip Frequency Distribution

Based on the data for Consolidated Passenger Trips by Trip Frequency, the travel behaviour across the six origin-destination (OD) pairs reflects a strong divide between highly regular commuting and occasional travel, heavily influenced by the specific needs of each corridor. Daily trips are most prevalent in OD 3 (58.85%) and OD 4 (45.15%), indicating that these routes are primarily used for consistent activities like work or education. In contrast, Monthly trips represent the largest share in OD 1 (37.49%) and OD 2 (31.90%), suggesting these corridors may serve regional travel or less frequent personal visits. Weekly travel remains a steady secondary frequency for most routes, peaking in OD 2 at 30.13%. Furthermore, Occasional trips show significant variation, ranging from as low as 8.51% in OD 3 to a high of 27.50% in OD 5, pointing to OD 5 as a route with a notably high proportion of discretionary or non-routine travel. Overall, the frequency data suggests that while some routes (like OD 3) are dedicated transit links for daily life, others (like OD 1 and OD 2) are utilized more strategically for long-interval movements.

OD 3 and OD 6 show a significantly higher dependency on Two-Wheelers (69.3% and 56.6% respectively) compared to other locations. Cars, Vans, Jeeps are the dominant mode of transport at OD 1, OD 2, and OD 4, accounting for approximately half of all trips. Work and Business are the primary reasons for travel across all locations, though OD 5 shows a distinctively high percentage of Tourism Religious trips (27.8%). Daily trips are most frequent at OD 3 (58.8%), whereas OD 1 and OD 2 have higher proportions of Monthly and Weekly travellers.

9.5.2 Traffic Volume Count

Table 9.20: Traffic Flow-Summary

TVC Points	Survey Locations	Daily Traffic in Vehicles	Daily Traffic in PCUs	Peak Hour in PCUs	Peak Hour %	Number of Lanes	V/C Ratio	Level of Service (LOS)
CVC 1 -	Chidambara Nagar - Thiraviapuram	55678	41361	2948	7.13	4 Lanes Divided	0.98	E
CVC 2 -	Sindalakottai - Thoothukudi	21659	21571	1545	7.16	4 Lanes Divided	0.51	C
CVC 3 -	Tharuvaikulam - Velankanni Nagar	18245	12424	897	7.22	2 Lanes Undivided	0.60	C/D
CVC 4 -	Siluvaipatti - Therepuram	10172	6268	537	8.57	2 Lanes Undivided	0.36	B
CVC 5 -	VOC Port Rd - West Great Cotton Road	22770	14440	1075	7.44	**2 Lanes Undivided**	0.72	D
CVC 6-	Levingipuram (NH 138)	31845	23925	1858	7.77	4 Lanes Divided	0.52	C
CVC 7 -	Threspuram - Alageshapuram Rd	15681	9681	790	8.16	2 Lanes Undivided	0.53	C
CVC 8 -	Tharuvaikulam - Veppalodai	8638	9631	648	6.73	2 Lanes Divided	0.43	B/C
CVC 9 -	Thoothukudi to Ettaiyapuram	16753	27870	1710	6.13	4 Lanes Divided	0.47	C
CVC 10 -	Ottapidaram - Kurukkuchalai	5258	4413	348	7.89	4 Lanes Divided	0.10	A
CVC 11 -	Tirunelveli to Thoothukudi	14922	17550	1194	6.80	4 Lanes Divided	0.33	B
CVC 12 -	Mukkani - Thoothukudi	22943	23990	1534	6.39	2 Lanes Undivided	1.02	F
CVC 13 -	Thoothukudi to Harbour Estate	22747	35830	2631	7.34	8 Lanes Divided	0.37	B

Level of Service (LOS)	Traffic Condition Inference
E	**Extremely Congested: Nearing total capacity; unstable flow.**
C	Stable Flow: Good condition; typical for design standards.
C/D	Stable but Dense: Flow is starting to become restricted.
B	Free Flow: Very good operating conditions.

Level of Service (LOS)	Traffic Condition Inference
D	Borderline Congested: Approaching unstable flow; high density.
C	Stable Flow: Smooth traffic movement.
C	Stable Flow: Satisfactory traffic conditions.
B/C	Comfortable Flow: Minimal delays.
C	Stable Flow: Common urban design level.
A	Excellent: Very low volume; free-flow conditions.
B	Free Flow: Efficient movement with little interference.
F	**Oversaturated: Volume exceeds capacity; frequent jams/stalls.**
B	Free Flow: High capacity (8 lanes) easily handles current volume.

Table 9.21: Level of Service (LOS) categories

V/C Ratio	Level of Service (LOS)	Description
0.0 – 0.2	A	Excellent (Free flow)
0.2 – 0.4	B	Very Good
0.4 – 0.6	C	Good (Stable flow - Design standard)
0.6 – 0.8	D	Fair / Poor (Approaching instability)
0.8 – 1.0	E	Very Poor (Capacity reached)
> 1.0	F	Worst (Forced flow / Breakdown)

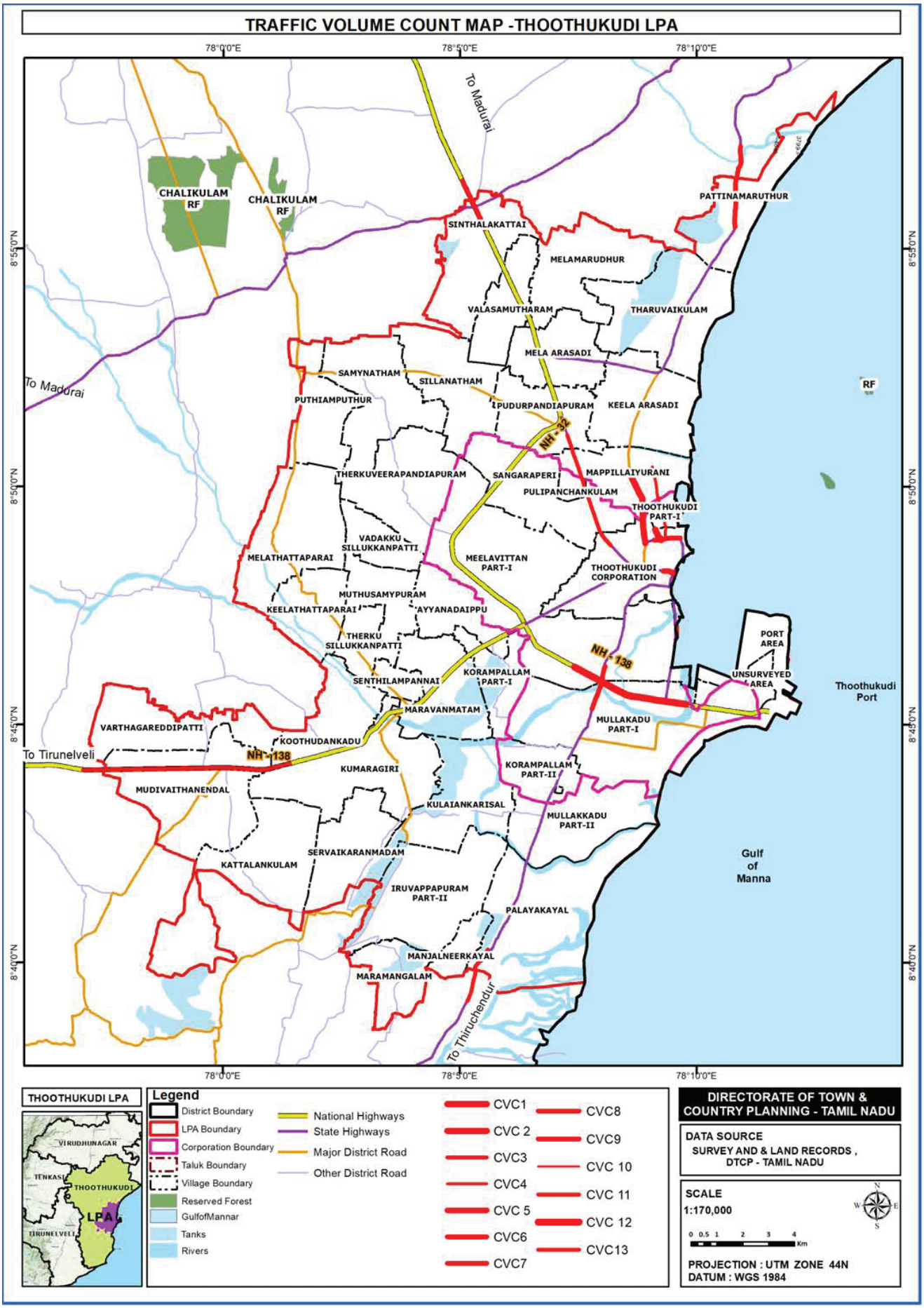
Based on the traffic characteristics summarized for the 13 CVC corridors, the analysis indicates a wide variation in operating conditions across the study area. Corridors such as CVC-1 (Chidambara Nagar–Thiruvapuram) and CVC-12 (Mukkani–Thoothukudi) are operating under highly congested to oversaturated conditions, with V/C ratios close to or exceeding 1.0 and Levels of Service E and F. These stretches experience demand levels approaching or exceeding their carrying capacity during peak hours, leading to unstable flow, frequent slowdowns, and occasional stop-and-go traffic. Such corridors are critical and require immediate traffic management or capacity augmentation measures.

Several corridors fall under moderate traffic conditions with LOS C and D, indicating stable but dense flow. Notable examples include CVC-2, CVC-3, CVC-5, CVC-6, CVC-7, and CVC-9, where V/C ratios range approximately

between 0.5 and 0.75. Although traffic movement remains largely continuous, these roads are beginning to show signs of congestion during peak hours, particularly on 2-lane undivided sections, suggesting limited overtaking opportunities and increased sensitivity to traffic disturbances.

On the other hand, corridors such as CVC-4, CVC-8, CVC-10, CVC-11, and CVC-13 demonstrate good to excellent operating conditions, with LOS A and B and relatively low V/C ratios. These stretches exhibit free-flow or near free-flow conditions, minimal delays, and efficient vehicular movement, especially on wider divided roads and the 8-lane corridor to Thoothukudi Harbour Estate. Overall, the analysis highlights that lane width, number of lanes, and traffic demand play a crucial role in determining performance, with narrower urban corridors showing higher congestion levels compared to wider arterial and access roads.

To address the traffic challenges in Thoothukudi, the 13 corridors require a tiered strategy based on their operating conditions. The most urgent priority is Capacity Augmentation for CVC 12 and CVC 1 specifically, the Mukkani–Thoothukudi stretch (CVC 12) must be widened to a 4-lane divided configuration as it has already surpassed its capacity (V/C 1.02), while the Chidambara Nagar (CVC 1) corridor requires a combination of transit-oriented development and signal synchronization to manage its near-failing flow. For corridors approaching instability like CVC 5 and CVC 3, Operational Management is key, involving the formalization of bus bays, provision of paved shoulders, and peak-hour heavy vehicle restrictions to reduce side-friction on these 2-lane undivided roads. In the stable flow areas like CVC 9 and CVC 7, the focus should shift to Right-of-Way (RoW) Protection, ensuring that service roads and non-motorized transport (NMT) facilities are developed to prevent commercial encroachment from degrading the existing Level of Service. Finally, for the high-performing 8-lane and 4-lane sections like CVC 13 and CVC 10, a Preservation Policy should be implemented, maintaining current free-flow conditions through strict parking enforcement and utilizing these surplus-capacity zones as primary anchors for future industrial or residential expansion.



Map 9.15: Traffic Volume Count Map showing with LOS

9.5.3 Traffic Movement Count

TMC 1 - VVD Juction

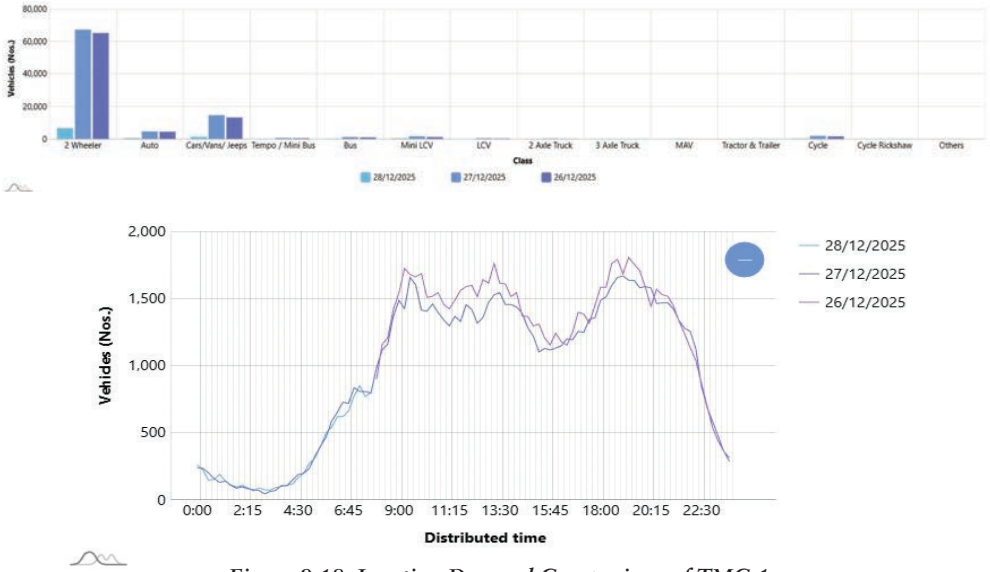


Figure 9.18: Junction Demand Comparison of TMC 1



Figure 9.19: Junction Diagram showing traffic flow of three different days in TMC 1

The traffic volume variation shows a clear daily trend with traffic building up after morning hours and reaching a major evening peak between 18:00 and 19:00 hrs. During this peak hour, the maximum traffic volume is about 1,700–1,800 vehicles per hour, with a secondary morning peak around 09:00–10:00 hrs carrying nearly 1,400–1,500 vehicles per hour. Traffic volumes decline sharply after 21:30 hrs, indicating typical urban commuter-dominated travel patterns with a high share of two-wheelers and cars.

This peak pattern is reflected in the turning movement diagrams, where the junction records peak-hour traffic volumes ranging from about 3,900 to 4,400 vehicles per hour during 18:00–19:00 hrs. In all cases, Anna Nagar Main Road carries the highest traffic load (approximately 2,350–2,600 vehicles/hour), while Thidambaranagar Main Road contributes around 1,500–1,800 vehicles/

hour. The consistently high straight and turning movements during the evening peak confirm heavy congestion pressure at the junction, driven mainly by work-return and commercial traffic.

TMC 2 - Periyar Statue Junction

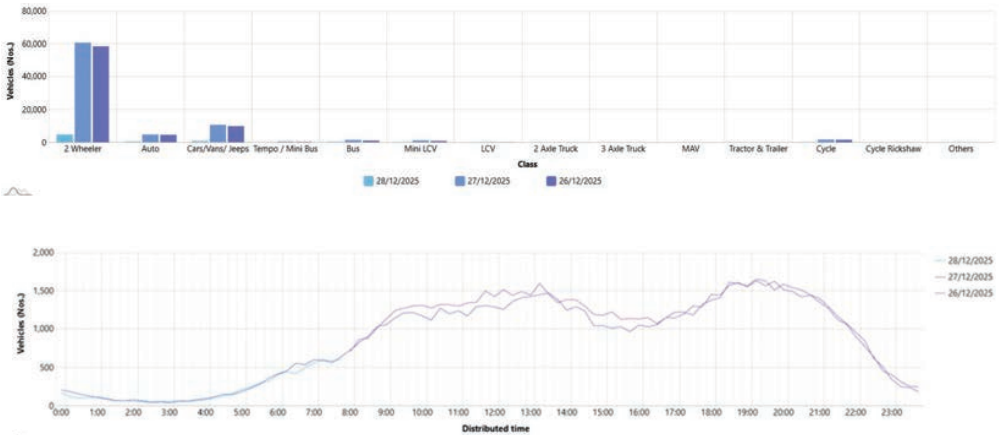


Figure 9.20: Junction Demand Comparison of TMC 2

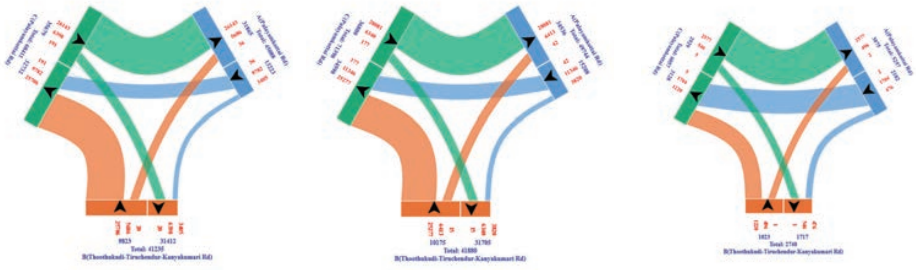


Figure 9.21: Junction Diagram showing traffic flow of three different days in TMC 2

For TMC–2, the traffic volume variation graph shows a steady rise from early morning, with traffic increasing sharply after 06:00 hrs and reaching a major evening peak between 18:00 and 19:00 hrs. During this peak hour, the maximum traffic volume is approximately 1,550–1,650 vehicles per hour, consistently observed across all three survey days. A secondary peak occurs during late morning to early afternoon (11:00–13:00 hrs), carrying around 1,400–1,500 vehicles per hour, while traffic drops significantly after 21:30 hrs. Vehicle classification indicates a strong dominance of two-wheelers, followed by cars/jeeps/vans, confirming mixed urban traffic conditions.

This temporal peak is reflected in the turning movement diagrams, where the junction records peak-hour total volumes of about 4,100–4,200 vehicles/hour on Day 1, around 4,180 vehicles/hour on Day 2, and about 2,700–

2,800 vehicles/hour on Day 3, all corresponding to the 18:00–19:00 hrs peak period. The Thoothukudi–Tiruchendur–Kanniyakumari Road approach carries the highest load, contributing roughly 1,700–2,000 vehicles/hour, while the opposing and cross approaches handle comparatively lower but still substantial volumes. Overall, the analysis confirms that TMC–2 operates under heavy congestion during the evening peak hour, mainly driven by commuter and regional through traffic, indicating a critical need for peak-hour traffic management at this junction.

TMC 3 - Anna Statue Junction

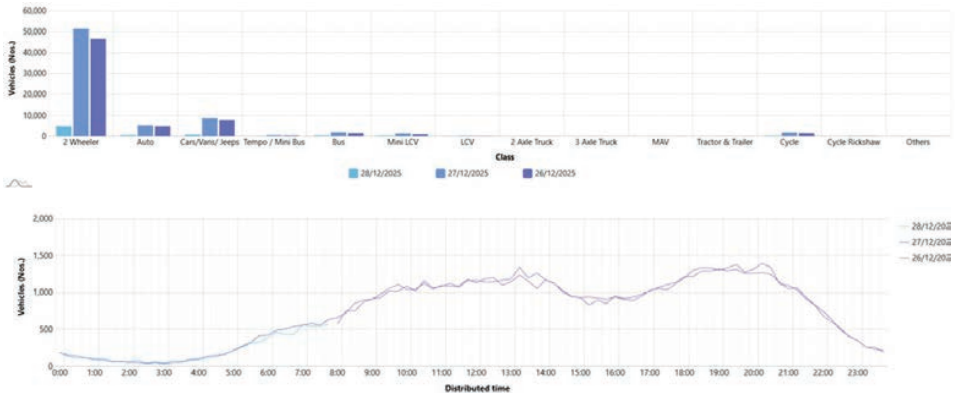


Figure 9.22: Junction Demand Comparison of TMC 3

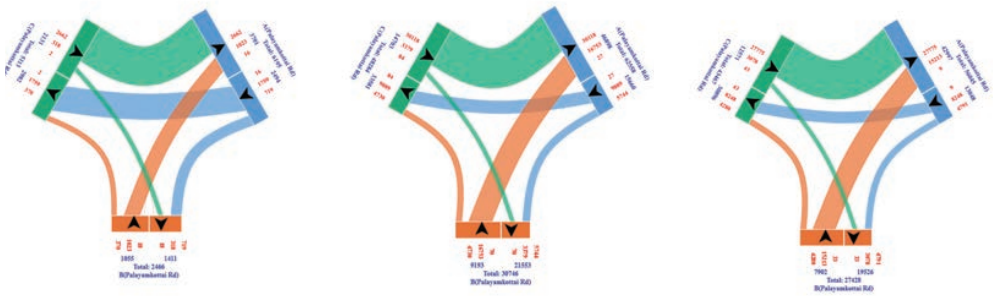


Figure 9.23: Junction Diagram showing traffic flow of three different in TMC 3 days

The traffic volume shows a significant dominance of 2-wheelers, peaking at approximately 51,000 vehicles on December 27th, followed by a slight decrease to roughly 47,000 on December 26th, while Sundays (December 28th) see a drastic drop in this category to under 5,000. Overall daily traffic follows a consistent bimodal distribution, reaching its primary peak time between 13:00 and 14:00 (1:00 PM – 2:00 PM) with over 1,300 vehicles per hour, and a secondary evening peak around 19:00 to 20:00 (7:00 PM – 8:00 PM). The

flow diagrams indicate that the heaviest movement occurs between Point A and Point C (Palayamkottai Rd), with total junction volumes reaching up to 62,558 vehicles on peak days, whereas weekend volume at the same junction falls significantly to a total of just 6,195 vehicles.

TMC 4 - Chidambaranagar Signal

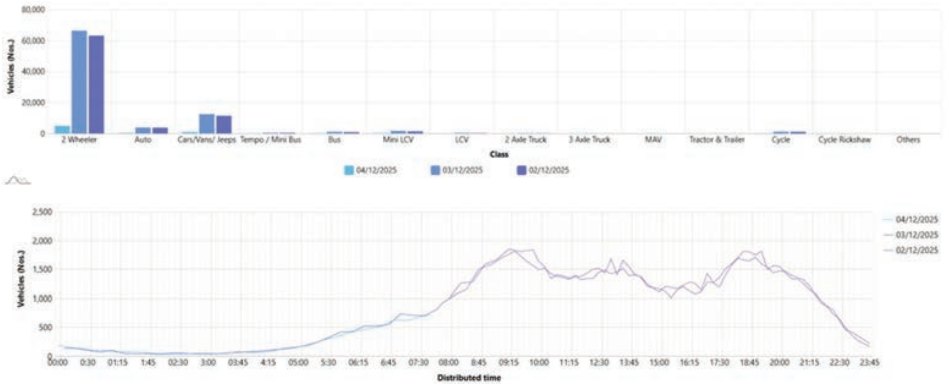


Figure 9.24: Junction Demand Comparison of TMC 4

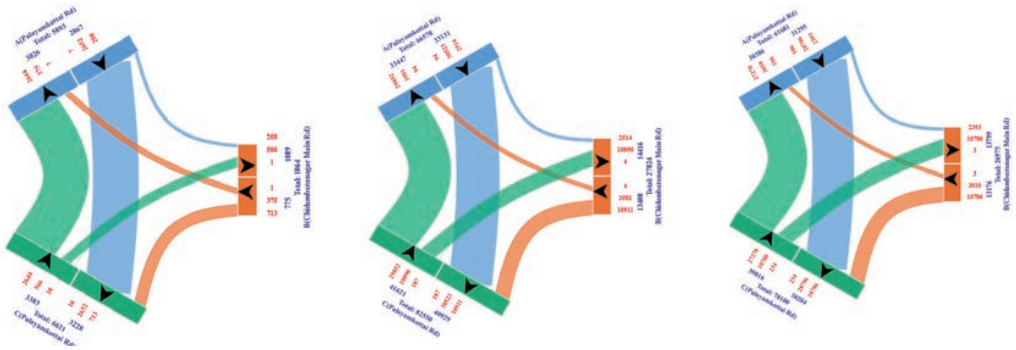


Figure 9.25: Junction Diagram showing traffic flow of three different in TMC 4

Based on the data for TMC 4, the traffic is heavily dominated by 2-wheelers, which reached a maximum volume of approximately 66,900 units on December 3, 2025. The daily traffic follows a distinct bimodal pattern, with the primary peak time occurring between 09:15 and 09:30, reaching nearly 1,900 vehicles, followed by a secondary evening peak of approximately 1,850 vehicles around 18:45. Analysis of the flow diagrams reveals that the heaviest movement is concentrated at Point C (Palayamkottai Rd), which recorded a total volume of 82,550 vehicles on its busiest day, while traffic on week day, showed a significant reduction across all points, with Point B (Chidambaranagar Main Rd) dropping to a total of only 1,864 vehicles.

TMC 5 - Shanmugapuram Junction

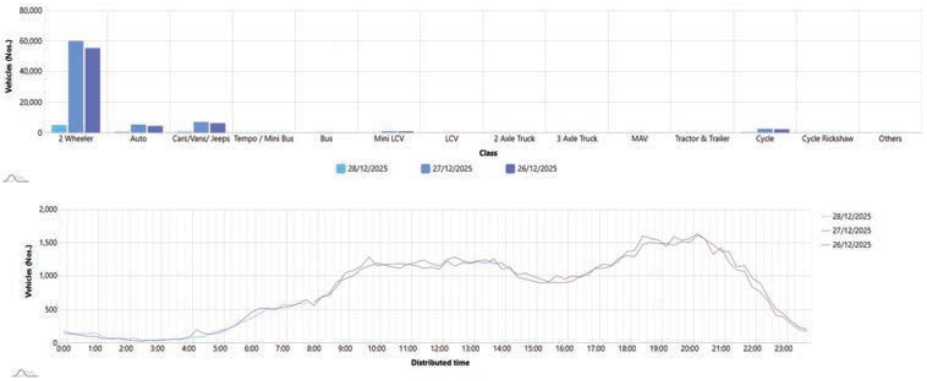


Figure 9.26: Junction Demand Comparison of TMC 5

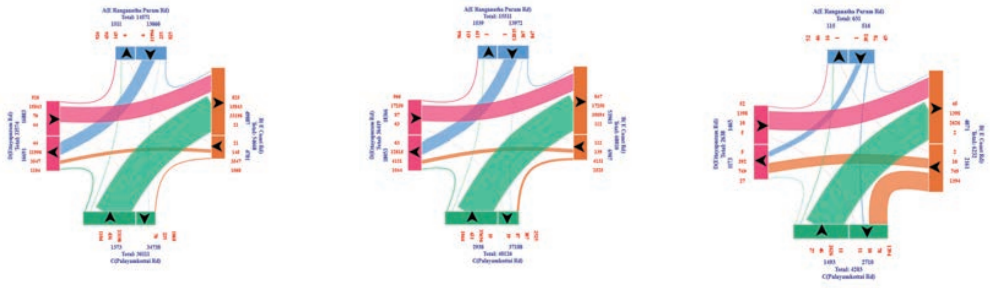


Figure 9.27: Junction Diagram showing traffic flow of three different in TMC 5

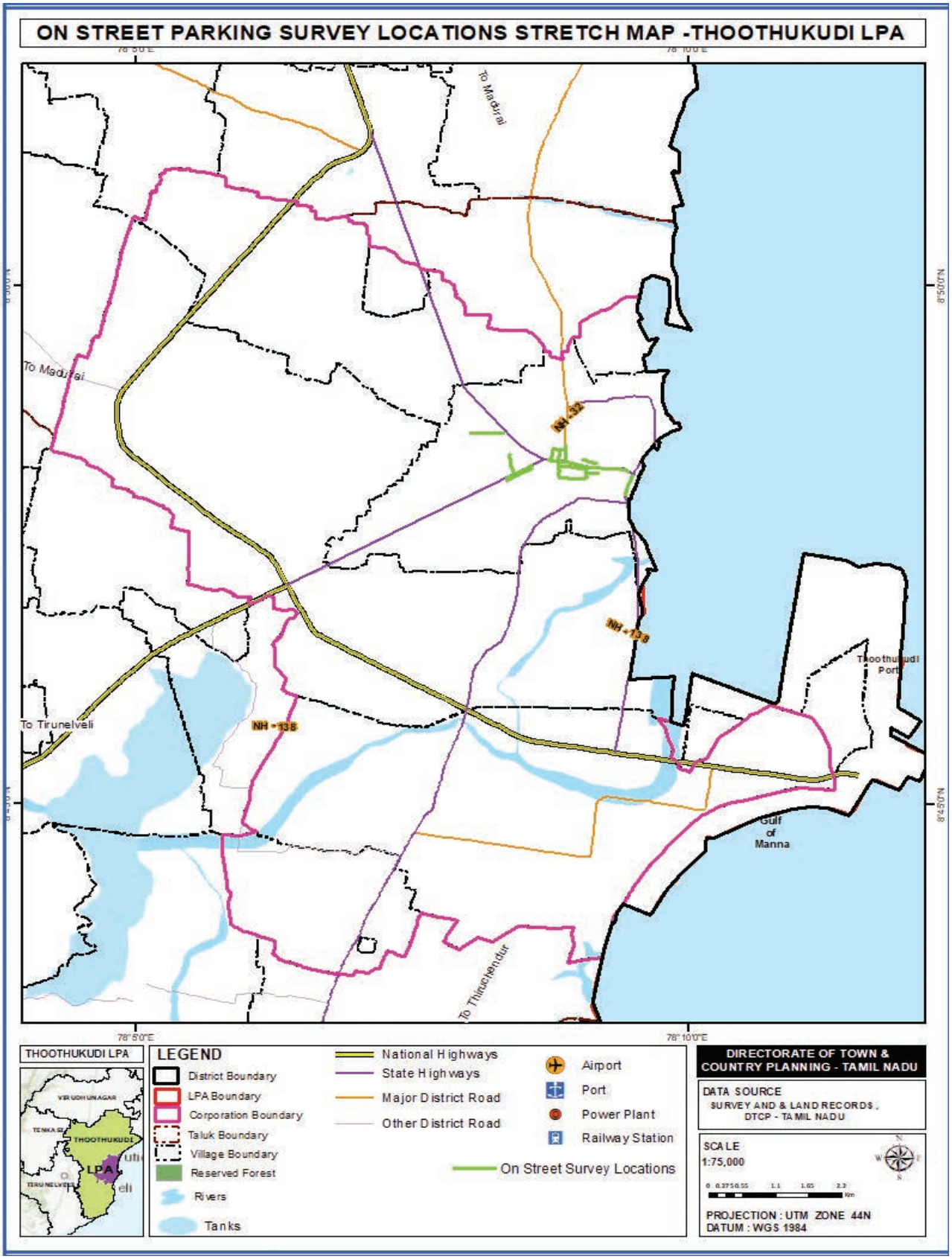
The traffic at this location is heavily dominated by 2-wheelers, which reached a maximum daily volume of approximately 53,000 units. The overall daily traffic follows a consistent bimodal distribution, with the primary peak time occurring between 09:30 and 10:00 AM, recording nearly 1,500 vehicles, and a secondary evening peak of approximately 1,300 vehicles around 06:15 PM. Flow diagrams indicate that the most significant movement is concentrated at Point C (Palayamkottai Rd), which observed a total volume of 68,460 vehicles on its peak day, while traffic on week day, showed a reduction across the junction, with Point B (Chidambaranagar Main Rd) recording a total of only 1,412 vehicles.

Table 9.22: Summary of Traffic Management Issues and Proposed Interventions at Key TMC Junctions

Location	Primary Issue	Proposed Intervention
TMC 1 & 2	Heavy Turning Congestion	Slip lanes and turning radius widening.
TMC 3	Unusual Mid-day Peak	Dynamic signal phasing (Mid-day mode).
TMC 4	Extreme Volume	Feasibility study for a Flyover on Palayamkottai Rd.
TMC 5	High Commuter Surge	Junction box yellow-coding to prevent gridlock.

9.5.4 Parking

ON – STREET PARKING



Map 9.16: On Street Survey Locations Map

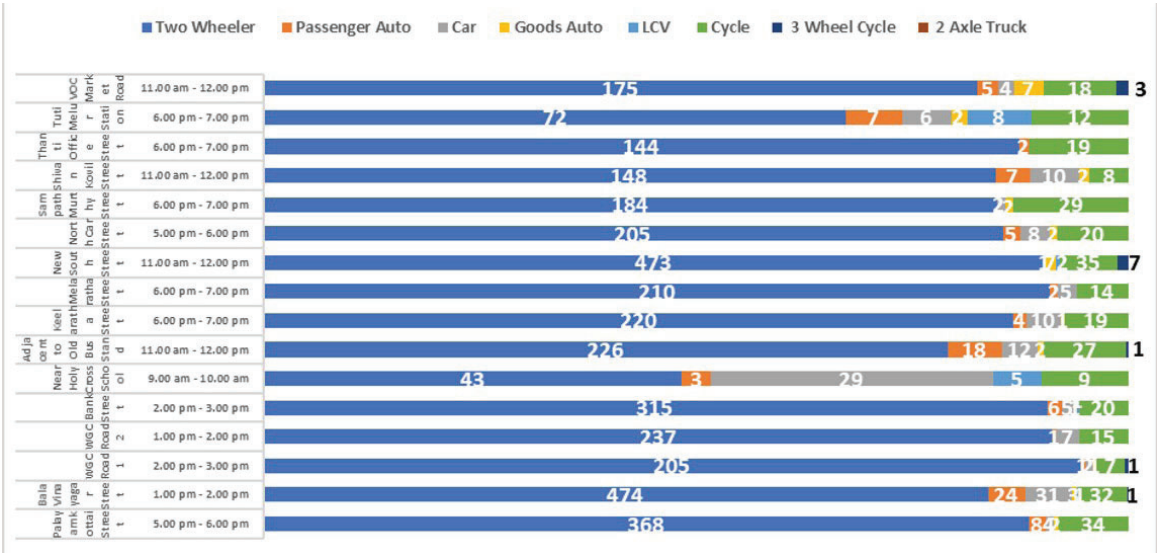


Figure 9.28: On-Street Parking Number of vehicles in Peak Hour - Weekday

At the 16 surveyed locations, weekday on-street parking shows a clear concentration of activity during the mid-day peak (1:00–2:00 pm). The highest peak-hour volume is recorded on Bala Vinayagar Street (1:00–2:00 pm) with about 474 vehicles and a peak-hour ECs value of nearly 164.7, reflecting severe congestion due to on-street parking. This is followed by New South Street (11:00 am–12:00 pm) with around 473 vehicles (≈126.5 ECs) and Palayamkottai Street (5:00–6:00 pm) with 368 vehicles (≈101 ECs). Overall, the observations indicate that on-street parking significantly affects traffic flow by reducing effective road width during peak activity hours, particularly on busy commercial streets.

Table 9.23: On-street Parking Peak Hour ECS- Weekday

Peak Hour	Area	Peak Hour ECS
5.00 pm - 6.00 pm	Palayamkottai Street	101
1.00 pm - 2.00 pm	Bala Vinayagar Street	164.7
2.00 pm - 3.00 pm	WGC Road 1	54.35
1.00 pm - 2.00 pm	WGC Road 2	66.75
2.00 pm - 3.00 pm	Bank Street	88.25
9.00 am - 10.00 am	Near Holy Cross School	43.5
11.00 am - 12.00 pm	Adjacent to Old Bus Stand	78.6
6.00 pm - 7.00 pm	Keelaratha Street	67.5

Peak Hour	Area	Peak Hour ECS
6.00 pm - 7.00 pm	Melaratha Street	58.5
11.00 am - 12.00 pm	New South Street	126.45
5.00 pm - 6.00 pm	North Car Street	62.75
6.00 pm - 7.00 pm	Sampath Murthy Street	49
11.00 am - 12.00 pm	Shivan Kovil Street	51.5
6.00 pm - 7.00 pm	Thanti Office Street	37
6.00 pm - 7.00 pm	Tuti Melur Station	33.3
11.00 am - 12.00 pm	VOC Market Road	54.05

The provided table offer a detailed analysis of peak-hour Equivalent Car Space (ECS) demand across various street locations, identifying when each area reaches its maximum parking load. The data reveals a significant disparity in parking pressure, as Bala Vinayagar Street records the highest peak demand with an ECS of 164.7 between 1:00 pm and 2:00 pm, followed by New South Street at 126.45 ECS during the 11:00 am to 12:00 pm window. These figures stand in sharp contrast to areas like Tuti Melur Station and Thanti Office Street, which experience the lowest peak intensities, both falling below 40 ECS during the evening hours. Overall, the inferences suggest that peak parking demand is not uniform across the city; while several commercial hubs experience their heaviest traffic during the midday hours (11:00 am – 2:00 pm), a secondary surge occurs in the evening (5:00 pm – 7:00 pm) for residential or transit-related streets, indicating a need for time-specific traffic management strategies in high-load zones.

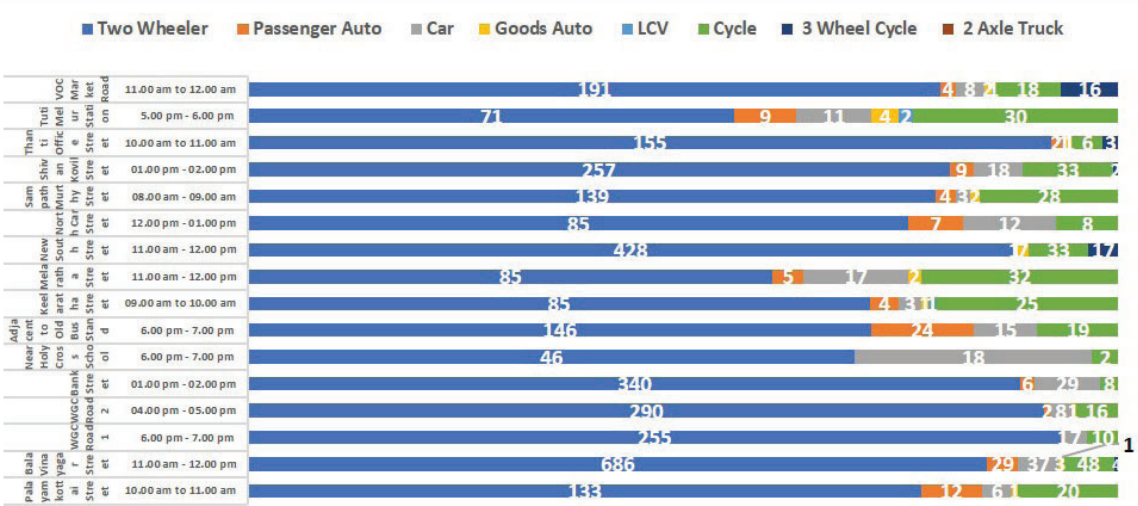


Figure 9.29: On-Street Parking Number of vehicles in Peak Hour - Weekend

Across the 16 surveyed locations, weekend on-street parking activity shows peak conditions occurring mostly during the late morning to afternoon period (11:00 am–2:00 pm). The highest peak-hour volume is observed on Bala Vinayagar Street between 11:00 am–12:00 pm, recording about 686 vehicles, indicating intense parking demand and congestion during weekend commercial activity. This is followed by New South Street (11:00 am–12:00 pm) with around 428 vehicles and Bank Street (1:00 pm–2:00 pm) with approximately 340 vehicles. Overall, the weekend pattern highlights increased on-street parking pressure during shopping and activity hours, with two-wheelers forming the dominant share, significantly affecting traffic movement on major commercial streets.

Table 9.24: On-Street Parking Peak Hour ECS- Weekend

Peak Hour	Area	Peak Hour ECS
10.00 am to 11.00 am	Palayamkottai Street	45.75
11.00 am - 12.00 pm	Bala Vinayagar Street	227.3
6.00 pm - 7.00 pm	WGC Road 1	71.25
04.00 pm - 05.00 pm	WGC Road 2	82
01.00 pm - 02.00 pm	Bank Street	117
6.00 pm - 7.00 pm	Near Holy Cross School	29.5
6.00 pm - 7.00 pm	Adjacent to Old Bus Stand	63.5
09.00 am to 10.00 am	Keelaratha Street	28
11.00 am - 12.00 pm	Melaratha Street	41.75
11.00 am - 12.00 pm	New South Street	113.7
12.00 pm - 01.00 pm	North Car Street	36.75
08.00 am - 09.00 am	Sampath Murthy Street	40.75
01.00 pm - 02.00 pm	Shivan Kovil Street	86.95
10.00 am to 11.00 am	Thanti Office Street	41.55
5.00 pm - 6.00 pm	Tuti Melur Station	38.25
11.00 am to 12.00 am	VOC Market Road	61.25

Across the 15 surveyed locations, weekend on-street parking peak-hour ECS values show a strong concentration during the late morning to afternoon period (11:00 am–2:00 pm). The highest peak-hour ECS is recorded at Bala Vinayagar Street between 11:00 am–12:00 pm (≈227.3 ECS), indicating very high

parking-induced congestion. This is followed by Bank Street (1:00–2:00 pm, ≈117 ECS) and New South Street (11:00 am–12:00 pm, ≈113.7 ECS), reflecting heavy commercial and shopping activity on weekends. Moderate ECS levels are observed at Shivan Kovil Street (≈87 ECS) and WGC Road 2 (≈82 ECS), while residential or institutional areas such as Near Holy Cross School (≈29.5 ECS) and Keelaratha Street (≈28 ECS) show comparatively lower weekend impact. Overall, the results indicate that weekend on-street parking congestion is most severe on major commercial streets during late-morning peak hours.

Based on the survey data provided for both weekdays and weekends, it is evident that the parking demand is heavily concentrated in commercial hubs like Bala Vinayagar Street, New South Street, and Bank Street. The peak hours vary from midday (11:00 am – 2:00 pm) to evening (5:00 pm – 7:00 pm), suggesting that a one-size-fits-all approach won't work.

Below are the recommended solutions categorized by the intensity of the parking pressure identified in your analysis.

1. High-Intensity Zones (Critical Load)

Locations: Bala Vinayagar Street, New South Street, Bank Street.

- These areas have ECS values exceeding 100. Implementing a variable pricing model (higher rates during the 11:00 am – 2:00 pm peak) will discourage long-duration parking and increase turnover. Enforce a maximum stay (e.g., 60–90 minutes) during peak hours to ensure the road width isn't permanently throttled by stagnant vehicles. Since these streets are likely narrow commercial hubs, shifting the static load to a nearby off-street MLCP is essential to restore effective road width.

2. Moderate-Intensity Zones (Medium Load)

Locations: WGC Road 1 & 2, Palayamkottai Street, Shivan Kovil Street, VOC Market Road.

- Use thermoplastic paint to clearly demarcate parking slots. This prevents cluttered parking that spills into the driving lane, which currently reduces the effective road width mentioned in your report. Switch from angular to parallel parking where road width is narrow to gain more moving space. Use angular parking (45° or 60°) only if the street is wide enough, as it allows for quicker ingress/egress.

3. Low-Intensity/Institutional Zones

Locations: Near Holy Cross School, Keelaratha Street, Tuti Melur Station, Thanti Office Street.

- For Holy Cross School (peak 9:00 am), implement a Park & Ride zone where parking is strictly prohibited, but idling for 30 seconds to

drop off students is allowed. In areas like Keelaratha Street, implement residential parking permits to ensure local residents aren't displaced by spillover commercial traffic. At Tuti Melur Station, focus on organized two-wheeler zones with easy access to the station entrance to prevent haphazard parking.

OFF – STREET PARKING

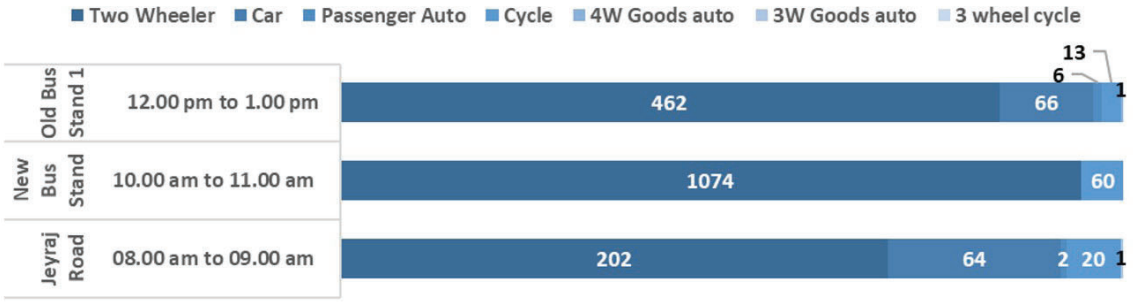


Figure 9.30: Off-Street Parking Number of vehicles in Peak Hour – Weekday

Across the 3 surveyed locations, off-street parking on a weekday shows clear peak demand associated with bus terminal activity. The highest peak occurs at the New Bus Stand between 10:00 am–11:00 am, with about 1,074 vehicles, dominated by two-wheelers, indicating intense late-morning passenger and commuter demand. This is followed by Old Bus Stand 1 during 12:00 pm–1:00 pm with approximately 462 vehicles, while Jeyraj Road records its peak between 8:00 am–9:00 am with around 202 vehicles, reflecting morning commuter usage. Overall, off-street parking demand is highest around bus stand areas during late-morning to early-afternoon peak hours, with two-wheelers forming the predominant share.

Table 9.25: Off-Street Parking Peak Hour ECS- Weekday

Peak Hour	Area	Peak Hour ECS
08.00 am to 09.00 am	Jeyraj Road	117.5
10.00 am to 11.00 am	New Bus Stand	274.5
12.00 pm to 1.00 pm	Old Bus Stand 1	185.8

Across the 3 surveyed locations, weekday off-street parking peak-hour ECS values indicate the highest parking demand around major bus terminals. The maximum peak-hour ECS is observed at the New Bus Stand between 10:00 am–11:00 am (≈274.5 ECS), reflecting intense commuter and passenger activity during late-morning hours. This is followed by Old Bus Stand 1 from 12:00 pm–1:00 pm (≈185.8 ECS), showing continued high parking demand into the early afternoon. In comparison, Jeyraj Road records a lower but notable peak

between 8:00 am–9:00 am (≈117.5 ECS), corresponding to morning commuter movements. Overall, the results show that off-street parking congestion is most severe at bus stand locations during late-morning peak hours on weekdays.

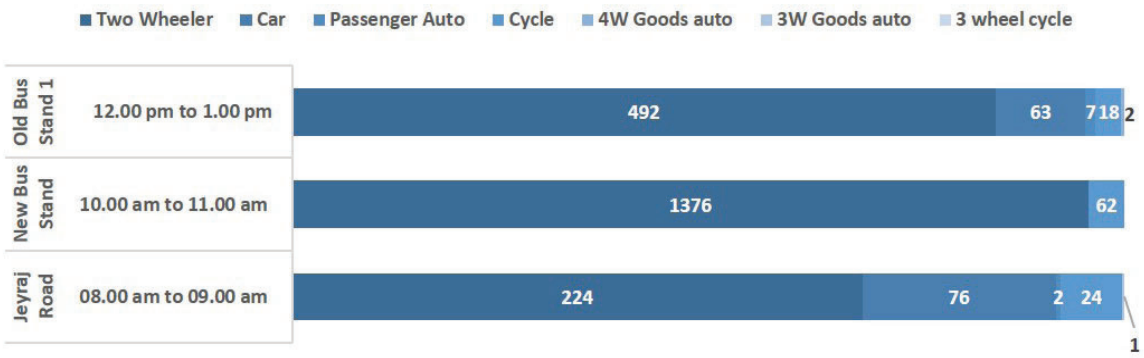


Figure 9.31: Off-Street Parking Number of vehicles in Peak Hour – Weekend

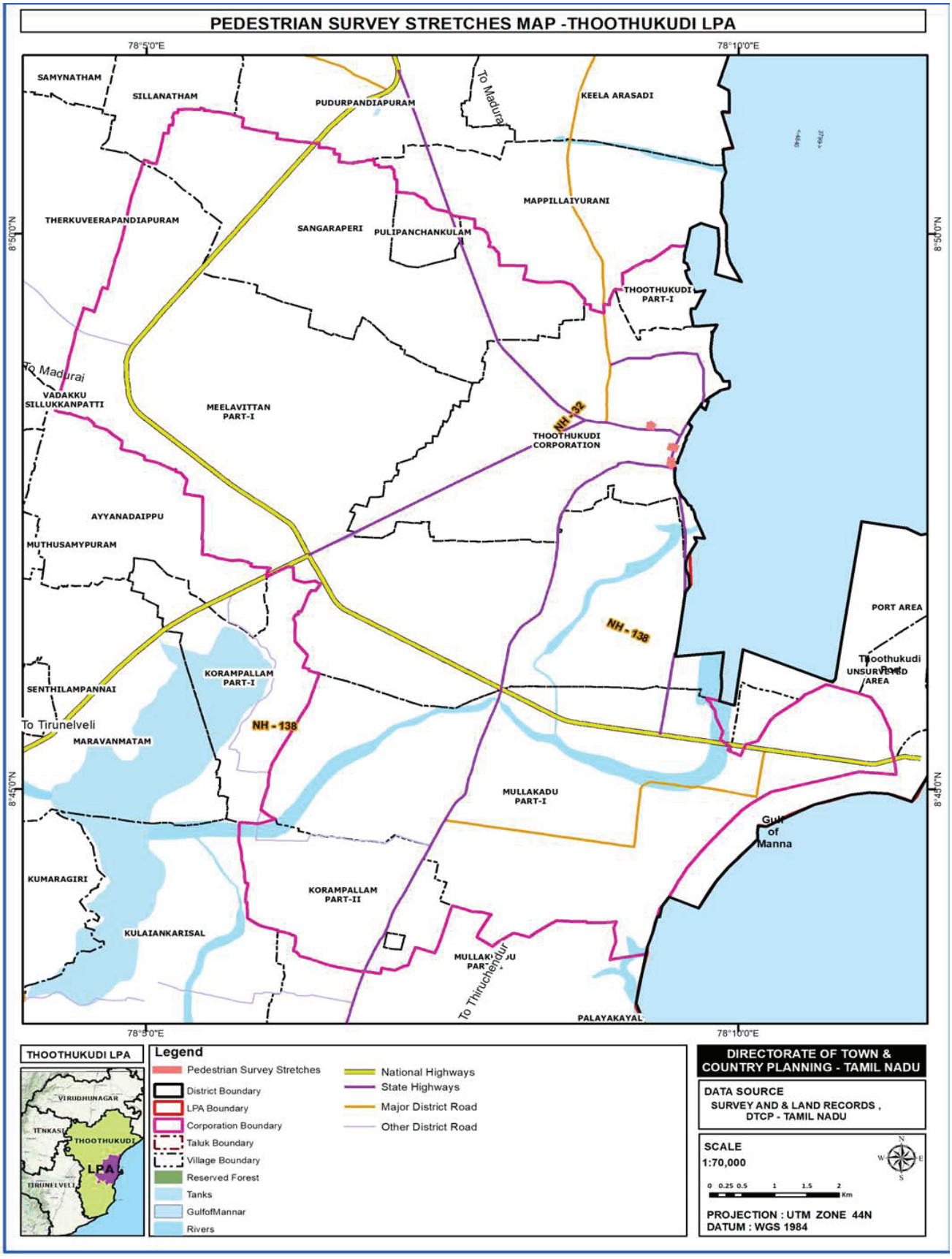
Across the 3 surveyed locations, weekday off-street parking shows clear peak demand concentrated around bus terminal areas. The highest peak occurs at the New Bus Stand between 10:00 am–11:00 am, recording about 1,376 vehicles, largely dominated by two-wheelers, indicating intense late-morning commuter and passenger activity. This is followed by Old Bus Stand 1 during 12:00 pm–1:00 pm with approximately 492 vehicles, while Jeyraj Road experiences its peak between 8:00 am–9:00 am with around 224 vehicles, reflecting morning commuter usage. Overall, off-street parking demand on weekdays is highest during late-morning to early-afternoon hours, with two-wheelers forming the predominant share across all locations.

Table 9.26: Off-Street Parking Peak Hour ECS- Weekend

Peak Hour	Area	Peak Hour ECS
08.00 am to 09.00 am	Jeyraj Road	135.4
10.00 am to 11.00 am	New Bus Stand	350.2
12.00 pm to 1.00 pm	Old Bus Stand 1	191.3

Across the 3 surveyed locations, weekend off-street parking peak-hour ECS values indicate very high parking demand at bus terminal areas. The highest peak-hour ECS is observed at the New Bus Stand between 10:00 am–11:00 am (≈350.2 ECS), reflecting intense weekend travel and commercial activity during late-morning hours. This is followed by Old Bus Stand 1 from 12:00 pm–1:00 pm (≈191.3 ECS), showing sustained parking demand into the afternoon. Jeyraj Road records a comparatively lower peak between 8:00 am–9:00 am (≈135.4 ECS), associated with early-day movements. Overall, the results show that off-street parking congestion is more pronounced on weekends, especially at major bus stands during late-morning peak hours.

9.5.5 Pedestrian



Map 9.17: Pedestrian Survey Locations Stretches

Bank Street

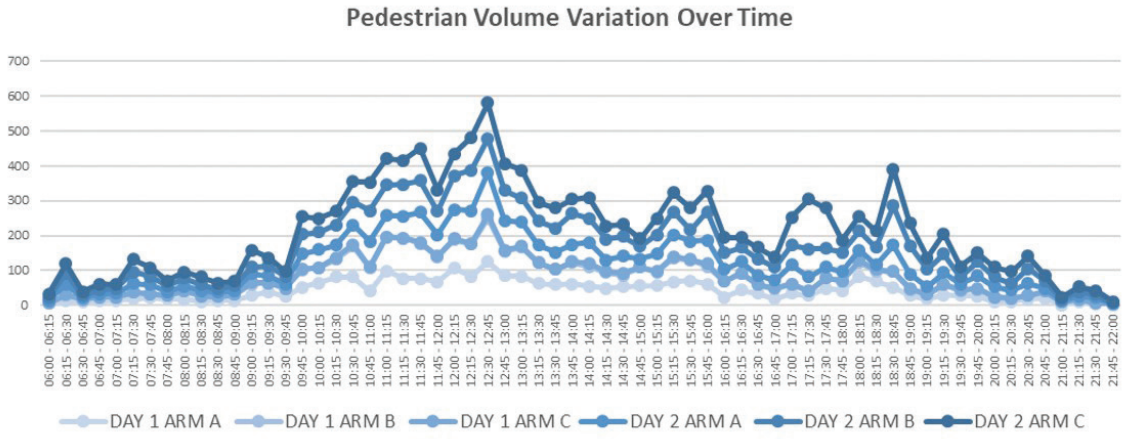


Figure 9.32: Pedestrian Volume Variation Over Time in Bank Street

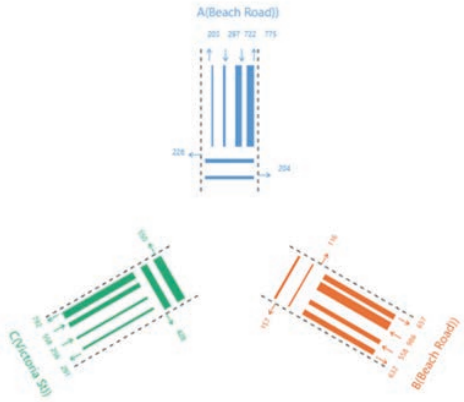


Figure 9.33: Pedestrian Junction Diagram in Bank Street

At Bank Street, Thoothukudi, pedestrian activity shows a clear peak during the late morning to early afternoon period, with the peak hour occurring around 12:15–13:15 hrs. During this peak hour, the maximum pedestrian volume reaches about 580–600 pedestrians per hour, observed mainly on Arm C, indicating it as the dominant movement direction. Arms connected to Beach Road (Arm A) and Victoria Street (Arm B) also record high peak-hour volumes in the range of 380–450 pedestrians per hour, reflecting strong cross-movement between commercial areas and major roads. The peak-hour surge is consistent on both days, though Day 2 shows slightly higher volumes, confirming that Bank Street functions as a busy commercial pedestrian corridor with peak demand concentrated around midday business and service activities.

Dsf Grand Plaza

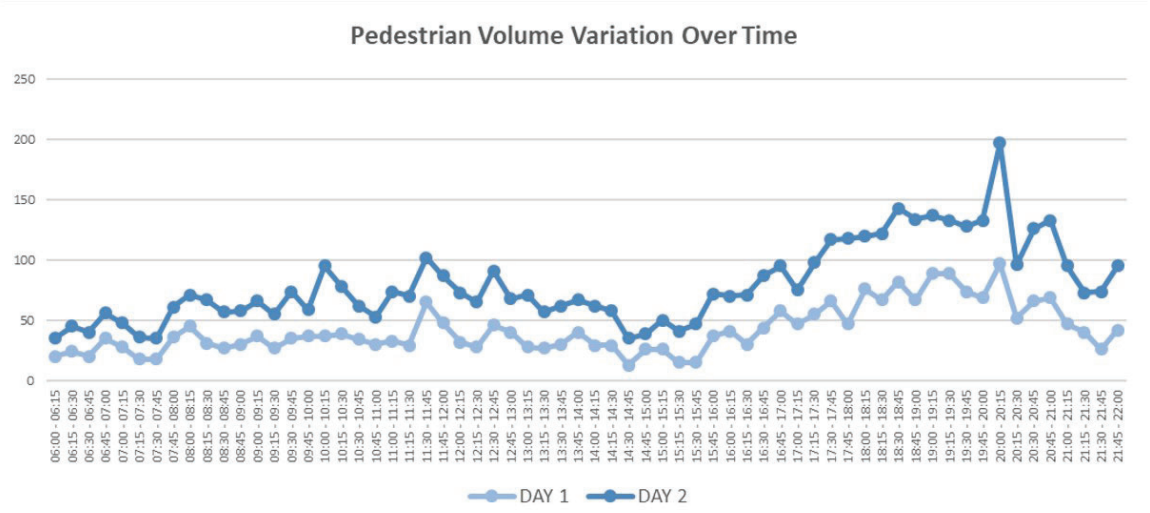


Figure 9.34: Pedestrian Volume Variation Over Time in DSF Plaza

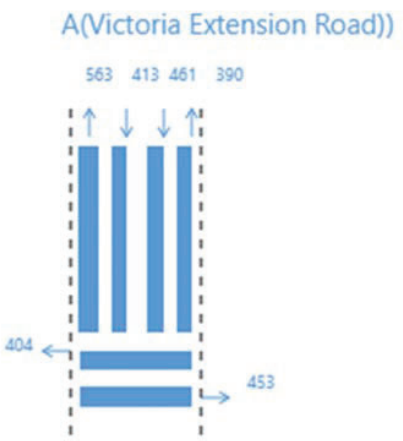


Figure 9.35: Pedestrian Junction Diagram in DSF Plaza

At DSF Grand Plaza (Victoria Extension Road), pedestrian activity shows a gradual build-up from morning hours, with a clear evening peak between 18:30 and 19:30 hrs. During this peak hour, the maximum pedestrian volume reaches approximately 190–200 pedestrians per hour, observed on Day 2, while Day 1 records a lower peak of about 130–140 pedestrians per hour. The movement diagram indicates strong bidirectional pedestrian flow along Victoria Extension Road, reflecting commercial, shopping, and recreational trips concentrated in the evening. Overall, the pattern confirms that DSF Grand Plaza experiences its highest pedestrian demand during post-work hours, driven by commercial and leisure-oriented activities rather than morning commuter movement.

OLD BUS STAND

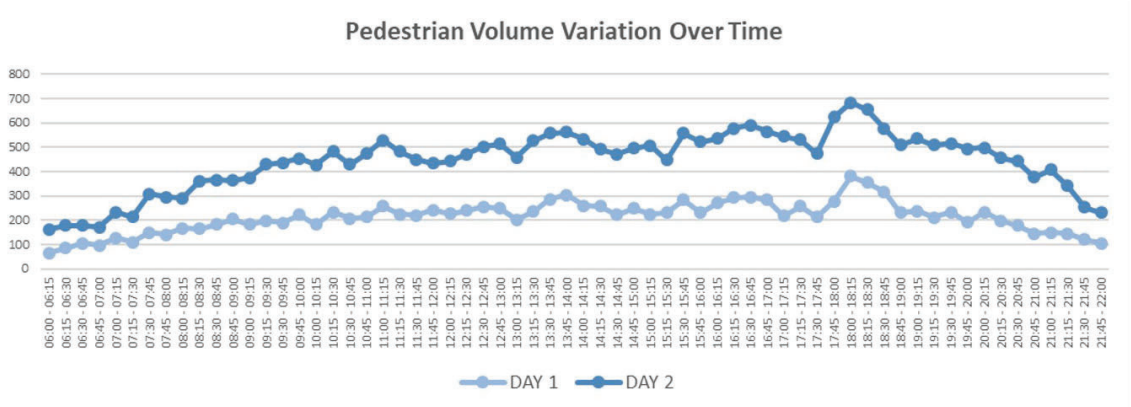


Figure 9.36: Pedestrian Volume Variation Over Time in Old Bus Stand

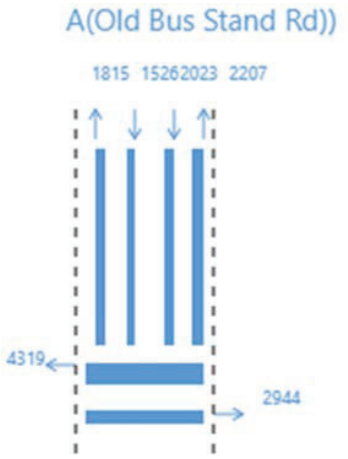


Figure 9.37: Pedestrian Junction Diagram in Old Bus Stand

At the Old Bus Stand, Thoothukudi, pedestrian volumes remain high throughout the day, reflecting its role as a major public transport hub. The time-series graph shows a pronounced peak hour during the late afternoon, around 17:30–18:30 hrs. During this peak hour, the maximum pedestrian volume reaches approximately 650–700 pedestrians per hour on Day 2, while Day 1 records a lower peak of about 350–380 pedestrians per hour. The movement diagram further indicates very strong directional pedestrian flows along Old Bus Stand Road, with heavy inbound and outbound movements associated with bus arrivals, departures, and adjacent commercial activities. Overall, the consistently high volumes and sharp evening peak confirm that the Old Bus Stand functions as one of the busiest pedestrian nodes in the city, driven primarily by transit-related and commercial pedestrian trips.

Old Tuticorin Corporation Building

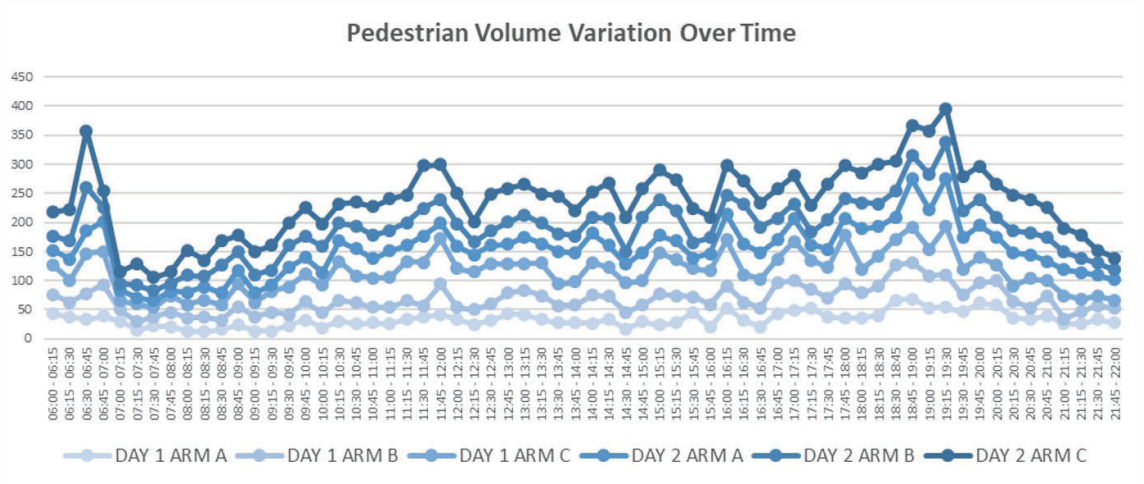


Figure 9.38: Pedestrian Volume Variation Over Time in Old Corporation Building

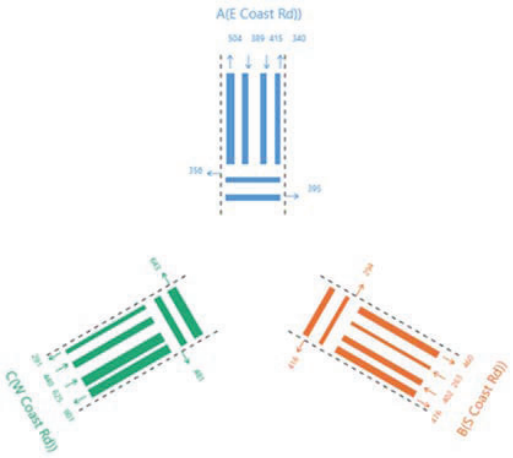


Figure 9.39: Pedestrian Junction Diagram in Old Corporation Building

At the Old Tuticorin Corporation Building junction, pedestrian movement shows clear fluctuations throughout the day with a distinct evening dominance. The peak hour occurs during 18:00–19:00 hrs, when pedestrian activity is highest across all arms. During this peak hour, the maximum pedestrian volume reaches about 380–400 pedestrians per hour, observed on Day 2, Arm C, indicating the most dominant movement direction. Other approaches, particularly those connected to E Coast Road and B.S. Coast Road, record peak-hour volumes in the range of 220–300 pedestrians per hour, reflecting strong cross-movement associated with office closures, nearby commercial activity, and transit access. Overall, the junction functions as a moderately high pedestrian activity node, with peak demand concentrated in the evening due to institutional and commercial trip generation rather than residential movements.

Periya Kovil Street

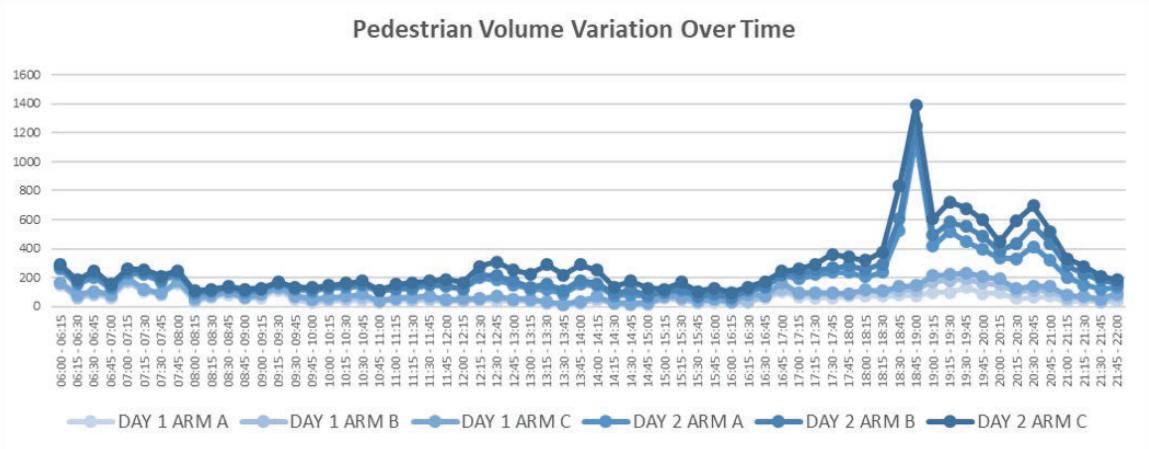


Figure 9.40: Pedestrian Volume Variation Over Time in Periya Kovil Street

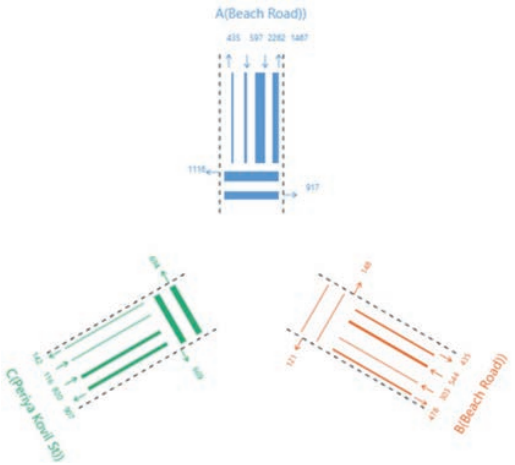


Figure 9.41: Pedestrian Junction Diagram in Periya Kovil Street

At Periya Kovil Street, Thoothukudi, pedestrian activity remains moderate during most of the day but shows a very sharp and short-duration surge in the evening. The peak hour occurs around 18:30–19:30 hrs, during which the maximum pedestrian volume reaches about 1,350–1,400 pedestrians per hour, clearly observed on Day 2 (Arm C). Other approaches connected to Beach Road and the cross streets also experience elevated peak-hour volumes in the range of 500–700 pedestrians per hour, indicating intense cross-movement. This pronounced evening spike reflects the influence of temple-related activities, nearby commercial establishments, and visitor congregation, confirming Periya Kovil Street as a high-intensity pedestrian zone with strong temporal concentration during evening hours.

Railway Street

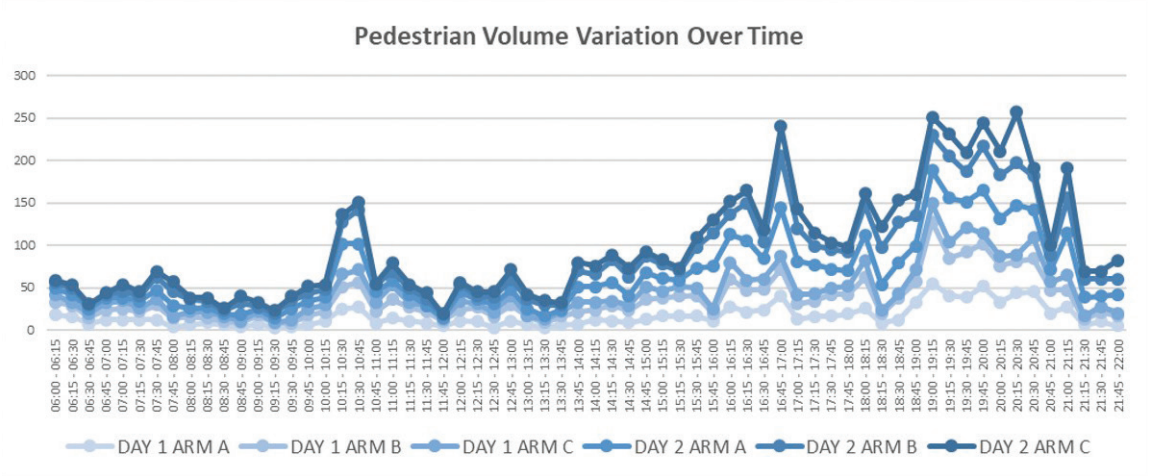


Figure 9.42: Pedestrian Volume Variation Over Time in Railway Street

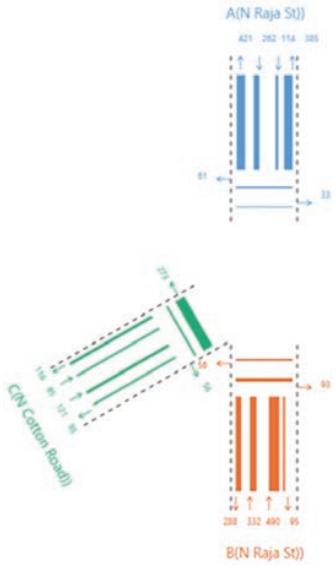


Figure 9.43: Pedestrian Junction Diagram in Railway Street

The pedestrian activity at Railway Street peaks significantly in the evening between 19:00 and 20:30 (7:00 PM – 8:30 PM), with the highest recorded volume reaching approximately 260 pedestrians in a 15-minute interval on Day 2. There are secondary spikes during the morning (10:30 AM) and late afternoon (5:00 PM), but the evening remains the busiest period overall. Spatially, Arm B (N Raja St) handles the highest total traffic with over 1,200 pedestrians recorded in the flow diagram, while the line chart indicates that Arm C consistently experiences the highest individual surges in volume, especially on the second day of the study.

Old Tuticorin Big Market

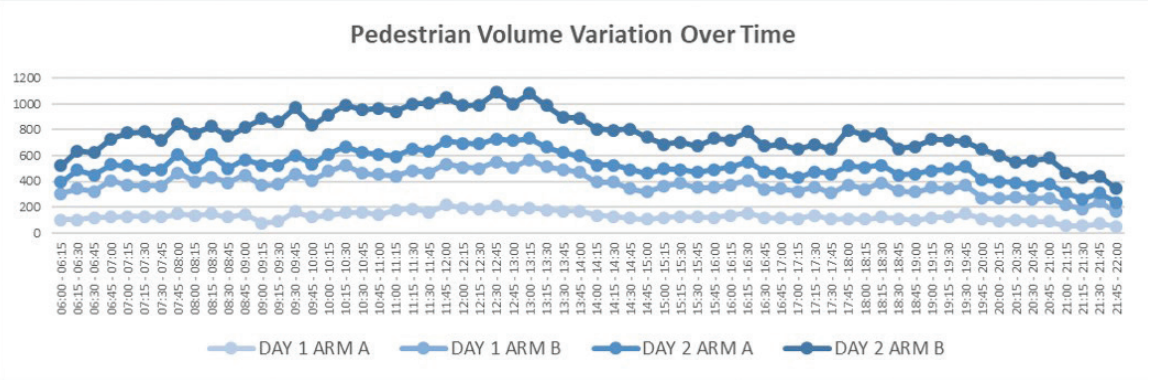


Figure 9.44: Pedestrian Volume Variation Over Time in Old Tuticorin Big Market

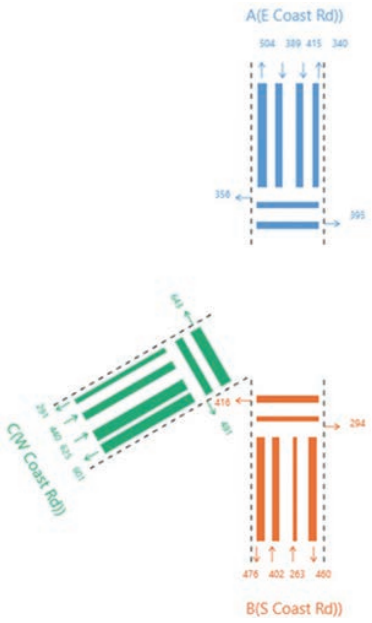


Figure 9.45: Pedestrian Junction Diagram in Old Tuticorin Big Market

At the Old Tuticorin Big Market, pedestrian movement is consistently high from morning hours, reflecting its role as a major wholesale and retail activity centre. The time-series graph indicates a clear morning peak between 10:30 and 11:30 hrs. During this peak hour, the maximum pedestrian volume reaches approximately 1,050–1,100 pedestrians per hour, observed on Day 2 (Arm B), while Day 1 records a comparatively lower peak of about 650–700 pedestrians per hour. The directional flow diagram shows strong bidirectional movements along E. Coast Road and S. Coast Road, indicating intensive market-oriented pedestrian trips. Overall, the dominance of the morning peak confirms that pedestrian demand at the Big Market is driven mainly by trading, shopping,

and goods-related activities, with reduced volumes during late afternoon and evening hours.

Table 9.27: Location-Specific Priority Actions Based on Pedestrian Peak Periods

Location	Primary Peak	Main Recommendation
Bank St	Midday	Shaded walkways & Mid-block crossings
DSF Plaza	Evening	Improved lighting & Tabletop crossings
Old Bus Stand	Evening	Sidewalk widening & Wayfinding
Old Corp. Bldg	Evening	Leading Pedestrian Signal Intervals
Periya Kovil St	Evening	High Priority: Temporary Pedestrianization
Railway St	Late Evening	Enhanced security lighting & CCTV
Big Market	Morning	Delivery management & Durable surfacing

9.6 Proposals

The efficiency of a city's growth is intrinsically linked to the robustness of its mobility spine. For Thoothukudi, a vital industrial and Freight hub of Tamil Nadu, the existing transportation network must evolve to accommodate rapid urbanization and increasing vehicular pressure. This proposal outlines a strategic Road Network Hierarchy, designed to streamline traffic flow from high-speed regional corridors down to local neighborhood streets.

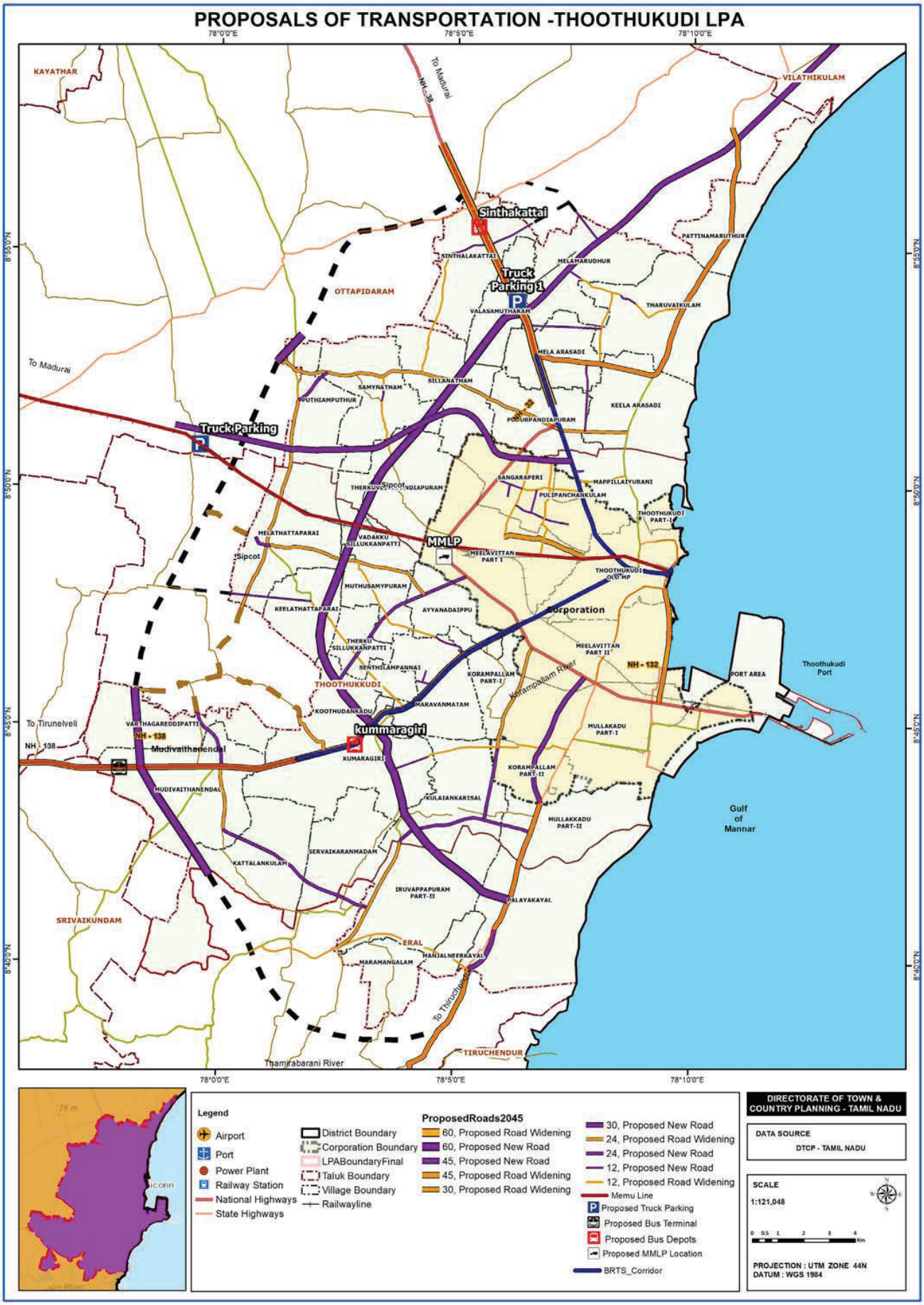
Table 9.28: Proposed Transport Network New Link

Proposed Road Link	Origin	Destination	Road Category	No of lanes	Proposed ROW (in m)	Distance (in Km)
A1 - A1	Kurukkuchalai	Kattalangulam	Proposed New Road	8 Lanes	60 M	44
A2 - A2	Melamaruthur	Palayakkayal	Proposed New Road	8 Lanes	60 M	28
B1 - B1	Vaippar	Kurukkusalai	Proposed New Road	6 Lanes	45 M	20
B2 - B2	S.Kumarapuram	Pudurpandiyapuram	Road Widening	4 - 6 lanes	45 M	11
B3 - B3	Thiruvengadapuram	Korampallam	Road Widening	4 - 6 lanes	45 M	23
C1 - C1	S.Kailasapuram	Jothi Nagar	Proposed New Road	6 Lanes	45 M	16.7
C2 - C2	Tuticorin Beach Road	Authur	Proposed New Road	4 lanes	30 M	5.5
C2 - C2	Tuticorin Beach Road	Authur	Road Widening	2 - 4 lanes	30 M	5.1
C2 - C2	Tuticorin Beach Road	Authur	Road Widening	2 - 4 lanes	30 M	5.2
C2 - C2	Tuticorin Beach Road	Authur	Proposed New Road	4 lanes	30 M	1.9
C3 - C3	Veppalodai	Mel Arasadi	Road Widening	2 - 4 lanes	30 M	15.2
C4 - C4	Meelavittan	Chinnakannupuram	Road Widening	2 - 4 lanes	30 M	3.3
C5 - C5	Shanmugapuram	Harbour Estate	Road Widening	2 - 4 lanes	30 M	4.4
D1 - D1	pudiyamputhur	Ayyanarpuram	Road Widening	2 - 4 lanes	24 M	14.4
D2 - D2	Mela Thattaparai	Ayyanadaippu	Road Widening	2 - 4 lanes	24 M	6.6
D2 - D2	Mela Thattaparai	Ayyanadaippu	Proposed New Road	4 lanes	24 M	0.76
D3 - D3	Eazhumalayan Nagar	Therku Silukkanpatti	Proposed New Road	4 lanes	24 M	6.7
D4 - D4	Timmarajapuram	Kuttudankadu	Road Widening	2 - 4 lanes	24 M	2.4
D5 - D5	Mullakadu	Sawyerpuram	Proposed New Road	4 lanes	24 M	5.4
D5 - D5	Mullakadu	Sawyerpuram	Proposed New Road	4 lanes	24 M	6.5
D5 - D5	Mullakadu	Sawyerpuram	Road Widening	2 - 4 lanes	24 M	2.4
D5 - D5	Mullakadu	Sawyerpuram	Proposed New Road	4 lanes	24 M	2.3

Proposed Road Link	Origin	Destination	Road Category	No of lanes	Proposed ROW (in m)	Distance (in Km)
D5 - D5	Mullakadu	Sawyerpuram	Road Widening	2 - 4 lanes	24 M	4.8
D6 - D6	Pottalkadu	Periyanayagapuram	Proposed New Road	4 lanes	24 M	2.9
D6 - D6	Pottalkadu	Periyanayagapuram	Road Widening	2 - 4 lanes	24 M	4.1
D7 - D7	Perurani	Swaminatham	Road Widening	2 - 4 lanes	24 M	8.5
D7 - D7	Perurani	Swaminatham	Proposed New Road	4 lanes	24 M	1.6
E1 - E1	Mela Maruthur	Keela Lakshmipuram	Proposed New Road	2 lanes	12 M	1.5
E2 - E2	K.Shanmukapuram	Tharuvaikulam	Road Widening	2 lanes	12 M	2.15
E2 - E2	K.Shanmukapuram	Tharuvaikulam	Proposed New Road	2 lanes	12 M	0.54
E2 - E2	K.Shanmukapuram	Tharuvaikulam	Road Widening	2 lanes	12 M	1.7
E2 - E2	K.Shanmukapuram	Tharuvaikulam	Proposed New Road	2 lanes	12 M	0.7
E3 - E3	A.M.Patti	Mela Arasadi	Road Widening	2 lanes	12 M	3
E4 - E4	Ottapidaram	Mela Maruthur	Proposed New Road	2 lanes	12 M	3
E5 - E5	K.Shanmukapuram	Sillanatham	Proposed New Road	2 lanes	12 M	3.4
E5 - E5	K.Shanmukapuram	Sillanatham	Road Widening	2 lanes	12 M	4.9
E6 - E6	Puliamarathu	Nethagi Nagar	Proposed New Road	2 lanes	12 M	2.7
E7 - E7	Sillanatham	Therku Veerapandiapuram	Road Widening	2 lanes	12 M	2
E7 - E7	Sillanatham	Therku Veerapandiapuram	Road Widening	2 lanes	12 M	0.57
E7 - E7	Sillanatham	Therku Veerapandiapuram	Proposed New Road	2 lanes	12 M	0.43
E8 - E8	Muthuswamipuram	Korampallam	Road Widening	2 lanes	12 M	4.6
E8 - E8	Muthuswamipuram	Korampallam	Proposed New Road	2 lanes	12 M	1.4
E9 - E9	Kumaragiri	Thattaparai Vilakku	Road Widening	2 lanes	12 M	5.6
E9 - E9	Kumaragiri	Thattaparai Vilakku	Proposed New Road	2 lanes	12 M	3.2
E10 - E10	Nattathi Zamin	Pazhaiyakayal	Road Widening	2 lanes	12 M	5.5
E10 - E10	Nattathi Zamin	Pazhaiyakayal	Road Widening	2 lanes	12 M	3.8

Proposed Road Link	Origin	Destination	Road Category	No of lanes	Proposed ROW (in m)	Distance (in Km)
E11 - E11	Kootampuli	Mithiya Puram	Road Widening	2 lanes	12 M	4.8
E11 - E11	Kootampuli	Mithiya Puram	Proposed New Road	2 lanes	12 M	1.5
E11 - E11	Kootampuli	Mithiya Puram	Road Widening	2 lanes	12 M	0.8
E12 - E12	Sankaraperi	Jothi Nagar	Proposed New Road	2 lanes	12 M	1
E12 - E12	Sankaraperi	Jothi Nagar	Road Widening	2 lanes	12 M	2.3
E13 - E13	Sankaraperi	Milavittan	Road Widening	2 lanes	12 M	3.2
E14 - E14	Jaya sundara nagar	Jothi Nagar	Road Widening	2 lanes	12 M	1.1
E14 - E14	Jaya sundara nagar	Jothi Nagar	Road Widening	2 lanes	12 M	1.2
E14 - E14	Jaya sundara nagar	Jothi Nagar	Road Widening	2 lanes	12 M	0.95
E14 - E14	Jaya sundara nagar	Jothi Nagar	Road Widening	2 lanes	12 M	0.65
E15 - E15	Pandarampatti Village	Jothi Nagar	Proposed New Road	2 lanes	12 M	2.2
E16 - E16	Davis Puram	T.Saveriarpuram	Road Widening	2 lanes	12 M	1.9
E17 - E17	South Sankaraperi	Pandarampatti Village	Proposed New Road	2 lanes	12 M	0.920
E18 - E18	Maravanmadam	Maravanmadam	Proposed New Road	2 lanes	12 M	0.46
E19- E19	Maravanmadam	Maravanmadam	Proposed New Road	2 lanes	12 M	0.63
E20 -E20	Sankaraperi	Pandarampatti Village	Proposed New Road	2 lanes	12 M	0.51
E21 -E21	Jothi Nagar	Davis Puram	Proposed New Road	2 lanes	12 M	0.365
Total Length (Kms)						**327.835**

 # Note:
All roads proposed for widening to the designated Right of Way (ROW) in this Plan shall be implemented on the ground by taking the existing center line of the road as the reference point with the widening distributed equally on either side, subject to site-specific technical feasibility.



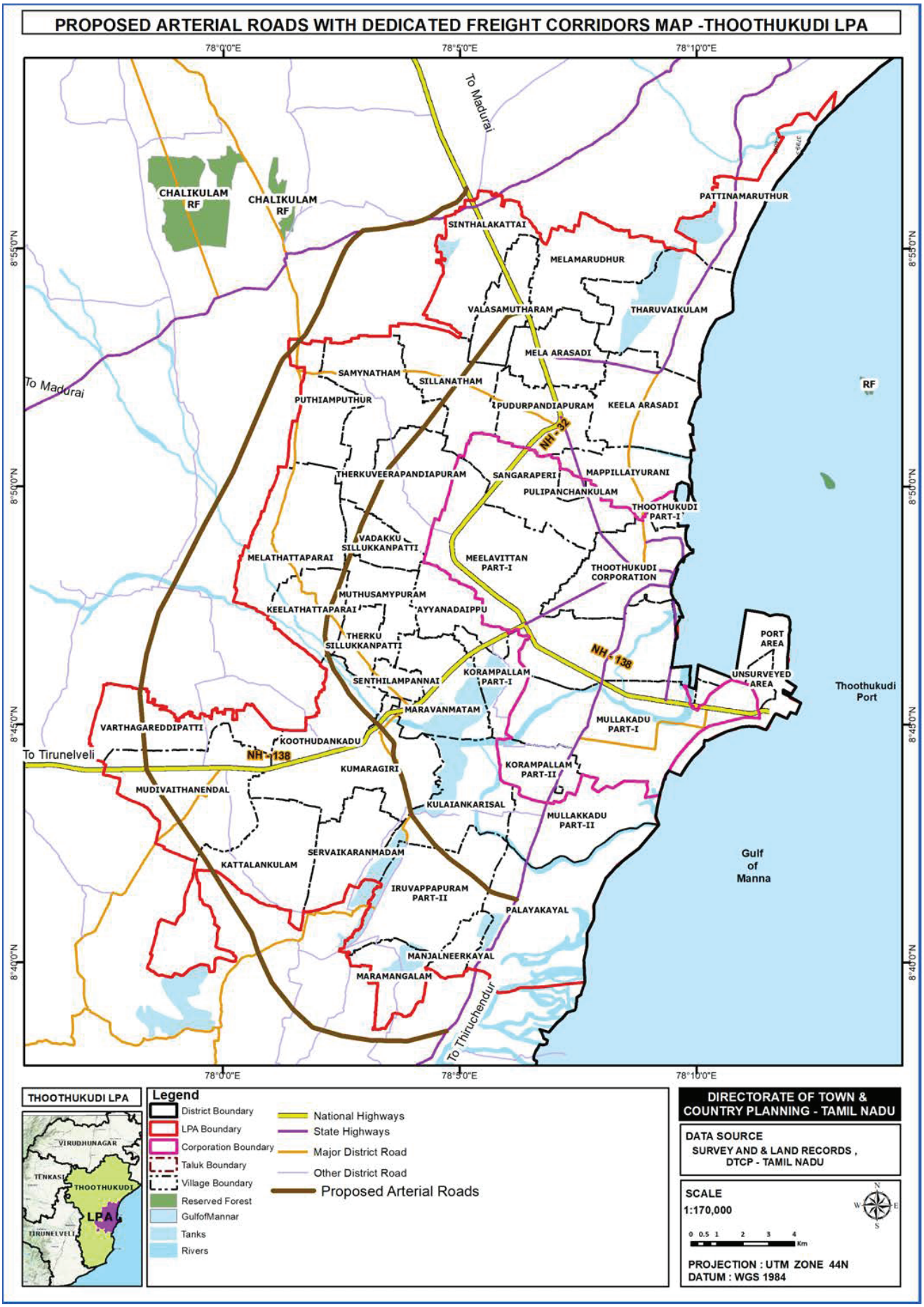
Map 9.18: Proposed Transport Network

A) Arterial Roads With Dedicated Freight Corridors

A proposed network of 60-meter-wide arterial roads with dedicated freight corridors is envisioned to streamline heavy freight movement and significantly reduce urban congestion within Thoothukudi. The Thoothukudi Master Plan 2045 recognizes the city's growing importance as a strategic maritime and industrial hub in South India, necessitating a robust road hierarchy capable of separating regional freight traffic from local urban movement. These high-capacity arterial roads are planned to function as primary freight spines, enabling uninterrupted movement of goods while protecting the city's internal road network from excessive heavy vehicle intrusion.

The primary arterial freight corridor is aligned to function as a regional bypass, facilitating long-distance freight movement around the urban core. This 60-meter-wide arterial road originates at Kurukusalai on NH-38 and traverses outside the core Local Planning Area (LPA), passing through Kurukusalai, Melathattaparai, Thalavaipuram, Varthagareddipatti, Mudivaithanendal, Kaduvetti, and Then Thirupperai, before terminating at SH-176 near Thannerpathal. This corridor is designed to directly serve major industrial and logistics destinations such as the proposed SIPCOT near Allikulam and the Tuticorin Airport. By enabling freight vehicles from the Madurai and Tirunelveli directions to bypass the congested city areas, the arterial corridor significantly reduces travel time, fuel consumption, and logistics costs, while improving overall network efficiency.

Complementing the regional bypass is the strategically aligned Inner Arterial Road with dedicated Freight Corridor, which focuses on the immediate industrial periphery of Thoothukudi. This road commences from NH 38, precisely at the termination point of the newly proposed highway connecting the Nagapattinam and Thoothukudi ports. Traveling parallel to the existing railway line, this serves as a critical link for the city's major economic engines. It passes through Melamaruthur, Valasamutharam, Sillantham, Therkuveerapandiapuram, Vadakku Sillukkanpatti, Keelathattaparai, Therku Sillukkanpatti, Koothudankadu, Kumaragiri, and Kulaiankarisal, before concluding at SH 176 near Palayakayal. This is specifically engineered to support the "Port-led Industrialization" model by connecting the International Furniture Park, the VinFast EV plant, the proposed Multi-Modal Logistics Park, and various container terminals. With a dedicated corridor for freight movement, the Inner Arterial Road with dedicated Freight Corridor ensures that the "Last Mile" connectivity for the port remains efficient and uninterrupted by local passenger traffic.



Map 9.19: Proposed Arterial roads with Dedicated Freight Corridors of Ring Roads

In the Indian planning context, the adoption of a 60-meter Right of Way (ROW) for these arterial roads is consistent with IRC:86-1983 and URDPFI Guidelines, which recommend such widths for major urban arterials catering to heavy traffic volumes and future capacity augmentation. The incorporation of dedicated freight lanes within the 60 m ROW follows IRC: SP:84-2014, ensuring safe and efficient movement of multi-axle freight vehicles by segregating them from smaller and slower-moving traffic. The parallel alignment of one arterial corridor with the railway line reflects the principles of the Gati Shakti framework, promoting multi-modal integration by creating a common freight movement spine for both road and rail. The 60 m ROW allows for divided carriageways, service roads for local access, landscaped medians, pedestrian infrastructure, and utility corridors essential for supporting industrial development.

The implementation of these arterial roads with dedicated freight corridors delivers multiple urban, economic, and environmental benefits for the Thoothukudi LPA. From an urban planning perspective, these corridors guide planned urban expansion, preventing unregulated ribbon development and encouraging structured growth within designated residential, commercial, and industrial zones. By diverting heavy freight traffic away from city streets, they significantly reduce congestion, air pollution, noise levels, and road safety risks within the corporation limits. Economically, improved freight efficiency enhances the competitiveness of the Tuticorin Port and strengthens Thoothukudi's position in global supply chains. The seamless integration of the port, airport, industrial parks, and logistics hubs through high-capacity arterial corridors positions the city as a resilient and self-sustaining industrial ecosystem aligned with the Master Plan 2045 vision.

To further support long-haul freight operations, way-side amenities and truck terminals are at regular intervals along these arterial corridors. These facilities include designated truck parking areas, restrooms, food courts, fuel stations, and emergency services, functioning as holding and buffer zones for freight traffic. Such infrastructure improves driver welfare, reduces unsafe roadside parking, and ensures smooth, uninterrupted movement along the city's principal freight corridors.

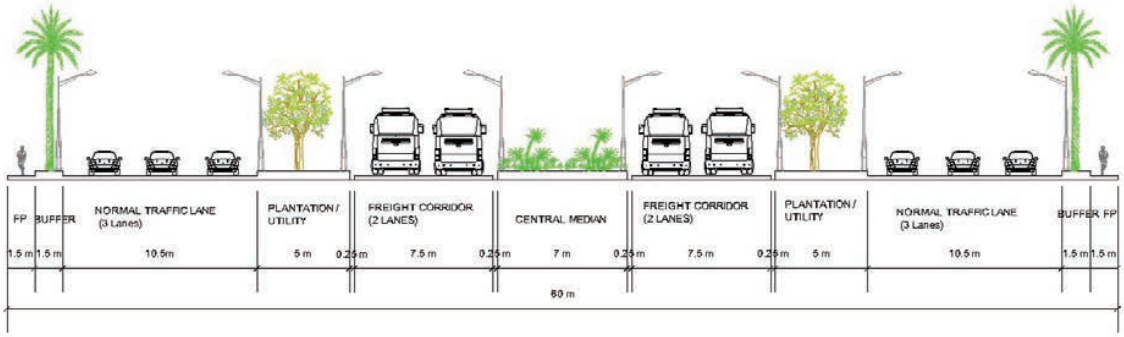


Figure 9.46: Proposed Typical Mid-Block Section for 60 m ROW Freight Corridor

B) Public Transport Strategy And Action Plan

India's National Urban Transport Policy (NUTP) emphasizes the paradigm shift toward moving people rather than vehicles. For the Thoothukudi Local Planning Area (LPA), achieving a higher proportion of trips via public transport is not merely a logistical goal but a necessity for evolving into an environmentally sustainable and energy-efficient industrial hub. Given the city's strategic role as a port city and its rapid industrial expansion, mass transit solutions significantly outperform personalized modes in terms of energy efficiency and carbon footprint reduction.

The Master Plan for Thoothukudi outlines a comprehensive strategy and action plan designed to elevate the public transport mode share. Drawing from regional mobility assessments and current traffic characteristics—where high volumes of internal and inbound transit are noted—this multi-faceted approach includes:

Strengthening of the Intra-City Bus System and Paratransit: Augmenting the existing fleet managed by TNSTC Tirunelveli to meet projected demand and improving the reliability of the paratransit network to ensure "Last-Mile" connectivity across the LPA.

Development of Integrated Inter-City Bus Terminals: Establishing modern, high-capacity facilities like the proposed 50-acre Vagaikulam terminal to cater to suburban expansion and inter-city movement, thereby reducing the pressure on the city core.

Modernization of Existing Transit Hubs: Phased upgradation of the Old and New Bus Stands to improve passenger amenities, safety, and operational efficiency through better terminal management.

Expansion of Maintenance Infrastructure: Development of new bus depots at Kumaragiri and Sinthalakattai to support a modernized and larger fleet, ensuring better vehicle upkeep and service frequency.

Integrated Multi-Modal Planning: Creating seamless linkages between bus services, the railway network (including Melur and Meelavittan), and industrial corridors to provide a holistic and attractive alternative to private vehicle use.

Table 9.29: Bus Fleet Requirement

Years	Existing Bus Fleet	Thoothukudi LPA Population and projection (lakhs)	Projected Bus Fleet Size
2025	366	7,02,029	280
2035	-	11,13,062	440
2045	-	15,77,110	640

Table illustrates the bus fleet requirement for 2025, 2035, and 2045. The augmentation of the bus fleet to the required strength shall be planned in accordance with the annual bus condemnation and replacement plan.

Following the Service Level Benchmarks (SLB), cities with a population up to 20 lakhs require 40 buses per lakh population. For Thoothukudi, which is projected to reach approximately 15.77 lakh by 2045, this standard dictates a significant expansion of the fleet. While the current existing fleet is 366 buses, the projections suggest a requirement of 640 buses by 2045 to maintain adequate service levels. To avoid the radial convergence issues (where all buses converge in the city center), Thoothukudi's expanded fleet should prioritize direct connectivity between suburbs.

Table 9.30: Phasing of Augmentation of bus system

S No	Phases	Period	No of Buses to be Augmented
1	Phase 1	2025 – 2030	50
2	Phase 2	2030 – 2035	50
3	Phase 3	2035 – 2040	90
4	Phase 4	2040 – 2045	90

The augmentation is back-loaded, with the largest increases (90 buses each) occurring after 2035. This matches the Aspirational Growth (AG) scenario modeled in regional planning, where high-value industrial and service sector expansion drives sudden spikes in migration and transit demand in the later decades. By phasing the augmentation, the LPA can ensure that infrastructure like depots and terminals is built before the fleet arrives, avoiding the congestion and unorganized parking challenges. It is recommended to introduce low-floor buses and increase air-conditioned services to improve passenger comfort and

encourage a shift from private vehicles to public transport. In line with the Government of Tamil Nadu's New Comprehensive Minibus Scheme, unserved habitations and villages shall be connected through privately operated minibuses, strengthening peripheral connectivity within the LPA and ensuring last-mile access.

Development and Upgradation of Bus Stops

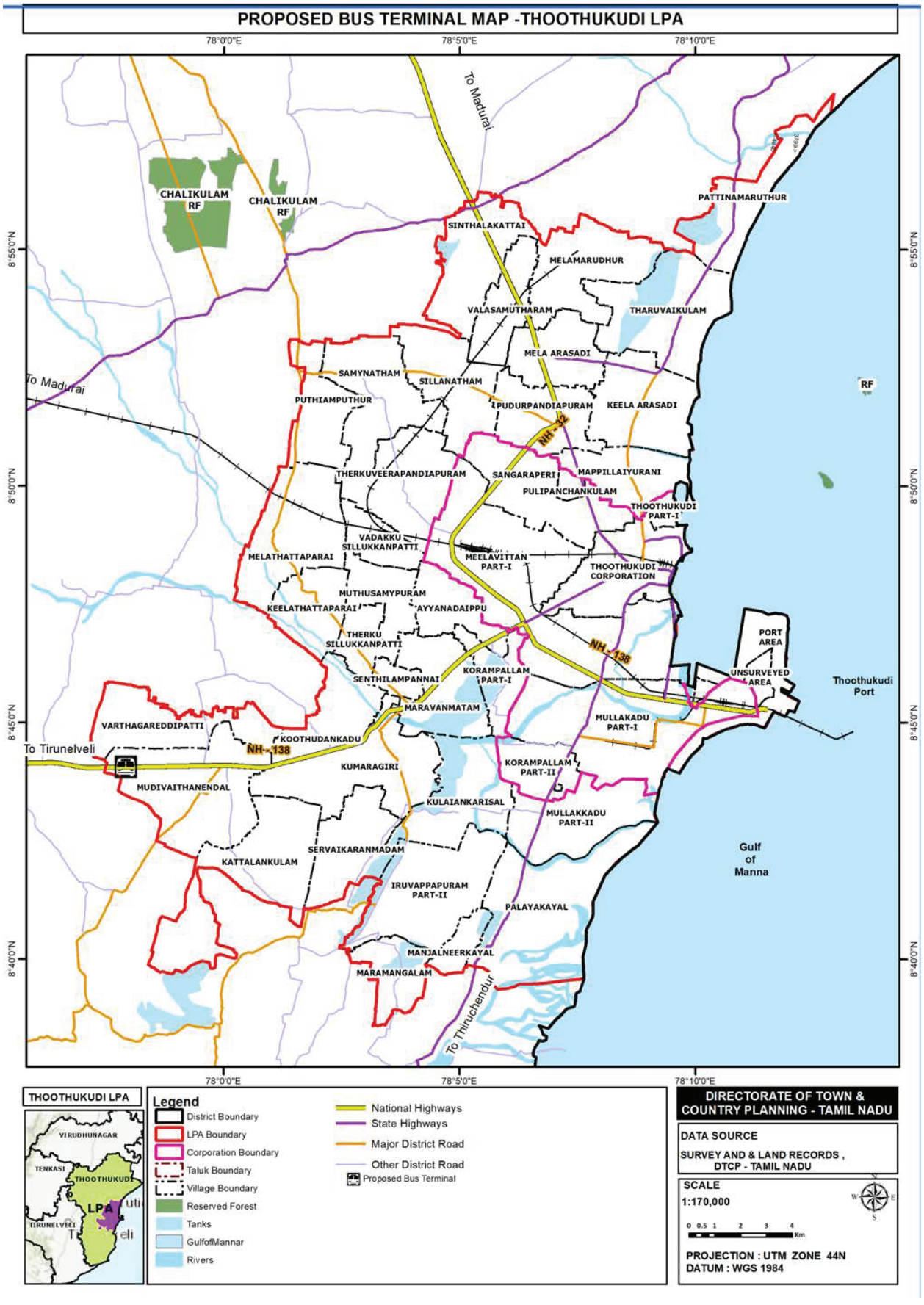
Existing bus stops within the LPA are largely unorganised, with buses halting on the carriageway, causing traffic disruptions and operational inefficiencies. To address this, well-planned, designated bus stops with shelters shall be provided along bus routes to enable orderly boarding and alighting. Bus stops shall be designed to ensure passenger comfort, convenience, and safety through adequate shelter, seating, lighting, and information systems.

Bus stops are recommended at intervals of 500–800 m along the core city transit network and at around 1 km in expanded areas, depending on population density.

Along arterial roads, provision of bus bays is recommended to avoid on-carriageway stopping, improve traffic flow, and enhance safety. Where required, limited land acquisition may be undertaken. Bus bay platform lengths shall be determined based on peak-hour bus frequency and passenger demand.



Proposed Bus Terminal



Map 9.20: Proposed Bus Terminal

This table identifies the primary new terminal project for the region.

Table 9.31: Details of Proposed New Bus Terminal for the Thoothukudi LPA

S No	Proposed Bus Terminal Locations	Area (acres)	Phase
1	Bus terminal at Vagaikulam	50	Phase -1

The selection of Vagaikulam (50 acres) for a major terminal in Phase 1 is a strategic move to decentralize traffic. At 50 acres, this terminal is significantly larger and is intended to function as an "Integrated Bus Terminal"

Proposed Bus Terminal Upgradation

Table 9.32: Proposed Bus Terminals Upgradation and Phasing

S No	Proposed Bus Terminal Locations	Phase
1	New Bus Stand	Phase -2
2	Old Bus Stand	Phase -1

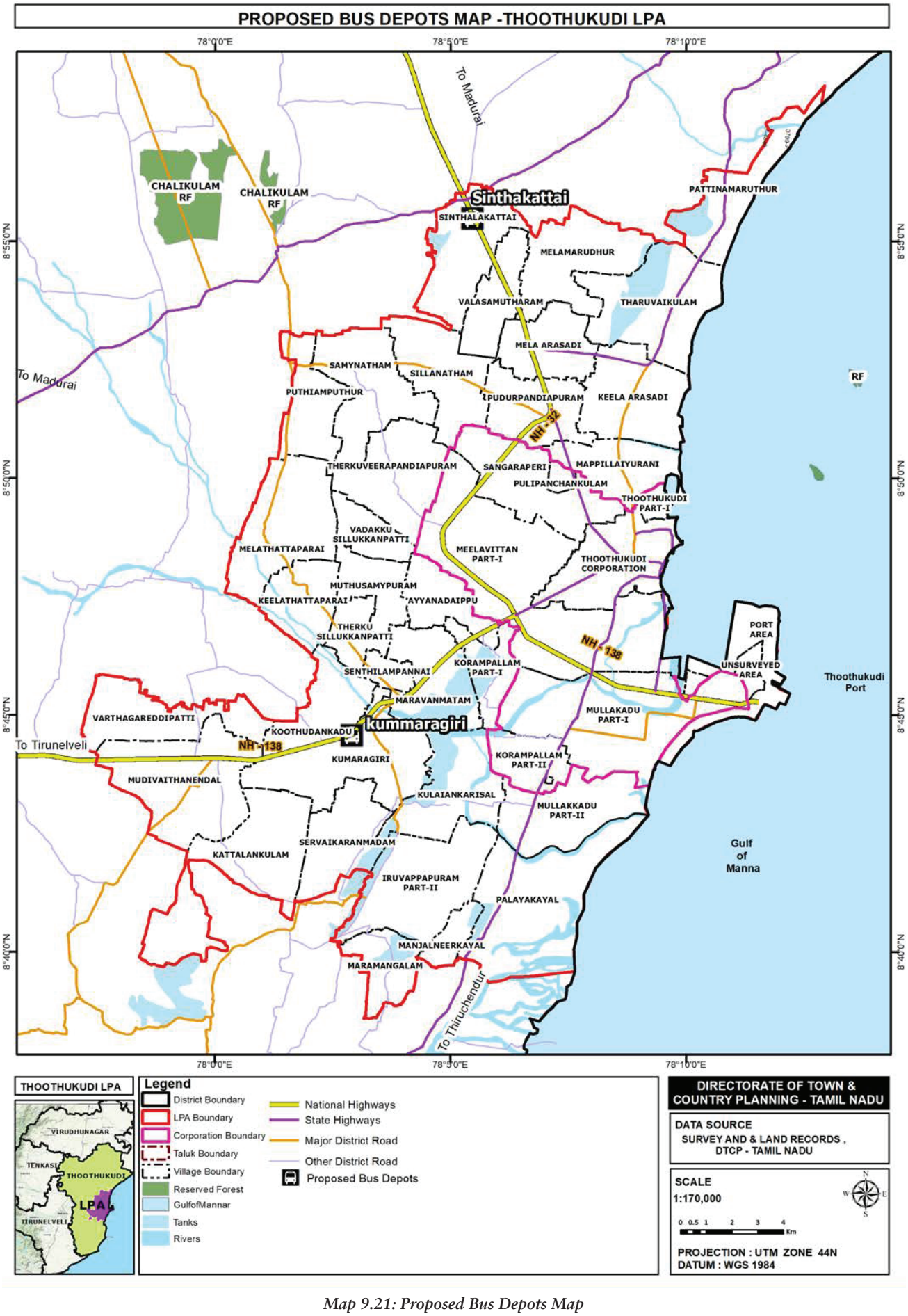
Upgrading the Old Bus Stand in Phase 1 suggests an urgent need to address existing congestion and passenger amenity gaps in the central business district. upgradation should focus on Multi-Modal Integration (MMI), ensuring seamless transfers between city buses and mofussil services, and providing dedicated pedestrian zones to improve safety, which is currently a major concern in high-footfall areas.

Both depots are scheduled for Phase 1, indicating that maintenance infrastructure is a prerequisite for the initial fleet augmentation of 50 buses. A 6.5-acre site for each depot provides sufficient space for fleet modernization and digital maintenance tracking, which are key strategies for sustainable urban mobility. These locations should be integrated into Industrial Clusters or Multi-Sectoral MSME Clusters to ensure they serve as transit nodes for workers, thereby reducing the reliance on private two-wheelers which currently account for the majority of road accidents.

Table 9.33: Details of Proposed Bus Depot Facilities

S No	Proposed Bus Depot Locations	Area (acres)	Phase
1	Kumaragiri	6.5	Phase -1
2	Sinthalakattai	6.5	Phase -2

Proposed Depot Locations



Map 9.21: Proposed Bus Depots Map

C) Integrated Mass Transit: The BRTS Corridors Of Thoothukudi

BRTS Corridor is proposed along the Palayamkottai and Ettaiyapuram road.

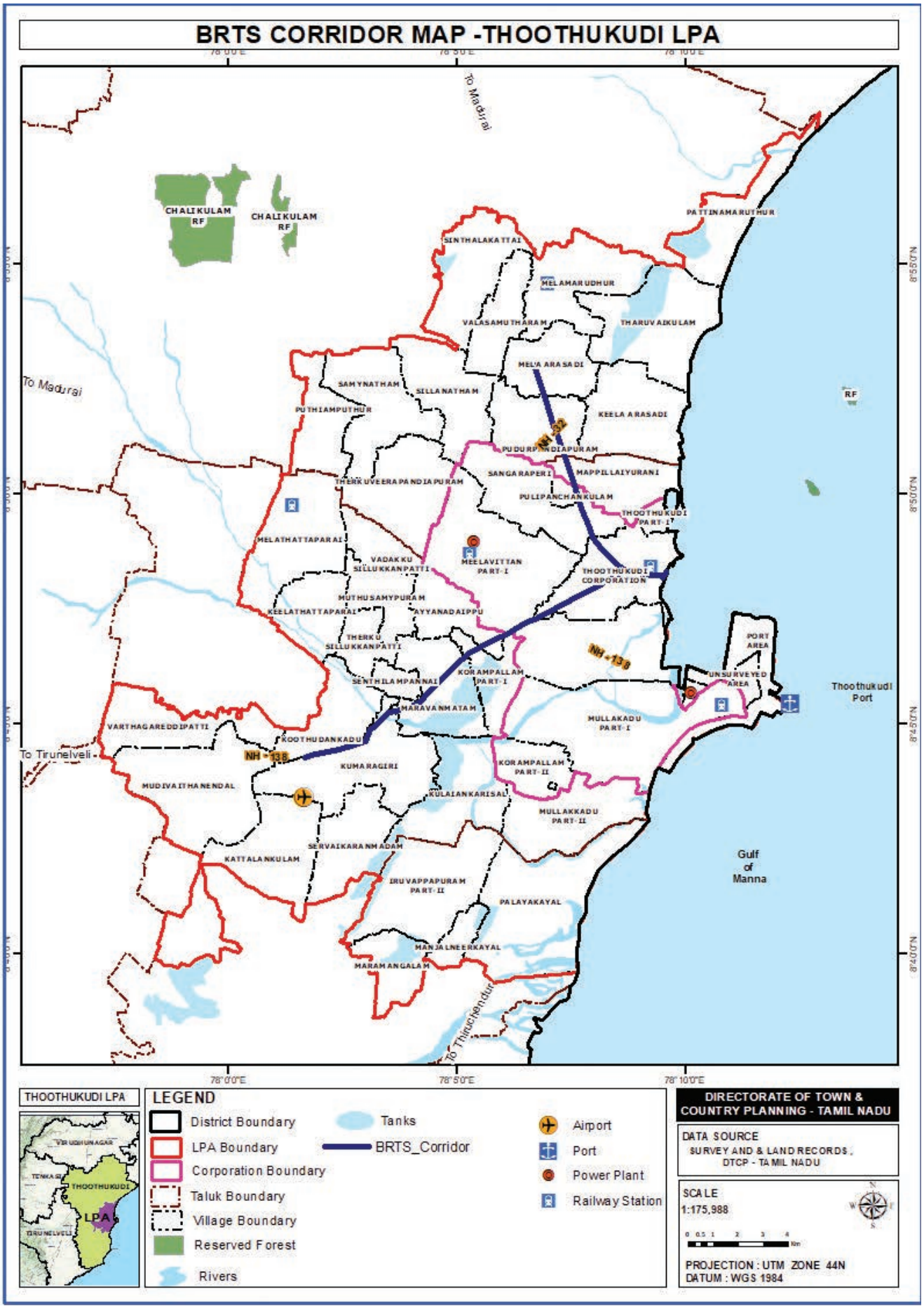
The proposal for two dedicated Bus Rapid Transit System (BRTS) corridors serves as the backbone of the city's future public transportation network. These corridors are designed to transform urban mobility in this industrial-port city by providing a high-frequency, reliable alternative to private transport.

The master plan identifies the Old Bus Stand as the central multi-modal hub from which two primary BRTS axes originate. The first corridor connects the Old Bus Stand to the Tuticorin Airport, traversing the city's major administrative and commercial zones. This link is vital for enhancing business connectivity, ensuring that air passengers and airport staff have a time-bound, congestion-free transit option. The second corridor extends from the Old Bus Stand to the Thoothukudi Outer Bypass Flyover. This alignment serves as a critical bridge between the dense urban core and the high-speed regional network of the Outer Ring Road. By terminating at the bypass flyover, the BRTS enables seamless transfers for commuters traveling from the hinterland and industrial suburbs into the city center. Together, these corridors form a "V" shaped transit spine that effectively covers the city's primary growth directions toward the west and southwest.

The proposal follows the IRC:124-2017 (Bus Rapid Transit Design Guidelines for Indian Cities), which advocates for a trunk and feeder model to maximize coverage. Key technical norms adopted for the Thoothukudi BRTS include:

Dedicated Right-of-Way (ROW): To ensure reliability, the buses will operate in physically segregated lanes, preferably aligned in the median of the road to minimize conflicts with turning traffic at side streets.





Map 9.22: Proposal of BRTS Corridor Map

Table 9.34: Details of Proposed Bus Depot Facilities

S No	Proposed BRTS Corridors	Kms	Phase
1	Thoothukudi Railway Station - Airport	18	Phase -1
2	Old Bus Stand – Mel Arasadi	10	Phase - 2

Level Boarding and Station Design: In line with Universal Accessibility standards, stations will feature platform-level boarding to facilitate quick entry and exit for all passengers, including the elderly and persons with disabilities.

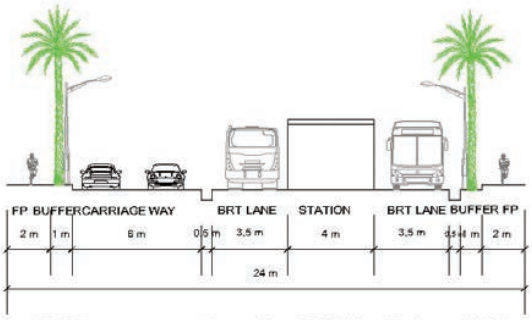
Off-Board Fare Collection: To minimize dwell time (the time a bus spends at a stop), the master plan proposes off-board ticketing systems, allowing passengers to validate their fare before the bus arrives.

Signal Priority: The implementation of Intelligent Transportation Systems (ITS) will provide BRTS vehicles with green-signal priority at major intersections, ensuring they remain independent of the prevailing traffic congestion.

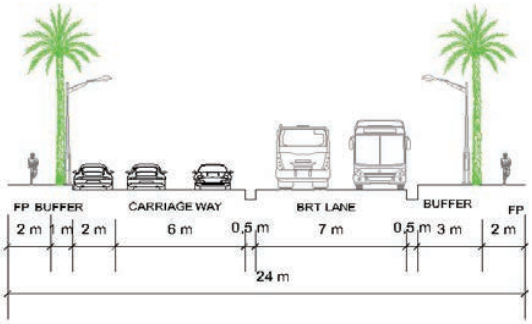
For a rapidly industrializing city like Thoothukudi, the BRTS offers several transformative advantages like A dedicated mass transit system provides affordable and efficient transport for thousands of industrial workers commuting to the furniture parks, SIPCOT zones, and the port, reducing their dependence on private two-wheelers, encourages a modal shift from private vehicles to high-capacity buses, the BRTS significantly reduces per-capita carbon emissions and mitigates the urban heat island effect caused by heavy traffic.

Dedicated lanes reduce the interaction between heavy buses and vulnerable road users like cyclists and pedestrians. Studies in Indian cities have shown that BRT implementation can lead to a significant drop in road fatalities. Unlike expensive Metro Rail projects, BRTS is a cost-effective solution that can be implemented incrementally. It optimizes the existing road space to move 30 times more passengers than private cars in the same area. By providing a high-quality alternative, the BRTS helps prevent the gridlock often seen around the Old Bus Stand and market areas, preserving the functional efficiency of the city's commercial heart.

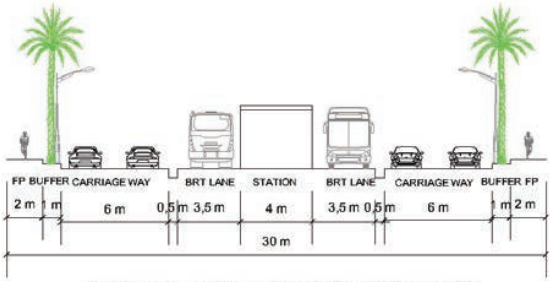
This two-corridor BRTS proposal, combined with the proposed Inner and Outer Ring Roads, ensures that Thoothukudi evolves into a 10-minute city, where major economic and transit hubs are within easy reach of every citizen.



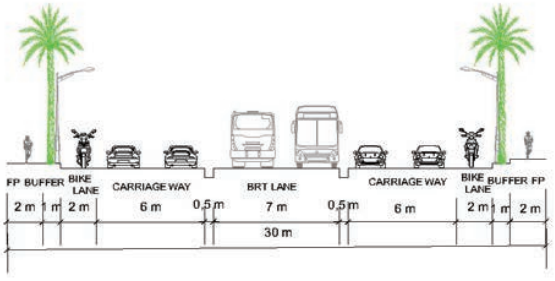
BRT cross sections for ROW of 24 m (With Station Area)



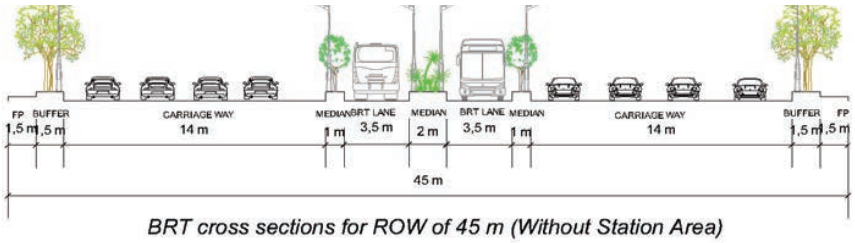
BRT cross sections for ROW of 24 m (Without Station Area)



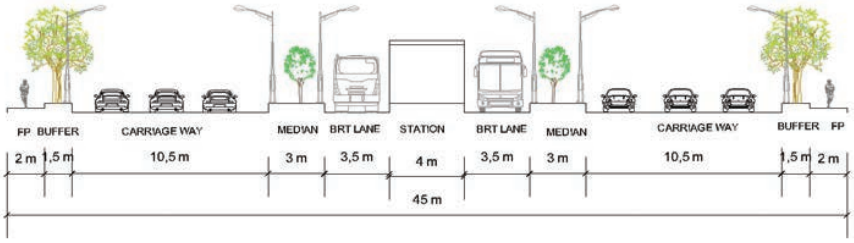
BRT cross sections for ROW of 30 m (With Station Area)



BRT cross sections for ROW of 30 m (Without Station Area)



BRT cross sections for ROW of 45 m (Without Station Area)



BRT cross sections for ROW of 45 m (With Station Area)

Figure 9.47: Proposed BRTS Cross-Section Designs for 24 m, 30 m, and 45 m ROW

D) Rail: Upgradation And Mainline Electric Multiple Unit (Memu) Train Services

The following structure is proposed for the Improvement of Existing Railway Stations in Thoothukudi.

Improvement of Existing Railway Stations

At present, Thoothukudi Railway Station serves as the primary terminal, but its location at a dead-end near the city center creates significant traffic bottlenecks and limits expansion. To support the projected population growth and industrial expansion, it is recommended to develop Thoothukudi Melur and Meelavittan railway stations as satellite passenger terminals. Developing Meelavittan as a secondary hub will help decongest the city core and provide better access to the industrial corridors and the upcoming Multi-Modal Logistics Park (MMLP). Connectivity to these satellite stations shall accordingly be improved through the expansion of the arterial road network.

In addition, the upgradation of existing railway stations is recommended with a focus on the following aspects:

Infrastructure and Facility Enhancements:

- Upgrade Thoothukudi, Thoothukudi Melur, and Meelavittan stations with expanded waiting halls, high-standard sanitation facilities, and integrated digital signage for real-time train tracking.

- Implement comprehensive CCTV surveillance and enhanced lighting (LED) across all platforms and approach roads to ensure commuter safety during late-night hours.
- Incorporate Braille signage, tactile paving, ramps, and lifts at all entry/exit points and foot overbridges (FOBs) to ensure "Barrier-Free" access for the elderly and persons with disabilities.

Accessibility and Last-Mile Connectivity:

- Strengthen and widen the road infrastructure leading to the Thoothukudi Melur and Meelavittan stations to accommodate increased bus and freight traffic.
- Provision of dedicated bays for Intermediate Public Transport (IPT) such as autos and taxis, along with designated bus stops within 100 meters of station entrances to facilitate seamless transfers.
- Strict enforcement of "No-Parking Zones" on station approach roads to prevent bottlenecks and ensure the smooth flow of transit vehicles.

Parking and Pedestrian Infrastructure:

- Develop multi-level or organized off-street parking facilities at the main Thoothukudi terminal to reclaim road space currently occupied by unorganized parking.
- Construction of wide, shaded pedestrian walkways with non-slip surfaces connecting the stations to the nearest major arterial roads, ensuring safety from vehicular traffic.
- Implementation of zebra crossings, pedestrian signals, and refuge islands at the primary entrance points of the stations.

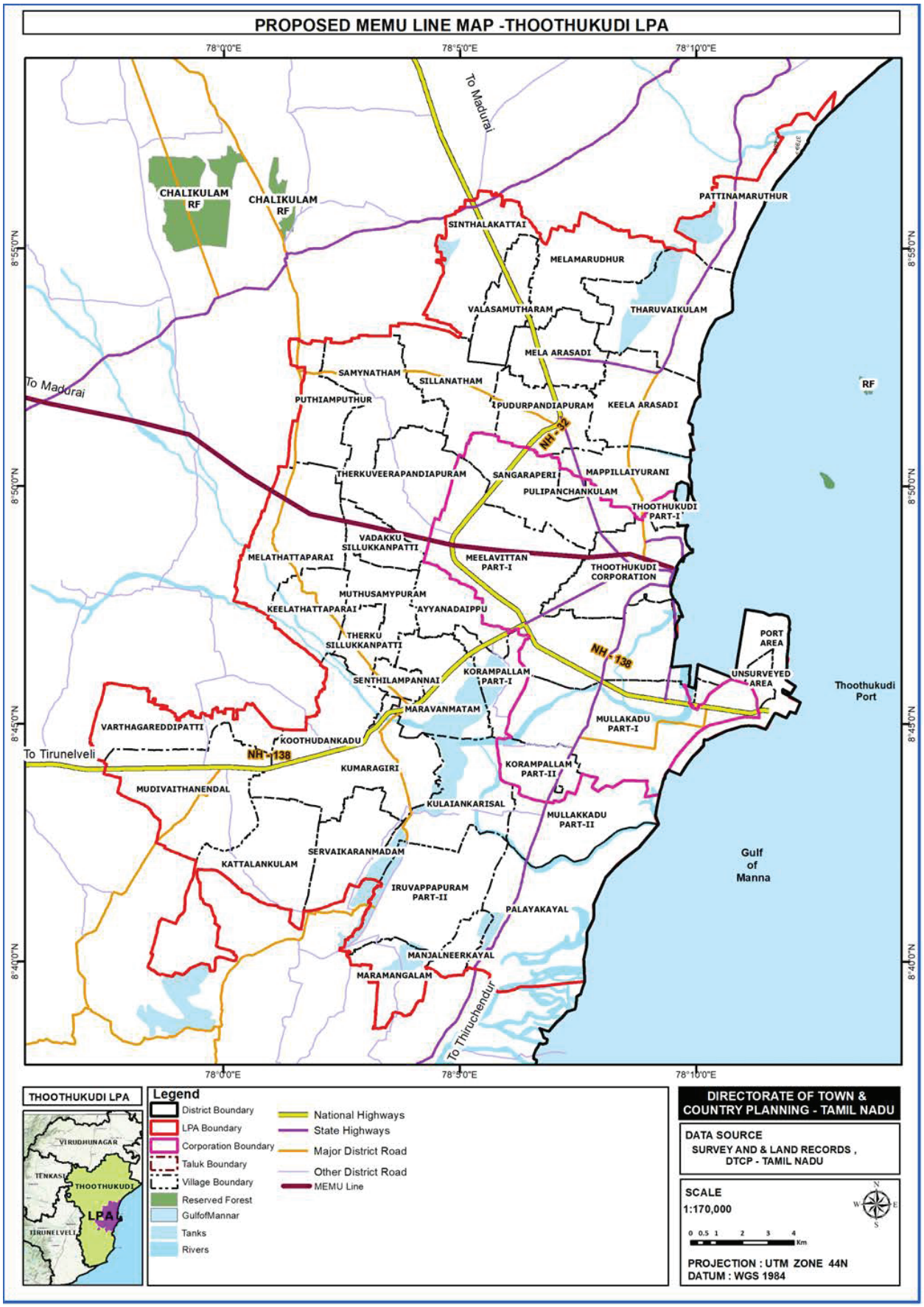
Railway Corridors and Level Crossings:

- Prioritize the construction of Road Over Bridges (ROBs) or Road Under Bridges (RUBs) at high-frequency level crossings (LCs) within the LPA, specifically targeting those on the corridors leading to the Port and the Industrial Estates.
- Align the development of the Meelavittan station with the proposed new bus terminal at Vagaikulam to create a robust multi-modal transit spine for the Thoothukudi region.

Table 9.35: Details of Proposed Madurai–Tuticorin Rail Corridor within LPA

S No	Rail Corridor Proposals	Length (km)	Phase
1	Madurai-Tuticorin via Aruppukottai Rail Line	33 (approximate length within LPA)	Phase -1

Rail Proposals



Map 9.23: Proposal of MEMU Line

In the context of the Thoothukudi Local Planning Area (LPA) Master Plan 2045, the proposal to introduce regular Mainline Electric Multiple Unit (MEMU) train services between Thoothukudi and Tirunelveli represents a paradigm shift from traditional inter-city rail to a high-frequency, commuter-centric transit system. This rail corridor is designed to serve as a Regional Rapid Transit Spine, mirroring the objectives of the National Urban Transport Policy (NUTP) which advocates for the integration of land use and transport planning to support balanced regional growth. By leveraging the existing broad-gauge electrified tracks, the MEMU service provides a cost-effective mass transit solution for the future workforce. It creates a seamless Commuter Shed where residents of Tirunelveli and intermediate towns can easily access the emerging industrial clusters in Thoothukudi, such as the VinFast EV manufacturing plant and the International Furniture Park, thereby reducing the need for workforce migration and promoting a sustainable live-work balance within the region.

The technical justification for adopting MEMU technology over conventional locomotive-hauled passenger trains is supported by Indian Railways standards and IRC:124-2017 design principles. MEMU trains are characterized by their superior acceleration and deceleration capabilities, which are essential for routes with frequent station stops, typically every 8–15 km in a regional context. This allows for a significant reduction in total travel time compared to traditional services. Furthermore, MEMUs utilize 3-phase IGBT-based regenerative braking systems that save up to 35% in energy consumption, aligning with the sustainable development goals of the URDPFI (Urban and Regional Development Plans Formulation and Implementation) Guidelines 2014. The dual-cabin configuration at both ends of the train eliminates the need for time-consuming rake reversals at terminal stations like Thoothukudi or Tirunelveli, effectively increasing the Sectional Capacity of the rail line and allowing for higher frequency during peak industrial shift hours.

The socio-economic benefits of a dedicated MEMU corridor for an industrial city like Thoothukudi are profound. Firstly, it facilitates Transit-Oriented Development (TOD) along the rail axis, where new affordable housing and commercial sub-centers can be planned around transit halts, preventing haphazard urban sprawl. Secondly, by shifting a substantial share of daily commuters from private two-wheelers and buses to rail, the corridor reduces the traffic load and accident risks on the heavily congested NH 138 (Thoothukudi-Tirunelveli Highway). For the industrial sector, the MEMU service ensures a reliable and punctual arrival of the workforce, which is critical for time-sensitive manufacturing operations. Additionally, the lower fare structure of MEMU services—often significantly cheaper than road-based transport—increases the disposable income of the workforce, thereby stimulating the local economy.



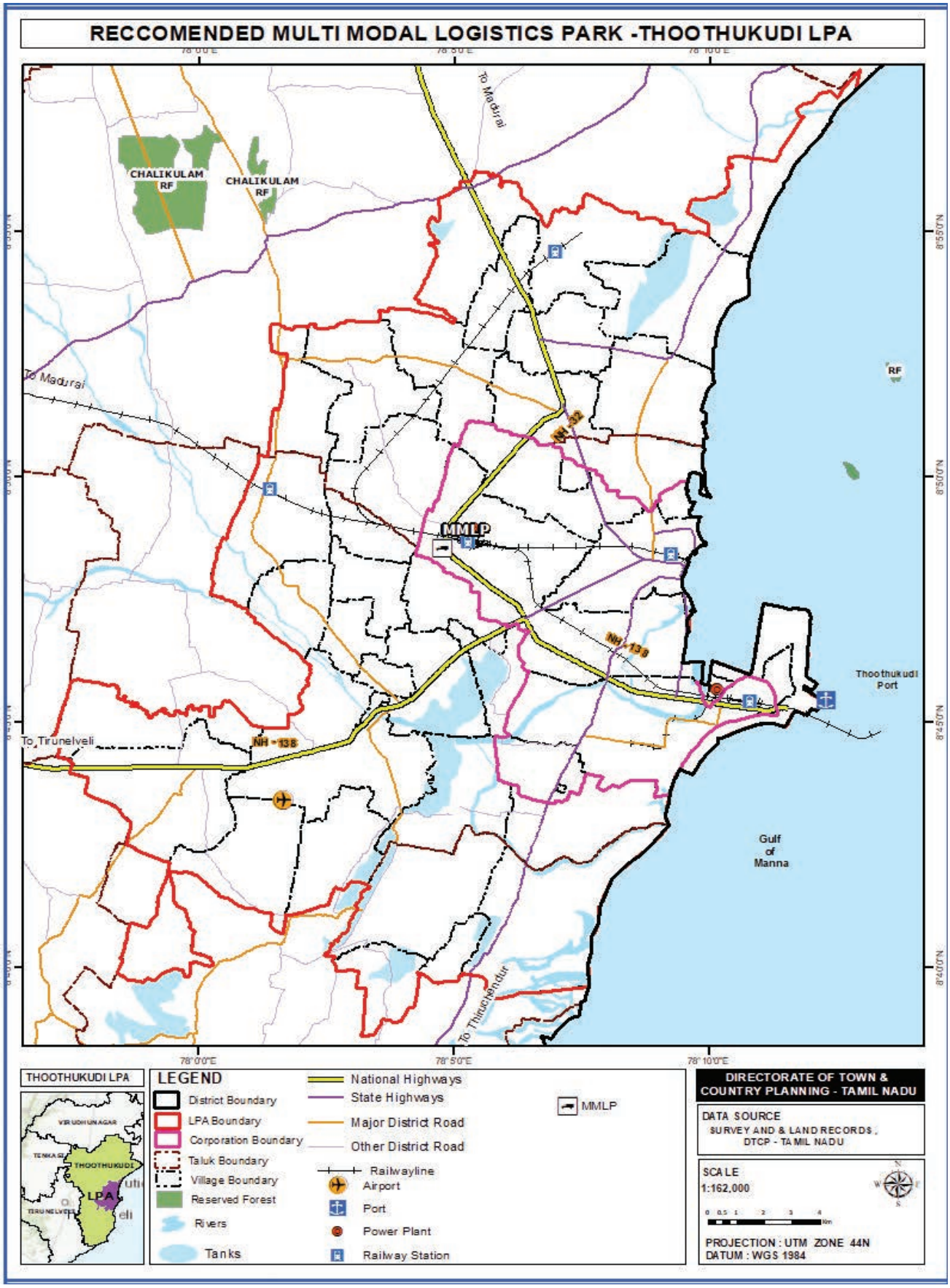
Table 9.36: Details of Proposed Madurai–Tuticorin Rail Corridor within LPA

S No	Rail Corridor Proposals	Length (km)	Phase
1	MEMU Railway Line	58	Phase -1

Ultimately, the MEMU proposal acts as a Multi-Modal Synergy tool, where the railway station serves as the primary node and the proposed BRTS corridors and Ring Roads act as feeder systems to provide last-mile connectivity to the industrial parks. This integrated approach ensures that Thoothukudi evolves not just as a port city, but as a well-connected metropolitan region capable of supporting the high-density travel demand of its 2045 horizon. The implementation of such a system is vital to handle the projected millions of person-trips and to maintain the city's competitive edge as a global industrial and logistics hub.



E) Proposal For Multimodal Logistics Parks: Melavittan



Map 9.24: Recommendation of Multi Modal Logistics Park

The proposal to establish a Multimodal Logistics Park (MMLP) near Melavittan Railway Station is a cornerstone of the Thoothukudi Master Plan 2045, designed to leverage the city's unique position as a port-led industrial hub. In the Indian context, MMLPs are no longer viewed merely as clusters of warehouses but as integrated, next-generation ecosystems where different transport modes—road, rail, and and sea—converge seamlessly to reduce the overall logistics cost, which currently stands at 13–14% of India's GDP. The Melavittan site is strategically selected to utilize the existing rail-head infrastructure, providing immediate access to the Indian Railways network for the evacuation of bulk and containerized cargo from the V.O. Chidambaranar Port. This location enables efficient consolidation and onward movement of port-linked freight while minimizing heavy truck movement through the urban core.

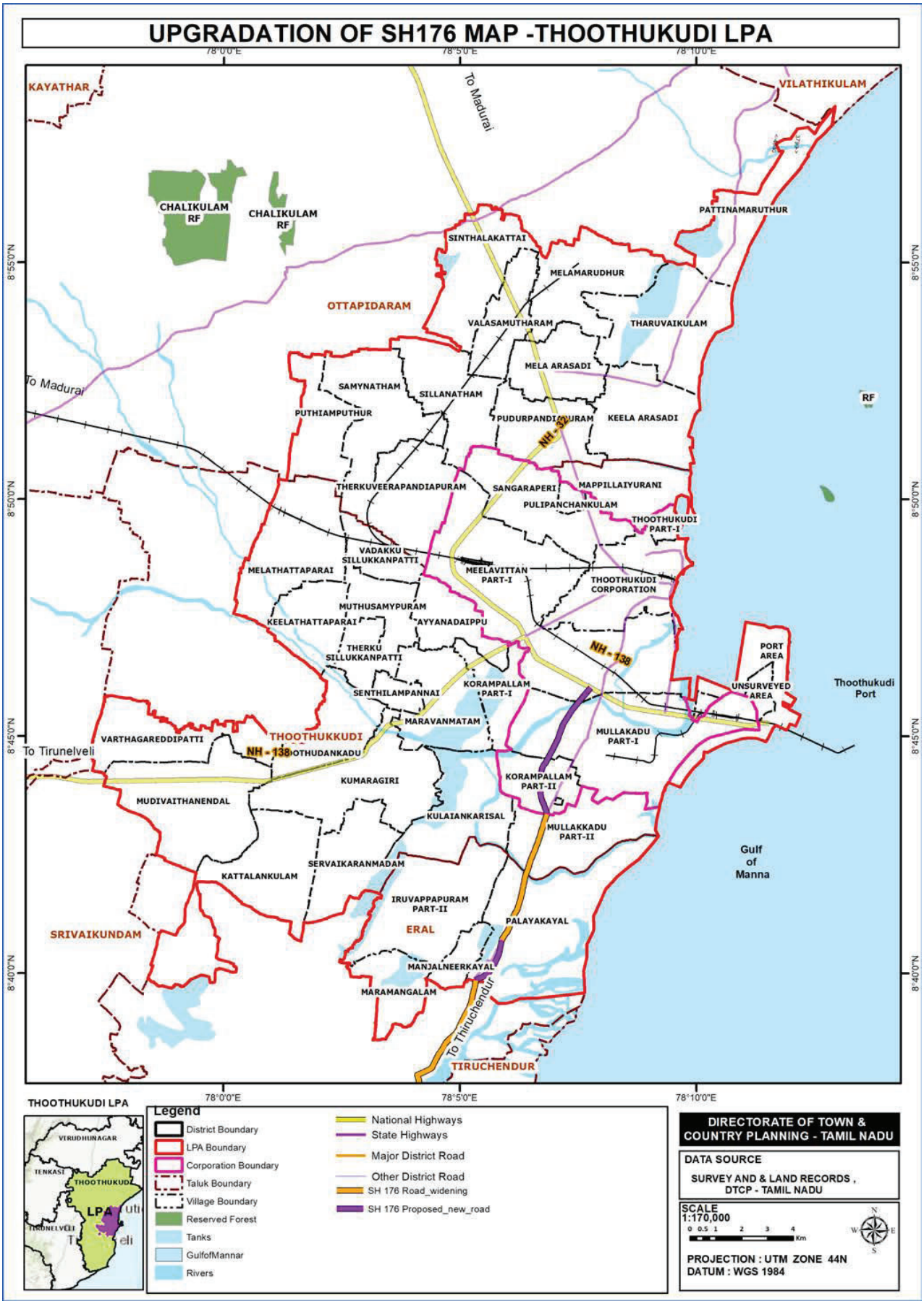
The planning framework for the Melavittan MMLP is derived from the Ministry of Road Transport and Highways (MoRTH) guidelines and IRC: SP:84-2014 for high-capacity logistics infrastructure. As per the Draft Policy on Development of MMLPs in India, a standard MMLP must occupy a minimum contiguous area of 100 acres to accommodate essential inter-modal facilities. The provision of 30 m and 60 m Right of Way (ROW) for the connecting highways, as recommended by IRC:73 and IRC:86, ensures smooth ingress and egress of heavy multi-axle freight vehicles without causing traffic bottlenecks on surrounding road networks. The close proximity of the site to the railway corridor allows for the development of a Gati Shakti Multi-Modal Cargo Terminal (GCT) in line with Indian Railways' GCT Policy, which mandates at least two rail-handling tracks and a dedicated rail siding. This enables a functional modal shift from road to rail, a key objective for reducing the carbon footprint of port-led cities.

To cater to the high freight intensity associated with a major port city like Thoothukudi, the Melavittan MMLP is required to comply with the provisions of the National Logistics Policy. The infrastructure shall include mechanized material handling systems and automated warehousing to ensure faster turnaround times for EXIM (Export–Import) cargo. The provision of Customs Bonded Areas and an Inland Container Depot (ICD) within the park enables on-site customs clearance, significantly reducing congestion at port gates. In addition, temperature-controlled cold storage facilities for food and pharmaceutical commodities, along with designated hazardous cargo handling yards, form essential components of the logistics ecosystem. The MMLP also supports Value Added Services (VAS) such as labeling, kitting, and light assembly, enabling global manufacturers to adopt Thoothukudi as a late-stage manufacturing and distribution hub. Integration with the Unified Logistics Interface Platform (ULIP) ensures real-time cargo tracking and seamless digital documentation across multiple government agencies.

The implementation of the Melavittan MMLP generates substantial socio-economic and environmental benefits. By consolidating freight movement at a single, rail-connected logistics hub, the city can achieve logistics cost savings of up to 10 percent by eliminating secondary freight movements between fragmented facilities. From an urban management perspective, the MMLP functions as a freight traffic interceptor, preventing heavy port-bound trucks from entering the city core and thereby reducing congestion, road deterioration, and air pollution. Economically, the logistics park is expected to attract ancillary industries such as packaging units, third-party logistics (3PL) providers, and technology-driven supply chain services, resulting in significant skilled employment generation. Environmentally, the emphasis on rail-based cargo evacuation aligns with India's Net Zero commitments by lowering per-ton carbon emissions. Overall, the Melavittan MMLP acts as the logistical backbone of the Thoothukudi industrial ecosystem, strengthening the city's competitiveness and resilience in alignment with the Master Plan 2045 vision.

F) Upgradation Of State Highway- 176

The proposal to upgrade the existing State Highway 176 (SH-176) to a 30-meter Right of Way (ROW) is a vital intervention aimed at addressing the current capacity constraints. SH-176 serves as a critical link between the core urban area and peripheral industrial zones, but its current performance is hampered by an oversaturated Volume-to-Capacity (V/C) ratio. This saturation leads to significant traffic delays, increased fuel consumption, and higher accident risks, particularly involving heavy multi-axle vehicles common in this port-driven economy. By expanding the ROW to 30 meters, the Master Plan seeks to restore a high Level of Service (LOS), ensuring that the road can effectively handle projected traffic volumes through the 2045 horizon. This expansion is essential for creating a Mobility Corridor that can sustain the rapid industrialization of Thoothukudi, facilitating the smooth flow of raw materials and finished goods from the port to the regional hinterland.

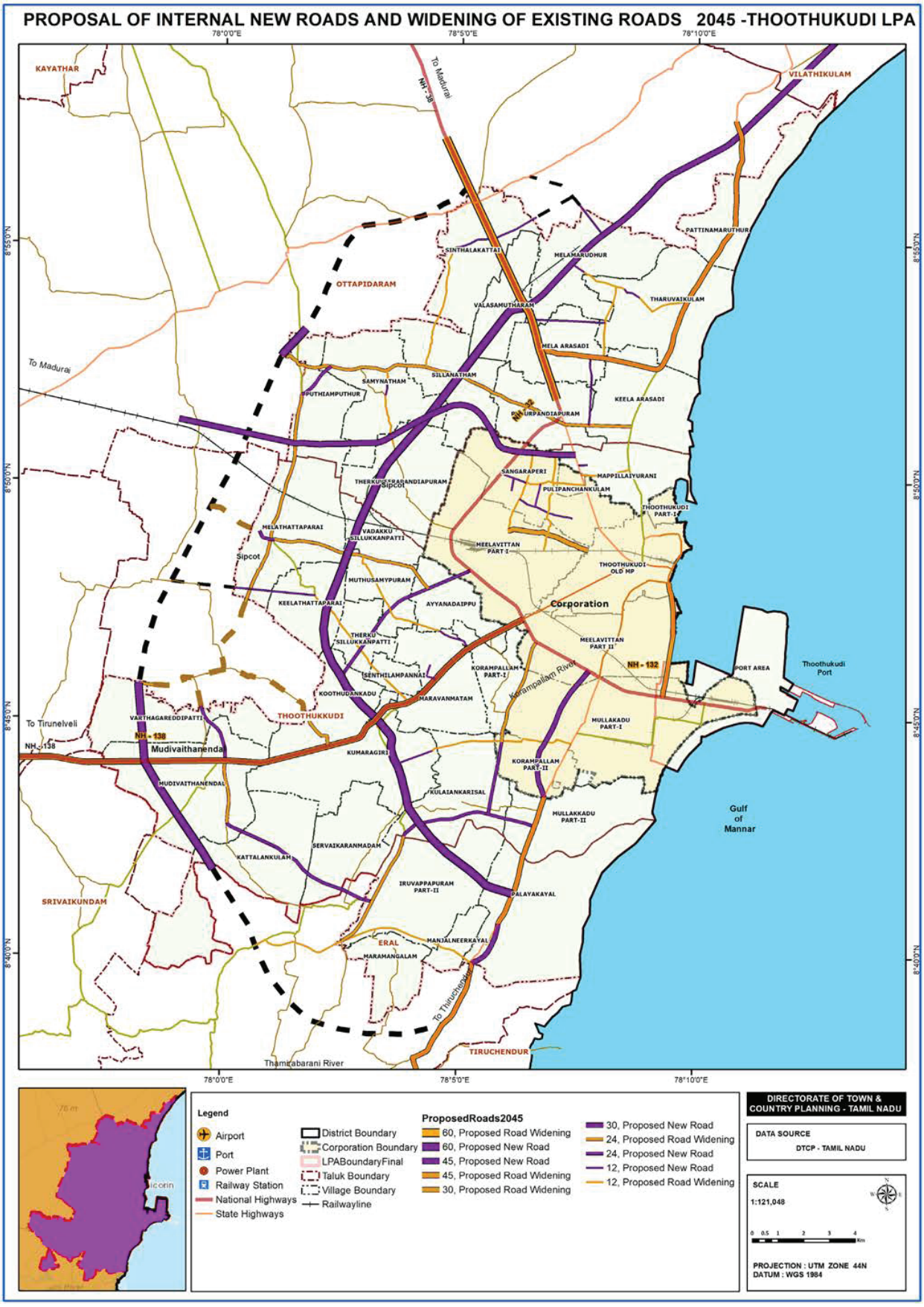


Map 9.25: Upgradation of SH-176

The justification for a 30-meter ROW is firmly rooted in the technical recommendations of the Indian Roads Congress (IRC) and the URDPFI Guidelines. According to IRC:73-1980 (Geometric Design Standards for Rural Highways) and IRC:86-2018 (Geometric Design Standards for Urban Roads), a 30-meter width is the standard requirement for an arterial or sub-arterial road designed to accommodate a four-lane divided carriageway with additional space for essential urban amenities. This ROW allows for the provision of 3.5-meter-wide lanes, a 2-to-3-meter central median to prevent head-on collisions, and dedicated 2.5-meter service lanes or utility corridors on either side. Furthermore, the IRC:64-1990 (Guidelines for Capacity of Roads) suggests that when the V/C ratio exceeds 0.8, widening becomes mandatory to prevent the road from reaching a complete state of gridlock. In the Indian planning context, this 30m standard also accounts for the Building Line and Control Line requirements, ensuring that future roadside developments do not encroach upon the highway's functional capacity and safety zones.

Upgrading SH-176 offers a multitude of benefits tailored to the unique needs of an industrial port city like Thoothukudi. From a logistics perspective, a widened highway reduces the Turnaround Time for freight trucks moving between the V.O. Chidambaranar Port and local industrial parks, directly enhancing the city's global trade competitiveness. Improved road geometry and the introduction of a central median significantly reduce the frequency of fatal accidents, which are often high on narrow, oversaturated highways carrying heavy industrial traffic. Additionally, the upgraded corridor facilitates better Workforce Mobility, allowing employees to commute safely and quickly from residential neighborhoods to the furniture parks and manufacturing units. Environmentally, the reduction in stop-and-go traffic leads to a decrease in per-vehicle emissions, contributing to better air quality within the LPA. By providing a reliable transit spine, the upgraded SH-176 also acts as a catalyst for Transit-Oriented Development (TOD), attracting organized commercial and institutional investments along its alignment and fostering a more structured and sustainable urban form for the year 2045.

G) Proposal For Internal New Roads And Widening Of Existing Roads



Map 9.26: Proposal of Internal Roads

The Thoothukudi Local Planning Area (LPA) Master Plan 2045 envisions a transformative infrastructure network that integrates regional freight movement with local urban mobility. Central to this vision, as indicated in the above map, is a hierarchical road system comprising ring roads, bypasses, and an extensive network of widened existing roads and new link roads. While the primary freight corridors like the 60m Arterial Roads cater to massive industrial clusters—including the International Furniture Park, VinFast EV plant, and the proposed Multi-Modal Logistics Park (MMLP) near Melavittan—the effectiveness of these high-capacity corridors depends significantly on the "last-mile" connectivity provided by the local street network. The proposal to widen existing roads to 40 feet (approximately 12 meters) and establish new link roads is a strategic move to ensure that the city's residential and commercial cores remain accessible and well-integrated with the regional expressways. This comprehensive approach ensures that the "ribbon development" often seen in industrial cities is replaced by a structured, grid-based growth pattern that facilitates smooth traffic transition from neighborhood streets to major thoroughfares.

The justification for these interventions is firmly rooted in Indian urban planning norms, specifically the URDPFI (Urban and Regional Development Plans Formulation and Implementation) Guidelines 2014 and IRC:86-2018 (Geometric Design Standards for Urban Roads and Streets). In the Indian context, a 40-foot (12m) ROW is categorized as a "Collector Street" or a major "Local Street," which is essential for roads serving as feeders to sub-arterial and arterial systems. According to IRC:106-1990 (Guidelines for Capacity of Urban Roads), widening existing narrow streets to a standard 12m allows for a two-lane undivided carriageway with dedicated space for safe pedestrian footpaths and essential utility ducting. This width is the minimum required to maintain a safe Level of Service (LOS) in mixed-traffic conditions, common in cities like Thoothukudi where two-wheelers, cars, and light commercial vehicles share the road. Furthermore, the creation of new link roads aligns with the principles of Network Connectivity and Redundancy, ensuring that in the event of congestion on a main artery, traffic can be redistributed through parallel link routes, thereby preventing total gridlock—a critical requirement for a city handling over 20,000 trucks at any given time.

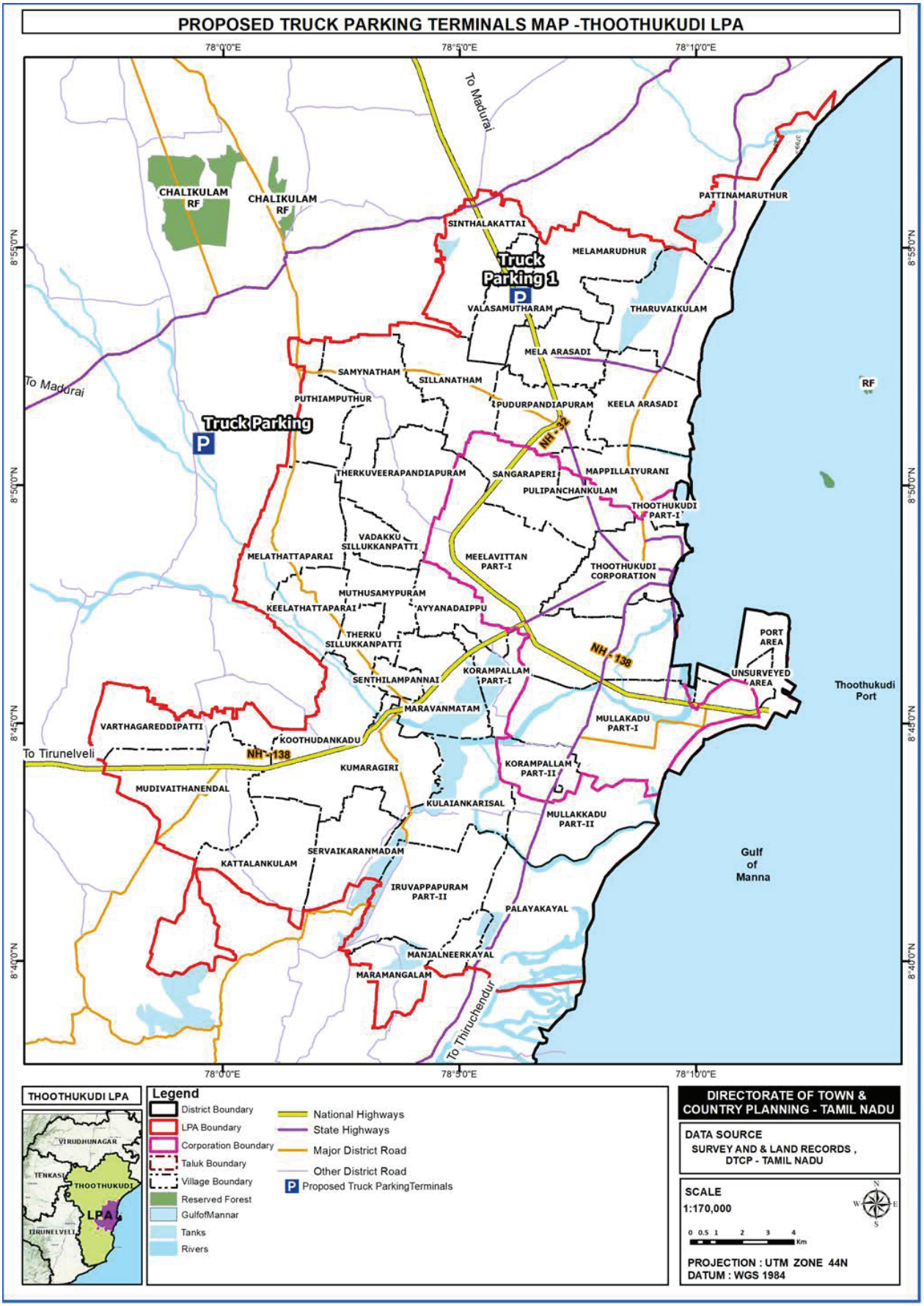
The collective benefits of these proposals—ranging from the massive Arterial roads to the 40ft link roads—are multifaceted and tailored to an industrial port-led economy. For the workforce, the MEMU train service to Tirunelveli and the BRTS corridors from the Old Bus Stand provide high-capacity public transit, but the link roads ensure that commuters can reach these transit hubs safely and quickly from their homes. For the logistics sector, the upgraded SH-176 (30m ROW) and the dual ring roads significantly reduce "Turnaround Time" for freight, while the widened local roads ensure that "Last-Mile Delivery" for domestic commercial sectors remains efficient. From a safety perspective, the

segregation of heavy port traffic onto dedicated 60m corridors like the ORR and IRR, while restricting local movement to a well-defined 40ft street network, drastically reduces the probability of fatal accidents involving heavy vehicles and vulnerable road users. Environmentally, a well-connected road network with optimized V/C ratios leads to smoother traffic flow, reducing idling time and per-vehicle emissions, thereby supporting Thoothukudi's transition into a livable, sustainable, and globally competitive industrial metropolis by 2045.

Only those roads that were previously proposed in the Detailed Development Plans (DDPs) and found to be feasible have been incorporated into the proposed new link roads.



H) Proposal For Integrated Container / Truck Parking Terminal



Map 9.27: Recommendation of Truck Parking Terminals

Integrated container and truck parking terminals were strategically proposed at Valasamutharam and S. Kailasapuram (outside LPA) to address the critical logistics needs of a port-led industrial city. These terminals are designed to function as the staging area for the thousands of heavy vehicles that traverse the region daily, preventing them from idling on highway shoulders or encroaching into the urban core. Valasamutharam, located at the intersection of major national highways and the proposed Outer Ring Road (ORR), acts as the primary northern gateway for freight arriving from Madurai and beyond. Similarly, S. Kailasapuram serves as a vital southern node, intercepting port-bound traffic from the Tirunelveli and hinterland directions before it reaches the central business districts. By integrating container handling with dedicated truck parking, these facilities evolve into Inland Container Depots (ICDs) or Way Side Amenities (WSA) that offer comprehensive services including customs clearance, warehousing, and mechanical workshops.

The technical justification for these terminals is derived from IRC: SP:84-2014 (Manual of Specifications and Standards for Four Laning) and the Ministry of Road Transport and Highways (MoRTH) guidelines on Way Side Amenities. According to the Integrated Logistics & Logistics Park Policy 2023, a modern trucker park should ideally be located within 2 km of a National or State Highway and occupy a minimum area of 10 to 25 acres to be functionally viable. The planning standards for such terminals mandate a minimum parking space of 80 sq. meters per truck, along with mandatory facilities such as rest areas for drivers, fuel stations, weighbridges, and medical centers. Furthermore, IRC:64 and IRC:106 emphasize that such terminals are essential once a road's Volume-to-Capacity (V/C) ratio exceeds saturation levels, as they provide the necessary buffer to manage peak-hour freight surges without paralyzing the arterial road network.

The proposal for these terminals must be viewed as an integral part of the larger 2045 transportation hierarchy. While the 60m Outer and Inner Ring Roads provide the speed, and the 30m SH-176 upgrade provides the reach, the Valasamutharam and S. Kailasapuram terminals provide the rest and regulation necessary for a safe logistics ecosystem. These terminals act as the anchors for the Multimodal Logistics Parks (MMLPs) at Melavittan and Thalavaipuram, allowing for the breaking and bulking of cargo before it is transferred to the MEMU rail corridor or the BRTS network. The inclusion of 40ft (12m) link roads and widened streets ensures that the Last-Mile distribution from these terminals to local industrial units like the VinFast EV plant is seamless and does not cause friction with local passenger traffic.

The collective benefits of this integrated approach are transformative for Thoothukudi. Firstly, the terminals significantly improve Road Safety by eliminating unruly roadside parking, which is a leading cause of fatal accidents on Indian highways. Secondly, they enhance Logistics Efficiency by centralizing

customs and documentation at these terminals, the Turnaround Time for containers at the V.O.C. Port is reduced, lowering the overall cost of trade. For the city's residents, this means a drastic reduction in air and noise pollution in the corporation areas, as heavy vehicles are intercepted at the periphery. Ultimately, this multi-layered proposal—combining ring roads, rail corridors, mass transit, and integrated terminals—positions Thoothukudi as a global-standard Smart Industrial Port City, where economic vigor is balanced with urban livability and sustainable growth.

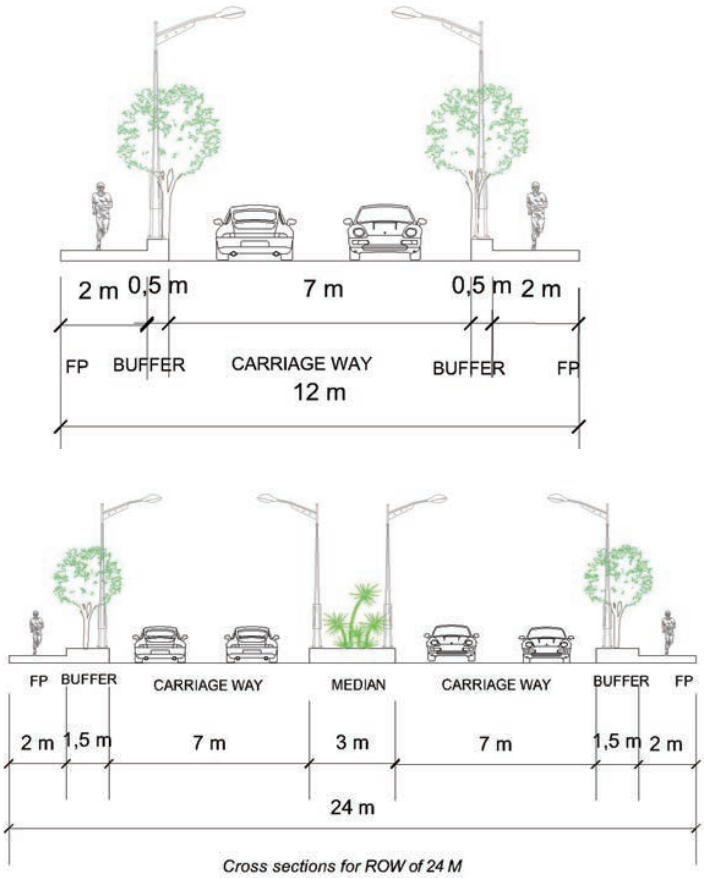
I) Proposal For Parking

Based on the analysis of the off-street parking surveys in alignment with IRC: SP:12 standards, it is recommended that the parking infrastructure be upgraded to accommodate the observed peak demands while incorporating a 10% buffer for maneuvering and future growth. For Jeyraj Road, which exhibits a diverse vehicle mix, the development of a segregated surface parking lot or a multi-level facility with a capacity of at least 150 ECS is proposed, specifically demarcating approximately 80 car bays and 250 two-wheeler slots to handle the weekend surge. The New Bus Stand, characterized by massive two-wheeler volumes peaking at 350.20 ECS, requires high-density 90-degree angled parking modules for over 1,400 motorcycles, supported by an automated smart parking management system to optimize turnover and reduce entry-point congestion. Finally, for Old Bus Stand 1, a transit-oriented design with a 215 ECS capacity is recommended, featuring dedicated stands for intermediate public transport (Autos) and separate entry/exit points for light commercial vehicles and private transport to streamline internal circulation and prevent spillover onto the main arterial roads.

J) Nmt And Pedestrian Infrastructure Development

To optimize pedestrian safety and urban mobility in Thoothukudi, the Master Plan advances a comprehensive Non-Motorized Transport (NMT)–led approach with a strong emphasis on Safe Streets for Women and Children, recognizing the city's walk-oriented, compact urban structure and high dependence on walking for daily activities. Key pedestrian-intensive corridors—Periya Kovil Street, Old Tuticorin Big Market, Old Bus Stand, Railway Street, Bank Street, Old Corporation Building, and DSF Grand Plaza—function as primary movement routes for women, children, the elderly, and transit users due to their close proximity to schools, markets, temples, civic institutions, and public transport nodes. High-intensity areas such as Periya Kovil Street and the Big Market require pedestrian-priority measures including temporary pedestrianization, regulated loading and unloading windows, guardrails, bollards, and durable interlocking pavers to reduce conflicts with vehicles. Transit hubs like the Old Bus Stand and Railway Street, witnessing peak pedestrian volumes of 1,200–1,400 persons per hour, necessitate widened and continuous footpaths, improved wayfinding, seamless interfaces between railway exits and adjoining

streets, pedestrian scrambles, and universal accessibility features such as ramps and tactile paving to safely accommodate children, women, elderly users, and persons with disabilities. Commercial and institutional stretches such as Bank Street and the Old Corporation Building focus on comfort and safety through shaded walkways, high-visibility crossings, Leading Pedestrian Intervals (LPI), and measures to prevent footpath encroachment, while leisure-oriented areas like DSF Grand Plaza incorporate traffic calming and enhanced street lighting to ensure safe evening and post-work movement. At the city scale, the plan proposes continuous, unobstructed footpaths (minimum 2.5 m width) within widened roads and segregated cycling tracks along 30 m and 60 m corridors, creating a connected NMT network linking residential areas to schools, parks, and BRTS stations, aligned with the National Urban Transport Policy (NUTP). Supported by Healthy Streets initiatives such as tree plantation, improved lighting, safe crossings, refuge islands, and low-speed street design, these Safe Street interventions can be implemented without major road widening, strengthening natural surveillance, reducing vehicular speeds, minimizing pedestrian–vehicular conflicts, and reinforcing Thoothukudi's commitment to gender sensitive, child-friendly, and people-centric urban development.



Cross sections for ROW of 24 M

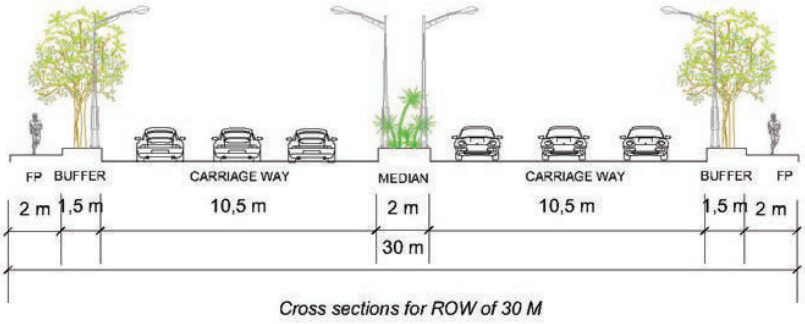


Figure 9.48: Detailed Cross sections for Internal Roads

K) Transport Strategies For Port Area

The transport strategy for the port area is built on the principle of Port-led Industrialization while protecting the urban core from heavy vehicle intrusion. The Inner Ring Road (60m) is specifically aligned to serve as the primary freight spine for the V.O. Chidambaranar Port, passing parallel to the railway line to maximize multi-modal synergy. This strategy ensures that port-bound containers can reach industrial hubs like the International Furniture Park without ever entering the corporation limits, thereby drastically reducing urban noise and air pollution.

To manage the massive volume of port-bound traffic, the plan utilizes the Gati Shakti framework to synchronize road and rail movements. The proximity of the Melavittan Railway Station to the port allows for the development of rail-based container terminals, shifting a substantial portion of the freight from road to rail. This reduces the wear and tear on the road network and lowers the carbon footprint of the port's logistics operations.



Specialized Freight Corridors with dedicated Truck-Only lanes are proposed for the sections of the ring roads closest to the port. These lanes will be built with higher pavement crust thickness to handle repetitive heavy axle loads, as per IRC: SP:84-2014. By providing these dedicated high-capacity links, the Master Plan ensures that the port remains globally competitive while the city remains safe and walkable for its residents.

L) Sustainable And Green Mobility Initiatives

Sustainable mobility is the overarching theme that ties all the infrastructure proposals together. The promotion of the MEMU rail corridor and the BRTS network represents a commitment to high-capacity, low-emission transit. By shifting a significant percentage of travelers from private vehicles to these electrified mass transit options, the city can achieve a substantial reduction in per-capita greenhouse gas emissions.

The Master Plan also encourages the adoption of Electric Vehicles (EVs) through the provision of charging infrastructure at the MMLPs and Truck terminals. Given the presence of the VinFast EV plant within the LPA, the city aims to become a pioneer in Green Logistics, where a portion of the short-haul freight between the port and industrial parks is moved using electric or green-hydrogen-powered trucks.

Furthermore, Green Mobility is reflected in the infrastructure design itself, through extensive landscaping and urban forestry along the 60m Arterial roads. These green belts act as Carbon Sinks and provide noise barriers for the adjacent residential zones. By integrating NMT infrastructure, mass transit, and electrified freight, the Thoothukudi Master Plan 2045 ensures that the city grows as a climate-resilient metropolis where industrial prosperity does not come at the cost of environmental health.



