Corporation of
Thiruvananthapuram

2015

CITY DISASTER MANAGEMENT PLAN

ഭരണഭാഷ - മാതൃഭാഷ

H1-8288/16

കളക്ടറേറ്റ്, സിവിൽസ്റ്റേഷൻ,
കുടപ്പനക്കുന്ന്, തിരുവനന്തപുരം
തീയതി - 16/03/2016

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സർ,

വിഷയം:- Climate Risk Management Project- City Disaster Management Plan
- CDMP -2015 അംഗീകരിച്ചത് - സംബന്ധിച്ച്

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4.03-03-16 ലെ H5- 17125/16 DDMA തീരുമാനം.

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Climate Risk Management Project മായി ബന്ധപ്പെട്ട് താങ്കൾ സൂചന (1) പ്രകാരം ലഭ്യമാക്കിയ city Disaster Management Plan സൂചന (2) പ്രകാരം ചേർന്ന DDMA ചർച്ച ചെയ്യുകയും ടി പ്ലാനിൽ ഓപ്പറേഷൻ അനന്തയുമായി ബന്ധപ്പെട്ട Feedback കൂടി ഉൾപ്പെടുത്തി അംഗീകരിക്കുന്നതിന് തീരുമാനിച്ചിരുന്നു. സൂചന (3) പ്രകാരം ഓപ്പറേഷൻ അനന്തയുമായി ബന്ധപ്പെട്ടുള്ള Feedback ഉൾപ്പെടുത്തി CDMP Plan ലഭ്യമാക്കിയത് സൂചന (4) പ്രകാരം ചേർന്ന DDMA അംഗീകരിച്ചിട്ടുള്ളതാണ്. മേൽ സാഹചര്യത്തിൽ സൂചന (3) പ്രകാരം ലഭ്യമാക്കിയ DDMP Plan - 2015 അംഗീകരിച്ചതായി ഇതിനാൽ അറിയിച്ചുകൊള്ളുന്നു.

വിശ്വസ്തതയോടെ,

ഡെപ്യൂട്ടി കളക്ടർ (DM)
ജില്ലാ കളക്ടർക്കു വേണ്ടി

എസ്.എസ്

MESSAGE

Responding to the dramatic increase in extreme weather events and mega disasters is one of the great challenges of our present age. Climate change, rapid urbanization and population growth in hazard – prone cities and coastal areas make action all the more urgent. Disaster risk reduction is a top priority as we seek to hold back the tide of rising economic and human losses. Its impact can be catastrophic for poverty reduction and substinable development efforts, especially in a country like ours.

Scientific communities in India and globally had undertaken various research studies which confirms that extremes are on the rise and developing countries are more vulnerable to climate change and poor people of these countries will bear the brunt of disasters. Every year the city of Thiruvanathapuram is affected by weather related disasters, especially untimely ad unexpected rains, causing urban flooding in many low lying area of the city. Lightening , high tides, eroding of coastal belt are other forms of recurrent disasters affecting the coastal communities. Land use pattern in the city has also changed drastically which adds to severity of the disaster. Hence, the twin concept of climate change and disasters are closely interrelated, thus making Disaster Risk Reduction vital for any climate change adaptation programme. It is high time that every city whether big, medium or small starts focus on reducing risks and vulnerabilities adopt systematic ad scientific planning process to mitigate disaster risks and vulnerability factors. Building capacities of state , district and local body institution and of the communities who lives with hazards are most important and are prelude for DRR initiatives.

I thank and appreciate United Nation Development Programme (UNDP) for supporting the Municipal Corporation of Thiruvananthapuram in Building capacities of the ULB and its staffs on Disaster Risk Reduction through the implementation of GoI – UNDP – DRR – URR Programme (2010 -12) and then with a new project aided by USAID titled " GoI – UNDP – Climate Risk Mangement Project in Urban Areas through Disaster Preparedness and Mitigation" (2013 -15) under which City Disaster Management Plan has been prepared.

I took this opportunity to express my sincere gratitude to our previous honorable Mayor Adv. K. Chandrika for supporting UNDP team with all her zeal in bringing out CDMP 2015 document. I also extend my heartfull thanks to all person's and institution's who contributed in their own way for developing City DM Plan for the City Thiruvananthapuram.

Adv. V.K. Prasanth
Mayor

In an era spiked by climate change and other large-scale extreme weather events, our cities must be resilient in order to survive and thrive. But what does that mean, exactly? What is known about our own vulnerability and what remains to be explored? And how can we put thinking into practice to create our city resilient to disasters in the future?

To help answer those questions Trivandrum City Corporation in association with United Nations Development Programme developed a City Disaster Management Plan under the project titled "GoI-UNDP-Climate Risk Management Project in Urban Areas through Disaster Preparedness and Mitigation" (2013-15) aided by USAID. In this context it is with great pleasure that the city Municipal corporation is releasing a comprehensive disaster management plan for our City.

While climate change is a global problem, its effects are—and increasingly will be—felt locally in communities across India and around the globe. Just as national and state level action on climate change is required, cities also play a critical role in mitigating after effects of climate change and helping society prepare for those impacts than it is too late to prevent.

The Cassandra call of warning and speculative analysis from various agencies has not been proven effective in reducing the vulnerability of disasters despite of a proper planning tool. In this context the significance of a City Disaster management Plan made by organically involving all stake holders in managing the perils of both natural and anthropogenic event is highly commendable. This document envisages on the current scenario will surely be a user's manual in live situation and will streamline all process to higher efficacy and standards reducing the impact of disaster.

I personally extent my warm regards to United Nations Development Programme (UNDP) for supporting the Municipal Corporation of Thiruvananthapuram in building capacities in DRR and I express my sincere gratitude to all other organizations who have contributed in delivering such a document for improving and empowering this ULB with resilience towards disasters.

Secretary
M. Nizarudheen

MESSAGE

Acknowledgment

The DM Act 2005 envisages a paradigm shift from the erstwhile response centric syndrome to a proactive, holistic and integrated management of disasters with emphasis on prevention, mitigation and preparedness. This national vision, inter alia, aims at inculcating a culture of preparedness among all stakeholders, especially the local self government in reducing the disaster vulnerabilities at community level.

Looking to the fact that an effective DM plan lies in the synergy between multiple stakeholders, immense efforts were put into collection and integration of relevant date various government departments. Ms. Vrindanath M.C, consultant hired on mission by the Municipal Corporation of Thiruvananthapuram under "GoI - UNDP - Climate Risk Management Project for Disaster Preparedness and Mitigation" played a crucial role in this process. I express my sincere thanks to her for the invaluable contribution she put in preparing City Disaster Management Plan (CDMP) 2015.

UNDP City Disaster Management Cell would like to extend its deepest appreciation to all key stakeholders who contributed data /literature for the preparation of City DM Plan. A word of special thanks for the significant contribution provided by IDSP Cell, District Medical Office, Directorate Health Service, RAY Cell Thiruvananthapuram Municipal Corporation, Kudumbashree, Irrigation Department, Town Planning Department, Kerala Fire & Rescue Services, NCESS, IKM, KSUDP, Health Wing of Thiruvananthapuram Municipal Corporation, NATPAC, Factories & Boilers and Institute of Land & Disaster Management.

To move away from erstwhile response centric approach to preparedness and mitigation, would need strategic planning at all levels starting from Hazard, Vulnerability and Risk Assessment. Since this document is foremost in conducting such analysis in the city of Thiruvananthapuram, I Acknowledge with thanks the valuable contributions we received from State Emergency Operation Centre, the research wing of Kerala State Disaster Managemetn Authority. I Acknowledge contribution made by Dr. Sekhar. L. Kuriakose, Head scientist SEOC (member KSDMA) and Mr. Joe George, State Project Officer UNDP for their contribution in revie in the CDMP. I express my deepest gratitude to all technical staffs of SEOC for supporting as by rproviding high quality GIS maps and relevant literatures.

valuable feedback which were received form various stakeholders during CDMP consultation workshop held December 2014 were appropriately and adequately absorbed in tothe City DM Plan. I acknowledge the effort an express my sincere gratitude to each department sho privided immense contribution is assisting the municipal corporation of Thiruvanthapuram for the preparation of this plan document.

I thank Ms. Abha Mishra, National Project Coordinator of GOI - UNDP - CRM project for help technical support and guidance in bringing out this document. A special appreciation is also extend to USAID ; Ministry of Home Affairs, GOI, UNDP and the department of revenue and Disaster Management Govt. of Kerala for funding as well as over all support.

I express my sincere thanks and gratitude to former Mayor Adv. K. Chandrika, Deputy Mayor Shri. G. Happy kumar, Chair person welfare standing committee, Shri. Palayam Rajan, Secretary, Shri. Venkatesapathy. S(IAS) and Additional Secretary Shri. G. Padmakumar for their support which was critical in preparing CDMP 2015. Finally I put on record my heart full thanks to Hon. Mayor Adv. V. K. Prasanth and Secretary Shri. N. Nizarudheen for their heightened support to the project in bringing out CDMP 2015.

Ramesh Krishnan
City Project Coordinator
GOI -UNDP-CRMP, Thiruvananthapuram

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INTRODUCTION

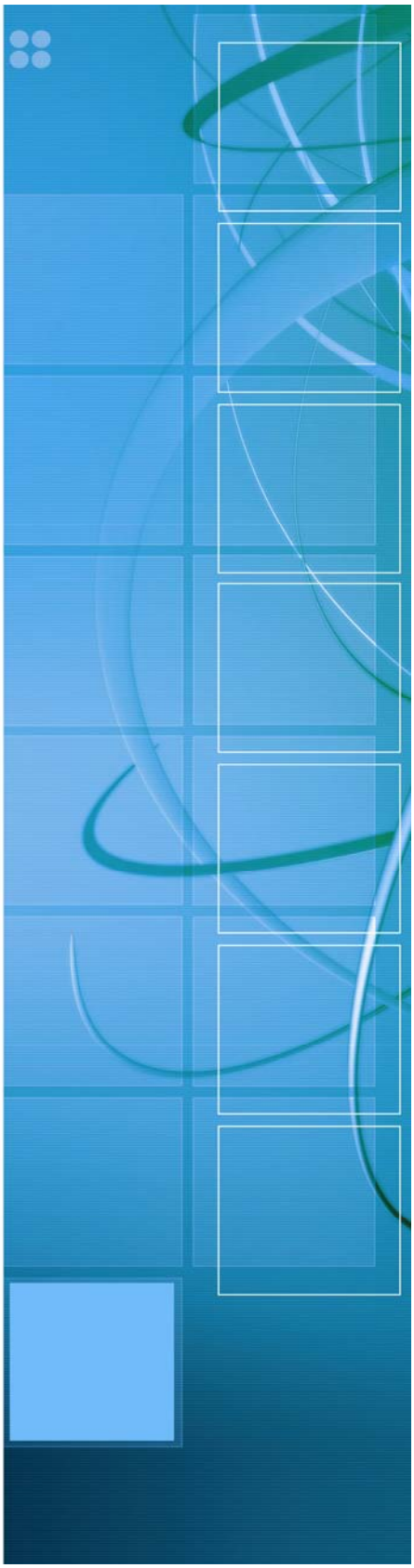
Thiruvananthapuram or Trivandrum, as it was conveniently re-christened by the English, is the southern-most district and it is the district headquarters as well as the State capital of Kerala. Thiruvananthapuram is known as god's own land, the jewel in the emerald necklace that Kerala is for the Indian sub-continent. The city gets its name from the word, Thiruvananthapuram, meaning the city of Anantha or "the town of Lord ANANTHA", the abode of the sacred Serpent Anantha on which Lord Vishnu, the preserver of the Hindu trinity, reclines.

The beautiful seaside city is one of the ancient cities that have references in Greek and Roman literatures dating back to 1000 BC. Rich in cultural heritage, blessed with all essential natural resources and skilled human potential, Thiruvananthapuram City has served as the capital to the area in pre-colonial period, colonial period, and post colonial period, functioning as administrative capital, which has enhanced the character of the city as a service centre, in the region.

The area of Thiruvananthapuram city stretches over the low lying coastal belt and undulating terrain of midland sandwiched between the high land comprising green mountain forests of Western Ghats and Lakshadweep Sea. Being the education, commercial, and medical hub of Kerala, Trivandrum is reaching new heights, with rapid development taking place across all sectors .Trivandrum city corporation has an area of around 214.86 Sq.Km with almost 1.7 million inhabitants as per the 2011 census. It is one of the most populous cities in Kerala, with population density of 4,454 /km², as against 860 per sq km for Kerala, and 368 per sq km for India.

As the city poises to leap ahead as an emerging metropolitan city in the southernmost part of India, with large and diversified population, high population density and unique geographical constraints makes the city extremely vulnerable to devastating consequences of disasters. Thus it's high time that the city must be primed with well planned, structurally coordinated city disaster management plan. Though disasters cannot be avoided, a planned approach covering all phases like mitigation, response and rehabilitation can minimize the impact of the disaster.

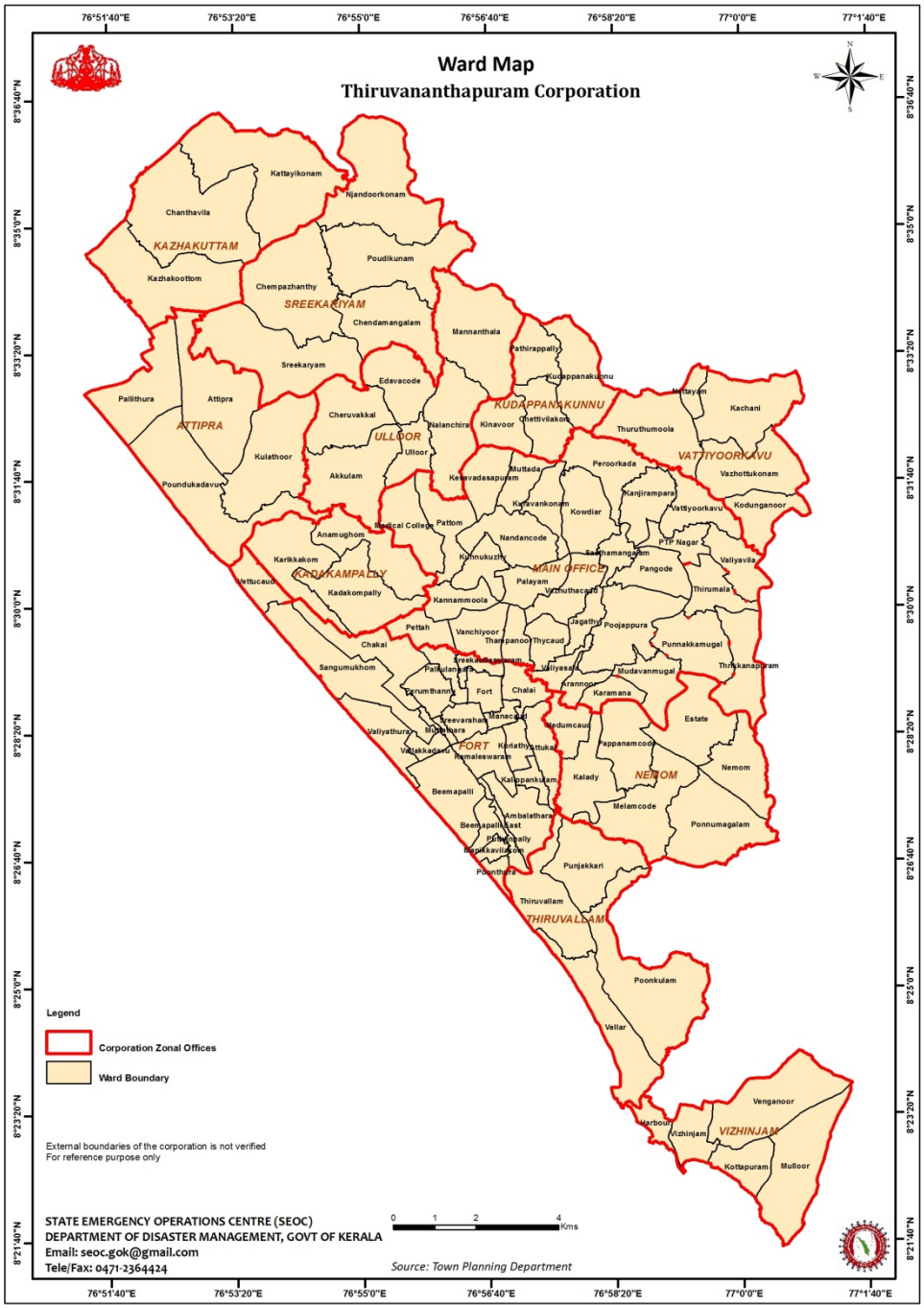
With this goal in mind, the UNDP supported City Disaster Management Cell functioning in the Corporation Office had launched a pilot initiative to prepare a CDMP under GoI-UNDP-DRR project 2010-12 and became successful in its venture to bring out a draft CDMP in the year 2013-15. On May 2014, the CDMP has been further reviewed & updated as per the recommendations made by the UNDP and newer strategies are adopted to bring together all stakeholders in disaster management to achieve perfection in collaborative efforts through knowledge sharing and rehearsals.



CITY DISASTER MANAGEMENT PLAN 2015

CITY PROFILE- 1

Digitized Map of Trivandrum Corporation



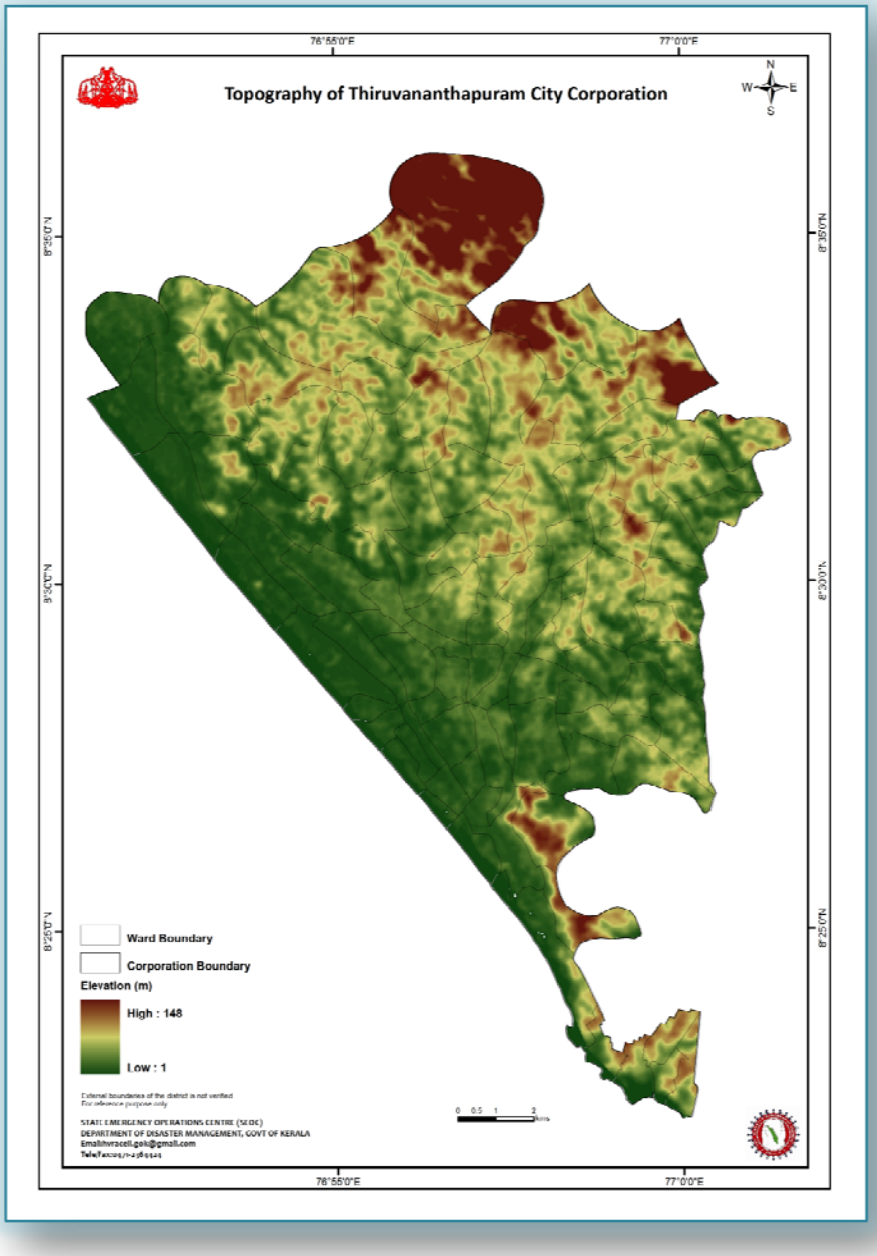
List of Corporation Wards with Ward numbers

Sl.No	Ward Name	Zonal Office	Sl.No	Ward Name	Zonal Office
1	Attipra	Attipra	51	Jagathy	Main Office
2	Kulathoor	Attipra	52	Sasthamangalam	Main Office
3	Poundukadavu	Attipra	53	Kowdiar	Main Office
4	Pallithura	Attipra	54	Peroorkada	Main Office
5	Valiyathura	Fort	55	Mudavanmugal	Main Office
6	Perumthanny	Fort	56	Arannoor	Main Office
7	Vallakkadavu	Fort	57	Poojappura	Main Office
8	Muttathara	Fort	58	Pangode	Main Office
9	Sreevaraham	Fort	59	PTP Nagar	Main Office
10	Fort	Fort	60	Kanjirampara	Main Office
11	Chalai	Fort	61	Vattiyoorkavu	Main Office
12	Beemapalli East	Fort	62	Punnakkamugal	Main Office
13	Manacaud	Fort	63	Thirumala	Main Office
14	Kuriathy	Fort	64	Valiyavila	Main Office
15	Attukal	Fort	65	Thrikkanapuram	Main Office
16	Manikkavilakom	Fort	66	Kuravankonam	Main Office
17	Poonthura	Fort	67	Karamana	Main Office
18	Palkulangara	Fort	68	Pettah	Main Office
19	Sangumukhom	Fort	69	Kalady	Nemom
20	Sreekandeswaram	Fort	70	Pappanamcode	Nemom
21	Vettucaud	Fort	71	Melamcode	Nemom
22	Chakai	Fort	72	Estate	Nemom
23	Kamaleswaram	Fort	73	Ponnumagalam	Nemom
24	Ambalathara	Fort	74	Nemom	Nemom
25	Kalippankulam	Fort	75	Nedumcaud	Nemom
26	Beemapalli	Fort	76	Sreekaryam	Sreekariyam
27	Puthanpally	Fort	77	Chendamangalam	Sreekariyam
28	Anamughom	Kadakampalli	78	Njandoorkonam	Sreekariyam
29	Kadakompally	Kadakampalli	79	Poudikunam	Sreekariyam
30	Karikkakom	Kadakampalli	80	Chempazhanthy	Sreekariyam
31	Kazhakoottom	Kazhakuttom	81	Thiruvallam	Thiruvallam
32	Chanthavila	Kazhakuttom	82	Vellar	Thiruvallam
33	Kattayikonam	Kazhakuttom	83	Poonkulam	Thiruvallam
34	Kinavoor	Kuddapanakunnu	84	Punjakkari	Thiruvallam
35	Pathirappally	Kuddapanakunnu	85	Ulloor	Ulloor
36	Kudappanakunnu	Kuddapanakunnu	86	Cheruvakkal	Ulloor
37	Chettivilakom	Kuddapanakunnu	87	Nalanchira	Ulloor
38	Kannammoola	Main Office	88	Edavacode	Ulloor
39	Pattom	Main Office	89	Mannanthala	Ulloor
40	Medical College	Main Office	90	Akkulam	Ulloor
41	Vanchiyoor	Main Office	91	Kodunganoor	Vattiyoorkavu
42	Palayam	Main Office	92	Thuruthumoola	Vattiyoorkavu
43	Kunnukuzhy	Main Office	93	Vazhottukonam	Vattiyoorkavu
44	Nandancode	Main Office	94	Nettayam	Vattiyoorkavu
45	Kesavadasapuram	Main Office	95	Kachani	Vattiyoorkavu
46	Thampanoor	Main Office	96	Harbour	Vizhinjam
47	Vazhuthacaud	Main Office	97	Vizhinjam	Vizhinjam
48	Muttada	Main Office	98	Kottapuram	Vizhinjam
49	Valiyasala	Main Office	99	Venganoor	Vizhinjam
50	Thycaud	Main Office	100	Mulloor	Vizhinjam

Topography

Thiruvananthapuram city is located at 8° 30′N and 76° 54′E. The City Corporation which spreads over an area of 215.86 km2 stretches over 35 km of low lying coastal belt. The undulating mid land is sandwiched between the green mountain forests of Western Ghats in the west and Lakshadweep Sea in the east. The elevation of land varies from 0m to 165m from sea level. Although the city has a rolling terrain towards the hills and plain towards the coastal belt, Kovalam- Vizhinjam regions show rolling terrain in the coastal belt and this natural feature of terrain blesses the city of Thiruvananthapuram be a natural sea port. Figure (1.1) displays the topography of Thiruvananthapuram City Corporation

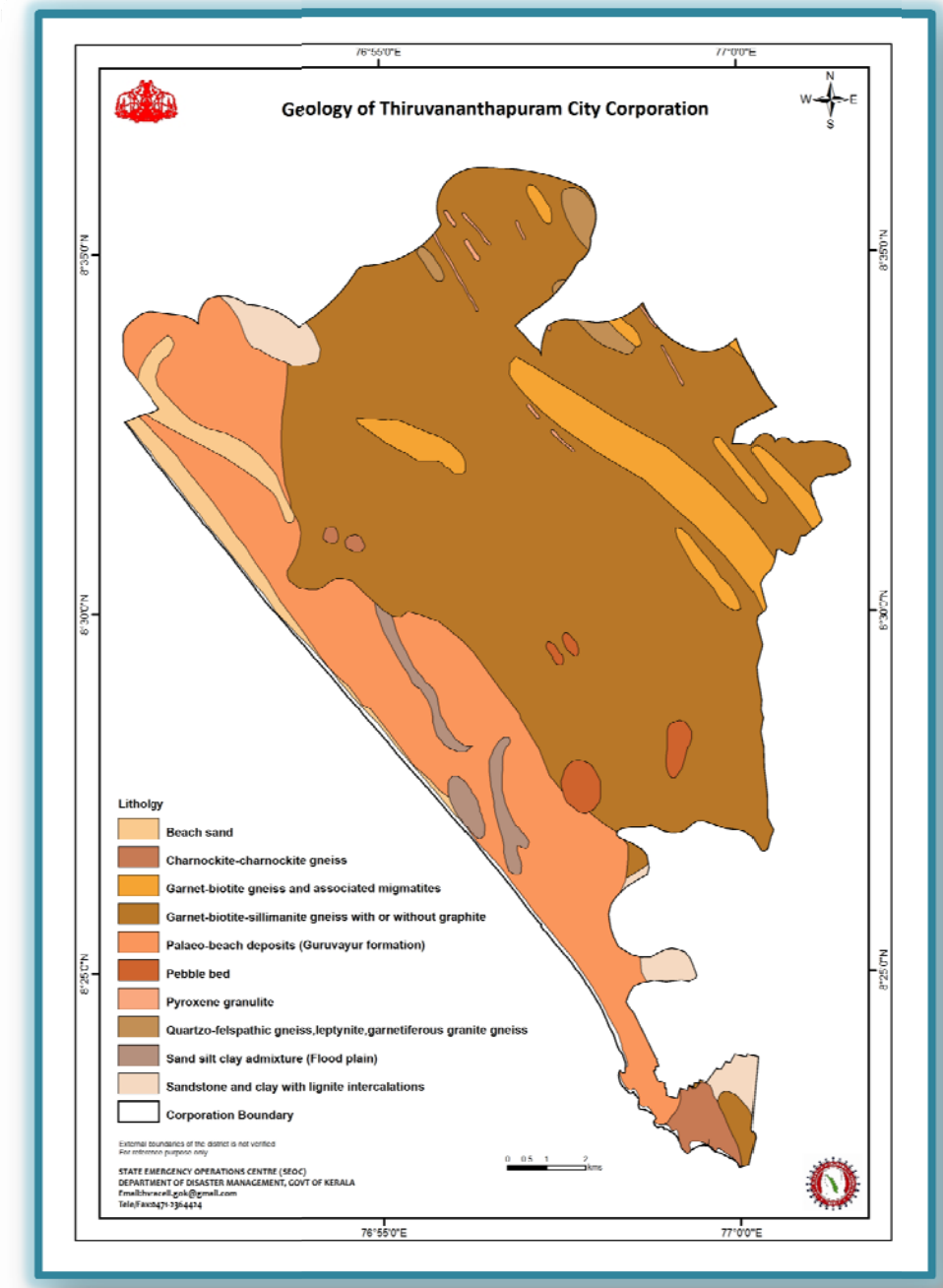
Figure (1.2)



Geology

Geologically, Thiruvananthapuram City is occupied by Precambrian crystalline acid to ultra basic intrusive of Archean to Proterozoic age, Tertiary, Sedimentary rocks and Quaternary Sediments of fluvial and marine origin. Both the crystalline and Tertiary sediments have been extensively laterised. Figure (1.2) shows the general geology of Thiruvananthapuram City Corporation

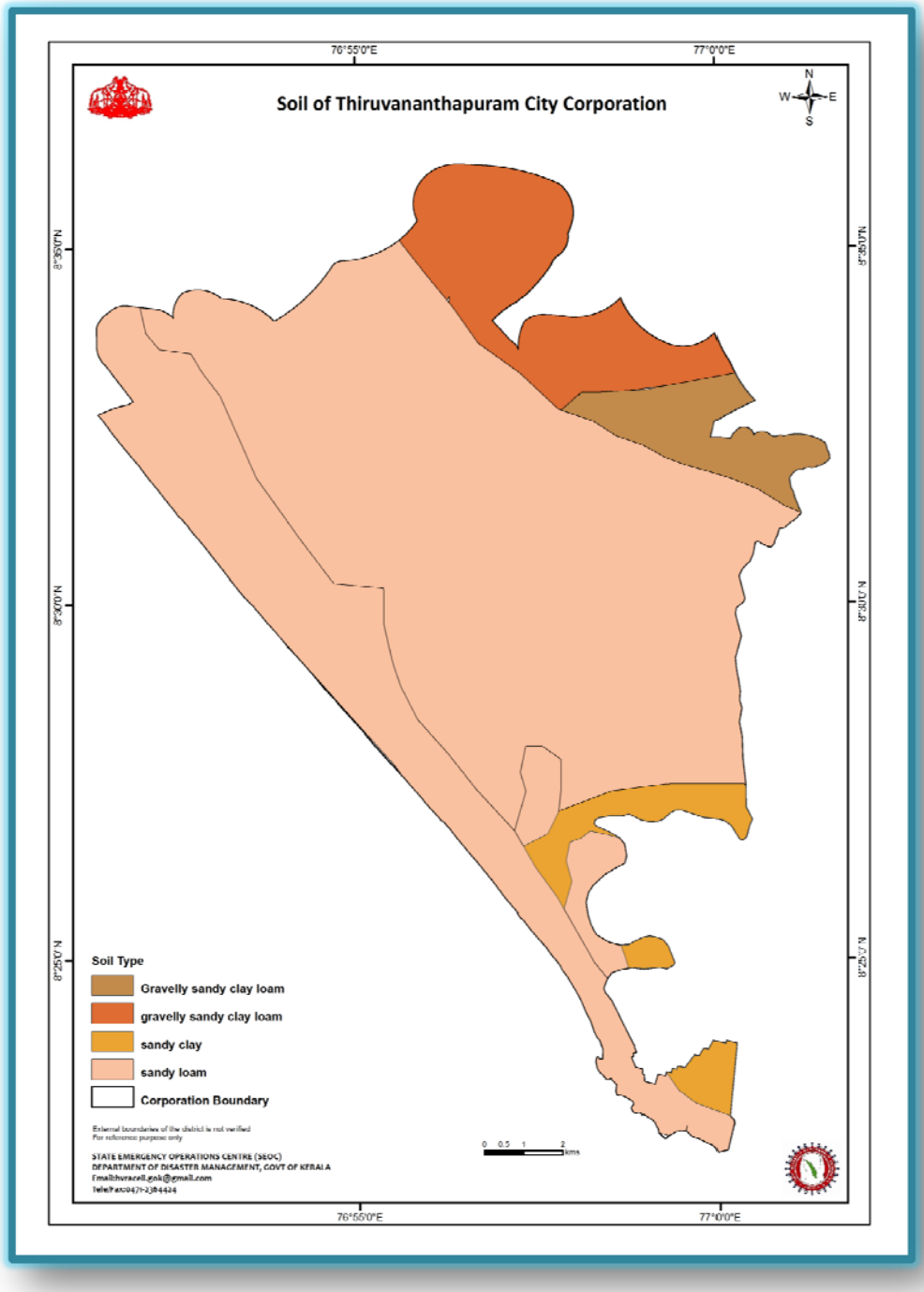
Figure (1.3)



Soil

The city has many types of soil, laterite and alluvial soils being the important kind. Alluvial soil is seen in low lying areas and valleys whereas laterite soils are found in the summits and slopping area. Sandy soil is found towards the beach. Figure 1.3 shows the wide-ranging distribution of soil type in Thiruvananthapuram City Corporation

Figure (1.4)



Seismic Zone Map of India

The Geological Survey of India has identified Thiruvananthapuram as a moderately earthquake-prone urban centre and categorized the city in the Seismic Zone III as shown in Figure (1.5) Eighteen earth tremors have been recorded in Kerala from the period 1341 AD to1975 and majority of them are located in the coastal region. Hence seismically, these can be considered moderately active

Figure (1.5)

Climate

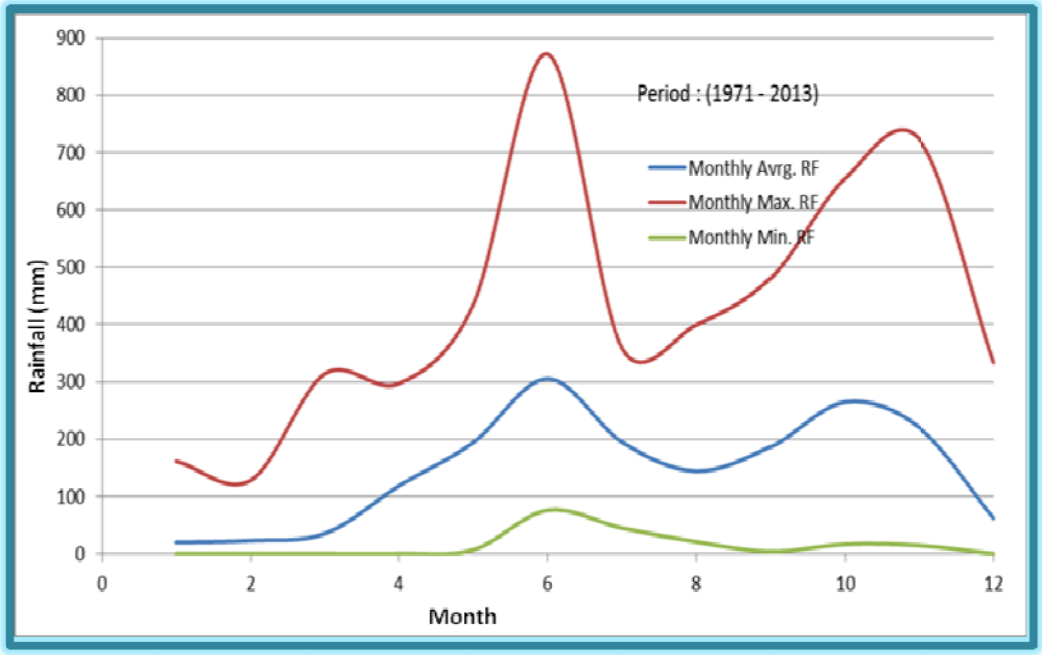
The climate of the city is generally hot tropical but actually it boarders between tropical savannah climate and a tropical monsoon climate. As a result it does not experience distinct seasons. The large forest reserves favourably affect the climate and induce rains. The mean maximum temperature is 32°C while the mean minimum temperature is 21°C. As the district stretches from north to south with the Arabian Sea in the west side, the relative humidity is generally high and rises to 90% to 95% during the monsoon season. Thiruvananthapuram is the first city along the path of the south-west monsoons and gets its first

showers in early June. The city gets heavy rainfall of around 1700 mm per year. The city also gets rain from the receding north-east monsoons which hit the city in October. The dry season sets in by December. December, January and February are the coldest months while March, April and May are the hottest. A climatic condition of the district is shown.

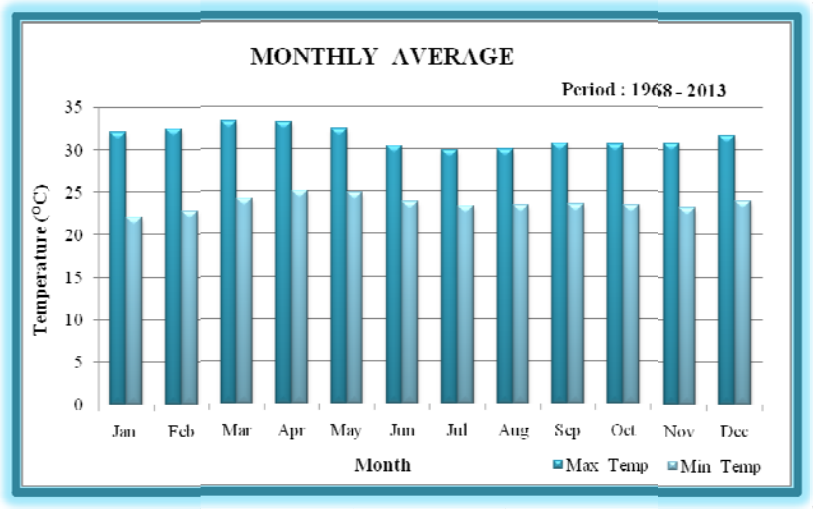
- **2348.7 mm in 1975 is the highest annual rainfall recorded in the city during the period 1971-2013**
- **872 mm in 1991 is the highest monthly rainfall recorded in the city during the period 1971-2013**

Temperature

The city has a mean maximum temperature 34°C and the mean minimum temperature is 21°C.The lowest temperature recorded during winter was 15 °C, and the highest temperature recorded in summer is 39°C.

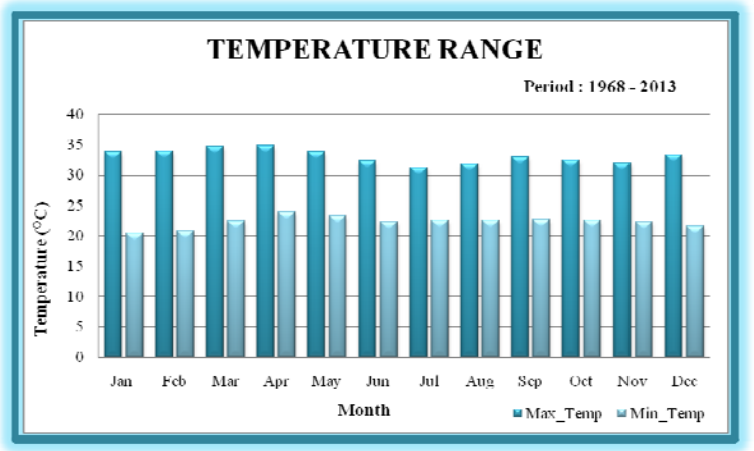


Graph 1.1: Rainfall range in the city, 1971-2013



Graph 1.2: Monthly average temperature, 1968-2013

- **The city experiences a moderately hot and dry climate throughout the year**
- **Highest monthly average Maximum temperature of 34.9°C was recorded on April 1998**
- **Lowest monthly average Minimum temperature of 20.4°C was recorded on January 1974**

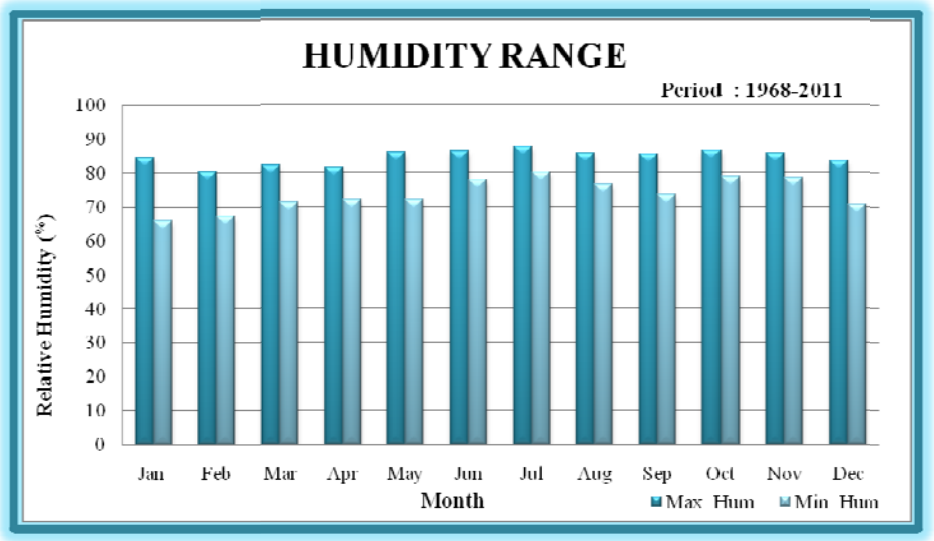


Graph 1.3: Temperature range, 1968-2013

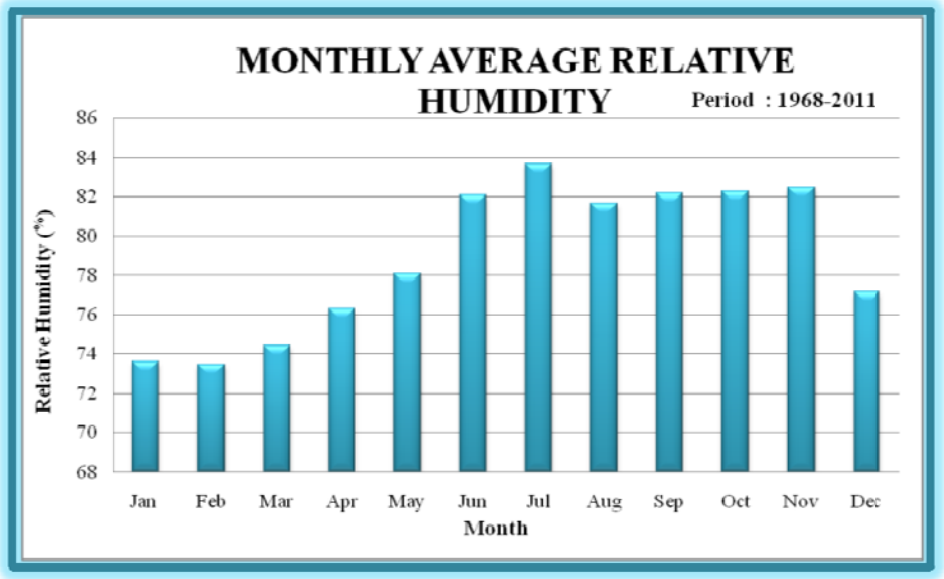
- **Highest annual Maximum temperature was recorded on 2009 (32.4°C)**
- **Lowest annual Minimum temperature was recorded on 2003 (22.3°C)**

Humidity

The humidity is high and rises to about 90% during the monsoon season and remains relatively high till December. In summer seasons the humidity is at its minimum.



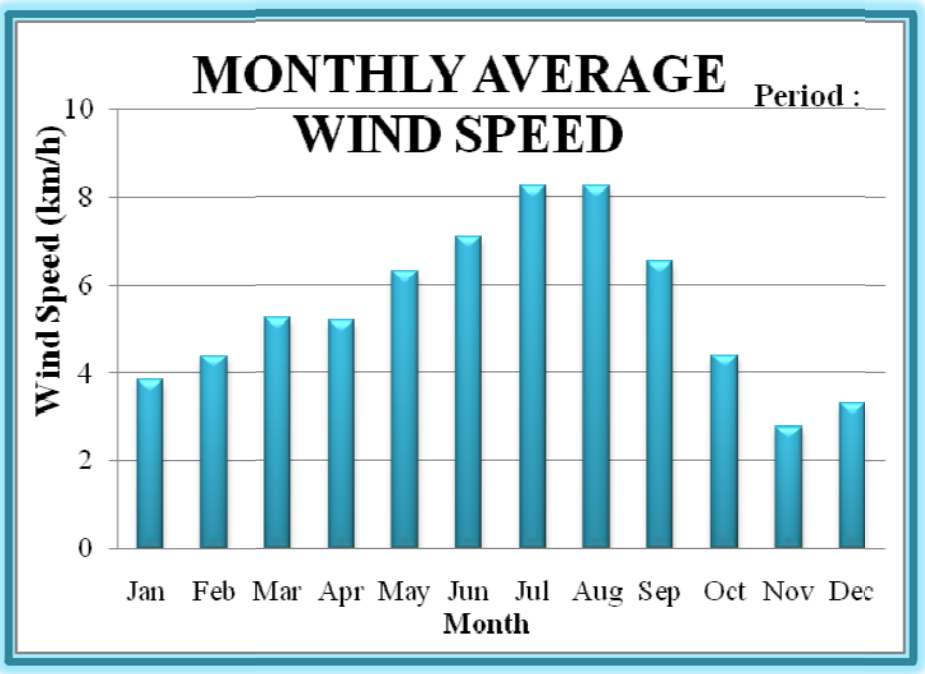
Graph 1.4: Humidity range, 1968-2011



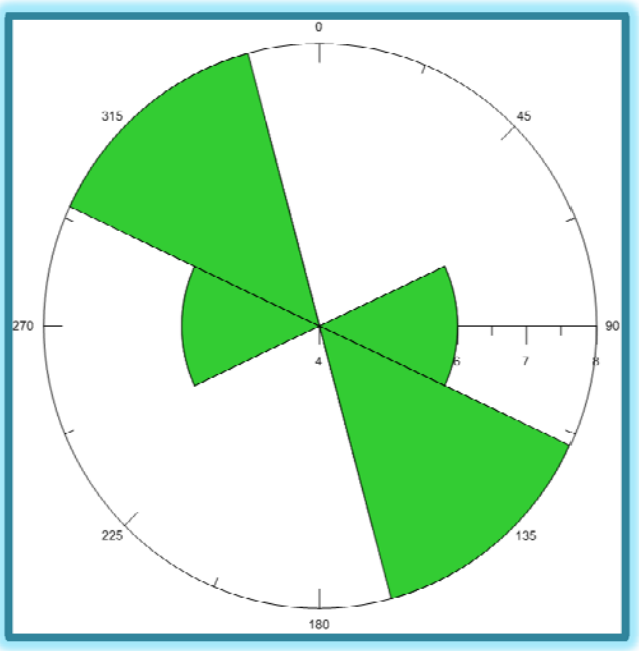
Graph 1.5: Monthly Average relative humidity, 1968-2011

Wind

The predominant wind direction is in the North West direction as shown in Figure 3a. The winds gradually gain speed during the pre-monsoon and is at its highest during the monsoon period.



Graph 1.6: Monthly Average wind speed, 2001-2011



Graph 1.7: Prominent wind direction

- **Highest monthly average wind Speed of 10.2km/h recorded was on July 2002.**
- **Highest daily wind Speed recorded is 28 km/h.**

Table: 1.1 Wind directions, 2001-2011

Month	Wind Direction	
Jan	Calm	0
Feb	Calm	0
Mar	West	27
Apr	Calm	0
May	West	27
Jun	North West	32
Jul	North West	32
Aug	North West	32
Sep	North West	32
Oct	Calm	0
Nov	Calm	0
Dec	Calm	0

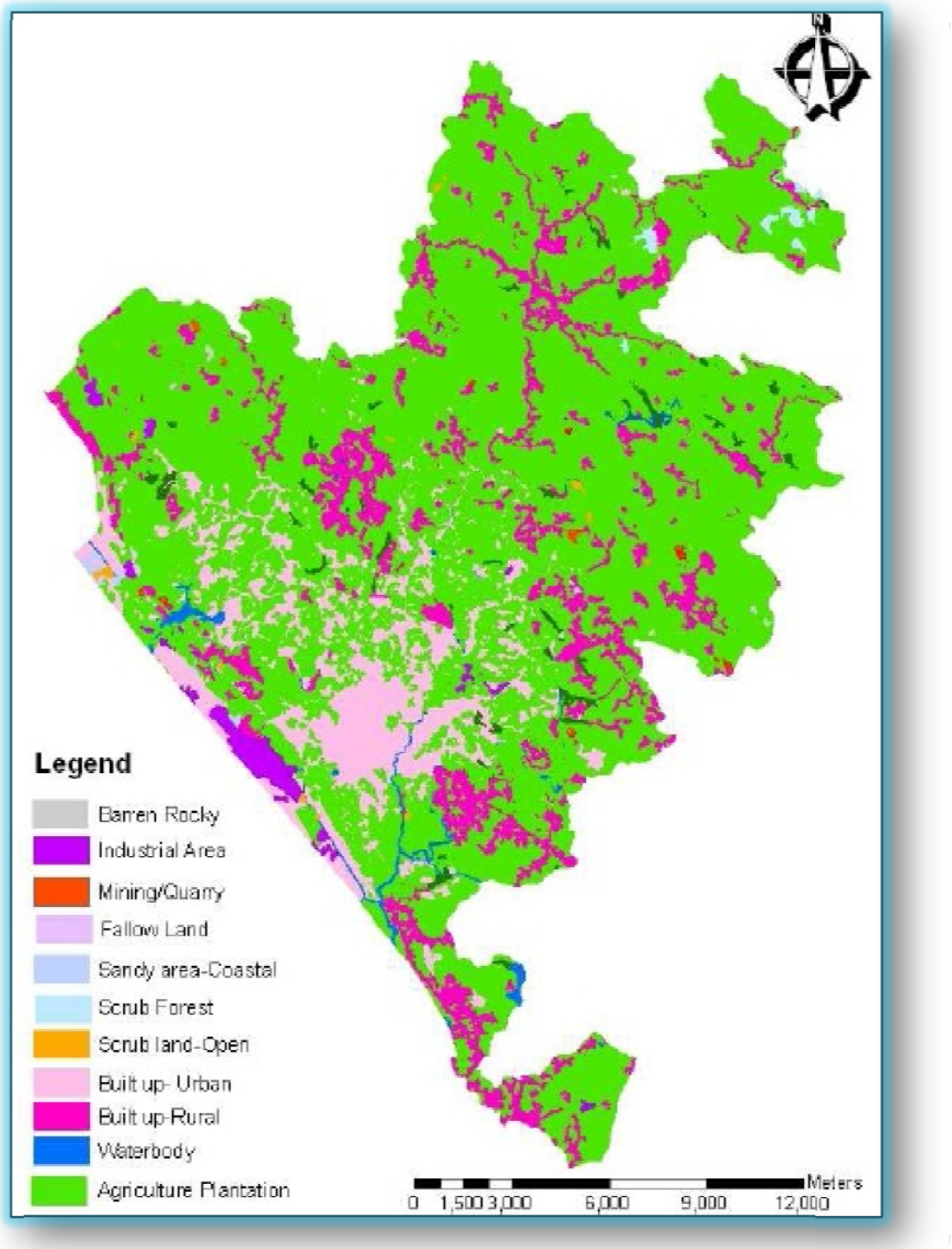
Agriculture & Forestry

The primary occupation of people of the Thiruvananthapuram is agriculture. Cultivable land is classified as wet, dry, garden and plantations. Rice is the most important crop cultivated in the wet lands. Tapioca and pulses are the important dry-land crops. Coconut is one of the most important crops of the district. The annual production of coconuts is about 516 million. Rubber cultivation is mainly confined to Nedumangad taluk which is close to the Thiruvananthapuram city. At present, there are about 269.99 km2 of rubber plantations and the annual production is estimated at 30,717 tonnes. Newly introduced agricultural development schemes have opened new vistas in this field. Fresh schemes are introduced in every Panchayat with a view to maximize yield per unit area by exploiting the production Potential of paddy and vegetables. Cashew is grown in 21.84 km^2 of land and the production is about 1,745 tonnes. Pepper cultivation covers an area of 50.9 km^2, and the yield is about 1824 tonnes.

Land use /Land cover

The city is covered with thick habitation. Two major rivers are flowing through the city i.e.Karamana and Killi. In addition to these rivers, the city is also having major canals/thodu namely Ulloor, Pattom, Vanchiyoor, Thekkinakara, Parvathy Puthnar and Amayizhanjan. These canals flowing through the city drain-off the surface runoff. Also there are many natural ponds within city. In and around the city two major water bodies Akulam Kayal and Vellayani Kayal reservoir are located. South East part of the city is fully covered with Lakshadweep Sea. The general land use/land cover along with crops of the district is shown in the Figure (1.6). The map shows the different land use classes in which arable land covers most part of the district.. Figure depicts eleven different landuse/ landcover classes with different color codes which reveal that agriculture land and built up are the two major classes.

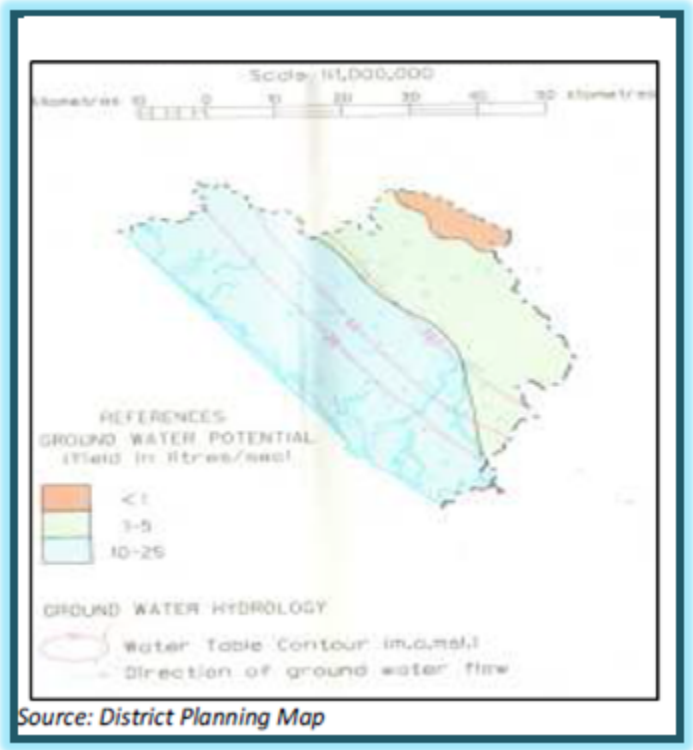
Figure.(1.6) : Land use Land Cover Map of Trivandrum Corporation



Hydrology of the Study Area

Figure (1.7) shows the ground water hydrology of the district which also depicts the water table contour having lower value towards the sea coast. The ground water potential in terms of yield in liters/sec increases towards the coastal line. The maximum ground water yield lies at coastline in rage of 10-25 lit/sec

Figure(1.7): Hydrology



Source: District Planning Map

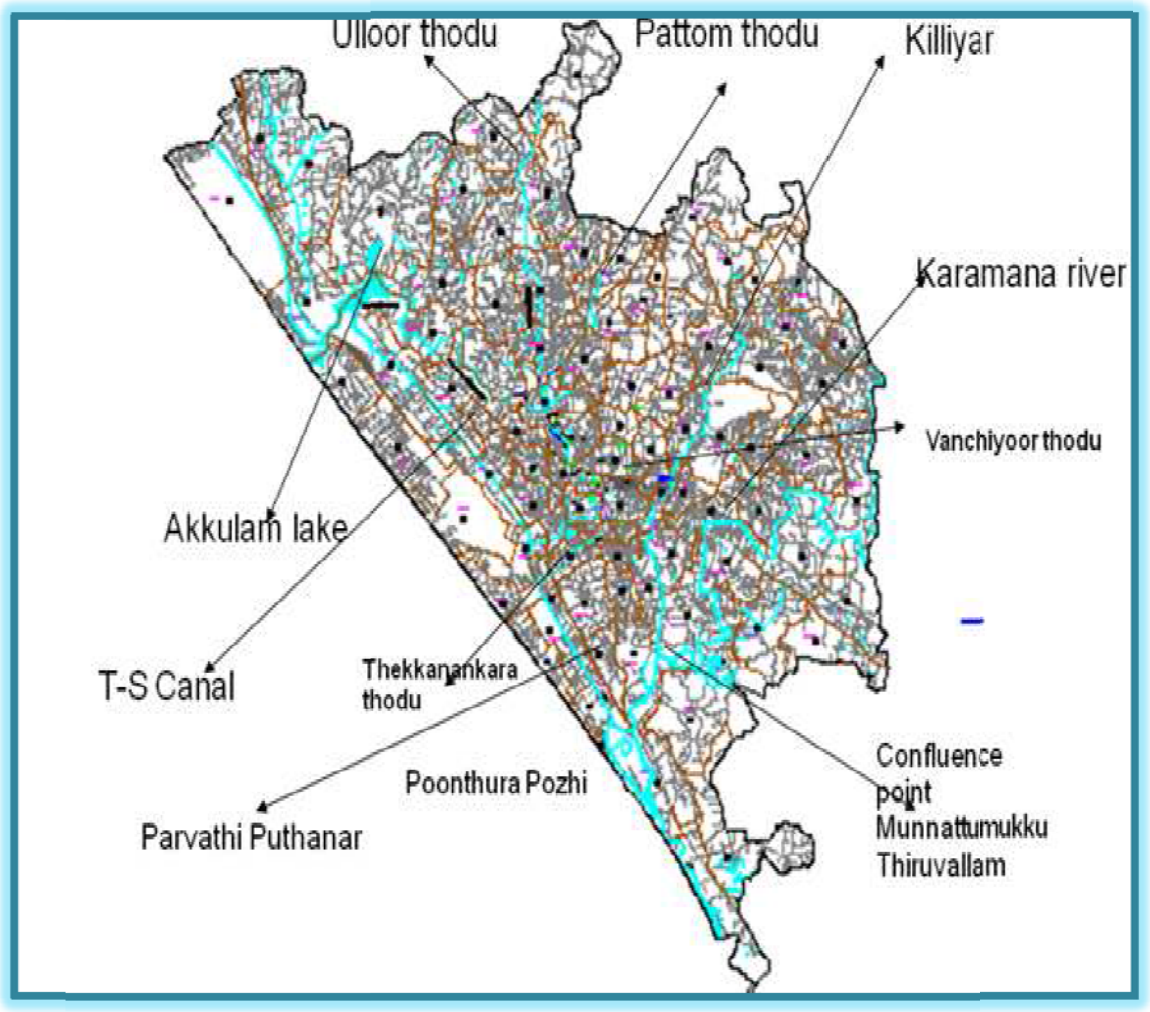
Drainage Pattern of the City

The Karamana river flows entirely through the Thiruvananthapuram district. This river originates from the Western Ghats at Agasthyakoodam and is the main source of water supply of Thiruvananthapuram city and Nedumangad town. Two dams are constructed across this river at Peppara and Aruvikkara. The total stretch of the river is about 61 km out of which 21 km flows within city and 40 km is at the upstream side. The main tributary of Karamana River is Killi, originates at Panavur in Nedumangad taluk of Thiruvananthapuram district. The river enters Thiruvananthapuram city at Vazhayila and flows through Jagathi, Killippalam, Attukal, Kalady, South and merges with Karamana River at Pallathu kadavu. The Killi river have total length of 33 km out of which 14km flows within city and 19km at upstream side in Anad panchayat of Nedumangad taluk.There are seven major thodus in the city viz. Pattom, Ulloor, Thekkanakara, Parvathi Puthnar, Poonthura Pozhi and Vanchiyoor. Ulloor thodu and Pattomthodu merges into the Aamayizhanjan thodu which flows finally to the Akkulam lake. Parvathi Puthnar is a

major waste water canal in the city. Most of the waste water of the city flows through this canal. Half of the waste water of this canal goes into the Akkulam lake and half portion of the canal merges into Karamana river at Thiruvellam which finally meets into the sea.

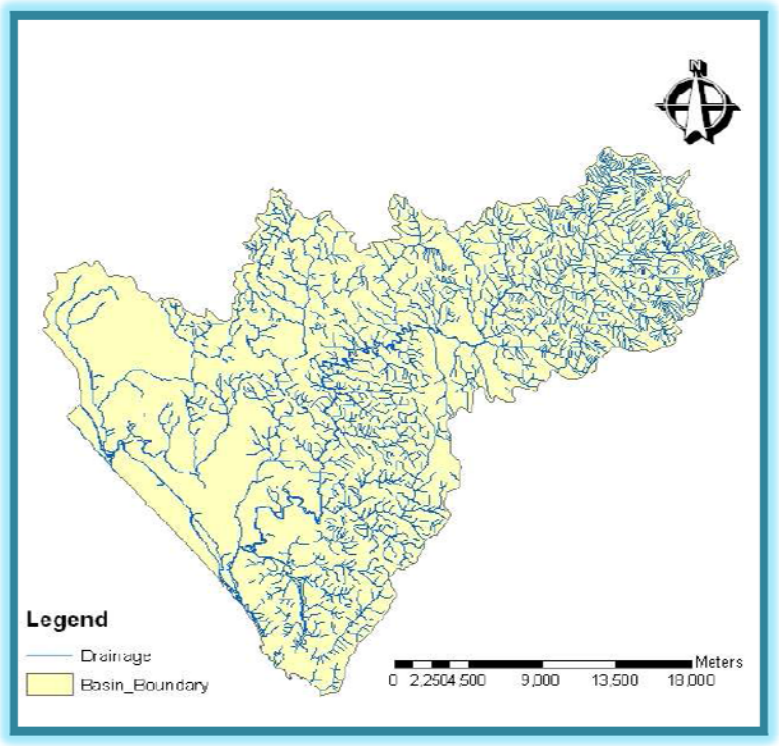
Pazhavangadi Thodu (drain) is one of the important storm water drain, which runs through the heart of the Thiruvananthapuram city. Pazhavangadi Thodu starts from Kerala Water Authority (KWA) at Vellayambalam and merges into Aamayizhanjan Thodu near Kannamoola and has a length of about 5.75 km. It is the main discharge channel of Trivandrum City and traverses through the key areas like Thampanoor, Pazhavangadi, Thakaraparambu, Vanchiyoor, Pattoor etc. Parvathi Puthanar is a major canal which joins the Karamanariver at Munnattumukku, Thiruvallam Figure 1.7 shows drainage pattern of the Karamana and Killi river basin.

Figure.(1.8): Drainage Map of Trivandrum Corporation



Source: Irrigation Department

Figure (1.9): Drainage basin



Source: Irrigation dept

Water Supply

Peppara and Aruvikkara dams on river Karamana are the main sources of water supply in Thiruvananthapuram city. For the city, water supply scheme is having an installed capacity of 273 MLD serving a population of 10.32 lakhs (as per 2011 census) and covering an area of 200 sq km inside the city except Vinzhinjam area which is included in Neyyathinkara block water supply scheme. It is found that within corporation limit 81% population are depending on KWA water supply. 10% of the population is dependent on open/bore well for their source of water whereas 4% are dependent on public tap and 3% on lorry service. Lorry services are provided mainly for coastal areas.

The water supply network is designed for the 24 hrs water supply. The distribution system consists of a total length of 1500 km. The size of main lines in the city are 1200 mm CI, 900 mm PSC and 1500 mm MS pipes used to convey water from Aruvikkara to Thiruvananthapuram city. There are 8 water treatment plants (WTP) viz Vellayambalam, Aruvikkara, Chinthirakkunu, Pappanamkode, Shantivila, PTP campus, Paramala and Vandithandam which have a total capacity of 273 MLD. Raw water is also pumped from Karamana river at Kundamankadavu, Aruvikkara, Adimadakkayam and Trikkannapuram to the respective treatment/pumping stations. Apart from main water treatment plant, water from bore wells

and open wells are used for drinking purposes located at Karikodam (0.5 MLD), Pallithura (0.05 MLD), Panchallor/Anakuzhy (0.50 MLD) and Muttakad (0.30 MLD).

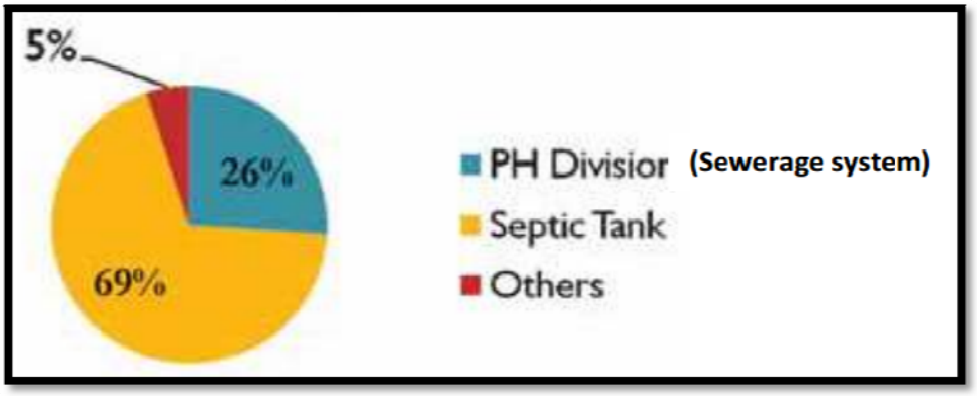
Sewerage System

The Thiruvananthapuram Corporation area is divided into 16 blocks and Attukkal Township and covers an area of 215 Sq. km. The existing Sewerage scheme comprises of 7 blocks out of which 5 blocks covers 30% of the city area (75 sq km) constructed in 1945. The Figure (1.10) shows the sewerage blocks existing in the city. The disposal system adopted presently is land treatment in the form of sewage farm at Muttathara. The most of sewage disposal in the city is through septic tank followed by sewerage system. The breakup of the method of sewage disposal is shown in Figure (1.11).

Fig (1.10): Sewerage Block Map of the City

Source: Irrigation Department

Fig: (1.11): Method of sewage Disposal in the City



The sewage from the pumping stations at Kuriathy, pattoor, Enchakkal and Kannanmoola is pumped to the stilling chamber at Valiyathura and Muttathara. The sewage farm is only existing sewage treatment facility which is receiving very limited sewage quantity (maximum upto 50 MLD). The sewage farm is maintained by the Dairy Development Department and fodder cultivation. As per the draft report on master plan of Thiruvananthapuram city, it is found that only 35 wards in the city have sewerage system. These wards are mainly located at the central part of the city. The remaining 65 wards do not have sewerage connections

Transportation

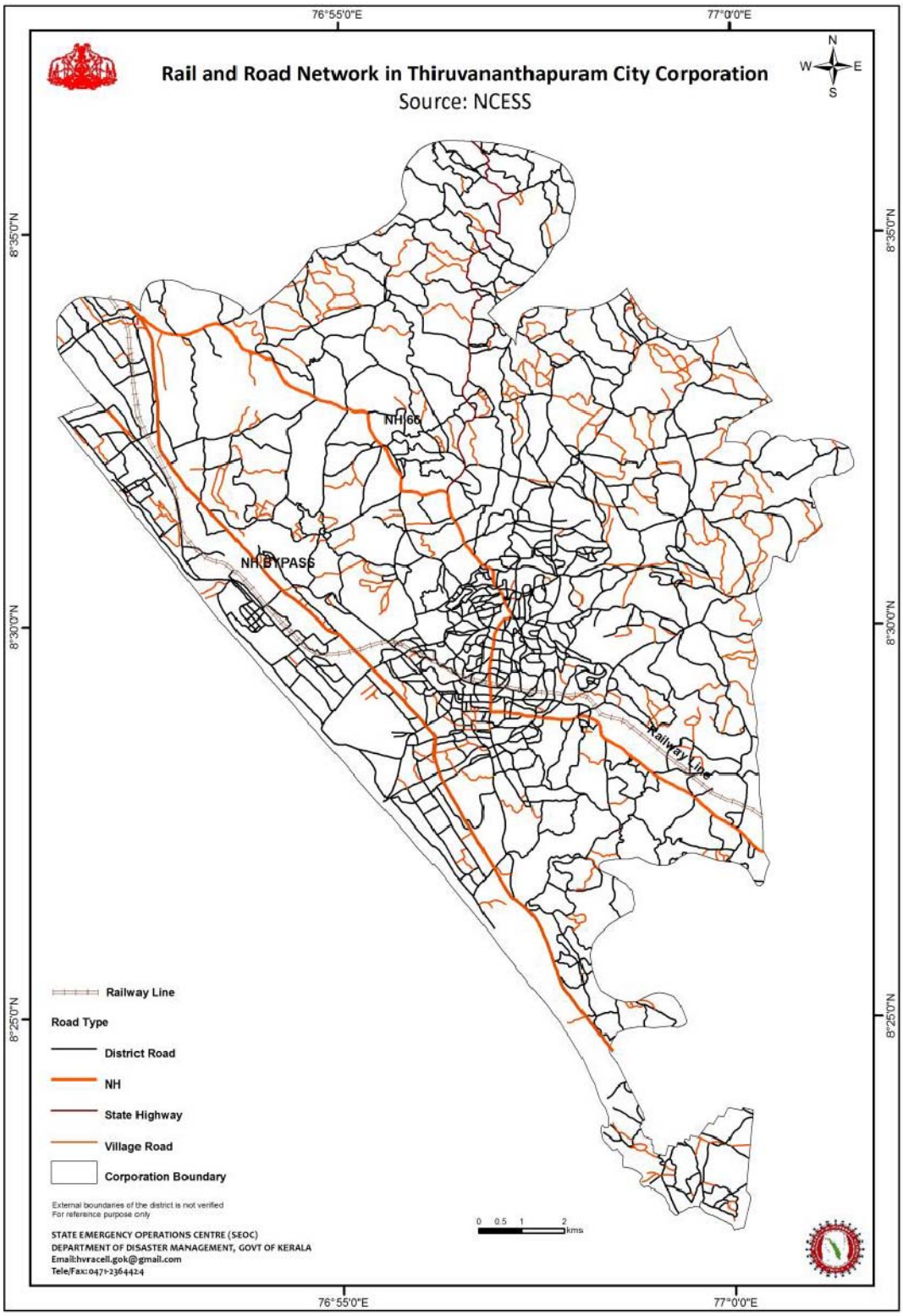
Road network

Road network is the most crucial transport medium in the city having a density of 4.11/km2. NH 66, which passes through city centre, divides it into two halves. National High Way is bypassed from Kazhakuttom to Kovalam and runs parallel to the coastline of the city. Other arterial roads, namely MC road, TS road, SH 02, MG road and PalayamChakai road serve as major lifelines of the city. The arterial roads along with the intra city link roads have a carriageway width ranging from 6 to 16 m.

Railways

The city is connected via rail network to all parts of the state and country. The urban population within and from neighboring districts depend on railways service for daily transportation. Apart from the central station at Thampanoor, there are stations at Thiruvananthapuram Pettah, Veli and one at Kazhakoottam.

Figure (1.12): Rail and Road Network



Socio-Economic Status of the City

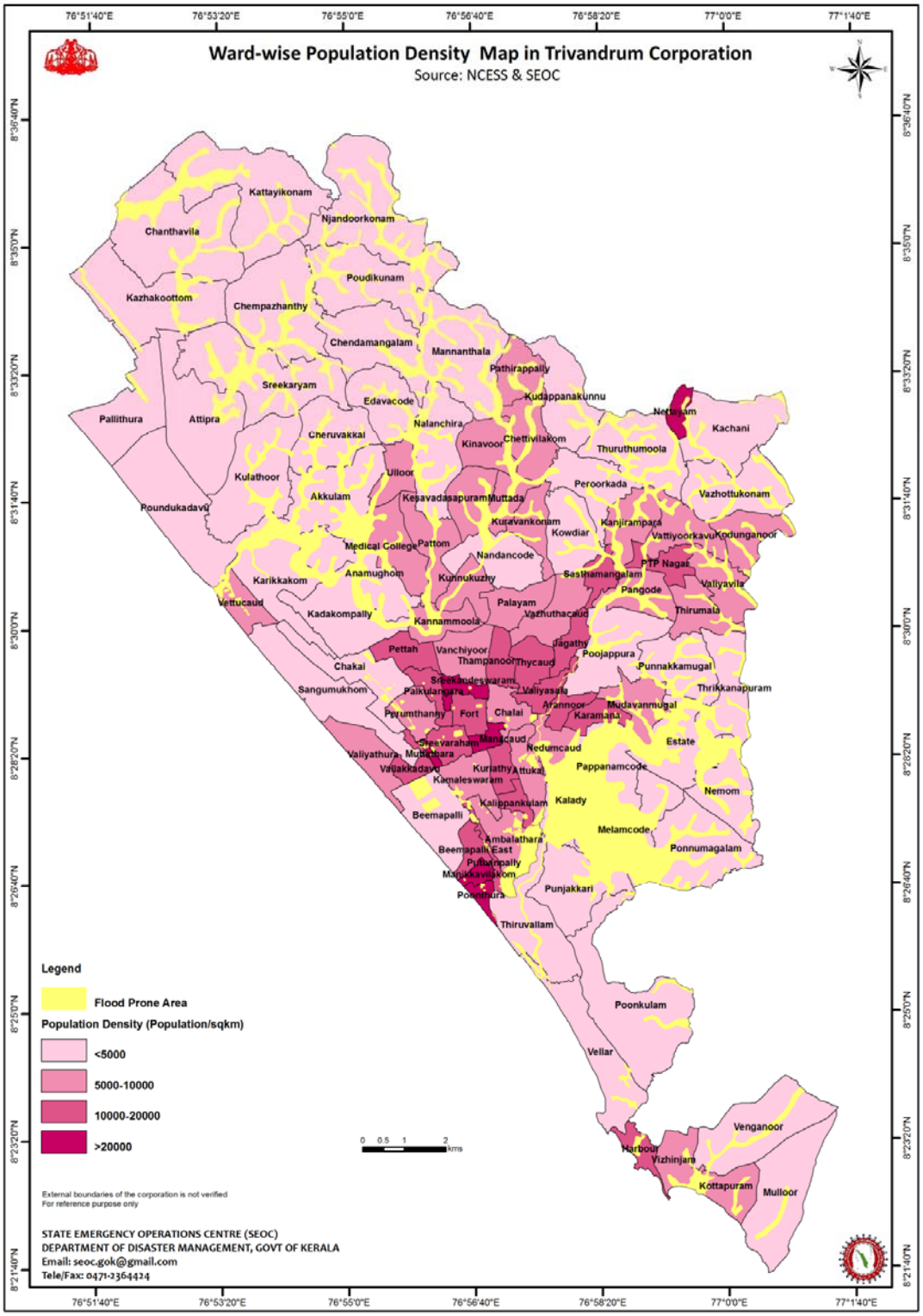
Thiruvananthapuram Corporation is the largest city corporation in Kerala (area) with a population of 10, 32,292 as per 2011 census. In October 2010, the area of the city has increased from 86 wards to 100 wards in addition of some panchayats i.e. Sreekaryam, Vattiyoorkavu, Kudappanakunnu, Vizhinjam and Kazhakuttam panchayats into the corporation. The city has now an area of 214.86 km². The highest population density lies in ward no 72, Manacaud (15908 persons/Sq km) and least in ward no 32, Thuruthumoola ward (723 persons/Sq km). The city has an average density of 4444 persons/Sq km. The distribution of population density among the wards within Thiruvananthapuram Corporation is shown in Figure 1.10. The population of women in Thiruvananthapuram is more than men with the sex ratio of 1,064 females to every 1,000 males. The major language spoken is Malayalam but English, Tamil, and Hindi are also widely understood. There is also a prominent minority of Tamil speakers and a few Tulu and Konkani speakers.

Economy of the city consists of tourism and leisure, information technology, rubber plantation, coffee production, tea production and education. Thiruvananthapuram is not an industrial region. But there are some industries like Travancore Titanium Products Ltd, English Indian Clay Ltd etc. There is less industrialization than in other major south Indian cities like Chennai and Bangalore. The main functional role as reflected in the occupational structure is services which comprise mainly of Government jobs and trade & commerce. As per 2001 census, the population below the poverty line in the city was 11,667. A BPL survey indicates the urban poor population as 120,367. Majority of these populace lives in slums and coastal fishing areas.

Tourism

Thiruvananthapuram City is a very famous tourist destination for both domestic and international tourists. It is also famous for being the evergreen city of India. Being the capital of Kerala, Thiruvananthapuram is also called as "God's own capital". There are many tourist destinations in or near the city including very famous beaches like Kovalam and Sanghumukham Beach. Another attractions are the Napier museum and Zoo (Yann Martelwrote his book Life of PI after studying a disabled lion, Simba for months together), Kuthira Malika palace and, Sree Padmanabha Swamy temple.

Figure (1.13): Population Density Map



CHAPTER - 2

An Introduction to CDMP

Introduction

Thiruvananthapuram City is vulnerable to numerous hazards. These can be natural hazards such as extreme weather events and human caused such as aircraft crashes, and those involving hazardous materials, infrastructure disruptions that could involve utility and power failures.

The City Disaster Management Plan establishes the framework that ensures the City is prepared to deal with any of these hazards. It is the methodology through which the City will mobilize its resources in the event of an emergency, thereby restoring the municipal Corporation to a state of normalcy. It is designed to ensure that all agencies which may become involved in an emergency are aware of their respective roles and responsibilities during that emergency and participate in the emergency management program.

Additionally, the Plan makes provisions for the earliest possible coordinated response to an emergency, an understanding of the personnel and resources available to the City, and recognition that additional expertise and resources can be called upon if required.

The City Disaster Management Plan in itself cannot guarantee an efficient, effective response to an emergency. It must be utilized as a tool to assist emergency and city services and officials in their emergency response activities. The Plan must be flexible enough to adapt to a broad spectrum of disasters and must be supported with:

- Adequate personnel, equipment and expertise from the response agencies;
- Familiarity with contents of the Plan by participating agencies;
- Training and exercises;
- Awareness of resources available from neighbouring municipalities and the private sector, supplemented by prearranged agreements;
- Testing of the Plan on a regular basis; and
- Review of the Plan following any incidents or exercises where it is implemented.

THE CITY DISASTER MANAGEMENT PLAN CAN BE WHOLLY DIVIDED INTO TWO PARTS, BASIC PLAN, AND RISK SPECIFIC PLAN.

The Basic Plan outlines how City agencies will respond to, recover from, and mitigate the impact of a disaster. The Basic Plan contains sections that describe purpose & scope, legal authorities, emergency management governance structure, preparedness and mitigation cycle.

Risk-Specific Plans are also supporting documents to the Emergency Plan. They contain specific response plans for hazards that may pose a threat to the City. These Plans reflect the City's Hazard Identification Vulnerability and Risk Assessment (HVRA).

Purpose

The aim of the City Disaster Management Plan is to provide the framework within which extraordinary arrangements and measures can be taken to protect the health, safety, and welfare of the inhabitants of the City when faced with an emergency.

The plan unifies the efforts of City organizations for a comprehensive and effective approach for responding to and reducing the impacts of a disaster. It is intended to increase the emergency response capability of the City by establishing a plan of action to efficiently and effectively deploy emergency services.

Scope

A disaster may result from an existing danger or it may be a threat of an impending situation abnormally affecting property or the health, safety and welfare of the community. Its nature and magnitude requires a controlled and coordinated response by a number of agencies, both governmental and private, under the direction of the Control Group, as distinct from routine operations carried out by an agency or agencies, e.g., fire fighting, police activities, normal hospital routines.

There are two major categories of hazards that may pose a threat to the Trivandrum City Corporation.

- ***Natural Events*** – severe weather, floods, drought, coastal erosion, lightning
- ***Anthropogenic & Infrastructural Disruptions*** – incidents involving hazardous materials, stampede, utility and power failures, transportation accidents, aircraft accidents, water supply failures, building or structural collapse, Radiological & Nuclear Disaster and epidemics.

Legal Authorities

Legislation under which the City Corporation, its' employees and agents are authorized to respond to an emergency are as follows:

Chapter – 6 of DM act, 2005: (1) Subject to the directions of the District Authority, a local authority shall –
(a) Ensure that its officers and employees are trained for disaster management;
(b) Ensure that resources relating to disaster management are so maintained as to be readily available for use in the event of any threatening disaster situation or disaster;
(c) Ensure all construction projects under it or within its jurisdiction conform to the standards and specifications laid down for prevention of disasters and mitigation by the National Authority, State Authority and the District Authority;
(d) Carry out relief, rehabilitation and reconstruction activities in the affected area in accordance with the State Plan and the District Plan.

(2) The local authority may take such other measures as may be necessary for the disaster management.

Disaster Management Governance Structure

The City Disaster Management Committee shall consist of representatives holding positions in the City, local Agencies, Divisions and organizations as the case may be, or those designated to act on their behalf from time to time. The following list of recommended City Disaster Management Committee members includes senior representatives from various divisions to provide executive leadership and policy direction and to manage the strategic response and support site operations by mobilizing necessary resources during an event. (Structure of CDMC is under finalising)

Objectives of City Disaster Management Committee

The City of Disaster Management Committee provides the City with an effective vehicle for developing and maintaining a comprehensive disaster management program, as defined under the *National Disaster Management Act*, 2005, and to manage emergency response activities, which will ensure:

- Mitigation, preparedness, response & recovery
- Support of emergency operations at the site(s)
- Overall strategic management of the emergency
- Risk identification, critical infrastructure protection
- Mobilization of all municipal, voluntary, and other agencies required
- Prevention of further injury, loss of life, property damage
- Establishment of information centres for the public and news media
- Procurement of essential resources
- Restoration of utilities and other essential services
- Rehabilitation

Authority to Activate the Emergency Operations Centre (EOC)

The Mayor/ Deputy Mayor of Trivandrum City Corporation have the authority and responsibility for the activation of EOC and otherwise initiate the implementation of the City Disaster Management Plan

City Emergency Operations Centre (EOC)

The City Emergency Operations Center is a state of the art facility which serves as the "nerve center" for the City's response and recovery efforts before, during and after an incident.The responsibilities of City EOC includes;

- Effective ***policy and strategic direction*** to the emergency
- ***Support*** of emergency operations at the Site(s)
- Providing ***resource management*** to support Site operations
- ***Coordinating management links*** to other Command / Operations Centres, ESF's
- ***Providing information*** to the public and news media
- ***Maintaining business continuity*** for the rest of the City

CHAPTER - 3

Hazard foot prints of the city

City Profile at a glance			
Head quarters	Thiruvananthapuram Muncipal Corporation		
Location (of the Headquarters)	8 °25′ N latitude, 76 °55′ E Longitude		
Total area(City)	214.86 SqKm		
Mayor	Adv. V.K. Prasanth		
Administrative Divisions			
Taluks	1		
Villages	25		
Wards	100		
Zonal Offices	12		
Geography & Topography			
Major Rivers	Karamana, Killi		
Lakes	Veli, Akkulam		
Canal	TS Canal (Connection b/n Akkulam-Veli Lake &Vellayani Lake		
Coastline (length in kms)			
Average Elevation	16ft above MSL		
Highest Point	Observatory (60mts)		
Mean Maximum Temperature	32 C		
Average Rainfall	170cm/Annum		
Demography			
Total population	1,687,406		
Male	815,200 (48.31%)		
Female	872,206 (51.69%)		
Sex ratio	1000:1070		
Age group population (0-6 years)	142,242		
Population density	4,454 /km²		
Literacy rate	Total	Male	Female
	93.24%	94.87	91.73

CLIMATIC DATA- 2014

Month	Max Temp (Degree Celsius)	Min Temp(Degree Celsius)	Rainfall (mm)
Jan-14	33.06	22.41	62.4
Feb-14	32.53	23.63	118.88
Mar-14	33.5	24.63	172.6
Apr-14	33.7	25.02	663.8
May-14	33.17	24.70	1293.4
Jun-14	32.45	24.8	766.7
Jul-14	29.68	24.56	547.2
Aug-14	31.91	31.66	2101.7
Sep-14	33.97	31.85	1136.5
Oct-14	31.05	23.88	1559.9
Nov-14	32.64	24.28	521.4

Hazard Profile of the City

Introduction

Thiruvananthapuram City is home to nearly 8 lakh people inhabiting 215 km² of land. With the current rate of urbanization and development, the city and the adjoining urban outgrowth is expected to witness a massive growth in its population. Thiruvananthapuram city is historically vulnerable to various natural disasters. The city is prone to naturally triggered hazards like flood, drought, coastal erosion, lightning and earthquakes and human induced hazards like petro-chemical accidents, transportation accidents and epidemics.

Understanding the disaster proneness of the city and undertaking appropriate risk management activity is essential to the wellbeing of the city dwellers. Increasing frequency of urban flooding, severe droughts and windfall of trees in the recent past has proved disastrous to life, property and livelihood in the city.

The 27.4 km long coastline is vulnerable to various hazards particularly during monsoon. Of the 100 wards in the city corporation, 14 wards fall in the coastal belt.

The city falls in seismic zone III and is thus vulnerable to earthquakes. Tremors of minor magnitude have occurred in and around the city in 2012.

Lightening, which is of common occurrence during north east monsoon claims several lives and causes damage to property almost every year. The rise in anthropogenic hazards such as industrial mishaps, road accidents are also of major concern. Wind storm is a common event in the city causing substantial damages to life and property.

The City Disaster Management Cell has identified and assessed the various hazards and risks to public health & safety that could give rise to disasters and has identified the facilities and other elements of the infrastructure that are at risk of being affected by disasters. They can be grouped into three categories:

Natural Events – severe weather events, floods, earthquakes, thunderstorm, storm surge, wind storm and lightning.

Anthropogenic /Accidental Hazards –incidents involving hazardous materials, stampedes, building or structural collapse, transportation accidents, aircraft accidents, epidemics, nuclear and radiological.

Infrastructure Disruptions – utility and power failures, water supply failures, and critical resource shortages.

Hazard Profile of the City

SL. No	Classification	Types of Disasters
	Natural	
1.	Weather related	Flood –Urban flooding, Riverine flooding
		Coastal – Tsunami, Coastal erosion, Storm surge, Kallakkadal
		Thunder & Lightning
		Cyclone, Heavy winds
		Drought
2.	Geological	Earthquakes
		Landslides
	Anthropogenic	
3.	Biological	Epidemics
.		Pest attack
		Food poisoning/ Hooch accidents
4.	Accidental	Industrial Explosions
		Offsite Petrochemical accidents
		Oil spill
		Dam break due to structural weakness
		Fire accidents – Fireworks/ Short Circuits/ LPG explosion
		Stampedes
		structural Collapse
		Boat capsizing
		Air Craft/ Rail / Road accidents
		Nuclear/ Radiological
5.	**Infrastructure Disruption**	Power failures
		Water supply Failure
		Sewerage failure
		Accumulation of Solid Waste
		Critical resource shortage

Hazard Risk Index

Magnitude> Probability	Catastrophic	Critical	Limited	Negligible
Highly Likely	Flood/Epidemics/Solid waste	Motor Vehicle Accidents		
Likely	Coastal erosion/Wind fall/Lightning	Fire/Utility Disruption/water pollution		Boat Capsizing
Occasional	Drought	Structural collapse	Earthquake	
	Stampede	Rail accidents	Chemical Disaster/aircraft accidents	Radiological Disaster/Nuclear Disaster

Relationship between Primary & Secondary Hazards

Disaster	J	F	M	A	M	J	J	A	S	O	N	D
Earthquake												
Drought												
Fire												
Storm surge												
Lightning												
Flood												
Anthropogenic												

Hazard Seasonality Mapping of the City

Primary hazards / Secondary Hazards	Earth quakes	Tsunami	Landslide	Flood	Coastal Erosion	Drought	Lightning	Wind storms	Hazmet Incidents	Fire
Earthquakes										
Tsunami										
Landslides										
Flood										
Coastal Erosion										
Drought										
Lightning										
Extreme Heat Events										
Wind storms										
Epidemics										
Fire/Electrocution										
Traffic Disruption										
Infrastructure failures										
Hazmat Incidents										
Power Outages										
Water Shortage										
Tree falling										
Communication Failure										
Sewerage Disruption										
Water Contamination										
Environmental Degradation										

Hazard foot Prints of the City

Flood Hazard

One of the earliest accessible Governmental records regarding the flood proneness of the present day Thiruvanathapuram city is the Royal Proceedings dated 21st December 1920 issued by Mr. N. Rajaram Row, Chief Secretary to Government. This proceedings talk about flooding in Karamana River due to which a Government farm located in present day Karamana had to be shifted from that location to other parts surrounding the city.

Table 1 shows the years that 5, 50 and 100 year return interval one day rainfall was exceeded in the City based on available rainfall records from 1986 to 2013 for 3 rain gauges surrounding the City. Continuous daily rainfall data pertaining to the City is not available and hence data from adjoining rain gauges are used. It is evident that occurrence of extreme rainfall events were few in number, however, urban flooding in the city is an annual event. This indicates that urban flooding in the City is primarily owing to inadequate maintenance and management of sewerage systems and storm water drains. Improper construction of pavements, buildings, roads, other impervious structures, choking of drainage etc. are factors that aggravate the magnitude of urban floods.

Table (3.1): Five, Fifty and Hundred year return interval daily rainfall and years of exceedance

Sl. No	Nedumangadu			Neyyattinkara			Varkala		
RI	5	50	100	5	50	100	5	50	100
Rainfall (mm)	127.5	159	168.1	108.3	131.6	138.4	131.9	155.9	162.9
Years exceeded	1993, 2003, 2004	2005, 2010, 2011	1992, 1996	1994, 2001, 2004, 2005, 2010	0	1993, 1995, 1998, 2003	1998, 2007	1989	1987, 2004, 2006, 2011

Pazhavangadi Thodu (drain) is one of the important storm water drains, which runs through the heart of the Thiruvananthapuram city. Pazhavangadi Thodu starts from Kerala Water Authority (KWA) at Vellayambalam and emerges into Aamayizhanjan Thodu near Kannamoola and has a length of about 5.75 km. It is the main discharge channel of Thiruvananthapuram City and traverses through key places of the city like Thampanoor, Pazhavangadi, Thakaraparambu, Vanchiyur, Pattoor etc. The water collected during a down-pour in the area adjacent to the railway station and bus stand is not drained quickly into the Thodu as the carrying capacity of the leading drains are significantly low in some places and not sufficient elsewhere. The most severe and frequent flooding in the city occurs at Thampanoor and East Fort/Pazhavangadi areas, followed by Uppilamoodu and Kannamoola areas. In 2014, flooding in Thampanoor between the Central Railway Station and the Bus Station has reduced owing to structural interventions. Discharge is monitored at three locations within the City they being Maruthamkuzhi,

Mankattukadavu and Karamana. Based on records available these locations, 5, 50 and 100 year return interval discharge and stage height values were calculated as is given as Table (3.2)

Fig. 3.1: Flood Inundation Map overlaid with Ward wise Population Density

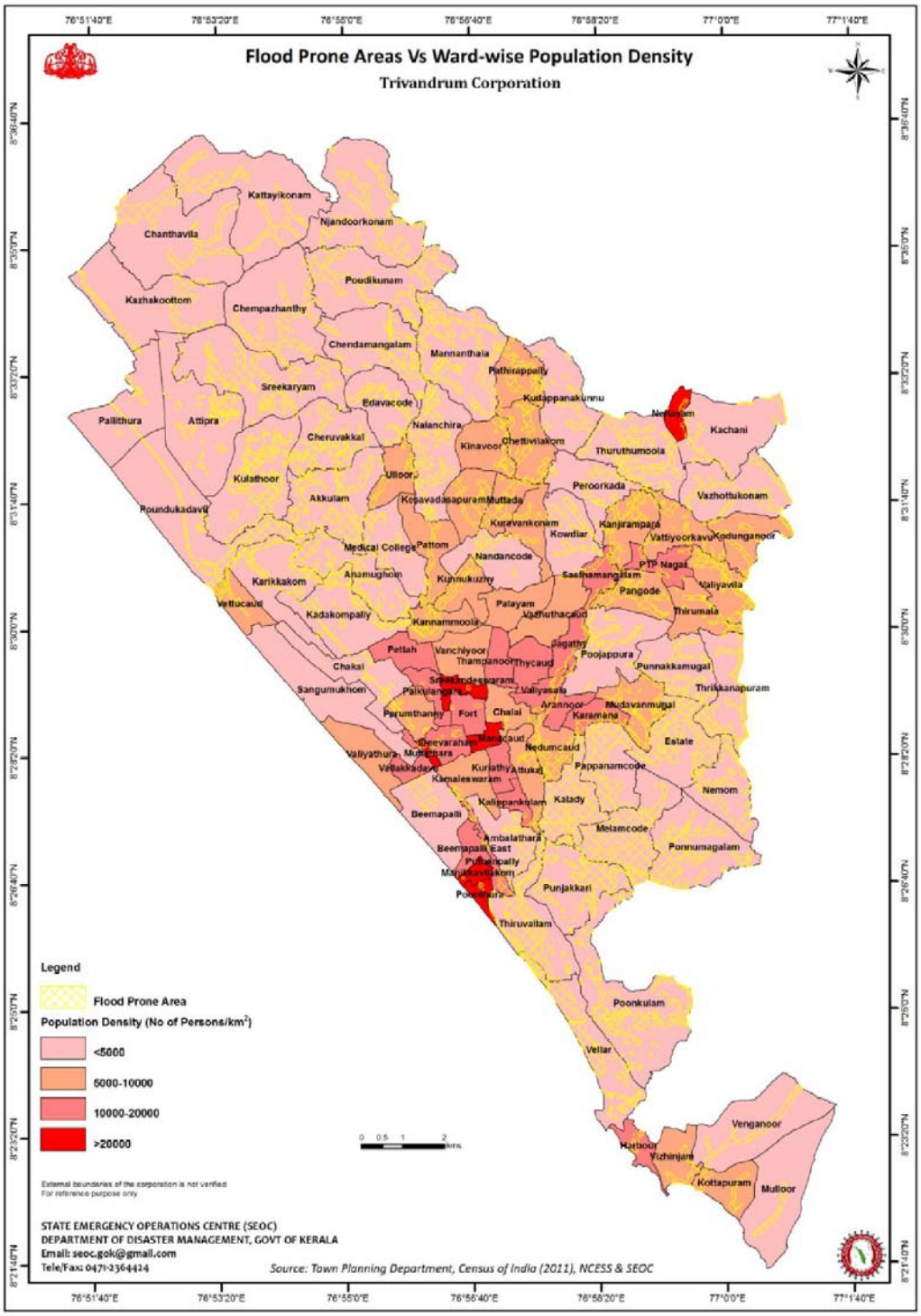


Table 3. 2: Five, Fifty and Hundred year return interval discharge (m3/sec) and gauge (m) readings

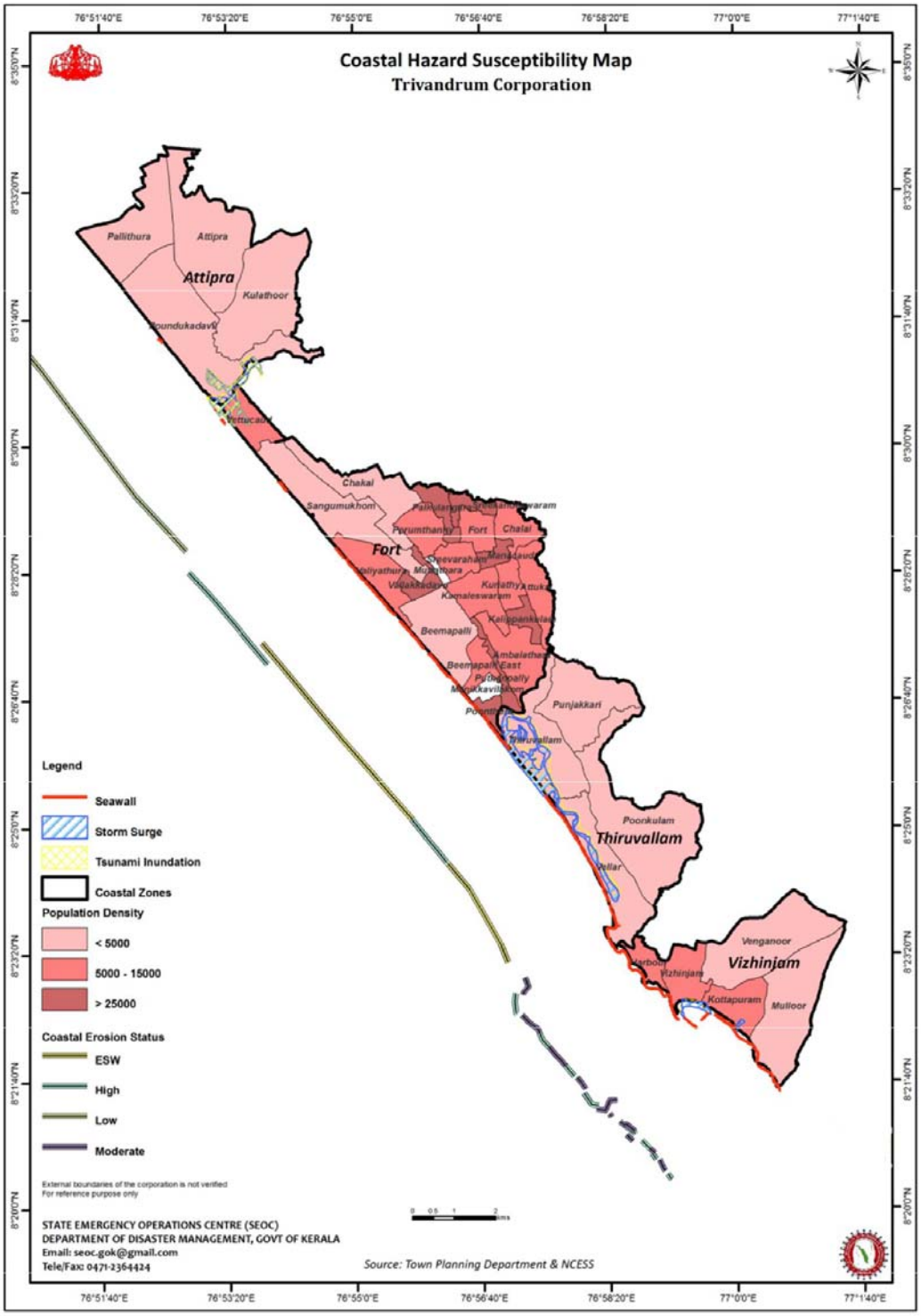
	Maruthamkuzhi (1979-2011)		Mankattukadavu (1989-2011)		Karamana (1972-1988)	
RI	Discharge	Gauge	Discharge	Gauge	Discharge	Gauge
T=5	5.44	1.42	25.31	1.62	8.28	2.82
T=50	7.75	1.52	34.76	1.90	12.38	2.94
T=100	9.01	1.57	39.91	2.05	14.61	3.00

Considering these values and the scarcity of long term data, it is safe to assume that natural flood plains are the maximum possible flood inundation extent within the city limits. Accordingly, a flood prone area map of the City was prepared based on inputs from satellite images, field data collection and from the natural flood plains mapped by National Centre for Earth Science Studies. Low lying flood prone areas which are prone to urban flooding were added to the map using data derived from field visits and high resolution satellite images. Figure 1 shows this flood prone area map of Thiruvananthapuram city. A total area of 29.02 km^2 has been identified as naturally flood prone in the City while 22.7 km^2 is assessed to be prone to urban flooding.

Coastal Hazards

Figure (3.2) shows the coastal erosion/accretion prone areas and the worst case scenario storm surge inundation limits (Tsunami 2004 inundation limits). Based on systematic field survey conducted by National Centre for Earth Science Studies, 6.5 km of the 27.4 km of Thiruvananthapuram City's coastline is prone to high rates of coastal erosion. In the worst case scenario, sea level may rise by 15 to 38 cm by mid-21st century [5]. Considering the tsunami inundation level this anticipated increase is negligible and thus, tsunami inundation level is also considered as the worst case scenario inundation level in the event of major storm surges.

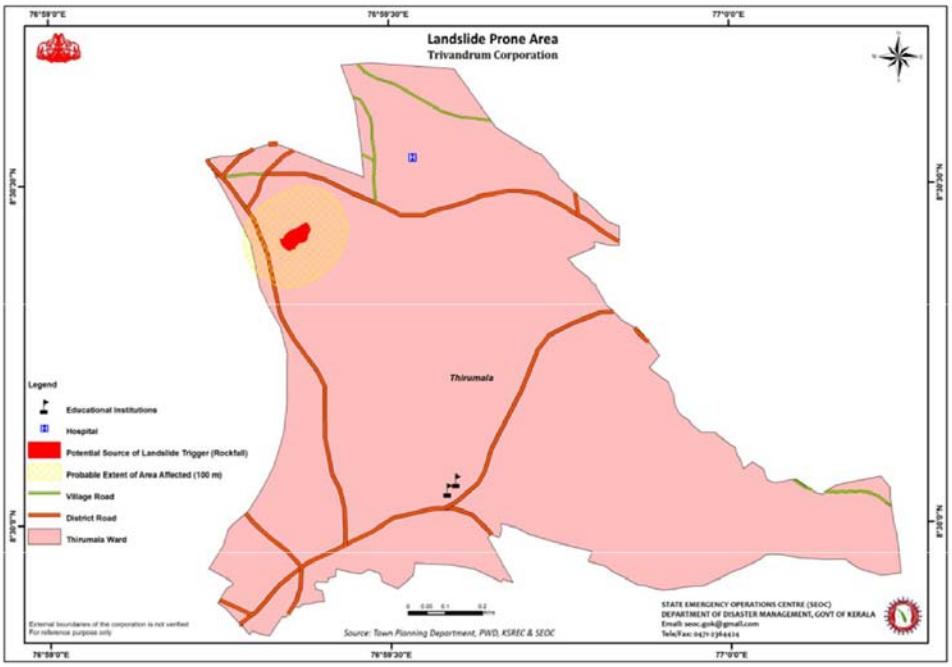
Fig 3.2: Tsunami and Storm Surge prone area overlaid with ward wise population density



Landslide

The City although is in an undulating terrain, the possibility of landslide is limited to one ward, namely Thirumala ward (Thirumala Village). This is owing to the presence of loose rock boulders atop Parakovil hill, a small hill housing a temple. All sides of the hill are densely populated and thus, extraction of the loose rock boulders is not an easy task. Figure (3.3) shows the map of the area prone to rock fall from Parakovil hill in Thirumala ward.

Figure 3.3: Landslide prone area and nearest critical facility



Drought

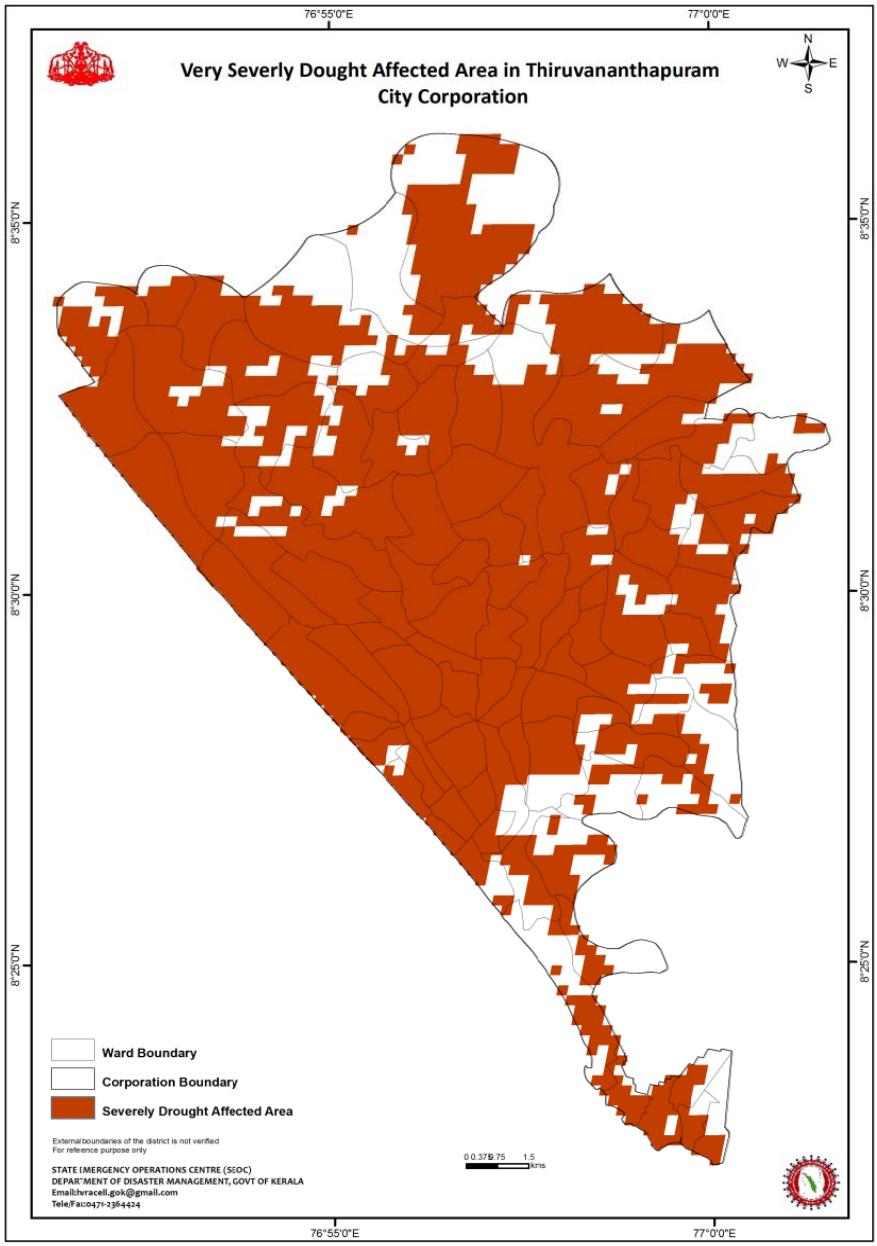
Based on available research it is noted that the frequency of dry days was increasing, the onset date of monsoon was being delayed in Kerala and the rainfall in monthly, seasonal and annual time scale was showing decreasing trend over the last 100 years period. The annual average rainfall of Thiruvananthapuram City is 1746 mm based on rainfall data from 1986 to 2013.During the period, the annual rainfall of the city was less than annual average in the years 1986,1988, 1989, 1990, 1995, 1996, 2000, 2002, 2003, 2009, 2011, 2012 and 2013 (13 times). Thus the general trend and the observations indicate that the City is increasingly prone to drought like conditions due to natural negative departure of rainfall from long period average.

The situation is aggravated by the fact that about 41% of the City has deficiency in availability of potable centrally supplied pipe water. Present capacity of potable drinking water production in the City is 273 Million Litres per Day (MLD) and there exist a gap of 137 MLD between production and demand; transmission loss is approximately 35.5%. The presence of sock pits, sewerage pipelines and open

sewerage canals restricts the possibility of digging open wells for potable drinking water, particularly in the City limits as ground water may be contaminated with the presence of coli form and faecal coli form. Monitoring results in Akkulam -Veli lakes and Parvathy Puthanar shows high values of total coli form and faecal coli form. This situation aggravates the natural drought proneness of the City.

A drought prone area assessment was carried out using rainfall data, Normalized Difference Vegetation Index derived from MODIS satellite and Ground Water departure data. The assessment showed that the entire City falls under moderately drought prone category.

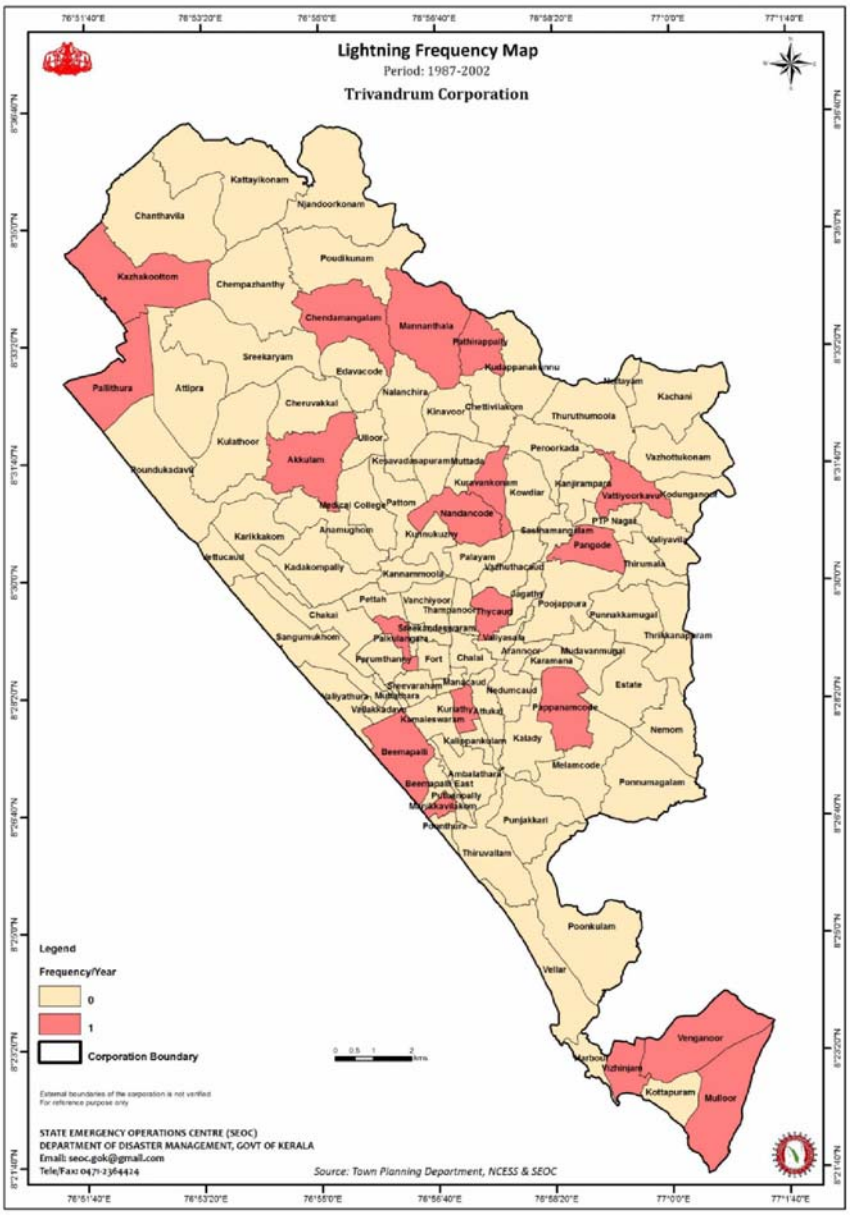
Fig: 3.4 Drought Prone area map



Lightning

The City experiences frequent incidence of lighting. Lighting being a random Phenomenon, its potential cannot be mapped as an aerial extent. The undulating terrain and the density of electrification of the households may be considered as factors that contribute to lighting fatality and damages in the city. Figure 3.4 shows the lightning incidents in the city and the frequency of lighting per ward based on long term data of fatal and major damage causing lighting events reported.

Fig: 3.5 Lightning frequency map



Anthropogenic Hazards

Industrial hazards

The Major Hazardous Installations in Trivandrum district are:
Bharat Petroleum Corporation Limited, LPG Plant , Kazhakuttom
Travancore Titanium Products Limited, Veli
English India Clay Limited. , Veli

All these installations are Petroleum & Chemical Manufacturing & Storage Units. The major products handled by these units are LPG, HSD, MS, other Petroleum products.

BHARAT PETROLEUM CORPORATION LTD, KAZHAKUTTOM

Principal Activity

The principal activity in the factory of Bharat Petroleum Corporation Limited is Receipt, Storage and Filling of Liquefied Petroleum Gas

Location

22 kms, Away from Trivandrum City, towards Kazhakuttam

Adjoining properties within 500m:

North West	:	KSSC Ltd.
North East	:	Public Road
South West	:	Private Land
South East	:	Residential Area

Storage Capacity

LPG Bulk	:	1180 MT
Filled Cylinders	:	10700 (14.2 kg)

TRAVANCORE TITANIUM PRODUCTS LTD

Principal Activity

The principal activity in the factory of Travancore Titanium Products Ltd Is Manufacturing Titanium Dioxide pigment (non-toxic) & Manufacturing and storage of concentrated Sulphuric acid.

Location

Kochuveli, Trivandrum

Adjoining properties within 500 m:

North	:	Kochuveli Industrial Development Area
East	:	Railway Siding
South	:	Residential Area
West	:	Coastal Area

Sl. No	Name of Chemical	Maximum Inventory
1	Sulphuric Acid	12455 MT
6	Sulphur	7000 MT
7	Superior Kerosene Oil	783 KL
9	Furnace Oil	424 KL

ENGLISH INDIA CLAY LTD

Principal Activity

Processed china clay Manufacturing

Location

Kochuveli, Trivandrum

Adjoining properties within 500 m:

North : Akkulam Lake

East : Parvathi Puthanar

South : Kochuveli railwaystation

West : Residential Area

Storage Capacity

Sl. No	Name of Chemical	Maximum Inventory
1	Furnace Oil	89 KL
2	HSD	82 KL
3	Sodium Hydrosulphite	18 MT
4	Sulphuric Acid	18 KL

OTHER INSTALLATIONS

In addition to the above three major hazardous installations, six installations as listed below are also considered hazardous, even though the threshold quantity of storage is less than the limit stipulated in respective statute, considering the hazardous nature of chemicals used:

Table : 3.3 – List of Industrial Installations in Trivandrum City

Sl. No	Name of Company	Name of Chemical	Storage Capacity
1	HLL Life care Ltd. Peroorkada	Ammonia Furnace Oil HSD LNG Sulphur	12500 KG 124 KL 15 KL 17224 KG 7500 KG
2	HLL Life care Ltd. Akkulam	Furnace Oil HSD	25 KL 25 KL
3	Indian Oil corporation, Air Port	ATF	1450 KL
4	Bharat Petroleum Corporation limited Airport	ATF	850 KL
5	Hindustan Petroleum Corporation limited Airport	ATF	140 KL

- Contact persons/number of all these facilities are attached in the annexure
- The chemical data sheets of these products are shown in **Annexure**

Transportation of Hazardous Goods

There has been a steady increase in the transport of hazardous substances throughout the country and this has brought in its wake a great potential for accidents involving these substances. Hazardous chemical carriers involved in accident can cause disastrous consequences like fire, explosion and spillage resulting in loss of life and property besides environmental pollution. Such accidents demand immediate availability of essential information to take appropriate counter measures. Transportation accidents always involve the public and therefore an off-site emergency requiring co-ordination and gearing up of a number of public authorities.

Emergency arising out of transportation of hazardous substances is therefore a part of the disaster management Plan of the City. The hazardous chemicals from manufacturing installations at Kochi, Malappuram and Kozhikode are transported either on road or rail through Trivandrum. Thus the roads are more prone to accident on State Highways in Trivandrum area.

Due to the lack of adequate data regarding the chemicals transported through the City, any analysis on offsite emergency cannot be initiated.

Fire Hazard

Fires are perhaps the most frequent disaster in urban areas. Urban issues like high population, overcrowding, unregulated commercial activities are frequently responsible for urban fires. Fire has emerged as critical issue in Urban Planning due to rising frequency of Fire accidents, leading to huge losses of life & property. Fires can occur with the same ferocity in residential buildings, slums and squatter settlements, public places like auditoria, cinema halls, shopping malls, LPG godowns/petrol pumps, industries, chemical handling units, etc.

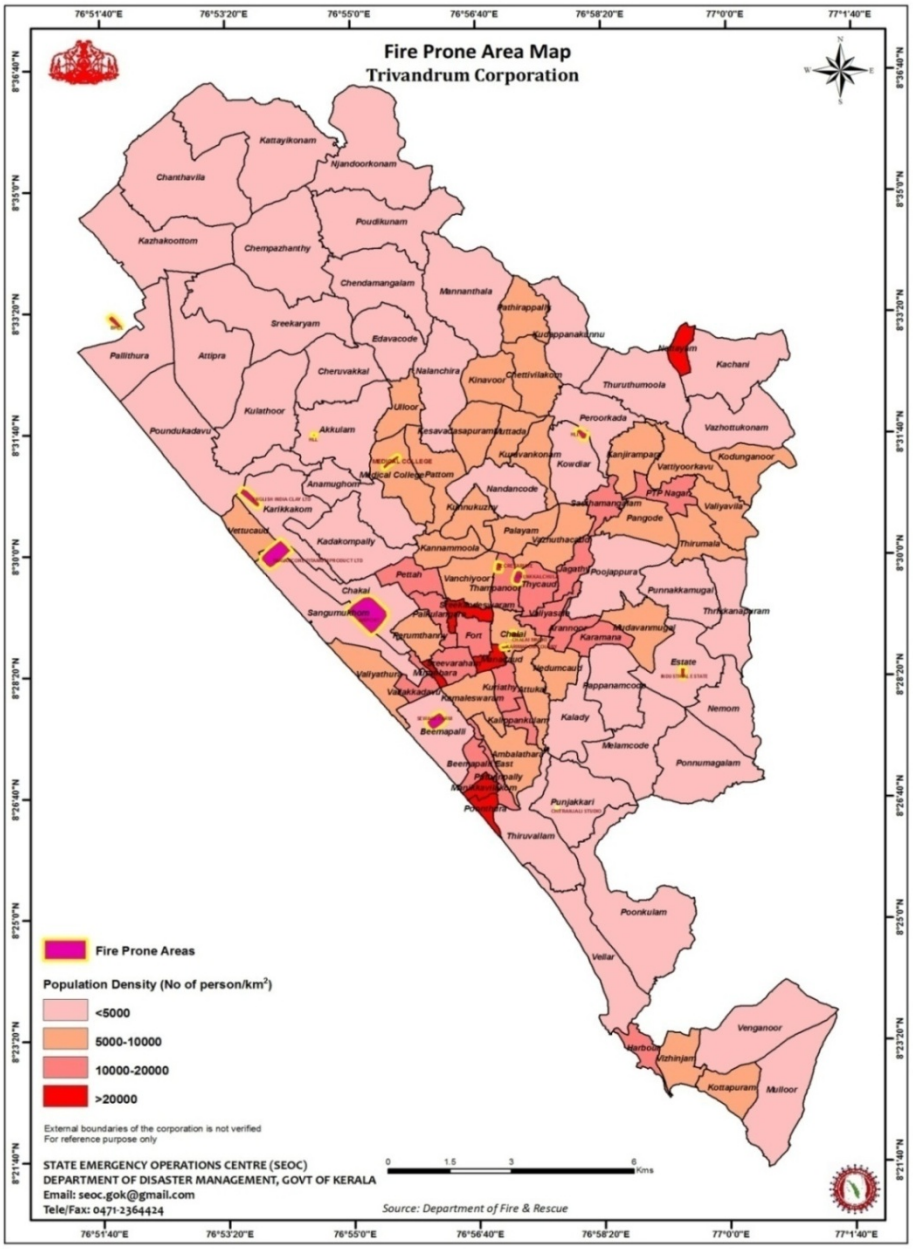
Trivandrum, the administrative capital of Kerala State has been substantially affected by globalization and rapid urbanization over the last decade. It is one of the fastest growing cities in Asia.

Thiruvananthapuram City is greatly diversified and practically has every type of fire risk. In Trivandrum the fire risk can arise from the following sources:

- Large number of closely built old timber framed buildings
- High-rise buildings with inadequate fire-fighting facilities
- Commercial activities in Chala, Palayam, Eastfort, MG road areas
- Small, medium and hazardous industries in suburban areas
- Large slum settlements.

Following is the Fire prone area map of Trivandrum City Corporation. List of Fire & rescue Services in the Trivandrum City Corporation and other major critical infrastructures are attached in the annexure.

Fig.3.6: Fire Prone Area Map of Trivandrum City



Mass gathering events

Thiruvananthapuram City experiences the following major mass gatherings, they being a) Attukal Pongala, b) Beemapally Urus, c) Madre De Deus Church, Vettucaud Pilgrimage and d) Onam Celebrations organized by the State Government.

Amongst these, Attukal Pongala which registers about 37 lakh women pilgrims congregating throughout the city is the most important. Devotees cook a mixture of rice, jaggery and coconut in earthen pots in the street that is offered to the goddess seeking divine blessings. The Chief Priest of the temple lights the main hearth from the fire inside the sanctum sanctorum of Attukal Temple. This fire is exchanged from one oven to another.

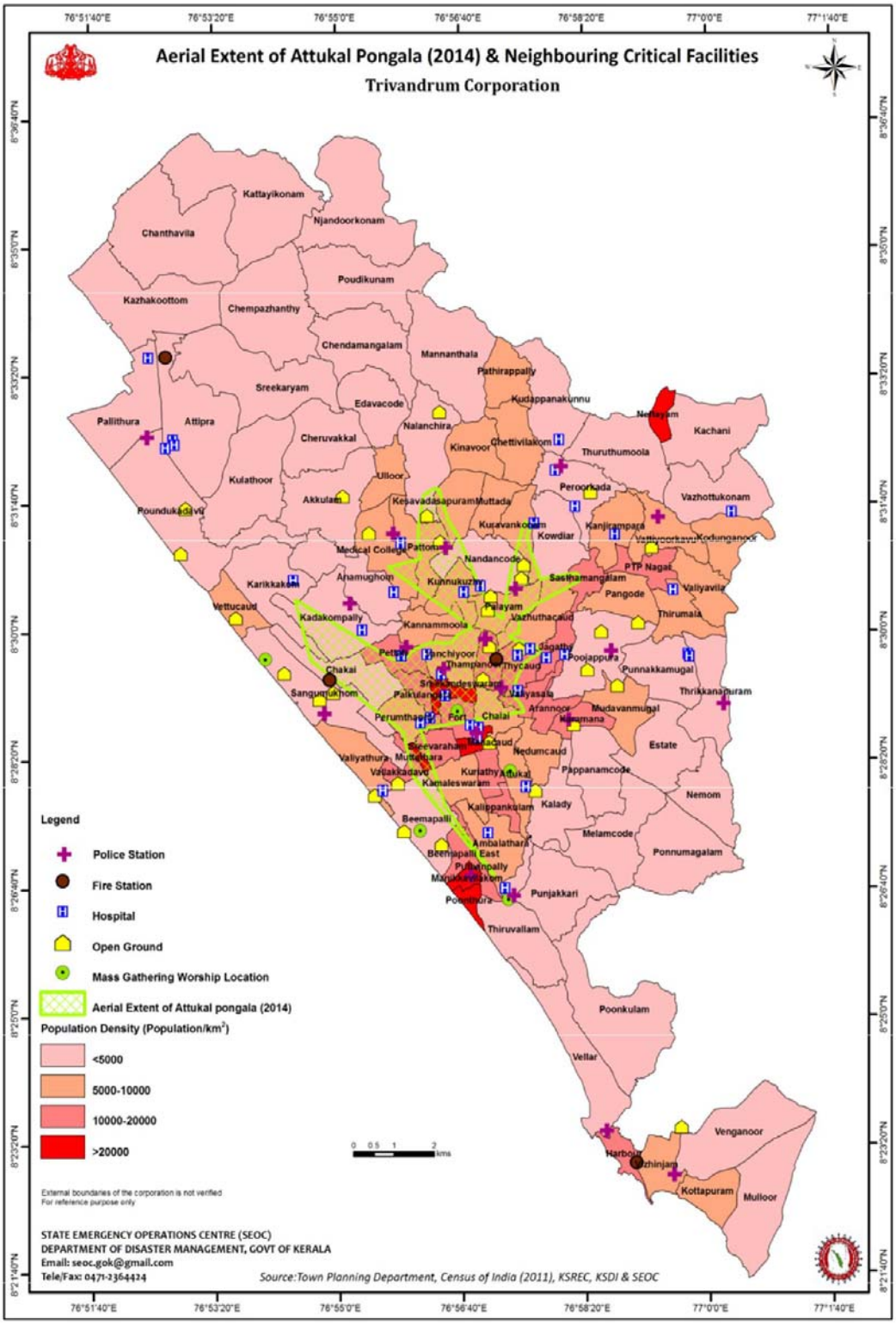
Being a traditional festival the devotees are self-disciplined and accidents involving fire have been minimal. However, the potential of stampede and fire outbreak cannot be ruled out. In order to assess the area occupied by the devotees and to evaluate the availability of resources, a team mapped the maximum areal extent of Attukal Pongala on 2014. Figure 3.7 shows the map of areal extent of Pongala in 2014.

Beemapally Uroos festival is celebrated during April of every year at Beemapally Mosque, one of the famous Muslim pilgrimage centre in Kerala. The 11 day long festival attract large crowd from various parts of the state. Even though there is no history of any untoward incidents during the celebrations, there exists element of risk.

Vettukadu Church annual festival at Vettucaud church or Madre De Deus Church is yet another major festival in the City. Vettucaud church or Madre De Deus Church situated at the coastal areas of Trivandrum (N- 08º 27.402'; E- 076º 56.078') is an ancient church in south India bearing a tradition of 500 years. Every year the church celebrates a holy festival during mid November that last for 10 days.

The State Government organizes Onam celebrations every year at Trivandrum City with grand processions, folk art presentations, music and dancing make. It's a large event organized in association with all government departments and City Corporation. Each year huge mass arrives in the City Centre for seeing this event.

Fig 3.7: Aerial extent of Attukal Pongala, population density & critical facilities



Radiological Instruments

Radiological exposure incidents have not been reported from Thiruvananthapuram City in the last 50 years. However, the March 2010 accident at Mayapuri Scrap Market, New Delhi was an eye opener to agencies involved in radioactive safety regulations in the country. An AECL Gamma cell 220 research irradiator owned by Delhi University since 1968, but unused since 1985, was sold at auction to a scrap metal dealer in Mayapuri on February 26, 2010. The orphan source arrived at a scrap yard in Mayapuri during March, where it was dismantled by workers unaware of the hazardous nature of the device. The Cobalt-60 source was cut into eleven pieces. The smallest of the fragments was taken by the scrap metal dealer who kept it in his wallet and two fragments were moved to a nearby shop, while the remaining eight remained in the scrap yard. Eight people were hospitalized as a result of radiation exposure, where one later died.

This incident points to the hazard potential of otherwise non-hazardous radiation sources such as X ray units, CT scanners, PET scanner, Gamma Chambers, Auto Radiography, Gas Chromatograph Units, Atomic Absorption Spectrophotometer, Microwave digestion system, CHNS Analyzer and Cyclotrones in the City.

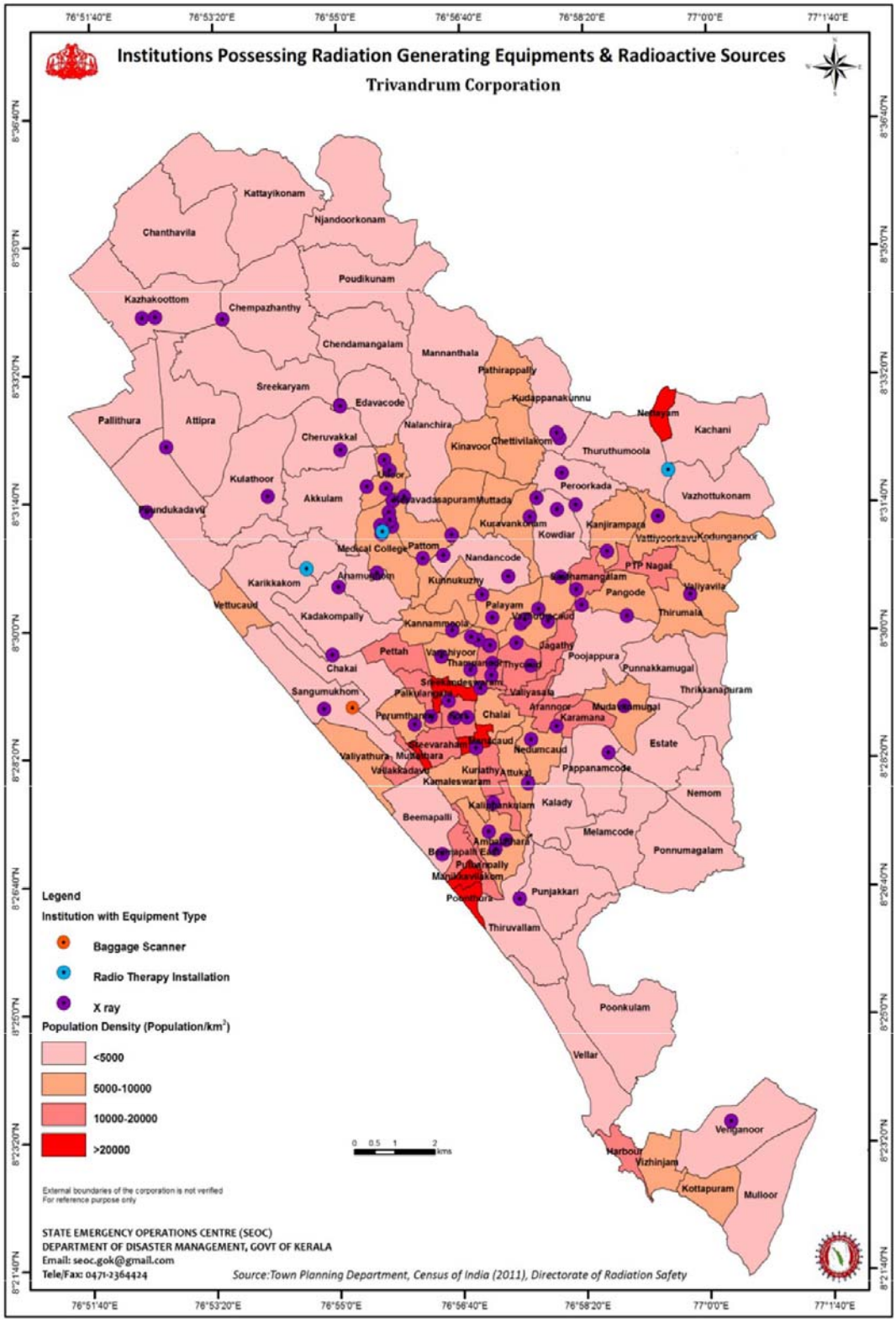
Trivandrum City is having the state of the art medical facilities and research centers with numerous radiological instruments

In Trivandrum, Regional Cancer Centre, Medical College, Sree Chitra Tirunal Institute for Medical Sciences & Technology are some of the hospitals using these radiological applications. Apart from this some research institutions like Central Tuber Crops Research Institute, Agriculture University are using instruments like Gamma Chamber, Auto radiography, Gas Chromatograph unit, Atomic Absorption Spectrophotometer, Microwave digestion System, CHNS Analyzer, Cyclotrone for research purposes which can also pose threat if it's not following the mandatory instructions and safety precautions

A map of institutions utilizing such radiological equipment is given as Fig 3.8

List attached in the annexure

Fig 3.8: Institutions possessing radiation generating equipment & radioactive sources



Epidemics

Thiruvanathapuram City due to its spatial attribute is one of the vulnerable locations in regards to epidemic outbreak. Every year thousands of people are affected with various kinds of epidemics with virulence of the disease increasing in each year. The City has become the focal point for a mosquito-borne plague that is sweeping the whole state. Out of the six diseases included under NVBDCP viz, Malaria, Dengue fever, Filariasis, Chikungunya, Kala azar and Japanese encephalitis, the first 5 are being reported in the City. A few cases of cutaneous leishmaniasis were also reported in the city in 2009 and in 2015.

Since 1994, indigenous Malaria was a problem at Valiyathura and neighboring areas in the coastal Thiruvananthapuram. During 2011, 13 indigenous cases were reported from Mukkola and in 2014 this was increased to 360 cases, in 2015 it became a serious threat to the coastal areas and numbers of cases are further increasing.

Dengue fever was first reported in the district in the year 2001. Maximum number of cases were reported in year 2013. Dengue fever still continues as one of the most threatening outbreak prone communicable diseases in the city.

Very recently another vector-borne disease seems to have surfaced, with the reporting of an indigenous case of Kala Azar or visceral Leishmaniasis at the Medical College Hospital. An infectious disease usually seen only in Bihar, West Bengal and Uttar Pradesh, this is a rare instance of Kala Azar being reported here. The disease, which had been eradicated in India in the late 1950s, resurfaced after 20 years and by the late 80s manifested again as a major public health problem.

Locally important Vector Borne Diseases

Dengue fever

The disease is prevalent in almost all parts of the district with more number of cases reported from Corporation areas, peri-urban areas, coastal areas and plantation areas. Outbreak can occur anywhere in the district. More number of cases is reported in the pre and post monsoon season.

Malaria

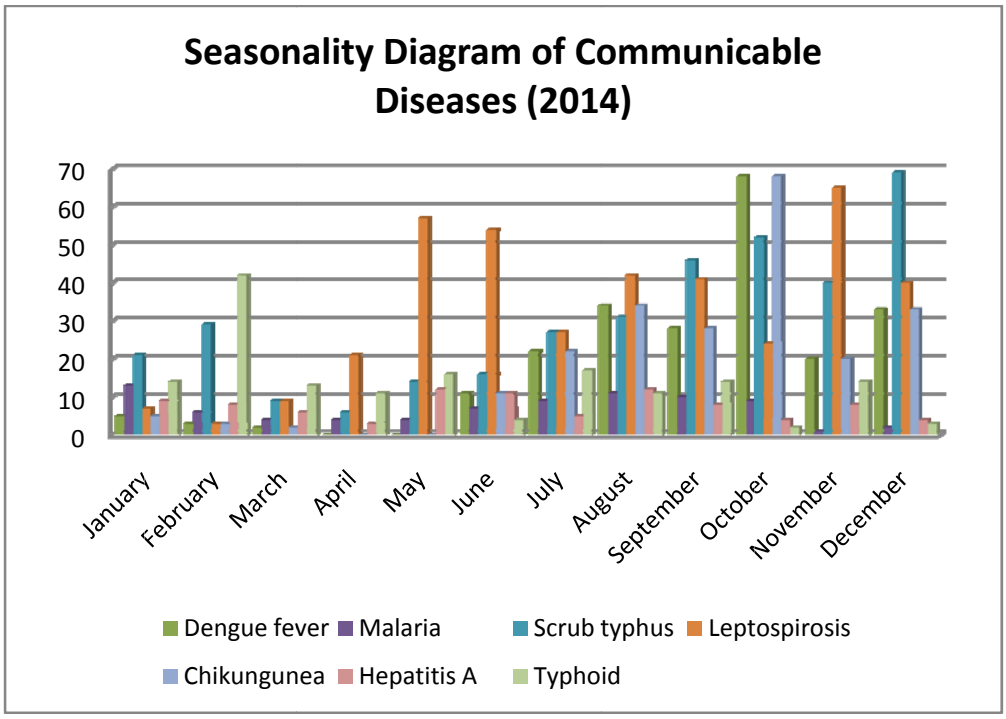
Not endemic. Randomly distributed imported cases with cases of seasonal focal outbreaks in some coastal pockets viz, Valiyathura, Pulluvila, Poovar, Pozhiyoor ,Vizhinjam etc.

Filariasis

Filariasis cases have drastically decreased during the last decade. But still new cases are detected. Mettukada, Rajajinagar, Nedumcadu, Sreevaraham, Chalai, Manacadu, Chenthitta, Karimadomcolony, Palkulangara, Fort, Karamana etc are hot spot areas.

In Thiruvananthapuram city, last year, there were outbreaks of Dengue fever, Hepatitis A & Scrub typhus. In addition there were cases and deaths due to Leptospirosis from different parts of the district. There were occasional / seasonal Cholera. There was fourfold increase in the number of dengue suspected cases in the last two years with proportionate increase in the number of dengue related deaths.

Graph 3.1: Seasonality Diagram of Communicable Diseases



Source: IDSP Cell Trivandrum

Table 3.4: Communicable Diseases scenario during the last 4 years

	2011		2012		2013		2014	
	Case	Death	Case	Death	Case	Death	Case	Death
Cholera	0	0	3	0	0	0	0	0
ADD	18940	0	20606	0	26661	0	25323	0
Leptospirosis	169	1	192	1	317	0	390	1
Typhoid	356	0	398	0	932	0	170	0
Hepatitis - A	21	0	33	0	37	0	90	0
Hepatitis - B	278	0	296	0	172	0	172	0
Hepatitis - C	46	0	11	0	17	0	18	0
Dengue Fever	865	1	2447	4	4192	5	1280	3
Chicken Pox	898	0	1191	0	1168	0	1276	0
Malaria	95	0	70	0	133	0	80	0
Chikungunya	35	0	43	0	219	0	225	0
Indigenous Malaria	7	0	0	0	0	0	360	3

The Common causes of epidemics are given below

Presence of mosquito breeding sites

Mosquitoes spread Dengue, Chikungunya, Malaria, Japanese Encephalitis and Filariasis

a. Water stored in vessels, pots, tanks etc (due to lack of regular water supply and concomitant water storage practice)
b. Construction sites – ground excavations, cement/synthetic tanks, curing surfaces, spaces for lift/ latrine, roof tops etc
c. Plantations and estates – Presence of natural / artificial containers like latex collecting cups, pineapple leaf axils, damaged cocoa fruits, areca nut leaves
d. Buildings and premises – artificial containers in and around houses, offices, hospitals, shops etc
e. Public places – streets, markets and blocked drains
f. Open shallow wells and uncovered ground level and over head water tanks

Unsafe drinking water

Unsafe water causes Water borne diseases like Diarrhoea, Cholera, Typhoid, Hepatitis A

a. Scarcity and inadequacy in supply
b. Improper treatment and Chlorination
c. Poor maintenance and leakages in supply lines
d. Low quality of water supplied through tankers
e. Contamination of drinking water sources by night soil, waste dumping etc

Inadequate Solid and Liquid Waste management system

a. Accumulation of waste in urban and rural areas and lack of adequate waste management system to deal with bio degradable and other wastes.
b. Common use of non degradable materials like plastic
c. Insanitary fish /vegetable markets and slaughter houses generating large quantity of organic waste which favour breeding / multiplication of flies, rats and dogs etc
d. Deficiency of sanitary toilets in coastal, hilly, tribal areas and urban slums
e. Lack of appropriate technology for toilet construction in water logged areas like Kuttanad

Unhygienic eateries and unhealthy food handlers

f. Unhygienic and low quality food supplied through fast food shops and road side eateries
g. Handling of food by disease carriers

h. Use of unsafe water and ice (commercial ice) for preparation of juices, colas, ice creams, sip ups, etc – eg: welcome drink in marriage parties, mixing pipe water with boiled water in hotels
i. Salads prepared using unwashed vegetables and fruits

Inadequate infection control measures

j. Improper sterilization of syringes, needles and instruments in private clinics, dental clinics, labs, clinics of traditional practitioners engaged in piles treatment and circumcision etc.
k. Inadequate bio hazard waste disposal in health care facilities
l. Use of same instruments, blades, stones etc in barber shops, beauty parlours and tattooing centers
m. Intravenous drug users

Influx of migrant labourers

n. Large influx of labourers from high endemic states causing emergence of communicable diseases viz malaria, filariasis, kala azar etc
o. Unhygienic living conditions predispose to water borne and vector borne diseases
p. Language barrier hinders timely health seeking
q. Comprehensive care of illnesses is often prevented by the pressures of labour contracts

Fig.3.9: Spatial Distribution Map of Dengue Fever in Trivandrum City

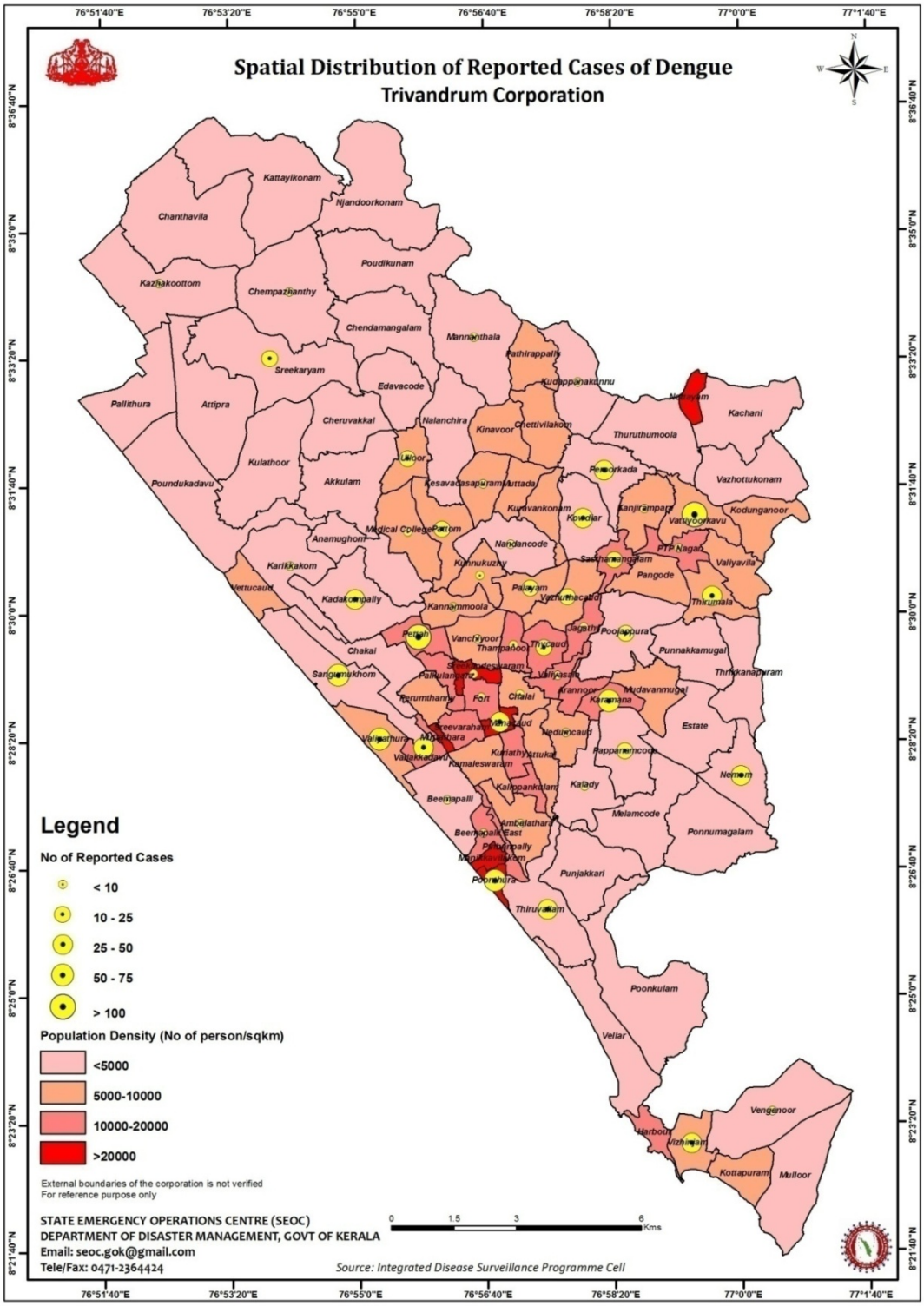


Fig.3.10: Spatial Distribution Map of Malaria in Trivandrum City

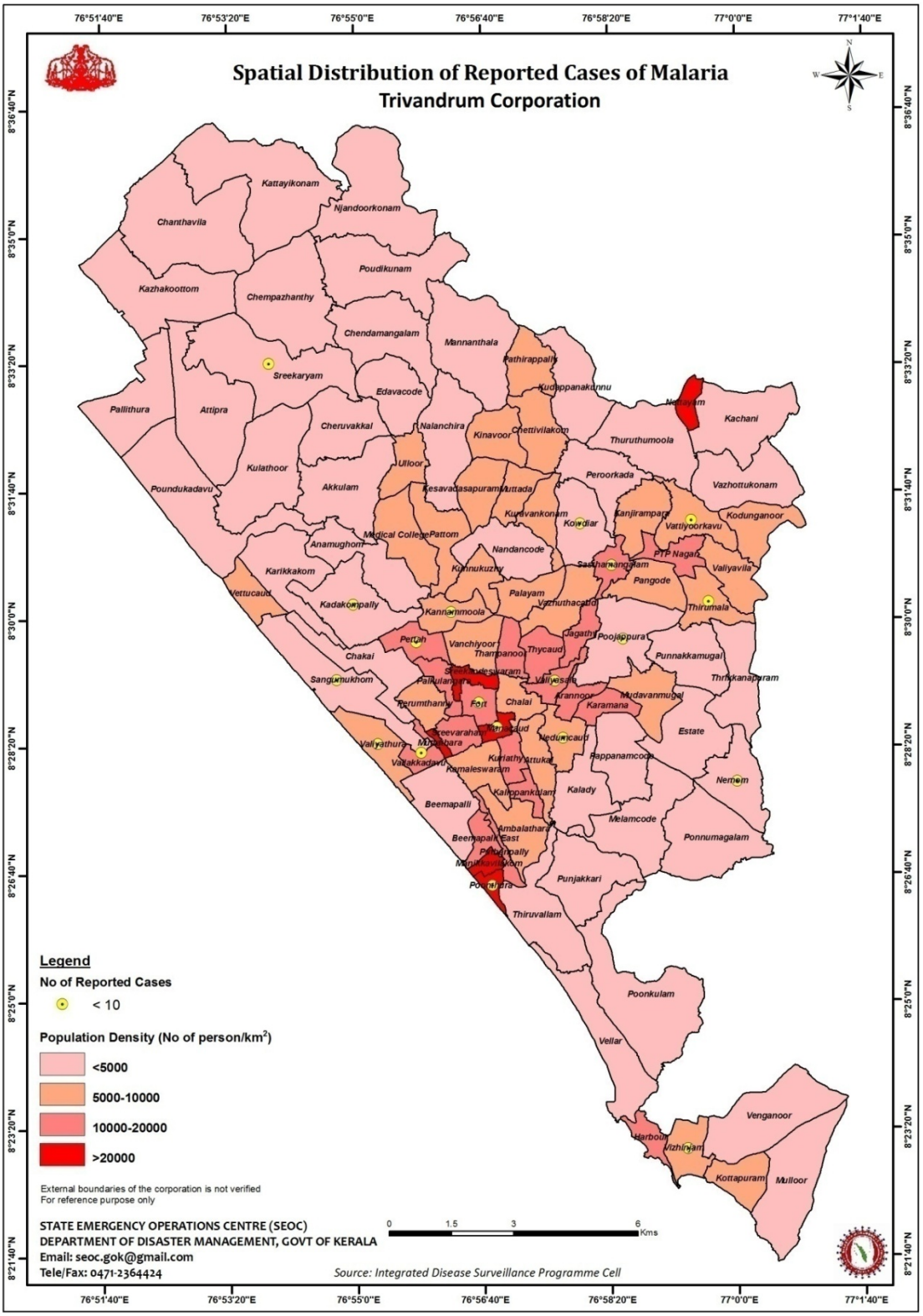


Fig.3.11: Spatial Distribution Map of Chickungunya in Trivandrum City

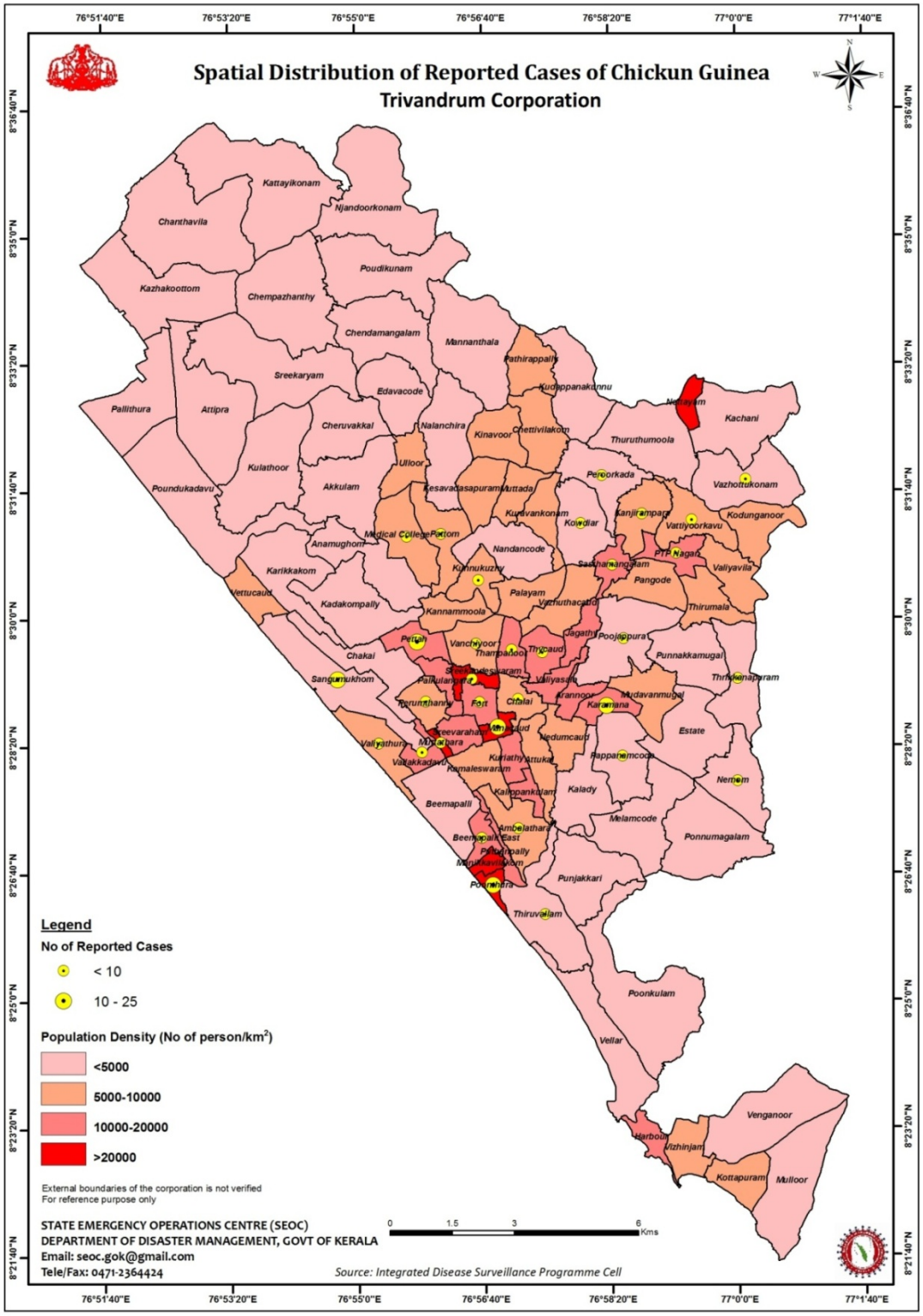


Fig.3.12: Spatial Distribution Map of Leptospirosis in Trivandrum City

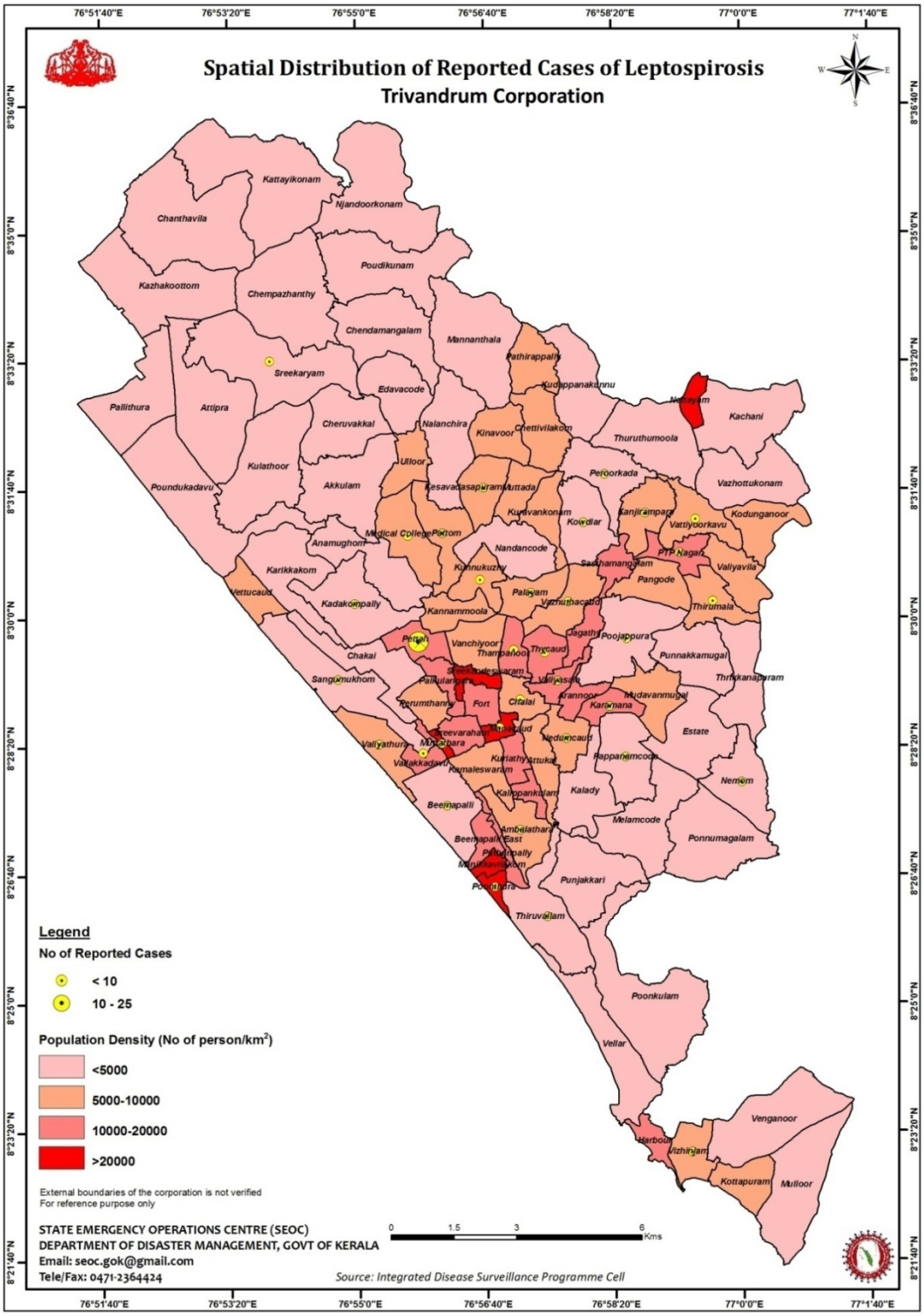


Fig.3.13: Spatial Distribution Map of Scrub Typhus in Trivandrum City

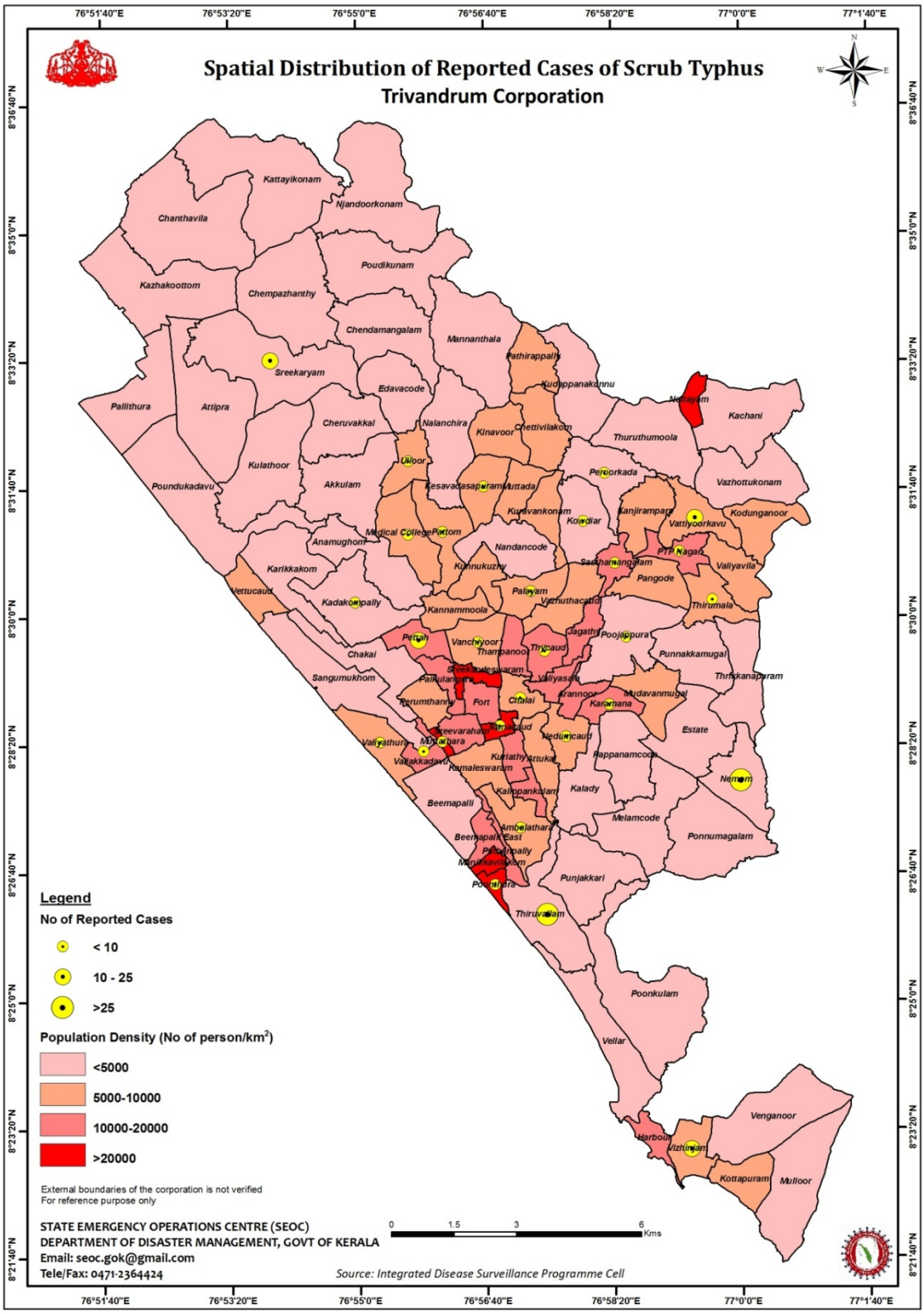


Fig.3.14: Spatial Distribution Map of Hepatitis A in Trivandrum City

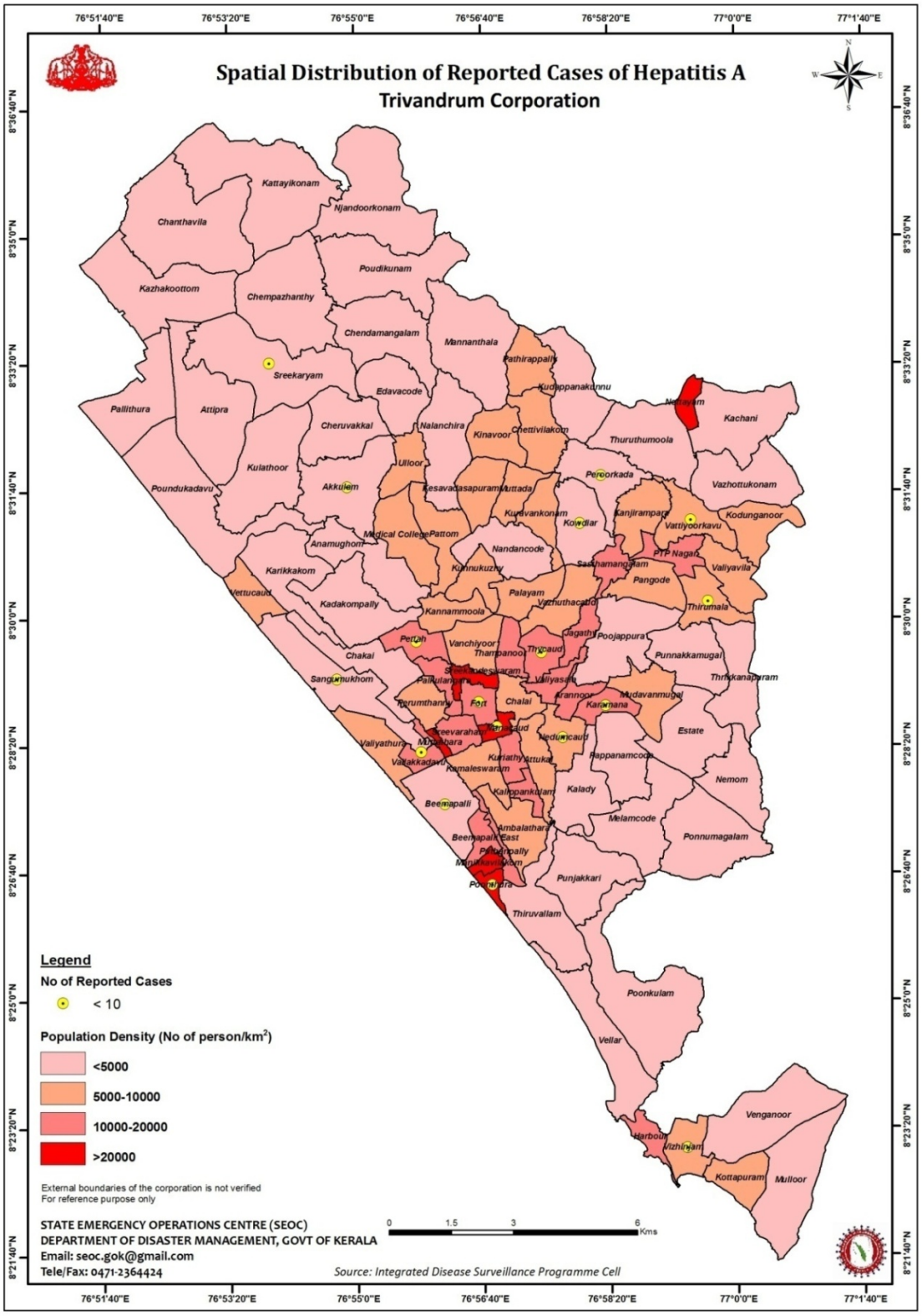


Fig.3.15: Spatial Distribution Map of Typhoid in Trivandrum City

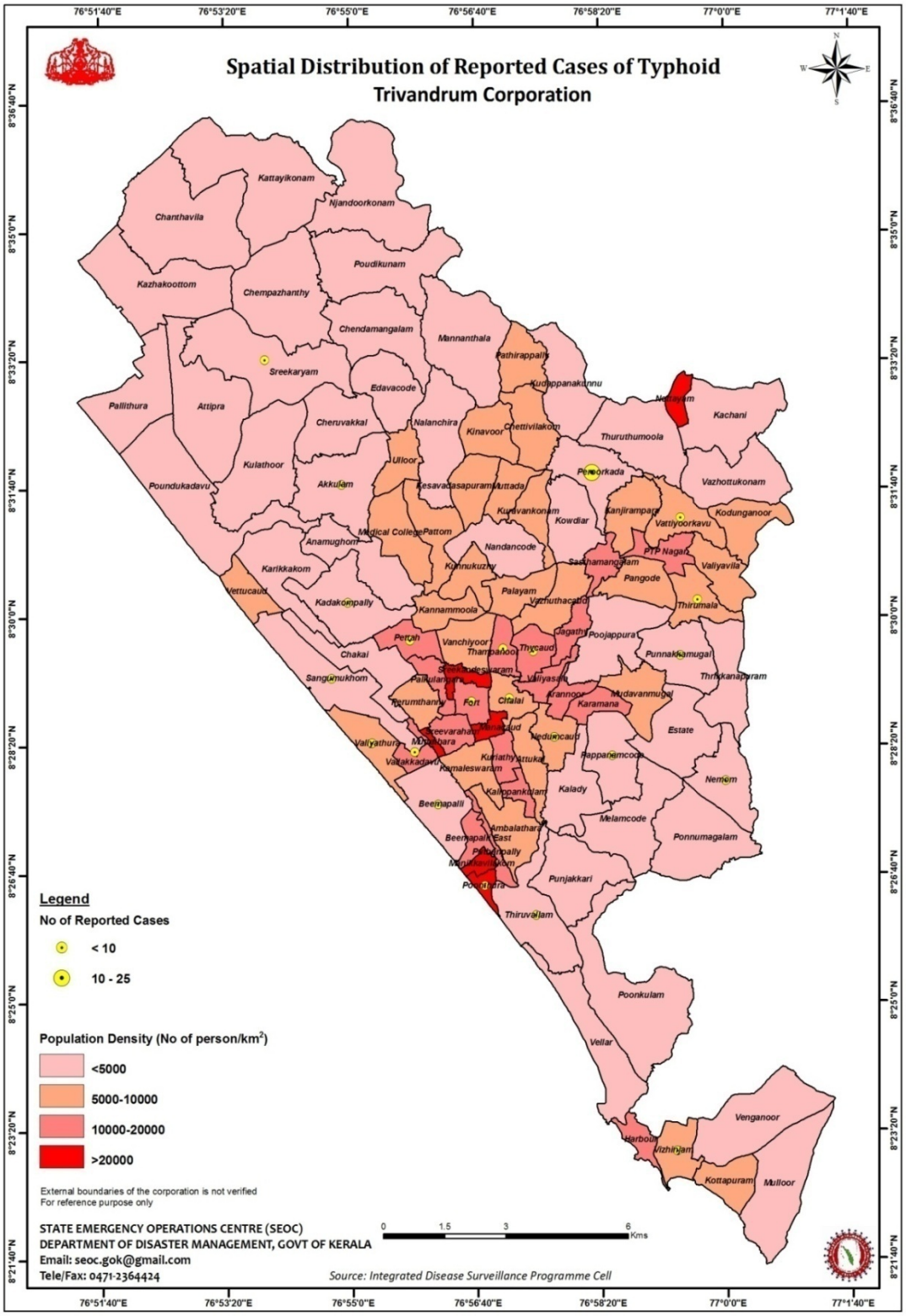
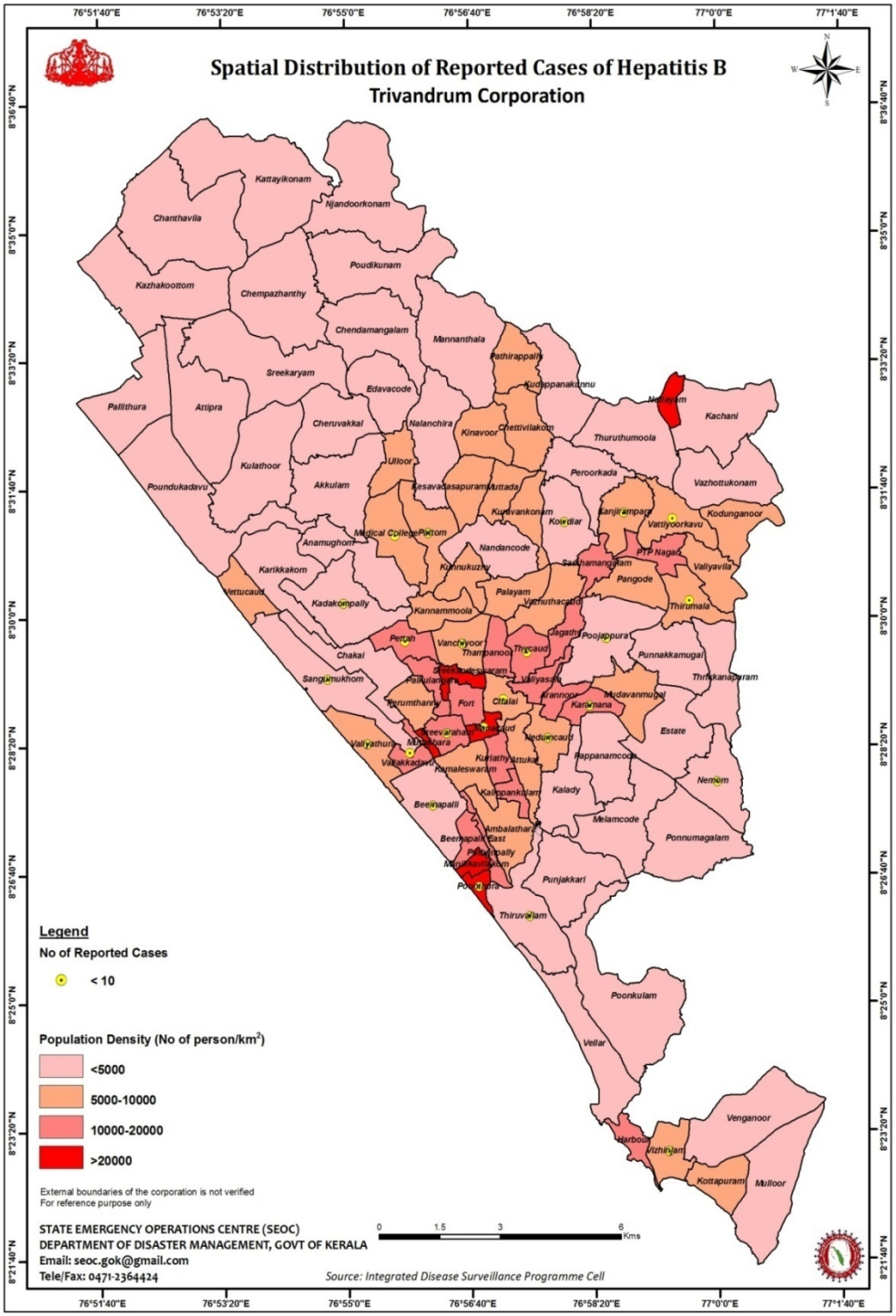


Fig.3.16: Spatial Distribution Map of Hepatitis B in Trivandrum City



Multi-hazard susceptibility ward map

Based on the maps mentioned above a multi-hazard ward map of Thiruvananthapuram City was

prepared using heuristic weighting. The heuristic criteria used for preparing the multi-hazard susceptibility ward map are as follows:

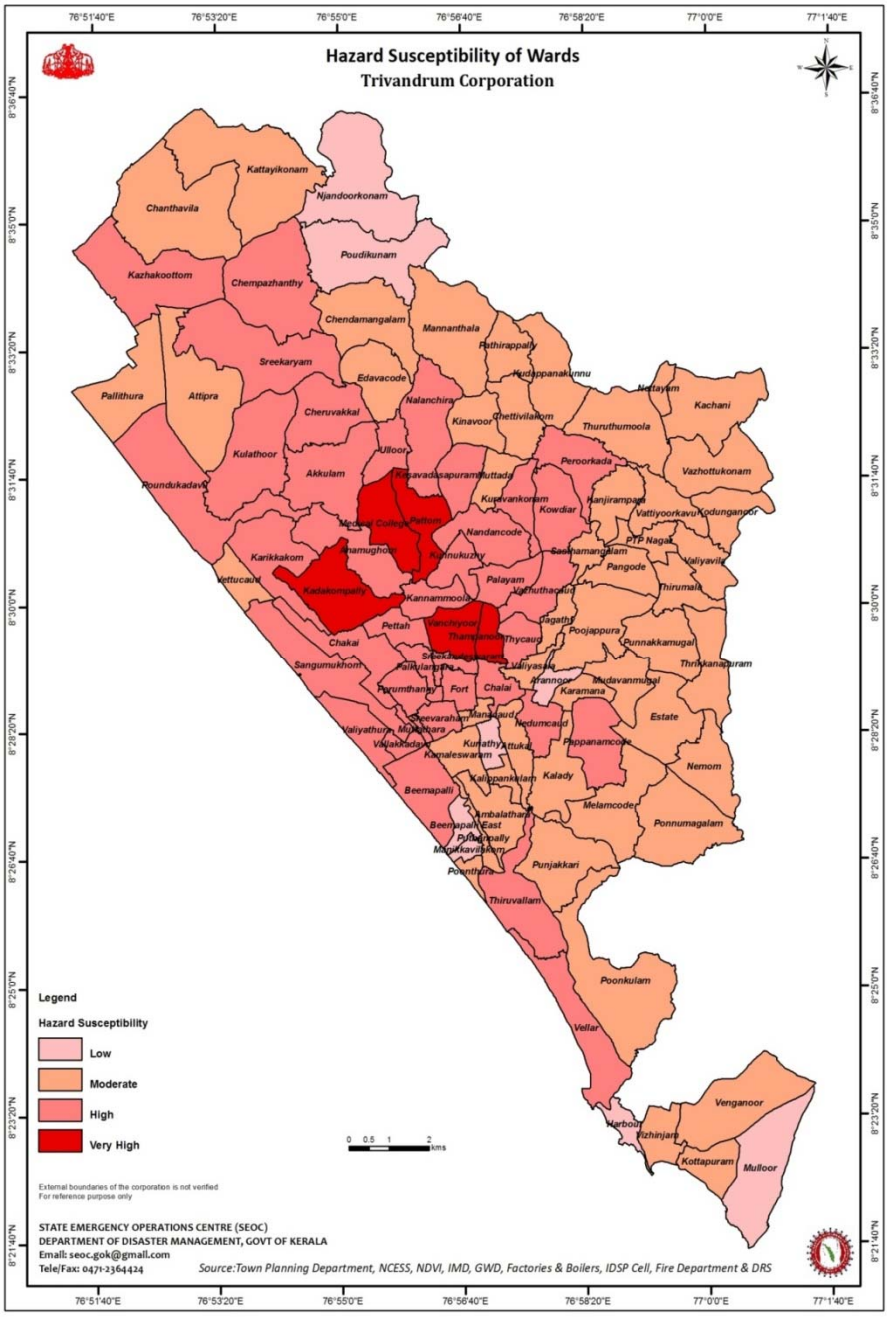
Table 3.5: Heuristic criteria used for preparing the multi-hazard susceptibility ward map

Hazard type	Ward category	Ward weighting
Flood	>50% of ward area	12
	25 to 50% of ward area	8
	5 to 10% of ward area	4
	>0 to 5% of ward area	1
	0	0
Drought (Moderate)	>50% of ward area	6
	25 to 50% of ward area	4
	5 to 10% of ward area	2
	>0 to 5% of ward area	1
	0	0
Coastal hazards	>50% of ward area	8
	25 to 50% of ward area	4
	5 to 10% of ward area	1
	>0 to 5% of ward area	0
	0	0
Lighting	>1 event	3
	No event	1
Epidemics	>10 events	10
	5 to 10 events	5
	>0 to 5 events	2
	0	0
Industrial hazards	>50% of ward area	8
	25 to 50% of ward area	4
	5 to 10% of ward area	2
	>0 to 5% of ward area	1
	0	0
Mass gathering	>50% of ward area	6
	25 to 50% of ward area	4
	5 to 10% of ward area	2
	>0 to 5% of ward area	1
	0	0
Landslide	>50% of ward area	4
	25 to 50% of ward area	3
	5 to 10% of ward area	2
	>0 to 5% of ward area	1
	0	0
Radiological entities	>3 entities	4
	1 to 3 entities	2
	0 entities	0

Relative rating of hazard susceptibility of wards based on the heuristic criteria

Multi-hazard rate	Hazard susceptibility
0	No hazard
1 to 15	Low
15 to 30	Moderate
30 to 45	High
>45	Very High

Fig 3.17: Multi-hazard susceptibility of wards



Environmental Issues

The Kerala State Disaster Management Policy asserts disaster as a serious disruption of the functioning of the society caused by a hazard or otherwise, having wide spread human, material, or **environmental and other losses**, which exceed the ability of the affected society to cope using its own resources. As per the Kerala State DM Policy 2010, the term disaster encompasses the environmental issues too. Under the section Kerala State Disaster Management Policy approach and Strategy, category 5 – Manmade disaster includes all kind of pollution (water, air & soil)

Any discussion on environment in Thiruvananthapuram highlights the issue of raw sewage being let off into the 'Parvathy Puthenar' which is on the coastal zone. In addition to this the second issue that is highlighted is on storm water stagnation in certain low lying areas of the city. Besides these air and water pollution, solid waste disposal are the other threats pertained to this city.

Water Pollution

The major possible sources of river pollution in Trivandrum city are due to the settlements along the river, non-functioning of sewage farm, solid waste disposal etc. The city drains meet the river at different locations of the river stretch. These drains carry waste water from the individual household outlet, overflow of septic tanks/existing choked sewerage or non-functioning of sewage pumping stations, leakage of water supply lines, orchards area etc. There is a sewage farm on the side of Parvathi Puthnar, which is almost abandoned and sewage is getting discharged into the river Karamana through Parvathi Puthanar.

Lack of Sewerage System

At present, only 30% of the city area has covered under the sewerage system .Most of the intercepting and main sewers are serving more than the designed population. It is observed that in some area manholes are punctured and waste water is flowing into the nearby drain which is ultimately disposed off into the river. The present sewerage system is not properly functioning at the desired level. In some areas due to head build up in the sewerage system people cannot connect their latrines/toilets to sewerage system. Hence the entire sewerage system is practically defunct with raw sewage finding its way through punctured manholes and leaky sewer lines, ultimately dumping in open yard or surface water bodies.

Disposal of Untreated Sewerage

At present there is no sewage treatment plant in operation. The sewage collected through sewerage network is carried to sewage farm at Muttathara. The sewage farm is very old and due to increase in the sewage load its absorption capacity is decreased. As per the study conducted by RITES, It is observed that sewage is discharged at 10 pm daily from the sewage farm into the Parvathy Puthnar which is major threat to the pollution of Karamana river. The people are facing problem of nuisance due to pungent smell and odour of partially treated sewage coming out of sewage farm. The organic load of sewage uses substantial oxygen depleting the oxygen level of river thereby upsetting the ecological balance of river. Sewage also carries microbial pathogens that are the cause for the spread of diseases.

Dumping of Dead animals

There is no proper collection and disposal system for the dead animals in the city. Therefore, people throw dead animals into the river which create odor, nuisance and pollution to the river water. The resident of the nearby is affected due to bad odor and areas become prone to spread of diseases due degradation of dead body of the animals.

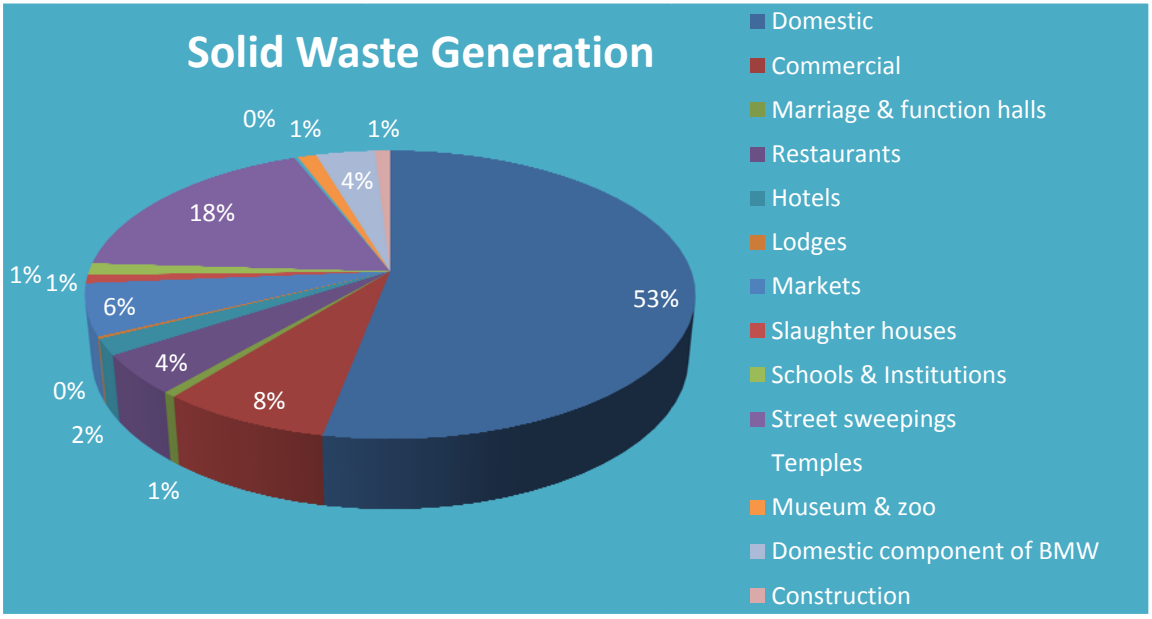
Discharge from Residential and Commercial Buildings

The Killi river is passing through densely populated areas of the city. The residential units near the river discharge their waste directly into the river. Also, the commercial buildings like hospitals, restaurants, marriage halls, cinema halls, banquet hall, automobile service centre and residential buildings etc are discharging their waste directly in to the river. This is mainly occurs in areas which are not connected with sewerage system

Solid Waste Dumping

Solid Waste Management of the city is in miserable condition due to which littering of solid waste are seen almost everywhere. The open dumping has become the normal practice for the disposal of solid waste. People are using rivers, open drains, railway track sides and vacant lands etc for the disposal of solid waste. The major impact of dumping of solid waste into the river is choking or obstructing the river flow. Also, it is responsible for increased BOD in river water. Earlier there was a solid waste treatment facility at Villappisala, which is abandoned since December2011 due to agitation of local people against the environmental issues such as leachate generation, odour nuisance etc from the plant. At present there is no centralized treatment plant exists in the City.

Graph 3.2: Sources of Solid Waste Generation



Source: Master Plan, Thiruvananthapuram Corporation

Discharge of Biomedical Waste

There are 300 hospitals in the city. There is only one common bio-medical waste facility existing in the state. BMW generated in the hospitals are presently disposing through 'IMAGE' (Indian Medical Association Goes Eco Friendly) a Bio Medical Waste Management agency under Indian Medical Association (IMA. Disposal of biomedical waste into the river creates pollution. As per the field study conducted by RITES, they have observed that some hospitals like S. K Hospital at Pangod, Eye Hospital near Karimodam colony etc are disposing untreated bio-medical waste into the Killi river. In the city, Government medical college, general hospital etc do not have bio-medical waste treatment facilities. It is also observed that the syringes, vaccine vials and drip sets were dumped in the drain behind the hospitals. The impacts due to improper disposal of medical waste are causing health hazard through pathogenic bacteria, mosquitoes and other water borne diseases. It is also dangerous for the aquatic life**.**

Slaughter House

There is only one slaughter house in the city under Municipal Corporation. During the field study it is observed that this slaughter house is not in operation. One unmaintained open slaughter house is located at Nedumangad panchayat . The waste water of this slaughter house goes into the Killi river. Total coliform and fecal coliform are especially high in this place.

Dhobi Ghats & Bathing Ghats

Major dhobi ghats in Killi river are at Parachira bridge and at Kavadivella, Kannadumukku and bathing ghat at Moolayalkadavu. Detergent content in river water increases due to activities at dhobi ghat, which ultimately results in rapid growth of algae. This process reduces oxygen content in water after algae dies and decay. Littering of sack and use of open ground for urinal etc causes unaesthetic view. Water quality analysis results reveal that due to activities at dhobi ghat and bathing ghat there is increase in BOD, COD, TC and FC values. According to a study conducted by RITES, it is observed that BOD increases from 4mg/l to 7mg/l due to activities at bathing ghat. It is also noticed that TC (56%) and FC (86%) increase took place with respect to its upstream location. Hence, river water is harmful to aquatic life and not fit for drinking or bathing purpose.

Health Issues

Most intestinal (enteric) diseases are infectious and are transmitted through faecal waste. Pathogens which include virus, bacteria, protozoa, and parasitic worms are disease producing agents found in the faeces of infected persons. These diseases are more prevalent in areas with poor sanitary conditions. These pathogens travel through water sources and interfuses directly through persons handling food and water. Hepatitis, cholera, dysentery, and typhoid are the more common water-borne diseases. People generally take bath in Karamana river. It is also observed that some students of swimming club got infected with the bacterial pollution while taking bath near Thiruvallam in Karamana river (April 2013). The infection was rat fever (Leptospirosis) and jaundice. Therefore primary health centre (PHC) of Thiruvallam has warned the people not to use Karamana river for swimming or taking bath.

Aquatic Life

River water samples were collected along the Killi and Karamana river stretches to know pollution status of river flowing through the city .In the water analysis it is found that the DO level is greater than 4 mg/l (required for survivalof aquatic life) in upstream portion of Karamana river. But DO level have dropped to 3.4 mg/l at Thiruvallam where, there would be significant impact on aquatic life.

Air pollution

The Kerala State Pollution Control Board is continuously monitoring the ambient air quality at 13 stations throughout the State. Of these, 4 monitoring stations are located in Thiruvananthapuram city area. The 4 ambient air quality monitoring stations in Thiruvananthapuram are situated at the premises of the High-tech, Chacka (Industrial area); SMV School Premises (Residential, rural and other area); Residential Premises at Sasthamangalam (Residential area); and in the premises of PRS Hospital (Sensitive area).

The monitoring results, obtained from the air quality monitoring stations in Thiruvananthapuram show that the quality of air is satisfactory. In the case of Thiruvananthapuram city the respirable Particulate Matter & Particulate Matter are occasionally exceeding the quality limits. However the trend shows that the concentration of the pollution parameters are steadily increasing mainly due to various developmental activities in the city area in general and the increase in the density of automobile population and the road conditions in particular.

Noise Pollution

As high noise levels are causing lot of health problems at present there is regulation to prevent unnecessary sound generation and control the noise levels. Certain studies conducted in Thiruvananthapuram city area show the noise levels are very high in certain areas. While laying noise level standards, the areas are classified into four namely industrial area, commercial area, residential area and sensitive area.

The studies reveal that the high levels of noise in major streets and commercial areas due to crowding of automobiles resulting in blowing horns. This is due to paucity of designated exclusive vehicle parking areas, narrow roads, road conditions, etc.

Industrial Pollution

Thiruvananthapuram city is not having many industries. Most of the industries are located at Veli industrial area and its vicinity. The industries, which are making discharge of wastewater, are brought under the consent administration of the Water (Prevention and Control of Pollution) Act, 1974. There is full proof mechanism to deal with any violation from the part of industries. In the case of emission from industries also all the industrial units making emissions are brought under the purview of the Water Act 1981.

Transportation Hazard

In 2003, Thiruvananthapuram District had 350,455 registered motor vehicles, of which majority of them were in the city region. This suggests that on average, there are 106 motor vehicles for every 1,000 persons and 160 vehicles per sq. km of area. This is significantly higher than the State average (78 motor vehicles per 1,000 persons and 65 vehicles per sq. km area). During the period 1991-2003, the average annual growth of vehicle population was 11%. From 2001 to 2003 a declining trend is seen (9.30%) .

Growth of motor vehicles and its pressure on the road network is significant, resulting in over utilization of road network in the region with frequent traffic problems like congestion and accidents. Available statistics indicate that road accidents are a major concern in Thiruvananthapuram District with 7% average annual growth rate during 2001-03.

Infrastructure Utility Failures

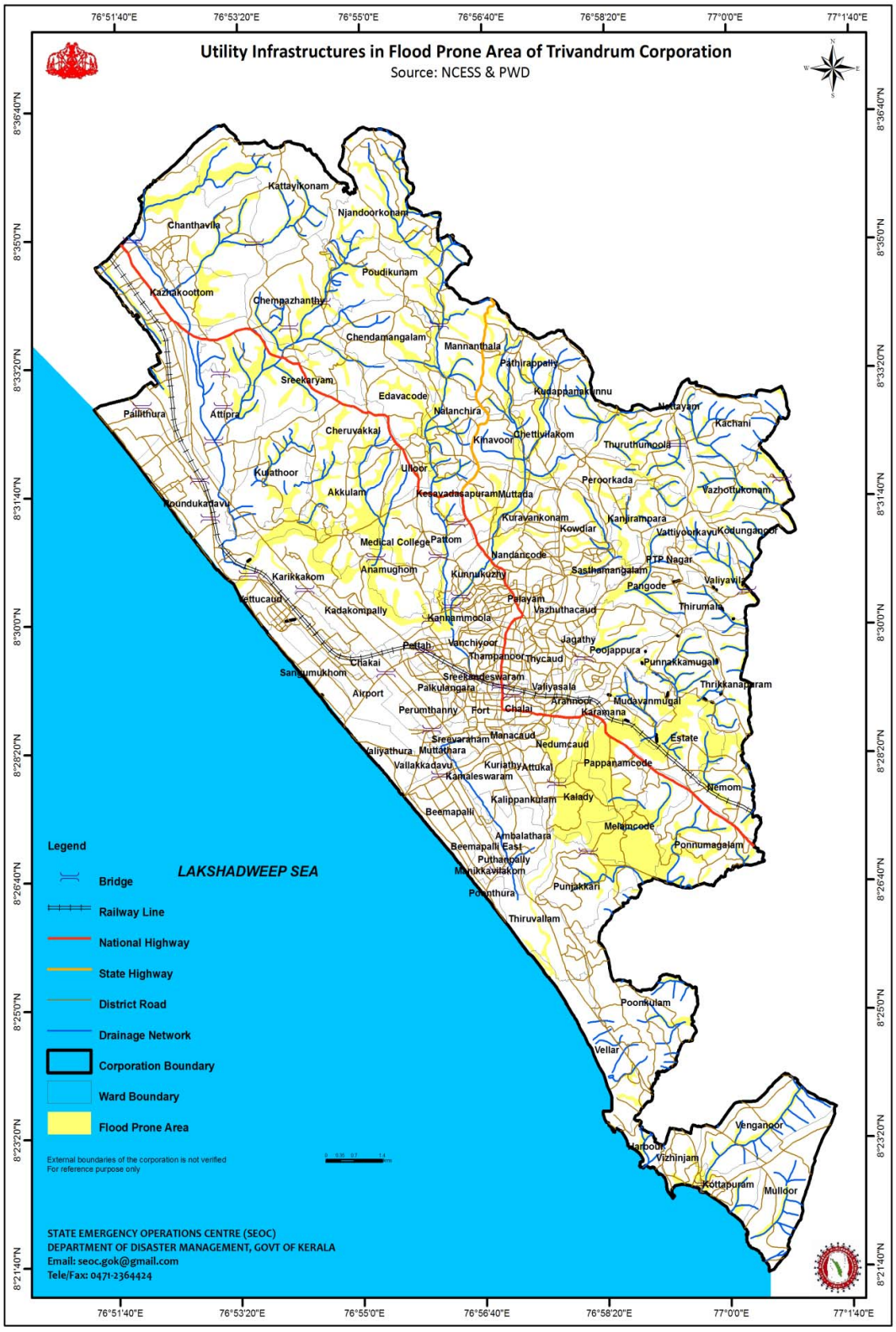
Urban societies depend heavily on the proper functioning of infrastructure systems such as electric power, potable water, and transportation networks. Normally invisible, this reliance becomes painfully evident when infrastructure systems fail during disasters. Moreover, because of the network properties of infrastructure, damage in one location can disrupt service in an extensive geographic area. The societal disruption caused by infrastructure failures is therefore disproportionately high in relation to actual physical damage.

Engineers have long tried to design infrastructure to withstand extreme forces, but recently they have begun to address the need for urban infrastructure systems that are *resilient* to disasters. Conceptually, resilience entails three interrelated dimensions: lower probabilities of failure; less-severe negative consequences when failures do occur; and faster recovery from failures (Bruneau et al., 2003). The emphasis on consequences and recovery suggests that improving the resilience of infrastructure systems is not only a technical problem, but it also has societal dimensions.

The consequences of recent flooding /windfall/storm surge have demonstrated that urban infrastructure systems in the Thiruvananthapuram Corporation remain highly vulnerable. Moreover, infrastructure failure is often a primary cause of economic and human losses. Inadequacy of infrastructure coverage, poor level of service, non-availability in certain areas of the city, lack of access to city level infrastructure for the urban poor further add its vulnerability.

Transport, water supply, sewerage and sanitation, storm water drainage, communication facilities are the essential utility services in the city that need special attention before and after a disaster. Unfortunately most of the infrastructure utilities are commissioned in the pre independence era that still lack any maintenance or up-gradation causing heavy damage during disaster.

Fig.3.18: Utility Infrastructure in Flood prone Area of Trivandrum City



Climate Change

Due to the proximity to the ocean and the Socio economic condition, Trivandrum is largely dependent on climate. Fishery and Tourism are the two major sources of income in coastal areas of Trivandrum which comes under the purview of City Corporation. While climate is the asset of tourism, climate change can pose a serious threat to it, affecting the industry here. Impact of climate change is manifested in sea level rise and rise in sea surface temperature which in turn will lead to depletion of marine resources. A rise in sea level will also cause soil erosion, thereby weakening solid structures of hotels in the coastal areas. It can induce intrusion of salty water into agricultural land, affecting crop production and protection

An increase in sea surface temperature can also lead to increased level of moisture into the atmosphere, thereby increasing humidity, increased rainfall, change in rainfall pattern and increase in frequency and intensity of cyclones. Vulnerabilities owing to climate change have huge dimension in the city. City has already been faced various types of developmental and environmental issues. Mean while climate change accelerates these issues into more complicated one. Water scarcity become more, spread of vector and water borne diseases, biodiversity degradation become severe are some of the common issues which may become severe and relevant in the recent years.

The physical and mental health of the people too is beginning to be affected by the changing weather conditions. Post 2000, the City has seen the emergence of a variety of diseases including dengue, chickungunya and even the return of malaria. More and more people are being hospitalized with sunstroke each year, something which used to be unheard here. The deviation of the population away from the traditional virtues to acquiring materialistic assets in an uncanny competitive society set under capitalistic rules has already started taking its toll on the mental health of the population.

Sea Level Rise and Projections

It's now established that the sea level is on the rise due to global warming and the projected sea level rise (SLR) along the coast of Kerala on a conservative estimation is about 100 to 200 mm over the next 100 years. Vulnerability to sea level rise would be of alarming to the majority coastal communities that live on sandy coasts, most of which are barrier beaches or spits. Back water banks, islands and filtration ponds / paddy fields are other sections of the coastal zone which are highly susceptible to Sea Level rise.

CHAPTER - 4

Vulnerability Analysis

Vulnerability

Vulnerability is the degree of loss to a given element or set of elements-at-risk resulting from the occurrence of a natural phenomenon of a given magnitude. Usually expressed on a scale from 0 (no damage) to 1 (total damage). Vulnerability has a wide range of interpretations and multiple definitions. Vulnerability refers to the conditions determined by physical, social, economic and environmental factors or processes that increase the susceptibility of a community to the impact of hazards. It is the susceptibility to damage and/or the intrinsic fragility of exposed elements, systems or communities that facilitate loss when affected by hazard events. It also covers the lack of resilience that influences the capacity to anticipate, cope with, resist, respond to, and recover from the impact of a hazardous event (www.move-fp7.eu/).

The vulnerability of communities and households can be analyzed in a holistic qualitative manner using a large number of criteria that characterize physical, social, economic and environmental vulnerability. The importance of each of these indicators is evaluated by assigning individual weights to them and combining them using spatial multi-criteria evaluation. Physical vulnerability is evaluated as the interaction between the intensity of the hazard and the type of element-at-risk, making use of heuristic or quantitative criteria. Vulnerability is, therefore, multi-dimensional (physical, social, economic, environmental, institutional, and human factors define vulnerability), dynamic (it changes over time), scale-dependent (it can be expressed on different scales from individuals to countries), and site-specific (each location might need its own approach) (http://drm.cenn.org).mIn this project, semi-quantitative heuristic solutions are used for the analysis of vulnerability.

Population vulnerability to hazards

Based on population density and worst case scenario hazard prone area, population exposed per ward to different hazards were calculated.

Table 4.1: Population exposure to hazards

Hazard type	Hazard prone area (km^2)	Population exposed	Ward wise details
Floods	39.9	1,58,477	Annexure 1
Drought	Entire City is Drought Prone		
Coastal Hazards	2.1	8,209	Annexure 2
Lightning*	44.2	1,81,640	Annexure 3
Landslide	0.05	393	Annexure 4
Industrial hazards	90	3,53,191	Annexure 5
Mass gathering**	15.93	1,36,568	Annexure 6

*Entire ward was classified as lightning prone, if at least one event has been reported from the ward
**Areal extent of Attukal Pongala alone was mapped as other events were limited to not more than 1.5 km from the respective religious centre

Physical vulnerability of public buildings

Physical vulnerability is essentially the potential for physical impact of hazards on the built environment and population. It is defined as the degree of potential loss, to a given element-at-risk or set of elements-at-risk, resulting from the occurrence of a natural phenomenon of a given magnitude; it is expressed on a scale from 0 (no damage) to 1 (total damage). Physical vulnerability is related to the characteristics of the elements-at-risk and the hazard intensity. Physical vulnerability, as such, is not a spatial component, but is determined by the spatial overlay of exposed elements-at-risk and hazard footprints (http://drm.cenn.org).

Thiruvananthapuram City has an assemblage of public buildings ranging from schools, hospitals, public offices and museums. In the event of calamities, functioning of local relief and rescue management will be significantly affected if these buildings are affected. Specific structural assessment of all these buildings are not feasible and is not required from a disaster risk reduction perspective. However, through a rapid visual screening, the general vulnerability of these buildings to accidents and hazards may be assessed. Hence a rapid visual screening (RVS) of 378 public buildings was conducted. These public buildings were chosen based on the inputs provided by local people's representatives. Table 6 shows the categories of public buildings that were subjected to RVS.

Table 4.2: Category of buildings subjected to Rapid Visual Screening

Sl. No	Category	No. of buildings
1	Higher Educational Institutions	45
2	Government Institutions	130
3	Hospitals	42
4	Public Buildings	44
5	Schools	117
	Total	**378**

Traditionally, RVS is conducted with several technical parameters which can only be handled by technically qualified personnel. This impedes the replicability of such techniques as a routine time bound procedure, particularly in situations of financial constrain. Hence, as part of this project, a simple, pragmatic and replicable RVS method has been adopted which contains ten parameters only. The parameters were chosen so as to represent the lumped vulnerability of individual buildings to hazard events after consultation with civil and electrical engineers, fire & rescue officers and town and country planning officials. Table 7 shows the criteria used.

Table 4.3: Criteria used for vulnerability assessment of selected public buildings

Sl. No	Criteria	Highly vulnerable	Moderately vulnerable	Least vulnerable
1	Safety equipment	Not equipped	Equipped but not well maintained	Highly equipped & well maintained
2	Accessibility for water tendersaround the building	No space for movement of water tenders around the building	<9 m space around the building & restricted movement of water tenders possible	9 m or more space all around the building for movement of water tenders
3	Evacuation routes	No evacuation routes marked	Evacuation routes are present, but not clearly marked	Well marked evacuation routes
4	Early warning systems	No alarms, smoke detectors or fire detectors present	Alarms, smoke detectors or fire detectors are present, but not well maintained	Well maintained alarms, smoke detectors or fire detectors are present

5	Occupancy	>1000 persons	500 to 100 occupants	<100 occupants
6	Accessibility of emergency services to the building	>1 km from main PWD roads	Within 1 km from main PWD roads	Within 200 m of PWD roads
7	Damageability of buildings	Very old, damaged and not properly maintained	Old, physical damages visible but maintained	No physical damages visible and well maintained
8	Electrical insulation	Electrical wires visibly hanging	Sealed and insulated, but not affixed properly to walls	Well insulated, sealed and affixed to the walls
9	Storage of fuel	Storage of petroleum products within the building	Storage of petroleum products immediately outside the building	Storage of petroleum products in separate fire resistant rooms; no storage of petroleum products
10	Accessibility to medical facilities	Distance to medical facility >1 km	Distance to medical facility within 1 km	Distance to medical facility within 200 m

City could be screened within 20 days with the involvement of 7 graduates in science hired on daily wages. Annexure 7 gives the list of buildings evaluated per ward and the vulnerability category that each building falls in, based on the RVS. Based on the absolute number of public buildings evaluated using RVS per ward, the wards were categorized into high, moderate and low vulnerability. Figure 18 shows the ward wise physical vulnerability map of Thiruvananthapuram City.

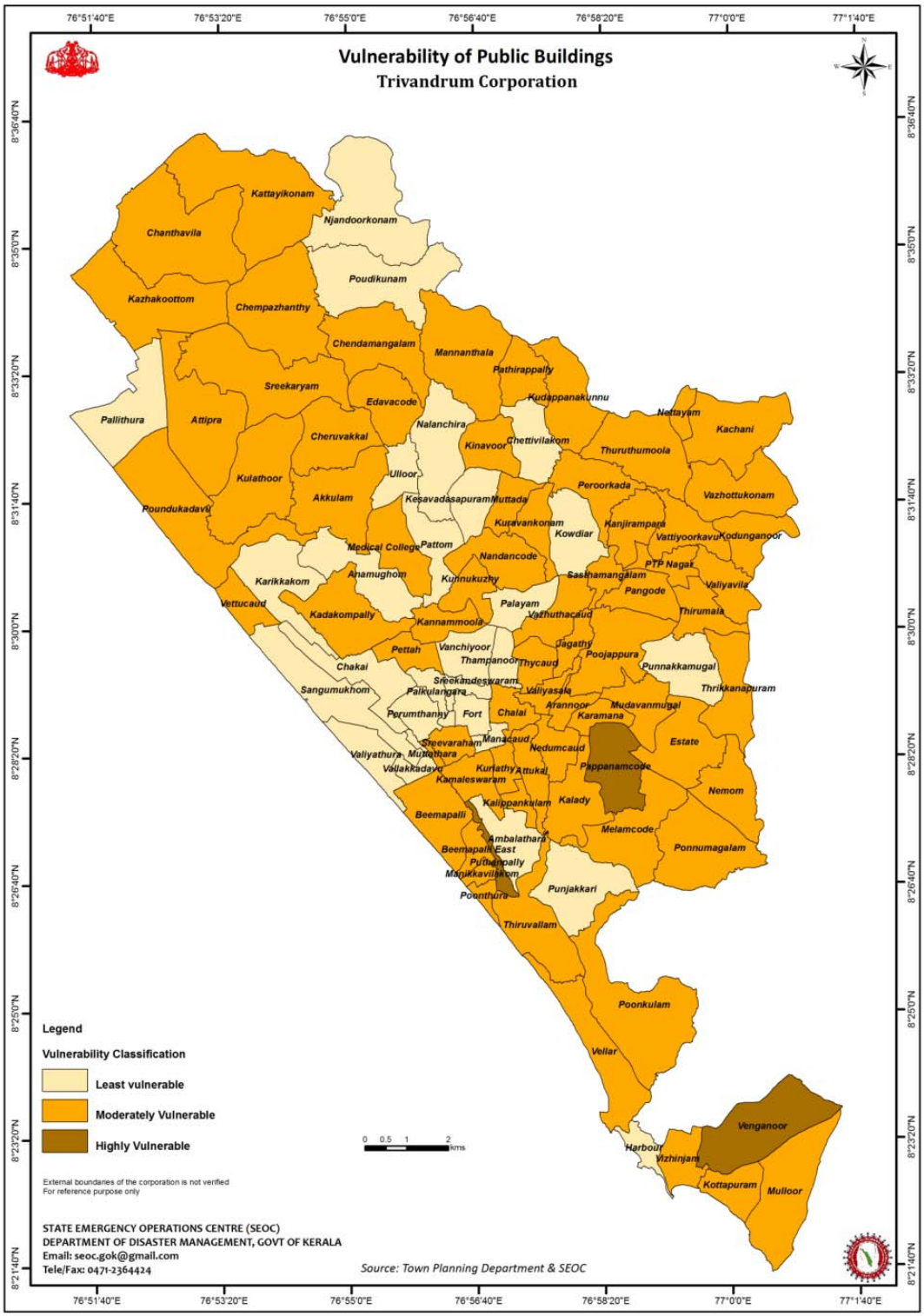
Loss-potential assessment

Based on the vulnerability assessment using the RVS, a loss-potential assessment was also conducted for using in the risk assessment. The criteria used for quantifying the loss were also kept simple and replicable. It may be noted that in Thiruvananthapuram City, building damage data pertaining to coastal erosion and windfall alone are available. Hence the scale has been based on field based expert judgments with data pertaining to coastal erosion. No specific vulnerability curves were utilized for the purpose as such curves are non-existent for the types of buildings in the City. Table 4.4 shows the criteria used for classifying the loss potential of buildings based on expert opinion of engineers.

Table 4.4: Criteria used for vulnerability assessment of selected public buildings

Hazard susceptibility	Building vulnerability class	Loss potential
	Highly vulnerable	0.2
No hazard	Moderately vulnerable	0.1
	Least vulnerable	0.1
	Highly vulnerable	0.6
Low	Moderately vulnerable	0.4
	Least vulnerable	0.2
	Highly vulnerable	0.8
Moderate	Moderately vulnerable	0.5
	Least vulnerable	0.3
	Highly vulnerable	0.9
High	Moderately vulnerable	0.6
	Least vulnerable	0.4
	Highly vulnerable	1
Very High	Moderately vulnerable	0.7
	Least vulnerable	0.5

Fig: (4.1) Vulnerability of wards based on physical vulnerability of public buildings



Socio-economic vulnerability assessment

Socio-economic vulnerability is the potential impact of events on vulnerable groups within a society. It considers public awareness of risk, ability of groups to self-cope with catastrophes, and the status of institutional structures designed to help them cope. In this project, the parameters used were literacy rate, total population, working population, sex ratio and number of households in a given ward. By incorporating working population into the social vulnerability assessment, the attempt was also to capture the economic vulnerability. Common data in terms of authenticated ward boundaries and Census 2011 data were available only for 78 wards. Hence, social vulnerability of only 78 wards could be assessed. Individual parameters were classified and weights were assigned to each class, heuristically. Wards were assigned specific vulnerability scores by aggregating the weights. As and when Census Department releases complete data regarding the 100 wards of the City, further additions will be made to this assessment.

Markets, Commercial Clusters and slums

Thiruvananthapuram city has a number of commercial clusters; places that have contiguous development of commercial establishment. There is 1 main market, 4 submarkets, 7 main zonal markets, 46 local markets and 4 road side markets. Only 3 markets (Kazhakuttom, Sreekariyam and Kanjirampara) have waste management facility. Unhygienic conditions prevail in most of the markets, particularly due to the absence of solid waste management facility. Figure 19 shows the commercial clusters and markets in Thiruvananthapuram city. Annexure 9 shows the list of commercial clusters and markets in the Thiruvananthapuram city and Annexure 10 shows the consolidated data of slums in Thiruvananthapuram city.

Livelihood

According to Census 2011, 84% of the city population are categorised under main other workers population and 14% are employed as marginal workers. Only 1% of population are involved in agricultural and household industrial activities and less than 1% is involved in cultivation activities. Thus the city's economic resilience in terms of livelihoods is significantly high in general and hence this criteria is not separately added to the socio-economic vulnerability assessment. However, special attention is needed for the marginal worker population who may be economically highly vulnerable to disasters. Annexure 8 shows the ward wise pattern of livelihood pattern of population.

Figure (4.2): Existing commercial clusters and markets of Thiruvananthapuram City

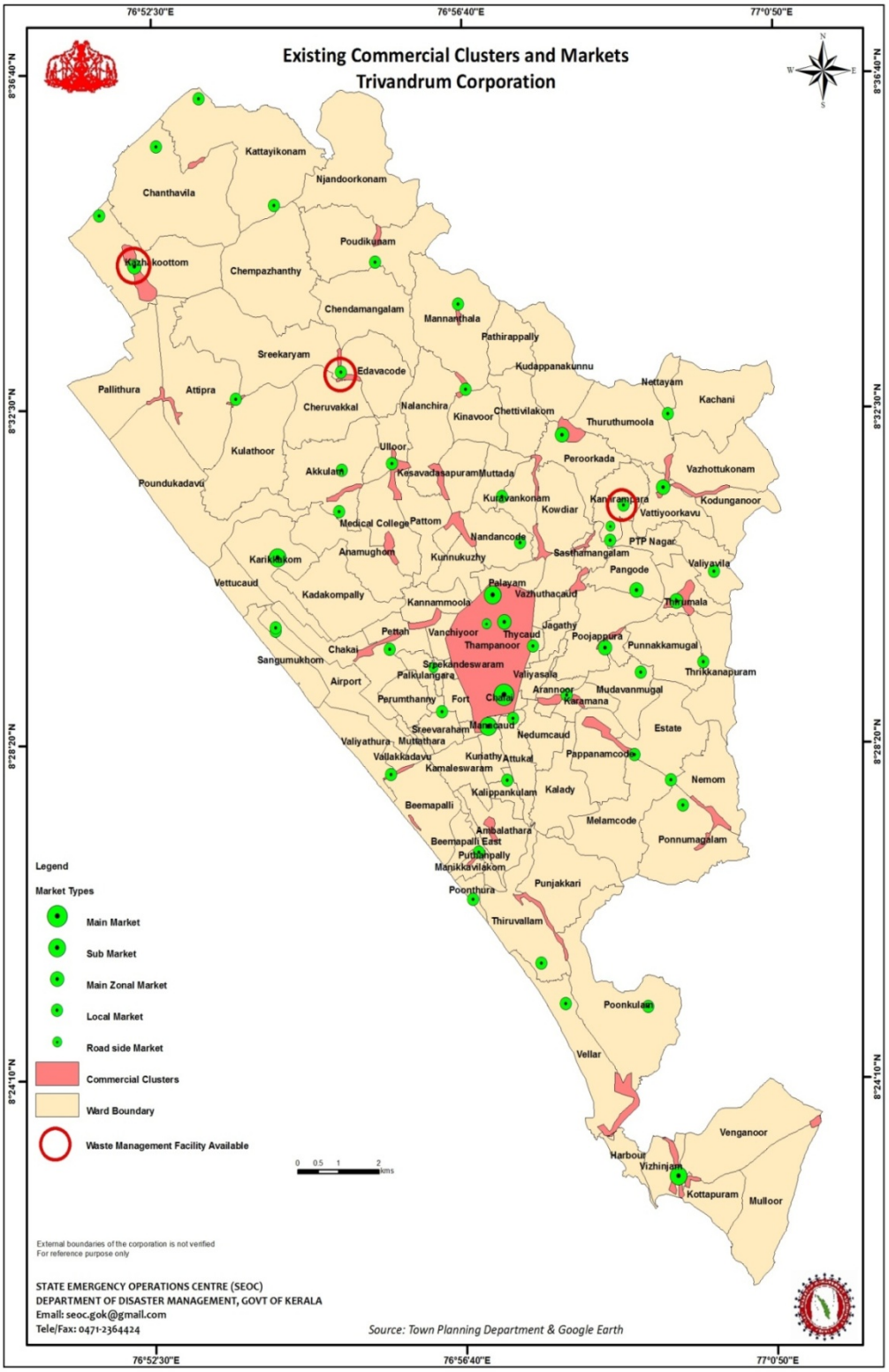
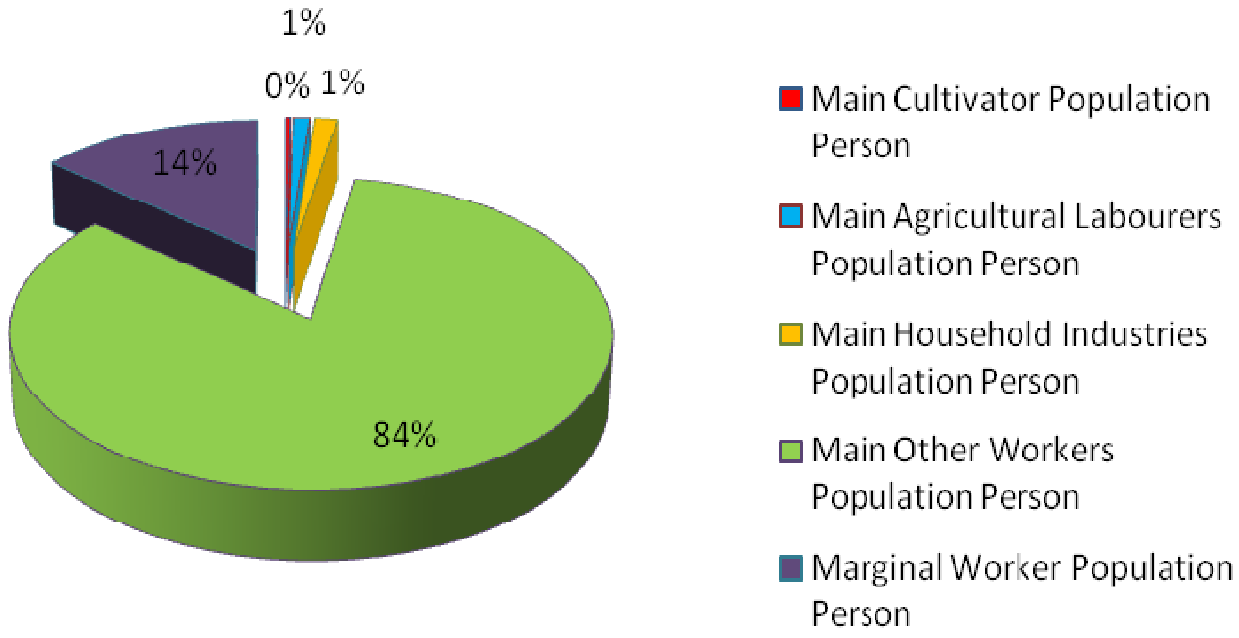


Figure (4.3): Livelihood pattern of Thiruvananthapuram City



Parameter weights and aggregate scores for socio-economic vulnerability assessment

Table 4.5 shows the parameter weights and Table 4.6 shows the aggregate scores and vulnerability class used for this project.

Table 4.5: Parameters, classes and weights used for social vulnerability assessment

Sl. No	Parameter	Class	Weight
1	Literacy rate: Representation of coping capacity; higher the literacy rate, higher is the coping capacity and hence vulnerability is low	>90%	1
2	Total population: Higher the population, higher is the vulnerability	<7000	2
		7000-10000	4
		>10000	6
3	Total working population: Higher the total working population, higher is the coping capacity and hence less vulnerability	>3000	1
		<3000	3
4	Sex ratio: Higher the sex ratio, higher is the exposure of women to hazards and hence higher is the vulnerability	<1000	1
		>1000	4

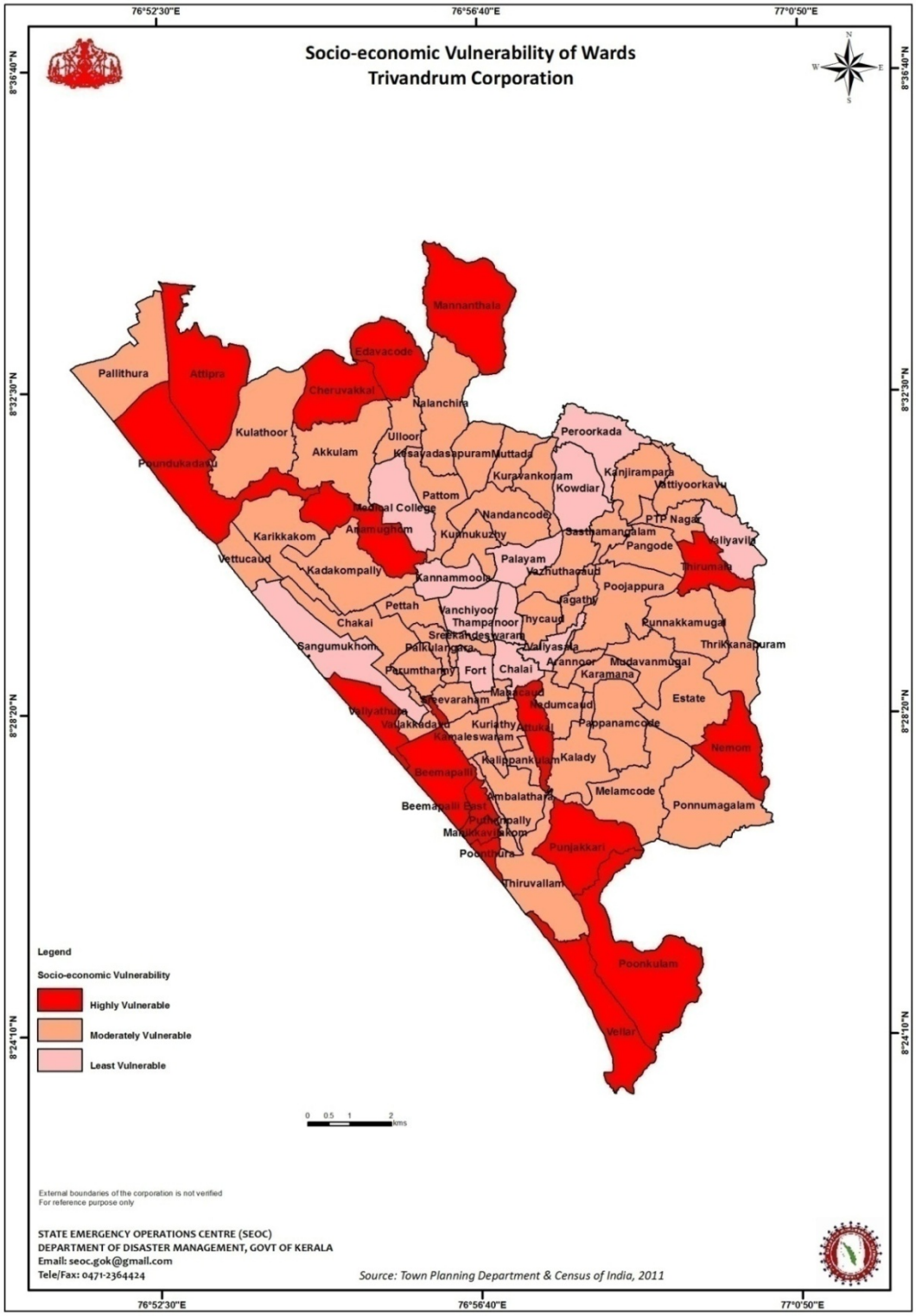
5	0-6 age group population: Higher the number of children, higher is the vulnerability to hazards as children below 6 are generally incapable of appropriate response to hazards	<500	2
		500-1000	4
		>1000	6
6	Households: Higher the number of households, higher is the vulnerability as higher will be the number of buildings affected	<1000	2
		1000-3000	4
		>3000	6
7	Households without electricity connection (% of the total households in the ward)	>1%	2
8	Households with no drainage & open drainage (% of the total households in the ward)	<25%	1
		25-50%	2
		>50%	4
9	Unhygienic drinking water source - untreated tap water/river/pond water (% of the total households in the ward)	<25%	1
		25-50%	2
		>50%	3
10	House roof - grass/thatch/bamboo/mud/plastic sheet/unburnt wood (% of the total households in the ward)	<10%	1
		10-15%	2
		>15%	4
11	House wall - grass/thatch/bamboo/mud/plastic sheet/unburnt wood (% of the total households in the ward)	<10%	1
		10-15%	2
		>15%	4
12	No. of Slums/ward– Higher the number of slums higher will be vulnerability	<5	1
		>5	4

Table 4.6: Aggregate weights and vulnerability class

Sl. No	Aggregate weight	Vulnerability
1	<25	Least
2	25-30	Moderate
3	>30	High

Figure (4.4) shows the social vulnerability of Thiruvananthapuram City based on the criteria above.

Figure (4.4): Socio-economic vulnerability of wards



Environmental vulnerability

In assessing the cost of damage to natural resources, economists generally assign value to "services" provided by natural resources. Examples of environmental services include hydrological features, atmospheric gas regulation and habitats. Services provided to humans by natural resources include commercial uses such as waterways, water provision, agriculture irrigation, timber harvest, recreation and health. Such an assessment requires bench marks for quantification of the costs of environmental services which is not available for the country. Hence, instead of attempting to quantify the losses, known issues are flagged herein. Thiruvananthapuram City has few selected environmental expanses. The most important of them are:

a) The Zoo and Museum Campus
b) The Kanakakunnu Palace Grounds
c) The Kawodiar Palace Grounds
d) The Golf Club Grounds

In addition to these locations, the city also has green expanses in the campus of many of the educational institutions and central agencies. Water front recreation facilities are available at multiple beaches along the city and at Velli and Akkulam lakes. Numerous ponds associated to temples are also present in the city.

These entities increase the relative resilience of the city. Presence of green cover increases resilience to industrial & traffic related pollution and industrial accidents that may release toxic plumes. Back waters offer a buffer to storm surges. Presence of fresh water ponds increase the surface water storage and thereby act as a buffer against severe drought conditions by offering ground water recharging.

However, presence of trees that have exceeded their critical growing age and those that have suffered damages to the roots due to structural developments and road cuts pose significant threat to life and property in the City. In 2013, as many as 300 windfall of trees were reported from the City which caused several fatalities and damage to property. Despite the presence of such green cover, the air quality of the City is assessed to be moderately polluted with the principal component of pollution in the City being suspended particulate matter. The health effects of exposure to PM10 (particulate matter less than 10 micrometer in diameter) using dose-response coefficients show that the effect is severe in terms of mortality and morbidity parameters.

Proximity of various industrial units with chemical storages to water sources poses a minor threat to the water quality and the environmental services offered by such water sources. The threat is categorised as minor given the steep terrain and the presence of several minor streams that drains through the back waters into the sea. Any release of toxic materials into the unconfined water sources such as lakes and back waters will be washed off into the sea, swiftly particularly during the monsoon seasons. Intensity of the event will be higher if it is during the lean, summer season during which water outflow through the streams are minimal. However, as a last resort contingency measure, water stored in Peppara, Neyyar and Aruvikkara dams can be released into streams to wash off any toxic chemicals, although this may reduce the availability of drinking water during the off season. In the event of chemical leakage, ground water contamination is inevitable.

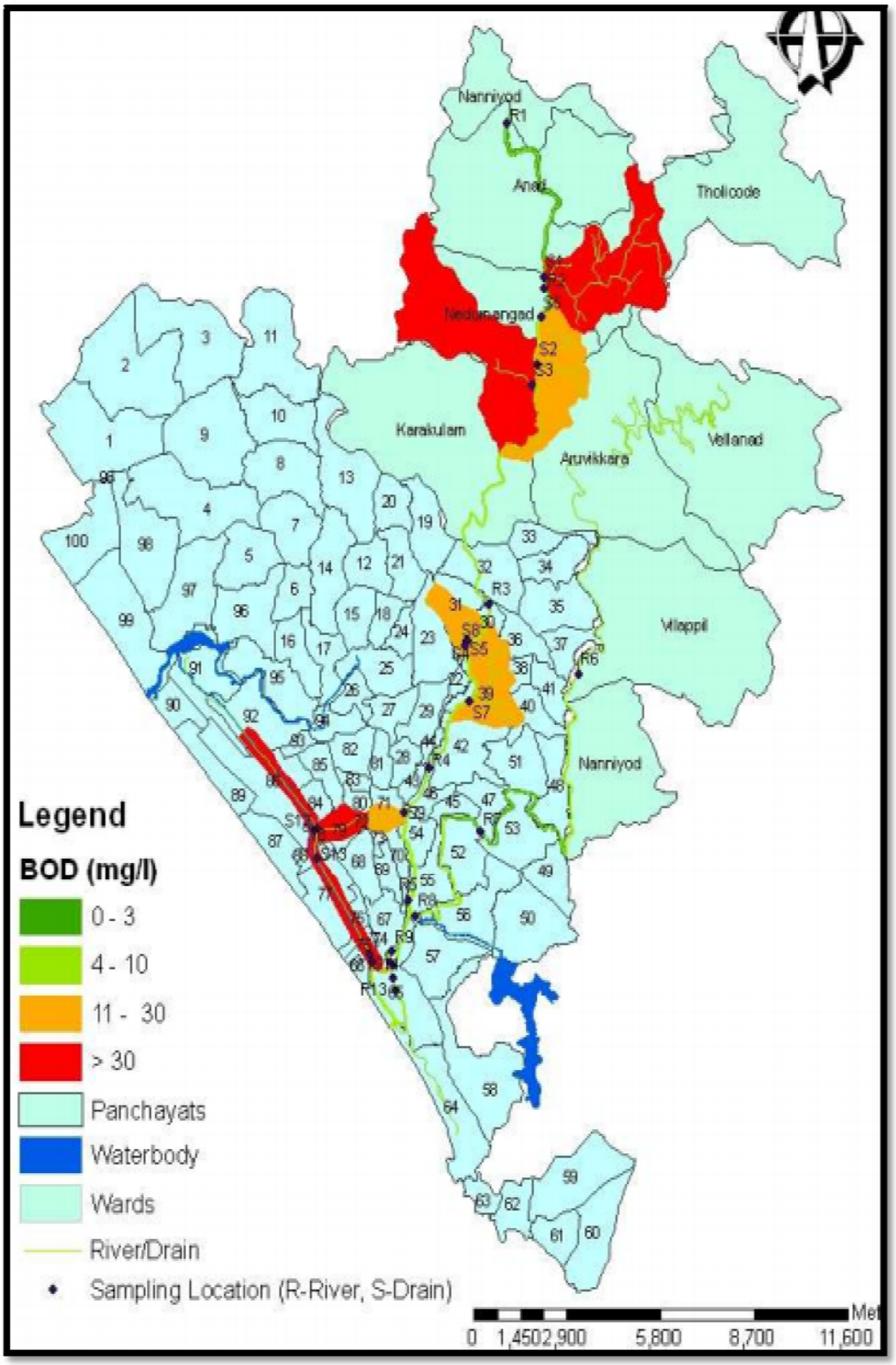
The groundwater quality of Thiruvananthapuram City is poor, particularly around the sewerage farm in Muttathara-Valiyathura area with total coliforms and faecal coliforms present beyond the permissible limits for drinking water quality. In a study report released by Kerala State Council for Science, Technology and Environment in 2010, analysis of water samples collected from 20 locations along the river showed contamination from different sources resulting in poor water quality, especially in the downstream areas of Karamana River, a principal stream that flows through the City. Thrikkannapuram, the Pachalloor estuarine area where tourism projects are centred, and Thiruvallam were found to be the most contaminated reaches. Seventy-five per cent of the river water samples were acidic in nature. Most of the physico-chemical water quality parameters exceeded the desirable limit prescribed by the Bureau of Indian Standards. Ninety percent of the groundwater samples collected from the river basin was acidic and 53 per cent bacteriologically contaminated. Biological analysis of surface water samples indicated heavy organic pollution at Thiruvallam and Pachallur. The report observes that the Parvathy Puthanar canal is a major source of pollution of the river waters. Bacteriological analysis of the river water clearly indicated microbial contamination. Almost all the stations showed higher index for total coliforms and faecal coliform. E.coli was present in the samples collected during different seasons. The garbage treatment plant at Vilappilsala was polluting the Meenampally Thodu, a stream joining the river in the upstream area. Analysis of sediment samples collected from the Pappanamcode industrial area revealed high concentration of heavy metals like iron, manganese, copper, cadmium and nickel.

Another major environmental disaster that the beaches and coastline of the City are prone to is oil spill pollution. The City is close to the international shipping line between Asia and Europe and there by several ships, including large oil tankers transit the area. The along shore currents of the coast may lead to a condition of oil spreading all across the coast and also may enter into the backwaters and estuaries

Pollution zones for Trivandrum Corporation has been prepared by RITES, based on the pollution load (BOD and bacteriological count) contributed by the existing drains while meeting into the river. The zones have been demarcated on the basis of catchment area of each drain. The pollution zones due to BOD and bacteriological counts are presented in the Figure (4.5) and Figure (4.6) respectively. These zones include panchayats like Nedumangad, Tholikkode of block Vellanadu, some part of Aruvikkara in Nedumangad block and some wards of Thiruvanthapuram Municipal Corporation.

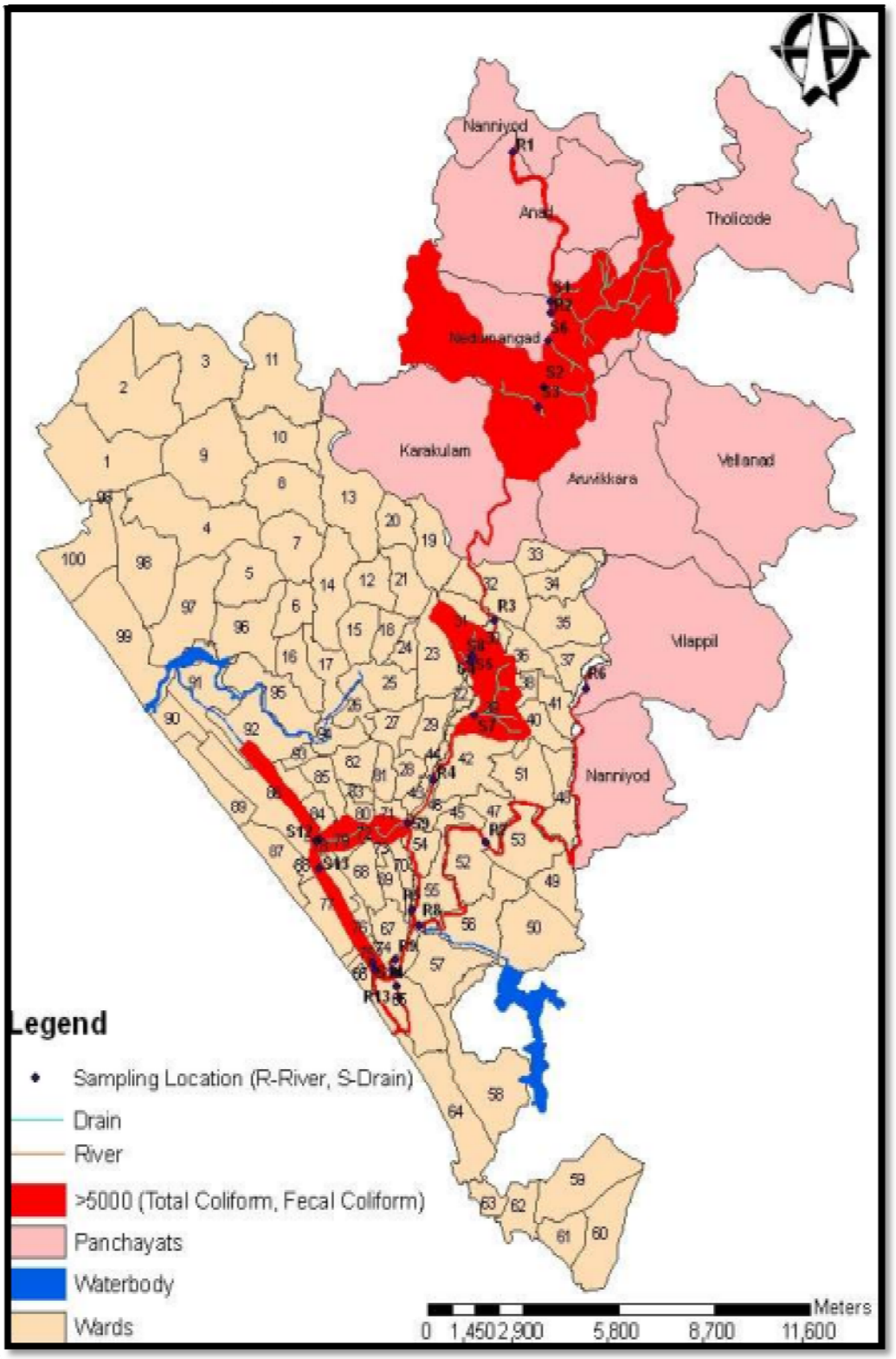
The zones are shown with the help of color code. Green colour indicates lesser pollution while red colour indicates the highest pollution. Nedumangad Panchayat and Parvathi Puthnar are in red colour which is the polluting zones or the Killi and Karamana river respectively.

Fig (4.5) Pollution Zoning Map based on BOD



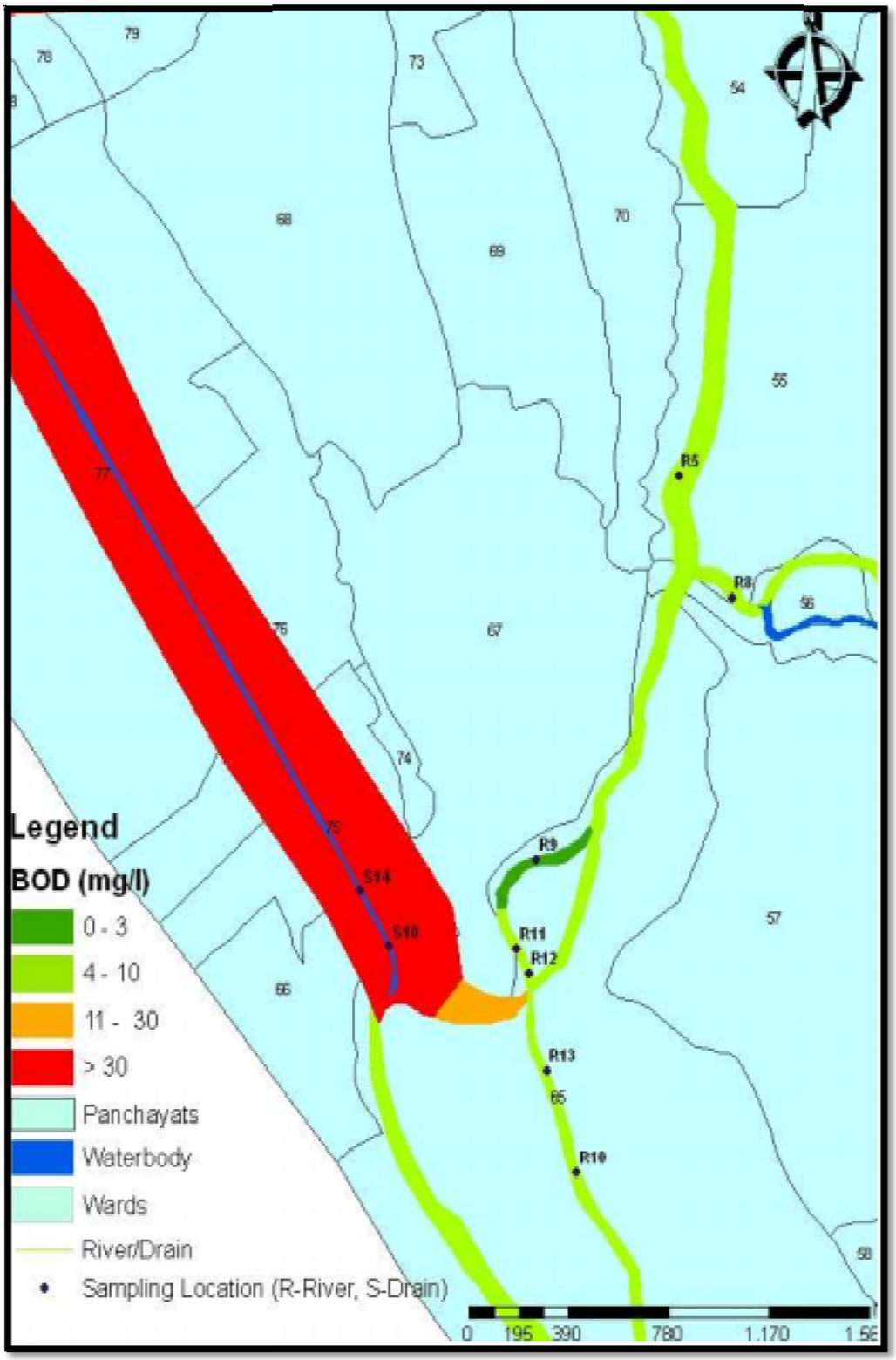
Source: Irrigation Department

Fig (4.6): Pollution zoning Map based on Bacteriological Count



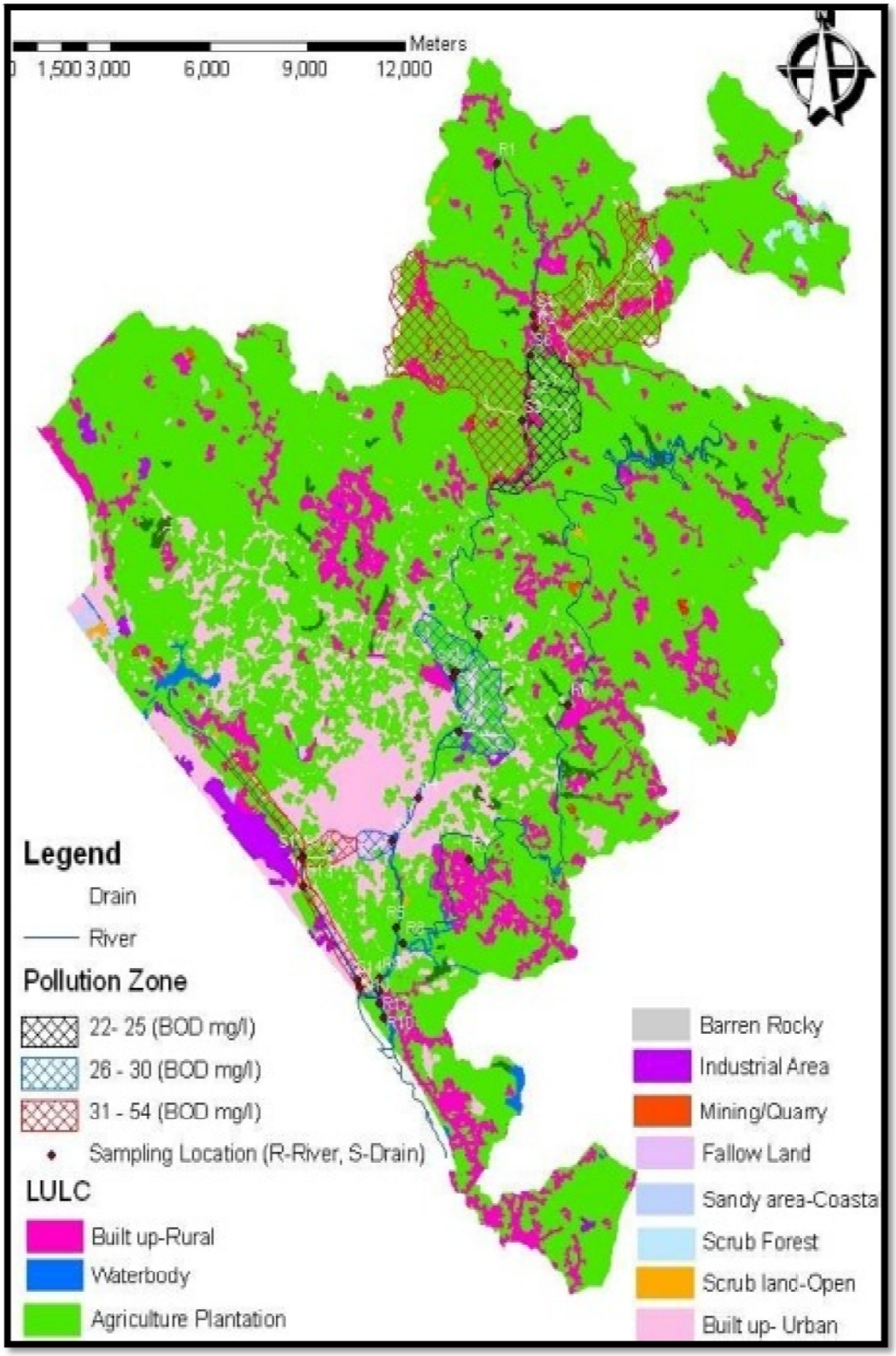
Source: Irrigation Department

Fig (4.7) Pollution Zoning Map of Thiruvallam Area



Source: Irrigation Department

Fig (4.8) Land Use Land Cover with Pollution Zones



Source: Irrigation Department

Climate change vulnerability

Review of peer reviewed research works was conducted and probable effects as pointed out by climate change researchers from a hazard probability are tabulated below in 4.7.

Table 4.7: Anticipated effects of Global Climate Change in Kerala – tabulated review results

Parameter	Effects	References (Annexure - 5)
Temperature	Annual mean surface temperature increase of 0.5 to 4.5°C in 100 years expected	[9], [10], [11], [12], [13]
Precipitation	Observed decreasing trend based on rainfall data for the last 100 years; extreme events expected to increase in frequency	[3], [9]
Wind	No reference to be found	-
Sea Level	Estimate of sea level rise of 1.30 mm/year based on past tide gauge data. Future global projections indicate an average increase of about 4 mm/year. Sea level may rise by 15 to 38 cm by mid-21st century	[5], [13]

Based on this inputs, the anticipated effects have been modified as follows:

1. Increase in autumn and winter season's extreme rainfall will increase the probability of urban flooding during the north-east monsoon period.
2. Decrease in spring rainfall would imply that the drinking water shortage faced by Thiruvananthapuram city during the peak summer (April-May) months will intensify.
3. Spring rainfall also has a cooling effect on the general urban temperature. The reduction in extreme rainfall during the period may increase the urban temperature and lead to intensification of urban heat-island effect. An increase in mean surface temperature by 0.5 to 4.5 degree Celsius may significantly increase the probability of epidemics.
4. Increase in sea-level may increase the intensity and extent of coastal erosion along the thickly populated coastline of Thiruvananthapuram city.

Although the intensity of drought, floods and coastal erosion may increase, the hazard footprint may not increase beyond the worst case scenarios mapped and hence separate hazard foot print assessment was not conducted.

Based on the assessment of probable increase in urban temperature, an attempt has also been triggered to map urban heat-island effects with data derived from ASTER satellite data. Increase in urban heat-island effect may increase incidence of sun-stroke and sun-burns and may alter the epidemic incidents in the City. This map will be included in the final report.

Coping capacity

Any effort to reduce vulnerability to natural disasters should focus on legal and instrumental aspects and on the institutional framework. Furthermore, vulnerability reduction requires focus on stabilizing factors such as diversity and resilience - that is, the capacity of natural and social systems to absorb both exogenous and endogenous changes. For this purpose, it is not enough to focus on a set of policies and instruments, but also to understand the intimate relationship between natural and social factors. An integral part of any vulnerability report is the coping capacity of the administrative unit in terms of institutional arrangements for responding to various hazards.

Thiruvananthapuram District has District Disaster Management Authority constituted vide SRO. No. 977/2008 dated 22nd September 2008 with the District Collector as Chairperson and District Panchayath President as Co-chairperson. The DDMA meets frequently and evaluates the disaster preparedness initiatives of various departments. Thus institutional arrangements for disaster management as envisaged in the Disaster Management Act, 2005 (Central Act, 53) is active at the district level.

Chapter 7 shows the zone-wise distribution of critical buildings useful for disaster response in the city.. In addition to these facilities, the City has the presence of multiple battalions of State Police, Indian Army and Indian Air Force. Presence of the State Incident Commanders (Chief Secretary and Principal Secretary, Revenue and Disaster Management) and the State Emergency Operations Centre in the City ensures prompt response to L2 and L3 level calamities and direct attention of the State Government, unlike other urban areas of the State. These strengths significantly increase the coping capacity of the city and thereby reduce the vulnerability of Thiruvananthapuram City to various hazards. In 2014 (26th to 30th May), the City has apportioned about Rs. 30 lakhs from its own funds for disaster risk reduction and has trained 25 of its official in Basic and Intermediate level Incident Response System. The City Administration is actively working towards mainstreaming disaster risk reduction with the support of the GoI-USAID-UNDP Climate Risk Management Programme implemented by the State Disaster Management Authority. Effort for preparing a comprehensive City Disaster Management Plan is in progress.

However, at the City level, there is a lack of coordination with the District Disaster Management Authority as envisaged in Chapter 6 of the Disaster Management Act, 2005 whereby, the Local Self Government is to work under the guidance of the District Disaster Management Authority in matters concerning disaster management.

Conclusions

- From the vulnerability assessment of the City, it is evident that Thiruvananthapuram is relatively a resilient city with a reasonable degree of coping capacity.
- Based on multi-hazard susceptibility, Kadakampally and Pattom wards are the most hazard susceptible wards of the City.
- Puthanpally and Pappanamcodu wards are the most vulnerable in terms of the physical vulnerability of public buildings.
- Forty two (42) wards of the City are highly vulnerable considering the socio-economic conditions of the population.
- Lack of long term epidemic data impedes a critical assessment of the epidemic proneness of the City.
- The City should develop an annual tree pruning policy such that over grown and root damaged trees are culled/thinned on time, particularly prior to the monsoon.
- Onsite plans and offsite plans for every industrial unit in the city must be prepared and a contingency plan for chemical leakage must be prepared.
- Petro-chemical accident contingency plan must be prepared.
- An oil spill contingency plan for the coastline of the City needs to be prepared and response measures have to be made ready.
- Political commitment with vision of long-term sustainable development is an absolute necessity at the City administration level. As a first step, setting priority areas for investment and institutional capacity, associated with formulating comprehensive national vulnerability reduction plans and environmental management plans should be established and executed.
- Environmental and social concerns should be integrated at every stage of planning, implementation, monitoring and evaluation of all programs, projects, and activities, and be included in related institutional and legal frameworks.
- There is an important regional dimension to environmental management to reduce vulnerability to natural hazards and hence close coordination with the District Disaster Management Authority is a must for effective and efficient vulnerability reduction.

- In order to reduce vulnerability to social and environmental hazards, the public sector and concerned stakeholders should be institutionally organized, adequately staffed and trained. Targets of training to build institutional capacity will include central and local government officials, local leaders and communities, NGOs, and, especially, populations vulnerable to hazards.
- Adaptation of a participatory development approach is essential, since it is almost impossible to accomplish a vulnerability reduction plan with only the public sector's "top-down" efforts. Basic to this is a "bottom-up" approach and "empowerment" concepts, which give local communities and concerned stakeholders the knowledge, power, and motivation to meet their needs and handle vulnerability mitigation with self-reliance. Public awareness, adequate formal and non-formal education, and appropriate, transparent information dissemination are also essential for this approach.
- Appropriate tools and measures – including state-of-the-art technology – are available and should be applied judiciously to implement vulnerability reduction and long-term development.

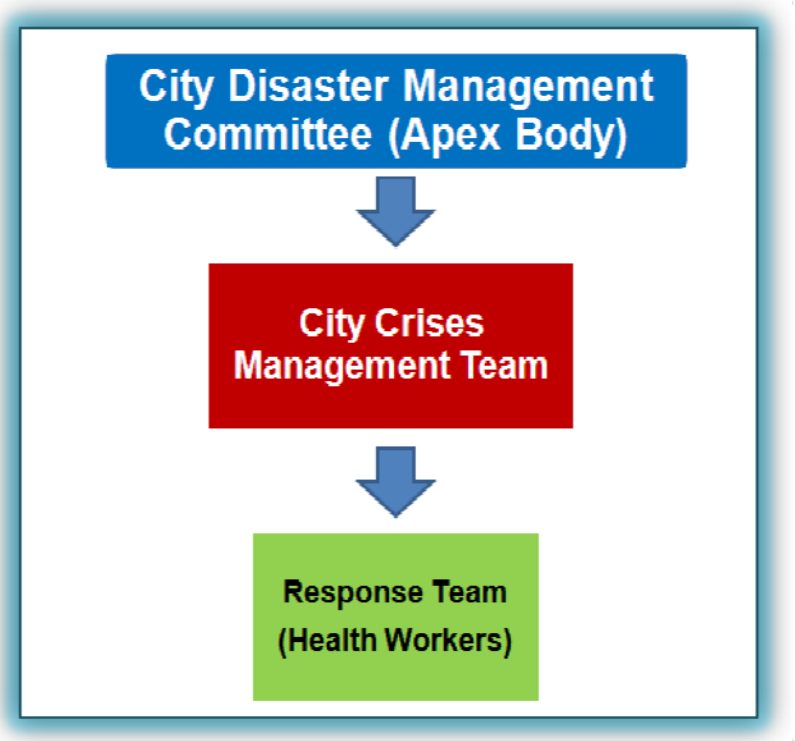
CHAPTER - 5

Institutional Arrangements

Organizational Structure-DM

The organizational structure of DM in the city is a three tier mechanism with City Disaster Management Committee at the apex level, City Crisis Management Team at the second level and then comes the City response Team.

Fig 5.1: Three - Tier Institutional Mechanism



City Disaster Management Committee

An apex body that constitute members from City Corporation as well as district administration that will coordinate and execute disaster related activities in the city corporation. It's a 19 member committee with Mayor as the Chairperson, Deputy
Mayor – Vice chairperson and Secretary Municipal Corporation as the Convener. The list of Committee members are given below.

1. Mayor (Chairperson)
2. Deputy Mayor (Vice Chairperson)
3. Secretary Municipal Corporation (Convener)

Members:-

1. City Police Commissioner
2. Standing Committee Chairperson (Health)
3. Standing Committee Chairperson (Welfare)
4. Standing Committee Chairperson (Works)
5. Standing Committee Chairperson (Development)
6. Standing Committee Chairperson (Tax Appeal)
7. Standing Committee Chairperson (Education)
8. Standing Committee Chairperson (Town Planning)
9. Additional Secretary, Municipal Corporation
10. Corporation Engineer
11. Health Officer, Municipal Corporation
12. DM Deputy Collector (Dist Administration)
13. District Medical Officer (DMO)
14. Additional Divisional Officer (Kerala Fire & Rescue Services)
15. Scientist (NCESS)
16. City Project Coordinator (UNDP)

City Crises Management Team (CCMT)

It's a second tier body exclusively for the members of corporation, who will take decisions and administer the overall process in accordance with the guidance of City DM Committee. Following are the list of members in the CCMT.

Corporation Staff Only

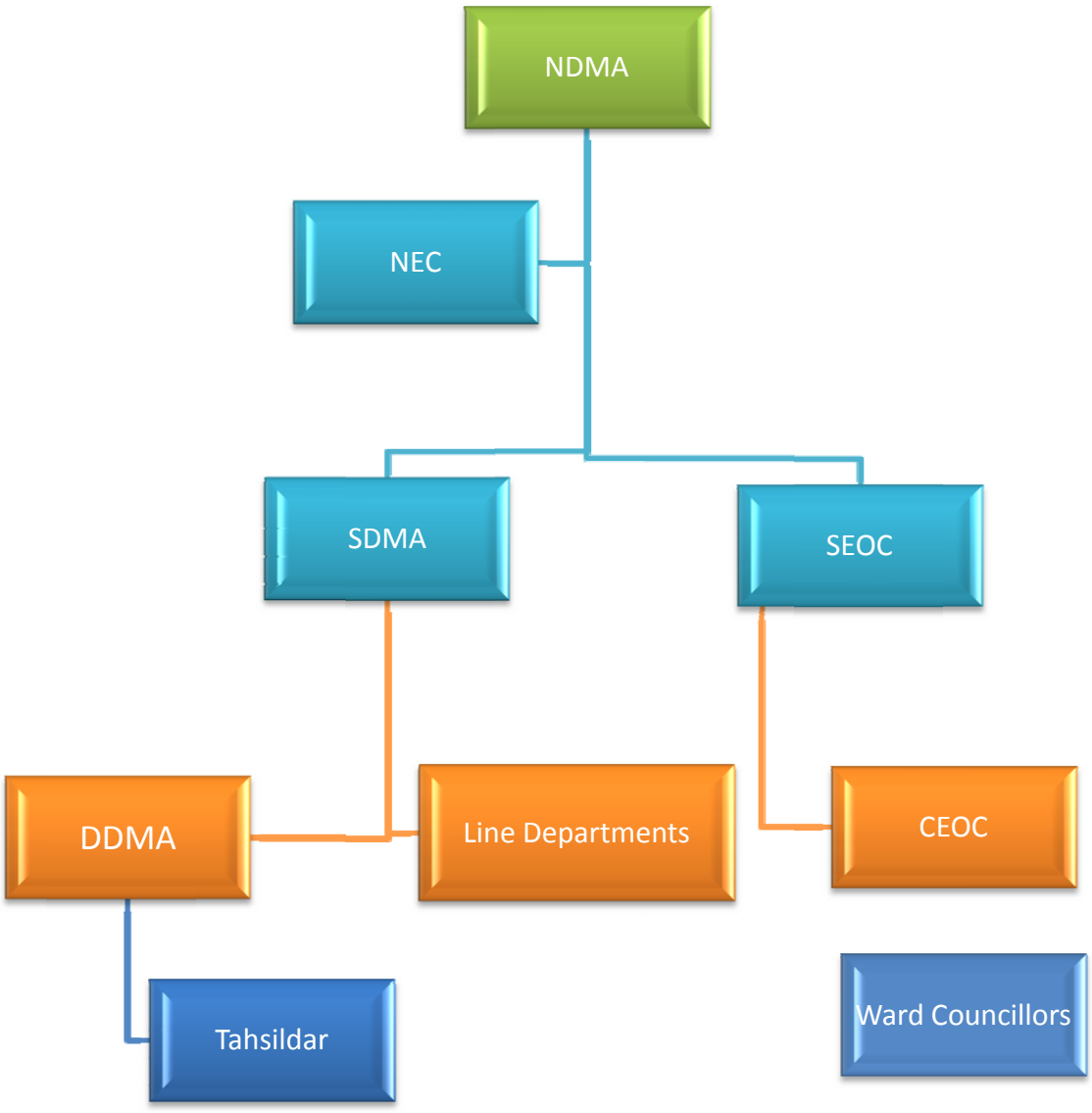
1. Additional Secretary – (Team Head / Convener)
2. Health Officer
3. Health Supervisors
4. Accounts Officer
5. Executive Engineer/s (South/Central/North)

City Response Team (RT)

City Response Team is a group of teams, who are equipped with various skills/ techniques/ resources/ equipments exclusively for responding to the disaster, which mainly comprises of trained workers from the city corporation. Following is the list of team members in the Response team

Health Supervisors - 2 Nos
Health Inspectors - 4 Nos
Junior Health Inspectors – 10 Nos
Junior Public Health Nurses- 4 Nos
Assistant Engineers- 2 Nos
Overseer- 4 Nos
Contingent Health Workers -40
Other volunteers

Fig.5.2: Institutional Linkages



CHAPTER - 6

Mitigation Plan

The purpose of hazard mitigation is to implement and sustain actions that reduce vulnerability and risk from hazards, or reduce the severity of the effects of hazards on people and property. Mitigation actions include both short-term and long-term activities which reduce the impacts of hazards, reduce exposure to hazards, or reduce effects of hazards through various means including preparedness, response and recovery measures. Effective mitigation actions also reduce the adverse impacts and cost of future disasters.

The Objectives of Hazard Mitigation Plan of Trivandrum Municipal Corporation is to create a safer community. It represents the City's commitment to reduce risks from natural and other hazards, and serves as a guide for decision-makers as they commit resources to reducing the effects of potential hazards.

Surrounded by greenbelt and the Arabian Sea in the west, Trivandrum City preserves the diversity and quality of its natural and built environments, creates a satisfying quality of life for its diverse population and workers, and attracts visitors from around the world. But every aspect of the city, its economic prosperity, social and cultural diversity, scenic beauty and historical character could be dramatically altered by a severe flood, earthquake, tsunami or fire.

Natural hazards that have affected the City in the past and those that may affect it in the future can be identified with a high degree of probability. However, the future extent of these hazards is unknown. Flooding, coastal erosion, Tsunami and earthquakes have all occurred in the City within the past several years. The City is prone to reoccurring floods and droughts and the City will periodically witness these conditions in the future as well. While we cannot predict or protect ourselves against every possible hazard that may strike the community, we can anticipate many impacts and take steps to avoid or reduce the harm they will cause. This Hazard Mitigation Plan will look into the aspects of identifying the most important steps to pursue in order to minimize these risks.

Mitigation Plan Objectives and Actions

Trivandrum City strives to be a disaster-resistant community that can avoid, mitigate, survive, recover from, and thrive after a disaster while maintaining its unique character and way of life. City government should be able to provide critical services in the immediate aftermath of a devastating event of any kind. The people, buildings and infrastructure should be resilient to disasters. The City's overall objective is to have basic government services and commercial functions resume quickly after a damaging flood or other significant event.

Mission & Goals

The mission of Hazard Mitigation Plan is to establish and promote a comprehensive mitigation policy and program to protect City residents, their property, public facilities, infrastructure and the environment from natural and manmade hazards.

Goal 1: Protect Life.

Objective 1.1 – Improve systems that provide warning and emergency communications.
Objective 1.2 – Develop or amend laws so they effectively address hazard mitigation.
Objective 1.3 – Reduce the impacts of hazards on vulnerable populations.
Objective 1.4 – Strengthen state and local building code enforcement.
Objective 1.5 – Train emergency responders.

Goal 2: Protect Property.

Objective 2.1 – Protect assets, particularly critical assets.
Objective 2.2 – Protect and preserve facility contents.
Objective 2.3 – Reduce repetitive and severe repetitive losses, including those caused by flooding

Goal 3: Protect the Environment.

Objective 3.1 – Develop hazard mitigation policies that protect and improve the Environment

Goal 4: Strengthen Partnerships

Objective 4.1 - Strengthen communication and coordinate participation among and within public agencies, residents, non-profit organizations, business, and industry to gain a vested interest in the implementation of mitigation measures.
Objective 4.2 - Encourage and support leadership within the private sector, non-profit agencies and community-based organizations to promote and implement local hazard mitigation activities.

Goal 5: Increase Public Preparedness for Disasters.

Objective 5.1 – Improve the understanding of natural hazards and the risk they pose.
Objective 5.2 – Improve hazard information, including databases and maps.
Objective 5.3 – Improve public knowledge of hazards and protective measures so individuals appropriately respond during hazard events.
Objective 5.4 – Develop new policies to enhance hazard mitigation initiatives.

Major Hazards and their mitigation strategies

Urban Flooding - "Operation Anantha"

Thiruvananthapuram City has been experiencing severe floods particularly at East Fort and Thampanoor even during a moderate rain. Despite repeated attempts involving various types of engineering intervention, the areas still face the menace of flooding and this causes significant loss to public and private properties. Despite spending crores of rupees by various agencies under the State Government the flooding situation has become a routine affecting the normal life of the people. The major reason for the frequent floods are manifold some of which are given below:-

- Large scale encroachments which have occupied the entire drain in certain areas.
- Narrowing of the drains due to encroachments from either side.
- Criss crossing of cables/utility pipelines etc. across the canals causing obstruction to the free flow of water.
- Filling up of ponds and conversion of ponds for other purposes (parks/playgrounds/buildings etc.)
- Silt depositions in canals.
- Dumping of solid waste directly into canals by both individuals and institutions.

Even during the recent summer rain of April - May of 2015 East Fort and Thampanoor got flooded, affecting the normal life and it was apprehended that there would be an impending disaster during the monsoon. The District Administration was to intervene aggressively to manage the flooding situation. Hence, it was decided that the emergency powers vested upon the District Collector as Chairman of District Disaster Management Authority invoking Kerala State Disaster Management Rules, 2007 under Chapter VI of the Disaster Management Act 2005 (DM Act, 2005) to ensure an immediate solution to tackle this threatening situation to life and public property.

Accordingly short and long term action plans were prepared for implementation by various organizations under the State Government like PWD (Roads), Minor Irrigation, Major Irrigation, KSUDP, KRFB, KWA (Sewerage), KWA (Water supply), Thiruvananthapuram Corporation, KSEB, BSNL etc. to mitigate the disastrous effect of flooding during the monsoon of 2015. The action plan named as "Operation Anantha" attaches top priority to clearing the encroachments and obstructions in the existing drains in and around East Fort and Thampanoor. The progress of action taken as per the action plan is being reviewed at the level of the Chief Secretary, Principal Secretary, District Collector and other senior officers of the respective departments. An amount of Rs. 10 crores has also been sanctioned for the above works.

Multiple agencies doing the flood eradication works often reduce its effectiveness and cause confusion. It was therefore suggested that a single nodal agency that can co-ordinate with all the stake holders would be a better solution to implement the project in a more effective way.Government have examined the case in detail and are pleased to order as follows:-

A Cabinet Sub Committee consisting of the following Ministers is constituted to monitor and oversee the various programs of flood control taken up under Operation Anantha:-

1. Sri. P.J.Joseph, Hon'ble Minister for Water Resources
2. Sri. V.K.Ibrahim Kunju, Hon'ble Minister for Public Works Department
3. Sri. Manjalamkuzhi Ali , Minister for Urban Affairs & Minority welfare
4. Sri. V.S. Shivakumar, Minister for Health & Dewasom
5. Sri. Adoor Prakash, Minister for Revenue and coir

A District Level Co-ordination Committee with District Collector as Chairman, Sub Collector as Convenor and officers of the various departments/organizations at the level of Executive Engineers shall also be constituted to oversee the progress of daily activities.

Kerala Road Fund Board (KRFB) shall be designated as the nodal agency for planning and co-ordinatinig the project for this monsoon (short term). A separate wing will be created in KRFB with professionals posted on working arrangement from various organizations, who are presently executing the works of "Operation Anantha". This wing will have the responsibility to plan, co-ordinate and monitor the works on a war footing under fast-track mode under Disaster Management Action Plan. All the encroachments affecting the smooth and normal flow of the existing drains in the city will be demolished and cleared. Drains will be constructed wherever necessary including through private properties in which case adequate compensation will be given to the owners, wherever eligible as per rules.

Accordingly short term and long term measures were proposed by the various agencies implementing Operation Anantha. State Level Monitoring Committee and District Disaster Management Authority (DDMA) discussed the proposals in detail and recommended implementation of the short term measures which were essential for the mitigation of flooding. The Empowered Committee chaired by the Chief Secretary will sanction works (both Administrative sanction and Technical sanction) costing more than Rs. 25 lakhs and the District Level Committee chaired by the District Collector will sanction works below Rs. 25 lakhs. Accordingly the State Government as well as the District Collector accorded administrative sanction for those works. The major works executed by the various agencies are detailed below:-

Sl. No.	Name of Work	Estimated Cost	Implementing Agency	Present status
1.	Re-construction of storm water drain from Pazhavangadi Ganapathy Temple to Abhedashram	2,94,41,790/-	KSUDP	Work Completed
2.	Widening and re-construction of RCC culvert at mosque lane near Thampanoor	29,80,000/-	KSUDP	Work Completed
3.	Widening of canal and construction of RCC retaining wall near Hotel Hycinth, Work in Progress Thampanoor	1,26,55,000/-	KSUDP	Work in Progress
4.	Widening of canal and re-construction of RCC retaining wall near Hotel Thamburu at Thampanoor	54,21,000/-	KSUDP	Work in Progress

5.	Re-construction of road side drain from Abhedashramam to Thekkinikara canal	1,29,00,000/-	PWD Roads Division	Work Completed
6.	Cross connection from Pazhavangadi thodu near Central Theatre to Putharikandam through pipe line for overflow of storm water from Pazhavangadi thodu	65,00,000/-	PWD Roads Division	Work Completed
7.	Construction of drain from Thampanoor Aristo junction to Mangalam	45,00,000/-	PWD Roads Division	Work in Progress
8.	Re-construction of RCC drain from Ramachandran Textile to Abhedashramam	72,00,000/-	PWD Roads Division	Work Completed
9.	Re-construction of road side drain in Manjalikulam road	66,00,000/-	PWD Roads Division	Work Completed
10.	Re-construction of culverts one each at Attakulangara near Mosque and at SKP junction	85,00,000/-	PWD Roads Division	Work Completed
11.	Re-construction of road side drain at Rubi Nagar Attakkulangara	1,16,00,000/-	PWD Roads Division	Work Completed
12.	Re-construction of drains of larger capacities along the right side of Attakulangara - Killippalam road	1,60,00,000/-	PWD Roads Division	Work in Progress
13.	Re-construction of drains of larger capacities along the left side of Attakulangara - Killippalam road	3,40,00,000/-	PWD Roads Division	Work in Progress
14.	Re-construction of existing drain near Kalpadrumam Hospital and RDR Auditorium at Edappazhinji	34,00,000/-	Minor Irrigation	Work Completed
15.	Re-construction of existing drain from Pattayavarayar Temple Aryasala to Attakulangara Bypass road	1,42,00,000/-	Minor Irrigation	Work in Progress

16.	Re-construction of existing drain from Marakkada road to Kuriyathy pump house road Erumakkuzhi	63,00,000/-	Minor Irrigation	Work in Progress
17.	Re-construction of existing drain from Chala market to Erumakkuzhi	34,00,000/-	Minor Irrigation	Cancelled
18.	Construction of RCC drain at Kuriyathi thodu near Rottikkada junction	34,00,000/-	Minor Irrigation	Work Completed
19.	Construction of RCC drain at Kuriyathi thodu near Karimadom Colony	1,38,00,000/-	Minor Irrigation	Work Completed
20.	Reconstruction of existing drain from Chenthitta towards Killippalam via Tamil School	26,00,000/-	Minor Irrigation	Work Completed
21.	Construction of RCC drain at Kuriyathi thodu near BSNL compound	63,50,000/-	Minor Irrigation	Work Completed
22.	Cleaning of Pattom Thodu from Vayalikkada to Kannamoola	20,00,000/-	Minor Irrigation	Cancelled
23.	Construction of RCC drain and slab from Yamuna Nagar to Karimadom colony (151 metres)	30,00,000/-	Tvpm Corporation	Work in Progress
24.	Construction of new drain from SS Kovil road to Amayizhanchan thodu	26,17,068/-	KRFB	Work Completed

The DDMA has accorded administrative sanction for works for which estimated cost less than 25 lakhs as for 149 works amounting to Rs. 412.58 lakhs. The works undertaken under Operation Anantha have attracted much appreciation from all corners of life. In order to maintain the smooth flow of storm water through the canals and drains constructed under Operation Anantha, regular cleaning and removal of debris are essential. Thiruvananthapuram Corporation may consider a permanent solution and work programme for preventing dumping of solid waste in to these canals, failing which the whole effort taken under Operation Anantha will be futile. The Corporation may also arrange for cleaning of the drains and canals under their administrative control regularly for prevailing the menace of flooding in the capital city.

Storm Surge & Coastal Erosion

The problems of coastal zone in the Thiruvananthapuram City is unique due to the high density of population, loss of land due to coastal erosion, drastic morphological and shoreline changes due to shore structures like harbour breakwaters, destruction and reclamation of wetland including mangroves, saline intrusion into the water table, decreasing fish catch, development related degradation of the environment and violation of the provisions of CRZ.

Severe beach erosion is reported along the Coast of Thiruvananthapuram during south west monsoon season. Rebuilding of beaches takes place during the latter part of monsoon and post monsoon period. The important mechanism for the high erosion during SW monsoon is the cross shore sediment transport than the long shore transport. The coastal community is the only sector that periodically loses dwelling places due to erosion. The destruction of natural habitats in the form of reclamation of wetlands, dumping of industrial and urban wastes worsens the plight of the coastal communities.

Proposed Mitigation Measures are;

Shelter belts can be constructed as complementary structures along the coastal line to provide adequate safety to coastal erosion.

The present practice of sea wall construction is to be supplemented with the plantation of Mangroves, and other suitable species of trees/vegetation to suit the soil condition which is most suited for stabilizing the banks. Mangroves and other trees can be used wherever the conditions are congenial.

An alternate method for preventing sea erosion using artificial offshore reefs is an environment friendly practice, which is much more sophisticated than simple rock walls and groins. This is a multipurpose perspective that goes beyond the simple aim of protecting a stretch of the coast. It is constructed with large sand filled geo textile bags having life up to 40 years. These reefs are safe and secure during storms and dampen wave activity so that the beach grows out and lost land is recovered. The reef acts as fish aggregation device and increases fish stock through extra habitat. The reefs promote tourism as it supports recreation, water sports and surfing. Such reefs can be introduced in some areas nearer to the tourist spots. Detailed study and consultancy is recommended

Construction of cut-off line Structures: To solve the problems like destruction of houses built on encroachments to the beaches arises due to roughness of sea, a permanent gabion wall is proposed to be constructed along the beach. This will make a line of cut off to future encroachments, leaving maximum wide beach thereafter towards sea. This structure can also be used as a walkway, as an extension to the existing walkway at Sankhumugham beach, towards both sides. Towards south, it can be extended upto Valiyathura Kadalpalam and from there to Poonthura. Towards north, it is proposed to be extended up to Kannanthura, Vettukad, Kochuveli and Veli.

Construct Multipurpose community centers in the coastal villages: During monsoons the fishermen households in the city are badly affected by sea-erosion. The affected families are taken to the schools / community centres nearby. Multipurpose community centres in the coastal villages can be used as shelters during emergency as well as for other community activities. Hence a multipurpose community centre cum disaster shelter in each fishing village is proposed.

Environmental Issues

Pollution mitigation measures are the actions to reduce, avoid or offset the potential adverse environmental consequences of the activities. On the basis of existing and required sanitation facilities gap analysis has been worked out. The CPHEEO Manual for sewerage and sewage treatment, Ministry of Urban Development is referred for gap analysis. This was worked out by considering environmental aspects like waste water, solid waste, hospital waste, Dhobi ghat, commercial activities etc. The mitigation measures have been suggested based on the gap analysis.

Waste Water Management system

Discharge of waste water from residential and commercial units is the major sources of pollution in river especially those near the Killi river bank. Pipes carrying waste water from these commercial and residential establishments are linked to the nearest storm water network which finally meeting into the river. Practically, it is very difficult to identify and close the illegal waste water pipe connections to the nearest storm water drains. It is also difficult to lay new sewerage line in this area due to space constraint. Hence, it is proposed a waste water collection system by laying pipes on both sides of river and along the river. The waste water from these areas will be collected through this proposed pipe by providing connections through manholes. The waste water from proposed lines will be temporarily stored in the sumps both sides at confluence point. This waste water further will be pumped to the proposed sewerage treatment plant which is likely to be proposed at about 300 m from Killi and Karamana river confluence

Sewerage system

The existing sewerage systems with ten pumping stations are very old which needs up gradation. As per CPHEEO manual on sewerage and sewage treatment, the age of existing sewerage system in the blocks A, B,& C is more than 30 years which needs to be replaced. Collection of sewage after provision of 100% sewerage system should be carried to sewage treatment plant. After treatment it should be reused for different purposes like agriculture, horticulture, landscaping, industrial processes, toilet flushing etc as per the degree of treatment.

The following measures shall be adopted for efficient sewerage system;

- A preliminary survey will be undertaken to identify the unsewered areas. For which detailed project report for the unsewered areas need to be prepared for their implementation.
- Coverage of city with 100% sewerage system is required to maintain a good sanitation system of the city and to prevent the river water pollution.
- CPHEEO manual and IS Codes should be followed for the designing of sewerage system
- Regular cleaning and maintenance should be carried out by concerned authority.
- Periodic awareness program conducting public consultation and arranging seminar at regular interval of time is required to be accomplished. This will help to prevent choking of sewerage due to disposal of poly-bags etc here and there.
- Condition survey will assist the project proponent to identify the shortcomings in the existing system and accordingly the up-gradation will be taken up for smooth functioning of the system.
- Sanitation system should be provided at the worship/temple locations along the river

- It is observed that at discharge point of some of drains, manual gates are installed but it is in poor condition hence should be replaced by new automatic type with bar screens
- For the improvement of existing storm water drains it is urgently required to cover 20% of existing open roadside drains with provisionof manholes/removable cover (Approximate length 87 Km).

Solid Waste Management

Waste minimization and source reduction are one of the best strategies for Solid waste management while considering Trivandrum City. Though the city does not have any centralised waste management facility, it has started significant ward level initiatives in source reduction programmes. At present the total quantity of solid waste generated in the city is reduced to 250 metric tonnes from 300 metric tonnes per day. Of these 150 metric tonnes of waste is daily processed in its source itself. The remaining 100 tonne is creating problems in the city corporation as per the information from the Health Department. The health department is responsible for all public health activities including solid waste management in Trivandrum Corporation.

The Corporation is currently introduced a campaign called ' ente nagaram sundara nagaram' to promote waste reduction/ management in the City, under which the health department promote various source reduction strategies like pipe composting, well composting, mass pit composting, pot composting, ring composting, vermin composting, portable house bio-gas composting, mini bio pedestal composting, portable bin or bucket composting, portable bio-bin composting, centralizing masonry bio tank composting, organic waste composting machine etc for individual households, flats, commercial buildings etc.

For the promotion of composting 80% subsidy for the pipe composting, 80% subsidy for bio gas , 80% subsidy for ring composting, 80% subsidy for vermin composting are provided. Ten bio gas plants are in implementation stage by corporation. As per the Director Suchitwa Mission, one sanitary landfill site at Chalai owned by Thiruvananthapuram Development Authority (TRIDA) is expected to complete soon based on the waste to energy technology. The plant is expected to produce 3.2 MW electricity per day. The plant is established under Public Private Partnership (PPP) with DBFOT (Design, Built, Finance, Operate and Transfer) format for treating 35 tonnes of waste per day initially, and to increase it to 100 tonnes per day.

Solid waste is being used for the construction of railway platform which contain three layers of solid waste and forth layer of soil. About 500 tons of solid waste from the city is utilized for constructing 2.5 m wide 1 m high railway platform at Murukkumpuzha railway station. About 1200 tonnes solid waste is utilized for constructing 2 m wide 1m high railway platform at Kochu Veli railway station.

Apart from this mobile incinerator, shredder units are being installed by the corporation in various places. For managing wastes in public places corporation is being installing Priyam aerobic bins and thumboor muzhy bins which can process waste of 2 tonnes per unit capacity. At present it is implemented in 12 wards in its sampoorna swichitwa ward programme. The wards declared as sampoorana swichitwa wards are Jagathy, Pattom, Edavacode, Ulloor, Palayam, Sreekandeswaram,

peroorkkada, Nedumcadu, Chettivilakom and Vazhuthacaud. Currently around 60 % people are treating their waste in house hold itself, remaining 40 % lacks any waste management facility due to lack of adequate spaces for treating the waste. Therefore a centralised waste processing unit is indispensable for the city as far as the amount of waste generation is considered. The local government needs to identify the site for sanitary landfill. The sanitary landfill site should be developed as per the Municipal Solid Waste Handling Rules 2000 and CPHEEO manual on Municipal Solid Waste Management.

As far as Hazardous wastes are considered, it should be collected separately and disposed-off properly through authorized agency. The hazardous waste must be handled and disposed off as per The Hazardous Wastes (Management, Handling, Transboundary Movement) Rule **2008.**
Following mitigation measures shall be adopted for the proper solid waste management in the city to avoid river pollution;

- Provision of 3 m high metal wire mesh along both side of the river stretch flowing through the city.
- Install signboard massages, banners, hoardings etc at various places along the river to aware the people from tossing things into the river
- Dust bins should be provided at road side and the worship/temple locations along the river
- Animal incinerator should be provided at suitable places
- Provision of Sanitary landfill site with windrow composting
- Provide sufficient assets to deal with situation and optimal management

Bio-Medical Waste

Following mitigation measures should be adopted for the proper management of bio-medical waste; Reduction/control of waste (by controlling inventory, wastage of consumable items, reagents, breakage etc).

- Segregation of wastes in Separate Containers (at the Point of Generation) according to their treatment/disposal.
- Segregated collection by labeling, color coding andtransportation to final treatment/disposal facility so that they do not getmixed.
- Proper treatment through incineration.
- Proper organization and management.

Modern Slaughter House

It is observed during the field study that, no proper slaughter house is in operation in the city. Hence, two number of modern slaughter house with its effluent treatment plant should be provided, one in Thiruvananthapuram corporation and one in Nedumangad panchayat.

Public Awareness

The public awareness aims to create awareness as well as to induce behavioral changes among the local population. Public awareness program should be carried out for the different groups/stakeholders i.e. local public officials and community leaders, local communities, Institutions, NGO's, government

organizations, schools and media etc. Also, campaigns through different media like TV, press, school children, poster competition etc should be conducted to create awareness. Segregation of wastes at source needs to be encouraged. A complaint cell should be created in each ward to provide assistance for waste management.

Imposition of Legal Action

It is necessary to impose enforcement mechanism under Water (Prevention and Control of Pollution) Act, 1981 to maintain the river water clean. The imposition of mechanism shall be ensured by state level authority i.e. state pollution control board. The strict implementation of rules and regulations will help to control the pollution of the river. Water monitoring should be started at the major pollution sites of the river. Dumping of domestic wastes and other polluting materials should be banned. There will be provision of fines/imprisonment based on their activities towards polluting the river water as per the relevant acts.

Provision of Cross Regulator at Parvathi Puthnar

Parvathy puthanaar canals opens into the sea at Poonthura and Veli to facilitate natural flushing of canal water.Due to closer of opening by sandbars, the water of Parvathy Puthanar has got diverted in karamana riverat Thiruvallam. The restoration work is required to be done to clear sand bars so that water of Parvathi Puthanar will meet directly into the sea without affecting the water quality of Karamana river. Secondly, a gate is also proposed to prevent mixing of Parvathi Puthanar water into Karamana river. A gate required to be in the location as shown in Figure (6.1). The closer of the gate will divert the water of Parvathi Puthanar to sea through existing natural channel. This channel requires cleaning for smooth diversion of Parvathi Puthnar flow to sea.

Fig: (6.1) provision of cross regulator at Parvathy Puthanar

Source: Irrigation Department

Air Pollution

In order to reduce air pollution, it is proposed to install 5 automatic ambient air quality monitoring stations at major stations in the city with digital display arrangements as the air quality deterioration directly affects the health of people. The suggested stations are at Thampanoor, Palayam, East Fort, Ulloor and Vellayambalam. All results from these monitoring stations are proposed to be transmitted to a control room in City Police Commissioner's office.

Based on the information received, necessary instructions such as diverting traffic, actions to avoid congestion, etc. can be given according to the pollution level. The data also can be utilised for the effective enforcement of automobile emission.

The trend clearly indicates the smoke or particulate matter emission from automobiles is to be minimized. In this connection, detailed study has to be conducted on the replacement of diesel with CNG.

Adequate attention will be given for maintaining better road condition, timely removal of construction waste and debris from the roads, even taking action to remove small amount of sand and soil from the road, etc.

Anthropogenic Disasters

Mass gathering Events

As far as mass gathering events are considered the mitigation strategy mainly must include all the possible measures to deal with managing crowds.

Event / Venue – Details & Descriptions

It is necessary that the plan for management of the mass gathering at event/ venue has all important information's needed for ascertaining safety aspects from all angle. An indicative list of components and sub-components to be included in event application is as given below. Event application will have, but not limited to following details:-

Event / Venue Details

- Event Location
- Brief history of the event/venue
- Duration of event (schedule and timing)
- Expected number of people
- Admission arrangement (Open to public / by invitation/tickets etc)
- Details of activities and how/when/where they will take place
- Event management structure ((set out the key management personnel)
- Functions of key personnel (Event Controller, Safety Officer and
- Health and Sanitation in- charge)
- Event control and communications (location of central control room, who
- will be there, what means) Of communication will be used for reporting)

- Any particular arrangements (special needs spectators, pre-launch ceremonies etc.)
- Overview of large equipment and temporary structures (staging, sanitary facilities, lighting etc.)
- Contact details and of Event organisers / administrator and venue owner

Site Map

The site plan must include maps showing location and details of -

- Transportation hubs (Bus-stops, Railway stations, Taxi stands etc.)
- Rest area / Places
- Information kiosks
- Places of interest at the venue/event
- Meeting points / Media Center
- Entry and exit points at event venue
- Water Outlets
- Food outlets / courts
- Toilets
- Phone booth
- Holding area(s), queue complex(s), routes for movement
- Watch towers at vantage locations for observing and monitoring the crowd.
- CCTV coverage at all vulnerable locations to be monitored at the control room.
- Sector wise deployment of Policemen with sector wise responsibility and wireless communication network between watch towers, CCTV control room and deployment inside the crowd.
- Police stations
- Reporting places for lost/stolen/found items, missing persons etc.
- Parking lots
- Health facilities
- Shopping areas
- Food joints
- Hazard points
- Emergency Exits
- Emergency Assembly Points
- First Aid services
- Emergency services (Fire, Ambulances,)
- Emergency Operations Center, Incident Command Posts etc

Hazard and Risk Assessment

This is necessary for event management to undertake a risk assessment of those hazards which could cause harm to staff and/or members of the public attending the event and can be done with the help of state emergency operation centre. An indicative list of hazards (natural and manmade) for any event/venue of mass gathering is given below.

1. Severe Storm / Heavy rains /flash flood
2. Earthquake
3. Cyclone
4. Fire
5. Hazardous Materials Incident
6. Bomb Blast
7. crowded situation leading to stampede
8. Vehicle accident
9. Structure Collapse

Functional plans will be prepared and annexed based on the hazard, risk and vulnerability assessment (HRVA).

Safety

Risk assessment forms the basis for designing the safety / security plan. Following are the salient components, but not limited to, of an event safety plan.

- Safety Policy Statement
- Event Risk assessment
- Signage (information service provided), installing PA system etc
- Critical control points Location, type, and purpose of barricading (based on the risk assessment)
- Crowd management (number of home guards/volunteers/police/others, responsibilities, location)
- Plans to involve home guards, civil defence, and community stake holders (how, when,)
- Security agencies deployed (license details, in case of private agencies)
- Entry and exit arrangements (routine and designation of emergency routes and assembly areas)
- Fire precautions (means of escape, safe holding capacity calculations, fire safety equipment)
- Structures (schedule of completion, certifying engineer)
- Electrical installations (lighting, auxiliary power provision)
- Environmental issues (noise, sanitation, catering, garbage / waste, drinking water, etc.)
- Vehicular access and exit (transport plan for site traffic and car parking arrangements)
- Medical/First Aid Provision (numbers required, location, ambulance, equipment)
- On site traffic management (where deliveries will be made, any parking etc.)
- Emergency power and lighting arrangements
- Firework permit, if applicable
- List and Locations of Food vendors using gas cylinders
- Fire and electrical safety assessment plans, mock drills, and action taken reports
- Communication plan (internal/external, before the event and in case of emergency)
- Command and control hierarchy Security:
- Screening and credential checks for suspicious persons
- Unattended packages
- Concealment areas

Preparedness and Capacity Building

Planning is the one of the key elements in the Preparedness cycle. Preparedness cycle illustrates the way the plans are continuously evaluated and improved through a cycle of planning, organizing, training, equipping, exercising, evaluating and taking corrective action. Following components should for a part of the preparedness process.

General Measures and Consideration

- Emergency Operation Center (Control room)
- Public Information
- Awareness – (local as well as wide area)
- Services and Utilities
- First aid and basic health services
- Visitors flow management
- Access for emergency resources including ambulances
- Hazard in the area and mitigation measures
- Services for people with special needs / disabled
- Transportation and Traffic Management
- Safety and Security Plan
- Lost and found
- Contractors and supplier management plan
- Chain of command
- Incident monitoring & reporting system
- Training and exercising
- Approach to Capacity Building
- Institutional capacity building
- Management/ policy makers
- Police, fire, health services
- Others
- Community capacity building
- Civil defense
- NGOs/ CBOs
- Volunteers
- Skill up-gradation, follow-up training programmes, certificate courses
- List of trained personnel with contact details and specialisation5.3 Health, Hygiene and Medical Services
- List of approved food vendors
- Drinking water availability (location, sources,)
- Toilets (location, numbers for males and females, cleaning schedule, and Responsibility etc.)
- Waste Management (garbage bin arrangements, waste collection schedule, recycling plans)
- Plans to include local community members

- Medical problems reported historically (impact of weather, terrain, etc.)
- Medical facilities (number of beds, equipment available etc.), staff (number of doctors, Surgeons, paramedics, nurses etc. and their expertise), number of ambulances available (with/without life support systems) and their locations
- Contact details, facilities and capacity of local hospitals, primary health centres, mobile hospitals, standby staff etc.
- Plan for first-aid training to volunteers, security personnel etc.
- A 5-year roadmap for improvements in facilities and emergency medical services (which facilities, how much, where, who will finance etc.)

Emergency Response Plan

Response plan guides the development of the more operationally oriented annexure. Its primary audience consists of the event/venue management/ authorities, local emergency management officials, and the community (as appropriate). The elements listed in this section should meet the needs of this audience while providing a solid foundation for the development of supporting annexes. Major components of response plan will include (but not limited to)

1. Incident Response System
2. Emergency Operations Centres
3. Response flow chart(s)
4. Hazard/Incident specific responsibility charts for emergency functions
5. Alert mechanisms, early warnings etc.
6. Procedure for the activation of plans, resource mobilization, seeking external help, coordination with different agencies
7. Media management and information dissemination

Functional annexure

Functional annexure - The functional annexes detail the goals, objectives, and courses of action of functions (e.g., evacuation, shelter, security, medical and health services, missing persons, relief supplies etc) that apply across multiple threats or hazards. Functional annexes discuss how the event and venue (including house of worship) manages a function before, during, and after an incident. Following is the list of major functional annexure:-

- Traffic Management Plan
- Medical Plan (in consultation with relevant Health Authority)
- Event Communications (including Wireless radio frequency channels to be used by event staff in schematic format) plan
- Emergency procedures (the publication of these procedures should be restricted to event staff and the statutory agencies) for stopping the event
- Action in the event of a bomb scare
- Action in the event of Fire

- Action in the event of any other emergency incident (Including Natural and human made disaster
- Evacuation of the venue and shelter management

Plan Management: Rehearsal, Review and Revision

Train Stakeholders on the Plan and Their Roles - Everyone involved in the plan needs to know their roles and responsibilities before, during, and after an incident.

Exercise the Plan

The more a plan is practiced and stakeholders are trained on the plan, the more effectively they will be able to act before, during, and after an incident to lessen the impact on life and property. Exercises provide opportunities to practice with local emergency management officials and community partners, as well as to identify gaps and weaknesses in the plan.

Chemical Hazard

Trivandrum City Corporation poses considerable risk related to industrial hazards. The City is vulnerable to both onsite and offsite emergencies. To mitigate the risk posed by chemical hazards following measures have been taken by the factories and boilers at the district level.

Crisis group

A Crisis Group has been constituted as per the G.O. (Ms) No. 3/98/STED dated 05.02.1998 with the Collector as Chairman to handle emergencies associated with chemical accidents/hazards effectively and to mitigate the consequences therefore, at the district level. There is a District Crisis Group (DCG) and Local Crisis Group (LCG) existing and functioning in Trivandrum District.

Offsite/Onsite chemical emergency plan

The preparation of onsite and Offsite emergency is a statutory requirement according to Factories Act, 1948 (amended in 1987) and manufacture, Storage and Import of Hazardous Chemicals rules 1989 respectively. Therefore preparations of these plans are necessary for the mitigation of chemical disasters.

Updating offsite emergency plan

The Offsite emergency plan requires updating at least once in three years or more frequently under the following conditions.

1) Commissioning of new industries manufacturing and storing of hazardous substance in quantities above the threshold limit.
2) Change of manufacturing process and capacity increase.
3) Development of new information and technology in the safety systems and the consequent major changes in the emergency plan of the individual units.
4) Amendment in statute.

Preparation of Standard Operating Procedures

The departments associated with responding to chemical disasters should prepare their own standard operating procedures and each concerned official authorized to respond this kind of incidents must have a basic understanding of their roles and responsibilities. Besides this a resource inventory should also be prepared and kept in ready for an event.

Training

Workers of the industrial establishment, minimum 10 % of the total strength shall be trained in fire fighting, First-Aid and handling the affected persons effectively as and when required. They shall be well trained in artificial respiration and external cardio massage. The transportation of victims to the nearest medical institutions is most important. Each establishment shall have sufficient first aid equipments and accessories for emergency use as required under *Kerala Factories Rules, 1957*

Transportation of hazardous goods transport

Centre Motor Vehicles Act, 1988 and Rules, 1989 prescribed certain regulations for transportation of hazardous goods by road. The salient features of these rules are as under:

1) Every goods carriage transporting hazardous goods shall display a distinct mark of the class label appropriate to the type of dangerous goods.
2) Every package shall also display the class label.
3) Size mode of display, position, colour etc. has also been prescribed.
4) Every goods carriage used for transportation of hazardous goods shall have an emergency information panel consisting of the following information.
    a. Correct technical name.
    b. Class label
    c. Name and telephone number of the emergency services, the consignor and the customer.
    d. UN Number
    e. HAZCHEM Code
5) The consignor shall supply requisite safety information to the transporters.
6) The transporters shall ensure that all details have been made available required for safe transport.
7) The owner shall ensure that the driver has sufficient knowledge of the goods transported.
8) The driver shall observe all precautions at all times.
9) In case of an accident, the driver shall report to the nearest police station. In case the driver and helper are victims of the accident, the police on duty at the nearest junction/patrol shall be responsible for the notification.
10) The driver of the vehicle shall possess the transport emergency card or TREMCARD.

In addition to this Material Safety Data Sheet of chemicals stored in Trivandrum are attached in the annexure.

List of chemicals transported

Even though hazardous industries are few in Trivandrum City many hazardous chemicals are being transported through the district. Some important chemicals, which their UN Number, Hazchem Code and risk and hazard classification, among them are attached in the annexure.

Epidemics

Action plan for the prevention and control of Communicable Diseases

Continuous disease surveillance throughout the year is essential for effective preparedness and eradication of epidemics. Discussion with private hospitals, private practitioners., HOD and Unit Chiefs of Medical Colleges has to be under taken to collect and update the data bank regarding various disease outbreaks. Rumor registers kept in health institutions, media reports, and information through informal networks etc can also act as a tool for surveillance. There has to be regular vector surveillance and integrated vector management wherever required with the cooperation of City Corporation and other departments & agencies. There should be regular IEC / BCC activities, proper monitoring, supervision, and reviews at each level. Additional measures have to be planned as per requirement depending on the situation. Following is a month wise specific action plan prepared by health department as part of their disaster preparedness activity.

Table 6.1: Calendar of activities

Month	Activities
January	Training Logistic arrangements Situation analysis and seasonality map Action Plan preparation
February	Intervention in water scarce areas Technical updates Advocacy and Sensitization meetings Inter sectoral Coordination meetings Discussion with plantation owners Neighborhood group gatherings Activate WHSNC Discussion for Labour Officer and Contractor's Associations
March	Advocacy and Sensitization meetings Awareness cum Action campaigns Waste management measures Rat and stray dog control Elimination of Lymphatic Filariasis
April	Advocacy and Sensitization campaigns Dry container and Key container elimination campaigns

	Move towards plantation campaigns Rapid response to outbreaks
May	Awareness cum action campaigns Clean public place campaigns Clean water campaigns Rapid response to outbreaks
June to August	Rapid response to outbreaks Strengthen treatment facility Weekly dry day observations Student campaign Observe Anti Malaria and Anti Dengue months PH Act implementation, Meetings
September to December	Advocacy and sensitization meetings Intensive screening of immigrants for malaria. Prevent breeding of malaria mosquitoes Release larvivorous fishes in wells and other water sources. IRS in endemic areas and focal spray in outbreak areas of malaria Supply of Doxycycline for the prevention of Leptospirosis. Waste disposal and rat control with the help of other agencies. Aedes control and surveillance against Dengue outbreaks Control of outbreaks of other diseases whenever needed Action campaigns may be organized if required

General guidelines for control activities

Control of mosquito borne diseases (Dengue, Chikungunya and Malaria)

Detection and elimination of breeding sources of Aedes mosquito

Conduct one survey every week in all JHI areas covering 30-50 or more houses (50 or more houses in populated areas and 30 or more houses in less populated areas) and assess the indices (CI, HI and BI). There should be efforts to detect all breeding sites including any newer sites and to eliminate breeding sites. This should be repeated weekly in all high risk areas until the area becomes low risk.

Identify buildings with water storage practice in water deficient areas and make necessary interventions to avoid mosquito breeding.

Visit construction sites and take steps to prevent mosquito breeding in water collected in sunken slabs, lift space, curing areas, terrace tops, tanks etc.

Undertake weekly source reduction in the campus of all health institutions (GH, DH, THQH, CHC, PHC, SC, DMO Offices etc).

During pre - monsoon cleaning, cleaning must be done in such a way that all hidden sources of Aedes (especially tyres and dry containers) are suitably disposed.

During summer, sources of Aedes will be minimum. Conduct a detailed Aedes survey (esp by DVC Unit) to trace out all potential sources and key containers and eliminate them so that during monsoon the density of Aedes can be kept low.

DVC Units have to find out Pupal indices in addition to larval indices so that the risk of the area and efficiency of source reduction in the area can be evaluated.

Detection and elimination of breeding sources of anopheles mosquitoes

In areas where malaria was detected and in areas where migrants are residing, search for breeding sites of Anopheles mosquito and undertake control measures (netting of tanks, deposition of abate solution or Diflubenzuron tablets, introduction of fish, IRS etc).

Visit construction sites and take steps to prevent mosquito breeding especially in the water tanks.

Arrange regular IRS in malaria endemic areas and focal spray in malaria outbreak areas.
Fogging may be done in areas where there is high mosquito density to reduce mosquito density. This may be done in health institutions also.
Fogging and source reduction should be done in the following areas. District Malaria Officer (DMLO) should coordinate these activities with the help of DVC unit.

Undertake Fogging and Source reduction in 30 – 50 houses around the house of all Dengue patients. This should be arranged with in 48 hours of diagnosing Dengue. The diagnosis of Dengue fever in Medical College, District hospital or any other hospital should be informed to the concerned CHC/PHC immediately to arrange fogging and source reduction.

In the campus of all hospitals where there is treatment for Dengue and Chikungunya. This should be done once a week.

Provide mosquito nets (preferably LLIN) to VBD patients or make the fever ward mosquito proof in major hospitals.

Improve surveillance for early detection of vector borne diseases

Improve active and passive blood sample collection for detection of malaria

Conduct regular screening of migrants to detect Malaria and Filaria. Field staff should visit residences and worksites of migrants regularly.

Sensitize contractors and work supervisors to get help for the screening.

Collect 5 samples of suspected cases from each GH, DH and THQH every week (3 to 4 major hospitals in a district) and test for Dengue/ Chikungunya. Samples may be sent to SSH for testing. Send report on or before 5th of every month. District Malaria Officer should coordinate these activities with the help of DLT.

Do necessary maintenance of all fish tanks (mini hatcheries) in health institutions and also in schools/ panchayaths, rear good number of larvivorous fishes (guppy) and distribute to selected water masses for biological control.

Control of water borne diseases (ADD, Typhoid, Cholera, Hepatitis A & E)

Work with LSGD and Water Resources department to ensure regular supply of safe drinking water. Work with concerned local authorities and civil society to protect drinking water sources and to purify and chlorinate before supply.

JHI should visit all pumping stations regularly to ensure proper chlorination (proper purification if possible).

Regularly visit hotels, shops and bakeries to ensure the use of chlorinated boiled water for preparing soda, cola, ice cream, sip up, sarbath, juices etc.

Arrange for water quality testing and corrective measures.

Work for decentralized waste disposal, plastic ban, sanitary latrines etc.

Active case search and preventive measures against Cholera in Wayanad and vulnerable areas in Thiruvananthapuram.

Control of Leptospirosis

- Supply Doxycycline tablets to all people engaged in high risk jobs.
- Work with LSGD for solid waste management.
- Seek the help of other LSGD and Agriculture departments for rodent control.
- Promote personal protection to high risk groups.

Control of Hepatitis B

- Ensure blood safety.
- Vaccinate all children up to 5 years.
- Sensitize laboratories, Dental clinics and hospitals regarding proper sterilization.
- Educate hair saloons, beauty parlour, tattoo centre workers about hygienic measures.

Control of other emerging diseases (H1N1 fever, Scrub Typhus, Leishmaniasis).

Specific guidelines issued earlier should be followed.

Implementation of PH Act.

Fire Hazard

The number of city fires in a year has multiplied by 10 times in India during the last three decades as per the findings of National Institute of Disaster Management. Haphazard growth of the city, proliferation of slums, and fragile infrastructure aggravates the situation. In a building, fires are primarily due to electrical short-circuiting, overloading, improper earthing, tripping, failures of fittings, improper use of inflammable gases etc.

In slums and squatter settlements, closely packed construction, construction with inflammable materials, narrow, winding lanes inhibiting access to fire engines, unauthorized tapped electrical connections, stocking of highly flammable and toxic scrap material, loose or unsafe wiring are major causes of fires.

In old residential areas, encroachment, household industries dealing with flammable materials, narrow roads result in fires, while unsafe handling of flammable substances, non adherence to safety norms like use of mobile phones etc are major causes of fires in petrol pumps/gas stations.

Prevention and mitigation of fire risks depends on a critical risk assessment followed by preparedness and risk reducing measures. Major preventive measures in high rise buildings may be listed as the following structural and non-structural measures:

Table 6.2 Fire Prevention & Mitigation Measures

Structural	Non Structural
Strict adherence to all safety measures Building by-laws with respect to Fire Fighting & Safety Standards	Implementation of Fire Order - role & responsibility of occupant
Building to have proper Emergency Exit	Ensuring Good House Keeping – Occupant participation
Escape route to be properly marked	Careful smoking
Building to have Fire Ring main & network of Hydrant & Water Monitor	Careful use of Hazardous product like LPG & SKO by occupants
Provision of Automatic Fire Siren System	Keeping means of Escape hindrance free
Dedicated Under Ground/Over ground Fire Water Tank & automatic Sprinkler	Evacuation Drill on regular Interval
Portable Fire Extinguisher	Regular Training of fire & Safety to occupant
Provision of Hose Reel	Regular Maintenance of Fire Safety Equipment
Lightning protection	Display of Important Telephone Numbers
Reticulated or piped gas Supplies of LPG/PNG	

Urban Fire Hazards demands a shift from Fire Fighting to Fire prevention by ensuring enrollment of all partners (Community, Administration, Occupant, Fire Department) & to identify Vulnerable areas/activities, assessing Fire Risk & making Fire Safety an integral part of Town Planning & Building Design to avoid heavy Human & Financial Losses.

At present, the State has Fire Force Act 1962, which need thorough revision and updation to meet provisions of National Building Code (NBC, 2005) in order to strict implementation of fire code in building design and construction. National Building Code (NBC) should be strictly adhered to in high-rise buildings, schools, colleges, shopping malls, cinema halls, hospitals, industrial units, institutions and public and private buildings. This can be ensured only by the city corporation before giving permission for construction activities.

The FRS in the city lacks in firefighting manpower and also there are shortage of emergency equipment's which need to be filled up at the earliest.

Based on prioritization of Fire Stations, State Fire Services needs to add new Fire Stations at a faster pace, as there is a huge gap both in urban and rural areas.

Online Vehicle tracking through GPS or and development of a fully computerized response system is another area for improvement.

Though Kerala State Fire and Rescue Services is creating public awareness programs through fire prevention wing and fire service officers in schools, hospitals, Govt. offices, etc. however, it is not meeting up to the desired level due to lack of trained manpower and funds. For that purpose sufficient manpower at senior officer levels have been recommended to have an effective State "Fire Prevention Wing". The fire prevention wing should have trained officials for fire inspection, awareness and training, so that fire incidences similar to that of AMRI, Kolkata should not occur. The Fire & Rescue Sevice should have a dedicated "Education Van" in for this purpose. The van should be well equipped with short video films as produced by MHA, distribution of pamphlets on "DO"s and "DONOT"s generated by MHA, and live demonstration of how to use "portable extinguishers" and handle small fires.

Periodic fire drills and fire-inspection of schools, colleges, cinema halls hospitals, shopping complexes, multi-storied buildings, and major industrial centers should be taken care by the FRS.

For congested areas, and by-lanes where movement of Water Tender and Water Bowser is difficult, QRTs and motorcycle with mist sets should be used for the fastest response, supplemented by the Water Tenders and Water Bowsers by laying the large hose pipelines. Additionally, Fire Service should identify congested areas and request district administration to decongest such areas with the help of police. The congestion could be in terms of illegal extension of residential buildings, shops, unauthorized parking on roads. For unauthorized parking, State traffic department can also play an important role. Here role of fire prevention officials is important as such, exercises are not one time exercise and should be carried out regularly.

Nuclear and radiological Emergencies

Public Awareness

Public awareness plays a key role in the emergency preparedness and response plans for any type of emergency/disaster where the participation/role of the public is of prime importance. The fact that one cannot see, feel or smell the presence of radiation, coupled with a general lack of credible and authentic information to the public at large about radiation and radiation emergencies and the wide publicity given to any nuclear/radiation-related incident, has resulted in several erroneous perceptions about nuclear technology.

To educate the people about the beneficial aspects of nuclear radiation and to remove their misgivings about it, awareness programmes should be conducted for the public and officials with the basics of radiation protection, safety limits, safety practices, and the dos and don'ts during a nuclear emergency.

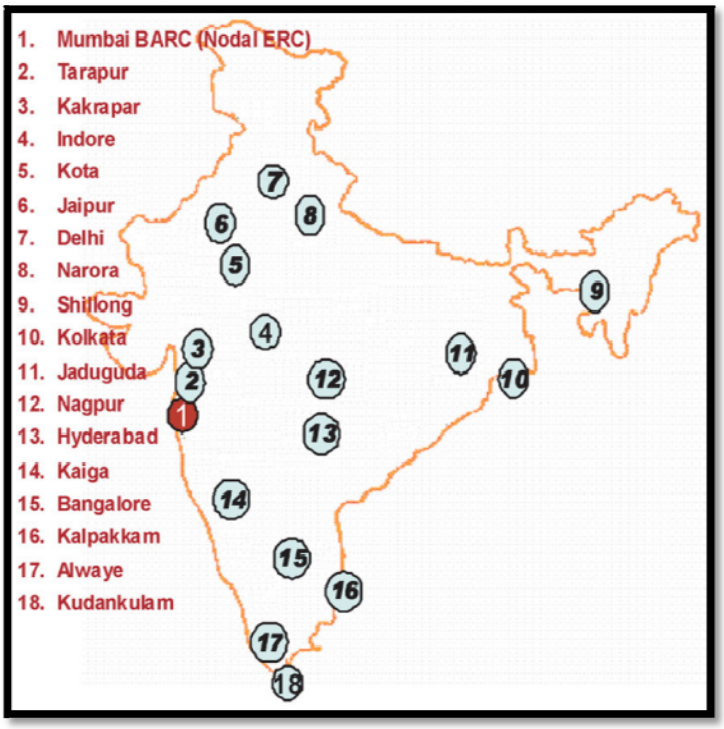
Network of Emergency Response Centres and Crisis Management Group

As a basic regulatory requirement, emergency preparedness exists at all nuclear and radiation facilities to respond to any on-site or off-site emergency in their areas. But to handle radiological emergencies arising from a transport accident or from the movement/ handling of 'orphan sources' (radioactive sources that have lost regulatory control are called 'orphan sources') or due to malevolent acts like explosion of an RDD, Radiation Exposure Device (RED) or IND any time or anywhere in the country, a network of 18 units of Emergency Response Centres (ERCs) has been established by BARC, DAE This network is basically meant for responding to such emergencies and also providing timely advice and guidance to first responders at the state and national levels. These ERCs are equipped with radiation monitoring instruments, protective gear and other supporting infrastructure. The geographical locations of these 18 ERCs are shown in Figure (4.12).

Check regulatory and enforcement roles

The AERB, the national regulatory authority, has been regulating the nuclear and radiation facilities in the country very effectively and has, over the years, issued a large number of codes, standards and guides. These cover the various activities relating to the nuclear fuel cycle as well as for radiation applications in medicine, industry, agriculture and research. As far as the city administration is concerned, its role is confined to informing the AERB, if any violation of codes or procedure is identified. The nearest ERC to Trivandrum City are located in Alwaye & koodankulam.

Fig.6.2: Network of Emergency Response Centres and Crisis Management Group



Source: National Disaster Management Authority

Emergency Plans to Respond to Transportation Accidents

The AERB has laid down guidelines to be adopted for the transport of radioactive materials and emergency response plans for accidents during their transportation The AERB's safety code covers the design of the transport container, its handling and loading, procedures for transporting and unloading, including the procedures to handle any accident en-route. The SOPs also indicate what will be done in the event of any radiation emergency—the precautions to be taken, the agencies to be notified, etc. The CMG, DAE, will also be available to direct the technical resources of DAE to any location and to assist the transporters/local authorities in responding to the emergency situation.

Strengthening the Institutional Frameworks (for Regulatory and Response Mechanisms)

It is well known that effective coordination mechanisms amongst the different agencies involved is the key to an efficient emergency response mechanism. This requires formal institutional frameworks and linkages, with the necessary statutory backing. Therefore a coordination mechanism between DAE and the local/district officials who would be responding to any radiation emergency in the public domain is essential for the implementation of a regulatory and enforcement mechanism by the AERB.

Provision of a Portable Radiation Detection System

With increasing incidences of terrorists activities and impending threat of an RDD, it is imperative that the police, which in all probability will be the first to reach the site of an explosion, should have some

simple portable monitoring instruments (at each police station within the areas with radiological threat perception) which will warn them as they approach the radiation area (from, say, a blast of RDD).

Strengthening the Medical Preparedness and Response Mechanism

Presently, there is no network of hospitals in the city which can handle radiation induced injuries on a large scale. The establishment of such a network is essential for handling nuclear emergencies/disasters. There should also be a dedicated and reliable communication facility among hospitals so that they can pool their resources when required.

Physical Protection

Facilities using radioactive sources need to strengthen their physical protection systems along with proper inventory and control procedures of the radiation sources. If possible, the city administration must have all the details of radioactive sources in the city along with the antidotes, communication officer of nearest ERC s and also details of hospitals that can handle nuclear emergencies and also essential medical supplies.'

Tansportation Safety

The National Urban Transport Policy aims to introduce Intelligent Transport System for traffic management. The policy is meant to improve safety, efficiency and economic productivity of transport system in an urban area. Though the full adaptation of the ITS available today is yet to get implemented in India, Area Traffic Control System (ATCS) which is one of the components of ITS, is applied to manage traffic here.

CDAC, Thiruvananthapuram has already developed an ATCS for Indian conditions and implemented in Pune. A similar traffic control system is proposed in Thiruvananthapuram. Traffic enforcement and monitoring with the help of camera stations and centralised traffic regulation will also help to reduce accidents.

Pedestrian facilities

Improvements to pedestrian facilities include footpaths along the roads), foot over bridges, subways, at grade pedestrian road crossing facilities, exclusive pedestrian pathways etc is highly required in the city. A bout 12 locations have been identified for providing pedestrian road crossing facilities. They are Thampanoor, East Fort, SMV School, Statue, Medical College, Pattom Kesavadasapuram, Cotton Hill, General Hospital Jn., Karamana, Vazhuthcaud and Manacaud.

Parking Facilities

Absence of off street parking facilities has caused traffic obstructions on many a road in the city by on street haphazard vehicle parking. Off street parking facilities are proposed as ground level facility, underground facility and/or multilevel facility.

A few critical locations are identified below. Palayam, Statue – Secretariat area, Vazhuthcaud, near Museum & Zoo, Ulloor – Medical College Hospital area, Peroorkada, East Fort – Chalai area, Thampanoor area & Vellayambalam – Sasthamangalam road.

Grade Separators for identified road intersection

In the Central Business area and places where major work centres are located, the pedestrian is in sharp conflict with vehicular traffic. In Thiruvananthapuram, pedestrians cross the roads at grade. Where a high volume of pedestrians cross a road of an equally heavy volume of vehicular traffic, proper grade separated pedestrian facilities should be provided. Traffic studies in the city has identified a few road intersections on the major roads which now have nearly 10000 PCUs per hour and the traffic projections show substantial increase in traffic volume. At grade solutions like signalling have been counterproductive leading to queuing up of vehicles especially at peak hours, disruption of traffic flow and resulting in increase in accidents.

Possible solution to this (apart from better mass transport facilities) is to construct grade separators (flyovers or underpasses). Road junctions identified are: Pattom, PMG Jn., Medical College Jn., Vellayambalam, Sreekariam, Ulloor Jn., Widening & improvements to Thampanoor flyover, Pettah – Anayara road, Peroorkada etc.

Climate Change Mitigation

Mitigation refers to any strategic intervention and/or anthropogenic action taken to remove the greenhouse gases (GHG) released into the atmosphere, or to reduce their amount, to reduce any risk and hazards of climate change to human life and environment.

The Intergovernmental Panel on Climate Change (IPCC) defines climate change mitigation as technological change and substitution that reduce resource inputs and emissions per unit of output. Although several social, economic and technological policies would produce an emission reduction, with respect to climate change, mitigation means implementing policies to reduce GHG emissions and enhance sinks.

Mitigation Measures

Switching to low-carbon energy sources such as wind power, solar, geothermal, hydroelectric or nuclear represents one of the major strategies for lowering the emissions of greenhouse gases in the atmosphere.

The scale of the challenge is daunting - fossil fuels make up about 80% of all energy. But technologies such as carbon capture and storage (CCS) could help reduce their impact. One form of CCS involves

chemically capturing the carbon dioxide from a power station flue, and then piping it underground so that the invisible gas is contained in rock formations without leaking.

Existing oil fields, un-mineable coal seams and underground salty aquifers are all among the geological sites that are considered suitable for CO2 storage. But while CCS could, in theory, limit the amount of carbon going into the atmosphere; it doesn't do much for the CO2 already there.

Greening urban areas can also make a difference. Cities are home to half the planet's population, and are responsible for three-quarters of energy consumption and 80% of carbon emissions. Retro-fitting buildings to make them more energy efficient and cutting the impact of transport emissions represent some of the strategies for doing this.

Tackling waste is also an issue. About 11.2 billion metric tonnes of solid waste is currently being collected around the world every year, and the organic portion that decays is contributing around 5 % to global greenhouse gas emissions. Experts would like to reduce its impact primarily by producing less but also recycling more and treating waste in a way that is less harmful to the environment or even using it as a sustainable energy fuel source.

Mitigation also extends to the protection of natural carbon "sinks" like the forests or oceans. New sinks can be created through, for example, forest regeneration.

CHAPTER - 7

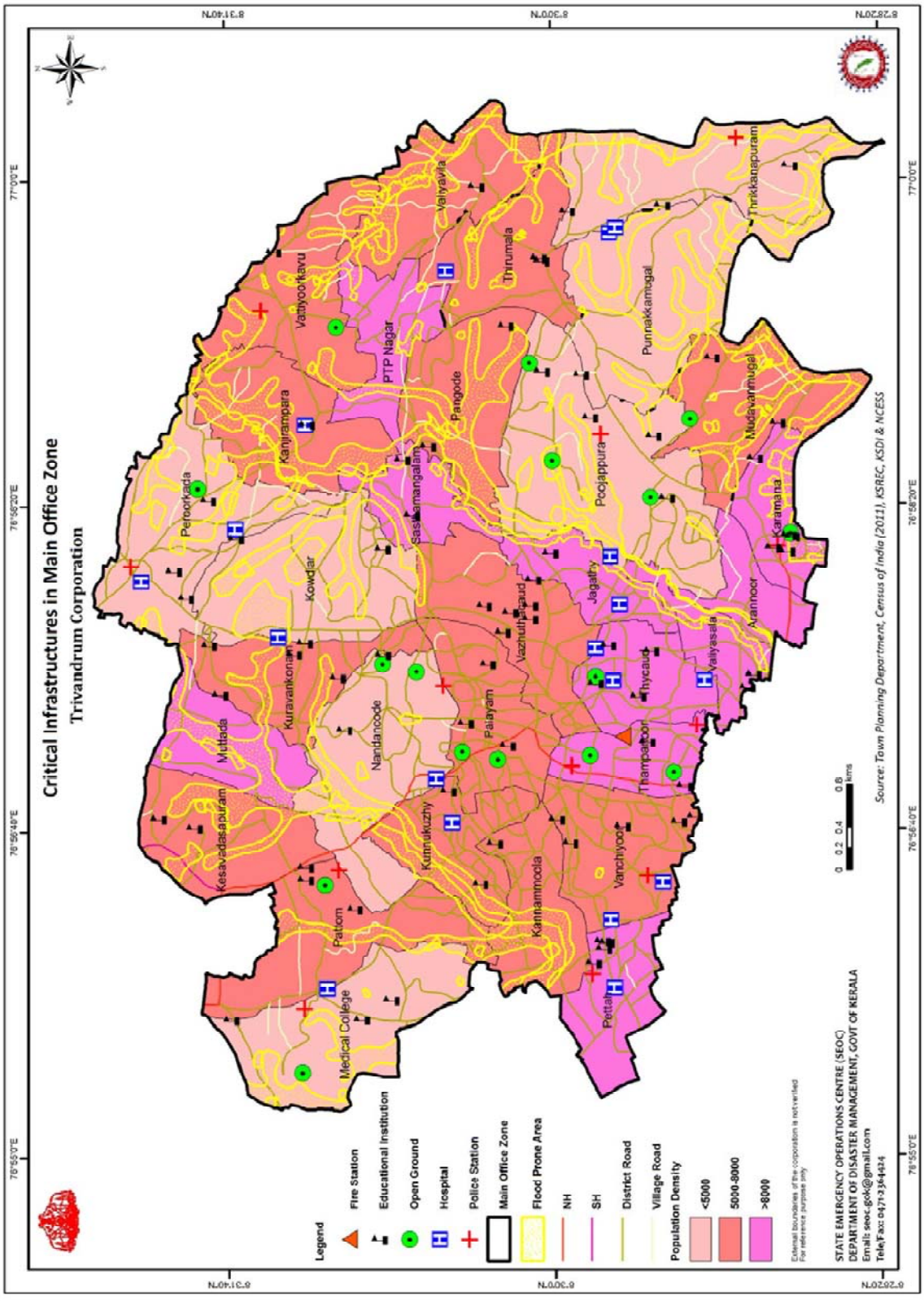
Planning & Response Structure

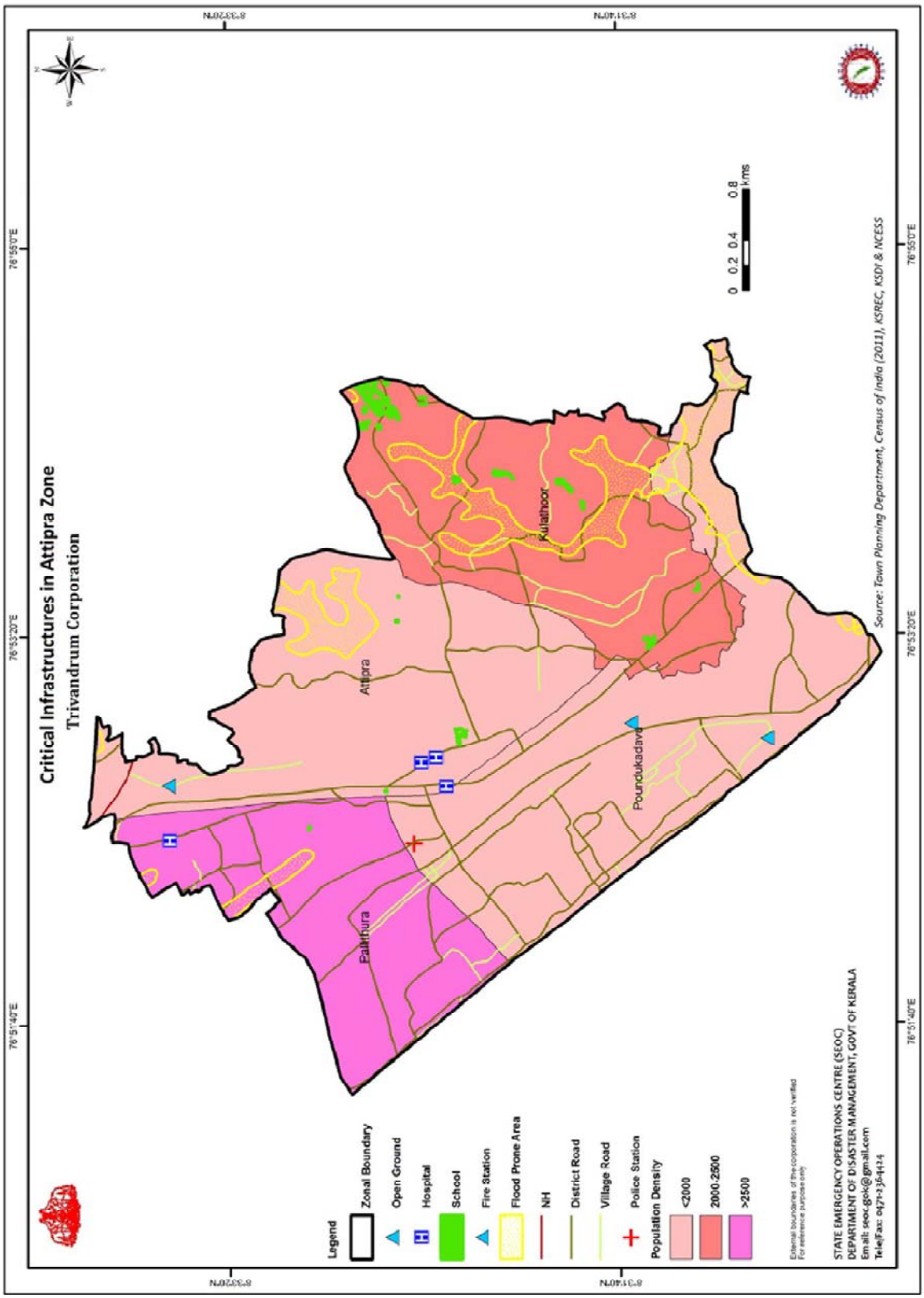
Grid Based Emergency Coordination

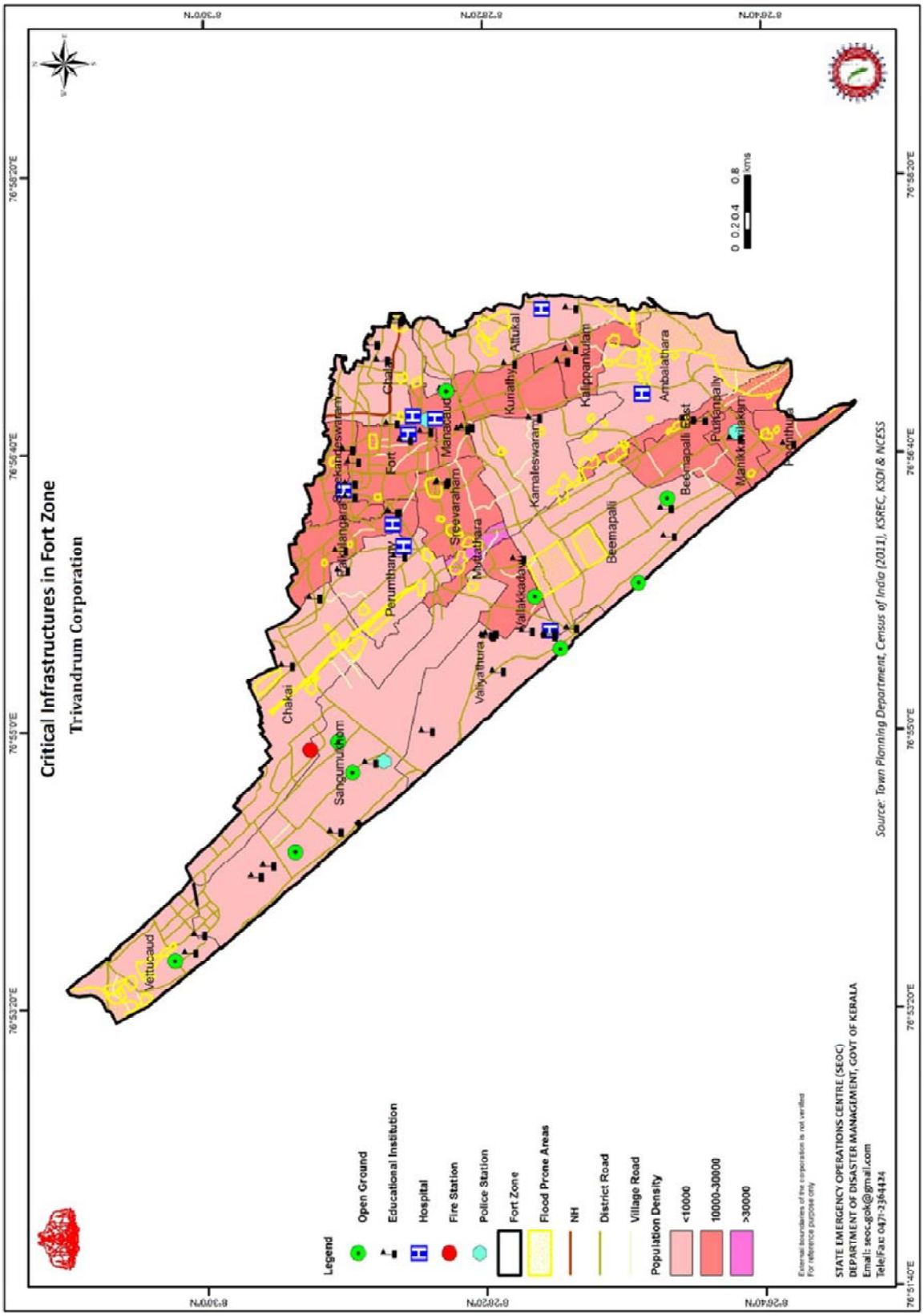
Segregation of City Corporation into various grids, ensuring effective management during a disaster helps in better planning and coordination by the supporting agencies. This grid system may divide the entire city corporation into twelve zones (based on the present zonal office) and capacity analysis of each zone is done, so that in an emergency, each grid will stand alone and act as a separate functional unit with its own resources and capacities, which in turn helps in quarantining and effective time management. The 12 Zonal Office in the Trivandrum City Corporation and associated wards are as follows.

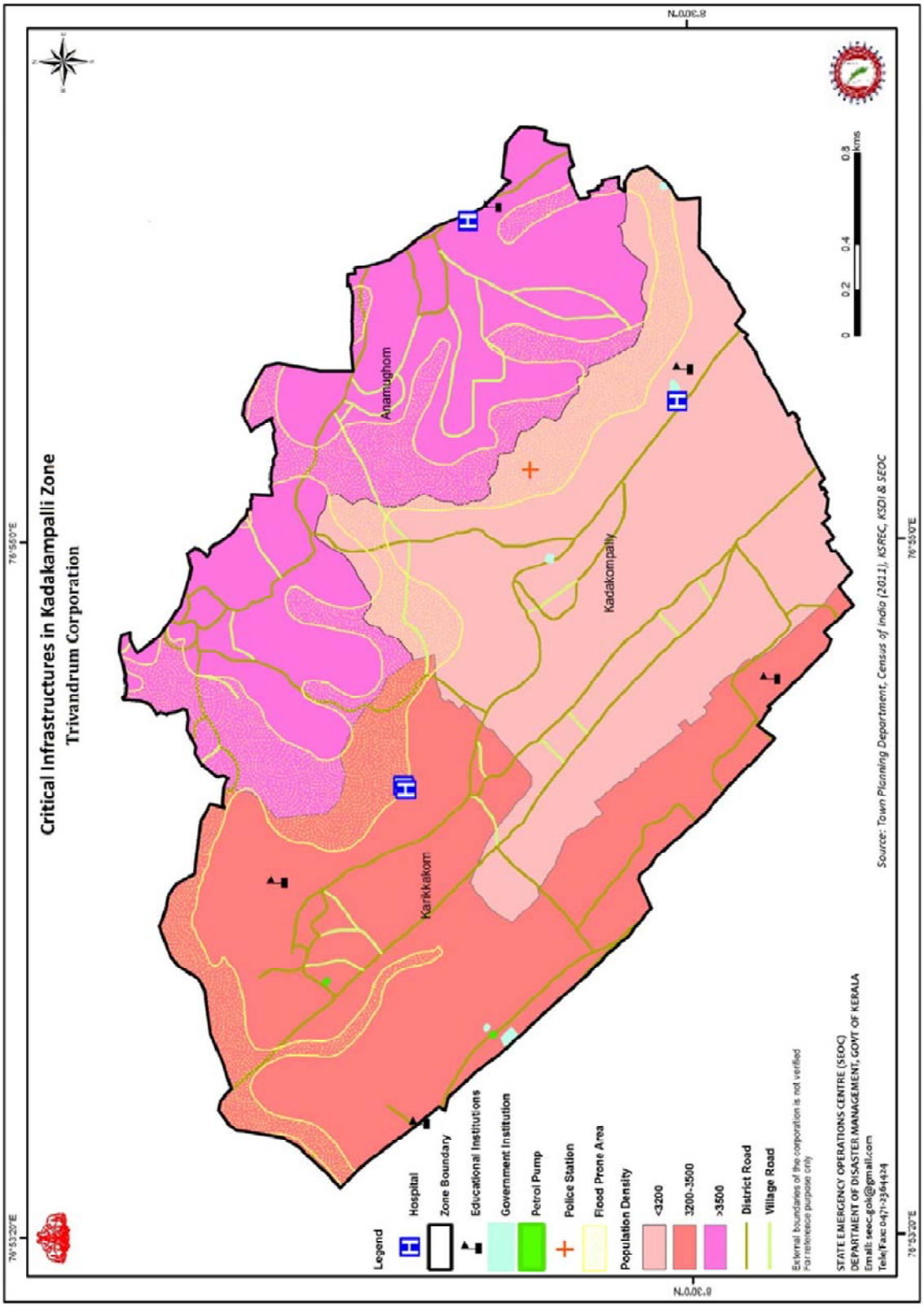
Table (7.1) Corporation Zones & Corresponding Wards

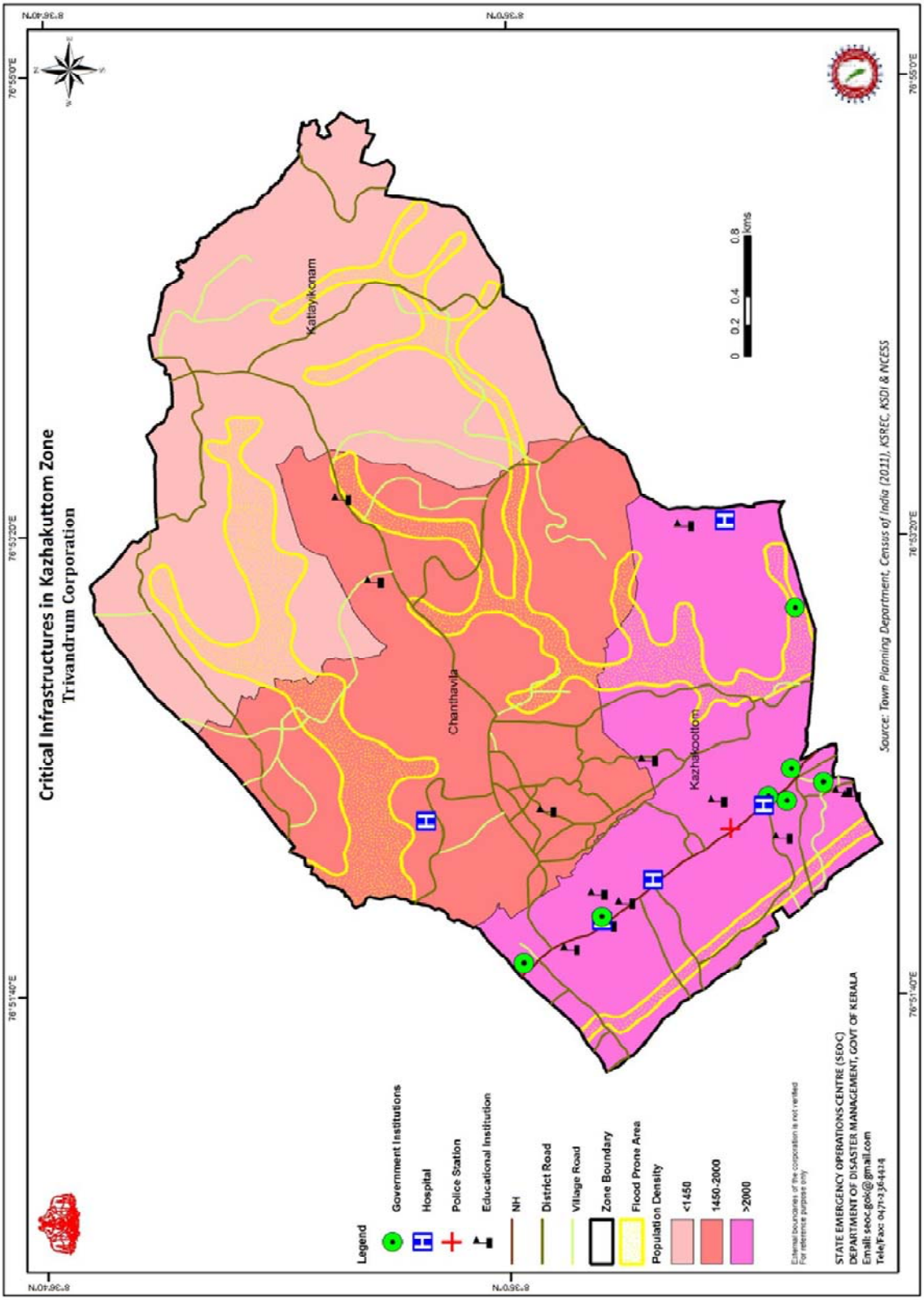
SL No	Zonal Office	Wards
1	**Attipra**	Pallithura, Kulathoor, Attipra, Poundkadavu
2	**Ulloor**	Cheruvaikal, Akkulam, Edavakkod, Mannanthala, Nalanchira, Ulloor
3	**Kadakampalli**	Anamukham, Karikkakom, Kadakampalli
4	**Fort**	Sreevaraham, Manacaud, Fort, Chala, Ambalathara, Attukal, Kuriathi, Kalippankulam, Kamaleswaram, Kaladi, Poonthura, Puthenpalli, Manikyavilakom, Beemapalli, Beemapalli East, Muttathara, Valiyathura, Vallakkadavu
5	**Thiruvallam**	Thiruvallam, Punchakari, Poonkulam, Vellar
6	**Nemom**	Estate, Pappanamcode, Nemom, Ponnumangalam, Melamcode
7	**Vattiyoorkavu**	Thuruthummoola, Nettayam, Kachani, Vazhottukonam, Kodunganoor
8	**Kudappanakunnu**	Kinavoor, Kudappanakunnu, Pathirappally, Chettivilakam
9	**Sreekaryam**	Chellamangalam, Chempazhanthy, Powdikonam, Njandoorkonam, Sreekaryam
10	**Kazhakuttom**	Kazhakuttom, Chanthavila, Kaattayikonam
11	**Vizhinjam**	Venganoor, Mulloor, Kottapuram, Vizhinjam, Harbour
12	**Main Office**	Nanthencode, Kesavadasapuram, Muttada, Kuravankonam, Pattom, Medical College, Kannammoola, Kowdiar, Kanjirampara, Valiyavila, Sasthamangalam, Vattiyoorkavu, Peroorkada, PTP Nagar, Kunnukuzhy, Palayam, Thampanoor, Valiyasala, Jagathy, Vazhuthacaud, Pangode, Thycaud, Thirumala, Thrikkannapuram, Mudavanmugal, Poojappura, Valiyavila, Karamana, Aranoor, Nedumkadu, Sreekandeswaram, Perumthanni, Palkulangara, Vanchiyoor, Chakka, Sankhumugham, Vettukadu, Pettah.

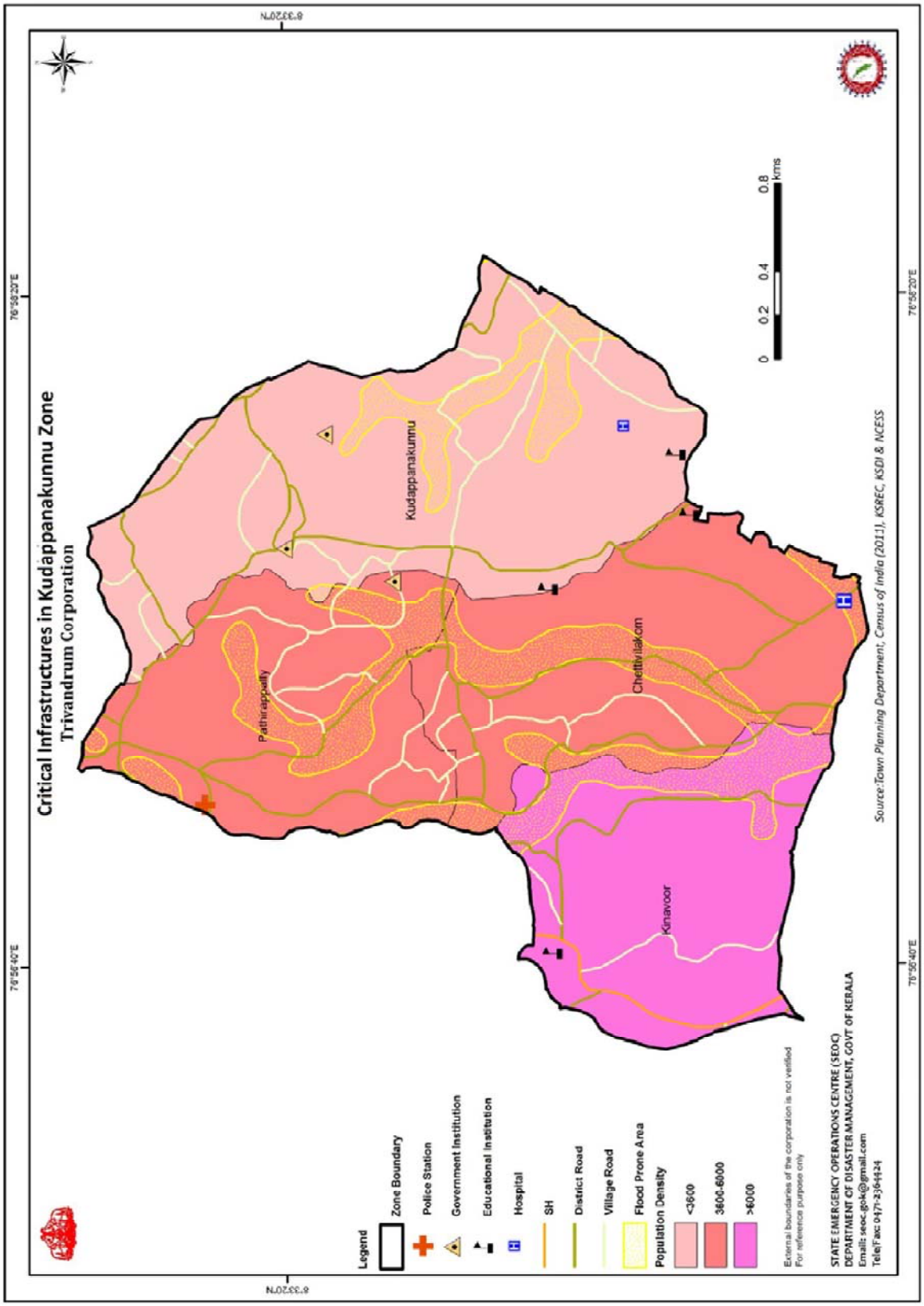

Critical Infrastructures in Main Office Zone
Trivandrum Corporation
Legend
Fire Station
Educational institution
Open Ground
Hospital
Police Station
Main Office Zone
Flood Prone Area
NH
SH
District Road
Village Road
Population Density
<5000
5000-8000
>8000
Source: Town Planning Department, Census of India (2011), KSREC, KSDI & NCESS
STATE EMERGENCY OPERATIONS CENTRE (SEOC)
DEPARTMENT OF DISASTER MANAGEMENT, GOVT OF KERALA
Email: seoc.gok@gmail.com
Tele/Fax: 0471-2364424
Medical College
Pattom
Kesavadasapuram
Kumrukuzhy
Kannammoola
Nanthancode
Kowdiar
Kuravankonam
Mettada
Peroorkada
Kanjirampara
Vattiyoorkavu
PTP Nagar
Vellayani
Thirumala
Pangode
Sasthamangalam
Poojappura
Punnakkamugal
Mudavanmugal
Thrikkannapuram
Karamana
Aranmoor
Jagathy
Vazhuthacaud
Thycaud
Vellayassala
Thampanoor
Palayam
Vanchiyoor
Pettah

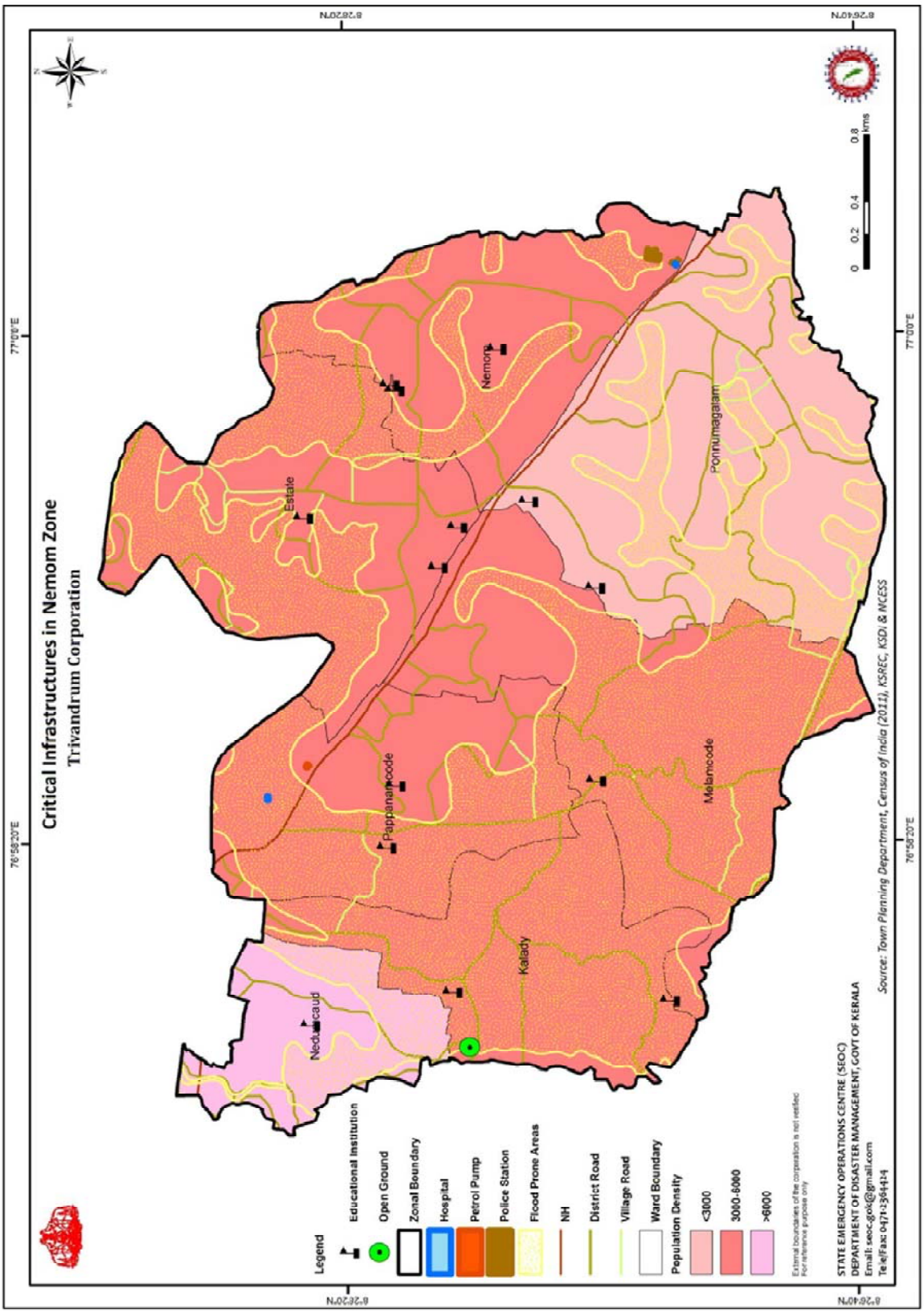

Critical Infrastructures in Attipra Zone
Trivandrum Corporation
Attipra
Kulathoor
Poundukadavu
Pallithura
Legend
Zonal Boundary
Open Ground
Hospital
School
Fire Station
Flood Prone Area
NH
District Road
Village Road
Police Station
Population Density
<2000
2000-2500
>2500
0 0.2 0.4 0.8 kms
Source: Town Planning Department, Census of India (2011), KSREC, KSDI & NCESS
STATE EMERGENCY OPERATIONS CENTRE (SEOC)
DEPARTMENT OF DISASTER MANAGEMENT, GOVT OF KERALA
Email: seoc.gok@gmail.com
Tele/Fax: 0471-2364424

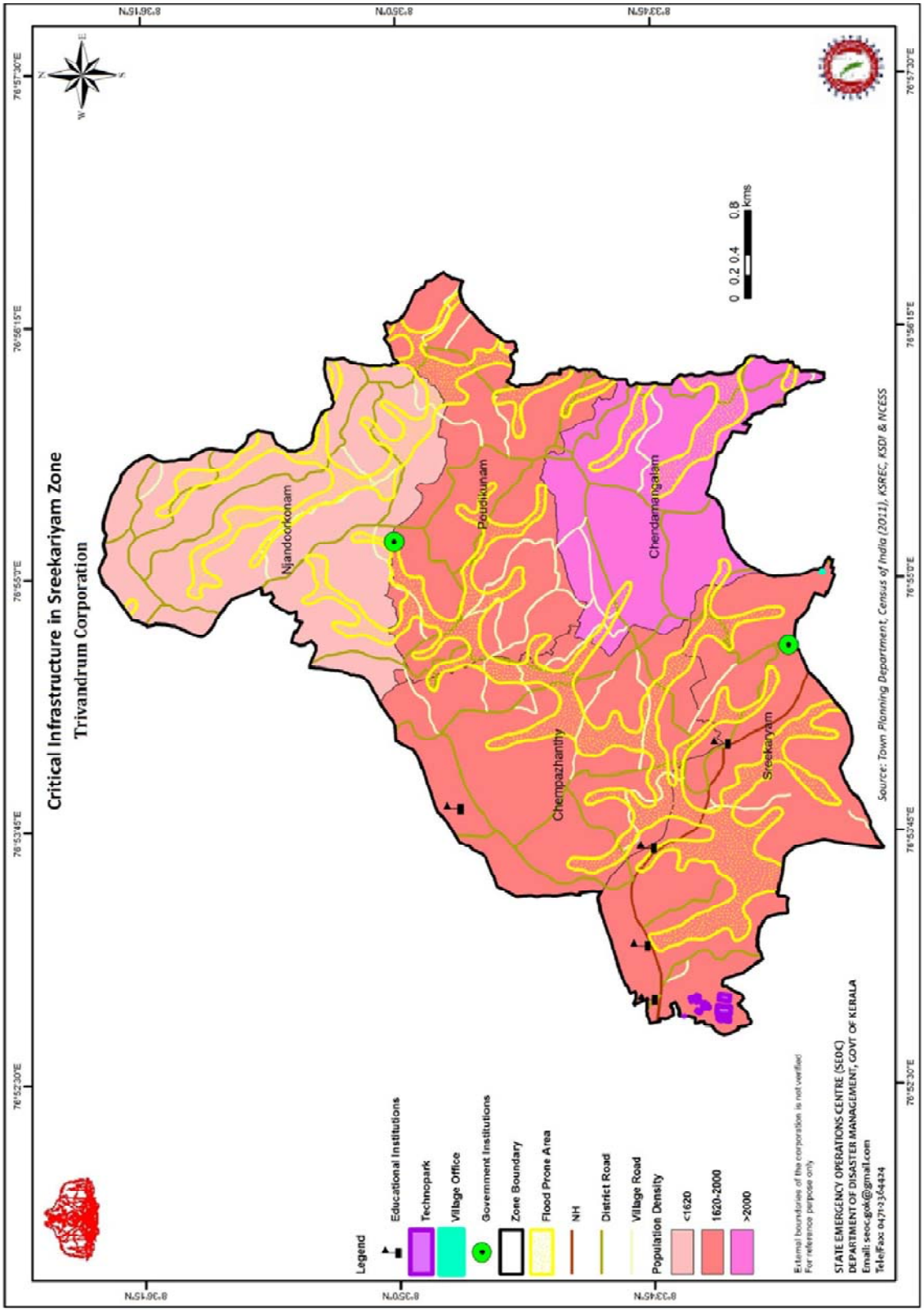

Critical Infrastructures in Fort Zone
Trivandrum Corporation
Source: Town Planning Department, Census of India (2011), KSREC, KSDI & NCESS
Legend
Open Ground
Educational Institution
Hospital
Fire Station
Police Station
Fort Zone
Flood Prone Areas
NH
District Road
Village Road
Population Density
<10000
10000-30000
>30000
0 0.2 0.4 0.8 kms
STATE EMERGENCY OPERATIONS CENTRE (SEOC)
DEPARTMENT OF DISASTER MANAGEMENT, GOVT OF KERALA
Email: seoc.gok@gmail.com
Tele/Fax: 0471-2364424
Vettucaud
Chakai
Sahgumukham
Valiyathura
Kallakkadavu
Perumthanny
Sreevaraham
Mudathara
Chalai
Fort
Manacaud
Kumarthy
Attukal
Kalippankulam
Kamaleswaram
Beemapalli
Beemapalli East
Ambalathara
Puthenpally
Manikkavilakam

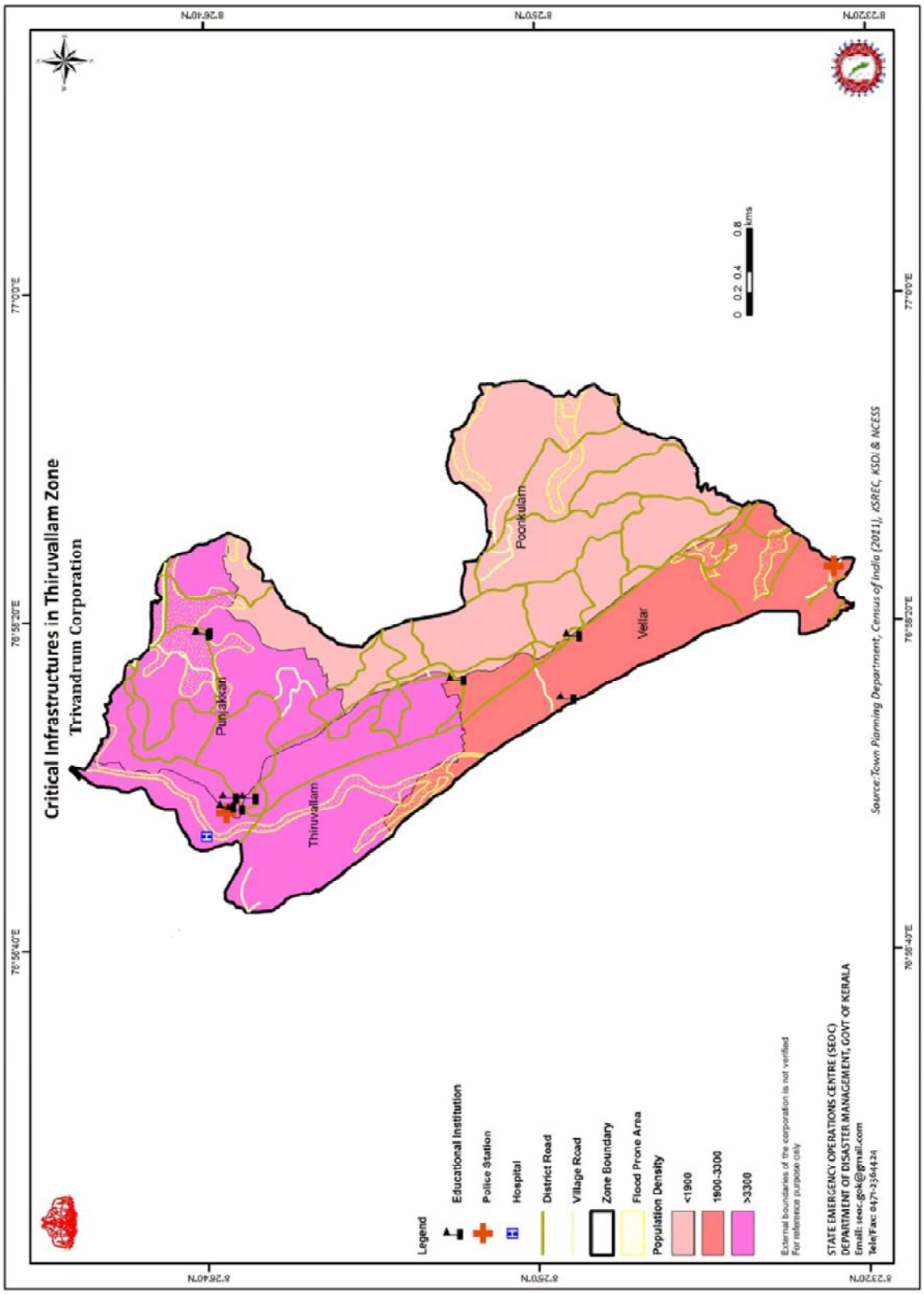

Critical Infrastructures in Kadakampalli Zone
Trivandrum Corporation
Anamughom
Kadakompally
Karikkakom
Legend
Hospital
Zone Boundary
Educational Institutions
Government Institution
Petrol Pump
Police Station
Flood Prone Area
Population Density
<3200
3200-3500
>3500
District Road
Village Road
External boundaries of the corporation is not verified
For reference purpose only
Source: Town Planning Department, Census of India (2011), KSREC, KSDI & SEOC
STATE EMERGENCY OPERATIONS CENTRE (SEOC)
DEPARTMENT OF DISASTER MANAGEMENT, GOVT OF KERALA
Email: seoc.gok@gmail.com
Tele/Fax: 0471-2364424
0 0.2 0.4 0.8 kms
76°53'20"E
76°55'0"E
8°30'0"N

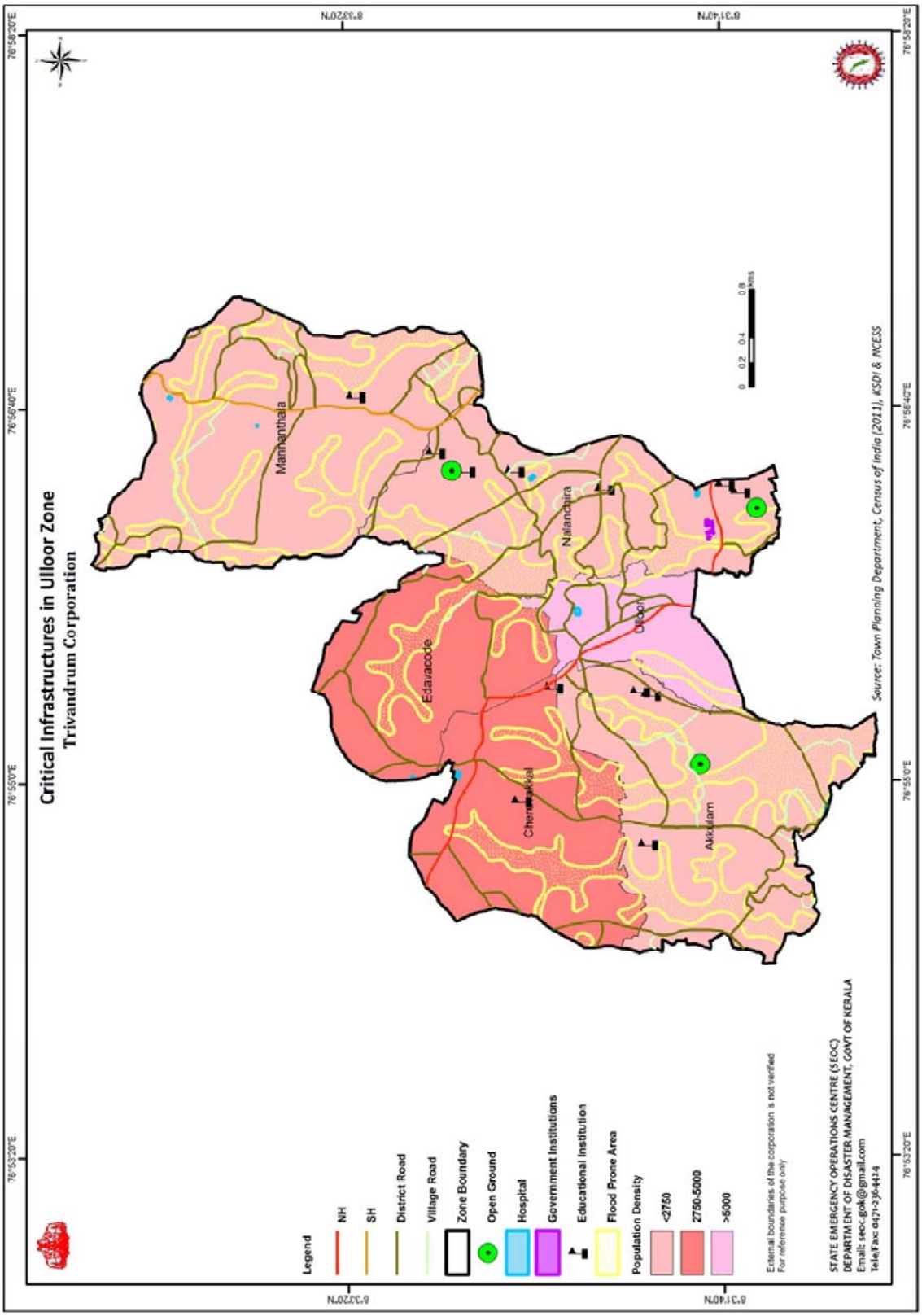

Critical Infrastructures in Kazhakuttom Zone
Trivandrum Corporation
Kattayikonam
Chanthavila
Kazhakoottom
0 0.2 0.4 0.8 kms
Source: Town Planning Department, Census of India (2011), KSREC, KSDI & NCESS
Legend
Government Institutions
Hospital
Police Station
Educational Institution
NH
District Road
Village Road
Zone Boundary
Flood Prone Area
Population Density
<1450
1450-2000
>2000
External boundaries of the corporation is not verified
For reference purpose only
STATE EMERGENCY OPERATIONS CENTRE (SEOC)
DEPARTMENT OF DISASTER MANAGEMENT, GOVT OF KERALA
Email: seoc.gok@gmail.com
Tele/Fax: 0471-2364424


Critical Infrastructures in Kudappanakunnu Zone
Trivandrum Corporation
Kudappanakunnu
Pathirappally
Chettivilakom
Kinavoor
0 0.2 0.4 0.8 kms
Source:Town Planning Department, Census of India (2011), KSREC, KSDI & NCESS
Legend
Zone Boundary
Police Station
Government Institution
Educational Institution
Hospital
SH
District Road
Village Road
Flood Prone Area
Population Density
<3600
3600-6000
>6000
External boundaries of the corporation is not verified
For reference purpose only
STATE EMERGENCY OPERATIONS CENTRE (SEOC)
DEPARTMENT OF DISASTER MANAGEMENT, GOVT OF KERALA
Email:seoc.gok@gmail.com
Tele/Fax:0471-2364424
8°33'20"N
76°56'20"E
76°56'40"E


Critical Infrastructures in Nemom Zone
Trivandrum Corporation
Nemom
Estate
Pappanamcode
Kaladу
Neduмcaud
Melamcode
Ponnumagalam
Legend
Educational Institution
Open Ground
Zonal Boundary
Hospital
Petrol Pump
Police Station
Flood Prone Areas
NH
District Road
Village Road
Ward Boundary
Population Density
<3000
3000-6000
>6000
0 0.2 0.4 0.8 kms
Source: Town Planning Department, Census of India (2011), KSREC, KSDI & NCESS
STATE EMERGENCY OPERATIONS CENTRE (SEOC)
DEPARTMENT OF DISASTER MANAGEMENT, GOVT OF KERALA
Email: seoc.gok@gmail.com
Tele/Fax: 0471-2364424


Critical Infrastructure in Sreekariyam Zone
Trivandrum Corporation
Njandoorkonam
Pottakunam
Cherdamangalam
Chempazhanthy
Sreekaryam
0 0.2 0.4 0.8 Kms
Source: Town Planning Department, Census of India (2011), KSREC, KSDI & NCESS
Legend
Educational Institutions
Technopark
Village Office
Government Institutions
Zone Boundary
Flood Prone Area
NH
District Road
Village Road
Population Density
<1620
1620-2000
>2000
External boundaries of the corporation is not verified
For reference purpose only
STATE EMERGENCY OPERATIONS CENTRE (SEOC)
DEPARTMENT OF DISASTER MANAGEMENT, GOVT OF KERALA
Email: seoc.gok@gmail.com
Tele/Fax 0471-2364424


Critical Infrastructures in Thiruvallam Zone
Trivandrum Corporation
Poonkulam
Velliar
Punjakkari
Thiruvallam
0 0.2 0.4 0.8 kms
Source:Town Planning Department, Census of India (2011), KSREC, KSDI & NCESS
Legend
Educational Institution
Police Station
Hospital
District Road
Village Road
Zone Boundary
Flood Prone Area
Population Density
<1900
1900-3300
>3300
External boundaries of the corporation is not verified
For reference purpose only
STATE EMERGENCY OPERATIONS CENTRE (SEOC)
DEPARTMENT OF DISASTER MANAGEMENT, GOVT OF KERALA
Email: seoc.gok@gmail.com
Tele/Fax: 0471-2364424


Critical Infrastructures in Ulloor Zone
Trivandrum Corporation
Manthanthala
Nalanchira
Edavacode
Ulloor
Chenkakkal
Akkulam
Source: Town Planning Department, Census of India (2011), KSDI & NCESS
Legend
NH
SH
District Road
Village Road
Zone Boundary
Open Ground
Hospital
Government Institutions
Educational Institution
Flood Prone Area
Population Density
<2750
2750-5000
>5000
External boundaries of the corporation is not verified
For reference purpose only
STATE EMERGENCY OPERATIONS CENTRE (SEOC)
DEPARTMENT OF DISASTER MANAGEMENT, GOVT OF KERALA
Email: seoc.gok@gmail.com
Tele/Fax: 0471-2364424
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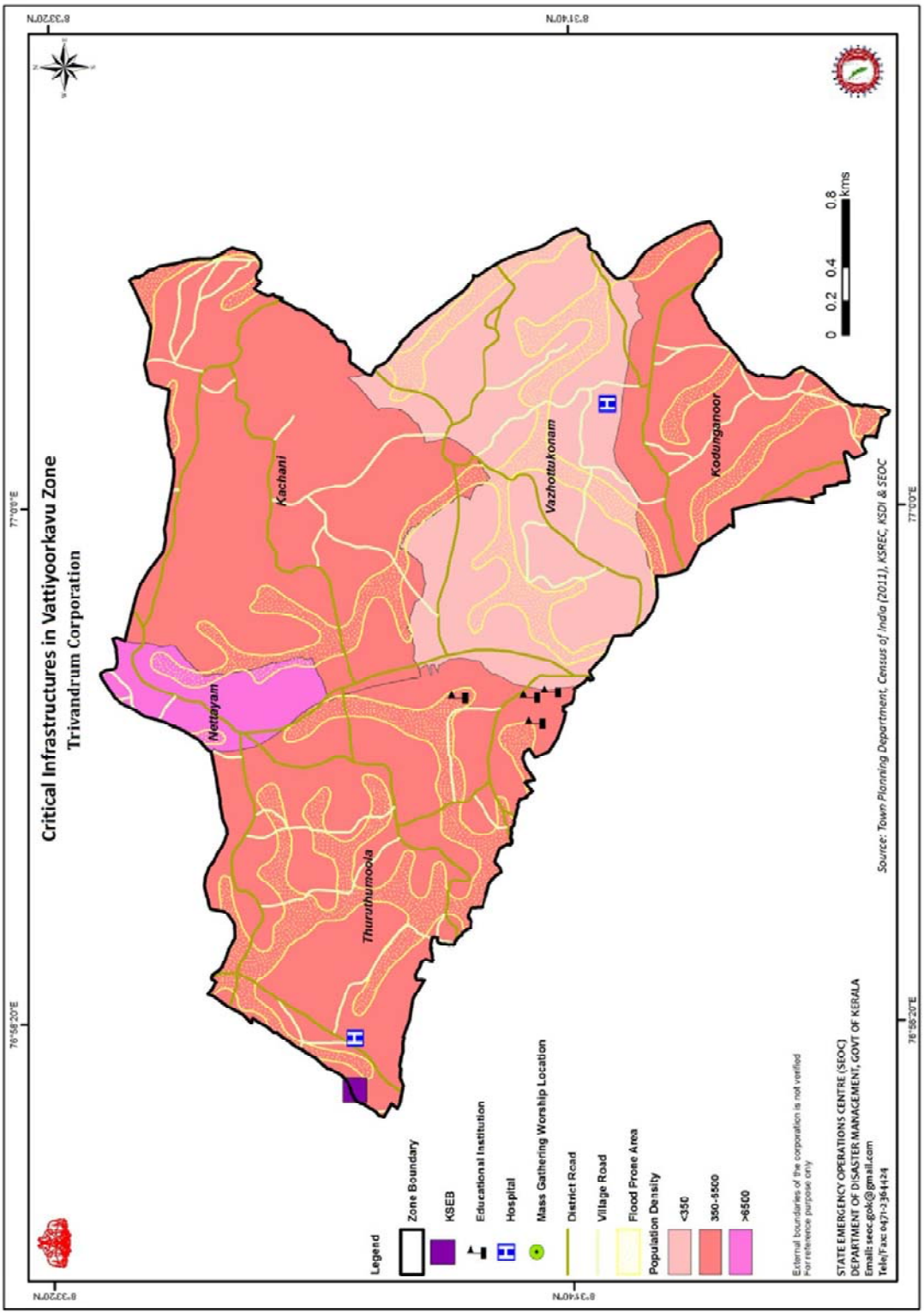
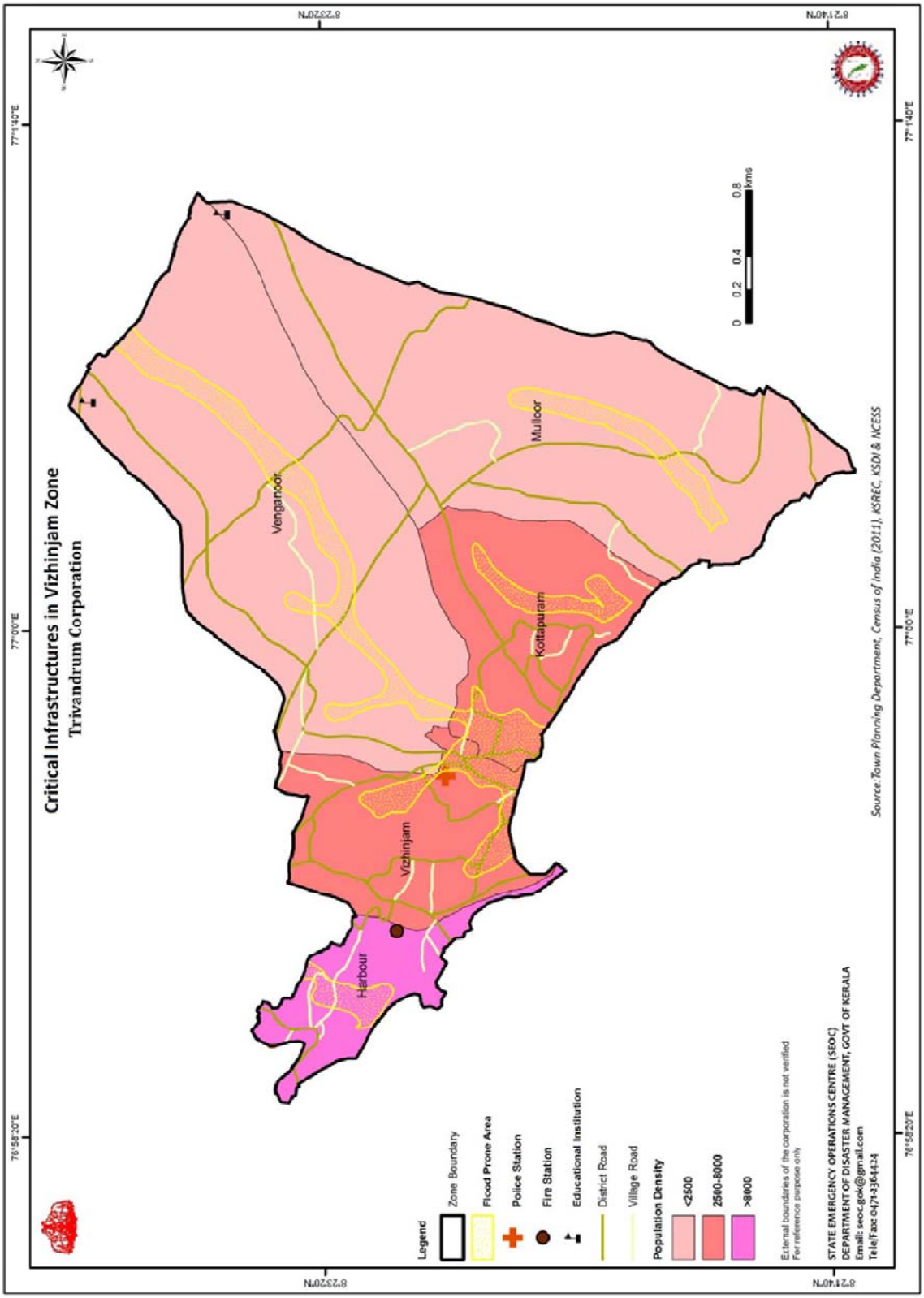
76°56'40"E
76°55'0"E
76°53'20"E
8°33'20"N
8°31'40"N


Critical Infrastructures in Vattiyoorkavu Zone
Trivandrum Corporation
Kachani
Vazhottukonam
Kodunganoor
Nettayam
Thuruthumoola
0 0.2 0.4 0.8 Kms
Legend
Zone Boundary
KSEB
Educational Institution
Hospital
Mass Gathering Worship Location
District Road
Village Road
Flood Prone Area
Population Density
<350
350-9500
>9500
Source: Town Planning Department, Census of India (2011), KSREC, KSDI & SEOC
STATE EMERGENCY OPERATIONS CENTRE (SEOC)
DEPARTMENT OF DISASTER MANAGEMENT, GOVT OF KERALA
Emails:seoc.gok@gmail.com
Tele/Fax:0471-2364424


Critical Infrastructures in Vizhinjam Zone
Trivandrum Corporation
Vengaloor
Mullloor
Kottapuram
Vizhinjam
Harbour
0 0.2 0.4 0.8 kms
Legend
Zone Boundary
Flood Prone Area
Police Station
Fire Station
Educational Institution
District Road
Village Road
Population Density
<2500
2500-8000
>8000
External boundaries of the corporation is not verified
For reference purpose only
STATE EMERGENCY OPERATIONS CENTRE (SEOC)
DEPARTMENT OF DISASTER MANAGEMENT, GOVT OF KERALA
Email: seoc.gok@gmail.com
Tele/Fax: 0471-2364424
Source: Town Planning Department, Census of India (2011), KSREC, KSDI & NCESS
8°23'20"N
8°21'40"N
77°1'40"E
77°0'0"E
76°58'20"E

Emergency Trigger Matrix

Level of Emergency	Colour Code & Type of Event	Actions
0	Normal (Day to Day)	**General:** Normal Operations **Executive:** Normal Functions **Command and Control :** Check status of EOC equipment and repair or replace as needed. Check status of EOC supplies and restocks needed. Update EOC resource data
1	Potential threat	**General:** The initial detection of an event occurring or anticipated to occur and has the potential to have a significant impact on the City Operations or the community. Assessment is made to determine the hazard(s), timing, and impact. An alert stage to warn City Departments of developing, near term threats which could significantly impact City operations - and/or -will likely result in the need for multi-agency coordination in the near term (within a few hours). Preparedness actions may include holding a coordination meeting of key response and recovery stakeholders –or- assembly of a Situation Assessment Team to make a more comprehensive threat assessment. Individual departments may enact internal preparedness or readiness plans or take actions based upon the threat and its impact. The EOC may be placed into Activation mode. **Executive:** The Mayor will review potential emergency situation, determine staff availability, and review emergency tasks assigned in the emergency management plan and annexes. Designate the personnel on call for emergency duty. **Command and Control:** Alert staffs, determine personnel availability & update EOC staff call lists. Consider situation briefings for senior staff.
2		**General:** An event or stage of an event that requires multi-agency coordination

		beyond what occurs on a day-to-day basis between agencies. Time span of operations is typically less than 24 hours. Activities typically involve coordination/acquisition of locally obtainable resources. Coordination of Plans or response actions by EOC.
	Limited Event	**Executive:** The City Mayor will brief the Departmental Heads on the potential emergency situation and plans to deal with it should it occur and ensure that on-call staff members are available by telephone and ready to report duty if called. Coordinate with the State & District Administration, if necessary. **Command & Control** Consider situation briefings for EOC staff. Determine specific EOC staff assignments and alert staff. Monitor potential emergency situation and determine possible impact areas. Update maps, charts, displays, and resource data.
3		**General:** An event or stage of an event either anticipated or actual where response actions will exceed the resource capabilities of the City & State Response activities will occur over multiple operational periods. Recovery actions may last over a period of weeks. **Executive** The City Mayor will brief the Departmental Heads on the potential emergency situation and plans to deal with it should it occur and ensure that on-call staff members are available by telephone and ready to report duty if called.
	Major Event	Coordinate with the State & District Administration **Command & Control** Monitor situation. Update maps, charts, displays, and resource lists. Arrange for essential service Determine possible hazard impact areas and potential hazard effects. Conduct briefings for senior staff and EOC staff. Formulate and implement precautionary measures to protect the public. Coordinate with adjacent jurisdictions that may be affected.

Early Warning System

A systematic approach towards managing risk through an established early warning system (EWS) can minimize loss of lives and adverse economic impact. EWS backed with effective institutional arrangements can predict hazards in a timely and effective manner, thereby empowering decision makers and community. Early warning of impending disasters and their effective dissemination by using various alternative communications are the key factors for effective prevention and preparedness. Advancement in observation and monitoring, mathematical modeling, computing capabilities, communication technology and conduct of scientific risk assessment facilitated dissemination of timely and accurate warnings by technical agencies and move people/assets from harm's way.

In Trivandrum District, early warning on an impending event is the key responsibility of District Collector (ex-officio Chairman of DDMA). The District Collector sends these early warning messages to various institutions, including Thiruvananthapuram Corporation via fax, email and phone calls. Thiruvananthapuram Corporation on receipt of warning informs the people within its Jurisdiction. Key agencies currently involved in the process of issuing early warning are IMD, INCOIS, GSI, NCESS, KSDMA, ILDM, SEOC, IDSP Cell, Port authority, Irrigation Department and Fisheries Department.

A detailed Early Warning Action plan is being prepared under GOI-UNDP Climate Risk Management Project and will be added as a supplementary document to the City Disaster Management Plan.

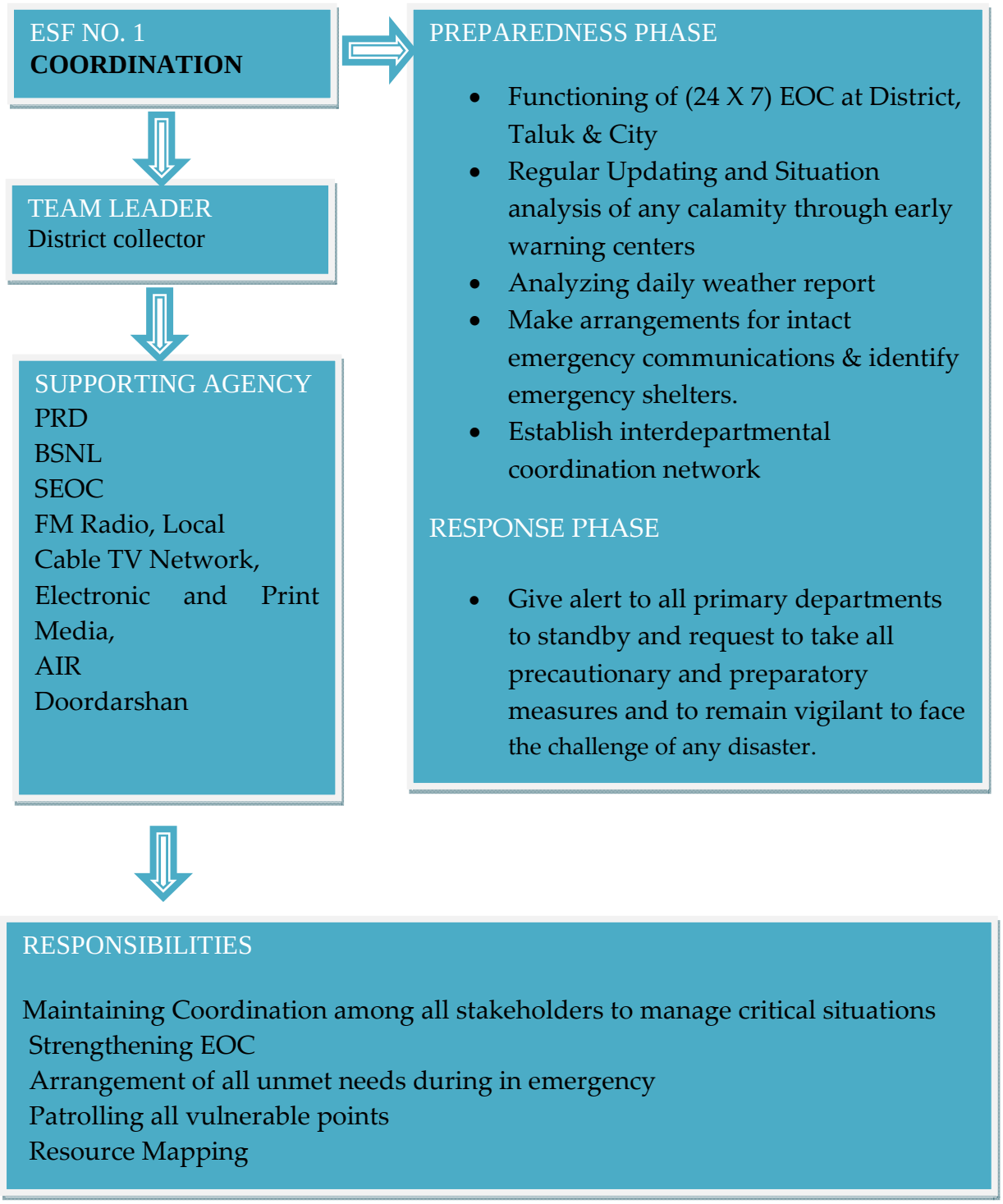
ESFS	Functions	Roles	Primary Department	Secondary Departments
ESF 1	Coordination	Establishing Effective Coordination mechanism for smooth Relief and Response Activities	District Collectorate	Revenue & DM Trivandrum City Corporation Fire & Rescue PWD Police DHS/ DMO
ESF 2	Communication	Establishing, maintaining, augmenting, and providing backup for all types of Communication devices needed during emergency response operations.	Home Department	NIC Police / Revenue Wireless operator Ham Radio Operator Clubs, Mobile Operators
ESF 3	Early Warning	Communicating alerts on disaster from various sources to the city emergency control operation centre.	Weather related – IMD (Indian meteorological Department) Flood – CWC (Central Water Commission) Landslide – GSI/NCESS (Geological Survey of India/ national Centre for earth science studies) Tsunami – INCOIS (Indian National Centre for Ocean information Service) Storm Surge – NCESS Health related- Directorate of	DEOC Revenue Dept Fisheries Coast Guard Police

			Health Services NEOC/ SEOC (National /State Emergency Operation Centre) State Disaster Management Authority Chemical – Factories & Boilers	
ESF 4	Information Dissemination	Preparation and dissemination of notifications, updates, warnings, and instructional messages, making the help line operational	PRD BSNL SEOC	FM Radio, Local Cable TV Network, Electronic and Print Media, AIR Doordarshan
ESF 5	Search & Rescue	Removal of trapped and injured persons from buildings collapses and other structural collapses, administering first aid, and assisting in transporting the seriously injured to medical facilities	Fire Department SDRF NDRF	Police Coast guard Navy Army Airforce Paramilitary forces CBDRM Emergency Response Team City response Team
ESF 6	Evacuation	Immediately following an alert from control room people may need to be evacuated to safe places	Revenue Department	Police Animal Husbandry CBDRM Emergency Response Team City response Team

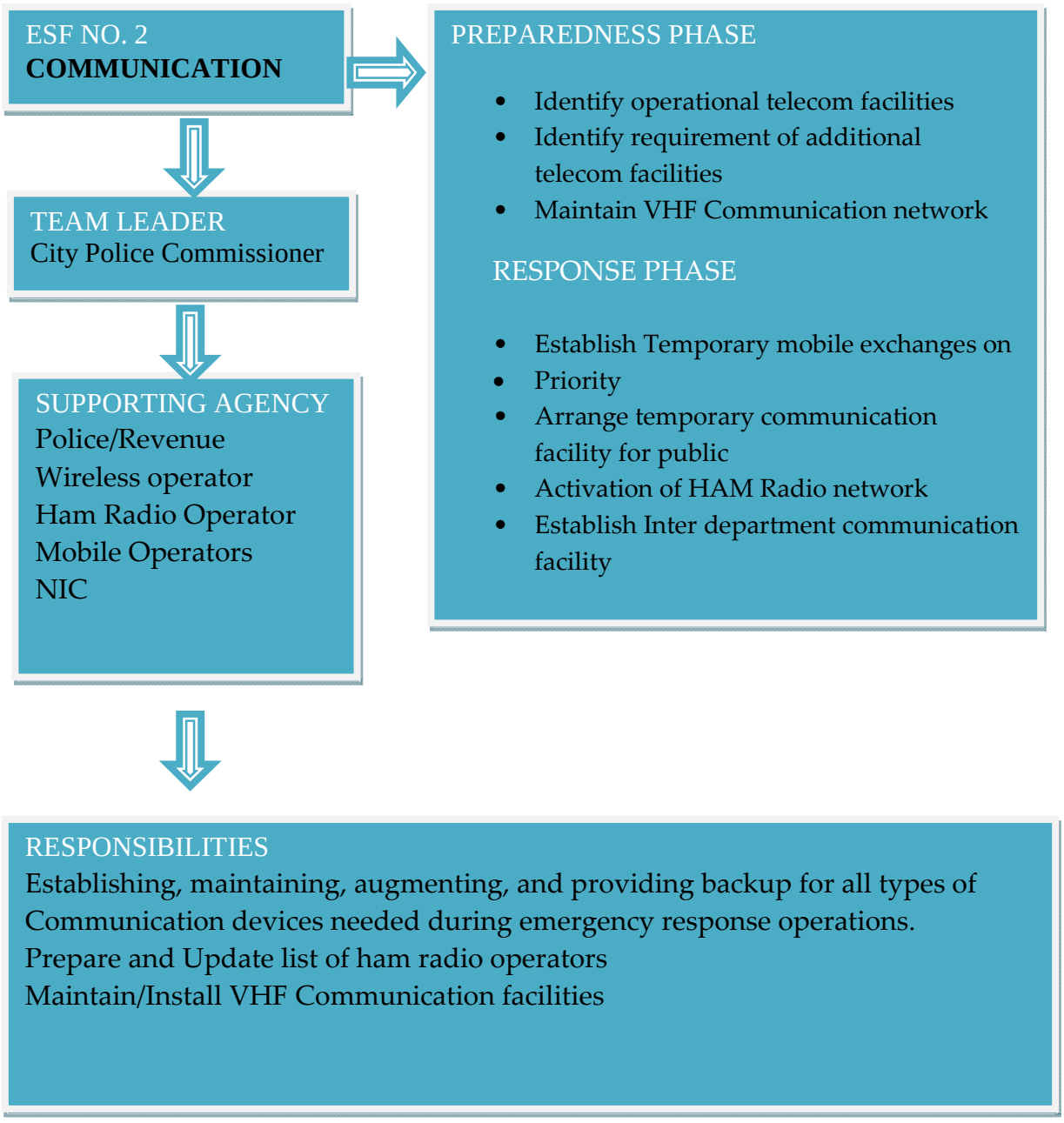
ESF 7	Emergency Medical Response	Mass fatality management, Public health, Medical, Mental health service	DHS/DMO,	Health Circle, Corporation Blood Banks CBDRM ERT's NGO's youth clubs
ESF 8	Relief	Optimizing Food and Civil Supplies to the needful. Accommodating homeless and affected people and providing mass care	District Collectorate	Food and Civil Supplies Revenue CBDRM ERT's
ESF 9	Infrastructure utility restoration	Restoration and repair of Electric and Water supply system to minimize the impact on critical service to the public	City Corporation	PWD Irrigation KSEB Health Department
ESF 10	Debris Clearance	The identification, removal, and disposal of rubble, wreckage, and other material which block or hamper the performance of emergency response functions	City Corporation	PWD NHAI KSEB Forest Fire & rescue Indian railways CBDRM ERT's City Response team
ESF 11	Law and Order	Law and Order enforcement for Public Safety Police Dept	Police	Home Guards

Structure of Emergency Support Functions

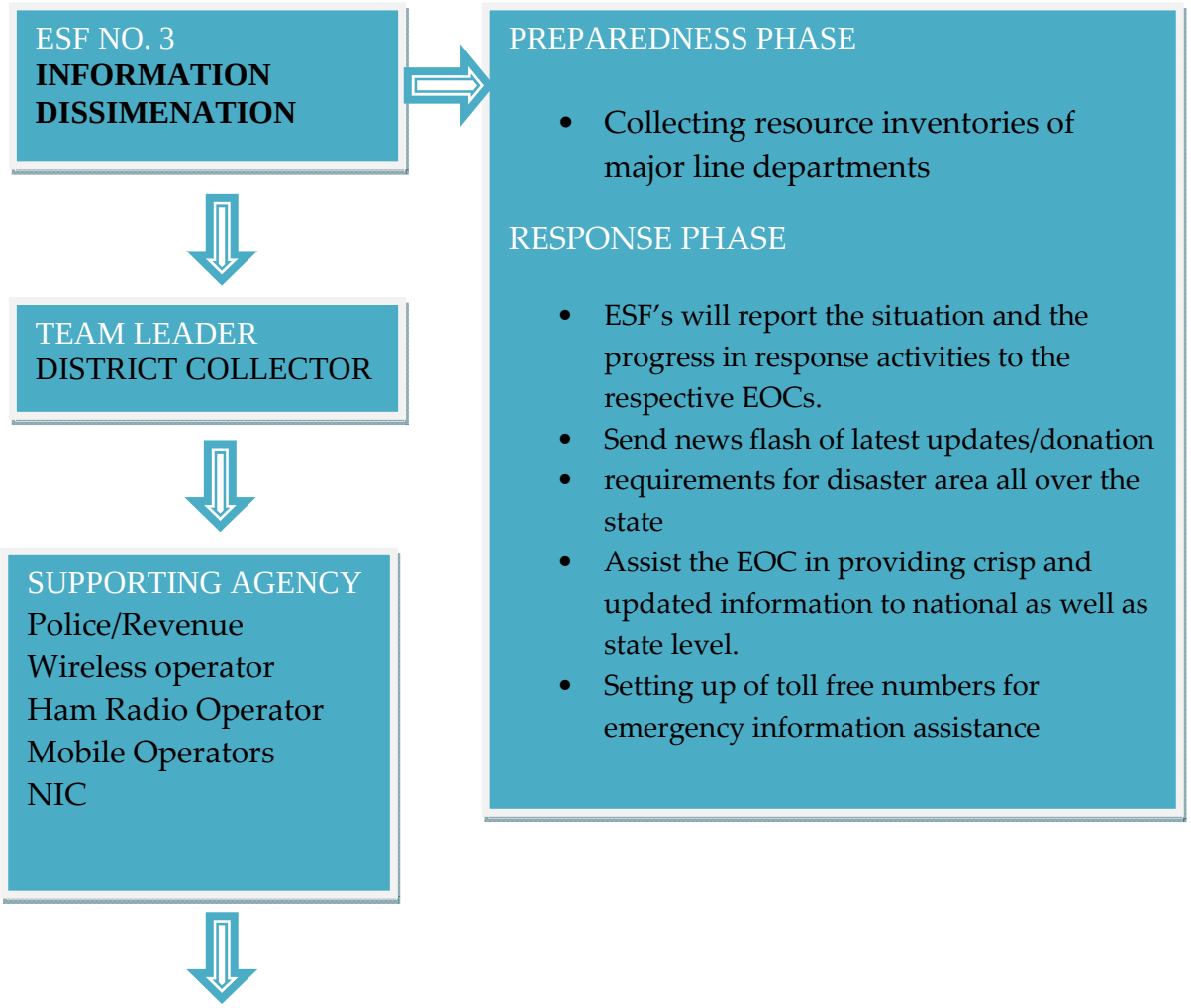
Response Frame Work # 1: Coordination



Response Frame Work # 2 : Communication



Response Frame Work # 3 : Emergency Public Information, Help line & Warning



RESPONSIBILITIES

To provide and collect reliable information on the status of the disaster and disaster victims for effective coordination of relief work at district level Coordinate with EOC's at the airport and railways for required information Coordinate with all TV and radio networks to send news flashes for specific needs.

Response Frame Work # 4 : Search & Rescue

ESF No. 4

SEARCH & RESCUE

TEAM LEADER
DIVISIONAL FIRE OFFICER

SUPPORTING AGENCY
Police
Coast guard/Navy/Army/Air force
Paramilitary forces
Health Dept
CBDRM Emergency Response Team(ward level task force)
City response Team
NSS/NYK/local club volunteers

PREPAREDNESS PHASE

- Identify and locate resource inventories
- Conducting emergency mockdrills/ Sop preparation
- Maintaining emergency equipments

RESPONSE PHASE

- The QRTs will be deployed at the affected site.
- QRTs will report the situation and the progress in response activities to the respective EOCs.
- Medical assistance and SAR for collapsed building structure.
- GIS is used to make an estimate of the damage area and the deployment of the SAR team in the area according to the priority.
- Ambulatory patients(Walking wounded) to be given first aid, and the rest to be transported to nearest hospital.

RESPONSIBILITIES

- Establish, maintain and manage state search and rescue response system.
- Coordinate search and rescue logistics during field operations
- Provide status reports of SAR updates throughout the affected areas.

Response Frame Work # 5: Evacuation

ESF No. 5

EVACUATION

TEAM LEADER
CITY POLICE COMMISSIONER

SUPPORTING AGENCY
Revenue Dept
Police
CBDRM Emergency Response Team(ward level task force)
City response Team
NSS/NYK/local club volunteers
City Corporation

PREPAREDNESS PHASE

- Identify and locate emergency shelters
- Conducting emergency mockdrills/ Sop preparation
- All district and Ward maps with clearly defined areas and road network.

RESPONSE PHASE

- Quick assessment of evacuation routes available through aerial and ground surveys
- Facilitate evacuation to safe shelters / open areas
- GIS is used to make an estimate of the damage area and identify the safest evacuation routes.
- Coordinate evacuation logistics during field operations
- Arrange transportation facilities to evacuate people to safe shelters

RESPONSIBILITIES

- Establish evacuation plans
- Identify fastest evacuation routes and alternate routes
- Coordinate evacuation logistics during field operations

Response Frame Work # 6: Medical Response

ESF No. 6

Medical response

TEAM LEADER
District Medical Officer/
Director DHS

SUPPORTING AGENCY

Private Hospitals
Asha Workers
NSS/NYK/local clubs
Ambulance Services
MotorVehicle Department
Indian Red cross Society
Blood Banks
Response Team(ward level task force)
Kerala medical Services Corporation Ltd

PREPAREDNESS PHASE

- Medical Health and Trauma preparedness and response plan containing emergency contact
- Check list for emergency first aid kits, emergency medicine supply, ambulance availability, Blood Banks etc.
- Conduct emergency mock drills/prepare Sop's

RESPONSE PHASE

- Provide information to all the hospital about likely damage and expected injuries
- Provide systematic approach to patient care Perform medical evaluation and treatment as needed
- Maintain patient tracking system to keep record of all patients treated the rest to be transported to nearest hospital.
- Determine type of injuries, illnesses and medicines needed

RESPONSIBILITIES

To coordinate, direct and integrate State level response
• Direct activation of medical personnel, supplies and equipment
• Coordinate the evacuation of patients
• To prepare and keep ready Mobile Hospitals.
• Keep and regularly update the reserves of medical supplies, equipments and drugs

Response Frame Work # 7: Relief

ESF No. 7
RELIEF

TEAM LEADER
Principal Secretary
Revenue & DM/ ADM

SUPPORTING AGENCY

Revenue & DM
District Supply Office
City Corporation
PWD
KWA
Market association
NGO's/clubs etc
BSNL/Private mobile operators
Police
KSEB

PREPAREDNESS PHASE

- Check list for onsite requirement for distribution of relief.
- Prepare emergency contact / resource inventory etc

RESPONSE PHASE

- Quick assessment of functional and stable buildings
- Clearing of the areas for establishment of relief camps
- Set up relief camps and tents
- Assist local authorities to set up important telecom and other services facilities
- Initiate, direct and market procurement of critical food available from different inventories
- Allocate food in different packs that can be given to families on a take-home / open community kitchen
- Make emergency food supplies available to population
- Locate adequate relief camps based on survey of damage
- Develop alternative arrangements for population living in structures that might be affected even after the disaster.

RESPONSIBILITIES

- Ensure the timely distribution of food to the people
- Control the quality and quantity of food
- Provide adequate and appropriate shelter to all population
- Quick assessment and identifying the area for the establishment of the
- relief camps
- Identifying the population which can be provided with support in their own place and need not be shifted reallocated

Response Frame Work # 8: Water & Electricity

ESF No. 8
WATER & Electricity

TEAM LEADER
Executive Engineer KWA
Executive Engineer KSEB

SUPPORTING AGENCY
City Corporation
PWD
Irrigation Dept
NHAI
Sewerage Division

PREPAREDNESS PHASE

- Prepare emergency plan/contingency plan
- Prepare emergency contact / resource inventory etc
- Emergency tool kits in place.

RESPONSE PHASE

Water

- The QRTs will be deployed at the affected site
- Setting up water points and key locations and in relief camps
- Maintaining water purity
- Provide chlorine tablets to people in affected area
- Providing clean drinking water at regular intervals in case of disruption of water pipe lines
- Locate drinking water facilities separate from sewer and drainage facilities

Electricity

- Review the total extent of damage to the power supply installations by a reconnaissance survey
- Dispatch emergency repair teams equipped with tools, tents and food
- Hire casual labour for the clearing of damaged poles etc

RESPONSIBILITIES

- Ensure the timely distribution of food to the people
- Control the quality and quantity of food
- Provide adequate and appropriate shelter to all population
- Quick assessment and identifying the area for the establishment of the
- relief camps
- Identifying the population which can be provided with support in their own place and need not be shifted reallocated

Response Frame Work # 9: Debris Clearance

ESF No. 9
DEBRIS CLEARANCE

TEAM LEADER
Secretary, Municipal corporation

PWD
Irrigation Dept
NHAI
KSEB
KWA
Forest DEPT
Revenue dept
MotorVehicle Department
Indian railways
CBDRM ERT's
City Emergency response Team

PREPAREDNESS PHASE

- Prepare emergency plan/contingency plan
- Prepare emergency contact / resource inventory etc
- Emergency tool kits in place.
- Check list for emergency equipments requirement and district maps with road network.

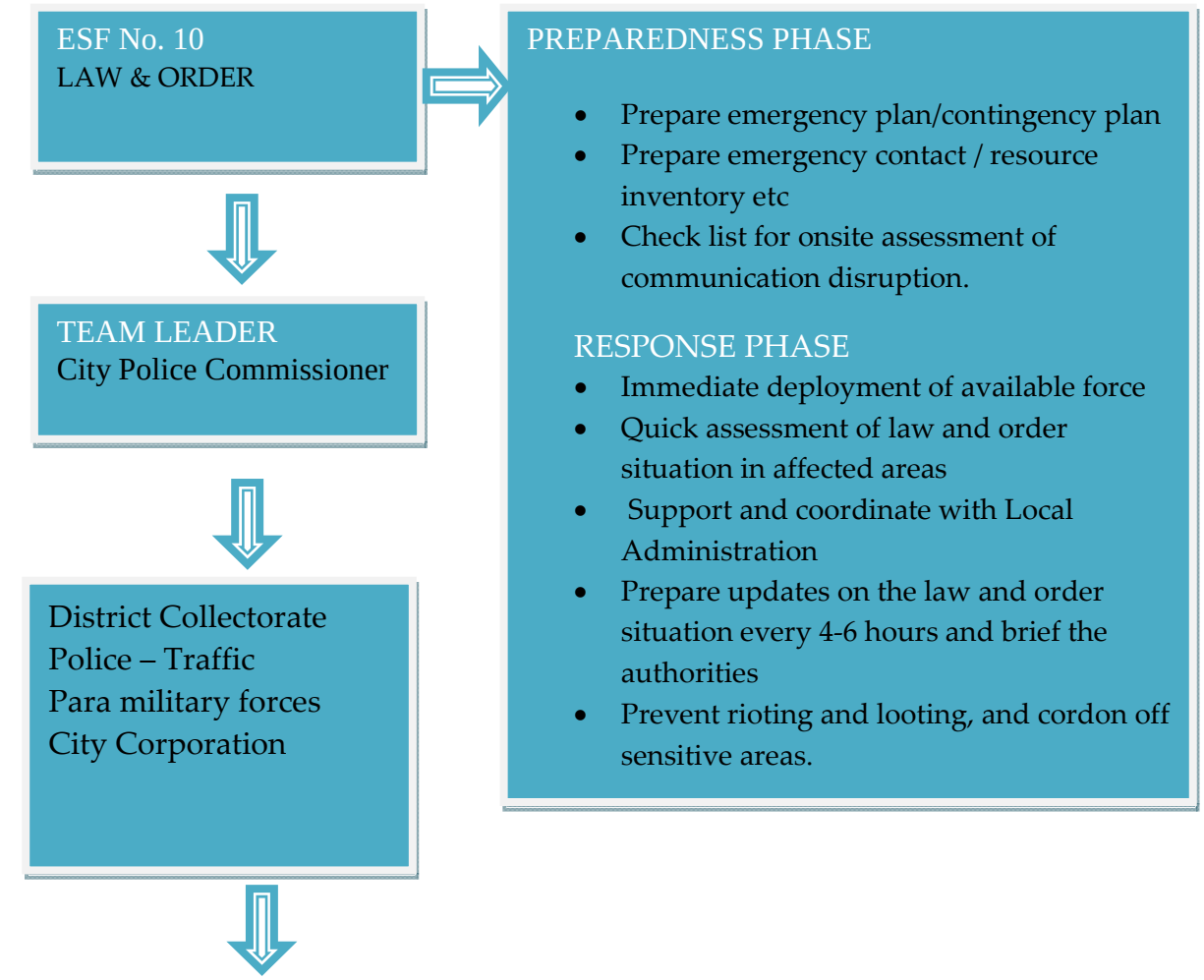
RESPONSE PHASE

- Keep national and other main highways clear from disaster effects such as debris etc.
- All technical officers should be notified
- Review and update precautionary measures and procedures
- Inspect all roads, bridges
- Inspect all buildings and structures of the State government
- Establish a priority list of equipments which will be opened first Identify locations for transit /relief camps
- Adequate road signs should be installed to guide and assist in relief work.

RESPONSIBILITIES

- Pre-positioning assessment teams headed by the primary agency coordinating officer
- Emergency clearing of debris to enable reconnaissance
- Coordinate road clearing activities to assist local relief work
- Provide a work team carrying emergency tool kits, depending on the nature of disaster, and essential equipment such as- Towing vehicles Earth moving equipments- Cranes-
- Construct temporary roads
- Keep national and other main highways clear from disaster effects such as debris etc.

Response Frame Work # 10: Law & Order



City Emergency Support Functions Assignments for response

P- PRIMARY S- SECONDARY C-COORDINATING DEPARTMENTS	COORDINATION	COMMUNICATIONS	EARLY WARNING	EVACUATION	SEARCH & RESCUE	RELIEF OPERATIONS	DEBRIS CLEARANCE	UTILITY RESTORATION	LAW & ORDER	MEDICAL RESPONSE
Police Dept	S	P	S	S	S	C	C	C	P	C
Fire & Rescue	C	C	C	C	P	C	P	C		C
Revenue	P	S	P	P	S	P	C	C	C	C
Irrigation	C		C	C		C	S	S		C
KSEB	C			C	C	C	C	S		C
MVD	C		C	C	C	C	C	S		C
BSNL/Mobile Operators	C	S	C	C	C	C	C	S		C
Forest	C		C	C	C	C	C	C		
Indian Railways/ NHAI	C		C	C	C	C	S	S		
City Corporation	S	S	C	C	C	C	S	P	S	C
KWA	C		C	C	C	C	C	S		C
Food & Civil Supplies	C		C	C		C		C		
Health	C		C	C		C		C		P
Paramilitary/ Military	C	C	C	C	C	C	C	C		
Animal Husbandry	C		C	S		S				S

ANNEXURE

Annexure 1: Population exposed to floods in the wards of Thiruvananthapuram

Sl. No	Ward Name	Ward population	Flood prone area (km^2)	Population exposed to floods
1	Akkulam	8856	1.27	3109
2	Ambalathara	8659	0.67	3368
3	Anamughom	9873	0.88	3305
4	Arannoor	10004	0.02	354
5	Attipra	8741	0.30	573
6	Attukal	8699	0.19	1335
7	Beemapalli	8642	0.29	1046
8	Beemapalli East	8790	0.00	21
9	Chakai	9754	0.13	544
10	Chalai	8692	0.05	434
11	Chanthavila	9351	1.19	1750
12	Chempazhanthy	10184	0.96	2006
13	Chendamangalam	10036	0.51	1464
14	Cheruvakkal	9357	0.56	1957
15	Chettivilakom	10496	0.40	2323
16	Edavacode	8659	0.35	1364
17	Estate	9856	1.50	5381
18	Fort	8888	0.02	199
19	Harbour	8692	0.09	1186
20	Jagathy	9872	0.01	69
21	Kachani	9328	0.36	991
22	Kadakompally	9908	0.50	1581
23	Kalady	8659	2.02	8036
24	Kalippankulam	8708	0.02	378
25	Kamaleswaram	8675	0.05	347
26	Kanjirampara	10004	0.47	2865
27	Kannammoola	9955	0.31	2713
28	Karamana	8856	0.09	1048
29	Karikkakom	9766	0.50	1669
30	Kattayikonam	9229	1.05	1489
31	Kazhakoottom	10528	0.66	1430
32	Kesavadasapuram	9856	0.26	1753
33	Kinavoor	10545	0.27	1828
34	Kodunganoor	10348	0.30	1941
35	Kottapuram	10610	0.27	2130
36	Kowdiar	10069	0.34	1579

37	Kudappanakunnu	9451	0.28	1007
38	Kulathoor	8938	0.53	1102
39	Kunnukuzhy	9512	0.13	1077
40	Kuravankonam	9840	0.16	1327
41	Manacaud	8660	0.00	46
42	Manikkavilakom	8315	0.00	93
43	Mannanthala	9525	1.09	2316
44	Medical College	10528	0.38	2005
45	Melamcode	10354	2.38	7446
46	Mudavanmugal	9020	0.48	2706
47	Mulloor	9778	0.19	480
48	Muttada	10020	0.35	3354
49	Muttathara	10527	0.03	2374
50	Nalanchira	8777	0.85	2354
51	Nandancode	9512	0.22	957
52	Nedumcaud	10528	0.50	4689
53	Nemom	9950	0.63	2827
54	Nettayam	10509	0.07	1464
55	Njandoorkonam	8501	1.01	1612
56	Palkulangara	9941	0.01	87
57	Pallithura	10044	0.11	329
58	Pangode	10200	0.51	3360
59	Pappanamcode	9872	1.43	6101
60	Pathirappally	8659	0.35	2018
61	Pattom	10545	0.23	1364
62	Peroorkada	9184	0.26	1098
63	Perumthanny	9290	0.08	752
64	Ponnumagalam	10168	1.10	2925
65	Poojappura	8644	0.37	1018
66	Poonkulam	10250	0.29	535
67	Poonthura	8659	0.02	439
68	Poudikunam	9004	0.99	2048
69	Poundukadavu	9676	0.54	967
70	PTP Nagar	10250	0.08	900
71	Punjakkari	10168	0.56	1902
72	Punnakkamugal	10168	0.56	2391
73	Puthanpally	8315	0.18	3142
74	Sangumukhom	10171	0.01	22
75	Sasthamangalam	10490	0.11	1579
76	Sreekandeswaram	9676	0.01	136
77	Sreekaryam	10455	1.24	2441

78	Sreevaraham	8659	0.06	703
79	Thirumala	9905	0.18	1220
80	Thiruvallam	10332	0.25	863
81	Thrikkanapuram	9856	0.52	2229
82	Thuruthumoola	10027	0.99	2953
83	Ulloor	9102	0.19	1496
84	Valiyasala	8774	0.01	175
85	Valiyavila	9348	0.37	2266
86	Vallakkadavu	8790	0.00	13
87	Vattiyoorkavu	9807	0.32	1814
88	Vazhottukonam	1037	0.68	232
89	Vazhuthacaud	9679	0.03	195
90	Vellar	9758	0.23	757
91	Venganoor	9696	0.46	1121
92	Vettucaud	10351	0.27	2650
93	Vizhinjam	8724	0.20	1434
	Total	**8,81,064**	**39.9**	**1,58,476**

Annexure 2: Population exposed to Tsunami and Storm Surge in the wards of Thiruvananthapuram

Sl. No	Ward Name	Ward Population	Tsunami & Storm Surge prone area (km^2)	Population exposed to Tsunami & storm surge
1	Poonthura	8659	0.001098	27
2	Thiruvallam	10332	0.812604	2759
3	Vellar	9758	0.628847	2045
4	Vizhinjam	8724	0.011926	84
5	Kottapuram	10610	0.037035	297
6	Vettucaud	10351	0.210119	2069
7	Karikkakom	9766	0.126489	419
8	Poundukadavu	9676	0.283001	509
	Total	**77,876**	**2.1**	**8209**

Annexure 3: Population exposed to landslide in the wards of Thiruvananthapuram

Sl. No	Ward Name	Ward Population	Landslide prone area (km^2)	Population exposed to landslide
1	Thirumala	9905	0.05	393

Annexure 4: Population exposed to lighting in the wards of Thiruvananthapuram

Sl. No	Ward Name	Area (km^2)	Population
1	Chendamangalam	3.5	10036
2	Nandancode	2.2	9512
3	Mannanthala	4.5	9525
4	Pathirappally	1.5	8659
5	Kuriathy	0.6	9266
6	Thycaud	1.0	10399
7	Manikkavilakom	0.3	8315
8	Pappanamcode	2.3	9872
9	Pangode	1.6	10200
10	Vattiyoorkavu	1.7	9807
11	Vizhinjam	1.2	8724
12	Venganoor	3.9	9696
13	Mulloor	3.8	9778
14	Kuravankonam	1.2	9840
15	Palkulangara	0.7	9941
16	Akkulam	3.6	8856
17	Beemapalli	2.4	8642
18	Kazhakoottom	4.9	10528
19	Pallithura	3.2	10044
	Total	**44.2**	**181640**

Annexure 5

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Annexure 6: Population exposed to Attukal Pongala related accidents in the wards of Thiruvananthapuram

Sl. No	Ward Name	Ward Population	Attukal Pongala prone area (km^2)	Population exposed to Attukal Pongala related accidents
1	Ambalathara	8659	0.01	64
2	Beemapalli	8642	0.33	1172
3	Beemapalli East	8790	0.05	772
4	Chakai	9754	1.45	6242
5	Chalai	8692	0.52	4916
6	Fort	8888	0.50	5989
7	Jagathy	9872	0.00	26
8	Kadakompally	9908	1.10	3516
9	Kamaleswaram	8675	0.08	557
10	Kannammoola	9955	0.09	801
11	Karikkakom	9766	0.14	456
12	Kesavadasapuram	9856	0.25	1711
13	Kowdiar	10069	0.03	149
14	Kunnukuzhy	9512	0.99	8252
15	Kuravankonam	9840	0.31	2560
16	Medical College	10528	0.25	1296
17	Muttathara	10527	0.14	10500
18	Nalanchira	8777	0.28	776
19	Nandancode	9512	0.83	3598
20	Palayam	9761	1.06	7863
21	Palkulangara	9941	0.63	9582
22	Pattom	10545	0.95	5692
23	Perumthanny	9290	0.90	8435
24	Pettah	10859	0.61	6641
25	Puthanpally	8315	0.04	719
26	Sangumukhom	10171	0.09	275
27	Sasthamangalam	10490	0.06	854
28	Sreekandeswaram	9676	0.46	9676
29	Sreevaraham	8659	0.14	1588
30	Thampanoor	9184	0.80	9184
31	Thycaud	10399	0.68	6986
32	Valiyasala	8774	0.13	1731
33	Vallakkadavu	8790	0.12	1948
34	Vanchiyoor	9498	1.38	8897
35	Vazhuthacaud	9679	0.52	3146
	Total	**3,34,253**	**15.93**	**1,36,568**

Annexure 7: List of public buildings in Thiruvananthapuram City which were rapidly screened for physical vulnerability

Sl. No	Name	Ward	Vulnerability
1	Govt. U.P. School, Cheruvackal	Akkulam	2
2	Ananthapuri Public School		1
3	Al-Arif Hospital	Ambalathara	1
4	National college of Arts & Science		2
5	Kendriya Vidyalaya, Akkulam	Anamugom	1
6	Corparation Zonal Office Kazhakuttom		2
7	Corparation Zonal Office Kulatoor		2
8	Kulathoor Govt. L.P.School	Attipra	1
9	Village Office, Aattipra		1
10	Our Own English Medium School		1
11	Govt. H.S.School, Kulathur		1
12	BSNL Telephone Exchange, Manacaud	Attukal	2
13	Govt. U.P. School, Beemapalli	Bheemapally	2
14	Govt. U. P School, Chakkai	Chakai	1
15	Govt. L.P. School, Kuriyathi		2
16	Kerala Water Authority, South Subdivision	Chalai	2
17	Govt. Girls High School, Chala		2
18	Govt. U.P.& Nursery School, Chalai		2
19	Sainik School		1
20	Ayurvedic Dispensary Amballor		2
21	Kinfra film & Video park	Chanthavila	2
22	Chanthavila HS		2
23	St: Thomas Institute of Science & Tchnology		2
24	Madhavavilasom .H.S	Chempazanthy	2
25	IISER Chvadimukku		1
26	Loyola School		2
27	Bethlehem English Medium School	Cheruvaikal	2
28	Mary Nilayam English Medium School		1
29	Govt. L.P School,Pongummood		2
30	Chinmaya	Chettivilakom	3
31	Santhwana Hospital		1
32	Seventh day advetistsec UP school	Estate	2

33	FCI	FCI	3
34	Christ nagar college of engineering		3
35	The Kerala Agro Industries Corporation Ltd, Office Of		
	The District Soil Conservation		1
		Fort	
36	Fort Girls Mission High School		1
37	Fort High School		1
38	Technical Education Directrate		1
39	Vizhinjam plice Station	Harbour	1
40	Vizhinjam light House		2
41	Vzhinjam 66 KV Sub station		1
42	Fire and rescue service station		1
43	Inspection Benglow		2
44	Office of the Health Inspector, Jagathy	Jagathy	2
45	Govt. High School	Kalady	2
46	R K D,SAS		2
47	Butterflies Kindergarten		3
48	Cenre of Environment & Department		2
49	Sivodaya Hospital		2
50	Post Office Kanjirampara	Kanjirampara	3
51	City Rationning Office		3
52	Govt: LPS Kanjirampara		3
53	Govt:ITI Anchamala		3
54	BPM English medium school	Kannamoola	2
55	Devayani Memorial Govt L.P.School		1
56	Urban Wholesale Agricultural Market		1
57	All Saints College	Karikakom	1
58	Govt. H.S School, Karikkarom		2
59	VPCK		2
60	Krishibhavan		2
61	Al ulsuman School		2
62	Nikunjam		1
63	Regional Vocational Training institute		2
64	A.J School		2
65	St Antony's LPS		3
66	AL-Saj		1
67	CSI-Hospital		1

68	A.J.Hospital		2
69	Police Station		2
70	Women's ITC		2
71	Jyothi Central School	Kazhakuttom	3
72	Alan Feldman School		1
73	Karyavattom Govt:College		2
74	Kerala Highway Research center		2
75	Kazhakuttam High School		2
76	Village Office		2
77	Sub-Registrar Office		2
78	Transport Office		2
79	Health center pangappra		1
80	Govt:Teacher's training center Karyavattom		2
81	INCPE		1
82	Electricity Office Kazhakuttam		2
83	Pothancode Block office		2
84	Govt: Vetinary Hospital Kazhakuttom		2
85	NSS H.S. School	Kesavadasapuram	1
86	St Mary's HSS Vizhinjam	Kottapuram	2
87	TVM Golf Club		2
88	Income Tax Commissioner Office	Kowdiar	2
89	National Informatics Centre		2
90	Farm Information Bureau		2
91	PSNM Govt. HSS		2
92	Kerala State SC/ST Federation		3
93	Ayurdhara Panchakarma Centre		2
94	Kolath Hospital		2
95	Punarjani Hospital		2
96	Kerala State Veterinary Council		2
97	Chempaka Kindergarten		2
98	Trivandrum Corporation Zonal Office, Kudappanakunnu		3
99	PSNMG, GHSS Peroorkada		3
100	Concodia School		1
101	Tvm Civil Station	Kudapanakunnu	1
102	Trivandrum Zonal Office, Kudappanakunnu		2
103	Dooradarshan Kendram		2
104	Livestock Management and Training Centre		2
105	BNV Hospital		1

106	Karakulam panchayat ofiice		2
107	Karakulam HS		2
108	Karakulam LPS		2
109	Veteritnary Hospital		2
110	KWA pamb House		2
111	Keltron		2
112	School of The Good Shepard		1
113	Dr. Ambedkar Memorial Residential School		2
114	College of Engineering, Thiruvananthapuram		2
115	The Holy Trinity English Medium H.S.School	Kulathoor	1
116	Govt. U.P.School, Kuzhivila		1
117	Mar Gregorious Memorial Central Public School		1
118	Dioscores College of Pharmacy		1
119	Model Hostel Boy's Vellayambalam		3
120	Air India office, Vellayambalam		1
121	Nirmala Bhavan		3
122	Salvation Army School		2
123	Income tax	Kuravankonam	3
124	VIT Kuravankonam		1
125	Soil conservation department		3
126	Nimala Bhavan Higher Secondary School		2
127	Kerala State Commission for Backward Class		2
128	Kerala Financial Corp		1
129	The Zonza Hospital	Manacaud	1
130	SUT Hospital		1
131	Oxford School		3
132	KSRTC Department		2
133	National Hospital		2
134	District Jail, Trivandrum		2
135	Post office Manacaud		3
136	Corporation Office Manacaud		3
137	KBM Hospital		3
138	Post Office, Manacaud		1
139	Chinmaya Vidhyalam School		1
140	Medical College		2
141	Central Diagonstical Laboratary		2
142	Sree Chithira Thirunal Institute of Imaging		2
143	Avittom Thirunal Hospital		2
144	Directorate of Medical Education	Medical College	2

145	Dental College		1
146	Kerala Irrigation Infrastructure Development Corporation		1
147	Govt. U.P.School, Ulloor		1
148	GVHSS UP School	Mullor	2
149	St. Mary's H.S. School, Pattom		1
150	Bureau of Indian Standards, BSNL	Nalanchira	1
151	Directorate of Mining & Geology		1
152	Directorate of Survey		1
153	Govt:Model Boy's HSS Vazhuthacadu		2
154	Kalabhavan		2
155	IHRD,Vazhuthacaud		2
156	Devasam Board		3
157	Kerala Sate Transport Project office		3
158	Christ nagar HS		2
159	Christ nagar HSS		2
160	Kerala road Fund board	Nandancode	2
161	Sandeepini School		1
162	Keltron CDAC		2
163	Devaswam Board Headquarters		2
164	Central Bureau of Investigation		3
165	Employees Privident Fund Organisation, Ministry of Labour Govt of India		1
166	Vidyuthi Bhavan		1
167	Kerala Womens Commission		2
168	Village Office		3
169	Shree vidhyaraja Homoeopathic Medical College	Nemom	2
170	Karakamandapam Govt: Hospital		2
171	Govt: LPS		2
172	Govt. HSS Ayiroorpara	Njandoorkonam	2
173	Public Sector re-structuring internal audit board		2
174	Jubilee Mission Hospital, Palayam		1
175	RBI		3
176	University hostel for women		1
177	KERAFED		2
178	KWA		2
179	Tourism information centre		1

180	PWD		3
181	Sate land bank		3
182	KFC		2
183	Fine Arts College	Palayam	3
184	State Library		2
185	Institute of Engineers		3
186	Panchayat Assosiation hall		3
187	University College, Trivandrum		1
188	MLA Quarters		1
189	Kerala Police Housing & Construction		1
190	Public Library		1
191	Post & Telecom Audit Office		2
192	Corporation Office, Trivandrum		1
193	Office of Electrical Inspector		1
194	Kerala Water Authority		2
195	Keltron		1
196	NSS Public School, Perumthanni, NSS H.S. School,	Palkulangara	
	NSS Art's College For Women		1
197	IITMK		1
198	KINFRA Apard park		1
199	Marian Eng: College		1
200	Marian Teacher's Institute		2
201	St' Xavier's College		2
202	Jyothi vilayam H.S.S	Pallithura	2
203	St:Jude H .S		3
204	Pallithura H.S		3
205	Food Corporation Of India		1
206	Govt. L.P.School, Attinkuzhi		1
207	Food Corporation Of India		1
208	Veterinary Hospital	Pangode	2
209	NSS College	Papanamcode	3
210	Kerala Police HQ		1
211	Peroorkada Panchayat Office	Pathirapally	2
212	P A Aziz College of engineering and tchnology		2
213	District Panchayath Office		1
214	Kendriya Vidyalaya, Pattom	Pattom	1
215	Kerala PSC		1

216	Pattom Village Office		1
217	Govt. Model Girls H.S.School, Pattom		1
218	Institute of Paramedical Science		1
219	Kerala Low Acadamy		2
220	J.J Hospital Peroorkada		2
221	Amardeep eye Hospital		1
222	KSRTC Peroorkada		1
223	ESI Hospital		1
224	Oolanpara Hospital		2
225	Peroorkada K.S.R.T.C. Bus Depot.		3
226	Village Office Kudappanakunnu		3
227	Kerala Water Authority		3
228	Post Office Peroorkada	Peroorkada	2
229	Peroorkada Police Station		2
230	Trivandrum Peroorkada District Panchayat Hospital		2
231	Indiragandhi National Open University		3
232	Health Inspector Diploma Course (Government Of Kerala)		3
233	All India Institute of Local Self Govt.(University Of Kerala)		3
234	ESI Dispensary Peroorkada		3
235	G.H.S.L.P.S. Peroorkada		2
236	GHSS Girls Peroorkada		1
237	BSNL Customer Service Centre, Ambalamukku		2
238	Lecode chempaka	Perumthanny	2
239	Govt. U.P. School, Enchakkal		1
240	Kerala Poultry Development Corporation		1
241	Govt. Girls Vocational Higher Secondary School, L.P. School, Pettah	Pettah	2
242	Govt. Boys High School, Pettah		2
243	St. Anne's U.P.School		1
244	Vectory Girl"s & Boy's HS		3
245	Vectory VHSE		3
246	Spinning mill	Ponnumangalm	3
247	Govt:UPS		3
248	Govt Health center		2
249	Govt LPS Pangode		1

250	Nath Memorial School		1
251	Hindu Mahila Mandiram GHSS		1
252	Nrithalaya Hospital		1
253	Police Station, Pujappura	Poojapura	2
254	HLL Lifecare Ltd, Pujappura		2
255	SBT , Pujappura		2
256	Panchakarma hospital		2
257	BSNL		2
258	SCERT and pareeksha bhavan		2
259	LBS centre for science and technology		2
260	central prison		2
261	social justice board and juvenile home		2
262	samsthana vigalanga kshema coorporation		2
263	Panchakarma hospital		2
264	Govt UPS, Pujappura		2
265	Vigilance and anticurreption Burueau		2
266	KSEB Pujappura		3
267	Rajiv Gandhi Centre for Biotechnology		1
268	Village Office Uliythara	Poudikonam	1
269	BNV College of teacher education		2
270	ACE College of engineering		1
271	MG College of Engineering	Punjakkari	1
272	BNV School		1
273	C-Dit Campus		1
274	IIMR	Puthanpally	3
275	St. Marys H.S. School	Sangumugom	1
276	Private L. P School, Shangumukham		2
277	V.O,SAS		2
278	Sree Ramakrishna Hospital		1
279	Sree Ramakrishna Vidyamandir, Maruthumkuzhi		1
280	Govt: Sasthamangalam		2
281	Kerala Chalachitra Acadammy		2
282	Sri Mookambika School Sasthamangalam		3
283	Govt. LPS Sasthamangalam	Sasthamangalam	2
284	Kerala State Beverages Corporation Office		3
285	Sri Mookambika Public School		2
286	Kerala State Chalachitra Academy		2
287	Post Office Sasthamangalam		2

288	Haree Sree School		2
289	Kerala State Social Welfare Board		2
290	Health Inspector Office		2
291	Pettah Village Office		1
292	Govt. U.P. Girl School, Fort	Sreekandeswaram	1
293	Passport Office, SBT		2
294	Campus		1
295	University teacher's Hostel		2
296	Information Kerala Mission		2
297	Govt: High school Sreekaryam	Sreekariyam	2
298	Mar Gregorious memorial school		2
299	Govt: UP school Karyavattom		2
300	Seventh day Adventist Secondary school		1
301	Govt. College of teacher education Thycaud		1
302	SMV H.S School	Thampanoor	1
303	NABARD		2
304	AG'S Office Trivandrum		1
305	K.V Pangode		1
306	Thirumala village office		1
307	AMHSS Thirumala		1
308	SBT Thirumala		2
309	Akshaya Centre	Thirumala	1
310	Sreekrishna Hospital		1
311	Post Office, Thirumala		1
312	Vijayamohini mill		1
313	Viswaprakash central School		2
314	Govt. LPS Thiruvallam	Thiruvallam	3
315	Karibhagam Coir Vyavasaya Sahakarana Sangam		2
316	Punarjani Hospital		2
317	KSEB Peroorkada	Thuruthumoola	2
318	Govt. Vocational HSS		2
319	Central polytechnic College Vattiyoorkavu		2
320	Swathithirunal Music College		2
321	Govt. Model boy's School Thycaud		2
322	DPI	Thycaud	2
323	Sisuvihar centre, Vazhuthacaudu		2
324	Jagathy Postoffice		3
325	Kerala State Cooperative Consumerfed	Ulloor	1

326	Govt. Model H.S. School For Boys Chalai, Office of the Deputy Director For Education		2
327	Govt. Dispensary	Valiyasala	3
328	Govt. Model H.S. School For Boys Chalai, Office of the Deputy Director For Education		2
329	Trivandrum Corporation Malstya Bhavan, Valiyathuraya		3
330	Govt. U.P. School, Valiyathura		3
331	Vallakkadavu L.P. School		1
332	Food Corporation Of India	Valiyathura	1
333	Govt. U.P.School, Valiyathura		1
334	St. Antony's H.S.School		1
335	Govt. V.H.S School, Valiyathura		2
336	Ponnara Sreedhar Memorial U.P. School	Vallakadavu	1
337	Magistrate Court		2
338	St. Joseph H.S. School		1
339	Govt. High School, Vanchiyoor		1
340	Sree Sankaracharya University of Sanskrit	Vanchiyoor	2
341	Kerala State IT Mission		2
342	Urban Resource Center		2
343	District Court		1
344	Fast Track Court		1
345	SN Public School Venpalavattom	Vattiyoorkavu	2
346	KSEB vattiyoorkavu		3
347	Govt: LPS Vattiyoorkavu		3
348	Primary Health center		2
349	Police Station		2
350	Village Office		2
351	KSFC		2
352	TVM corparation ward committee		2
353	Mother- baby care centre		2
354	Health Inspector Office		2
355	Shirdhi Sai Daycare&Nursery School		3
356	Post Office Vattiyoorkavu		3
357	Cotton Hill GHSS		2
358	Cotton Hill GLPS		2
359	Forest HQ		2
360	Forest Office		2
361	Women's College		2

362	Kerala Social Welfareboard	Vazhuthucaud	3
363	Govt: Arts College		3
364	Carmel GHSS		2
365	sarvavikjanakosha institute		2
366	ulloor smarakam		2
367	TRIDA		2
368	Family Welfare Centre	Vellar	2
369	C-DAC	Vellayambalam	2
370	AgriculturalUniversity		3
371	Vizhinjam SVLPS	Venganoor	2
372	Santhinikethen school		3
373	KSRTC Vizhinjam		2
374	Castal Police Station Vizhinjam		1
375	Govt:HALPS	Vizhinjam	2
376	Indian cost Gard		1
377	Vhinjam Post Office		3
378	Govt: Model HSS Kalliyoor		2

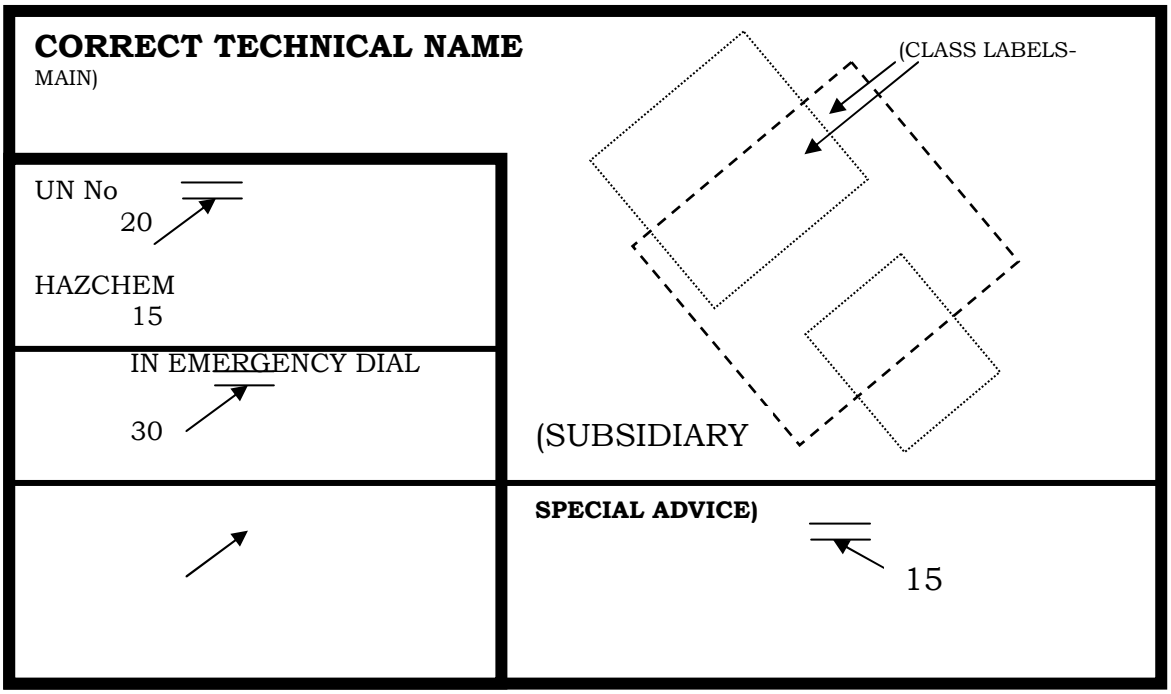
1: Least Vulnerable
2: Moderately Vulnerable
3: Highly Vulnerable

Annexure 8
Transportation of Hazardous Goods

Emergency information panel

The Emergency Information Panel provides information in the event of an emergency. It indicates the correct technical name of the substance being transported, its UN Number, HAZCHEM code and UN Hazard class label. The panel also provides a contract telephone number in an emergency for specialist advice. The size and shape of the class label is shown in the Annexure G. Each term in the Emergency Information Panel is explained below. (See figure).

The emergency information panel shall ber marked on three places on the road tankers – at both sides and rear end.



Class Label:

Symbols of material shall be marked giving the label in particular colour at top right area of the panel. The subsidiary risk label shall be on the bottom-right of the class label.

Chemicals have been grouped into nine basic classes depending on nature of hazard, represented numerically from 1 to 9. Many of these classes are further separated into divisions. They are:

1. Class I Explosives
   - 1.1 Substances and articles, which have a mass explosion hazard.
   - 1.2 Substances and articles, which have a projection hazard but not a mass explosion hazard.

1.3 Substances and articles which have fire hazard and either a minor blast hazard or a minor projection hazard or both but not a mass explosion hazard.

1.4 Substances and articles, which present no significant hazard, i.e. the effects are confined largely to the package is to be expected. An external fire must not cause practically, instantaneous explosion of virtually the entire contents of the package.

1.5 Very insensitive substances, that is substances, which are so insensitive that there is very little probability of initiation or of transition from burning to detoriation under normal conditions or transport.

1.6 Extremely insensitive substances.

2. Class 2: Gases

2.1 Non-flammable gases.

2.2 Flammable gases

2.3 Toxic gases

3. Class 3 Gases

3.1 Liquids with a flash point below 18^{o} C

3.2. Liquids with a flash point above 18^{o} C and below 23^{o} C

3.3 Liquids with a flash point above 23^{o} C and upto 61^{o} C

4. Class 4 Flammable solids.

4.1 Solids other than classed as explosives, which under conditions encountered in transport are readily combustible or may cause or contribute to give through friction.

4.2 Substances liable to spontaneous combustion

4.3 Substances, which in contact with water emit inflammable gases, substances, which on interaction with water are liable to become spontaneously inflammable to dangerous quantities.

5. Class 5. Oxidising substances, organic peroxides.

5.1. Oxidising substances other than peroxides

5.2 Organic peroxides.

6. Class 6,. Poisonous (toxic and infectious stances)

6.1 Poisonous (toxic) stances

6.2. Substances which give off a poisonous (toxic) gases or vapours.

6.3 Poisonous substances other than those giving off poisonous gases or vapours.

6.4 Infectious substances containing decease producing micro organisms.

7. Class 7: Radioactive substances.

8. Class 8: Corrosives

9. Class 9: Miscellaneous dangerous substances.

9.1 Substances not falling within the other clauses or the divisions of this class.

9.2 Lachrymatory substances not falling with other class. Each United Nations Hazard Class Label (With the exception of Class 9) has a distinctive diamond shaped label bearing a pictogram for quick hazard recognition. Each label also has a characteristic background colour.

Each United Nations Hazard Class Label (With the exception of Class 9) has a distinctive diamond shaped label bearing a pictogram for quick hazard recognition. Each label also has a characteristic background colour.]

Table 1: Colour Code.

Hazard Type	Colour
Explosives	**Orange**
Flammable	**Red**
Water reactive	**Blue**
Oxidizing substances	**Yellow**
Toxic / Infectious	**White**
Radioactive	**Yellow and White**
Corrosive	**Black and white**

The advantage of this system is that the shape, colour and pictogram of the labels clearly convey the nature of dangers in the chemicals being transported; it helps overcome language barriers and literacy problems, extremely beneficial in the multilingual country like ours. The other advantages are:

1. Dangerous goods in transit are recognizable from a distance because of the distinctive colour.
2. The danger of the risk is made more apparent by means of black symbols each representing a particular risk, e.g. the flame denoting the risk of fire.

The upper half of the diamond shaped label (Square, set an angle of 45 degree) is reserved for the black symbol representing the nature of the risk. The reference symbols are provided for each of the UN. Class. The number of class or division is shown in black colour in the bottom corner of the label.

UN Number

The UN Committee has classified various hazardous various hazardous substances according to the risk involved. Each hazardous substance included in the list has been allocated a unique four digit number, which are the substances 'UN Number'. So far there are over three thousand chemicals, which have been allotted UN Numbers. Since numbers are in Arabic letters, it helps in ready identification of the chemical being transported.

HAZCHEM Code

The Hazchem code is an emergency action code designed by the London Fire Brigade. It shall be clearly marked on the left middle area of the panel; it reveals properties of that material and safe handling methods. This enables the fire brigade to know at once the action to be taken in case of fire, spilling or leakage. It also ensures the use of appropriate protective closing.

The Hazchem code consists of a numeral 1 to 4 in conjunction with one or two alphabets. The first digit indicates fire – fighting method while the alphabet after the digit indicates whether to contain or to dilute. The letter 'E' indicate evacuation, letter 'V' indicate violently reactive etc. Details are given in next page.

Examples of a few chemicals along with their Hazchem codes are given below:

Benzene	2 WE
Chlorine	2 XE
Sulphuric Acid	2 P
Oleum	4 WE
Phenol	2 X
Cumene	3 Y
Acetone	2 YE
Monocychlo Hexylamine	3 WE

TREMCARD

Under the act, every vehicle of dangerous goods has to carry a Transport Emergency card. The Emergency Information Panel only provides very essential data to enable immediate action to be taken in case of a mishap. However, detailed instructions on fire, spillage or leakage and action to deal with the emergency are indicated in the TREMcard. This card, which is to be provided by the consigner, is to be carried by the driver in his cabin. The TREMcard for LPG is shown in Annexure D. This will also help the driver to act responsibly because he has been given information in writing on the immediate action that should be taken in the event of an emergency.

HAZCHEM CODE

1	JETS
2	FOG
3.	FOAM
4	DRY AGENT

P	V	Full	DILUTE
R			
S	V	BA	
S		BA for FIRE only	
T		BA	
T		BA for FIRE only	
W	V	Full	
X			CONTAIN
Y		BA	
Y		BA for FIRE only	
Z		BA	
Z		BA for FIRE only	

E	CONSIDER EVACUATION	

Note

V.	Can be violently or even explosively reactive
FULL	Fully body protective clothing with BA
BA	Breathing apparatus plus protective gloves.
DILUTE	May be washed to drain with large quantities of water
CONTAIN	Prevent by any means available spillage from entering drains of water course.

LIST OF CHEMICALS TRANSPORTED

Even though hazardous industries are numerous in Trivandrum district, many hazardous chemicals are being transported through the district. Some important chemicals, which their UN Number, Hazchem Code and risk and hazard classification, among them are detailed below:

Table: 2 – List of Chemicals

Sl. No	UN No.	Hazchem Code			Name of Chemical	UN Hazard Class	
						Main Risk	**Sub Risk**
1	1001	2	S	E	Acetylene, dissolved	2	**3**
2	1002	2	T		Air compressed	2	-
3.	1005	2	P	E	Ammonia	2	**3**
4	1017	2	X	E	Chlorine	2	**6.1**
5	1038	2	W	E	Ethylene, refrigerated liquid	2	**3**
6.	1049	2	S	E	Hydrogen, compressed	2	**3**
7.	1066	2	T		Hydrogen, compressed	2	**3**
8.	1072	2	S		Oxygen, compressed	2	**5.1**
9.	1075	2	W	E	Petroleum gas, liquefied	2	**3**
10.	1077	2	W	E	Propylene (Propane)	2	**3**
11.	1086	2	W	E	Vinyl Chlorine, inhibited	2	**3**
12	1090	2	Y	E	Acetone	3	-
13	1114	3	W	E	Benzene (Benzol)	3	-
14	1134	2	Y		Chlorobenzene (Monochloro – benzene)	3	-
15	1170	2	S	E	Ethanol (Ethyl alcohol	3	-
16.	1188	2	S	E	Ethanol (Ethyl alcohol)	3	-
17	1198	2	S	E	Formaldehyde solutions, flash point not more than 61 degree C.	3	-
18.	1202	3	Z		Gas oil (Diesel)	3	-
19	1203	3	Y	E	Motor spirit include Gasoline or Petrol	3	-
20	1204	2	S	E	Nitro-glycerine solution in alcohol containing not more than 1% nitroglycerine.	3	-
21	1208	3	Y	E	Hexane and its isomers	3	-
22	1219	2	S	E	Isopropanol (Isopropyl-alcohol)	3	-
23	1223	3	Y		Kerosene (Paraffin)	3	-

24	1230	2	P	E	Methanol (Methyl alcohol, Wood alcohol, Columbian (Spirit)	3	**6.1**
25	1255	3	Y	E	Naphtha, petroleum	3	-
26	1256	3	W		Naphtha, solvent	3	-
27	1267	3	W	E	Petroleum, crude oil	3	-
28	1294	3	Y	E	Turpentine	3	-
29	1299	3	Y		Turpentine	3	-
30	1350	2	Z		Sulphur	4.1	-
31	1381	2	W	E	Phosphorus, white or yellow dry or under water or in solution	4.2	**6.1**
32	1428	4	W		Sodium, metal	4.3	-
33	1671	2	X		Phenol	6.1	-
34	1719	2	R		Caustic alkali liquids, n.o.s.	8	
35	1789	2	R		Hydrochloric acid	8	-
36	1830	2	P		Sulphuric acid	8	-
37	**1846**	**2**	**Z**		**Carbon Tetrachloride**	**6.1**	

Annexure 9 -CLASS LABEL

HAZARDOUS GOODS CLASS LABELS

14

Annexure 10

Baggage scanners (x-ray)

1. High court of kerala , eranakulam
2. Airport, thiruvananthapuram
3. Airport, nedumbasserry, ernakulam
4. Airport, karipur, malappuram

List of hospitals with radio therapy installations in trivandrum corporation
Radio active sources for tele therapy

Government medical college, medical college p.o., trivandrum, kerala-695 011

Linear accelerators

1. Kims, p b no 1, anamugham, anayara p o, trivandrum, kerala, pin. 695 029, 0471 3041000
2. Isro, thiruvananthapuram (industrial use)
3.

Gamma scan centres

1. Regional cancer centre. Medical college p.o., trivandrum, kerala. Pin. 695 011

Brachy therapy centres

1. Kims, p b no 1, anamugham, anayara p o, trivandrum, kerala, pin. 695 029, 0471 3041000
2. Regional cancer centre. Medical college p.o., trivandrum, kerala. Pin. 695 011
3. Government medical college, medical college p.o., trivandrum, kerala-695 011

List of Institutions possessing X-rays

Arumana hospital, airport road,trivandrum 695 008 , 4712468991
Ambika x-rays, opp. Medical college hospital, trivandrum (w.u)
Ajira, clinical lab, meena building, sreekaryam, trivandrum - 17
Al arif hospital, poonthura p.o., trivandrum 695 026 , 0471 2381715
Appolo dental centre, vellayambalam, trivandrum - 11
Aisha memorial hospital, parathikuzhi jn. Manacaud p.o., trivandrum 2456423
Ads scan & hospital pvt. Ltd., pazhaya road, medical college, tvm
Bio clinical centre, opp. Puthunppally lane, pazhaya road, medical college, trivandrum
Bnv hospital, thiruvallam, trivandrum - 27
Clinical diagnostic & research centre, market junction, mancaud p.o., trivandrum 695 009
Cm xray, oppo.medical college police station, medicalcollege p.o., trivandrum 695511, ph. 0471 2444397
Chelsa medical care pvt,ltd, sastri nagar jn, kunjalumoodu, karamana,trivandrum 695 002 ph. 0471 2342252
Ddrc wellspring pathlabs pvt.ltd., aster square, medical college p.o., trivandrum 695 011, ph. 0471 2447227
Devi scans pvt. Ltd, ulloor, trivandrum
Devi x-ray clinic, peroorkada,thiruvananthapuram pin;695005, ph. 0471 2432135
Dental college, medical college, trivandrum 695 011, ph 0471 2444092
Ct scan, near blood bank, medical college hospital, trivandrum, kerala. Pin-695011, ph, 0471-2528386
Cardiology department, medical college hospital, trivandrum, kerala. Pin-695011 , ph, 0471 2528386
Dhanwanthari centre, medical college hospital, trivandrum -11
Dr.govindans hospital, convent road, trivandrum 695 001 , ph. 0471 2453652
Esi hospital, peroorkada, thivandrum 695 005 , ph. 0471 2433075
Govt. General hospital, trivandrum, ph. 0471 2307874, 9745508891
Govt. Thq hospital, peroorkada, trivandrum
Instant bio lab, kumarapuram, trivandrum
James x ray ecg clinical laboratory, poovar.p.o., trivandrum 695925 , ph. 0471 2211020
Jubilee memorial hospital, mead's lane, palayam, thiruvananthapuram, kerala. Pin- 695 034, , ph.0471 2334562, 2334561
Kvs, ulloor, trivandrum
Kurup's clinical lab, statue road, trivandrum
Kolath medical centre, peroorkada, thivandrum 695 005 , ph. 0471 2433327
Mitraniketan, vellanad, trivandrum
Travancore scans health care pvt ltd., mediplaza , medical college.p.o.., trivandrum 11 , ph. 0471 2551050
Medicare lab, kumarapuram, trivandrum
Dianova laboratories, abg complex, pazhaya road, medical college, trivandrum., 0471-2445722
Nirmala hospital, chalakuzhy road, medical college, trivandrum 695 011 , ph. 0471 2445320
Prs hospital, killipalam, karamana po, thiruvananthapuram, kerala. Pin-695 002, ph. 0471-2344443
Prasad clinic, pmg, trivandrum
Regional cancer centre. Medical college p.o., trivandrum, kerala. Pin. 695 011, ph. 0471 2442541
Raveendra x-ray clinic, medical college p.o., trivandrum 11, ph. 0471 2555389
Rotary hospital, poojapura, trivandrum
Swantham hospital, pearl nagar, peroorkada, tvm
St.vincent diabetes centre, pattom, trivandrum 695 004 , ph. 04722443328

St.jude hospitals, killipalam, karamana, trivandrum 695 002 , ph.04712343274
Srvs diagnostic & research institute, aj hall, medical college p.o., Trivandrum
Sri ramakrishna ashrama charitable hospital, sasthamangalam, trivandrum 695 010 , ph. 04712722125
S.r hospital, ambalathara, trivandrum
Srevya medicare research & rehabiliation centre, santhwana hospital building, ambalamukku p.o., trivandrum 695 005 , ph.0471 2432121
Sree uthradom thirunal hospital, pattom, trivandrum, kerala, pin. 695 004, ph. 0471 4077777
Dept. Of is&ir, sree chitra thirunal institute for medical sciences, trivandrum, kerala. Pin- 695 011, ph,0471 2443152, 0471-2524131
S p fort hospital, fort, trivandrum, kerala. Pin- 695 023, ph. 0471 2450540
Sreechitra thirunal institute of medical sciences and technology, medical college campus, trivandrum, kerala, pin. 695 011, 0471-2524431
Span hospital, manacad, trivandrum
Dr. Gopinath's diagnostic services, medical college.p.o, trivandrum 695 011 , ph. 0471 2445940
Dr. Gopinath's diagnostic services,opp.government 0471-2445940hospital,peroorkada trivandrum 695 0005 , ph. 0471 2445940
S.challenge memorial health, muttacadu, trivandrum
Sasikala poly clinic, statue road, trivandrum
University health centre, kariavattom, trivandrum
Universal lab & research centre, south centre, fort, trivandrum, 695 023 , ph. 04712450084
Venus x-ray clinic, c/o nathanis diagnostic clinic, chalakuzhy junction, pattom, trivandrum, kerala. Pin- 695 004, ph.0471 2550122
Sree uthram thirunal royal hospital, kochulloor, trivandrum, kerala. Pin- 695 011, ph. 0471 6541087
Women and children hospital, thycaud, thiruvanathapuram, kerala, pin. 695 014, ph.0471 2323457, 9847180479
Aranta diagnostic, air port road,shanghumugom, trivandrum, 695008
Aj hospital, kazhakuttom. P.o, thiruvananthapuram, kerala. Pin- 695 582, ph, 0471-2418452
Chandra sekhar memorial x-ray, chandra buildings, medical college p.o,tvm
Cosmopolitan hospitals private ltd, murinjapalam, pattom p.o, thiruvananthapuram, kerala. Pin-695 004, , ph,0471-2521252
Diagnostic services, opp.cathiolic syrian bank, kumarapuram, medical college p.o., trivandrum 695 011, ph, 04712442465
Devi scans pvt ltd, kumarapuram, medical college-po, trivandrum. Pin- 695 011, ph,0471-2552727
Fathima clinic, statue road, trivandrum 695 001 , ph. 0471 2477179
Doctors diagnostic research service x-ray, shams complex, east junction, attingal, trivandrum, kerala, pin. 695 101,ph. 9447013825
G.g. hospital, p.b. no. 2443, trivandrum , murinjapalam, medical college p.o, thiruvananthapuram, kerala. Pin- 695 011, ph. 0471 2557744
Kims, p b no 1, anamugham, anayara p o, trivandrum, kerala, pin. 695 029, 0471 3041000
Sri sankara dental college,akathumuri,varkala, trivandrum - 695318. , ph.
Rajadhani hospital, kottakakam, east fort, trivandrum
Lords hospital, tc 76/2183(1), anayara, trivandrum, kerala, pin-695 029, ph.0471-3045111
Travancore scan centre, medical college, tvm
Royal x-ray clinic, ulloor, medical college p.o, trivandrum
Medical college hospital, trivandrum
Mental hospital, trivandrum

Sat hospital, trivandrum
Zoo hospital, trivandrum
Sanatorium for chest deseases, pulayanarkotta, trivandrum
Jaya lab, opp. Government l.p school, vizhinjam, tvm
Lal's medical diagnostic centre, kazhakkutom p.o., trivandrum 695582 , ph. 0471 3208105
Triveni nursing home, vachiyoor, trivandrum 695 035, ph. 0471 2470450
Daniels x-ray, vithura, trivandrum
Ananthapuri hospitals & research institute (ahri), chacka, nh bypass, trivandrum-695 024., ph,0471-2579900, 2506565, 2506767, fax:0471-2506969
Punarjani institute of medical science & research pvt ltd, akg nagar road, peroorkada p.o, trivandrum, kerala. Pin-695 005, ph. 0471 2539901/ 2539902
Al ameen diagnostic centre, gandhari ammn covil road, thampanoor, g.p.o., tvm 695 001, ph, 0471 3251722
S k hospital, edappazhinji junction, trivandrum 695 006 , ph. 0471 4081111
The great india health care management limited, palayam, tvm
Athira x-ray & lab, sreekaryam, trivandrum
Health support services division - diagnostics, kazhakuttam p.o, trivandrum 695 582 , ph.0471 2413737
Health care diagnostic centre, t.c. 41/2445, kamaleswaram road, manacaud, tvm 695 009 , ph. 0471 2458309
Alshafa diagnostic centre, yatheimkhana shopping complex, vallakkadavu, trivandrum 695 008, ph, 0471 2502642
Doctors diagnostic research centre, ulloor jn, medical college, trivandrum
Muthoot scans mri ct-labs & research centre, opp.puthupally lane, pazhaya road, medical college p.o., trivandrum 695 011 , ph.0471 2443651
Attukaldevi institute of medical sciences ltd, attukal, manacaud, trivandrum, kerala. Pin- 695 009, , ph,0471 2459040
K.k. o.p.g. and dental x-ray, murinjapalam, medical college -695011
Rural health training centre, kazhakuttam, thiruvananthapuram-695 582., ph:0471 2418378
M.r.r. ayurvedic hospital, trivandrum - 695 001
R.r. children's hospital & surgical centre, attinkuzhi, kazhakkuttom, trivandrum, kerala – pin: 695 582, ph.0471 2414473
Pallavi hospital, pazhayakada, trivandrum
Credence hospital, ulloor, medical college, trivandrum, kerala. Pin- 695 011, , ph, 0471 4033333
Mullackals diagnostic centre, sowbhagya buildings, fort p.o, trivandrum, keralaPin- 695 023, , ph.0471 3010714/ 715
C.m. x-ray, opp. Medical college police station, medical college p.o., trivandrum
Rins hospital, nedumangad, trivandrum
Sai diagnostics, t.c. 55/92, kaimanam junction, trivandrum
Amma x-rays, general hospital junction, trivandrum
Meditrust diagnostics & laboratory, spectrum chambers, kuravankonam, pattom- kowdiar road, kowdiar-po, trivandrum, kerala. Pin- 695 003, ph. 0471 2310222
Welcare diagnostic centre, city plaza, medical college junction, trivandrum, kerala. Pin- 695 011,ph. 0471 6459696
Mullackals diagnostic centre, marapalam, pattom, trivandrum, kerala. Pin- 695 004
Doctors diagnostic nuclear medicine & research centre pvt, ltd, aster square, medical college p.o.,
Kims ddnmrc, kims hospital, anayara p.o., trivandrum, kerala. Pin-695 029, , ph.0471-2550104
Beema maheen hospital, beemapally, thiruvananthapuram, kerala, pin. 695 008, , ph,0471 2508080
Lab centre, medical college, trivandrum

The appolo clinic law college junction vikas bhavan trivandrum
Meditrina hospital, plamoodu, pattom, trivandrum, kerala. Pin. 695004, ph.0471 6452011
Govt dental college trivandrum, kerala-695 011,, ph. 0471 2444092
Imaging and diagnostics solutions (ids), manjadimoodu, vattiyoorkavu, trivandrum , ph. 0471 3298700
Instant biolab, medical college p.o., trivandrum 695511, ph. 0471 2442484
Kodakeril cosmetric dental clinic, kariyavattom, tvm
Lekshmi clinical laboratory, sourtherstar buidling, opp.w & c hospital. Thycaud, trivandrum 695 014 , ph. 0471 4068700
M.b. dental clinic, n.h. road, kazhakkuttam, tvm
Modern diagnostic services, computerised lab, ecg, x-ray, nadesh tower, chakkalamukku, sreekariyam 17 , ph.0471 2597196
Rural institute of medical sciences, govt.college road, nedumangad 695 541
Sapphire medical centre, vrindavan terrace, opp.trivandrum club, trivandrum 695 010 , ph. 9847311333
Trivandrum diagnostic centre, priya cottage, vallakadave, airport road, trivandrum , ph. 04713268675
Vanchinad hospital ltd., pongummood, trivandrum
Station medicare centre, head quarters southern air command akkulam thuruvickal
Sut m&b hospital ,manacaud , trivandrum kerala 695 009
Ddrc srl diagnostic pvt ltd, kanjirmpara, opp.govt.hospital, peroorkada ,trivandrum,kerala, pin. 695 005 . Ph. 0471 2303018
Government ayurveda college, trivandrum - 695001. Ph 0471-2260190
Kamala health care private limited vazhuthacaud, trivandrum, kerala - 695014. Ph. 0471-2338420
Sreedevi lab& scans, ulloor, medical dollege p.o, trivandrum,pin- 695 011, 0471-2554636
Sut life care clinic, tc4/1632, vellayambalam, kowadiar.p.o, trivandrum, ph. 9447144433
Govt homoeopathic medical college hospital, trivandrum, 0471-2462746
Dr.farook's childrens hospital, paravankunnu jn, manacadu.p.o, trivandrum, pin – 695 009
Capital diagnostic centre,twinkle plaza, panvila junction,trivandrum 695014, 0471 4066850
Devi scans pvt. Ltd, kumarapuram(gitanjali hospital, vazhuthakkad) 0471 2443074
Military hospital, pangode, military camp, trivandrum 695 006, 0471 2354294
Tsc hospital (pvt) ltd, by pass, kulathoor, kazhakkuttam, trivandrum pin 695 583, ph. 0471 2412127
Tmss ltd, sut preventive clinic, tc4/1632, kowdiar.p.o., trivandrum 695 003, ph. 0471 2724696

Annexure 11
Resource Inventory

Thiruvananthapuram Corporation Office
Telephone Directory
Phone Number 0471 :- 2320821, 2320894, 2320785, 2320113, 2320597, 232047
Fax Number 0471 :- 2332083 (For contact dial extension number after 2320821)

Administrative Officers/Section/Officer	Office	Extension	Residential
Mayor	2322470	404	2478844
Mayor Section		433	
Deputy Mayor	2329905	437	2598072
Secretary	2332085	406	2573745
Deputy Secretary		401	2225401
Corporation Engineer		402	2333767
Health Officer		452	9496434485
Health Supervisor		421	
Town Planning Officer		415	2311270
Waste Garbage Section		403	
Standing Committees			
Chairman Financial Standing Committee		437	2598072
Chairman Development Standing Committee		409	2300252
Chairman Welfare Standing Committee		461	2450094
Chairman Health & Educational Standing Committee		432	2495729
Chairman Standing Committee		445	2340806

Chairman Town Planning Standing Committee	**424**	**2307750**
Garage		**2473832**
Main Office Garage	**460**	**2336014**

Corporation Zonal Offices		
Zonal Offices	**Phone Number**	**Wards**
Fort	**04712472937**	**Sreevaraham, Manacaud, Fort, Chala, Ambalathara, Attukal, Kuriathi, Kalippankulam, Kamaleswaram, Kaladi, Poonthura, Puthenpalli, Manikyavilakom, Beemapalli, Beemapalli East, Muttathara, Valiyathura, Vallakkadavu**
Attipra	**04712418350**	**Pallithura, Kulathoor, Attipra, Poundkadavu**
Ulloor	**04712442070**	**Cheruvaikal, Akkulam, Edavakkod, Mannanthala, Nalanchira, Ulloor**
Kadakampalli	**04712741897**	**Anamukham, Karikkakom, Kadakampalli**
Thiruvallam	**04712382786**	**Thiruvallam, Punchakari, Poonkulam, Vellar**
Nemom	**04712391703**	**Estate, Pappanamcode, Nemom, Ponnumangalam, Melamcode**
Vizhinjam	**04712480226**	**Venganoor, Mulloor, Kottapuram, Vizhinjam, Harbar**
Kazhakuttom	**04712418252**	**Kazhakuttom, Chanthavila, Kaattayikonam**
Sreekariam	**04712598393**	**Chellamangalam, Chempazhanthy, Powdikonam, Njandoorkonam, Sreekaryam**
Kudappanakkunnu	**04712733311**	**Kinavoor, Kudappanakunnu, Pathirappally, Chettivilakam**
Vattiyoorkavu	**04712360134**	**Thuruthummoola, Nettayam, Kachani, Vazhottukonam, Kodunganoor**

Hospitals	
Name	**Phone/fax/Email**
Medical College	**2444270**
General Hospital	**2307874**
Ophthalmic Hospital	**2304046**
S P Fort Hospital	**2450540,2451659**
Regional Cancer Centre, Medical College	**2442541**
Sree Ramakrishna Ashram Charitable Hospital, Sasthamangalam	**2722125**
Cosmopolitan Hospital	**2448182,2449188**
PRS Hospital, Killipalam	**2344443,2345358**
Sree Chitirathirunal MD Centre, Medical College	**2443152,2446433**
SUT Hospital, Pattom	**2446220,2444304**
Women's and Children's Hospital, Thycaud	**2323442**
GG Hospital	**2557744,2448463**
Mental Hospital	**2433868**
Super Speciality Dental Hospital, Medical College, TVM	**2441890, 2556566**
Kerala Institute of Medical Sciences (KIMS)	**2447676 ,2446535**
Ananthapuri Hospital, Near Terminal (2), Chacka, NH Bypass Service Road,	**0471 257 9900**
Lords Hospital, Anayara P.O, Chackai,	**0471 304 5111**
Vasan Eye Care, pattom	**0471 398 9000**
Chaithanya Eye Hospital, Kesavadasapuram	**0471 244 7183**
SK Hospital Edappazhinji, Pangode,	**0471 302 2222**
TSC Hospital, Bypass Rd, Kulathoor,	**0471 241 2128**
Jubilee Memorial Hospital Meads Lane, Palayam,	**0471 233 4561**
Punarjani Hospital AKG Nagar Rd, Peroorkada	**0471 6454466, 2539901, 2539903**

Aster Medcity Information Center 3 & 14, 1st Floor, Kailas Plaza, Pattom,	**081119 98083**
Sree Uthram Thirunal Royal Hospital Hospital Rd, Pongumoodu,	**0471 417 7777**
Precise Eye Care Hospital PMG Junction TTC Junction Road,	**0471 276 6666**
Vasan Dental Care Pattom Medical College Road	**0471 440 0900**
Al Arif Hospital Ambalathara, Thiruvananthapuram,	**0471 238 0917**
A J Hospital kazhakootam	**0471 241 8452**
SAT Hospital Medical College Campus	**0471 252 8302**
ARUMANA HOSPITAL VKK Nagar, Perunthanni,	**0471 246 7374**
ESI Hospital Peroorkada, Thiruvananthapuram	**0471 243 3075**
NIMS Aralumoodu, Neyyattinkara,	**0471 222 6513**
Sree Gokulam Medical College Venjaramoodu P.O., Trivandrum,	**203-284-2818**
Saraswathy Hospital NH47, Kurumkutty, Parassala,	**0471 220 2598**
Kalyan Hospital	**0471 246 0076**
Meditrina Hospital, Pattom,	**0471 306 3000**
GOVT FORT HOSPITAL	**0471 2471766**
General Hospital Neyyatinkara	**0471-2221935**
Mental Health Center, Peroorkada	**0471-2434762**
Speciality (TB) Pulayanarkotta	**0471-2442041**
Specialaity(W&C H) W&C Thyucaud	**0471-2323457**
District TB Centre	**0471-2471544**
Government Ayurvvedic Maternity Hospital,	**0471-2350938**
District Hospital Peroorkada	**0471-2432071**
TH Nemom	**0471-2390276**
CHC Iranimuttom	**0471-2455620**
CHC Palode	**0472-2840561**
CHC Poonthura	**0471-2380427**

CHC Kallara SCP	**0472-2860857**
CHC Vakkom	**0470-2653882**
CHC Poovar	**0471-2210017**
CHC Manamboor	**0470-2688354**
CHC Perumkadavila	**0471-2276169**
CHC Vellanadu	**0472-2882199**
CHC Kattakada	**0471-2293828**
CHC Vizhinjam	**0471-2480400**
CHC Vilappil	**0471-2289185**
PHC Valiyathura	**0471-2502480**
PHC Vattiyoorkavu	**0471-2914181**
PHC Pozhiyoor	**0471-2213345**
PHC Thiruvallom	**0471-2380007**
PHC Palace dispensary Kowdiar	**0471-2433758**
PHC Karamana	**0471-2244749**
PHC Chettivilakam	**0471-2730404**
PHC Kadakampally	**0471-2559392**
MCH Unit (PHC) Pangappara	**0471-2418038**

Kerala State Disaster Management Authority	**0471-2331345**
State Emergency Operation Centre	0471-2364424
District Disaster Management authority	0471-
Control Room District Collectorate	0471-2730067, 2730045
Deputy Collector, DM	8547610015
Institute of Land and Disaster Management	0471-2365559
Taluk Office, Fort	0471-2462006

GOVERNMENT DEPARTMENTS	
Agriculture Department	**04712304481**
Animal Husbandry Department	**04712302283**
Armed Police Battalion	**04712338144**
Ayurveda	**04712322620**
Chemical Examiner's Lab	**04712461568**
Civil Supplies	**04712321152**
Collectorate Office	**04712462361**
District Collectorate	**04712462471**
Collectorate Taluk Office, Fort/Thahasildar	**04712462006**
Directorate Of Health Services	**04712302490**
Directorate Of Mining & Geology	**04712447184**
Directorate Of Ports	**04712724533**
Drugs Control	**04712471896**
E S I	**04712323960**
Forensic Laboratory	**04712721533**
Government Analysis Laboratory	**04712472192**
Government Press	**04712331458**
Ground Water Department	**04712553039**
K S I D C	**04712330613**
Kerala Hi-tech Industries Limited	**04712501325**
Kerala Live Stock Development Board Limited	**04712440920**
Medical Council	**04712443227**
National Highway Wing	**04712326147**
Legislative Assembly Complex	**04712512524**

Pharmacy Council Directorate	**04712470951**
Raj Bhavan	**04712721100**
State Motor Vehicles & Transport	**04712474866**
State Pollution Control Board	**04712318150**
State Sports & Youth Affairs	**04712327271**

Other Institutions

24 Hours Working Medical Stores, Community Pharmacy Services, Medical College	**0471-2443850**
In House Drug Bank, S A T Hospital	**0471-2528343**
District Collector Thiruvananthapuram	**0471-2462471**
District Superintendent Of Police Thiruvananthapuram	**0471-2478524**

Auditorium

Auditorium	Phone Numbers
Senate Hall	**0471-2305971**
Tagore Theatre	**0471-2329656**
V J T Hall	**0471-2477441**
Ananthapuri Auditorium	**0471-2322534**
Bank Employees Union Hall	**0471-2460569**
Bishop Pereira Hall	**0471-2327872**
Co-Bank Towers	**0471-2317081**
Hassan Marikkar Hall	**0471-2306823**
Institute Of Engineers Hall	**0471-2322991**
Karthika Thirunal Hall	**0471-2471335**
Kesari Memorial Hall	**0471-2471909**
Madhavanthampi Hall	**0471-2441661**

YMCA	**04712330059**
YWCA	**0471-2463690**
Trivandrum Club	**0471-2726444**
Sreemoolam Club	**04712722980**
Trivandrum Hotel	**04712331142**
Theerdhapadamandapam	**04712477011**
Attukal Shopping Complex	**0471-2461859**
Attukal Karthika Kallyanamandapam	**0471-2463130**
University Students Centre	**0471-2302923**
Alakapuri Auditorium	**0471-2725457**
Aravind Auditorium	**0471-2447085**
AKG Memorial Hall	**0471-2305731**
BTR Hall	**20471331449**
Rajadhani Auditorium, East Fort	**0471-2473353**
Kilimanoor Townhall Kilimanoor	**0470-2672060**
LMV Auditorium	**0471-2422333**

Ambulance Services

Institution	Phone
Attukal Bhagavathi Temple Trust	0471- 2456456
Ayyappaseva Sangham	0471- 2451296
City Corporation	0471- 2473832
Corporation of Trivandrum	0471- 2320821, 2336014
Frat	0471- 2474745
Intensive Care on Wheels	0471- 2556611
K J Ambulance Service, Pettah	0471- 24686662
Malankara Central Council	0471- 2310193

Sevabharathi	0471- 2448593
Siva Sena	0471- 2460100
Vincent De Paul Society	0471- 2542588
Yesoram Ambulance Service, Medical College	0471- 2558006
Cosmo Hospital	0471- 2448182
Dhanwanthary Center	0471- 2550531, 2554409
KIMS	0471- 2448585
P R S Hospital	0471- 2344443
Sree Ramakrishna Hospital	0471- 2722125
S U T	0471- 2446220

Blood Banks

Institution	Phone
Medical College	0471- 2528230
Sree Chithra	0471- 2524606
S U T	0471- 2446220
Dr. Rao's	0471- 2443740
KIMS	0471- 2447575
Premier	0471- 2443740
St. Jude, Killippalam	0471- 2345514
Superior, Statue	0471- 2331156
Superior Blood Bank	4712331156
Rao's Blood Bank	4712443740
Santhwana Hospital - Blood Bank	0471 2432121, 0471 2435490
General Hospital	0471 2307874, 0471 2304827
PRS Hospital	0471 2344443
Regional Cancer Centre (RCC)	0471 2522256/ 0471-2442541
Sreechithra	4712524606

Mobile Mortuary	
Apsara Medical Center	0471- 2444382
Jayaram Mobile Mortury Service	0471- 2553015
K J Ambulance	0471- 2468662
Kerala Ambulance	0471- 3950399
Royal Mobile Mortury	0471- 2442946
Sreeram Ambulance Service	0471- 2443923
St. George Mobile Mortury	0471- 2554281
Yesoram Mobile Mortury	0471- 2558006

Village Office

Thycaud	**8547610107**
Sasthamangalam	8547610115
Vattiyurkkavu	8547610109
Kowdiar	8547610116
Peroorkkada	8547610110
Kudappanakunnu	8547610111
Pattom	8547610112
Ulloor	8547610125
Cheruvaikkal	8547610128
Attipra	8547610129
Kadakampally	8547610102
Pettah	8547610103
vanchiyur	8547610106
muttathara	8547610104
manacaud	8547610105
Thiruvallom	8547610114
nemom	8547610113
Tirumala	8547610108

List of Fire Stations

Divisional Officer -0471- 2571354 (O)

Sl. No	Location of Fire Station	Officer-in– charge	Telephone
1	Trivandrum	Station Officer	0471-2333101, 101
2	Chacka	Station Officer	0471-2501255
3	Vizhinjam	Station Officer	0471-2480300, 2482101
4	Neyyattinkara	Station Officer	0471-2222307, 2222101
5	Attingal	Station Officer	0470-2622000
6	Varkala	Station Officer	0470-2607700
7	Kazhakoottam	Station officer	0471-2700099
8	Vithura	Station Officer	0472-2857101
9	Poovar	Station Officer	0471-2210101
10	Parassala	Station Officer	0471-2201717, 2202536
11	Kattakkada	Station Officer	0471-2280101
12	Nedumangadu	Station Officer	0472-2812101

Strength of Personnel

Sl. No.	Fire Station	Station officer	Asst. Station officer	Leading Fireman	Driver mechanic	Fireman Driver	Fireman
1	Trivandrum	4	3	10	2	30	68
2	Chacka	1	1	9	1	14	39
3	Vizhinjam	1	1	4	1	9	24
4	Neyyattinkara	1	1	4	1	9	24
5	Attingal	1	1	4	1	7	24
6	Varkala	1	1	4	1	7	24
7	Kazhakoottam	1	1	2	1	3	12
8	Vithura	1	1	4	1	7	24
9	Poovar	1	1	4	1	7	24
10	Parassala	1	1	4	1	7	24
11	Kattakkada	1	1	3	1	5	18
12	Nedumangadu	1	1	4	1	5	12

List of Appliances

Sl. No.	Fire Station	No. Of water tender	Crash tender	Emergency tender with spl rescue equipments	Water lorry	Ambulance	Jeep	Trailer pump	Portable pump	Recovery vehicle	Industrial water tender
1	Trivandrum	6	nil	1	1	1	1	1	1	1	nil
2	Chacka	2	1	nil	nil	1	nil	nil	nil	nil	nil
3	Vizhinjam	2	nil	nil	1	nil	1	nil	1	nil	nil
4	Neyyattinkara	2	nil	nil	1	nil	1	nil	1	nil	nil
5	Attingal	2	nil	nil	nil	1	1	nil	1	nil	nil
6	Varkala	2	nil	nil	1	1	nil	nil	2	nil	nil
7	Kazhakoottam	1	nil	nil	nil	nil	nil	nil	2	nil	nil
8	Vithura	2	nil	nil	nil	1	1	nil	nil	nil	nil
9	Poovar	1	nil	nil	nil	nil	1	nil	2	nil	nil
10	Parassala	1	nil	nil	nil	1	1	nil	1	nil	nil
11	Kattakkada	2	nil	nil	nil	1	nil	nil	1	nil	nil
12	Nedumangadu	2	nil	nil	1	1	1	nil	1	nil	nil

IMPORTANT TELEPHONE NUMBERS

Sl.No	Name	Telephone number	
		Office	**Residence**
1	District Collector	0471-2731177	2318746
2	Additional Disrict Magistrate	0471-2731188	
3	Superintendent of Police	9497996985	2741545
4	Inspector of Factories & Boilers	2471458	
5	Controller of Explosives,Kochi	(0484)2427286	
6	District Fire Officer	2322354,2320872	
7	District Information Officer	0471-2731300	9496003215
8	Disrict Medical Officer	0471-2473257	
9	Executive Engineer,KWA(distribution)	0471 236 0790	
10	Dy. Chief engineer,KSEB,TVM	0471 251 4424	
11	GM(Telephones)	**04712570000**	
12	Regional Transport Officer	**0471-2333336**	**8281786097**
13	Suptd. MCH		
14	GM.Dist. Industries		
15	BPCL,Kazhakuttom	04712705202	
18	Hindustan Latex Limited,Peroorkada		
19	Travancore Titanium Limited		
20	IOC Airport,Trivandrum		
21	BPCL-Airport, Trivandrum		

Police station

Designation	Office	VPN	Mob
District Police Chief [DIG]	**2320579**	**10100**	
	2320579	**10100**	**9497996988**
DCP L/O & Traffic	**2321676**	**10101**	**9497996987**
DCP Admn. & Crimes	**2322682**	**10102**	
DCP & CSO, Sree Padmanabha			**9497981198**
Swami Temple, TVPM	**2570200**		
City Police Office	**2320486**	**10103**	**9497965267**
Sr. Administrative Assistant	**2320486**	**10103**	**9497965286**
Senior Superintendent	**2320486**	**10103**	

Manager	**2320486**	**10103**	**9497965313**
AO	**2320486**	**10103**	**9497990001**
AC Special Branch	**2321399**	**10104**	**9497990000**
AC DCRB	**2324033**		**9497990002**
AC Narcotic Cell	**2337800**		**9497990003**
AC Crime Dett.	**2337800**		**9497975998**
Cyber Cell	**2329107**	**10108**	
Crime Stopper	**2329107**	**10108**	**9497990232**
Commandant AR Camp	**2320746**	**10109**	**9497990248**
AC ADJ	**2320746**	**10109**	
AR Camp - 1	**2321146**	**10110**	
AR Camp - 2	**2320746**	**10111**	**9496102573**
Mounted Police [RSI]			**9446324478**
Dog Squad [ASI]			**9497990004**
AC Control Room	**2331403**		
Duty Officer	**2331843**	**10112**	**9497987004**
Control Room CI-1	**2331843**	**10112**	**9497987003**
Control Room CI-2	**2331843**	**10112**	
Police Control Room	**2335410, 2336410, 2337410**		
Police Canteen	**2321186**		**9497990005**
AC Traffic [South]	**2558724**	**10114**	**9497990006**
AC Traffic [North]	**2558721**	**10115**	**9497987002**
CI Traffic [South]	**2558726**	**10116**	**9497987001**
CI Traffic [North]	**2558734**	**10117**	**9497987014**

BASEMAP

THIRUVANANTHAPURAM CORPORATION

Legend

- Important Place
- Major Road
- Railway
- Waterbody
- Ward Boundary
- Corporation Boundary

Scale

1 cm = 580 meters

870 435 0 870 1,740 2,610 Mts.

TITLE:-

Basemap

PROJECT:-

Rajiv Awas Yojana (RAY)
Preparation of Georeferenced City Map-
Thiruvananthapuram Corporation

CLIENT:-

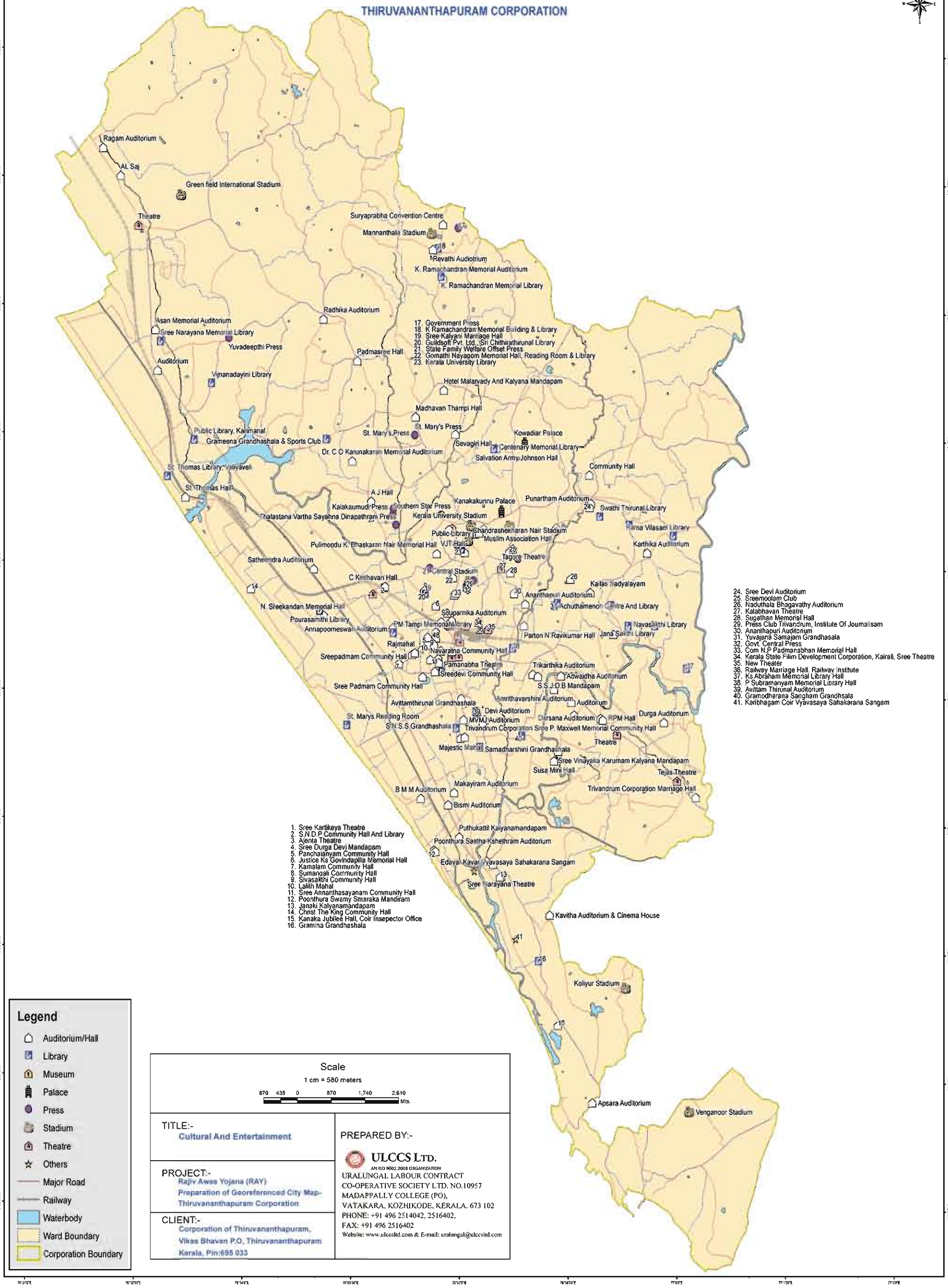
Corporation of Thiruvananthapuram,
Vikas Bhavan P.O, Thiruvananthapuram
Kerala, Pin:695 033

PREPARED BY:-

ULCCS LTD.
AN ISO 9001:2008 ORGANIZATION
URALUNGAL LABOUR CONTRACT
CO-OPERATIVE SOCIETY LTD. NO.10957
MADAPPALLY COLLEGE (PO),
VATAKARA, KOZHIKODE, KERALA. 673 102
PHONE: +91 496 2514042, 2516402,
FAX: +91 496 2516402
Website: www.ulccsltd.com & E-mail: uralungal@ulccsltd.com

CULTURAL AND ENTERTAINMENT

THIRUVANANTHAPURAM CORPORATION



Legend

- Auditorium/Hall
- Library
- Museum
- Palace
- Press
- Stadium
- Theatre
- Others
- Major Road
- Railway
- Waterbody
- Ward Boundary
- Corporation Boundary

Scale

1 cm = 580 meters

870 435 0 870 1,740 2,610 Mts.

TITLE:-
Cultural And Entertainment

PROJECT:-
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Preparation of Georeferenced City Map-
Thiruvananthapuram Corporation

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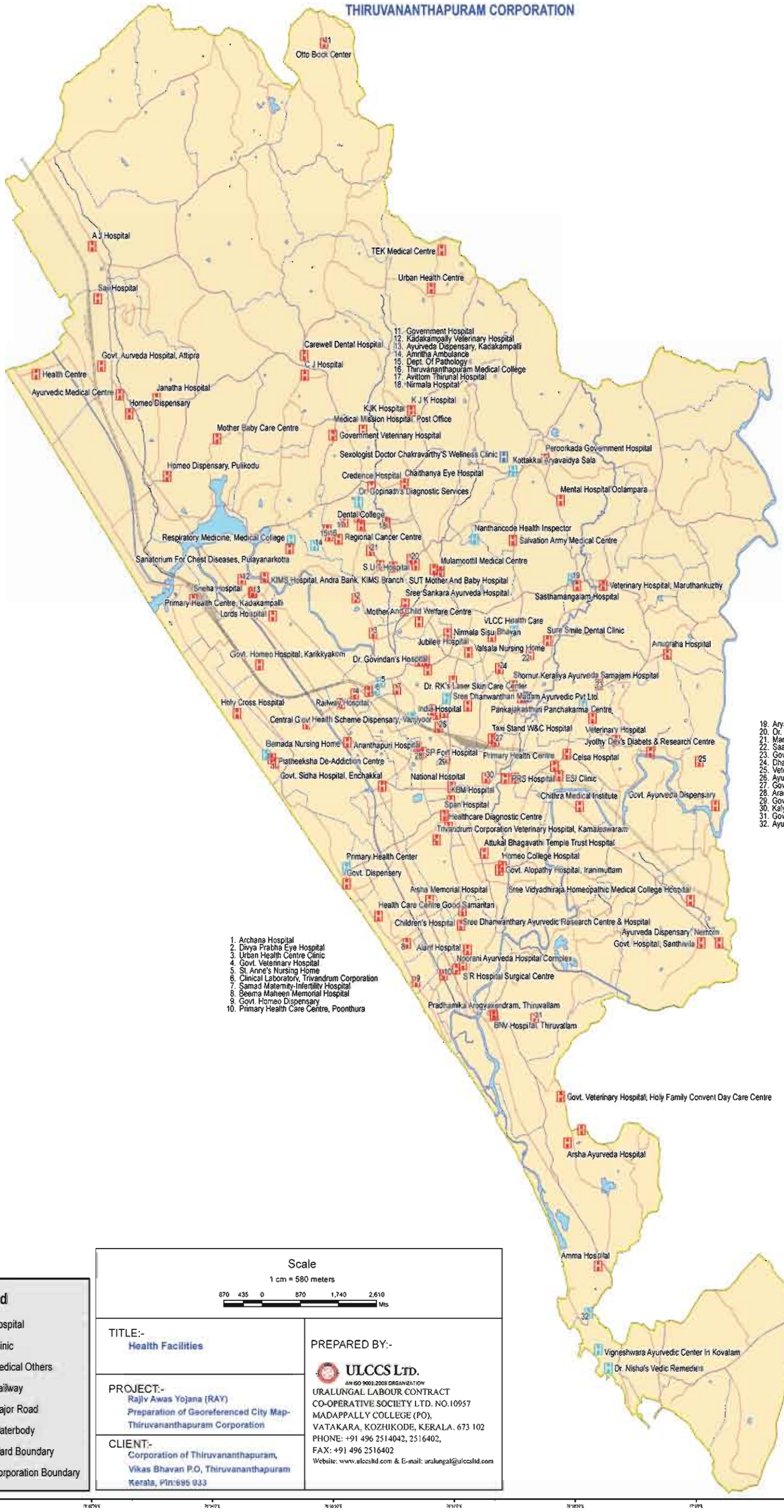
HEALTH FACILITIES

THIRUVANANTHAPURAM CORPORATION



Legend

- Hospital
- Clinic
- Medical Others
- Railway
- Major Road
- Waterbody
- Ward Boundary
- Corporation Boundary

Scale

1 cm = 580 meters

870 435 0 870 1,740 2,610 Mts

TITLE:-
Health Facilities

PROJECT:-
Rajiv Awas Yojana (RAY)
Preparation of Georeferenced City Map-
Thiruvananthapuram Corporation

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Corporation of Thiruvananthapuram,
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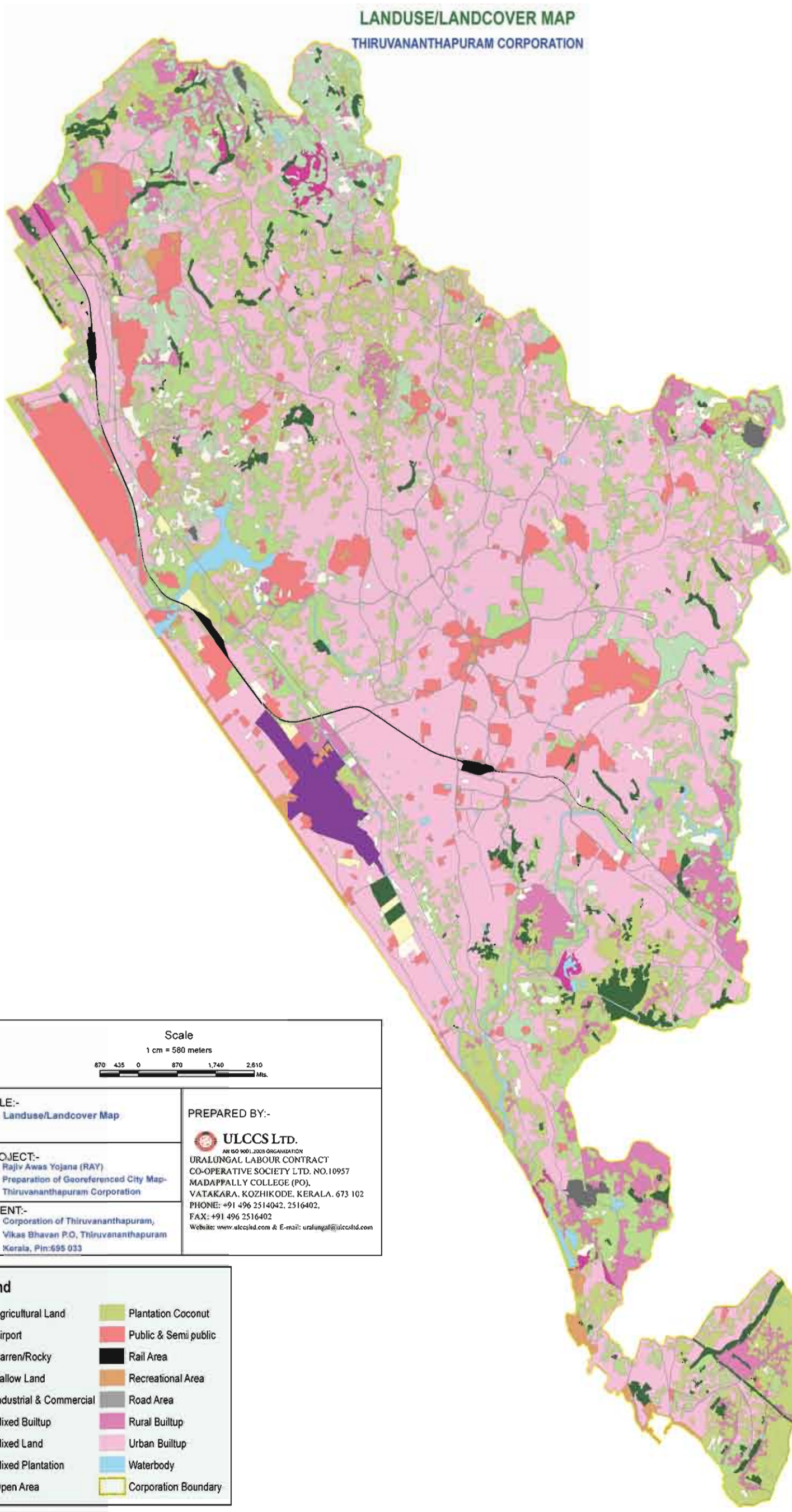
LANDUSE/LANDCOVER MAP

THIRUVANANTHAPURAM CORPORATION



Scale

1 cm = 580 meters

870 435 0 870 1,740 2,610 Mts.

TITLE:-
Landuse/Landcover Map

PROJECT:-
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Preparation of Georeferenced City Map-
Thiruvananthapuram Corporation

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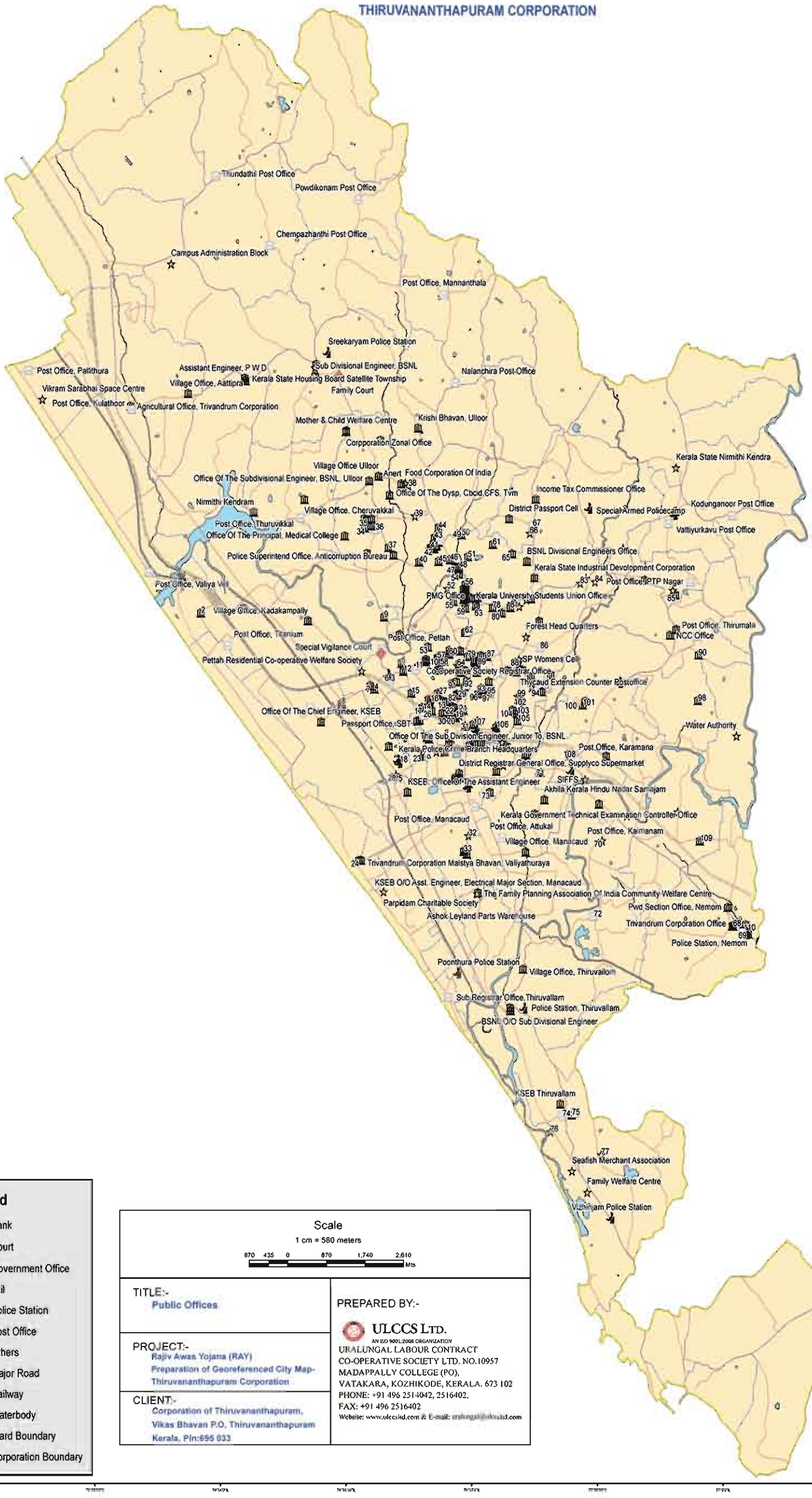
Legend

- Agricultural Land
- Airport
- Barren/Rocky
- Fallow Land
- Industrial & Commercial
- Mixed Builtup
- Mixed Land
- Mixed Plantation
- Open Area
- Plantation Coconut
- Public & Semi public
- Rail Area
- Recreational Area
- Road Area
- Rural Builtup
- Urban Builtup
- Waterbody
- Corporation Boundary

PUBLIC OFFICES

THIRUVANANTHAPURAM CORPORATION



Legend

- Bank
- Court
- Government Office
- Jail
- Police Station
- Post Office
- Others
- Major Road
- Railway
- Waterbody
- Ward Boundary
- Corporation Boundary

Scale

1 cm = 580 meters

870 435 0 870 1,740 2,610 Mts

TITLE:-
Public Offices

PROJECT:-
Rajiv Awas Yojana (RAY)
Preparation of Georeferenced City Map-
Thiruvananthapuram Corporation

CLIENT:-
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Website: www.ulccsltd.com & E-mail: [illegible]

PUBLIC SERVICES & OTHERS

THIRUVANANTHAPURAM CORPORATION

1. SMV Lodge
2. Veli Youth Hostel
3. Artech Realtors Pvt. Ltd.
4. Oriental Bank Of Commerce
5. Sree Chitra Institute Quarters
6. Canara Bank
7. Medical College Men's Hostel 3
8. Hotel Libra
9. Punjoyd Labor Quarters
10. Ramya Lodge
11. Krishna Vegeterian Hotel
12. Hotel Al Madeena
13. SSN Lodge
14. District Co-Operative Bank
15. Nisa Home
16. University Staff Quarters
17. Don Bosco Orphanage
18. Dr. Ambedkar Memorial Residential School Quarters
19. CET Staff Quarters
20. CET Men's Hostel A Block
21. Post Graduate Ladies Hostel
22. Office Of The Assistant Engineer, Pwd Electrical Wing
23. Prasanthi Apartments
24. Loyola Ladies Hostel
25. Mary Nilayam Womens Hostel
26. Punjab National Bank
27. Pratibha Bhavan Louis Catholic Hostel
28. Yanipaveedam Apartments
29. Nair Union Society Hostel
30. Anjaneya Apartments
31. Nikunjam Heritage
32. Dream Land Apartment
33. Sulabh Comfort Station
34. Railway Quarters
35. EMS Housing Board Flats
36. Agastya Apartments
37. Law College Mens Hostel
38. South Indian Bank Limited
39. Canara Bank
40. State Bank Of Travancore
41. Amba Inn
42. Coaxial Staff Quarters
43. Trivandrum City Service Sahakarana Bank
44. Trivandrum Co-Operative Urban Bank
45. O.L.G Service Centre
46. BSNL
47. Punjab National Bank
48. Sai Airport Hotel
49. SBT, Airport
50. Trivandrum District Co-operative Bank
51. Touchstone Manor Apartments
52. Trivandrum Corporation Secretaries Quarters
53. Central Exercise Quarters
54. Drinage Office
55. Vignesh Plaza Apartments
56. Trivandrum Corporation Ladies Hostel
57. Bhima, Syndicate Bank (Elankath Complex)
58. Gemini Tourist Home
59. ICICI Bank
60. Corporation Rest House
61. Canara Bank
62. IDBI Bank Atm
63. Mar Aprem Hostel
64. State Bank Of Hyderabad
65. State Bank Of Travancore
66. Rail Mail Service
67. Vijay Tourist Home
68. Central Bank Of India
69. Karnataka Bank
70. ICICI Bank
71. Indian Overseas Bank
72. Hotel Highland Park
73. Hotel Highland
74. SBT, East Fort
75. Canara Bank
76. Trivandrum Corporation Flat
77. JM Avanue Appartments
78. Golden Turtles Beach Resorts
79. Hotel Sree Visakh Tourist Home
80. GH Family Club Homestays Kovalam
81. Uday Samudra Leisure Beach Hotel
82. Kadaloram Beach Resort
83. Basellos Staff Hostel
84. Jayamatha Orphanage
85. Jayamatha Boys Hostel
86. Catholic Syrian Bank
87. Anugraha Apartments
88. Ivanios Staff Hostel
89. State Bank Of Travancore
90. Palm Drive Apartments
91. SBT, KSEB Adm Complex Branch
92. State Bank Of India
93. Swagath Resorts
94. Neelakanta Beach Resort
95. Oliva Ayurvedic Beach Resort
96. Sagara Beach Resort
97. Trivandrum Co-Operative Agricultural And Rural Development Bank
98. Police Quarters
99. Aashiyana Ladies Hostel
100. KG Lodge
101. Service Co-Operative Bank
102. Anjali Apartments
103. Karamana Co-operative Bank
104. Indian Overseas Bank, Killippalam Branch
105. Meena Thai Oldage Home Ananda Madam
106. Country Spa Wellness Beach Resort
107. Udaya Samudhra Resort
108. Swagath Holiday Resort
109. Hotel Kadaltheeram Beach Resort
110. Chalet Hotel & Resorts
111. Hotel Blue Sea
112. Hotel Rock 'N' Beach
113. Green Palm Resorts
114. Hill & Sea View Ayurvedic Beach Resort
115. Thapovan Heritage Home
116. Vayalkara Seaside Ayurvedic Resorts
117. State Bank Of Travancore
118. Mudavanmugal Service Co-Operative Bank, Thrikkannapuram
119. Govt. Ayurveda College, Mens Hostel, Poojappura
120. Government Guest House
121. Hotel Grand
122. Hotel Residency Tower
123. Institute Of Co-Operative Management And Kerala State Co-Operative Bank
124. Sai Womens Hostel
125. Federal Bank Ltd
126. Hotel Olivia
127. Union Bank Of India, Ministry Of Indian Affairs
128. SBT Holiday Inn
129. Jas Hotel Private Limited
130. Hotel Teekay Palace
131. BSNL
132. Hotel Thampuru
133. State Bank Of Travancore ATM
134. Dreamz Hotel
135. Subash Institute Of Banking Studies (SIBS)
136. IDBI Bank
137. Hotel JINS International
138. Vikas Bhavan Police Family Quarters
139. Federal Bank
140. Trivandrum District Co-operative Bank, Kunnukuzhi Branch
141. Syndicate Bank
142. SBT, University Branch
143. SI Apartment
144. Hotel Oasis
145. Anita Joseph's Beauty Care Solutions
146. Gaan Apartments
147. Indian Overseas Bank
148. Indian Overseas Bank
149. L F Bethany Hostel
150. Hotel Magic Days
151. Panavila Hoster For Employed Women (Phew)-Trivandrum
152. Artech Realtors
153. State Bank Of Travancore
154. Central Bank Of India
155. Hotel Windsor Rajadhani
156. Indian Bank
157. Indian Overseas Bank
158. SBI, Treasury Branch
159. State Bank Of Travancore
160. The Dhanalekshmi Bank
161. Cliff Dale Apartments
162. S.B.I. Jawahar Nagar
163. Thiruvananthapuram Urban Co-Operative Bank
164. Thiruvananthapuram Service Co-Operative Bank
165. State Bank Of Travancore
166. Fast Gate Apartments
167. Canara Bank
168. Dream Land Apartments
169. Bank Of India PTP Nagar
170. IIM Women's Hostel
171. BSNL Office
172. Catholic Syrian Bank
173. Thiruvananthapuram Service Co-Operative Bank
174. SBT, Valiyavila

Legend

- ATM
- Bank
- Flat
- Guest House
- Hostel
- Hotel/ Lodge
- Others
- Press
- Resort/ Tourist Home
- Major Road
- Railway
- Waterbody
- Ward Boundary
- Corporation Boundary

Scale

1 cm = 580 meters

870 435 0 870 1,740 2,610 Mts.

TITLE:-
Public Services & Others

PROJECT:-
Rajiv Awas Yojana (RAY)
Preparation of Georeferenced City Map-
Thiruvananthapuram Corporation

CLIENT:-
Corporation of Thiruvananthapuram,
Vikas Bhavan P.O, Thiruvananthapuram
Kerala, Pin:695 033

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RELIGIOUS CENTERS

THIRUVANANTHAPURAM CORPORATION

1. PMG Church
2. Ambalathinkara Juma Masjid
3. Manvila Muslim Jumaath
4. St. Mary's Magdaleena Chruch
5. Sree Krishna Swami Temple
6. Thaikkappalli
7. Balasubramanya Temple
8. St. Thomas Agnus Chruch, Pallithura
9. Melath Bhagavathy Temple
10. MSC Church, Vimalapuram
11. Thripaadapuram Sree Krishna Temple
12. Malor Thripaapur Sri Mahadeva Temple
13. Ulakudaya Perumal Thampuran Temple
14. St. Joseph Church
15. Chembakathinmudu Yogiswasra Temple
16. CSI Church, Kattela
17. Alappurath Ayiravathy Sree Bhadrakali Temple
18. Sree Krishna Vilasom Shiva Kshethram
19. Pullukkad Christian Church
20. Elampulingal Dharma Sastha Temple
21. Velankanni Matha Church
22. Sree Chamundeshwari Temple
23. Bethestha Church, Near KIMS Hospital
24. Kunnathode Madan Temple
25. St. Thomas Church, Valiyaveli
26. Nambikkal Sree Krishna Swamy Temple
27. St. Francis Convent
28. Veyloorkonnam Bhagavathy Temple
29. Varambasseril Sree Bhagavathy Temple
30. Church Of God Prayer Centre
31. Gowreesa Pattom Sri Mahadeva Temple
32. CSI Chruch
33. St. Xavier Church
34. Church Of God (Full Gospel) In India
35. Namaskarapalli, Prasanth Nagar
36. Vanadurga Devi Temple
37. City Revival Church, Bezek Mission Hall
38. St. Thomas Orthodox Church
39. Kankkakom Sri Chamundi Temple
40. St. Thomas Orthodox Syrian Church
41. Masjid Ul Rahma
42. Trivandrum Islamic Mission Trust
43. Thekkathil Sree Chamundeswari Temple
44. Trinity Marthoma Church
45. Christ The King Golden Memorial Parochial House
46. Costal Gospel Mission Prayer Hall
47. Parasseri Kavu
48. St. Sebastian Church
49. Fathima Matha Church
50. St. Joseph Chappel
51. Sree Mahaganapathi Temple
52. Sree Kallamman Devi Temple
53. Vanchivoor Sree Athiyaramadam Devi Temple
54. Minor Kammath Sree Mahaganapathi Temple
55. St. Thomas Marthoma Syrian Church
56. Sree Mutharamman Temple
57. Pettah Siva Temple
58. Kanjiravilakom Devi Temple
59. Sree Uchani Mahakali Amman Temple
60. Kerala Jamath Federation Office & Masjid
61. Bhajanapura Palace
62. Mahaganapathi Temple
63. Panayil Devi Temple
64. Sree Ayyappa Temple, Thampanoor
65. Sree Nagaraja Temple
66. Vallakkadavu Muslim Jamath
67. Ayyappa Temple
68. Pazhavangadi Temple
69. Pentacostal Church
70. St. Antony's Church
71. CSI Church Vallathura
72. Panammodu Bhagavathy Temple
73. Irumkulangara Durga Devi Kshethram
74. The Penthacoastal Mission Fort View Nagar, Valiyathura
75. Thuryil Sree Annapoornaswari Temple
76. Sree Mahaganapathi Temple
77. Sree Amman Temple
78. Sakthi Ganapathi Temple
79. Dikeer Palli
80. Jawahar Masjid
81. Aryasala Devi Temple
82. Chenthitta Devi Temple
83. Bhadrakali Temple, Chalai
84. Sree Rajarajeswari Temple
85. Nithya Sahaya Matha Church
86. Mosque, Thampanoor
87. Cherithitta Esakkiamman Temple
88. Melamgode Bhagavathi Temple
89. Aryasala Isakiamman Temple
90. Durga Temple
91. Thycavu Palli
92. Sree Muppalathadi Tampuran Temple
93. Smasana Madan Temple
94. Sree Muthariamman Temple
95. Uthram Auditorium - Kariyam Devi Temple
96. Sreekaryam Juma Masjid
97. Bishop's House
98. St. Joseph's Church
99. Jasmin Lila Memorial CSI Church
100. Mary Nilayam Convent
101. Ulloor Subramanya Swami Temple
102. Neerazhi Temple
103. Elankavil SHri Bhagavathi Temple
104. India Pentecostal Assembly
105. St. Antony's Seminary
106. SH Convent
107. Sree Balasubrahmanya Temple
108. Kizhakke Marappalam Temple
109. SFS Pattom Square
110. SFS Mayfair
111. The Penthecosth Mission
112. South Kerala Session Of Seventh Day Adventistis
113. Varuvila Sri Nagaraja Temple
114. Areathe Devi Temple
115. CSI Thaliyal
116. Kanthalloor Srimahadeva Temple
117. Charanath Sree Indilayappan Kovil
118. Sree Lekshmi Naravana Temple
119. Sree Ugramoorthy Mahavishnu Temple
120. Neduvanam Nagaramma Temple
121. Mannadi Sri Bhagavathi Mahadevar Temple
122. Kottayil Bhagavathy Temple
123. Kunnumpuram Thekkathil Srichamundeswari Temple
124. Anjuthamburan Temple
125. Cherupazhanji Devi Temple
126. Kollappazhanji Elangam Devi Temple
127. Sree Mutharamman Temple
128. Sree Narayana Temple
129. Nagakanyaka Devi Temple
130. Attupuram Thampuran Temple
131. Malankara Catholic Church
132. CSI Church, Koliyur
133. Sree Mahadeva Temple
134. St. Jude Church
135. Karamana Mosque
136. Mahadeva Temple
137. Siva Temple
138. Thaikkavu Palli
139. Sree Krishna Swami Temple, Trikkannapuram
140. Pattarathe Sri Durga Temple
141. Thykka Palli
142. Mangala Vinayaka Temple
143. Kanchipuram Madam Temple
144. Karamana Jumma Masjid
145. St. Thomas Evangelical Church
146. Nandancode Bhadrakali Temple
147. Sasthamangalam Mahadeva Temple
148. Sree Krishna Temple
149. Sastha Temple, Kanjiram Para
150. SFS Church
151. Yogeswara Swami Temple
152. Keshavapuram Sri Krishna Swami Temple
153. Arappura Eswariamman Devi Temple
154. St. Paul's Mar Thoma Church
155. Udiyannur Devi Temple
156. Ganapathi Temple, Arappura
157. Vyki, Art Of Living Ashramam
158. CSI Church, PTP Nagar
159. Sree Mahaganapathy Sevasramam
160. Mannadi Bhagavathy Temple
161. Madathuvilakathu Madan Kovil
162. Velankanni Matha Church
163. Ponnarathala Sri Bhadra Kali Temple
164. Kusakkodu Mahadeva Temple
165. Vattavila Juma Ath Mosque
166. Kundaman Kadavu Devi Temple
167. Kallara Madam Sri Bhagavathy Temple
168. 7th Day Advantist Church
169. Mayur Vilakam Devi Temple
170. Arayallur Devi Temple
171. Jeasus Calls Prayer Tower
172. Lurdes Ferano Church
173. St. Pius Tenth Knanaya Catholic Church
174. Hanuman Swami Temple
175. Kingdom Hall Of Jehovah's Witnesses
176. Palayam Muslim Juma Masjid
177. St. Peters Church
178. Madathuvilakam Sree Bhadrakali Temple
179. Nadutheta Bhagavathy Temple
180. Sree Nalanu Kavu Temple, Pulappura
181. Sree Balasubramannya Temple
182. Chenkallur Mahadeva Temple
183. PTC Masjid
184. Madan Kovil
185. Catholic Church, Thycaud
186. Sree Vigneswara Temple, Tampannoor
187. Sree Karakandeswara Siva Temple
188. Kanchipuram Sri Bhadra Bhagavathi Temple
189. Kovilkadavu Nagar Temple
190. Sree Chandanamariamman Temple
191. Annur Bhagavathy Temple
192. Wills Memorial Church
193. Sree Adipara Sakthi Temple
194. Swayampurnashrama Temple
195. Sree Kandan Sastha Temple
196. Melamkodu Bhagavathy Temple
197. Aramada C S I Church
198. Bethel Church Of God
199. India Pentecostal Divyasabha
200. Kunnil Melamkodu Temple
201. Erathu Thamburan Temple
202. Church Of God
203. Punavan Moola CSI Church
204. Sree Bhagavathi Temple
205. Madathingal Sri Bhagavathy Temple
206. CSI Church Pappanamcode
207. St. Antony's Church
208. Salafi Masjid

Temple, Church, 9th Century Cave Temple, Mosque, The Holy Apostolic Catholic Assyrian Church Of The East, Trivandrum , India, Kabaradi Muslim Juma Masjid, Sree Mahadeva Temple, Karyavattom University Mosque, Christ The King Church, Sree Narayana Guru Temple, Madan Kovil, CSI Church Kazhakoottam, St. Joseph Church, Ganapathi Temple, Kazhakuttom, Bethel Marthoma Church, Ardha Nareeswara Temple, Fathima Matha Church, Medavathukkal Muslim Jama Ath, St. Christopher's Church, Attinkuzhi Devi Temple, Mar Baselios Mar Gregorios Orthodox Syrian Church, Ranigiri Church, Kezhkunnam Amma Sastha Temple, Anandavalleswaram Devi Temple, CSI Church Kudappanakunnu, Secret Heart Convent, Jayamatha Seminari, Ilamkulam Mahadeva Tmple, Kushamuttam Bhagavathy Temple, St. Mary's Church, St. Mary's Syrian Orthodox Church, St. Jude Church, Kolothukara Siva Kshethram, Kariprathala Sree Bhagavathi Temple, Shiva Temple, Thurithipally Sree Dharma SHastha Temple, Tahampuran Kshethram, St. Mary's Church & Dm Convent, Kuzhivila Devi Temple, Ebenezer Marthoma Church And Parsonage, Ulloor Sri Mutharamman Temple, Muttada CSI Church, Arappura Devi Temple, Juma Masjid, Karavummoola Thampuran Kshethram, Kunnuvila Bhagavathi Temple, Perrorkada Sree Krishna Swami Temple, Kanjirottu Puthen Palli, CSI Church, Akkulam, C S I Church, St. Antony's Church, Malankara Church, South Kerala Central Church, Brethren Church, Valiyaveli, Kunjuveedu Devi Temple, Salvation Army Church, Dharmasastha Temple, Kunjuveedu Thampuran Temple, Sacred Heart Church, Erode Appoppan Temple, Assemblies of God Church, Anayara, ST. Pauls Church, Manthramoorthy Temple, Venpalavattom Sree Bhagavathy Temple, Sree Durga Bhagavathi Temple, Matha Bhuvaneswary Temple, Sree Chathanpara Yogishwaran Temple, Mateer Memorial Church, Kollaperuvam Sree Devi Temple, Madhavapuram Jumamasjid, St. Mary's Malankara Cathalic Church, Vadakke Mullor Durga Bhagavathi Temple, Palayam Mahaganapathi Temple, Muthumariyamman Kovil, Aarumala Appupan Temple, Ganapathy Temple, Panokkakudi Sree Chamundi Temple, Jagathy Sree Krishna Swamy Temple, Salaphi Centre, Arappura Vilakom Sree Bhagavathy Temple, Mutharamman Kovil, Appupan Kovil, Sree Chamundeshwari Temple, St. Antony's Church, Karari Siva Parvathy Temple, Sree Durga Devi Temple, St. John CSI Church, St. Anee's Church, Vallkadavu Muslim Jamath, Sree Varaham Temple, Sree Chakrathil Siva Temple, Niramankara Sree Mahadeva Temple, Thaliyal Sree Mahadevi Temple, Manacaud Valiyapally Jumamasjid, Pattuvilakam Sree Yoghiswara Swamy Devi Kshethram, Kamaleswaram Sree Mahadeva Kshethram, Chevelie Church, Pattarathu Chamundeswari Temple, Manarul Huda Trust, Enippikkal Bhagavathi Temple, Noorulhuda Jumamasjid, Masjidul Juma Masjid, Juma Masjid, Assumption Church, Sree Ujjain Mahakali Devi Temple, Sree Muthariyamman Devi Temple, Athar Palli Mosque, Kardiyode Vishnavi Devi Temple, Sree Mahaganapathi Temple, Thaikkavu Palli, Ambalathara Sivakshethram, Ambalathara Sree Puthukkad Devi Kshethram, Sree Thakkala Swamy Samathu Shiva Kshethram, Poonthura Devi Kshethram, Sree Padayarakam Devi Kshethram, Sree Bala Dharmasastha Temple, SH Church Thiruvallam, Pachallur Juma Masjid, Fathima Church, Chamundeswari Kshethram, Panathura Sree Subramanniya Swamy Kshethram, Danul Uloom Masjid, Panathura Masjid, Panavilakom Devi Kshethram, Thuppanathkavu Temple, Nedumam Masjid, Kovalam Juma Masjid

Legend

- Church
- Temple
- Mosque
- Others
- Major Road
- Waterbody
- Railway
- Ward Boundary
- Corporation Boundary

Scale

1 cm = 580 meters

870 435 0 870 1,740 2,610 Mts.

TITLE:-
Religious Centers

PROJECT:-
Rajiv Awas Yojana (RAY)
Preparation of Georeferenced City Map-
Thiruvananthapuram Corporation

CLIENT:-
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Kerala, Pin:695 033

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Website: www.ulccsltd.com & E-mail: uralungal@ulccsltd.com

ROAD MAP

THIRUVANANTHAPURAM CORPORATION

Legend

- Important Place
- Major Road
- Other Road
- Railway
- Ward Boundary
- Corporation Boundary

Scale

1 cm = 580 meters

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TITLE:-
Road Map

PROJECT:-
Rajiv Awas Yojana (RAY)
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SLUM MAP

THIRUVANANTHAPURAM CORPORATION

1. Kazhakkoottam
2. Chanthavila
3. Kattayikonam
4. Sreekariam
5. Cheruvaikkal
6. Ulloor
7. Edavacode
8. Chellamangalam
9. Chempazhanthy
10. Powdikonam
11. Njandoorkonam
12. Kinavoor
13. Mannanthala
14. Nalanchira
15. Kesavadasapuram
16. Medical College
17. Kavaloorkonam
18. Muttada
19. Kudappanakkunnu
20. Pathirapally
21. Chettivilakom
22. Sasthamangalam
23. Kowdiar
24. Kuravankonam
25. Nanthancode
26. Poochedivila
27. Lenin Nagar
28. Idappazhanji
29. Vazhuthacaud
30. Kanjirampara
31. Peroorkada
32. Thiruthummoola
33. Nettayam
34. Kachani
35. Vazhottukonam
36. Vattiyoorkavu
37. Pangode
38. PTP Nagar
39. Pangode
40. Thirumala
41. Valiyavila
42. Poojapura
44. Jagathy
45. Karamana
46. Aranoor
47. Mudavanmughal
48. Thrikkannapuram
49. Nemom
50. Ponnumangalam
51. Punnakkamughal
52. Pappanamcode
53. Estate
54. Kunnumpara
55. Kalady
56. Melamcode
57. Punchakkari
58. Poonkulam
59. Venganoor
60. Muliloor
62. Vizhinjam
63. Harbour
64. Vellar
65. Thiruvallam
66. Manikyavilakom
67. Ambalathara
68. Kamaleswaram
69. Sanghumugham
70. Attukal
71. Chalai
73. Kuriyathy
74. Puthenpalli
75. Manikyavilakom
76. Kannammoola
77. Beema Palli
78. Muttathara
79. Sree Varaham
80. Fort
82. Vanchiyoor
83. Sreekaryam
84. Peruthanni
85. Palkulangara
86. Chackai
87. Valiyathura
89. Vayyamoola Thivilakom
90. Vettukadu
91. Kankkakom
92. Kadakampally
93. Pettah
94. Kannammoola
95. Anamukham
96. Akkulam
97. Kulathur
98. Attipra
99. Poundkadavu
100. Pallithura

Ambedkar Nagar Laksham Veedu
Keerikuzhy Colony
Ayyankali Nagar Colony
Ambalathinkara Harijan Colony
Randamchira Colony
Plakkottu Potta Cheri
Sneha Cheri
Chevoorkonam Cheri
Thalikkadu Cheri
Vazhinjaku Cheri
Pulliyil Colony
Vayalarikathu Colony
Kodunganoor Laksham Veedu
Vinayaka Nagar (Goods Guard Colony)
Plamoodu Bund Colony
Thykootum
Valkalam Rose Puradiyam
Vighneswara Nagar
Balanagar
Sabariyar Colony
Pandaravilakathu Colony
Manali Colony (Punjabi House)
ITI Puthuval Colony
Thengappura Line Colony
Rajaji Nagar From Thoppupally to Housing board
Parampazhinikulam
Bhajanamadom
Vazhavila
Charuvila Poojappura
Vayyamoola Thivilakom
Karimadom colony
Poonthoppu Colony
Puthenpalam
Chithra Nagar
Kattachal
Padasseri Chirakkuzhi
Padasseri
MSK Nagar
PD Nagar Bangladesh Colony
Ganga Nagar
Kezhambil Kadavu
Vazhavilakom
Aaryan Kuzhi
Thoppuvilakom
Kottayil Cheri
Chirappalam
Idagramam
Palaarakonam Colony
Aazhangal Narippil Chanal Kara
Koliyakkode Chery
Thulavila Cheri
Kudathara Vilakom
Mahatma Road Colony
Paruthikuzhi
Pallitheruvu Cheri
Pulimuttikkadavu
Settlement Colony
Mannu Vilakam
Vattavila
Studio Road
Sadam Nagar
Azad Nagar
Panthukalam
Veedanthara Colony
Menilam-Chemmannu Vila
Aaya mangalam
Punjakkari Junction
Kalladichan Moola
Studio Melathil
Maithri Nagar
Aira Parakkal Colony
Pachalloor Vattom
Nedumpara
Vellam Ninna Vila
Poonkulam
Kaithavila
Kannankodu Kannankodu
EMS Colony
Karayadivila
Chennaivilakom
Township
Kaniramvila
Laksham Veedu
Pallithura
Thulavila
Manjvar Nagar
Vazha Vilakam
Kannikkara Vilak

1. Tagore Garden Cheri
2. Marappalam Thopu Cheri
3. Plamoodu Bund Colony
4. Karali Attuvarambu Colony
5. Punnakkathoppu Boatpura
6. Pandit Colony
7. Keezhikonam
8. Kunnumpuram Pandara Vilakom
9. Chempaka Nagar
10. Pound Kulam
11. Veppinmuttu Fisherman Colony
12. Ukkachivila Cheri
13. Kunathy Rottikada Colony
14. Naduvilakom
15. Kuzhivilakom
16. Puthuval Purayidam
17. Alukadu
18. SLThomas Colony
19. IDP Colony
20. Pallikadavu Cheriyamuttam
21. Panangattuvila
22. Kallampotta
23. Kalady South
24. Nilama Kalladi Mugham
25. Muttalakuzhi
26. Muttalakuzhi Laksham Veedu
27. Kuzhivila Pappamchani
28. Paravila Fisherman Colony
29. Vadakkeplavarathala
30. Keezhur colony
31. Poonkulam Charuvila
32. Thanni Ninna Vila
33. Cherumanal Kappachal
34. Neelankantah Colony
35. Mathipuram-Thazhe Veetu Vilakom
36. Kottapuram Colony
37. Ossavila Charuvila
38. Kadakkulam - Kanimballykara colony
39. Kadakkulam Vayalinkara
40. Nellikkathattu Pinar Vilakom
41. Kuzhipallam colony
42. Vallayam Ninna Vila Thundevila

Scale

1 cm = 580 meters

870 435 0 870 1,740 2,610 Mts.

Legend

- Major Road
- Railway
- Slum Boundary
- Ward Boundary
- Corporation Boundary

TITLE:-
Slum Map

PROJECT:-
Rajiv Awas Yojana (RAY)
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TRANSPORT FACILITIES

THIRUVANANTHAPURAM CORPORATION

Panimoola Bus Stop
Ariyottukonam Bus Stop
Ayiroopara Bus Stop
Andoorkonam Bus Stop
Narikkallu Bus Stop
Vattakarikkakom Junction Bus Stop
Ashramam Junction Bus Stop
Cherikottukonam Bus Stop
Vettu Road Junction Bus Stop
Anandeswaram Bus Stop
Kunshadi Junction Bus Stop
Aniyoor Bus Stop
Powdikonam Society Junction Bus Stop
Chempazhanthy Bus Stop
Kazhakuttam Taxi Stand
Kazhakkoottam Market Bus Stop
Karyavttom Bus Stop
Substation Bus Stop
Pangappara Palam Bus Stop
Kazhakuttom Railway Station
Venchavode Bus Stop
Technopark Bus Stop
Pangappara Bus Stop
Mankuzhi Bus Stop
Attinkuzhi Junction Bus Stop
Chavadimukku Bus Stop
Chekkalamukku Sreekaryam Bus Stop
Nehru Junction Bus Stop
Sreekariam Bus Stop
Auto Stand. Sreekaryam
Pallithura Bus Station
Mukkolakal Junction Bus Stop
Kallampally Bus Stop
Engineering College Junction Bus Stop
Kulathoor Bus Stop
Manvila Bus Stop
Pongummood Bus Stop
1. Techexpress Bhavani Bus Stop
2. Kesevadasapuram Bus Stop
Infosys Jn. Auto Stand
Kattela Bus Stop
Thamburan Mukku Taxi Stand
Preman Nair Junction Bus Stop
Poundukadavu Junction Bus Stop
Veli Railway Station
Akkulam Boat Club
Medical College Bus Stop
Medical College School Bus Stop
Kumarapuram Bus Stop
Kochuveli Railway Station
3. GMGHSS Bus Stop
4. Medical College Taxi Stand
5. Pattom Bus Stop
6. Eanchakkal Bus Stop
7. Vazhapalli Bus Stop
8. Model School Bus Stop
Pattoor Bus Stop
Railway Station, Pettah
Chakka Bus Stop
KSRTC Bus Station, Thampanoor
Trivandrum International Airport
Sankumughom Bus Stop
Eanchakkal Autostand
Vallakadavu Boat Jetty
Airport Bus Stop
Ulloor Bus Stop
Prasanth Nagar Bus Stop
St. Mary's Bus Stop
Kuravankonam Bus Stop
LIC Bus Stop
RP Lane Bus Stop
Kawdiar Taxi & Auto Stand
Marappalam Bus Stop
Murinjapalam Bus Stop to East Fort
Plammood Bus Stop
Vellayambalam Towards SHasthamangalam Bus Stop
Vikas Bhavan K.S.R.T.C Bus Stand
Kizhakkethil Junction Bus Stop
Lords Hospital Junction Bus Stop
Anayara Bus Stop
Vazhuthacaud Bus Stop
Statue Bus Stop
Women's College Bus Stop
DPI Junction Bus Stop
Southern Railway Reservation Office
Trivandrum Central Railway Station Second Terminal
Lorry Stand, Chenmitta
East Fort Bus Stop
KSRTC Bus Stand
Private Taxi Stand
KSRTC, Trivandrum
Attukal Bus Stop
Medamukku Bus Stop
Valiyathura Bus Stop
Iranimuttom Bus Stop
Kalady Bus Stop
KSRTC Centrtal Works
Old Karakkamandapam Bus Stop
Elamthengu Junction Bus Stop
Karumom Junction Bus Stop
Nemom Bus Stop
Nemom Junction
S M Lock Bus Stop
Milma Junction Bus Stop
Thiruvallam School Junction Bus Stop
Thiruvallam Bus Stop
Studio Junction Bus Stop
Studio Next Bus Stop
Pachalloor Bus Stop
Kovalam Junction Bus Stop
Mukkola Bus Stop
KSRTC Vizhinjam Bus Depot
Keraladithyapuram Junction
Paruthippara Bus Stop
Perurkada Bus Stop
Peroorkada K.S.R.T.C. Bus Depot
Melethumele Bus Stop
Oolanpara Junction Bus Stop
Kanjirampara Bus Stop
Thozhuvancode Bus Stop
Palathara Bus Stop
Mukkola Bus Stop
Mananthala Bus Stop
Civil Station Bus Stop
Panchayath Office Bus Stop
Kottamughal Bus Stop
Kunissadi Bus Stop
Vazhayila Junction Bus Stop
Christ Nagar Bus Stop
Joseph Lane Bus Stop
Onnanpara Bus Stop
Mukkola Yamuna Nagar Bus Stop
Malamukal Bus Stop
Kalink Junction Bus Stop
Nettayam Junction
Moonnamoodu Bus Stop
CPT Bus Stop
Vayalikada Bus Stop
Mannarakonam Bus Stop
Vazhottukonam Bus Stop
Perurkada Bus Stop
Kerala Taxi
Thozhuvancode Bus Stop
PTP Nagar Last Bus Stop
PTP Nagar Bus Stop
Elippodu Junction
Bakery First Bus Stop
MH Bus Stop
Thirumala Junction Bus Stop
Thirumala Pallimukku Auto Stand
Vijayan Mohini Mills Auto Stand
Mangattukadavu Bus Stop
SBT Poojappura Bus Stop
Aana Edavazhi Bus Stop
Kunnapuzha School Bus Stop
Mudavanmugal Bus Stop
Trikkannapuram Bus Stop
Kaimanam TVS Junction Bus Stop
Neeramankara Bus Stop
Industrial Estate Bus Stop
Estate Bus Stop

1. Kulasekharam Bus Stop
2. Kadavil Mudambu Bus Stop
3. Kunshadi Junction Bus Stop
4. Kodunganoor Bus Stop
5. Vattiyoorkavu Junction Bus Stop
6. Thirumala Junction
7. Pallimukku Bus Stop
8. Chengallor Bus Stop
9. Commissioner Office Bus Stop
10. Poojappura Bus Stop
11. Kunnapuzha Junction
12. Aramada Church Bus Stop
13. Pappanamcode Bus Stop
14. Pappancode KSRTC Station
15. Karakkamandapam Bus Stop

9. Azangal Bus Stop
10. Chiramukku Bus Stop
11. Chekkittuvilakam Junction Bus Stop
12. Kuthukalinmoodu Junction Bus Stop
13. Kamaleswaram Bus Stop
14. Kovalam Bus Depot

Legend

- Airport
- Auto/Taxi Stand
- Bus Stand
- Bus Stop
- Junction
- Railway Station
- Others
- Railway
- Major Road
- Waterbody
- Ward Boundary
- Corporation Boundary

Scale

1 cm = 580 meters

870 435 0 870 1,740 2,610 Mts.

TITLE:-
Transport Facilities

PROJECT:-
Rajiv Awas Yojana (RAY)
Preparation of Georeferenced City Map-
Thiruvananthapuram Corporation

CLIENT:-
Corporation of Thiruvananthapuram,
Vikas Bhavan P.O, Thiruvananthapuram
Kerala, Pin:695 033

PREPARED BY:-

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