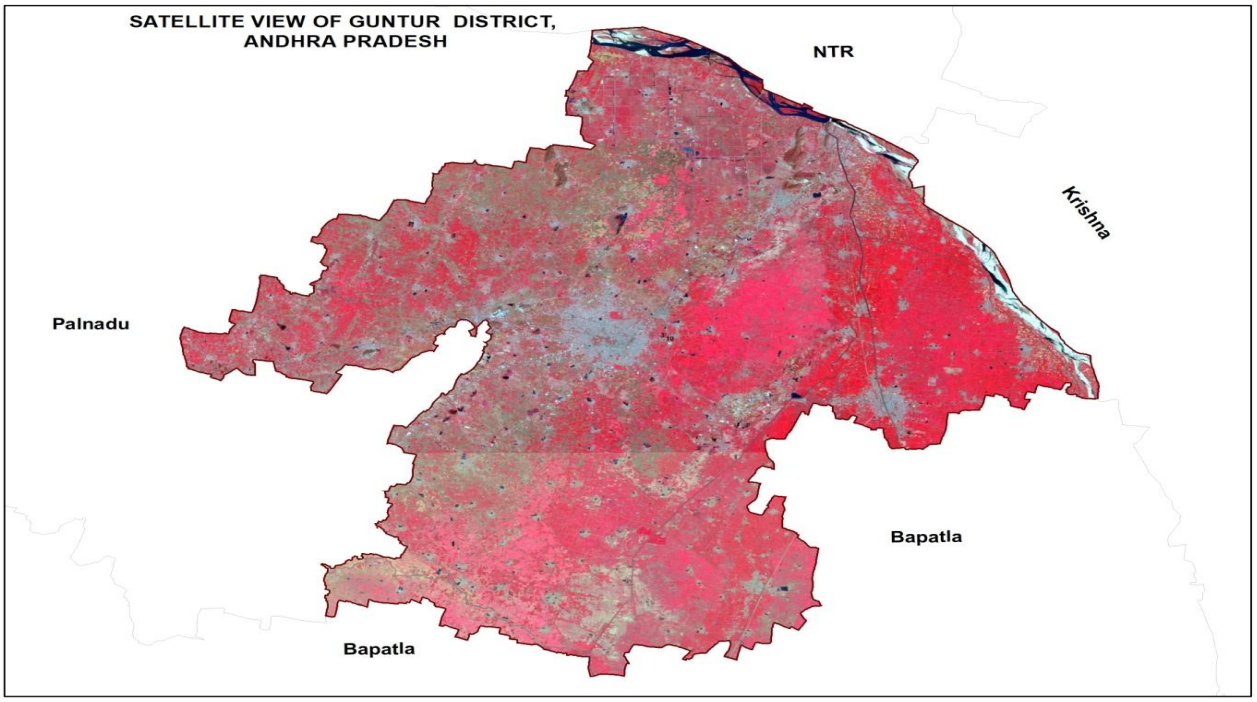
# DISTRICT SURVEY REPORT
# FOR
# SAND AND OTHER MINOR MINERALS
# GUNTUR DISTRICT, ANDHRA PRADESH

(FOR THE DEPARTMENT OF MINES AND GEOLOGY, GOVT. OF AP)

**As per Notification No. S.O. 141 (E), 15.01.2016, S.O. 3611(E), 25.07.2018, & Enforcement & Monitoring Guidelines for Sand Mining 2020 of MOEF & CC, GoI**




**Prepared by**

**ANDHRA PRADESH SPACE APPLICATIONS CENTRE (APSAC)**
**ITE and C Department, Govt. of Andhra Pradesh**

**Submitted to**

**DEPARTMENT OF MINES AND GEOLOGY**
**Government of Andhra Pradesh**

**December 2023**

# Andhra Pradesh Space Applications Centre
# Document Control Sheet

| | | | | |
|---|---|---|---|---|
| 1 | Security Classification | Unrestricted | | |
| 2 | Distribution | User Department of the Directorate of Mines and Geology for official use only | | |
| 3 | Report / Document version | (a) Issue no.1<br>(b) Issue no.2 | (b) Revision and Date | 21-07-2023<br>02-12-2023 |
| 4 | Report / Document Type | Technical Document | | |
| 5 | Document Control Number | APSAC-DMG-2023 | | |
| 6 | Title | District Survey Report – Guntur District 2023 | | |
| 7 | Particulars of collation | Pages –107 | Tables - 31 | Figures-30 |
| 8 | Project Co-ordinators | Sri. A. Nageswara Rao, Director (Technical), Sri.VVRM Narayana Rao, Director (Admin)and Dr.T.Vani, Scientist-SC | | |
| 9 | Scrutiny Mechanism | Enclosed (PTO) | | |
| 10 | Technical Reviewed by | Sri. A. Nageswara Rao, Director(Technical), Sri.Dr.Govindu, Senior Consultant, APSAC | | |
| 11 | Final Review | Sri.C. Chandrasekhar Reddy, Advisor, APSAC, ITE and C Dept. GoAP | | |
| 12 | Affiliation of authors | Andhra Pradesh Space Applications Centre, ITE and C Department, Govt. of Andhra Pradesh | | |
| 13 | Approved by : | Dr. Sundar Balakrishna, IFS<br>Vice Chairman, APSAC<br>ITE and C Department, Govt. of Andhra Pradesh | | |
| 14 | Originating unit | Andhra Pradesh Space Applications Centre (APSAC), ITE and C Department, Govt. of Andhra Pradesh | | |
| 15 | Sponsor(s) / Name and Address | Department of Mines and Geology (DMG), Govt. of AP | | |
| 16 | Date of Initiation | July 2023 | | |
| 17 | Date of Publication | December 2023 | | |

# Report Scrutiny Mechanism

<table>
<tr><th>S.No.</th><th>Name of the Chapter</th><th>Maps Prepared/ Data Generated by (Senior Project Associate/Project Associate)</th><th>Draft Report Prepared by</th><th>Quality Checked by</th><th>Signature</th></tr>
<tr><td>1</td><td rowspan="5">Chapter-I</td><td rowspan="5">Sri. D.Krishna<br>Smt.N.Vijayasanthi<br>Smt. M.Vanajakshi<br>Sri. N.Venkaiah<br>Smt. D. Jnaneswari<br>Sri.R.Kanaka Durgaiah,<br>Smt. V.Sujatha<br>Sri. G.Suresh Babu<br>Sri. B. Ramanarasimha Rao<br>Dr.K.Raghuveer Naidu<br>Smt.M.Madavi<br>Technical Support:<br>Smt. M.Vanajakshi,<br>Sri. M.N.Naik,<br>Sri.A.Pavan Kumar</td><td rowspan="5">Sri KLK Reddy<br>Smt. N.Prathyusha<br>Sri.Ch. Tata Babu<br>Sri. Sudheer Kumar Tiwari,<br>Sri R. Kannan<br>Sri. N.Venkaiah<br>Sri.R.Sriramamurty<br>Smt.B. Sunanda</td><td rowspan="5">Sri. G. Prasada Rao, Scientist-SF<br><br>Sri. S. Chandra Sekhar, Scientist-SC<br><br>Sri.Ch.Tata Babu, Scientist-SC<br><br>Sri R. Kannan, Scientist-SC<br><br>Sri. Sudheer Kumar Tiwari, Scientist-SC</td><td></td></tr>
<tr><td>2</td><td></td></tr>
<tr><td>3</td><td></td></tr>
<tr><td>4</td><td></td></tr>
<tr><td>5</td><td></td></tr>
<tr><td>6</td><td>Chapter-II and Chapter-III</td><td colspan="3">Sri. P Raja Babu, Joint Director, DMG<br>Dr.M.J.Ratnakanth Babu, Royalty Inspector, DMG</td><td></td></tr>
<tr><td>7</td><td>Report compiled</td><td colspan="3">Dr.T.Vani, Scientist-SC</td><td></td></tr>
<tr><td>8</td><td>Technical Reviewed by</td><td colspan="3">Sri. A. Nageswara Rao, Director(Technical),<br><br>Sri.Dr.Govindu, Senior Consultant, APSAC</td><td></td></tr>
<tr><td>9</td><td>Final Review</td><td colspan="3">Sri.C. Chandrasekhar Reddy, Advisor, APSAC</td><td></td></tr>
</table>

## PREFACE

The Natural resource inventory is the assessment of the status of a given natural resource of an area at a given point in time. Population pressure results in over- exploitation of resources. The baseline information on the resources would help the administration for better planning and decision making. The main purpose of the report is to disseminate data on the natural resource up to the lowest administrative functionary to facilitate micro level planning and development. The efforts have been made to assess and document the information on land use/land cover, crop, surface water resource, soils, slope, groundwater prospects, groundwater quality, geological information, and minerals resources in Guntur district, Andhra Pradesh, based on the satellite remote sensing data and socioeconomic information.

The Department of Mines and Geology (DMG), Government of Andhra Pradesh (AP) requested the Andhra Pradesh Space Applications Center (APSAC) to update the district survey reports with availability of sand mineral information, major and minor mineral details, and river morphology for all the districts in the State. The District Survey report emphasizes and updated the major and minor minerals in the districts of AP. The District Survey reports are updated following the "Sustainable Sand Mining guidelines" issued in 2016 and 2020 and SO 741 of 2016 of the Ministry of Environment, Forests and Climate Change provided by the DMG. The comments received from the public, if found fit, shall be incorporated in the report. A list of leases in the district will be provided by the concerned Assistant Directors of Mines and Geology.

The report is an outcome of the efforts of the Scientists and Project Associates at APSAC. I heartily congratulate the team for compiling the report.

(Dr. Sundar Balakrishna, IFS)
Vice-Chairman
APSAC

## ACKNOWLEDGEMENTS

Our sincere gratitude to **Sri Gopal Krishna Dwivedi, IAS**, **Principal Secretary,** Department of Mines and Geology, Govt. of Andhra Pradesh for whole-hearted support.

Our sincere gratitude to **Sri Kona Sasidhar, IAS**, **Secretary to Government,** Information Technology, Electronics and Communications (ITE&C), Govt. of Andhra Pradesh and the **Chairman,** APSAC Governing Body, for his constant encouragement.

We would like to express our sincere gratitude to **Dr. Sundar Balakrishna, IFS**, **Special Secretary to Government,** Information Technology, Electronics and Communications (ITE&C), Govt. of Andhra Pradesh and the **Vice-Chairman, APSAC** Govt. of Andhra Pradesh, for his meticulous guidance and supervision.

We are grateful to the **Sri. V.G. Venkata Reddy**, **Director**, Department of Mines and Geology, Govt. of Andhra Pradesh for entrusting the work for the preparation of District Survey Reports of Andhra Pradesh.

We owe a great deal to **Sri. P Raja Babu, Joint Director,** Department of Mines and Geology for his overall support and guidance during the execution of this work.

We are very much thankful to **Dr.M.J.Ratnakanth Babu, Royalty Inspector (Head Office**), Mines and Geology for his support to complete the work successfully.

We are also thankful to the **District Mines and Geology Officer,** Guntur District for their support in providing information

Our sincere thanks are due to the scientific staff of APSAC who has generated all the thematic maps for District Survey Reports.

**APSAC**

# Contents

## List of Tables

## LIST OF CONTENTS AS PER THE GAZETTE NO: 2827,Dt:25.07.2018

## List of Abbreviations

| | |
|---|---|
| APSAC | : Andhra Pradesh Space Applications Centre |
| APMMC | : Andhra Pradesh Minor Mineral Concession |
| AMSL | : Above Mean Sea Level |
| AWiFS | : Advanced Wide Field Sensor |
| APWALTA | : Andhra Pradesh State Water, Land and Trees Authority |
| APMDC | : Andhra Pradesh Mineral Development Corporation |
| Bgl | : Below ground level |
| BT Road | : Bituminous Road |
| Cl | : Chlorine |
| CC Road | : Cement concrete |
| CRZ | : Coastal Regulatory Zone |
| CPSU | : Central Public Sector Undertaking |
| CGWB | : Central Ground Water Board |
| cu.m/day | : Cubic meter per day |
| DMF | : District Mineral Fund |
| DSR | : District Survey Report |
| DMG | : Directorate of Mines and Geology |
| DM&GO | : District Mines and Geology Officer |
| DES | : Directorate of Economics and Statistics |
| DEM | : Digital Elevation Model |
| dS/m | : Decisiemens per metre |
| EIA/EMP | : Environmental Impact Assessment |
| F | : Fluorine |
| FAC | : Full Additional Charge |
| FASAL | : Forecasting Agricultural output using Space, Agro-meteorology and Land-based observations |
| Fe | : Iron |
| Ft | : feet |
| GD | : Geosciences Division |
| GIS | : Geographical Information System |
| GSI | : Geological Survey of India |
| Ha | : Hectare |
| Km | : Kilometre |
| IRS | : Indian Remote Sensing Satellite |
| ITE and C | : Information Technology Electronics and Communications |
| LISS | : Linear Imaging Self Scanning |
| LULC | : Land Use / Land Cover |
| Lps | : Litres per second |

| | |
|---|---|
| M | : meter |
| MERIT | : Mineral Exploration Research Innovation Trust Fund |
| Mi | : mile |
| mm | : millimetre |
| MT | : Million Tonne |
| MoEF | : Ministry of Environment and Forests |
| MSL | : Mean Sea Level |
| NIRD | : National Institute of Rural Development |
| NH | : National Highway |
| $NaNO_3$ | : Sodium nitrate |
| NRSA | : National Remote Sensing Agency |
| NRSC | : National Remote Sensing Centre |
| PESA | : Panchayaths Extension to Scheduled Areas |
| pH | : Power of hydrogen |
| PSD | : Performance Security Deposit |
| PSU | : Public sector Undertakings |
| R2 | : ResourceSat-2 |
| RGNDWM | : Rajiv Gandhi National Drinking Water Mission |
| RWS and S | : Rural Water Supply and Sanitation |
| SAR | : Synthetic Aperture Radar |
| SEB | : Special Enforcement Bureau |
| $SO_4$ | : Sulphate |
| Sq.Km | : Square Kilometre |
| Sq.m | : Square metre |
| TA | : Tantalum |
| TIN | :Triangular Irregular Network |
| TGA | : Total Geographical Area |
| TIS | : Tank Information System |
| TTD | : Tirumala Tirupati Devasthanams |
| WBM | : Water Bound Macadam |

# Chapter I – Introduction &General Profile

## 1.1 Administrative Setup

Guntur district is one of coastal districts of the state of Andhra Pradesh with Guntur town as its administrative headquarters. The district has about 100 km (approximately) of coastline on the right bank of the Krishna River.

Geographically, Guntur district is bounded on the south and east by Bapatla district, on the west by Palnadu district and on the north by NTR district and Krishna district. The total geographical area of the district is 2,443 sq.km. It is covered by 2 Revenue divisions namely Guntur and Tenali and comprising of 18 revenue mandals and 226 revenue villages. Ponnur & Thullur mandals have the maximum number of villages (21) and Guntur Urban mandal has the minimum number of villages (4). Out of 18 mandals, the maximum area (193.19 sq.km) is occupied by Tadikonda mandal and the minimum area is occupied by Guntur Urban mandal (43.08 sq.km).

The mandals covered in each revenue division are shown in Table - 1 and its spatial extent is shown in the Figure- 1. The satellite view of the map is also shown in Figure-2.

*Table 1 List of mandals covered in each Revenue division*

| S.No | Guntur Division | Tenali Division |
|---|---|---|
| **1** | Guntur Rural | Chebrolu |
| **2** | Guntur Urban | Duggirala |
| **3** | Medikonduru | Kakumanu |
| **4** | Pedakakani | Kollipara |
| **5** | Pedanandipadu | Mangalagiri |
| **6** | Phirangipuram | Ponnur |
| **7** | Prathipadu | Tadepalle |
| **8** | Tadikonda | Tenali |
| **9** | Thullur | |
| **10** | Vatticherukuru | |

*Data Source: APSAC, Vijayawada.*

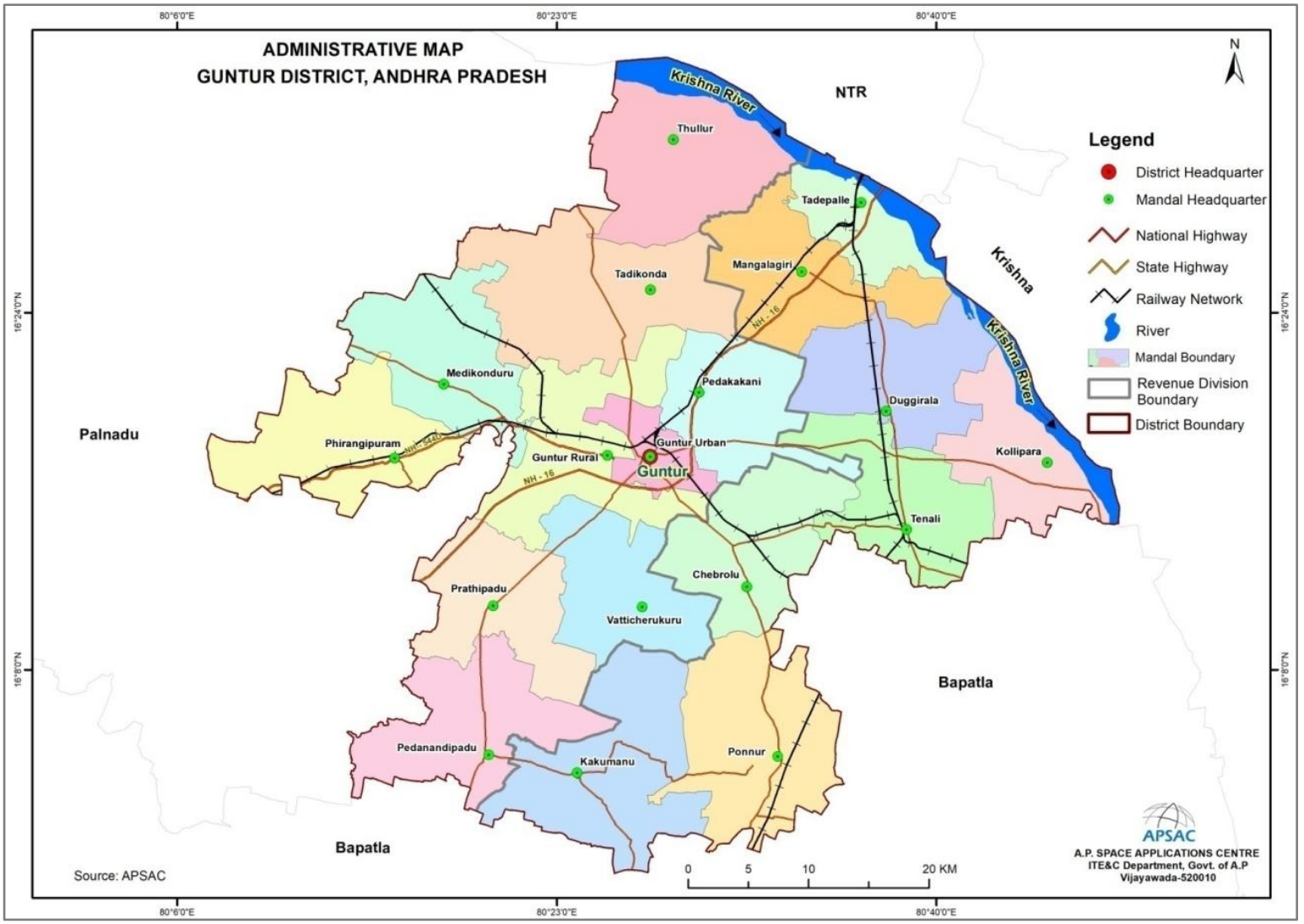



*Figure-1: Administrative Map of Guntur district, Andhra Pradesh*

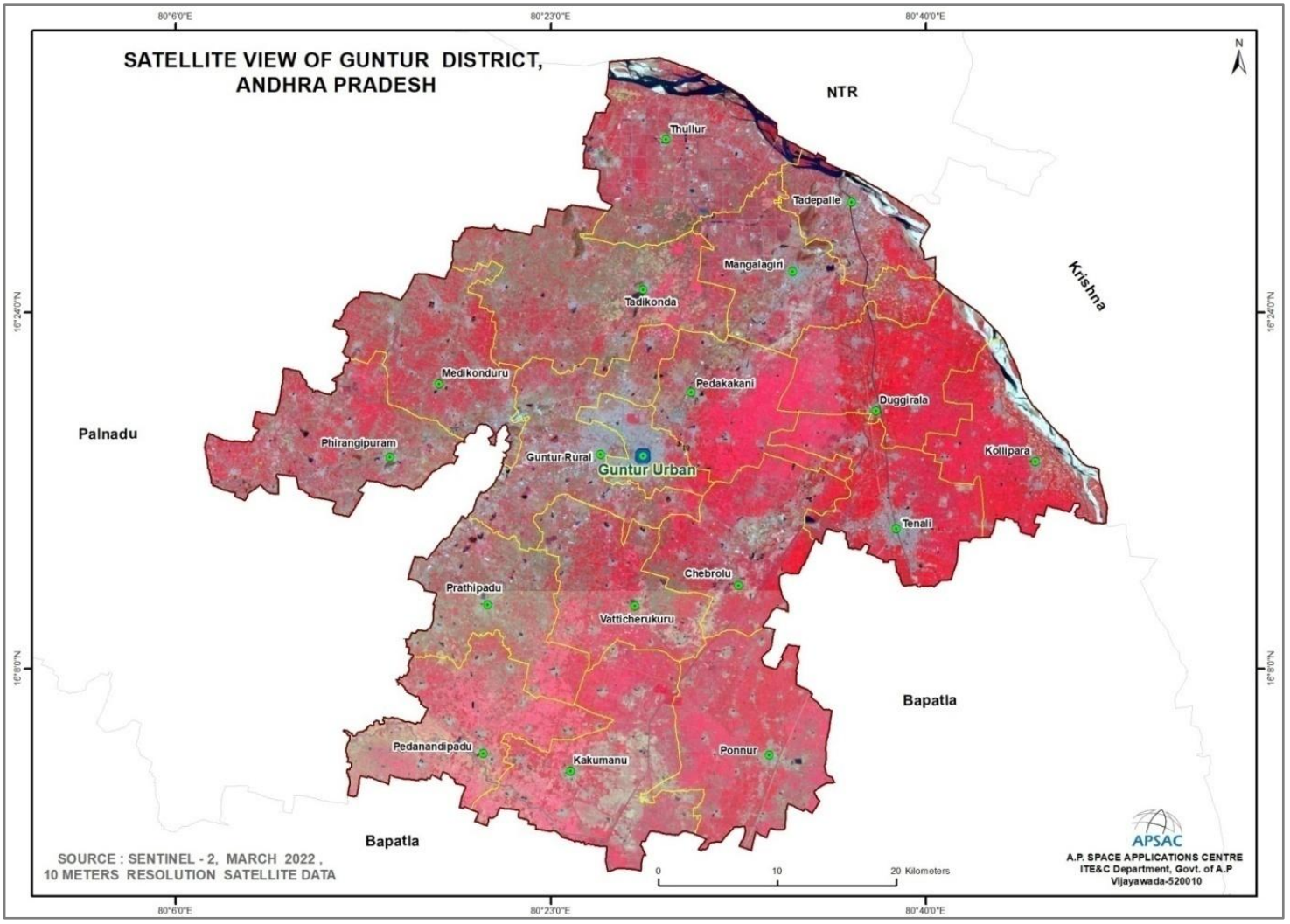



*Figure-2: Satellite View of Guntur District*

## 1.2 Physiography

### 1.2.1 Physiography

Physiographically, Guntur District is a delta region and composed of gently sloping and rolling grounds with isolated hill ranges in the northern part of the district. The prominent landform in the district is coastal plain.

### 1.2.2 Relief

As per the guidelines of the All India Soil and Land Use Planning (AIS & LUP), Soil Survey manual, the slope distribution of the district is clearly shows that the district terrain has deltaic plains (Figure-3). The slope map shows that the majority of the district land is nearly level, followed slightly by very gently sloping areas. They account for about 95% of the district's total area. Isolated hillocks are found in the north eastern parts of the district which belong to the Eastern Ghats.

### 1.2.3 Climate & Rainfall

#### 1.2.3.1. Climate:

Tropical climate conditions with extremely hot summer and cold winter prevail in the Guntur District. April to June months is hottest months and high temperature in the month of May. The climate of the district is moderate and characterized by tropical rainy climate with aggressive summer. The period from December to middle of February is generally dry and cool winter season. The summer season is from March to May. The weather averages for the month of July, temperature averages around 33.3°c and at night it feels like 25.5°c in district head Guntur. The maximum and minimum temperatures in the district are 40.5° C to 44.4° C. A and 18.3° C to 28.3° C respectively. The locations of the Automatic Weather Stations (AWS) in the Guntur District are shown in Figure-4.

#### 1.2.3.2. Rainfall:

The average annual rainfall of the district is 877.12 mm, of which 596.04 mm falls in South-West (June-September) monsoon and 196.09 mm for the North-East (October-December) monsoon. The mean minimum and maximum temperatures recorded in the district are 40.5° C to 44.4°in May, respectively. The average rainfall for the last 25 years is used for the analysis. The average annual rainfall is shown in Figure-5 and details are given in Table-2.

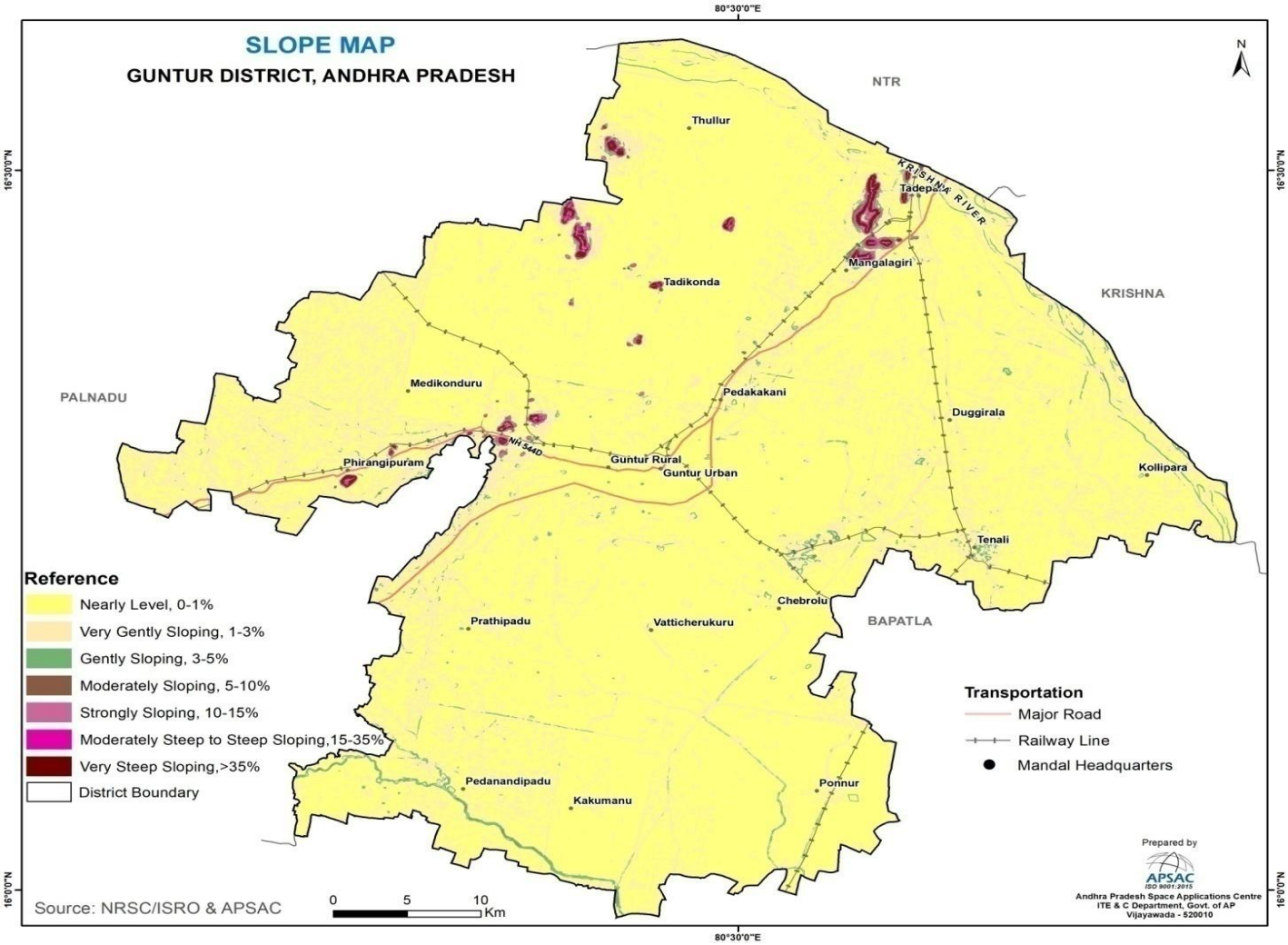



*Figure-3: Slope Map of Guntur District*

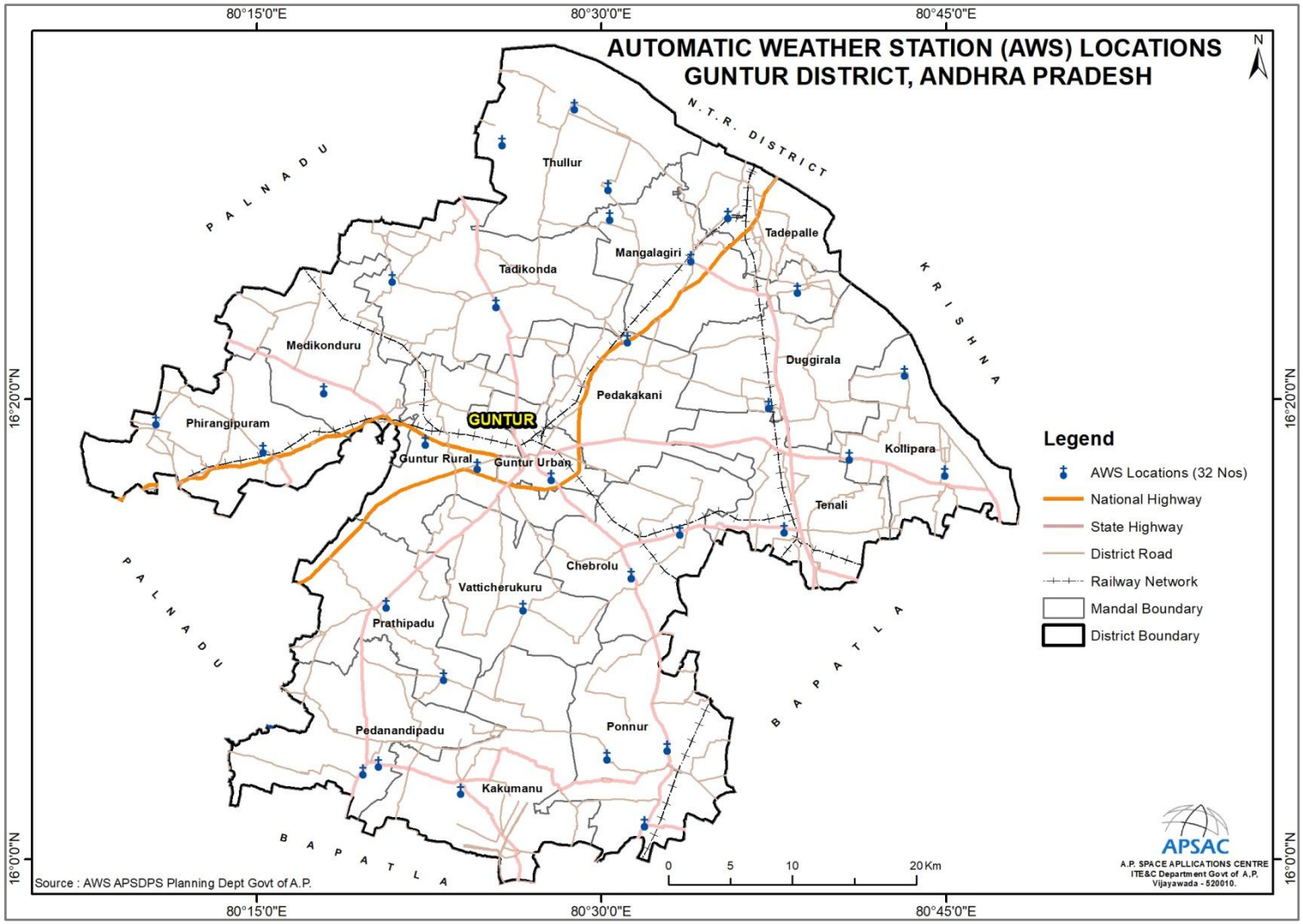



*Figure-4: Locations of Automatic Weather Stations (AWS) in Guntur District*

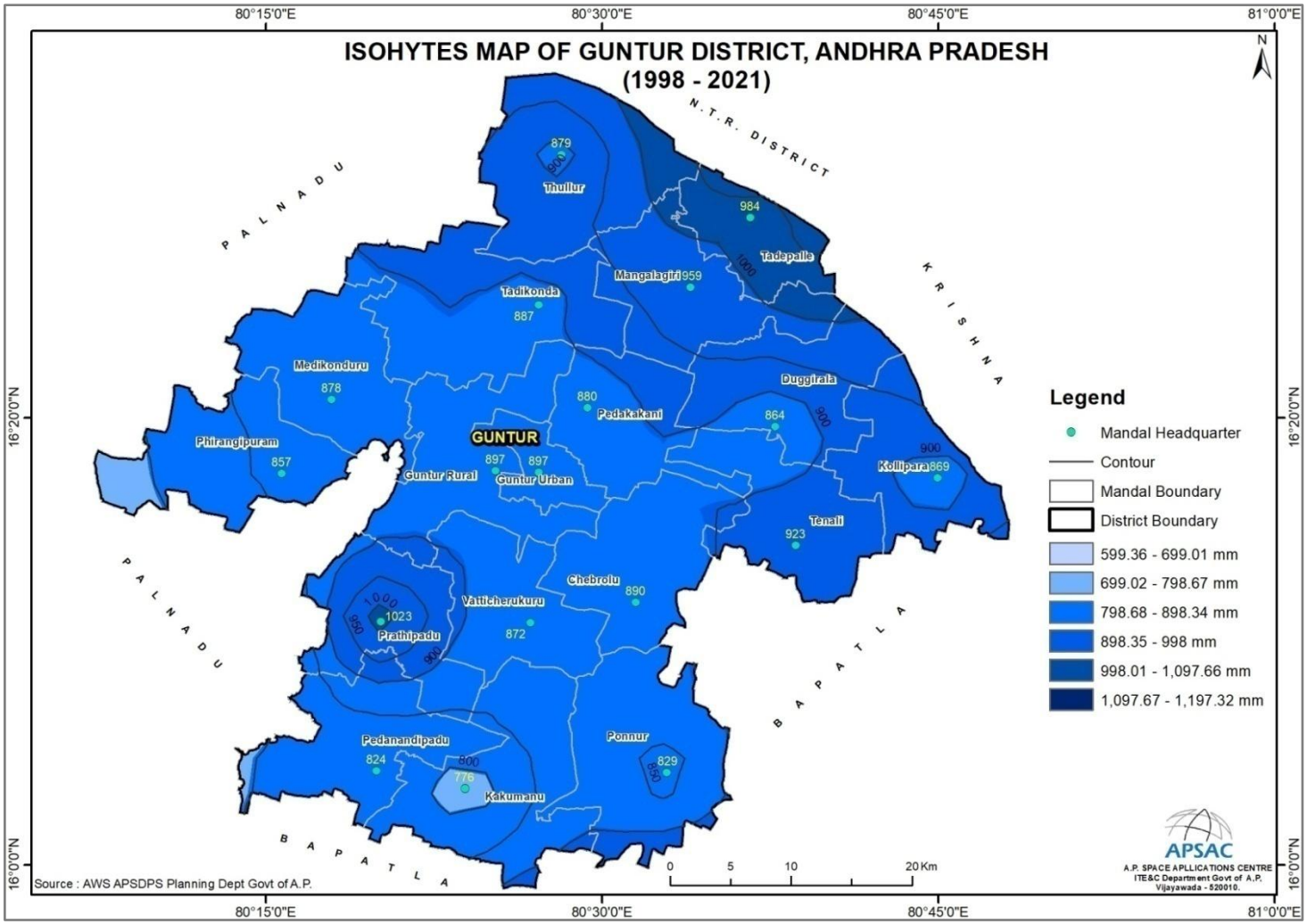



*Figure-5: Rainfall distribution in Guntur District*

*Table 2 Average Annual Rainfall (mm) in the district, during the year 1998-2021*

| S.No | Month | Average Annual Rainfall (mm) |
|---|---|---|
| 1 | January | 6.63 |
| 2 | February | 8.9 |
| 3 | March | 8.98 |
| 4 | April | 13 |
| 5 | May | 47.49 |
| 6 | June | 103.03 |
| 7 | July | 166.34 |
| 8 | August | 174.16 |
| 9 | September | 152.5 |
| 10 | October | 120.57 |
| 11 | November | 61.8 |
| 12 | December | 13.71 |
| | **Total** | **877.12** |

*Data source: AWS & APSDPS, Vijayawada*

**Details of the Occupational Health issues in the District** (Last five-year data of number of patients of Silicosis): No cases were reported during the last 5 years due to mining activity

### 1.2.4 Drainage

The Krishna River is the major River in the district and the tributaries are Pedda vagu and Kondaveeti vagu. The Kondaveeti vagu rises near Kondaveedu hills, Medikonduru mandal, Guntur district, and it flows towards the north direction and joining into Krishna River near Vykuntapuram village, Amaravathi mandal, Palnadu district. The Pedda vagu rises near Kondaveedu hills, and flows towards the north-west direction and joining into Krishna River near Prakasam Barrage.

The Vogeru vagu and Konda vagu are also covered in other part of the district. The Vogeru vagu tributaries are Nallamada vagu, Nakka vagu originated near Gouthikonda hills, Nekarikallu of Palnadu district and enters into southern part of the Guntur district, and merged with Nallamada vagu at Pedanandipadu.

The Konda vagu tributaries are Rama vagu and Tummalapalem vagu are rises near Kondaveedu hills and flows towards the South west direction and joining to Tungabhadra drain near Kollimarla village, Kakamanu mandal in the Guntur district.

## 1.3 Population and Literacy

**1.3.1. Population:** The total population of the district is 20,91,075, of which male and female are 10,42,101 and 10,48,974 respectively, as per the 2011 census of India. Amongst all the mandals, Guntur urban mandal is having highest population of 6,78,442, where as Kakumanu mandal has a lowest population of 40,681.

The total scheduled caste (SC) population in the district is 4,05,925, of which male and female are 2,02,006 and 2,03,919 respectively. The scheduled tribe (ST) population is 69,017. Out of which, male and female are 34,619 and 34,398 respectively. The mandal wise the total population is shown in Table-3, and its spatial distribution is depicted in Figure-6.

**1.3.2. Literacy**: The total literacy in the district is 14,00,575, of which male and female are 7,53,162 and 6,47,413 respectively. The total illiterates in the district is 6,90,500. Out of male and female are 2,88,939 and 4,01,561 respectively, as per the 2011 Census of India. The mandal wise literacy is shown in the Table-4.

**1.3.3. Details of the Occupational Health issues in the District (**Last five-year data of number of patients of Silicosis): No cases were reported during last 5 years due to mining activity.

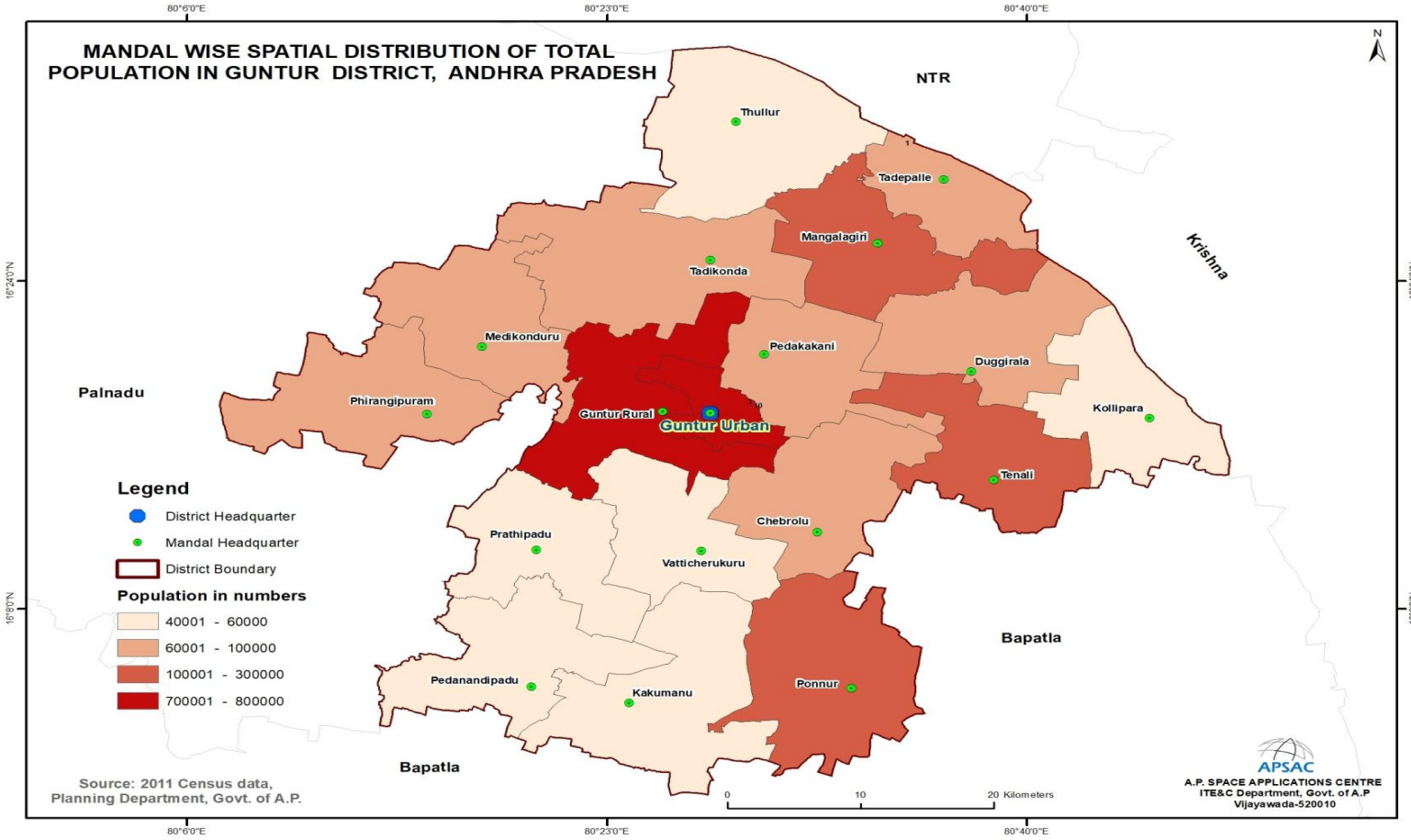



*Figure-6: Mandal wise Spatial Distribution of Population in Guntur district, Andhra Pradesh*

*Table-3: The mandal wise total population in Guntur District*

| S.No | Mandal Name | Total House Holds | Total Population | Total Male Population | Total Female Population | Total SC Population | Male SC Population | Female SC Population | Total ST Population | Male ST Population | Female ST Population |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | Chebrolu | 19622 | 72141 | 36015 | 36126 | 14535 | 7313 | 7222 | 2155 | 1069 | 1086 |
| **2** | Duggirala | 18406 | 62655 | 31269 | 31386 | 19981 | 9997 | 9984 | 1847 | 930 | 917 |
| **3** | Guntur Rural | 24460 | 100847 | 53962 | 46885 | 19502 | 9828 | 9674 | 2713 | 1413 | 1300 |
| **4** | Guntur Urban | 171218 | 678442 | 335620 | 342822 | 76346 | 37186 | 39160 | 15074 | 7560 | 7514 |
| **5** | Kakumanu | 12091 | 40681 | 20082 | 20599 | 10501 | 5258 | 5243 | 1968 | 1017 | 951 |
| **6** | Kollipara | 17686 | 56662 | 27953 | 28709 | 16554 | 8263 | 8291 | 1598 | 791 | 807 |
| **7** | Mangalagiri | 42639 | 160303 | 80363 | 79940 | 29022 | 14730 | 14292 | 4563 | 2347 | 2216 |
| **8** | Medikonduru | 15909 | 60144 | 30682 | 29462 | 14973 | 7654 | 7319 | 3338 | 1693 | 1645 |
| **9** | Pedakakani | 19990 | 73689 | 36396 | 37293 | 16748 | 8302 | 8446 | 2747 | 1361 | 1386 |
| **10** | Pedanandipadu | 12212 | 41980 | 20643 | 21337 | 12338 | 6223 | 6115 | 1404 | 691 | 713 |
| **11** | Phirangipuram | 17119 | 63449 | 31654 | 31795 | 15723 | 7953 | 7770 | 2418 | 1210 | 1208 |
| **12** | Ponnur | 34297 | 123417 | 60953 | 62464 | 29425 | 14451 | 14974 | 6542 | 3277 | 3265 |
| **13** | Prathipadu | 13448 | 49390 | 25085 | 24305 | 12759 | 6441 | 6318 | 1711 | 859 | 852 |
| **14** | Tadepalle | 26618 | 99428 | 49662 | 49766 | 24809 | 12390 | 12419 | 4136 | 1996 | 2140 |
| **15** | Tadikonda | 18838 | 67962 | 33655 | 34307 | 17270 | 8569 | 8701 | 3310 | 1693 | 1617 |
| **16** | Tenali | 64681 | 240031 | 118616 | 121415 | 43577 | 21498 | 22079 | 9310 | 4632 | 4678 |
| **17** | Thullur | 15505 | 54081 | 26791 | 27290 | 19767 | 9929 | 9838 | 2705 | 1335 | 1370 |
| **18** | Vatticherukuru | 12805 | 45773 | 22700 | 23073 | 12095 | 6021 | 6074 | 1478 | 745 | 733 |
| | **Grand Total** | **557544** | **2091075** | **1042101** | **1048974** | **405925** | **202006** | **203919** | **69017** | **34619** | **34398** |

Data Source: Census - 2011, DES.

*Table 4: Literacy statistics summary of 2011 Census.*

| S.No | Mandal Name | Total Literacy | Male Literacy | Female Literacy | Total Illiterates | Male Illiterates | Female Illiterates |
|---|---|---|---|---|---|---|---|
| **1** | Chebrolu | 42462 | 23069 | 19393 | 29679 | 12946 | 16733 |
| **2** | Duggirala | 40244 | 21545 | 18699 | 22411 | 9724 | 12687 |
| **3** | Guntur Rural | 65035 | 38823 | 26212 | 35812 | 15139 | 20673 |
| **4** | Guntur Urban | 488387 | 256843 | 231544 | 190055 | 78777 | 111278 |
| **5** | Kakumanu | 25945 | 14079 | 11866 | 14736 | 6003 | 8733 |
| **6** | Kollipara | 37663 | 19671 | 17992 | 18999 | 8282 | 10717 |
| **7** | Mangalagiri | 104479 | 56954 | 47525 | 55824 | 23409 | 32415 |
| **8** | Medikonduru | 34029 | 19522 | 14507 | 26115 | 11160 | 14955 |
| **9** | Pedakakani | 45243 | 24439 | 20804 | 28446 | 11957 | 16489 |
| **10** | Pedanandipadu | 27209 | 14907 | 12302 | 14771 | 5736 | 9035 |
| **11** | Phirangipuram | 36514 | 20696 | 15818 | 26935 | 10958 | 15977 |
| **12** | Ponnur | 81904 | 43405 | 38499 | 41513 | 17548 | 23965 |
| **13** | Prathipadu | 29781 | 17177 | 12604 | 19609 | 7908 | 11701 |
| **14** | Tadepalle | 66781 | 35818 | 30963 | 32647 | 13844 | 18803 |
| **15** | Tadikonda | 40162 | 22421 | 17741 | 27800 | 11234 | 16566 |
| **16** | Tenali | 174711 | 90920 | 83791 | 65320 | 27696 | 37624 |
| **17** | Thullur | 32578 | 17867 | 14711 | 21503 | 8924 | 12579 |
| **18** | Vatticherukuru | 27448 | 15006 | 12442 | 18325 | 7694 | 10631 |
| | **Grand Total** | **1400575** | **753162** | **647413** | **690500** | **288939** | **401561** |

*Data Source: 2011 Census data, Planning Department & DES.*

## 1.4 Land Utilization Pattern

### 1.4.1 Land Use / Land Cover

The Land Use / Land Cover (LULC) pattern of any region is an outcome of various physical and cultural factors and their utilization by man in time and space. Land use refers to the type of utilization to which man has put the land. It also refers to the evaluation of the land with respect to various natural characteristics. But land cover describes the vegetal attributes of the land. Land use/land cover data is essential for planners, decision-makers and those concerned with land resource management. For the proper understanding of the influence of the various human-induced land-use practices with regard to environmental change, it is essential to help simulate the land-use changes. Remote sensing technology is considered the most effective as it provides timely and authentic information about the spatial distribution of land use/land cover, while the Geographical Information System (GIS) provides a flexible digital environment for collecting, storing, visualizing and analyzing the spatial data. Remote sensing is a vital tool for the rapid assessment and monitoring of a natural resource. When combined with GIS, it makes it possible to map land use/cover phenomena in detail for further planning, development, and decision-making, which is essential for meeting the increasing demands and welfare of the ever-growing population.

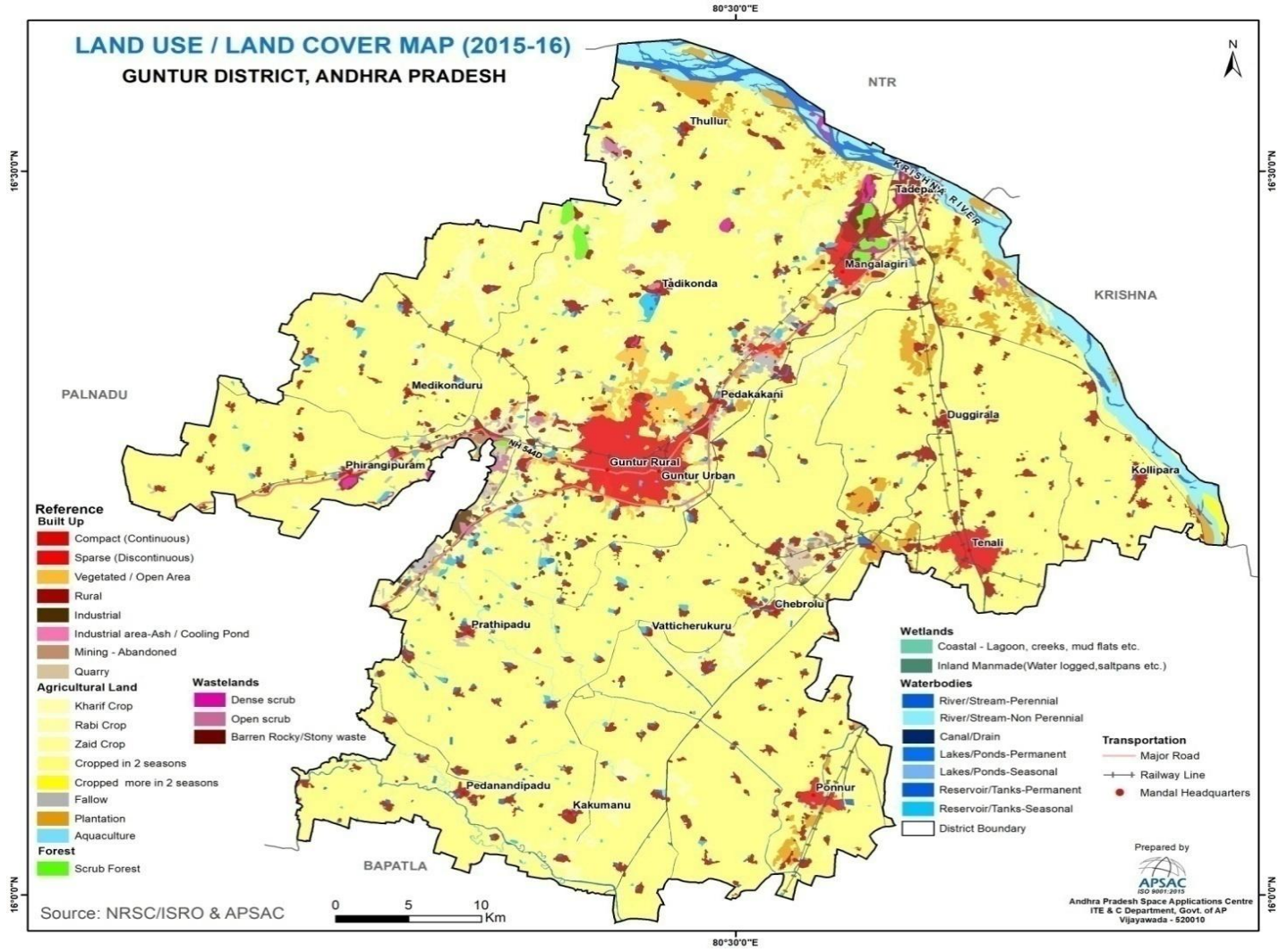



*Figure-7: Land use / land cover map of Guntur District 2015-16*

### 1.4.2 Spatial Distribution of Land Use / Land Cover

Using on-screen interpretation techniques, the major common LULC categories such as built-up (208.32 sq. km), agriculture (2076.16 sq. km), forest (7.42 sq. km), wastelands (16.40 sq. km), wetlands (0.56 sq. km), and water bodies (134.08 sq. km) were identified and delineated. The study area has been divided into 29 level-III LULC classes. The predominant category is agricultural land followed by built-up category. About 85% of the land is under the agriculture category spread over the district. The spatial distribution of land use / land cover map of the Guntur district is presented in Figure-7 and the area statistics are shown in Table-5.

*Table 5 Category-wise distributions of Land Use/Land Cover during 2015-16*

| S. No | LULC categories | Area in sq. km | % to total |
|---|---|---|---|
| **Built-Up** | | **208.32** | **8.53** |
| 1 | Compact (Continuous) | 52.26 | 2.14 |
| 2 | Sparse (Discontinuous) | 9.14 | 0.37 |
| 3 | Vegetated / Open Area | 22.86 | 0.94 |
| 4 | Rural | 103.53 | 4.24 |
| 5 | Industrial | 8.44 | 0.35 |
| 6 | Industrial area-Ash / Cooling Pond | 0.05 | 0.00 |
| 7 | Mining - Abandoned | 2.92 | 0.12 |
| 8 | Quarry | 9.17 | 0.38 |
| **Agricultural Land** | | **2076.16** | **84.99** |
| 9 | Kharif Crop | 141.79 | 5.80 |
| 10 | Rabi Crop | 4.51 | 0.18 |
| 11 | Zaid Crop | 12.36 | 0.51 |
| 12 | Cropped in 2 seasons | 1843.28 | 75.45 |
| 13 | Cropped more in 2 seasons | 2.58 | 0.11 |
| 14 | Fallow | 20.80 | 0.85 |
| 15 | Plantation | 50.57 | 2.07 |
| 16 | Aquaculture | 0.27 | 0.01 |
| **Forest** | | **7.42** | **0.30** |
| 17 | Scrub Forest | 7.42 | 0.30 |
| **Wastelands** | | **16.40** | **0.67** |

| | | | |
|---|---|---|---|
| 18 | Dense Scrub | 6.35 | 0.26 |
| 19 | Open Scrub | 5.36 | 0.22 |
| 20 | Barren Rocky/Stony Waste | 4.68 | 0.19 |
| **Wetlands** | | **0.56** | **0.02** |
| 21 | Coastal - Lagoon, creeks, mud flats etc. | 0.45 | 0.02 |
| 22 | Inland Manmade (Water logged, saltpans etc.) | 0.11 | 0.00 |
| **Water bodies** | | **134.08** | **5.49** |
| 23 | Reservoir/Tanks-Permanent | 14.10 | 0.58 |
| 24 | Reservoir/Tanks-Seasonal | 19.43 | 0.80 |
| 25 | Canal/Drain | 17.49 | 0.72 |
| 26 | Lakes/Ponds-Permanent | 0.17 | 0.01 |
| 27 | Lakes/Ponds-Seasonal | 0.38 | 0.02 |
| 28 | River/Stream-Non Perennial | 55.75 | 2.28 |
| 29 | River/Stream-Perennial | 26.77 | 1.10 |
| **Total** | | **2442.95** | **100.00** |

*Data source: NR Census 3rd cycle mapping, NRSC/ISRO & APSAC, GoAP*

#### 1.4.2.1. Built-up

These are the areas where people live and are supported by infrastructure such as buildings, roads, and other modes of transportation, as well as utilities connected to water, vegetation, and open spaces. It consists of built-up (compact and sparse), vegetated / open area, rural, industrial, and mining/quarry. It occupies an area of 208.32 sq. km, which is about 8.53% of the total geographical area of the district. The built-up category includes district headquarters, some mandal headquarters, industrial areas, and rural settlement areas based on size and population. Many vacant lands with layouts and fencing are being developed for real estate development on the outskirts of the major Guntur, Mangalagiri, and Tenali towns.

#### 1.4.2.2. Built-up - Compact (Continuous)

Most of the land is covered by buildings, roads, and artificially surfaced areas and covers almost all the ground. The built-up-compact class is assigned where impermeable surfaces such as the transportation network and urban structures take up more than 80% of the surface area. This category occupied 52.56 sq. km, which is found in Guntur, Mangalagiri, and Tenali towns.

#### 1.4.2.3. Built-up - Sparse (Discontinuous)

Most of the land is covered by the structures like buildings, roads, and artificially surfaced areas associated with vegetated areas and bare soil, which occupy discontinuous but significant surfaces. Between 30 to 80 % of the total surface should be impermeable. Scattered blocks of residential flats, hamlets, and small villages are delineated under this category. It contributes an area of 9.14 sq. km, which is found in peri-urban areas.

#### 1.4.2.4. Vegetated / Open Area

These are vegetated areas within the urban agglomeration (situated within or in contact with urban areas). The vegetation cover of trees, shrubs, and herbs covers the surface area, and it has been delineated. Open areas used as Parks, sport and leisure facilities, camping grounds, sports grounds, leisure parks, golf courses, and racecourses, including formal parks etc are considered in this category. This category occupies an area of 22.86 sq. km and is found in and around Guntur, Mangalagiri, and Tenali towns.

#### 1.4.2.5. Built-up – Rural

These are the lands used for human settlement of size comparatively less than the urban settlements of which more than 80% of the people are involved in the primary activity of agriculture and associated with non-commercial and allied classes are identified as a built-up (rural) category. The rural built-up area is the predominant category among the built-up category and is spread over the district. It contributed an area of 103.53 sq. km (4.22%).

#### 1.4.2.6. Industrial

Non-linear impervious surfaces are included in this class which is related to trade, manufacturing, distribution, and commerce. These are areas where human activity is observed in the form of manufacturing along with other supporting establishments for maintenance. The industrial area occupies an area of 8.44 sq. km, which is observed in and around towns.

#### 1.4.2.7. Mining - Abandoned

These are the areas where large-scale surface operations of removal of economically important ores were carried out in the past but presently kept abandoned due to various reasons like economic, operational, viability, disturbances, etc. A total of 2.92 sq. km in the district is mapped by the category of abandoned mining.

#### 1.4.2.8. Quarry

These are manifestations of surface mining operations wherein small-scale excavation of the land surface of sand, gravel, granite, quartzite quarries, etc., are taking place. They are mostly characterized by their nearness to urban areas. It contributes an area of 53.48 sq. km and accounts for 9.17% of the district's total area.

#### 1.4.2.9. Agricultural Land

Agriculture land is primarily used for the production of food, fiber, and other commercial and horticultural crops. It includes land under crops namely cropland, fallow land, agricultural plantation, and aquaculture. The district's economy is primarily based on agriculture, which was found to account for 2076.16 sq. km (84.99%) of its total area during the period. It is also found that the double-cropped area accounts for about 75.45% of the district total.

#### 1.4.2.10. Kharif Crop

The agricultural area cultivated between June/July to September/October coinciding with the southwest monsoon season is considered Kharif crop. It is associated with rain-fed crops under dry land farming with limited or no irrigation and areas of rain-fed paddy and other dry crops. Kharif cropland is the second-largest agricultural category, covering 141.79 sq. km (5.80%). During the Kharif season, a variety of crops including rice, sugarcane, jowar, maize, red gram, cotton, castor, and others are widely grown in the district.

#### 1.4.2.11. Rabi Crop

These areas are cultivated between November/December to February/March. It is associated with areas under assured irrigation irrespective of the source of irrigation. However, Rabi-cropped areas also occur in rain-fed regions, under residual soil moisture conditions especially in black soil areas with high rainfall during the Kharif season. Mainly irrigated crops like rice, sugarcane, and chillies are grown during the Rabi season by utilizing canals, tanks, and groundwater resources. In some places, lift irrigation is also practiced in the district. Rabi cropland occupied an area of 4.51 sq. km (0.18%) during the year 2015-16.

#### 1.4.2.12. Zaid Crop

These are the areas that are cropped during two cropping seasons that are often seen associated with irrigated areas. Three combinations are possible in this category viz., - Kharif + Rabi, Kharif + Zaid, and Rabi + Zaid. Areas

under crop during any two seasons are mapped under cropped in 2 seasons category and it occupies an area of 1843.28 sq. km (75.45%). These can be found all over the district, with reliable irrigation facilities provided by canals, tanks, and groundwater.

### 1.4.2.13. Cropped in two seasons

These are the areas that are cropped in more than two cropping seasons. It includes triple-cropped areas (Kharif, Rabi, and Zaid), and areas under multiple cropping. Long-duration crops like sugarcane, cotton, banana, and tobacco are considered under this category. This category accounts for 2.58 sq. km (0.11%) of the district's total geographical area.

### 1.4.2.14. Fallow land

The agricultural land which is being used for cultivation, but is temporarily allowed to rest or un-cropped for one or more seasons, but not less than a year, and for not more than five years is referred to as fallow land. The fallow land covers an area of 20.80 sq. km and is devoid of crops during both cropping seasons for various reasons.

### 1.4.2.15. Agricultural Plantation

These are the areas under agricultural tree crops planted adopting agricultural management techniques. These also include the areas of land use systems and practices wherein the cultivation of herbs, shrubs, and vegetable crops are deliberately integrated with crops mostly in irrigated conditions for ecological and economic reasons. These areas are separable from cropland, especially with the data acquired during the Rabi/Zaid season. Plantations appear in dark-red to red tones of different sizes with regular and sharp edges indicating the presence of a fence around it. Plantations such as banana, cashew, eucalyptus, teak, and others are grown throughout the district. The plantations category occupies an area of 50.57 sq. km (2.07%) of the total geographical area of the district.

### 1.4.2.16. Aquaculture

These are the areas where fish and shrimp are bred and reared for commercial purposes. Aquaculture ponds are located mostly along the coast or in lakes, rivers and estuaries. This also includes the breeding and rearing of fresh water or marine fish in captivity. The aquaculture category occupies an area of 0.27 sq. km.

### 1.4.2.17. Forest

The term forest is used to refer to land with a tree canopy cover of more than 30 percent and an area of more than 0.5 ha. Forest is determined both by the presence of trees and the absence of other predominant land uses within the notified forest boundaries. The trees should be able to reach a minimum height of 5 m within the notified forest boundaries. The forest area occupies an area of 7.42 sq. km (0.30%) and is found in the north and northeast of the district where several forest species grow. The important species are teak, nalla maddi, rosewood, devadari, etc.

### 1.4.2.18. Scrub Forest

These are the forest areas that are generally seen on the fringes of dense forest cover and settlements, where there is biotic and abiotic interference. Most times they are located closer to habitations. Forest blanks, which are the openings amidst forest areas, devoid of tree cover, observed as openings of assorted sizes and shapes as manifested in the imagery are also included in this category. The scrub forests accounted for 7.42 sq. km (0.30%), which are generally prone to the conversion of forest plantations and other development activities within the notified forest

### 1.4.2.19. Wastelands

Wasteland is described as degraded land which can be brought under vegetative cover with reasonable effort and which is currently underutilized and land which is deteriorating due to lack of appropriate water and soil management or on account of natural causes. Wastelands can result from inherent/imposed disabilities such as location, environment, chemical and physical properties of the soil, or financial or management constraints. During the study, the area under the wasteland category was mapped at 16.40 sq. km (0.67%), which includes the subcategories of dense scrub, open scrub, and barren rocky/stony waste.

### 1.4.2.20. Dense scrub

The scrub is usually confined to topographically elevated areas, on the hill slopes generally surrounded by agricultural lands. These areas possess shallow and skeletal soils, at times chemically degraded, extremes of slopes, severely eroded, and lands subjected to excessive aridity with scrubs dominating the landscape. It is found with varying sizes of small to large areas having a contiguous or dispersed pattern. The dense scrub areas can

be found on hills with moderate slopes. The area was mapped over 6.35 sq. km during the period.

#### 1.4.2.21. Open scrub

This category is similar to dense scrub, except that it has sparse vegetation or is devoid of scrub and has a thin soil cover. Open scrub areas can be found in the foothills and on moderate to gentle sloping terrain surrounded by agricultural lands. The area mapped under this category is about 5.36 sq. km.

#### 1.4.2.22. Barren Rocky/Stony waste

The barren rock exposures are especially confined to hilly terrain with down slopes with rock outcrops, stony waste, and fragments. Barren rocky areas have been observed as rocky outcrops in the forest and scrubland. It is found that most of the barren rocky areas are being quarried for various construction activities in the district. The area under this category is 4.68 sq. km and it occupies 0.19 % of the district.

#### 1.4.2.23. Wetlands

All submerged or water-saturated lands, natural or man-made, inland or coastal, permanent or temporary, static or dynamic which necessarily have a land-water interface, are defined as wetlands. Hence, the portions of the water body (partial or full) having emergent vegetation or observable submerged vegetation is placed in the wetlands category. The wetland category contributes 0.56 sq. km and is found along the coastal areas.

#### 1.4.2.24. Coastal - Lagoon, creeks, mud flats, etc.

These are the areas which are submerged by high tides at some stage of the annual tidal cycle. Non-wooded areas are tidally, seasonally or permanently waterlogged with brackish or saline water. These include estuaries, lagoons, creeks, backwaters, bay tidal flat/mud flat, mangrove, salt marsh/marsh with vegetation and other hydrophytic vegetation. These are found in coastal areas of the district with an area of 0.45 sq. km.

#### 1.4.2.25. Inland Manmade (Water logged, saltpans, etc.)

For the majority of the year, these are the areas flooded or prone to flooding by fresh, brackish, or standing water, with specific vegetation coverage consisting of low shrub, semi-ligneous, or herbaceous species. Waterlogged areas (seasonal and perennial) are formed as a result of the negative effects

of human management practices and are vegetated. The saltpans are flat expanses of salt-covered land, usually white under the Sum. Saltpans are manmade saline ecosystems from which crude salt is extracted during summer. These are un-drained, usually small and shallow, natural depressions or hollows in which brackish water accumulates and evaporates leaving behind salt deposits. Only 0.11 sq. km is occupied by this category in the district.

### 1.4.2.26. Water Bodies

This category comprises areas with surface water, either impounded in the form of ponds, lakes, and reservoirs or flowing as streams, rivers, canals, etc are delineated. These are seen clearly in the satellite image in blue to dark blue or cyan color depending on the depth of water. This category comprises rivers, streams, canals, lakes, ponds, reservoirs, and tanks. The water bodies which include all the sub-categories are about 134.08 sq. km (5.49%).

### 1.4.2.27. River/Stream-Perennial

Rivers/streams are the natural course of water flowing on the land surface along a definite channel/slope regularly or intermittently towards a sea in most cases or a lake or an inland basin in desert areas or a marsh or another river. The rivers/streams that flow continuously throughout the year are considered as perennial. It contributes an area of 26.77 sq. km. The Krishna River flows through the district in a north-southeast direction.

### 1.4.2.28. River/Stream-Non Perennial

When the water covers the surface for less than nine months each year, it is considered non-perennial. This also includes the dry part of the river generally characterized by the presence of sand or exposed rocks. It is found most of the rivers/streams are under the non-perennial category and it contributes an area of 55.75 sq. km.

### 1.4.2.29. Canal/Drain

Canals and drains are artificial watercourses constructed for irrigation, navigation or to drain out excess water from agricultural lands. It is found mostly in the coastal plains with an area of 17.49 sq. km.

### 1.4.2.30. Reservoir/Tanks-Permanent

The reservoir is an artificial lake created by the construction of a dam across the river specifically for hydel power generation, irrigation, and water supply for domestic/ industrial needs, flood control, either singly or in combination. Tanks are small lakes of impounded waterways constructed on land surfaces for irrigation. They are associated with croplands, lowlands, and reservoirs surrounded by hills without vegetation. This includes all reservoirs/tanks with water spread seen at least during one season in a year is considered under the permanent category. The reservoir/tanks-permanent category was delineated by an area of 14.10 sq. km. These are one of the sources of the irrigation and spread throughout the district.

#### 1.4.2.31. Reservoir/Tanks-Seasonal

Dry reservoirs/tanks are those which do not have water spread throughout the year and are considered seasonal. During the mapping period, where the water spread is not found in the three seasons, those areas are mapped in this category. Many of the tanks are found to be seasonal, with a total area of 19.43 sq. km.

#### 1.4.2.32. Lakes/Ponds-Seasonal

Lakes/ponds are those that retain water in them either for one season or throughout the year and are usually not subject to extreme fluctuation in water level. Ponds are a body of water limited in size, either natural or artificial, regular in shape, smaller in size than a lake, and generally located near settlements. These accounted for an area of 0.38 sq. km only.

#### 1.4.2.33. Lakes/Ponds-Permanent

Perennial lakes/ponds are those that retain water in them either for more than one season (usually more than three months of a year or throughout the year and are usually not subjected to extreme fluctuation in water level. Ponds are a body of water limited in size, either natural or artificial, regular in shape, smaller in size than a lake, and generally located near settlements. This category contributes a tiny area of 0.17 sq. km

### 1.4.3 Forest Cover Distribution

The forest cover maps were prepared based on the interpretation of multi-source topographical maps and satellite data. The term forest is used to refer to land with a tree canopy cover of more than 10 percent and an area of more than 0.5 ha. Forest is determined both by the presence of trees and the absence of other predominant land uses within the notified forest

boundaries. The trees should be able to reach a minimum height of 5 m within the notified forest boundaries. It is noted that Nidumukkala hill forest and Mangalagiri reserved forests are distributed in the northeast and north-western parts of the district. The area contributed is about 7.42 sq. km (0.30%) and are scrub forest. The spatial distribution of forest cover and its statistics are presented in Figure-8 and Table-6. As per the Forest Department, Government of Andhra Pradesh the Forest boundary map is presented in Figure-9. There is no wildlife sanctuary in the District.

*Table 6 Forest cover distribution in Guntur District*

| | Type of Forest | Area in sq. km | % to district total |
|---|---|---|---|
| 1 | Scrub Forest | 7.42 | 0.30 |
| **Total Forest** | | **7.42** | **0.30** |

*Data source: NR Census 3rd cycle mapping, NRSC/ISRO & APSAC, GoAP*

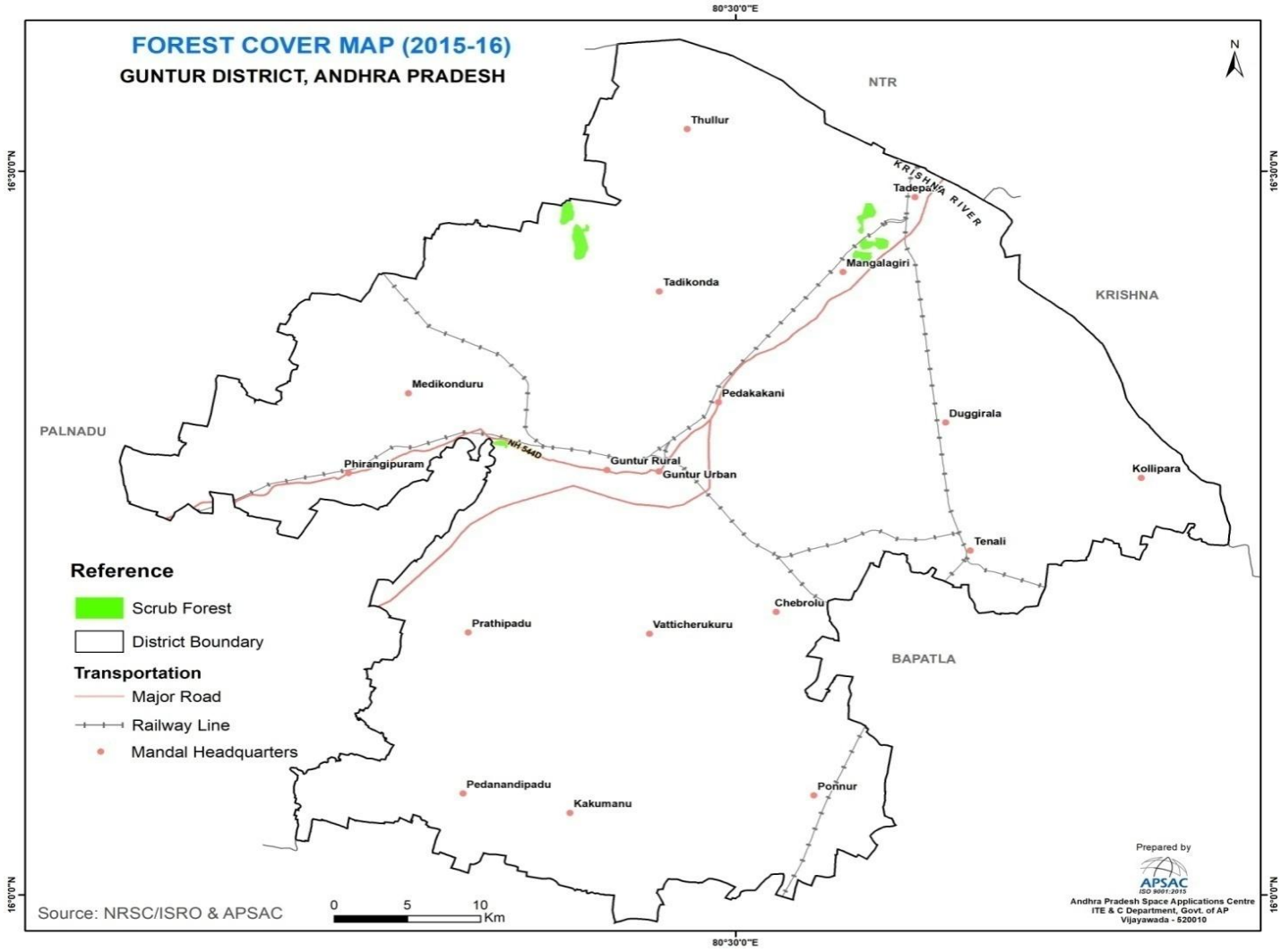



*Figure-8: Forest cover map of Guntur District*

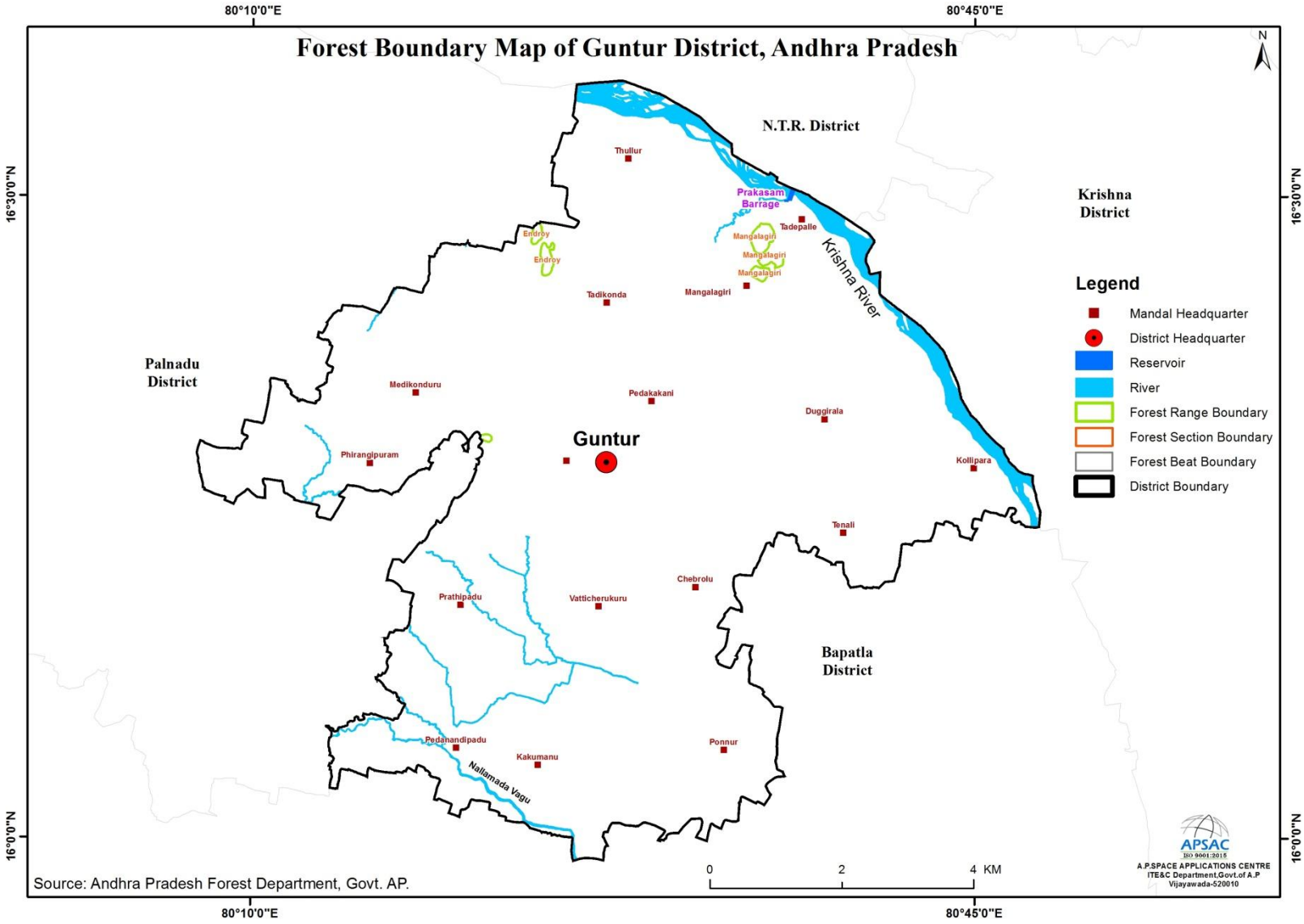



*Figure-9: Forest boundary map of Guntur District*

### 1.4.4 Agricultural Resources in Guntur District

Over the past two decades, APSAC has effectively employed remote sensing technology in agriculture, encompassing both spatial and temporal dimensions across various projects. The continuous evolution of satellite remote sensing technology has facilitated systematic monitoring of crop conditions and vigor across extensive regions. Within the realm of spectral vegetation indices derived from remote sensing data, the Normalized Difference Vegetation Index (NDVI) stands out as the most widely utilized for operational drought assessment. Its popularity stems from its straightforward calculation, ease of interpretation, and the capacity to mitigate the impacts of atmospheric conditions, illumination geometry, and other variables.

APSAC conducted in-season crop condition assessments at the Mandal level in Andhra Pradesh. This initiative aimed to provide administrators and planners with crucial insights for strategic decision-making regarding drought management, import-export policies, and trade negotiations. The NDVI is calculated using the formula (NIR–Red)/(NIR+Red), where NIR and Red represent the reflectance in the visible and near-infrared channels, respectively. Water, clouds, and snow exhibit higher reflectance in the visible region, causing NDVI to assume negative values for these features. Bare soil and rocks, with similar reflectance in both visible and near-infrared regions, yield index values close to zero. NDVI values for vegetation typically range from 0.2 to 0.6, with higher values associated with greater green leaf area and biomass. The Shortwave Infrared (SWIR) band is sensitive to soil and crop canopy moisture. Early in the cropping season, when soil background dominates, SWIR is sensitive to top 12 cm soil moisture. As crop growth progresses, SWIR becomes sensitive to leaf moisture content, providing surface wetness information.

The Normalized Difference Wetness Index (NDWI), computed using SWIR data, complements NDVI for drought assessment, especially in the early cropping season. NDWI is derived as follows: NDWI=(NIR-SWIR)/(NIR+SWIR), where NIR and SWIR represent reflected radiation in the Near-Infrared and Shortwave Infrared channels. Higher NDWI values indicate increased surface wetness.

For satellite-based crop condition anomalies indicating agricultural drought, the Vegetation Condition Index (VCI) of both NDVI and NDWI can be computed. When combining VCI values of NDVI and NDWI, the minimum of the two can be considered. For instance, if at least one is categorized as severe, the overall category is considered severe. If at least one is moderate, the overall category is taken as moderate. The vegetation conditions and corresponding ranges are detailed in Table-7.

*Table 7 Vegetation condition and range in percentage*

| VCI range (%) | Vegetation | Description |
|---|---|---|
| **60-100** | Normal | Crop condition is Normal |
| **40-60** | Moderate | Crop condition is Moderate |
| **0-40** | Severe | Crop condition is Severe |

*Data Source: Drought Manual-2016*

#### 1.4.4.1 Kharif Crop Condition Assessment

Andhra Pradesh Space Applications Centre (APSAC) conducted a crop condition assessment in Guntur district during Kharif 2022-23 utilizing MODIS (Moderate Resolution Imaging Spectroradiometer) satellite data. The assessment revealed that out of the total mandals in the district, 9 were categorized as having a normal crop condition, 2 were classified as moderate, and 6 were identified as severe. Notably, urban and forest cover mandals were excluded from the vegetation condition assessment. This comprehensive evaluation provides valuable insights into the agricultural landscape of Guntur district, aiding in targeted interventions and resource allocation to mitigate the impacts of varying crop conditions.

#### 1.4.4.2 Rabi Crop Condition Assessment

During Rabi 2022-23, The assessment identified 13 mandals with normal crop conditions and 4 mandals categorized as moderate. Notably, mandals predominantly covered by urban or forest areas were excluded from the vegetation condition assessment. This evaluation provides valuable insights into the agricultural status of Guntur district during the Rabi season, facilitating informed decision-making and resource allocation to support agricultural sustainability and productivity.

### 1.4.5 Soil Resources of the Guntur District

Guntur district in Andhra Pradesh exhibits a variety of soil types, with the predominant ones being loamy to clayey skeletal deep reddish brown soils covering an area of 782.68 sq.km (33.6%), followed by clayey to gravelly clayey moderately deep dark brown soils spanning 672.91 sq.km. (28.9%). Additionally, the district features moderately deep calcareous black soils occupying 388.07 sq.km (16.6%), moderately deep black clayey soils covering 242.11 sq.km (10.4%), and loamy to gravelly clay deep dark reddish brown soils extending over 100.57 sq.km (4.3%). The soil resource map, depicted in Figure-10, provides a visual representation of these diverse soil types, while Table-8 presents a breakdown of the soil categories along with their respective areas. These insights into the soil composition of Guntur district are invaluable for agricultural planning and land use management initiatives.

*Table 8 Soil classes in Guntur district*

| S.No | Classification | Area in Sq.km | Percentage (%) |
|---|---|---|---|
| **1** | Clayey to gravelly clayey moderately deep dark brown soils | 672.91 | 28.9 |
| **2** | Deep black clayey soils | 88.65 | 3.8 |
| **3** | Gravelly loam to gravelly clayey shallow dark brown soils | 46.36 | 2.0 |
| **4** | Loamy to clayey skeletal deep reddish brown soils | 782.68 | 33.6 |
| **5** | Loamy to gravelly clay deep dark reddish brown soils | 100.57 | 4.3 |
| **6** | Moderately deep black clayey soils | 242.11 | 10.4 |
| **7** | Moderately deep calcareous black soils | 388.07 | 16.6 |
| **8** | Shallow gravelly red soils | 5.08 | 0.2 |
| **9** | Very dark brown moderately deep wet silty soils | 5.09 | 0.2 |
| | Total | 2331.52 | 100 |

[#]*Excluding the Urban and Water bodies area*

*Data Source: APSAC, Vijayawada*

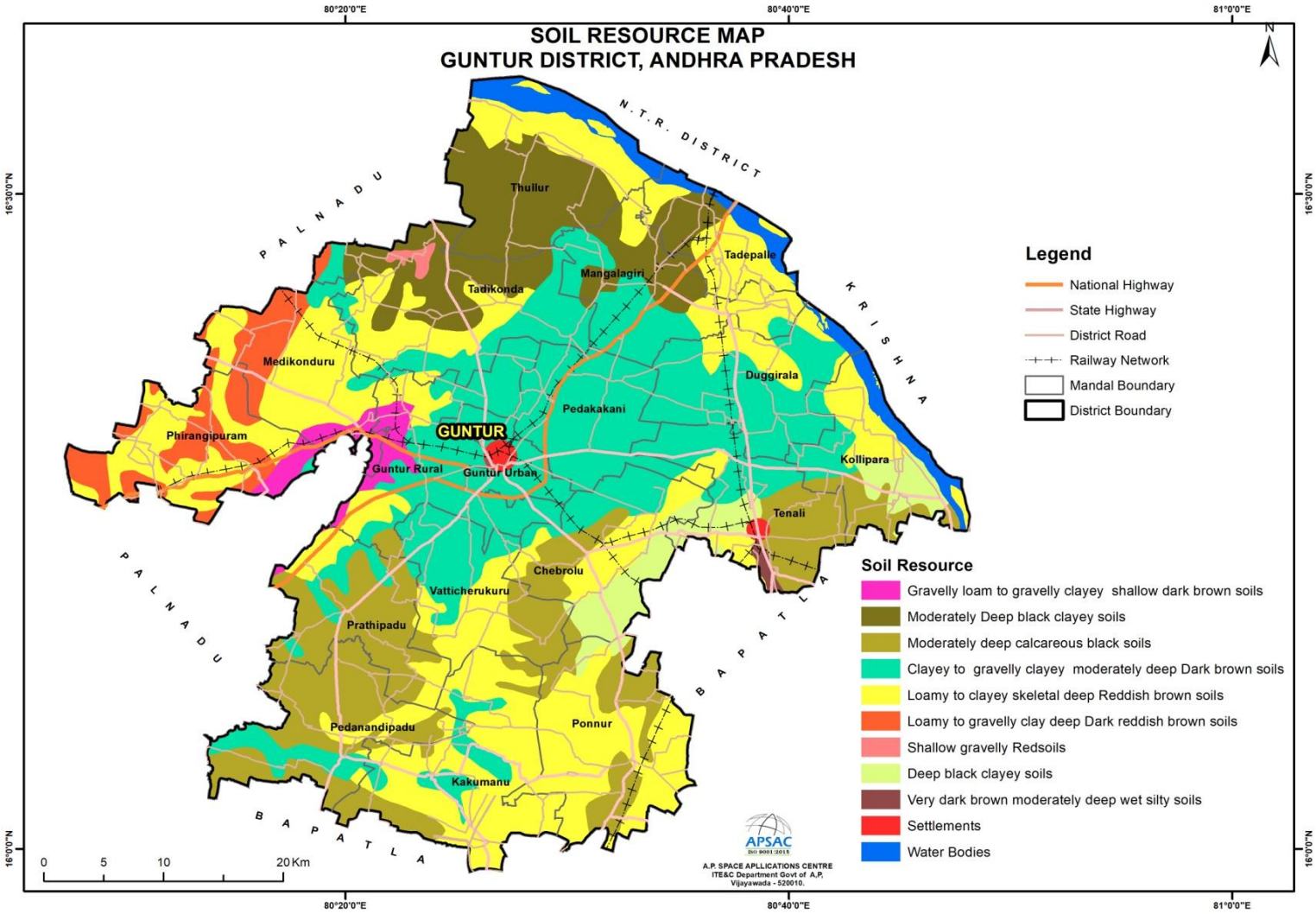



*Figure-10: Soil resource map of Guntur District*

### 1.4.6 Salt-affected land:

The term "salt-affected soil/land" refers to soils where salts impede normal plant growth, categorized as saline, saline-sodic, or sodic based on salt levels, types, sodium content, and soil alkalinity. These lands often exhibit excessive concentrations of soluble or exchangeable salts, resulting from factors such as mismanagement of canal irrigation, leading to rising water tables and salt accumulation in the root zone, especially in arid, semi-arid, and dry conditions, or intrusion of seawater in coastal areas, alongside the use of high-salt groundwater. Salinization can also occur due to salt-rich parent materials or saline groundwater. Coastal saline soils may experience seawater ingress or inundation. In Guntur district, the area of salt-affected soil/land spans 3,196 hectares (Ha), as depicted in Figure-10, underscoring the significance of understanding and managing these soils for sustainable agriculture and land use practices.

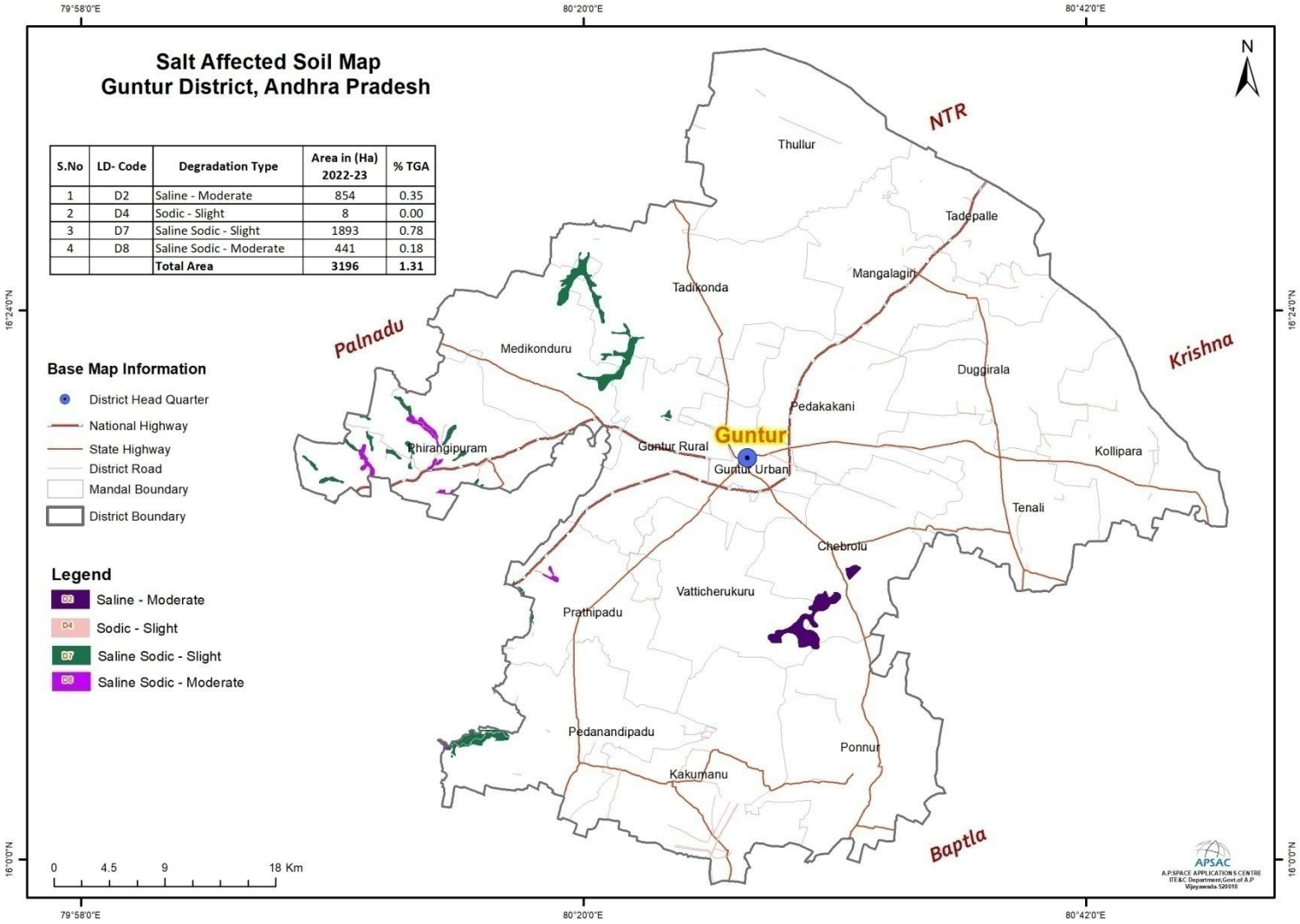



*Figure-10: Illustrates the spatial distribution of salt affected soil in Guntur district.*

### 1.4.7 Horticulture

Horticulture encompasses both the scientific and artistic aspects of producing, utilizing, and enhancing various horticultural crops, including fruits, vegetables, spices, ornamentals, plantation, medicinal, and aromatic plants. It also encompasses activities such as plant conservation, landscape restoration, garden design and maintenance, arboriculture, and the cultivation of ornamental trees and lawns.

In the Guntur district, Oil Palm emerges as the primary horticultural crop, cultivated across 5.65 hectares, followed closely by Guava covering 5 hectares. Acid Lime occupies 3.63 hectares of land, while Mangoes are cultivated over 2.98 hectares. The total area dedicated to horticultural crops in the district sums up to 18.59 hectares. This distribution underscores the significance of Oil Palm and other horticultural crops in the agricultural landscape of Guntur district, contributing to both economic prosperity and agricultural diversity. The horticulture crop-wise detail is shown in the Table-9.

*Table 9 Area of horticultural crops in Guntur district*

| S.No | Crop | Area in ha |
|---|---|---|
| **1** | Banana | 0.89 |
| **2** | Ber | 0.44 |
| **3** | Mangoes | 2.98 |
| **4** | Guava | 5.00 |
| **5** | Acid Lime | 3.63 |
| **6** | Oil Palm | 5.65 |
| | **Total Area** | **18.59** |

*Source: Government of Andhra Pradesh Rashtriya Krishi Vikas Yojana-2022-23.*

## 1.5 Ground Water Prospects in the District:

Groundwater occurs in most geological formations, and its potential depends on the nature of geological formations, geographical setup, and the incidence of rainfall, recharge, and other hydrogeological characteristics of the aquifer. In consolidated formations, groundwater

occurs under unconfined to semi-confined conditions. Groundwater in these formations is developed by dug wells, dug cum bore wells, and bore wells tapping weathered and fractured zones. The groundwater prospects in the district are depicted in Figure-12. Groundwater prospects are very good in the delta area, good to moderate in the middle, moderate to poor in parts of Medikonduru, Prathipadu, Pedanandipadu, etc., and poor to negligible in the upland areas of Mangalagiri, Guntur rural, and its surroundings.

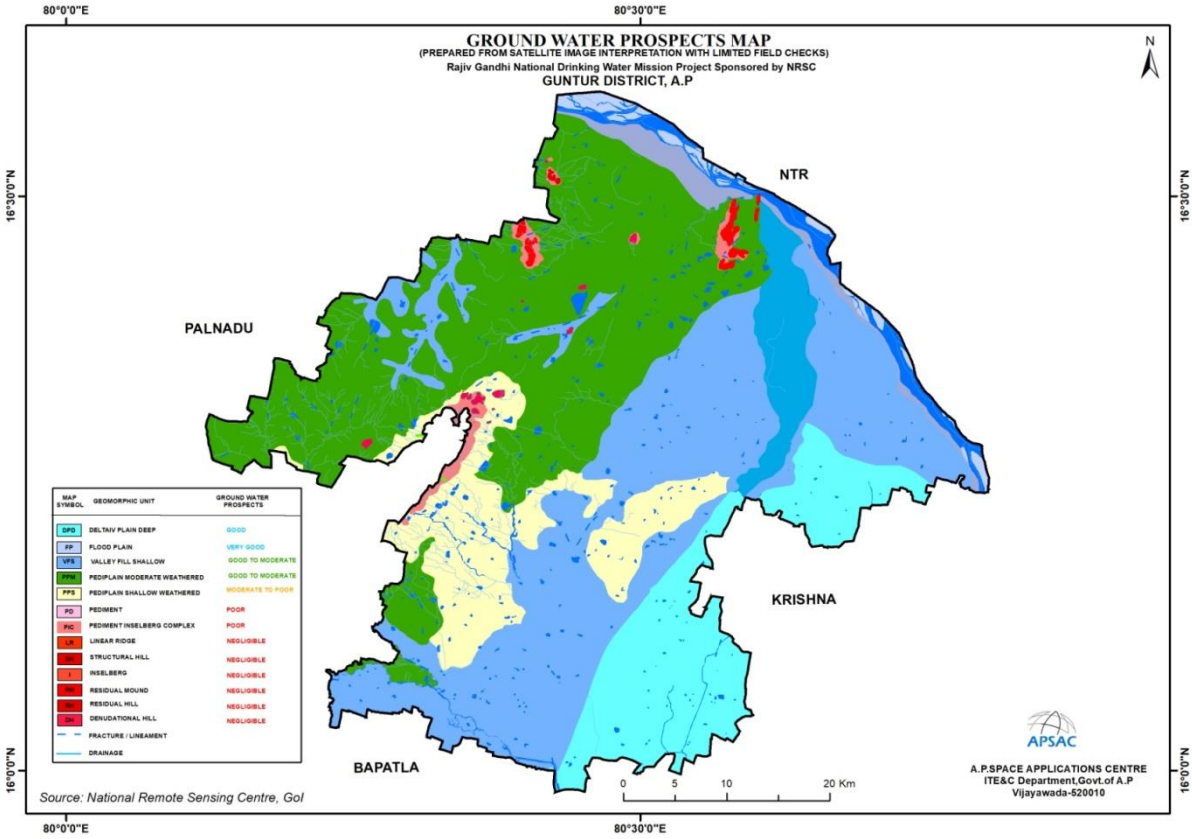



*Figure-12: Ground Water prospects in Guntur District, Andhra Pradesh*

## 1.6 Infrastructure

### 1.6.1 Transport Network

Guntur district has a well-connected by various modes of transportation such as Road and Rail. The connectivity of each category is also depicted in Figure-13. The details of each transport network distribution in the district are as given below.

**1.6.1.1. Road Transport**: The road network of the district has been delineated by using high resolution satellite data under Space Based

Information Support for Decentralized Planning (SIS-DP) project and arrived the lengths of the each type of road network. It can be observed that the Guntur district has a well-developed road network that facilitates connectivity to all towns within the district, and to other major cities and towns of nearby districts. The major road network includes National Highways (NH), State Highways (SH), and District Roads (DR). The rural areas of the district also have good connectivity via Panchayat Raj roads / village roads.

The total length of the road network in the district is about 6,884.35 Km. Of which, the length of the National Highways is about 85.28 Km, State Highways having a length of about 237.56 Km. The district roads connect all towns and mandals having a length of 928.15 Km. The length of each road category covered in the district is shown in Table - 10.

The Guntur district is traversed by two National Highways. The traverse and description of each highway is as given below:

**1.6.1.1.1. National Highway 16 (NH16):** The NH16 is a major National Highway that runs through east coast of West Bengal, Odisha, Andhra Pradesh, and Tamil Nadu. It is a part of the Golden Quadrilateral project to connect India's major cities.

The NH starts at Odisha border which passes through the coastal districts in Andhra Pradesh and enters in Srikakulam district at Ichchapuram Mandal and passes through the Srikakulam, Vizianagaram, Visakhapatnam, Anakapalli, Kakinada, East Godavari, Eluru and Krishna districts with covers major mandals namely Bhogapuram, Anandapuram, Pendurthi, Anakapalle, Tuni, Prathipadu, Rajahmundry, Devarapalli, Eluru, Gannavaram, Vijayawada. It traverse through Guntur District via Tadepalle, Mangalagiri, Pedakakani and Guntur mandals and connects to Bapatla, Prakasam, S.P.S. Nellore and Tirupati districts before connects to Tamil Nadu Border at Tada.

**1.6.1.1.2. National Highway 544D (NH544D**): The NH starts at Karnataka border and enters at Rayadurg mandal, Anantapuramu district, and passes through the Nandyal, Prakasam and Palnadu districts. It connects the NH44 near Anantapuramu and passes through the mandals Singanamala, Tadipatri in Anantapuramu district, Kolimigundla, Owk and Banaganapalle in Nandyal district. It traverse through Giddalur,

Bestawaripeta, Cumbum and Tripurantakam mandals in Prakasam district and passes through Vinukonda, Savalyapuram and Narasaropeta in Palnadu district, and enters at Phirangipuram mandal in Guntur district and connects NH16 at Guntur mandal.

SomeimportantStateHighwaysegmentscoveredinthedistrictaregivenbelow.

- Guntur-Hanumanpalem road(SH255),
- Guntur-Chirala road(SH040),
- Guntur-Parchoo rroad(SH249),
- Tenali-Mangalagiri road(SH316),
- Guntur-Amaravathi road(SH288),
- Ponnuru-Kakumanu-road(SH273)
- Bapatla-pedanandipadu road(SH271).

*Table 10 Road category wise lengths*

| S.No | Road Type | Length in Km |
|---|---|---|
| **1** | National Highway | 85.28 |
| **2** | State Highway | 237.56 |
| **2** | District Road | 928.15 |
| **3** | Village Road | 3,644.87 |
| **4** | Cart Track | 1,514.02 |
| **5** | Foot Path | 378.91 |
| **6** | City Road | 95.55 |
| Total Length | | **6884.35** |

Data Source: R&B Department and APSAC, Vijayawada.

**1.6.1.2. Railways:** The Indian Railway line traversing from East to West and North to South in the Guntur district covering various stations to cater to the transportation needs of the people. The length of the Rail network covered in the district is about 163.79 km connecting 25 railway stations. Among these, the important railway stations in the district are Chinnaravuru, Duggirala, Guntur Junction, Krishna Canal junction, Mangalagiri, Namburu, New Guntur, Nidubrolu, Pedakakani Halt, Pedavadlapudi, Siripuram, Tenali Junction, Vejandla; and the train stations are Angalakuduru, Bandarupalle, Chiluvur, Kolakalur, Kolanukonda, Machavaram, Mandapadu, Nallapadu Junction, Nudurupadu, Perecherla, Phirangipuram, and Sangam Jagarlamudi.

The Guntur district is traversed by a significant railway line that connects various parts of the district and provides connectivity to neighbouring

regions. The Guntur-Guntakal railway line is a broad gauge type railway line facilitates the movement of people and goods between the various parts within the district and neighbouring areas. It passes through important railway stations in the district such as Perecherla, Phirangipuram and Nudurupadu. It also connecting the stations such as Narasaraopeta and Vinukonda in Palnadu district, Kurichedu, Donakonda, Markapur, Cumbum and Giddalur in Prakasam district, Nandyal Junction, Betamcherla and Dhone Junction in Nandyal district, Tuggili and Maddikera mandals in Kurnool district and destination to Guntakal junction in Anantapuramu District.

The Krishna Canal-Secunderabad stretch was a part of the important East-West coast link that connects stations like Mangalagiri, Pedakakani, and Guntur mandals in Guntur district, Pedakurapadu, Sattenapalle, Reddigudem, Piduguralla and Nadikude Junction in Palnadu district and ends at Secunderabad.

The Vijayawada-Gudur section is a railway line that connects the stations such as Vijayawada, Pedavadlapudi, Duggirala, Tenali Junction in Guntur district and passes through Bapatla and Chirala towns in Bapatla district, Ongole and Singarayakonda in Prakasam district, Kavali and Nellore mandals in Nellore district, and destination to Gudur junction in Tirupati district.

In addition to the above main lines, there are various branch lines and spur lines namely Guntur- Tenali & Tenali- Repalle that extend from the main line to connect specific towns with in Guntur district. These lines provide local connectivity and transportation services to different parts of the district.

### 1.6.2 Irrigation

#### 1.6.2.1. Major and Medium Irrigation Projects in Guntur district:

Irrigation has assumed an increasing significance in agriculture in the context of new technology, where high yielding varieties and multiple cropping are being practiced. The main reasons for low yields are inadequate rainfall, uneven and uncertain rains during the period of crop growth. It is generally found that the introduction of irrigation is associated with changes in the cropping pattern. The shift from a traditional cropping pattern to the most advantageous cropping pattern is possible only in the presence of irrigation facilities. The new agricultural

technology is highly based on sufficient moisture conditions. Thus, the development of irrigation is crucial for increasing agricultural production. The irrigation projects are classified as major, medium and minor irrigation details are shown in Table-11 and Figure-14.

#### 1.6.2.1.1. Major Irrigation Projects:

In Guntur district there are 03 major irrigation projects (Completed) in the district, they are Krishna Delta System (KDS) an ayacut of 1,71,486 Acers (Ac.), Nagarjunasagar Project (NSRC) an ayacut of 94,484 Ac., Guntur Channel an ayacut of 27,000 Ac.

#### 1.6.2.1.2. Medium Irrigation Projects:

In Guntur district there are 02 no. of medium irrigation projects (Ongoing), and they are Kondaveeti Vagu and Vykuntapuram Barrage. Under Kondaveeti vagu the designed Ayacut of 13.500 Ac. The Vykuntapuram Barrage is water storage project and located at Vykuntapuram village, Amaravathi mandal. It is ongoing project on Krishna River 23 km upstream of existing Prakasam Barrage with FRL 25 m. It is designed to store 10 TMC of flood water coming from the Vyra and Munneru rivers. The water mainly used for Irrigation, drinking water supply and Flood diversion. It causes obstruction to the traffic during flood times and causes the inundation to the fields in the mandals of Medikonduru, Amaravathi, Tadikonda, and Thulluru.

The A.P.S.I.D.C Lift Irrigation Schemes consists of existing Lift Irrigation Schemes (LIS) (222 Nos), ongoing LIS (8 Nos) and proposed LIS (16 Nos), under these schemes benefited an Ayacut of 2,60,442 Ac in combined Guntur district.

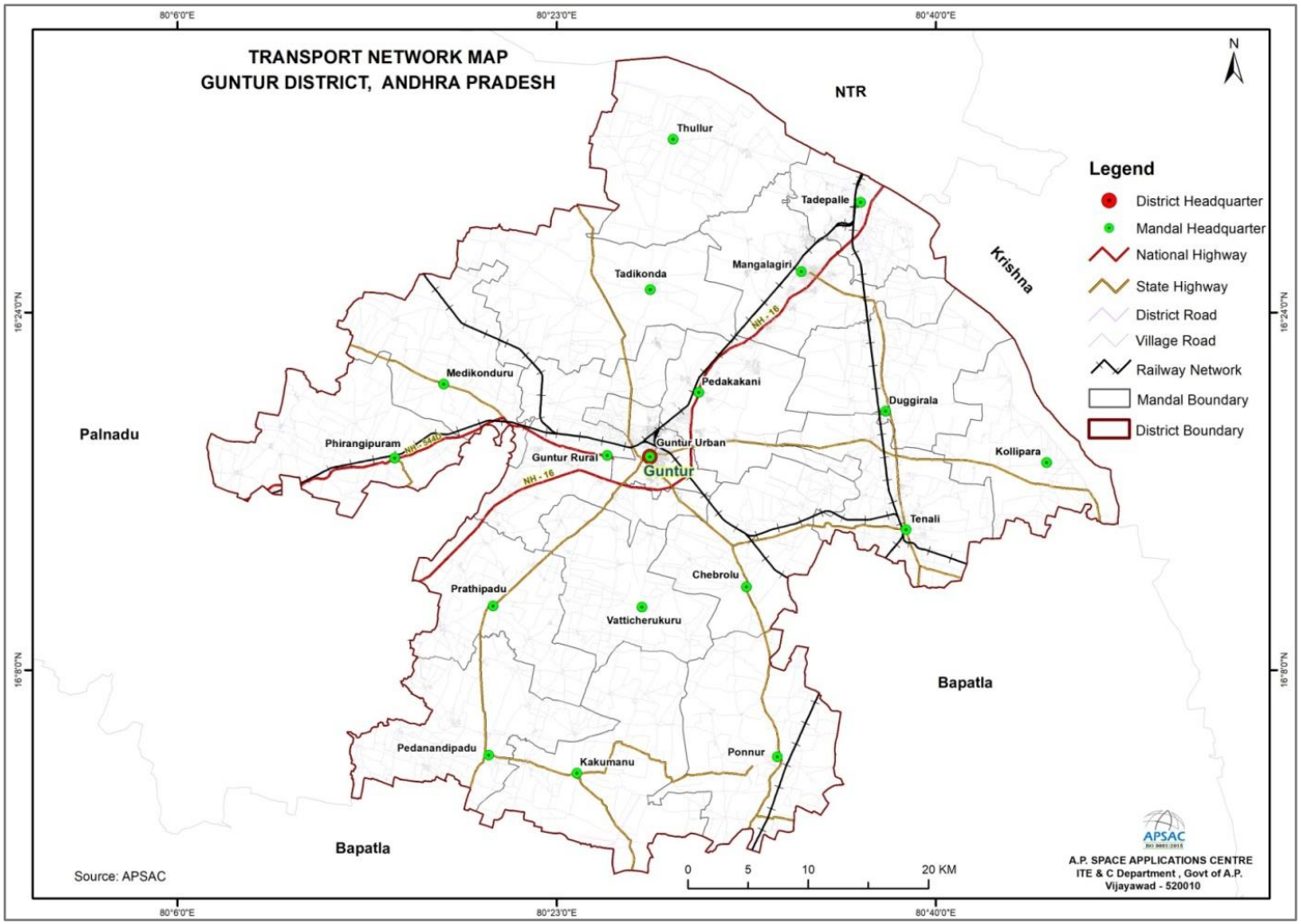



Figure-13: Transport Network of Guntur District, Andhra Pradesh

*Table 11 Major and Medium Irrigation Projects in Guntur District*

| S. No | Project Type | Name of the Project | Status | Ayacut in Acers |
|---|---|---|---|---|
| 1 | Major | Nagarjunasagar Project (NSRC) | Completed | 94,484 |
| 2 | | Krishna Delta System | | 1,71,486 |
| 3 | | Guntur Channel | | 27,000 |
| 4 | Medium | VykuntapuramBarrage (Flood diversion) | Ongoing | - |
| 5 | | Kondaveeti Vagu | | 13,500 |
| 6 | Minor | A.P.S.I.D.C Lift Irrigation Schemes (222 Nos) (**Combined district)** | Completed | 2,20,643 |
| 7 | | Lift Irrigation Schemes Under A.P.S.I.D.C (8 Nos) **(Combined district)** | Ongoing | 15,390 |
| 8 | | Lift Irrigation Schemes Under A.P.S.I.D.C (16 Nos) **(Combined district)** | Contemplated | 24,409 |
| 9 | | Minor Irrigation Tanks - Water Resources Dept. (above 100 Acres-5 Nos) | Completed | 2130 |
| 10 | | Minor Irrigation Tanks (below 100 Acres - 38 Nos) | | 1614.84 |
| | | | **Total** | **5,70,657** |

*Data source: WRD, APWRIMS, Govt. of A.P.*

### 1.6.2.2. Tank Information System

As per the information of Water Resources Departmental portal, Andhra Pradesh Water Resources Information & Management System (APWRIMS) and the URL:https://apwrims.ap.gov.in/ in Guntur district has 44 minor irrigation tanks. The Designed Storage Capacity of minor irrigation tanks in Guntur district is 332.25mcft and Current Storage Capacity is 199.61mcft. The mandal wise minor irrigation tanks details of Guntur district are shown in Table-12.

*Table 12 Mandal wise Minor Irrigation Tanks details of Guntur district*

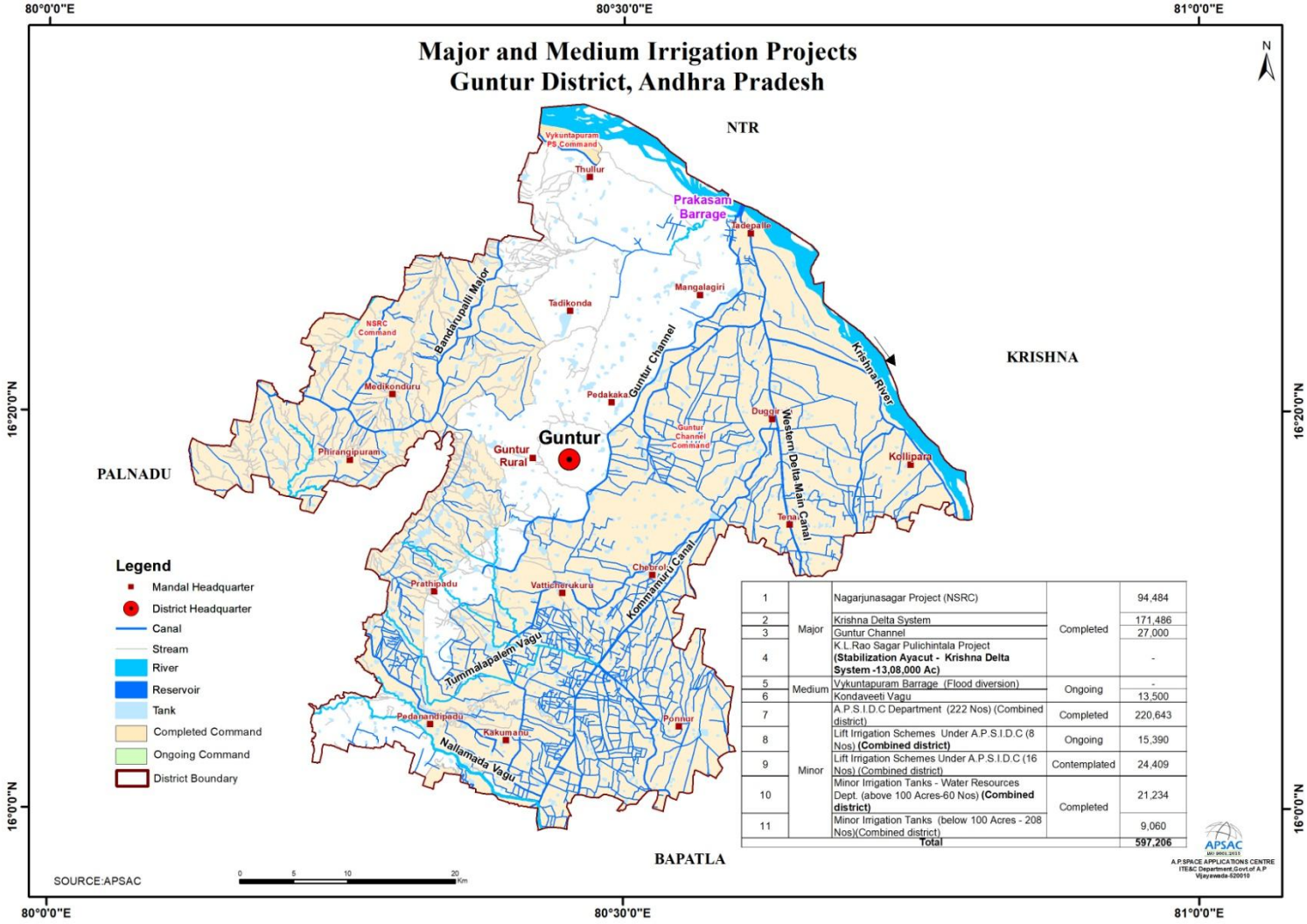
| S.No | Mandal | No.of MI Tanks | DesignedStorage Capacity (mcft) | Current Storage Capacity (mcft) |
|---|---|---|---|---|
| 1 | GUNTUR MANDAL | 14 | 102.22 | 64.53 |

| | | | | |
|---|---|---|---|---|
| 2 | MANGALAGIRI | 7 | 28.17 | 12.68 |
| 3 | PEDAKAKANI | 5 | 22.62 | 8.59 |
| 4 | PHIRANGIPURAM | 5 | 25.09 | 10.89 |
| 5 | PRATHIPADU | 4 | 41.38 | 25.41 |
| 6 | TADIKONDA | 6 | 105.8 | 73.58 |
| 7 | THULLUR | 2 | 3.58 | 1.4 |
| 8 | VATTICHERUKURU | 1 | 3.38 | 2.53 |
| **TOTAL** | | **44** | **332.25** | **199.61** |

*Data source: WRD, APWRIMS, Govt. of A.P.*

### 1.6.3 Eco-sensitive areas and important:

Guntur district is known for its rich cultural heritage, historical sites, and natural beauty. The important popular tourist, religious and cultural places to visit in the district are shown in the Table - 13 and the geographical location of each place is depicted in Figure-15.




| | | | | |
|---|---|---|---|---|
| 1 | Major | Nagarjunasagar Project (NSRC) | Completed | 94,484 |
| 2 | | Krishna Delta System | | 171,486 |
| 3 | | Guntur Channel | | 27,000 |
| 4 | | K.L.Rao Sagar Pulichintala Project **(Stabilization Ayacut - Krishna Delta System -13,08,000 Ac)** | | - |
| 5 | Medium | Vykuntapuram Barrage (Flood diversion) | Ongoing | - |
| 6 | | Kondaveeti Vagu | | 13,500 |
| 7 | Minor | A.P.S.I.D.C Department (222 Nos) (Combined district) | Completed | 220,643 |
| 8 | | Lift Irrigation Schemes Under A.P.S.I.D.C (8 Nos) **(Combined district)** | Ongoing | 15,390 |
| 9 | | Lift Irrigation Schemes Under A.P.S.I.D.C (16 Nos) (Combined district) | Contemplated | 24,409 |
| 10 | | Minor Irrigation Tanks - Water Resources Dept. (above 100 Acres-60 Nos) **(Combined district)** | Completed | 21,234 |
| 11 | | Minor Irrigation Tanks (below 100 Acres - 208 Nos)(Combined district) | | 9,060 |
| | | **Total** | | **597,206** |

*Figure-14: Major and Medium Irrigation Projects of Guntur District*

*Table 13 Important places of Tourism in Guntur district.*

| S.No | Name | Village | Mandal |
|---|---|---|---|
| 1 | Bhavani Island | Undavalli Rural | Thadepalle |
| 2 | Chebrolu Temple Complex | Chebrolu | Chebrolu |
| 3 | Crazi World | Guntur Rural | Guntur |
| 4 | East paris Baptist Church | KantamrajuKonduru | Duggirala |
| 5 | Guntur Corporation | Nallapadu Rural | Guntur |
| 6 | Haailand Water Park | Chinakakani | Mangalagiri |
| 7 | Hosanna mandir | Tadikonda | Tadikonda |
| 8 | Mangalagiri Handloom & Sarees | Mangalagiri (M) | Mangalagiri |
| 9 | NidumukkalaBaji Baba Darga | Nidumukkala | Tadikonda |
| 10 | NTR Manasa Sarovaram | Guntur Rural | Guntur |
| 11 | Panakala Narasimha Swami Temple | Mangalagiri (M) | Mangalagiri |
| 12 | Phirangipuram Church | Phirangipuram | Phirangipuram |
| 13 | Ponnur Anjaneya Swamy Temple | Ponnuru | Ponnur |
| 14 | Tenali Siva Temple | Tenali Rural | Tenali |
| 15 | Undavalli Caves | Undavalli Rural | Thadepalle |
| 16 | Uppalapadu Bird Sanctuary | Uppalapadu | Pedakakani |
| 17 | Bhavannarayana Temple | | Ponnuru |

*Data Source: Tourism Department, Government of Andhra Pradesh*.

**A brief description of certain tourist places are given below:**

**1.6.3.1. Undavalli Caves:** Undavalli caves are located at a distance of 30 km from the district headquarter i.e Guntur. These caves are located near the village of Undavalli. The caves feature rock-cut architecture and house several Hindu and Jain sculptures. The largest cave has a beautiful monolithic statue of Lord Vishnu in a reclining posture.

**1.6.3.2. Uppalapadu Bird Sanctuary:** Uppalapadu Bird Sanctuary is located at a distance of 10 km from the district headquarter. The bird watching, Uppalapadu Bird Sanctuary is a must-visit place. It is located near Guntur and provides a home to a wide variety of migratory birds, including pelicans and painted storks. The sanctuary is a serene spot for nature lovers and bird enthusiasts.

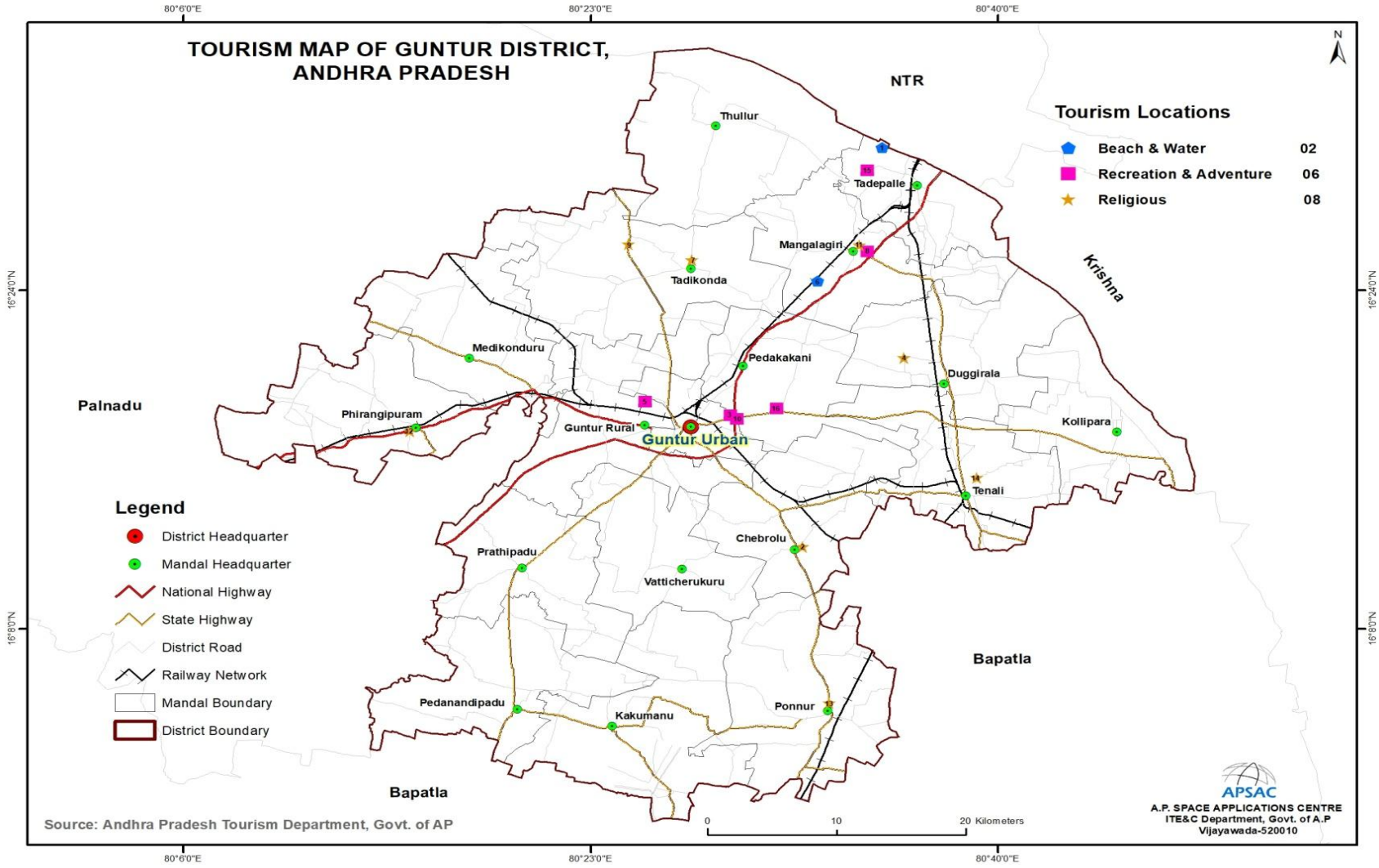



*Figure: 15 Tourist Map of Guntur District, Andhra Pradesh*

**1.6.3.3. Bhavani Island :** Bhavani Island situated in the midst of the Krishna river, at Undavalli Village, Tadepalli mandal. It is located at the upstream of Prakasam Barrage and is considered one of the largest river islands in India, with an area of 133 acres. The island is located in close proximity to the Lord Kanaka Durga temple.

**1.6.3.4. NTR Manasa Sarovaram Park:** The NTR Manasa Sarovaram Park is located at a distance of 6 km from the district headquarter. It is a man-made park that was named after Shri N.T. Rama Rao. Since, it is home to Crazy World Water park – an amusement park, this place makes for an amazing adventurous affair for the visitors. Located on the Chennai-Howrah NH5.

**1.6.3.5. Haailand:** Haailand is located at a distance of 27 km from the district headquarter. It is a resort and theme park in Andhra Pradesh. It is considered to be the most deliciously designed and themed water cum amusement park in the region. It offers a plethora of fun games and activities.

### 1.6.4 Places of Religious and Cultural importance

**1.6.4.1. Panakala Lakshmi Narasimha Swamy Temple:** Panakala Lakshmi Narasimha Swamy Temple is located at a near by Vijayawada-Madras trunk road (NH16) and is famous from the pre-historic times. Mangalagiri is a hill of bliss by virtue of the location of the famous temple of Lord Panakala Lakshmi Narasimha Swamy.

**1.6.4.2. Bhavanarayana Swamy temple:** Bhavanarayana Swamy temple is located at a distance of 53 km from the district headquarter Guntur. It is located at a distance of 29 Km from Guntur on the Guntur-Chirala state highway and it is famous for its Bhavanarayana Swamy temple, attracting large number of devotees. Among the other temples, Sri Anjaneya Swamy and that of Garutmanta are noted for the giant size (about 30’ in height) and rare statues of the duties.

**1.6.4.3. Phirangipuram Church:** Phirangipuram Church is located at a distance of 21 km from Guntur town. The architecture of the Phirangipuram Church is typically grand, featuring a distinctive design that is characteristic of many Catholic churches.

## 1.7 Drainage Pattern

### 1.7.1 Drainage

The Krishna River is the major River in the district and the tributaries are Pedda vagu and Kondaveeti vagu. The Kondaveeti vagu rises near the Kondaveedu hills, Medikonduru mandal, Guntur district, and it flows towards the north direction and joining into the Krishna River near Vykuntapuram village, Amaravathi mandal. The Pedda vagu rise near Kondaveedu hills, and it flows towards the north-west direction and joins the Krishna River near Prakasam Barrage.

The Vogeru vagu and Konda vagu Rivers are also covered in other part of the district. The Vogeru Vagu tributaries are Nallamada vagu, Nakka vagu originated near Gouthikonda hills, Nekarikallu of Palnadu district and enters into the southern part of the Guntur district, merged with Nallamada vagu at Pedanandipadu.

The Konda vagu tributaries are Rama Vagu and Tummalapalem vagu are rises near the Kondaveedu hills and flows towards the South west direction and joins to the Tungabhadra drain near Kollimarla village, Kakamanu mandal in Guntur district. The Figure-16 illustrates the drainage system and the surface water bodies of the district.

### 1.7.2 Geomorphology of the District:

Using IRS satellite data and GIS, a detailed geomorphology and structural map of Guntur District was generated according to the guidelines of the Rajiv Gandhi National Drinking Water Mission (RGNDWM) at a scale of 1:50,000. The objective of this mapping was to delineate lithology, geomorphology, and structural characteristics of the area at a 1:50,000 scale and integrate them to identify potential groundwater prospect zones and recommend suitable structures for groundwater recharge. Various hydrogeomorphic units were delineated, and suitable recharge structures were proposed for villages affected by drinking water scarcity under this project. The description of geomorphic units of different origins depicted in Figure-17 in Guntur District is as follows:

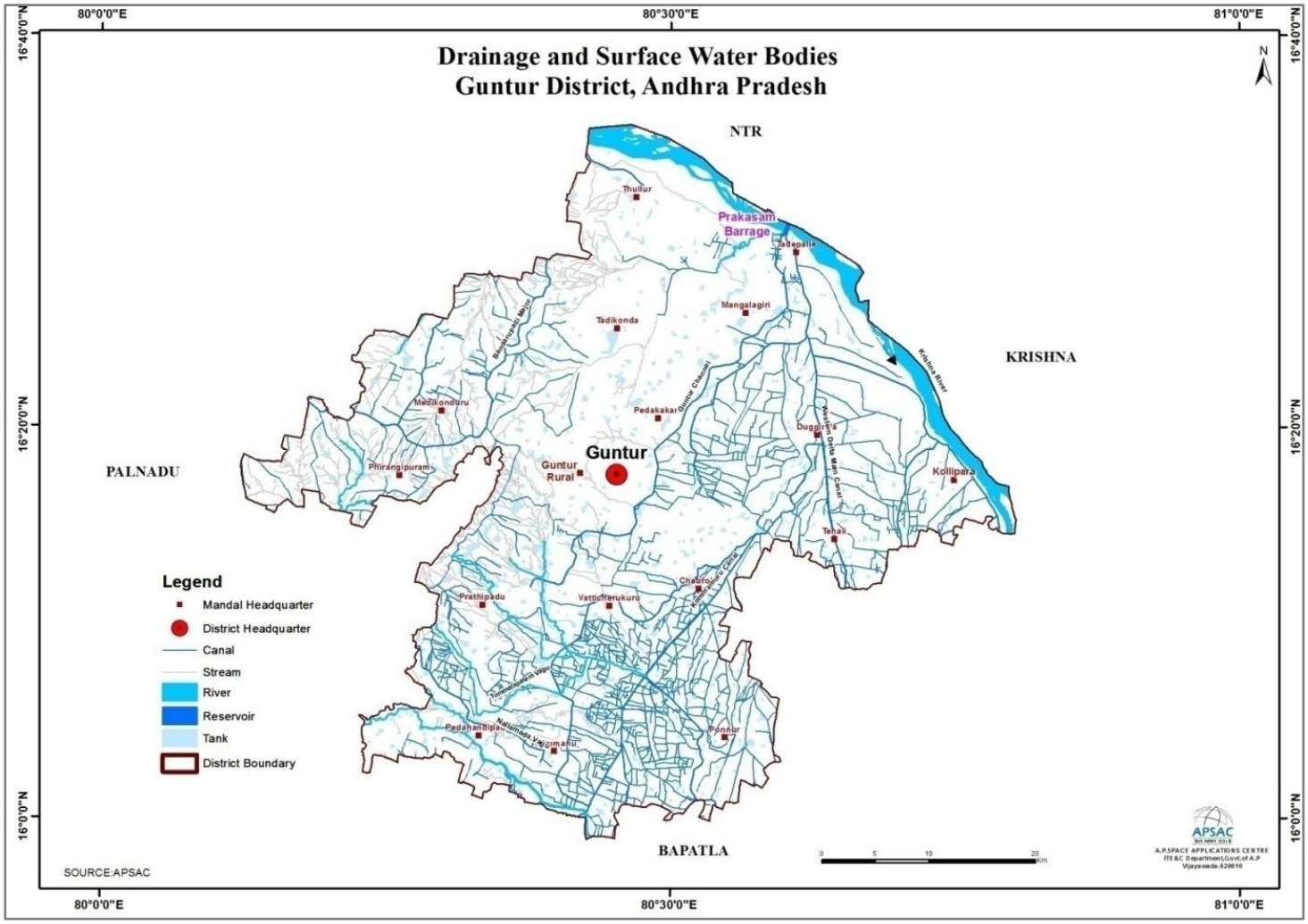



*Figure - 15: Drainage Network and Surface Water Bodies of the Guntur District*

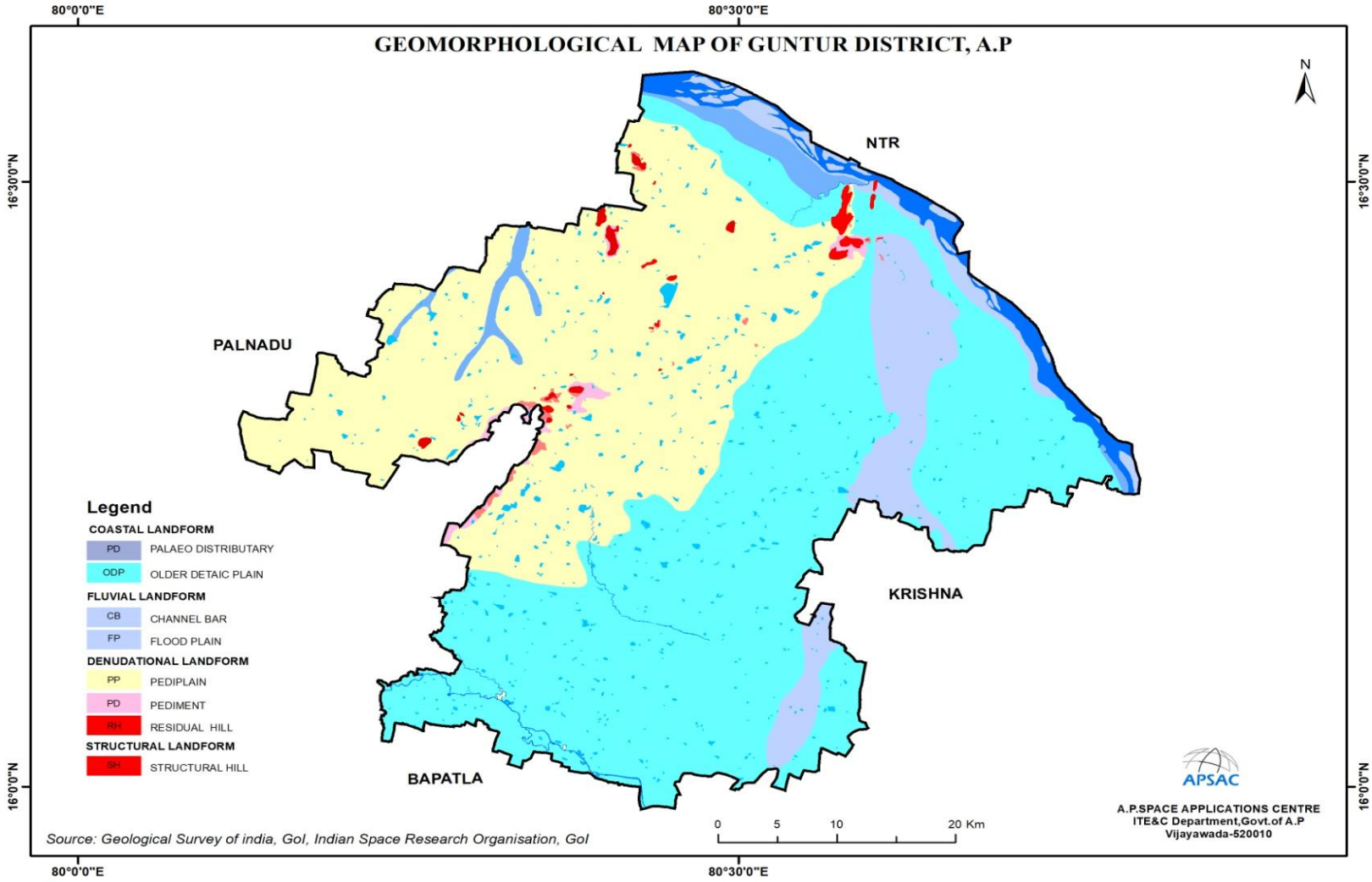



*Figure 17: Geomorphology of Gunutr District, Andhra Pradesh*

### 1.7.3 Landforms of Fluvial origin

The term "fluvial" is used in Earth science to refer to processes and landforms created by flowing water. Like other surface processes, flowing water can either erode material from the Earth's landscape or deposit layers of sediment. The resulting landforms can thus be classified as either erosional or depositional. The incredible power of flowing water in shaping various erosional and depositional landforms is well known. Although the quantity of water in a stream is small at certain times of the year, very large volumes of water move through the channel, forming an important component of the hydrological cycle. The fluvial dissection of the landscape consists of valleys, which include channel ways organized into a system of connections known as a drainage network. Drainage networks exhibit many types of quantitative regularities that are useful in analyzing both the fluvial systems and the terrain they dissect (NRSA, 2007).

**1.7.3.1. Alluvial plain:** A level or gently sloping tract, or a slightly undulating land surface produced by extensive deposition of alluvium, usually adjacent to a river that periodically overflows its banks. It may be situated on a flood plain, a delta, or an alluvial fan. This landform is predominantly seen in the northern part of the district.

**1.7.3.2. Palaeochannel:** Deep valleys cut into the bedrock terrain and filled largely with alluvium, glacial outwash gravels and sands, or with tills. These are a good source of underground water.

**1.7.3.3. Flood plain:** The surface or strip of relatively smooth land adjacent to a river channel, constructed (or in the process of being constructed) by the present river in its existing regime. It is covered with water when the river overflows its banks during times of high water. It is built of alluvium carried by the river during floods and deposited in the sluggish water beyond the influence of the swiftest current.

**1.7.3.4. Delta:** The low, nearly flat, and alluvial tract of land deposited at or near the mouth of a river. It commonly forms a triangular or fan-shaped plain of considerable area, enclosed and crossed by many distributaries of the main river. It may extend beyond the general trend of the coast and results from the accumulation in a wider body of water (usually a sea) of sediment supplied by a river in such quantities that it is not removed by tides, waves, and currents.

**1.7.3.5. Valley fill:** The unconsolidated sediment deposited by any agent to fill or partly fill a valley.

### 1.7.4 Landforms of Coastal origins

The coasts are a unique assemblage of erosional and depositional processes. The various landforms of coastal areas are almost exclusively the result of the action of ocean waves. Wave action creates some of the world's most spectacular erosional landforms. Where wave energy is reduced, depositional landforms like beaches are created. The source of energy for coastal erosion and sediment transport is wave action. A wave possesses potential energy as a result of its position above the wave trough and kinetic energy caused by the motion of the water within the wave. This wave energy is generated by the frictional effect of winds moving over the ocean surface.

The higher the wind speed and the longer the fetch or distance of open water across which the wind blows and waves travel, the larger the waves and the more energy they possess. Long open ocean waves or swells travel faster than short, locally generated sea waves. They also have longer wave periods, and this is how they are distinguished from the short sea waves upon reaching the coast. Long swells, which have traveled hundreds of kilometers, may have wave periods of up to 20 seconds. Smaller sea waves have wave periods of 5 to 8 seconds. Where ocean depths are greater than the length of the waves, the wave motion does not extend to the ocean floor and therefore remains unaffected by the floor.

As the ocean depth falls below half the wavelength, the bottom increasingly affects the wave motion. As the depth of water decreases, the wave height increases rapidly, and the wavelength decreases rapidly. Thus, the wave becomes more and more peaked as it approaches the shore, finally curling over as a breaker and breaking on the shore. As the wave breaks, its potential energy is converted into kinetic energy, providing a large amount of energy for the wave to do work along the shoreline. Transportation by waves and currents is necessary to move rock particles eroded from one part of a coastline to a place of deposition elsewhere. One of the most important transport mechanisms results from wave refraction. Since waves rarely break onto a shore at right angles, the upward movement of water onto the beach (swash) occurs at an oblique angle. However, the return of water (backwash) is at right angles to the beach, resulting in the net movement of beach material laterally. This movement is known as beach drift. The endless cycle of swash and

backwash and the resulting beach drift can be observed on all beaches. Frequently, backwash and rip currents cannot remove water from the shore zone as fast as it is piled up there by waves.

As a result, there is a buildup of water that leads to the lateral movement of water and sediment just offshore in a direction with the waves. The currents produced by the lateral movement of water are known as longshore currents. The movement of sediment is known as longshore drift, which is distinct from the beach drift described earlier, operating on land at the beach. The combined movement of sediment via longshore drift and beach drift is known as littoral drift. Tidal currents along coasts can also be effective in moving eroded material. While incoming and outgoing tides produce currents in opposite directions daily, the current in one direction is usually stronger than the other, resulting in a net one-way transport of sediment. Longshore drift, longshore currents, and tidal currents in combination determine the net direction of sediment transport and areas of deposition. Using multi-temporal satellite data can reveal the dynamics of the coast (NRSA, 2007).

**1.7.4.1. Beach:** A gently sloping zone, typically with a concave profile, of unconsolidated material that extends landward from the low-water line to the place where there is a definite change in material or physiographic form (such as a cliff) or to the line of permanent vegetation (usually the effective limit of the highest storm waves).

**1.7.4.2. Beach ridge:** A low, essentially continuous mound of beach or beach and dune material (sand, gravel, shingle) heaped up by the action of waves and currents on the backshore of a beach beyond the present limit of storm waves or the reach of ordinary tides, occurring singly or as one of a series of approximately parallel deposits. The ridges are roughly parallel to the shoreline and represent successive positions of an advancing shoreline.

**1.7.4.3. Coastal plain:** A low, generally broad but sometimes narrow plain that has its margin on the shore of a large body of water (especially the ocean), with its strata either horizontal or very gently sloping toward the water. It generally represents a strip of recently emerged sea floor or continental shelf.

**1.7.4.4. Dune and Swale complex:** It is a large complex of parallel wetland swales and upland beach ridges (dunes) found in coastal embayment and on large sand spits along the shorelines of the Great Lakes. The upland dune ridges are typically forested, while the low swales support a variety of herbaceous or forested wetland types, with open wetlands more common near the shoreline and forested wetlands more prevalent further from the lake.

**1.7.4.5. Tidal flat:** An extensive, nearly horizontal, marshy or barren tract of land that is alternately covered and uncovered by the rise and fall of the tide, consisting of unconsolidated sediment (mostly mud and sand). It may form the top surface of a deltaic deposit.

### 1.7.5 Landforms of denudational origins

The landforms of denudational origin are formed where the denudation process dominates over other processes. Most of the landforms resulting from this process are the combined effect of mechanical and chemical weathering. Denudation is the process of material removal by erosion and weathering, which directly influences the relief of the area, especially in reducing relief to the base level. The agents involved are mostly water, ice, and wind. The major factors affecting denudation are geology, climate, tectonics, and anthropogenic effects. All rocks and minerals at or near the surface are subject to attack by physical and chemical processes. The effect of this process is not the same everywhere due to varying resistance of rocks to change. As a result, weathering and erosion yield a number of landforms with typical shapes and forms. Weathering is an essential part of the rock cycle. The parent material, or rock weathered material, is disaggregated to form smaller fragments, and some minerals are dissolved and removed by the agent of water. This removal of material is erosion and is accomplished by running water, wind, glaciers, etc. Weathering provides raw material for sedimentary rock and soil (NRSA, 2007).

**1.7.5.1. Denudational Hill:** It is a highly dissected hill that has obliterated the structures.

**1.7.5.2. Inselberg:** A prominent, isolated, steep-sided, usually smoothed and rounded residual knob, hill, or small mountain rising abruptly from and surrounded by an extensive and nearly level, lowland

erosion surface in a hot, dry region (as in the deserts of Southern Africa or Arabia), generally bare and rocky although partly buried by the debris derived from and overlapping its slopes; it is characteristic of an arid or semiarid landscape in a late stage of the erosion cycle.

**1.7.5.3. Pediment:** A broad, flat or gently sloping, rock-floored erosion surface or plain of low relief, typically developed by subaerial agents (including running water) in an arid or semiarid region at the base of an abrupt and receding mountain front or plateau escarpment, and underlain by bedrock (occasionally by older alluvial deposits) that may be bare but more often partly mantled with and discontinuous veneer of alluvium derived from the upland masses and in transit across the surface.

**1.7.5.4. Pediment-Inselberg Complex:** The pediments are dotted by numerous inselbergs of small sizes, which makes it difficult to distinguish from the pediments. Hence it is called a complex of pediment and inselberg.

**1.7.5.5. Pediplain:** An extensive, multi-concave, rock-cut erosion surface formed by the coalescence of two or more adjacent pediments and occasional desert domes, representing the result (the "peneplain") of the mature stage of the erosion cycle. Based on the thickness of weathering, they are further classified as shallow, moderate, and deep pediplains.

**1.7.5.6. Residual Hill:** A small remnant hill, which has witnessed all forms of denudation.

### 1.7.6 Structural Features of Guntur District

All linear features are to be interpreted from the satellite image. The lineament may not be a single continuous line; rather, it has to be shown as discontinuous line segments. Lineaments from remote sensing data can be identified mainly based on their linear nature, presence of moisture, alignment of vegetation, alignment of ponds, straight stream segments, etc. However, interpretation of lineaments is to be done in conjunction with other diagnostic criteria such as channel offset, bank erosion, down-cutting of channel along lineament, warping and displacement of sediment layer, abrupt change of river course, presence of dry channel in an active river course, channel rejuvenation, land subsidence, linear ridges, scarp surface, linear alignment of water bodies,

and straight channel segments. Major lineaments occurring in the Guntur District have been mapped as part of the lineament map generation.

The structural map (Figure 18) shows both faults and lineaments. There are two faults, one located in the northern area minute in nature running NE-SW direction and the other big in nature located in the central part of Guntur District and running in SW direction. There are a number of dykes present in the study area West to East direction structures from the Narji Formations are prominent. The eastern part of Guntur District is covered with delta area and lineaments cannot be deciphered because this area is totally covered in alluvium.

**1.7.6.1. Micro lineaments -** Very small (magnitude) linear features frequently observed in the image. They correspond to minor faults, fractures, joints, and bedding traces in the rock. Geomorphologically, they are expressed as linear alignments of local depressions/ponds and tonal changes in soil and vegetation. For quantification purposes, lineament length < 3 km is classified as micro lineaments, which are covered in the mandals of Atchampet, Veldurthi, Vinukonda, Macherla, Machavaram, Bollapalle, Ipur, Edlapadu, Rajupalem, and Tadikonda.

**1.7.6.2. Mega lineaments -** Large linear features coincide with regional trends/structural features. They cut across various geomorphic units both in time and space. Lineament length > 3 km is classified as mega lineaments, the majority of which are covered in the mandals of Karempudi, Gurajala, Dachepalle, Bellamkonda, Sattenapalle, Krosur, Nakerekallu, and Piduguralla.

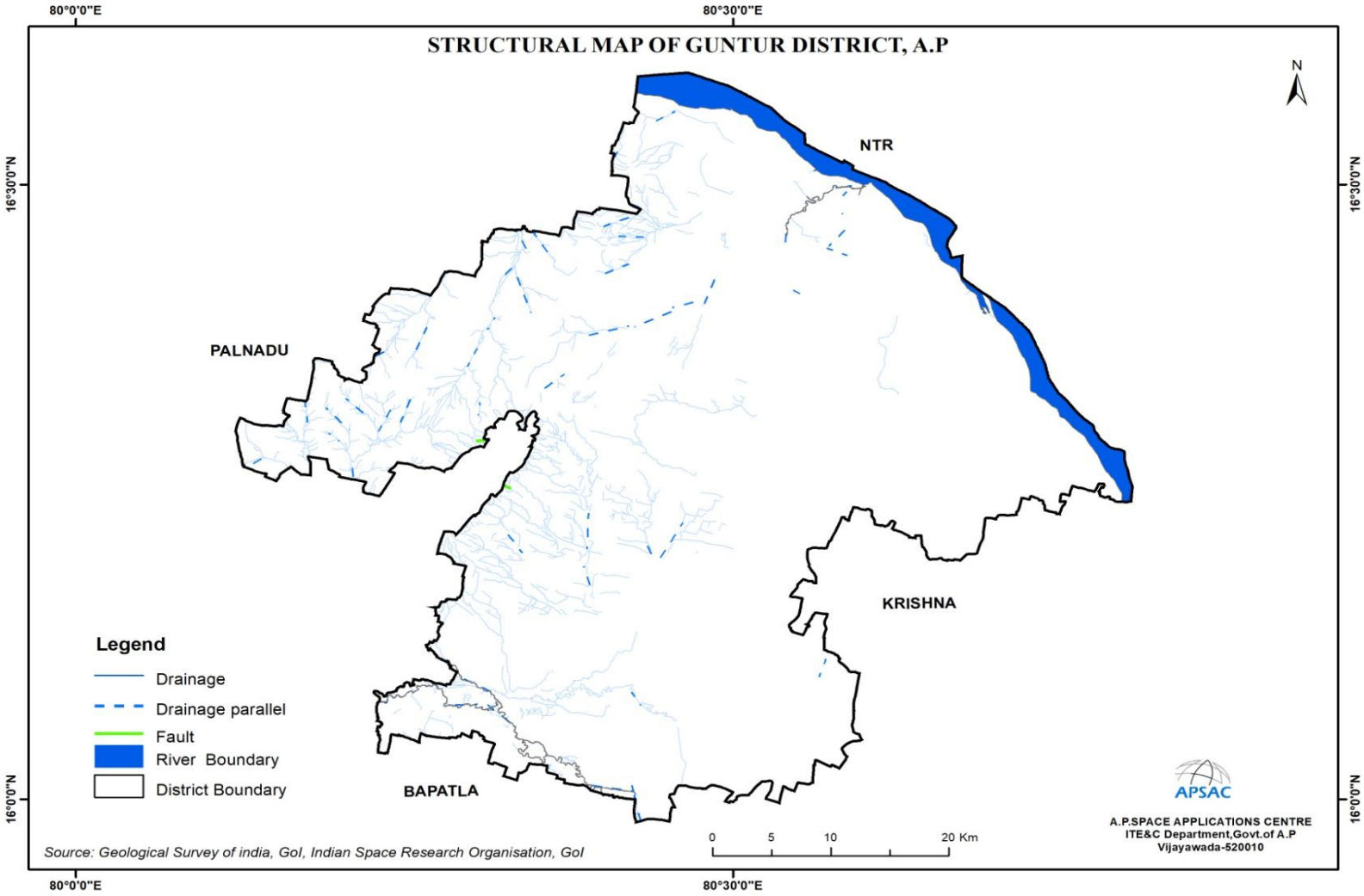



*Figure-18 : Structural Map of Guntur District, Andhra Pradesh*

### 1.7.7 Ground Water Quality in the Guntur District

The groundwater quality laboratory analyzed physico-chemical parameters such as Total Dissolved Solids (TDS), Total Hardness (TH), Chloride ($Cl^-$), Nitrate ($NO_3$), Fluoride (F), Iron (Fe), Total Alkalinity (TA), and Sulphate ($SO_4$) using standard techniques. Groundwater quality samples were collected for two seasons, i.e., post-monsoon and pre-monsoon, from the Rural Water Supply and Sanitation Department (RWSS) from December 2017 to June 2019. The samples were compared with the BIS (2015) standards in terms of desirable, permissible, and non-potable classes. Blue, yellow, and red colors indicate pre-monsoon quality, and +, ., - symbols indicate post-monsoon quality for desirable, permissible, and non-potable classes, respectively (Figure-19).

From the analysis, it has been observed that the groundwater is polluted in both pre-monsoon and post-monsoon seasons, with about 10% of the area falling under the non-potable category due to high concentrations of Nitrate, Iron, Fluoride, Alkalinity, and Total Hardness. Approximately 80% of the area falls under the potable category, while the remaining 10% of the area is covered by hills and water bodies throughout the entire district. The occurrence and movement of groundwater in an area are governed by several factors such as topography, lithology, geological structure, depth of weathering, extent of fractures, drainage pattern, and climatic conditions, as well as the interrelationship between these factors (APSAC, 2017b).

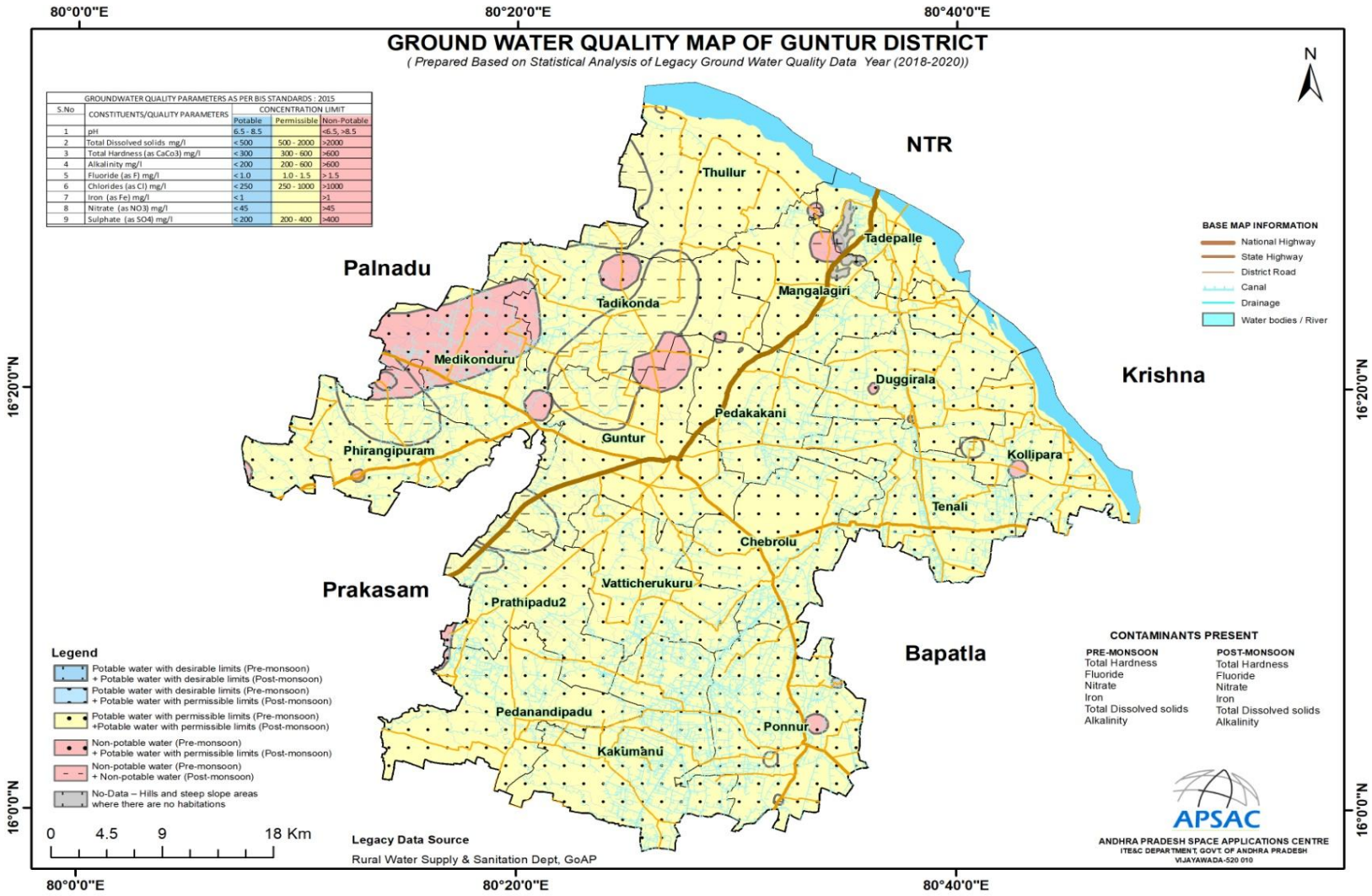



*Figure-19: Ground Water Quality Map of Guntur District*

# Chapter – II Minor Minerals

## 2.1 Overview of Mining Activity

The following leases exist in the Guntur district office jurisdiction. Mineral Regulatory, the important functioning of this office in these aspects are:-

i. Achievement of Targets of Mineral Revenue collections is fixed to this office annually.
ii. Receiving and processing of the Mineral Concession Applications, duly conducting the Technical inspection, Survey and demarcation of the Mineral bearing applied areas.
iii. Execution and Regulation of the operations of the Mining / Quarry leases in accordance with the Acts and Rules.
iv. Issuing of dispatch permits, duly collecting the Advance Royalty / Seig.fee from the lease holders on the minerals produced and intend to dispatch from their leased areas through online permit system.
v. Controlling the illegal mining / quarrying and transportation by conducting the periodical inspections of the mines and quarries and also conducting the surprise vehicular checking and imposing penalties.
vi. Finalisation of Demand, Collection and Balance statements of the leases on annual basis.

The Guntur District is one of the chief minor minerals producing districts in the state and endowed with rich & varied minor mineral resources such as colour granite, black granite. Other minor minerals like gravel, ordinary earth, road metal and slate are found and mined in the district.

There are 110 mineral leases in force in Guntur district. It is estimated that during the year 2022-23, 196 Cum of Color Granite, 7476 CuM of Black Granite are produced. A total of 1,91,788CuM of gravel,1,02,938 Cum of Road metal, etc are produced in Guntur in 2022-23.

## 2.2 Geology of the District

**Generalized Litho-stratigraphic Succession of Andhra Pradesh**

| Geological Time (a) | Supergroup (b) | Group (c) | Formation (d) | |
|---|---|---|---|---|
| Holocene | - | - | Alluvium, river terraces, beach sands and soils | |
| Pleistocene | - | - | Laterite and Gravel | |
| Mio-Pilocene | - | - | Rajahmundry Fm. | |
| Late Cretaceous Eocene | - | - | Deccan Trap with infra-and inter-trappeans | |
| Lower Cretaceous to Upper Carboniferous | Gondwana | Upper Gondwana | Godavari Valley (Fluviatile) Chikiala Fm. Gangapur Fm. | Coastal Area (Fluvio-marine) Tirupati Fm. (Vejendla Fm) Raghavapuram Fm. (Vemavaram), Kandukuru, SriperambadurFms) Gollapalle Fm. (Satyavedu Fm.) |
| | | Lower Gondwana | Kota Fm. Maleri Fm. | Kamthi Fm. Barren Measures, Barakar Fm. Talchir Fm. |
| | | | **Cuddapah Basin** | **Pakhal Basin** |
| Sullavai Sandstone | | | | |
| Middle to Upper Proterzoic (980-500 m.y) | Kurnool | | Nandyala Shale Koilakuntla Limestone PanyamQuarzite Owk Shale Narji Limestone Banaganapalli Quartzite | Putnur Limestone Penganga Group Takalapalle Arkose |

| | | | | |
|---|---|---|---|---|
| | | | **Srisailam Quartzite** | **Alabaka Sandstone** |
| | | Nallamalai | Cumbum Fm. | Lankavaram Shale |
| | | | | Pattipalle Quartzite |
| | | | Mulug Group | Polavaram Fm. |
| Middle Proterozoic (1600-1300 m.y.) | Cuddapah | | | Jakaram Arkose |
| | | | Bairankonda Quartzite | |
| | | Chitravathi | Gandikota Quartzite | Pandikunta Shale |
| | | | Tadipatri Fm. | Gunjeda Dolomite |
| | | | Pulivendula Quartzite | |
| | | | Mallampalli Group | |
| | | Papaghni | Vempalle Fm. | Bayyaram Quartzite |
| | | | Gulcheru Quartzite | Bolapalle Fm. |
| EPARCHAEAN INTERVAL | | | | |
| Middle Proterozoic to Late Archean (2600-970 m.y) | Eastern Ghats | | Charnockite | Charnockite with megacrystic k-feldspar charnockite |
| | | | Khondalites | Two pyrozene granulite / amphibolite |
| | | | | Calc-silicate / granulite, Garnet-sillimanite-quartz-graphite gneiss (biotite-k-feldspar (Khondalite) |
| | | | | Quartzite (gernet, sillimanite) |
| Late Archaean (2700 m.y) | Dharwar | Ramagiri-Penakacherla, Kolar, Kadiri, Gadwal-Narayanpet, Jonnagiri, VeligalluPeddavuru Schist Belts &W.Part of Nellore Belt. | | Pyroclastic Rocks, local conglomerate / event conglomerate Metabasalt (Pillowed), Acid volcanics, minor andesite, dacite, rhyodacite, amphibolites, metaultramafics, minor quartzite, calcsilicates, phyllites, intrusives of basic rocks and granites, rare lamprophyres. |

| | | | |
|---|---|---|---|
| Middle Archaean (3100-2900 y.m) | Older Supracrustals (Sargur) | Eastern and Southern parts of Nellore. | High Grade schists include include garnet, staurolite, kyanite, sillimanite, cordierite (rarely sapphirine-kornuropine as in Karimnagar) Mica schists, calcilicate rocks, crystalline limestone (minor). BIF, fuchsite quartzite, hornblende granulite, amphibolite, migmatite streaky biotite gneiss. |
| Gneissic Complex | | | Banded Tonalite-Trondhjemite Gneiss. |

Geologically, the State of Andhra Pradesh forms a part of peninsular India and is one of the most ancient land masses. The geological formations of Andhra Pradesh range from the oldest to the recent.

The Sargur Supracrustals are the oldest rocks in Southern India. They are mostly present as enclaves within the migmatitic gneiss. These supracrustal rocks are exposed in the eastern and southern parts of the Nellore schist belt. The lithology of Sargur mostly comprises garnet, staurolite, kyanite schists, BIFs, quartzites, granulites, and amphibolites. The gneissic complex comprises banded tonalite trondhjemite gneiss, which is the basement rock of the study area, along with migmatitic gneiss and biotite granite gneiss. TTGs are sodic, quartz-bearing granitic (plutonic) rocks with plagioclase as the most common feldspar, and K-feldspar ranging from subordinate to nearly absent. The Dharwarian rocks in Andhra Pradesh are exposed in the western part of the Nellore belt and many other areas like Anantapur, Ramagiri-Penakacherla, Kolar, Kadiri, Gadwal-Narayanpet, Jonnagiri, Veligallu Peddavuru Schist Belts & western part of Nellore Belt. The lithology mostly comprises metabasalt (pillowed), acid volcanics, minor andesite, dacite, rhyodacite, amphibolites, metaultramafics, minor quartzite, calcsilicates, phyllites, intrusives of basic rocks and granites, rare lamprophyres, also some pyroclastic rocks and local conglomerate/event conglomerate, defining hiatus in stratigraphy, is observed in the study area. Rocks from the middle Proterozoic to late Archaean are exposed in the Eastern Ghats mobile belt; they are extremely high grade and fall under granulite metamorphic

facies. They mostly include khondalites and charnockites. The metamorphic facies of rocks in the Eastern Ghats go up to granulite facies. Charnockite with megacrystic K-feldspar, two pyroxene granulite/amphibolite, calc-silicate/granulite, garnet-sillimanite-quartz-graphite gneiss (biotite-K-feldspar), quartzite (garnet, sillimanite), and were exposed in most of the state. The Cuddapah basin is a part of the Dharwar craton and is the second-largest Purana basin in Peninsular India. It marks the profound unconformity Eparchaean unconformity in early literature. The Cuddapah basin formation exposes rocks from the late Proterozoic to upper Proterozoic. The Cuddapah basin is divided into four groups: Nallamalai, Chitravathi, Papaghni, and Kurnool. Papaghni comprises dolomite and limestones, Chitravathi comprises shale, dolomite, and quartzites, Nallamalai comprises shale, quartzites, and arkosic sandstones, Kurnool comprises shales, quartzites, and limestones. The Cuddapah basin is characterized by a rhythmic pattern of quartzite-shale-carbonate cycles. Uraniferous limestone is also reported from the Cuddapah basin. The major exposures of Purana rock formations are in Prakasam, Kurnool, Cuddapah, Chittoor, and Nellore. The Deccan traps are found in East and West Godavari districts, with exposures near Rajahmundry. Outcrops of Tertiary formations are found in East and West Godavari and Visakhapatnam districts, and the Quaternary sediments occurring as thick blankets of alluvium are found in the river valleys, deltas, and along the East coast.

The Guntur district area is underlain by various geological formations of different age groups ranging from Archaean to recent. The Archaean basement complex comprises granite-gneisses, schists, khondalites, charnockites, and basic dykes of dolerites, which form the predominant rock types in the central part. The granitoid and granitic gneisses are intruded by a number of gabbros, norite, and dolerite dykes. The fringe of the Archaean in the central part is represented by the Cuddapah basin, namely the Nallamalai group of Upper Cuddapahs. In sequential order, the younger Kurnools occurring in the Cuddapahs and those in the western parts of the district are thrust over by the Cuddapahs, and these in turn by the Archaean granite-gneisses. The Upper Gondwana group of sandstones and shales outcrop are seen at places between Guntur and Tenali. The youngest rock types of the district appear to be of Mio-Pliocene age followed by the alluvial deposits of Recent to Sub-Recent age.

Basic charnockites are exposed in the applied area in the form of boulders. They are made up of hypersthene, quartz, biotite, grey feldspar, and other mafic minerals. These rocks belong to the granulite facies of metamorphism and they are expected to have been formed due to paleogenic fusion and metamorphism. These rocks represent the Precambrian basement of the Eastern Ghats province. The khondalites of this area are melanocratic (dark color) and crystalline. The size of the grains ranges from very medium to coarse-grained, and anhedral to subhedral porphyritic texture is the characteristic feature. The geological map of the district is depicted in Figure-20. The Eastern Ghats belt, extending in a NE-SW direction from Ongole in the southern part of Andhra Pradesh to the Brahmani River in Orissa, parallel to the east coast of India, over a distance of 900 km, encompasses parts of the eastern coastal districts of Prakasam, Bapatla, Guntur, Krishna, East and West Godavari, Visakhapatnam, Vizianagaram, and Srikakulam and is more than 600 km in length with a maximum width of 100 km in the northern part. It tapers down to less than 50 km in the south. It has a broad arcuate trend with a westward convexity, in conformity with the shapes of the Nellore schist belt and the eastern margin of the Cuddapah basin, on the west.

The mobile belt is divided into three longitudinal zones viz., the Western Charnockite Zone (WCZ), the Central Khondalite Zone (CKZ), and the Eastern Migmatite Zone (EMZ).

SUCCESSION OF THE EASTERN GHATS SUPERGROUP

<table>
<tr><td rowspan="3">Granitoid Suite</td><td>Granitoid with megacrystic k-feldspar</td><td>Intrusives</td><td>Layered anorthosite and associated mafic and chromiferousultramafics.</td></tr>
<tr><td rowspan="3">Undifferentiated (with migmatiticdiatexite, augen / porphyroblastic granite, gneisses, garnet + biotite homophanous granite / gneiss leptynite, local charnockiticneosomes and relicts.</td><td rowspan="2">Charnochkite Group</td><td>Charnokite with magacrystic k-feldspar<br>Charnockite Two pyroxene granulite / amphibolite</td></tr>
<tr><td rowspan="2">Khondalite Group</td><td>Calc-silicate, granulite</td></tr>
<tr><td></td><td>Garnet + sillimanite + quartz + biotite + k-feldspar + graphite gneiss (khondalite)</td></tr>
</table>

| | | | |
|---|---|---|---|
| | | | Quatzite + garnet + sillimanite |

(P.K.Ramam and V.N. Murthy)

Quaternary deposits occupy the coastal tract and are classified under three environments: residual, marine, and fluvial. The residual environment is represented by residual soils, fluvial sediments include flood basins and active channel deposits, and the marine environment includes paleotidal flats. The paleobeach and active beach ridge, buff-colored volcanic ash occurs discontinuously along the terrace of the Gundlakamma River, which is correlated to Toba volcanic activity. The rich haul of fossils, comprising limb bones of Bovides, Cervides, Ephus, and Equus molars, and also premolars of Equus, horn of stag, and shell of turtle, were found in the Gundlakamma river valley. The Archaean schists and gneiss show foliation varying from Northeast (NE)-Southwest (SW) to Northwest (NW)-Southeast (SE) with moderate to steep dips on either side. The general disposition of the plutonic bodies is concordant with the axes of folds. The layering in gabbro and nepheline syenite is conformable to the regional trend of the adjacent quartzo-feldspathic mica schist. The rocks of the Cuddapah Supergroup show north and south plunging broad antiforms and narrow synforms. These antiforms resemble domal structures in some cases. The eastern contact of this Supergroup with the schists shows en-echelon thrusts, sub-parallel or oblique to the basin margin, with moderate to steep dips towards the east. The Srisailam Quartzite is traversed by several WNW-ESE faults.

The Geological Survey of India (GSI, 2000) gave a detailed account of the geology/lithology of the district with a map on 1:250,000 scale and an elaborate legend with a stratigraphic sequence as below.

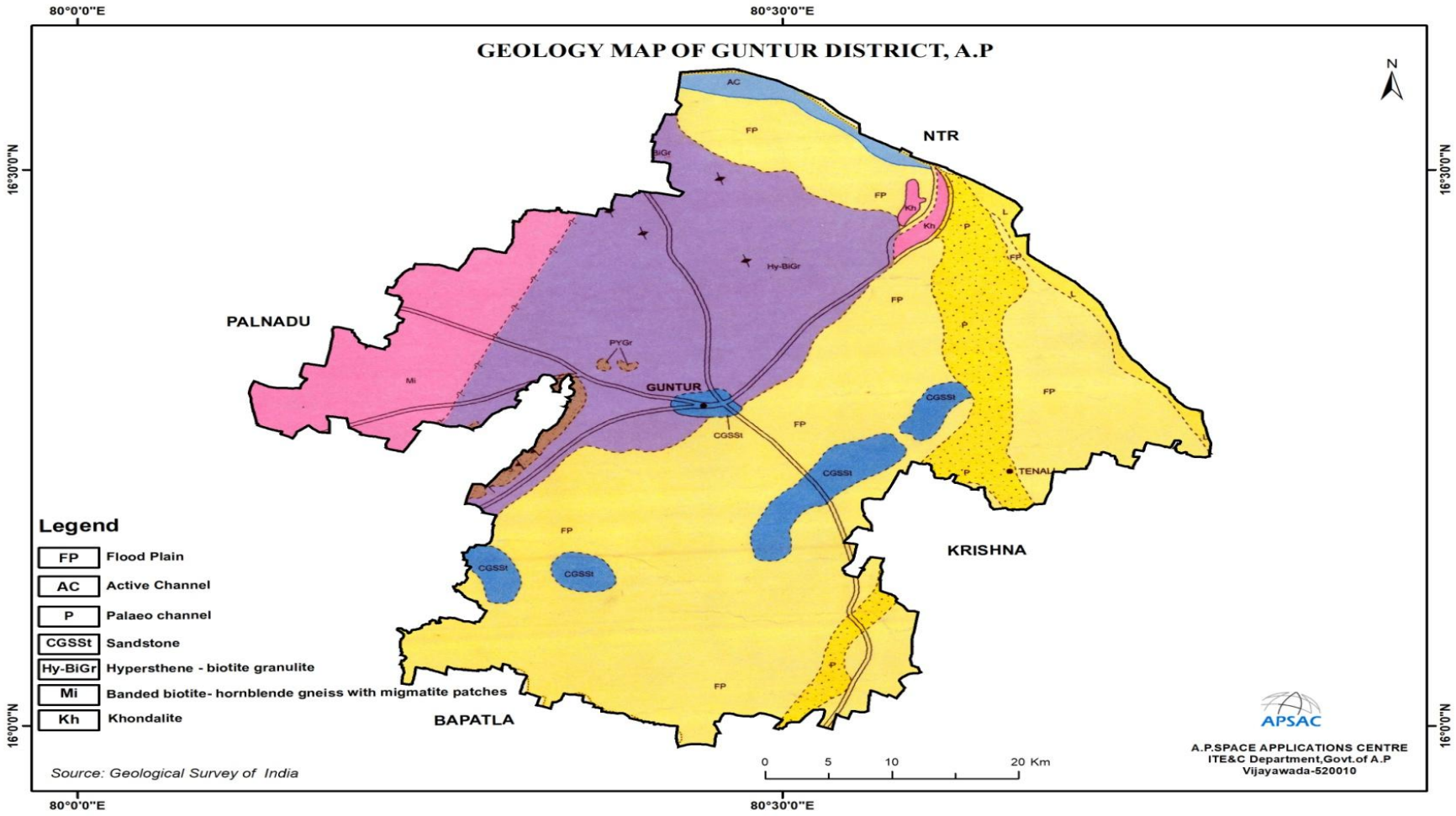
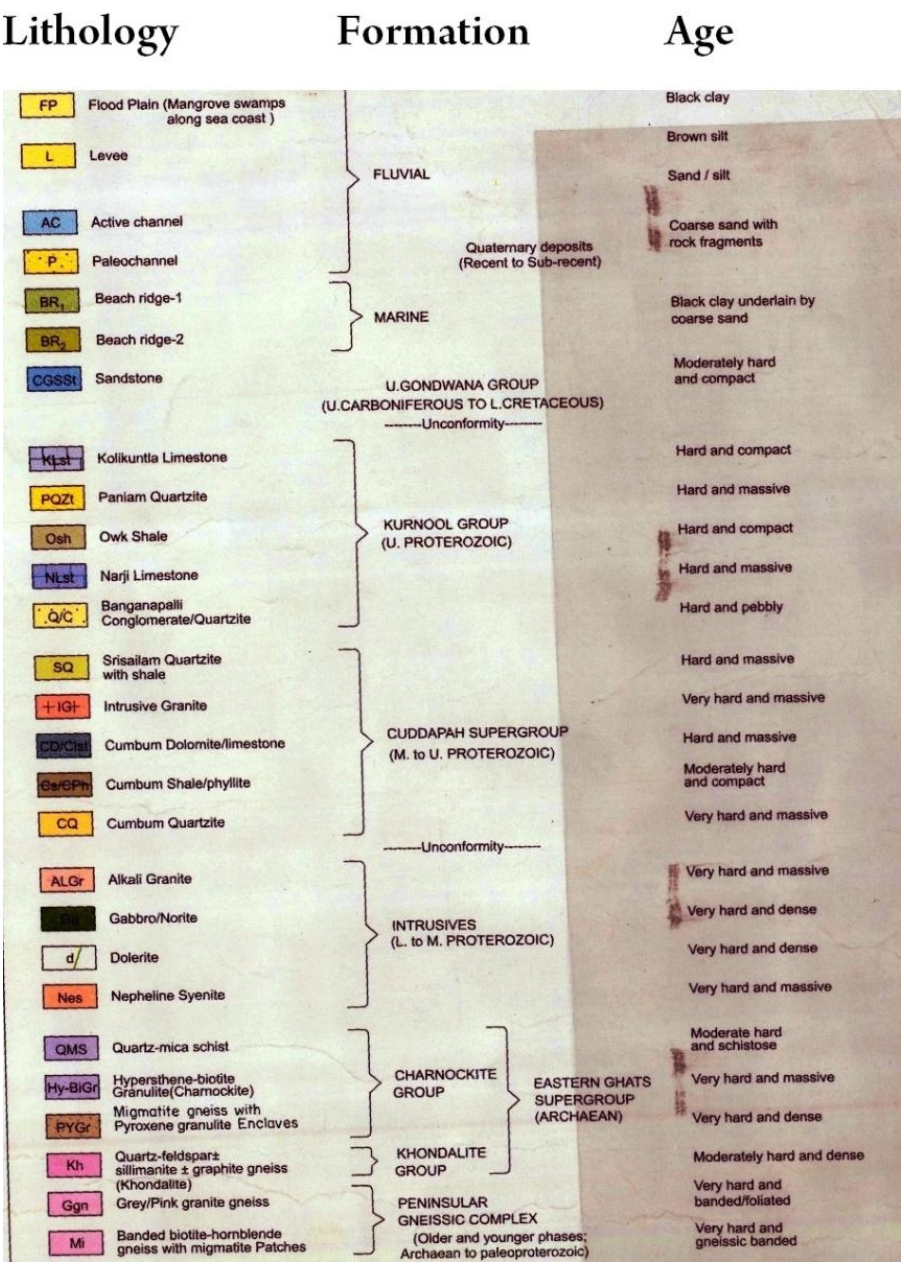



*Figure 20: Geology of Guntur District, Andhra Pradesh (Source: GSI, 2000)*




*Detailed Legend with Stratigraphic Sequence of Guntur District*

## 2.3 Minor Mineral Resources of Guntur District:

The following minerals are available in the Guntur District.

The Guntur District is endowed with mineral potentialities and the activity is spread throughout the district. The mineral deposits in the jurisdiction of Asst. Director of Mines and Geology, Guntur, predominantly Granite (Black and Colour), Road Metal, Gravel, Sand, Limestone, and Mosaic chips etc., The Mineral Revenue of this office mainly depends on the collection of Seig. The fee on Road Metal and Granite.

The principal minerals available are lime stone, lime kankar, copper and lead. Limestone is being utilized by the Cement factories. There are copper mines at Agnigundala of Ipur Mandal. The mineral Reserve available in the district is shown in Table-14 and the map is shown in Figure-21.

### 2.3.1. Economic minerals:

The district has significant resources of Colour Granite, White shale, Gravel, lime stone, glass sand, lime-kankar (caliche), quartz and road metal

1. **Black Granite:** Black granite that occurs in Guntur is also commercially called G20, a premium variety. Its appearance is completely black and is predominantly used for monuments, as well as dimension stones for flooring and wall tiling. Black Granite is available in Phirangipuram and Repudi villages in Phirangipuram mandal.
2. **Road Metal:** Exfoliated massifs and sheet rocks of charnockite and pyroxene granulite provide excellent road metal and construction material. The charnockite-pyroxene granulite belt, occurring along the Guntur-Vijayawada State Highway, is already under active exploitation by private entrepreneurs at several places for road metal. The road metal is utilized for construction purposes, and also as railway ballast, and is available in Chinapalakaluru village in Guntur Mandal, Nallapadu village in Guntur Mandal, Pericherla Village in Medikonduru Mandal, Ameenabad, Repudi, Phirangipuram villages in Phirangipuram Mandal, Nadimpalem village in Prathipadu Mandal, and Latchannagudipudi village in Tadikonda mandal.
3. **Gravel:** Gravel is used for the formation of kacha roads and filling low-level areas, and is available in Chebrole and Sekur villages in Chebrole mandal, Chinapalakaluru village in Guntur mandal, Nallapadu and Pothuru villages in Guntur mandal, Dokiparru and Pericherla villages in Medikonduru Mandal, and Latchannagudipudi village in Tadikonda mandal.
4. **Slate:** Slate is a fine-grained metamorphic rock, with cleavage in one direction, and made essentially of quartz, sericite, and chlorite micas in varying proportions. Exploitation is essentially by the open-cast, manual, or semi-mechanized method of working. Slate is used for roofing purposes, as it is a good heat and electric insulator. In

Guntur, it is available near Erragonda Palem (16°03': 79°18', 16°15': 79°21').

5. **Quartz:** Quartz occurring near Narsaraopet (16°14': 80°02'30", 65 D/4) is being mined for use in the ferro-alloys (Ferro-silicon) plants established in other districts.
6. **Colour Granite:** This Color Granite variety, predominantly used for monuments and also as dimension stones for flooring and wall tiling, is available in Chigurupadu village in Achampeta mandal, Mothadaka and Ponnekallu villages in Tadikonda mandal, and Ananthavaram and Vaddamanu village in Thullur mandal.

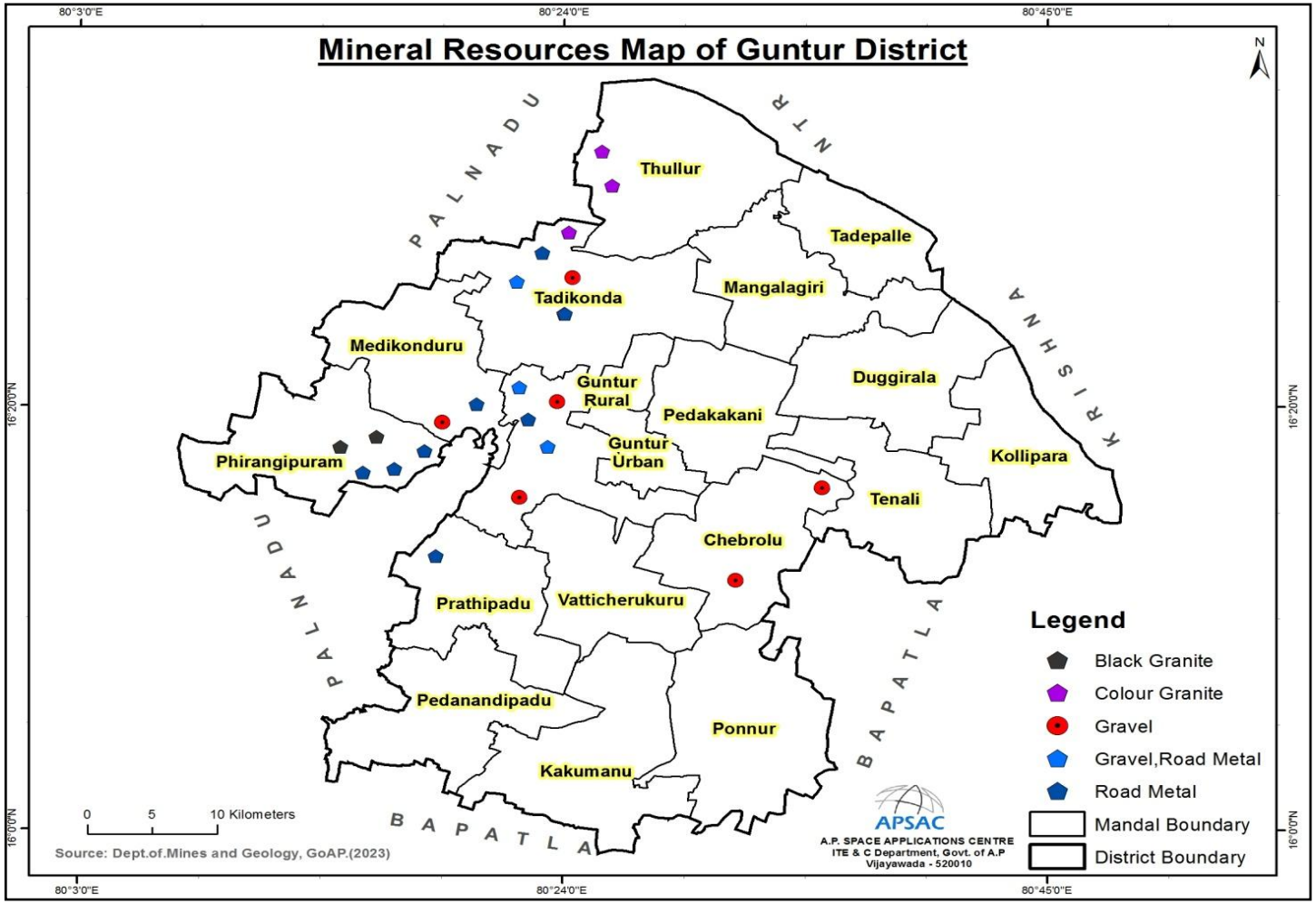



*Figure-21: Mineral Resurce Map of Guntur District*

The Detailed list of statement showing the leases for Minor Minerals during the period described in Table-14:

*Table 14 Statement showing the List of details Leases wise for Minor Minerals in Guntur District during the Period (Present Status)*

| OFFICE OF THE DISTRICT MINES AND GEOLOGY OFFICER, GUNTUR | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Statement showing the List of Leases for Minor Minerals | | | | | | | | | | | | Geo-Coordinates | |
| **S.No** | **LeaseId** | **Name of the Leaseholder** | **Old District** | **New District** | **Mandal** | **Village** | **Sy.No** | **New Office** | **Extent** | **Mineral** | **Status** | **Longitude** | **Latitude** |
| 1 | 711000293 | Kalpana Stone Crusher | Guntur | Guntur | Phirangipuram | Repudi | 134/628 | Guntur | 1.505 | Road Metal | Working | 16°17'00.33" | 80°15'55.07" |
| 2 | 711030152 | Sri Saikrishna Stone Crusher | Guntur | Guntur | Guntur | Chinapalakaluru | 111 | Guntur | 1.105 | Road Metal | Working | 16°19'36.56 | 80°22'25.48 |
| 3 | 711040228 | M/s. FujiiGtanites | Guntur | Guntur | Thullur | Vaddamanu | 110/B | Guntur | 3.405 | Colour Granite (Others) | Non Working | 16°31'21.51" | 80°25'16.65" |
| 4 | 711050229 | Sri Balaji Stone Crusher | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 4.986 | Gravel,Road Metal | Working | 16°19'17.70" | 80°21'35.40" |
| 5 | 711050233 | The PerecherlaTella Quarry Vaddera QWLCC Sty. Ltd., | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 0.323 | Road Metal | Non Working | 16°19'12.10 | 80°21'43.72 |
| 6 | 711050234 | The PerecherlaTella Quarry Vaddera QWLCC Sty. Ltd., | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 1.538 | Road Metal | Working | 16°19'12.59 | 80°21'42.17 |
| 7 | 711050236 | Sundaram Stone Crusher | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 0.749 | Road Metal | Non Working | 16°19'25.57 | 80°21'51.82 |
| 8 | 711050363 | M/s. Siva Stone Crusher | Guntur | Guntur | Medikonduru | Pericherla | 379/1 | Guntur | 1.214 | Road Metal | Non Working | 16°19'08.84 | 80°20'10.42 |
| 9 | 711060 | M/s V.S | Gunt | Gunt | Guntur | Chinapalaka | 111 | Guntur | 1.462 | Road Metal | Non | 16°19'29.96 | 80°22'27.43 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 160 | Engineering (P) Ltd., | ur | ur | | luru | | | | | Working | | |
| 10 | 711060192 | P.V.R. Chalapathi Metal Inds., | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 1 | Road Metal | Non Working | 16°19'29.68" | 80°21'36.33" |
| 11 | 711060260 | Sri Gayathri Stone Crusher | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 1 | Road Metal | Non Working | 16°19'33.26" | 80°21'33.41" |
| 12 | 711060322 | Sri Siddi Vinayaka Stone Crusher | Guntur | Guntur | Phirangipuram | Ameenabad | 232/6B2 | Guntur | 1.728 | Road Metal | Non Working | 16°18'28.05" | 80°17'24.28" |
| 13 | 711070137 | M/s.Vinayaka Krupa Granites | Guntur | Guntur | Phirangipuram | Repudi | 134/628 | Guntur | 0.749 | Black Granite | Working | 16°16'52.06" | 80°15'36.45" |
| 14 | 711070197 | Yak Granite Inds., | Guntur | Guntur | Thullur | Ananthavaram | 221 | Guntur | 5.984 | Colour Granite (Others),Gravel,Road Metal | Non Working | 16°31'16.75" | 80°25'25.77" |
| 15 | 711070241 | M/s K.B.C.Infrastructures Pvt ltd | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 4.755 | Road Metal | Working | 16°19'19.19" | 80°21'22.62" |
| 16 | 711070244 | M/s Ganesh Metal Crushers | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 1.214 | Road Metal | Non Working | 16°19'25.09" | 80°21'47.94" |
| 17 | 711070247 | Naimisha Enterprises | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 0.506 | Road Metal | Non Working | 16°19'27.50" | 80°21'25.00" |
| 18 | 711070249 | M/s.Sai Raghavendra Stone Crusher | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 0.445 | Road Metal | Non Working | 16°19'26.50" | 80°21'23.00" |
| 19 | 711070296 | Sri Lakshmi Srinivasa Stone Crusher | Guntur | Guntur | Phirangipuram | Repudi | 134/628 | Guntur | 0.85 | Road Metal | Non Working | 16°17'01.78" | 80°15'58.94" |
| 20 | 711080135 | M/s.G.I. Estates | Guntur | Guntur | Phirangipuram | Repudi | 160 | Guntur | 1 | Black Granite | Working | 16°16'48.05" | 80°15'16.29" |
| 21 | 711080139 | M/s.Kalpana Enterprises | Guntur | Guntur | Phirangipuram | Repudi | 134/628 | Guntur | 1.57 | Black Granite | Non Working | 16°17'01.78" | 80°15'58.94" |
| 22 | 711080159 | Surya Metal Crusher | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 0.85 | Road Metal | Non Working | 16°19'27.10" | 80°21'30.80" |
| 23 | 711080171 | M/s.Sreeram Metal Inds | Guntur | Guntur | Guntur | Chinapalakaluru | 111 | Guntur | 1.724 | Road Metal | Working | 16°19'35.53" | 80°22'20.39" |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24 | 711080172 | M/s.Sreeram Metal Inds., | Guntur | Guntur | Guntur | Chinapalakaluru | 111 | Guntur | 0.494 | Road Metal | Working | 16°19'34.33" | 80°22'18.64" |
| 25 | 711080185 | M/s. S.R. Infra Projects | Guntur | Guntur | Guntur | Chinapalakaluru | 111 | Guntur | 0.405 | Road Metal | Working | 16°19'33.16" | 80°22'24.84" |
| 26 | 711080222 | M/s.Tirumala Granites | Guntur | Guntur | Thullur | Ananthavaram | 221 | Guntur | 1.695 | Colour Granite (Others),Gravel,Road Metal | Non Working | 16°30'55.27" | 80°25'36.98" |
| 27 | 711080237 | Sundaram Stone Crusher | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 0.332 | Road Metal | Working | 16°19'24.52" | 80°21'51.80" |
| 28 | 711080238 | Sundaram Stone Crusher | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 0.566 | Road Metal | Working | 16°19'18.23" | 80°21'50.27" |
| 29 | 711080250 | M/s.PVRChalapathi Metal Inds | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 4.484 | Road Metal | Working | 16°19'27.71" | 80°21'42.09" |
| 30 | 711080252 | Sri Satya Sai Metal Suppliers | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 2 | Road Metal | Working | 16°19'16.10" | 80°21'43.70" |
| 31 | 711080302 | Sri Lakshmi Venkata Stone Crusher | Guntur | Guntur | Phirangipuram | Repudi | 134/628 | Guntur | 0.769 | Road Metal | Non Working | 16°17'01.78" | 80°15'58.94" |
| 32 | 711090130 | V.S. Engineering Pvt. Ltd., | Guntur | Guntur | Guntur | Chinapalakaluru | 111 | Guntur | 0.809 | Road Metal | Working | 16°19'39.57" | 80°22'20.10" |
| 33 | 711090132 | V.S. Engineering Pvt. Ltd., | Guntur | Guntur | Guntur | Chinapalakaluru | 111 | Guntur | 0.688 | Road Metal | Working | 16°19'40.17" | 80°22'18.56" |
| 34 | 711090141 | M/s.Om Sri Enterprises | Guntur | Guntur | Phirangipuram | Repudi | 134/628 | Guntur | 2 | Black Granite | Working | 16°16'55.93" | 80°15'35.05.64" |
| 35 | 711090142 | Sri Sairam Stone Crushing | Guntur | Guntur | Phirangipuram | Phirangipuram | 628/134 | Guntur | 4.047 | Black Granite,Road Metal | Working | 16°17'03.91" | 80°15'58.04" |
| 36 | 711090235 | The PerecherlaTella Quarry Vaddera QWLCC Sty. Ltd., | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 0.971 | Road Metal | Working | 16°19'18.25" | 80°21'42.26" |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 37 | 711090253 | N. Sivanagendramma | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 0.809 | Road Metal | Working | 16°19'19.02" | 80°21'39.27" |
| 38 | 711100169 | Ganesh Metal Crusher | Guntur | Guntur | Guntur | Chinapalakaluru | 111 | Guntur | 0.486 | Road Metal | Working | 16°19'44.12" | 80°22'21.46" |
| 39 | 711100231 | Vijayasree Granite Metals | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 2 | Road Metal | Non Working | 16°19'23.99" | 80°21'31.20" |
| 40 | 711100254 | Rajamma Stone Crusher | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 2.347 | Road Metal | Working | 16°19'17.80" | 80°21'36.00" |
| 41 | 711100350 | M/s. Venkata Sai Stone Crusher | Guntur | Guntur | Phirangipuram | Ameenabad | 232/6B2 | Guntur | 2.703 | Road Metal | Working | 16°18'21.64" | 80°17'50.84" |
| 42 | 711110177 | K. Sankara Rao | Guntur | Guntur | Guntur | Chinapalakaluru | 111 | Guntur | 1 | Road Metal | Non Working | 16°19'46.02" | 80°22'27.45" |
| 43 | 711110186 | M/s.S.R.Infra Projects | Guntur | Guntur | Guntur | Chinapalakaluru | 111 | Guntur | 1.315 | Road Metal | Working | 16°19'28.51" | 80°22'26.99" |
| 44 | 711110194 | P.V.R. Chalapathi Metal Inds., | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 1.568 | Road Metal | Non Working | 16°19'28.43" | 80°21'32.30" |
| 45 | 711110263 | SRI SAI KRISHNA STONE CRUSHER | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 0.19 | Road Metal | Working | 16°19'20.80" | 80°21'38.60" |
| 46 | 711110431 | Sri Lakshmi Srinivasa Stone Crusher | Guntur | Guntur | Phirangipuram | Ameenabad | 232/6B2 | Guntur | 0.526 | Road Metal | Non Working | 16°18'32.43" | 80°17'24.03" |
| 47 | 711120153 | Sri Saikrishna Stone Crusher | Guntur | Guntur | Guntur | Chinapalakaluru | 111 | Guntur | 0.356 | Road Metal | Working | 16°19'37.58" | 80°22'24.42" |
| 48 | 711120196 | P.V.R. Chalapathi Metal Inds., | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 1.214 | Road Metal | Working | 16°19'23.41" | 80°21'35.95" |
| 49 | 711120239 | Sundaram Stone Crusher | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 2.954 | Road Metal | Non Working | 16°19'21.46" | 80°21'51.35" |
| 50 | 711120242 | Pardhasaradhi Stone Crusher | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 3.339 | Road Metal | Non Working | 16°19'14.44" | 80°21'13.91" |
| 51 | 711120258 | M/s PUS Stone Crusher | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 1.012 | Road Metal | Non Working | 16°19'08.60" | 80°21'14.08" |
| 52 | 711120 | Sri Gayathri | Gunt | Gunt | Guntur | Chinapalaka | 155/A1 | Guntur | 1.568 | Road Metal | Non | 16°19'30.30 | 80°21'33.94" |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 264 | stone Crusher | ur | ur | | luru | | | | | Working | " | |
| 53 | 711120294 | Kalpana Stone Crusher Inds., | Guntur | Guntur | Phirangipuram | Repudi | 134/628 | Guntur | 0.417 | Road Metal | Working | 16°16'51.37" | 80°15'48.33" |
| 54 | 711120305 | Sri Shirdi Sai Stone crusher | Guntur | Guntur | Phirangipuram | Repudi | 134/628 | Guntur | 0.809 | Road Metal | Non Working | 16°016'59.13" | 80°15'56.56" |
| 55 | 711120307 | Kalpana Stone Crusher Inds., | Guntur | Guntur | Phirangipuram | Repudi | 134/628 | Guntur | 0.546 | Road Metal | Working | 16°016'59.13" | 80°15'56.56" |
| 56 | 711120312 | Kanaka Durga Stone Crusher Inds | Guntur | Guntur | Prathipadu | Nadimpalem | 317 | Guntur | 2.594 | Road Metal | Working | 16°11'38.75" | 80°15'46.65" |
| 57 | 711120335 | Sri Balaji Stone Crusher | Guntur | Guntur | Tadikonda | Latchannagudipudi | 151/P | Guntur | 3.763 | Road Metal | Working | 16°26'21.09" | 80°23'50.42" |
| 58 | 711120346 | Sri Srinivasa Stone Crusher | Guntur | Guntur | Phirangipuram | Ameenabad | 232/6B2 | Guntur | 1.271 | Road Metal | Working | 16°18'23.15" | 80°17'31.52" |
| 59 | 711120355 | Sri L.N.S. Stone Crusher | Guntur | Guntur | Phirangipuram | Ameenabad | 232/6B2 | Guntur | 1.271 | Road Metal | Working | 16°18'24.46" | 80°17'29.86" |
| 60 | 711130219 | Venkateswara Stone Inds., | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 1 | Road Metal | Non Working | 16°19'29.65" | 80°21'36.50" |
| 61 | 711130230 | PoluNarasaiah | Guntur | Guntur | Thullur | Ananthavaram | 221/P | Guntur | 2 | Colour Granite (Others),Gravel,Road Metal | Non Working | 16°31'21.51" | 80°25'16.65" |
| 62 | 711130301 | DasariJosfin | Guntur | Guntur | Phirangipuram | Repudi | 134/P | Guntur | 0.801 | Road Metal | Non Working | 16°016'59.13" | 80°15'56.56" |
| 63 | 711130366 | M/s Sai Yasasvi Stone Crusher | Guntur | Guntur | Guntur | Chinapalakaluru | 111 | Guntur | 2.072 | Road Metal | Non Working | 16°19'39.52" | 80°22'30.04" |
| 64 | 711140174 | M/s.Sreeram Metal Inds., | Guntur | Guntur | Guntur | Chinapalakaluru | 111 | Guntur | 1.505 | Road Metal | Working | 16°19'39.10" | 80°22'17.60" |
| 65 | 711140190 | M/s.Vijaya Mining Works | Guntur | Guntur | Tadikonda | Mothadaka | 159/B | Guntur | 1.671 | Colour Granite (Others) | Non Working | 16°27'58.01" | 80°24'07.81" |
| 66 | 711140221 | P.U.S. Stone Crusher | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 0.619 | Road Metal | Non Working | 16°19'25.92" | 80°21'43.12" |
| 67 | 711140246 | K. Ramadevi | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 0.805 | Road Metal | Working | 16°19'23.20" | 80°21'25.40" |
| 68 | 711140 | S. Adilakshmi | Gunt | Gunt | Guntur | Chinapalaka | 155/A1 | Guntur | 0.421 | Road Metal | Working | 16°19'27.30 | 80°21'27.20" |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 248 | | ur | ur | | luru | | | | | | ″ | |
| 69 | 711140367 | M/s.Sai Raghavendra Stone Crusher | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 0.477 | Road Metal | Working | 16°19′25.70″ | 80°21′26.50″ |
| 70 | 711150381 | P. Srinivasa Rao | Guntur | Guntur | Guntur | Chinapalakaluru | 111 | Guntur | 0.858 | Gravel,Road Metal | Working | 16°19′29.91″ | 80°22′40.75″ |
| 71 | 711150383 | PVR Chalapathi Metal Inds | Guntur | Guntur | Guntur | Chinapalakaluru | 155/B1,B2,B3 | Guntur | 1.186 | Gravel,Road Metal | Working | 16°19′25.52″ | 80°21′33.99″ |
| 72 | 711150389 | V Koteswara Rao | Guntur | Guntur | Tadikonda | Ponnekallu | 467/Part | Guntur | 3 | Color Granite (Black Pearl-Prakasam and Guntur),Color Granite (Indian Aurora-Nizamabad),Color Granite-Leptinites, Colour Granite (Others),Colour Granite (Srikakulam Blue) | Working | 16°24′02.30″ | 80°23′18.51″ |
| 73 | 711150410 | M/s.SaiYasasvi Stone Crusher | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 1.404 | Road Metal | Working | 16°19′20.70″ | 80°21′36.60″ |
| 74 | 711150411 | M/s.S.R.Infra Projects | Guntur | Guntur | Guntur | Chinapalakaluru | 111 | Guntur | 1.708 | Road Metal | Working | 16°19′32.57″ | 80°22′26.52″ |
| 75 | 711150412 | M/s.Sentinal Granites | Guntur | Guntur | Thullur | Ananthavaram | 221/Part | Guntur | 2.023 | Color Granite (Black Pearl- | Working | 16°31′05.50″ | 80°25′28.45″ |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Prakasam and Guntur),Color Granite (Indian Aurora-Nizamabad),ColorGranite-Leptinites, Colour Granite (Others),Colour Granite (Srikakulam Blue),Gravel,Road Metal | | | |
| 76 | 711150413 | M/s.Bethan Granites | Guntur | Guntur | Thullur | Ananthavaram | 221/Part | Guntur | 1.392 | Color Granite (Black Pearl-Prakasam and Guntur),Color Granite (Indian Aurora-Nizamabad),Color Granite-Leptinites, Colour Granite (Others),Colour | Working | 16$^{0}$31'21.51" | 80$^{0}$25'16.65" |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Granite (Srikakulam Blue),Gravel,Road Metal | | | |
| 77 | 711160429 | M/s.Ganesh Metal Crushers | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1, Plot No.8P | Guntur | 2.954 | Road Metal | Working | 16$^0$19’23.19” | 80$^0$21’44.80” |
| 78 | 711160435 | M/s.P.U.S. Stone Crusher | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 2.226 | Road Metal | Working | 16$^0$19’07.08” | 80$^0$21’16.30” |
| 79 | 711160436 | L.Veeraiah | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1 | Guntur | 0.949 | Road Metal | Working | 16$^0$19’07.50” | 80$^0$21’23.40” |
| 80 | 711160439 | M/s.Venkata Sai Krishna Stone Crusher | Guntur | Guntur | Phirangipuram | Repudi | 134/628 | Guntur | 1.874 | Road Metal | Working | 16$^0$16’49.50” | 80$^0$15’45.48” |
| 81 | 711160448 | M/s.P.U.S.Stone Crusher | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1, Plot No.9 | Guntur | 0.279 | Road Metal | Non Working | 16$^0$19’8.90” | 80$^0$21’42.40” |
| 82 | 711160449 | M/s.Rank Silicon and Industries Pvt. Ltd., | Guntur | Guntur | Guntur | Chinapalakaluru | 111/Part | Guntur | 4.047 | Road Metal | Working | 16$^0$19’35.13” | 80$^0$22’31.77” |
| 83 | 711160450 | M/s.Rank Silicon and Industries Pvt. ltd | Guntur | Guntur | Guntur | Chinapalakaluru | 111/Part | Guntur | 1.463 | Road Metal | Working | 16$^0$19’30.46” | 80$^0$22’37.62” |
| 84 | 711160451 | L.Veeraiah | Guntur | Guntur | Guntur | Chinapalakaluru | 155/A1, Plot No.12P | Guntur | 1.091 | Road Metal | Working | 16$^0$19’17.80” | 80$^0$21’30.50” |
| 85 | 711170480 | M/s V.S Engineering (P) Ltd., | Guntur | Guntur | Guntur | Nallapadu | 723 | Guntur | 2.832 | Gravel,Road Metal | Working | 16$^0$19’327.14” | 80$^0$22’35.31” |
| 86 | 711170486 | Tirumala Sai Stone Crusher | Guntur | Guntur | Phirangipuram | Ameenabad | 232/6B2 | Guntur | 1.214 | Road Metal | Non Working | 16$^0$18’15.03” | 80$^0$17’13.48” |
| 87 | 711170489 | P.SivaSankara Rao | Guntur | Guntur | Guntur | Nallapadu | 723 | Guntur | 1.214 | Road Metal | Working | 16$^0$19’26.17” | 80$^0$22’39.15” |
| 88 | 711180494 | Sri K. Narendra Babu | Guntur | Guntur | Medikonduru | Pericherla | 573 | Guntur | 2.1 | Gravel | Working | 16$^0$18’12.01” | 80$^0$21’15.04” |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 89 | 711180497 | SR Infra Projects | Guntur | Guntur | Guntur | Chinapalakaluru | 111/P | Guntur | 1.255 | Road Metal | Working | 16°19'28.73" | 80°22'29.51" |
| 90 | 711180498 | Sreeram Metal Industries | Guntur | Guntur | Guntur | Chinapalakaluru | 111/Part | Guntur | 1.804 | Gravel,Road Metal | Working | 16°19'44.64" | 80°22'30.89" |
| 91 | 711180499 | Sai Teja Constructions | Guntur | Guntur | Medikonduru | Dokiparru | 255/4B & 250/5 | Guntur | 1.121 | Gravel | Working | 16°18'51.23" | 80°18'39.76" |
| 92 | 711180500 | Sri Sai Krishna Stone Crusher | Guntur | Guntur | Guntur | Chinapalakaluru | 111/Part | Guntur | 0.158 | Road Metal | Working | 16°19'40.35" | 80°22'27.93" |
| 93 | 711190503 | Sri N. Sivarama Prasad | Guntur | Guntur | Medikonduru | Pericherla | 0 | Guntur | 1.234 | Road Metal | Non Working | 16°18'51.23" | 80°18'39.76" |
| 94 | 711190508 | Ms Sri Saibabna Stone Crusher | Guntur | Guntur | Guntur | Chinapalakaluru | 111/Part | Guntur | 0.996 | Road Metal | Working | 16°19'41.30" | 80°22'21.64" |
| 95 | 711190509 | Sri Palugudi Vikram Raja | Guntur | Guntur | Tadikonda | Latchannagudipudi | 151/Part | Guntur | 1.251 | Gravel,Road Metal | Working | 16°26'26.10" | 80°23'40.46" |
| 96 | 711190511 | B. Venkatesh | Guntur | Guntur | Tadikonda | Latchannagudipudi | 113/C, 113/B-A, 114/2B, 2C | Guntur | 2.221 | Gravel | Working | 16°26'21.09" | 80°23'50.42" |
| 97 | 711200526 | Smt K. Uma Sarada | Guntur | Guntur | Guntur | Pothuru | 553 | Guntur | 1.813 | Gravel | Working | 16°16'05.14" | 80°29'41.97" |
| 98 | 711200533 | M/s.Aditya Infra Projects | Guntur | Guntur | Chebrole | Sekur | 372/P,500-B(P),500-C(P) | Guntur | 1.376 | Gravel | Working | 16°16'50.14" | 80°34'42.97" |
| 99 | 711200534 | M/s.Aditya Infra Projects | Guntur | Guntur | Chebrole | Sekur | 373 | Guntur | 0.781 | Gravel | Working | 16°16'54.14" | 80°34'49.97" |
| 100 | 711200535 | Sri B.Venkateswara Rao | Guntur | Guntur | Medikonduru | Dokiparru | 250-1A, 250-2D, 250-6, 255 | Guntur | 3.484 | Gravel | Working | 16°19'08.84 | 80°20'10.42 |
| 101 | 711200541 | SmtVasireddy Nirmala | Guntur | Guntur | Chebrole | Sekur | 328 | Guntur | 0.639 | Gravel | Working | 16°16'45.14" | 80°34'41.97" |
| 102 | 711200547 | Sri G. Venugopal | Guntur | Guntur | Chebrole | Sekur | 332/P | Guntur | 0.538 | Gravel | Working | 16°16'40.14" | 80°34'39.97" |
| 103 | 711210643 | Ms Deepika Bio Fertilizers | Guntur | Guntur | Chebrole | Chebrole | 68/5,68/6,75/6C | Guntur | 3.161 | Gravel | Working | 16°16'41.14" | 80°35'41.97" |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Ltd | | | | | | | | | | | |
| 104 | 711210653 | Sri D. Sivaramakrishna | Guntur | Guntur | Guntur | Pothuru | 552 | Guntur | 1.703 | Gravel | Working | 16°16'05.14" | 80°29'41.97" |
| 105 | 711220736 | M Anil Kumar | Guntur | Guntur | Achampeta | Chigurupadu | 231 | Guntur | 1.954 | Colour Granite (Others) | Working | 16°16'05.14" | 80°29'41.97" |
| 106 | 711220739 | M/s Vinayaka Krupa Granites | Guntur | Guntur | Phirangipuram | Repudi | 134/628 | Guntur | 1.82 | Black Granite | Working | 16°16'53.43" | 80°15'41.83" |
| 107 | 711960227 | M/s.Fujii Granites | Guntur | Guntur | Thullur | Vaddamanu | 109/2C | Guntur | 1.798 | Colour Granite (Others) | Working | 16°31'21.51" | 80°25'16.65" |
| 108 | 711970364 | M/s. Siva Stone Crusher | Guntur | Guntur | Medikonduru | Pericherla | 379/1 | Guntur | 1.153 | Road Metal | Non Working | 16°19'05.33 | 80°20'07.47 |
| 109 | 711150359 | K.Siva Reddy, S/o.Gopi Reddy, D.No.10-1-53/38, Flat No. 206, Raja Kishore Residency, Tilak Road, Chenchupet, Tenali town, Guntur District | Guntur | Guntur | Mangalagiri RF | Guntur Division | Comp. No.132 | Guntur | 4.001 | Road Metal & Gravel | Non Working | 16°44'97.09" | 80°59'34.54" |
| 110 | 711150360 | S.Rangaswamy, S/o. Eswaraiah, H.No. 12-945, Mahanadu, Tadepalli village & Mandal, Guntur District | Guntur | Guntur | Mangalagiri RF | Guntur Division | Comp. No.132 | Guntur | 3.931 | Road Metal & Gravel | Non Working | 16°45'23.73" | 80°59'39.67" |

*Data Source: District Mines and Geology Officer, Guntur District, Andhra Pradesh*

The Detailed statement showing the letter of intent (LoI) in the district in Table-15:

*Table 15 The Details of the letter of intent (LoI) in the district*

| Sl. No. | Name of the Mineral | Name of the Lessee | Address & Contact No. of Letter of Intent Holder | Letter of Intent Grant Order No. and Date | Area of quarry lease to be allotted | Validity of LoI | Use (Captive / Non-captive) | Location of the quarry lease (Latitude & Longitude) | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | Road Metal | M/s. Hanuman Nagar V.LCCS Ltd. | M/s.The Hanuman Nagar Vaddera Labour Contract Co-operative Society Limited, President: Sri Battula Edukondalu, Perecherla Village, Medikonduru Mandal, Guntur District. | 2670/Q1/2021, dt. 13.12.2021 | Sy.No. 155/A1, Chinapalakaluru Village, Guntur Rural Mandal, extent 0.728 hect | 12.12.2023 | NIL | N16$^0$19'27.44761" E79$^0$21'30.68463"<br>N16$^0$19'26.66124" E79$^0$21'46.19064"<br>N16$^0$19'27.44761" E79$^0$21'30.68463"<br>N16$^0$19'27.23214" E79$^0$21'34.72941"<br>N16$^0$19'25.08021" E79$^0$21'33.38841"<br>N16$^0$19'25.00642" E79$^0$21'30.52413" | LoI extention of time issued on 22-12-2022 |
| 2 | Road Metal | Sk. Rahamthullah | Sri Shaik Rahamthulla, S/o. Subhani, D.No.1-196, Vemuluripadu Village, Phirangipuram Mandal, Guntur District. | 3205/Q1/2020, dt. 19.12.2020 | Sy.No. 232/6B2, Vemuluripadu Village, Phirangipuram Mandal, extent 0.328 hect | 18.12.2022 | NIL | N16$^0$18'16.06542" E80$^0$17'11.61252"<br>N16$^0$18'34.11240" E80$^0$17'26.48451"<br>N16$^0$18'25.69421" E80$^0$17'17.78452"<br>N16$^0$18'25.59421" E80$^0$17'18.90124"<br>N16$^0$18'24.22451" E80$^0$17'18.70124"<br>N16$^0$18'22.36542" E80$^0$17'17.06245"<br>N16$^0$18'22.78452" E80$^0$17'15.94124" | Extention of time issued on 20.06.2022 |

*Data Source: District Mines and Geology Officer, Guntur District, Andhra Pradesh*

## 2.4 Details of Royalty in the last 3 years

The royalty of the last three years in the district detailed list is given in Table-16.

*Table 16 Details of Royalty in the last 3 years*

**Royalty for 2022-23**

| S. No. | Mineral | Royalty (in Rs. Lakhs) | Consideration Amt. (in Rs. Lakhs) | DMF (In Rs. Lakhs) | MERIT (in Rs. Lakhs) |
|---|---|---|---|---|---|
| 1 | Black Granite | 190.287 | 95.143 | 23.266 | 3.723 |
| 2 | Colour Granite (Others) | 5 | 2.5 | 0.619 | 0.099 |
| 3 | Gravel | 86 | 86 | 25.90 | 1.726 |
| 4 | Ordinary Earth | 35.88 | 35.88 | 10.76 | 0.718 |
| 5 | Road Metal | 360.64 | 180.32 | 108 | 7.1 |
| 6 | Slate | 92.64 | 92.64 | 27.80 | 1.85 |
| **Total** | | **770** | **492** | **196** | **15** |

**Royalty for 2021-22**

| S. No. | Mineral | Royalty (in Rs. Lakhs) | Consideration Amt. (in Rs. Lakhs) | DMF (In Rs. Lakhs) | MERIT (in Rs. Lakhs) |
|---|---|---|---|---|---|
| 1 | Black Granite | 150.324 | 37.581 | 18.791 | 3.006 |
| 2 | Colour Granite (Others) | 9.003 | 2.25075 | 1.125 | 0.18 |
| 3 | Gravel | 149.859 | 74.9295 | 44.958 | 2.997 |
| 4 | Ordinary Earth | 31.64 | 15.82 | 9.492 | 0.633 |
| 5 | Road Metal | 140.872 | 70.436 | 42.262 | 2.817 |

| S. No. | Mineral | Royalty (in Rs. Lakhs) | Consideration Amt. (in Rs. Lakhs) | DMF (In Rs. Lakhs) | MERIT (in Rs. Lakhs) |
|---|---|---|---|---|---|
| **Total** | | **571** | **246** | **143** | **11** |

**Royalty for 2020-21**

| S. No. | Mineral | Royalty (in Rs. Lakhs) | DMF (In Rs. Lakhs) | MERIT (in Rs. Lakhs) |
|---|---|---|---|---|
| 1 | Black Granite | 130.132 | 16.266 | 2.6 |
| 2 | Colour Granite (Others) | 9.5 | 1.18 | 0.19 |
| 3 | Gravel | 158.4 | 47.53 | 3.1 |
| 4 | Ordinary Earth | 7.7 | 2.32 | 0.15 |
| 5 | Road Metal | 289.7 | 86.7 | 5.7 |
| **Total** | | **595** | **154** | **12** |

*Data Source: District Mines and Geology Officer, Guntur District, Andhra Pradesh*

## 2.5 Details of Production in last 3 years

Production of the last three years in the district details is given in Table-17.

*Table 17 Details of Production in the last 3 years*

**Production for 2022-23**

| S. No. | Mineral | Unit | Production |
|---|---|---|---|
| 1 | Black Granite | Cubic Meter | 7,476 |
| 2 | Colour Granite (Others) | Cubic Meter | 196 |
| 3 | Gravel | Cubic Meter | 1,91,788 |

| | | | |
|---|---|---|---|
| 4 | Ordinary Earth | Cubic Meter | 79,750 |
| 5 | Road Metal | Cubic Meter | 1,02,938 |
| 6 | Slate | MT | 299 |

**Production for 2021-22**

| S. No. | Mineral | Unit | Production |
|---|---|---|---|
| 1 | Black Granite | Cubic Meter | 5793.865 |
| 2 | Colour Granite (Others) | Cubic Meter | 359.92 |
| 3 | Gravel | Cubic Meter | 290548.69 |
| 4 | Ordinary Earth | Cubic Meter | 55904 |
| 5 | Road Metal | Cubic Meter | 97,673 |
| 6 | Slate | MT | 899 |

**Production for 2020-21**

| S. No. | Mineral | Unit | Production |
|---|---|---|---|
| 1 | Black Granite | Cubic Meter | 5,211 |
| 2 | Colour Granite (Others) | Cubic Meter | 378 |
| 3 | Gravel | Cubic Meter | 3,52,062 |
| 4 | Ordinary Earth | Cubic Meter | 17,223 |
| 5 | Road Metal | Cubic Meter | 1,69,998 |

*Data Source: District Mines and Geology Officer, Guntur District, Andhra Pradesh*

## 2.6 Impact on environment

The extraction and utilization of minor minerals have become integral to our modern way of life, fueling infrastructure development, construction, and various industries. However, the impact of these activities on the environment cannot be underestimated. Minor minerals, which include granite, road metal, gravel, clay, and more, play a significant role in shaping the natural landscape and ecosystems. The various environmental consequences associated with the extraction and use of minor minerals are:

i. **Habitat Destruction:** The mining of minor minerals often entails the removal of topsoil and vegetation, leading to habitat destruction. This can disrupt ecosystems, displace wildlife, and threaten the survival of numerous species. Loss of biodiversity is a significant concern in regions with extensive mining operations.

ii. **Land Degradation:** Mining activities can lead to land degradation, including soil erosion and compaction. This not only reduces the land's fertility but also affects its ability to support agriculture and vegetation growth. Moreover, land degradation can contribute to increased vulnerability to natural disasters like floods.

iii. **Water Pollution:** Mining operations can contaminate nearby water bodies through the discharge of sediments, chemicals, and heavy metals. This pollution can have detrimental effects on aquatic life, disrupt local hydrology, and compromise the quality of water available for human consumption.

iv. **Air Quality:** Dust emissions from mining sites can deteriorate air quality in surrounding areas. The fine particles and pollutants released during the excavation and transportation of minor minerals can pose health risks to both workers and nearby communities.

v. **Regulatory Challenges:** Enforcing regulations and monitoring mining activities in remote or unregulated areas can be

challenging, allowing illegal and unsustainable practices to persist.

The extraction and utilization of minor minerals are essential for economic development, but they come at a cost to the environment. Recognizing the environmental impacts of these activities is crucial for sustainable resource management.

## 2.7 Remedial Measures

The provisions of Rule 12 (1) and Rule 12 (5) and Andhra Pradesh Minor Mineral Concession Rules, 1966 allow the State Government to issue letters of intent (LoI) with the stipulated conditions to submit An Approved Mining Plan (AMP), Environment Clearance (EC) and Consent for Establishment (CFE) for grant of lease.

The Mine Plan stipulates the maximum permissible annual production of the mineral from the designated lease area and also includes an estimated quantum of solid waste generation and its method of disposal, etc. Based on the Approved Mine Plan projections, an Environment Management Plan shall be prepared and SEIAA makes the decision to grant the EC based on the EMP.

Leaseholders commit to all the remedial measures in the Mining Plan and the State Environment Impact Assessment Authority (SEIAA) ensures the remedial measures are being adhered to during the tenure of the Environmental Clearance.

Leaseholders in the district have adopted various remedial measures to mitigate the impact of mining on the environment. These measures aim to reduce the environmental footprint of mining operations and address the associated challenges. Some common practices include:

i. **Environmental Impact Assessments (EIAs):** Leaseholders conduct comprehensive EIAs to evaluate the potential environmental consequences of mining projects. They shall use this information to develop mitigation strategies.

ii. **Reclamation and Rehabilitation:** Leaseholders work to restore mined areas by re-contouring landscapes, replanting

native vegetation, and stabilizing soils to promote ecosystem recovery.

iii. **Water Management:** Proper management of water resources is crucial. Leaseholders use techniques like sedimentation ponds, water recycling, and water treatment facilities to minimize water pollution and ensure responsible water use.

The following preventive measures are being followed to minimize adverse effects on the water regime:

- Small Gully checks, gully check dams, silt settling tanks, silt traps, etc. shall be constructed.
- Along all discharge points leaving the mining lease, into the surrounding area, a suitable number of filter walls of sufficient lengths shall be erected across the flow, at intervals, all along the length to prevent suspended solids from entering the surrounding streams/ drains/ water courses, to confine the discharge water quality to the permissible limits.
- Regular monitoring may be carried out and further remedial steps as may be necessary may be taken.

iv. **Waste Management:** Effective management of mining waste, such as tailings and slag, involves containment in secure facilities to prevent soil and water contamination. Advances in waste disposal technologies are also being explored.

Steps being followed for effective waste management:

- Implementation of practices to minimize waste generation at the source. This involves optimizing extraction techniques, reducing overburden removal, and improving resource utilization.
- Encouraging recycling and reuse of waste materials wherever possible within the mining operation.

- Selection of an appropriate disposal method based on waste characteristics and environmental considerations. Common methods include landfilling, controlled dumping, and backfilling.
- Treatment of contaminated water and effluents using appropriate technologies before discharge.

v. **Afforestation:** Leaseholders carry out a year-wise afforestation plan for the initial years with a detailed costing of each plant, its maintenance per piece, etc.

While these measures represent positive steps toward mitigating environmental impact, it's important to note that the effectiveness of these practices can vary widely depending on factors such as the location, scale, and specific mineral being mined. Continuous improvement and adaptation are essential in the mining industry's ongoing efforts

## 2.8 Reclamation Measures

As per Rule 7A (ii) of Andhra Pradesh Minor Mineral Concession Rules, 1966, the Mine Closure Plan shall be submitted by the leaseholder before 6 months of expiry of the lease in the proforma as prescribed by the Director. The Deputy Director concerned shall approve the mine closure plan and ensure compliance with the conditions of the approved mine closure plan before the expiry of the lease period.

Financial assurance of Rs.50,000/-(Rupees Fifty Thousand) for the quarry lease granted below five(5) hectares and Rs.10,000/- (Rupees Ten Thousand) per Hectare or part thereof for the quarry lease granted five (5) hectares and above, shall be submitted in the form of deposit. If the leaseholder does not reclamation the area as mentioned in the Mine Closure Plan, the deposit shall be forfeited and the Department of Mines & Geology ensure the proper implementation of the Mine Closure Plan.

## 2.9 Risk Assessment & Disaster Management Plan

Leaseholders conduct a comprehensive risk assessment, prepare a model disaster management plan, and submit it in the Mining Plan.

The leaseholders maintain and arrange the following resources at the mine site:

a) Firefighting equipment

b) Ambulance services with location

c) List of volunteer organizations

d) List of Civil, Police, and other authorities to be informed in case of an accident

e) Last of mobile crane operators (Government, Public Sector, and Private Sector).

f) List of mines, contacts, and facilities available nearby

g) List of first aiders and contacts.

h) The list of Officers of DGMS to be informed in case of serious accidents Concerned DGMS officers concerned is displayed at the mine head.

The leaseholders shall monitor the total execution of the disaster management plan. The resources of all departments including men and material are being promptly made available. They are also conducting regular mock rehearsals with their staff to update the risk register and accordingly, disaster management plan

### 2.9.1. Mineral Regulatory:

The important functions of the District Mines and Geology Officer, Guntur are:-

1. Achievement of Targets of Mineral Revenue collections being fixed to this office annually

2. Receiving and processing of the Mineral Concession Applications duly conducting the Technical Inspection, Survey, and demarcation of the Mineral bearing applied areas

3. Execution and Regulation of the operations of the Mining / Quarry leases in accordance with the Acts and Rules

4. Issuing of dispatch permits duly collecting the Advance Royalty / Seig.fee from the leaseholders on the minerals produced and intend to dispatch from their leased areas through an online permit system

5. Controlling the illegal Mining / Quarrying and transportation by conducting periodical inspections of the Mines and Quarries and also conducting surprise vehicular checking and imposing penalties

6. Finalisation of Demand, Collection, and Balance statements of the leases on an annual basis

## 2.10 Plantation & Green Belt Development

Leaseholders are complying with the plantation and green belt development programmes as committed in their Mining Plans.

# CHAPTER III: SAND

## 3.1 Sand Mineral Resources of the Guntur District

### 3.1.1 General Sand Mineral Details Guntur District

(Prepared as per Sustainable Sand Mining Management Guidelines 2016 and 2020)

In Guntur District, there is one major river, i.e., the River Krishna, covering a total length of 265 km. This river is the major contributor to sand deposits. The said river is perennial, flowing in full spate during the flood season, whereas in the remaining period of the year, it flows in small channels, resulting in the exposure of the sand deposits on the riverbed. In addition to this, there are seven streams covering a length of 245 km and are mostly non-perennial. There are 166 existing check dams and two major reservoirs across the River Krishna. The details of the production of sand in the last three years in the district are shown in Table-18.

*Table 18 Details of the Production of Sand in the last year in the District*

| Details of Production of Sand in the year 2022-23 in the Guntur District | | | |
|---|---|---|---|
| **Sl. No.** | **Category** | **Production of Sand in MT** | **Revenue Generated** |
| 1 | Open Reach | 4,16,189 | 3,66,24,632 |

*Data Source: District Mines and Geology Officer, Guntur District*

### 3.1.2 River Basins in Guntur District

The Romperu (VogeruVagu) basin covers 60% of the district and the remaining part of the district is covered with Krishna and minor drainages Joined directly to the Sea in the Guntur district basins. The catchment area of each basin is delineated by using master plan records and updated with Survey of India toposheet (1:50K). The Romperu basin and Krishna basin catchment areas are 1,405.65 Sq.km and 799.3 Sq.km in the district. The district has total tanks and ponds including MI tanks 1,064.

The State is adjacent to the Bay of Bengal, many rivers deposit huge deposits of sand carried from their origin and various drainage basins the

hydrological units in the district are shown in Table-19. The drainage system with a description is shown in Table-20.

*Table 19 Hydrological units of Guntur District*

| S.No | Major Basin | Minor Basin | Catchment Area (Sq.km) | No of. Tanks |
|---|---|---|---|---|
| 1 | Krishna | Krishna Basin in Guntur District | 799.3 | 243 |
| 2 | Minor Drainages Joining Direct to Sea in Guntur District | Minor Drainages Joining Direct to Sea in Guntur District | 211.1 | 113 |
| 3 | Romperu | VogeruVagu | 1,397.16 | 700 |
| 4 | Romperu | Romperu | 8.49 | 8 |
| **Total** | | | **2,416** | **1,064** |

*Data Source: District Mines and Geology Officer, Guntur District, Andhra Pradesh*

*Table 20 Drainage System with Description of main rivers*

| S. No | Name of the Minor Basin | Area Drained (Sq. Km) | % Of Area Drained in the District |
|---|---|---|---|
| 1 | Krishna Basin in Guntur District | 801.07 | 33.16 |
| 2 | VogeruVagu | 1395.40 | 57.76 |
| 3 | Romperu | 8.49 | 0.35 |
| 4 | Minor Drainages Joining Direct to Sea in Guntur District | 211.10 | 8.74 |

*Data Source: District Mines and Geology Officer, Guntur District, Andhra Pradesh*

As per the WALTA Rules 2004, sand mining is permitted in the III Order Streams such as Gundlakamma River, Vogeru vagu, Romperu vagu, only if the deposition of sand is more than 5,000 Cum. The sand excavated in these areas is only allowed for local use and not for commercial purposes. Therefore, undertaking replenishment studies for the streams of III and

below orders is not required. The length of the River in the district is shown in Table-21. The silent features of the districts and their rivers are shown in Table-22.

*Table 21 River Lengths in Guntur District*

| S. No | Name of the Major Basin | Name of the Minor Basin | Name of the River | River Length in Km |
|---|---|---|---|---|
| 1 | Krishna | Krishna Basin in Guntur District | KondavitiVagu | 20.79 |
| 2 | | | Krishna River | 93.44 |
| 3 | | | MadaVagu | 33.05 |
| 4 | | | PeddaVagu | 11.36 |
| 5 | | VogeruVagu | IskaVagu | 25.80 |
| 6 | | | Konda Vagu | 25.40 |
| 7 | | | NakkaVagu | 36.81 |
| 8 | | | NallamaduguVagu | 39.23 |
| 9 | | | Rama Vagu | 20.38 |
| 10 | | | TummalapalemVagu | 30.35 |
| 11 | | | VogaruVagu | 0.40 |
| | | | Total | **337.01** |

*Data source: APSAC, Vijayawada*

*Table 22 Salient Features of Important Rivers in Guntur District*

| S.No | Name of the River | Place of Origin | Altitude at Origin (m) |
|---|---|---|---|
| 1 | VogeruVagu (NallamadaVagu) | Nekarikallu of Palnadu district | 358 |
| 2 | Konda Vagu | Kondaveedu Hills, Edlapadu, Palnadu district | 359 |
| 3 | Rama Vagu | Kondaveedu Hills, Edlapadu, Palnadu district | 510 |
| 4 | TummalapalemVagu | Kondaveedu Hills, Edlapadu, Palnadu district | 510 |
| 5 | PeddaVagu | Kondaveedu Hills, Medikonduru, Guntur district | 510 |
| 6 | KondaveeduVagu | Kondaveedu Hills, Medikonduru, Guntur district | 510 |

*Data source: APSAC, Vijayawada*

### 3.1.3 Process of Deposition of Sediments in the Rivers of the District

Sediment transport is a natural process, and many have argued that the point of rivers is to move sediment downstream. However, with land use changes, e.g., deforestation and construction; agricultural practices; and development activities, accelerated erosion rates are ubiquitous. Sediment in the water column reduces transparency and can be deposited downstream and exacerbate flooding. Three principal sources of sediment are the following:

Sediment transport is the movement of organic and inorganic particles by water. In general, the greater the flow, the more sediment will be conveyed. Water flow can be strong enough to suspend particles in the water column as they move downstream, or simply push them along the bottom of a waterway. Transported sediment may include mineral matter, chemicals and pollutants, and organic material. Another name for sediment transport is sediment load. The total load includes all particles moving as bedload, suspended load, and wash load.

#### 3.1.3.1. Bedload

As the name suggests, this element of sediment movement consists of loose, granular particles at the sediment-water interface (such as a stream bed or tidal flat). Air or water that moves across the bed will be able to move grains if the flow velocity is great enough to overcome the force of gravity and any resistance at grain contacts. This is the **threshold velocity** (Figure-22).

The bedload contains two main components:

- the **traction load**, or traction carpet, and
- the **saltation loads**.

The various components of force involved in the initiation of grain movement are shown above. Here, fluid flowing over a sediment bed produces shear stresses that can be resolved into a component of drag (parallel to the bed) and a lift component normal to the bed. At the threshold velocity when the resultant fluid force on grains is greater than gravity, grains begin to roll, slide, and jostle along the bed like a moving carpet – the **traction carpet**.

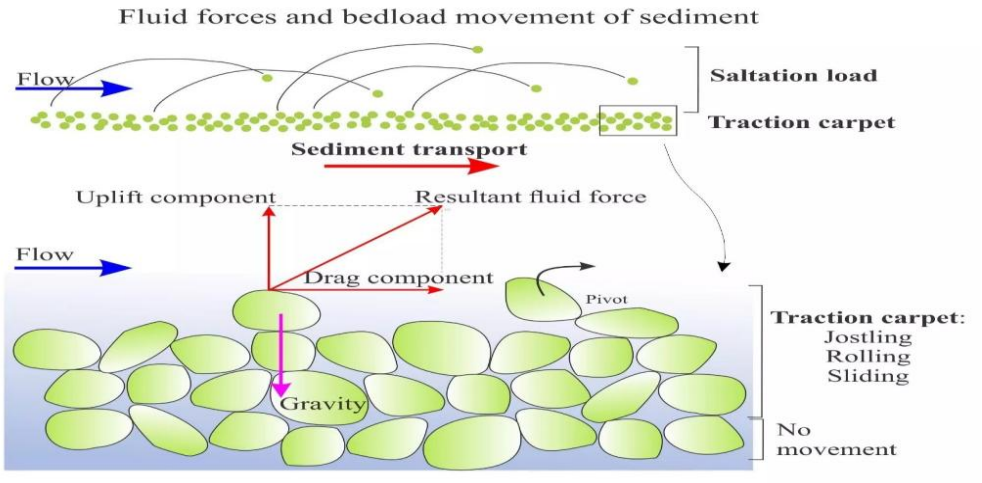



*Figure-22: Bedload Movement of Sediment*

**3.1.3.2. Suspended Load** Most natural flows in rivers, shallow marine settings, and air are turbulent. Even at low-flow velocities, the speed and trajectories of flow can vary considerably – witness the eddies and boils in seemingly tranquil streams. Very fine particulate sediment (particularly clays) can be kept in suspension for long periods by turbulence; the stresses generated by turbulent flow balance or overcome the gravitational force acting on the particles.

If turbulence decreases significantly, for example when a river empties into a lake, then most particles will gradually settle into the sediment bed. The rate at which a particle settles out of suspension is called the **settling velocity**, where the force of gravity (downwards) exceeds the combined effects of upward-directed **buoyancy forces** acting on a grain and the drag on a particle caused by **fluid (viscous) resistance**. Thus, the rate of settling depends on the size, shape, and density of particles, and the viscosity of the fluid. In general, settling through air is much more rapid than through water.

Both bedload and suspension load are important processes in the generation of sedimentary structures. In particular, bedload transport of loose sand is the critical process for the growth of bedforms and their internal cross-stratification (crossbedding). The description of **bedforms** (crossbeds) and the flow conditions (**flow regime**) under which they form have been described in other posts (Figure-23).

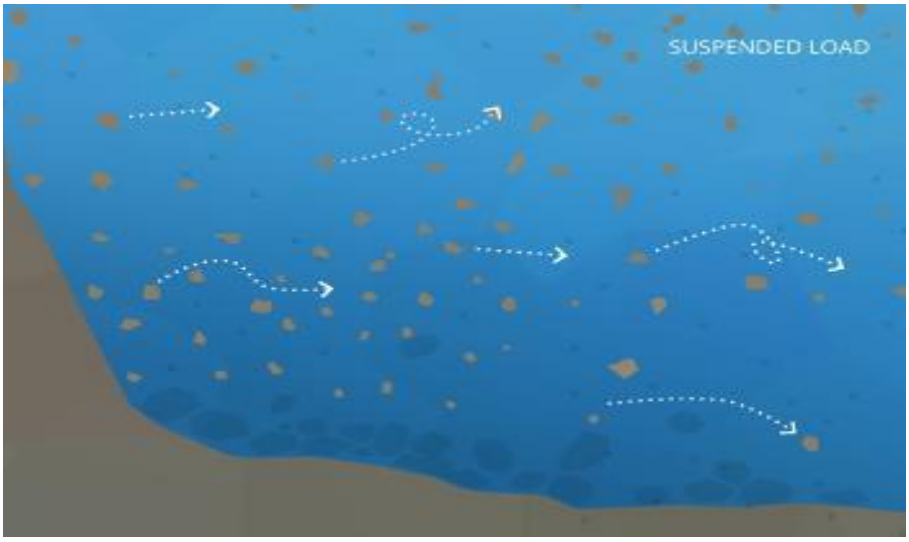



*Figure-23: Sediment Load*

### 3.1.3.3. Wash Load

The wash load is the portion of sediment that will remain suspended even when there is no water flow. The wash load is a subset of the suspended load. This load is comprised of the finest suspended sediment (typically less than 0.00195 mm in diameter). The wash load is differentiated from the suspended load because it will not settle to the bottom of a waterway during a low or no flow period. Instead, these particles remain in permanent suspension as they are small enough to bounce off water molecules and stay afloat. However, during flow periods, the wash load and suspended load are indistinguishable. Turbidity in lakes and slow-moving rivers is typically due to the wash load 8. When the flow rate increases (increasing the suspended load and overall sediment transport), turbidity also increases. While turbidity cannot be used to estimate sediment transport, it can approximate suspended sediment concentrations at a specific location (Figure-24).

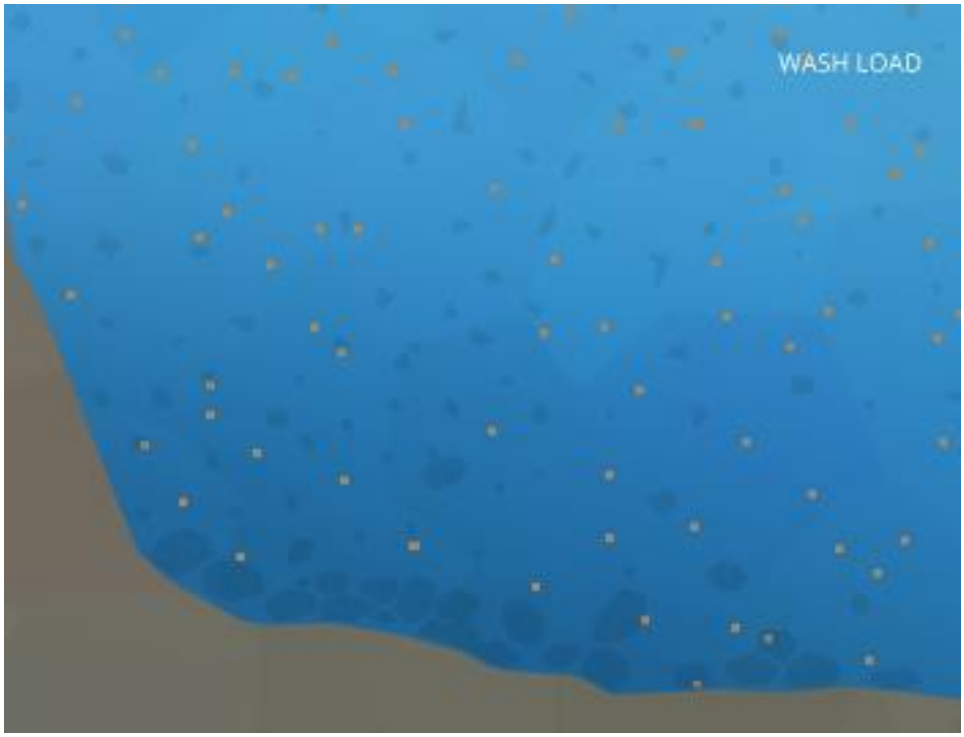



*Figure-24: Wash Load*

### 3.1.3.4. Settleable Solids

The suspended particles that fall to the bottom of a water body are called settleable solids. As they are found in riverbeds and streambeds, these settled solids are also known as bedded sediment. The size of settleable solids will vary by water system – in high-flow areas, larger, gravel-sized sediment will settle out first. Finer particles, including silt and clay, can be carried all the way out to an estuary or delta (Figure-25).

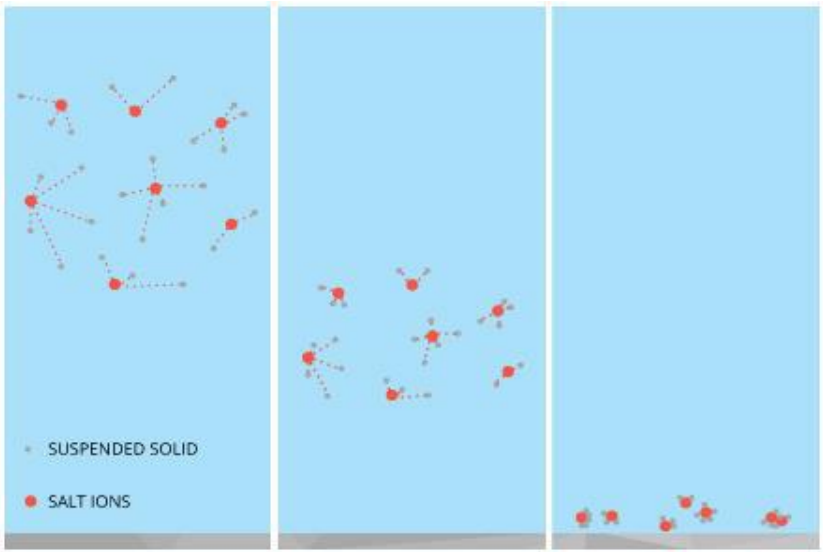



*Figure-25: Settleable Solids*

### 3.1.3.5. Sediment Deposition

Sediment is necessary for the development of aquatic ecosystems through nutrient replenishment and the creation of benthic habitats and spawning areas. These benefits occur due to sediment deposition – when suspended particles settle down to the bottom of a body of water. This settling often occurs when water flow slows down or stops and heavy particles can no longer be supported by the bed turbulence. Sediment deposition can be found anywhere in a water system, from high mountain streams to rivers, lakes, deltas, and floodplains. However, it should be noted that while sediment is important for aquatic habitat growth, it can cause environmental issues if the deposition rates are too high, or too low. Sediment transportation and Deposition depend upon various factors like Slope of the Area, Annual Rainfall, Lithology, flow intensity of the River, Geomorphology, Soil, Geology, and Land use.

In sediment transport, a distinction is generally made between fine and coarse sediment, because the transport mechanisms differ. Coarse sediment (grain size >63 μm) tends to be characterized by particles that remain separate and are chemically inert; fine sediments (<63 μm) on the other hand tend to come together as flocculated populations (flocs) and have a tendency to attract organic material and contaminants to their surface. A great deal has been researched and written about the breakup and flocculation of these primary particles under turbulence and subsequent settling (e.g., Uncles et al., 2010). These differences imply important variations in the rate of transport and settling characteristics for the same flow conditions for different sediments. The nature of the physical environment also has an important bearing on this, in that fine sediment tend to be found in sheltered environments (shallow, enclosed estuarine systems), while beaches on open coasts are characterized by coarser materials. This reflects the energy of the water in which the particles become suspended and their subsequent fate (Figure-26).

Rates of transport of material are generally expressed in terms of flux, as kg/s for example, where this figure is generally obtained by considering the product of the flow rate (in $m^3/s$) and the concentration of material in suspension ($kg/m^3$). This does not necessarily imply a requirement for the material to be suspended; it is equally possible to express a bed load using the same units, for example, but it does imply that to obtain an estimate of the sediment flux it is necessary to know both the concentration and the flow rate over a given cross-section. Both these quantities can be measured and there are a variety of techniques

available to do this, using in-situ collection or sampling, in situ optical or acoustic methods, or remote sensing from aircraft or satellites (Uncles and Mitchell, 2017)

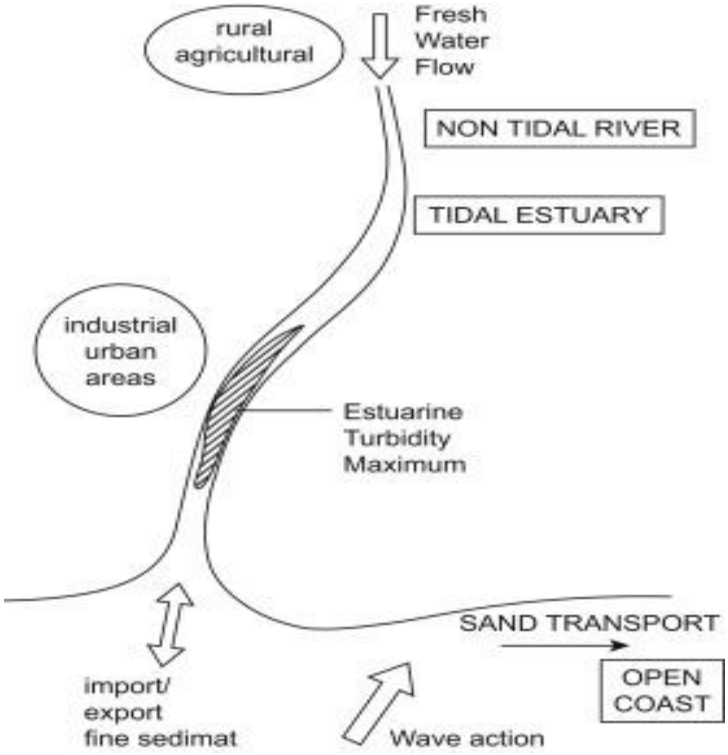



*Figure-26: Sediment Deposition Process*

Process of Deposition of Sediments in the Rivers of the District Sand is deposited because of the following reasons: (a) Floods: The surface or strip of relatively smooth land adjacent to a river channel constructed (or in the process of being constructed) by the present river in its existing regimen and covered with water when the river overflows its banks at times of high water. It is built of alluvium carried by the river during floods and deposited in the sluggish water beyond the influence of the swiftest current (b) Valley fill: The unconsolidated sediment deposited by any agent so as to fill or partly fill a valley.

### 3.1.4 Replenishment Study

A replenishment study for riverbed sand is required in order to nullify the adverse impacts arising due to excessive sand extraction. Mining within or near the riverbed has a direct impact on the stream's physical characteristics, such as channel geometry, bed elevation, substratum composition and stability, in-stream roughness of the bed, flow velocity, discharge capacity, sediment transport capacity etc. For sustainable river

sand mining, it is necessary that the mine pits formed as a result of sand excavation are refilled with sand by the natural process of replenishment in a reasonable period so that the area is again available for mining. The rate of gross erosion is dependent upon many physical factors like climatic conditions, the nature of the soil, the slope of the area, topography, and land use. The effect of any of these variables may vary greatly from one geographic location to another, and the relative importance of controlling factors often varies within a given land resource area (Dendy, 1976).

There is no denial of the fact that bed load changes from hour to hour, day to day, and year to year; estimating annual bed load rates is a dynamic process involving careful examination. Therefore, proper care has been taken before applying the empirical model to calculate the sediment yield from the watershed.

The estimation of sand replenishment is based on empirical and analytical approaches. There are many sediment transport equations as well as models which are suitable for use in the prediction of the replenishment rate of rivers/watersheds. The sedimentation models include SWAT, HEC-HMS etc. These models are developed based on the fundamental hydrological and sedimentological processes. They may provide detailed temporal and spatial simulation but usually require extensive data input. Hourly/daily input values of meteorological and radiation variables are required for continuous simulations. Some of the empirical equations for estimating sediment transport are as follows.

The annual Replenishment Rate for sand for Major Sand Resource Area is determined using the empirical mathematical expression Dendy Bolton Equation and reproduced below:

- Einstein (1950)
- Laursen (1958)
- Bagnold (1966)
- Engelund-Hansen equation (1967)
- Yang equations (1973)
- Dendy- Bolton equation (1976)
- Modified Universal Soil Loss Equation (MUSLE) developed by Williams and Berndt (1977)
- Van Rijn (1984)
- Zanke (1987)

To estimate the transport capacity or the sediment load being conveyed by a water stream, one of the many transport equations that are available in the literature is frequently used. Einstein (1950) introduced statistical methods to represent the turbulent behaviour of the flow. Bagnold (1966) introduced an energy concept and related the sediment transport rate to work done by the fluid. Engelund and Hansen (1967) presented a simple and reliable formula for the total load transport in rivers. The Yang equation makes use of the total bed hydraulic radius, and studies show that it is good for estimating the sediment transport in the channel for the condition of dunes on the bed. MUSLE includes only one type of sediment yield (sheet and rill Erosion). Van Rijn (1984) solved the equations of motions of an individual bed-load particle and computed the saltation characteristics and the particle velocity as a function of the flow conditions and the particle diameter for plane bed conditions. The equations of Zanke and Van Rijn seem to be only moderately satisfactory in estimating the sediment transport in the channel for the condition of dunes on the bed. However, it appears that no single equation could provide reliable estimates of a total load of sediment transport for all of the bed forms that could occur sequentially or randomly in alluvial channels or natural water courses. The comparison of the equations for estimating sediment rate is given below Table 23 –

*Table 23: Sediment Transport Equation*

| Sl.No. | Sediment Transport Equation | Remarks |
|---|---|---|
| 1 | Einstein (1950) | Bed load function was determined for many but not all types of stream channels |
| 2 | Laursen (1958) | Laursen equation outperforms other transport equations in the silt range |
| 3 | Bagnold (1966) | Bagnold related the sediment transport rate to work done by the fluid |
| 4 | Engelund-Hansen equation (1967) | The original Engelund-Hansen relation (OEH) is based on a single characteristic grain size, which limits its applicability in sand-bed rivers with a wide GSD |

| Sl.No. | Sediment Transport Equation | Remarks |
|---|---|---|
| 5 | Yang equations (1973) | It makes use of a total bed hydraulic radius |
| 6 | Dendy- Bolton equation (1976) | It uses both drainage area and means annual runoff for estimation of sediment yield. It calculates all types of sediment yield like sheet and rill erosion, gully erosion, channel bed and bank erosion and mass movement |
| 7 | Modified Universal Soil Loss Equation (MUSLE) developed by Williams and Berndt (1977) | MUSLE includes only one type of sediment yield (sheet and rill Erosion) |
| 8 | Van Rijn (1984) | Calculated equations of motions of an individual bed-load particle for plane bed conditions |
| 9 | Zanke (1987) | Zanke was found to be moderately satisfactory for the condition of the dunes on the bed. |

*Data Source: District Mines and Geology Officer, Guntur District, Andhra Pradesh*

In this study, the rate of gross silt production in the watershed and the ability of the stream system to transport the eroded material in a river have been carried out by the Dendy-Bolton equation. The Dendy-Bolton formula is often used to calculate the sedimentation yield as it uses both drainage area and mean annual runoff as key parameters to give a yield value. Also, the Dendy-Bolton equation calculates all types of sediment yield like sheet and rill erosion, gully erosion, channel bed and bank erosion, and mass movement.

The drainage area of Krishna River in Guntur district is situated both upstream and downstream of the Prakasam Barrage. For calculation of sediment yield, the total surplus discharge of the Prakasam Barrage for water year 2022-23 (June 2022 to May 2023) of 1525 TMC upstream & 1330 TMC downstream is taken as run-off.

The annual Replenishment Rate for sand for Major Sand Resource Area is determined using the empirical mathematical expression Dendy Bolton Equation and the data obtained from Water Resources Dept., GoAP (Water releases from N.S. Dam & DR KLRS P.P. Dam and inflow at Prakasam Barrage in TMC as on 01.06.2023) was used and reproduced below:

**For Average Annual Run-off less than 2"**

S = 1280 x Q0.46 [1.43 – 0.26 log(A)] -------- FORMULA (A)

**For Average Annual Run-off more than 2"**

S = 1965 x ($e^{-0.055 \times Q}$) [1.43 – 0.26 log(A)] -------- FORMULA (B)

Q = Mean Annual Run-off in mm

A = Net drainage Area in Sq. km

S = Sediment yield (tons/Sq. km/yr)

The sedimentation yield for Krishna River in Bapatla District is arrived based on the above Dendy Bolton Equation or Formula (B). Ssedimentation yield for Krishna River in Guntur District is shown in Table-24 and Table 25.

*Table 24 Sedimentation yield from Krishna River (upstream) in Guntur District*

| Name of the River | Area Drained (sq. km) | Mean Annual Run-off (in mm) | Rate of Annual Deposition in the River (tons / sq. km /year) | Annual Deposition (tonnes/year) |
|---|---|---|---|---|
| Krishna | 801.07 | 147.68 | 391.32 | 3,13,476* |

*Data Source: District Mines and Geology Officer, Guntur District, Andhra Pradesh.*

***Note**: The sedimentation yield was calculated manually by APSAC and the value is **3,45,528 Tones/ year.** The details are provided as an Annexure at page number 113-114.

*Table 25 Sedimentation yield from Krishna River (downstream) in Guntur District*

| Name of the River | Area Drained (sq. km) | Mean Annual Run-off (in mm) | Rate of Annual Deposition in the River (tons / sq. km /year) | Annual Deposition (tonne) |
|---|---|---|---|---|
| Krishna | 801.07 | 128.8 | 407.65 | 3,26,557** |

*Data Source: District Mines and Geology Officer, Guntur District, Andhra Pradesh*

****Note**: The sedimentation yield was calculated manually by APSAC and the value is **3,59,937 Tones/ year.** The details are provided as an Annexure at page number 115-116.

In this report, the sediment yield was calculated using the standard records of the Department of Water Resources. To ensure systematic and scientific studies, the Department of Mines & Geology is in the process of selecting NABET Accredited agency for conducting detailed & regular replenishment studies for potential sand bearing areas.

### 3.1.5 Details of Sand Mining Leases:

| Sl.No | Mandals |
|---|---|
| 1 | Kollipara |
| 2 | Duggirala |
| 3 | Thulluru |
| 4 | Mangalagiri |
| 5 | Tadepalli |

*Data Source: District Mines and Geology Officer, Guntur District, Andhra Pradesh*

Proposed potential Sand Mining Leases in the Guntur district shown in Table-26.

*Table 26 The details of Potential Sand Mining Leases*

| Reach Name | Quantity | Geo-Coordinates | Remarks |
|---|---|---|---|
| Veerlapalem - 2, H/o Pedakonduru | 49100 Cbm/ 73,650 MTs | 16°24' 00.64" 80°41' 51.61"<br>16°24' 02.67" 80°41' 54.57"<br>16°24' 17.78" 80°41' 49.78"<br>16°24' 13.62" 80°41' 47.18"<br>16°37' 09.03" 80°11' 46.13"<br>16°37' 04.19" 80°11' 53.80"<br>16°36' 59.39" 80°11' 50.40 | Proposed |
| Bommuvanipalem - 14 | 48400 Cbm/ 72,600 MTs | 16°18' 12.14" 80°45' 52.26<br>16°18' 18.40" 80°45' 58.93<br>16°18' 22.77" 80°45' 55.18<br>16°18' 16.50" 80°45' 48.53 | Proposed |
| Bommuvanipalem - 15 | 48000 Cbm/ 72,000 MTs | 16°18' 33.25" 80°45' 40.75"<br>16°18' 39.82" 80°45' 48.53"<br>16°18' 44.67" 80°45' 44.40"<br>16°18' 37.39" 80°45' 38.62" | Proposed |
| Gundimeda Sand Reach 2 | 74,565 MTs | N16°27'18.0" E80°39'48.6"<br>N16°27'23.4" E80°39'50.6"<br>N16°27'29.1" E80°39'42.0"<br>N16°27'24.6" E80°39'40.2" | Proposed |
| Munnangi Sand Reach | 73,290 MTs | N16°20'09.9" E80o44'06.9"<br>N16°20'11.9" E80o44'09.4"<br>N16°20'12.2" E80o44'12.1"<br>N16°20'12.3" E80o44'14.5"<br>N16°20'10.5" E80o44'18.5"<br>N16°20'10.5" E80o44'18.5"<br>N16°20'08.4" E80o44'19.4"<br>N16°20'04.9" E80o44'16.1" | Proposed |

*Data Source: District Mines and Geology Officer, Guntur District, Andhra Pradesh*

Probable Sand bearing areas in the district are shown in Table-27 and the map is shown in Figure-30. The name of the sand bearing index is given from the North to South direction. The Probable Sand bearing areas were identified through a field survey with the help of hand-held GPS (Global Positional System) and the help of existing literature.

*Table 27: Probable Sand Mining reaches in the Guntur District*

| S.No | Name of the River | Sand Bearing Area | Central Coordinates | | Area in Ha. |
|---|---|---|---|---|---|
| | | | Latitude | Longitude | |
| 1 | Krishna River | A | 16° 37' 56.145" N | 80° 11' 11.016" E | 74.66 |
| 2 | Krishna River | B | 16° 36' 27.145" N | 80° 12' 35.662" E | 22.22 |
| 3 | Krishna River | C | 16° 35' 29.173" N | 80° 15' 26.436" E | 13.85 |
| 4 | Krishna River | D | 16° 35' 42.291" N | 80° 20' 43.251" E | 144.42 |

*Data Source: District Mines and Geology Officer, Guntur District, Andhra Pradesh*

### 3.1.6 Details of De-Siltation Location: (Lakes/Ponds/Dams etc.)

The detail of the potential of de-siltation location in Guntur Distict is shown in Table-28.

*Table 28 List of Potential De-Siltation Location: (Lakes/Ponds/Dams etc.) (Existing and proposed)*

| Name of the Reservoir/Dams | Maintain/ Controlled by State Govt./PSU etc. | Location | District | Tehsil | Size (Ha) | Quantity MT/Year | Existing/ Proposed |
|---|---|---|---|---|---|---|---|
| NIL | | | | | | | |

*Data Source: District Mines and Geology Officer, Guntur District, Andhra Pradesh*

### 3.1.7 Details of Patta Lands in the District:

The detailed list of Patta Lands in the Guntur district is shown in Table-29.

*Table 29 Details of Patta Lands.*

| Owner | Sy. No. | Area (Ha) | District | Tehsil | Village | Total Reserve (MT) | Total Mineral to be mined (MT) | Existing/ Proposed |
|---|---|---|---|---|---|---|---|---|
| Nil | | | | | | | | |

*Data Source: District Mines and Geology Officer, Guntur District, Andhra Pradesh*

### 3.1.8 Details of M-Sand Plants in the District:

The details list of Manufacturing Sand in the Guntur district is shown in Table-30.

*Table 30 Shown Details of Details of M-Sand Plants*

| Plant Name | Owner | District | Tehsil | Village | Geo-location | Quantity Tonnes/Annum |
|---|---|---|---|---|---|---|
| NIL<br>There are no existing M - Sand units under this Guntur office jurisdiction | | | | | | |

*Data Source: District Mines and Geology Officer, Guntur District, Andhra Pradesh*

### 3.1.9 Details of Cluster of Sand Mining Leases

The area of Cluster of Mining Leases in Guntur jurisdiction is shown in Table-31.

*Table 31 Details Cluster of Mining Leases in Guntur District*

| Sl.No | Name of the Cluster | Location (Latitude and Longitude) | Extent (in Ha) | Total No. of Mining Leases in the Cluster | No.of Leases working | Extent of the working leases (in Ha) |
|---|---|---|---|---|---|---|
| NIL | | | | | | |

*Data Source: District Mines and Geology Officer, Guntur District, Andhra Pradesh*

### 3.1.10 Details of Contiguous Clusters

The area of Contiguous Cluster of Sand Reaches in Guntur jurisdiction is shown in Table-32.

*Table 32 Details of Contiguous Cluster of Sand Reaches in Guntur District*

| Sl.No | Name of the Cluster | Location (Latitude and Longitude) | Extent (in Ha) | Total No. of Mining Leases in the Cluster | No.of Leases working | Extent of the working leases (in Ha) |
|---|---|---|---|---|---|---|

| NIL |
|---|

*Data Source: District Mines and Geology Officer, Guntur District, Andhra Pradesh*

### 3.1.11 Sand Reaches Details in Guntur District

The Department of Mines and Geology has already identified sand reach points in Guntur. The locations details of the sand reach points are provided by the District Mines and Geology Officer, Guntur. Based on these location details, the sand reach points are shown in Figure-27 and Figure-28. Apart from the existing ones, new sand reaches are identified and shown in Figure-29. The Probable Sand-bearing areas were identified through a field survey with the help of hand-held GPS (Global Positioning System) devices and existing literature. The Probable Sand-bearing areas in the Guntur District are shown in Figure-30.

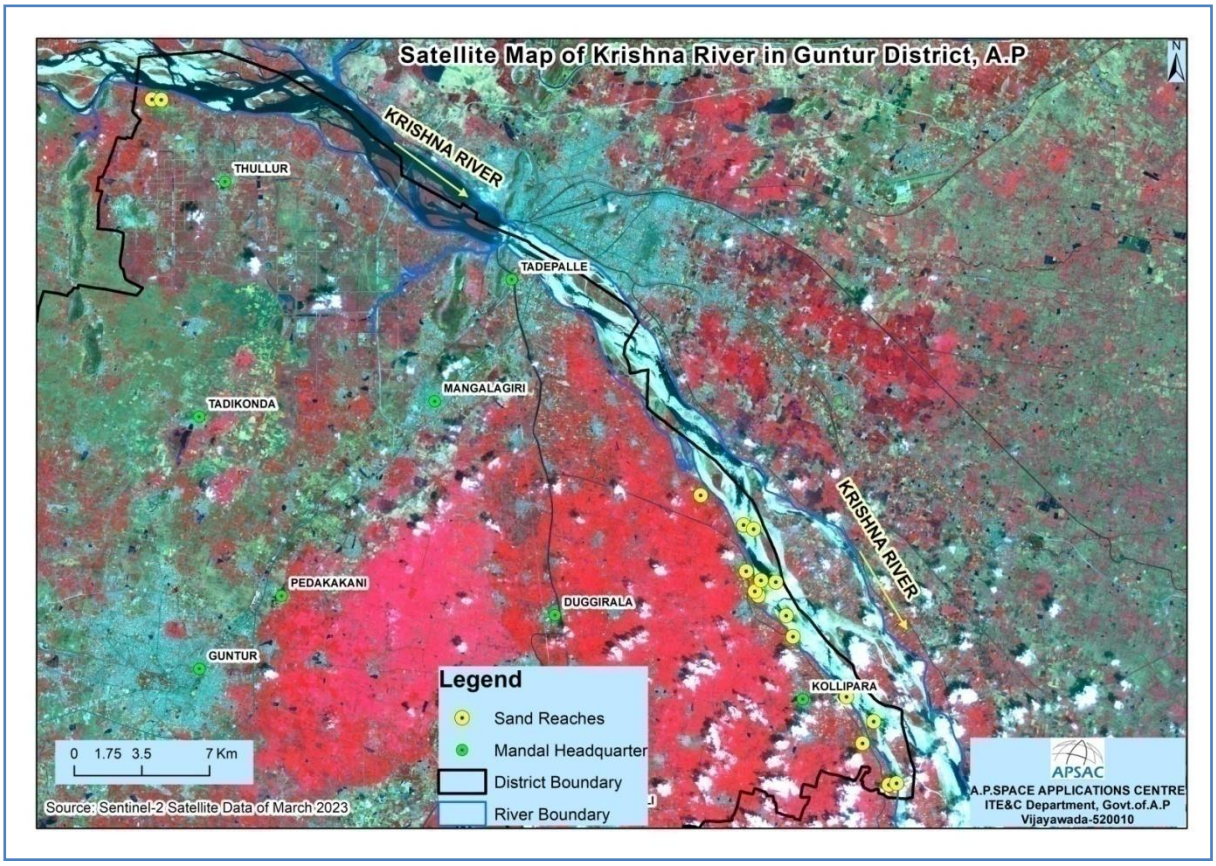



Figure-27: Satellite View of Krishna River map in Guntur District.

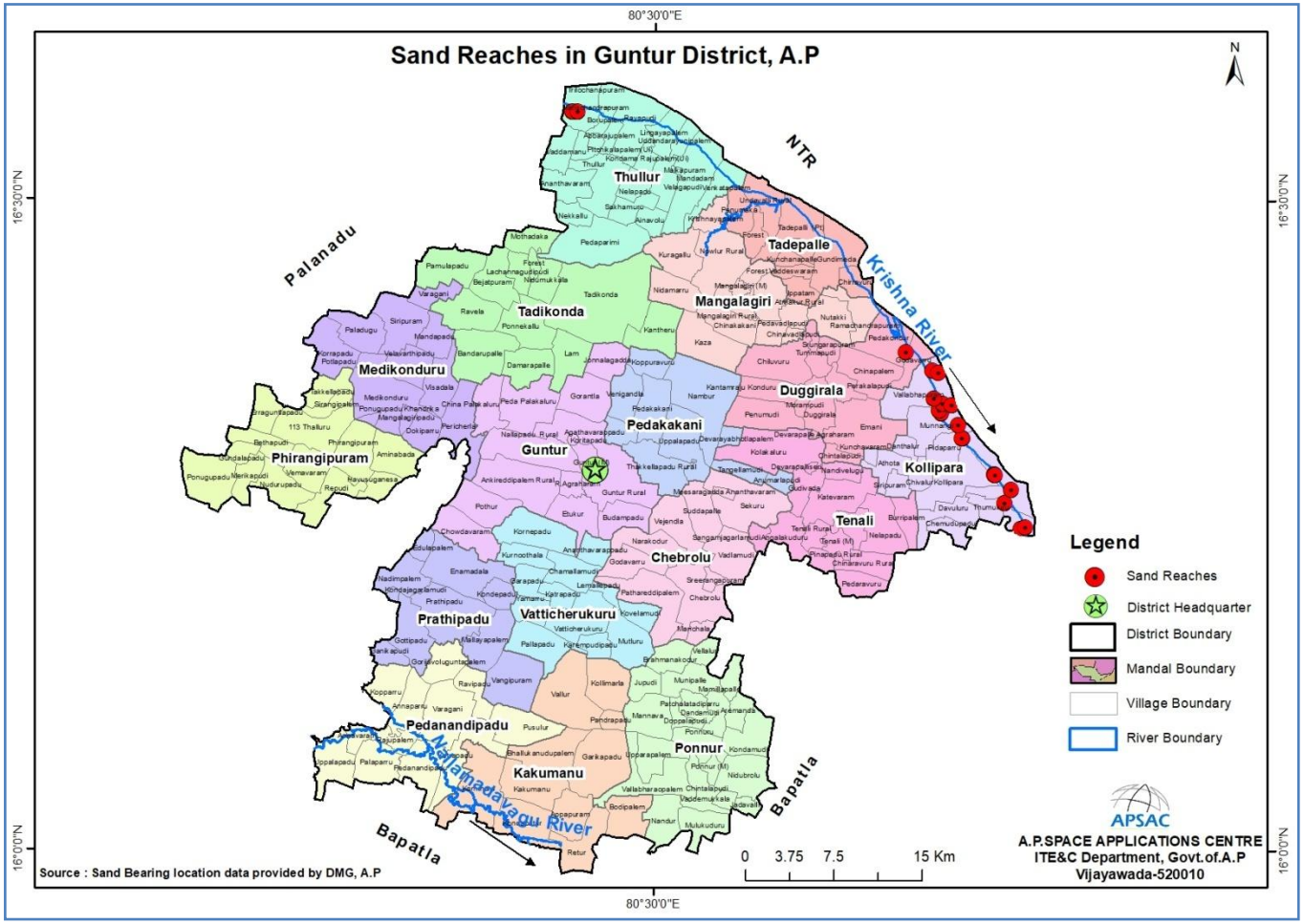



*Figure-28: Mandal wise Sand Reaches map in Guntur District*

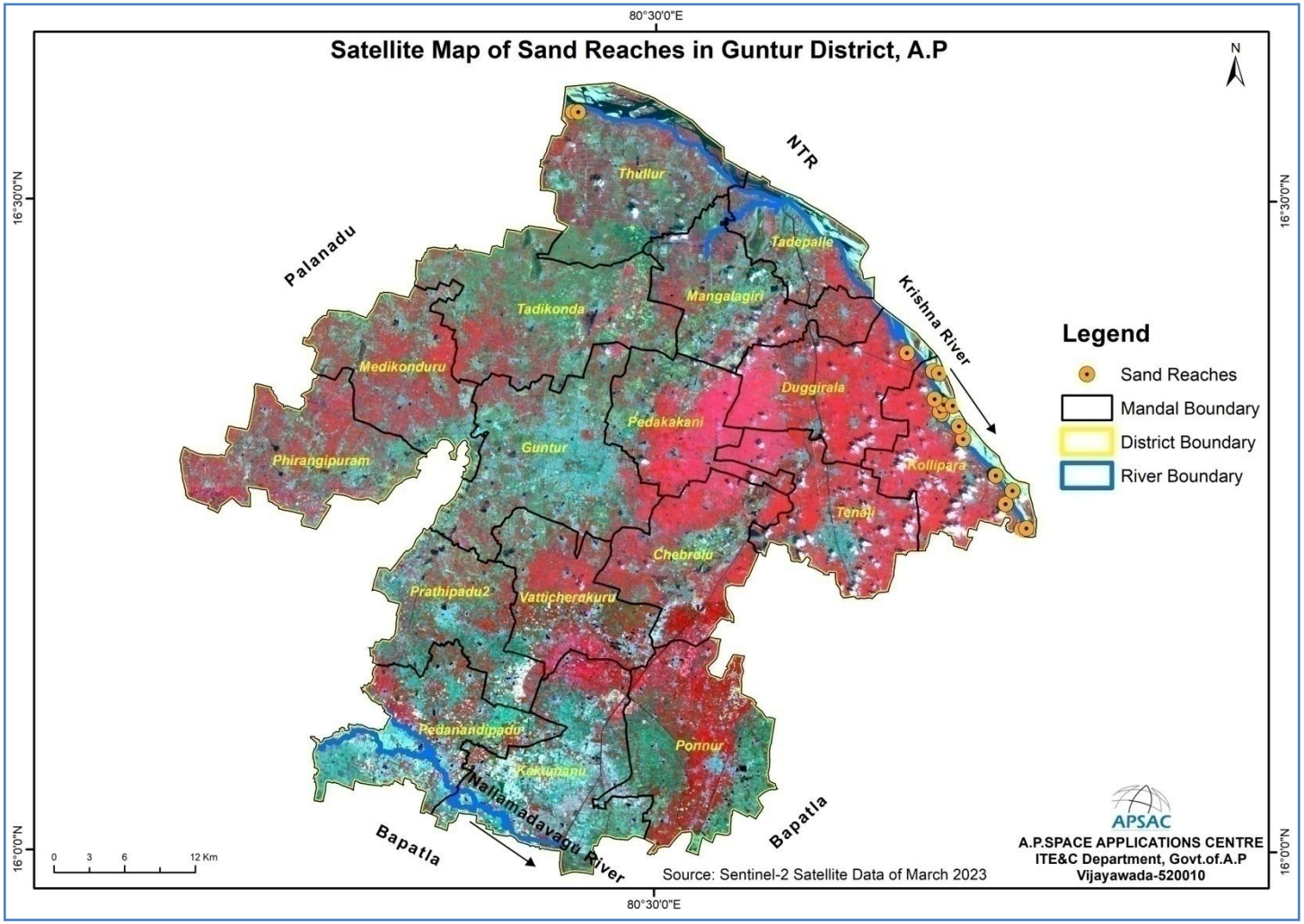



*Figure-29: Satellite Map of Sand reaches in Guntur District*

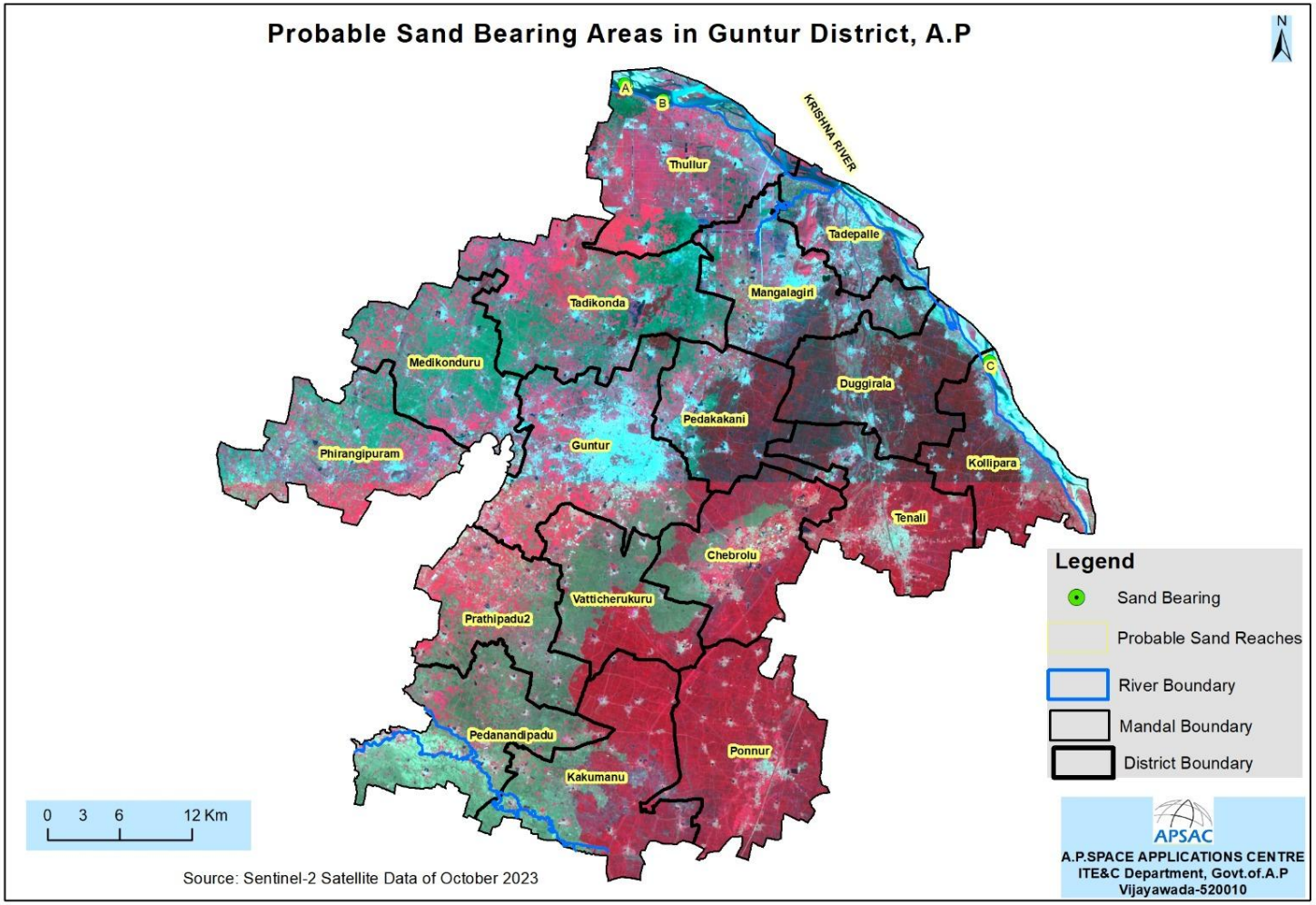



Figure-30: Probable Sand bearing areas in the Guntur District

# References


1. Andhra Pradesh Space Applications Centre (APSAC) (2017a) Identification of potential sites for aquaculture development in coastal districts of Andhra Pradesh using high-resolution satellite data, Project Report, 191p.
2. Andhra Pradesh Space Applications Centre (APSAC)(2017b) Ground Water Quality Mapping of Andhra Pradesh, Technical Report, 40p.
3. Dendy, F.E. and Bolton, G.C., 1976. Sediment yield-runoff drainage area relationships in the United States. Journal of Soil and Water Conservation,31,264−266.
4. Directorate of Economics and Statistics (DES) (2015) Handbook of Statistics, Guntur District, Chief Planning Officer,
5. Department of Mines and Geology (DMG) District Survey Report, Guntur District, AP.
6. Enforcement and Monitoring Guidelines for Sand Mining, January 2020.
7. Geological Survey of India (GSI) (2000) District Resource Map, Guntur District, Andhra Pradesh
8. Ground Water Brochure, Guntur District, Andhra Pradesh, Ministry of Water Resources, Government of India
9. National Remote Sensing Agency (NRSA) (2006) Manual of National Land Use Land Cover Mapping Using Multi-Temporal Satellite Data. National Remote Sensing Centre, Department of Space, Government of India, Hyderabad.
10. National Remote Sensing Agency (NRSA)(2007) Ground Water Prospects Mapping Using Remote Sensing Techniques and Geographic Information System, Rajiv Gandhi National Drinking Water Mission Project, Phase-III, Manual, 222p.
11. National Remote Sensing Centre (NRSC) (2009) Space Based Information Support for Decentralized Planning (SIS-DP), Manual, 214p.
12. National Remote Sensing Centre (NRSC) (2011) Ground Water Quality Mapping (RGNDWM), Methodology Manual, 75p.
13. P. K. Ramam, Mineral Resources of Andhra Pradesh, Geological Society of India, 1999.
14. Sustainable Sand Mining Management Guidelines, 2016
15. Sand Mining Framework 2018

16. Uncles, R. J., Mitchell, S. B., Estuarine and Coastal Hydrography and Sediment Transport, ISBN 10: 1107040981 / ISBN 13: 9781107040984, 2017.
17. http://apsdps.ap.gov.in/RealtimeData/SensorNetwork.html, AWS and APSDPS, Vijayawada
18. http://www.apsdps.ap.gov.in/WeatherPages/Reports-Publications/Socio-eco/Socio_Economic_Survey_2020-21.pdf
19. NR Census 3rd cycle mapping, NRSC/ISRO and APSAC (2018)
20. Andhra Pradesh Rashtriya Krishi Vikas Yojana-2022-23, GoAP
21. https://aprdc.ap.gov.in/Documents/DOWNLOADDOCUMENTS/STATE%20SH%20ROADS.pdf, R and B Department and APSAC, Vijayawada.
22. https://aptourism.gov.in/
23. https://apwrims.ap.gov.in/ (WRD, APWRIMS, Govt. of A.P.)
24. Ground Water Year Book, 2013-14, CGWB, 2013
25. BURA- Specification (2015), FAD 02 (19226)

# ANNEXURE-I

As the average annual run-off more than 2" in the Guntur District, the sedimentation yield for Krishna River in Guntur District, APSAC arrived manually based on the Dendy Bolton Equation or Formula and is given below.

$$S = 1965 \times (e^{-0.055 \times Q}) [1.43 - 0.26 \log(A)]$$

Q = Mean Annual Run-off in mm
A = Net drainage Area in Sq. km
S = Sediment yield (tons/Sq. km/yr)

Sedimentation yield from Krishna River (upstream) in Guntur District

| Name of the River | Area Drained (sq. km) | Mean Annual Run-off (in mm) |
|---|---|---|
| Krishna | 801.07 | 147.68 |

Data Source: District Mines and Geology Officer, Guntur District, Andhra Pradesh and APSAC, Vijayawada

The given drained area value converted from Sq.Km to Sq.mile and the mean annual run-off converted from mm to inches for the calculations.

$$S = 1965 \times (e^{-0.055 \times Q}) [1.43 - 0.26 \log(A)]$$ **Tones/sq.mile/year**

Drainage Area (A) = 801.07 sq. Km (1 Sq.km = 0.386 Sq.mile)
= 801.07 x 0.386
A = 309.213 Sq.mile ----------(1)

Mean Annual Run-off (Q) = 147.68 mm (1 mm = 0.0393 inches)
= 147.68x 0.0393
Q = 5.803824 inches ----------(2)

e is Euler's number and the value is =2.718 ----------(3)

$$S = 1965 \times (e^{-0.055 \times Q}) [1.43 - 0.26 \log(A)]$$ **Tones/sq.mile/year**

$$S = 1965 \times (2.718^{-0.055 \times 5.803824}) [1.43 - 0.26 \log (309.213)]$$

**Log 30 of 9 = 0.4900**
**0.2 = 3**
**As per base, the value = 2.0000**
**_____(+)**
**Log 309.213=2.4903** ----------(4)

$= 1965 \times (2.718^{-0.055 \times 5.803824}) [1.43 - 0.26 \times 2.4903]$

$= 1965 \times (2.718^{-0.31921}) [1.43 - 0.6474]$

$= 1965 \times (2.718^{-0.31921}) [0.7825]$

**The value of $2.718^{-0.5192}$**

**$1/2.718^{0.5192}$ = 0.72674** ----------(5)

$= 1965 \times 0.72674 \times 0.7825$

$= 1117.445$

S = 1117.445 **Tones/sq.mile/year** ----------(6)

For total district Sedimentation Yield =

Per Sq.mile Sedimentation Yield (6) x Total Drainage Area (1)

1117.445 x 309.213 = 3,45,528

As the Sedimentation yield calculated manually,

The sedimentation in the total River in the Bapatla District = **3,45,528 Tones/ year**

# ANNEXURE-II

As the average annual run-off more than 2" in the Guntur District, the sedimentation yield for Krishna River in Guntur District, APSAC arrived manually based on the Dendy Bolton Equation or Formula and is given below.

$$S = 1965 \times (e^{-0.055 \times Q}) [1.43 - 0.26 \log(A)]$$

Q = Mean Annual Run-off in mm
A = Net drainage Area in Sq. km
S = Sediment yield (tons/Sq. km/yr)

Sedimentation yield from Krishna River (downstream) in Guntur District

| Name of the River | Area Drained (sq. km) | Mean Annual Run-off (in mm) |
|---|---|---|
| Krishna | 801.07 | 128.8 |

Data Source: District Mines and Geology Officer, Guntur District, Andhra Pradesh and APSAC, Vijayawada

The given drained area value converted from Sq.Km to Sq.mile and the mean annual run-off converted from mm to inches for the calculations.

$$S = 1965 \times (e^{-0.055 \times Q}) [1.43 - 0.26 \log(A)]$$ **Tones/sq.mile/year**

Drainage Area (A) = 801.07 sq. Km (1 Sq.km = 0.386 Sq.mile)
= 801.07 x 0.386
A = 309.213 Sq.mile ----------(1)

Mean Annual Run-off (Q) = 128.8 mm (1 mm = 0.0393 inches)
= 128.8x 0.0393
Q = 5.06184 inches ----------(2)

e is Euler's number and the value is =2.718 ----------(3)

$$S = 1965 \times (e^{-0.055 \times Q}) [1.43 - 0.26 \log(A)]$$ **Tones/sq.mile/year**

$$S = 1965 \times (2.718^{-0.055 \times 5.06184}) [1.43 - 0.26 \log (309.213)]$$

**Log 30 of 9 = 0.4900**
**0.2 = 3**
**As per base, the value = 2.0000**
**_____(+)**
**Log 309.213=2.4903** ----------(4)

$= 1965 \times (2.718^{-0.055 \times 5.06184}) [1.43 - 0.26 \times 2.4903]$

$= 1965 \times (2.718^{-0.2784}) [1.43 - 0.6474]$

$= 1965 \times (2.718^{-0.\ 2784}) [0.7825]$

**The value of $2.718^{-0.5192}$**

**$1/2.718^{0.5192}$ = 0.75701** ----------(5)

$= 1965 \times 0.75701 \times 0.7825$

$= 1164.045$

S = 1164.045 **Tones/sq.mile/year** ----------(6)

For total district Sedimentation Yield =

Per Sq.mile Sedimentation Yield (6) x Total Drainage Area (1)

1164.045 x 309.213 = 3,59,937

As the Sedimentation yield calculated manually,

The sedimentation in the total River in the Bapatla District = **3,59,937 Tones/ year**

******END******