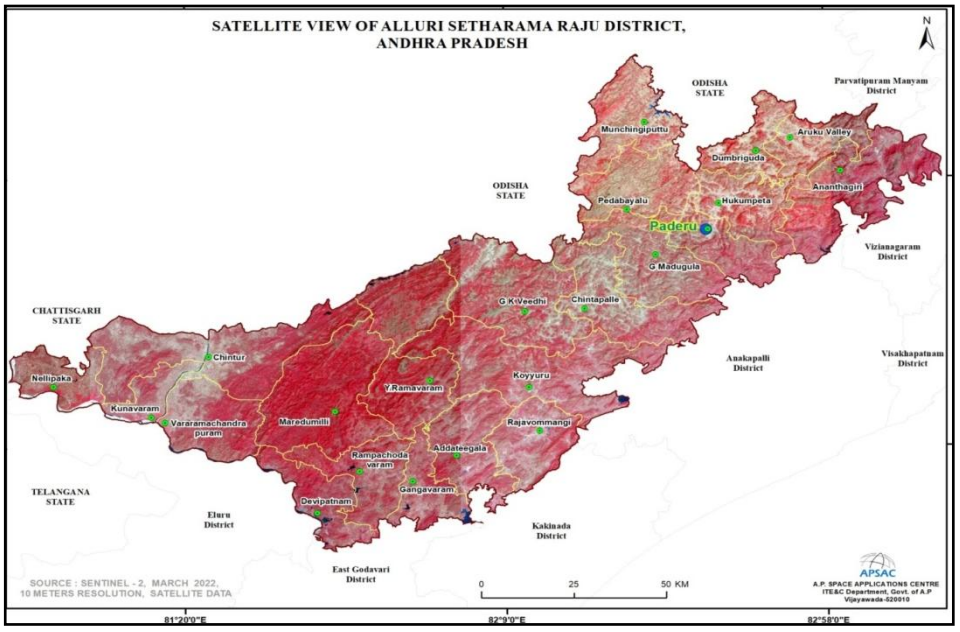
DISTRICT SURVEY REPORT
FOR
SAND AND OTHER MINOR MINERALS
ALLURI SITHARAMA RAJU DISTRICT,
ANDHRA PRADESH

(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, and Enforcement and Monitoring Guidelines for Sand Mining 2020 of MOEF and CC, GoI



Prepared by

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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 Alluri Sitharama Raju 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

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We are also thankful to the **District Mines and Geology Officer,** Alluri Sitharama RajuDistrict 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

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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
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 meter
EIA/EMP	: Environmental Impact Assessment
F	: Fluorine
FAC	: Full Additional Charge
FASAL	: Forecasting Agricultural output using Space, Agrometeorology and Land-based observations
Fe	: Iron
Ft	: feet
GD	: Geosciences Division
GIS	: Geographical Information System
GSI	: Geological Survey of India
Ha	: Hactar
Km	: Kilometer
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
Mi	: mile
mm	: millimetre
MT	: Million Tonne
MoEF	: Ministry of Environment and Forests
MSL	: Mean Sea Level
NIRD	: National Institute of Rural Development
NH	: Natinal Highway
$NaNO_3$	: Sodium nitrate
NRSA	: National Remote Sensing Agency
NRSC	: National Remote Sensing Centre
PESA	: Panchayats 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	: Sulfate
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

Alluri Sitharama Raju district is one of the North - Eastern districts in the state of Andhra Pradesh. It was formed on 4th April 2022 with administrative headquarters as Paderu.

Geographically, Alluri Sitharama Raju district is bounded on north by partly of Odisha, Chattisgarh and Telangana States, on the south by Anakapalli, Kakinada and East Godavari districts, on the west covered by Godavari River and on the east by Vizianagaram and Parvathipuram Manyam districts. Total geographical area of the district is 12,251sq.km. It is covered with 2 Revenue divisions namely Paderu and Rampachodavaram and comprising of 22 Revenue mandals and 3326 Revenue villages. Among all the all mandals, G.Madugula mandal is having maximum number of villages (361) and Devipatnam mandal having minimum number of villages (47). The maximum extent of area (1038.77 Sq.km) is occupied by Chintur mandal and minimum area in Kunavaram mandal (218.70 Sq.km). The mandals covered in each Revenue division are shown in Table-1 and its spatial distribution is shown in Figure-1. The satellite view of the district is shown in Figure-2.

Table 1 List of Mandals Covered in each Revenue division

Paderu Division	Rampachodavaram Division
Ananthagiri	Addateegala
Araku Valley	Chintur
Chintapalle	Devipatnam
Dumbriguda	Gangavaram
G.Madugula	Kunavaram
Gudem Kotha Veedhi	Maredumilli
Hukumpeta	Nellipaka
Koyyuru	Rajavommangi
Munchingi Puttu	Rampachodavaram
Paderu	Vararamachandrapuram
Peda Bayalu	Y.Ramavaram

Data Source: APSAC, Vijayawada.

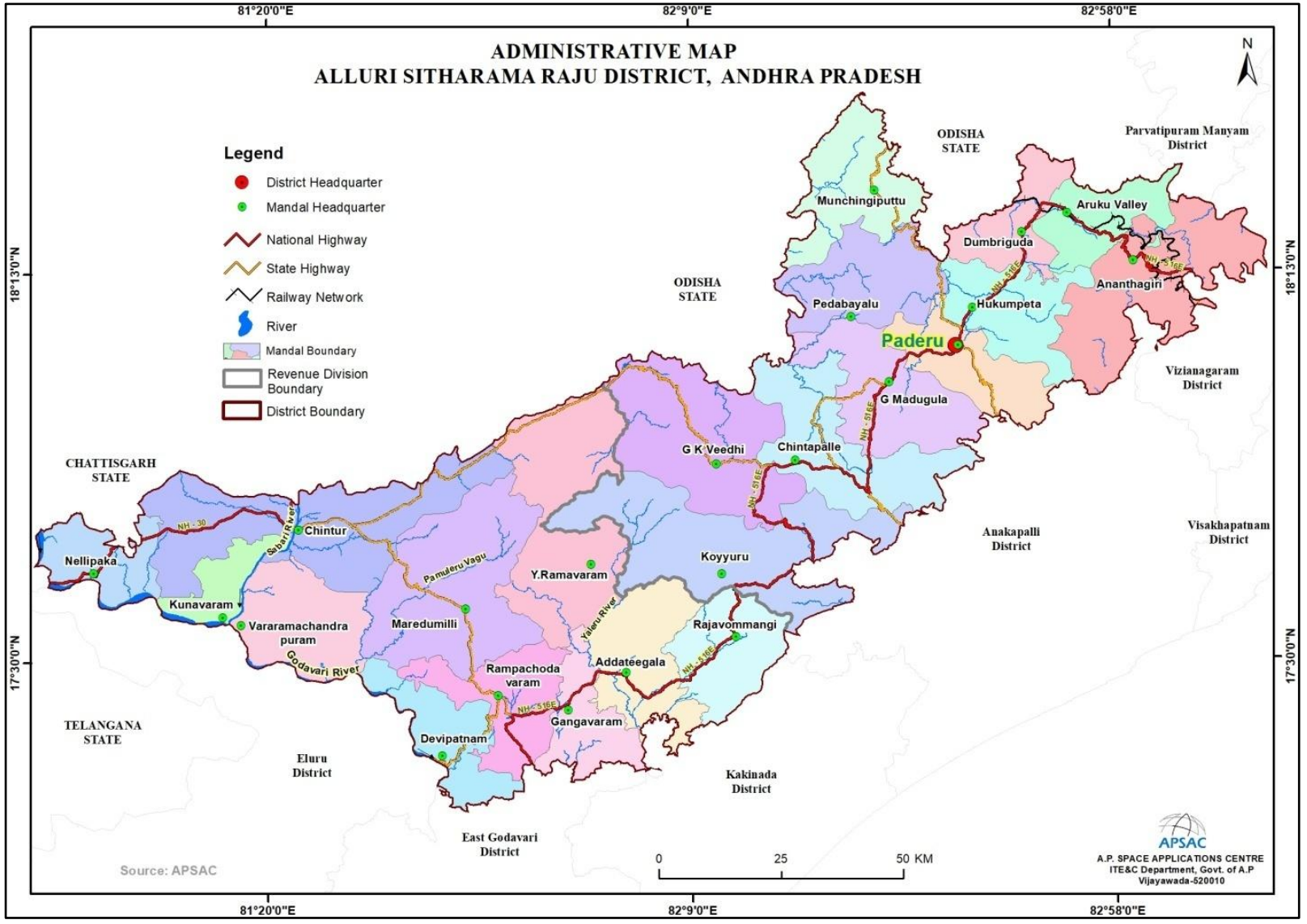


Figure-1: Administrative Map of Alluri Sitharama Raju District, Andhra Pradesh

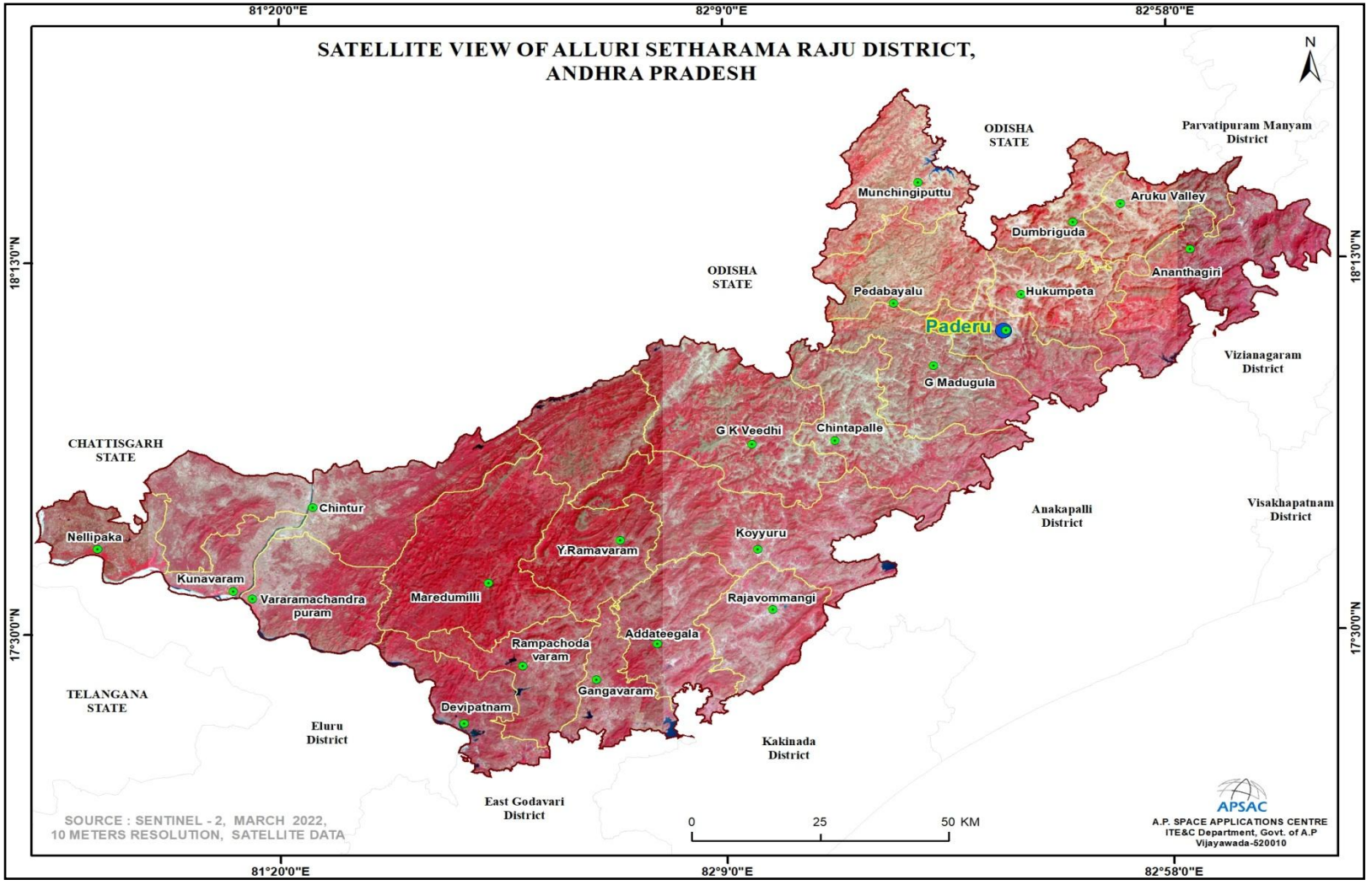


Figure-2: Satellite View of Alluri Sitharama Raju District

1.2 Physiography

The District presents a distinct geographic division. It consists of the hilly regions covered by the Eastern Ghats with an altitude of about 900 meters dotted by several peaks exceeding 1200 meters. Forest block topping with 1615 meters embraces the Mandals of Paderu, G.Madugula, Munchingput, Araku Valley, Ananthagiri, and Chinthapalli.

1.2.1 Relief

As per the guidelines of All India Soil and Land Use Planning (AIS & LUP) soil survey manual, the slope distribution clearly shows that the district terrain is undulating with hills (Figure-3). The slope map shows that the majority of the district land is moderate to steeply sloping, followed slightly by very gently sloping areas. They account for about 90% of the district's total area.

1.2.2 Climate & Rainfall

1.2.2.1. Climate: The climate of the district is varied and has differing climatic conditions in different parts. Near the plain area, the air is humid and moist and relaxing, but gets warmer towards the interior and cools down in the hilly areas on account of elevation and dense vegetation. The district consists of the hilly regions covered by the Eastern Ghats with an altitudeof about1,500 m. The temperature in Lambasingi goes as low as 2°C, with bouts of snowfall in the winter from November to January. The minimum and maximum temperatures recorded in the district are 13.3°C in January and 43.3°C in May respectively. The average rainfall for the last 25 years data used for the analysis. The locations of Automatic Weather Stations (AWS) are in Alluri Sitharama Raju District is shown in Figure-4.

1.2.2.2. Rainfall: The average annual rainfall of the district is 1327.22 mm, of which 963.76 mm falls as South-West (June-September) and 201.95 mm as North-East (October-December) monsoon. The minimum and maximum temperatures recorded in the district are 13.3°C in January and 43.3°C 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.

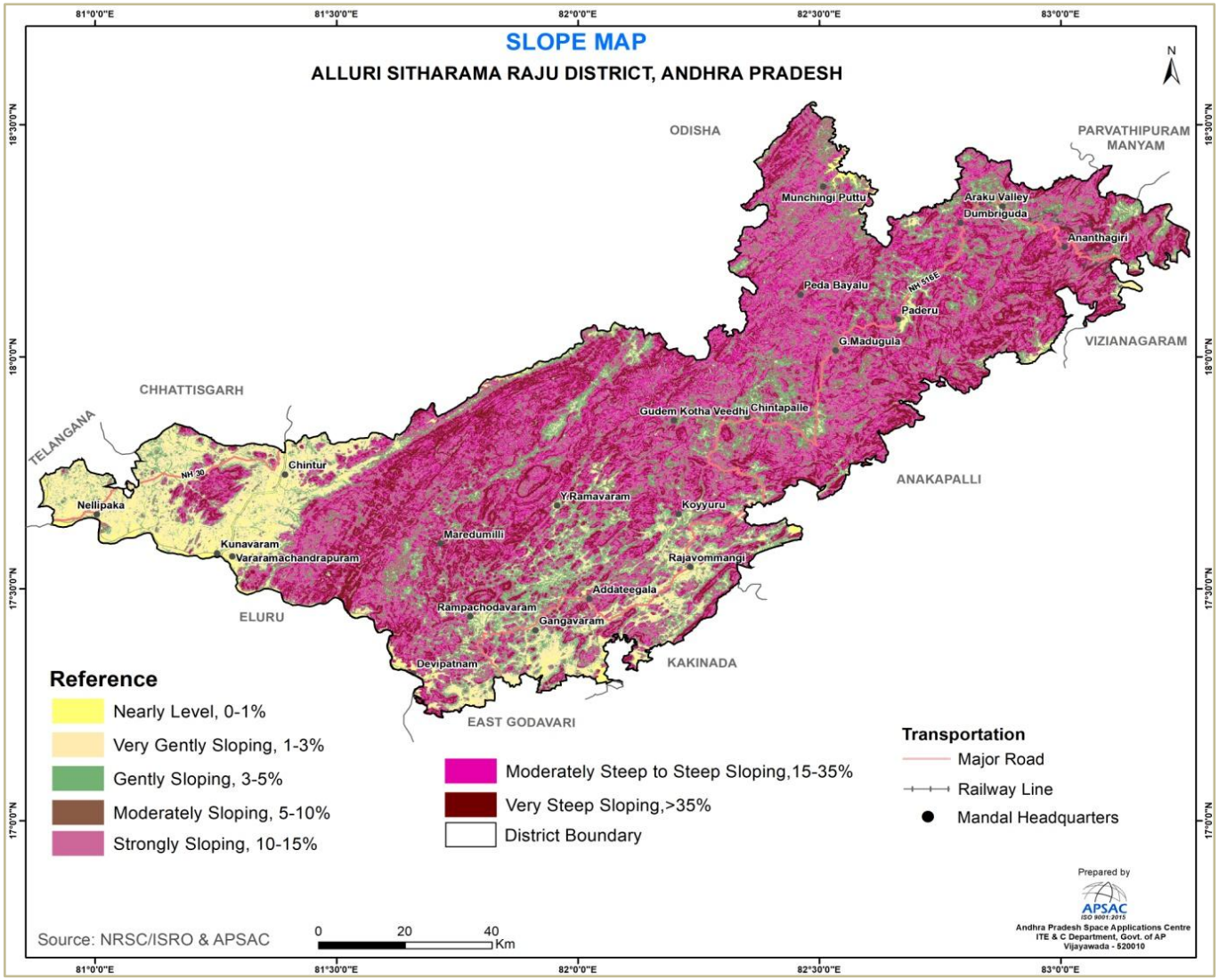


Figure-3: Slope Map of Alluri Sitharama Raju District

Table 2 Average Annual Rainfall (mm) in the district, during the year 1997-2021

S.No	Month	Average Annual Rainfall (mm)
1	January	5.04
2	February	6.73
3	March	17.14
4	April	53.18
5	May	79.40
6	June	188.52
7	July	276.38
8	August	274.12
9	September	224.75
10	October	147.92
11	November	42.10
12	December	11.94
	Total	**1327.22**

Data source: AWS & APSDPS, Vijayawada

1.3 Population and Literacy

1.3.1. Population: The total population of the district is 9,53,960 (as per the 2011 census of India); of which male and female are 4,66,270 and 4,87,690 respectively. Among all the mandals, Chintapalli Mandal is having maximum population of 71,640; whereas Maredumilli Mandal is having minimum population of 19,507.

The total schedule caste (SC) population in the district is 23,788; of which male and female are 11,803 and 11,985 respectively. The schedule tribe (ST) population is7,88,680; of which male and female are 3,84,204 and 4,04,476 respectively. The mandal wise population is shown in Table-3. The mandal wise spatial distribution of total population is depicted in Figure-6.

1.3.2. Literacy: The total literacy in the district is 4,03,541; of which male and female are 2,34,381 and 1,69,160 respectively. The total illiterates is 5,50,419; of which male and female are 2,31,889 and 3,18,530 respectively. The mandal wise Literacy Statistics Summary is shown in 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.

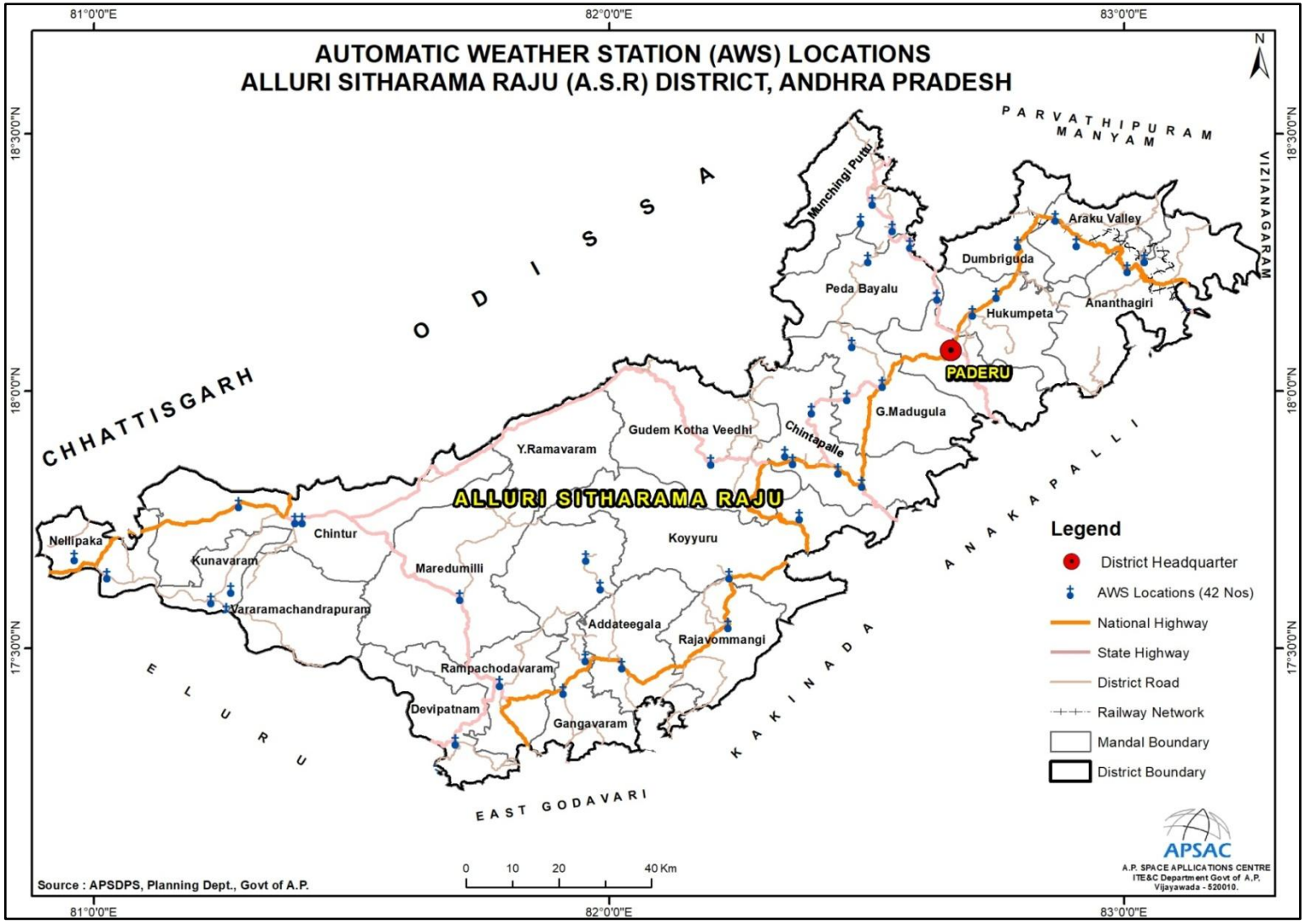


Figure-4: Locations of Automatic Weather Stations (AWS) in Alluri Sitharama Raju District

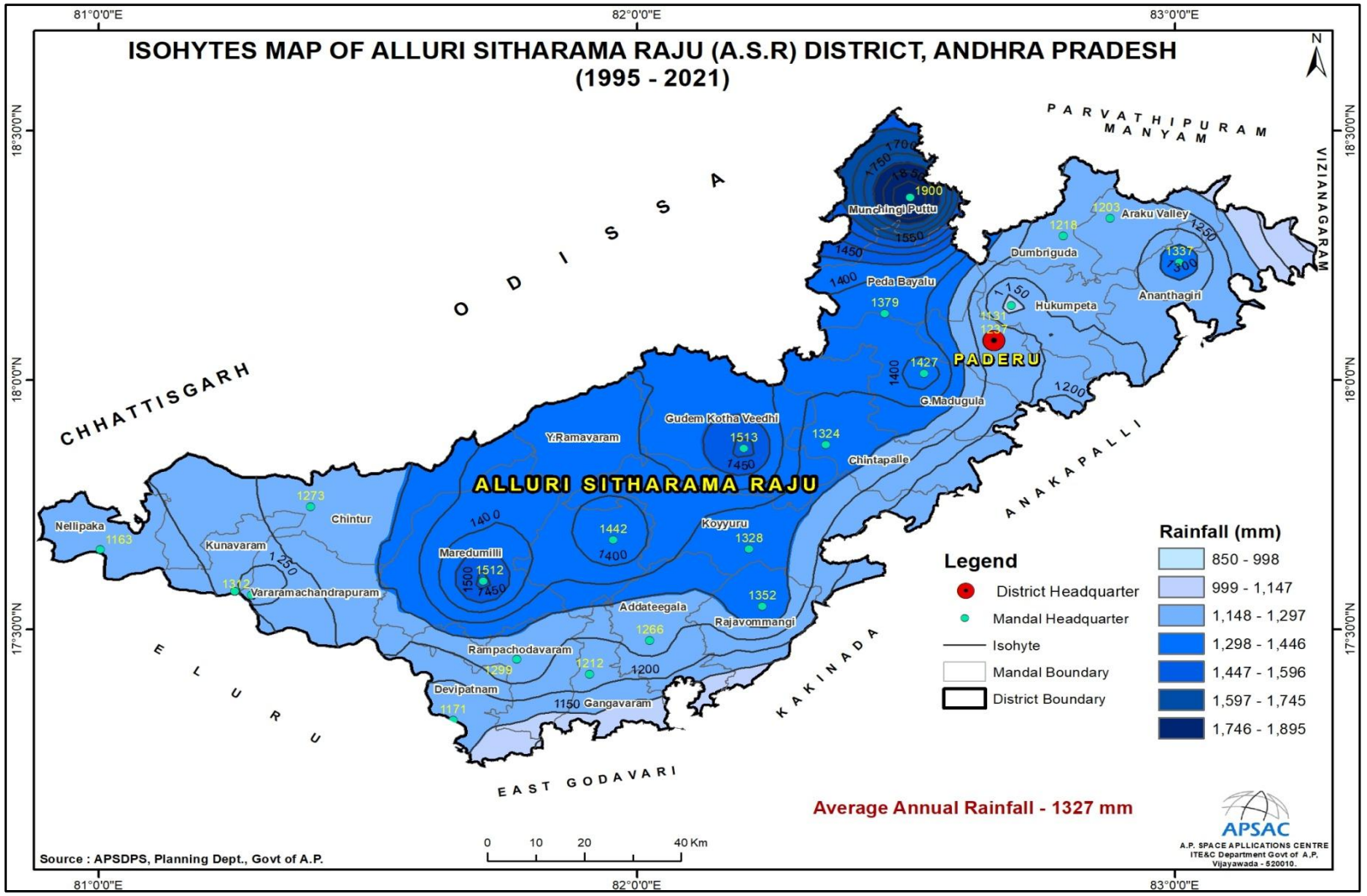


Figure-5: Rainfall distribution in Alluri Sitharama Raju District

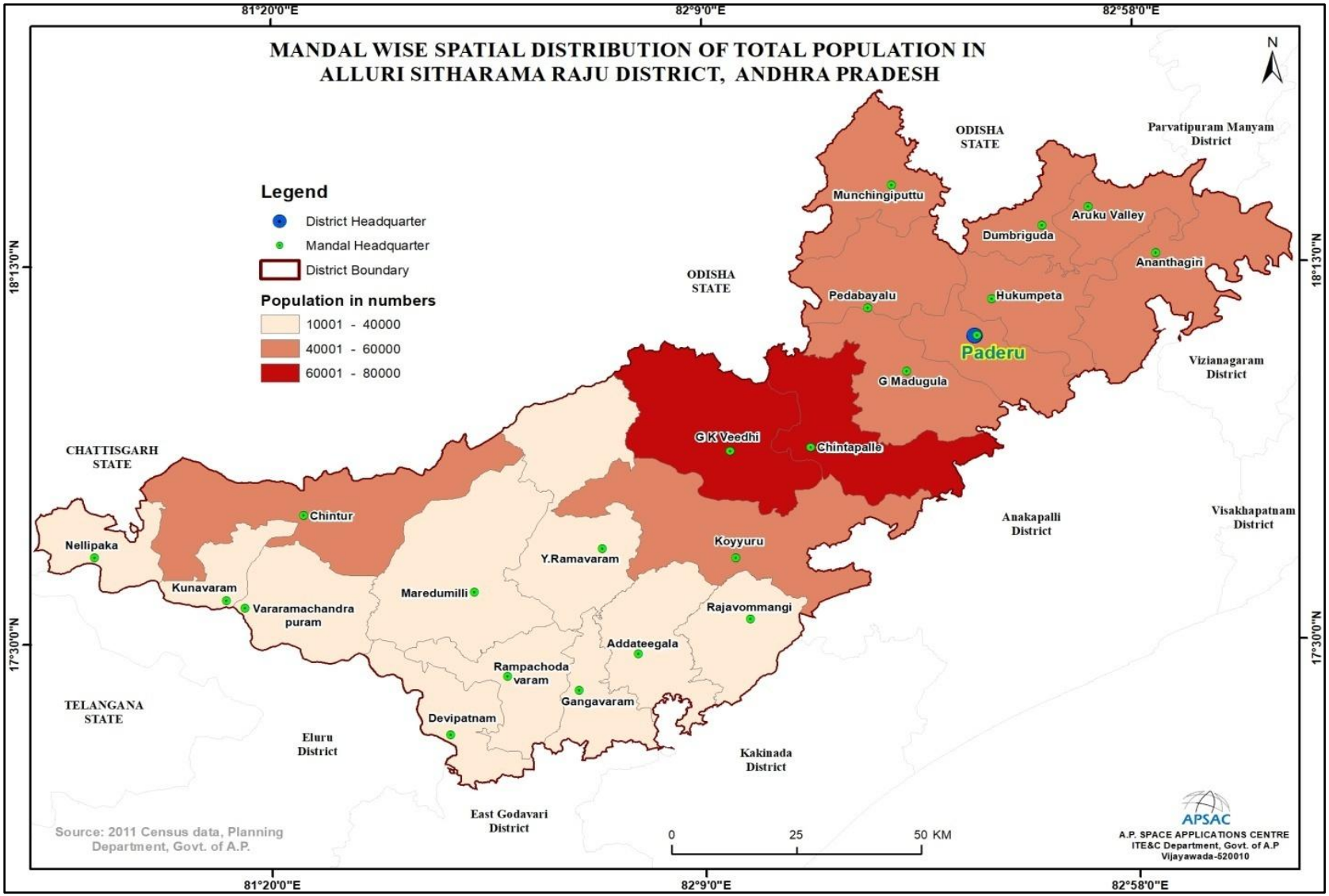


Figure-6: Mandal wise Spatial Distribution of Population in Alluri Sitharama Raju District

Table 3 Mandal wise total population in Alluri Sitharama Raju 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	Addateegala	10811	37241	18686	18555	2030	1022	1008	24663	12445	12218
2	Ananthagiri	11687	49019	24427	24592	821	393	428	44190	21928	22262
3	Aruku Valley	12407	56674	27492	29182	497	240	257	51876	25067	26809
4	Chintapalle	17142	71640	35217	36423	600	286	314	64703	31791	32912
5	Chintur	10925	40725	19899	20826	1326	703	623	31239	15088	16151
6	Devipatnam	8711	28178	13669	14509	1683	837	846	16394	7856	8538
7	Dumbriguda	11624	49029	23801	25228	102	51	51	46479	22558	23921
8	G K Veedhi	14944	63174	30486	32688	784	378	406	56757	27265	29492
9	G Madugula	13119	53884	26966	26918	93	44	49	49970	24765	25205
10	Gangavaram	7550	25912	12393	13519	1682	812	870	17422	8173	9249
11	Hukumpeta	13024	51697	25137	26560	57	32	25	49594	24121	25473
12	Koyyuru	13570	50639	25047	25592	546	266	280	41213	20406	20807
13	Kunavaram	7726	26245	12351	13894	3187	1534	1653	15886	7362	8524
14	Maredumilli	4801	19507	10166	9341	89	56	33	18199	9462	8737
15	Munchingiputtu	11941	47418	22937	24481	65	36	29	44538	21470	23068
16	Nellipaka	10811	38961	19195	19766	6833	3368	3465	20612	10148	10464
17	Paderu	14689	58983	28644	30339	563	318	245	48694	23507	25187
18	Pedabayalu	12826	51890	25542	26348	26	16	10	49937	24575	25362
19	Rajavommangi	11168	39582	19102	20480	821	422	399	22786	11005	11781
20	Rampachodavaram	10554	39351	19185	20166	1090	571	519	31206	15136	16070
21	Vararamachandrapuram	7361	25597	12171	13426	687	314	373	16112	7528	8584
22	Y.Ramavaram	7418	28614	13757	14857	206	104	102	26210	12548	13662
	Grand Total	**244809**	**953960**	**466270**	**487690**	**23788**	**11803**	**11985**	**788680**	**384204**	**404476**

Data Source:Census - 2011, DES.

Table 4 Literacy statistics summary

S.No	Mandal Name	Total Literacy	Male Literacy	Female Literacy	Total Illiterates	Male Illiterates	Female Illiterates
1	Addateegala	19240	10473	8767	18001	8213	9788
2	Ananthagiri	16486	10280	6206	32533	14147	18386
3	Aruku Valley	26433	15555	10878	30241	11937	18304
4	Chintapalle	26411	16334	10077	45229	18883	26346
5	Chintur	15720	8888	6832	25005	11011	13994
6	Devipatnam	15081	7920	7161	13097	5749	7348
7	Dumbriguda	17607	11175	6432	31422	12626	18796
8	G K Veedhi	23533	13810	9723	39641	16676	22965
9	G Madugula	17960	11672	6288	35924	15294	20630
10	Gangavaram	12184	6114	6070	13728	6279	7449
11	Hukumpeta	19497	12069	7428	32200	13068	19132
12	Koyyuru	21987	12678	9309	28652	12369	16283
13	Kunavaram	12645	6633	6012	13600	5718	7882
14	Maredumilli	10036	6328	3708	9471	3838	5633
15	Munchingiputtu	15875	9926	5949	31543	13011	18532
16	Nellipaka	18813	10307	8506	20148	8888	11260
17	Paderu	31274	17867	13407	27709	10777	16932
18	Pedabayalu	17231	11370	5861	34659	14172	20487
19	Rajavommangi	20166	10405	9761	19416	8697	10719
20	Rampachodavaram	22185	11900	10285	17166	7285	9881
21	Vararamachandrapuram	12322	6535	5787	13275	5636	7639
22	Y.Ramavaram	10855	6142	4713	17759	7615	10144
	Grand Total	**403541**	**234381**	**169160**	**550419**	**231889**	**318530**

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 the result of various physical and cultural factors, as well as man's use of them over 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. Data on land use/land cover are critical for planners, decision-makers, and those involved in land resource management. Understanding the impact of various human-induced land use practices on environmental change is essential to aid in the simulation of land use changes. Remote Sensing (RS) technology is considered to be the most effective because it provides timely and accurate information about the spatial distribution of land use/land cover, whereas Geographical Information Systems (GIS) provide a flexible digital environment for collecting, storing, visualizing, and analyzing the spatial data. Remote sensing is an important tool for rapid assessment and monitoring of natural resources. When combined with GIS, it allows for detailed mapping of land use/land cover phenomena for future planning, development, and decision-making, which is essential for meeting the increasing demands and welfare of the ever-growing population.

1.4.2 Spatial Distribution of Land Use / Land Cover

Under level 3 classification, various land use / land cover categories have been delineated using three seasons (Kharif, Rabi, and Zaid) satellite data. Visual image interpretation techniques i.e. size, shape, color, tone, texture, association, and pattern have been considered for the land use/land cover classification (NRSA, 2006). This data is used for general planning at the district or municipal levels. The broad categories are built-up, agricultural land, forest, wastelands, wetlands, and water bodies. The spatial distribution of land use/land cover of the Alluri Sitharama Raju district is shown in Figure 7 and area statistics are presented in Table 5.

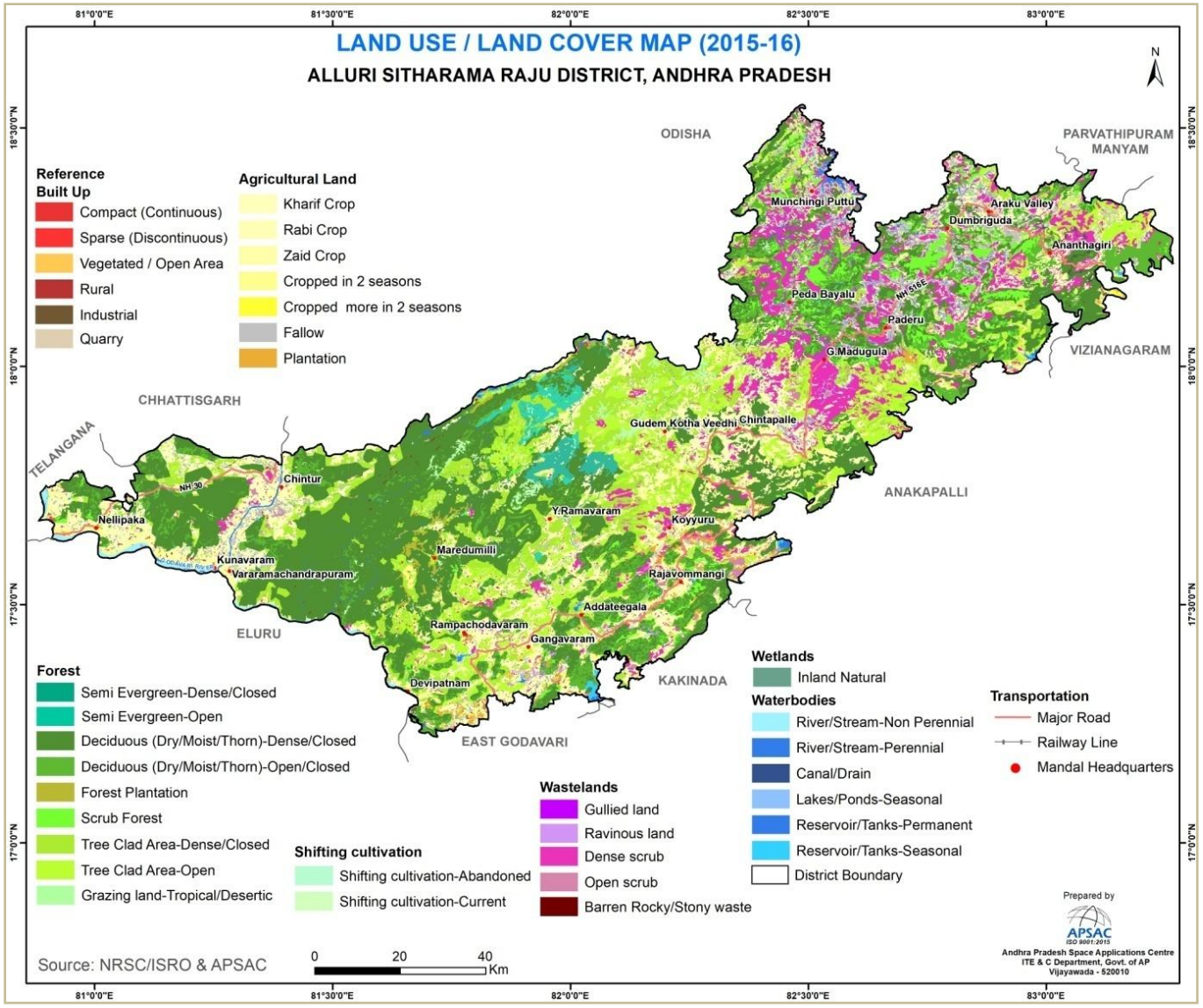


Figure-7: Land use / land cover map of Alluri Sitharama Raju District 2015-16

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		**79.15**	**0.65**
1	Compact (Continuous)	1.34	0.01
2	Sparse (Discontinuous)	1.90	0.02
3	Vegetated / Open Area	0.11	0.00
4	Rural	73.26	0.60
5	Industrial	1.19	0.01
6	Quarry	1.34	0.01
Agricultural Land		**2862.10**	**23.36**
7	Kharif Crop	1723.05	14.06
8	Rabi Crop	43.64	0.36
9	Zaid Crop	2.81	0.02
10	Cropped in 2 seasons	476.64	3.89
11	Croppedmore in 2 seasons	11.88	0.10
12	Fallow	488.83	3.99
13	Plantation	115.25	0.94
Forest		**7838.36**	**63.98**
14	Evergreen / Semi Evergreen-Dense/Closed	90.08	0.74
15	Evergreen / Semi Evergreen-Open/Closed	94.19	0.77
16	Deciduous (Dry/Moist/Thorn)-Dense	3650.86	29.80
17	Deciduous (Dry/Moist/Thorn)-Open	1084.28	8.85
18	Forest Plantation	56.50	0.46
19	Scrub Forest	434.44	3.55
20	Tree Clad Area-Dense	1169.76	9.55
21	Tree Clad Area-Open	1166.14	9.52
22	Grazing land	92.11	0.75
Wastelands		**1146.89**	**9.36**
23	Gullied land	0.45	0.00
24	Ravinous land	14.01	0.11
25	Dense scrub	912.27	7.45
26	Open scrub	214.98	1.75
27	Barren Rocky/Stony waste	5.18	0.04
Wetlands		**2.43**	**0.02**
28	Inland Natural	2.43	0.02
Water bodies		**306.98**	**2.51**
29	River/Stream-Perennial	161.36	1.32
30	River/Stream-Non Perennial	58.10	0.47
31	Canal/Drain	2.25	0.02
32	Lakes/Ponds-Permanent	0.09	0.00
33	Reservoir/Tanks-Permanent	43.45	0.35
34	Reservoir/Tanks-Seasonal	41.73	0.34

Shifting cultivation		**15.09**	**0.12**
35	Shifting cultivation-Current	14.00	0.11
36	Shifting cultivation-Abandoned	1.09	0.01
Total		**12251.00**	**100.00**

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

1.4.2.1. Built-up

These are human habitation areas with buildings, transportation and communication, utilities associated with water, vegetation, and vacant lands. It consists of built-up (Compact and Sparse), Vegetated / Open Area, Rural, Industrial, and Mining/Quarry. It covers 79.15 sq. km, which is about 0.65% of the district's total geographical area.

1.4.2.2. Built up - Compact (Continuous)

The majority of the land is covered by buildings, roads, and artificially surfaced areas that cover nearly the entire area. The built-up (compact) class is assigned when urban structures and transportation networks (i.e. impermeable surfaces) occupy more than 80% of the surface area. This category is occupied by 1.34 sq. km, which is found in the Araku, Paderu, and other mandal headquarters.

1.4.2.3. Built up - Sparse (Discontinuous)

Most of the land is covered by structures such as buildings, roads, and artificially surfaced areas, which are associated with vegetated areas and bare soil and 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 covers an area of 1.90 sq. km and is located in the peri-urban areas.

1.4.2.4. Vegetated / Open Area

These are vegetated areas within 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 race courses, including formal parks etc, are considered in this category. This category occupies an area of 0.11 sq. km.

1.4.2.5. Built up – Rural

These are the lands used for the human settlement of size comparatively less than the urban settlements of which more than 80% of the people are involved in the primary agriculture activity and associated with non-commercial and with allied classes are identified as built up (rural) category. The rural area contribution is about 73.26 sq. km and is distributed throughout the district.

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 1.9 sq. km.

1.4.2.7. Quarry

These are manifestations of surface mining operations, in which small-scale excavation of land surfaces is carried out for sand, gravel, clay-phosphate mines, limestone quarries, and so on. They are primarily distinguished by their proximity to urban areas. It contributes an area is about1.34 sq. km.

1.4.2.8. Agricultural Land

The land use category 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 agricultural category is found as the major category covering 2862.10 sq. km during 2015-16. Rain-fed farming is the characteristic feature of agriculture in the district; most of its area is cultivated purely under rain-fed conditions. It is also found that Kharif cropland is the predominant category of the district.

1.4.2.9. Kharif Crop

Agricultural area cultivated between June/July to September/October coinciding with the SW monsoon season is considered as Kharif crop. It is associated with rain-fed crops under dryland farming with limited or no irrigation and areas of rain-fed paddy and other dry crops. Kharif is found to be the major agricultural category with an extension of 1723.05 sq. km (14.06%) in the district. Most of the Kharif cropland is under rain-fed areas and is seen throughout the district.

1.4.2.10. 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. The extent of the rabi-cropped area is about 43.64 sq. km (0.36%). The rabi-cropped areas found along the irrigated areas of canals and reservoirs.

1.4.2.11. Zaid Crop

These are the areas that are grown during the summer (April to May), and they are only found in plains and delta regions. They are mostly connected to irrigated areas with fertile soils. This category occupies an area of 2.81 sq. km during the period.

1.4.2.12. Cropped in two seasons

These are the areas that are cropped during two cropping seasons that are often seen associated with irrigated areas. Normally Kharif + Rabi and Kharif + Zaid combination is possible in double-cropped areas. It is found that this is the second major agricultural category with an extent of 476.64 sq. km (3.89%). This category can be found along the river's course and is grown using groundwater in the district.

1.4.2.13. Cropped in more than two seasons

These are the areas that are cropped in more than two cropping seasons. It includes triple-cropped areas (Kharif, RabiandZaid), and areas under multiple cropping. Long-duration crops like sugarcane, cotton, banana, etc., are considered under this category. It contributes an area of 11.88 sq. km.

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 as fallow land. The fallow land occupies an area of 488.83 sq. km, which is due to the non-availability of water resources in the district.

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 tone of different sizes with regular and sharp edges indicating the presence of a fence around them. The agricultural plantations are delineated in an area of 115.25 sq. km.

1.4.2.16. Forest

Land with a tree canopy cover of more than 10% and a size of more than 0.5 ha is referred to as a forest. The notified forest boundaries are considered to contain a forest if there are both trees and no other dominant land uses there. Within the notified forest boundaries, the trees must be capable of growing to a minimum height of 5 meters. Around 7838.36 sq. km (63.98%) of the land area is covered by forest. The important species are teak, nalla maddi, rosewood, devadari, etc.

1.4.2.17. Evergreen / Semi Evergreen-Dense/Closed

This term as such describes the phonology of perennial plants that are never entirely without green foliage. This category comprises tall trees, which predominantly remain green throughout the year. It includes both coniferous and tropical broadleaved evergreen species. Semi-evergreen is a forest type that includes a combination of evergreen and deciduous species with the former dominating the canopy cover. This category includes all areas where the canopy cover/density is more than 40 %. It occupies an area of 90.08 sq. km of the district total.

1.4.2.18. Evergreen / Semi Evergreen-Open/Closed

This category comprises of tall trees, which predominantly remain green throughout the year, and all the areas where the canopy cover/density ranges between 10 and 40 %. It contributes an area of 94.19 sq. km of the district total.

1.4.2.19. Deciduous (Dry/Moist/Thorn)-Dense

Most of the species in this category only lose their leaves once a year, usually in the summer. The majority of these tropical forests are broad-leaved and have a yearly leaf-falling tendency. This category includes all the areas where the canopy cover/density is more than 40% and contributed 3650.86 sq. km.

1.4.2.20. Deciduous (Dry/Moist/Thorn)-Open

This category is predominantly composed of species, which shed their leaves once a year, especially during summer. These are mostly broad-leaved tropical forests with a tendency to shed their leaves annually. This category includes all the forest areas where the canopy cover/density ranges between 10 - 20 percent. An area of 1084.28 sq. km., is attributed to this category.

1.4.2.21. Forest Plantation

These are the areas of tree species of forestry importance, raised and managed especially in notified forest areas. Most of these are located in uplands, coastal areas within notified areas. Many of these can be identified based on the sharp boundaries exhibited by them. Forest plantations, mainly teak, bamboo, casuarinas, etc have been delineated with an area of 56.50 sq. km during the period.

1.4.2.22. Scrub Forest

These are the forest areas that are generally seen at 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. Most of the scrub forests are found in fringe areas of reserved forests and account for 434.44 sq. km (3.55%), which are generally prone to the conversion of forest plantations and other development activities within the notified forest.

1.4.2.23. Tree Clad Area-Dense

Areas with tree cover lying outside the notified forest area with a woody perennial plant with a single, well-defined stem carrying a more-or-less-defined crown and being at least 3 m tall. Plants essentially herbaceous but with a woody appearance (e.g. Bamboos and ferns) are also classified as trees if the height is more than 5 m and as shrubs if the height is less than 5 m. This category includes all the areas where the canopy cover/density is more than 40%. It occupies an area of 1169.76 sq. km, which is found along with notified forest areas.

1.4.2.24. Tree Clad Area-Open

Areas with tree cover lying outside the notified forest area with a woody perennial plant with a single, well-defined stem carrying a more-or-less-

defined crown and being at least 3 m tall. Plants essentially herbaceous but with a woody appearance (e.g. Bamboos and ferns) are also classified as trees if the height is more than 5 m and as shrubs if the height is less than 5 m. This category includes all the forest areas where the canopy cover/density ranges between 10 - 40%. It covers an area of 1166.14 sq. km.

1.4.2.25. Grazing Land

These areas are described as the natural potential (climax) plant cover as being composed of principally native grasses, Forbes, and shrubs. These are the grasslands that are located in the temperate zone and sub-tropical zone respectively. This category occupies an area of 92.11 sq. km.

1.4.2.26. 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 by location, environment, chemical and physical properties of the soil, or financial or management constraints. The area under the wasteland category was mapped at 1146.89 sq. km (9.36%) during the study, which consists of further subcategories of gullied land, ravinous land, dense scrub, open scrub, and barren rocky/stony waste.

1.4.2.27. Gullied land

Gullies are formed as a result of localized surface run-off affecting the unconsolidated material resulting in the formation of perceptible channels causing the undulating terrain. Gullies develop from rills which are tiny water channels a few centimetres deep, formed as a resultant impact of heavy rainfall and the wearing action of runoff generated therefrom. They are commonly found on sloping lands, developed as a result of concentrated runoff. Further classification of this category is possible based on the depth, width, bed slope, frequency, and morphology of the bed material of the ravines. They appear in light yellow to bluish-green depending on the surface moisture and depth of erosion. They vary in size and shape with irregular broken network patterns. The gullied lands are mapped in the areas of pediment and the foothill zones, accounting for 0.45 sq. km.

1.4.2.28. Ravinous land

The word ravine is usually associated not with an isolated gully but an intricate network of gullies formed generally in deep alluvium and entering a nearby river, flowing much lower than the surroundings. Ravines are extensive systems of gullies developed along the river course. It covers an area of 14.01 sq. km.

1.4.2.29. 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 is mostly identified on the hills and occupies an area of 912.27 sq. km.

1.4.2.30. Open scrub

This category has a similar description as mentioned in the dense scrub except that they possess sparse vegetation or devoid of scrub and have a thin soil covers. The open scrub areas are found at the foothills and moderate to gentle slopping areas are surrounded by agricultural lands. The open scrub category occupied an area of 214.98 sq. km.

1.4.2.31. 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 occupied under this category is 5.18 sq. km of the district's geographical area.

1.4.2.32. Wetlands Inland - Natural

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. These are the regions that have vegetation and features like ox-bow lakes, cut-off meanders, waterlogged areas, swamps, marshes, peat bogs, etc. This category contributes to 2.43 sq. km of the district total.

1.4.2.33. Water Bodies

This category includes locations with surface water, either flowing as streams, rivers, canals, etc., or being impounded in the form of ponds, lakes, and reservoirs. According to the water's depth, these are visible on the satellite image in a distinct blue to dark blue or cyan color. The water body category covers about 306.98 sq. km, which is 2.51% of the district's total area. The important rivers flown in the district are Godavari and Sabari.

1.4.2.34. 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. These are the rivers/streams that flow continuously throughout the year as considered perennial. It contributes an area of 161.36 sq. km.

1.4.2.35. River/Stream-Non Perennial

The water covers the surface for less than nine months in each year considered as non-perennial. This also includes the dry part of the river generally characterized by the presence of sand or exposed rocks. It is found that most of the streams are under the non-perennial category and contribute an area of 58.10 sq. km.

1.4.2.36. 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 plains with an area of 2.25 sq. km.

1.4.2.37. 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, FAO, 2005) 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 occupies an area of 0.09 sq. km.

1.4.2.38. 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 surface 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. This category occupies an area of 43.45 sq. km.

1.4.2.39. 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. It is found that many of the tanks fall under the seasonal category with an area of 41.73sq. km.

1.4.3 Forest Cover Distribution

The interpretation of various topographical maps from different sources and satellite data were used to create the forest cover maps. Land with a tree canopy cover of more than 10% and a size of more than 0.5 ha is referred to as a forest. If there are both trees and no other dominant land uses within the notified forest boundaries, the area is considered a forest. The trees should be able to reach a minimum height of 5 m within the notified forest boundaries. The spatial distribution of forest cover and its statistics for the Alluri Sitharama Raju district are shown in Figure 8 and Table 6. As per the Forest Department, Government of Andhra Pradesh the Forest boundary map is presented in Figure-9 and Wildlife sanctuary boundary map of West Godavari District is shown in Figure-9A.

Table 6 Forest cover distribution in Alluri Sitharama Raju District

S. No	Forest Category	Area in sq. km	% to district total
1	Evergreen / Semi Evergreen-Dense	90.08	0.74
2	Evergreen / Semi Evergreen-Open	94.19	0.77
3	Deciduous (Dry/Moist/Thorn)-Dense	3650.86	29.80
4	Deciduous (Dry/Moist/Thorn)-Open	1084.28	8.85

5	Forest Plantation	56.50	0.46
6	Scrub Forest	434.44	3.55
7	Tree Clad Area-Dense	1169.76	9.55
8	Tree Clad Area-Open	1166.14	9.52
9	Grazing land	92.11	0.75
Total		**7838.36**	**63.98**

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

Based on IRS R2 LISS III data interpretation (2015-16), the district's forest cover is 7838.36 sq. km, accounting for 63.98% of the district's geographical area. The district's forest cover can be found throughout the district. The district has a fairly wide distribution of bamboo and timber species throughout the area. The forests are evergreen and deciduous in nature and spread throughout the district. The district's forests are divided into nine forest classes according to the land use/land cover manual (NRSC 2016).

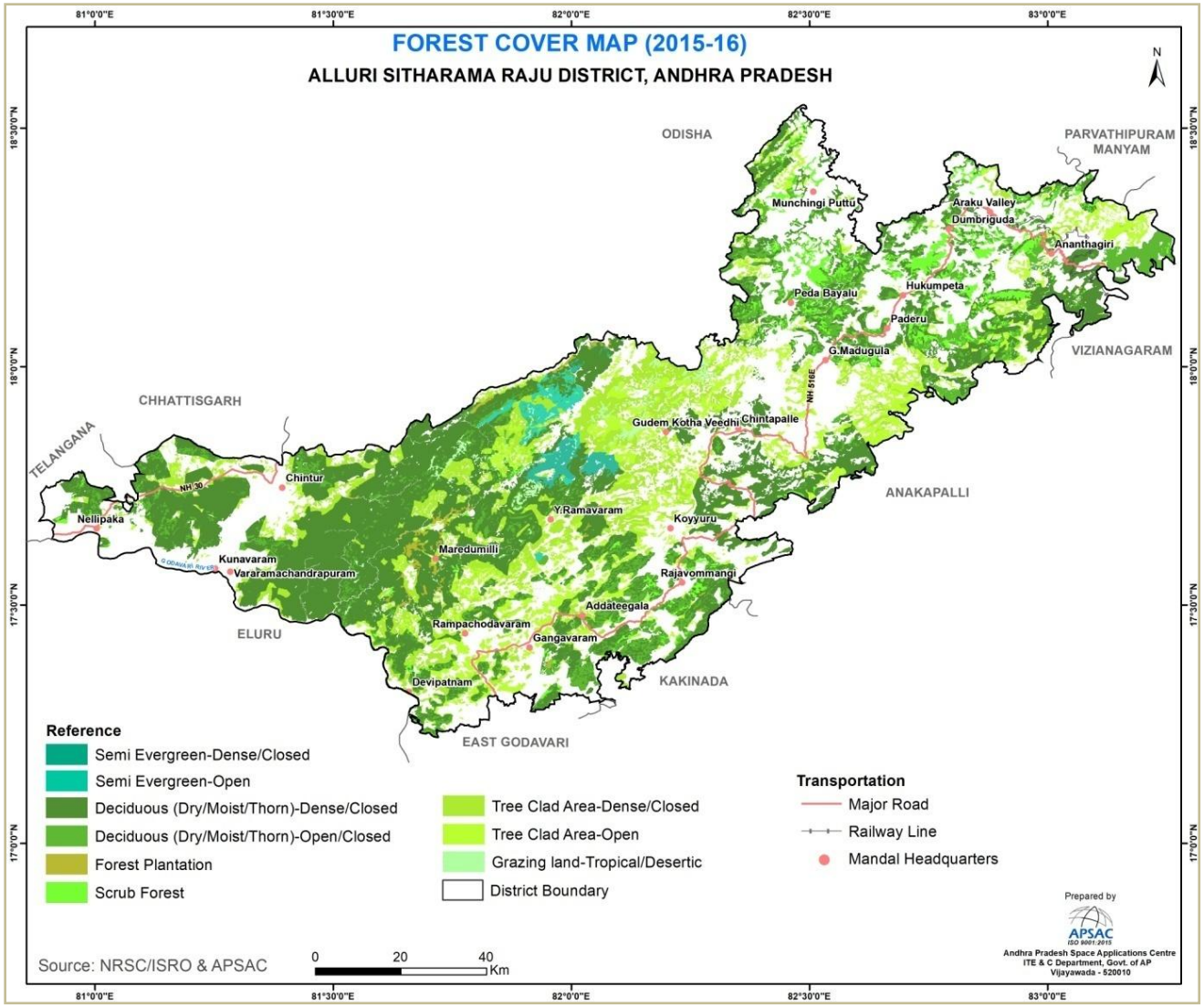


Figure-8: Forest cover map of Alluri Sitharama Raju District

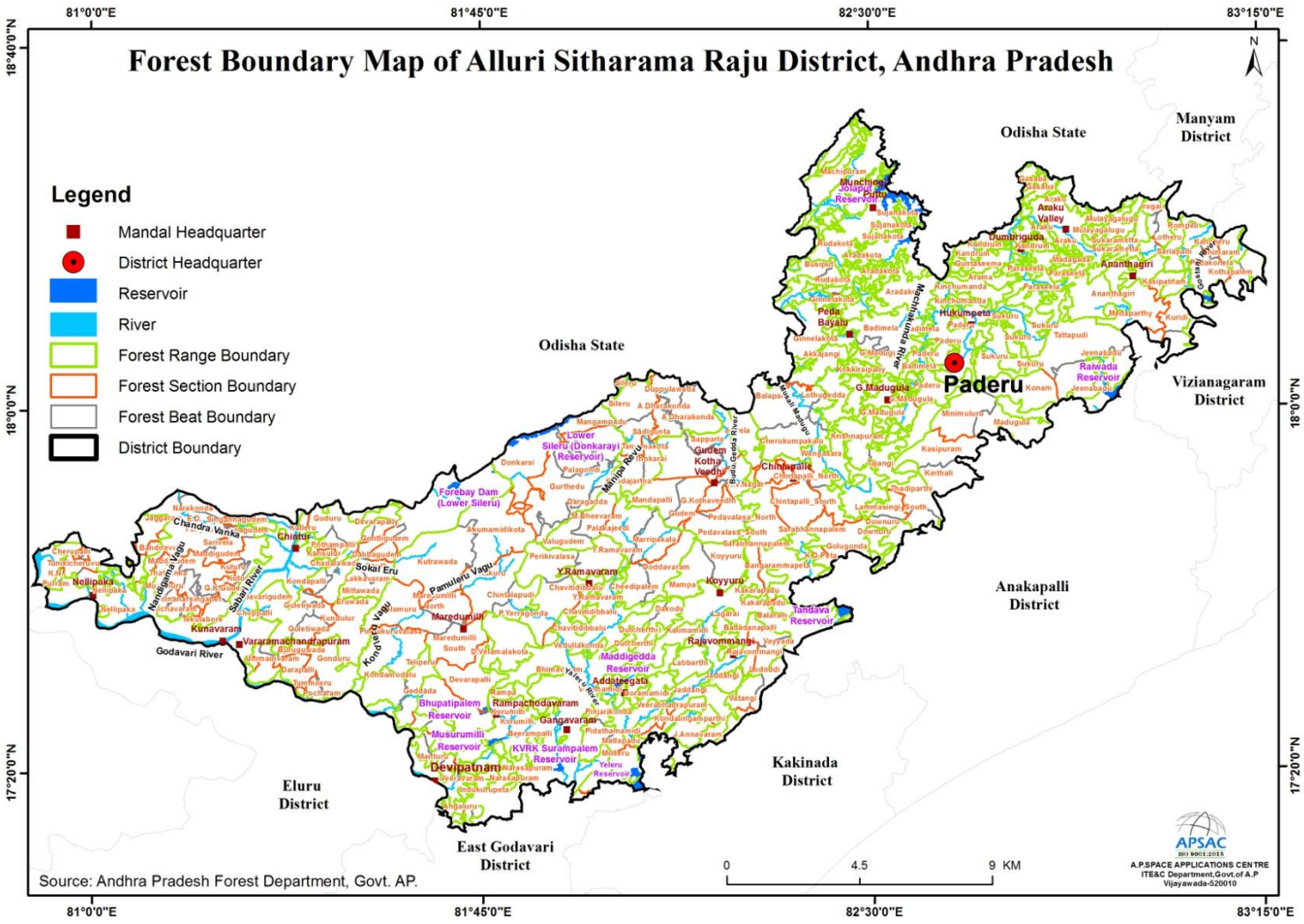


Figure-9: Forest boundary map of West Godavari District

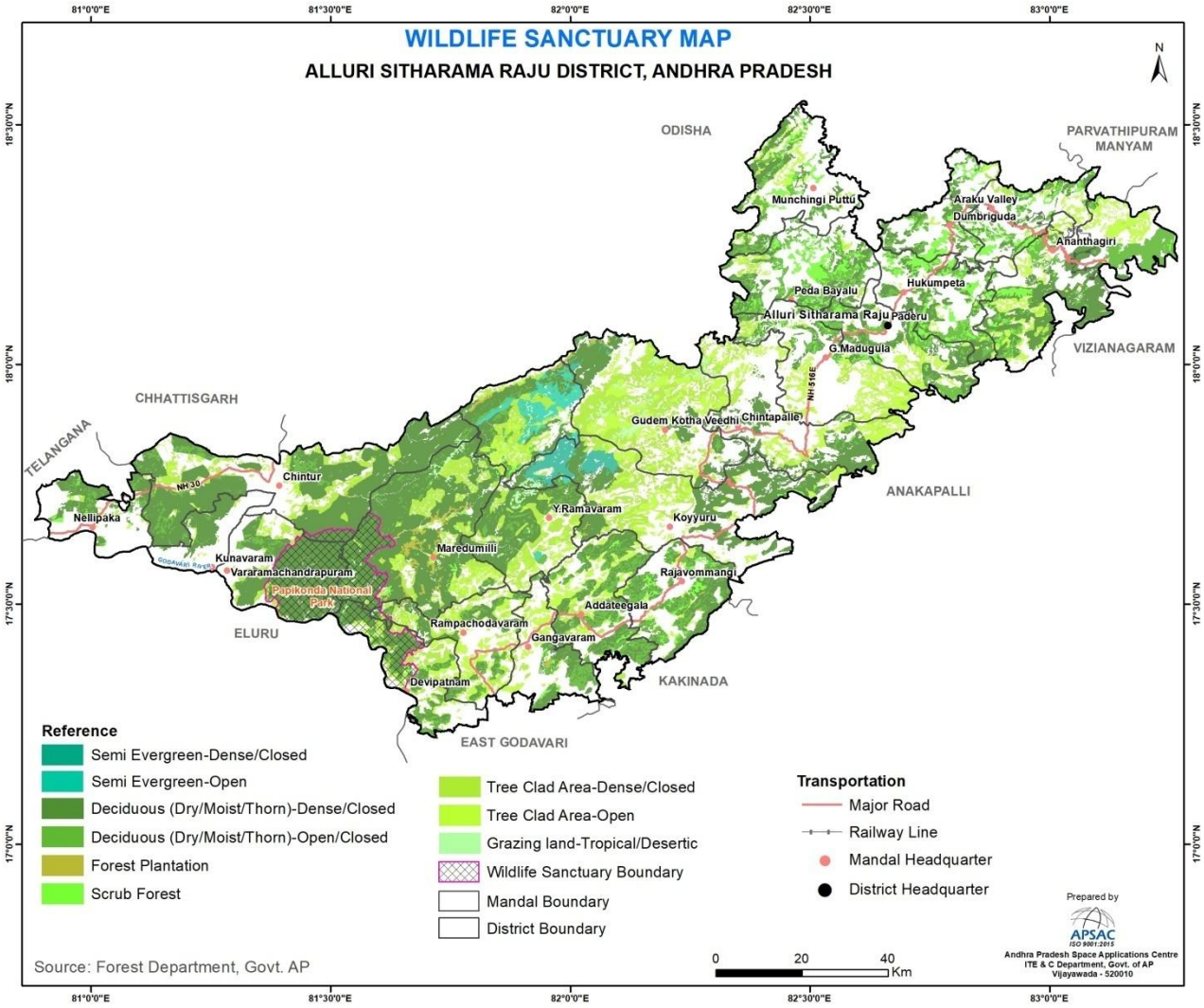


Figure-9A: Wildlife sanctuary boundary map of West Godavari District

1.4.4 Agricultural Resources in Alluri Sitharama Raju 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 Condition	Description
60-100	Normal	Crop condition is Normal
40-60	Moderate	Crop condition is Moderate
0-40	Severe	Crop condition is Severe

1.4.4.1 Kharif Crop Condition Assessment

Andhra Pradesh Space Applications Centre (APSAC) conducted a crop condition assessment in Alluri Sitharama Raju 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, 13 were categorized as having a normal crop condition, 05 were classified as moderate, and 03 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 Alluri Sitharama Raju 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 08 mandals with normal crop conditions, 13 mandals categorized as moderate, and 01 were identified as severe. 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 Alluri Sitharama Raju 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 Alluri Sitharama Raju District

In the Alluri Sitharama Raju district of Andhra Pradesh, a diverse range of soil types contributes to its unique landscape. The predominant soil types in the district include clayey to gravelly clayey moderately deep dark brown soils, covering 4550.14 sq.km (36.34%); loamy to clayey skeletal deep reddish brown soils, spanning 3170.9 sq.km (25.32%); gravelly loamy moderately deep grassland soils, extending over 2790.21 sq.km (22.28%); and gravelly clayey moderately deep grassland soils, occupying 800.97 sq.km (6.40%). Additionally, loamy to gravelly clay deep dark reddish

brown soils cover an area of 669.67 sq.km (5.35%), while fine loamy gravelly clayey shallow reddish brown soils encompass 403.67 sq.km (3.22%). Furthermore, moderately deep calcareous black soils stretch across 136.59 sq.km (1.09%), with moderately deep calcareous moist clayey soils found in a smaller area of 0.51 sq.km (0.004%).The soil resource map of the district is shown in Figure-10 and the soil category with area is shown in Table-8.

Table 8 Soil classes in Alluri Sitharama Raju district

S.No	Classification	Area in Sq.km	Percentage (%)
1	Clayey to gravelly clayey moderately deep dark brown soils	4550.14	36.34
2	Fine loamy gravelly clayey shallow reddish brown soils	403.67	3.22
3	Gravelly clayey moderately deep grass land soils	800.97	6.40
4	Gravelly loamy moderately deep grass land soils	2790.21	22.28
5	Loamy to clayey skeletal deep reddish brown soils	3170.9	25.32
6	Loamy to gravelly clay deep dark reddish brown soils	669.67	5.35
7	Moderately deep calcareous black soils	136.59	1.09
8	Moderately deep calcareous moist clayey soils	0.51	0.004
	Total[#]	12522.66	100.00

[#]Excluding the Urban and Water bodies area
Data Source: APSAC, Vijayawada

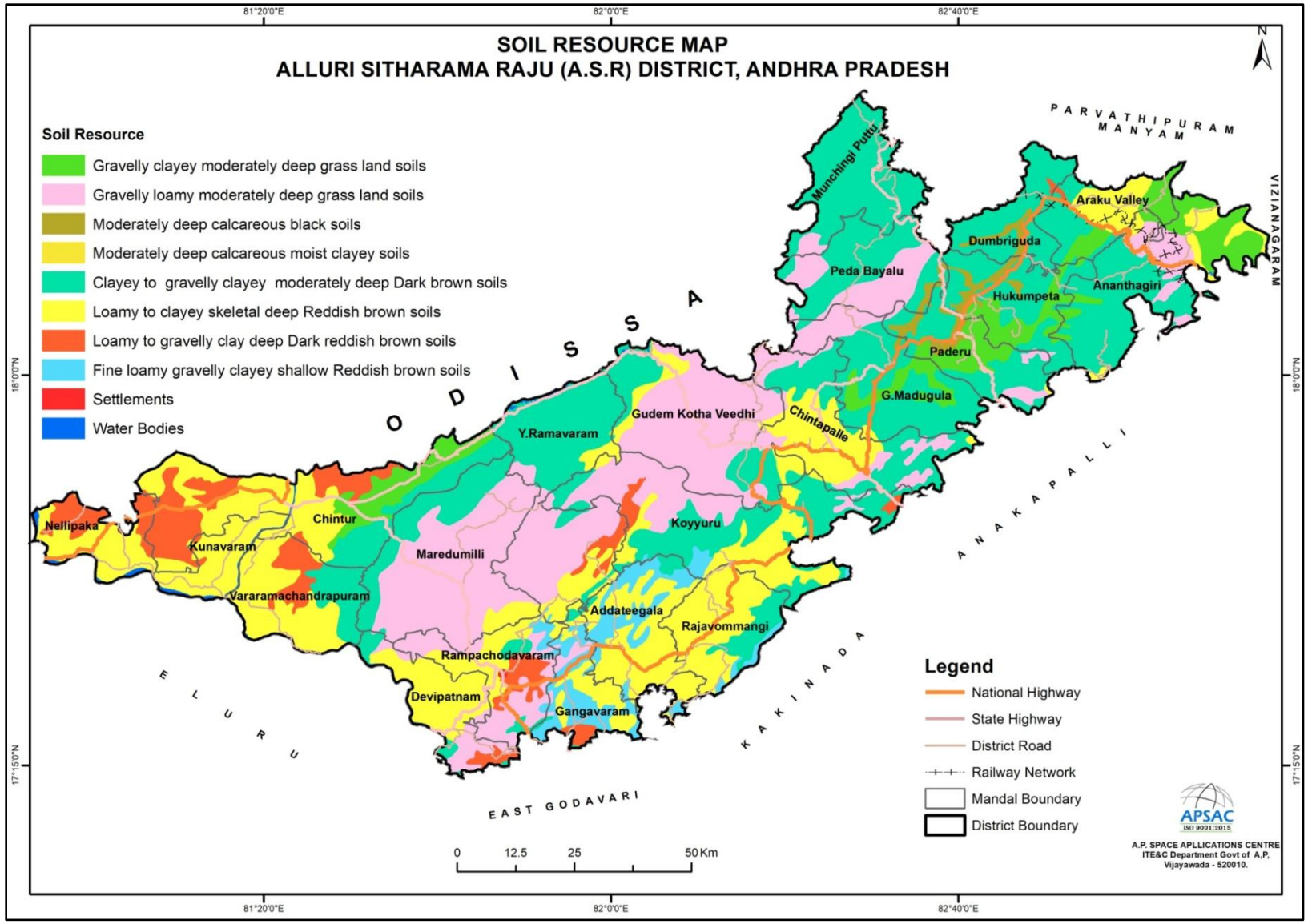


Figure-10: Soil resource map of Alluri Sitharama Raju District

1.4.6 Horticulture

Horticulture is a science, as well as, an art of production, utilization and improvement of horticultural crops, such as fruits and vegetables, spices, ornamental, plantation, medicinal and aromatic plants. It also includes plant conservation, landscape restoration, landscape, garden design, construction, maintenance,arboriculture, ornamental treesand lawns.
In the Alluri Sitharama Raju district, Oil palm is the major horticulture crop, cultivated in an area of (36.13 ha.) followed by Mango plantations (1.3 ha.). The total area under horticulture crops is 37.43. The horticulture crop-wise detail is shown in the Table-9.

Table 9 Area, Production and Productivity of Horticulture Crops in Alluri Sitharama Raju District

S.No	Crop	Area in ha
1	Mangoes	1.3
2	Oil Palm	36.13
Total Area		**37.43**

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

1.5 Ground Water Prospects in the District:

The groundwater in the major part of the district, within the Eastern Ghats Supergroup of rocks, is fracture-controlled. The potentiality is high along with the fractures, while it is low to moderate away from fractures. The permeability in these rocks ranges from 0.50 to 20 m/day, and the specific yield is between 0.005 and 0.025 liters/second. Groundwater occurs at shallow depths in floodplains. The quality of groundwater suffers in the coastal plains, but potable water is tapped from shallow depths in the beach ridges. Groundwater occurs under water table conditions in weathered residuum and semi-confined to confined conditions in deeper fracture zones. The thickness of weathering varies from 4 to 20 m, in general. The weathered zone is porous and extends to deeper levels in Khondalites compared to other formations. Groundwater abstraction is mostly through dug wells or shallow bore wells, primarily for domestic purposes. The depth of the dug wells ranges from 2 to 22 meters below ground level (mbgl), with a general depth between 7 and 12 mbgl. Bore wells range in depth from 15 to 80 mbgl, with yields between 0.5 and 3

liters per second (lps). Higher yields are observed in Khondalites compared to quartz-feldspathic gneisses and Charnockites.

The district can be divided into two distinct hydrogeological zones. The first zone is the hilly region with limited groundwater potential and minimal utilization. The second zone, sandwiched between the hill zone and the coastal zone, consists mostly of pediplains with thick soil cover and medium groundwater resources. Groundwater resources are primarily found in the weathered zone and a few hard rock aquifers, especially along the fractured zone. This zone extends along the rivers deep into the second zone, possibly containing some paleo-rivers that may yield sufficient water for local water supply schemes.

Approximately 10 percent of the district area has a fairly thick alluvial cover, while the rest is covered by Khondalites and Charnockites. These high-grade metamorphic rocks have limited groundwater potential in unfractured zones, typically confined to a thin weathered zone with a maximum thickness of about 15 meters. In the hilly areas, residual laterite indicates an old erosional surface, with the thickness of the weathered zone reaching up to 25 meters or more. These hills are generally uninhabited, but a few perennial springs originate from these horizons and are used by the local community as a water source.

In the hard rocks, the main aquifers are in the weathered and fractured zones. Dug wells are common in the district, with depths ranging from 5 to 10 meters and rarely exceeding 10 meters. The depth to the water level varies between 4 and 18 meters below ground level (bgl), with dug wells yielding between 30 and 70 cubic meters per day. Wells piercing fresh and jointed gneiss yield between 0.3 and 15 cubic meters per hour, but generally around 5 cubic meters per hour. Wells in these areas yield up to 25 cubic meters per hour.

Alluvial areas occur along the major rivers, their larger tributaries, and along the coast. The widest patch of alluvium is seen near the Madugula area, where alluvial fans of several tributaries coalesce and form potential areas for sinking shallow tube wells. In the alluvial areas, groundwater is tapped through dug wells, Dug cum Borewells (DCBs), filter points, and shallow tube wells. The depth to the water level varies from artesian conditions to about 8 meters bgl, with shallow dug wells yielding between 50 and 300 cubic meters per day, and tube wells yielding between 20 and 60 cubic meters per hour.

Along the coastal zone, there is a thin strip of dunes or beach sands, with the depth to the water level ranging between 3.55 and 8.65 meters bgl

The distribution of this resource is uneven, with the hard rock hilly regions in the north having very low resources, while the southern alluvial plains are better endowed. The groundwater resource is equivalent to 9% of the average rainfall contribution. In general, the recuperation rate of alluvial wells is 10 times that of wells in the hard rock terrain. Shallow wells hardly yield water for irrigation and dry up in the summer months. The plains area, with alluvium, has higher resources compared to the hilly northern part, which has a hard rock terrain. The hilly area acts as a runoff zone, while the plains act as recharge and discharge zones. The groundwater resource of the district is about 9 percent of the average rainfall. The depth to the water level varies widely within the same hydrogeological unit, depending on topography, drainage patterns, and fracturing. Most of the wells show a quick response to rainfall, indicating very permeable soil conditions. In some areas, groundwater fails to get recharged as it is already near surface levels, and excess amounts are rejected as springs. The groundwater prospects map of the Alluri Sitharamaraju district is shown in Figure-11.

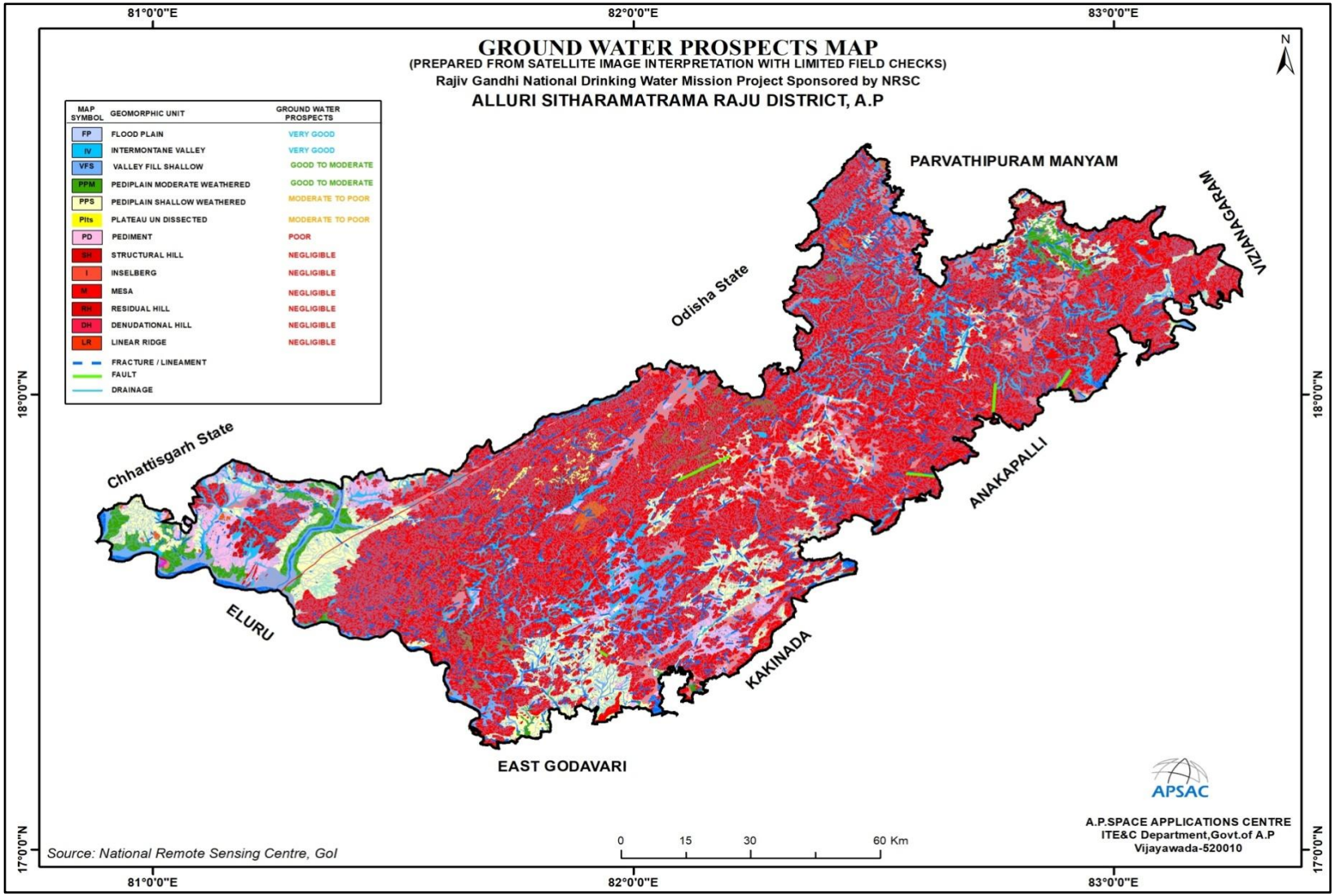


Figure-11: Ground Water prospects in Alluri Sitharama Raju District, Andhra Pradesh

1.6 Infrastructure

1.6.1 Transport Network

Alluri Sitharama Raju district is well-connected by various modes of transportation such as Road and Rail. The connectivity of each category is also depicted in Figure-12. The details of each transport network distribution in the district is 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 Alluri Sitharama Raju 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 remote rural areas of the district also good connectivity by Panchayat Raj roads / village roads.

The total length of the road network in the district is about 11284.58 km. Of which, the length of the National Highways is about 367.21 Km, State Highways is having a length of about 395.32 Km connecting all major towns and cities in the district. The district roads are connecting all towns and mandals having a length of 778.61 Km. The length of each road category covered in the district are shown in Table-10.

Table 10 Road Category wise Lengths.

S.No	Road Type	Length in Km
1	National Highway	367.21
2	State Highway	395.32
3	District Road	778.61
4	Village Road	5899.07
5	Cart Track	2899.15
6	Foot Path	945.23
Total Length		**11284.58**

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

Alluri Sitharama Raju 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 516E (NH516E): NH-516E traverses the state of Andhra Pradesh in India and It is a spur road of National Highway 16. The NH starts at Rajahmundry, East Godavari district and connects NH26 at Vizianagaram district passess through Alluri Sitharama Raju district via Rampachodavaram, Addateegala, Rajavommangi, Koyyuru, Chintapalle, G. Madugula, Paderu, Hukumpeta, Dumbriguda, Araku Valley and Anantagiri. with the road length of about 307.07 Km in Alluri Sitharama Raju district.

1.6.1.1.2. National Highway 30 (NH30): National Highway 30 is a primary national highway in India. NH 30 starts at Sitarganj in Uttarakhand with Ibrahimpatnam, Vijayawada in Andhra Pradesh. It starts at the junction of NH 9 at Sitarganj and ends at the junction of NH 65 at Ibrahimpatnam, Vijayawada. It traverse through Alluri Sitharama Raju District and passes through the mandals Nellipaka and Chintur with the road length of about 60.13 Km in Alluri Sitharama Raju district.

Some important State Highway segments are covered in the district are given below:

Paderu- Pedabayalu - Munchangiputtu - Jalaput Road (SH005)

Narsipatnam-Chintapalli- Sileru Road (SH007)

Vaddadi - Madugula - Paderu - Dumbriguda - Araku Road (SH008)

Narsipatnam-Lakkavaram Road (SH010)

Narsipatnam-Devipatnam Road (SH011)

Rajahmundry -Maredumilli -Bhadrachalam Road (SH012)

Paderuto ChinthapalliRoad (SH070)

1.6.1.2. Railways: The Indian Railway line traversing from north to south in Alluri Sitharama Raju district covering the various stations to cater the transportation needs of the people. The length of Rail network in the district is about 85 km covering 8 railway stations. Among these, the important railway station in the district are Araku and the Train stations are Araku Valley, Boddavara, Borra Guhalu, Chimidipalli, Gorapur, Karakavalasa and Shimiliguda. Alluri Sitharama Raju district is traversed by a significant railway line that connects various parts of the district and provides connectivity to neighbouring regions.

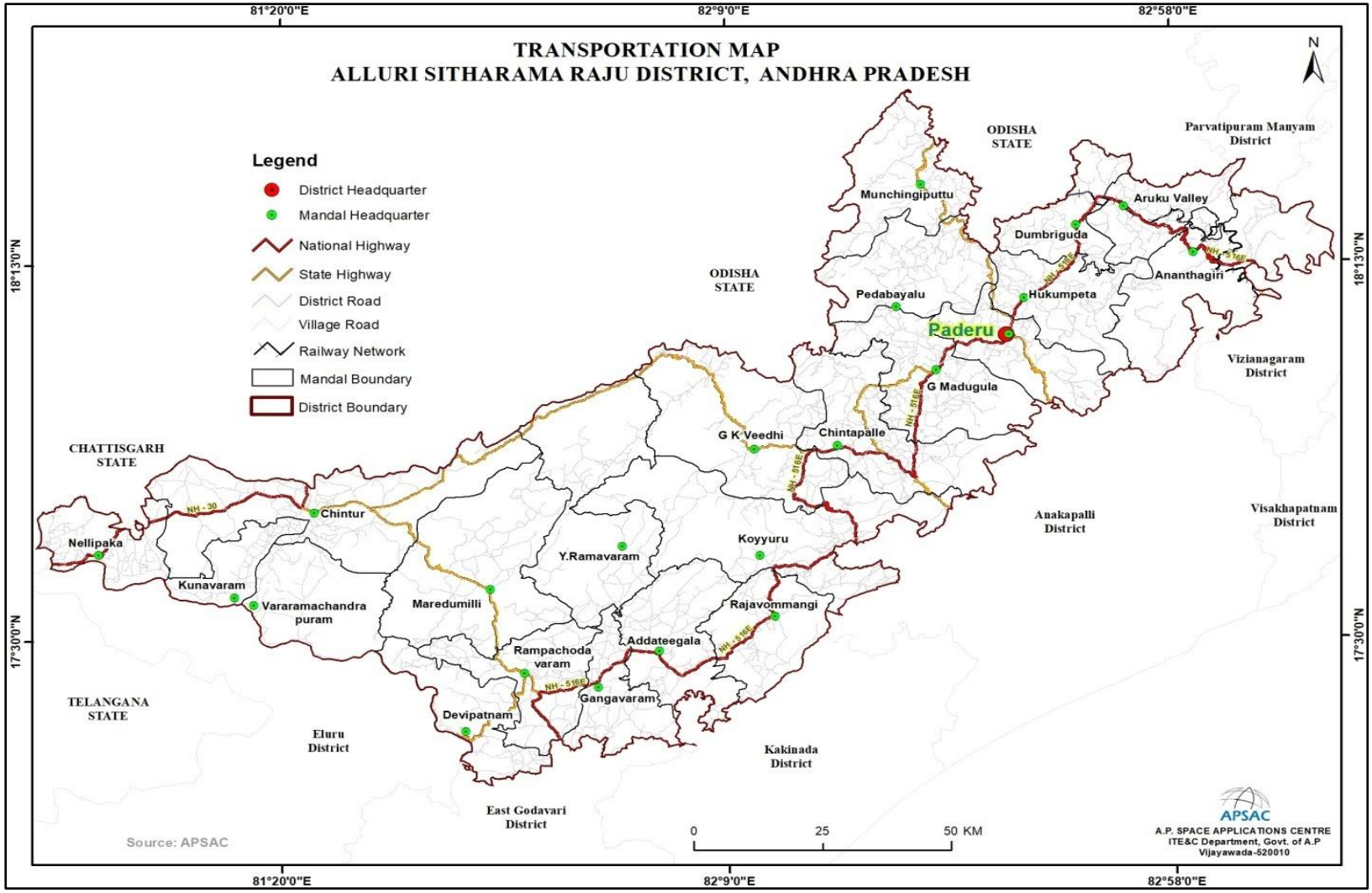


Figure-12: Transport Network of Alluri Sitharama Raju District, Andhra Pradesh

1.6.2 Irrigation

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-13.

1.6.2.1. Major Irrigation Projects:

In Alluri Sitharama Raju district there are Three major irrigation projects i.e., Polavaram Project, Upper Sileru Project (240MW Hydro Power Project) and Lower Sileru Project (460MW Hydro Power Project). The ayacut details of Polavaram Project an extent of 1,635 Ac ayacut covered in Rampachodavaram Assembly Constituency in Alluri Sitharama Raju district.

1.6.2.2. Medium Irrigation Projects:

In Alluri Sitharama Raju district there are four medium irrigation projects i.e., Bhupathipalem Reservoir Project, Sri KV Rama Krishna Surampalem Project, Musurumilli Reservoir project and Maddigedda Reservoir Project.

There are 24Nos completed and 50Nos of ongoing minor lift irrigation schemes in the district under Andhra Pradesh State Irrigation Development Corporation Limited (APSIDC), an extent of 3,228 Ac and 6,550 Ac ayacut, 645Nos of M.I Sources *(Anicuts, Groynes, Open Head Channels, Check Dams-above 100 Ac ayacut)* covered in the district an extent of 53,370 Ac ayacut and 156Nos of M.I Sources *(Anicuts, Groynes, Open Head Channels, Check Dams-bellow 100 Ac ayacut)* covered in the district an extent of 7,704 Ac ayacut of Alluri Sitharama Raju district.

The Water Resources Department 71Nos of minor irrigation tanks covered in the district an extent of 13,492 Ac and 269Nos of minor irrigation tanks (above 100 Ac ayacut) covered in the district an extent of 9,700 Ac ayacut.

Table 11 Major and Medium Irrigation Projects in Alluri Sitharama Raju District

S. No	Project Type	Name of the Project	Status	Ayacut in Ac
1	Major	Polavaram Project	Completed	1,635
2		Upper Sileru Project (Guntawada Reservoir) *240MW Hydro Power Project*		-
3		Lower Sileru Project (Donkarayi Reservoir) *460MW Hydro Power Project*		-
4	Medium	Bhupathipalem Reservoir Project		11,526
5		Sri KV Rama Krishna Surampalem Project		7,844
6		Musurumilli Reservoir project	Ongoing	22,042
7		Maddigedda Reservoir Project		4,225
8	Minor	M.I Sources - 645Nos (Ayacut above 100 Acres) *(Anicuts, Groynes,Open Head Channels,Check Dams)*	Completed	53,370
9		M.I Sources - 156Nos (Ayacut bellow 100 Acres) *(Anicuts, Groynes,Open Head Channels,Check Dams)*		7,704
10		Lift Irrigation Schemes under APSIDC (24Nos)		3,228
11		Lift Irrigation Schemes under APSIDC (50Nos)	Ongoing	6,560
12		Minor Irrigation Tanks - 71Nos *(Ayacut above 100 Acres)*	Completed	13,492
13		Minor Irrigation Tanks - 269Nos *(Ayacut bellow 100 Acres)*		9,700
			Total	**1,41,326**

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

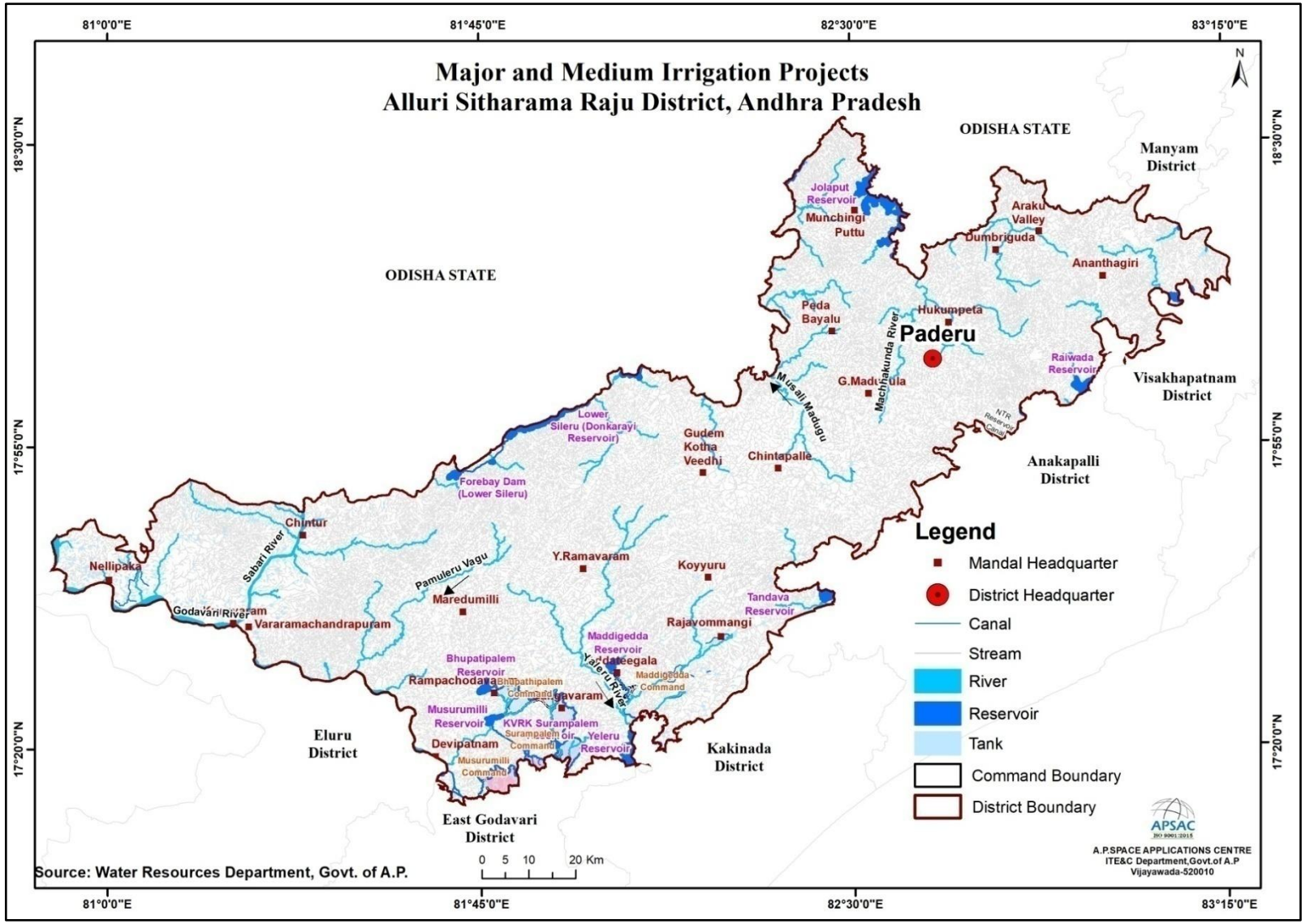


Figure-13: Major and Medium Irrigation Projects of Alluri Sitharama Raju District

1.6.2.3. 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 Alluri Sitharama Raju district has 511 minor irrigation tanks. The Designed Storage Capacity of minor irrigation tanks in East Godavari district 490.16 mcft and Current Storage Capacity is 318.67mcft. The mandal wise minor irrigation tanks details of Alluri Sitharama Raju district are showninTable-12.

Table 12 Mandal wise Minor Irrigation Tanks details of Alluri Sitharama Raju district

S. No	Mandal	No.of MI Tanks	Designed Storage Capacity (mcft)	Current Storage Capacity (mcft)
1	ADDATEEGALA	67	29.13	19.97
2	ANANTHAGIRI	19	29.47	25.97
3	ARAKU VALLEY	1	18	13.5
4	CHINTAPALLE	5	63	43.38
5	CHINTUR	13	0	0
6	DEVIPATNAM	61	21.58	13.17
7	DUMBRIGUDA	1	5.5	4.13
8	GANGAVARAM	59	23.43	14.09
9	KOYYURU	6	58.84	7.9
10	KUNAVARAM	11	0	0
11	MAREDUMILLI	13	4.85	2.9
12	NELLIPAKA	27	0	0
13	PADERU	1	1.11	1.11
14	RAJAVOMMANGI	82	197.83	148.37
15	RAMPACHODAVARAM	55	20.13	11.78
16	VARARAMACHANDRAPUR	14	0	0
17	Y RAMAVARAM	76	17.29	12.41
	TOTAL	**511**	**490.16**	**318.67**

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

1.6.3 Eco-sensitive areas and Important places

Alluri Sitharama Raju district is blessed with several tourist attractions that offer a mix of historical, cultural, and natural wonders. The important popular tourist, religious and cultural places to visit in the Alluri Sitharama Raju district are shown in Table-13 and the geographical location of each place is depicted in Figure-14.

Table 13 Important places of Tourism in Alluri Sitharama Raju District

S.No	Name	Village	Mandal

1	Anantagiri	Forest	Ananthagiri
2	Araku Valley	Padmapuram	Araku Valley
3	Bhupathi Palem Reservoir	Gandhinagaram	Rampachodavaram
4	Borra Caves	Forest	Ananthagiri
5	Chaprai Water Falls	Pedapadu	Dumbriguda
6	Dhimsa	Padmapuram	Araku Valley
7	Katika Water Falls	Forest	Ananthagiri
8	Kollputtu Water Falls	Forest	Ananthagiri
9	Kothapalli Water Falls	Lakkulu	G Madugula
10	Lambasingi	Liammasingi	Chintapalle
11	Lothugedda	Garugubilli	Ananthagiri
12	Maredumalli	Kuduru	Maredumilli
13	Matsyagundam	Forest	Paderu
14	Paderu	Gudivada	Paderu
15	Padmapuram garden	Padmapuram	Aruku Valley
16	Rampa Waterfalls	Forest	Rampachodavaram
17	Sri Modakondamma Temple	Gudivada	Paderu
18	Tatiguda Water Falls	Tadiguda	Ananthagiri
19	Thajangi Reservoir	Tajangi	Chintapalle
20	The Woods Resorts	Forest	Maredumilli
21	Tribul Museum	Kantabamsuguda	Aruku Valley
22	Tyda	Forest	Ananthagiri
23	Vanjangi Hill View Point	Forest	Paderu

Data Source: Tourism Department, Government of Andhra Pradesh.

A brief description of certain tourist places is given below:

1.6.3.1. Ananthagiri: Ananthagiri is located at a distance of about 126km from the district headquarter Paderu. It is situated on the way to Araku Valley, Ananthagiri is a spot with an enchanting beauty. Extensive coffee plantations, numerous waterfalls, of which Tadimada waterfalls are most famous and rivulet add beauty to this place. It is also considered as a health resort.

1.6.3.2. Araku Valley: Araku Valley is located at a distance of about 44 km from the district headquarter Paderu. The altitude is between 600 and 900meters above mean sea level. The entire area is inhabited by aboriginal tribes and attracts visitors from all over the country. The journey to Araku Valley on the ghat road with thick forests on either side is itself interesting and thrilling. The Ananthagiri hills on the way to Araku Valley are famous for coffee plantation. The natural beauty of this valley

is enhanced by the tribal people who abound here with their own folklore and traditions.

1.6.3.3. Bhupathi Palem Reservoir: Bhupathi Palem Reservoir is located at a distance of about 190 km from the district headquarter Paderu. The Reservoir Project is a medium irrigation project constructed on Seethapalli Vagu, which is a hill stream and tributary to river Godavari near Bhupathipalem Village, Rampachodavaram Mandal in Alluri Sitharama Raju District.

1.6.3.4. Borra Caves: Borra caves being the natural formation in Eastern ghats is situated in Ananthagiri Mandal at a distance of 81 Km from the district headquarter Paderu. The caves popularly known as Borra Caves have geological and Historical importance. Deep in the caves there is Sivalingam over which the water drips from above which is said to be the origin of the river Gosthani. The river Gosthani flowing from these caves with natural roaring sounds is a beautiful sight to enjoy. These caves were beautifully electrified and illuminated and a large number of tourists including foreigners are visiting every day.

(Ref: https://allurisitharamaraju.ap.gov.in/tourism-2/)

1.6.3.5. Chaprai Water Falls: Chaprai Water Falls are located at a distance of about 31 km from the district headquarter Paderu. Chaparai is a beautiful water cascade situated on Paderu - Araku Road in Alluri Sitharama Raju district of Andhra Pradesh. Also known as Dumbriguda Waterfalls, it is a scenic place surrounded by forests and is one of the popular Araku Tourist Places.

1.6.3.6. Dhimsa: Dhimsa is located at a distance of about 43 km from the district headquarter Paderu. The Dhimsa is an exceptional dance achieved by the hill tribes of Araku Valley About 15 to 20 women attired in emblematic ethnic dresses and stuffs, dance to the beat of gadgets like Mori, Thudum and Dappu, frolicked by the male associates, in approval of the native divinity. Ample of the old-style art and culture of this area can be observed throughout the Utsavas.

1.6.3.7. Katika Water Falls: Katika Water Falls are located at a distance of about 64 km from the district headquarter Paderu. Katiki waterfalls is a nature lover's paradise. It is as if the entire location has been tailor-made to suit the adventurous, trotting through dense forest and creating some beautiful memories. Katiki waterfalls promote ultimate relaxation and take your stress away from you.

1.6.3.8. Kollputtu Water Falls: Kollputtu Water Falls are located at a distance of about 48 km from the district headquarter Paderu. A beautiful

waterfall in the nature, a peaceful Tribal village, innocent indigenous people.

1.6.3.9. Kothapalli Water Falls: Kothapalli Water Falls are located at a distance of about 29 km from the district headquarter Paderu. The Kothapalli waterfalls is a waterfall near the southeastern coast of India at Gangaraju Madugula mandal near Paderu in the Alluri Sitarama Raju district of Andhra Pradesh. Although the falls lack any public infrastructure, they have become a tourist attraction in the Alluri Sitarama Raju district.

1.6.3.10. Lambasingi: Lambasingi is located at a distance of about 47 km from the district headquarter Paderu**.** Lambasingi is a small village in the Eastern Ghats of Chintapalli Mandal of Alluri Sitharama Raju district in the state of Andhra Pradesh. With an altitude that of 1000 m above sea level, the area is cooler than the surrounding plains and is covered in moist deciduous forest cover. There are several coffee, pine, and eucalyptus plantations around the area and some small attempts to grow apple and strawberry. The region was formerly densely covered in forests and known in the past to have supported tigers. The large wildlife in the region includes gaur. The region is known for its diversity of bird life.

1.6.3.11. Lothugedda:Lothugedda is located at a distance of about 95 km from the district headquarter Paderu. The village Contains the ruins of 3 or 4 granite temples of Siva the largest of which has elaborate sculptural depictions. The villagers believe that the men of the builders of the temple and that the barbers were probably roared on the hills in those days.

1.6.3.12. Maredumilli: Maredumilli is located at a distance of about 187 km from the district headquarter Paderu. Most popular and highly fascinating forest covered area is Maredumilli. Traveling around the forest area of this region aids tourists observe and interact with local plant and animal life in their natural habitats. The experience is beyond words and the intangible. Another tourist place near to Maredumilli is Seetapalli which is having Natural Waterfall and attracts the nature lovers. Development of Eco-Tourism in these places attracts large number of tourists.

1.6.3.13. Matsyagundam: Matsyagundam is located at a distance of about 17 km from the district headquarter Paderu. Matsyagundam is place near Paderu situated in small, picturesque valley. A rivulet flows with musical sound in which abundant fish are seen. The wonder here is that the fish come to the surface of the water and take the eatables

offered by the visitors. There is a small Shiva Temple and Sivaratri festival will be celebrated every year.

1.6.3.14. Paderu: Paderu is a broad picturesque and rich valley with an altitude of over 900 meters above the sea level. The entire Paderu is inhabited by schedule tribes with different sects and is surrounded by good number of hill streams. The presiding deity here is Modakondamma and important religious observation will be celebrated every year attracts a large number of pilgrims and especially fireworks will entertain the Viewers.

1.6.3.15. Rampa Waterfalls: Rampa Waterfalls are located at a distance of about 191 km from the district headquarter Paderu. Rampa Waterfalls the Semi evergreen forests of Agency track in Alluri Sirarama Raju District and is blessed with many picturesque spots and perennial waterfalls. Sri Neelakanteswara Vana Vihara sthali is situated at about 4km from Rampachodavaram village.

1.6.3.16. Padmapuram garden: Padmapuram garden is located at a distance of about 45 km from the district headquarter Paderu. The famed Padmapuram gardens are located in the beautiful and serene valley Araku. Padmapuram Botanical Gardens are a part of the Eastern Ghats and are situated in the Araku road. The garden was built during the time of the Second World War with the aim of growing vegetables for the soldiers who were fighting in the war. It was simply called Botanical Garden back then. However, now there is much more to the gardens than simply growing vegetables.

1.6.3.17. Tatiguda Water Falls: Tatiguda Water Falls are located at a distance of about 72 km from the district headquarter Paderu. The waterfalls is fast emerging as a must see tourist destination in the district. Situated on the Gosthani river, the waterfalls has towering rocks on the one side and lush green fields on the other side.

1.6.3.18. The Woods Resorts: The Woods Resorts are located at a distance of about 46 km from the district headquarter Paderu. Set along the slope of a forest clad hill, beside three branches of a sprightly mountain stream and broadening at the end of the slope, Maredumilli Resort is an exquisite jungle hideaway and a naturalist's treasure trove. Wrapped in the enchantment of a tropical rainforest, beneath an enormous, interlaced Rubber Plants, stone paved paths fringed by tropical plants wind through leading to Maredumilli Luxury Cottages, designed in architecture influenced to a great extent by the vernacular of the region. The accommodations are spacious, equipped with the state of the art in

amenities and verandas that look out at fabulous views of the forest, an intimate experience of the surrounding sights and sounds.

1.6.3.19. Thajangi Reservoir: Thajangi Reservoir is located at a distance of about 41 km from the district headquarter Paderu. One could have seen a variety of reservoirs all their life, but this one located amidst the dewy mountains and misty meadows provides such a glorious view.

1.6.3.20. Tribal Museum at Araku: Tribal Museum is located at a distance of about 45 km from the district headquarter Paderu. Located in Araku Valley, near Padmapuram Botanical Gardens. It was set up with the aim of conserving and displaying the tribal culture of the region. Various indigenous ways of living are exhibited in the museum through the display of objects of daily use such as jewellery, hunting tools and kitchen tools. Scenes of quotidian life are staged through the arrangement and construction of life-sized statues. The museum itself is fashioned out of mud and metal. The museum also has a Tribal Art and Crafts Centre which holds workshops and seminars promoting tribal and folk art.

1.6.3.21. Vanjangi Hill View Point: Vanjangi Hill View Point is located at a distance of about 7.6 km from the district headquarter Paderu. Perched at a whopping height of 3,400 feet above sea level, Vanjangi Hills is a scenic destination, fast becoming popular among nature lovers, hikers, trekking enthusiasts, and photographers.

1.6.3.22. Tyda: Tyda is located at a distance of about 73 km from the district headquarter Paderu. Tyda is being developed with camping facilities at jungle bells to provide an enchanting experience in wilderness to the tourists. A home for variety of wild mammals and avifauna, Tyda is ideal for viewing wild life and bird watching, other attractions are rock climbing, trekking and targeting with bow and arrows. They can also learn the language of the jungle, identification of calls, marks, etc. Tourists can enjoy their stay in logouts and tents set in tribal environs.

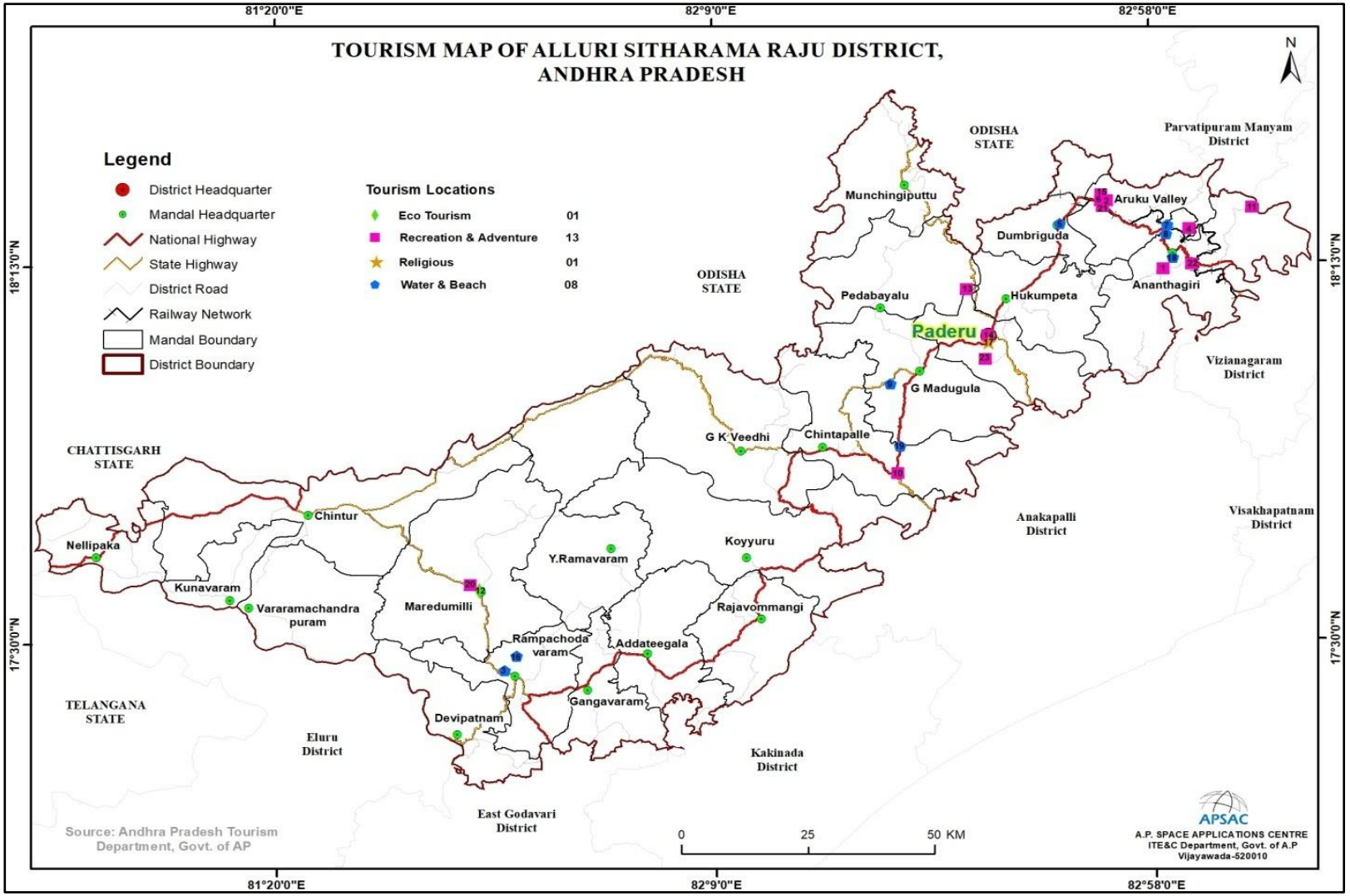


Figure-14 Tourist Map of Alluri Sitharama Raju District, Andhra Pradesh

1.6.4 Places of Religious and Cultural importance

1.6.4.1. Sri Modakondamma Temple: Sri Modakondamma Temple is located at a distance of about 290 m from the district headquarter Paderu. Sri Modakondamma Temple is a well-known temple in Paderu that attracts a large number of devotees every day. Devotees hold the firm belief that by praying to the deity, their sins are washed away and their desires are fulfilled. As a result, the number of pilgrims visiting this temple has risen dramatically over the years. The important religious observance will be celebrated every year, attracting a large number of pilgrims, and fireworks will, as always, entertain the audience.

1.7 Drainage Pattern

1.7.1 Drainage

The principal rivers flowing in the district are Godavari, Yeleru, Thandava, Sarada, Gosthani rivers and partially covered with Suddagedda, Pampa, Varaha, Champavathi, Nagavali rivers. The district consists of the hilly regions covered by the Eastern Ghats with an altitude of about 1,500m.The Sabari, Pamuleru, Sethapallivagu, Burdakalva, Yeleru, Suddagedda, Pampa, Varaha, Thandava, Sarada, Gosthani and Champavathi rivers are rises in the Eastern Ghats of Alluri Sitharama Raju district.

The Godavari River rises near Trimbakeshwar in the Nashik district of Maharashtra about 80 km from the Arabian Sea at an elevation of 1,067 m and The total length of Godavari from its origin to outfall into the Bay of Bengal is 1,465 km. The Godavari River and tributaries are covered with 65% of the total area in north part of the district and main tributaries are Sabari, Pamuleru, Sethapallivagu, Burdakalva. It enters into the district near Gollagudem village in Nellipaka mandal and flows towards southern direction through Nellipaka, Kunavaram, Vararamachandrapuram, Devipatnam mandals in Rampachodavaram Assembly Constituency and leaves the district at Anguluru village in Devipatnam mandal.

The Yeleru river rises near Puttakota RF, Koyyeru mandal in Alluri Sitharama Raju district and flows towards south direction passes through Koyyuru,Y.Ramavaram, Gangavaram, Addateegala mandals. It leaves the district at Thimmapuram in Addateegala mandal and joining to the Bay of Bengal in Kakinada district. The Suddagedda river rises near Vatangi RF, Rajavommangi mandal in Alluri Sitharama Raju district and flows towards south east direction and joining to the Bay of Bengal near Kothapalle mandal, Kakinada district.

The Pampa River rises near Lododdi RF, Rajavommangi mandal in Alluri Sitharama Raju district and flows towards south east direction and joining to the Bay of Bengal near Payakaraopeta mandal in Anakapalli district. The Thandava river rises near Bointi RF, G K Veedhi mandal in Alluri Sitharama Raju district and flows towards south direction and joining to the Bay of Bengal near Pentakota village, Payakaraopeta mandal in Anakapalli district.

The Sarada river originates in Ananthagiri RF, Ananthagiri mandal in Alluri Sitharama Raju district and flows towards south direction passes through Ananthagiri, G Madugula, Paderu, Hukumpeta and Chintapalle mandals in Aruku Valley and Paderu Assembly Constituencies and leaves the district near Pedduru in Ananthagiri mandal and joining to Bay of Bengal near Revuvatada, S Rayavaram mandal in Anakapalli district.

The Varaha River rises in Sanivaram RF, Chintapalle mandal in Alluri Sitharama Raju district and flows towards south direction passes through Koyyuru, Chintapalle mandals and leaves the district near Konadasntha village in Koyyuru mandal. The Gostani River originates in Ananthagiri RF, Srungavarapukota near Borra caves and flows towards south direction passes through Ananthagiri and Aruku Valley mandals. It leaves the district at Tatipudi reservoir, Dabbalapadu in Ananthagiri mandal and joining to Bay of Bengal near Bheemunipatnam in Visakhapatnam district.

The Champavathi River originates from Eastern Ghats, Ananthagiri hills, Aruku Valley in Alluri Sitharama Raju dsitrict, passes through Ananthagiri, Aruku Valley mandals and leaves the district near Garugubilli in Ananthagiri mandal. It flows towards south-east direction and joins Bay of Bengal near Konada village, Pusapatirega mandal of the district. Figure-15 Illustrates the drainage system and the surface water bodies.

1.7.2 Geomorphology of the District:

Using IRS satellite data and GIS, a detailed geological, geomorphological, and structural map of Alluri Sitharama Raju District was generated in accordance with the Rajiv Gandhi National Drinking Water Mission (RGNDWM) guidelines on a 1:50,000 scale. The objective of this mapping was to delineate the lithology, geomorphology, and structural characteristics of the area at a 1:50,000 scale and to integrate this information 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 drinking water-affected villages under this project. The description of geomorphic units of different origins mapped in Alluri Sitharama Raju District is shown in Figure 16

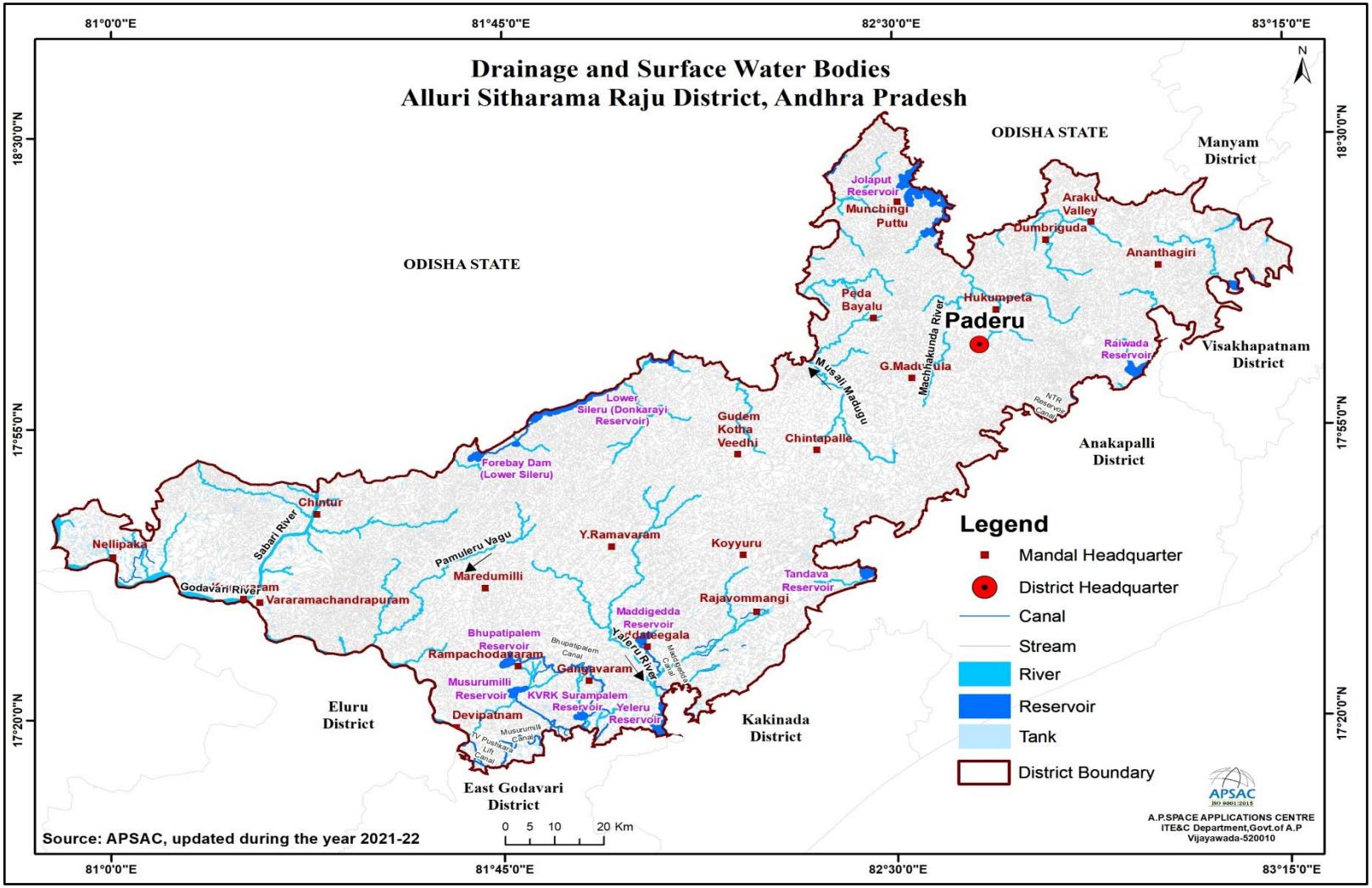


Figure 15: Drainage Network and Surface Water Bodies map of the Alluri Sitharama Raju District

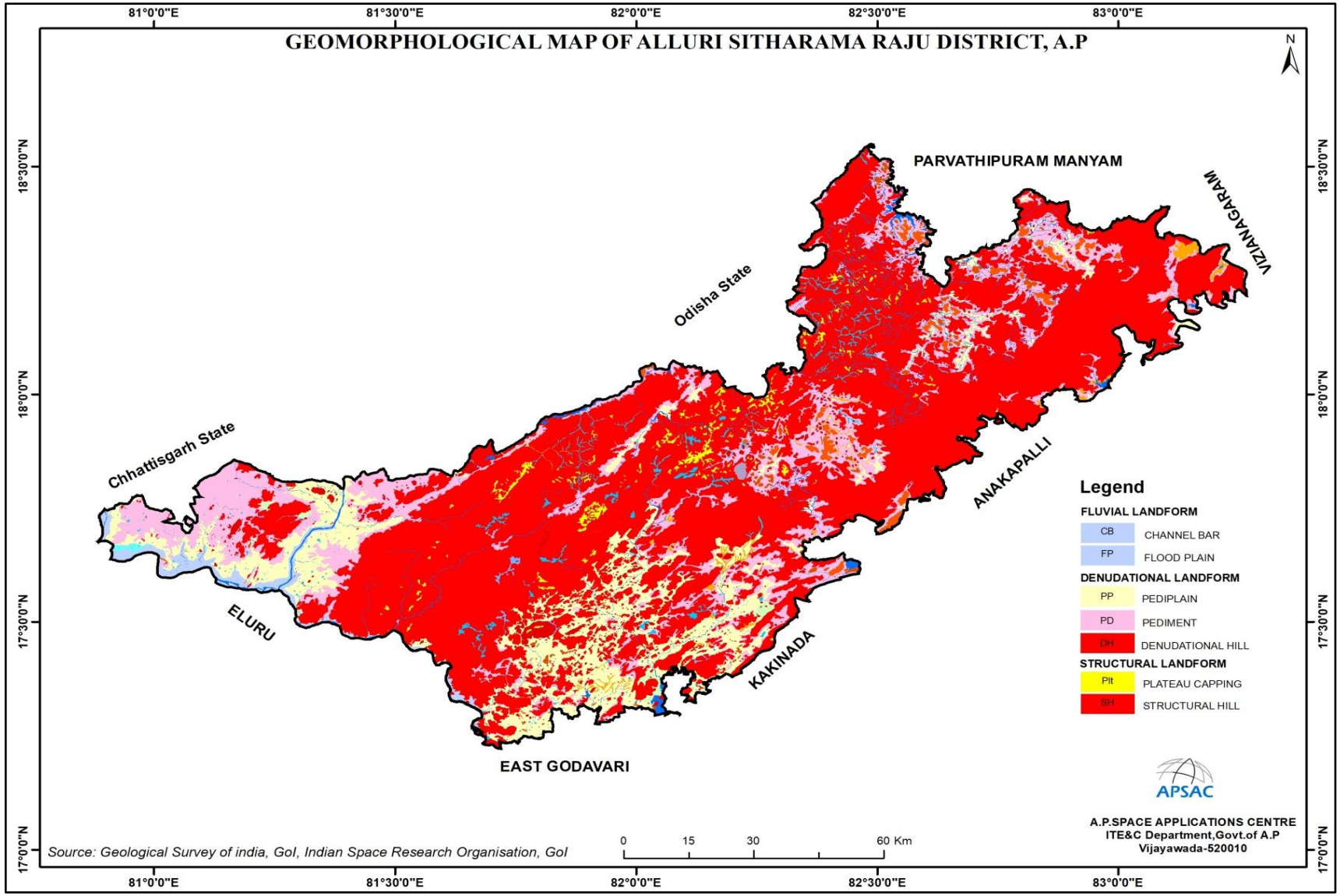


Figure 16: Geomorphology of Alluri Sitharama Raju District, Andhra Pradesh

1.7.3 Landforms of Fluvial origin

The word 'fluvial' is used in Earth science to refer to processes and landforms produced by running water. Like other geological processes, running 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 landforms. The incredible power of running water in carving various erosional and depositional landforms is well known. Although the quantity of water in the stream may be 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 and their included channelways organized into a system of connections known as a drainage network. Drainage networks display many types of quantitative regularities that are useful in analyzing both the fluvial systems and the terrains that 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 alluvial fan. This landform is predominantly seen in the western part of the District.

1.7.3.2. Palaeochannel: Deep valleys cut in the bedrock terrain that are filled largely with alluvium, glacial outwash gravels, and sands or with tills. These are good sources 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 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.

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

1.7.4 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, which involves the removal of material by

erosion and weathering, directly influences the relief of the area, especially in reducing relief to the base level. The agents primarily involved in denudation are water, ice, and wind. Major factors affecting denudation include geology, climate, tectonics, and anthropogenic effects. All rocks and minerals at or near the surface are subject to physical and chemical processes. The effects of these processes vary due to rocks' varying resistance to change. Consequently, weathering and erosion yield various landforms with typical shapes and forms. Weathering is an essential part of the rock cycle, where parent material or rock undergoes disaggregation to form smaller fragments, and some minerals are dissolved and removed by agents such as water. This removal of material, known as erosion, is accomplished by running water, wind, glaciers, etc. Weathering provides the raw material for sedimentary rock and soil (NRSA, 2007).

1.7.4.1. Denudational Hill: This is a highly dissected hill where structures have been obliterated.

1.7.4.2. Inselberg: A prominent, isolated, steep-sided, usually smoothed and rounded residual knob, hill, or small mountain of circumdenudation rising abruptly from and surrounded by an extensive and nearly level, lowland erosion surface in a hot, dry region, such as the deserts of southern Africa or Arabia. Inselbergs are generally bare and rocky, though partly buried by debris derived from and overlapping their slopes. They are characteristic of arid or semiarid landscapes in the late stages of the erosion cycle.

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

1.7.4.4. Pediment-Inselberg Complex: Pediments dotted by numerous small inselbergs, making it difficult to distinguish between them. Hence, it is termed a complex of pediment and inselberg.

1.7.4.5. Pediplain: An extensive, multi-concave, rock-cut erosion surface formed by the coalescence of two or more adjacent pediments and occasional desert domes. Pediplains represent the mature stage of

the erosion cycle, known as the "peneplain." They are further classified based on the thickness of weathering as shallow, moderate, and deep pediplains.

1.7.4.6. Residual Hill: A small remnant hill that has experienced all forms of denudation

1.7.5 Landforms of Structural Origin

The landforms of structural origin are closely related to the geological structure of the area. Many of the landforms in this category owe their genesis to the underlying structure. Structural features play a crucial role in influencing the resistance of rock, leading to the formation of various geomorphic forms. These variations can range from minor to mega-scale, with the latter having a significant impact on landform development. Mapping such mega-scale features indirectly provides insights into the structural configuration of the area. Structural elements like faults and folds, depending on their type, greatly influence the formation of structural landforms. The influence of geological structures on landscape development is profound, ranging from large-scale features shaping entire landscapes to smaller features affecting individual landforms and associated geomorphic processes. Structural control can arise from active formations directly shaping modern landscapes or from ancient structural features primarily influencing modern landscapes through differential erosion (NRSA, 2007).

1.7.5.1. Structural Hills: These are hills and valleys formed by tectonic processes and highly dissected by drainage lines. They can be further categorized based on the density of joints and drainage into high, moderate, and low dissection. Interpretation of these features is often conducted using planimetric satellite data, although classification may be subjective.

1.7.6 Structural Features of Alluri Sitharama Raju District

The district forms a part of the Eastern Ghats Mobile Belt exposing all the characteristic litho units of the Eastern Ghat Supergroup such as the Khondalite, Charnockite, and Migmatite. The marine sediments of active beaches and tidal flats are seen in the narrow Coastal plain. The coastal plain south of Elamanchili is rocky, scarp, and believed to be fault-controlled. The rocks along the coast bear the impressions of sea level fluctuations up to an elevation of 130m above mean sea level (MSL). The structural grain of the litho units is defined by foliation which is

considered to have developed because of the first phase of folding and uniformly shows parallelism with the primary layering wherever preserved. The strike of the foliation varies from northeast-southwest to northwest-southeast with moderate to steep dips. The rocks have been subjected to tight isoclinals folding having a regional trend of northeast-southwest. As a result of cross-folding on the northwest-southeast axis, structural domes and basins have been formed in the area. These are well developed in the proximity of the ridges around Alluri Sitharama Raju district. Faults and lineaments trending mostly North East - SouthWest and NorthWest - SouthEast are seen in the area. The Structural Map of Alluri Sitharama Raju District is shown in Figure-17.

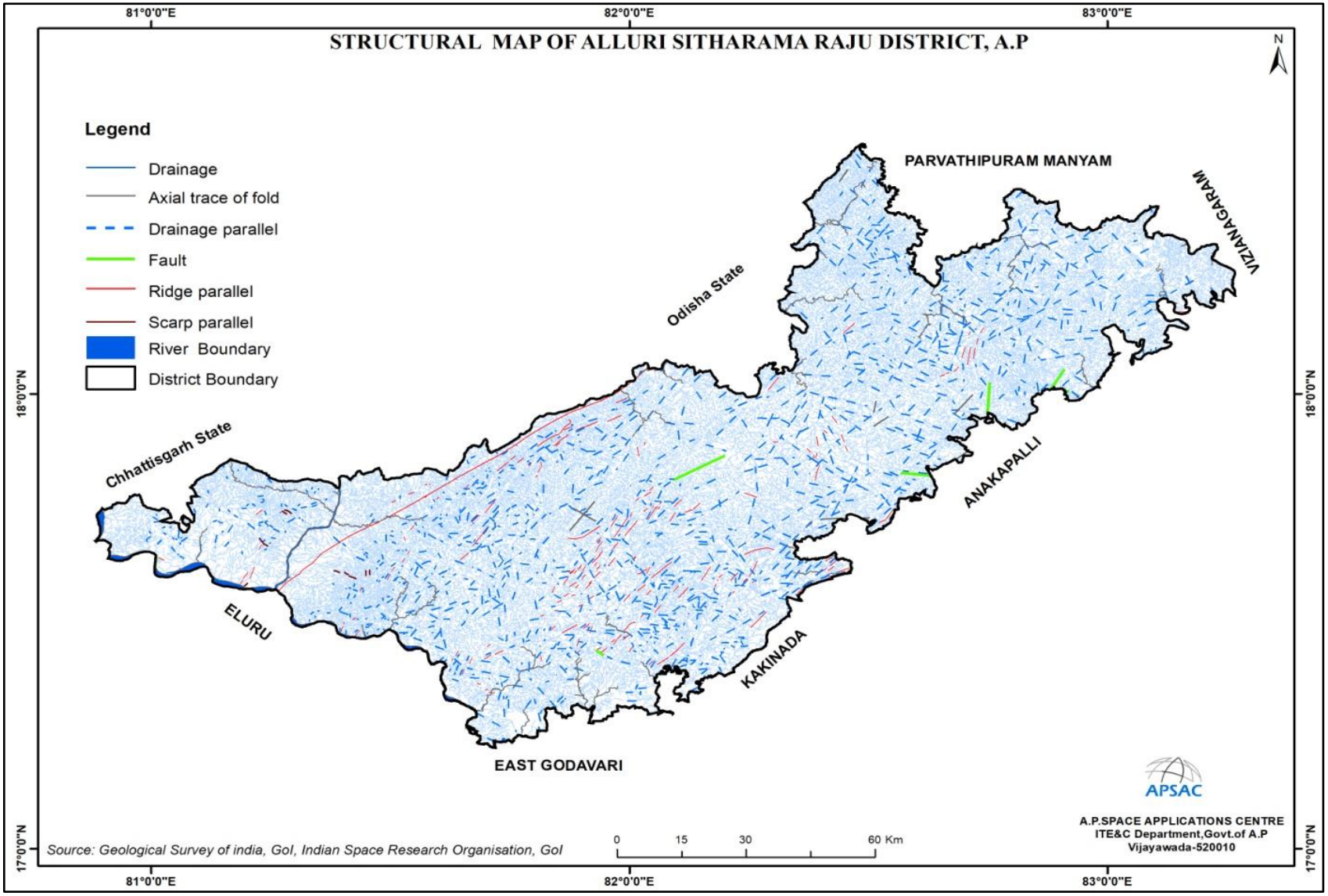


Figure-17 : Structural Map of Alluri Sitharama Raju District, Andhra Pradesh

1.7.7 Ground Water Quality in the Alluri Sitharama Raju District

The groundwater quality laboratory analyzed physico-chemical parameters such as Total Dissolved Solids, Total Hardness, Chlorides, Nitrate, pH, Fluoride, Iron, Alkalinity, and Sulphate using standard techniques. Groundwater quality samples were collected for two seasons, i.e., post-monsoon and pre-monsoon, from December 2017 to June 2019 by the Rural Water Supply and Sanitation Department (RWS&S) and compared with the Bureau of Indian Standards (BIS) guidelines from 2015, categorizing them as desirable, permissible, and non-potable classes. Blue, yellow, and red colors indicate pre-monsoon quality, while symbols (+, -) indicate post-monsoon quality for desirable, permissible, and non-potable classes, respectively.

From the analysis, it has been observed that groundwater is polluted in both pre-monsoon and post-monsoon seasons, with about 5% of the area falling under the non-potable category due to high concentrations of Nitrate, Total Dissolved Solids, and Fluoride. Approximately 20% of the area is categorized as potable, while the remaining 75% is covered by hills and water bodies throughout the 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 climate conditions, and the interrelationship between these factors. The groundwater quality map of the Alluri Sitharama Raju district is shown in Figure-18.

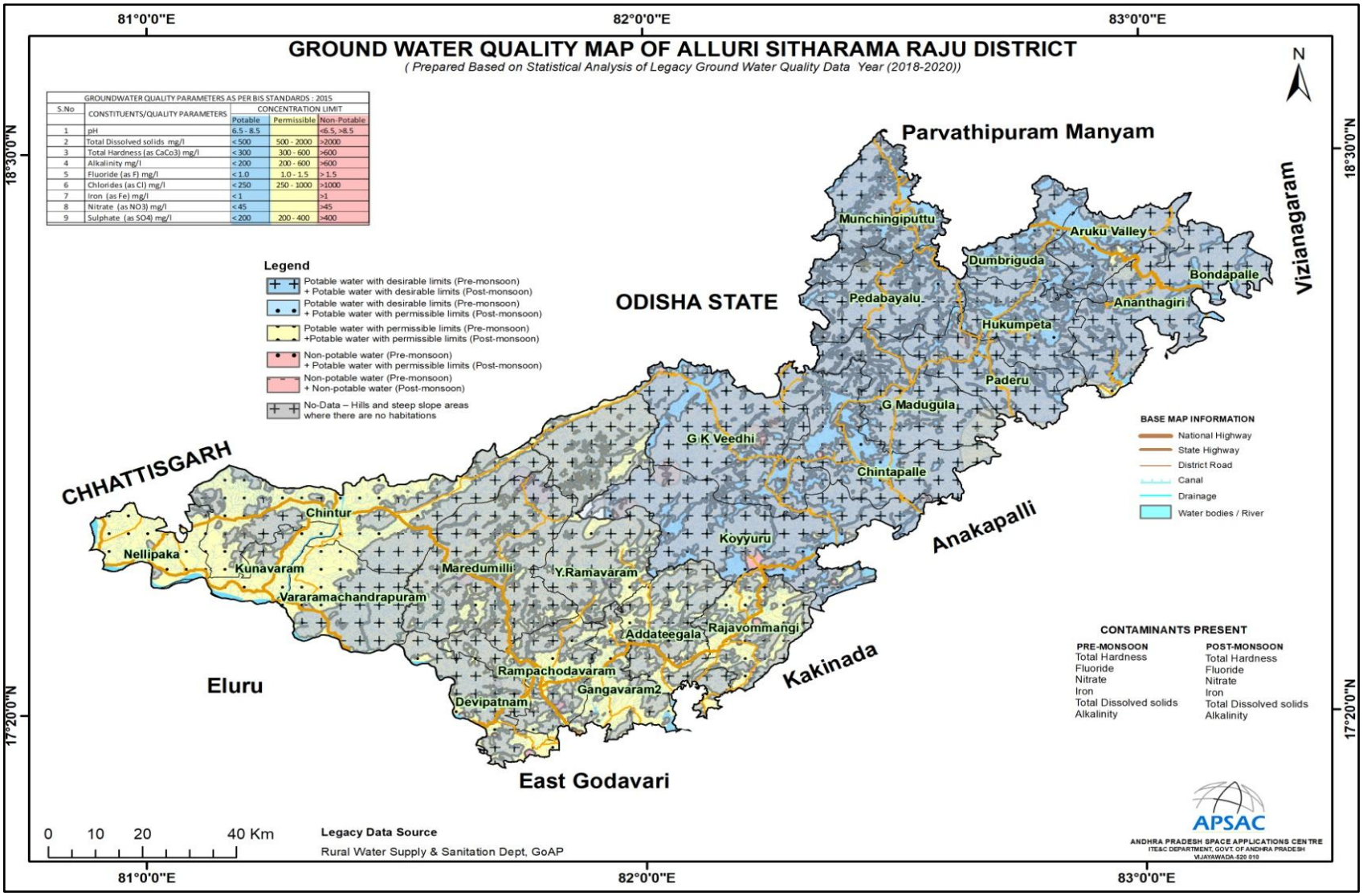


Figure-18: Ground Water Quality Map of Alluri Sitharama Raju District

Chapter – II Minor Minerals

2.1 Overview of Mining Activity

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

i. Achievement of Targets of Mineral Revenue collections being 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 the penalties
vi. Finalisation of Demand, Collection and Balance statements of the leases on annual basis

Alluri Sitharama Raju district contains Calcite and mica/Quartz/Limestone, China Clay, Color Granite-Leptinites, Colour Granite, and gravel mining Prospecting Licenses and Quarry leases for the year 2022-23. There are 64” Nos. Mining Leases are in force in the district, out of which “36” Nos. are Working.

2.2 Geology of the District

Genaralized 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 Eocenetrappeans	-	-	Deccan Trap with infra-and inter-

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, Sriperambadur Fms)
		Lower Gondwana	Kota Fm. Maleri Fm.	Gollapalle Fm. (Satyavedu 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 Panyam Quarzite Owk Shale Narji Limestone Banaganapalli Quartzite	Putnur Limestone Penganga Group Takalapalle Arkose
Middle Proterozoic (1600-1300 m.y.)	Cuddapah	Nallamalai	**Srisailam Quartzite** Cumbum Fm. Mulug Group Bairankonda Quartzite Gandikota Quartzite Tadipatri Fm. Pulivendula Quartzite Mallampalli Group Vempalle Fm. Gulcheru Quartzite	**Alabaka Sandstone** Lankavaram Shale Pattipalle Quartzite Polavaram Fm. Jakaram Arkose Pandikunta Shale Gunjeda Dolomite
		Chitravathi		
		Papaghni		Bayyaram 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, Veligallu Peddavuru 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, mostly present as enclaves within migmatitic gneiss. They are exposed in the eastern and southern parts of the Nellore schist belt. The lithology of Sargur primarily comprises garnet, staurolite, kyanite schists, Banded Iron Formations (BIFs), quartzites, granulites, and amphibolites. The gneissic complex includes banded tonalite-trondhjemite gneiss, which forms the basement rock of the study area along with migmatitic gneiss and biotite granite gneiss. TTGs (Tonalite-Trondhjemite-Granodiorite) are sodic, quartz-bearing granitic plutonic rocks, characterized by plagioclase as the most common feldspar and subordinate to nearly absent K-feldspar. Dharwar rocks in Andhra Pradesh are exposed in the western part of the Nellore belt and various other areas such as Anantapur, Ramagiri-Penakacherla, Kolar, Kadiri, Gadwal-Narayanpet, Jonnagiri, Veligallu, and Peddavuru Schist Belts, as well as the western part of the Nellore Belt. The lithology mostly comprises Metabasalt (Pillowed), Acid Volcanics, minor Andesite, Dacite, Rhyodacite, Amphibolites, Meta-ultramafics, minor Quartzite, Calcsilicates, Phyllites, intrusives of basic rocks and granites, rare Lamprophyres, and some Pyroclastic Rocks, with local conglomerates or event conglomerates, indicating stratigraphic hiatuses in the study area.

Rocks from the middle Proterozoic to late Archaean periods are exposed in the Eastern Ghats Mobile Belt, exhibiting extremely high-grade metamorphism falling under the granulite facies. They primarily include Khondalites and Charnockites. The structural control in the area is significant, with faulting and folding playing crucial roles in the genesis of landforms. The Cuddapah basin, part of the Dharwar craton, is the second-largest Purana basin in Peninsular India, exhibiting rocks from the late Proterozoic to upper Proterozoic periods. The basin is divided into four groups: Nallamalai, Chitravathi, Papaghni, and Kurnool, each characterized by different lithologies. The Cuddapah basin is known for its rhythmic pattern of quartzite-shale-carbonate cycles, with occurrences of uranium-bearing limestone. Purana rock formations are majorly exposed in Prakasam, Kurnool, Cuddapah, Chittoor, and Nellore.

The Deccan Traps are found in East and West Godavari districts, with exposures near Rajahmundry. Tertiary formations and Quaternary

sediments occur as thick blankets of alluvium in river valleys, deltas, and along the East coast.

The study area geologically belongs to the Precambrian age, characterized by metasediments and intrusive meta-igneous bodies. Recent sediments such as red sediments with calcium carbonate calcretes, dune sands, and economically important black sand concentrations are also present. These rocks and sediments exhibit various geomorphic features distributed from the deepest hinterland to near coastal plains.

The study area is part of the Eastern Ghats Mobile Belt, characterized by denudational hills ranging from 30 to 594 meters above mean sea level, with a general Northeast-Southwest trend. Chief rock types include garnet-sillimanite-biotite gneisses (Khondalites), hypersthene granites (Charnockites), garnetiferous granites (Leptynites), quartzites, and pegmatites, forming bedded, banded, and massive formations in the Alluri Sitharama Raju district. The area can be termed as the Archean high-grade metamorphic migmatite complex of the Eastern Ghats mobile belt.

The Eastern Ghats Super Group, comprising Khondalite and Charnockite Groups, is exposed in the central part of the upland area. These groups consist of quartz, K-feldspar, garnet, sillimanite, and graphite, with or without corundum. The geology map and detailed legend with a stratigraphic sequence of the Alluri Sitharama Raju District are shown in Figure-19.

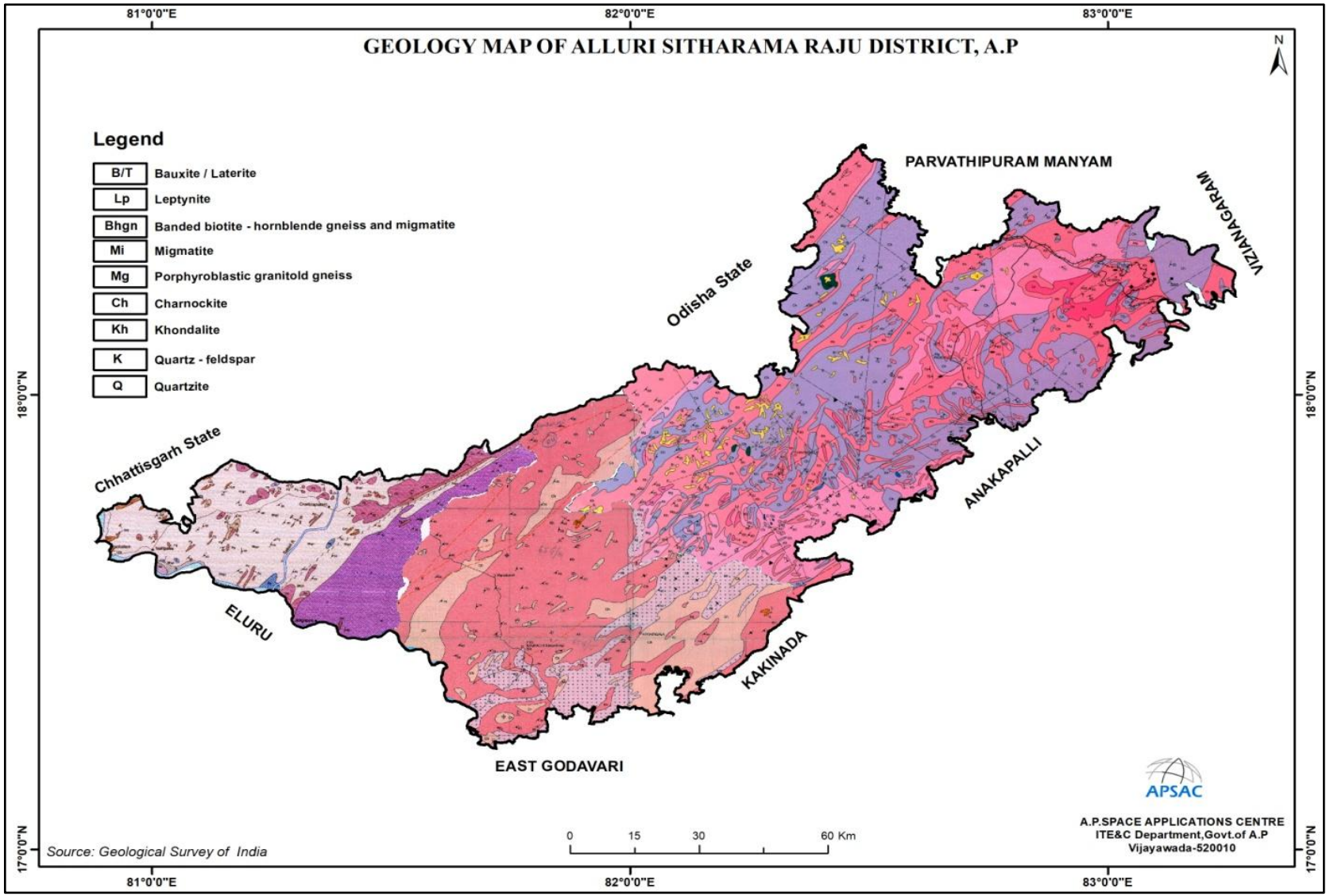
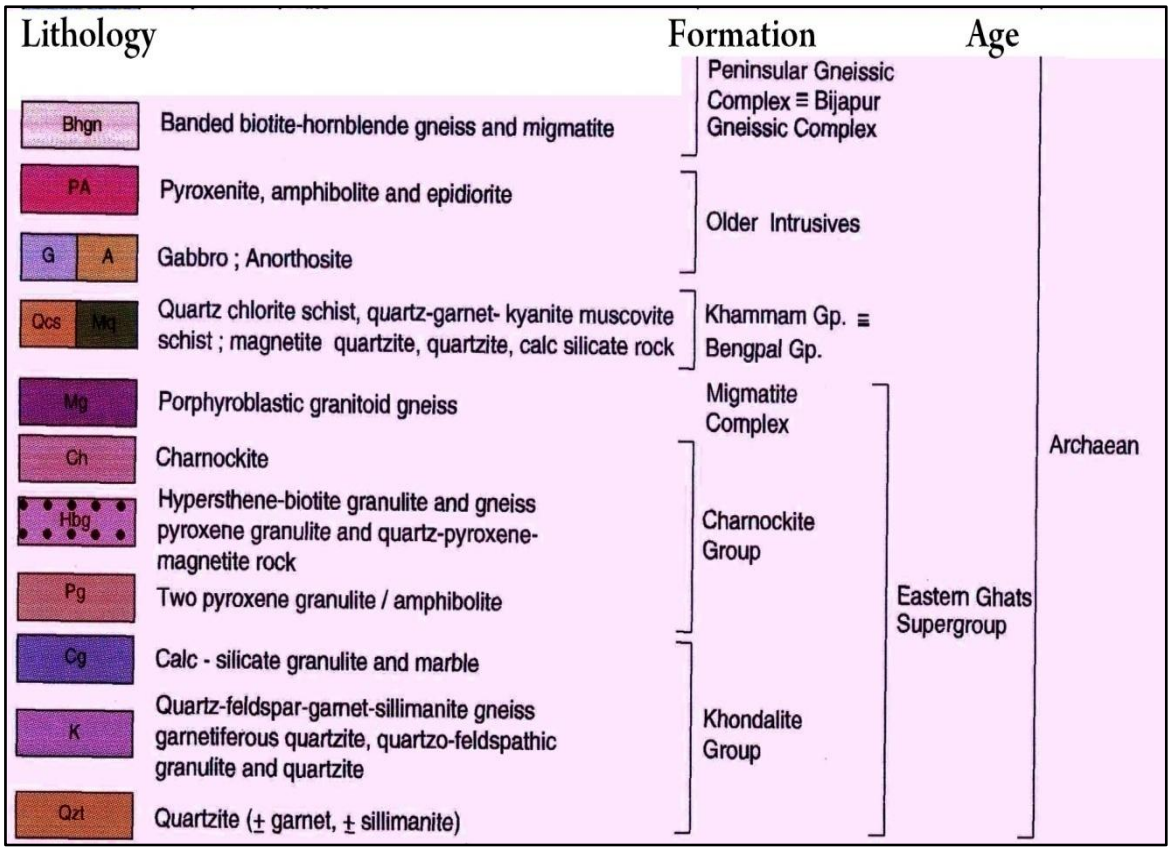


Figure 19: Geology of Alluri Sitharama Raju District, Andhra Pradesh (Source: GSI, 2000)



Detailed Legend with Stratigraphic Sequence of Alluri Sitharama Raju District

2.3 Minor Mineral Resources of Alluri Sitharama Raju District:

The geology of Alluri Sitharama Raju District is rich and diverse, encompassing various geological formations from ancient times to the Quaternary period. This district is known for its abundant mineral resources, including quartzite, calcite, colour granite, garnet, laterite, and various building stones. Additionally, minerals from neighbouring states are transported to Alluri Sitharama Raju via rail and road networks. Specifically, this district is known for its location-specific industrial minerals, which include laterite, calcite, and quartzite. The district's geology offers a wide range of opportunities for mining and utilization of these mineral resources. Colour granite, for instance, is essential for construction and decorative purposes, while road metal, building stone, gravel, and rough stones are crucial for civil construction projects. Overall, Alluri Sitharama Raju District's geological diversity and rich mineral deposits contribute significantly to the local economy and industrial activities.

2.3.1. Economic minerals:

The district has significant resources of Colour Granite, quartz, road metal, calcite, etc.

1. **Road Metal:** Road metal is utilized for construction purposes, as well as railway ballast. The Road metal is available in Gontuvanipalem, Puligogulapadu villages in Addateegala Mandal, Padmapuram village in Arakuvalley Mandal, Sarabhavaram village in Devipatnam Mandal, Kinchumanda village in Dumbriguda Mandal, Molleru, Ramuldevapuram villages in Gangavaram Mandal, Kontapalle, Matham villages in Hukumpeta Mandal, Arabeeru village in Munchingiputtu Mandal, Devarapalli village in Paderu Mandal, Narasapuram village in Rampachodavaram Mandal.
2. **Colour Granite:** This color granite variety is predominantly used for monuments and also as dimension stones for flooring and wall tiling. This mineral is available in Nandikota village in Ananthagiri mandal, Terapalle village in Chintapalle Mandal, Jaderu, Nellipudi, and Patharamavaram villages in Gangavaram Mandal, and Chupparipalem village in Rampachodavaram Mandal.
3. **Quartz:** The quartz available in the Alluri Sitharamaraju district is used in paint, ceramic tiles, and glass industries and is available in Kesaram village in Chintur Mandal
4. **Calcite:** Dekkapuram, Nimmalapadu, and Tumbarti villages in Ananthagiri Mandal.

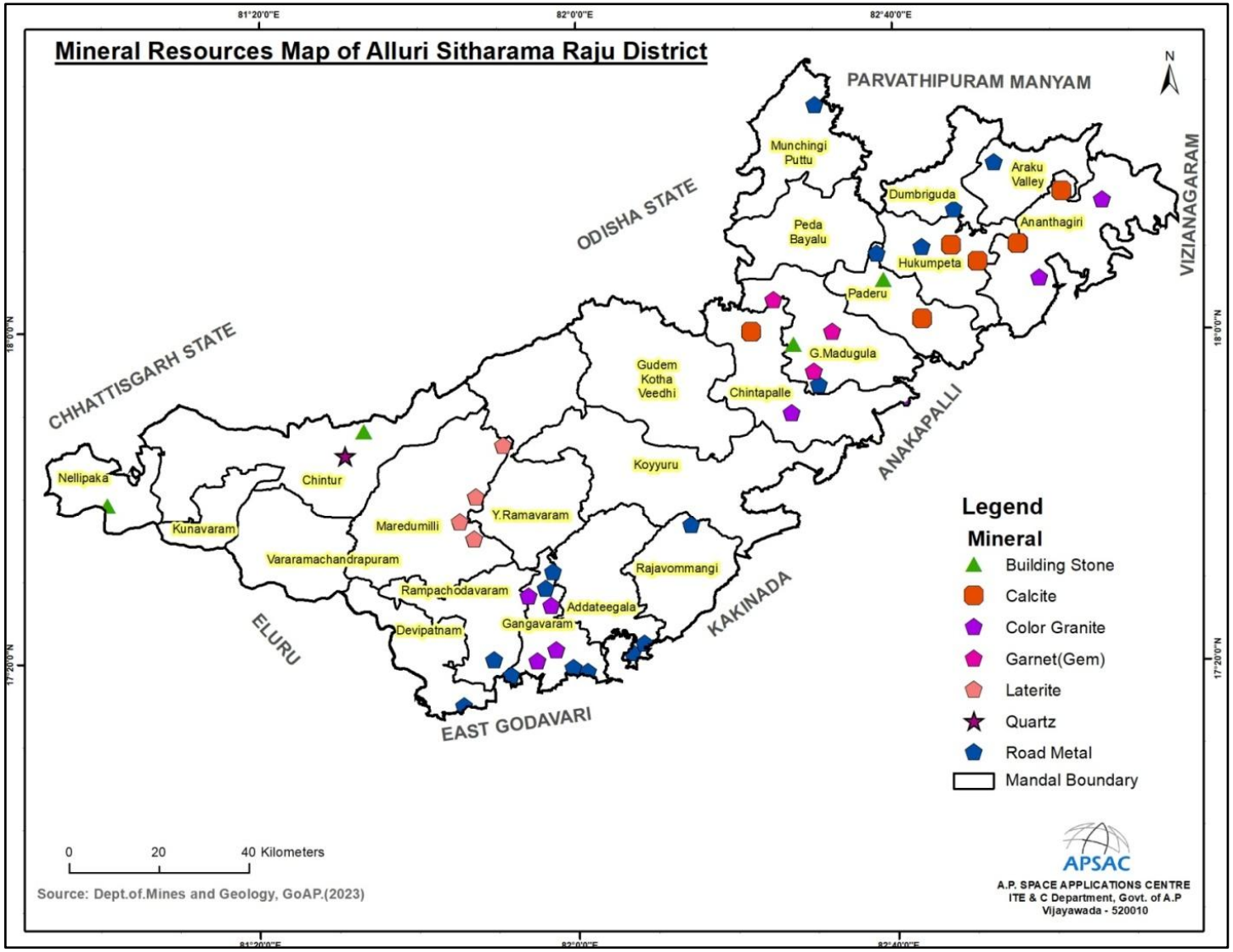


Figure-20: Mineral Resurce Map of Alluri Sitharama Raju District

The Details List of statement showing the Leases wise for Minor Minerals during the period described in Table-14 and the list of the letter of intent (LoI) in the district is shown in Table-15.

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

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of the Lessee	Quarry Lease Grant Order No. & Date	Area of quarring lease (ha)	Period of Mining Lease (Initial)		Period of Mining Lease (1st & 2nd renewal)		Status (Working/non-working/Temp.working for dispatch etc.,)	Captive/ Non-captive	Obtained environmental clearance (YES/No), if Yes Letter No. with date of grant of EC	Location of the Mining Lease (Latitude & Longitude)					Method of Mining (Opencast/ Underground)
						From	To	From	To				Sy.No.	Village	Mandal	Geo-coordiantes		
1	Road Metal	Pradani Dasu	9441998379	-	1.5	9/11/2008	3/31/2024	-	-	Renewal Pending	Non-captive	No	47	Padmapuram	Araku Valley	18-20-34.10424	82-52-48.67325	Opencast
																18-20-31.78715	82-52-53.15428	
																18-20-28.87835	82-52-51.59563	
																18-20-31.11228	82-52-47.09274	
2	Road Metal	L.Nageswara Rao	8985081132	-	0.5	4/20/2012	3/31/2024	-	-	Renewal Pending	Non-captive	No	47	Padmapuram	Araku Valley	18-20-29.00515	82-52-47.75295	Opencast
																18-20-27.53829	82-52-50.78420	
																18-20-25.89617	82-52-49.86501	
																18-20-27.61944	82-52-46.76848	
3	Color Granite	M/s Chaitanya GLCC Society	9494198998	-	0.9	8/5/2005	8/4/2025	-	-	INACTIVE	Non-captive	No	178/2	Thungamadugula	Addateegala	-	-	Opencast

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of the Lessee	Quarry Lease Grant Order No. & Date	Area of quarring lease (ha)	Period of Mining Lease (Initial)		Period of Mining Lease (1st & 2nd renewal)		Status (Working/non-working/Temp.working for dispatch etc.,)	Captive/ Non-captive	Obtained environmental clearance (YES/No), if Yes Letter No. with date of grant of EC	Location of the Mining Lease (Latitude & Longitude)					Method of Mining (Opencast/ Underground)
4	Color Granite	Sri Ganesh Sainadha Granites	94941 98998	-	3	2/10/2006	2/9/2026	-	-	INACTIVE	Non-captive	No	37	Addate egala	Addate egala	-	-	Opencast
5	Road Metal	Sri J. Satya Vara Prasad	94408 89218	-	2	6/25/2008	6/24/2028	-	-	INACTIVE	Non-captive	No	24	Puligogulapadu	Addate egala	-	-	Opencast
6	Road Metal	Sri N.Naga Raju	94408 89218	-	6	7/4/2008	7/3/2028	-	-	INACTIVE	Non-captive	No	24	Puligogulapadu	Addate egala	-	-	Opencast
7	Road Metal	M/s Gontivanipalem Girijana QW Indl.co Society	99896 01858	-	1.507	7/4/2008	7/3/2028	-	-	INACTIVE	Non-captive	No	207/1	Gontuvanipalem	Addate egala	17-19-46.93275	82-07-15.82220	Opencast
																17-19-44.52301	82-07-18.13957	
																17-19-39.79419	82-07-16.91321	
																17-19-42.25403	82-07-14.58635	
8	Road Metal	M/s Vijaya Girijana Q. L.C.c. Society	83412 59362	-	3.87	6/4/2008	6/3/2028	-	-	INACTIVE	Non-captive	No	207/1	Gontuvanipalem	Addate egala	17-19-42.25403	82-07-14.58635	Opencast
																17-19-41.70851	82-07-14.00046	
																17-19-40.49684	82-07-15.15827	
																17-19-41.02659	82-07-15.74744	
																17-19-39.79419	82-07-16.91321	
																17-19-35.49308	82-07-11.89729	

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of the Lessee	Quarry Lease Grant Order No. & Date	Area of quarring lease (ha)	Period of Mining Lease (Initial)		Period of Mining Lease (1st & 2nd renewal)		Status (Working/non-working/Temp.working for dispatch etc.,)	Captive/ Non-captive	Obtained environmental clearance (YES/No), if Yes Letter No. with date of grant of EC	Location of the Mining Lease (Latitude & Longitude)					Method of Mining (Opencast/ Underground)
																17-19-40.19817	82-07-07.26490	
9	Road Metal	Smt Palla Sanyasamma,	9866623113	-	1	6/10/2008	6/9/2018	-	-	INACTIVE	Non-captive	No	207/1	Gontuvanipalem	Addateegala	17-19-49.93332	82-07-14.16286	Opencast
																17-19-49.70686	82-07-15.77736	
																17-19-46.93275	82-07-15.82220	
																17-19-42.25403	82-07-14.58635	
																17-19-43.42790	82-07-13.44073	
10	Road Metal	M/s Bhavani Girijana Quarry Workers LC C Society	8142219999	-	0.85	6/26/2008	6/25/2028	-	-	INACTIVE	Non-captive	No	207/1	Gontuvanipalem	Addateegala	17-19-49.70686	82-07-15.77736	Opencast
																17-19-47.31364	82-07-17.99472	
																17-19-44.52301	82-07-18.13957	
																17-19-46.93275	82-07-15.82220	
11	Road Metal	Sri Manepalli Chandra Rao,	9989601858	-	9.5	7/31/2008	7/30/2028	-	-	INACTIVE	Non-captive	No	207/1	Gontuvanipalem	Addateegala	17-19-45.06926	82-06-57.60337	Opencast
																17-19-44.63642	82-07-12.26128	
																17-19-40.19817	82-07-07.26490	
																17-19-37.71426	82-07-09.54597	

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of the Lessee	Quarry Lease Grant Order No. & Date	Area of quarring lease (ha)	Period of Mining Lease (Initial)		Period of Mining Lease (1st & 2nd renewal)		Status (Working/non-working/Temp.working for dispatch etc.,)	Captive/ Non-captive	Obtained environmental clearance (YES/No), if Yes Letter No. with date of grant of EC	Location of the Mining Lease (Latitude & Longitude)					Method of Mining (Opencast/ Underground)
																17-19-34.38688	82-06-56.65172	
																17-19-36.26666	82-06-58.23691	
																17-19-40.08529	82-06-59.94436	
																17-19-41.24100	82-06-53.98921	
12	Road Metal	Sri Manepalli Chandra Rao	9989601858	-	1.4	7/31/2008	7/30/2028	-	-	INACTIVE	Non-captive	No	207/1	Gontuvanipalem	Addate egala	17-19-45.06926	82-06-57.60337	Opencast
																17-19-40.19817	82-07-07.26490	
																17-19-37.71426	82-07-09.54597	
																17-19-34.38688	82-06-56.65172	
																17-19-36.26666	82-06-58.23691	
																17-19-40.08529	82-06-59.94436	
13	Road Metal	Sri Pallala Sanyasamma	9866623113	-	0.125	12/18/2012	6/3/2028	-	-	INACTIVE	Non-captive	No	207/1	Gontuvanipalem	Addate egala	-	-	Opencast
14	Color Granite	Ms Benita Granites Limited	9390085828	-	24.54	5/16/2018	5/15/2038	-	-	ACTIVE	Non-captive	SEIAA/AP/VSP/MIN/06/2017/333, dt. 15.07.2017	4/p	Nandikota	Ananthagiri	18-17-02.69	83-06-37.43	Opencast
																18-16-55.15	83-06-51.82	
																18-16-37.66	83-06-37.66	
																18-16-34.59	83-06-33.88	
																18-16-40.12	83-06-31.71	

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of the Lessee	Quarry Lease Grant Order No. & Date	Area of quarring lease (ha)	Period of Mining Lease (Initial)		Period of Mining Lease (1st & 2nd renewal)		Status (Working/non-working/Temp.working for dispatch etc.,)	Captive/ Non-captive	Obtained environmental clearance (YES/No), if Yes Letter No. with date of grant of EC	Location of the Mining Lease (Latitude & Longitude)					Method of Mining (Opencast/ Underground)
																18-16-50.93	83-06-37.49	
																18-16-55.09	83-06-30.69	
15	Color Granite	Saviour Mines and Minerals Pvt Ltd	91003 01277	-	23	5/15/ 2018	5/14/ 2038	-	-	ACTIVE	Non-captive	No	4/P	Nandikota	Ananthagiri	18-16-50.80	83-06-37.36	Opencast
																18-16-55.29	83-06-30.30	
																18-16-29.91	83-06-17.14	
																18-16-27.96	83-06-21.05	
																18-16-27.87	83-06-25.60	
																18-16-34.51	83-06-33.73	
																18-16-40.00	83-06-31.62	
16	Calcite	Andhra Pradesh Mineral Development corporation ltd	94910 35727	-	8.72	12/20 /1994	12/19 /2044	-	-	ACTIVE	Non-captive	SEIAA/ AP/VSP - 105/2013/4503, dt. 13.05.2025	29/1,2	Nimmalapadu	Ananthagiri	18-10-28.26394	82-55-46.88437	Opencast
																18-10-28.3382	82-55-49.22383	
																18-10-28.95313	82-55-50.27455	
																18-10-30.16443	82-55-50.00966	
																18-10-30.41048	82-55-50.83698	
																18-10-29.60054	82-55-51.62063	
																18-10-26.78602	82-55-51.27842	

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of the Lessee	Quarry Lease Grant Order No. & Date	Area of quarring lease (ha)	Period of Mining Lease (Initial)		Period of Mining Lease (1st & 2nd renewal)		Status (Working/non-working/Temp.working for dispatch etc.,)	Captive/ Non-captive	Obtained environmental clearance (YES/No), if Yes Letter No. with date of grant of EC	Location of the Mining Lease (Latitude & Longitude)					Method of Mining (Opencast/ Underground)
																18-10-26.82563	82-55-51.82191	
																18-10-27.93704	82-55-54.49845	
																18-10-27.81822	82-55-55.39915	
																18-10-26.47870	82-55-55.68699	
																18-10-25.66250	82-55-55.13613	
																18-10-24.87795	82-55-56.27612	
																18-10-23.48858	82-55-54.28699	
																18-10-20.26927	82-55-56.90035	
																18-10-19.57955	82-55-56.56079	
																18-10-16.81832	82-55-55.72437	
																18-10-16.22410	82-55-54.94349	
																18-10-18.51199	82-55-47.16525	
																18-10-23.09638	82-55-47.08104	

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of the Lessee	Quarry Lease Grant Order No. & Date	Area of quarring lease (ha)	Period of Mining Lease (Initial)		Period of Mining Lease (1st & 2nd renewal)		Status (Working/non-working/Temp.working for dispatch etc.,)	Captive/ Non-captive	Obtained environmental clearance (YES/No), if Yes Letter No. with date of grant of EC	Location of the Mining Lease (Latitude & Longitude)					Method of Mining (Opencast/ Underground)
17	Calcite,Mica,Quartz	Andhra Pradesh Mineral development corporation ltd	9491035727	-	37.895	7/4/1996	3/31/2024	-	-	ACTIVE	Non-captive	No	35/p	Nimmalapadu	Ananthagiri	-	-	Opencast
18	Calcite,Mica	Aiswarya Tribal Labour Contract Mutually Aided Co-operative Society Ltd	9100301277	-	4.21	5/31/2006	5/30/2026	-	-	ACTIVE	Non-captive	SEIAA/AP/VSP/MIN/06/2019/1044/044, dt. 13.09.2019	1/9,1/10,2	Tumbarti	Ananthagiri	18-10-23.909901	82-55-40.300838	Opencast
																18-10-25.401602	82-55-42.822532	
																18-10-26.285063	82-55-42.579874	
																18-10-26.457488	82-55-42.843953	
																18-10-26.597436	82-55-43.247946	
																18-10-26.495637	82-55-43.402526	
																18-10-26.629474	82-55-44.027964	
																18-10-27.824494	82-55-43.901424	
																18-10-26.829176	82-55-46.950935	
																18-10-26.179407	82-55-46.981711	
																18-10-18.480252	82-55-47.165236	
																18-10-20.207715	82-55-42.640816	

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of the Lessee	Quarry Lease Grant Order No. & Date	Area of quarring lease (ha)	Period of Mining Lease (Initial)		Period of Mining Lease (1st & 2nd renewal)		Status (Working/non-working/Temp.working for dispatch etc.,)	Captive/ Non-captive	Obtained environmental clearance (YES/No), if Yes Letter No. with date of grant of EC	Location of the Mining Lease (Latitude & Longitude)					Method of Mining (Opencast/ Underground)
																18-10-19.471415	82-55-42.502967	
																18-10-20.210907	82-55-39.231807	
																18-10-21.595729	82-55-39.864984	
																18-10-22.869168	82-55-40.00006	
																18-10-22.982601	82-55-40.209326	
19	Calcite	Durga S.T.Sand Stone quarries L.C.Co-op Society	98661 24455	-	1.48	1/11/ 2010	1/10/ 2030	-	-	ACTIVE	Non-captive	No	1/4to1 /8	Tumbarti	Ananthagiri	18-10-29.10	82-55-46.70	Opencast
																18-10-27.00	82-55-46.99	
																18-10-27.80	82-55-44.80	
																18-10-27.10	82-55-43.58	
																18-10-27.14	82-55-42.96	
																18-10-27.28	82-55-42.77	
																18-10-27.12	82-55-42.41	
																18-10-26.91	82-55-42.13	
																18-10-26.20	82-55-42.60	
																18-10-23.90	82-55-40.30	
																18-10-24.70	82-55-40.10	

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of the Lessee	Quarry Lease Grant Order No. & Date	Area of quarring lease (ha)	Period of Mining Lease (Initial)		Period of Mining Lease (1st & 2nd renewal)		Status (Working/non-working/Temp.working for dispatch etc.,)	Captive/ Non-captive	Obtained environmental clearance (YES/No), if Yes Letter No. with date of grant of EC	Location of the Mining Lease (Latitude & Longitude)					Method of Mining (Opencast/ Underground)
																18-10-24.84	82-55-40.29	
																18-10-25.06	82-55-40.21	
																18-10-24.85	82-55-39.92	
																18-10-25.21	82-55-39.84	
																18-10-25.56	82-55-39.69	
																18-10-25.92	82-55-39.98	
																18-10-26.04	82-55-39.62	
																18-10-26.70	82-55-39.59	
																18-10-26.89	82-55-40.25	
																18-10-27.18	82-55-40.27	
																18-10-27.40	82-55-41.10	
																18-10-29.40	82-55-41.00	

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of the Lessee	Quarry Lease Grant Order No. & Date	Area of quarring lease (ha)	Period of Mining Lease (Initial)		Period of Mining Lease (1st & 2nd renewal)		Status (Working/non-working/Temp.working for dispatch etc.,)	Captive/ Non-captive	Obtained environmental clearance (YES/No), if Yes Letter No. with date of grant of EC	Location of the Mining Lease (Latitude & Longitude)					Method of Mining (Opencast/ Underground)
																18-10-29.30	82-55-41.91	
																18-10-29.52	82-55-41.19	
																18-10-29.30	82-55-43.30	
																18-10-28.70	82-55-45.30	
20	Calcite,Mica	D.Pentam Naidu	9502777779	-	6.44	11/15/2002	3/31/2024	-	-	ACTIVE	Non-captive	No	4	Kudiya	Anantha giri	-	-	Opencast
21	China Clay	SUPRAKASH DAS	9885697777	-	1.097	11/20/2020	11/19/2040	-	-	ACTIVE	Non-captive	DEIAA/AP/VSP-02/2017, dt. 21.01.2023	2/P	Gatuguda	Anantha giri	-	-	Opencast
22	Color Granite	Sri J . Mark Raju	9848922177	-	10	10/24/2016	10/23/2036	-	-	ACTIVE	Non-captive	SEIAA/AP/VSP/MIN/04/2016/73, dt. 04.08.2016	11/p	Sariya	Anantha giri	18-01-53.90	82-53-38.90	Opencast
																18-02-01.40	82-53-23.70	
																18-01-51.90	82-53-25.40	
																18-01-49.00	82-53-23.60	
																18-01-47.90	82-53-29.20	
																18-01-50.30	82-53-34.50	
																18-01-52.50	82-53-37.10	

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23	Road Metal	RAMAVATH KRISHNA NAIK	95151 55231	-	1.366	11/10/2023	2/7/2024	-	-	ACTIVE	Non-captive	SEIAA/AP/VSP/MIN/11/2020/2527/dt 22.07.2021	176/2 & 176/3	Antharla	Chintapalle	-	-	Opencast
24	Laterite	D.Pothu Raju	99595 95997	-	4.27	5/31/2002	3/31/2024	-	-	ACTIVE	Non-captive	DEIAA/AP/VSP-01/2017/04, dt. 28.07.2017	59/1,2, 60/1,2, 4,5	Chintapalle	Chintapalle	-	-	Opencast
25	Color Granite	Sri J.Mark Raju	70368 99777	-	7.99	10/21/2016	10/20/2036	-	-	ACTIVE	Non-captive	SEIAA/AP/VSP/MIN/04/2016/73, dt. 04.08.2016	68,69	Terapalle	Chintapalle	-	-	Opencast
26	Color Granite	Lakshmi S.T. Mining Leasing Labour	88018 31460	-	1.7	7/6/2017	7/5/2037	-	-	ACTIVE	Non-captive	SEIAA/AP/VSP/MIN/03/2017/306/1	68/4 to 6 and 69/2	Terapalle	Chintapalle	17-49-59.83 17-50-04.98 17-50-07.10	82-26-52.18 82-26-53.39 82-27-07.33	Opencast

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of the Lessee	Quarry Lease Grant Order No. & Date	Area of quarring lease (ha)	Period of Mining Lease (Initial)		Period of Mining Lease (1st & 2nd renewal)		Status (Working/non-working/Temp.working for dispatch etc.,)	Captive/ Non-captive	Obtained environmental clearance (YES/No), if Yes Letter No. with date of grant of EC	Location of the Mining Lease (Latitude & Longitude)					Method of Mining (Opencast/ Underground)
		Contract Mutually Aided Cooperative Society Limited										93.57& 190.49, dt. 26.08.2022				17-49-54.80	82-27-02.73	
27	Color Granite	J.Mark Raju	8801831460	-	8.15	11/21/2019	11/20/2039	-	-	ACTIVE	Non-captive	No	66 & 67	Terapalle	Chintapalle	17-49-59.83	82-26-52.18	Opencast
																17-50-5.14	82-26-54.90	
																17-50-07.53	82-26-47.38	
																17-50-06.61	82-26-41.68	
																17-50-04.87	82-26-39.71	
																17-49-56.79	82-26-45.87	
																17-49-55.76	82-26-50.11	
28	Quartz	P.SATYA NARAYANA	9492027996	-	0.874	3/25/2009	3/24/2029	-	-	INACTIVE	Non-captive	No	26	Kesaram	Chintur	17-45-20.1	81-31-14.7	Opencast
																17-45-16.7	81-31-15.3	
																17-45-17.4	81-31-18.8	
																17-45-20.0	81-31-18.2	
29	Road	ANIGI	94404	-	2.95	12/18	12/17	-	-	INACTIVE	Non-	No	36/P	Kansul	Chintur	17-43-21.86	81-27-00.09	Opencast

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	Metal	SEETHA	50219			/2019	/2029				captive			uru		17-43-21.37	81-27-02.05	
																17-43-19.35	81-27-02.93	
																17-43-17.07	81-27-02.31	
																17-43-15.55	81-27-00.27	
																17-43-17.25	81-26-54.37	
																17-43-18.20	81-26-55.36	
																17-43-18.81	81-26-56.38	
																17-43-20.63	81-26-57.50	
30	Road Metal	G.BALAJI BABU	94921 23458	-	3.306	5/30/ 2022	5/29/ 2032	-	-	INACTIVE	Non-captive	No	80	Sarabh avaram	Devipat nam	17-14-05.69907	81-45-12.28502	Opencast
																17-14-09.48192	81-45-15.08540	
																17-14-09.80089	81-45-15.13979	
																17-14-14.32049	81-45-11.76337	
																17-14-14.57656	81-45-10.53273	
																17-14-07.50480	81-45-07.99200	
31	Road Metal	D.KRSHNA MURTHY	72472 57272	-	4.98	6/8/2 022	6/7/2 032	-	-	INACTIVE	Non-captive	No	80	Sarabh avaram	Devipat nam	-	-	Opencast
32	Road	M SATYA	93922	-	4.273	12/3/	12/2/	-	-	INACTIVE	Non-	No	80	Sarabh	Devipat	17-14-16.28454	81-45-19.11038	Opencast

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	Metal	SRI	22420			2022	2032				captive			avaram	nam	17-14-24.48359	81-45-13.73580	
																17-14-24.48527	81-45-12.50324	
																17-14-22.78992	81-45-10.30942	
																17-14-16.31590	81-45-10.63219	
33	Road Metal	Ramavath Krishna Naik	9515155231	-	4.95	11/10/2021	11/9/2031	-	-	ACTIVE	Non-captive	No	38	Kinchumanda	Dumbriguda	18-15-11.22612	82-47-38.32012	Opencast
																18-15-05.47332	82-47-44.18853	
																18-15-00.81052	82-47-39.44162	
																18-15-06.56342	82-47-33.57316	
34	Laterite	P.Demudu	9390361893	-	11.61	1/13/2004	3/31/2024	-	-	ACTIVE	Non-captive	SEIAA/AP/VSP/-62/2012-1961, dt. 21.01.2012	19/1,2,4,5,20/1,2,21/1,2,22/1,7	Chaparathipalem	Gudem Kothaveedhi	17-46-10.30	82-17-18.91	Opencast
																17-46-10.36	82-17-27.32	
																17-46-13.20	82-17-31.64	
																17-46-20.89	82-17-88.12	
																17-46-25.87	82-17-38.57	
																17-46-27.04	82-17-46.38	
																17-46-25.57	82-17-53.23	
																17-46-23.68	82-17-53.09	

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of the Lessee	Quarry Lease Grant Order No. & Date	Area of quarring lease (ha)	Period of Mining Lease (Initial)		Period of Mining Lease (1st & 2nd renewal)		Status (Working/non-working/Temp.working for dispatch etc.,)	Captive/ Non-captive	Obtained environmental clearance (YES/No), if Yes Letter No. with date of grant of EC	Location of the Mining Lease (Latitude & Longitude)					Method of Mining (Opencast/ Underground)
																17-46-23.58	82-17-49.40	
																17-46-15.78	82-17-38.50	
																17-46-06.87	82-17-30.04	
																17-46-07.23	82-17-22.56	
																17-46-07.70	82-17-19.14	
35	Garnet (Gem)	S.RAMA SATYA HARI	9440940159	-	4.95	11/18/2009	11/17/2029	-	-	ACTIVE	Non-captive	No	23/1,24/2,21/P,25	Busipalli	Gangarajumadugula	18-00-45.00	82-32-54.7	Opencast
																18-00-42.00	82-33-10.00	
																18-00-42.00	82-33-10.00	
36	Gravel,Road Metal	K.Simhadri	9440133262	-	1.62	7/30/2022	7/29/2032	-	-	ACTIVE	Non-captive	SEIAA/AP/VSP/MIN/02/2022/3949/, dt. 30.07.2022	43/2P, 43/3P & 43/4P	G.nittaputtu	Gangarajumadugula	18-02-01.29758	82-32-28.38170	Opencast
																18-02-03.44185	82-32-32.75621	
																18-02-03.50001	82-32-36.47565	
																18-02-01.37641	82-32-35.79738	
																18-02-00.91974	82-32-33.88397	
																18-02-00.45652	82-32-31.20722	
																18-01-59.22831	82-32-28.59518	
37	Road Metal	Sri K.Srinivas	9133228870	-	1.5	5/12/2006	5/11/2026	-	-	INACTIVE	Non-captive	No	1	Pothandorapalem	Gangavaram	-	-	Opencast

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of the Lessee	Quarry Lease Grant Order No. & Date	Area of quarring lease (ha)	Period of Mining Lease (Initial)		Period of Mining Lease (1st & 2nd renewal)		Status (Working/non-working/Temp.working for dispatch etc.,)	Captive/ Non-captive	Obtained environmental clearance (YES/No), if Yes Letter No. with date of grant of EC	Location of the Mining Lease (Latitude & Longitude)					Method of Mining (Opencast/ Underground)
38	Color Granite	RATHOD PREM	98490 39929		1	8/10/ 2016	8/9/2 036	-	-	INACTIVE	Non-captive	No	487	Nellipudi	Gangavaram	17-20-00.92810	81-57-16.38694	Opencast
																17-20-00.11142	81-57-19.48846	
																17-20-03.43143	81-57-21.05497	
																17-20-03.88845	81-57-17.63010	
																17-20-03.71539	81-57-17.57252	
39	Color Granite	K.SEETHA RAM	98859 21086	-	3.391	2/6/2 023	2/5/2 043	-	-	ACTIVE	Non-captive	SEIAA/ AP/EG/ MIN/0 6/2022 /4362/ 1, dt. 6.2.202 3	436	Nellipudi	Gangavaram	17-20-04.87701	81-56-33.11149	Opencast
																17-20-03.73819	81-56-33.45740	
																17-20-01.37101	81-56-33.59138	
																17-19-58.44631	81-56-33.72825	
																17-19-58.42691	81-56-27.68222	
																17-20-00.47953	81-56-26.92823	
																17-20-00.75842	81-56-26.94817	
																17-20-01.73748	81-56-27.20080	
																17-20-02.94701	81-56-27.35603	
																17-20-04.32182	81-56-28.88737	
40	Color	M/s Mars	99590	-	1.52	10/5/	10/4/	-	-	INACTIVE	Non-	No	486/1,	Nellipu	Gangav	17-20-03.88845	81-57-17.63010	Opencast

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of the Lessee	Quarry Lease Grant Order No. & Date	Area of quarring lease (ha)	Period of Mining Lease (Initial)		Period of Mining Lease (1st & 2nd renewal)		Status (Working/non-working/Temp.working for dispatch etc.,)	Captive/ Non-captive	Obtained environmental clearance (YES/No), if Yes Letter No. with date of grant of EC	Location of the Mining Lease (Latitude & Longitude)					Method of Mining (Opencast/ Underground)
	Granite	Granites	70555			2005	2025				captive		488/1	di	aram	17-20-04.61058	81-57-19.35070	
																17-20-05.56181	81-57-20.47541	
																17-20-06.50290	81-57-20.11406	
																17-20-10.36621	81-57-21.93566	
																17-20-10.11966	81-57-22.00049	
																17-20-12.53335	81-57-22.77242	
																17-20-14.22569	81-57-24.44465	
																17-20-15.23717	81-57-23.36781	
																17-20-12.42552	81-57-21.55184	
																17-20-11.61897	81-57-20.29463	
																17-20-10.40476	81-57-19.89689	
																17-20-10.20141	81-57-19.34131	
																17-20-06.69914	81-57-19.54410	
																17-20-06.83793	81-57-18.99507	
																17-20-06.61899	81-57-18.15212	
41	Road Metal	L.SATYAVATHI	8328074558	-	4.6	1/30/2021	1/29/2031	-	-	INACTIVE	Non-captive	No	1	Pothandorapalem	Gangavaram	-	-	Opencast

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of the Lessee	Quarry Lease Grant Order No. & Date	Area of quarring lease (ha)	Period of Mining Lease (Initial)		Period of Mining Lease (1st & 2nd renewal)		Status (Working/non-working/Temp.working for dispatch etc.,)	Captive/ Non-captive	Obtained environmental clearance (YES/No), if Yes Letter No. with date of grant of EC	Location of the Mining Lease (Latitude & Longitude)					Method of Mining (Opencast/ Underground)
42	Road Metal	S.SUHASINI	9948411699	-	4.95	4/25/2022	4/24/2032	-	-	INACTIVE	Non-captive	No	1	Pothandorapalem	Gangavaram	-	-	Opencast
43	Color Granite	CH.INDIRA PRIYADARSHINI	9966266566	-	10	5/6/2019	5/5/2039	-	-	INACTIVE	Non-captive	No	1/2	Patharamavaram	Gangavaram	17-19-17.48	81-55-02.89	Opencast
																17-19-20.01	81-55-04.33	
																17-19-20.07	81-55-04.69	
																17-19-21.03	81-55-04.99	
																17-19-22.85	81-55-03.84	
																17-19-23.78	81-55-04.41	
																17-19-26.61	81-55-00.60	
																17-19-23.76	81-54-58.71	
																17-19-22.76	81-54-58.15	
																17-19-21.10	81-54-54.16	
																17-19-16.90	81-54-55.65	
																17-19-13.64	81-54-50.98	
																17-19-11.43	81-54-50.49	

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of the Lessee	Quarry Lease Grant Order No. & Date	Area of quarring lease (ha)	Period of Mining Lease (Initial)		Period of Mining Lease (1st & 2nd renewal)		Status (Working/non-working/Temp.working for dispatch etc.,)	Captive/ Non-captive	Obtained environmental clearance (YES/No), if Yes Letter No. with date of grant of EC	Location of the Mining Lease (Latitude & Longitude)					Method of Mining (Opencast/ Underground)
																17-19-08.97	81-54-49.01	
																17-19-07.13	81-54-50.82	
																17-19-14.55	81-54-59.51	
45	Road Metal	M/s United Minerals	9494092727	-	4.856	11/6/2020	11/5/2030	-	-	INACTIVE	Non-captive	No	266	Molleru	Gangavaram	17-18-47.97	81-59-53.50	Opencast
																17-18-44.17	81-59-48.72	
																17-18-44.89	81-59-37.83	
																17-18-45.71	81-59-38.24	
																17-18-49.51	81-59-41.50	
46	Road Metal	CH.DURGA RAGHUNADH	9490685812	-	4.9	5/18/2022	5/17/2032	-	-	INACTIVE	Non-captive	No	121	Ramuldevapuram	Gangavaram	17-18-29.20631	82-01-44.24389	Opencast
																17-18-29.41640	82-01-48.04990	
																17-18-27.04248	82-01-53.63078	
																17-18-27.21230	82-01-85.46440	
																17-18-30.95501	82-01-57.60449	
																17-18-31.53958	82-01-54.27252	
																17-18-32.12418	82-01-50.94029	
																17-18-23.70872	82-01-47.60832	

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of the Lessee	Quarry Lease Grant Order No. & Date	Area of quarring lease (ha)	Period of Mining Lease (Initial)		Period of Mining Lease (1st & 2nd renewal)		Status (Working/non-working/Temp.working for dispatch etc.,)	Captive/ Non-captive	Obtained environmental clearance (YES/No), if Yes Letter No. with date of grant of EC	Location of the Mining Lease (Latitude & Longitude)					Method of Mining (Opencast/ Underground)
																17-18-33.27041	82-01-44.40650	
47	Color Granite	D.V.V.S.N .MAHESH	94926 70014	-	7.5	5/30/ 2018	5/29/ 2038	-	-	INACTIVE	Non-captive	No	53	Jaderu	Gangavaram	17-29-06.71603	81-57-27.99693	Opencast
																17-29-05.29969	81-57-28.36041	
																17-29-05.09188	81-57-28.61050	
																17-29-04.07832	81-57-28.13872	
																17-29-01.37718	81-57-28.16495	
																17-28-59.84213	81-57-27.38319	
																17-28-59.18915	81-57-26.82139	
																17-28-57.59105	81-57-26.59011	
																17-28-57.30695	81-57-26.10170	
																17-28-55.82454	81-57-25.92686	
																17-28-53.90442	81-57-24.66092	
																17-28-54.05766	81-57-24.12349	
																17-28-53.23879	81-57-23.56756	
																17-28-52.72670	81-57-23.54156	

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of the Lessee	Quarry Lease Grant Order No. & Date	Area of quarring lease (ha)	Period of Mining Lease (Initial)		Period of Mining Lease (1st & 2nd renewal)		Status (Working/non-working/Temp.working for dispatch etc.,)	Captive/ Non-captive	Obtained environmental clearance (YES/No), if Yes Letter No. with date of grant of EC	Location of the Mining Lease (Latitude & Longitude)					Method of Mining (Opencast/ Underground)
																17-28-53.63014	81-57-19.33507	
																17-29-06.20789	81-57-22.35247	
48	Road Metal	BANOTHU RAVINDER	9381483788	-	3.99	12/13/2021	12/12/2031	-	-	ACTIVE	Non-captive	SEIAA/AP/VSP/MIN/01/2021/2753/, dt.21.2.2021	120	Kontapalle	Hukumpeta	18-10-10.52660	82-44-16.99750	Opencast
																18-10-06.59301	82-44-20.14912	
																18-10-04.86010	82-44-17.66560	
																18-10-04.71452	82-44-16.53541	
																18-10-05.36601	82-44-15.95530	
																18-10-03.81610	82-44-14.49162	
																18-10-00.97712	82-44-08.98230	
																18-10-06.47043	82-44-10.59281	
49	Road Metal	MATTAM CHITTI NAIDU	8500907797	-	1.994	7/22/2022	7/30/2032	-	-	ACTIVE	Non-captive	SEIAA/AP/VSP/MIN/7/3337/2021/1, dt. 30.11.2	116/6P	Mathamm	Hukumpeta	18-09-46.285736	82-38-12.850461	Opencast
																18-09-48.309359	82-38-11.835115	
																18-09-45.917991	82-38-06.619751	
																18-09-40.639064	82-38-09.268481	

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of the Lessee	Quarry Lease Grant Order No. & Date	Area of quarring lease (ha)	Period of Mining Lease (Initial)		Period of Mining Lease (1st & 2nd renewal)		Status (Working/non-working/Temp.working for dispatch etc.,)	Captive/ Non-captive	Obtained environmental clearance (YES/No), if Yes Letter No. with date of grant of EC	Location of the Mining Lease (Latitude & Longitude)					Method of Mining (Opencast/ Underground)
												022				18-09-41.679991	82-38-11.538672	
																18-09-44.93534	82-38-09.905313	
50	Laterite	Smt G.Sumitra	9494198998	-	4.636	12/19/2007	12/18/2027	-	-	ACTIVE	Non-captive	No	4/P	Chavidikota	Maredumilli	-	-	Opencast
51	Laterite	L.Ravi Kumar	9133451538	-	7.02	12/7/2004	12/6/2024	-	-	ACTIVE	Non-captive	No	1/B,C,D,E,G	Arjunalova	Maredumilli	17-40-14.99	81-47-21.03	Opencast
																17-40-14.68	81-47-22.63	
																17-40-14.88	81-47-20.36	
																17-40-03.69	81-47-15.48	
																17-40-06.93	81-47-17.17	
																17-40-06.12	81-47-17.20	
																17-40-02.75	81-47-17.00	
																17-39-57.91	81-47-22.99	
																17-39-59.64	81-47-24.21	
																17-40-04.44	81-47-22.29	
																17-40-11.10	81-47-22.50	
																17-40-11.15	81-47-23.11	
																17-40-11.19	81-47-22.78	

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of the Lessee	Quarry Lease Grant Order No. & Date	Area of quarring lease (ha)	Period of Mining Lease (Initial)		Period of Mining Lease (1st & 2nd renewal)		Status (Working/non-working/Temp.working for dispatch etc.,)	Captive/ Non-captive	Obtained environmental clearance (YES/No), if Yes Letter No. with date of grant of EC	Location of the Mining Lease (Latitude & Longitude)					Method of Mining (Opencast/ Underground)
52	Laterite	Basavayya Minerals	9494198998	-	2.98	3/10/2003	3/31/2024	-	-	ACTIVE	Non-captive	No	22	Vetukuru	Maredumilli	-	-	Opencast
53	Laterite	Rajiv Tribal Quarry Labour Contract Co-Operative Society	9440670917	-	16.39	10/26/2013	10/22/2033	-	-	ACTIVE	Non-captive	No	37,38	Maddiveedu	Maredumilli	17-34-48.14284	81-46-59.31065	Opencast
																17-34-50.96455	81-46-59.36432	
																17-34-55.75946	81-46-59.73116	
																17-34-58.64191	81-46-59.55020	
																17-35-00.93026	81-46-59.44573	
																17-35-03.73358	81-47-00.82278	
																17-35-03.64526	81-47-04.04003	
																17-35-03.53039	81-47-07.71698	
																17-35-03.42250	81-47-11.51443	
																17-35-03.30356	81-47-15.3181	
																17-35-02.39906	81-47-18.12966	
																17-35-02.05595	81-47-18.18493	
																17-34-01.05235	81-47-15.15546	
																17-34-59.78753	81-47-11.77272	
																17-34-58.90975	81-47-11.1617	

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of the Lessee	Quarry Lease Grant Order No. & Date	Area of quarring lease (ha)	Period of Mining Lease (Initial)		Period of Mining Lease (1st & 2nd renewal)		Status (Working/non-working/Temp.working for dispatch etc.,)	Captive/ Non-captive	Obtained environmental clearance (YES/No), if Yes Letter No. with date of grant of EC	Location of the Mining Lease (Latitude & Longitude)					Method of Mining (Opencast/ Underground)
																17-34-56.42321	81-47-10.89693	
																17-34-54.00260	81-47-10.7431	
																17-34-51.67684	81-47-10.50992	
																17-34-49.15453	81-47-02.62589	
54	Road Metal	G.Neelakantam	9492391718	-	1	11/6/2015	11/5/2025	-	-	ACTIVE	Non-captive	No	16	Arabeeru	Munchingiputtu	-	-	Opencast
55	Building Stone,Road Metal	S.SIMHADRI VENKATA PRASAD	9533969536	-	1.946	12/28/2020	12/27/2030	-	-	ACTIVE	Non-captive	SEIAA/AP/VSP/MIN/06/2020/1945/dt 21.01.2020	22/1P&22/2P	Devarapalli	Paderu	18-05-53.13236	82-38-50.79188	Opencast
																18-05-56.99547	82-38-49.47516	
																18-06-00.607171	82-38-47.10577	
																18-05-59.06819	82-38-45.57515	
																18-05-55.02984	82-38-46.69525	
																18-05-53.26707	82-38-46.19178	
																18-05-53.43567	82-38-48.10793	
56	Color Granite	CHUPPARAPALEM GIRIJANA QUARRY WORKERS	9381283156		3.93	9/15/2011	9/14/2031	-	-	INACTIVE	Non-captive	No	37/1,70/2,72	Chuppa ripalem	Rampachodavaram	17-28-38.89052	81-52-57.52245	Opencast
																17-28-32.71753	81-53-00.91373	
																17-28-33.00807	81-52-54.06505	
																17-28-30.14934	81-52-53.19159	

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of the Lessee	Quarry Lease Grant Order No. & Date	Area of quarring lease (ha)	Period of Mining Lease (Initial)		Period of Mining Lease (1st & 2nd renewal)		Status (Working/non-working/Temp.working for dispatch etc.,)	Captive/ Non-captive	Obtained environmental clearance (YES/No), if Yes Letter No. with date of grant of EC	Location of the Mining Lease (Latitude & Longitude)					Method of Mining (Opencast/ Underground)
		LABOUR CONTRACT CO-OPERATIVE SOCIETY LTD														17-28-30.41634	81-52-51.83781	
																17-28-33.20919	81-52-49.32313	
																17-28-33.18046	81-52-50.00055	
																17-28-33.83057	81-52-50.03049	
																17-28-34.08788	81-52-54.84096	
																17-28-38.25052	81-52-52.45587	
57	Road Metal	K.Annavaram	9490710311	-	2	1/12/2023	1/11/2033	-	-	INACTIVE	Non-captive	No	226	Utla	Rampachodavaram	17-21-45.39332	81-52-09.00518	Opencast
																17-21-49.21221	81-52-12.47118	
																17-21-52.06051	81-52-09.35058	
																17-21-48.32332	81-52-05.80554	
58	Road Metal	BAPANAMMA QUARRY WORKERS LABOUR CONTRACT COOPERATIVE SOCEITY LIMITED	9989955799	-	2.784	5/18/2022	5/17/2032	-	-	INACTIVE	Non-captive	No	105	Narasapuram	Rampachodavaram	-	-	Opencast

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of the Lessee	Quarry Lease Grant Order No. & Date	Area of quarring lease (ha)	Period of Mining Lease (Initial)		Period of Mining Lease (1st & 2nd renewal)		Status (Working/non-working/Temp.working for dispatch etc.,)	Captive/ Non-captive	Obtained environmental clearance (YES/No), if Yes Letter No. with date of grant of EC	Location of the Mining Lease (Latitude & Longitude)					Method of Mining (Opencast/ Underground)
59	Road Metal	K.RAJESWARI	9490946896	-	1.724	5/19/2020	5/18/2030	-	-	INACTIVE	Non-captive	No	105	Narasapuram	Rampachodavaram	-	-	Opencast
60	Quartz	G.PADMAVATHI	9493525941	-	1.25	9/27/2005	9/26/2025	-	-	INACTIVE	Non-captive	No	17/A 17/VU	Rangapuram	Yetapaka	-	-	Opencast

Data Source: District of Mines and Geology, Alluri Sitharama Raju District, Andhra Pradesh

Table 15: The list of the letter of intent (LoI) in the district

S.NO	Name of the Mineral	Name of the Lessee	Address & Contact No. of Letter of Intent Holder	Letter of Intent Grant order No. & Date	Area of Mining lease to be allotted				Validity of LoI	Use (Captive/Non-captive)	Location of the Mining lease (Latitude & Longitude)
					Sy.No.	Village	Mandal	Extent			
NIL											

Data Source: District of Mines and Geology, Alluri Sitharama Raju District, Andhra Pradesh

2.4 Details of Royalty in last 3 years

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

Table 16 Details of Royalty in 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	Colour Granite (Leptinite)	172.67	86.335	21.55	3.50
2	Road Metal	194.23	97.115	58.26	3.84
3	Calcite	8.97	4.48	2.685	0.179
4	Quartz	0.45	0.23	0.135	0.009
Total		**376.32**	**188.16**	**82.63**	**7.53**

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	Color Granite-Leptinites	325.555	81.38875	40.694	6.511
2	Colour Granite (Others)	31.484	7.871	3.935	0.63
3	Gravel	38.102	19.051	11.431	0.762
4	Laterite (Cement)	12.478	6.239	3.734	0.249
5	Laterite (Metallugical	2.08	1.04	0.624	0.042

S. No.	Mineral	Royalty (in Rs. Lakhs)	Consideration Amt. (in Rs. Lakhs)	DMF (In Rs. Lakhs)	MERIT (in Rs. Lakhs)
	Grade)				
6	Ordinary Earth	4.05	2.025	1.215	0.081
7	Quartz	1.26	0.63	0.378	0.025
8	Road Metal	64.63	32.315	19.389	1.293
Total		**479.64**	**150.56**	**81.40**	**9.59**

Royalty for 2020-21

S. No.	Mineral	Royalty (in Rs. Lakhs)	DMF (In Rs. Lakhs)	MERIT (in Rs. Lakhs)
1	Calcite	0.50	0.146	0.01
2	Color Granite-Leptinites	440	55	8.8
3	Colour Granite (Others)	10.70	1.336	0.214
4	Quartz	0.18	0.054	0.004
5	Road Metal	12.175	3.653	0.244
Total		**595**	**154**	**12**

Data Source: District of Mines and Geology, Alluri Sitharama Raju District, Andhra Pradesh

2.5 Details of Production in last 3 years

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

Table 17 Details of Production in last 3 years

Production for 2022-23

S. No.	Mineral	Unit	Production
1	Colour Granite (Leptinite)	Cubic Meter	5,619.57
2	Road Metal	Cubic Meter	2,15,801
3	Calcite	MT	9,943
4	Quartz	MT	500

Production for 2021-22

S. No.	Mineral	Unit	Production
1	Color Granite-Leptinites	Cubic Meter	9,936
2	Colour Granite (Others)	Cubic Meter	1,215
3	Gravel	Cubic Meter	84,672
4	Laterite (Cement)	MT	12,446
5	Laterite (Metallugical Grade)	MT	1,040
6	Ordinary Earth	Cubic Meter	9,000
7	Quartz	MT	1,400
8	Road Metal	Cubic Meter	71,811

Production for 2020-21

S. No.	Mineral	Unit	Production
1	Calcite	MT	542
2	Color Granite-Leptinites	Cubic Meter	13,790
3	Colour Granite (Others)	Cubic Meter	413
4	Quartz	MT	200
5	Road Metal	Cubic Meter	13,528

Data Source: District of Mines and Geology, Alluri Sitharama Raju 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 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 of Andhra Pradesh Minor Mineral Concession Rules, 1966 allows the State Government to issue the Letters of Intent with the stipulated conditions to submit Approved Mining Plan (AMP), Environment Clearance (EC) and Consent for Establishment (CFE) for grant of lease.

Mine Plan stipulates the maximum permissible annual production of the mineral from the designated lease area and also includes estimated quantum of solid waste generation and its method of disposal, etc. Based on the Approved Mine Plan projections, 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 for minimizing adverse effects on 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, suitable number of filter walls of sufficient lengths shall be erected across the flow, at intervals, all along the length to prevent suspended solids 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 methods 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 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, 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 of conditions of the approved mine closure plan before 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 reclamate the area as mentioned in the Mine Closure

Plan, the deposit shall be forfeited and the Department of Mines & Geology ensure's the proper implementation of the Mine Closure Plan.

2.9 Risk Assessment & Disaster Management Plan

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

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

a) Fire fighting 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, facility available nearby

g) List of first aiders and contacts.

h) 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 functioning of District Mines and geology Officer, Alluri Sitharama Raju 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 lease holders on the minerals produced and intend to dispatch from their leased areas through online permit system

5. 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 the penalties

6. Finalisation of Demand, Collection and Balance statements of the leases on 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 Alluri Sitharama Raju District

3.1.1 General Sand Mineral Details Alluri Sitharama Raju District

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

In Alluri Sitharama Raju District, the major rivers are Gosthani, Nagavali, Pampa, Sarada, Suddagedda, Thandava, Varaha, and Yeleru. These rivers are key contributors to sand deposits. The sand rivers are seasonal, mostly flowing during the rainy season. The Alluri Sitharamaraju District Mines Office has recently been formed as per the district bifurcation, so the production of sand information has not been available in the last three years, as shown in Table-18

Table 18 Details of Production of Sand in the last three years in the District

Si. No.	Year	Production of Sand in CBM/Tons	Revenue Generated (in Rs)
1	2020-21	--	--
2	2021-22	0	0
3	2022-23	26,845	23,62,360

Data Source: Assistant Director of Mines and Geology, Alluri Sitharama RajuDistrict, Andhra Pradesh

3.1.2 River Basins in Alluri Sitharama Raju District

In Alluri Sitharama Raju district there are 10 major river basins i.e., Godavari, Yeleru, Suddagedda, Pampa, Thandava, Varaha, Sarada, Gosthani, Champavathi and Nagavali basins. The Godavari and Yeleru major river basins are covered with 83% of the total area in the district and remaining part partially covered with Suddagedda, Pampa, Thandava, Varaha, Sarada, Gosthani, Champavathi and Nagavali basins.

The district consists of the hilly regions covered by the Eastern Ghats with an altitude of about 1,500m. The Godavari tributaries of Sabari, Pamuleru, Sethapallivagu, Burdakalva and Yeleru, Suddagedda, Pampa, Varaha, Thandava, Sarada, Gosthani and Champavathi rivers are originates in Eastern Ghats of Alluri Sitharama Raju district. The hydrological units of

ASR district is shown in Table-19, Drainage system with description of main rivers are shown in the Table-20.

Table 19 Hydrological units of Alluri Sitharama Raju District

S. No	Major Basin	Minor Basin	Catchment Area (Sq.km)	No. of Tanks
1	Champavathi	Champavathi	131.09	12
2	Godavari	Minor Vagu Joining Godavari	242.72	2
3		Sabari	5,385.31	191
4		Sethapallivagu	606.94	42
5		Burdakalva	381.46	100
6		Pamuleru	769.74	0
7		Lower Godavari	857.66	198
8	Gosthani	Gosthani	372.71	26
9	Nagavali	Nagavali	64.30	0
10	Pampa	Pampa	22.92	0
11	Sarada	Sarada	898.54	5
12	Suddagedda	Suddagedda	80.92	13
13	Thandava	Thandava	424.60	18
14	Varaha	Varaha	183.96	0
15	Yeleru	Yeleru	2,208.70	158
		Total	**12,631.56**	**765**

Data source: APSAC, Vijayawada

Table 20 Drainage System with Description of main Rivers

S. No	Name of the River	Area Drained (Sq.Km)	% of Area Drained in the district
1	Sabari	5,385.31	42.63
2	Yeleru	2,208.70	17.49
3	Sarada	898.54	7.11
4	Lower Godavari	857.66	6.79
5	Pamuleru	769.74	6.09
6	Sethapallivagu	606.94	4.80
7	Thandava	424.60	3.36
8	Burdakalva	381.46	3.02
9	Gosthani	372.71	2.95
10	Minor Vagu Joining Godavari	242.72	1.92
11	Varaha	183.96	1.46
12	Champavathi	131.09	1.04
13	Suddagedda	80.92	0.64
14	Nagavali	64.30	0.51
15	Pampa	22.92	0.18

Data source: APSAC, Vijayawada

The catchment area of each river basin is delineated by using master plan records and updated with survey of India toposheets (1:50K). The Godavari and Yeleru river basins catchment areas are 8,243.83 Sq.km and 2,208.70 Sq.km in the district. The district having total number of

tanks including ponds and minor irrigation tanks 765. Salient features and altitudes origin of rivers shown in the Table-21 and River's lengths of ASR district are shown in Table-22.

Table 21 Salient Features of Important Rivers in Alluri Sitharama Raju District

S. No	Name of the River	Place of Origin	Altitude at Origin (m)
1	Godavari	Nasikatrayambkam, Maharastra	1,067
2	Yeleru	Puttakota RF, Koyyeru mandal in Alluri Sitharama Raju district	1,269
3	Sabari	Eastern Ghats, Vantala RF, G Madugula mandal in Alluri Sitharama Raju district	1,573
4	Pamuleru	Puttakota RF, Koyyeru mandal in Alluri Sitharama Raju district	1,160
5	Sethapallivagu	Maredumilli RF, Maredumilli mandal in Alluri Sitharama Raju district	918
6	Burdakalva	Bandapalli RF and Lakkonda RF, Gangavaram mandal in Alluri Sitharama Raju district	504
7	Suddagedda	Vatangi RF, Rajavommangi mandal in Alluri Sitharama Raju district.	699
8	Pampa	Lododdi RF, Rajavommangi mandal in Alluri Sitharama Raju district	827
9	Varaha	Sanivaram RF, Chintapalle mandal in Alluri Sitharama Raju district	1,164
10	Thandava	Bointi RF, G K Veedhi mandal in Alluri Sitharama Raju district	1,412
11	Sarada	Ananthagiri RF, Ananthagiri mandal in Alluri Sitharama Raju district	1,565
12	Gosthani	Eastern Ghats, Ananthagiri hills, Borra Caves of Alluri Sitharama Raju district	1,278
13	Nagavali	Thuamul Rampur block, Kalahandi District of Odisha state	1,300
14	Champavathi	Eastern Ghats, Ananthagiri hills, Aruku Valley in Alluri Sitharama Raju district	1,291

Data source: APSAC, Vijayawada

Table 22 Rivers Lengths in Alluri Sitharama Raju District

S.No	Name of the Major Basin	Name of the Minor Basin	Name of the River	River Length in Km
1	Champavathi	Champavathi	Champavati River	15.98
2	Godavari	Burdakalva	Burada Kalava	51.92
3			Pedda Kalava	21.99
4			Uppudu Kalava	6.28
5		Lower Godavari	Alugu Vagu	15.53
6			Godavari River	9.49
7			Kasu Vagu	5.40
8			Nandigama Vagu	16.90
9			Pedda Vagu	6.30

10			Turubaka Vagu	3.86
11		Minor Vagu Joining Godavari	Akuru Kalava	15.67
12			Godavari River	425.84
13			Pamuleru Vagu	66.29
14		Pamuleru	Babihukka Nadi	6.36
15			Kondleru Vagu	26.91
16			Pamuleru Vagu	0.14
17			Sangva Vagu	5.86
18			Vantenarevu Vagu	2.75
19		Sabari	Alumeru Vagu	11.47
20			Andar Vagu	32.11
21			Budu Gedda River	32.78
22			Chandra Vanka	38.54
23			Chilaka Vagu	2.94
24			Dippa Gedda	32.56
25			Gede Gedda	12.79
26			Ginnelakota Gedda	53.32
27			Kilumulu Revu	17.67
28			Kukurhagarh Nadi	6.74
29			Kumuda Gadda Nadi	18.15
30			Machhakunda River	72.71
31			Madigamallu Revu	14.18
32			Manipa Revu	16.27
33			Mundi Gedda	28.55
34			Muratal Gedda	18.54
35			Musali Madugu	61.42
36			Narangijodi Gedda	10.52
37			Pala Eru	7.71
38			Patala River	28.23
39			Pedda Gedda	18.75
40			Pedda Vagu	8.92
41			Pilla Vagu	10.20
42			pita Garh	4.07
43			Pulusu Vagu	1.59
44			Pusu Vagu	12.41
45			Ralla Revu	8.23
46			Reyyilagedda Nadi	8.81
47			Sabari River	44.90
48			Sapa Gedda	2.45
49			Sileru River	38.08
50			Sokal Eru	42.92
51			Taber Kalva	23.24
52			Tadika Vagu	13.37
53			Tikkala Gedda	6.82
54			Valasa Gedda	11.84
55		Sethapallivagu	pala Kalva	9.02
56			Rampa kalva	18.50
57			Sitapalli Vagu	18.14
58	Gosthani	Gosthani	Gostani River	35.92
59	Sarada	Sarada	Iska Gedda	5.61
60			Pedda Eru	30.86
61			Sarada River	43.58
62	Thandava	Thandava	Tandava Nadi	98.63
63	Varaha	Varaha	Tulabada Gedda	7.63
64	Yeleru	Yeleru	Doni Gedda	15.09

65			Kanneru Nadi	37.09
66			Maddi Gedda	5.05
67			Madi Eru	48.61
68			Vatti Gedda	12.75
69			Yaleru River	150.39
			Total	**2,014.18**

Data Source : APSAC, Vijayawada

3.1.2.1. The Godavari River: The Godavari River is India's second longest river after the Ganga River and drains into the third largest basin in India, covering about 10% of India's total geographical area. Its source is in Trimbakeshwar, Nashik, Maharashtra. It flows east for 1,465 kilometres (910 mi), draining the states of Maharashtra (48.6%), Telangana (18.8%), Andhra Pradesh (4.5%), Chhattisgarh (10.9%) and Odisha (5.7%). The river ultimately empties into the Bay of Bengal through an extensive network of distributaries.[6] Measuring up to 312,812 km2 (120,777 sq mi), it forms one of the largest river basins in the Indian subcontinent, with only the Ganga and Indus rivers having a larger drainage basin.[7] In terms of length, catchment area and discharge, the Godavari is the largest in peninsular India, and had been dubbed as the Dakshina Ganga (Southern Ganges).

3.1.2.2. River Champavathi is a small river which originates in the Eastern Ghats at an altitude of 1,200 metres above mean sea level near Andra village and flows eastwards and joins the Bay of Bengal near the village Konada. The river passes through Gajapathinagaram, Nellimarla, Saripalli, Denkada, Palem and Natavalasa of Vizianagaram district. The river has four main tributaries Eduvampula Gedda, Chitta Gedda, Pothula Gedda and Gadi Gedda. The basin has a drainage area of 1,410 square kilometres. This area is divisible into Hilly terrain (Madugula hills), Vizianagaram plains and Coastal plains

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 is 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 that 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 being 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-21).

The bedload contains two main components:

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

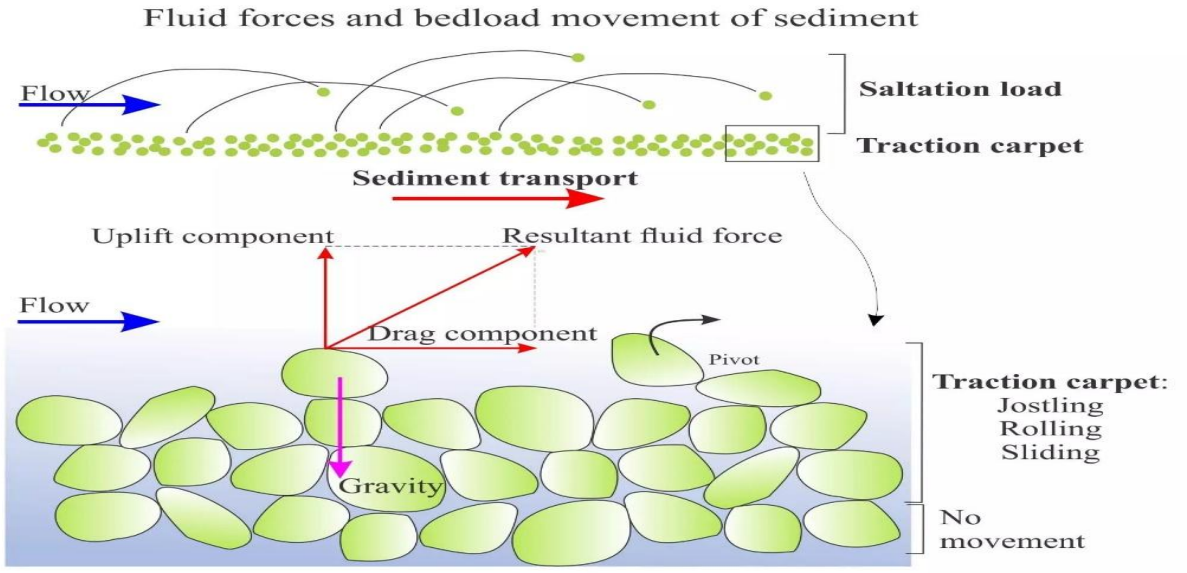

Figure-21: Bedload Movement of Sediment

The various components of force involved in 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**.

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 to 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 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-22).

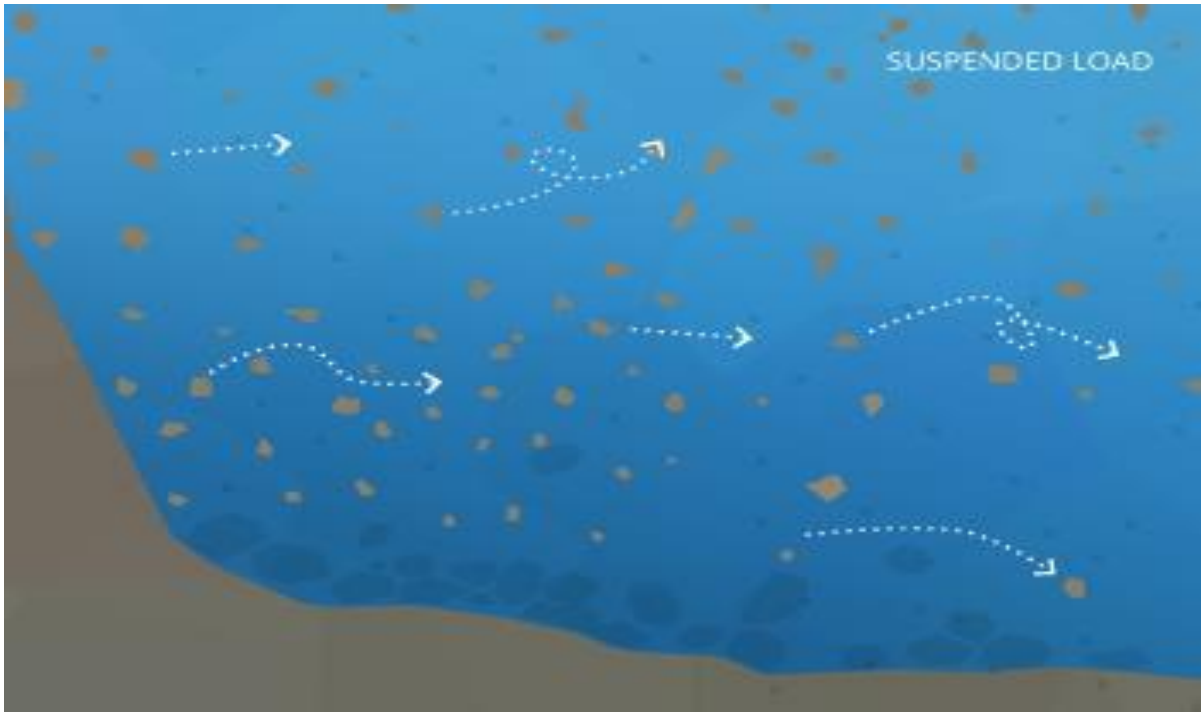

Figure-22: Sediment Load

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 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-23).

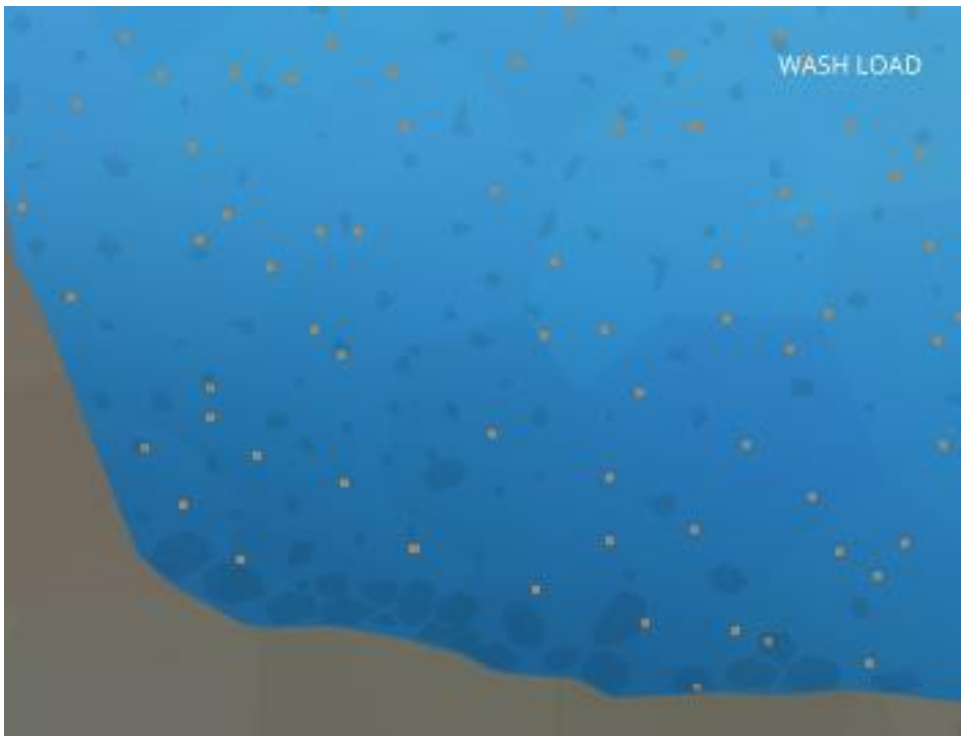

Figure-23: Wash Load

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-24).

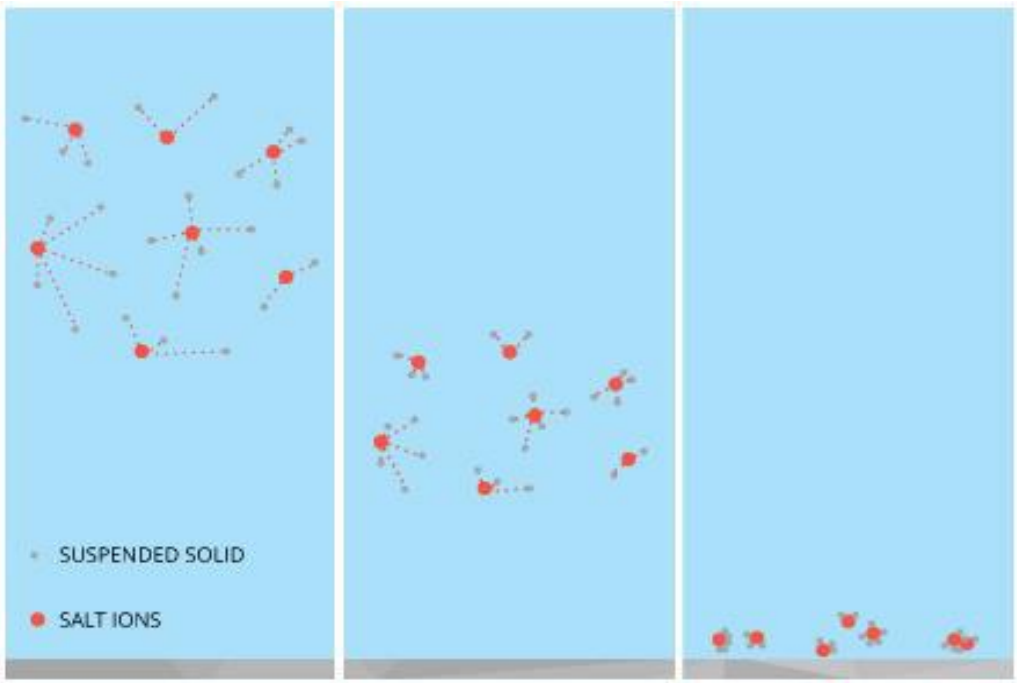

Figure-24: Settleable Solids

3.1.3.5. Sediment Deposition

Sediment is necessary to the development of aquatic ecosystems through nutrient replenishment and the creation of benthic habitat 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 depends upon various factors like Slope of the Area, Annual Rainfall, Lithology, flow intensity of 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 characterised 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 the tendency to attract organic material and contaminants to their surface. A great deal has been researched and written about the break up 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 characterised by coarser materials. This reflects the energy of the water in which the particles become suspended and their subsequent fate (Figure-25).

Rates of transport of material are generally expressed in terms of a 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)

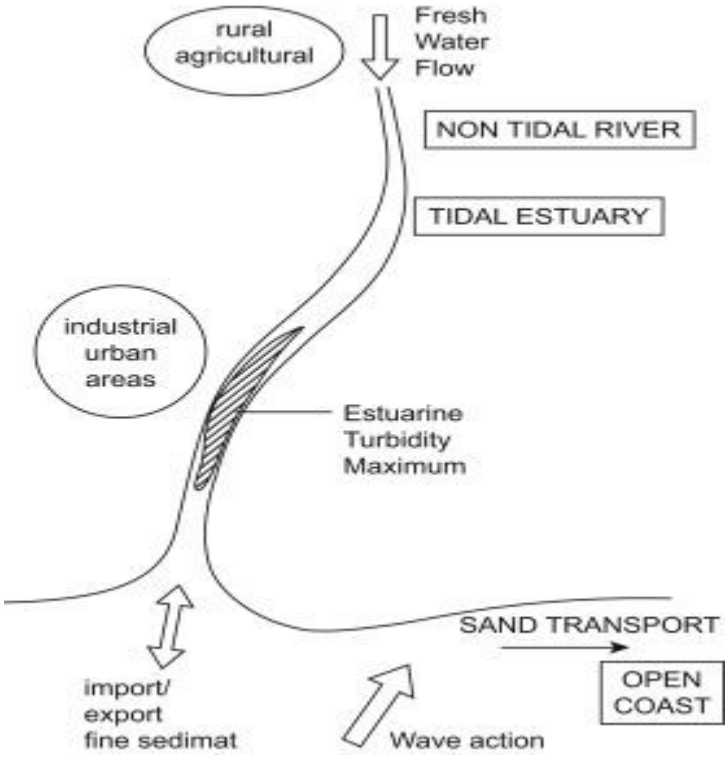

Figure-25: Sediment Deposition Process

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.

Annual Replenishment Rate for sand for Major Sand Resource Area is determined using 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: Types of 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
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.

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. 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, 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 Godavari River in Alluri Sitharama Raju district is situated in upstream of the Polavaram Barrage. For calculation of sediment yield, the total realization of the Polavaram Barrage for water year 2022-23 (June 2022 to May 2023) of6,250.56 TMC is taken as run-off.

Rest of the rivers in Alluri Sitharama Raju district are of 3rd Order streams. The Sand extraction in Alluri Sitharama Raju District shall be as per Rule 23(1)(a) of AP Water Land and Tree Rules, 2004 where the transportation of sand shall be by means of bullock carts/ Tractors for the local use.

In case, if the sand deposition exceeds 5,000 Cu.M in a part of the stretch, then manual mining shall be permitted after obtaining Statutory Clearances. the District Collector shall put in place proper administrative mechanism for enforcement of WALTA regulations in extraction and transportation of sand in I, II & III order streams.

Sand extraction is permitted for commercial usage in sand reaches of III Order streams having sand deposition of more than 5,000 Cum, after obtaining AMP, EC, CFE & CFO (G.O. Ms. No. 2, PR&RD Dept, dated 06.01.2022).

Annual Replenishment Rate for sand for Major Sand Resource Area is determined using emperial mathematical expression Dendy Bolton Equation and the data obtained from Water Resources Dept., GoAP was used and reproduced below:

For Average Annual Run-off less than 2”

$$S = 1280 \times Q0.46\ [1.43 - 0.26 \log(A)] \text{-------- FORMULA (A)}$$

For Average Annual Run-off more than 2”

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

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 Godavari River in Alluri Sitharama Raju District is arrived based on the above Dendy Bolton Equation or Formula (B). The Sedimentation yield for Godavari River in Alluri Sitharama Raju District is shown in Table-24.

Table 24 Sedimentation yield from Godavari River (upstream) in Alluri Sitharama Raju 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 (tons)
Godavari	8,243.83	58.82	314.77	25,94,871*

Data Source: District of Mines and Geology, Alluri Sitharama Raju District, Andhra Pradesh

***Note**: The sedimentation yield was calculated manually by APSAC and the value is **28,59,445 Tons/ year**. The details are provided as an Annexure at page number 128-129.

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

3.1.5 Details of Sand Mining Leases:

Name of the river	List of Mandals
Godavari	Yetapaka

Data Source: District of Mines and Geology, Alluri Sitharama Raju District, Andhra Pradesh

Proposed potential Sand Mining Leases in Allur Sitharama Raju district are shown in Table-25.

Table 25 The detail of Potential Sand Mining Leases

Reach Name	Quantity (in MTs)	Geo-Coordinates	Remarks
Kanayagudem/2022-14	64500	170 43’ 13.94’’ N, 800 53’ 45.60’’E 170 43’ 19.95’’N, 800 53’ 46.72’’E 170 43’ 18.08’’N, 800 53’ 54.27’’E 170 43’ 12.34’’N, 800 53’ 53.05’’E	Proposed
Kanayagudem/2022-15	61500	170 43’ 42.11’’N, 800 53’ 49.92’’E 170 43’ 38.02’’N, 800 53’ 49.97’’E 170 43’ 36.45’’N, 800 53’ 59.19’’E, 170 43’ 41.59’’N, 800 53’ 59.64’’E,	Proposed
Yetapaka/2022-16	63600	170 41’ 58.65’’N, 800 53’ 44.97’’ E, 170 41’ 51.79’’N, 800 53’ 44.49’’ E, 170 41’ 51.10’’N, 800 53’ 51.25’’ E, 170 41’ 57.59’’N, 800 53’ 51.72’’ E	Proposed
Yetapaka/2022-17	60000	170 42’ 23.28’’N, 800 53’ 46.62’’ E 170 42’ 17.95’’N, 800 53’ 47.05’’ E 170 42’ 18.39’’N, 800 53’ 54.46’’ E 170 42’ 24.15’’N, 800 53’ 54.68’’ E	Proposed
Gundala/2022-18	60000	170 38’ 33.52’’N, 800 55’ 32.11’’ E 170 38’ 25.61’’N, 800 55’ 32.51’’ E 170 38’ 25.42’’N, 800 55’ 37.77’’ E 170 38’ 33.69’’N, 800 55’ 37.60’’ E	Proposed
Gundala/2022-19	63000	170 38’ 31.36’’N, 800 55’ 55.52’’ E 170 38’ 23.48’’N, 800 55’ 55.46’’ E 170 38’ 23.22’’N, 800 56’ 1.27’’ E 170 38’ 30.79’’N, 800 56’ 1.34’’ E	Proposed
Rayanapeta/2022-20	60000	170 38’ 38.25’’N, 800 57’ 12.73’’ E 170 38’ 32.70’’N, 800 57’ 15.05’’ E 170 38’ 35.52’’N, 800 57’ 21.96’’ E 170 38’ 40.94’’N, 800 57’ 18.82’’ E,	Proposed
Gommu-Koyagudem/2022-21	60000	170 36'24.59"N, 810 1'1.03"E 170 36'17.71"N, 810 0'57.25"E 170 36'15.06"N, 810 1'2.30"E, 170 36'22.02"N, 810 1'5.83"E	Proposed
Gommu-Koyagudem/2022-22	63000	170 36'13.62"N 810 1'24.81"E 170 36'7.55”N 870 1'22.67"E 170 36'5.29"N 810 1'28.70"E 170 36'11.86"N 810 1'31.56"E	Proposed
Gommu-Koyagudem/2022-23	48000	170 36'7.56"N 810 1'53.58"E 170 36'1.52"N 810 1'53.33"E 170 36'1.15"N 810 1'59.03"E 170 36'7.46"N 810 1'59.03"E	Proposed

Data Source: District Mines and Geology Officer, Alluri Sitharama Raju District, Andhra Pradesh

Probable Sand Mining reaches in Alluri Sitharama Raju district shown in Table-26. Name of the sand bearing index are given from North to South direction. The Probable Sand bearing areas were identified through field survey with the help of hand held GPS (Global Positional System) and the help of existing literature.

Table 26: Probable Sand bearing in the ASR District

S.No	Name of the River	Sand Bearing Area	Central Coordinates		Area in Ha.
			Longitude	Latitude	
1	Godavari River	A	80° 53' 43.043" E	17° 44' 7.656" N	83.17
2	Godavari River	B	80° 53' 45.210" E	17° 41' 35.016" N	16.43
3	Godavari River	C	80° 55' 4.470" E	17° 38' 34.241" N	38.06
4	Godavari River	D	80° 56' 6.961" E	17° 38' 12.870" N	13.94
5	Godavari River	E	81° 0' 50.250" E	17° 36' 13.632" N	22.67
6	Godavari River	F	81° 4' 46.556" E	17° 36' 57.438" N	129.04
7	Godavari River	G	81° 8' 29.542" E	17° 35' 5.332" N	151.7
8	Godavari River	H	81° 11' 4.355" E	17° 34' 36.529" N	81.4
9	Godavari River	I	81° 13' 24.864" E	17° 34' 6.047" N	46.95
10	Godavari River	J	81° 14' 47.191" E	17° 34' 22.043" N	36.98
11	Godavari River	K	81° 18' 49.904" E	17° 29' 36.397" N	16.35

Data Source: District Mines and Geology Officer, Alluri Sitharama Raju District, Andhra Pradesh

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

The details of potential de-siltation locations in Alluri Sitharama Raju District are shown in Table-27.

Table 27 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, Alluri Sitharama Raju District, Andhra Pradesh

3.1.7 Details of Patta Lands in the District:

The details of Patta Lands in the Alluri Sitharama Raju district are shown in Table-28.

Table 28 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, Alluri Sitharama Raju District, Andhra Pradesh

3.1.8 Details of M-Sand Plants in the District:

The details of Manufacturing Sand in Guntur district are shown in Table-29.

Table 29 Details of M-Sand Plants

Plant Name	Owner	District	Tehsil	Village	Geo-location	Quantity Tonnes/Annum
NIL There are no existing M - Sand units under this Alluri Sitharama Rajuoffice jurisdiction						

Data Source: District Mines and Geology Officer, Alluri Sitharama Raju District, Andhra Pradesh

3.1.9 Details of Cluster of Sand Mining Leases

The area of Cluster of Mining Leases in Alluri Sitharama Raju jurisdiction is shown in Table-30.

Table 30 Details Cluster of Mining Leases in Alluri Sitharama Raju 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, Alluri Sitharama Raju District, Andhra Pradesh

3.1.10 Details of Contiguous Clusters

The area of Contiguous Cluster of Sand Reaches in Alluri Sitharama Raju jurisdiction is shown in Table-31.

Table 31 Details of Contiguous Cluster of Sand Reaches in Alluri Sitharama Raju 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, Alluri Sitharama Raju District, Andhra Pradesh

3.1.11 Sand Reaches Details in Alluri Sitharama Raju District

The Department of Mines and Geology has already identified sand reach points in Alluri Sitharama Raju District. Furthermore, many sand reach points have been identified in places along the Godavari River. These sand reach points in administrative boundaries are shown in Figure-26 and Satellite map shown in Figure-27.

The probable sand-bearing areas were identified through field surveys with the help of handheld GPS (Global Positioning System) devices and existing literature. The probable sand-bearing areas in Alluri Sitharama Raju District are shown in Figure-28.

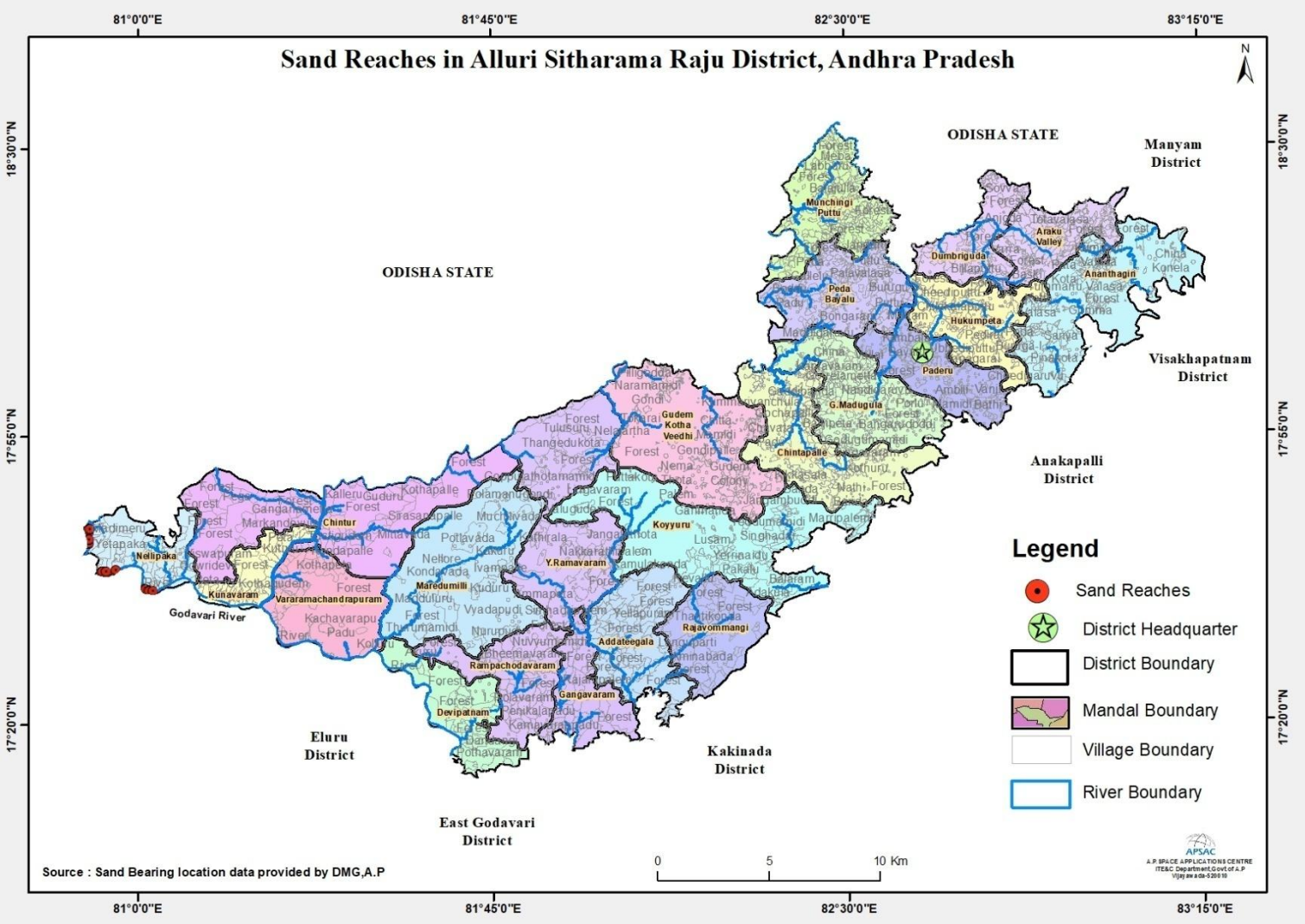

Figure-26: Sand reach map of Godavari River in ASR District

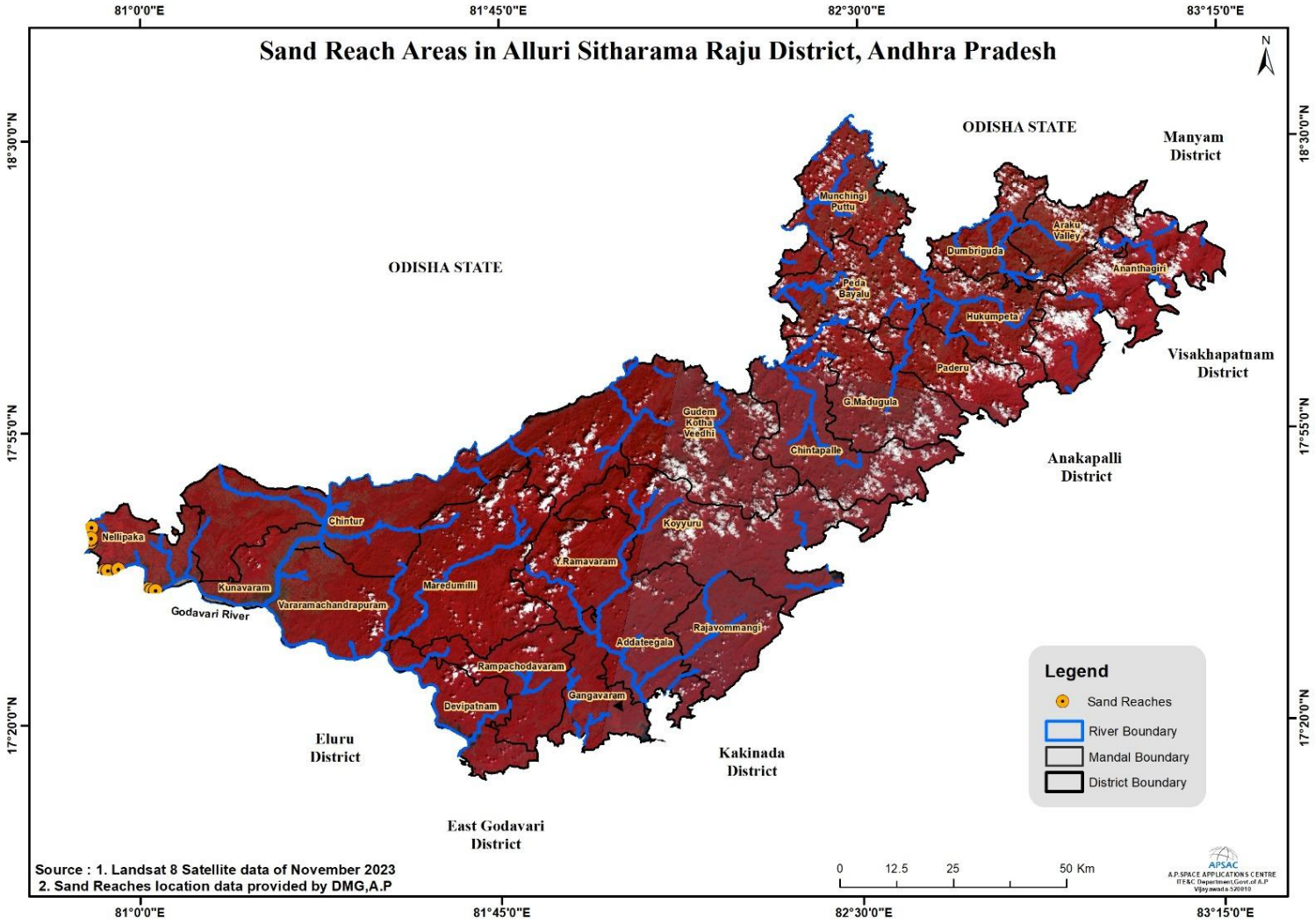

Figure-27: Satellite View of Godavari River sand reach map in ASR District

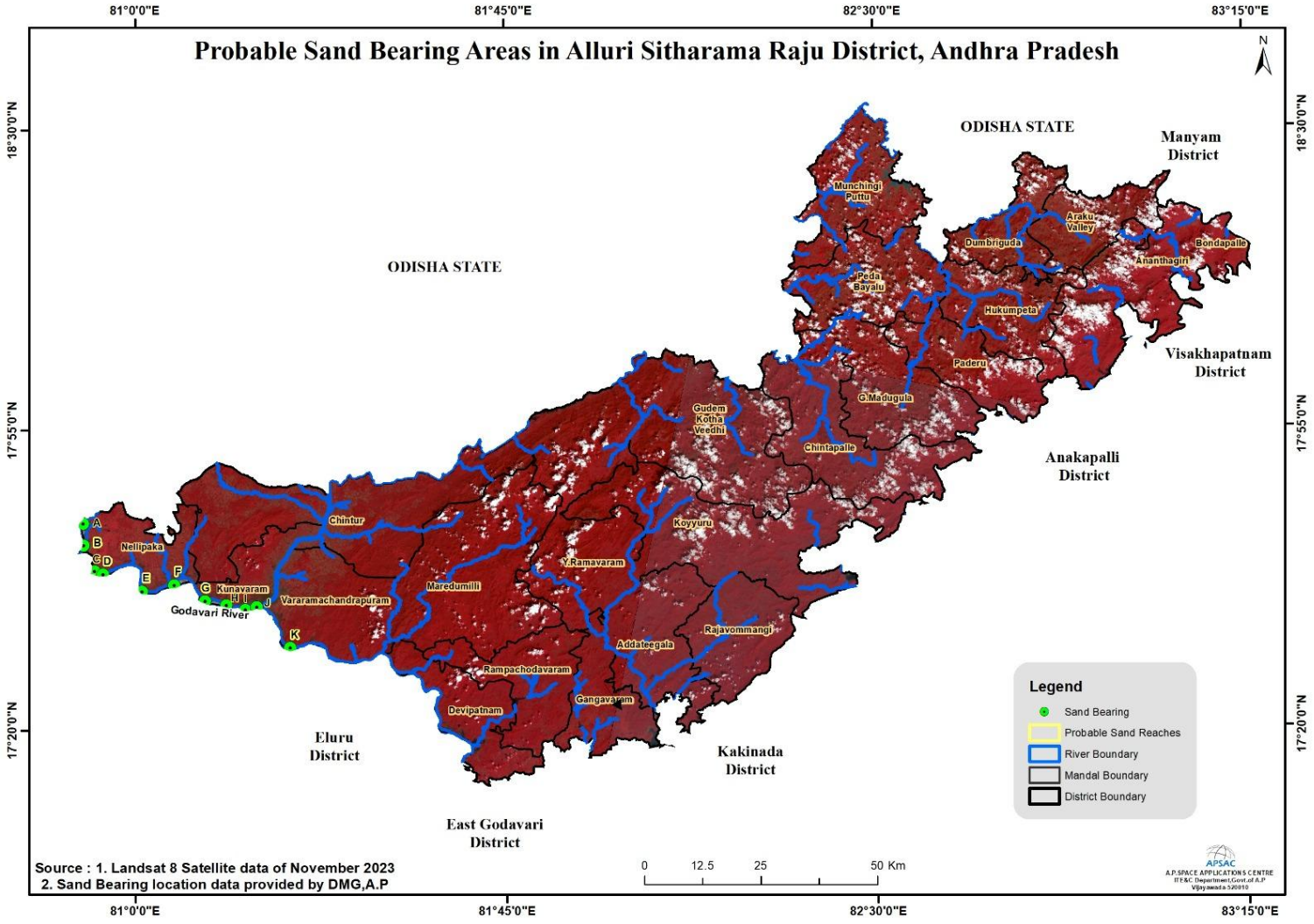

Figure-28: Probable Sand bearing areas in the District

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ANNEXURE

As the average annual run-off more than 2" in the Alluri Sitharama Raju District, the sedimentation yield for Godavari River in Alluri Sitharama Raju District, APSAC manually arrived the value 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 for the Godavari River in Alluri Sitharama Raju District

Name of the River	Area Drained (sq. km)	Mean Annual Run-off (in mm)
Godavari	8,243.83	58.82

Data Source: District Mines and Geology Officer, Alluri Sitharama Raju 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.

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

Drainage Area (A) = 8,243.83sq. Km (1 Sq.km = 0.386 Sq.mile)
= 8,243.83x 0.386
A = 3182.118 Sq.mile ----------(1)

Mean Annual Run-off (Q) = 58.82 mm (1 mm = 0.0393 inches)
= 58.82 x 0.0393
Q = 2.311626 inches ----------(2)

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

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

$S = 1965 \times (2.718^{-0.055 \times 2.311626}) [1.43 - 0.26 \log (3182.118)]$

Log 31 of 8 = 0.5024
0.2 = 3
As per base, the value = 3.0000
_____(+)
Log 3182.118 = 3.5027 ----------(4)

$= 1965 \times (2.718^{-0.055 \times 14.44118}) [1.43 - 0.26 \times 3.5027]$

$= 1965 \times (2.718^{-0.12714}) [1.43 - 0.91071]$

$= 1965 \times (2.718^{-0.12714}) [0.51929]$

The value of $2.718^{-0.12714}$
$1/2.718^{0.12714}$ = 0.880622 ----------(5)

$= 1965 \times 0.880622 \times 0.51929$

$= 898.598$

$S = 898.598$ **Tons/sq.mile/year** ----------(6)

For total district Sedimentation Yield =

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

898.598 x 3182.118 = 28,59,445

As the Sedimentation yield calculated manually,

The sedimentation in the total River

in the Alluri Sitharama Raju District = **28,59,445 Tons/ year**

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