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INTEGRATED TECHNIQUES TO IDENTIFY GROUNDWATER POTENTIAL REGION IN PALANI TALUK, TAMILNADU, INDIA USING ELECTRIC RESISTIVITY, REMOTE SENSING AND GIS TECHNIQUES

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ABSTRACT

Groundwater is a standout amongst the most significant natural assets, which supports human health, economic development and ecological diversity. Overexploitation and unabated contamination of this indispensable asset are undermining our biological systems and even the life of who and what is to come the present review to investigate groundwater potential at different regions in Palani Taluk, Tamilnadu, India. To decide the resistivity and thickness of the distinctive layers, Schlumberger Vertical Electrical Sounding review (VES) was done in 27 arbitrarily chose areas, where groundwater assumes a fundamental part in farming, local and modern district. The ground information was translated by IPI2WIN programming software to break down the resistivity and thickness of first and second layer fracture regions of the diverse layers. Consequences of the geophysical strategy were utilized to plan spatial distribution map by IDW tool device in GIS programming. By utilizing GIS (Geographical Information System) and RS (Remote Sensing) strategies standard methodology was proposed to recognize Groundwater potential region in Palani Taluk. The map was generated via GIS tools like IDW, overlay & etc. To obtain accurate results following parameters need to be considered such as slope, geology, drainage density, geomorphology along with lineament density map are generated by using Survey of India toposheets (SOI) of scale 1:50000 and satellite data. It is then coordinated with weighted overlay in ArcGIS and reasonable rank was allotted for every parameter. For instance, different parameters of topography units, weight components are chosen based on their ability to store groundwater. This methodology is rehashed for every single other layer and resultant layers are reclassified. Groundwater potential regions are grouped into four classifications from very poor to excellent in the review range. We have to superpose output map, groundwater potential region district distinguished by the geophysical method and groundwater potential region recognized by GIS and Remote Sensing. The resultant map gives us most favorable locations which are identified by low resistivity and more thickness (geophysical method) within areas comes under the good and excellent region of groundwater potential region (GIS & Remote sensing) in the review region. Accurate location can be identified in the study region, which helps to construct suitable recharge region structure to improve the groundwater level.

Keywords: groundwater, geographical information system, geophysical data, electric resistivity, remote sensing, potential regions.

1. INTRODUCTION

Groundwater is one of the prime wellsprings of consumable water. It is a major resource for agriculture, industries, and human consumption. The appearance of current innovations and the man's expanding mission for ideal utilization of the accessible common assets had its effect on the groundwater; without any proper planning of recharge of groundwater, too much of groundwater was extracted. In India, Groundwater represents over half of aggregate irrigated territory, 80% of drinking water and other residential prerequisites and a sizable part of mechanical necessities. Along these lines the size of extraction of ground water requires no specifying, causing unfriendly impacts on the hydrologic adjust and nature of water. Farming is the primary movement for the dominance of the number of inhabitants in the review region. The fundamental hotspot for water system in the territory is groundwater. Groundwater is the biggest accessible wellspring of fresh water. It has turned out to be urgent to discover groundwater potential regions as well as to screen and monitor this critical asset [1]. GIS overlay examination is very useful in finding the groundwater potential regions [2-3].

At the point when contrasted with other geophysical techniques Schlumberger resistivity study is the most reasonable strategy for groundwater examinations in hard rock region. Geophysical overviews for groundwater investigation in hard rock regions have been endeavored by many authors [4-9]. The geophysical strategy is generally utilized as a part of delicate and hard rock regions [10].

Remote sensing and GIS strategies utilized for groundwater investigation in hard rock territories have been endeavored by many authors [11-15].

Palani Taluk, Dindigul District, Tamilnadu, India has been confronting a serious water deficiency issue for both irrigation and residential purposes in the course of recent years. Consistently in summer most surface water sources become scarce, causing genuine water deficiencies for both household and irrigation purposes. What's more, in light of the fanciful way of the southwest monsoon in India, the accessibility of surface water can't be guaranteed in the correct amount at the required time Palani Taluk, Tamilnadu. Hence, the majority of the irrigated region in the Shanmuganathi basin is being cultivated with the help of groundwater acquired from dug wells and tube wells. In any case, the unlimited over the excessive pumping of groundwater has brought about groundwater bringing down in a few sections of the review territory. dug wells and hand pumps additionally end up plainly defective consistently amid the dry time frame, along these lines irritating the water issue in the review region. To date, extremely constrained reviews utilizing Geoinformatics systems have been led in Peninsular India as a rule and Western Ghats of Tamilnadu specifically. Accordingly, the target of the present review was to distinguish groundwater potential region in the Palani Taluk. Therefore, the present study objective was to identify groundwater potential region in the Palani Taluk, Dindigul District, Tamilnadu by considering suitable thematic layers that have indirect and/or direct power over groundwater occurrence using electrical resistivity, GIS & Remote Sensing technology.

2. STUDY AREA

The review region lies between the latitudes 10°20'2'' N to 10°38'24'' N as well as longitudes 77°18'6'' E to 77°35'41'' E covering a region of 766.83 km^2 . Out of which plain land covers a region of 649.98 km^2 (figure 1). The review territory goes under in Dindigul area of Tamilnadu.. The significant wellspring of revive of water around there is precipitation, amid storm season. The normal average rainfall is 690mm for 33 years (1980 - 2013). As the review region is underlain by Archean crystalline rocks, groundwater for the most part happened in the fractured regions.

2.1 Geophysical survey methodology

Base map, Geology was prepared from Survey of India [16] toposheet of scale 1:50,000. A geophysical study was more costly and tedious technique, So Schlumberger Vertical Electrical Soundings (VES) the corresponding field study was carried out at 27 randomly selected locations (Figure-2) in Palani taluk, where groundwater is frequently necessary for household and irrigation purpose. Geophysical Schlumberger VES field survey was completed most extreme electrode spacing, dividing of 250 m. the current electrode (AB/2) spacing separating from 0.5 to 125 m and the potential electrode (MN/2) dispersing differed from 0.2 to 15 m. once the field information was gathered, it was translated by IPI2WIN programming software to decide the thickness and resistivity of various layers. They results were imported into GIS programe. Using IDW (spatial analysis) tools, interpolation map was prepared. The output map of thickness and resistivity layers of first and second fractured region was accomplished by using Inverse Distance Weightage methods. This map was superimposed over geology map [17]. The suitable region for groundwater having low or very low resistivity with high or very high thickness areas was identified in stuy region.

2.2 Remote sensing methodology

Base map, Geology, Drainage map was collected from SOI (Survey of India) toposheet of scale 1:50,000. Geomorphology, Lineament, Landuse and Landcover map be primed from LISS III RESOURCESAT - I, image and slope map were prepared from Cartosat satellite image. To prepare various thematic layers, the collected map was scanned, traced, digitized and geo-referenced in Remote Sensing program & GIS software. The whole thematic map were reclassify and appropriate rank and weight were doled out to them, all reclassify thematic layers was overlay with GIS software to find the incorporated yield of potential regions of groundwater at present study region. It was sort out by 4 types such as excellent, good, moderate as well as poor groundwater potential region.

In the wake of getting two groundwater potential region outcomes about (one from the Geophysical technique and another from RS and GIS strategy) two map was joined to get overall final output map, by utilizing the overall final output map we can choose a correct area by low electric resistivity with more thickness with good or excellent potential of groundwater regions.

3. RESULTS AND DISCUSSIONS

3.1. Demarcating groundwater potential region using electrical resistivity survey

The VES field overview comes about appeared in Table-1, outfit the topsoil resistivity & thickness, weathered region resistivity & thickness and First and second region resistivity & thickness values. This outcome be imported in GIS environment as a point attribute.

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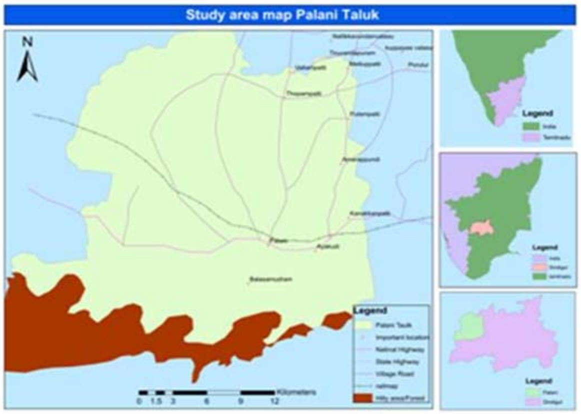

Figure-1. Study area map Palani Taluk .

Figure-2. VES survey location map.

Table-1. Geophysical examinations area and its fracture regions resistivity and fracture regions thickness and VES curve are stated.

VES No.	Station name	Resistivity Ohm-m				Thickness (m)				Total thickness (m)	Curve types
		ρ1	ρ2	ρ3	ρ4	h1	h2	h3	h4		
1	Balasamudhram	0.57	225.31	4985.02	41324.00	1.74	0.45	22.45	54.41	79.05	AA
2	Vellampatti	0.48	2014	3498.14	12445.23	0.021	1.3	8.45	70.45	80.221	AA
3	Ayakudi	0.61	812.45	647.24	1899.70	1.54	2.54	23.45	60.57	88.1	KH
4	Tiruvanadapuram	0.94	1.48	2900.09	2015.00	0.34	0.21	49.41	10.24	60.2	AK
5	Amarappundi	2.14	4066.24	3704.5	889.24	1.92	2.24	8.14	30.21	42.51	KQ
6	Mettuppatti	3.47	218.24	2304.15	6155.20	0.24	1.24	4.54	22.31	28.33	AA
7	Pulampatti	12.14	7.41	5098.54	16792.24	0.3	1.38	13.27	31.21	46.16	HA
8	Kannivadi	1.47	417	6205.8	5259.00	1.68	0.45	1.92	61.1	65.15	AK
9	Talaiyuthu	78.47	8.56	842.68	2457.00	0.31	1.31	9.04	46.45	57.11	HA
10	Thoppampatti	22.14	214.46	32011.26	12656.00	0.023	0.004	12.14	59.14	71.307	AK
11	Palani	1.47	0.82	1200.24	2878.87	0.38	2.94	1.47	27.14	31.93	HA
12	Pushpattur	0.98	9.47	2022.48	1438.21	0.47	0.94	27.11	9.24	37.76	AK
13	Neikarapatti	0.54	0.21	4159.24	1589.00	1.42	1.78	5.67	38.74	47.61	HK
14	Andipatti	1.45	27.84	920.25	7145.24	0.06	0.04	3.25	17.38	20.73	AA
15	Paraipatti	6.47	1.44	3042.35	62725.00	0.41	0.97	15.24	57.41	74.03	HA
16	A.Kalaiyamuthur	23.89	4.57	507	18271.60	0.37	0.87	52.14	58.24	111.62	HA
17	Palani -Paraipatti	15.89	4127.56	3737.17	37858.04	0.5	1.45	44.59	69.14	115.68	KH
18	Palani -Dharapuram	17.48	0.24	4581.26	6248.00	0.39	1.48	9.45	62.98	74.3	HA
19	Muthunayakanpatti	3.19	0.67	12214.04	2724.00	0.27	0.09	46.28	67.23	113.87	HK
20	Kannakanpatti	1.78	497	667.48	2146.00	1.54	2.45	19.24	32.24	55.47	AA
21	Mapoor	2.45	0.21	21114.87	37524.94	1.23	0.04	10.59	67.24	79.1	HA
22	Kiranoor	22.14	1.48	5257.47	14545.32	1.74	2.81	24.87	64.21	93.63	KA
23	Rajampatti	16.24	332.24	5105.21	8541.20	0.34	1.11	33.38	41.26	76.09	AA
24	Kovilampatti	40.26	23.27	4145.87	6498.24	0.48	0.91	2.31	10.49	14.19	HA
25	Korikadavu	6.21	56.97	3147.23	2499.21	0.41	3.45	12.48	65.69	82.03	AK
26	Chitarevu	0.47	1.24	798.25	3147.21	0.29	0.07	2.45	49.24	52.05	AA
27	Vilvethampatti	56.24	9.24	145.36	1357.05	0.25	2.87	23.24	19.24	45.6	HA

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3.1.1 Thickness and resistivity of fracture regions

The result of the analysis giving first and second fractured layers of minimum and maximum resistivity and thickness values are exposed in Table-2. The highest value of electrical resistivity indicates that the formation is compact at this depth. It is also evidenced in the field that, the borehole is drilled nearby this location does not yield a good amount of water. The values of low resistivity designates the water-bearing formation. The areas having low resistivity with high thickness value yield good groundwater. in our study area low resistivity with high thickness value falls in second fracture region, village name A. Kalaiyamuthur, having a high thickness of 52.14m with resistivity low of 507 Ωm. The field or ground evidence too proves that low resistivity (LR) areas with resistivity value of 507 ohm-m yield good groundwater at a depth of 52.14m. Similarly, the high thickness region indicates a good amount of groundwater storage.

Table-2. Maximum and minimum values of first layer resistivity and thickness variation in Palani taluk.

Fractured layer	Max./Min.	Village name	Fracture region resistivity and thickness	Village name	Fracture region thickness and resistivity
First fractured layer	Maximum	Thoppampatti	32011.26 Ωm (12.14m)	A.Kalaiyamuthur	52.14 m (507 Ωm)
	Minimum	Vilvethampatti	145.36 Ωm (23.24m)	Palani	1.47 m (1200.24 Ωm)
Second fractured layer	Maximum	Paraipatti	62725.00 Ωm (57.41m)	Vellampatti	70.45 m (12445.23Ωm)
	Minimum	Amarappundi	889.24 Ωm (30.21m)	Pushpattur	9.24 m (1438.21Ωm)

3.1.2 GIS analysis

The fracture region first layer resistivity map (Figure-3a) was superimposed over fracture region first layer thickness map (Figure-3b) and output map 1 (Figure-3c) was derived. Result show 15 numbers of combinations. The fifteen combinations are LT- VLR, LT-LR, LT-MR, LT-HR, MT-VLR, MT-LR, MT-MR, MT-HR, HT-VLR, HT- LR, HT-MR, HT-HR, VHT-VLR, VHT-LR,VHT-MR Among these HT& LR (Low Resistivity and High Thickness) 13 number of combination covers a large area of 97km^2, due to shallow depth, this area is appropriate for dug well construction Similarly, the fracture region second layer resistivity map (Figure-4a) was superimposed over fracture region second layer thickness map (Figure-4b) and the output map-2 (Figure-4c) was derived. Results show 13 number of the combination. Among these MT&LR (Low Resistivity and Medium Thickness) combination covers a large area of 97.16 km^2 this combination show the deeper depth of water for this area tube well need to be considered.

The output map 1 (Figure-3c) was superposed with output map 2 (Figure-4c) which was overlaid by geology (S. Venkateshwaran, *et al* (2014)) the resultant output map 3 (Figure-5) which has 107 combinations types, among them, few combination are shown below (Figure-6).

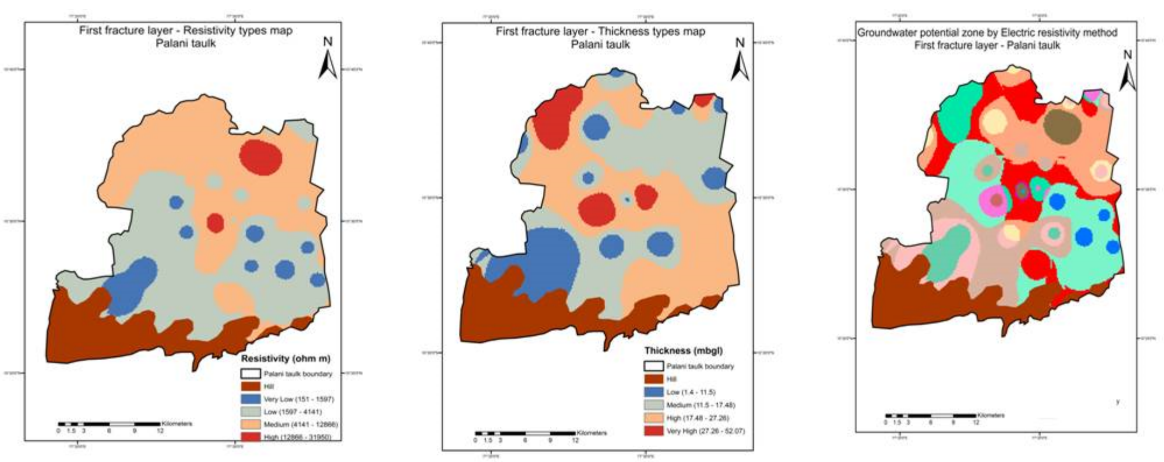

Figure-3. (a) Spatial distribution map of first fracture layer- resistivity map types-Palani Taluk,
(b) Spatial distribution map of first fracture layer-thickness map types-Palani Taluk,
(c) Spatial distribution map of GWP of first fracture layer Palani Taluk

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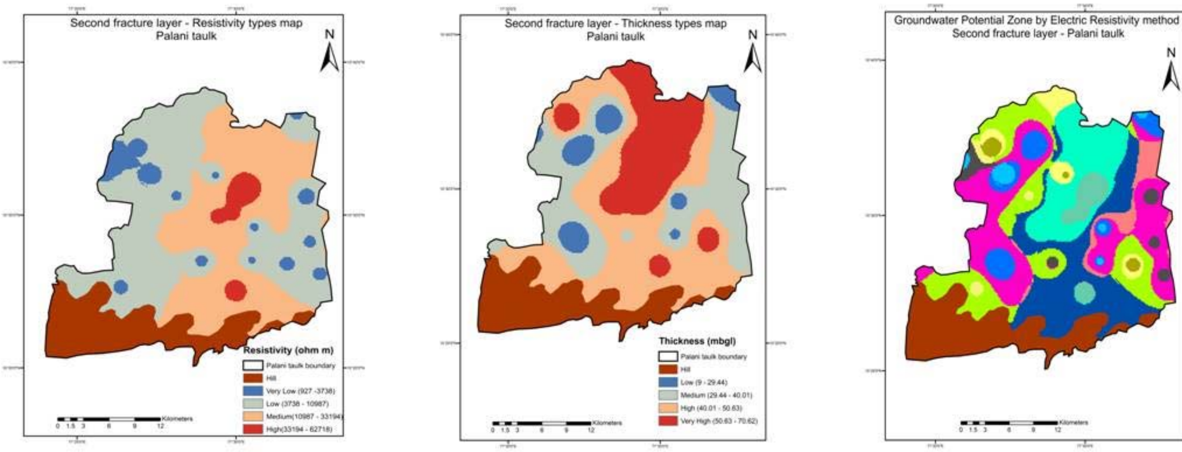
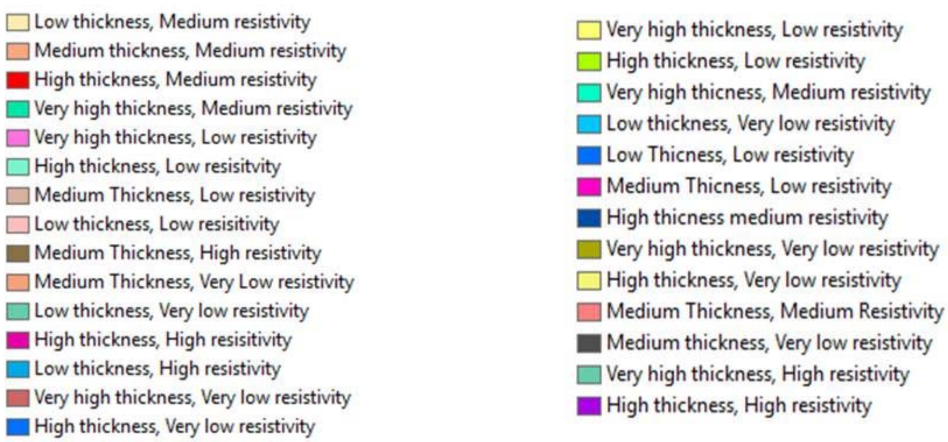


Figure-4. (a) Spatial distribution map of second fracture layer-resistivity map types-Palani Taluk, **(b)**Spatial distribution map of second fracture layer-thickness map types-Palani Taluk, **(c)** Spatial distribution map of GWP of second fractured layer-Palani Taluk



Among this combination most favorable and favorable locations of groundwater potential area locations fall on hornblende-biotite gneiss lithology Because most of the part in study area comes under hornblende-biotite gneiss lithology. HT&LR, HT&LR, hornblende-biotite gneiss covers 21.08 Km^2 and HT&LR, MT&LR and hornblende-biotite gneiss cover 27.02 Km^2 are high groundwater potential region which was also verified in the field. Most favorable groundwater potential region covers 25.51Km^2 and favorable groundwater potential region covers 31.32Km^2.

3.2 Groundwater potential region by remote sensing and GIS

The groundwater potential map is prepared by giving appropriate weight and rank to various thematic layers:

Geology map, Geomorphology map, Slope map, Drainage density, lineament density & LULC map [18-20].

3.2.1 Geology map of Palani Taluk

A vast piece of the review region possessed by Hornblende biotite gneiss lithology sorts and little parts of the territory involved by Granite and Charkonite (Figure-9). Among the lithology types, Charkonite have good groundwater prospects, Hornblende biotite-gneiss have moderate groundwater prospects and granite have poor groundwater prospects. With respect to groundwater prospects suitable weight and rank was assigned to the lithology, which was shown in Table 3, to acquire suitable groundwater potential regions.

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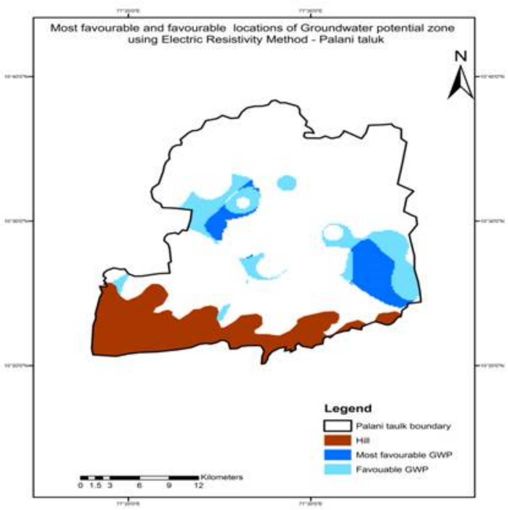

Figure-5. Most favourable groundwater potential zone map by electric resistivity method.

Figure-6. Few combinations from output map 3 was listed.

3.2.2 Drainage density map of Palani Taluk

Drainage network helps in the delineation of watersheds. Drainage thickness and sort of drainage gives data identified with porousness, penetration, and overflow. Dendritic drainage demonstrates homogenous rocks, the trellis, rectangular and parallel drainage examples show auxiliary and lithological controls. The coarse drainage surface demonstrates exceptionally permeable and porous rock developments; though fine waste surface is more typical in less pervious arrangements. Significant faults, lineaments now and then associates at least two drainage basins and go about as courses (Interconnecting channel ways). The stream of groundwater along these week regions is a set up certainty. Drainage patterns reflect surface attributes and also a subsurface development [21]. (Examine range waste system was appeared in Figure-7).
Study area drainage density map was equipped (Figure-10), Drainage density map is a appraise of the quantitative length of linear attribute communicated in (Km/Km^2). Low drainage density has good groundwater prospects and more drainage density have low groundwater prospects, with respect to groundwater aspects proper weight and rank was assigned to five different types of drainage density pattern was exposed in Table 3 to obtain proper groundwater potential regions.

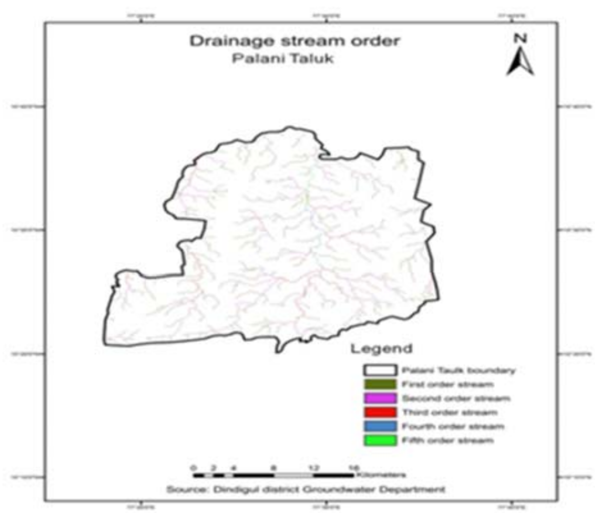

Figure-7. Drainagemap- Palani Taluk.

3.2.3 Geomorphology map of Palani Taluk

Geomorphology map was primed from Resourcesat - I, LISS III imagery which was scanned, traced and digitized in GIS software (Figure-11). There are 5 different types of geomorphology was occupied in the study region such as Denudational Origin, Water bodies, Structural origin, Fluvial origin and Anthropogenic origin. As per groundwater prospects is concerned Fluvial origin comprise very good groundwater prospects, 1.6% of whole area have fluvial origin, surface water bodies covers 7.2 % of the whole area and Anthropogenic Origin covers very small that is 0.2 % of the entire area, the both water bodies and anthropogenic origin comprise good groundwater prospects, Denudational Origin comprise moderate groundwater prospects, 75.7 % of entire area was occupied by Denudational Origin and structural origin comprise

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poor ground water prospects and it covers nearly 15.3 % of the whole area. With respect to groundwater prospects of various geomorphological types appropriate weigh and rank was assigned to find suitable groundwater potential regions.

3.2.4 Lineament density map of Palani Taluk

In an earth surface, visibility of lineaments is so straight [22], state that it is a "lines of landscape". Due to geological or geomorphic development reason the lineaments are the major indication on discontinuation of Earth's surface [23]. Faults, shear regions, fractures, dykes and so forth, are the major geological features which offer ascent to lineaments

Lineament have more application related to fold and faults, deposition of various minerals, groundwater studies and etc. satellite images is important to find lineaments in earth surface. With remote sensing program and image interpretation techniques, lineaments are identify easily. With the help of GIS software identify lineaments are digitized and by IDW tool density map was equipped for Palani Taluk.

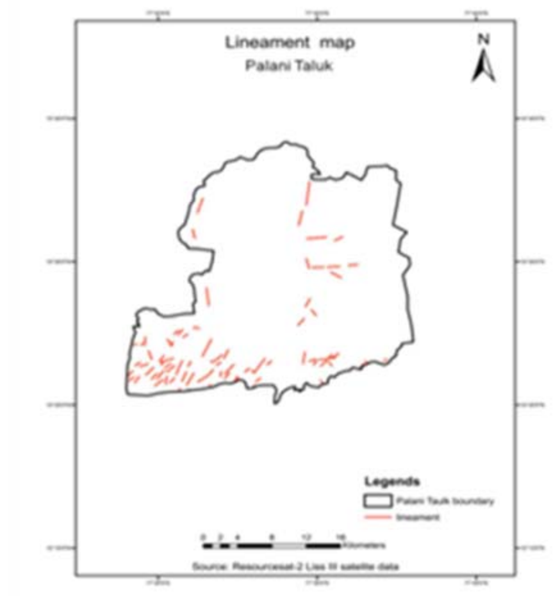

Figure-8. Lineament map-Palani Taluk.

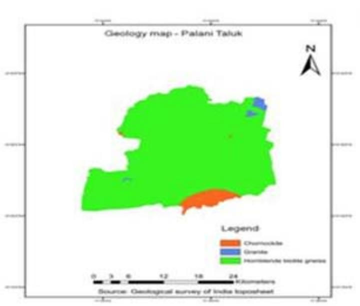

Figure-9. Geology map.

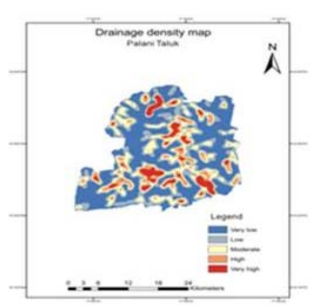

Figure-10. Drainage density map.

Figure-11. Geomorphology map.

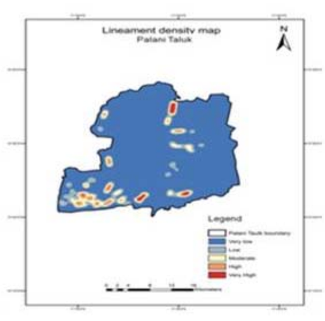

Figure-12. Lineament density map.

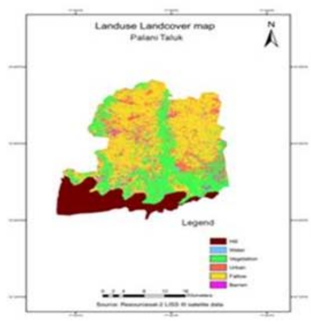

Figure-13. Landuse landover.

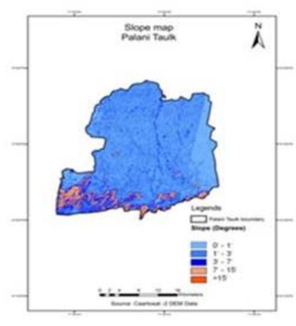

Figure-14. Slope map.

Importance of lineaments

With respect to their length lineaments are distinguish by two types. 1) less than 3 Km length is minar lineament and 2) if length is more than 2 km is major lineament.

Lineaments for present study were shown in (Figure-18). The lineament mostly associated with geomorphic lineament i.e. drainage parallel lineament. In present study area lineaments of both minor and major lineaments talkesplace, lineament length varies from 0.11Km to 3.25 Km. The lineament density map was created with help of GIS software and it was classified into five different types. Lineament density map is a evaluate of the quantitative length of linear attribute communicated in (Km/Km^2). Lineament density of a region impacts groundwater expectation of that territory. In present review territory with high lineament density (>2.34) having great groundwater potential range with low lineament thickness (0-0.6) having poor groundwater potential. The whole map arranged into five classes as appeared in Table-3 and delineated in Figure-14.

Table 3: Rank and weight for different parameter of groundwater potential zone.

Parameters	Classes	Area covered in %	Weight (%)	Rank
Geomorphology	Fluvial origin	1.6	30	5
	Anthropogenic origin	0.2		4
	Water body	7.2		4
	Denudational origin	75.7		3
	Structural origin	15.3		1
Slope classes	Nearly level (0⁰-1⁰)	41.6	20	5
	Very gently sloping (1⁰-3⁰)	43.6		4
	Gently Sloping (3⁰-7⁰)	5.7		3
	Moderately sloping (7⁰-15⁰)	6.5		2
	Strong sloping (>15⁰)	2.6		1
Drainage density Km/Km²	0 - 1.0	43.8	15	5
	1.0 - 2.3	24.8		4
	2.3 - 3.8	17.9		3
	3.8 - 6.3	8.3		2
	> 6.3	5.3		1
Lineament Density Km/Km²	0 - 0.6	87.7	15	1
	0.6 -1.17	6.7		2
	1.17 - 1.76	3.4		3
	1.76 - 2.34	1.7		4
	> 2.34	0.5		5
Land use / Land cover	Vegetation	26.4	15	5
	Water body	0.4		4
	Fallow land	43.4		3
	Urban	8.6		2
	Barren land / Hill	21.2		1
Geology	Charconite	4.4	5	5
	Hornblende biotite genesis	94.4		3
	Granite	1.1		2

3.2.5 Landuse landcover of Palani Taluk

LULC mapping has numerous and crucial applications of remote sensing. For groundwater prospects research study LULC play a key role. LULC map was required to determine infiltration, evapotranspiration, surface runoff, water body and etc. By LULC map we can easily distinguish the area having falls in more infiltration or more discharge. If discharge is more, infiltration of water is less and if there is a reduced in discharge, infiltration is more on that surface. For example in vegetation areas runoff is less and infiltration is more, and in urban areas infiltration is less. By Remote sensing software once can easily analysis the LULC type by supervised classification. LULC of Palani Taluk has been investigated for LISS III Resourses at - I, satellite image (Figure-15). By performing supervised classification major portion of the LULC map of study area is fallow land; it covers 43.4 % of total area, falls in moderate groundwater prospects. Barren land (5.9%) and Hill covering the area (15.3%) and total covering area is 21.2% of total study area come under very poor groundwater prospects. The Urban area occupied 8.2 % of the total study region have poor ground water prospects. Vegetation covers 26.4 % of the total Palani Taluk, which was counter check in the field. have occupied excellent groundwater prospects, suitable weight and rank were assigned to a variety of LULC type was exposed in Table-3, to acquire suitable groundwater artificial recharge region location, Palani Taluk.

3.2.6 Slope map of Palani Taluk

The slope of of present study region was primed from CARTOSAT - I DEM image. By remote sensing software the DEM was converted into slope map, it was expressed either in degree or in percentage. In present study region the slope was expressed in degrees, in general, the slope having very less gap or space was represents as a steeper slope and the slope having very wide gap or space represents gentle slope, in the raster form of slope each and every cell will have unique slope values. In the raster format, the slope is deliberate by the recognition of rate of change of maximum in slope value from each cell value to its neighboring cells value was exposed in Figure-8. In Figure-8, the slope map was classified based on the groundwater prospects, the gentle slope indicates flatter terrain and steeper slope indicates hilly terrain. The slope values are deliberately measured either in percentage or degrees in both vector and raster

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forms, (Figure-16). If the degree slope is very less (0 to 1) degree it falls under good groundwater potential area because, surface runoff flow is very slow and infiltration rate is very high in these slope regions. The area which is having more than 15 degree of slope value will have more runoff and very less infiltration, those areas will falls under very poor groundwater potential region. The overall study region was divided into five different classes of slopes and based on their groundwater prospects suitable weight and ranks are assigned and it was exposed clearly in Table-3.

3.2.7 GIS analysis

After reclassifying all thematic maps with suitable weight and ranks, all reclassifying image was integrated into GIS software to obtain a final output, the output map 4 was revealed in Figure-19. By GIS & Remote Sensing the groundwater potential region map was prepared, the resultant map indicated as the majority of the regions in Palani Taluk appear in moderate Groundwater potential region, only some areas comes under excellent ground water potential area was exposed clearly in Table-4.

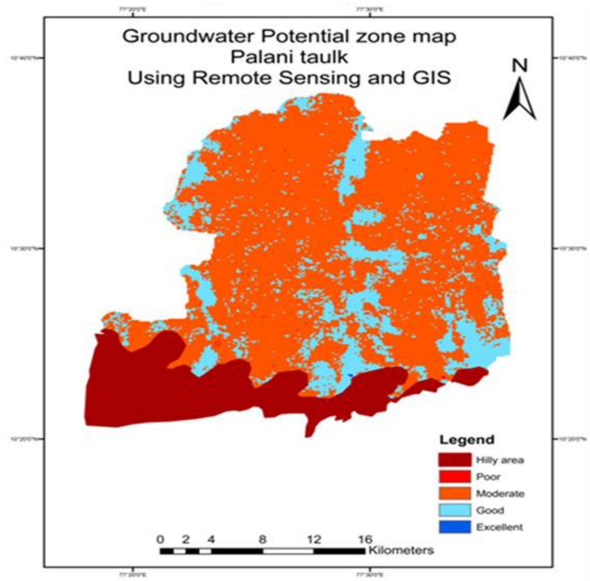

Figure-15. Groundwater potential zone map, using remote sensing and GIS.

Table-4. Groundwater potential regions coverage in percentage and in km^2.

S. No	Groundwater potential region type	Area covered in %	Area covered in km^2
1	Excellent GWP	0.01	0.09
2	Good GWP	15.33	132.30
3	Moderate GWP	67.72	506.80
4	Poor GWP	1.64	10.79
5	Hilly area / Restricted area	15.30	116.85

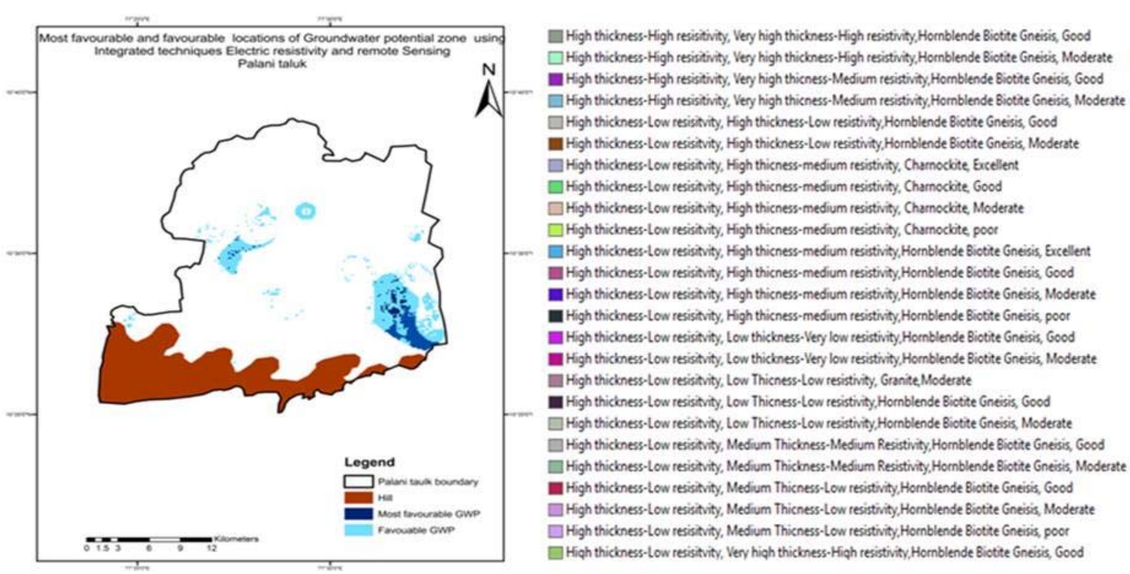

Figure-16. Locations of groundwater potential zone using, integrated techniques electric resistivity method and remote sensing method.

3.3 Integrated result of groundwater potential region determined by electric resistivity method and GIS & remote sensing method

Groundwater potential region map using Electric resistivity method, the output map 3 (Figure-9) was combined with Groundwater potential region map using GIS & Remote Sensing techniques, the output map 4 (Figure-19) to get the integrated result of both methods, the output map 5 (Figure-20). The output map 5, have 206 combination types, few combinations from output map 5 was shown below (Figure-21). The maximum area covered is 27.86 Km^2 in the combination of HT&LR, MT&LR, Hornblende biotite-gneiss, Moderate.

The area coverage comparison of groundwater potential region by integrated techniques, Electric resistivity method and by GIS & Remote Sensing Techniques are exposed in Table-5. The result indicates that there is a vast difference in result between Electric resistivity and Remote sensing method, when we integrate both the result will give us best suitable site for groundwater potential region, once the site was selected we can construct suitable artificial recharge structure to improve the groundwater level.

Table-5. Area coverage comparison of groundwater potential region by integrated techniques, electric resistivity method and by remote sensing and GIS.

S. No	Groundwater potential region identified method	Area coverage in Percentage (Km^2)	
		Most favorable / Excellent groundwater potential region	Favorable/good groundwater potential region
1	Electric Resistivity Method	25.51	35.32
2	Remote Sensing and GIS method	0.09	132.30
3	Integrated Method	10.61	36.82

4. CONCLUSIONS

The study of integrated techniques to identify groundwater potential region is more and more on ERT imaging, RS and GIS-based groundwater studies is being carried out in combination with field investigations for successfully development of the intensifying potential of ERT, RS and GIS techniques, which will have a perfect standardization as well as it will evolve as new approaches and applications. The research will conclude that ERT with RS and GIS techniques with Pre and Post Monsoon data will have great potential to revolutionize the monitoring and management of vital groundwater resources at least in up-coming era, though some challenges are daunting before hydro-geologists and hydrologist.

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