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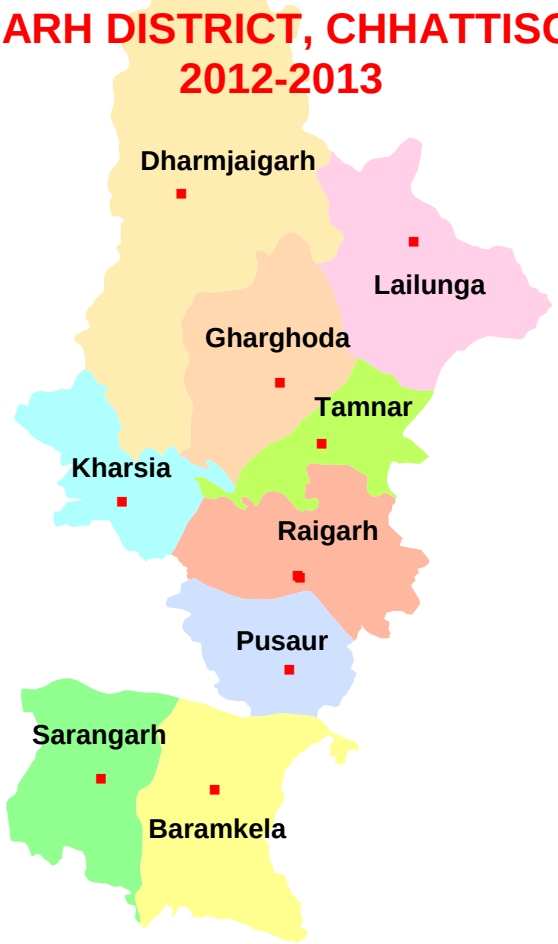
MINISTY OF WATER RESOURCES
CENTRAL GROUND WATER BOARD

GROUND WATER BROCHURE OF
RAIGARH DISTRICT, CHHATTISGARH
2012-2013



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June 2013

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GROUND WATER BROCHURE OF RAIGARH DISTRICT

DISTRICT AT A GLANCE

I. General

1. Location	: North-eastern corner of the State : 82°55'35'' to 83°48'14'' E : 21°20'32'' to 22°47'26'' N
2. Geographical area	: 6275 sq.km.
3. Community Development blocks	: 9 nos.
4. Villages	: 1438 nos.
5. Population	: 14,93,627 (as per Census 2011)
6. Rainfall	: 1240 mm (average rain fall of the district)
7. Major physiographic unit	: Chhattisgarh Plain & Northern Hill
8. River Basins and major drainage	: Mahanadi Basin Major rivers and streams: (Mand, Kurket, Kelo & Ib, etc.)
9. Forest area	: Nearly 33% of geographical area

II. Major Soils

1. Alfisols	: Red gravelly/sandy
2. Ultisols	: Red & Yellow lateritic
3. Inceptisols	: Shallow black

III. Principal crops (2011)

Crop seasons	: Two (Kharif and Rabi)
1. Rice	: 240388 ha
2. Pulses	: 33160 ha
3. Jowar & Maize	: 970 ha
4. Wheat	: 2272 ha

IV. Irrigation (2011)

1. Net sown area	:272001 ha
2. Gross irrigated area	:66274 ha
a) By dug wells	:3796 nos. (670 ha)
b) By tube wells	:10280 nos. (32522 ha)
c) By tanks/ponds	:2721 nos. (4932 ha)
d) By canals	:81 nos. (20261 ha)
e) By other sources	:8897 ha

V. Geology :Alluvium & Laterite (Sand, clay), Gondwana Supergroup (Sandstone, shale, coal), Chhattisgarh Supergroup (Limestone, Dolomite, Sandstone, shale) Basement Crystallines (Granites, Gneiss, Schists & metamorphic)

VI. Hydrogeology

Water bearing formations	:Major formations are weathered , fractured & porous sandstone, shale, limestone, siltstone, coal seams and Granite gneisses, etc.

VII. Ground water monitoring (by CGWB)

1. No. of monitoring stations	:41 nos.
a) Dug wells	:38 nos.
b) Piezometers	:03 nos.
a) Pre-monsoon water level (2011)	:1.30 to 13.90 mbgl (average-4 to 9 mbgl)
b) Post-monsoon water level (2011)	:0.87 to 10.13 mbgl (average- 3 to 6 mbgl)
c) Water level fluctuation	:0.43 to 6.34 m (average- 2 to 5 m)
d) Water level trend (2002-2012)	: No significant rise and fall

VIII. Ground water exploration (by CGWB)

1. Total no. of wells drilled	:134 nos.
a) Exploratory wells	:86 nos.
b) Observation wells	:13 nos.
c) Piezometers	:35 no.s
2. Depth range	:31.76 to 300.32 mbgl
3. Discharge	:0.1 to 19.5 lps
4. Transmissivity	: 2 to 142 m^2/day

IX. Ground water quality :Fit for all purposes

X. Ground water resources(as on March2009)

1. Annual available resources	: 49970.22 ham
2. Ground water draft	: 20489.49ham
3. Stage of ground water development	: 43.16 %

XI. Awareness and Training activity : Mass awareness at Kharsiya in the year 2002-03

XII. Artificial recharge and rain water harvesting

1. Projects by CGWB	:Nil
2. Projects under technical guidance	:Nil

XIII. Ground water control and regulation :Nil (No critical/ notified /Over exploited areas)

XIV. Major ground water problems and issues :Nil

Ground Water Brochure of Raigarh district, Chhattisgarh
By
D. Chakraborty, Scientist 'C'

1. General

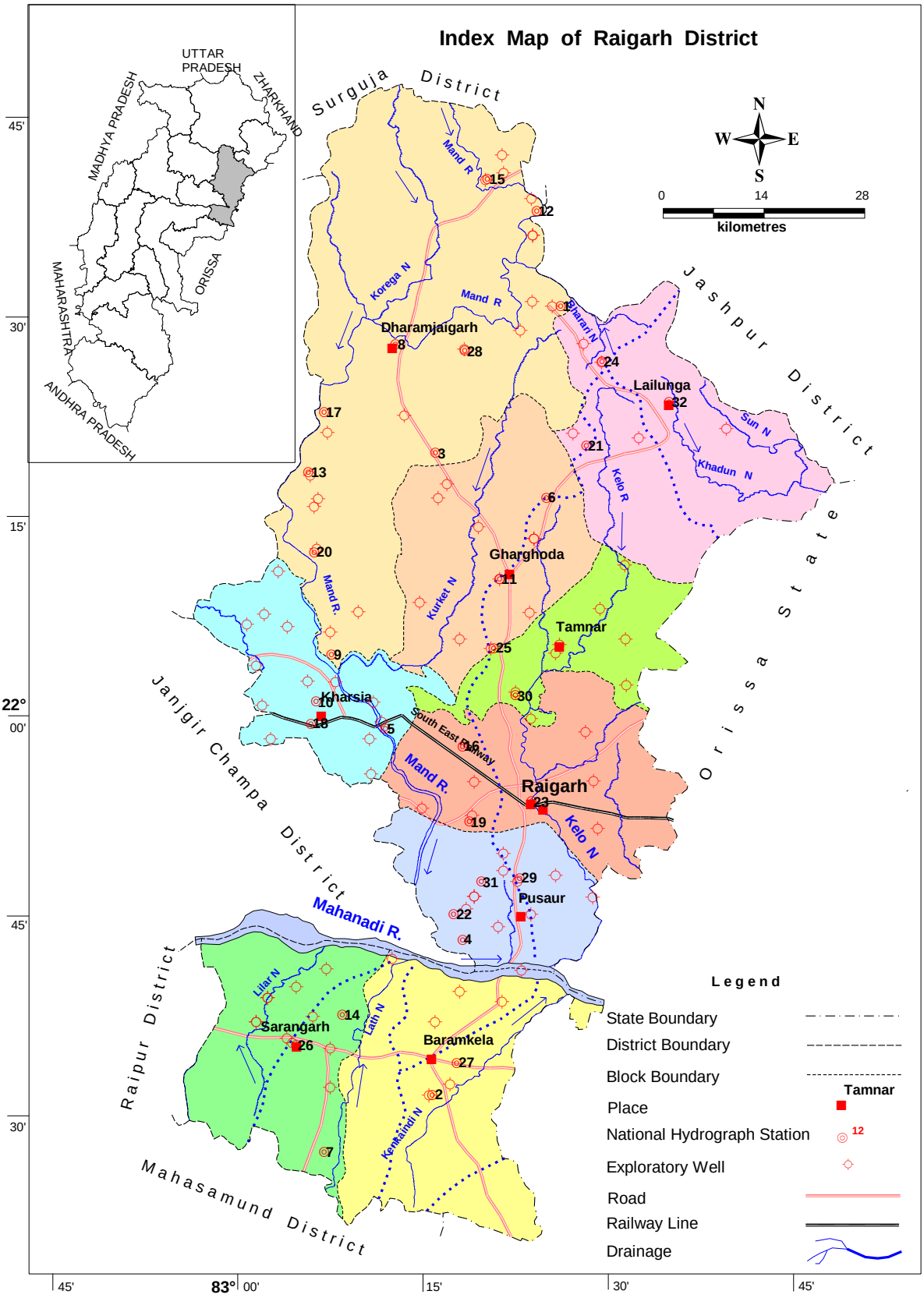
The Raigarh district covers an area of 6275 sq. km. It consists of 1438 no of villages. For administrative convenience these villages are grouped into 9 no of Development Blocks. Raigarh is the district headquarters. The block head quarters are Baramkela, Dharamjaigarh, Gharghoda, Kharsiya, Lailunga, Pussore, Raigarh, Sarangarh and Tamnar. Nearly 33% of geographical area is covered by forest. Total population of the district is 14,93,627 (as per Census 2011). **Plate.1** shows the location of the area along with the drainage, block head quarters, location of NHS and location of exploratory wells drilled in the district.

The drainage system of the district may be divided into two parts. The streams and rivers originating in the northern hills of Chhotanagpur plateau have southward slope and most of the important rivers- Mand, Kelo, Kuruket and Ib are perennial in nature. The drainage system has moderate and steep valleys between hill ranges. The drainage pattern is dendritic to sub parallel. Kuruket nala joins Mand river which finally joins Mahandi at Chanderpur before draining the entire northern and central parts of the district. Kelo and Ib rivers also join Mahanadi. The drainage system originating at the southern part of the district flow in N and to NE direction before joining the Mahanadi river. These rivers are non-perennial in nature except the Lath nala. The drainage pattern is parallel to sub parallel and controlled by the structural and linear hills developed in the southern parts of the district.

The annual rainfall in the district is around 1240 mm. The rainfall increase slightly from South to North. Out of the total annual rainfall, 90% occurs in SW monsoon in-between 15th June to 15th September. This generates average run off of nearby 2465 MCM by the river Mand. Due to the sub-tropical climate the maximum temperature ranges between 35 to 48°C where as humidity varies from 36% and 86%.

Broadly, the entire district can be divided into two physiographic regions namely Mahanadi plain (Chhattisgarh plain) and Northern hills of Chhotanagpur plateau. Chhattisgarh plain covers the southern part of the district and is divided into two parts by Mahanadi river. The Mahanadi valley extends in Raigarh and Sarangarh tehsils between Chanwardal and Sarangarh hills. The general width of the plain is about 24 kms on both sides of the river. The general elevation of the plain ranges between 190 and 240m amsl. The area comprises one of the most fertile tracts and is thickly populated region in the district. A linear hill range, the Chanwardal hills, runs from northwest to southwest all along the northern limits of Mahanadi plain. A linear hill range known as Sarangarh hills in Sarangarh tehsil extend in north- south direction and towards south bifurcates in SW-NE and western direction. These hill tracts disturb the plain topography of Sarangarh tehsil. These structural hills are covered with thick forests in the north of Chanwardal hills. The altitude goes on increasing towards Dharamjaigarh and Lailunga. The elevation ranges from 300 to 1000 m amsl. This

Plate No. - I


Index Map of Raigarh District
UTTAR PRADESH
ZHARKHAND
MADHYA PRADESH
MAHARASHTRA
ORISSA
ANDHRA PRADESH
Surguja District
Jashpur District
Orissa State
Janjgir Champa District
Raipur District
Mahasamund District
Mahanadi R.
Mand R
Korega N
Dharamjaigarh
Lailunga
Sun N
Khadun N
Kelo R
Gharghoda
Mand R.
Kurket N
Tamnar
Kharsia
South East Railway
Raigarh
Kelo N
Pusaur
Lilar N
Lath N
Sarangarh
Baramkela
Kendaindi N
N
W
E
S
0
14
28
kilometres
Legend
State Boundary
District Boundary
Block Boundary
Place
Tamnar
National Hydrograph Station
12
Exploratory Well
Road
Railway Line
Drainage
45'
30'
15'
22°
00'
45'
30'
45'
83°
00'
15'
30'
45'

region has a general slope towards the south. This is characterized by hilly tract and intermediate plains, flanked by high mounds or hillocks rising to an altitude of more than 700 m amsl. The foothills are characterized by pediments. This region is feeder to the drainage network of the northern portion of the district, and has narrow and moderate steep valleys between hill ranges.

The soils of the district have a large aerial variation. The red coloured residual soil are derived from the lateritisation of shale and sandstones and the areas covered by such type of soil is known as 'Bhata'. The black coloured soils are locally known as 'Kanhar similarly there are pale yellow sandy loamy soils which are locally known as 'Matasi" and 'Dorsa'.

2. Geology and Hydrogeology

The district is mainly covered by rocks of Archaean to Cretaceous age, with some isolated pockets of Recent to Sub-recent alluvium. Based on the water bearing property, the rocks of the district can be divided into (i) hard rocks: comprising crystalline and metamorphic and consolidated sedimentary rocks of Chhattisgarh Supergroup (ii) Soft rocks: comprising semi consolidated rocks belonging to Gondwana Supergroup and younger alluvium. These crystalline and metamorphic rocks mainly occur along the northern boundary of the district with some patchy occurrence in Baramkela, Sarangarh, Kharsia and Raigarh blocks. The crystalline in parts of Dharamjaigarh- Lailunga- Tamnar blocks are part of Chhotanagpur-gneissic complex. These are mainly composed of quartz mica schist and quartzite with granite gneiss, intruded by granite and dolerite. The Chhotanagpur gneissic complex covers 20 % of the district area. The rocks of unclassified metamorphic belt of Bilaspur-Raigarh Ambikapur occurs in parts of Kharsia, Ghargoda blocks in linear patches.

The south and south central part of the district is covered with unmetamorphosed, structurally less disturbed Proterozoic sediments of Chhattisgarh Supergroup. These sediments cover nearly 40% of total area of the district; these are horizontally bedded non-fossiliferous formations. The Chhattisgarh Supergroup in the district can be classified into two Groups i.e. Chandrapur and Raipur group The Raigarh Formation in the district has been intruded by dolerite dyke trending WNW- ESE. The outcrop of dolerite dykes can be seen in Kharsia-Raigarh blocks around Bhupdeopur- Gejamunda- Nansian and Aneri and Karrakot villages in Baramkela block. These are mainly doleritic to gabbroic in texture, hard and massive.

The Gondwana sediments cover 40% area of the district. The Gondwana rocks of the area are divided into (1) Talchir Formation (2) Karharbari Formation (3) Barakar Formation and (4) Kamthi Formation. The Gondwana rocks are faulted and intrusives are rarely present in the district. The Talchir Formation in the district is mainly represented by shale and silty shale with occasional boulder bed at the base. The shales are thinly laminated and bedded and interbedded with silty shale. Talchir shale is found in some parts of Kharsia and Dharamjaigarh blcoks. Karharbari Formation in the Dharamjaigarh block, Talchir Formation is overlain by Karharbari Formation, which consists of sandstone and shale intercalation. It occupies only small patches in the district. Barakar Formation covers maximum part of Gondwana area. The Barakars are

Plate No. - II

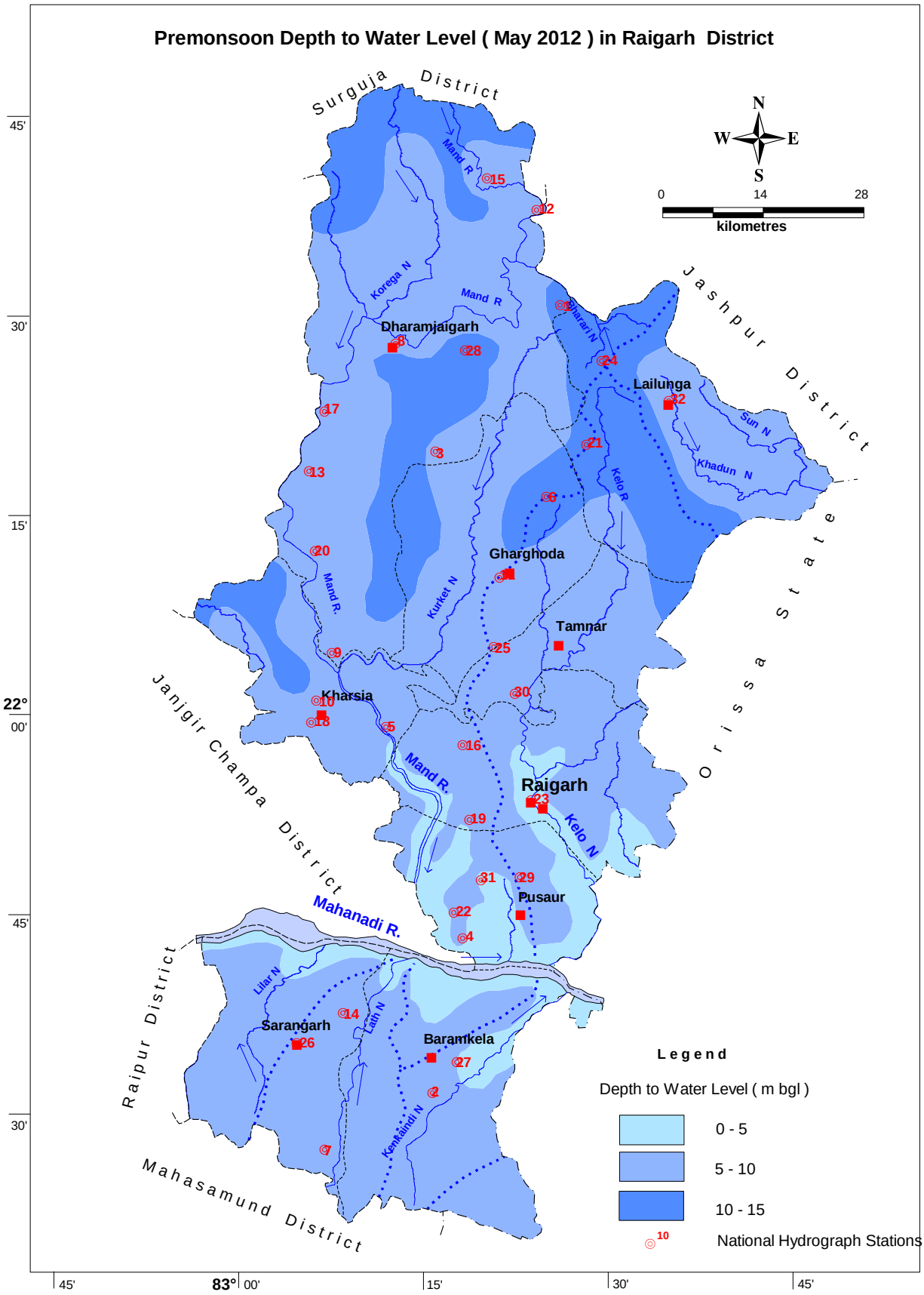
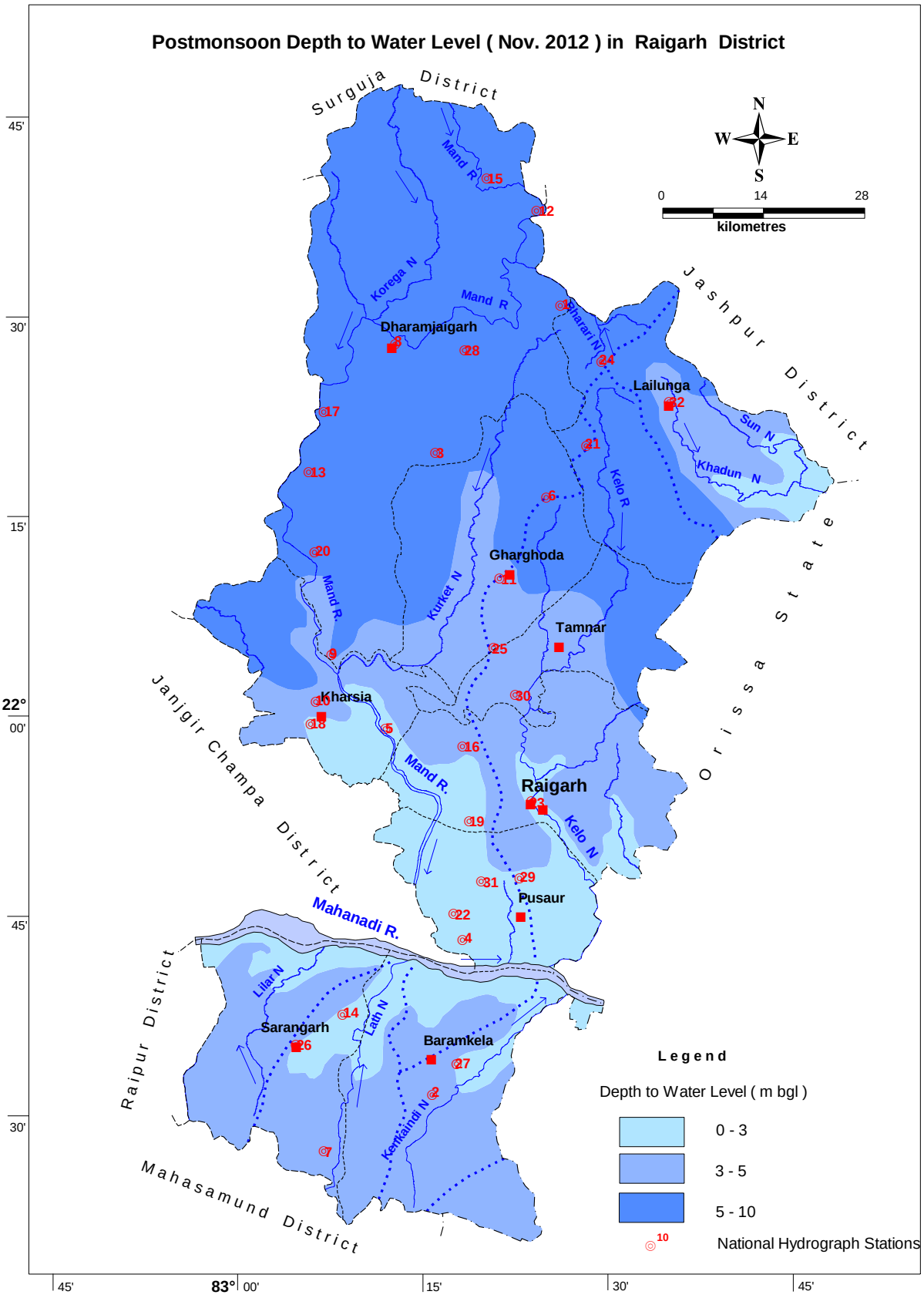

Premonsoon Depth to Water Level (May 2012) in Raigarh District
Surguja District
Jashpur District
Orissa State
Janjgir Champa District
Raipur District
Mahasamund District
Dharamjaigarh
Lailunga
Gharghoda
Tamnar
Kharsia
Raigarh
Pusaur
Sarangarh
Baramkela
Mahanadi R.
Mand R.
Korega N
Kurket N
Kelo R
Kelo N
Sun N
Khadun N
Lilar N
Lath N
Kenkaindi N
N
W
E
S
0
14
28
kilometres
Legend
Depth to Water Level (m bgl)
0 - 5
5 - 10
10 - 15
National Hydrograph Stations
45'
30'
15'
22°
00'
45'
30'
45'
83°
00'
15'
30'
45'

Plate No. - III


Postmonsoon Depth to Water Level (Nov. 2012) in Raigarh District
Surguja District
Jashpur District
Orissa State
Janjgir Champa District
Raipur District
Mahasamund District
N
W
E
S
0
14
28
kilometres
Dharamjaigarh
Lailunga
Gharghoda
Tamnar
Kharsia
Raigarh
Pusaur
Sarangarh
Baramkela
Korega N
Mand R
Kharari N
Sun N
Khadun N
Kelo R
Kurket N
Mand R.
Kelo N
Mahanadi R.
Lilari N
Lath N
Kenkalindi N
Legend
Depth to Water Level (m bgl)
0 - 3
3 - 5
5 - 10
National Hydrograph Stations
45'
30'
15'
22°
00'
45'
30'
45'
83°
00'
15'
30'
45'

represented by thick sequence (>500 m) of sandstone, shale, clay stone, and sand shale intercalation. The Barakar are only coal bearing formation in the district. Many coal seams have been found in the area both in shallow and deeper zone. Coal mining in the district is presently restricted to Dharamjaigarh and Tamnar blocks.The Barakar sandstone/ shale is semi -consolidated, horizontally to low dipping strata.

The sandstone is sub-arkosic in composition, fine to coarse grained, poor to moderately sorted. The shales are generally black and carbonaceous. Kamthi occupies the second largest area within Gondwana covered area. Being the youngest member Kamthi Formation occupies the hilltops of Gondwana hills. Sandstones and shales mainly represent them. These sandstones are rich in iron contents, dirty to brownish colour. Kamthi in the district is generally devoid of coal seams. Alluvium and Laterite occupy small isolated patches. The Alluvium is generally present all along the major streams. The right bank of Mahanadi in Baramkela block has linear patches of alluvium. These mainly consist of fine sand, silt and gravel (Panhchdhar). The thickness of this alluvium varies between 2 to 10 m.The laterites are both insitu and transported in nature and widely distributed over the district. More than 5 m. thick laterite cover over dolomite of Baramkela and Pausar has been observed.

The aquifer material controlling ground water flow can be broadly divided into two major media (1) Fractured media and (2) Porous media. The shallow aquifers both in hard and soft rocks in the district are wide spread and largely in use except in few parts of Baramkela, Pusaur and Raigarh blocks. The shallow aquifers are being tapped through dug wells, dug cum bore wells or shallow bore wells drilled to a depth of 60 m. The weathered mantle and shallow fractures mainly constitute the shallow aquifers. The thickness of weathered mantle varies from 5 to 20 m bgl. Nearly 90% of wells are in the depth range between 5 and15 mbgl. The hand pumps installed by PHED for drinking water taps the shallow fracture zone down to 60 m bgl. The deeper aquifers have been identified in both hard and soft rocks. The development of the deeper aquifer in hard rock area is localized in patches of Baramkela, Pusaur and Raigarh blocks occupied by Raigarh Formation. The deeper aquifer is being tapped by using power pumps. The depth of these bore wells varies between 60 to 120 m bgl.The deeper zone in Barakar Formation beyond 180m depth is more potential. The ground water occurrence in hard rocks particularly in crystalline and metamorphic terrain which covers 1372.4 sq. km (22%) area is restricted to phreatic zone only, which extends down to 60m. Exploration, in this terrain revealed that no potential zone occurs below phreatic zone. The distribution of ground water in these formations show that the morphological low areas have better ground water prospect than the highs. The area is suitable for dug wells and shallow bore wells up to 60 m depth. The rocks of Chhattisgarh Supergroup comprise of both phreatic and semi confined aquifer in weathered mantle, fractures and cavernous zones.The Chandarpur Sandstone covers 753 sq. km area mostly in hill ranges. The sandstones of Chandarpur is highly silicified and devoid of primary porosity. They produce springs in the area. The low-lying Chandarpur sandstone covered area has phreatic aquifer. However, deep fractured zone at Kerajhar and Kutela has been found, controlled by deep-seated lineaments. The Chandarpur shale is acquiclude in nature, they hardly posses any weathered zone and covers a small area in Sarangarh and Raigarh block. The distribution of ground water in Chandarpur area is poor and the movement of water is restricted along joints and fractures. The ground water occurrence in areas covered by Raigarh Formation, (148sq. km) is in phreatic or semi

confined condition. These shales are calcareous in subsurface and many times gypsiferous, having good secondary porosity in parts of Raigarh, Pusaur and Kharsia blocks. The Raigarh Formation in Baramkela block is predominantly dolomite having cavernous zones and is good repository of ground water. Seasonal weak auto flow conditions exist at few places within Raigarh Formation like Gotma village.

The shally part of Raigarh Formation in Baramkela and Sarangarh blocks is poor aquifer to aquiclude. The occurrence of ground water in shales of Raigarh Formation is restricted to weathered mantle only. The limestone of Raigarh Formation around Sarangarh is also not productive except at Kudhri, where the limestones are largely productive and suitable for bore wells down to depth of 150m bgl. The dolerite dykes within the Raigarh Formation in Raigarh block have acted as good barrier obstructing the deeper ground water movement and thus turning the northern part of these linear dykes rich in ground water. The hill range of Chandarpur sandstone, north of these dykes with slope and dip towards south act as recharge area for the narrow strip of land 5 to 1km wide where a large numbers of high yielding wells exist. The potential of ground water immediately south to the dyke is moderate. Overall the Raigarh Formation covered area in the district is good for ground water development because of its high yield potential. The aquifer can be divided into two zones shallow and deeper aquifers. The sustainability of the shallow zones in hard rocks particularly in the bore wells tapping Raigarh Formation in Baramkela- Raigarh-Sarangarh- Pusauar and Kharsia blocks are under threat. Many dug wells and hand pumps get dried up during summer. The shallow aquifer in Granitic terrain also has poor sustainability but not that severe as in areas covered by Raigarh Formation. The dug wells are abandoned or defunct in large parts of Raigarh-Pusaur and Baramkela blocks Exploration in hard rocks revealed that out of 30 borewells drilled in the district, 27 borewells encountered fracture zones between10-60 m bgl, frequency of occurrence of deeper fracture zones are less.Porous media- the Gondwana rocks, alluvium and laterite pockets, which cover nearly 42% of the district, comprise the porous media and forms the soft rock formations. The semi-consolidated Gondwana Formations occupies the entire Gharghoda and Tamnar block and large part of Dharamjaigarh block and parts of Kharsia, Raigarh and Lailunga blocks. The Gondwana rocks possess both primary and secondary porosity. Ground water in this formation occurs in phreatic, semi-confined and confined condition. The alluvium is present in isolated pockets and cover very small area. Thin cover of alluvium occurs in parts of Baramkela, Sarangarh, Raigarh and Gharghoda blocks. The alluvium cover has primary porosity where phreatic aquifer is developed. The area covered by Gondwana Formation has no problem of sustainability. The weathered zone followed by granular and fractured zone provides sufficient water to the wells. In the Gondwana formation the deeper aquifer to a depth of 450m bgl has been deciphered.Construction of 30 tube wells through exploration in Gondwana Formation has proved that the deeper aquifer zones are more productive than shallower zones. The tube wells constructed beyond 200m depth have good discharge. All other wells having depth range of 200m have limited discharge. In these wells the upper 30m zone has not been tapped.

The Gondwana rocks covers 42% of the area (2667 sq.km.) within the district. Barakars are the most promising formation covering an area of 1644 sq. km. The ground water occurs in both phreatic and semi-confined to confined condition. Two distinct perennial autoflow zones have been demarcated, one in Tamnar and the other one at Gharghoda,

and Dharamjaigarh blocks in the Mand and Kelo rivers sub basins respectively. The deeper aquifer zones encountered between 150-400 m bgl has maximum of 6 m piezometric head above ground level. At Tamnar water with temperature as high as 500C and high Sulphur contamination has been encountered in the tube wells drilled by GSI and CGWB. This free flowing zone having a linear extent of nearly 15 km from Devgarh to Milupara via Tamnar is a result of synclinal axis passing through this area within Barakar Formation (Tewari, 1999). The other shallow autoflow area up to a depth of 10m has been demarcated around Sithra, Khadgaon, Bayasi around Dumparpali area of Gharghoda, Dharamjaigarh and Lailunga blocks. This zone is not affected with Sulphur contamination. The water is at normal temperature. Oozing of springs is common in Barakar sandstone/shale area. Ground water in Kamthi and Karharbari Formations, which cover nearly 80sq.km area occurs in phreatic and semi-confined to confined condition. Kamthi covered area has good granular zone in shallow depth in comparison to that of Barakar Formation. Springs are also common in the Kamthi Formation. The Kamthi- Karharbari area is suitable for both shallow and deep tube wells. The Talchirs are predominantly shale and are aquiclude in nature is devoid of any
deeper zone and have only phreatic zone. The area is suitable for dug wells and shallow tube wells only.

The alluvium covered areas particularly in southern bank of Mahanadi in Baramkela block and some part of Pusaur block have good potential aquifer in shallow zones and are good for development through filter point wells. The distribution of ground water in this alluvium is not continuous but in isolated patches. Transmissivity of Raigarh Formation varies from 14 to 510 m2/ day whereas the Storativity is recorded between 0.14×10^{-4} and 1.18×10^{-6}. The Transmissivity and Storativity of Barakar Formation ranges between 3 to 143 m^2/ day and 1.72×10^{-2} to 7.86×10^{-4} respectively. In all there are 48 no. of observation wells (i.e. National Hydrograph Network Stations); out of which 40 no are dug wells and 8 no are piezometers were established in the district to monitor the water levels four times a year and water quality once a year. Depth to water level in the phreatic aquifer during pre-monsoon period remains mostly between 3 and 14 m bgl **(Plate. 2)** and that in post-monsoon period lies between 2 to 6 m bgl **(Plate. 3).** Similarly, the water level in the semi-confined to confined aquifers vary from 10 to 60 m bgl in pre-monsoon and 5-15 m bgl in post-monsoon period. Two auto flow zones have been demarcated in the Barakar Formation area having maximum piezometric head of 6 m above ground level. Long term trend analysis of water level data show fall in 36% and rise in 18% of dugwells in pre-monsoon whereas in post-monsoon 38% of the wells registered fall in water level and 18% of the dug wells showed rise in the water levels. The overall scenario shows shift in water use from phreatic to semi-confined zone and increased draft for irrigation purpose in selected pockets of Baramkela- Pusaur- Raigarh and Kharsia blocks. The statistical analysis shows that more than 70% abstraction structures of the district lie within these blocks and tap shale- dolomite- limestone belonging to Raigarh Formation. The hydrogeological map prepared for the district is presented in **(Plate. 5)**.

3. Ground water resource (as on March 2009)

The ground water resources for Raigarh district has been estimated based on the GEC.1997 methodology. The estimates indicate that the annual replenishable ground water resource for the district is 49970.22 Ham. The net annual ground water availability

is 47471.72 Ham. The gross annual draft has been estimated as 20489.49 Ham and out of which, the draft for irrigation is 17769.59Ham and for domestic & industrial water supply purpose is 2719.9 Ham.

Ground water resources for Raigarh district								
Assessment Unit / Block	Total Annua Recharge in Ham	Net Ground Water Availability in Ham	Existing Gross Ground Water Draft for Irrigation in Ham	Existing Gross Ground Water Draft for Domestic & Industrial Water Supply in Ham	Existing Gross Ground Water Draft for All Uses in Ham	Allocation For Domestic & Industrial Water Supply in Ham	Net Ground Water Availability for Future Irrigation Development in Ham	Stage of Ground Water Development in %
Baramkela	5550.88	5273.34	4388.4675	339.4	4727.8675	447.41	437.46247	89.66
Dharamjaigarh	7064.99	6711.74	2338.75	416.5	2755.25	549.06	3823.93	41.05
Gharghota	3648.3	3465.89	686.3	153.51	839.81	202.36	2577.23	24.23
Kharsia	5823.3	5532.14	2037.892	276.85	2314.742	364.95	3129.298	41.84
Lalilunga	5283.29	5019.13	669.09247	281.21	950.30247	370.71	3979.3275	18.93
Pussore	6865.53	6522.25	3846.35	308.31	4154.66	406.43	2269.47	63.7
Raigarh	6824.01	6482.8	1862.6045	306.9	2169.5045	404.57	4215.6255	33.47
Sarangarh	5393.88	5124.19	1261.1403	441.96	1703.1003	582.6	3280.4497	33.24
Tamnar	3516.04	3340.24	679	195.26	874.26	257.39	2403.85	26.17
District	**49970.22**	**47471.72**	**17769.597**	**2719.9**	**20489.497**	**3585.48**	**26116.643**	**43.16**

4. Ground water development

The ground water development estimated for Raigarh block is 43.16%, for Baramkela block is 89.66%, for Dharamjaigarh block is 41.05%, for Gharghoda block is 24.23%, for Kharsiya block is 41.44%, for Lailunga block is 18.93%, for Pussore block is 63.7%, for Sarangarh block is 33.24% and for Tamnar block is 26.17%. The overall stage of ground water development for the district is 43.16 %. **Plate.4** shows the stage of ground water development in the district and **Plate.6** shows the yield potential and suitable abstraction structures for the area.

The dug well depth varies from 6.5 to 17 m and the dia. varies from 1.5 to 4.7m. The bore wells drilled in the area are 60 to 90 m deep with dia. varying from 0.1 to 0.15 m. Diesel or electric operated pumps of 0.25 to 1HP or traditional teda is used to lift the water from dug wells for the irrigation purposes. The electrical pump or rope and bucket is used to lift the water for domestic purpose. Submersible electical pumps of 3 to 5 HP are used for irrigation purpose in case of bore wells in the area. The bore wells in granitic terrain can irrigate an area of 0.5 to1.5 ha paddy crop. The ground water is the main sources of drinking water in the district covering 1438 no of villages.

In all 10280 no of bore wells and 3796 no of dug wells exists in the district. Together they irrigate around 33192 ha. The contribution of ground water for irrigation comes to nearly 50% in the district. The use of ground water in non-command area is maximum.

Plate No. - IV

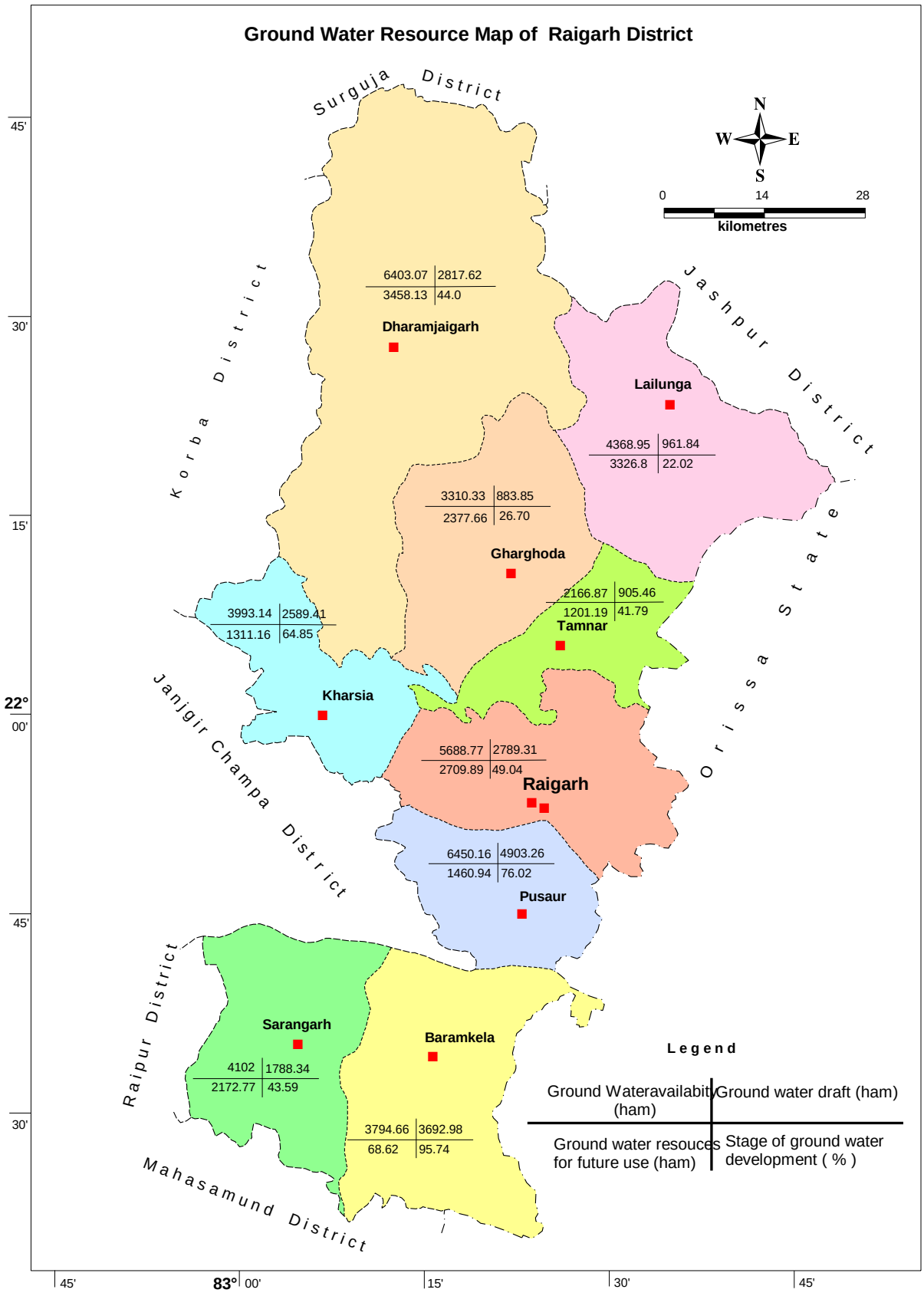
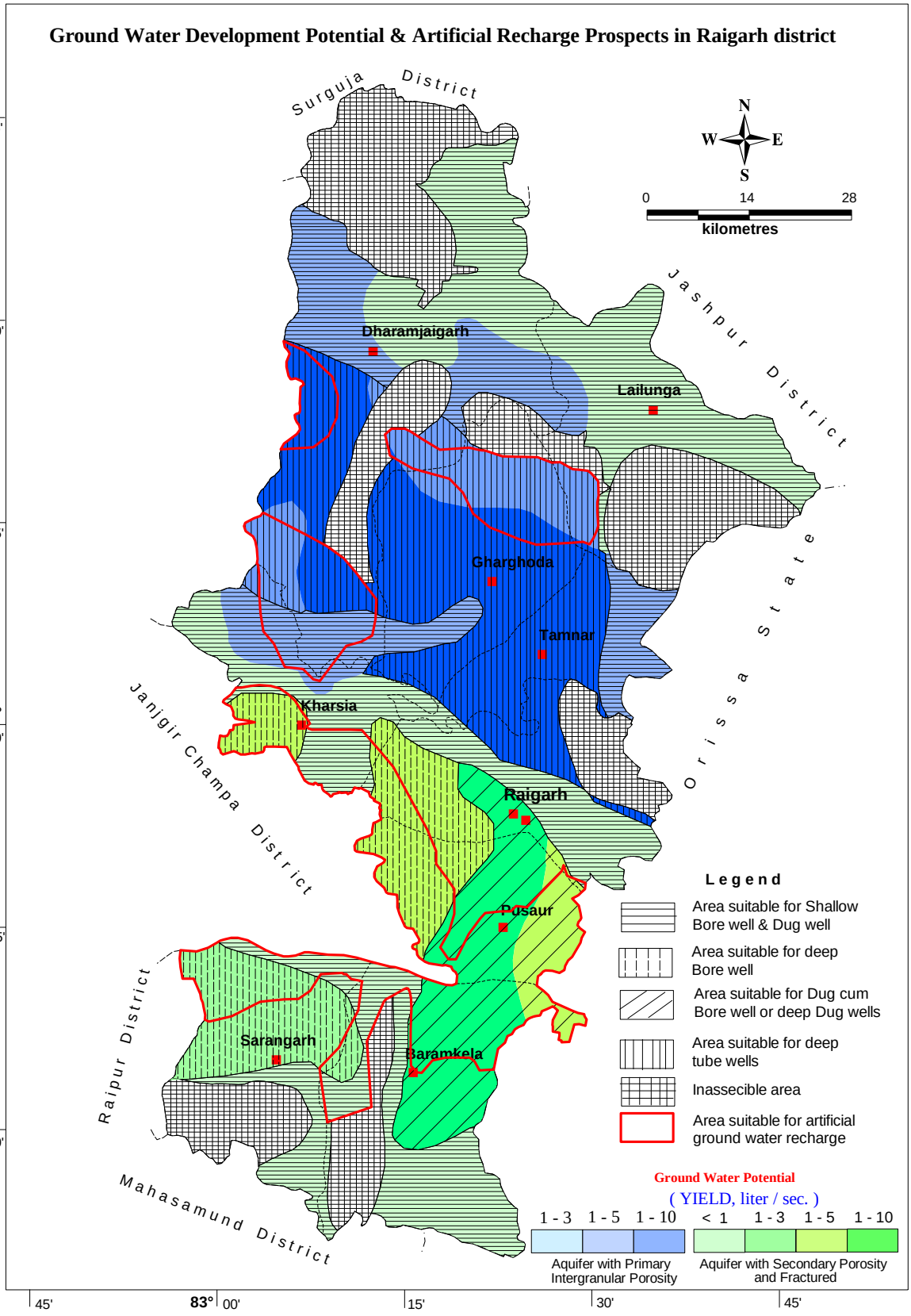

Ground Water Resource Map of Raigarh District
Surguja District
Korba District
Jashpur District
Orissa State
Janjgir Champa District
Raipur District
Mahasamund District
N
W
E
S
0
14
28
kilometres
6403.07 | 2817.62
3458.13 | 44.0
Dharamjaigarh
Lailunga
4368.95 | 961.84
3326.8 | 22.02
3310.33 | 883.85
2377.66 | 26.70
Gharghoda
2166.87 | 905.46
1201.19 | 41.79
Tamnar
3993.14 | 2589.41
1311.16 | 64.85
Kharsia
5688.77 | 2789.31
2709.89 | 49.04
Raigarh
6450.16 | 4903.26
1460.94 | 76.02
Pusaur
Sarangarh
4102 | 1788.34
2172.77 | 43.59
Baramkela
3794.66 | 3692.98
68.62 | 95.74
Legend
Ground Wateravailabity (ham)
Ground water draft (ham)
Ground water resouces for future use (ham)
Stage of ground water development (%)
45'
30'
15'
22° 00'
45'
30'
45'
83° 00'
15'
30'
45'

Plate No. - 6


Ground Water Development Potential & Artificial Recharge Prospects in Raigarh district
Surguja District
Jashpur District
Orissa State
Janjgir Champa District
Raipur District
Mahasamund District
Dharamjaigarh
Lailunga
Gharghoda
Tamnar
Kharsia
Raigarh
Pusaur
Sarangarh
Baramkela
N
W
E
S
0
14
28
kilometres
45'
30'
15'
22°
00'
45'
30'
45'
83°
00'
15'
30'
45'
Legend
Area suitable for Shallow Bore well & Dug well
Area suitable for deep Bore well
Area suitable for Dug cum Bore well or deep Dug wells
Area suitable for deep tube wells
Inassecible area
Area suitable for artificial ground water recharge
Ground Water Potential
(YIELD, liter / sec.)
1 - 3
1 - 5
1 - 10
< 1
1 - 3
1 - 5
1 - 10
Aquifer with Primary Intergranular Porosity
Aquifer with Secondary Porosity and Fractured

5. Ground water quality

The water samples collected from NHNS during the month of May 2012 (Pre-monsoon) were analyzed to determine the quality of ground water in the district. The analysis shows that the concentrations of the major ions are within limit as per BIS Standards and the ground water in the district is suitable for all purposes. The plot of Piper Trilinear Diagram and US Salinity Diagram indicates that the ground water in the district is suitable for drinking, irrigation and all other purposes. The EC values ranges between 106 to 1220 micro siemens/cm at 25°C (Fig 5) and the pH values ranges between 7.7 to 8.5. The overall composition of ground water indicates that it is moderately alkaline and predominantly CaHCO3 type (calcium bicarbonate).

6. Ground water management strategy

There exists a wide scope for ground water development in the district. The available ground water resources for the district are of the order of 47471.721Ham and the ground water draft is 20489.49 Ham. The stage of ground water development is only 43.16 %.
It is estimated that with the available ground water resources a total of 23736 no.s of bore wells can be constructed in the district. By adopting suitable developmental strategies, the less developed blocks like Gharghoda, Lailunga, Raigarh, Sarangarh and Tamnar can be further developed by way of increased irrigation.

7. Water conservation and Artificial Recharge

The average annual rainfall for the district is 1240 mm. There exist a huge surplus non-committed run off in the district. Rain water harvesting and artificial recharge structures at suitable locations can be constructed to improve the storage capacity of the surface and subsurface reservoirs. **Plate 6** is presented to show the area suitable for artificial recharge and future ground water development.

8. Awareness and Training activity

So far no Training programme on ground water conservation and artificial recharge is conducted by the department at Raigarh. However one Mass awareness at Kharsiya in the year 2002-03 was organized. Villagers, NGO.s and farmers participated during the programme.

Acknowledgement

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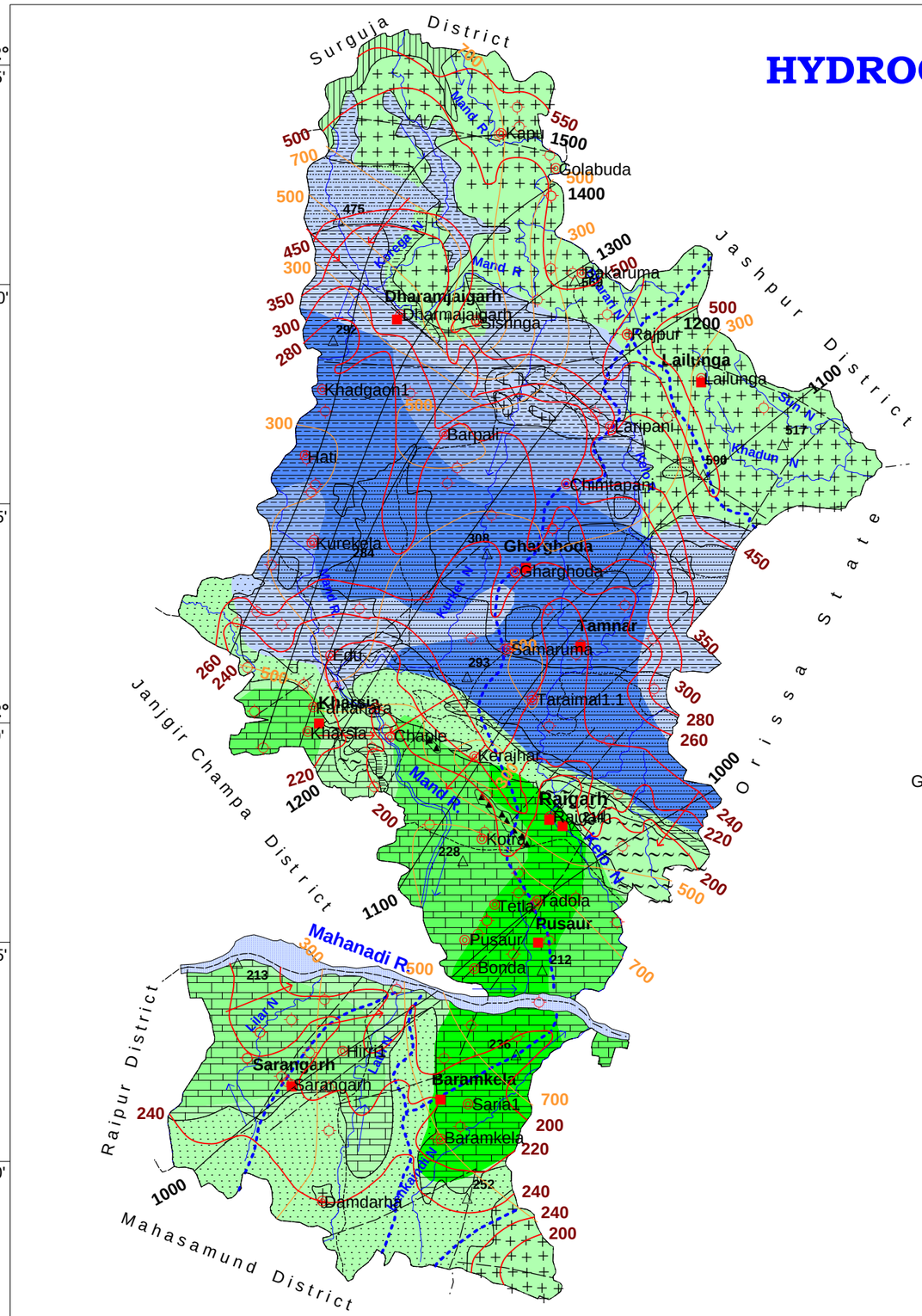
D. CHAKRABORTY
Scientist ‘C’

Plate V

HYDROGEOLOGICAL MAP OF RAIGARH DISTRICT



Legend

Group	Formation	Lithology
Gondwana Supergroup	Deccan trap	Basalt
	Kamthi	Ferruginous Sandstone
	Barakar	Arkosic Sandstone, Shale and Coal seams
	Karharbari	Greywackes, Sandstone, pebbly Sandstone
	Talchir	Shale, Sandstone, Boulder bed
Chhattisgarh Supergroup	Raigarh	Unclassified Shales, Limestone and Dolomite
	Chandrapur	Sandstone and Conglomerate
Chhota Nagpur Gneissic complex	Basic intrusives	Dolerite sill and Dykes
	Chhota Nagpur	Unclassified Granite gneiss
	Unclassified	Unclassified Metamorphics

- 300 — Water table countour (m amsl)
- Ground Water Flow Direction
- Drainage
- 630 — Triangulation height (m amsl)
- Lineament
- Surface Water Divide
- 1100 — Isohyet (mm)
- 500 — EC microsiemens/cm
- 10 — National Hydrograph Station
- Exploratory Well
- Block Headquarter
- District Headquarter

Ground Water Potential

(YIELD, Litres / Sec.)

Aquifer with Primary Intergranular Porosity: 1 - 3 | 1 - 5 | 1 - 10

Aquifer with Secondary Porosity & Fractured: > 1 | 1 - 3 | 1 - 5 | 1 - 10

22° 45' | 30' | 15' | 22° 00' | 45' | 30'

45' | 83° 00' | 15' | 30' | 45' | 84° 00' | 15' | 30' | 45'