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भारत सरकार

Central Ground Water Board

Department of Water Resources, River Development and Ganga Rejuvenation,

Ministry of Jal Shakti

Government of India

AQUIFER MAPPING AND MANAGEMENT OF GROUND WATER RESOURCES

CUTTACK DISTRICT, ODISHA

दक्षिण पूर्वी क्षेत्र, भुवनेश्वर

South Eastern Region, Bhubaneswar

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CUTTACK DISTRICT AT A GLANCE

I. GENERAL PARTICULARS

(a) Location	:	'20^0 00' & 20^0 40' North Latitudes 84^0 52' & 86^0 01' East Longitudes
(b) Area	:	**3932 Km^2**
(c) District Head quarters	:	**Cuttack**
(d) Subdivision	:	**3** – *1. Cuttack sadar* *2. Banki* *3. Athagarh*
(e) Tehsils		**11**
(f) Blocks	:	**14**

Athgarh	Kantapada
Badamba	Mahanga
Banki	Narsingpur
Baranga	Niali
Cuttack	Nichintkoilli
Dampada	Salepur
TangiChoudwar	Tigiria

(g) Towns *(including Census Towns)*	:	11
(h) Municipalities	:	2 – Cuttack, Choudwar
(i) N.A.C.s	:	2 – Athgarh, Banki
(j) Gram Panchayats	:	342
(k) Villages	:	Total : 1969 *Inhabited : 1856* *Uninhabited : 113*

(l) Population *(as per Census 2011)*	:	Total	: 1936310
		Male	*: 995733*
		Female	*: 940577*
		Sex ratio	*: 940*
		Density	*: 667*

II CLIMATOLOGY

(a) Normal Annual Rainfall	:	1424.3 mm
(b) Average Monthly Rainfall	:	118.69 mm
(c) No of Rainy days	:	68.5
(d) Temperature	:	Maximum – 42°C
		Minimum – 7.5°C
(e) Relative humidity	:	84 % (Morning – 0830 Hrs)
		42 % (Evening – 1730 Hrs)

III LAND USE

(a) Forest Land	:	77759.59 Ha
(b) Area Under waste Land	:	15338.32 Ha
(c) Net Sown Area	:	174007 Ha

IV	**IRRIGATION POTENTIAL CREATED** *(source -wise) (2016)*		**Kharif (Ha)**	**Rabi (Ha)**
	(a) Major and medium irrigation Projects (Flow)	:	89131	54710
	(b) Minor irrigation Projects	:	24515	3823

(Flow)			
(c) Minor irrigation Projects (Lift)	:	30368	17594
(d) Others	:	31752	30971

V EXPLORATORY WELLS

Bore wells drilled by CGWB under Normal Exploration Programme	:	*Exploratory Wells &Observation Wells*	*:* 84

VI DYNAMIC GROUND WATER RESOURCES (As on 31.03.2017)

a) Annual ground water resource assessed	:	68227.30 ham
b) Annual ground water draft (for all uses)	:	28839.81 ham
c) Net ground water available for future use	:	38600.7 ham

VII Stage of ground water development : 42.27 %

VIII Ground Water Issues

Water logging in the Eastern
Parts of the district.

Underutilization of GW Resources

Ground Water Salinity in Eastern Parts of the district

FOREWORD

Cuttack District is the most thickly populated districts of Odisha. The district is endowed with vast arable lands and has an agrarian economy. Because of increase in population and other developmental activities, development of ground water becomes extremely unavoidable to meet up the domestic, industrial and agricultural needs.

The district is underlain by alluvial deposits and is endowed with a huge ground water resource potential and the present stage of ground water development is only 42.27% leaving a vast scope for ground water development in the district. Ground water irrigation practices can insure the agriculture against drought to a great extent. Apart from irrigation, drinking water scarcity can also be mitigated through judicious utilization of ground water.

Due to wide variation in hydrogeological set up in the district, the occurrence and distribution of aquifers are non-uniform and so also their yielding properties. The common modes of ground water exploitation in the district are dug well, dug-cum-bore well, shallow tube well etc. Proper site and designing of wells hold the key to the success of ground water development, which requires a thorough knowledge of hydrogeology and pattern of water usage in the terrain.

Based on the available data and the earlier hydrogeological studies taken up in the district, an attempt has been made in this report to compile all relevant information, such as hydrogeological, agriculture, irrigation, land use, rain fall, chemical quality of water and other collateral data.

The present report on "**Hydrogeological Framework, Ground Water Development Prospects & Aquifer Management Plan of Cuttack District, Odisha**". **has been prepared by Smt Sandhya Mohapatra Scientist 'D'**. The sincere efforts in preparation of the report will no doubt be very useful and benefit the state. It is hoped that, it will be of immense help to different ground water user agencies, administrators and planners in preparation of ground water development plans and will be a handy tool in effective management of ground water resources in the district.

Place : Bhubaneswar
Date : May 2018

(Dr UTPAL GOGOI)
RegionalDirector

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1.0 INTRODUCTION

1.1 Objective

Central Ground water Board has taken up National Aquifer Mapping (NAQUIM) programme during the XIIth five year plan to carry out integration of micro level hydrogeological, geophysical, hydro chemical data and information on geology, geomorphology, soil, hydrometeorology, hydrology, landuse, cropping pattern etc on a GIS platform to formulate district, block or aquifer-wise Ground Water Management Plan. The formulation of sustainable ground water management plan would help in achieving the demand for drinking, irrigation and industrial need for water with minimal stress on the aquifer.

The activities under NAQUIM are aimed at identifying the aquifer geometry, aquifer characteristics their yield potential along with the quality of water occurring at various depths, aquifer wise assessment of ground water resources and development. Aquifer mapping itself is an improved form of groundwater management – recharge, conservation, harvesting and protocols of managing groundwater.

1.2 Scope of the study

Aquifer mapping is a multidisciplinary study wherein a combination of geological, geophysical, hydrological, hydrogeological, meteorological and hydro-chemical information is integrated to characterize the spatial and temporal variation of quantity and quality of the aquifer system. This involves in depth studies of the Aquifer Disposition in the Cuttack District (Administrative Block wise) in respect of availability, potential, quality & quantity, identification of problems and finding solutions which require immediate interventions. The following were the broad objectives for the same:

- To define the aquifer geometry with precise lateral and vertical demarcation.
- To define Ground water regime behaviour in time and space.
- To study the hydraulic characteristics of both shallow and deeper aquifer.
- To study the Geochemistry of aquifer systems down to the depth of 200 m in Hard Rock areas and upto a depth of 300 m(or upto Bed Rock) in Alluvial areas.
- To prepare Aquifer Maps indicating dispositions of aquifers along with their characterization.

- To formulate the Aquifer Management Plans for sustainable development and management of ground water resources.

1.3 Approach and methodology

Approach and Working Methodology: Multi-disciplinary approach involving geological, geophysical, hydrological, hydrogeological and hydro-geochemical survey would be carried out in toposheet scale (1:50000) to meet the aim and objectives listed above. GIS would be used to prepare the maps.

Compilation of Existing data and identification of Data gaps: Preliminary work will consist of the collection and review of all existing data which relate to the area. This usually included the results of any previous hydrogeological studies. Also, Exploration data which have been carried out by CGWB and State agencies and by local administrations shall be collected and compiled to identify the data gaps in the study area. After the Data Compilation all the data were Integrated and Analyzed.

Hydrogeological Investigations: Review of background information will lead the study teams to the further studies in the field, where they will employ various techniques to determine the three-dimensional extent and aquifer characteristics of the significant water-bearing formations. Key Observation wells representing the different aquifers will be established and monitoring will be carried out. Village wise well inventory and data collection is to be carried out to strengthen the data base. Exploratory wells and Observation wells will be constructed, Litholog samples of aquifer materials and ground waters samples will be collected. Aquifer Performance tests will be carried out to determine the aquifer parameters. The analysis of the data will be carried out for preparing maps.

Geo -hydro chemical Investigations: Water Samples will be collected, analyzed and interpreted to bring out ground water quality scenario of the study area.

Geophysical Investigations: Geophysical studies would be carried to assist the hydrogeological survey in aquifer mapping/geometry.

Generation of relevant thematic layers using GIS:

- Drainage
- Soil
- Land use and land cover
- Geomorphology
- Geology
- Hydrogeological Map
- Aquifer Disposition
- Ground Water Quality

Development of aquifer wise management plan: Collaborative studies that combine geologic, hydrogeological, hydrological, geochemical and geophysical information are to be integrated. Determining aquifer potential for effective, development and management are carried on for long-term sustainable development of aquifers.

1.4 Study area

During XII five year plan, the National Aquifer Mapping Programme (NAQUIM) were taken up for detailed hydrogeological investigation, data-gap analysis and Aquifer Mapping in Cuttack district covering an area of 3932 sq. km. The index map of the study area is presented in **Fig.1.4a** while an administrative map is presented as **Fig. 1.4b.**

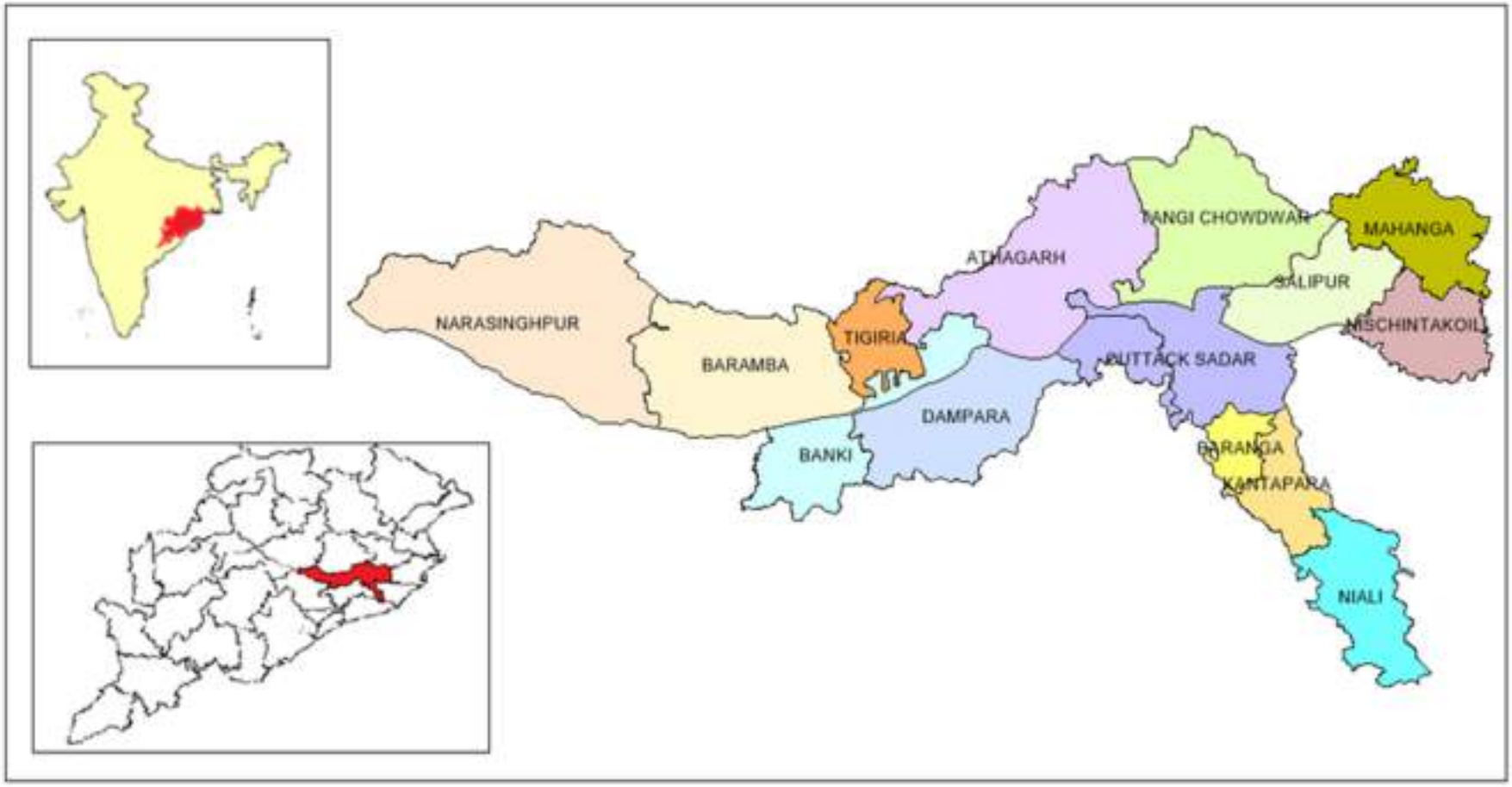
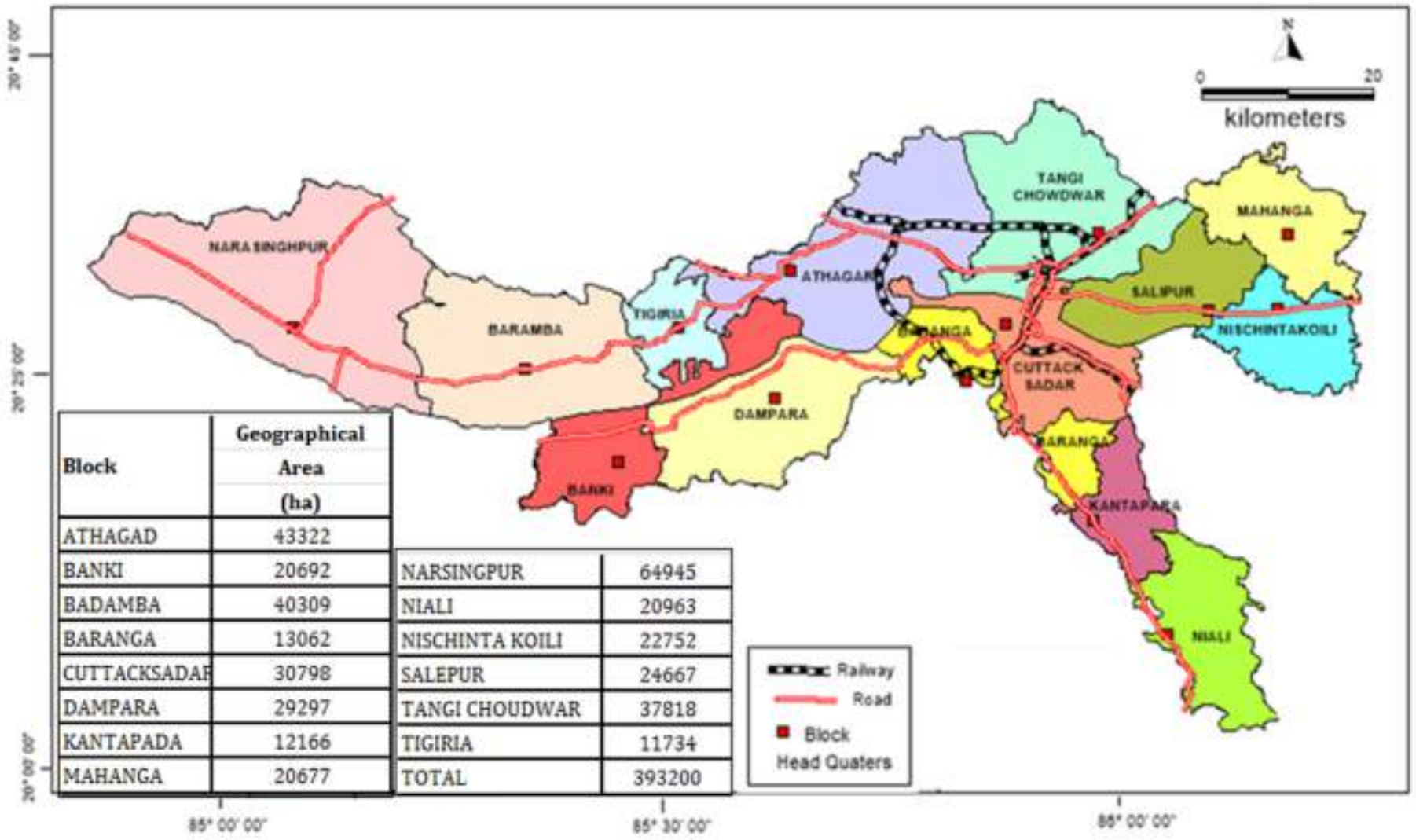


Fig 1.4 a: INDEX MAP OF CUTTACK DISTRICT, ODISHA



Block	Geographical Area (ha)
ATHAGAD	43322
BANKI	20692
BADAMBA	40309
BARANGA	13062
CUTTACKSADAR	30798
DAMPARA	29297
KANTAPADA	12166
MAHANGA	20677
NARSINGPUR	64945
NIALI	20963
NISCHINTA KOILI	22752
SALEPUR	24667
TANGI CHOUDWAR	37818
TIGIRIA	11734
TOTAL	393200

Fig 1.4 b: ADMINISTRATIVE MAP OF CUTTACK DISTRICT

1.4.1 Administrative Setup : The district is divided into 14 Community Development Blocks, which in turn are further subdivided into 342 Gram Panchayats comprising of 1969 villages in the rural front and on the urban side it comprises of 2 Municipal Corporation and 2 Notified Area Councils.

Table – 1.4a : Administrative Setup of Cuttack District

Sl No	Block	Geographical Area (ha)	Total Villages	NAC
1	ATHAGAD	43322	201	1
2	BANKI	20692	110	1
3	BADAMBA	40309	138	
4	BARANGA	13062	78	
5	CUTTACKSADAR	30798	118	2
6	DAMPARA	29297	49	
7	KANTAPADA	12166	89	
8	MAHANGA	20677	195	
9	NARSINGPUR	64945	248	
10	NIALI	20963	130	
11	NISCHINTA KOILI	22752	221	
12	SALEPUR	24667	164	
13	TANGI CHOUDWAR	37818	178	
14	TIGIRIA	11734	50	
	TOTAL	393200	1969	

Source: District irrigation plan of Cuttack

1.4.2 Demographic Setup : As per the Census Data of 2011, the total population of the District is 1936310, Of this the Male population is 995733 and the female population is 940577.

Table – 1.4b : Demographic Setup of Cuttack District

Sl No	Block	Total Population		
		Male	Female	Total
1	**ATHAGAD**	74008	70662	144670
2	**BANKI**	59692	55710	115402
3	**BADAMBA**	78297	71496	149793
4	**BARANGA**	46197	43904	90101
5	**CUTTACKSADAR**	72409	69284	141693
6	**DAMPARA**	51385	47509	98894
7	**KANTAPADA**	45859	43655	89514
8	**MAHANGA**	96119	90811	186930
9	**NARSINGPUR**	74733	157201	231934
10	**NIALI**	74857	72278	147135
11	**NISCHINTA KOILI**	96085	92514	188599
12	**SALEPUR**	98785	95153	193938
13	**TANGI CHOUDWAR**	80882	76919	157801
14	**TIGIRIA**	38690	35949	74639
	TOTAL	**995733**	**940577**	**1936310**

2.0 RAINFALL AND CLIMATE

The district is characterized by tropical monsoon climate having three distinct seasons in a year, viz. winter, summer and rainy seasons. Winter commences from late November and continues till end of February. Winter is followed by the summer season, which extends up to mid-June. During the period between April and May, 3 to 4 cyclonic rains generally occur in the district. The rainy season sets in the district at the advent of the southwest monsoon, generally from the middle of June and continues till end of September.

Lowest and the highest temperatures recorded for the district are 7.5 ^{0}C and 42.0 ^{0}C respectively. The December and January are the coldest and May is the hottest month. The normal annual rainfall is 1424.3 mm (2000-2015) with the average monthly of 118.69 mm. The mean annual wind velocity is 3.4 km/hr. The wind speed during cyclonic storms becomes very high and ranges from 70 to 100 km/hr or even more. Major direction of wind is from south and southwest.

The relative humidity, on an average, varies from 41 to 84% during the year and during monsoon it is much more where as in winter it is less. The mean monthly potential evapo-transpiration varies from 57 mm during January to 320 mm during May.

The South-west monsoon is the principal source of rainfall in the area. The normal rainfall of the district is 1424 mm. Rainfall distribution pattern in Cuttack district is shown in fig 2.1.

Table 2.0 Year wise Annual Rainfall of Cuttack District (2000 to 2015)

BLOCK	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Athagarh	1016	2479	2479	2519	1770	2784	2479	2462	2569	2542	2444	1886	2559	1919	1690.5	1393
Banki-Dampada	988	2269	2269	1451	985	1528	2269	1723	2109	2719	1834	1553	3806	2879	2707	1677
Barang	921	1753	1753	2135	1392	1770	1753	1565	1534	1217	1369	1536	1457	1679	1749	1035
Badamba	1202	1523	1523	1810	1164	1556	1523	1301	1456	1493	1213	1314	1730	1413	1618	984
Cuttack Sadar	1030	1902	1902	1996	1310	2854	1902	1523	1512	1327	931	1401	790	1232	1652	1341
Kantapada	1026	2632	2632	1566.9	1301	2309	2632	2408	2370	2177	1946	1564	1093	842	1764.1	1697
Mahanga	1079	2401	2401	1973	1928	2219	2401	2343	2212	2395	1314	1449	1399	1397	1807	1224
Niali	61	1904	1904	2080.5	1715	1996	1904	1403	1615	1686	1386	1183	1299	757	1551	1047
Nischintakoili	738	1476	1476	1193.5	1281	1463	1476	1761	1840	1537	1182	1623	1469	1787	1878	705
Narasinghpur	862	1374	1374	1524	1061	1888	1374	1659	1284	1449	1151	1511	1748	1766	1355	1117
Salepur	733	1769	1769	1174	1217	1545	1769	1951	1646	1554	1274	1612	1489	1288	1454	1191
Tangi-Choudwar	800	1590	1590	1600	1469	1729	1590	1829	1623	1456	1206	1493	853	971	1810.5	844
Tigiria	1455	1981	1981	2016	1593	2506	1981	2020	2320	1932	902	1350	1596	1458	1642	1031
Total	11912	25053	25053	23039	18186	26147	25053	23948	24090	23484	18152	19475	21288	19388	22678	15286
Average	980.98	1927.15	1927.15	1772.22	1398.92	2011.31	1927.15	1842.15	1853.08	1806.46	1396.31	1498.08	1637.54	1491.38	1744.47	1175.85

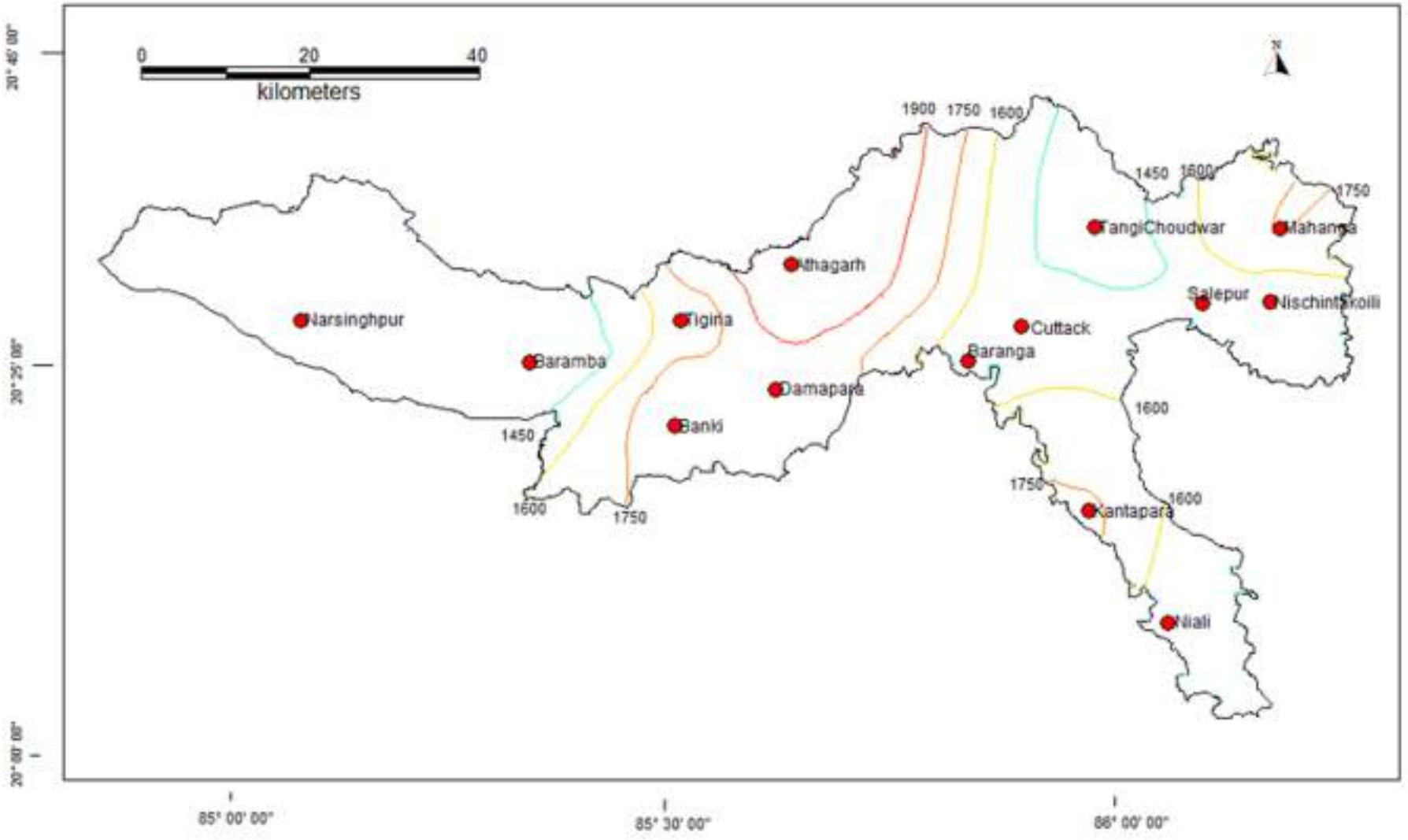


FIG 2.0 RAINFALL DISTRIBUTION PATTERN IN CUTTACK DISTRICT

3.0 PHYSIOGRAPHIC SETUP

Physiographically the district can be divided into two distinct units' viz-deltaic plain and lateritic uplands and hilly tract.

Lateritic uplands and hilly tract: The lateritic uplands and hilly tract is seen in the western part of the district. The Laterite upland bordering the hilly tract is characterized by moderately undulating topography supporting some vegetation. The hilly tract consists of a series of detached hill ranges of Pre- Cambrian and upper Gondwana formation. The average altitude varies from 50 to 100 m. above msl with the maximum of 446m above msl.

Deltaic plains: The deltaic plains occupy the eastern part of the district which is formed under the fluvial environment. The area is characterized by parallel to radial drainage pattern. It forms the most fertile part of the district. The average altitude varies from 10 to 20 m amsl.

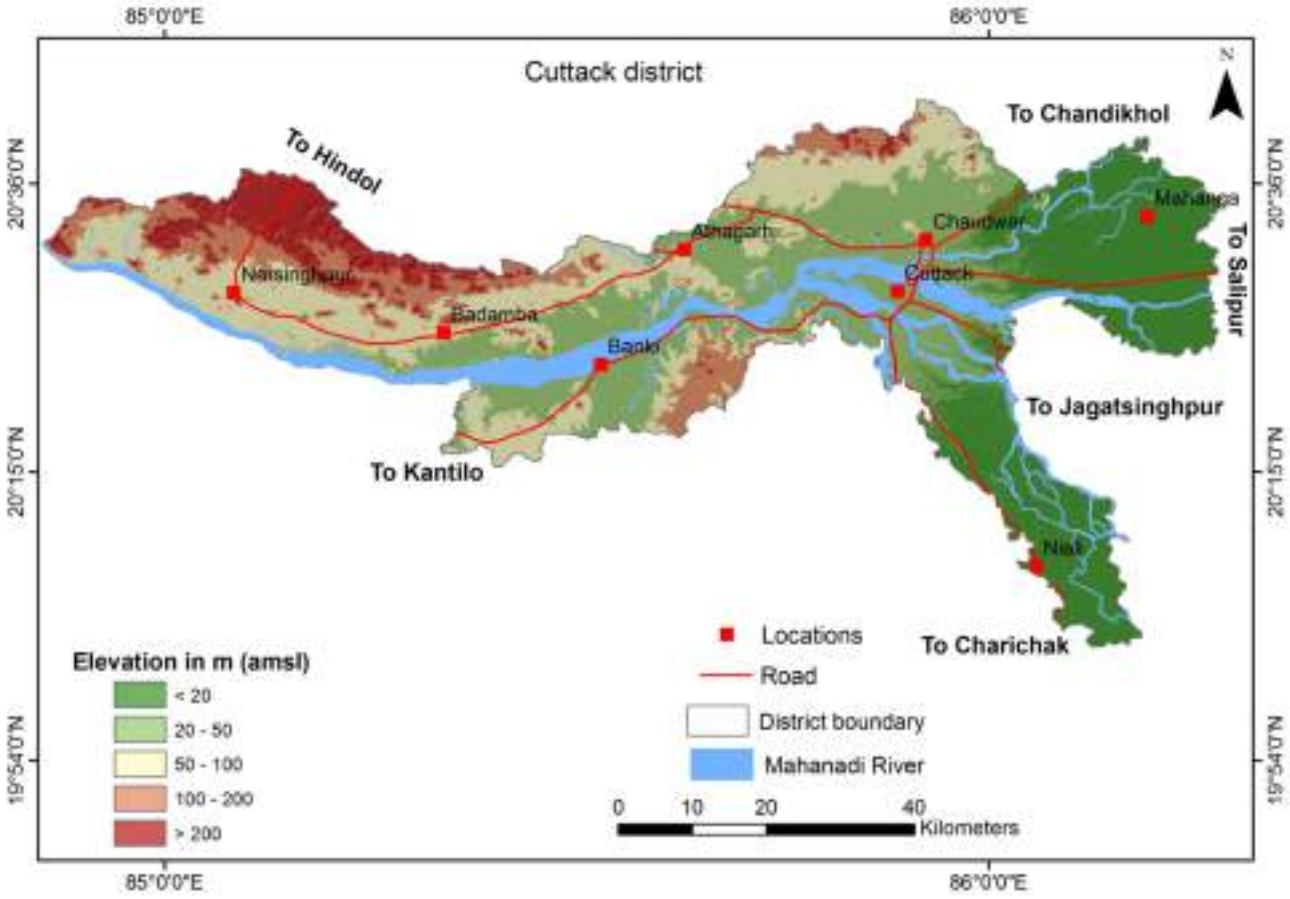


FIG. 3.0: LAND ELEVATIONS MAP OF CUTTACK DISTRICT

3.1 GEOMORPHOLOGY

The analysis of geomorphological data and map reveals that the hilly terrains in northern and North-western portions were separated by central deltaic plains. The geomorphology of the area is shown in **Fig. 3.2.**

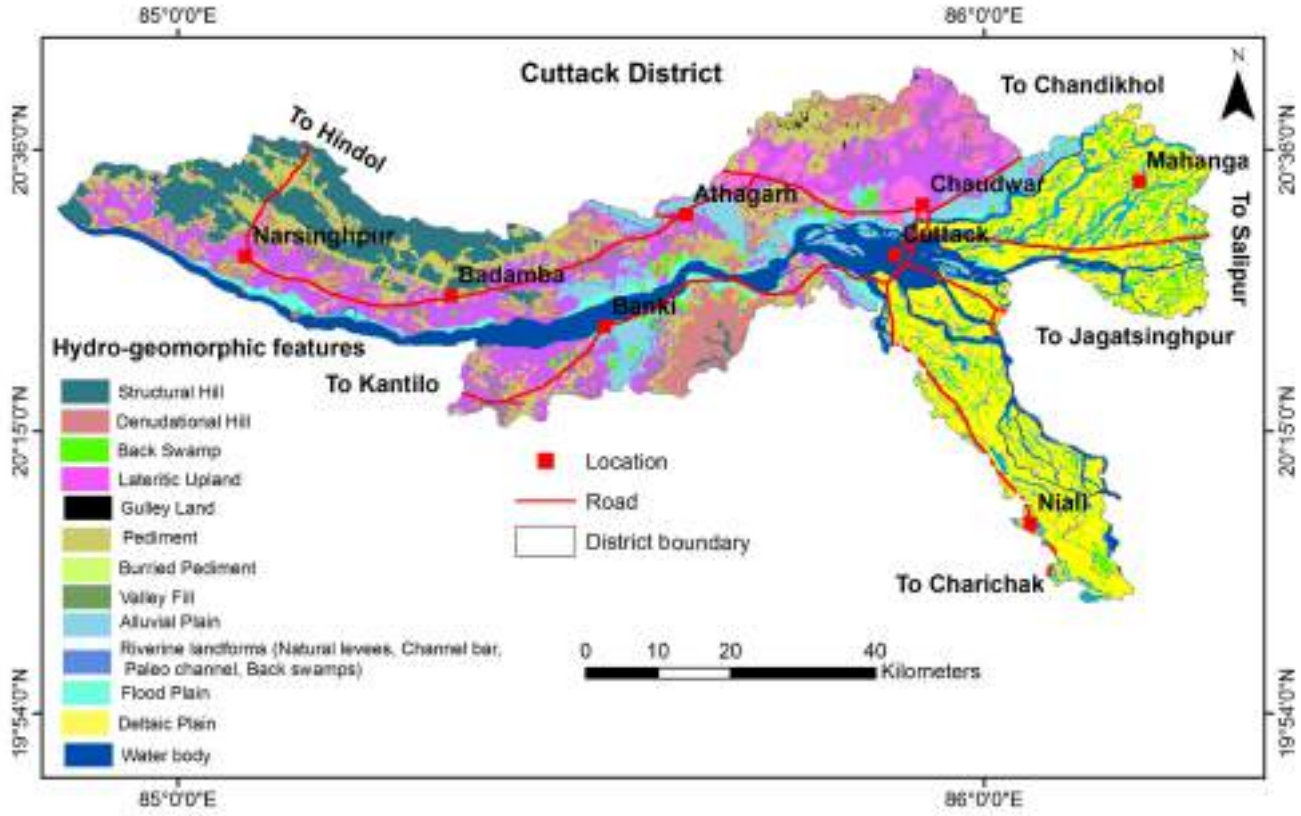


FIG. 3.1: GEOMORPHOLOGICAL MAP OF CUTTACK DISTRICT

3.2 LAND USE AND CROPPING PATTERN

Agriculture occupies a vital place in the economy of Cuttack district. The net sown area of the district is 174007 ha constituting 44.25 percent of the total geographical area of the district. Within the district, the forest area is maximum in the Narsinghpur block followed by Athgarh and Badamba blocks. The land use pattern of the blocks under the study area is shown in **Table 3.2.**

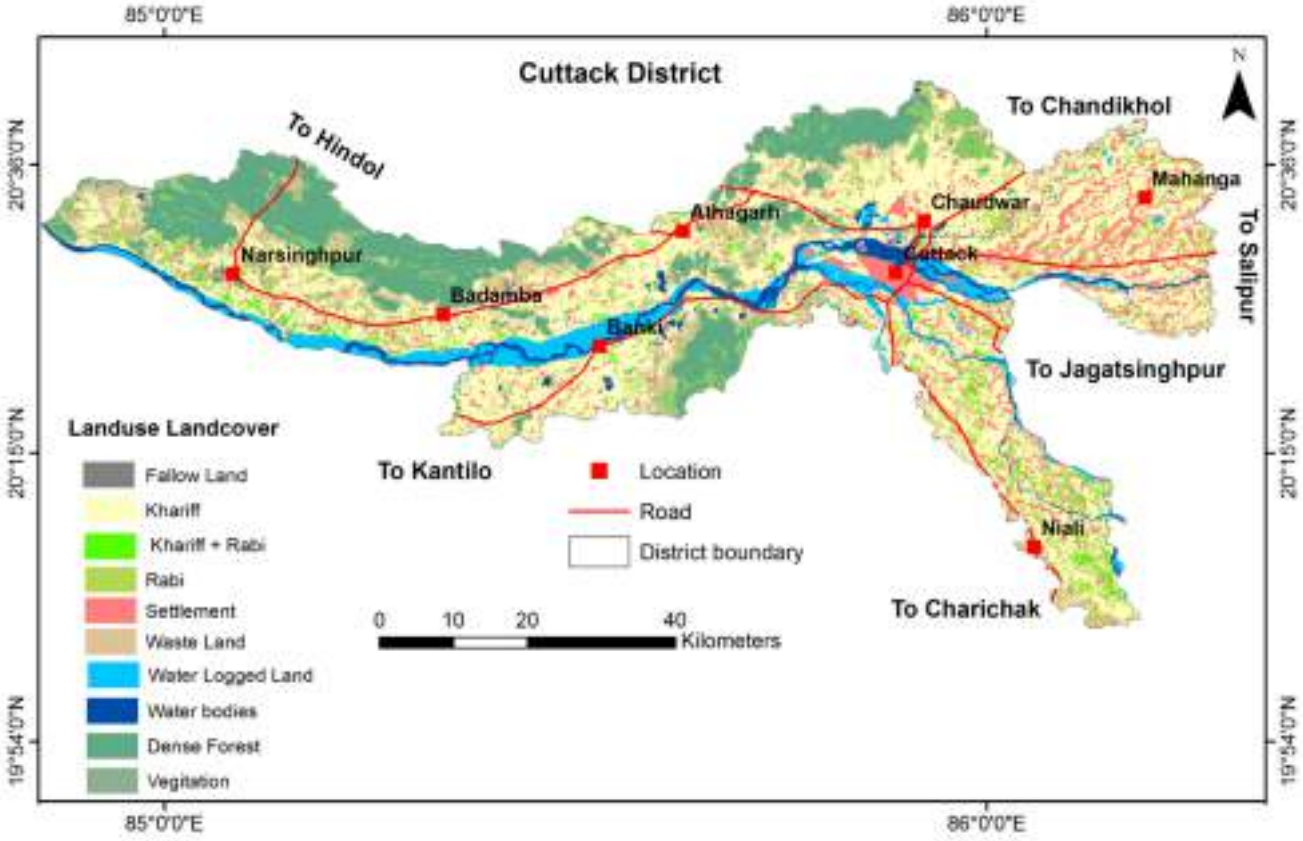


FIG. 3.2: LAND USE PATTERN OF THE NAQUIM AREA, CUTTACK DISTRICT

TABLE 3.2: LAND USE PATTERN OF DIFFERENT BLOCKS OF DISTRICT CUTTACK

Sl No	Name of the block	Total Geographical area	Area under Agriculture			Area under Forest	Area under Wasteland	Land other uses
			Gross cropped area (1)	Net area sown (2)	Area sown more than once (1-2)			
1	Athagarh	43321.65	36616	18403	18213	13609.42	2697.48	8611.75
2	Banki	20691.58	17925	9954	7971	1681.82	1110.71	7945.05
3	Baramba	40309.19	25706	13043	12663	12740.15	1576.19	12949.85
4	Baranga	13061.78	14807	6973	7834	43.46	844.34	5200.98
5	Cuttack sadar	30797.5	22247	10344	11903	3.61	954.44	19495.45
6	Dampada	29297.11	21210	11950	9260	7957.75	3375.81	6013.55
7	Kantapada	12165.74	15480	7621	7859	0	14.79	4529.95
8	Mahanga	20676.67	27428	14015	13413	0	107.7	6553.97
9	N.Koili	22751.62	28865	13612	15253	0	61.41	9078.21
10	Narasinghpur	64945.08	32949	18498	14451	30066.18	2079.42	14301.48
11	Niali	20963.47	27343	11865	15478	0	104.86	8993.61
12	Salipur	24667.32	33350	16060	17290	11.09	548.52	8047.71
13	T.Choudwar	37817.52	31514	15857	15657	9225.97	1677.67	11056.88
14	Tigiria	11733.76	12605	5812	6793	2420.14	184.98	3316.64
Total		**393200**	**348045**	**174007**	**174038**	**77759.59**	**15338.32**	**126095.08**

Source: District irrigation plan of Cuttack

Paddy is the major crop in the district, besides paddy other crops grown wheat, maize, ragi, oil seeds, pulses and vegetables.

The **kharif** crops include paddy, maize, ragi, small millets, arhar, biri, mung, ground nut, til, castor, cotton, turmeric, ginger and vegetables like brinjal, tomato, and early cauliflower. On the other hand, **Rabi** crops include paddy, wheat, maize, field pea, mung, biri, onion, garlic, coriander, vegetables, sugar cane etc.

3.3 IRRIGATION

The district is blessed with good canal systems and productive aquifer systems. The Mahanadi system supplies water to the existing canals of the Mahanadi Division at Cuttack. To supply water to the canals of this system, three anicuts have been constructed. One of them is at Naraj (1,169 meters) at the head of the Kathajori, which serves as feeder anicut by diverting the water to the Mahanadi. The other two are at Jobra (1,936 meters) on the Mahanadi and at Choudwar over Birupa (604 meters). The anicuts help in making an artificial detention reservoir at the apex of the delta. The major source of irrigation is the canal system which provides irrigation of 64575 ha during kharif and 35576 ha during rabi in normal years through Mahanadi South division, Mahanadi North Division, Prachi Division, Kendrapada division, Jagatsinghpur Division, Nimapada Division, Birupa & Genguti Division, Jaraka Division to 8 blocks out of 14 blocks namely Cuttack Sadar, Baranga, Kanrapada, Niali, T.Choudwar, Salipur, N.Koili, and Mahanga the total irrigation potential available so far from all sources is about 152939 ha. (100326 ha. during kharif and 52613 ha. during Rabi).

From hydrological point of view the entire district falls under MAHANADI river basins. In major irrigation project, under Mahanadi river basins, canal systems developed are divided in to 6 divisions which have designed ayacut area of 80805.07ha and are able to provide irrigations to 64575.78 ha with a canal length of 1532 Km.

TABLE 3.3.a IRRIGATION BASED CLASSIFICATION

Block	Irrigation (Area in ha)		Rainfed (Area in ha)	
	Gross irrigated area	Net irrigated area	Partially irrigated/protective Irrigation	Un-irrigated or totally rainfed
ATHGARH	6576	5388	0	14578
BANKI	1650	1132	0	9822
BARAMBA	5116	3784	0	9509
BARANGA	8216	5298	0	2520
CUTTACK SADAR	16739	10918	0	721
DAMPADA	3885	2612	0	9463
KANTAPADA	9951	6516	0	1289
MAHANGA	18264	12249	0	1845
NARSINGPUR	4729	3488	0	16145
NIALI	17141	11143	0	2857
NISCHINTKOILI	22042	13524	0	257
SALIPUR	26315	15828	0	612
TANGI CHOUDWAR	10071	6877	0	13186
TIGIRIA	2244	1569	0	5020
TOTAL	**152938**	**100326**	**0**	**87824**

Source: District irrigation plan of Cuttack

TABLE 3.3.b: IRRIGATION POTENTIAL CREATED IN (HECTERS)

Sl.No	Source	Area, ha		
		Kharif	***Rabi***	**Total**
1	Surface Irrigation			
(i)	Canal (Major & Medium Irrigation)	89131	54710	143841
(ii)	Minor Irrigation tanks	24515	3823	28338
(iii)	Lift Irrigation / Diversion	30368	17594	47962
(iv)	Other sources (Various Water Bodies including Rain water harvesting etc.)	31752	30971	62723
(v)	Treated Effluent Received from STP	0	0	0
(vi)	Untreated Effluent	0	0	0
(vi)	Perennial sources of water.	0	0	0
2	Ground Water			0
(i)	Open Well	0	0	0
(ii)	Deep Tube Well	2330	586	2916
(iii)	Medium Tube Well	0	0	0
(iv)	Shallow Tube Wells	307	6	313
		178403	107690	286093

Source: District irrigation plan of Cuttack

3.4 SOIL

It has been observed that the following three types of soils, viz. Alfisols, Ultisols and Entisols occur in the district.

Alfisols : These soils can be further sub-divided in to red loamy soils, red sandy soils, older alluvial soils and deltaic alluvial soils .The red soils are found in the hilly area in the western part of the district and older alluvial soils are found in minor pockets in northern part. The deltaic soil are found in major parts of the district.

Ultisols: These include laterite and lateritic soils, which are found in pockets and characterized by compact to vesicular mass in subsoil horizon composed essentially of a mixture of the hydrated oxide of allumina and iron. It is mostly found in Tigiria, Athgarh, Barang and TangiChoudwar block.

Entisols : These soils include younger alluvial soils occurring along the course of Mahanadi river mainly in western part and central part of the district. These soils are deficient in nitrogen, phosphoric acid and humus, but not in potash and lime.

The Thematic map on the soil distribution in the study area is shown in **Fig.3.4.**

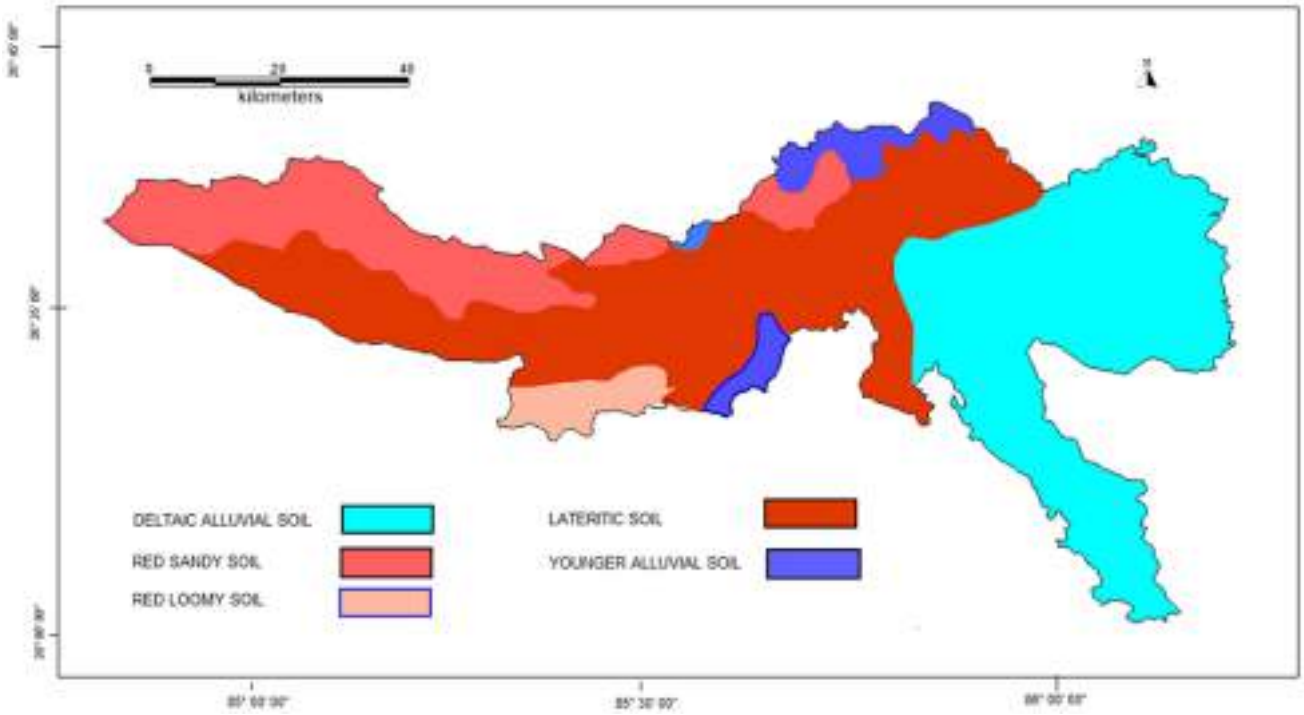


FIG. 3.4: SOIL MAP OF CUTTACK DISTRICT

3.5 DRAINAGE

The river Mahanadi and its distributaries and also tributaries control the drainage system of the district. The Mahanadi river traverses the district from west to east. In the eastern part of the district is the deltaic plains the Mahanadi river and its distributaries form the anatomizing drainage pattern and among the distributaries Birupa, Koakhye, Katjhuri, Chitropal are prominent. The drainage map of study area is shown in **Fig.3.5**

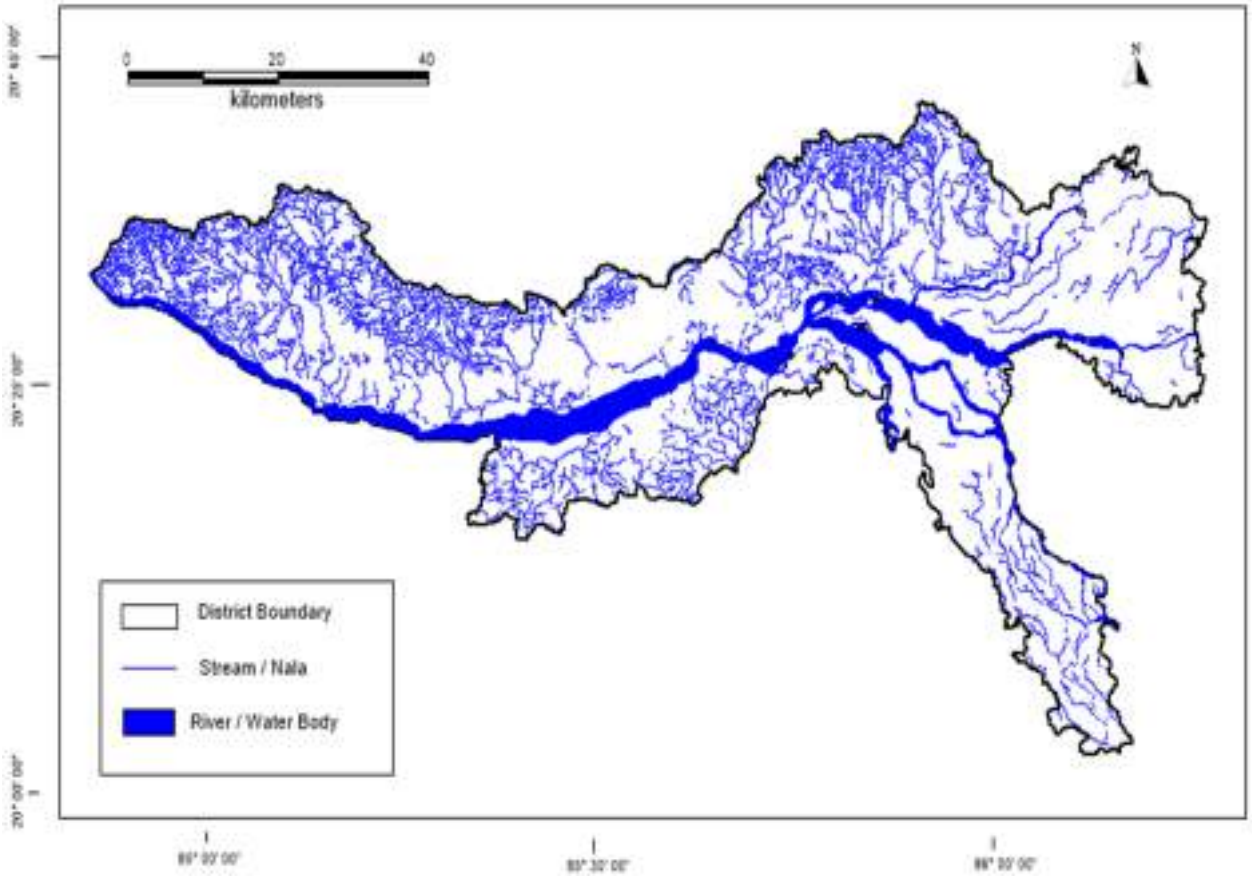


FIG. 3.5: DRAINAGE MAP OF CUTTACK DISTRICT

4.0 GEOLOGY

4.1 Geology Sequence

The geological formations encountered in the district range in age from Precambrian to recent. The Precambrian rocks occur in the western part of the district, the quaternary formations mainly occur in the eastern part of the district. The Mesozoic rocks are exposed in the west central part of the district. The generalized stratigraphic sequence is given in **Table 4.1** and the geological map of the study area is shown in **Fig**. **4.1.**

TABLE 4.1: **GENERALIZED STRATIGRAPHIC SEQUENCE IN CUTTACK DISTRICT**

Age	Lithology
Quaternary	Recent Alluvial, older Alluvium , Laterites and lateritic gravels
Upper tertiary	Brown , yellowish brown and gray clay, sand gravel, pebbles, gritty sand stone, limestone, shale and shale fragments)
UNCONFORMITY	
Mesozoic	Shale-Sand stone sequence of Athgarh formation
UNCONFORMITY	
Precambrian	Granites and granite gneisses, Charnokite, Khondalite

4.1.1 Pre-Cambrians

The Precambrian rocks occupy Narsinghpur, Baramba, Banki, Tigiria and parts of Athagarh, Tangi- choudwar and Dampara blocks. The granitic rocks mainly form undulating plain and the Khondalite and Charnockites form mostly the hills. The granitic rocks and charnokite-Khondalite rocks occupy more or less fifty -fifty geographical area, in hard rock terrain.

The shale - sandstone sequence of Athgarh formation of upper Gondawana group are exposed as patches mainly in Athgarh and Barang block. This formation is capped by laterites in major part of the area. The sandstone are fine to coarse grained, white to gray feldspatic but sometimes

pebbly, conglomerates to gritty and ferruginous. Layers of grayish white and pinkish shale are intercalated with sandstones. These sandstones are friable at some places and hard and compact at other places.

4.1.2 Tertiary Formations

The tertiary formations are encountered in the bore holes at different depth ranges. The Miocene formation is marine and fosssiliferous. It consists of yellowish brown limestone, gray clay and fine to coarse sand. The Mio Pliocene formations are estuarine deposits. They consist of mainly brown yellowish brown and gray clay, gritty sandstones and gravels.

4.1.3 Alluvial Deposits and Laterites

The older alluvium occurs mainly in the upper part of the Mahanadi delta. This sediment is grey to brown in colour.

The younger alluvium occupies the major part of the deltaic plain and also occurs strips of limited thickness along the course of major rivers and streams in the hard rock and semi consolidated terrain. This deposit consists of clay, sand, gravels and pebbles which are deposited by the Mahanadi river and its distributaries and tributaries.

Laterites occur as patches capping over the crystalline rocks and also over Athgarh formation. The average thickness is around 5 to 6 m with maximum around 30m.

4.1.4 Structural Features

The general strike of the Precambrian rocks varies from NE-SW towards extreme western part of the district. The rocks are jointed and joint plains exhibit three different directions varying from NE-SW to NW-SE with steep dip. The Athgarh sandstone are fairly jointed with joint direction NE-SW, NW-SE, N-S and dips of dips of joint plains are mostly vertical .The bedding plain of sand stone dip at low angles.

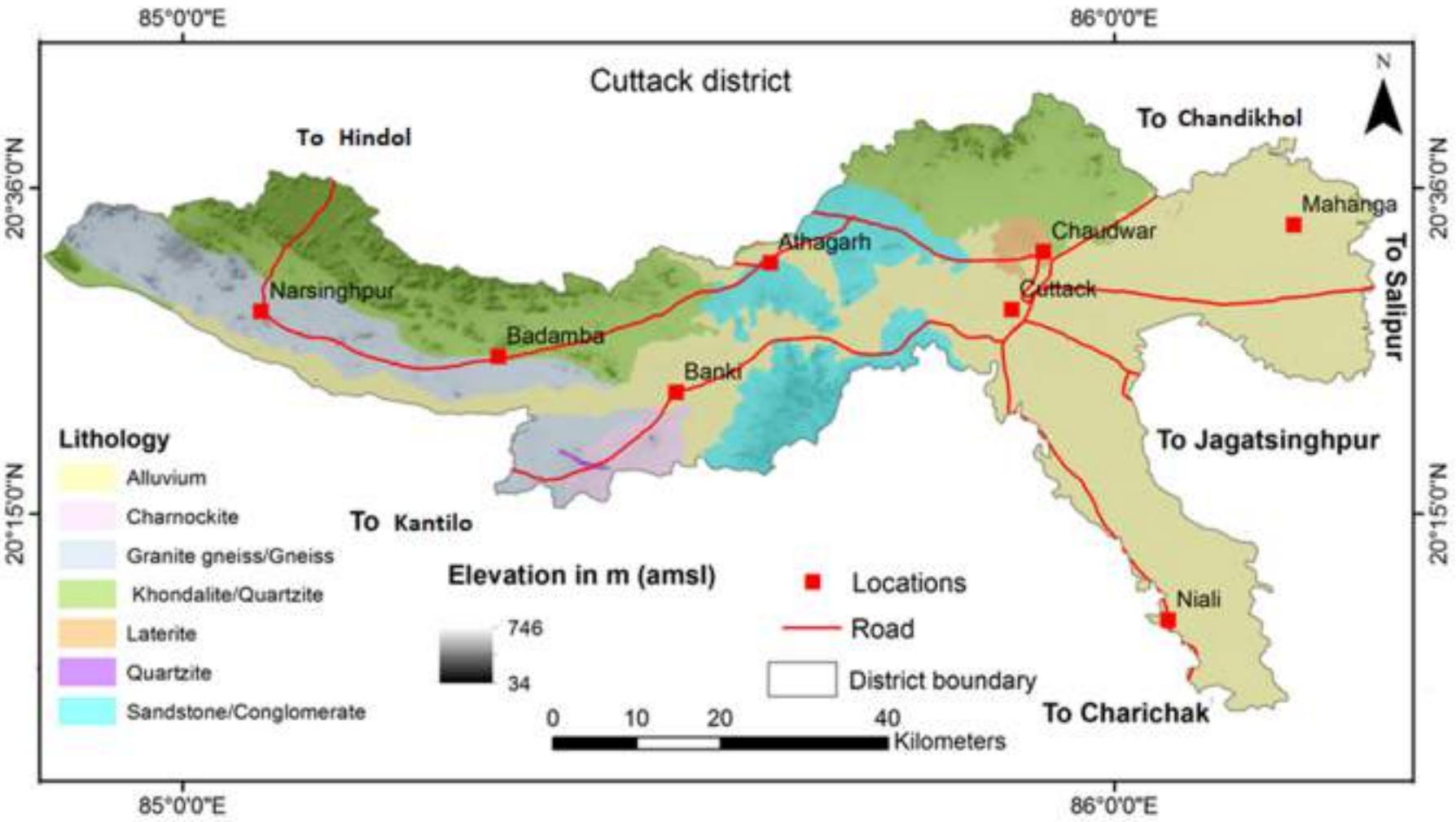


FIG. 4.1: GEOLOGICAL MAP OF CUTTACK DISTRICT

5.0 HYDROGEOLOGY

The hydrogeological condition of the study area can be broadly grouped into two units. The hydrogeological map of the area is present in **Fig. 5.1**.

5.1 Water bearing formations- The water bearing formation of the area can be divided into (a) Fissured formation (b) Porous type.

(a) Fissured formation- The Pre-Cambrian crystalline which mainly consists of granitic rocks, Khondalites and Charnockites and occupy western part of the district formed the fissured formation. Ground water in these rock types occurs under unconfined condition within the weathered residuum and under semiconfined to confined condition in fracture at depth. The thickness of the weathered zone varies from negligible to 35- 40 m. In general thickness of weathered zone is minimum in Charnokite and maximum in Khondalite. On an average the thickness of weathered zone is restricted to 7 to 8 m in Charnokite and it is within 12 m in granitic rock while in Khondalite it is around 20m. The weathered zone forms the shallow unconfined aquifers. Among all rock type the weathered zone in granitic rocks form better aquifers and Charnokite forms poor aquifers. The yield from existing dug wells which tap weathered formation are on an average 20 to 22 m^3/day with the maximum of 36 to 40 m^3/day in granitic rocks while in khondalite and charnokite it is 10 to 12 m^3/day with the maximum around 20 m^3/day.

The depth of exploratory bore hole drilled in khondalite varies from 82 to 169 m and the thickness of weathered zone varied from 16 to 26 m. The depth of the saturated fracture varied from 21 to 72 m and yield varied from 0.5 to 9.55 lps. The static water level varied from 2.6 to 4.96 mbgl.

The granitic rock is having yield up to 10 lps with average of 3 to 5 lps. The fracture zones are mostly confined within 75 to 100 m depth and within this depth 2 to 3 fractures are generally encountered.

The yield from bore wells in charnokite is generally restricted within 2 lps.

(b) Porous formation-The porous formation comprises of

I. Semi consolidated Athagarh formation
II. Quarternary alluvium and upper tertiary sediments
III. Laterites in limited area.

Semi consolidated Athagarh formation: They occurs in between hard rocks and unconsolidated formation covering the parts of Athagarh, Barang and Tangi-Choudwar blocks. It is composed of mainly alternate layer of shale and sandstone.

The aquifer system is mainly formed by sandstone at shallow as well as deeper depths. The shale form mainly phreatic aquifers and that also with limited yield potential. The weathered zone in sandstone extent down to a depth of 12 to 15 m. The yield of dug well in weathered zone of sandstone is around 20 to 25 m^3 /day. The yield of deeper aquifer varied from 0.75 to 17 lps. The fracture zones were found to occur down to 100m depth and within this depth 2 to 4 sets of fractures were encountered. It was noted that prominent saturated fractures commonly occur within hard and compact ferruginous sandstone. The depth of the static water level varies from 0.6 to 26.35 mbgl.

Quaternary and Upper Tertiary sediments: The quaternary alluvial deposits underlain by upper tertiary sediments occupy half of the district covering eastern sector. The regional hydrogeological survey and ground exploration and also other drilling data revealed the following facts about the aquifers. The Sands, gravels and pebbles form the main aquifer and groundwater occurs under phreatic condition at shallow depth and semi confined to confined in deeper depth in these formation .At deeper depth granular zones contains both saline and fresh water in the extreme south-eastern part and also in pockets in extreme eastern and north eastern part. The shallow near surface aquifers, which are mainly exploited by, dug wells yield fresh water in the entire district. The yield of the existing dug well varies from 30 to 50 m3/day. The average depth of these dug well is around 6 to 7 m.

Laterites: The laterite occur as capping over consolidated and semi consolidated formation and prominent occurrence are found in parts of Barang and Tangi Choudwar blocks where thick laterite occur over the semi consolidated Athgarh formation. It generally forms the shallow aquifer and ground water mostly tapped by shallow dug wells. On an average the yield from dug wells in laterites, is around 25 to 30 m^3/day with the maximum of 40 to 45 m^3/day.

Saline Aquifers: Salinity problem exists in the southern part of Niali block and in parts of Mahanga and Nischintkoili block. The fresh water bearing zone in Niali extends down to 60- 70 m and below it lies the saline aquifer upto a depth of 300 m. At Mahanga the fresh water aquifer lies within 65-70 m and below it lies the saline aquifer down to 156m depth. Nischintkoili block is having fresh water aquifer upto 120 m and from 120-153 m depth exist the saline aquifer.

5.2 Aquifer parameter:

The aquifer parameters of shallow and deep aquifers were determined from the pumping test data conducted during the hydrogeological survey and exploratory drilling. Aquifer characteristics of shallow and deeper aquifers are noted below.

Shallow Aquifers: Near surface aquifer in which ground water occurs under unconfined (phreatic) condition and is mainly tapped by dug wells for ground water extraction is generally identified as shallow aquifer. The specific capacity and hydraulic conductivity in different formations are stated in table 5.1.

Table 5.1 Specific capacity and hydraulic conductivity in different formations

Formation	Specific Capacity Index (lpm/min/m draw down)	Hydraulic conductivity (m/day)
Alluvium	1.42-3.61	4.72-13.68
Laterite	1.1-2.89	3.66-9.23
Athgarh formation	0.7-2.11	2.78-10.15
Granitic rocks	0.60-2.23	1.89-8.21
Khondalite and Charnockite, etc	0.41-0.82	1.66-3.62

Deeper Aquifers: Aquifers, which occur below the phreatic zone and extends down to a greater depth, are termed as deeper aquifers. Ground water in deeper aquifer occurs under semi-confined to confined conditions. Deeper aquifers are tapped by tube/bore wells for ground water extraction. Characteristics of deeper aquifers are noted below.

Consolidated Formation: The specific capacity values for khondalites and Charnockites are low and generally restricted within 0.09 lps/m of drawdown and Transmissivity values are mostly within 30 m^2 /day. While the specific capacity values for granitic rocks may go up to 5 lps/m of draw down. Transmissivity values range between 0.23 and 36 m^2 /day, with the average value ranging from 5 to 10 m^2 /day.

Semi-Consolidated Formation: The specific capacity values in semi consolidated Athgarh formation ranges from 0.19 to 5.60 lps/m of drawdown while the transmissivity values are from 0.48 to 305 m^2 /day.

Unconsolidated Formation: The specific capacity values in unconsolidated formation range from 1.46 to 20.2 lps/m of drawdown and Transmissivity values ranges from 16 to 985 m^2 /day. Storativity values calculated from two exploratory wells at Kantapara and Madhab of Niali block were 8.34 x10 $^{-4}$ and 2.11 x10 $^{-4}$ respectively indicating semi confined to confined conditions of aquifer.

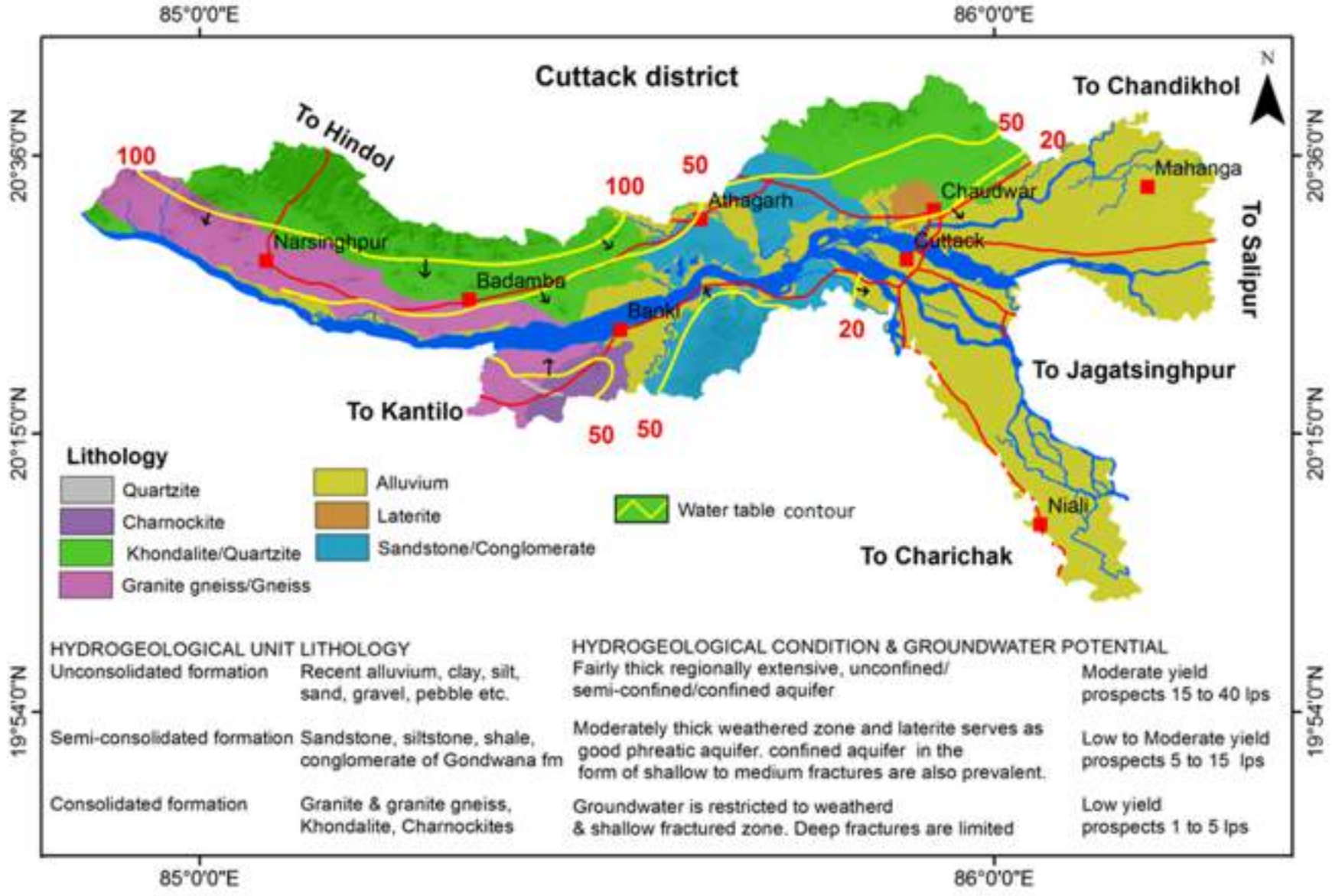


FIG 5.1 HYDROGEOLOGICAL MAP OF CUTTACK DISTRICT

6.0 GROUND WATER EXPLORATION

Ground water exploration data, down to the depth of 200 m bgl in the NAQUIM area, has been taken up for the preparation of Aquifer Map. The total no of Exploration points including EW, OW and piezometers is 84.

The major objective of ground water exploration in the study area was

I. To understand aquifer geometry of the area.
II. Estimation of various aquifer parameters required for formulation of the aquifer management plan.
III. Assessment of ground water quality in various aquifers system occurring up to 200 m depth for ensuring its suitability for various uses.

The exploration and monitoring locations are shown on map is in **Fig 6.0.a**

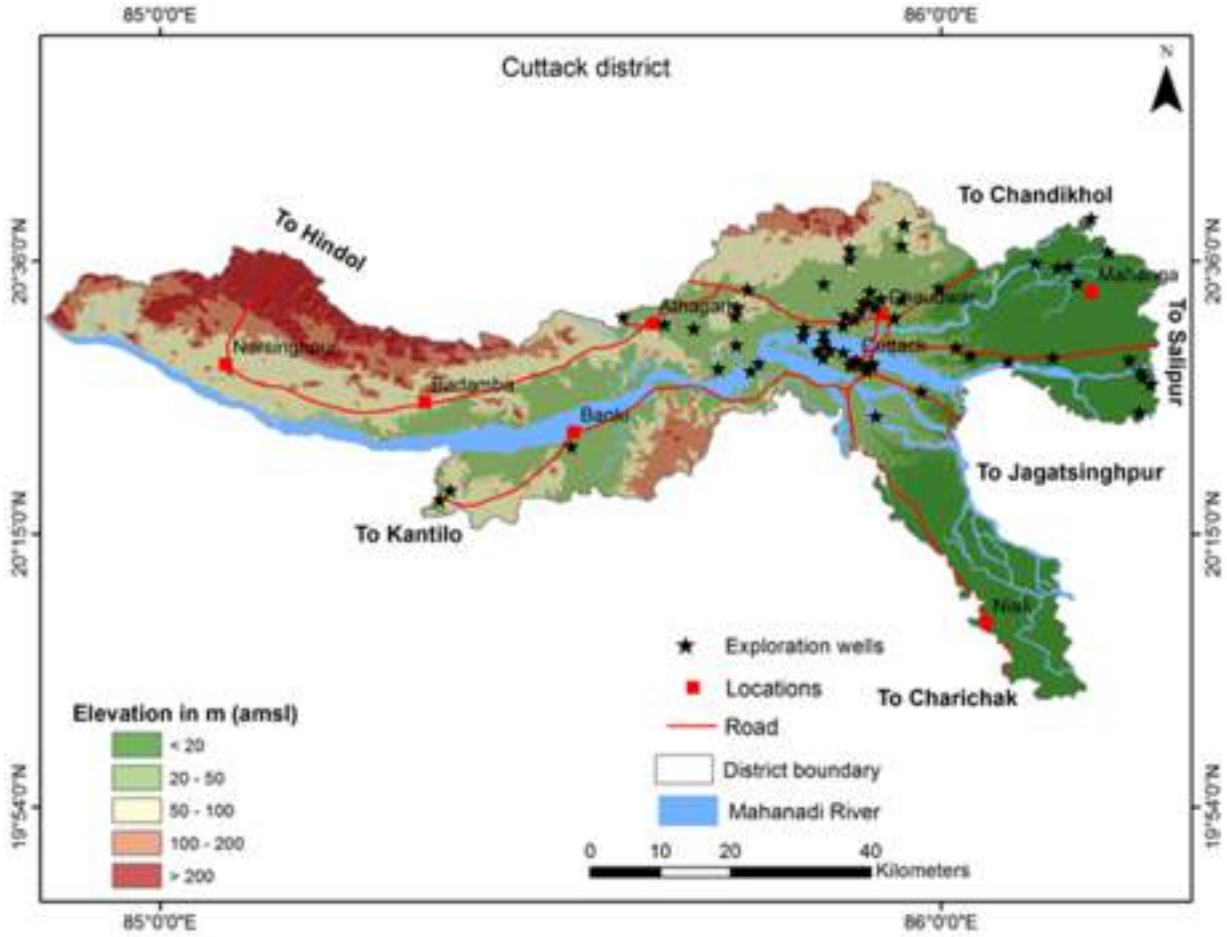


FIG. 6.0.a: LOCATIONS OF EXPLORATORY WELLS IN CUTTACK DISTRICT

6.1 GROUND WATER DYNAMICS

Central Ground Water Board carries out the ground water monitoring through a network of observation wells - the National Hydrograph Network Stations. The National Hydrograph stations set-up is a system of spatially distributed observation points for ground water regime monitoring at which periodic monitoring is carried out viz. recording of water levels, temperature and collection of water samples for chemical quality analysis for building a robust database to cater to multitude of needs for ground water management. CGWB has 77 National Hydrograph Network Stations in Cuttack district. Similarly 35 no. of tube wells and 27 no of Dug well were established in the NAQUIM area for monitoring of ground water regime as well as assessment of ground water quality of the aquifer. The locations of monitoring stations are shown in **Fig6.0.b.**

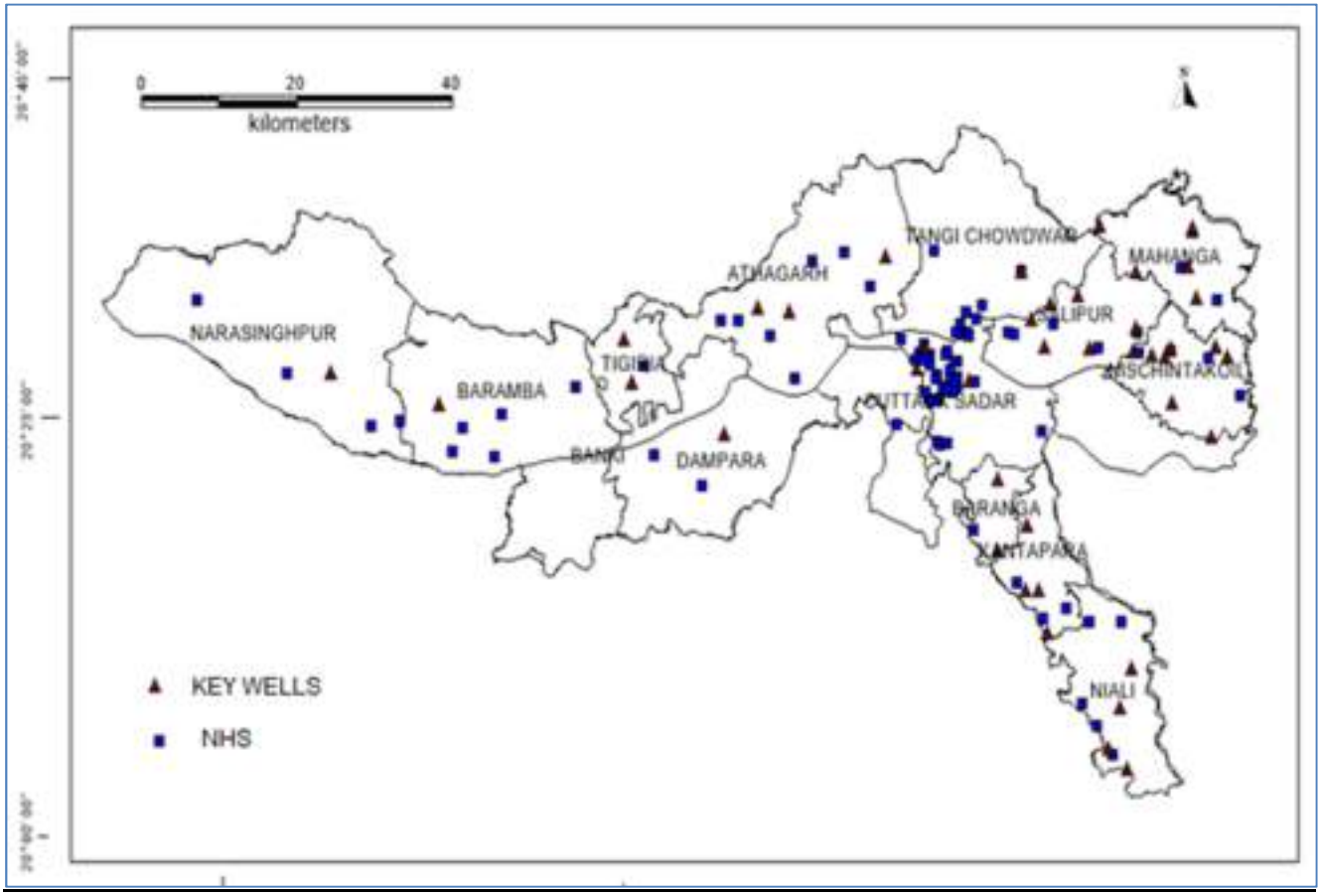


FIG. 6.0.b: LOCATIONS OF GROUND WATER MONITORING STATIONS IN CUTTACK DISTRICT.

Depth to water level (Aquifer-I)

Depth to Water Level (Pre-Monsoon 2016)

The depth to water levels during April 2016 ranges between 0.9 mbgl in Cuttack Sadar to 12.95 mbgl in Bindhanima in Tigiria Block. Depth to water levels map during pre-monsoon shows water levels mostly lies within 6-8 mbgl in the western part of the district and shallow water level of 2-4 and 4-6 mbgl in north eastern part of the district . Deepest water level of more than 8 mbgl is observed in patches mostly in Tangi Choudwar, Tigiria and Badamba block. The pre-monsoon depth to water level map is given in **Fig.6.1.a**.

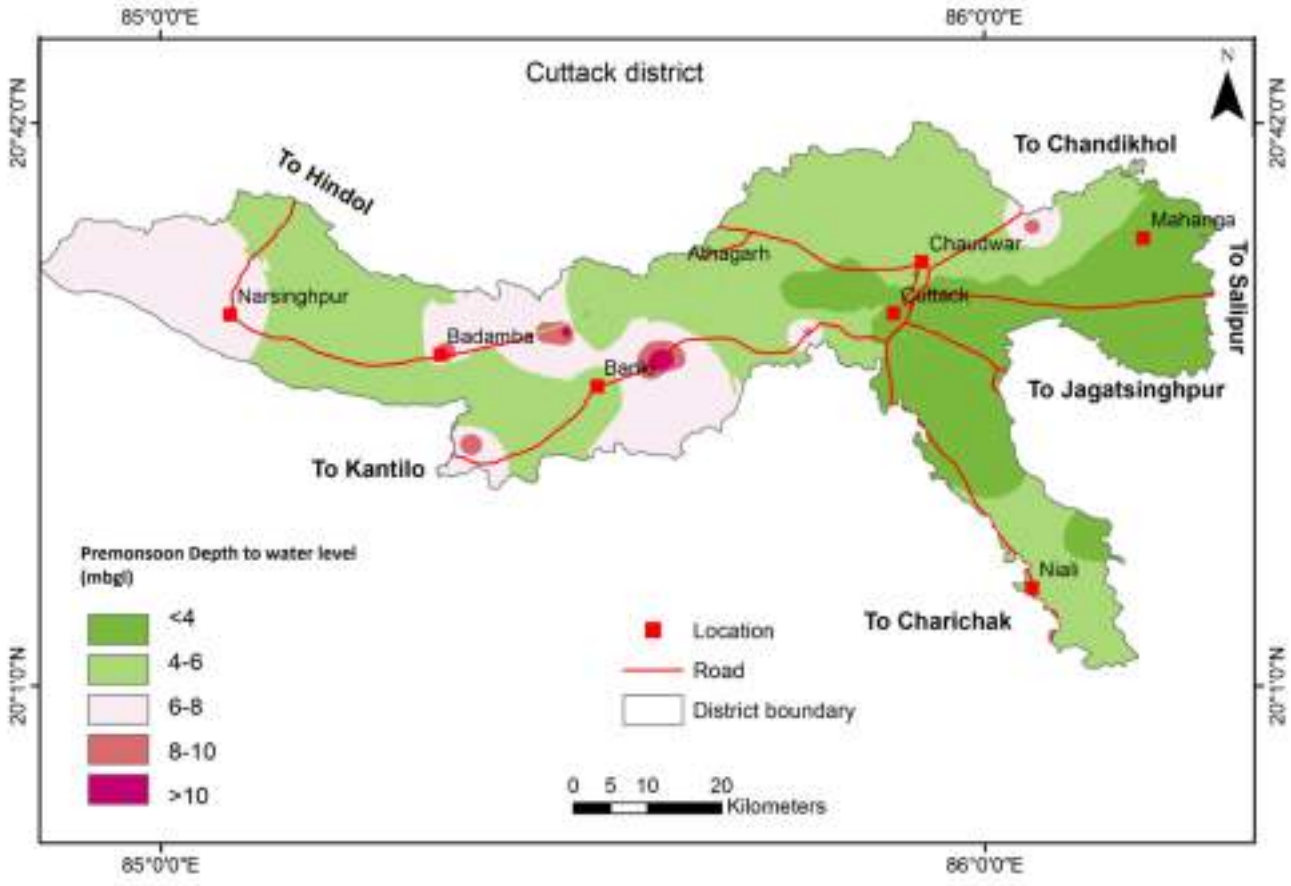


FIG. 6.1.a: DEPTH TO WATER LEVEL (AQUIFER-I) (PRE-MONSOON 2016)

Depth to Water Level (Post-monsoon 2016)

The depth to water levels during November 2016 ranges between 0.37 mbgl in Tigiria to 10.75 mbgl at Ghasiput in Dampada Block. Except small isolated patches, depth to water level is mostly less than 4 mbgl. Deeper water level of more than 6 mbgl was observed in pockets in Badamba, Dampada, Tangi choudwar and Tigiria blocks.

The post-monsoon depth to water level map is given in **Fig.6.1.b**.

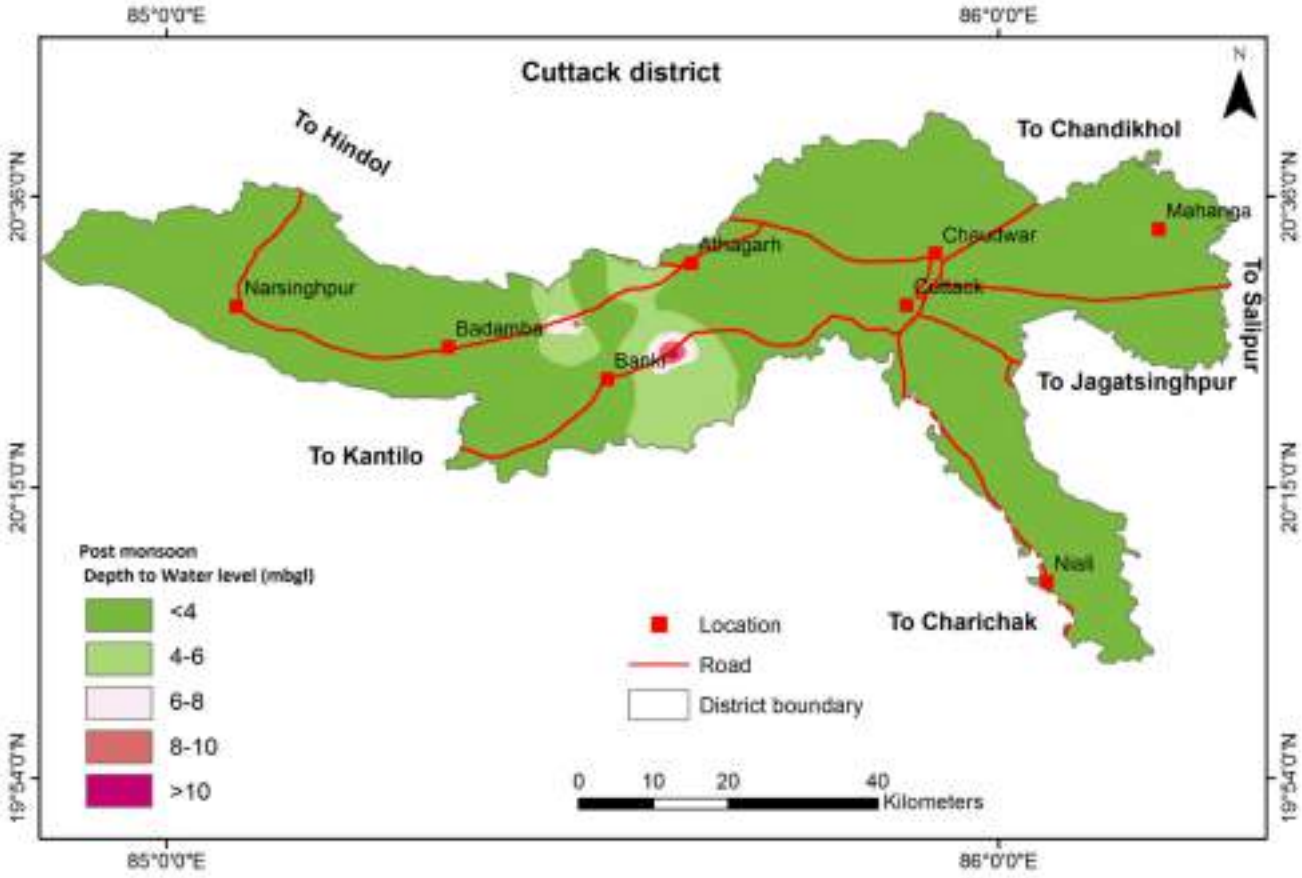


FIG. 6.1.b: DEPTH TO WATER LEVEL (AQUIFER-I) (POST-MONSOON 2016)

Water Level Fluctuation (Aquifer-I)

The water level measured during pre and post monsoon period was used to calculate the fluctuation. The seasonal fluctuation (April 16-Nov 16) in water level was obtained from difference in water level during pre and post monsoon water level. It is observed that minimum water level fluctuation was measured at Radha Govindpur village (0.11m) in Athgarh Block while maximum water level fluctuation was measured at Tangi (4.4m) in Tangi Chouwdwar. The water level fluctuations are grouped under two categories and are discussed under.

0-2m and 2-4 m	-	Less water level fluctuation
4-6m	-	Moderate water level fluctuation
>6 m	-	High water level fluctuation

The water level fluctuation map shows that majority of the area is having less water level fluctuation.

The seasonal fluctuation of water level of Aquifer-I is shown in **Fig.6.1.c**

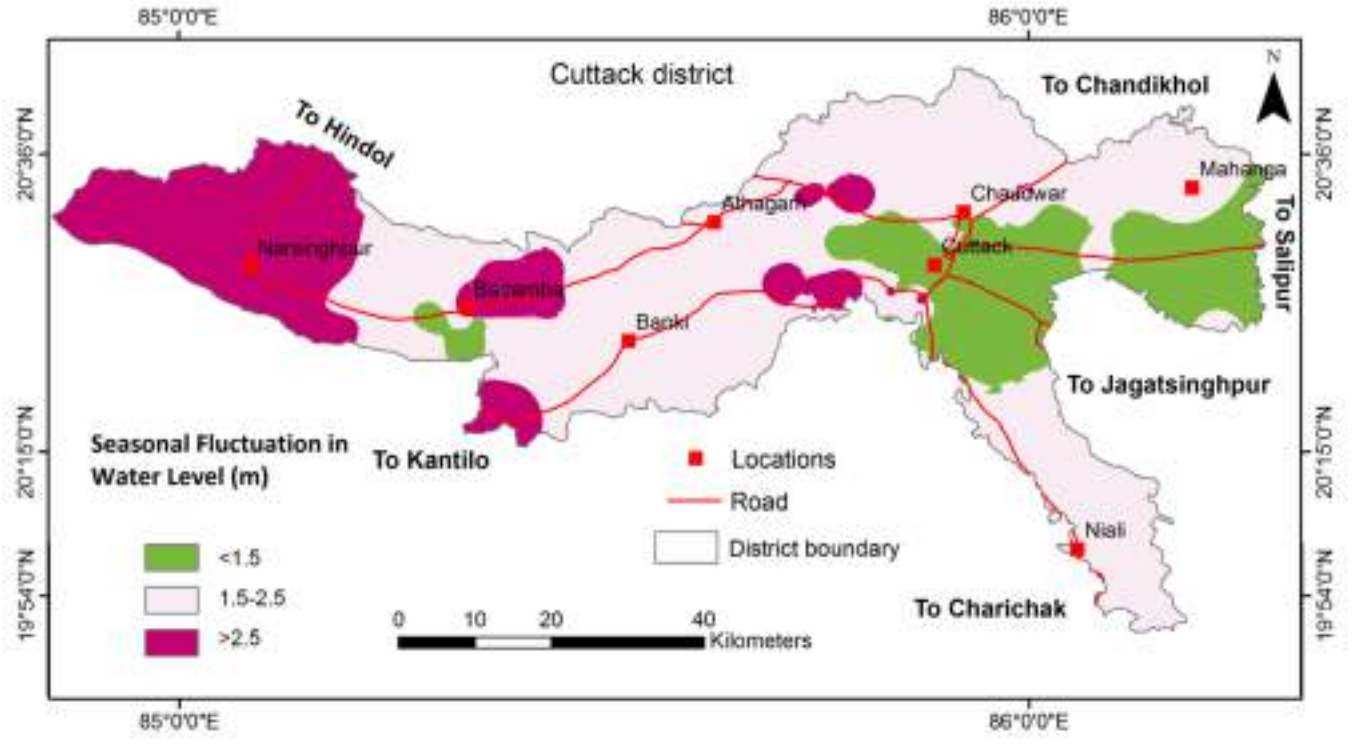


FIG. 6.1.c: SEASONAL FLUCTUATION IN WATER LEVEL (AQUIFER-I) (PRE VS. POST-MONSOON 2016)

6.2 HYDROGRAPH ANALYSIS

The hydrographs of 15 ground water monitoring stations were analysed for the period from 2006 to 2016. The variation in short term and long-term water level trends may be due to variation in natural recharge due to rainfall and withdrawal of groundwater for various agricultural activity, domestic requirement & industrial needs. The analysis of hydrographs show that the annual rising limbs in hydrographs indicate the natural recharge of groundwater regime due to monsoon rainfall as the monsoon rainfall is the only source of water (**Fig. 6.2.a to 6.2.o**). However, the groundwater draft continuously increases as indicated by the recessionary limb. The groundwater resources are not replenished / recharged fully and the groundwater levels are under continuous stress and depleting. It has also been observed that there were few years when the recharge exceeded draft for a particular period or year but in the next successive year, the draft again exceeded recharge.

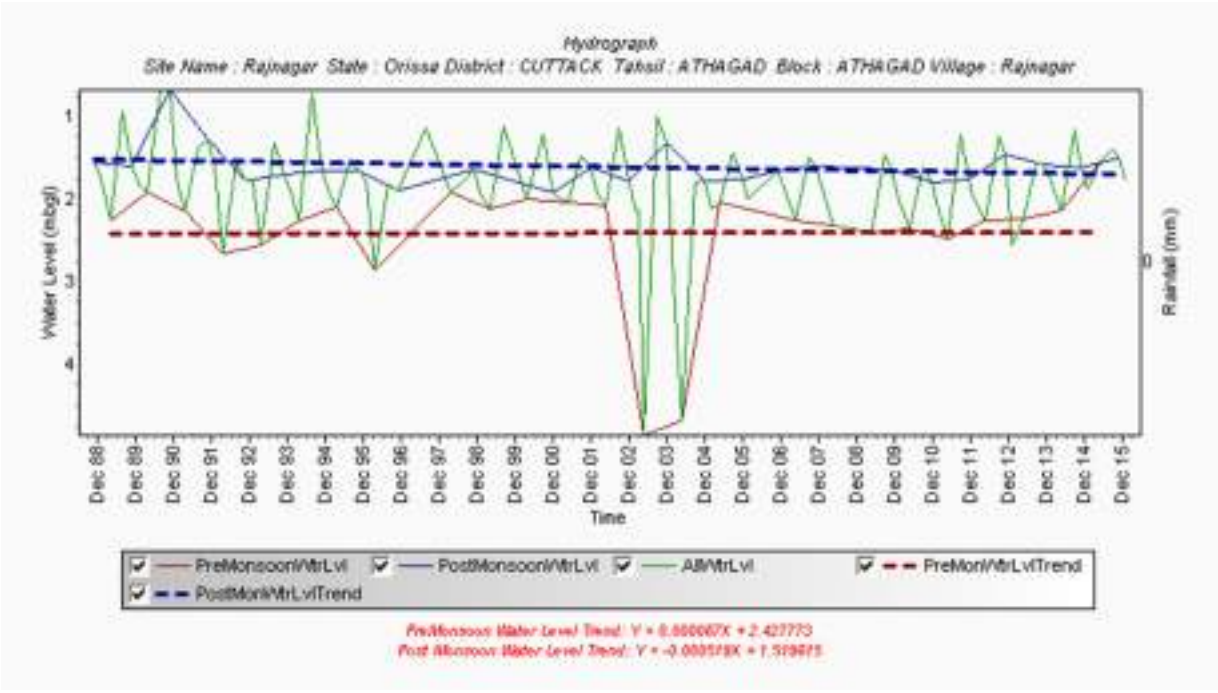


Fig 6.2.a: Hydrograph of Rajnagar, Athgarh block, Cuttack District

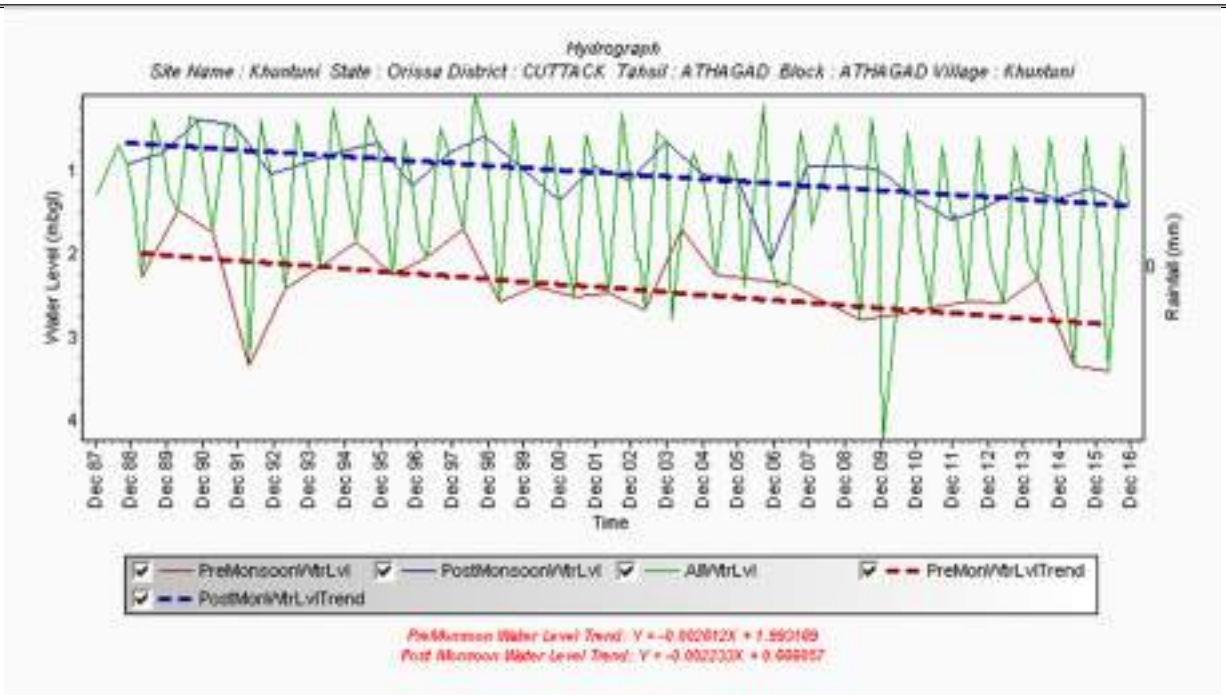


Fig 6.2.b: Hydrograph of Khuntuni, Athgarh block, Cuttack District

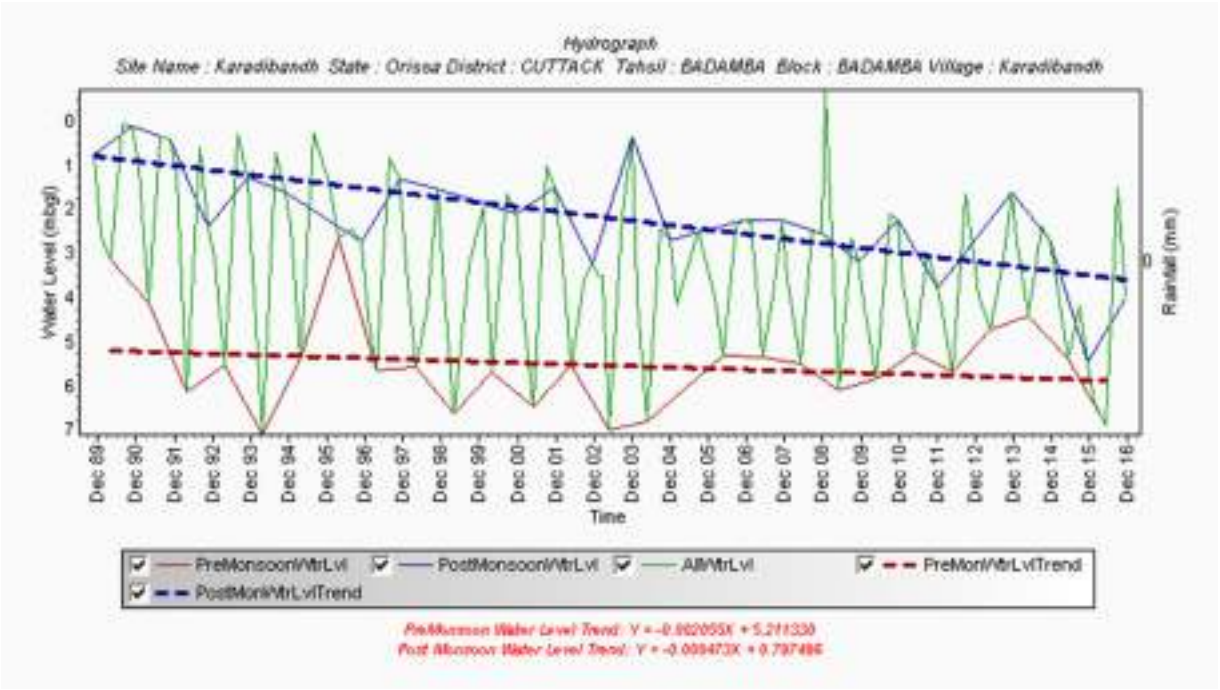


Fig 6.2.c: Hydrograph of Karadibandh, Badamba block, Cuttack District

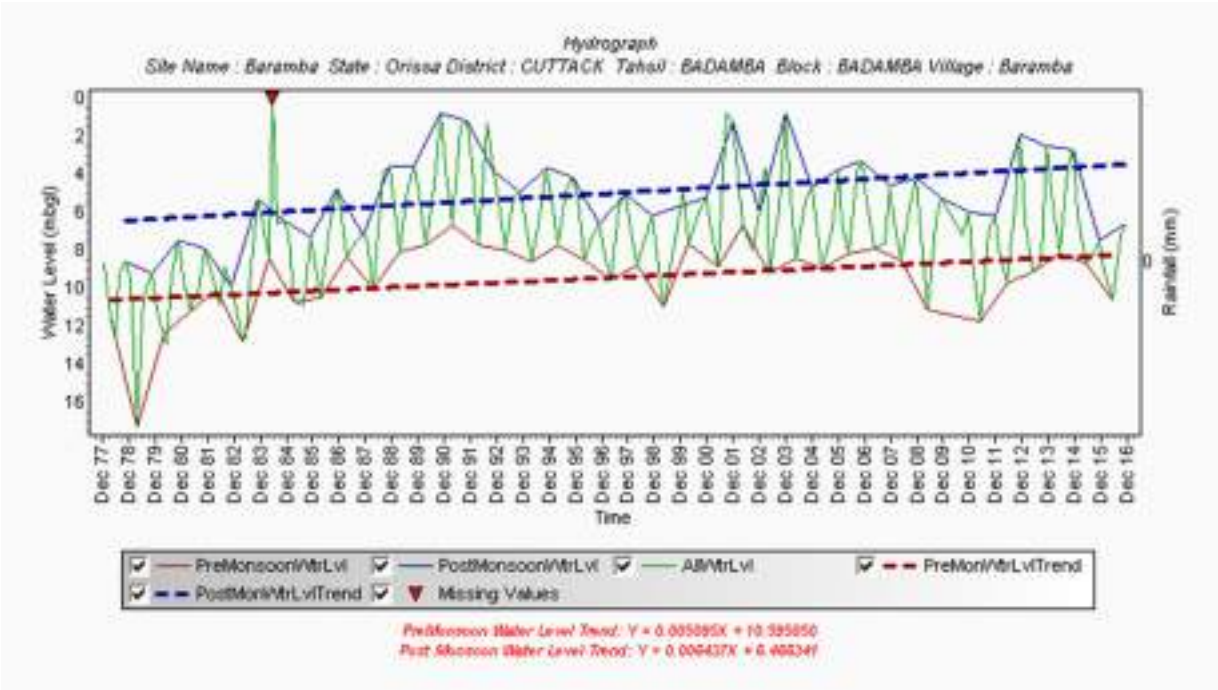


Fig 6.2.d: Hydrograph of Badamba, Badamba block, Cuttack District

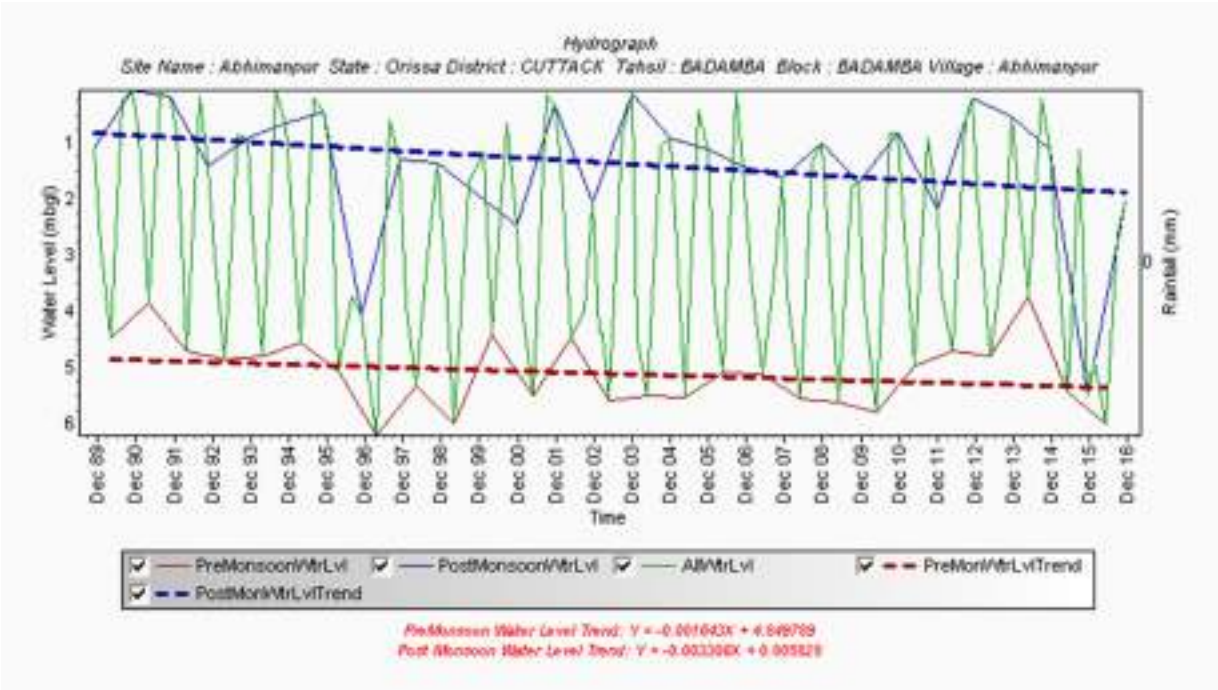


Fig 6.2.e: Hydrograph of Abhimanpur, Badamba block, Cuttack District

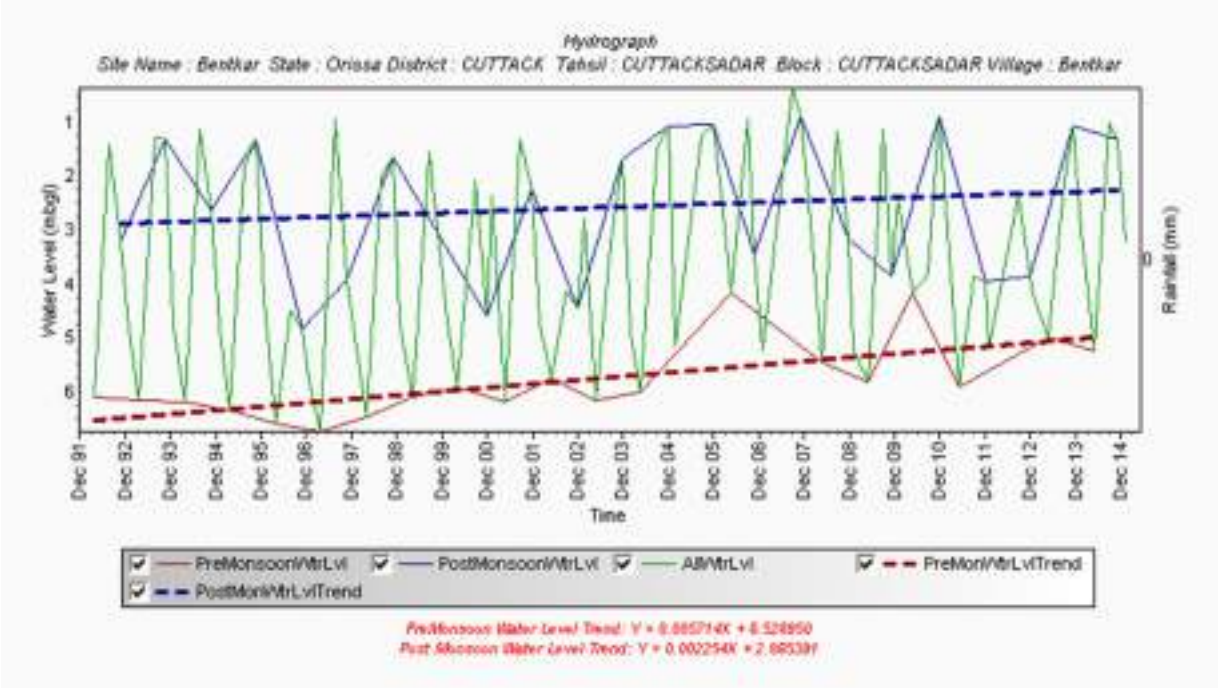


Fig 6.2.f: Hydrograph of Bentkar, Cuttack Sadar block, Cuttack District

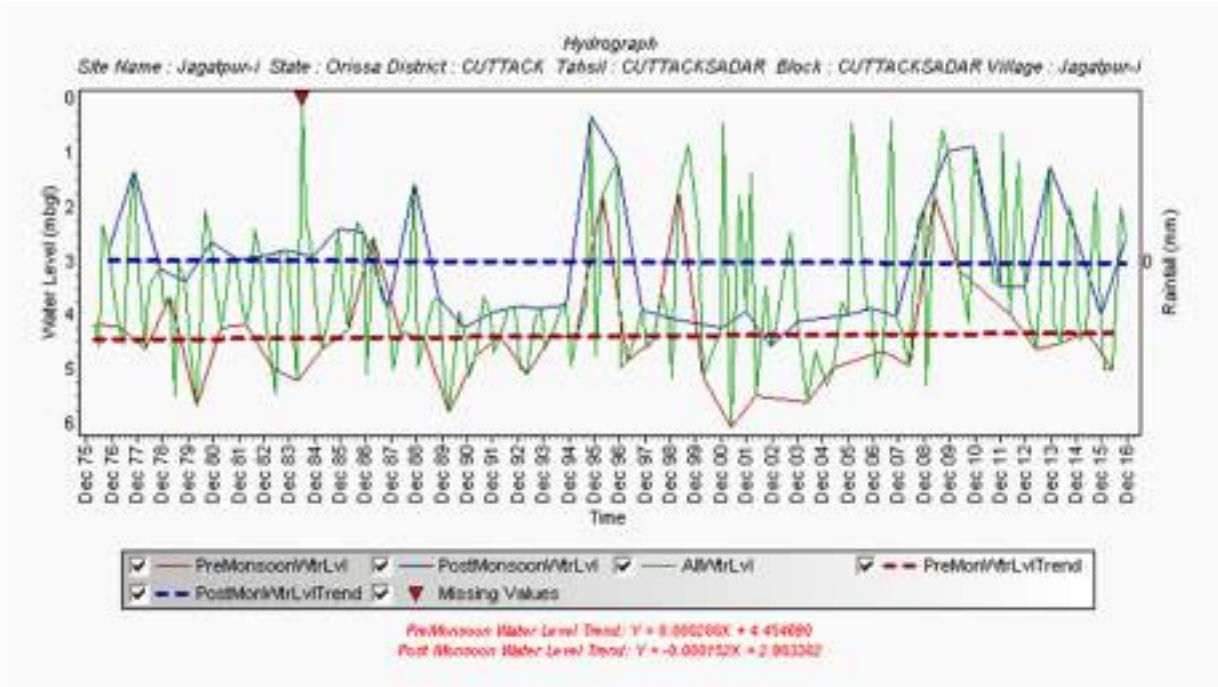


Fig 6.2.g: Hydrograph of Jagatpur, Cuttack Sadar block, Cuttack District

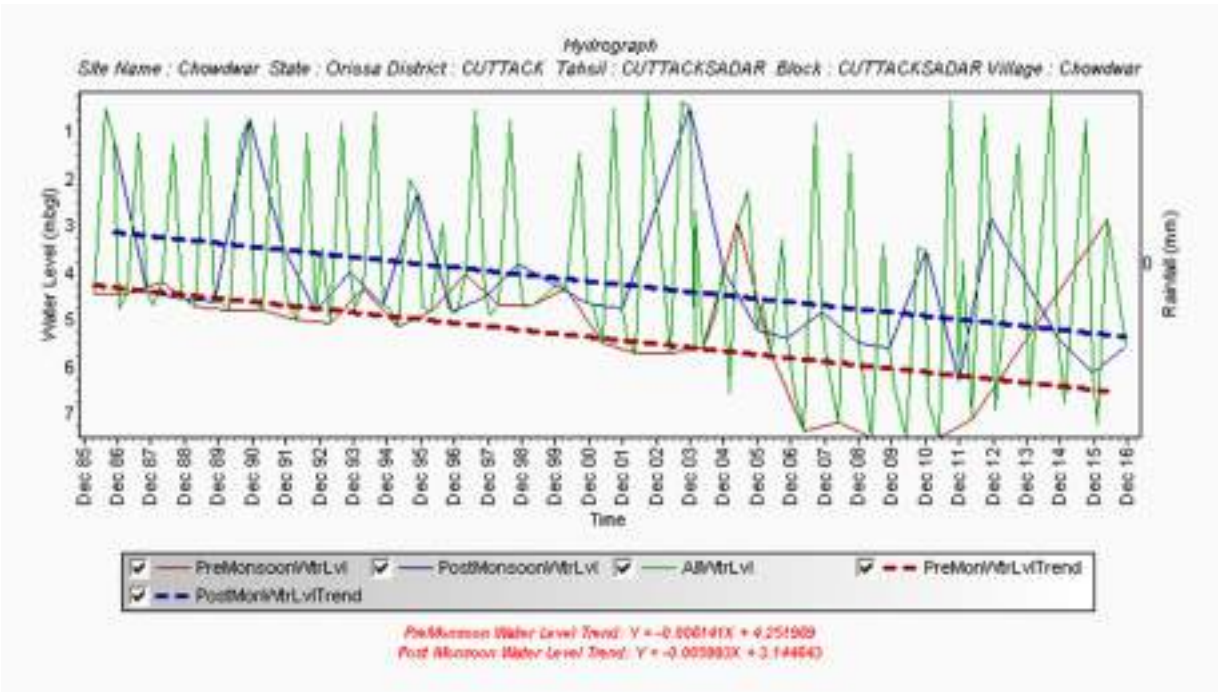


Fig 6.2.h: Hydrograph of Choudwar, Cuttack Sadar block, Cuttack District

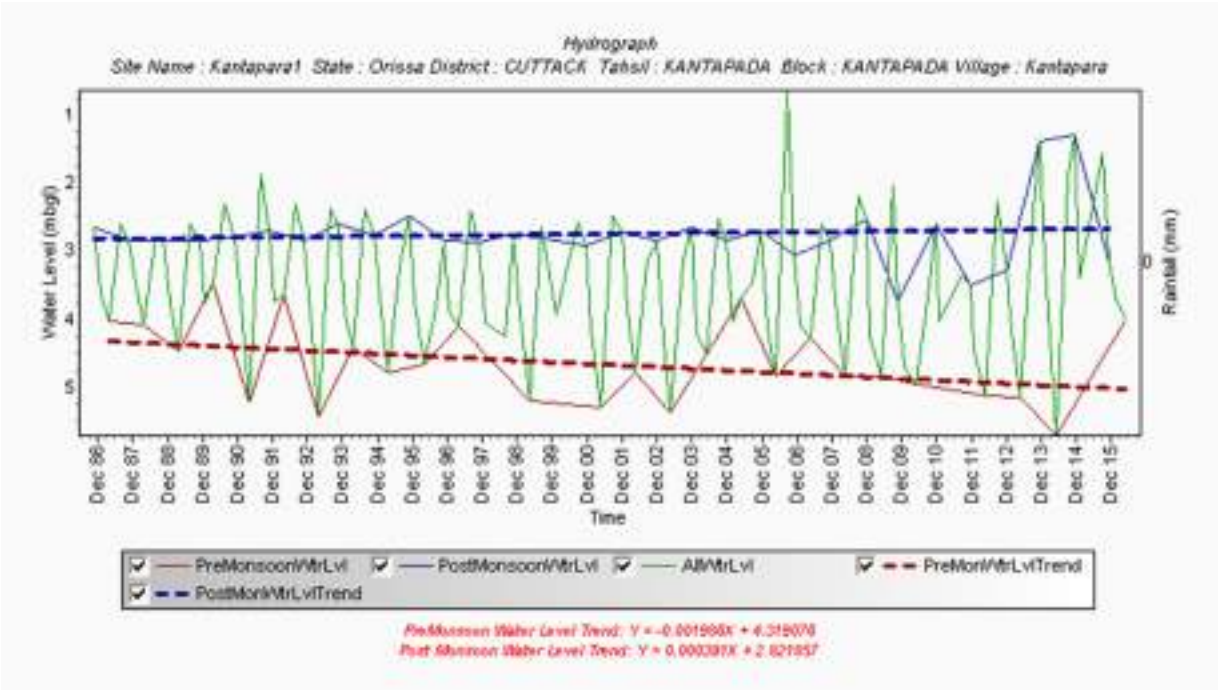


Fig 6.2.i: Hydrograph of Kantapara, Kantapara block, Cuttack District

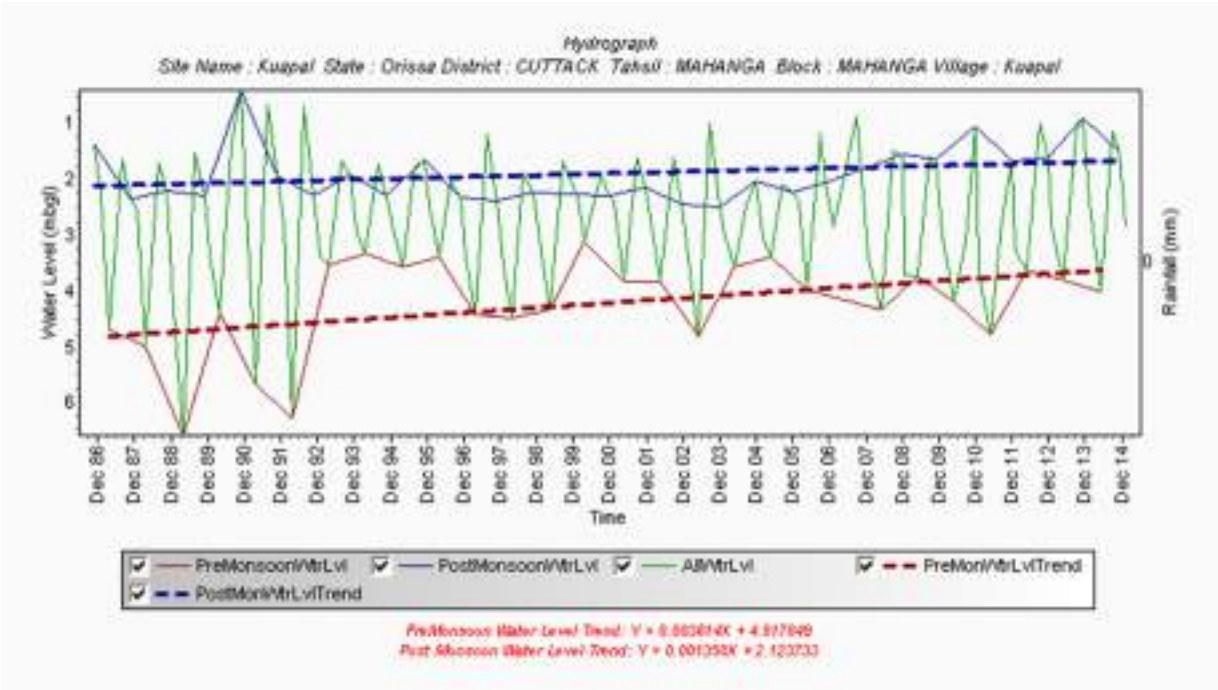


Fig 6.2.j: Hydrograph of Kuapal, Mahanga block, Cuttack District

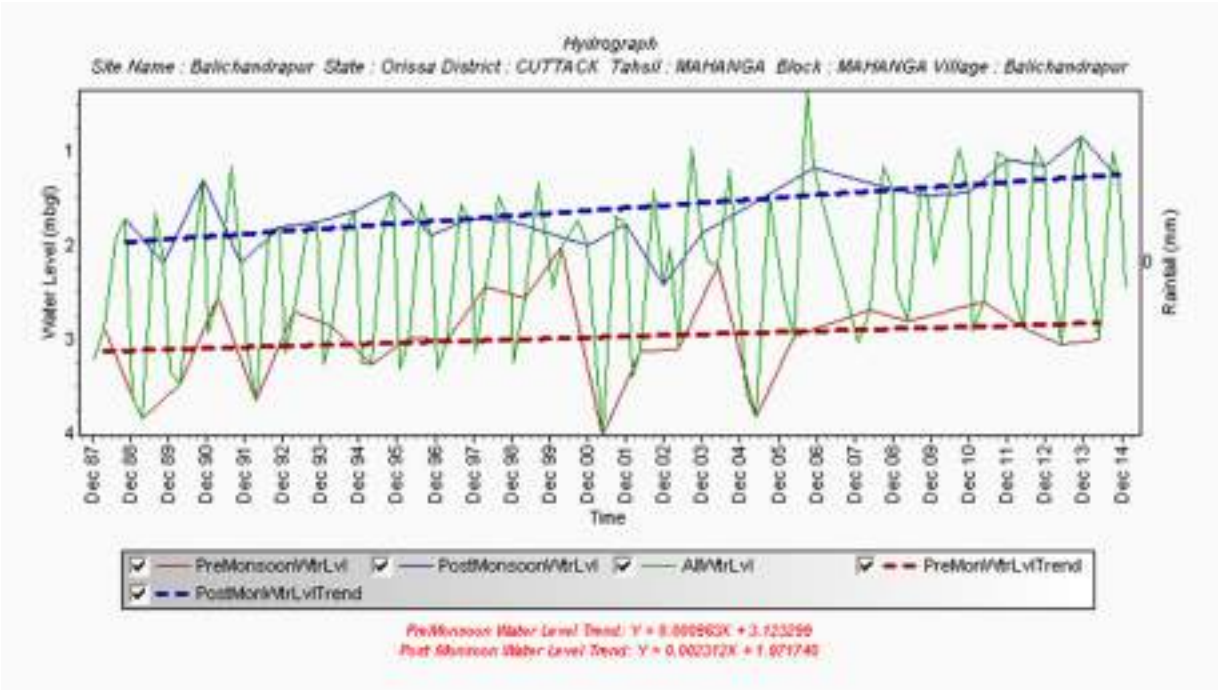


Fig 6.2.k: Hydrograph of Balichandrapur, Mahanga block, Cuttack District

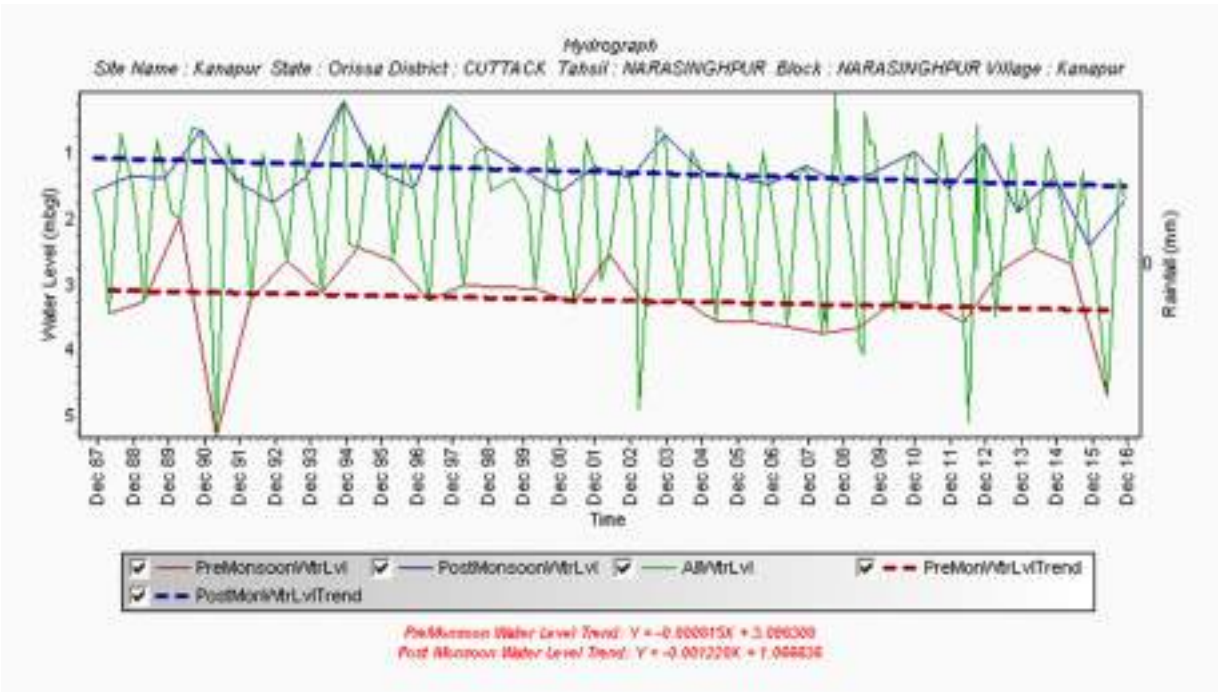


Fig 6.2.l: Hydrograph of Kanapur, Narsingpur block, Cuttack District

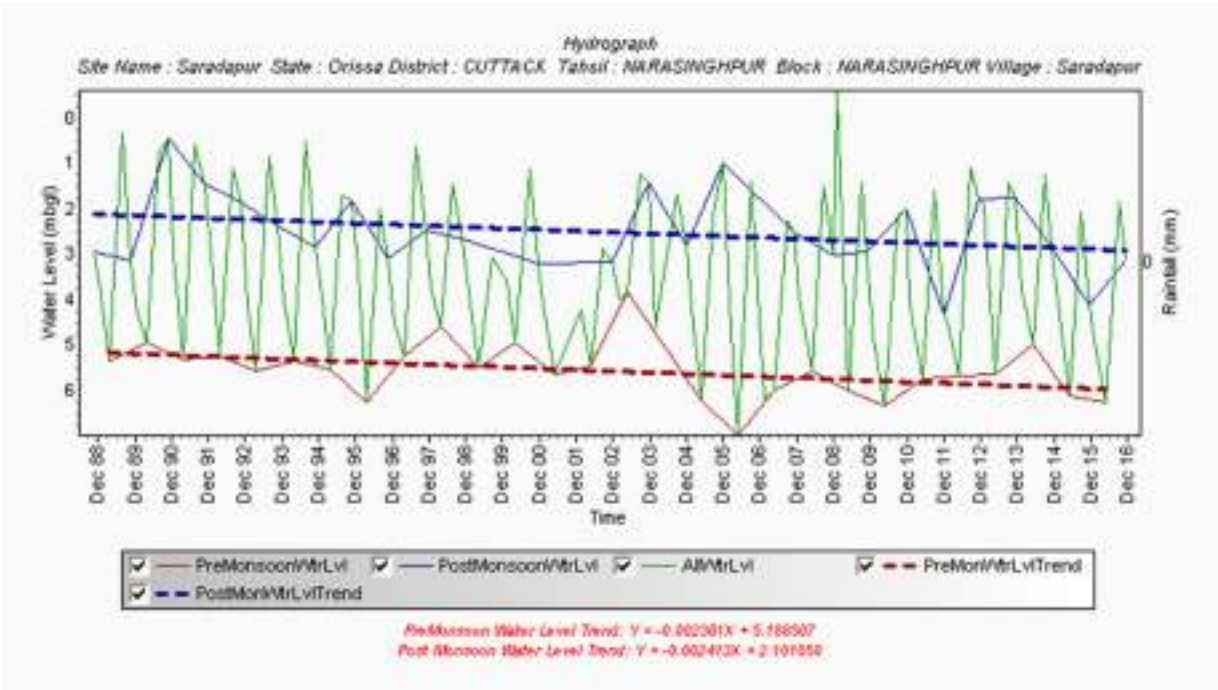


Fig 6.2.m: Hydrograph of Saradapur, Narsinghpur block, Cuttack District

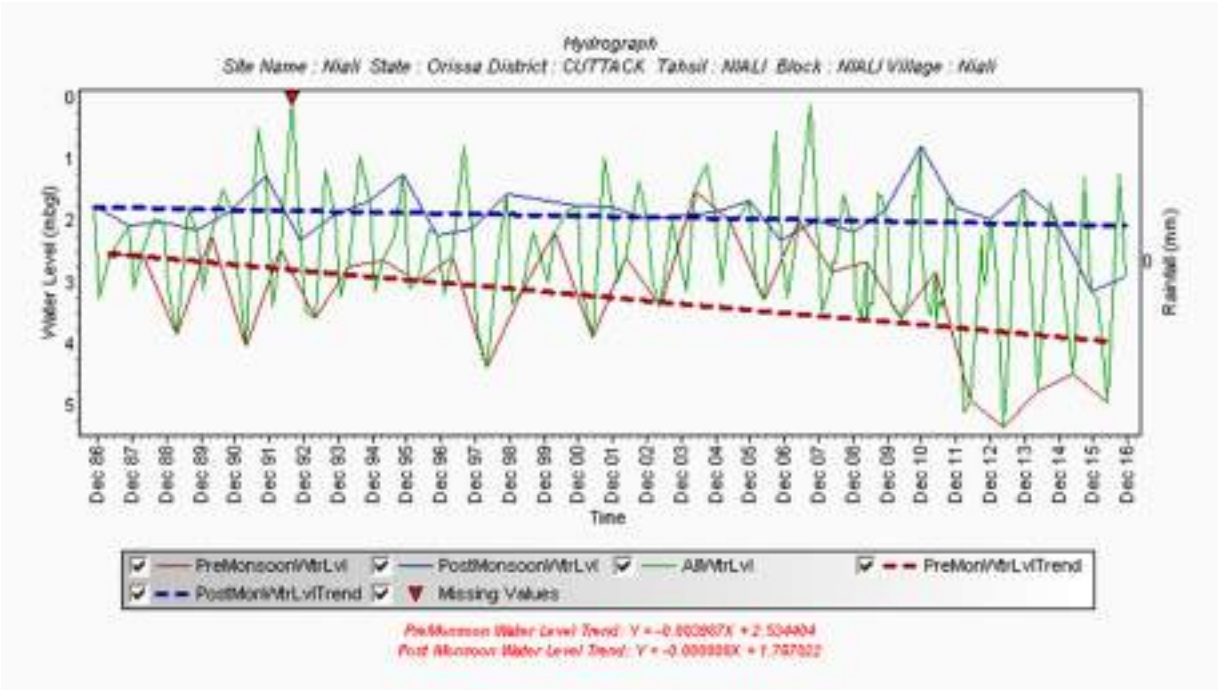


Fig 6.2.n: Hydrograph of Niali, Niali block, Cuttack District

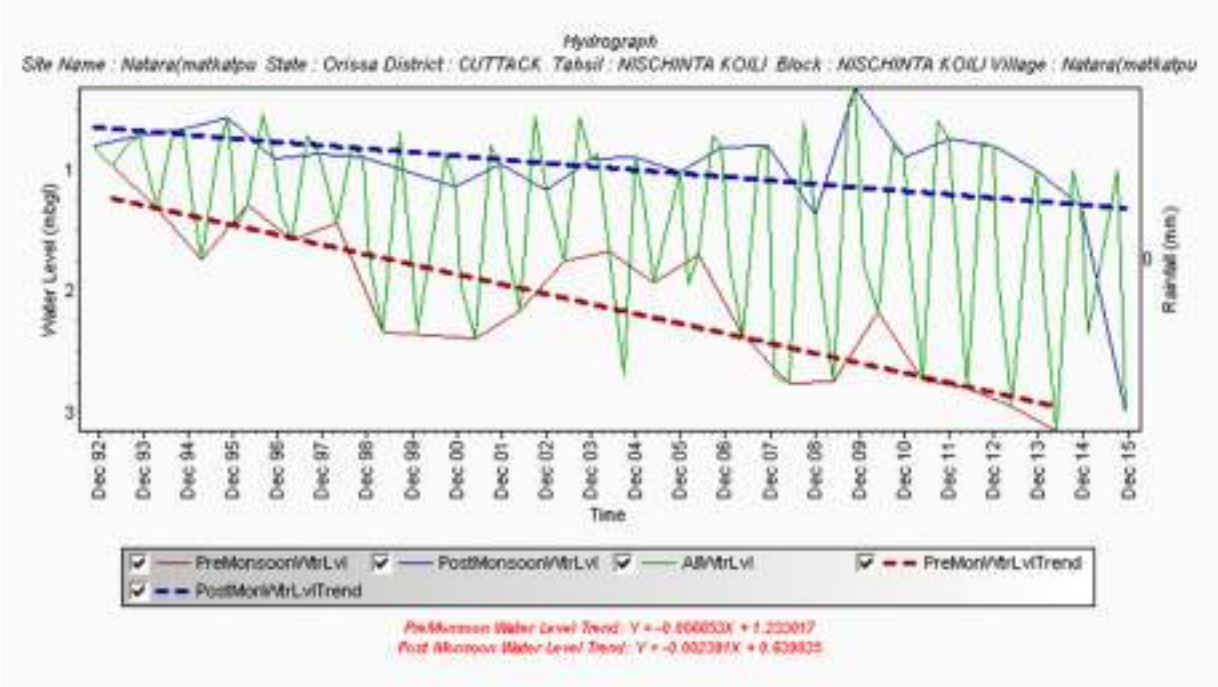


Fig 6.2.o: Hydrograph of Natara, Nichintkoili block, Cuttack District

Depth to water level (Aquifer-II)

Depth to Water Level (pre-monsoon 2016)

The depth to water levels of the confined aquifer during April 2016 ranges from 2.03 mbgl in Nischintkoili to 14.7 m bgl in Ghasiput in Dampada. Depth to water levels during pre-monsoon shows water levels in aquifer II mostly within 6-8 mbgl and shallow water level of 4-6 mbgl in north eastern part of the district. Deepest water level of more than 8 mbgl is observed in patches mostly in Athgarh, and Badamba block. The pre-monsoon depth to water level map of aquifer II is given in **Fig.6.3.a**.

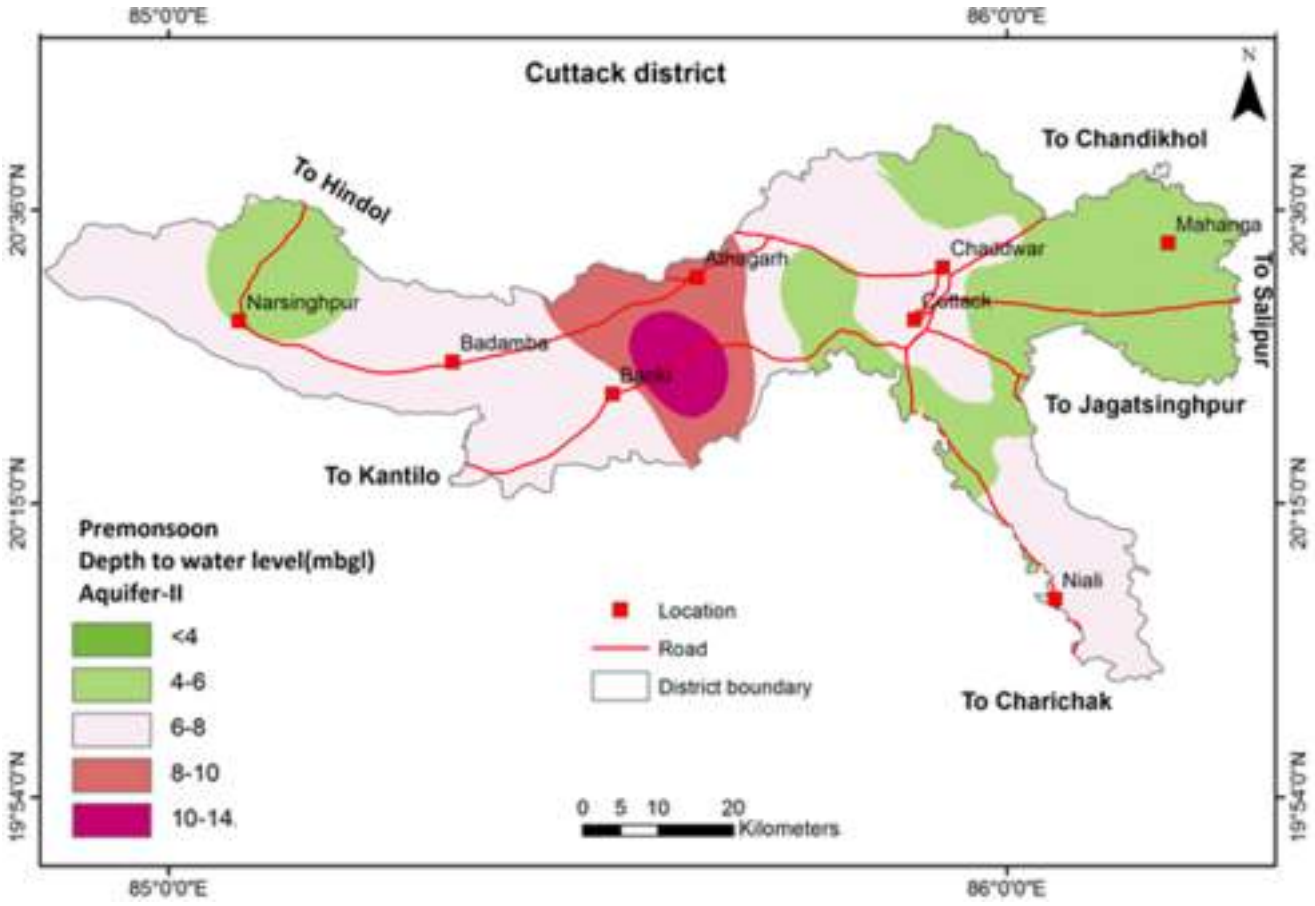


FIG. 6.3.a: DEPTH TO WATER LEVEL (AQUIFER-II) (PRE-MONSOON 2016)

Depth to Water Level (Post-monsoon 2016)

The depth to water levels during November 2016 ranges between 1.35 mbgl in Nichintkoili to 12.2 mbgl in Dampada block . Except small isolated patches, depth to water level is mostly within 4-6 mbgl. Deeper water level of more than 6 mbgl was observed at the boundary of Athgarh and Dampada blocks.

The post-monsoon depth to water level map is given in **Fig.6.3.b**.

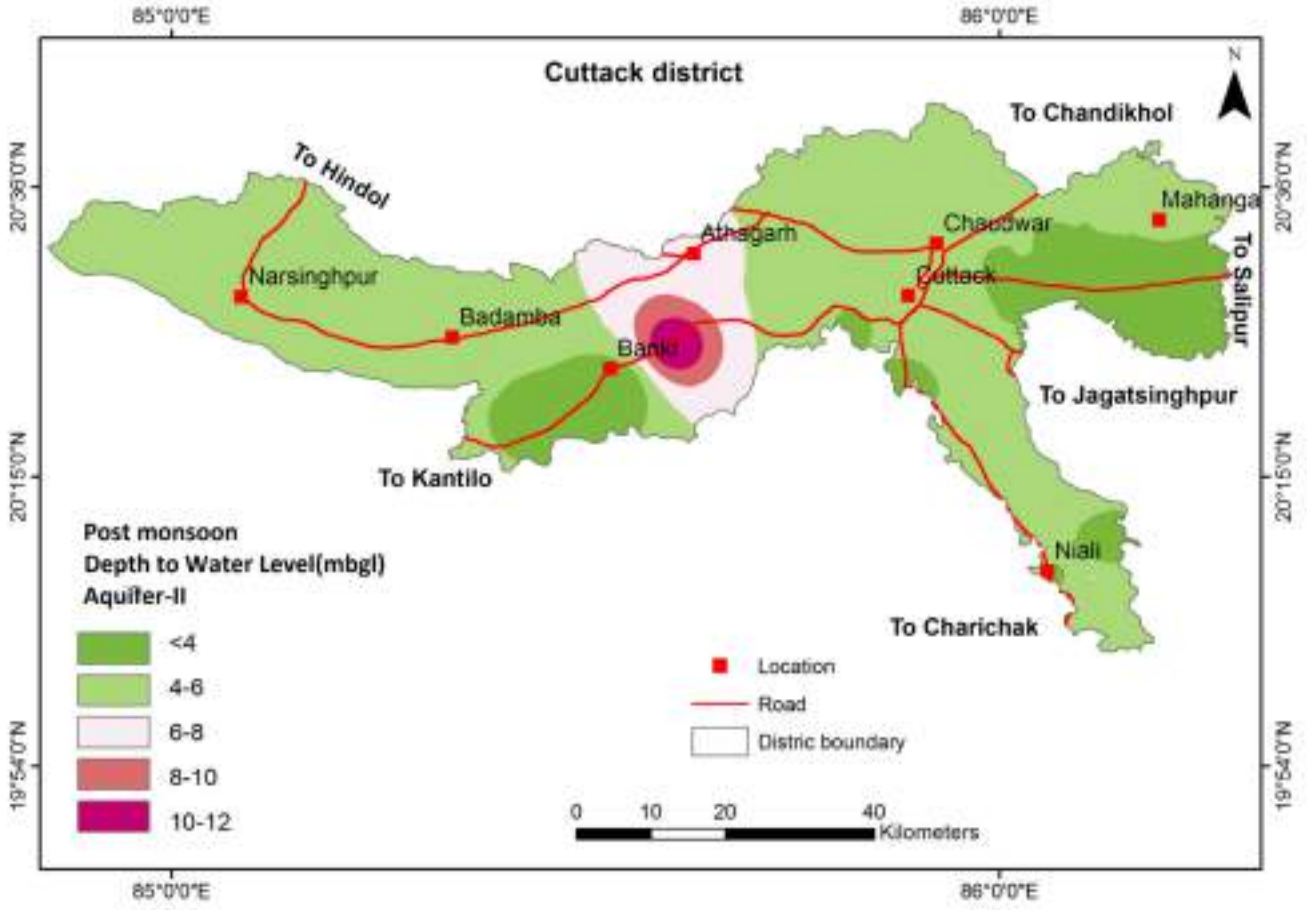


FIG. 6.2.b: DEPTH TO WATER LEVEL (AQUIFER-II) (POST-MONSOON 2016)

Water Level Fluctuation (Aquifer-II)

The water level measured during pre and post monsoon period was used to calculate the fluctuation. The seasonal fluctuation (April 16-Nov 16) in water level was obtained from difference in water level during pre and post monsoon water level.

About 93% of well show fluctuation within 2 m. Fluctuation more than 3 m is mostly found in Banki -Dampada block.

The seasonal fluctuation of water level of Aquifer-II is shown in **Fig.6.2.c**

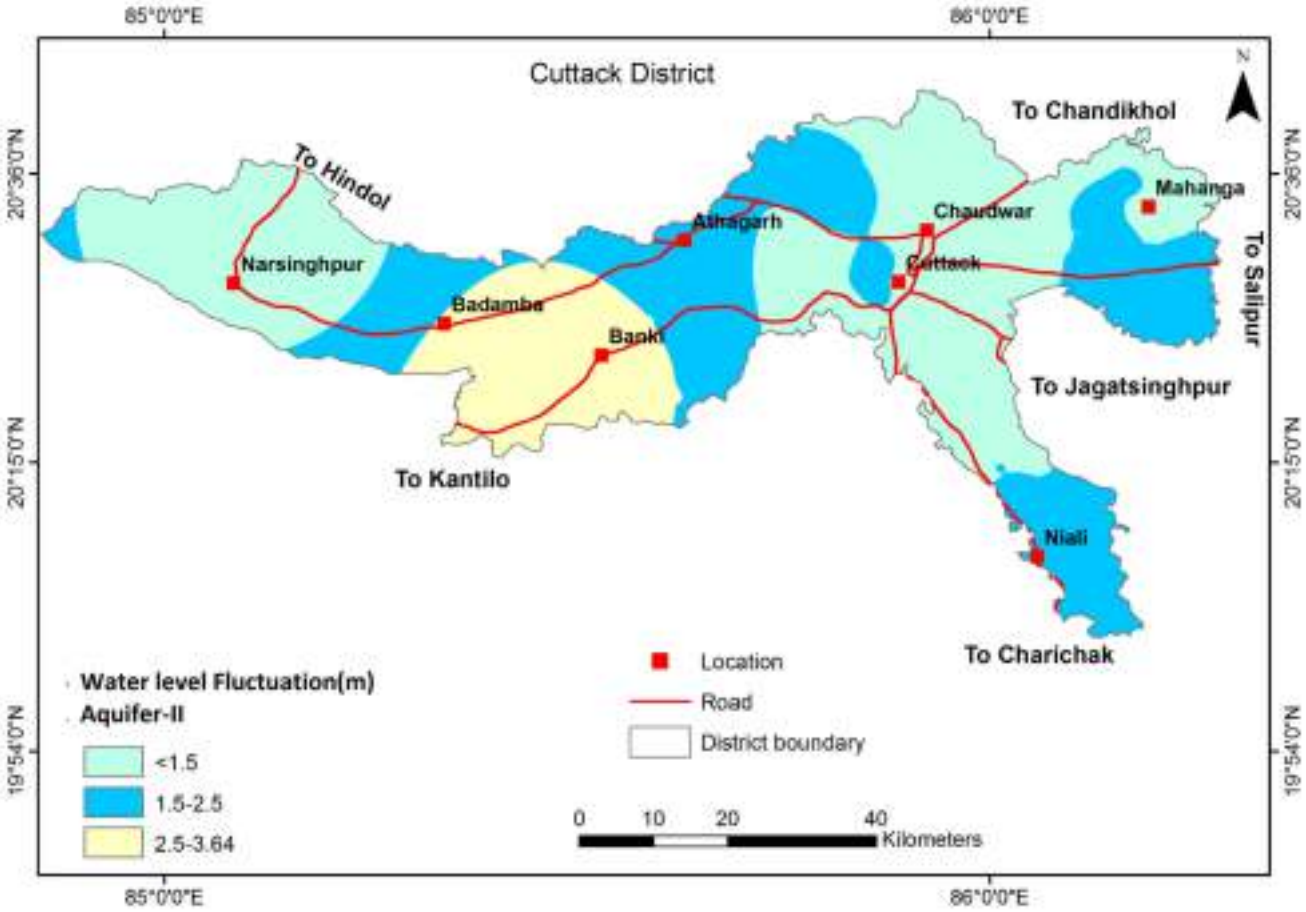


FIG. 6.2.c: SEASONAL FLUCTUATION IN WATER LEVEL (AQUIFER-II) (PRE VS. POST-MONSOON 2016)

7.0 GROUND WATER QUALITY

The suitability of ground water for drinking/irrigation/industrial purposes is determined keeping in view the effects of various chemical constituents present in water on the growth of human being, animals, various plants and also on industrial requirement. Though many ions are very essential for the growth of plants and human body but when present in excess, have an adverse effect on health and growth. The chemical quality of ground water in the district is monitored annually on a routine basis by CGWB through its national Hydrograph Network Stations. Quality of ground water from deeper aquifers was assessed during the Exploration activities like drilling and pumping tests.. During the NAQUIM programme, water samples collected during pre-monsoon period and were analysed for chemical quality. Taking the results of chemical analysis and the available historical chemical data, the aquifer wise ranges of different chemical constituents present in ground water, are determined and given in **Table 7.1.**

Table 7.1: Aquifer wise ranges of chemical constituents in NAQUIM area, Cuttack district.

Parameter	Unit	Shallow (Aquifer-I)		Deep (Aquifer-II)	
		Minimum	Maximum	Minimum	Maximum
pH	-	7.3	8.81	5.82	8.22
EC	mS/cm	40	2120	120	2250
TDS	mg/L	20	1117	69	1190
TH	mg/L	15	610	25	729
TA	mg/L	15	605	40	385
Ca	mg/L	4	128	8.0	110.2
Mg	mg/L	1.0	96	1.0	110.2
Na	mg/L	0.01	203	4.0	181.5
K	mg/L	0.68	164	0	23
CO_3	mg/L	0	66	-	-
HCO_3	mg/L	18	738	49	470
Cl	mg/L	4.0	475	9.5	646
SO_4	mg/L	0	82	0.6	98
F	mg/L	0.01	1.28	0.02	2.88

Based on the chemical analysis of water samples from different sources, it was observed that, almost all chemical parameters lie within permissible limit for drinking and irrigation purpose except few samples of some isolated pockets. The iso-conductivity map of Aquifer I and II has been prepared and presented as **Fig 7.1**. and **7.2.** From the water quality data it is found that EC above 1000 mS/**cm** is found in pockets of Mahanga, Salepur and Tangi Choudwar Blocks in pockets.

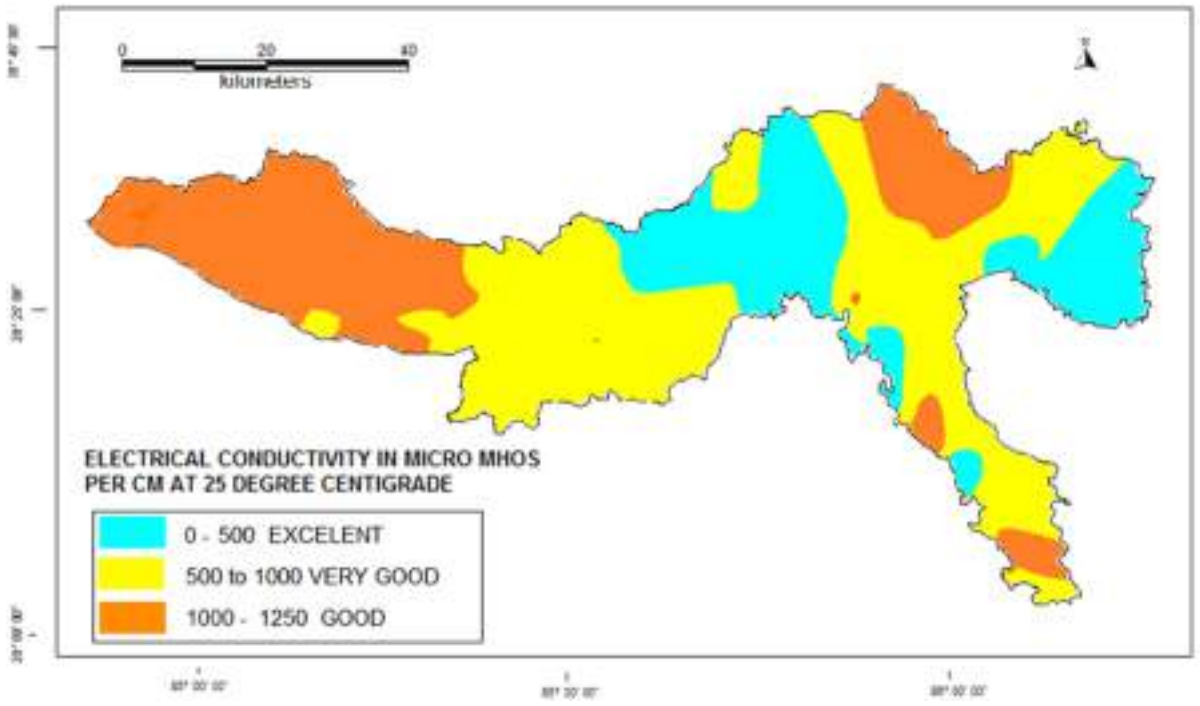


Fig. 7.1: ISO-CONDUCTIVITY MAP OF AQUIFER I OF CUTTACK DISTRICT

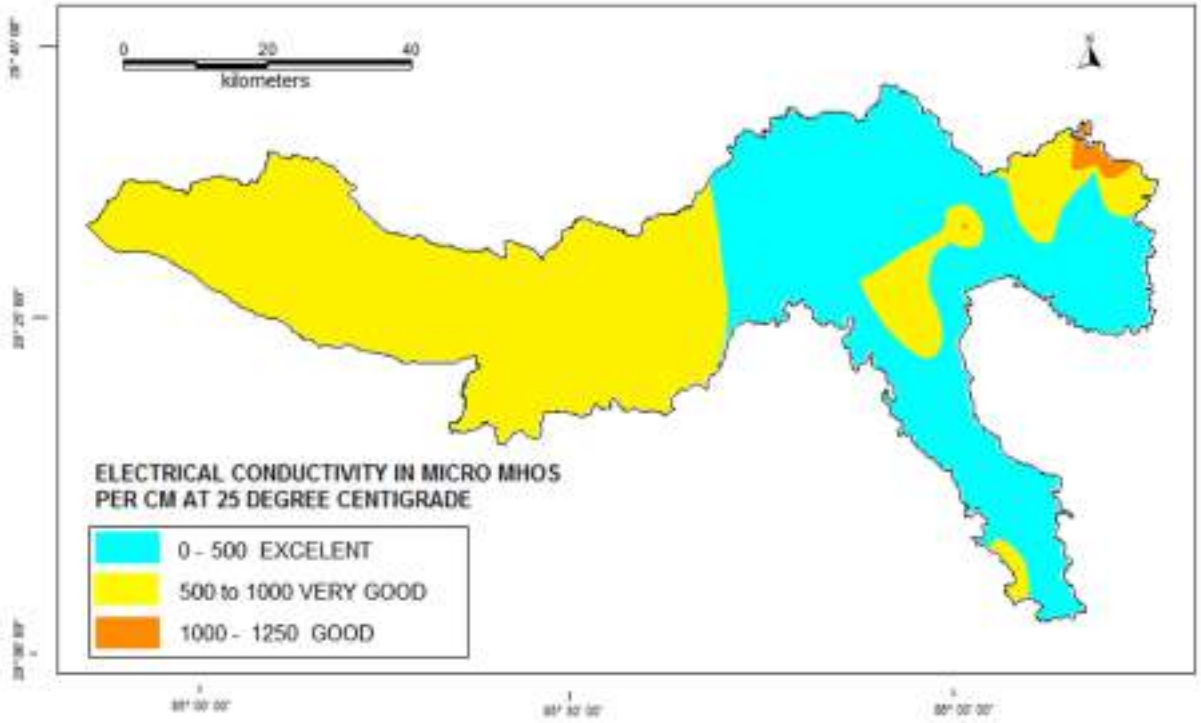


FIG. 7.2: ISO-CONDUCTIVITY MAP OF AQUIFER II, OF CUTTACK DISTRICT

Assessment of groundwater quality for irrigation

The most extensive use of ground water in the world is for the irrigation consumption. The chemical quality of ground water is an important factor to be considered in evaluating its usefulness for irrigation as poor-quality ground water may cause salinity, specific ion toxicity, infiltration problem in soils. Such effect may adversely affect crop production. Water quality constraints in irrigation can be examined using a number of empirical indices that have been established on the basis of field experience and experiments.

Sodium Adsorption Ratio (SAR) is a very important property of water from its irrigation application point of view. The sodium (Na^{+}), Calcium (Ca^{++}) and Magnesium (Mg^{++}) ions are important for determining SAR value of water. SAR of water is calculated by the following equation given by Richard (1954) as:

$$SAR = \frac{Na^{+}}{\sqrt{\frac{Ca^{++} + Mg^{++}}{2}}}$$

Where all the ions are expressed in mq/l.

There is a significant relationship between SAR values of irrigation water and the extent to which sodium is absorbed by the soil. Sodium replacing adsorbed calcium and magnesium is a hazard that damage soil structure as indicated by the high SAR. The U.S. Salinity Laboratory (USSL) diagram was used to classify the waters for irrigation (Richard, 1954). In the USSL diagram, Electrical Conductivity (EC) is taken as the salinity hazard and SAR as the alkalinity hazard. These two parameters are important to assess the quality of water for irrigation in USSL diagram.

The USSL diagram for shallow and deeper aquifer in Cuttack district is shown in Fig 7.3 and 7.4.

SALINITY HAZARD OF GROUNDWATER ACCORDING TO ELECTRICAL CONDUCTIVITY

Water Class	Range of EC in µS/cm	Salinity significance	
C1	<250	Low salinity water	Most crops on most soils
C2	250-750	Medium salinity water	Plants with moderate salt tolerance
C3	750-2250	High salinity water	Plants with good salt tolerance, special management for salinity control
C4	>2250	Very high salinity water	Not suitable for irrigation

CLASSIFICATION OF GROUNDWATER ON THE BASIS OF SODIUM ADSORPTION RATIO

Parameter	Range	Class	Water classification
Sodium Adsorption Ratio (SAR)	<10	S1	Excellent
	10-18	S2	Good
	18-26	S3	Fair
	>26	S4	Poor

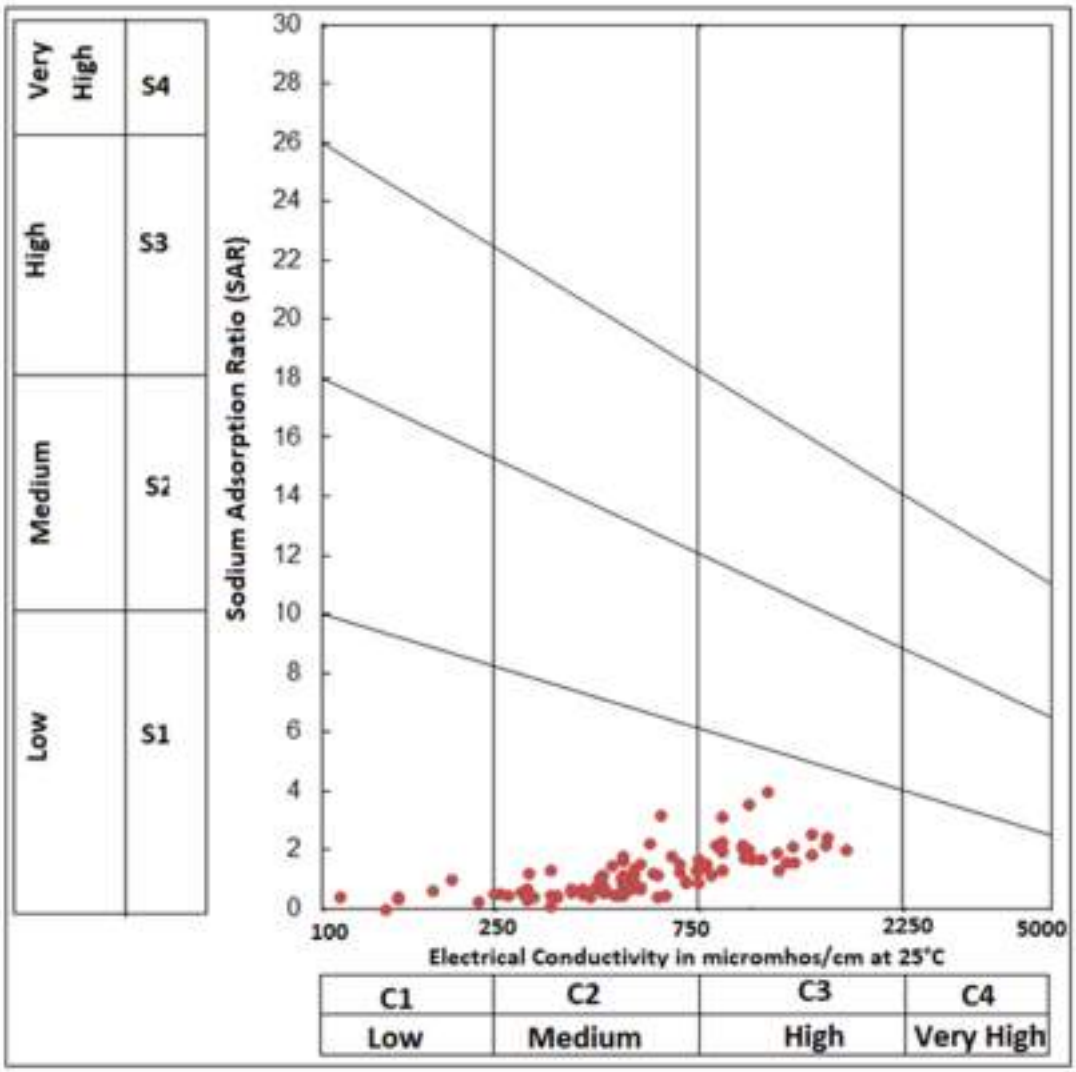


FIGURE 7.3 US-SALINITY DIAGRAM, AQUIFER-I

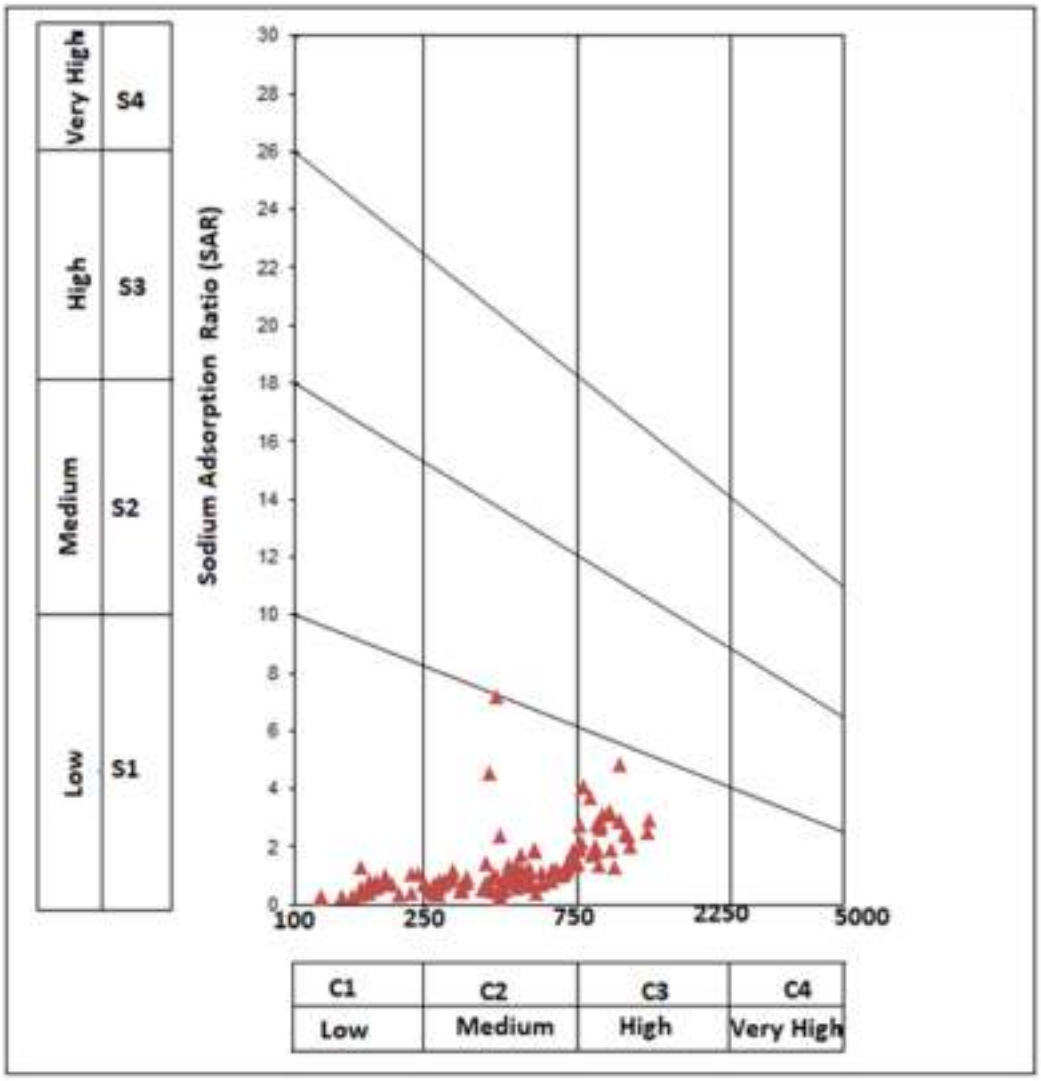


FIGURE 7.4 US-SALINITY DIAGRAM, AQUIFER-II

The USSL diagram shows that most of the samples from aquifer I and aquifer II fall under the C2S1 category, indicating medium salinity and low alkali hazard and C3S1 quality with a high salinity hazard with low sodium hazard. These groundwater sources (C2S1) can be used to irrigate all types of soils while C3S1 groundwater sources can be suitable for plants having good salt tolerance and it thus restricts their suitability for irrigation especially to soils with a restricted drainage.

8.0 GROUND WATER GEOPHYSICS

Geophysical investigation plays a significant role to gather subsurface information both in hard rock and alluvial areas. It helps to delineate the subsurface lithological units comprising of weathered layers, fractures, joints etc and also to delineate the fresh and saline aquifer disposition of that area.

In Cuttack district boreholes are logged in the saline area. Starting from Kantapada in the southern part, the borehole logs revealed that the formations are saturated with fresh water down to 120m and saline at the bottom from 120 to 175m. The exploratory wells at Gangeswar Kusupur, Mahanga Madhab, Nemalo (Figure-8.1), Sipura and Dahijunga have indicated bottom salinity. The Piezometer wells at Salepur and Nischintakoili tapped the shallow aquifers and hence the quality of the bottom aquifers is not established. In these wells the formation resistivity within the fresh regime registered higher order in the range of 45 to 65 Ohmm, representing coarse grained and clean nature of the aquifer formations. The well logs of Kusupur (Figure-8.2) indicate fresh water bearing aquifer within 20 – 65 mbgl while the zone from 80-156 mbgl is found to be saline in nature.

Table 8.1 Fresh/Saline Water Disposition in Cuttack District

BLOCK	LOCATION	LATITUDE	LONGITUDE	DEPTH RANGE(mbgl)	QUALITY OF THE ZONE
TANGI CHOUDWAR	Ganeswarpur	20.582	86.074	26-130	Brackish to Saline
MAHANGA	Kusupur	20.614	86.208	20-65	Fresh
				80-156	Saline
MAHANGA	Mahanga	20.560	86.193	23-77	Fresh
				77-93	Brackish to Saline
				93-114	Fresh
				114-154	Brackish
MAHANGA	Sipura	20.551	86.158	26-130	Brackish to Saline
NIALI	Madhab	20.100	86.106	40-70	Fresh
				70-300	Saline
NISCHINTKOILI	Nemalo	20.436	86.175	Upto 120	Fresh
				120-153	Saline
NIALI	Dahijunga	20.188	86.079	20-98	Fresh
				142-160	Brackish to Saline

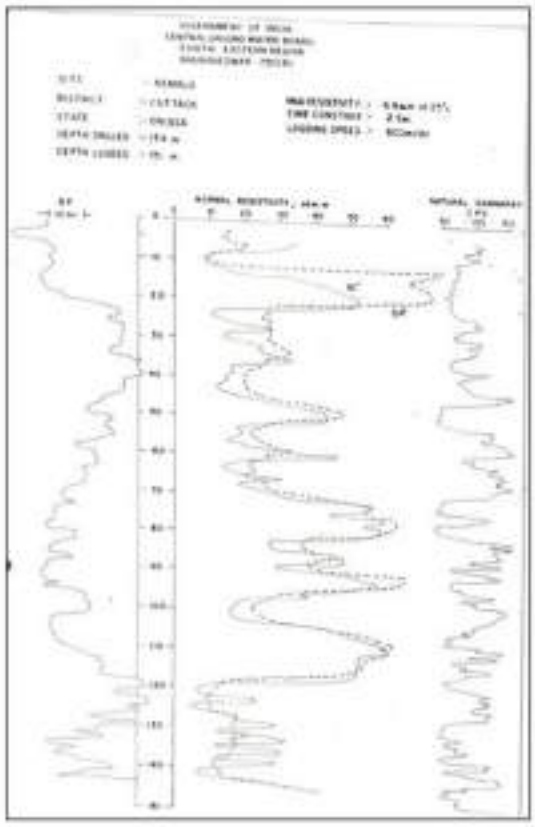


FIG 8.1 GEOPHYSICAL LOG AT NEMALO

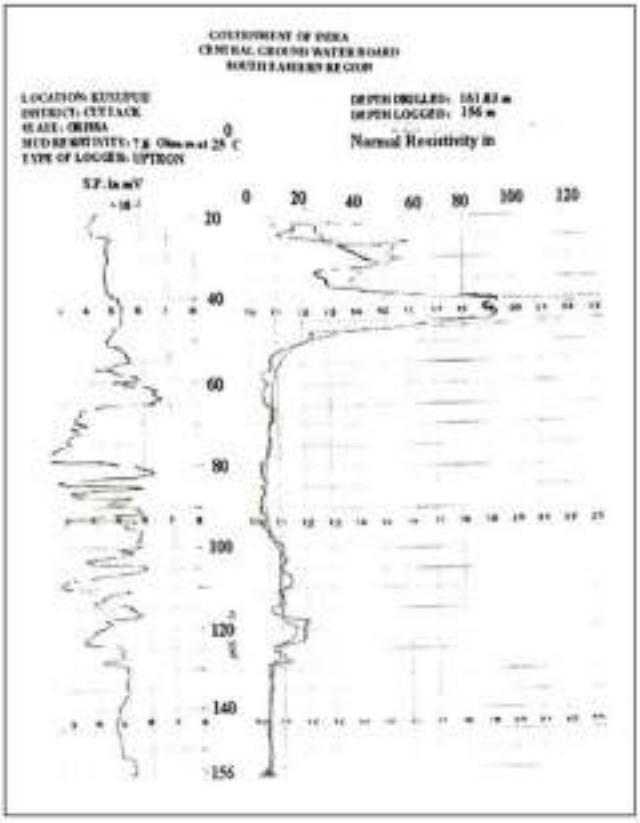


FIG 8.2 GEOPHYSICAL LOG AT KUSUPUR

GEOPHYSICAL LOCATION IN CUTTACK DISTRICT (SALINE AQUIFER)

9.0 AQUIFER MAP AND AQUIFER CHARACTERISTICS

Aquifer Characteristic

The geological formations encountered in the district range in age from Precambrian to recent. The Precambrian rocks occur in the western part of the district, the quaternary formations mainly occur in the eastern part of the district. The Mesozoic rocks are exposed in the west central part of the district.

The Pre-cambrian crystallines which mainly consists of granitic rocks, khondalites and charnockites and occupy western part of the district formed the fissured formation. Ground water in these rock types occurs under unconfined condition within the weathered residuum and under semi confined to confined condition in fracture at depth.

The semi consolidated Athgarh formation which occurs in between hard rocks and unconsolidated formation and is composed of mainly alternate layers of shale and sandstone. The aquifer system is mainly formed by sandstone at shallow as well as deeper depths. The shale form mainly phreatic aquifers and that also with limited yield potential. The weathered zone in sand stone extent down to a depth of 12 to 15 m. The fracture zones were found to occur down to 100m depth and within this depth 2 to 4 sets of fractures were encountered. It was noted that prominent saturated fractures commonly occur within hard and compact ferruginous sandstone.

The quaternary alluvial deposits underlain by upper tertiary sediments occupy half of the district covering eastern sector. The Sands, gravels and pebbles form the main aquifer and groundwater occurs under phreatic condition at shallow depth and semi confined to confined in deeper depth in these formation. The shallow near surface aquifers, which are mainly exploited by, dug wells yield fresh water in the entire district.

The laterite occurs as capping over consolidated and semi consolidated formations. It generally forms the shallow aquifer and ground water is mostly tapped by shallow dug wells.

8.2 Aquifer Group Thickness & Demarcation

Based on extensive analysis of historical data, micro level hydrogeological survey data generated and ground water exploration carried out in the area, the following two types of aquifers can be demarcated and the details are given below:

Aquifer I - Unconfined aquifer, occurs in entire area except rocky outcrops, formed by the weathered mantle atop all crystalline as well as Gondwana formations and discontinuous alluvial tracts along major river channels. This aquifer generally occurs down to maximum depth of 30 m bgl.

Aquifer II – Semi-confined to confined aquifer. Generally occurs in as fracture zone aquifers in the entire area irrespective of rock types. However the aquifer properties, the yield of bore wells constructed in them depends on the rock type. As per the ground water exploration, carried out by CGWB. Aquifer-II in Granitic rocks and Gondwanas have better yield in comparison to Charnockites and Khondalites. In general, most of the fracture zones are encountered within 0 to 150 mbgl and seldom beyond that. Thus that maximum depth for the Aquifer-II can be safely taken as 200 mbgl.

Aquifer III- Aquifer III occurs in Semi confined to confined condition in Alluvial formation at a depth of 150-300 mbgl and the maximum discharge is around 15 lps.

Based on field survey and ground water exploration, the deeper aquifer i.e. Aquifer-II in the Charnockite and Khondalite have comparatively poorer yield prospect than the Granitic aquifers and Gondwana sandstone. The aquifer characteristic of NAQUIM area has been computed and is given in **Table 9.1.**

Table 9.1 : AQUIFER CHARACTERISTIC OF CUTTACK DISTRICT

Type of Aquifer	Formation	Depth range of the aquifers (mbgl)	Yield (lps)	Aquifer parameter (T : m^2/day)	Suitability for drinking/ irrigation
Aquifer-I (phreatic)	Weathered-Granite Gneiss, Charnockite, Khondalite, mica quartzite, Sandstone, shale	0-20	Neg. to 2	-	Yes for both (except Fluoride affected villages for drinking)
Aquifer-II (semi-confined to confined)	Fractured Charnockite, Khondalite,	50-200	Negl. to 10	Negl - 33	Yes for both
Aquifer-II (semi-confined to confined)	Fractured-Sandstone, Shale	50-200	1.8 -17	0.48 - 305	Yes for both
Aquifer-I (phreatic/ Shallow TW Zone)	Alluvial Deposits	0-50	15-30	-	Yes for both
Aquifer-II (semi-confined to confined)	Alluvial Deposits	50-150	8.33 - 68.7	16 - 985	Yes for both (Fe and salinity in pockets)
Aquifer-III (semi-confined to confined)	Alluvial Deposits	150-300	15	-	Yes for both (Fe and salinity in pockets)

8.3 AQUIFER DISPOSITION

The ground water exploration data has been used to generate the 3D disposition of deeper aquifers. It comprises of all existing litho-units and the zones tapped during the ground water exploration, forming an aquifer. Based on the ground water exploration and micro-level hydrogeological survey data and aquifer delineation method, a schematic 2D section for West – East has been shown in fig 9.0. **and a** 3-D aquifer disposition has been prepared and shown in Fig. 9.1 and

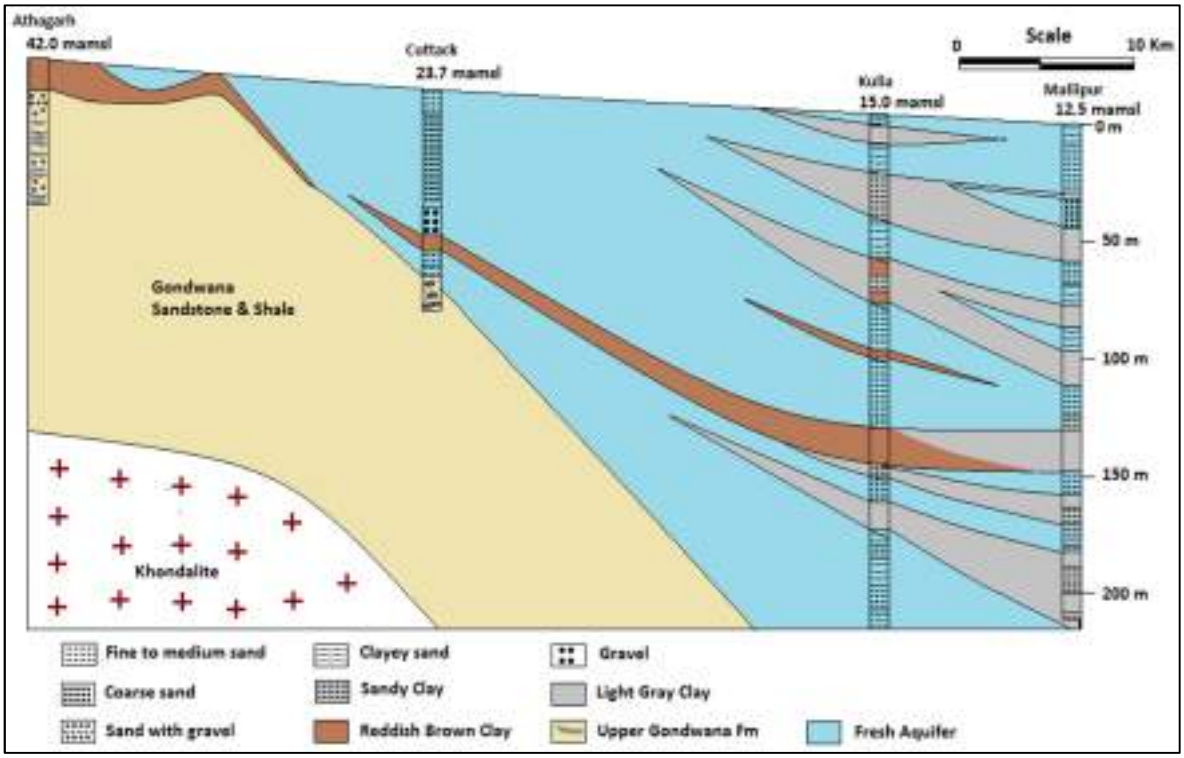


FIG. 9.0: LITHOLOGICAL SECTION ALONG 'WEST-EAST SECTION' CUTTACK DISTRICT

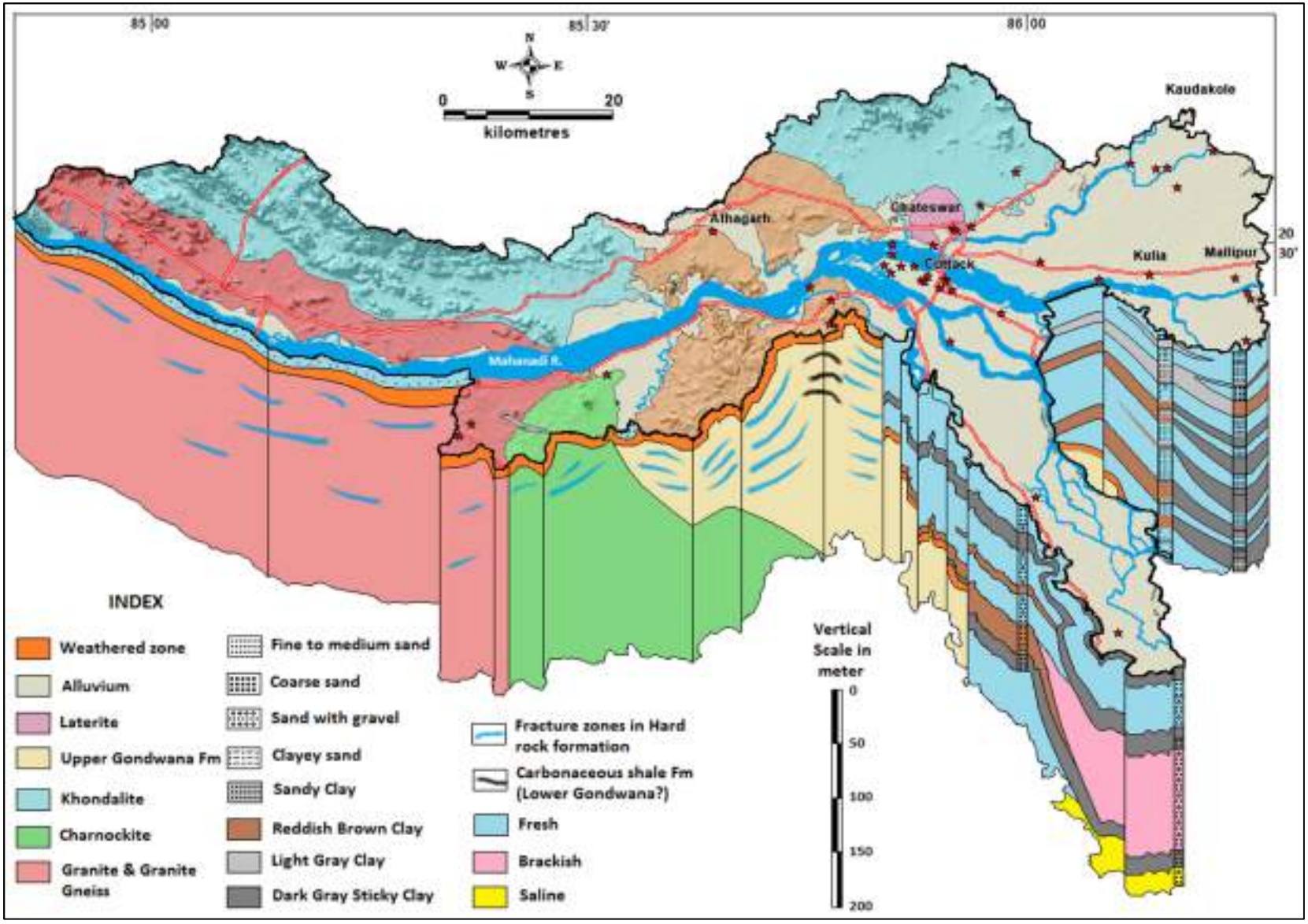
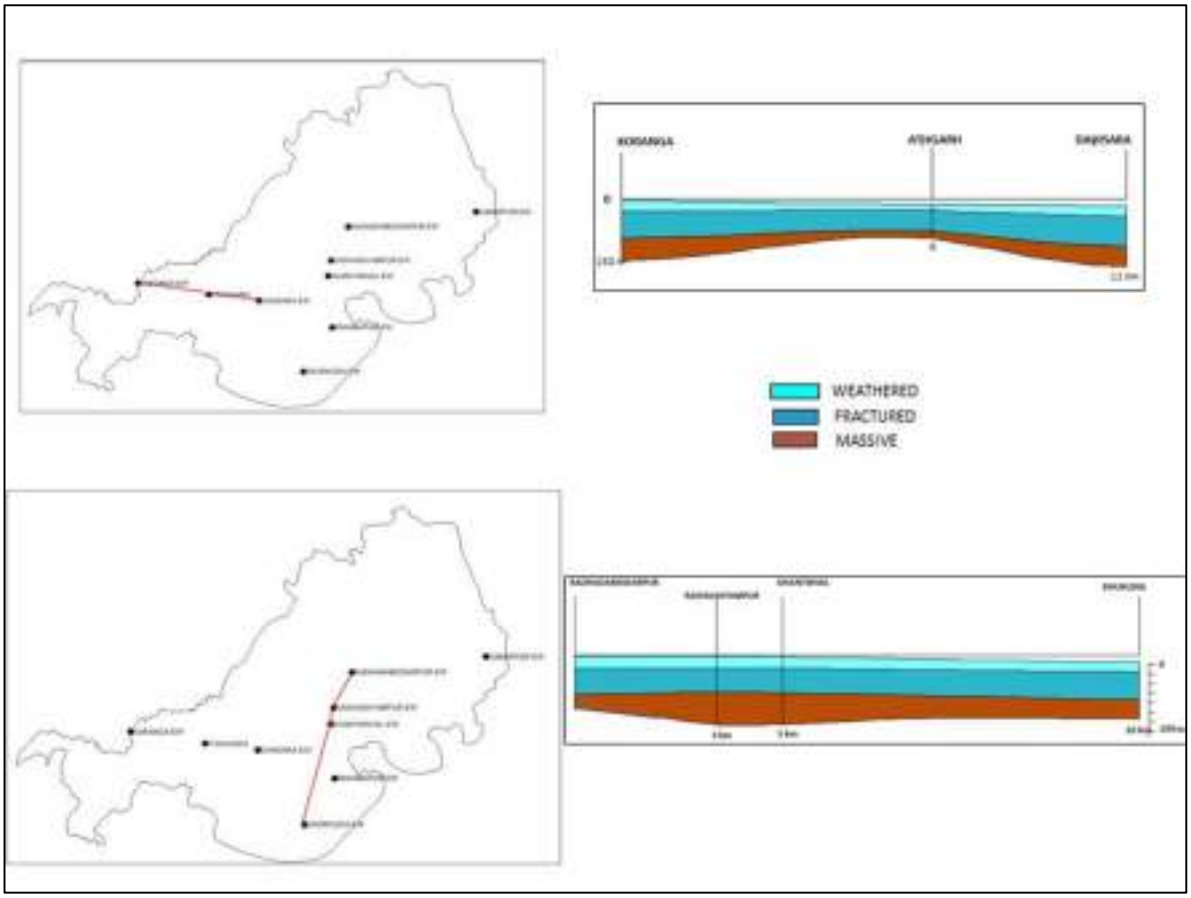
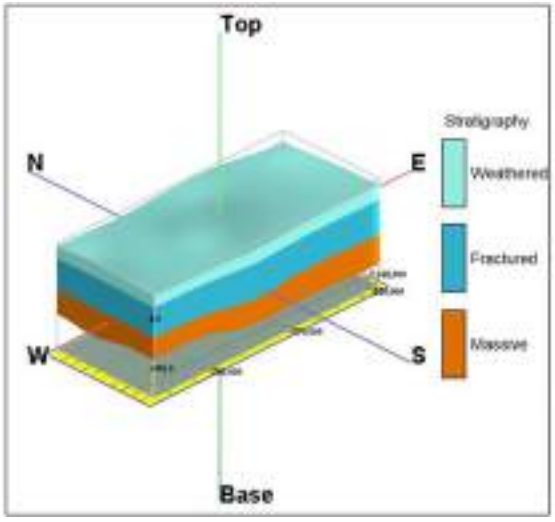


FIG 9.1: SCHEMATIC 3-D AQUIFER DISPOSITION IN CUTTACK DISTRICT

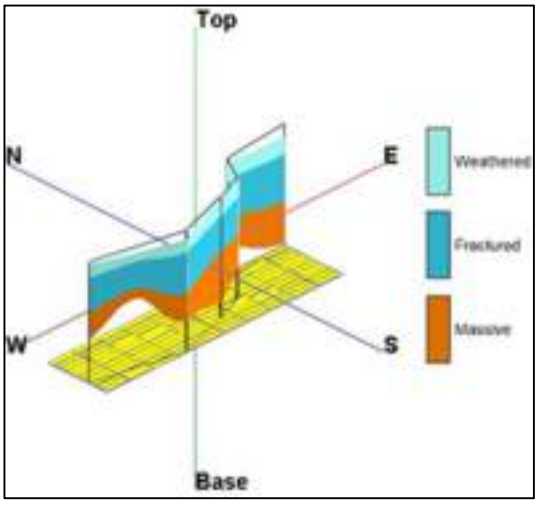
FIG 9.2 AQUIFER DISPOSITION IN ATHGARH BLOCK



2D AQUIFER DISPOSION

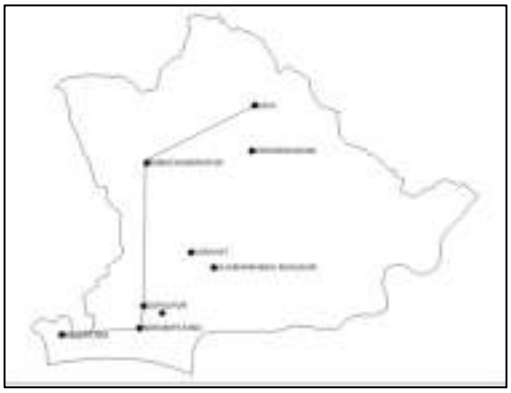


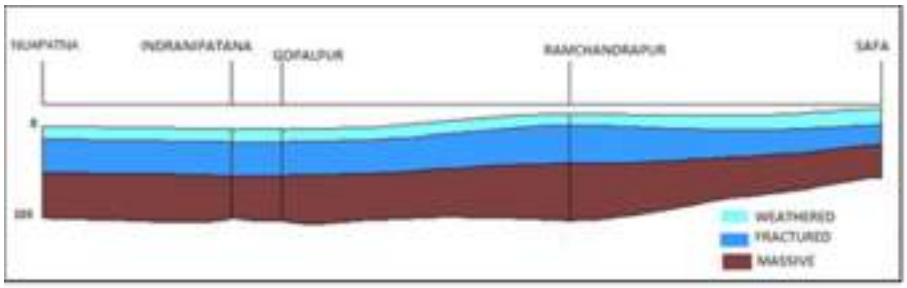
3 D AQUIFER DISPOSITION



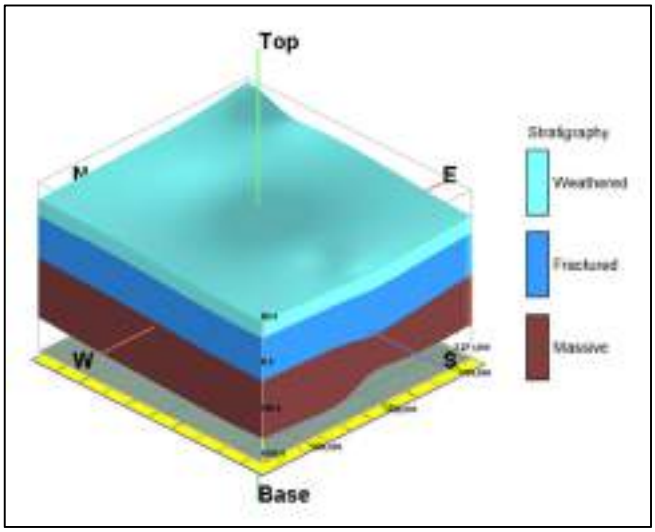
FENCE DIAGRAM

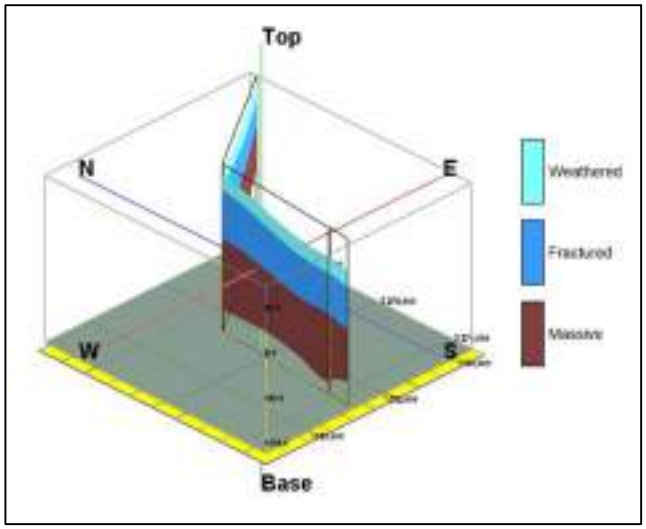
FIG:9.3 AQUIFER DISPOSITION IN TANGI CHOUWDWAR BLOCK





2D AQUIFER DISPOSITION





3D AQUIFER DISPOSION

FENCE DIAGRAM

10.0 RECHARGE PARAMETERS

During monsoon season, the rainfall recharge is the main recharge parameter, which is estimated as the sum total of the change in storage and gross draft. The change in storage is computed by multiplying groundwater level fluctuation between pre and post monsoon periods with the area of assessment and specific yield. The specific yield value as estimated from dry season balance method or field studies was taken, wherever available. In absence of field values of specific yield values through above methods recommended values as per GEC-2015 norms has been taken. The sp. yield value of 0.1-0.03 has been used for ground water estimation in the Cuttack district.

The monsoon ground water recharge has two components- rainfall recharge and recharge from other sources. The other sources of groundwater recharge during monsoon season include seepage from canals, surface water irrigation, tanks and ponds, ground water irrigation, and water conservation structures. The discharge parameters include natural discharge in the form of springs and base flow and discharge for ground water irrigation, domestic and industrial draft.

GROUND WATER RESOURCES

Central Ground Water Board and Ground Water Survey and Investigation (GWSI) have jointly estimated the ground water resources based on GEC-2015 methodology as on March 2017. The ground water resource can be divided into Dynamic and Static resource. The dynamic resource is the part of resource within the water level fluctuation zone which is also the annual replenishable resource. The resource below the water level fluctuation zone is termed as the In-storage (Static) resource. As per the resource estimated during 2017, the Stage of ground water development is maximum in Cuttack Sadar block (62.14%) and minimum in Dampada block (22.3%) which indicates that sufficient scope exists for further ground water development. The ground water resources for Aquifer-I and Aquifer II for Hard rock and Soft rock have been calculated separately and are given in **Table 10.1 to 10.7.**

TABLE 10.1: Dynamic Ground Water Resources of Aquifer-I, Hard rock area, Cuttack District (As on March 2017)

Sl No	Block	Total Annual Ground Water Recharge (Ham)	Annual Extractable Ground Water Recharge (Ham)	Current Annual Ground Water Extraction (Ham)	Annual GW Allocation for for Domestic Use as on 2025	Net Ground Water Availability for future use	Stage of Ground Water Extraction (%)
1	Athagarh	4436.91	4215.07	1678.06	535.98	2484.89	39.81
2	Barang	4774.76	4432.95	1628.61	285.47	2785.46	36.74
3	Badamba	4483.14	4258.98	1815.22	437.97	2417.83	42.62
4	Banki	2463.14	2339.99	790.03	460.69	1498.85	33.76
5	Dampara	3485.09	3310.84	738.26	303.86	2539.67	22.3
6	Narasinghpur	4981.42	4732.35	1939.1	478.46	2743.87	40.98
7	Tigiria	1692.16	1607.55	975.88	235.17	615.37	60.71
8	Tangi-Choudwar	4526.64	4219.18	1204.15	873.47	2883.89	28.54

TABLE 10.2: In-Storage Ground Water Resources of Aquifer-I, Hard rock area, Cuttack District

Sl No	Block	Assessment Area	Bottom Depth of Aquifer	Average Pre-monsoon Water Level	Total Saturated Thickness (2-3)	Average Specific Yield	In Storage Ground Water Resources [(1)*(4)*(5)]
		(Ha) 1	(mbgl) 2	(mbgl) 3	(m) 4	5	(Ham) 6
1	Athgarh	43427	6.92	4.38	2.54	0.03	3309.1
2	Baranga	15719	7.15	4.12	3.03	0.03	1428.8
3	Badamba	40058	9.64	5.6	4.04	0.02	3236.6
4	Banki	22258	8.45	2.86	5.59	0.02	2488.4
5	Dampada	29942	9.25	4.9	4.35	0.02	2604.9
6	Narsinghpur	61156	8.1	6.27	1.83	0.03	3357.4
7	Tigiria	10717	5.62	3.98	1.64	0.03	527.2
8	Tangi_Chowdwar	37166	9.7	4.4	5.3	0.03	5909.3
	TOTAL	260443	-	-	-	-	22861.7

TABLE 10.3: Total Ground Water Resources of Aquifer-I, Hard rock area, Cuttack District

Sl No	Block	Dynamic Resource	In Storage Resource	Total Ground Water Resource
		(Ham)	(Ham)	(Ham)
1	Athgarh	4215.07	3309.1	7524.17
2	Baranga	4432.95	1428.8	5861.75
3	Badamba	4258.98	3236.6	7495.58
4	Banki	2339.99	2488.4	4828.39
5	Dampada	3310.84	2604.9	5915.74
6	Narsinghpur	4732.35	3357.4	8089.75
7	Tigiria	1607.55	527.2	2134.75
8	Tangi-Chowdwar	4219.18	5909.3	10128.48
	TOTAL	29116.91	22861.7	51978.61

TABLE 10.4: In-Storage Ground Water Resources of Aquifer-II, Hard Rock Area, Cuttack District

Sl No	Block	Assessment Area	Top Depth of Aquifer	Bottom Depth of Aquifer	Total Satu-rated Thickness (3-2)	Percentage of fractured zone	Avg. Sp. Yield	In Storage Ground Water Resources (1)*(5)*(6)
		(Ha) 1	(mbgl) 2	(mbgl) 3	(m) 4	(%) 5	6	(Ham) 7
1	Athgarh	43427	15	100	85	5	0.04	8685.4
2	Baranga	15719	20	100	80	5	0.04	3143.8
3	Badamba	40058	20	120	100	3	0.03	3605.22
4	Banki	22258	15	120	105	2	0.03	1335.48
5	Dampada	29942	20	100	80	5	0.04	5988.4
6	Narsinghpur	61156	15	120	105	2	0.03	3669.36
7	Tigiria	10717	15	120	105	3	0.3	9645.3
8	Tangi_Chowdwar	37166	20	120	100	3	0.04	4459.92
	TOTAL	260443	-	-	-	-	-	40532.9

TABLE 10.5: Dynamic Ground Water Resources of Aquifer-I, Soft Rock Area, Cuttack District (As on March 2017)

Sl No	Block	Total Annual Ground Water Recharge (Ham)	Annual Extractable Ground Water Recharge (Ham)	Current Annual Ground Water Extraction (Ham)	Annual GW Allocation for for Domestic Use as on 2025	Net Ground Water Availability for future use	Stage of Ground Water Extraction (%)
1	Cuttack Sadar	8887.1	8269.3	5138.3	2163	2939.6	62.14
2	Kantapada	4824.2	4432	1851.8	259.98	2560.1	41.78
3	Mahanga	7125.6	6575.3	2462.1	574.27	4051.1	37.44
4	Niali	7634.3	7080.1	3647.7	434.96	3394.5	51.52
5	Nischintakoili	7137	6780.2	3429.6	557.13	3302.2	50.58
6	Salepur	6527.4	5973.5	1541	571.94	4383.4	25.8

TABLE 10.6: Ground Water Resources of Aquifer-II, Soft Rock Area, Cuttack District

Sl No	Block	Assessment Area	SWL bgl of 2st Aquifer	Maximum permitted decline in water level	Maximum permitted SWL (3-2)	Avg. Sp. Yield	GW Resources 2st Aquifer (1*4*6)
		(Ha) 1	(mbgl) 2	(mbgl) 3	(mbgl) 4	6	(HaM) 7
1	Cuttack	22748	4.15	6	1.85	0.1	4208.4
2	Kantapada	12100	3.2	6	2.8	0.1	3388
3	Mahanga	20000	5.02	6	0.98	0.1	1960
4	Niali	20683	5.4	6	0.6	0.1	1241
5	Nischintakoili	17158	5.12	6	0.88	0.1	1509.9
6	Salepur	19727	4.66	6	1.34	0.1	2643.4
	Total	112416	-	-	-	-	14951

- Presuming specific yield of deeper aquifer as 0.1

TABLE 10.7: Ground Water Resources of Aquifer-III, Soft Rock Area, Cuttack District

Sl No	Block	Assessment Area	SWL bgl of 3rd Aquifer	Maximum permitted decline in water level	Maximum permitted SWL (3-2)	Avg. Sp. Yield	GW Resources 3rd Aquifer (1*4*6)
		(Ha) (1)	(mbgl) (2)	(mbgl) (3)	(mbgl) (4)	(6)	(HaM) (7)
1	Mahanga	20000	3.05	6	2.95	0.1	5900
2	Nischintakoili	17158	1.80	6	4.2	0.1	7206.3
3	Salepur	19727	3.60	6	2.4	0.1	4734
	Total	56885	-	-	-	-	17840.3

Presuming specific yield of deeper aquifer as 0.1

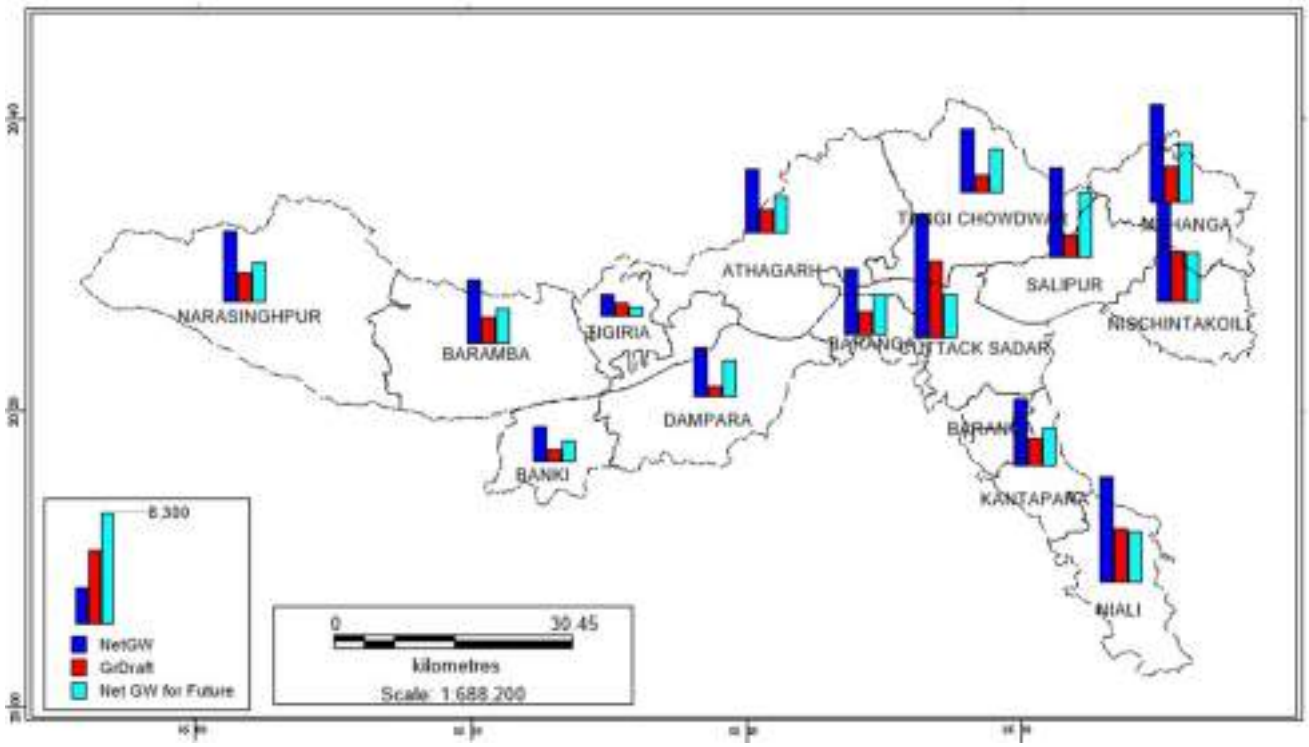


FIG 10.0 DYNAMIC GROUND WATER RESOURCE MAP OF CUTTACK DISTRICT (AS ON 31.3.2017)

11.0 GROUND WATER RELATED ISSUES

1. Water Logging Condition in Nischintakoili & Niali blocks.

The eastern parts of the district are underlain by alluvial deposits and also enjoy irrigation facilities through major irrigation projects. Normally depth to water level in alluvial tract is generally shallow and as the area get surface irrigation through flow irrigation system the chances of water logging is more. The depth to water level map of post monsoon period indicate that the water levels in canal command area is less than 2 m below ground level. Besides this, in major part of central sector of the district, the water level is less than 2m below ground level. But the depth to water level map shows water logging only in small pockets in Nischintkoili and Niali block, because of local depression.

2. Unavailability of Ground Water in Bore Wells in Tangi-Chowdwar & Athgarh block.

Unavailability of ground water in the bore well in Tangi Choudwar & Athgarh is due to the presence of thick clayey laterite and weathered zone developed on shale creates casing failure. Presence of shale in some locations is upto a depth of 50 to 60 mbgl. During the NAQUIM programme around 27 nos of wells (EW+OW) were drilled in Athgarh and Tangi Chowdwar block in Gondwana formation with a maximum depth of 200m at RADHASHYAMPUR in Athgarh block. The maximum discharge in Athgarh block was around 15 lps (GHANTHIKHAL) while in Tangi block was 11 lps (INDRANIPATANA) .

3. Under Utilization of Ground Water Resources

Under Utilization of Ground Water Resources is due to canal irrigation availability in delta blocks, only Kharif crop in blocks underlain by hard rock and Failure of bore wells in Granites, Khondalites and Charnockites.

4. Ground Water Salinity

Geophysical logging in parts of Mahanga (depth- 20-154m), Niali(40-160m) and Nischinkoili(120-153m) block reveals the presence of Saline aquifer. Hence the wells in these blocks should be tapped upto 40 m to get fresh water.

12. AQUIFER MANAGEMENT PLAN

A through study was carried out based on data gap analysis, data generated in-house, data acquired from State Govt. departments and maps procured from GSI and other sources, an integrated approach was adopted while preparing aquifer management plan of the NAQUIM area of Cuttack district. Based on this, geomorphology, soil, land use, field data, lithological information and ground water related issues, the aquifer management plan is prepared.

Water Logging Condition in Nischintakoili & Niali blocks:-

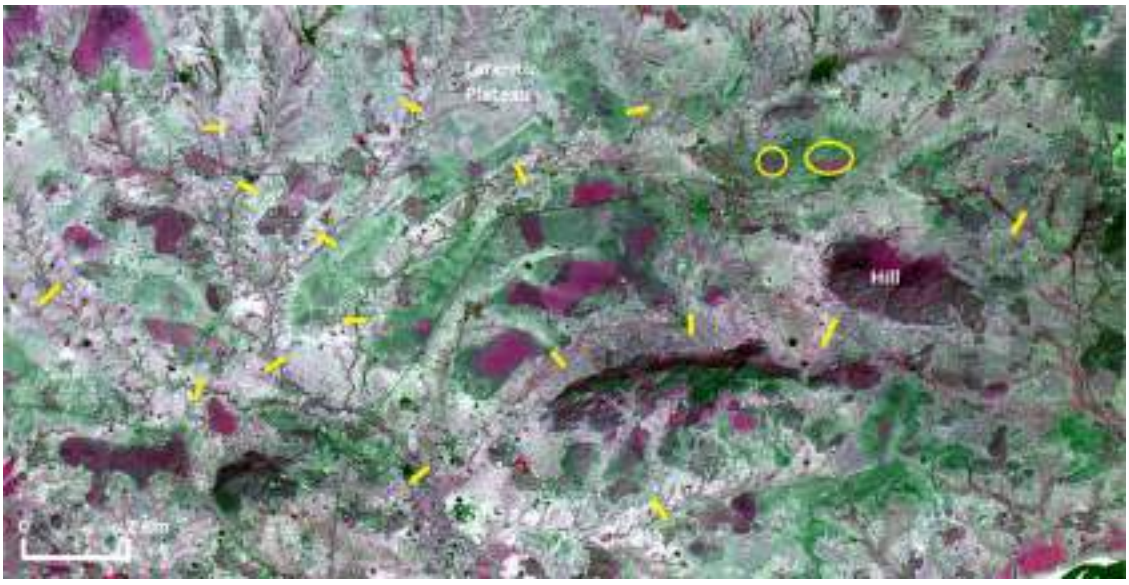
Lining of canals and conjunctive use of both surface and ground water. This will also help in reducing area under water logging condition.

Unavailability of Ground Water in bore wells in Tangi-Chowdwar & Athgarh block.

The problem is site specific and can be mitigated by :

1. 15 check dams can be constructed
2. Harvested water can be injected to well-designed recharge wells
3. Lateritic pits can be modified into water conservation structures

Proposed Sites for artificial recharge in Part of Tangi & Athgarh Block



CHECK DAM AND LATERITIC PIT RENOVATION

FUTURE GROUND WATER DEVELOPMENT POTENTIAL

From the ground water resource estimation carried out for the Aquifer-I , the present ground water development ranges from 22.3 % in to maximum 62.14 % in Cuttack district. This includes ground water usage for all usage domestic, industrial as well as irrigation. Taking ground water development safely up to 60% of the resource available, the ground water potential for further development is calculated. The details of the same are shown in **Table 12.1 to 12.4**.

Table 12.1

GROUND WATER SURPLUS AND NUMBER OF GROUND WATER ABSTRACTION STRUCTURES FEASIBLE TO ACHIEVE 60% STAGE OF GROUND WATER DEVELOPMENT IN HARD ROCK OF CUTTACK DISTRICT

Block	Net Ground Water availability (Ham)	Stage of Ground Water development (%)	Present Ground Water Draft (Ham)	Ground Water draft at 60% Stage of development (Ham)	Surplus Ground Water at Present Stage of development (Ham)	Number of BW/ STW Recommended in Each block(assuming unit draft as 2.21/ ham/structure/ year) 50%	Number of DW Recommended in Each block(assuming unit draft as 0.26/ ham/structure/ year) 50%
Athgarh	4215.07	39.81	1678.06	2529.1	851.0	193	1637
Baranga	4432.95	36.74	1628.61	2659.7	1031.1	233	1983
Badamba	4258.98	42.62	1815.22	2555.4	740.2	167	1424
Banki	2339.99	33.76	790.03	1404.1	614.1	139	1181
Dampada	3310.84	22.3	738.26	1986.3	1248.1	282	2400
Narsinghpur	4732.35	40.98	1939.1	2839.1	900.0	204	1731
Tigiria	1607.55	60.71	-	-	-	-	-
T.Chowdwar	4219.18	28.54	1204.15	2531.5	1327.3	300	2553

Table 12.2

ADDITIONAL IRRIGATION POTTENTIAL TO BE CREATED FROM GROUND WATER IN HARD ROCK BLOCKS OF CUTTACK DISTRICT

Block	Present Stage of Ground Water Development (%)	Surplus Ground Water Available for 60% stage of Development (Ham)	Irrigation Potential likely to be created for Paddy (Ha)	Irrigation Potential likely to be created for Ground Nut, Oil seed (Ha)	Irrigation Potential likely to be created for vegetables (Ha)	Projected Area to be Irrigated (ha)
Athgarh	39.81	851.04	472.80	-	945.60	1418.40
Baranga	36.74	1031.07	572.81	-	1145.63	1718.44
Badamba	42.62	740.23	205.62	711.76	822.48	1739.85
Banki	33.76	614.05	170.57	590.43	682.28	1443.28
Dampada	22.30	1248.09	346.69	1200.09	1386.77	2933.54
Narsinghpur	40.98	899.99	250.00	865.38	999.99	2115.37
Tigiria	60.71	-	-	-	-	-
T.Chowdwar	28.54	1327.35	368.71	1276.30	1474.83	3119.84

Table 12.3

GROUND WATER SURPLUS AND NUMBER OF GROUND WATER ABSTRACTION STRUCTURES FEASIBLE TO ACHIEVE 60% STAGE OF GROUND WATER DEVELOPMENT IN SOFT ROCK OF CUTTACK DISTRICT

Block	Net Ground Water availability (Ham)	Stage of Ground Water development (%)	Present Ground Water Draft (Ham)	Ground Water draft at 60% Stage of development (Ham)	Surplus Ground Water at Present Stage of development (Ham)	Number of BW/ STW Recommended in Each block(assuming unit draft as 2.21/ ham/structure/ year) 50%	Number of DW Recommended in Each block(assuming unit draft as 0.26/ ham/structure/ year) 50%
Cuttack	8269.3	62.14	-	-	-	-	-
Kantapada	4432.03	41.78	1851.84	2659.4	807.6	183	1553
Mahanga	6575.31	37.44	2462.08	3945.6	1483.6	336	2853
Niali	7080.07	51.52	3647.65	4248	600.4	136	1155
Nischintakoili	6780.16	50.58	3429.58	4068.3	638.7	145	1228
Salepur	5973.51	25.8	1541.01	3583.7	2042.7	462	3928

Table 12.4

ADDITIONAL IRRIGATION POTTENTIAL TO BE CREATED FROM GROUND WATER IN SOFT ROCK BLOCKS OF CUTTACK DISTRICT

Block	Present Stage of Ground Water Development (%)	Surplus Ground Water Available for 60% stage of Development (Ham)	Irrigation Potential likely to be created for Paddy (Ha)	Irrigation Potential likely to be created for Ground Nut, Oil seed (Ha)	Irrigation Potential likely to be created for vegetables (Ha)	Projected Area to be Irrigated (ha)
Cuttack	62.14	-	-	-	-	-
Kantapada	41.78	807.58	224.33	776.52	897.31	1898.15
Mahanga	37.44	1483.56	412.10	1426.50	1648.40	3487.00
Niali	51.52	600.39	166.77	577.30	667.10	1411.17
Nischintakoili	50.58	638.72	177.42	614.16	709.69	1501.27
Salepur	25.80	2042.73	567.43	1964.17	2269.70	4801.30

13. SUMMARY AND RECOMMENDATIONS

The existing hydrogeological setup and availability of huge ground water resources indicate that development of ground water requires scientific development and management strategy. Thus government's initiative is very much essential especially for the development of ground water. Moreover problems like water logging and drainage congestion, are also to be addressed. Under this backdrop, the author has recommended some of the strategies to tackle these major issues related to ground water which will improve the situation in the district.

Considering the local physiographical and hydrogeological set up the following ground water management strategy is suggested.

1 As the current stage of ground water withdrawal is within 50%, utilization of ground water resource for the socio-economic development is feasible.

2 Artificial recharge through construction of Percolation tank and check dams are feasible where source water is available. The check dams should be constructed on 2nd and 3rd order drainages.

3 The scope of conjunctive use of surface and ground water should also be done in command area of Delta stage I and stage II irrigation project. This will help in minimizing water logging problem.

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ANNEXURE

DEPTH TO WATER LEVEL OF AQUIFER I IN CUTTACK DISTRICT **ANNEXURE -I**

SL NO	DISTRICT	BLOCK	VILLAGE	WELL TYPE	LATITUDE	LONGITUDE	PRE MONSOON WL(mbgl)	POST MONSOON WL(mbgl)	FLUCTUATION
1	CUTTACK	ATHAGAD	Athagarh	DW	20.509	85.617	6.6	3.6	3
2	CUTTACK	ATHAGAD	Megha	DW	20.453	85.708	5.5	2.48	3.02
3	CUTTACK	ATHAGAD	Rajnagar	DW	20.494	85.677	2.3	1.4	0.9
4	CUTTACK	ATHAGAD	Khuntuni	DW	20.569	85.731	3.4	1.45	1.95
5	CUTTACK	ATHAGAD	Radha Gobindapur	DW	20.509	85.638	2.01	1.9	0.11
6	CUTTACK	ATHAGAD	orando	DW	20.546	85.798	7.74	4.06	3.68
7	CUTTACK	ATHAGAD	Radhasyampur	DW	20.556	85.738	6.96	4.02	2.94
8	CUTTACK	ATHAGAD	Parsurampur	DW	20.513	85.669	6.03	3.13	2.9
9	CUTTACK	ATHAGAD	Naduapada	DW	20.516	85.603	6.61	5.84	0.77
10	CUTTACK	ATHAGAD	Athgarh	DW	20.516	85.631	5.87	3.32	2.55
11	CUTTACK	ATHAGAD	Banakhandi	DW	20.496	85.669	5.54	2.48	3.06
12	CUTTACK	ATHAGAD	Megha	DW	20.494	85.675	5.02	2.43	2.59
13	CUTTACK	BADAMBA	Abhimanpur	DW	20.444	85.438	6	2	4
14	CUTTACK	BADAMBA	Baramba	DW	20.418	85.346	10.59	6.6	3.99
15	CUTTACK	BADAMBA	Gopapur	DW	20.403	85.296	2.8	2.4	0.4
16	CUTTACK	BADAMBA	Karadibandh	DW	20.379	85.285	6.86	4	2.86
17	CUTTACK	BADAMBA	Sankhmiri	DW	20.375	85.336	2	1.65	0.35
18	CUTTACK	BADAMBA	G.Mathura	DW	20.402	85.351	2.7	1.65	1.05
19	CUTTACK	BANKI	Baideswar	DW	20.353	85.386	3.3	1.65	1.65
20	CUTTACK	BANKI	Rajib	DW	20.349	85.421	4.6	2.2	2.4
21	CUTTACK	BANKI	Kurumchaini	DW	20.359	85.466	5.05	3.4	1.65
22	CUTTACK	BANKI	Baghei	DW	20.312	85.377	8.95	4.9	4.05
23	CUTTACK	BARANGA	Baranga	DW	20.407	85.835	4.5	3.05	1.45
24	CUTTACK	BARANGA	Brahmana Jhharilo	DW	20.302	85.929	3.8	2.25	1.55
25	CUTTACK	BARANGA	Madhupur	DW	20.439	85.840	5.15	1.9	3.25

SL NO	DISTRICT	BLOCK	VILLAGE	WELL TYPE	LATITUDE	LONGITUDE	PRE MONSOON WL(mbgl)	POST MONSOON WL(mbgl)	FLUCTUATION
26	CUTTACK	BARANGA	Godisahi	DW	20.447	85.785	8.25	4.2	4.05
27	CUTTACK	BARANGA	K.C.Pur	DW	20.442	85.847	8.55	7.75	0.8
28	CUTTACK	CUTTACKSADAR	Kadampada	DW	20.411	85.922	2.9	1.8	1.1
29	CUTTACK	CUTTACKSADAR	Cuttack	DW	20.463	85.872	3	1.85	1.15
30	CUTTACK	CUTTACKSADAR	Nayabazar	DW	20.456	85.920	3.35	2.15	1.2
31	CUTTACK	CUTTACKSADAR	Kalapada	DW	20.383	85.966	5.05	3.95	1.1
32	CUTTACK	CUTTACKSADAR	Jagatpur	DW	20.496	85.926	1.89	1.12	0.77
33	CUTTACK	CUTTACKSADAR	Cuttack Urban	DW	20.442	85.902	4.74	3.2	1.54
34	CUTTACK	CUTTACKSADAR	Nuagarh	DW	20.390	85.885	3.7	2.35	1.35
35	CUTTACK	CUTTACKSADAR	Cuttack Urban	DW	20.495	85.783	1.22	1	0.22
36	CUTTACK	CUTTACKSADAR	Badambari	DW	20.456	85.885	2.76	2.4	0.36
37	CUTTACK	CUTTACKSADAR	Cuttack Urban	DW	20.498	85.923	3.64	2	1.64
38	CUTTACK	CUTTACKSADAR	Cuttack Urban	DW	20.476	85.896	1.5	1.03	0.47
39	CUTTACK	CUTTACKSADAR	Cuttack Urban	DW	20.444	85.892	2.95	2.32	0.63
40	CUTTACK	CUTTACKSADAR	Cuttack Urban	DW	20.466	85.875	1.15	1.01	0.14
41	CUTTACK	CUTTACKSADAR	Cuttack Urban	DW	20.479	85.898	4.4	3.12	1.28
42	CUTTACK	CUTTACKSADAR	Cuttack Urban	DW	20.469	85.911	1.1	0.51	0.59
43	CUTTACK	CUTTACKSADAR	Cuttack Urban	DW	20.486	85.868	4.2	2.9	1.3
44	CUTTACK	CUTTACKSADAR	Cuttack Urban	DW	20.471	85.858	5.76	3.78	1.98
45	CUTTACK	CUTTACKSADAR	Cuttack Urban	DW	20.472	85.868	7.33	5.73	1.6
46	CUTTACK	CUTTACKSADAR	Cuttack Urban	DW	20.444	85.909	0.9	0.5	0.4
47	CUTTACK	CUTTACKSADAR	Gopalpur	DW	20.431	85.885	3.4	2.2	1.2
48	CUTTACK	CUTTACKSADAR	Cuttack Urban	DW	20.495	85.923	4.46	3.32	1.14
49	CUTTACK	CUTTACKSADAR	Cuttack Urban	DW	20.452	85.883	2.46	2.06	0.4
50	CUTTACK	CUTTACKSADAR	Cuttack Urban	DW	20.476	85.876	4.1	2	2.1
51	CUTTACK	CUTTACKSADAR	Cuttack Urban	DW	20.469	85.907	2.11	1.4	0.71
52	CUTTACK	CUTTACKSADAR	Nachhipur	DW	20.388	85.896	4	2.1	1.9
53	CUTTACK	CUTTACKSADAR	Cuttack Urban	DW	20.491	85.839	1.9	1	0.9

SL NO	DISTRICT	BLOCK	VILLAGE	WELL TYPE	LATITUDE	LONGITUDE	PRE MONSOON WL(mbgl)	POST MONSOON WL(mbgl)	FLUCTUATION
54	CUTTACK	CUTTACKSADAR	Cuttack Urban	DW	20.498	85.908	2.81	1.14	1.67
55	CUTTACK	CUTTACKSADAR	Jagatpur-i	DW	20.506	85.913	5	2.6	2.4
56	CUTTACK	CUTTACKSADAR	Kantarpur	DW	20.400	86.014	3.8	2.4	1.4
57	CUTTACK	CUTTACKSADAR	Cuttack Urban	DW	20.431	85.875	5.65	3.45	2.2
58	CUTTACK	CUTTACKSADAR	Telengapenth	DW	20.387	85.888	3.75	2.45	1.3
59	CUTTACK	CUTTACKSADAR	Cuttack Urban	DW	20.508	85.940	3.14	1.86	1.28
60	CUTTACK	CUTTACKSADAR	Cuttack Urban	DW	20.511	85.933	5.12	4.6	0.52
61	CUTTACK	CUTTACKSADAR	Cuttack Urban	DW	20.449	85.931	6.36	3.67	2.69
62	CUTTACK	CUTTACKSADAR	Cuttack Urban	DW	20.477	85.862	1.44	1.02	0.42
63	CUTTACK	CUTTACKSADAR	Cuttack Urban	DW	20.439	85.871	2.17	0.4	1.77
64	CUTTACK	CUTTACKSADAR	Cuttack Urban	DW	20.441	85.897	3.03	2.72	0.31
65	CUTTACK	CUTTACKSADAR	Tulsipur	DW	20.575	86.167	3.9	2.32	1.58
66	CUTTACK	DAMPARA	Banki	DW	20.377	85.533	4.9	2.4	2.5
67	CUTTACK	DAMPARA	Damapara	DW	20.388	85.618	5.9	4.4	1.5
68	CUTTACK	DAMPARA	Ghasiput	DW	20.410	85.608	12.6	10.75	1.85
69	CUTTACK	KANTAPADA	Dimirimathha	DW	20.224	86.044	6.1	3.15	2.95
70	CUTTACK	KANTAPADA	Kantapara	DW	20.251	85.983	4	2.5	1.5
71	CUTTACK	KANTAPADA	Patasundarpur	DW	20.267	86.020	3.05	1.15	1.9
72	CUTTACK	MAHANGA	Mahanga	DW	20.562	86.187	3.85	2.25	1.6
73	CUTTACK	MAHANGA	Raniguda	DW	20.543	86.178	4	1.75	2.25
74	CUTTACK	MAHANGA	Bhanraj	DW	20.561	86.182	4.15	2	2.15
75	CUTTACK	NARASINGHPUR	Balijhari	DW	20.411	85.219	6.85	4.35	2.5
76	CUTTACK	NARASINGHPUR	Saradapur	DW	20.529	84.967	6.25	3.15	3.1
77	CUTTACK	NARASINGHPUR	Kanapur	DW	20.406	85.183	4.7	1.7	3
78	CUTTACK	NARASINGHPUR	Narsingpur	DW	20.457	85.079	7.3	3.6	3.7
79	CUTTACK	NARASINGHPUR	Siaria-2	DW	20.420	85.189	4.85	2.8	2.05
80	CUTTACK	NARASINGHPUR	Bagadharia	DW	20.444	85.143	5.95	2.8	3.15
81	CUTTACK	NIALI	Belasahi	DW	20.108	86.083	5.15	1.8	3.35

SL NO	DISTRICT	BLOCK	VILLAGE	WELL TYPE	LATITUDE	LONGITUDE	PRE MONSOON WL(mbgl)	POST MONSOON WL(mbgl)	FLUCTUATION
82	CUTTACK	NIALI	Kasarda	DW	20.212	86.073	5.2	2.05	3.15
83	CUTTACK	NIALI	Madhab	DW	20.079	86.103	3.95	2.8	1.15
84	CUTTACK	NIALI	Niali	DW	20.131	86.064	4.95	2.9	2.05
85	CUTTACK	NIALI	Sasanpada	DW	20.215	86.142	3.6	1.3	2.3
86	CUTTACK	NIALI	Sithal	DW	20.201	86.113	3.2	2	1.2
87	CUTTACK	NISCHINTA KOILI	Dingeswar	DW	20.477	86.126	3.08	2.03	1.05
88	CUTTACK	NISCHINTA KOILI	Sanarautpati	DW	20.455	85.999	5.12	3.13	1.99
89	CUTTACK	NISCHINTA KOILI	Patapur	DW	20.484	86.154	3	2.04	0.96
90	CUTTACK	NISCHINTA KOILI	Mulusuanga	DW	20.395	86.224	4.09	2.11	1.98
91	CUTTACK	NISCHINTA KOILI	Orati	DW	20.436	86.261	3.05	2	1.05
92	CUTTACK	NISCHINTA KOILI	Nischintakoili	DW	20.479	86.173	2.1	1.9	0.2
93	CUTTACK	NISCHINTA KOILI	Kulia Market	DW	20.477	86.135	3.1	2.1	1
94	CUTTACK	SALEPUR	Bahugram	DW	20.483	86.021	2.4	1.24	1.16
95	CUTTACK	SALEPUR	Sisua	DW	20.483	86.084	3.4	1.5	1.9
96	CUTTACK	SALEPUR	Anantapur	DW	20.498	85.973	3.15	2.05	1.1
97	CUTTACK	SALEPUR	Sankilo	DW	20.511	86.127	2.1	1.85	0.25
98	CUTTACK	SALEPUR	Ganapur	DW	20.507	86.029	3.6	3.05	0.55
99	CUTTACK	SALEPUR	Anantapur	DW	20.498	85.975	3.9	2.15	1.75
100	CUTTACK	TANGI CHOUDWAR	Chowdwar	DW	20.538	85.920	5.55	2.34	3.21
101	CUTTACK	TANGI CHOUDWAR	Tangi	DW	20.558	85.989	8.3	3.9	4.4
102	CUTTACK	TANGI CHOUDWAR	Kakhadi	DW	20.508	85.819	2.05	1.15	0.9
103	CUTTACK	TANGI CHOUDWAR	Charigharia	DW	20.519	85.897	5.55	3.9	1.65
104	CUTTACK	TANGI CHOUDWAR	Govindpur	DW	20.574	86.056	8.55	6.1	2.45
105	CUTTACK	TANGI CHOUDWAR	kalyanipur	DW	20.558	85.988	6.33	4.87	1.46
106	CUTTACK	TANGI CHOUDWAR	Bhatimunda	DW	20.526	86.026	4.31	3.21	1.1
107	CUTTACK	TANGI CHOUDWAR	Nemaisahpur	DW	20.576	85.985	4.13	3.04	1.09
108	CUTTACK	TANGI CHOUDWAR	Brahmapur	DW	20.598	85.917	3.88	2.12	1.76
109	CUTTACK	TANGI CHOUDWAR	Choudwar	DW	20.529	85.921	7.89	6.34	1.55

SL NO	DISTRICT	BLOCK	VILLAGE	WELL TYPE	LATITUDE	LONGITUDE	PRE MONSOON WL(mbgl)	POST MONSOON WL(mbgl)	FLUCTUATION
110	CUTTACK	TANGI CHOUDWAR	Agrahat	DW	20.558	85.988	4.68	2.32	2.36
111	CUTTACK	TANGI CHOUDWAR	Tangi	DW	20.560	85.978	7.72	6.89	0.83
112	CUTTACK	TANGI CHOUDWAR	Choudwar	DW	20.518	85.916	3.05	2	1.05
113	CUTTACK	TANGI CHOUDWAR	Nimpur	DW	20.498	85.906	4.9	3	1.9
114	CUTTACK	TANGI CHOUDWAR	Barpada	DW	20.564	85.992	5.67	3.25	2.42
115	CUTTACK	TIGIRIA	Seshagaon	DW	20.487	85.544	6.05	5.02	1.03
116	CUTTACK	TIGIRIA	Tigiria	DW	20.458	85.517	2.29	1.21	1.08
117	CUTTACK	TIGIRIA	Nuapatna Gridsahi	DW	20.446	85.464	8.92	7.23	1.69
118	CUTTACK	TIGIRIA	Bindhanima	DW	20.447	85.494	12.95	10.12	2.83
119	CUTTACK	TIGIRIA	Tigiria	DW	20.465	85.521	3.07	0.37	2.7
120	CUTTACK	TIGIRIA	Bindhanima	DW	20.450	85.502	4.15	1.9	2.25
121	CUTTACK	TIGIRIA	Kumbhiput	DW	20.467	85.529	6.75	4.1	2.65

DEPTH TO WATER LEVEL OF AQUIFER II IN CUTTACK DISTRICT								ANNEXURE -II	
Sl NO	**DISTRICT**	**BLOCK**	**VILLAGE**	**WELL TYPE**	**LATITUDE**	**LONGITUDE**	**PRE MONSOON WL(mbgl)**	**POST MONSOON WL (mbgl)**	**FLUCTUATION**
1	CUTTACK	ATHGARH	Narangabasta	TW	20.506	85.781	3.5	3.05	0.45
2	CUTTACK	ATHGARH	Gurudijhatia	BW	20.564	85.810	6.75	4.3	2.45
3	CUTTACK	ATHGARH	Athagarh	TW	20.519	85.639	9.65	7.2	2.45
4	CUTTACK	BANKI	Pathuriapada	BW	20.327	85.442	7.4	3.75	3.65
5	CUTTACK	BARANGA	Madhuban	TW	20.433	85.828	3.3	3	0.3
6	CUTTACK	CUTTACK SADAR	Zobra	TW	20.475	85.896	8.35	7.8	0.55
7	CUTTACK	CUTTACK SADAR	Fulnakhara	TW	20.363	85.893	3.4	2.25	1.15
8	CUTTACK	CUTTACK SADAR	Jagatpur	TW	20.495	85.928	6.08	5.41	0.67
9	CUTTACK	CUTTACK SADAR	Bentakar	TW	20.405	85.940	7.15	5.7	1.45
10	CUTTACK	CUTTACK SADAR	Bentakar	TW	20.405	85.940	6.9	5.55	1.35
11	CUTTACK	CUTTACK SADAR	Bentakar-	TW	20.405	85.940	7	5.7	1.3
12	CUTTACK	CUTTACK SADAR	Bidyadharpur	TW	20.450	85.924	5.99	4.86	1.13
13	CUTTACK	CUTTACK SADAR	Bauxibazar	TW	20.485	85.870	7.63	5.45	2.18
14	CUTTACK	CUTTACK SADAR	ring road	TW	20.462	85.859	8.62	6.23	2.39
15	CUTTACK	DAMPARA	Gopalpur	BW	20.355	85.534	4.7	1.55	3.15
16	CUTTACK	DAMPARA	Ghasiput	BW	20.409	85.608	14.7	12.2	2.5
17	CUTTACK	KANTAPADA	Sundargram	TW	20.283	85.960	4.98	4.02	0.96
18	CUTTACK	KANTAPADA	salaibedapur	TW	20.201	86.021	5.41	5.02	0.39
19	CUTTACK	KANTAPADA	Bairoi	TW	20.243	85.994	6.35	5.72	0.63
20	CUTTACK	KANTAPADA	Bara saila	TW	20.308	85.997	6.1	5.97	0.13
21	CUTTACK	KANTAPADA	Cheda	TW	20.243	86.011	7.2	5.98	1.22
22	CUTTACK	KANTAPADA	Adaspur	TW	20.212	86.017	5.7	2.95	2.75
23	CUTTACK	MAHANGA	Mahanga	TW	20.575	86.575	5.57	4.98	0.59
24	CUTTACK	MAHANGA	Kuanpal	TW	20.590	86.174	7.4	5	2.4
25	CUTTACK	MAHANGA	Kuanpal	TW	20.590	86.174	7.4	5.2	2.2

Sl NO	DISTRICT	BLOCK	VILLAGE	WELL TYPE	LATITUDE	LONGITUDE	PRE MONSOON WL(mbgl)	POST MONSOON WL (mbgl)	FLUCTUATION
26	CUTTACK	MAHANGA	Sanarautpati	TW	20.558	86.132	6.85	4.27	2.58
27	CUTTACK	MAHANGA	Haripur	TW	20.604	86.086	5.12	4.89	0.23
28	CUTTACK	MAHANGA	Mahanga	TW	20.564	86.195	6.13	5.59	0.54
29	CUTTACK	MAHANGA	Bagsarpur	TW	20.603	86.200	6.44	5.73	0.71
30	CUTTACK	MAHANGA	kundi	TW	20.599	86.200	8.06	7.78	0.28
31	CUTTACK	NIALI	Niali-2	TW	20.129	86.068	5.2	3.3	1.9
32	CUTTACK	NIALI	Niali	TW	20.129	86.068	5.4	3.5	1.9
33	CUTTACK	NIALI	Niali	TW	20.129	86.068	7.25	4.95	2.3
34	CUTTACK	NIALI	Niali	TW	20.129	86.068	7.25	5	2.25
35	CUTTACK	NIALI	Pahanga	TW	20.165	86.125	4.69	2.58	2.11
36	CUTTACK	NIALI	Krusnaprasad	TW	20.067	86.120	5.57	4.12	1.45
37	CUTTACK	NIALI	Madhav	TW	20.087	86.096	8.31	5.67	2.64
38	CUTTACK	NIALI	Podana	TW	20.127	86.111	7.85	6.02	1.83
39	CUTTACK	NIALI	Niali	TW	20.243	86.011	9.57	7.65	1.92
40	CUTTACK	NICHCHINKOILI	Nischinkoili	TW	20.482	86.175	4.37	2.02	2.35
41	CUTTACK	NICHCHINKOILI	Buhalo	TW	20.474	86.166	3.3	2.3	1
42	CUTTACK	NICHCHINKOILI	Sukharpada	TW	20.485	86.230	4.83	2.53	2.3
43	CUTTACK	NICHCHINKOILI	Dingeswar	TW	20.480	86.128	4.46	2.89	1.57
44	CUTTACK	NICHCHINKOILI	Gopinathpur	TW	20.395	86.224	5.43	3.02	2.41
45	CUTTACK	NICHCHINKOILI	Baunpati	TW	20.476	86.151	5.11	3.1	2.01
46	CUTTACK	NICHCHINKOILI	Malipur	TW	20.474	86.244	4.65	3.13	1.52
47	CUTTACK	NICHCHINKOILI	Nemalo Gadi	TW	20.429	86.175	9.25	7.98	1.27
48	CUTTACK	NICHCHINKOILI	Nischintakoili	TW	20.480	86.189	3.1	1.55	1.55
49	CUTTACK	NICHCHINKOILI	Nischintakoili	TW	20.480	86.174	2.03	1.35	0.68
50	CUTTACK	NICHCHINKOILI	Orikanta	TW	20.425	86.166	4.8	3.1	1.7
51	CUTTACK	NICHCHINKOILI	Jiginipur	TW	20.489	86.157	4.3	3.2	1.1
52	CUTTACK	SALEPUR	Ganapur	TW	20.512	86.002	4.12	3.03	1.09

Sl NO	DISTRICT	BLOCK	VILLAGE	WELL TYPE	LATITUDE	LONGITUDE	PRE MONSOON WL(mbgl)	POST MONSOON WL (mbgl)	FLUCTUATION
53	CUTTACK	SALEPUR	Salepur	TW	20.483	86.074	4.34	3.23	1.11
54	CUTTACK	SALEPUR	Rameswar	TW	20.535	86.059	4.6	3.76	0.84
55	CUTTACK	SALEPUR	Monaharpur	TW	20.504	86.131	5.15	4.13	1.02
56	CUTTACK	SALEPUR	Bahugram	TW	20.484	86.018	4.56	4.16	0.4
57	CUTTACK	SALEPUR	Bahugram	TW	20.483	86.019	3.95	2.1	1.85
58	CUTTACK	SALEPUR	Salipur	TW	20.478	86.107	6.15	3.7	2.45
59	CUTTACK	TANGI CHOUDWAR	Biswanahakani	BW	20.614	85.960	4.9	4.2	0.7
60	CUTTACK	TANGI CHOUDWAR	Bhatimunda	TW	20.526	86.026	5.75	4.23	1.52
61	CUTTACK	TANGI CHOUDWAR	Mathasahi	TW	20.558	85.988	8.11	7.2	0.91

GROUND WATER QUALITY OF PHEATIC AQUIFER (NHS STATIONS) IN CUTTACK DISTRICT														ANNEXURE -III
SL NO	**BLOCK_NAME**	**VILLAGE_NAME**	**EC**	**PH**	**TDS**	**TH**	**Ca^{++}**	**Cl^{-}**	**Na^{+}**	**K^{+}**	**Mg^{++}**	**HCO_3^{-}**	**SO_4^{-}**	**F^{-}**
1	ATHAGAD	Athagarh	60	7.5	36.5	30	8	4	3	0.98	2.44	37	1	0.131
2	ATHAGAD	Megha	495	8.81	255	170	40	21	32.3	2.66	17.07	146	2.8	0.196
3	ATHAGAD	Rajnagar	35	7.3	20	15	4	4	2	0.95	1.22	18	0	0.968
4	ATHAGAD	Khuntuni	550	8.16	303.5	145	44	92	43	49.15	8.56	177	27	0.253
5	ATHAGAD	Radha Gobindapur	110	7.67	65.5	45	14	21	6	1.84	2.45	37	1	0.178
6	ATHAGAD	Oranda	60	7.46	36	25	8	11	4	2.24	1.23	24	0	0.09
7	ATHAGAD	Kulailo	200	7.55	99.5	55	10	21	17	10.28	7.31	79	5	0.097
8	BADAMBA	Abhimanpur	350	8.1	216.5	160	58	103	14	1.4	3.72	61	7	0.321
9	BADAMBA	Baramba	530	7.95	342.5	245	42	96	41	1.12	34.09	189	35	0.287
10	BADAMBA	Gopapur	650	7.4	408.5	230	40	138	63	15.36	31.66	165	53	0.2
11	BADAMBA	Karadibandh	850	7.9	455.5	210	70	216	77	8.31	8.59	73	47	0.461
12	BADAMBA	Sankhmiri	850	8.22	478.5	275	72	156	75	6.94	23.19	195	55	0.229
13	BARANGA	Baranga	150	7.3	86	65	20	20	8	3.7	3.67	60	4	0.135
14	BARANGA	Brahmana Jhharilo	300	8.02	189.5	140	40	37	18	2.84	9.77	133	18	0.455
15	CUTTACKSADAR	Nuagarh	150	8.15	94	75	26	7	7	0.93	2.46	92	6	0.191
16	CUTTACKSADAR	Cuttack Urban	400	8.03	242.5	185	38	60	22	11.79	21.93	189	6	0.729
17	CUTTACKSADAR	Badambari	550	8.35	325	250	74	71	25	14.71	15.89	244	17	0.394
18	CUTTACKSADAR	Cuttack Urban	500	8.3	300	240	56	57	22	16.83	24.38	256	13	0.61
19	CUTTACKSADAR	Cuttack Urban	600	8.18	364.5	310	76	46	17	13.63	29.27	311	41	0.281
20	CUTTACKSADAR	Cuttack Urban	520	8.11	265.5	185	46	50	22	17.7	17.08	189	36	0.037
21	CUTTACKSADAR	Cuttack Urban	500	8.08	308	245	42	64	23	10.81	34.09	214	38	0.358
22	CUTTACKSADAR	Khapuria	380	8.2	246.5	200	48	50	18	19.07	19.51	207	8	0.247
23	CUTTACKSADAR	Cuttack Urban	500	8.15	305	185	46	74	28	65.14	17.08	244	18	0.011
24	CUTTACKSADAR	Cuttack Urban	350	8.1	239.5	195	46	35	14	1.38	19.51	171	40	0.059
25	CUTTACKSADAR	Cuttack Urban	400	7.85	279.5	235	58	64	18	5.72	21.95	201	17	0.363
26	CUTTACKSADAR	Gopalpur	310	7.9	187.5	160	32	37	12	2.25	19.49	145	15	0.32

SL NO	BLOCK_NAME	VILLAGE_NAME	EC	PH	TDS	TH	Ca^{++}	Cl^{-}	Na^{+}	K^{+}	Mg^{++}	HCO_3^{-}	SO_4^{-}	F^{-}
27	CUTTACKSADAR	Cuttack Urban	550	8.13	304	210	76	99	25	13.15	4.96	98	50	0.102
28	CUTTACKSADAR	Cuttack Urban	450	8.32	272	205	42	60	21	21.59	24.36	232	9	0.043
29	CUTTACKSADAR	Cuttack Urban	480	7.87	346	295	76	53	18	3.59	25.62	244	51	0.27
30	CUTTACKSADAR	Cuttack Urban	550	8	336.5	245	42	71	27	23.85	34.09	189	68	0.021
31	CUTTACKSADAR	Nachhipur	375	8.5	222.5	170	38	52	20	8.33	18.28	121	25	0.299
32	CUTTACKSADAR	Cuttack Urban	430	7.86	234.5	170	42	67	22	8.49	15.85	159	8	0.504
33	CUTTACKSADAR	Cuttack Urban	850	7.98	443	250	52	138	72	19.67	29.24	244	30	0.171
34	CUTTACKSADAR	Kantarpur	450	8.3	232	175	38	27	26	6.69	19.5	236	4	0.697
35	CUTTACKSADAR	Cuttack Urban	460	7.9	319.5	245	54	60	20	11.88	26.81	153	82	0.494
36	CUTTACKSADAR	Cuttack Town	500	7.7	270.5	200	48	69	25	5.25	19.51	151	34	0.346
37	CUTTACKSADAR	Telengapenth	450	7.84	264.5	210	36	54	24	7.44	29.22	211	16	0.346
38	CUTTACKSADAR	Cuttack Urban	750	8.01	483	300	78	156	67	15.31	25.62	262	25	0.804
39	CUTTACKSADAR	Cuttack Urban	300	8	227.5	205	40	21	11	1.39	25.58	207	26	0.123
40	CUTTACKSADAR	Cuttack Urban	1250	8.01	731	515	64	351	82	7.85	86.39	250	23	0.155
41	CUTTACKSADAR	Cuttack Urban	500	8.36	322.5	290	50	39	18	17.02	40.18	311	17	0.017
42	CUTTACKSADAR	Tangi	1200	7.75	633	405	76	316	74	27.89	52.37	128	51	0.469
43	DAMPARA	Banki	340	8	189.5	180	60	10	3	3.46	7.37	217	1	0.484
44	KANTAPADA	Kandarpur	450	7.9	318	265	58	71	22	9.48	29.25	226	25	0.248
45	MAHANGA	Mahanga	610	8.1	378	160	42	64	92	4.75	13.42	278	28	1.2
46	NARASINGHPUR	Balijhari	1150	7.74	668.5	480	122	245	67	4.29	42.7	275	54	0.151
47	NARASINGHPUR	Saradapur	850	7.8	463.5	300	64	124	52	31.53	34.12	275	52	0.662
48	NARASINGHPUR	Kanapur	800	8.06	416	250	56	121	43	74.36	26.81	250	44	0.3
49	NARASINGHPUR	Narsingpur	850	8.4	458.5	210	20	64	39	105	38.93	323	69	1.03
50	NIALI	Belasahi	1000	8.4	503	310	28	130	68	62	58.39	320	56	0.556
51	NIALI	Madhab	950	8.6	439	180	34	106	63	133	23.14	302	50	0.145
52	NISCHINTA KOILI	Kulia Market	230	8	145.5	130	26	15	7	0.68	15.84	145	9	0.451
53	NISCHINTA KOILI	Nischintakoili	470	7.6	311	200	24	49	49	15.5	34.07	260	25	0.556
54	SALEPUR	Sisua	435	7.99	220.5	150	32	49	30	6.53	17.06	181	2	0.439
55	SALEPUR	Padmapur	850	8.4	392	205	30	86	44	110.3	31.64	338	28	0.14

SL NO	BLOCK_NAME	VILLAGE_NAME	EC	PH	TDS	TH	Ca^{++}	Cl^{-}	Na^{+}	K^{+}	Mg^{++}	HCO_3^{-}	SO_{4-}	F^{-}
56	SALEPUR	Anantapur	285	7.4	175.5	140	32	22	16	5.93	14.63	169	6	0.432
57	SALEPUR	Sankilo	520	8.3	259.5	180	40	54	32	6.53	19.5	199	15	0.166
58	TANGI CHOUDWAR	Nimpur	530	8.4	322	240	68	52	32	7.54	17.1	254	23	0.253
59	TIGIRIA	Tigiria	780	7.8	449	280	70	191	59	1.26	25.61	122	42	0.356

GROUND WATER QUALITY OF KEY WELLS IN CUTTACK DISTRICT **ANNEXURE -IV**

Sl No.	BLOCK	LOCATION	SOURCE	EC	pH	TDS	TH	Ca++	Cl-	Na+	K+	Mg++	HCO3-	SO4=	F-	Alkalinity
1	Athgarh	Parsurampur	DW	600	8	304	180	20	63.8	37.03	27.75	31.6	225.7	10.5	0.29	185
2	Athgarh	Banakhandi	DW	180	7.5	89	55	12	14.2	10.79	5.07	6.1	79.3	0.8	0.07	65
3	Athgarh	Orando	DW	160	7.3	81	50	8	21.3	9.33	5.2	7.3	48.8	5.1	0.05	40
4	Nischintkoili	sanarautpati	DW	600	7.7	309	170	38	63.8	53.52	3.06	18.2	256.2	4.1	0.46	210
5	Nischintkoili	Patapur	DW	1000	8.1	514	320	64	120.5	60.65	34.2	38.9	347.7	22.2	0.24	285
6	Nischintkoili	Mulusuanga	DW	570	7.7	272	225	48	33.3	23.69	1.11	25.5	231.8	24.7	0.77	190
7	Tangi Choudwar	Koirapari	DW	2120	7.5	1117	610	128	475	203.3	2.91	70.5	427	23.9	0.52	350
8	Tangi Choudwar	kalyanipur	DW	2020	8.3	1076	585	76	244.6	83.4	164.4	96	738.1	42.1	0.14	605
9	Tangi Choudwar	Bhatimunda	DW	1290	7.8	681	350	34	149.6	75.2	97.4	64.4	439.2	40.6	0.17	360
10	Tigiria	Seshagaon	DW	800	8.2	437	225	26	92.2	47.56	58.6	38.9	298.9	24.7	0.32	245
11	Tigiria	Nuapatna Gridsahi	DW	210	7.9	109	65	20	23.8	11.35	8.83	3.6	79.3	1.7	0.20	65
12	Salepur	Bahugram	DW	300	7.9	150	115	28	16.6	15.76	1.25	10.9	140.3	7.5	0.16	115
13	Cuttack sadar	Bauxibazar	TW	210	7.14	104	81	16.3	19	7.7	2	9.9	92.4	3	0.43	76
14	Cuttack sadar	Ring road	TW	400	7.83	206	148	40.8	33.3	18.7	7.3	11.2	166.4	13.1	0.16	136
15	Cuttack sadar	Bidyadharpur	TW	680	8.01	337	240	59.2	78.3	38.9	11.5	22.3	216	21.3	0.12	177
16	Kantapada	Sundargram	TW	230	7.99	114	92	18.4	9.5	9.2	1.3	11.2	129.4	0.7	0.15	106
17	Kantapada	Bara saila	TW	450	7.9	208	179	24.5	16.6	15.7	1.1	28.5	246.5	0.6	0.34	202
18	Kantapada	Cheda	TW	390	7.95	196	102	28.6	28.5	32.6	6	7.4	184.9	2.5	0.17	152
19	Kantapada	Bairoi	TW	430	7.87	213	92	22.4	40.4	52.1	5.8	8.7	166.6	1.7	0.13	137
20	Kantapada	Salaibedapur	TW	180	7.84	93	56	16.3	14.3	14.6	1.9	3.7	80.1	3.1	0.13	66
21	Mahanga	Madhanga	TW	430	7.93	202	184	28.6	28.5	7.6	1.1	27.2	209.5	5.7	0.24	172
22	Mahanga	Haripur	TW	530	7.89	257	163	34.7	42.8	35.2	1.9	18.6	240.3	5.3	0.50	197
23	Mahanga	kundi	TW	490	8.02	232	153	22.4	28.5	30.5	3.9	23.5	240.4	5	0.67	197
24	Mahanga	Bagsarpur	TW	1100	8.15	565	342	65.2	170.9	86.1	6.8	43.5	351.4	20.1	0.65	288
25	Mahanga	Mahanga	TW	2250	7.59	1190	729	110.2	646	181.5	1.1	110.2	184.9	50.1	0.33	152
26	Mahanga	Sanarautpati	TW	820	8.11	444	158	59.2	116.3	108	7.6	2.5	283.7	11.4	0.19	233
27	Niali	Niali	TW	310	8.04	150	102	8.2	14.3	21.6	1.9	19.8	166.6	2.3	0.15	137
28	Niali	Podana	TW	380	7.88	168	158	14.3	21.3	14.8	0.6	29.7	172.7	2.9	0.33	142

Sl No.	BLOCK	LOCATION	SOURCE	EC	pH	TDS	TH	Ca++	Cl-	Na+	K+	Mg++	HCO3-	SO4=	F-	Alkalinity
29	Niali	Pahanga	TW	300	8.04	149	92	24.5	23.8	18.5	4.7	7.5	141.7	0.7	0.35	116
30	Niali	Madhav	TW	760	8.03	401	179	42.8	137.5	84.5	6.2	17.4	221.8	4	0.29	182
31	Niali	Krusnaprasad	TW	390	8.11	187	112	8.2	28.5	34.4	1.9	22.3	184.9	0.8	0.27	152
32	Nischintkoili	Nischinkoili	TW	500	8.05	243	158	30.6	14.3	35.4	2.5	19.8	283.7	0.8	0.45	233
33	Nischintkoili	Sukharpada	TW	310	8.16	156	87	24.4	21.4	25.9	1.2	6.2	154.4	1.2	0.44	127
34	Nischintkoili	Malipur	TW	200	8.02	105	60	18.4	16.6	12.5	5.4	3.4	92.7	2.9	0.27	76
35	Nischintkoili	Nemalo Gadi	TW	530	8.22	264	168	36.7	23.8	37	6.4	18.6	277.3	5.5	0.41	227
36	Nischintkoili	Dingeswar	TW	390	8.02	197	148	42.8	11.9	21	4.4	9.9	215.7	0.7	0.43	177
37	Nischintkoili	Baunpati	TW	410	7.97	200	133	32.6	21.4	27.3	1.9	12.4	209.5	1	0.80	172
38	Nischintkoili	Gopinathpur	TW	340	8.1	169	112	36.7	19	19.3	8.2	5	160.2	1.9	0.31	131
39	Nischintkoili	Buhalo	TW	480	8.04	231	143	24.5	16.6	34	4.6	19.8	265	1.6	0.40	217
40	Salepur	Monaharpur	TW	500	8.09	242	125	18.4	26.1	44	4.8	19.2	252.6	4.9	0.46	207
41	Salepur	Salepur	TW	330	8.08	166	122	42.8	14.3	16.6	5.5	3.7	166.4	1.1	0.38	136
42	Salepur	Bahugram	TW	330	8.01	164	113	38.8	19	12.7	7	3.8	164.7	1.3	0.28	135
43	Salepur	Ganapur	TW	520	7.95	244	180	26.5	30.9	34.6	4.1	27.6	234.2	4.9	0.48	192
44	Salepur	Rameswar	TW	330	7.94	163	135	40.8	23.8	11.9	3.7	8	134.2	9.1	0.24	110
45	Tangi Choudwar	Mathasahi	TW	410	7.93	196	175	42.8	31.9	13.7	1.4	16.5	178.8	1.4	0.51	147
46	Tangi Choudwar	Bhatimunda	TW	1020	7.84	550	180	32.6	209.2	150	1.9	23.9	243.4	13	0.37	200
47	Salepur	Santapur	TW	280	8.11	141	87	26.5	11.9	17.8	6.6	5	147.9	1	0.27	121

GROUND WATER QUALITY OF EXPLORATORY WELLS IN CUTTACK DISTRICT **ANNEXURE -V**

Sl No	Block	Location	EC	pH	TDS	TH	Ca++	Cl-	Na+	K+	Mg++	HCO3-	SO4=	F-	TA
1	Athgarh	Dhurkudia	280	7.76	141	105	24	25	14.0	0.6	11.0	128.0	4.0	0.20	105
2	Athgarh	Dahisara	260	7.51	137	110	26	28	11.0	1.7	11.0	116.0	2.0	0.20	95
3	Athgarh	Ghantikhal 1	255	7.47	151	85	20	50	15.0	12.0	9.0	49.0	21.0	0.00	40
4	Athgarh	Radha Damodarpur	440	8.03	218	185	30	20	15.0	5.4	27.0	214.0	16.0	0.19	175
5	Athgarh	Ghantikhal	290	6.11	162	85	20	50	15.0	22.2	9.0	61.0	16.0	0.04	50
6	Athgarh	Kumarpur	400	7.90	213	45	14	43	70.4	1.1	2.4	158.6	3.1	1.37	130
7	Athgarh	Radhashyampur	420	7.30	232	25	8	89	82.4	1.7	1.2	97.6	1.5	2.88	80
8	Baranga	Bentua	670	7.14	307	217	34	64	33.8	5.8	32.0	254.0	13.0	0.16	208
9	Mahanga	Jagnnathpur	170	7.70	104	80	20	11	8.4	0.8	7.3	98.0	6.5	1.85	80
10	Mahanga	Kusupur	230	7.60	153	95	22	18	24.0	2.3	9.7	140.0	3.1	0.80	115
11	Mahanga	Kaudokole-1	830	7.70	430	265	30	78	64.1	2.1	46.2	366.0	29.9	0.67	300
12	Mahanga	Kaudokole-2	850	7.80	434	260	28	71	75.2	2.4	46.2	366.0	31.5	0.73	300
13	Mahanga	Kaudakole	780	7.70	439	155	14	78	116.2	2.5	29.2	323.4	39.5	0.61	265
14	Mahanga	Mahanga	1010	8.20	567	270	8	128	111.0	5.2	60.8	317.3	98.1	0.74	260
15	Mahanga	Mulabasant	902	7.73	406	160	18	78	91.1	2.5	27.9	280.6	47.7	0.64	230
16	Nilali	Niali	770	7.19	416	223	39	117	74.0	0.6	30.0	216.0	49.0	0.23	177
17	Nilali	Niali EW 1	710	6.85	379	214	29	93	52.0	23.0	35.0	178.0	61.0	0.05	146
18	Nilali	Niali EW2	250	6.96	118	87	10	18	15.0	1.0	15.0	102.0	9.0	0.06	84
19	Nilali	Niali Handpump	460	6.90	256	138	31	32	30.0	19.0	15.0	115.0	72.0	0.02	94
20	Nischinkoili	Mallipur	540	7.80	-	190	32	71	26.0	14.0	27.0	201.0	-	0.45	165
21	Nischinkoili	Taratsasan	620	7.60	351	270	66	21	31.3	1.1	25.5	390.0	12.4	2.72	320
22	Nischinkoili	Kulia	1020	7.80	541	270	34	99	109.0	0.8	45.0	470.0	21.4	0.90	385
23	Nischinkoili	Barkolia	520	7.87	287	215	50	28	25.4	0.5	21.9	305.0	8.1	0.38	250
24	Nischinkoili	Narendrapur	450	7.82	228	160	46	25	25.3	3.2	10.9	231.8	1.2	0.39	190
25	Nischinkoili	Uttarkul	480	7.86	238	185	32	21	25.2	2.0	25.5	256.2	3.8	0.49	210
26	Salepur	L.N.Pur	460	7.78	-	170	40	34	28.0	1.0	17.0	214.0	-	0.50	175

Sl No	Block	Location	EC	pH	TDS	TH	Ca++	Cl-	Na+	K+	Mg++	HCO3-	SO4=	F-	TA
27	Salepur	Raghavpur	420	7.89	-	135	40	16	25.0	14.0	9.0	226.0	-	0.59	185
28	Salepur	Raghavpur-I	430	8.20	248	205	52	18	19.1	1.9	18.2	262.0	4.6	2.52	215
29	Salepur	Raghavpur-II	430	8.00	281	210	58	36	19.8	1.8	15.8	287.0	4.3	2.56	235
30	Salepur	Lakhna	880	7.86	421	310	76	93	55.0	1.3	29.0	214.0	-	1.39	175
31	Salepur	Kishinapur	460	8.20	245	155	30	25	34.5	0.2	19.4	256.2	7.5	0.43	210
32	Tangi-Choudwar	Jajabhairabhanuagaon	950	7.42	475	217	28	33	104.5	4.5	35.0	429.0	60.2	0.57	351
33	Tangi-Choudwar	Tangi-Choudwar	170	7.54	88	50	14	17	13.3	2.0	4.0	66.0	5.4	0.06	54
34	Tangi-Choudwar	Ramachandrapur	160	7.53	85	35	12	12	17.2	2.1	1.0	74.0	4.0	0.28	61
35	Tangi-Choudwar	Biswanahakani	180	7.05	91	60	14	23	10.0	3.0	6.0	49.0	11.0	0.06	40
36	Tangi-Choudwar	Safa	540	7.59	262	217	36	16	24.2	2.2	30.0	308.0	2.0	0.42	253
37	Tangi-Choudwar	Gopalpur	120	7.36	70	56	8	12	5.0	2.0	10.0	59.0	4.0	0.09	49
38	Tangi-Choudwar	Devinagar	140	6.82	69	60	16	15	5.0	3.0	5.0	53.0	2.0	0.14	45
39	Tangi-Choudwar	Nuapatna	280	6.60	145	99	24	19	17.8	2.9	10.0	130.0	7.0	0.13	107
40	Tangi-Choudwar	Indranipatna	270	6.34	119	103	21	14	8.6	3.0	13.0	112.0	5.0	0.11	92
41	Tangi-Choudwar	Chintamanipur	470	8.15	232	168	29	17	29.0	2.0	23.0	259.0	5.0	0.35	216

DETAILS OF EXPLORATORY WELLS IN CUTTACK DISTRICT **ANNEXURE VI**

Block	Location	Latitude	Longitude	Lithology	Depth drilled (mbgl)	Aquifer zones tapped / Fracture(mbgl)	SWL (mbgl)	Discharge (lps)	Drawdown (m)	T (m^2 / day)	S
ATHAGARH	KORANGA	20.53	85.59	Gondwana	151	39	12	2.1		0.48	
ATHAGARH	KUMARPUR	20.57	85.85	Gondwana	190	188	1.95	2.2	27.78	4.64	
ATHAGARH	RADHASHYAMPUR	20.54	85.74	Gondwana	200	163	16.63	1.8	22.85	5.3	
ATHAGARH	RADHADAMODARPUR	20.56	85.75	Gondwana	103	49,54,74	5.26	9.1	16.07	31.56	0.158
ATHAGARH	DHURKUDIA	20.46	85.72	Gondwana	150	40,46	7.1	3.7	3.77	64.37	0.0078
ATHAGARH	DAHISARA	20.51	85.68	Gondwana	150	61,66	7.1	12.5	8.31	78.89	0.191
ATHAGARH	GHANTHIKHAL	20.53	85.74	Gondwana	103	54	6.72	15.38	3.87	270.91	0.1135
ATHAGARH	ATHAGARH	20.52	85.65	Gondwana	62.48	14-19.68 20.04-27.00 29.00-31.00 39.00-42.00 44.50-45.50 46.50-48.0, 53-54	3.95	10.86	2.65		
BANKI	MADHUAPALLI	20.29	85.36	Khondalite	93		2.45	0.5		-	
BANKI	BAGHEI	20.31	85.37	Khondalite	81.90		4.96	2.11			
BARANGA	MUNDALI	20.46	85.76	Gondwana	111.70	-	26.35	17	2	305.463	
CUTTACK SADAR	KILLAMAIDAN	20.48	85.88	Alluvium	80	30-55.00	4.63	53.53	3.687		
CUTTACK SADAR	SHANKARPUR	20.43	85.98	Alluvium	86.50	34.50-56.50 68.50-81.50	5.305	58.00	2.873		
CUTTACK SADAR	COLLECTORATE COMPOUND	20.49	85.84	Alluvium	98.85	36.10-49.00 58.00-79.00	4.253	55.61	11.931		
CUTTACK SADAR	J.G COMPOUND	20.48	85.87	Alluvium	74.85	25.0-55.00 57.0-65.00	3.585	67.28	12.785		
CUTTACK SADAR	NAYABAZAR II	20.46	85.90	Alluvium	94.09	30.00-60.00	4.454	68.7	5.72		
CUTTACK SADAR	TULSIPUR II	20.49	85.86	Alluvium	55.35	27-48.00	3.22	56.55	13.77		
CUTTACK SADAR	BADAMBARI	20.46	85.89	Alluvium	200	-	5.82	63.84	7.71		
CUTTACK SADAR	BIDANASI II	20.48	85.84	Alluvium	96	30.0-55.0	4.45	37.78	5.25		

Block	Location	Latitude	Longitude	Lithology	Depth drilled (mbgl)	Aquifer zones tapped / Fracture(mbgl)	SWL (mbgl)	Discharge (lps)	Drawdown (m)	T (m^2 / day)	S
CUTTACK SADAR	DISTRICT DAKBUNGALOW	20.47	85.91	Alluvium	62	18.00-30.00 35.00-52.00	2.855	61.76	7.16		
CUTTACK SADAR	KUANPAL	20.59	86.15	Alluvium	166.5	-	1.09	8.33	-		
CUTTACK SADAR	DHOBANDA	20.48	85.85	Alluvium	90	47.49 ,54.56 65.69, 73-75.50	5.624	54.06	11.397		
CUTTACK SADAR	JAGATPUR	20.53	85.94	Alluvium	60	-	-	-			
CUTTACK SADAR	CUTTACK TOWN-OSAP	20.46	85.91	Alluvium	77.65	48.00-63.00	-	-	-		
CUTTACK SADAR	PRATANAGRI	20.40	85.92	Alluvium	78	30-50.00	1.02 mbgl	15.77	-		
CUTTACK SADAR	DEWANBAZAR	20.47	85.89	Alluvium	87.6	25.58-30.00 33.50-34.50 36.50-37.00 45.00-52.00 55.50-58.00 63.00-67.50 69.00-72.00	5.889	68.7	6.859	-	
CUTTACK SADAR	FRIENDS COLONY	20.47	85.89	Alluvium	78.35	26.00-53.00 56.00-61.00	1.621	48.9	4.196	491.04	
CUTTACK SADAR	CHOWDWAR II	20.54	85.92	Alluvium	50.73	19.01-28.04 38.04-40.04 42.04-49.04	2.635	8.33	13.165	402	
CUTTACK SADAR	CHOWDWAR I	20.54	85.90	Alluvium	98.14	76.12-82.12 89.12-97.12	-	-	-	16.77	
CUTTACK SADAR	CHATESWAR	20.50	85.82	Alluvium	90.60	23.00-39.00 41.50-43.00 49.00-52.00	3.935	1.66	8.722	985.68	
CUTTACK SADAR	KURANG SASAN	20.30	85.95	Alluvium	113	87-93	4.17	15			
CUTTACK SADAR	BENTKAR	20.41	85.94	Alluvium	90	49-70	5.3	12			
DAMPADA	GOPALPUR	20.36	85.53	Khondalite	122.5		2.6	1.5			

Block	Location	Latitude	Longitude	Lithology	Depth drilled (mbgl)	Aquifer zones tapped / Fracture(mbgl)	SWL (mbgl)	Discharge (lps)	Drawdown (m)	T (m^2 / day)	S
MAHANGA	J N COLLEGE	20.57	86.17	Alluvium	184.13	66-72,77-86,92-98,106-112	3.05	11	5.45	420	
MAHANGA	JAGANNATHPUR	20.60	86.12	Alluvium	94.62	43-46,48-51,66-75	3.56	15	5.45	115.3	
MAHANGA	KUSUPUR	20.61	86.21	Alluvium	161.83	37-47	3.52	14	1.91		
MAHANGA	KOUDOKOL	20.65	86.19	Alluvium	86	57-72	5.25	15		325.5	
MAHANGA	KOTPADA	20.59	86.16	Alluvium	96.15	57.5-63.5		10			
NIALI	NIALI1	20.13	86.06	Alluvium	102	26-32,39-51	4.8	10			
NIALI	DAHIJUNGA	20.18	86.08	Alluvium	171	142-160	2.85	12			
NISCHINTAKOILI	MALLIPUR	20.47	86.24	Alluvium	210.4	37-73,59-65,94-97,116-122	5.25	28			
NISCHINTAKOILI	TARATSASAN	20.46	86.26	Alluvium	219.17	57-63,89-95,122-134		10	9.98	346	
NISCHINTAKOILI	KULIA	20.48	86.14	Alluvium	219.27	84-90,96-99,114-123,125-131	2.8	7	15.75		
NISCHINTAKOILI	NARENDRAPUR	20.40	86.25	Alluvium	218	35-41,102-114		15			
NISCHINTAKOILI	BARKOLIA	20.44	86.27	Alluvium	209.74	56-62,90-96,99-105,120-135		15			
SALEPUR	L N PUR	20.49	86.02	Alluvium	153.5	77-80,84-87,93-105,111-120,126-132,138-144.	4.28	30			
SALEPUR	RAGHAVPUR	20.47	86.09	Alluvium	162.43	60-66,84-90-102	3.52	12			
SALEPUR	KISHINAPUR	20.05	86.05	Alluvium	199.7	52-58,61-64,68-71,77-89,127-132		15		484.5	
TANG-CHOUDWAR	DEVINAGAR	20.52	85.89	Gondwana	94	72,92	7.55	4	30.39	9.31	
TANG-CHOUDWAR	RAMACHANDRAPUR	20.61	85.88	Gondwana	150	42,58	0.6	4.4	11.75	18.89	0.7642

Block	Location	Latitude	Longitude	Lithology	Depth drilled (mbgl)	Aquifer zones tapped / Fracture(mbgl)	SWL (mbgl)	Discharge (lps)	Drawdown (m)	T (m^2 / day)	S
TANG-CHOUDWAR	SAFA	20.65	85.95	Khondalite	94	73,93.5	6.48	7.7	25.23	23.4884	0.0013
TANG-CHOUDWAR	BISWANAHAKANI	20.62	85.95	Khondalite	110	39,60,63,72,75	5.1	9.55	14.5	33.12	0.1178
TANG-CHOUDWAR	NUAPATANA	20.51	85.82	Gondwana	103	83,90,102	12.18	7.4	15.05	41.03	0.0143
TANG-CHOUDWAR	GOPALPUR	20.53	85.88	Gondwana	151	36.50,42,43,57,60	14.76	7.86	15.06	35.23	0.0104
TANG-CHOUDWAR	INDRANIPATANA	20.52	85.87	Gondwana	101	18,44,59,97	6.58	11.57	14.23	101.74	
TANG-CHOUDWAR	TANGI	20.56	86.00	Alluvium	71.8	48.00-63.00	-	0.75	-		