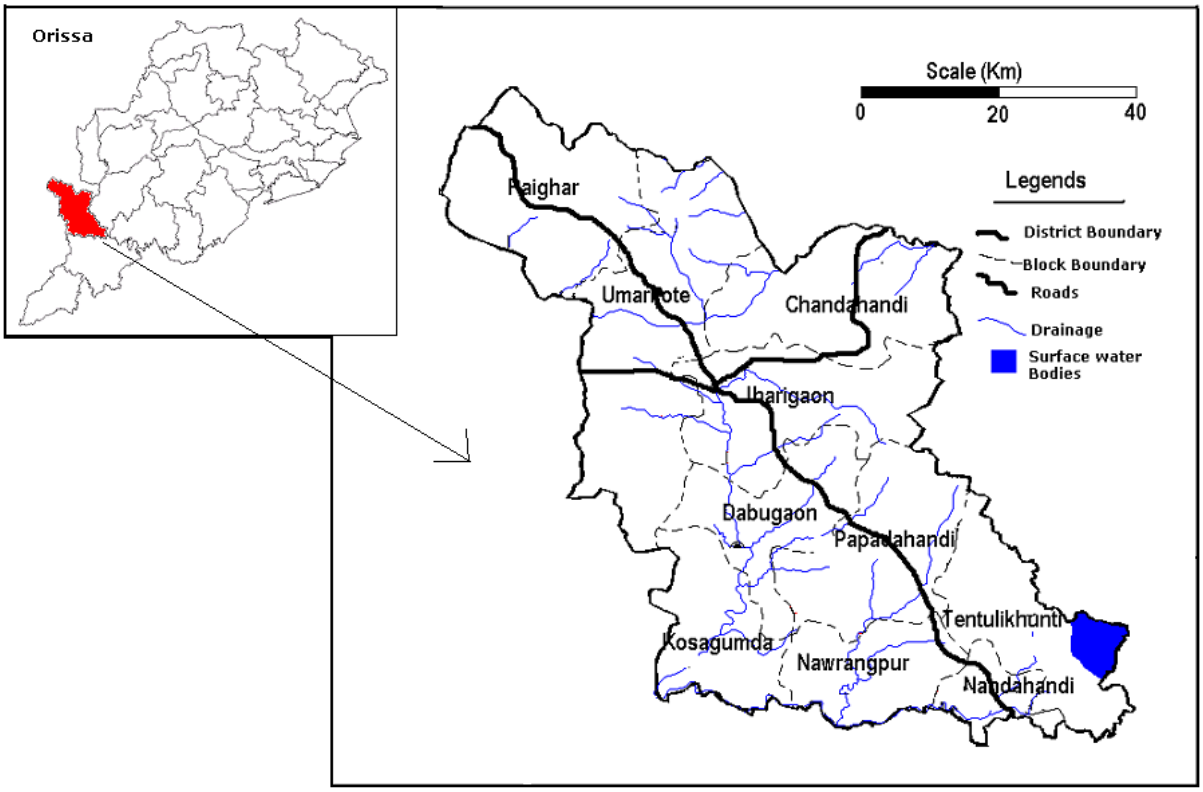
GROUND WATER INFORMATION BOOKLET

NAWARANGPUR DISTRICT, ORISSA



Ministry of Water Resources
Central Ground Water Board,SER
Bhubaneswar
January, 2013

DISTRICT AT A GLANCE

Sl.No.	Items	Statistics
1	**GENERAL INFORMATION** i) Geographical Area (Sq km) ii) Number of Blocks iii) Number of Panchayat iv) Number of Village iv) Population as on 2011 Census v) Average annual rainfall (mm)	 5291 10 169 901 10,25,766 1030.21 mm to 1569.50 mm
2	**GEOMORPHOLOGY** (i)Major Physiographic Units (ii) Major Drainages	 (i) Undulating plains dotted with residual hills (ii) Scattered hills with high relief Indravati, Bhaskel & Tel
3	**LAND USE (SQ KM)** a) Forest Area b) Net Area Sown	 669.05 21111.29 (Kharif)
4	**MAJOR SOIL TYPE**	1-Alfisol, 2- Utisol, 3- Vertisol
5	**AREA UNDER PRINCIPAL CROPS (as on 2011) (SQ.KM)**	1- Autumn – 517.68 2- Winter – 12216.51 3- Summer – 22.35
6	**IRRIGATION BY DIFFERENT SOURCES (Area and no. of structures)** 1. Canals 2.Net Irrigated Area	 (i) Major & Medium Irrigation Project – 3500 Ha (Kharif) 1190 Ha (Rabi). (ii) Minor Irrigation Project (Flow) – 4975 Ha (Kharif); 475 Ha (Rabi) (iii) Lift Irrigation Project – 2979 (Kharif) ; 2046 (Rabi) 99454 Ha (Kharif) 3701 Ha (Rabi)
7	**NUMBER OF GROUN WATER MONITORING WELLS OF CGWB (as on 31.3.2011)** 1. No of Dug Wells	 20

	2. Nos of Piezometers	Nil
8	**PREDOMINANT GEOLOGICAL FORMATIONS**	(I) Eastern Ghat Super Group of Rocks (Precambrian Crystalline Rocks) (II) Bengpal Group of Rocks (III) Quaternaries
9	**HYDROGEOLOGY** • Major Water Bearing Formations • Pre-Monsoon Depth to Water Level during 2006 • Post-Monsoon Depth to Water Level during 2006 • Long Term water level trend in 10 yrs (1997-2006) in m/yr	Weathered & Fractured Crystalline rocks 3.52 mbgl to 9.10 mbgl 0.34 mbgl to 5.10 mbgl 35.7% of wells show rise from 0-2 m, 7.1 % wells show rise from 2-4 m. (Pre-monsoon) 93.3% of wells show rose in 0-2 m, 6.7% of wells show rise from 2-4 m. (Post – monsoon).
10	**GROUND WATER EXPLORATION BY CGWB (As on 31.3.2011)** No of wells drilled (EW,OW,Pz,SH,Total) Depth Range (m) Discharge (lps) Transmissivity(m^2/day)	E/W – 19 (departmental) O/W – 10 (do) E/W – 10 (Outsourcing) Total –39 19.5 – 200.00 m 0.2 to 16.3 0.248 – 8.58 (Weathered Granite Gneiss) 1.60 – 7.0 (Weathered Granite Gneiss) 1.033 – 3.55 (Shale)
11	**GROUND WATER QUALITY** Presence of Chemical constituents more than permissible limit (e.g. EC ,F,AS, Fe) Type of water	High concentration of Nitrate in Jharigaon High concentration of Fluoride in Chandahandi. Slightly Alkaline (pH 7.16 to 8.25 milligram / ltr)
12	**DYNAMIC GROUND WATER RESOURCES (2004 in mcm)** 1. Annual replenishable Ground Water Resources 2. Net Annual Ground Water Draft 3. Projected demand for domestic and industrial uses up to 2005	481.01 53.71 39.26

	4. Stage of Ground Water Development	11.17%
13	**AWARENESS AND TRAINING ACTIVITY** Mass Awareness Programmes organized Date Place No of Participants	 One 17.02.06 Nowrangpur Town, Nowrangpur block, 120
	Water Management and Training Programmes Organised Date Place No of Participants	One 18.02.06 Nowrangpur Town, Nowrangpur block, 50
14	**EFFORTS OF ARTIFICIAL RECHARGE & RAIN WATER HARVESTING** Projects compiled by CGWB (No & Amount spent) Projects under technical guidance of CGWB (numbers)	 Nil Nil
15	**GROUND WATER CONTROL AND REGULATION** No of OE Blocks No of Critical Blocks No of Blocks Notified	Nil
16	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	Ground water contamination, pollution & depletion

(Latest data to be incorporated)

1.0 INTRODUCTION

Nawarangpur was conferred the status of district in the early part of 1992, when erstwhile Koraput district was divided into four new districts. About 94% of the population of the district live in the rural areas and depend for their livelihood largely on agriculture. However, the irrigation facilities existing in the district are limited, leaving agriculture to the mercy of the monsoon. Hence necessity for optimal utilisation of the existing water resources in the district is rather compelling while terrain conditions restrict the scope of surface water development. Nawarangpur districts situated in the south western part of Orissa lying between the north latitudes 19^0 $09^/$ and 20^0 $06^/$ N and east longitudes 81^0 $51^/$ and $82^0 52^,$ E, falling in Survey of India degree sheet Nos. 64 H, L and 65 E and I. It is bordered by Bastar district of Madhya Pradesh in the West, Raipur district of Madhya Pradesh in the North, Kalahandi district of Orissa in East and Koraput district of Orissa in the South. The

district covers an area of 5291 sq. km. and is divided into 10 administrative blocks (Plate I). The district headquarters at Nawrangpur approachable by National Highway 43 which passes through southern border of the district and connects the headquarters Vishakhapatnam port. The major towns of the district are connected to the district headquarters by road.

The Indravati river is the most prominent river in the district. It is a tributary of the Godavari and sustains perennial flow. It originates in the Kalahandi district flows through Nawarangpur and Koraput districts and enters in Bastar district of Madhya Pradesh. The Tel and Bhaskel are the other rivers flowing through the district.

The district has limited irrigation facilities as per available data. The net irrigated area from different sources is 9454 ha and 3711 ha for Kharif and Ravi respectively. The source wise Irrigation potential created in the district from various sources has been tabulated in Table-1.1.

Table 1.1 Source-wise Irrigated area (March 2010)

Sl.No.	**Source**	**Irrigated area (Ha)**	
		Kharif	**Rabi**
1	Major / Medium Irrigation Projects	3500	1190
2	Minor Irrigation Projects	4975	475
3	River lift Projects	2979	2046
4	Other sources (Tanks, Nala, etc.)		
5	Groundwater Source		
	Total :-	**9454**	**3711**

The area has been covered by Systematic Geological Mapping by Sh. V. Ravikumar, Sh. B.Sarangi and Sh. Z.Iqbal of G.S.I. The Systematic Hydrogeological Surveys were carried out by Sh. S.K. Guha and Sh. P.Nag, Geologists of G.S.I. during the season 1966-67 and by Sh. S.V.Choughla, Sh. M.V.Rao and Sh. D.P.Pati, Scientist. 'B' of C.G.W.B on 1: 50,000 scale during the season 1976-77 and 1987-88. The Reappraisal hydrogeological surveys were conducted on 1:50,000 scale by Sh.A.D.Rao, Jr. Hydrogeologist and Sh. G.Y. Setty, Asstt. Hydrogeologist in the district.

Ground water exploration by deep drilling upto 200m has been taken up in the district and 39 nos. exploratory wells so far has been drilled to delineate the deeper potential water saturated fracture zones. The location of the wells is depicted in Plate –I. Ground water monitoring is being done through 20 hydrograph network stations four times in a year.

2.0 RAINFALL & CLIMATE

The climate of the district is typically tropical to subtropical with three distinct seasons e.g. summer, winter, and monsoon. December is the coldest month with mean daily average temperature of 25^{o} C which reaches a maximum of 40^{0} C in May. The rain fall in the area is mostly from the south west monsoon lasts from middle of June to October. The average annual rainfall varies from 1030.21mm to 1569.50 mm. A persual of these data indicates that the average annual rainfall is higher in the central parts as compared to other parts of the district. Further droughts are frequent in Nawarangpur, Raighar and Umerkote blocks.

3.0 GEOMORPHOLOGY & SOIL TYPES

The district has varied geomorphological features. The geomorphic units are (i) Lateritic Upland, (ii) Pediplane, (iii) Denudational Hills, (iv) Flood Plain, (v) Structural Hills, (vi) Inselberg, (vii) Mesa & Butte, (viii) Residual Hills, (ix) Intermontane Valleys, (x) Bazada (Plate-V).

The distribution of different soil types in the district depends much on its physiographic and lithologic variations. Based on the physical and chemical characteristics, mode of origin and occurrence, soils of the district may be classified into two groups namely Alfisols and Vertisols.

Alfisols : It includes red sandy soils and red loamy soils. The red loamy and sandy soils are occurring in throughout the district. The characteristic features of red soils are (1) light texture, porous and friable structure, (2) absence of lime Kankar and free carbonates and (3) soluble salts in a small quantity usually not exceeding 0.05%. These are usually deficient in nitrogen, phosphate, organic matter and lime. These soils are suitable for cultivation of paddy and other crops.

Vertisols : These are medium black soils found in the North Eastern Corner of the district in the Chandahandi block. The soils are highly argillaceous and contain high amount of iron, calcium and magnesium. These are poor in organic matter, nitrogen and phosphorous but rich in potash and lime. The pH varies from neutral to alkaline and texture varies from loam to clayey loam. These are quite fertile soils.

4.0 GROUNDWATER SCENARIO

4.1 Hydrogeology

The hydrogeological conditions vary from place to place depending upon the aquifer characteristics of the litho units, sources of groundwater recharge and the structural setting of the area. The hydrogeological units of the area are broadly categorized into three groups namely:

A. Consolidated formations.

B. Semi Consolidated formations
C. Unconsolidated formations

Consolidated Formations:- This hydrogeological unit comprises hard crystalline rocks like granites, granite gneisses, Khondalites, Charnokites, Schists, Quartzites and also Pre Cambrian Sediments like Sandstone and Shale. These formations lack primary porosity. The weathered residuum and jointed and fractured zones of the hard rocks form the main repository of ground water. Ground water occurs under phreatic condition in the weathered zone and circulates through fractures and fissures below. The yield potentials of the fractured zones depend upon intensity of fracturing and interconnection of the fractures with the near surface saturated zone.

Water bearing properties of the consolidated formations:

Granites and Granite Gneisses: The granite and granite gneisses occupy low-lying plains and are foliated, jointed, highly weathered. On weathering and leaching of Kaolinised clay these rocks are reduced to a losse quartzose assemblage. The depth of weathering varies from 9 to 20 metres below ground level. Three sets of intersecting joints are present in this litho unit striking ESE-WNW, NE-SW and NW-SE with steep dips ranging from 55 ^{0} to vertical. The opening of the joints vary from few millimeters to about 35 mm. Joints are often closely spaced. The depth to water level varies from 1.77m to 11.45m below ground level during Pre-monsoon period and 1.08m to 10.41m below ground level during Post – monsoon period. The specific capacity Index varies from 0.44-9.02 lpm/m/m^2. The yield potential is good to moderate ranging upto 6 lps for shallow aquifers and 10 lps for deeper fractured aquifers.

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Charnockite & Khondalites: The weathered residuum of these rocks constitute the aquifers. Three sets of joints are encountered in these litho units. But these rock types generally form hilly, rugged terrain and hence do not form potential aquifers except in narrow valleys. The yield is low ranging upto 3 LPS.

Bengpal Group of Rocks: The Schists and Amphibolites of Bengpal group of rocks are generally poor water yielder. Weathering is limited to a depth of 8-10m. only.

Quartzite –Shale – Sandstone: group of rocks are weathered down to a depth of about 15 m below ground level. Due to pronounced weathering and existence of two sets of open joints, this formation act as good aquifers. Shale and sandstone form potential water yielder in the fissured

and fractured portions. The depth to water table during pre monsoon period varies from 5 to 10 m below ground level and during post monsoon period between 3 to 6.5 m. The Specific

Capacity Index of wells in these formations varies from 3.2 to 4.86 lpm/m/m^2. These formations sometimes yield upto 5 lps.

Semi-Consolidated Formation:

Laterites : Laterites are porous and have generally developed on granite gneiss formations. The thickness of the laterites varies from 5 to 15 m. The depth to water table in pre monsoon period varies from 8.50 to 12.20 m. below ground level and 6.85m. to 12.00 m. below ground level in post monsoon period. The seasonal fluctuation of water table varies from 0.2 to 2.8 m. The yield of the dug wells in this formation is less than 7 lps for a drawdown of 3-4 m.

Unconsolidated Formation: The sand and gravel layers occurring as valley fills and along the river banks from potential aquifers. The yield potential of the formation is upto 15 lps.

Aquifer Characteristics of Crystalline: In the hard crystalline rock recharge of ground water from precipitation or seepage from surface water bodies percolate into the weathered (saprolite) zone. In case the underlying basement rocks (both weathered and fresh) are incised by open fractures, the downward movement of the water from the upper regolith zone (comprising the top soil and saprolite horizon) is facilitated. In the saprolite/regolith horizon ground water generally occurs under unconfined condition where as is the fractured bedrock aquifers it occurs under semi-confined to confined conditions. The ground water potentials of various zones i.e. saprolite (tapped by dug wells), weathered basement rock and shallow fractured basement rock horizon (tapped by the hand pumps) and deeper fractured basement rock (tapped by the deep boreholes by CGWB) vary considerably depending upon their lithological and structural characteristics. Perusal of all results related to pumping test indicates that granite gneiss forms the most potential aquifer both in shallow and deeper horizons followed by Khondalite.

In Lateites the specific capacity Index of dug wells vary from 2.32-to 10.27-lpm/m/m^2.

In limited extant the alluvium forms potential shallow aquifers.

Groundwater Exploration

Exploratory drilling has been taken up by the Central Ground Water Board in Nowrangpur district with the objective to delineate deeper water bearing fractures in the consolidated formation and their yield potentiality within a maximum depth of 200m. Till March 2011, 29 exploratory and observation wells were drilled in hard crystalline and semiconsolidated formations in the district under Normal Ground Water Exploration Programme and Accelerated Exploration Drilling Programme. The depth range of these wells varies from 32m to 180 m below ground level. The thickness of the overburden ranges from 5.5 to 35.5m. The yield of exploratory wells varies from negligible to 16.63 LPS. Formation wise yield range of the wells is given in the table 4.1.

Table 4.1 Details of Exploration (Litho unit wise)

Sl.	Lithological Unit	No. of Wells	Depth range of wells (mbgl)	No. of wells with yield (LPS)		
				<2	2-5	>5
1.	Granite and granite gneisses	20	82.1-200	7	4	6
3.	Khondalites, Charnokites and Calc silicate rocks	4	141-93	1	1	2
4.	Sandstone and shale	5	125-200	2	1	2

Depth to Water Level (Pre-monsoon and Post-monsoon, 2011)

The depth to water level is measured from the National Hydrograph Staions situated in different blocks of the Nowrangpur District. The Pre monsoon, 2011 water level data varies from 3.52 mbgl to 9.10 mbgl. The shallow water level was measured from Dondasora and the deepest water level was measured at Dabugaon. The depth to water level map of pre -monsoon, 2011 is displayed in Plate II.
The depth to water level data of Post-monsoon, 2011 represents 0.34 mbgl to 5.10 mbgl. The Raigarh shows deepest water level and Dondasora shows shallowest one. Plate III represents depth to water level map of post –monsoon, 2011.

Seasonal Fluctuation

The fluctuation of depth to water level in 2011 shows rise in water level from 2.95 to 7.37 mbgl in all the NHS.

Long Term Water Level Trend in Last 10 years in Ground Water Monitoring wells

The long term trend (10 years) in water level for the **pre-monsoon** shows rise of 0-2m in 35.7% of wells and 2-4 m rise in 7.1% of wells in Nawarangpur district.

The long term trend of (10 years) in water level for **post monsoon** season shows rise in water level for 0-2m in 93.3% of wells and 2-4 m rise in 6.7 % wells in the district.

4.2 Ground Water Resources

The Ground Water Resources of the district has been assessed adopting the methodology recommended by the Groundwater Estimation Committee (1997), constituted by Govt. of India. The task was jointly carried out by the Central Ground Water Board and Ground water Survey & Investigation, Department of Water Resources, Govt. of Orissa. The block wise computation of ground water resources in the district has been presented in Table 4.3. The ground water resources in the district are computed as 50306 Ha-m, out of which the existing Ground Water Draft for irrigation is 4050 Ha-m. The ground water draft for irrigation is through dug wells

and shallow tube wells. A large number of hand pumps fitted in PHED bore wells and tube wells also cater to the rural and urban water supply needs. On the basis of the estimated ground water potentials a detailed scheme for ground water development may be launched in the district. So far ground water development in the district has been meager, and all the blocks fall under the safe category. The stage of ground water development varies from 9.16% to 24.45% in different blocks. The overall Stage of Groundwater development of the district is 13.88%. There is ample scope for stepping up ground water development in the district. The ground water budget of the district is presented in Plate No. V.

Table 4.2 : Stage of Ground Water Development Of Nawarangpur District, Blockwise as on 31st March , 2009

Sl No	Block	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for Irrigation	Existing Gross Ground Water Draft for domestic & Industrial Supply	Existing Gross Ground Water Draft for all uses	Provision for domestic & industrial requirement supply for next 25 years	Net Ground Water Availability for future irrigation development	Stage of Ground Water Development
		(ham)	(ham)	(ham)	(ham)	(ham)	(ham)	(%)
1	2	3	4	5	6	7	8	9
1	Chandahandi	9031.00	569.00	181.00	750.00	402.00	8133.00	8.30
2	Dabugaon	2928.00	227.00	226.00	453.00	521.00	2180.00	15.47
3	Jharigaon	6097.00	414.00	354.00	768.00	818.00	4865.00	12.60
4	Kasagumuda	4790.00	787.00	384.00	1171.00	890.00	3113.00	24.45
5	Nabarangapur	2246.00	306.00	195.00	501.00	432.00	1508.00	22.31
6	Nandahandi	2732.00	170.00	156.00	326.00	346.00	2216.00	11.93
7	Papdahandi	4500.00	329.00	321.00	650.00	736.00	3435.00	14.44
8	Raighar	6908.00	615.00	451.00	1066.00	1034.00	5259.00	15.43
9	Tentulikhunti	2555.00	301.00	216.00	517.00	474.00	1780.00	20.23
10	Umerkote	8519.00	332.00	448.21	780.00	977.00	7210.00	9.16
	District Total	**50306.00**	**4050.00**	**2932.21**	**6982.00**	**6630.00**	**39699.00**	**13.88**

Ground Water Quality

The chemical quality of ground water in the district has been assessed on the basis of ground water samples collected during ground water monitoring, hydrogeological surveys and ground water exploration. The range of different chemical constituents in shallow and deeper aquifers is as follows

The specific conductance and chloride values generated from the chemical analysis of the region are found to be within normal range throughout the district. However In localized patches at Jharigaon and Chandahandi the concentration of Nitrate and Fluoride is found to be 111mg/l and 2.1 mg/l respectively which are higher than the permissible limit. Otherwise the chemical analysis data suggests that the quality of ground water both from shallow and deeper aquifers are well within the permissible limit of utilisation for drinking purposes.

It may be noted that about 100% of the groundwater samples collected from the phreatic and deeper aquifers are good for irrigation purposes.

4.4 Status of Ground Water Development

Ground water development in the district is mainly through dug wells, Dug-cum-bore wells and bore wells. Ground water is mainly used for domestic and irrigation purpose and in limited scale for industrial purposes. The stage of development of Ground Water in the district is low. So far only 13.88% of its resources have been exploited. Hence a strategy for detailed ground water development is required. The hydrogeological, remote sensing studies and ground water exploration so far carried out in the district depict the tentative possibilities of ground water development through suitable ground water abstraction structures in various hydrogeological settings (Plate –VI).

Dugwells : The wells may be sited in the topographic lows and should tap the maximum saturated thickness of the weathered zone. The depth of the dugwells may vary from 9 to 12m with 4.5m to 6m diameter. The wells may be fitted with 1.5 to 2 H.P. centrifugal pumps. The wells may sustain yield maximum up to 3 lps.

Dug-cum-borewells : Dug-cum-borewells may drilled down to a depth of 25 to 30m below ground level, tapping the saturated shallow fracture below the regolith and in top portion of the hard basement. The wells should be fitted with 2 H.P. centrifugal / submersible pumps may sustain yield up to 3 lps.

Borewells : Borewells may tap the deeper saturated fractures found to occur in the depth range of 100 to 120m. The borewells should be 100 to 150mm. diameter and may be flitted with submersible pumps of 2 to 2.5 H.P Capacities. The wells drilled in the vicinity of NNW-SSE and NE-SW trending lineaments are likely to be successful which has been established based on exploratory drilling by CGWB in the Western and Southern tracts of the district. The suitable sites for drilling may be selected in the district with the aid of Remote Sensing studies, Surface Geological, hydrogeological and Geophysical surveys.

Since the surface water resources are inadequate and the district often comes under the grip of drought, development of ground water resources may help in expanding irrigated agriculture in the district. An optimal utilisation of ground water in the district requires adoption of a suitable cropping pattern and energisation of the wells. The block wise ground water structures feasible as per Study Group Report (March, 2004) has been given in Table below.

Assesment Unit/ District	No. of additional GW structures feasible for irrigation use			
	MDTW	SDTW	FPTW	DW
Nawarangpur	0	20	48	25390

5.0 Ground Water Management Strategy

5.1 Ground Water Development

The Ground Water Development of the entire Nawarangpur is depicted in Plate VI. Depending on the hydrogeological condition of the area the development possibilities has been predicted.

Water Conservation & Artificial Recharge

Nawarangpur district is mostly traversed by Precambrian consolidated formations. The deeper water level of the order of 5-10 mbgl is observed near Papadahandi, Nawarangpur and Chandahandi block. The Papadahandi blocks mostly shows deeper water condition during pre monsoon and post monsoon periods due to rapid recessation of ground water level. The data of water level of 10 years shows fall in the Papadahadi and Umarkote blocks during Post monsoon period. This is mainly due to prevailing topographic conditions and water table gradient, which facilitates flow of ground water through nalas and rivers and streams as base flows. To arrest the rapid decline of water table in these areas special studies may be taken up to pin point the areas where water scarcity problems are more pronounced during post monsoon and premonsoon period. In these pockets suitable sites are required to be pin pointed to adopt artificial recharge techniques and rain water harvesting methods based on site specific conditions. This artificial recharge will also help in increase in storage and also in improving the quality of water etc. The most feasible artificial recharge and rain water harvesting structures are percolation tanks, nala/contour bunding, small check dams/weirs, renovation of old tanks to percolation tanks, subsurface dykes, water spreading, gully plugging, gabion structures etc.

6.0 Ground Water related issues & Problems

Ground Water Problems: The ground water problems include Ground Water Pollution and Ground Water Depletion.

Ground Water Pollution: Based on the chemical analyses of water samples collected from different aquifers, it is observed that almost all chemical constituents are well with in the permissible limit for drinking as well as irrigational purposes. However, in the localized patches of Jharigaon and Chandahandi blocks the concentration of Nitrate and Fluoride is found to be 111mg/l and 2.1 mg/l respectively which are higher than the permissible limit

Ground Water Depletion: The stage of ground water development in different blocks varies from 6.91 % (Chandahandi) to 16.68 % (Kosagumunda) with the overall stage of development 11.17% in the district. From the perusal of 10 years of data it has been realized that there is a falling trend in 46.4% of water level measuring wells within the range of 0-2 m during pre monsoon and 13.5% of wells shows fall during post monsoon within range of 0-2 m. Chandahandi, Papadahandi and Nawarangpur blocks show major fall during premonsoon period. Umarkote and Papadahandi blocks shows major fall during postmonsoon.

7.0 Awareness & Training Activity

Mass Awareness Programme (MAP) & Water Management Training Programme (WMTP) by CGWB

Nawarangpur town, Nawarangpur Blocks, Nawarangpur District

The Mass Awareness programme on "Groundwater Development, Protection & Conservation" as well as the Training Programme on the Watershed Management were organized on 17th February 2006 and 18th February, 2006 on aegis of CGWA at the Mission Shakti Conference Hall (DRDA) in Nabarangpur Town, Nabarangpur District, Orissa. The main aim of the programme was to make the State Government machinery and the general public aware of the ground water situation in the district and its importance on conservation and protection from pollution hazards.

Sri Bhaskar Sarma, IAS, Collector & District Magistrate, Nabarangpur inaugurated the function as the chief guest. Speaking on the occasion, the chief guest Sri. Sarma stressed on the need for conservation and recharge to ground water. Deliberations on ground water development protection and conservation were held among the participants and CGWB scientists.

The Mass Awareness Programme was attended by a large number of people from various departments /organizations like State Govt. Officers, Zilla Parisad Members, District level Officials, NGOs, VOs, leading farmers etc. About 120 persons attended the programme. The public actively participated in the programme and interacted with the scientists on various issues of ground water conservation and management in Nabarangpur District.

The exhibition was arranged in which the achievements of CGWB were displayed through different models, plates, photographs and instruments. Different posters were displayed for conservation of ground water, ground water pollution and its effects and slogans protecting this valuable resource. The programme have received high appreciation and were widely covered by press as well as electronic media.

8.0 Areas Notified by CGWA

The stage of Groundwater development is well within Safe Category and there is no overexploitation and major threat of Groundwater pollution and depletion. Hence no area has been notified by CGWA.

9.0 Recommendations

1. Large scale planning for Ground Water Resources development should be preceded by intensive hydrogeological and geophysical survey aided by Remote Sensing studies and ground truth data.

2. Bore wells/dug wells should be located in the vicinity of NNW-SSE and NE-SW trending lineaments which have been proved to be high yielding & productive and in thickly buried pediment areas.

3. Existing dug wells should be deepened to tap the maximum saturated thickness of the weathered mantle or vertical bores maybe drilled to enhance the yield of the well where normally the dug wells get dried up.

4. Energisation of wells should be stepped up to ensure optimal utilisation of the ground water resources to create additional irrigation potential.

5. The State Ground Water Organization should render expert guidance for sitting ground water structures in favourable hydrogeological settings.

6. The farmers should be educated through agricultural extension services, Mass Awareness and water management training programme to adopt suitable cropping pattern, conservation of ground water and irrigation practices especially for drought tolerant crops for optimal utilisation of available ground water resources.

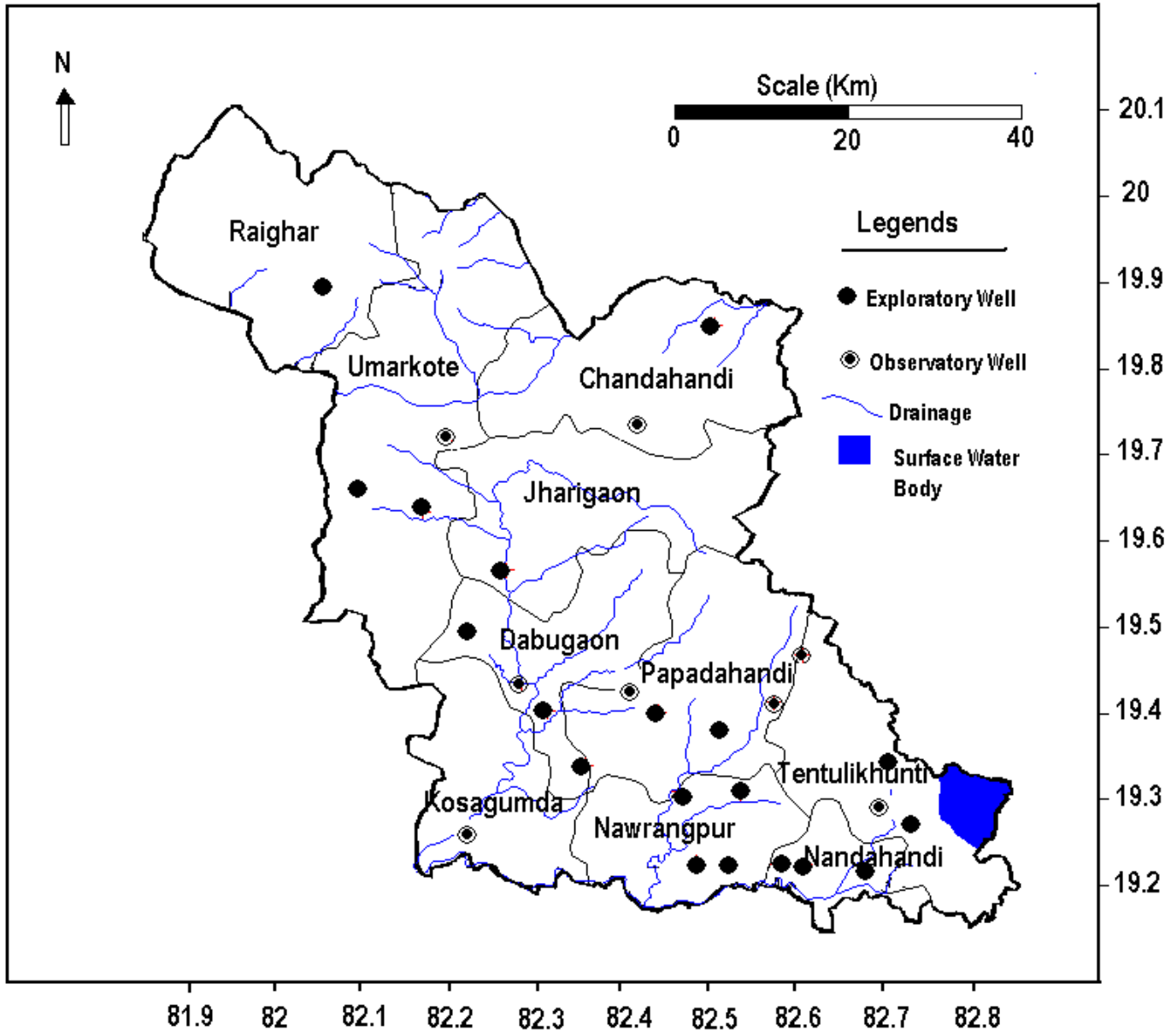
7.Programme for artificial recharge may also be taken up in areas where deeper water table condition coupled with high fluctuation is observed for augmentation of ground water resources through construction of percolation tanks, subsurface dykes, check dams, nala bunding and contour bunding and other site specific favourable artificial recharge structures.

8. In areas of shallow water table lying with in 0 to 5 m bgl during post monsoon period, surface water bodies like local ponds, farm ponds and small earthen dam along small streams may be constructed to hold water for long duration and for replenishment of soil moisture.

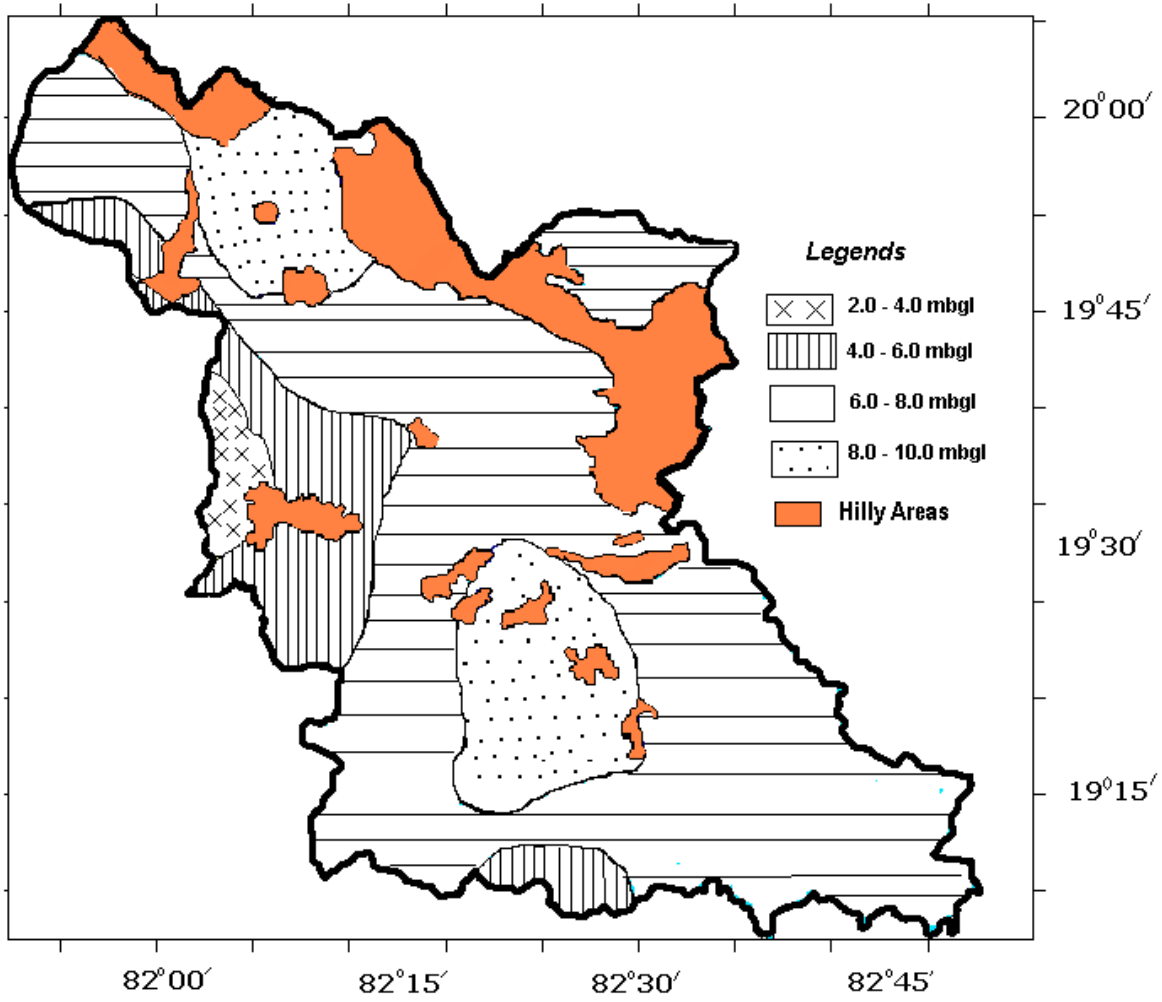
9. For augmentation of drinking water supply to the major towns and villages near the major rivers, infiltration galleries or collector wells may be constructed in suitable locales to fruitfully harness the base flow /subsurface flow which otherwise goes as waste.

10. Growth of sugarcane and cash crops may be encouraged along the thin linear alluvial patches lying adjacent to major rivers where prolific ground water is available throughout the year.

INDEX MAP OF NOWRANGPUR DISTRICT, ORISSA



DEPTH TO WATER LEVEL MAP OF PRE-MONSOON (APRIL, 2011)



DEPTH TO WATER LEVEL MAP OF POST MONSOON (NOV, 2011)

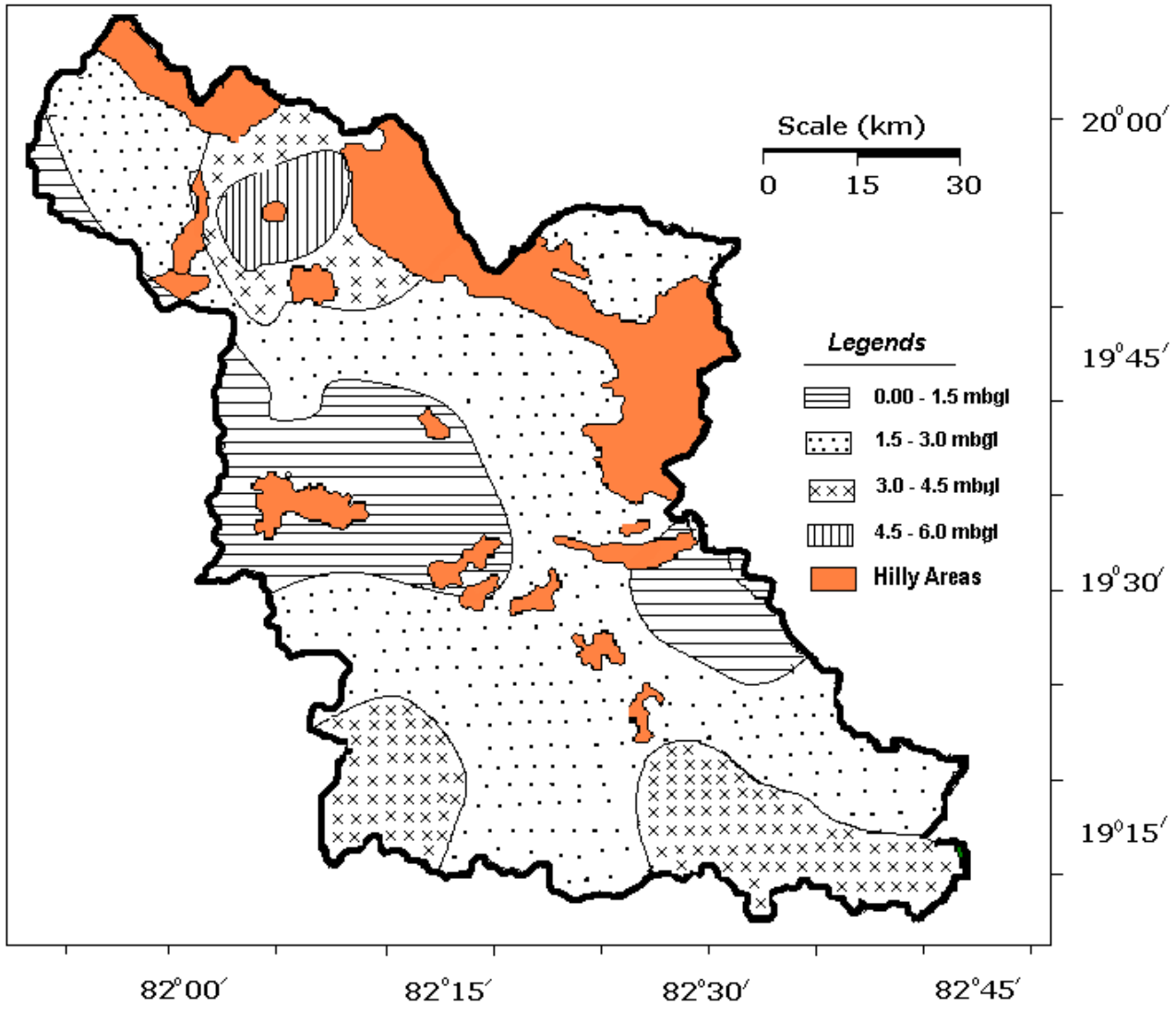
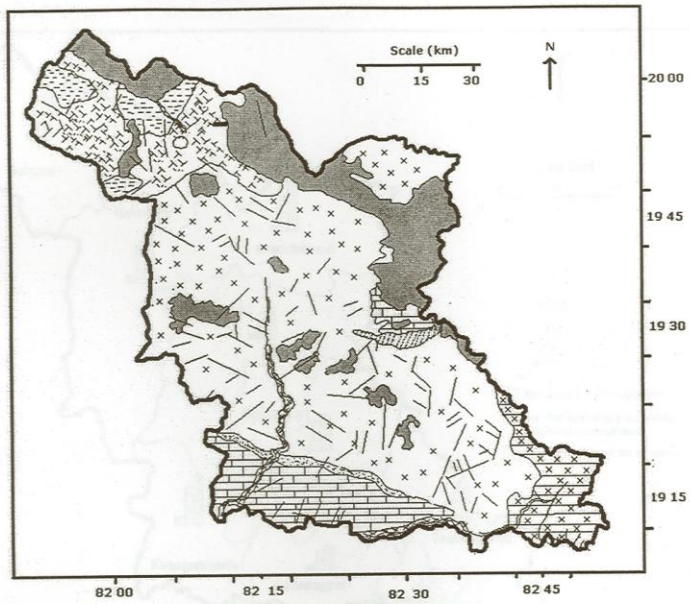


Plate IV

HYDROGEOLOGICAL MAP OF NAWARANGPUR DISTRICT, ORISSA



LEGENDS

Age Group		Lithology	Ground water Potential
Unconsolidated Formation	Recent	Alluvium	Inland River Valleys maximum thickness 20 m. Unconfined to semi confined conditions, yield <15 lps
	Recent to Sub Recent	Laterites	Ground water restricted to porous zone (Down to 15 m deep) Unconfined condition, yield <8lps
Semi Consolidated Formation		Basic Dyke	Ground water occurs in weathered residuum and circulates through fractures and fissures below unconfined to semiconfined conditions. Yield <3 lps. From weathered zone and<5lps from Fractures and fissures.
		Quartz Reef	
Consolidated Formation	Precambrian	Shale, Sandstone Quartzite Bengpal Group Consisting Amphibole, Quartzites, Banded Magnetite Jaspar	
	Archean	Mica Schist Charnokite Khondalite Hornblende Granite Granite & Granite Gneiss	Ground water occures in weathered residuum and circulates through fractures and fissures bekow unconfined to semi confined conditions yield <5 lps from weathered mantle and <10 lps from fractures and fissures.
			Hilly area without productive aquifers except in pockets. yield <1lps.

NOWARANGPUR DISTRICT

Dynami Ground Water Resources
(As on 31.03.2009)

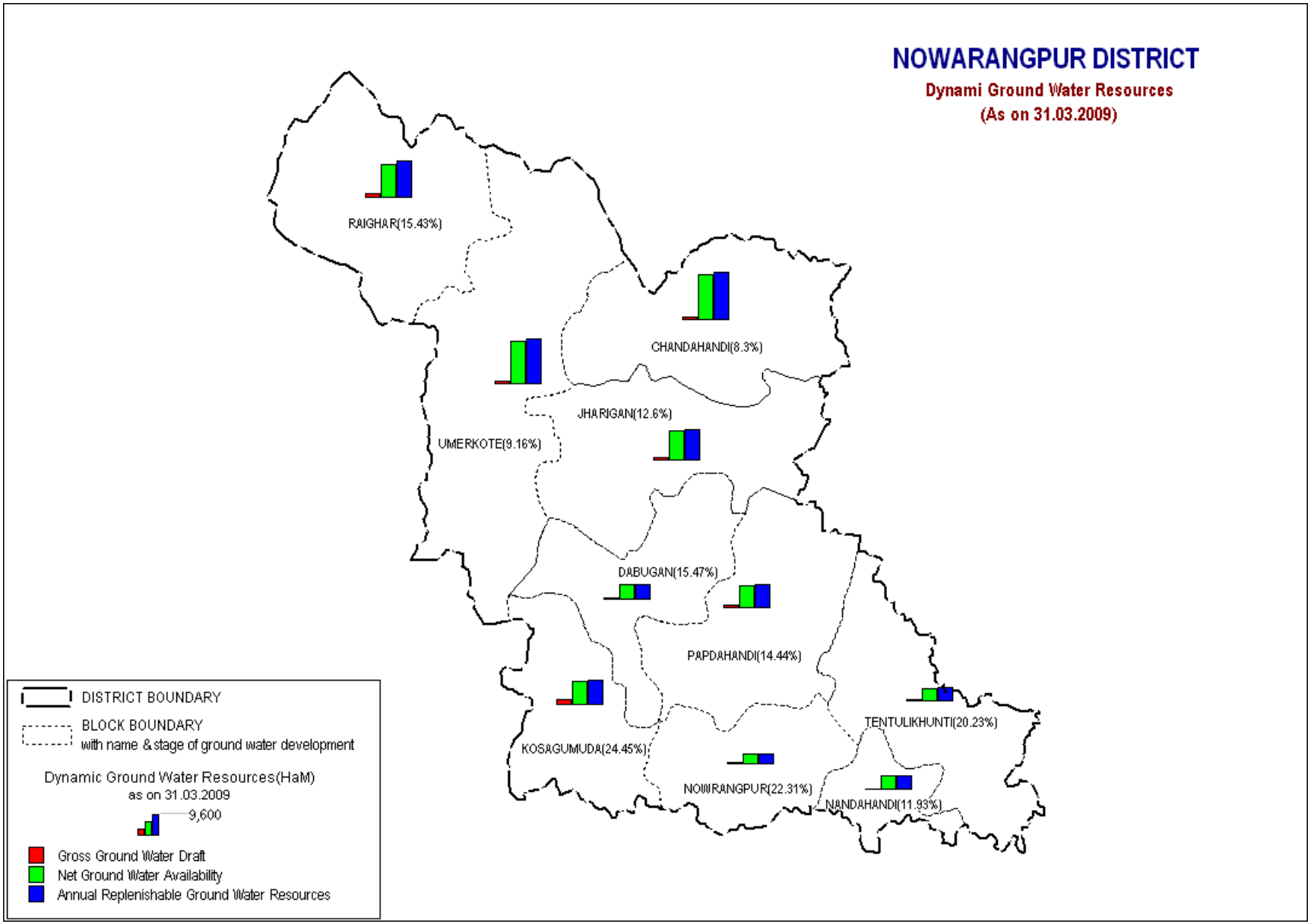
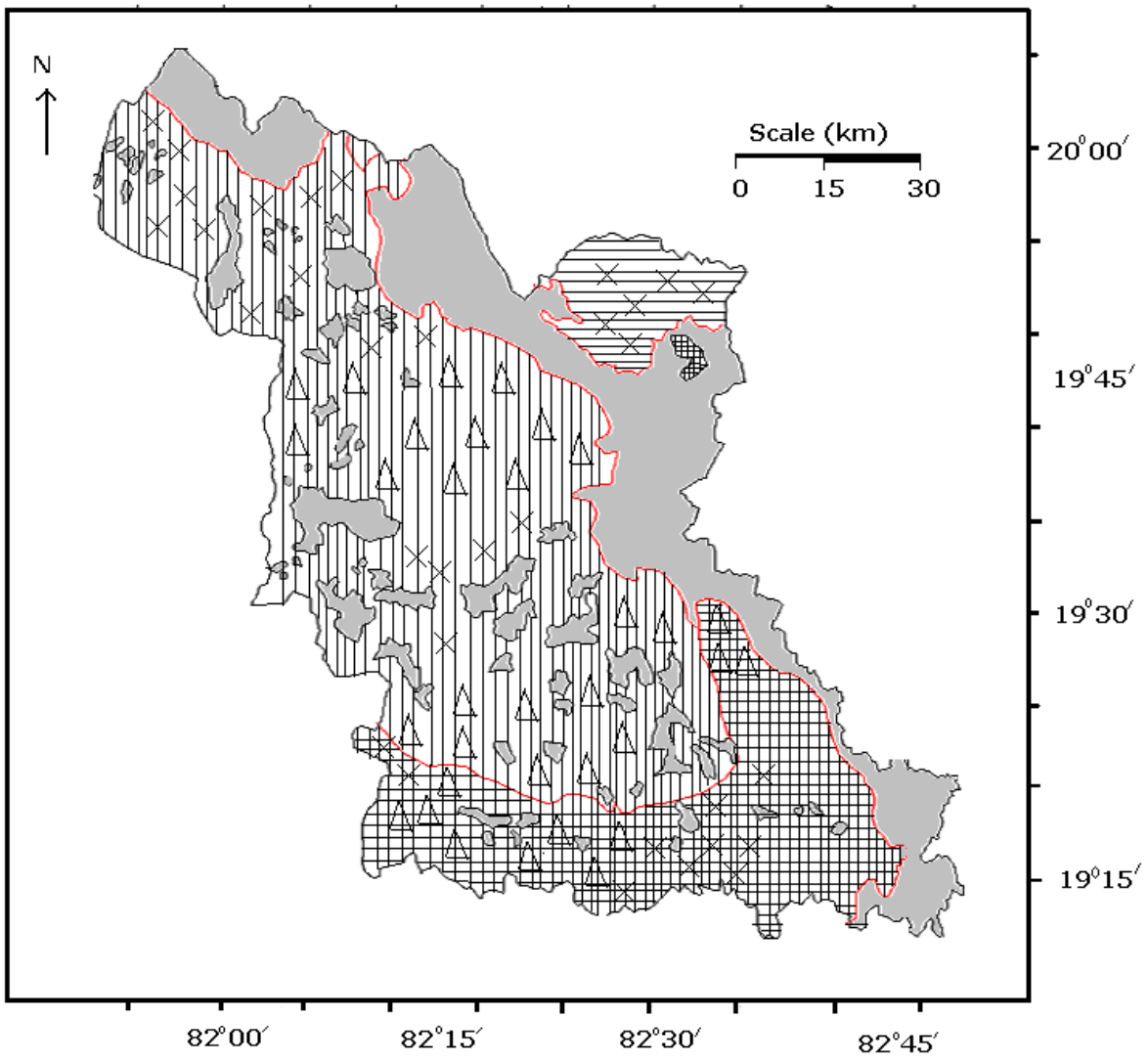


Plate- VI

GROUND WATER DEVELOPMENT POSSIBILITES MAP OF NAWARANGPUR DISTRICT, ORISSA



INDEX

10 - 12m deep, 4-5m dia, centrifugal pump, 2-3 H.P. yield less than 5lps. Dug cum borewell, Dugwell upto 12 m deep, vertical borewell upto 25 - 30 m deep below ground level, centrifugal/submersible pump 2-3 H.P. yield <7lps

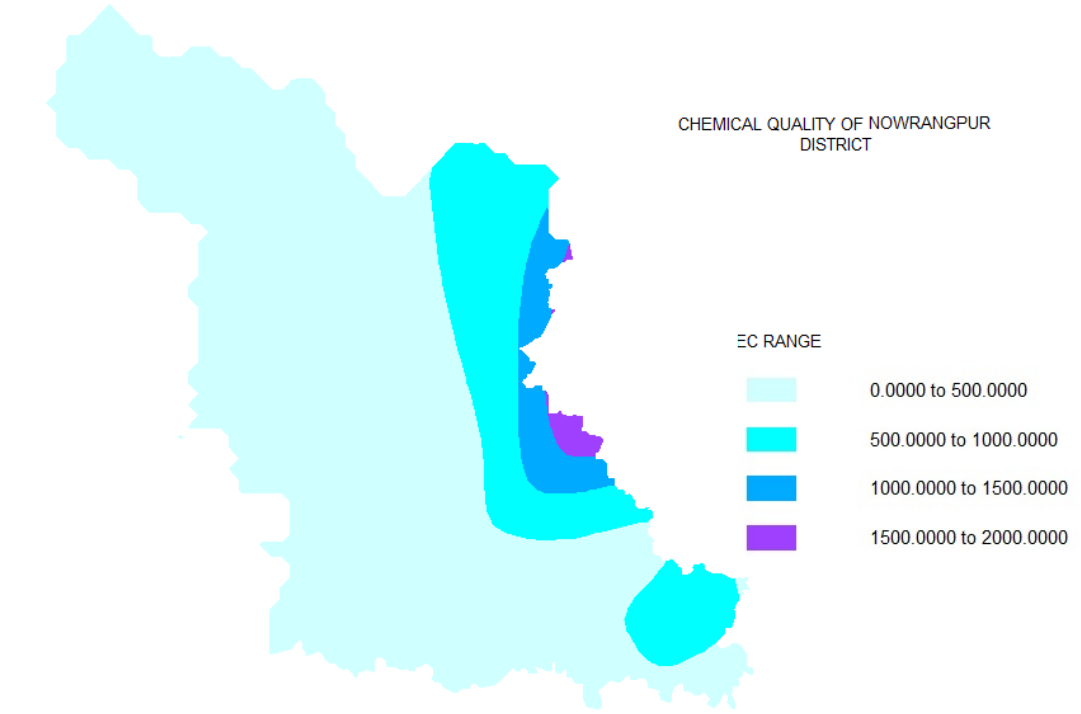
12-15m deep, 4-5 m dia centrifugal/submersible pump, 2-3 H.P. yield less than 5 l[s. Dug cum borewell,dug well upto 15m deep, vertical bore well upto 25 - 30 m deep, centrifugal/submersuble pump, 2-3 H.P, yield <7 lps

15 - 18 m deep, 4-5 m dia centrifugal/submersible pump, 2-3 H.P. yield less than 5 l[s. Dug cum borewell,dug well upto 18m deep, vertical bore well upto 25 - 30 m deep, centrifugal/submersuble pump, 2-3 H.P, yield <7 lps

100 - 150 m deep, 15 cm dia, submersible pump, 2-3 H.P.yield 5-10 lps

100 - 150 m deep, 15 cm dia, submersible pump, 2-3 H.P.yield <5 lps

10 -15 m deep, 4-5 cm dia. small dia borewell 60 m deep, feasible at pockets in the intermontane valley.


CHEMICAL QUALITY OF NOWRANGPUR DISTRICT
EC RANGE
0.0000 to 500.0000
500.0000 to 1000.0000
1000.0000 to 1500.0000
1500.0000 to 2000.0000