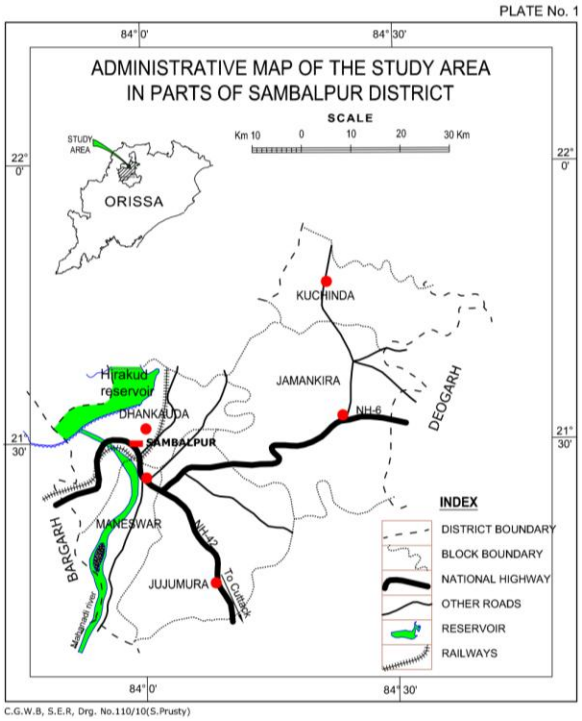
GROUND WATER INFORMATION BOOKLET

SAMBALPUR DISTRICT



Central Ground Water Board

South Eastern Region

Bhubaneswar

GROUND WATER BROCHURE OF SAMBALPUR DISTRICT, ORISSA

CONTENTS

SAMBALPUR DISTRICT GROUND WATER BROCHURE

DISTRICT AT A GLANCE

S. No.	Items		Statistics
1	**GENERAL INFORMATION**		
	i) Geographical area		6657 Km^2
	ii) Administrative division (year 2011)		Sambalpur
	Number of Sub divisions		3
	Number of Tehsils		4
	Number of Blocks		9
	Number of Revenue Circles		40
	Number of Gram Panchayats		148
	Number of Villages		1320
	iii) Population as per 2011 census		1,044,410
	Male		5,29, 424
	Female		5,14, 986
	iv) Average annual rainfall mms		1088
	Number of Rainy days		66
2	**GEOMORPHOLOHY** Major physiographic units	Following are major physiographic features in Sambalpur district; i) Northern hilly terrain of Bamra and Kuchinda ii) South eastern plateau and ridges of Rairakhol. iii) South eastern valley and plains of Sambalpur Sub-division.	
	Major drainage	Mostly drained by Mahanadi (with Harihar Jore, Surbali Jore, Karandi Jore and Jhul Jore as tributaries), ib (along with Bhedan as tributaries) and Bramhani (with Tikara as tributary) Hirakund reservoir occupies about 250 Km^2 of area in Sambalpur	
3	**LANDUSE**	Pattern	Area in Km^2
		Forest	1301.49
		Net Sown	1427.87
		Cultivable	217.54
4	**MAJOR SOIL TYPE**	Red sandy and red loamy soils	
5	**AREAS UNDER PRINCIPAL CROPS** (As per latest available data)	Crop	Area in Km^2
		Paddy	1600.18
		Ragi	0.06
		Oil seeds	29.22
		Vegetables	3.22
		Gram	302.86
		Wheat	2.68
		Sugarcane	0.48

		Maize	1.14	
6	**IRRIGATION BY DIFFERENT SOURCES**	Source	Area in Km^2	
		Major Project	545.1	
		Minor Project	197.6	
		Lift irrigation	102.4	
		Gross Ground water	122.8	
7	**NUMBER OF GROUND WATER MONITORING WELLS OF CGWB** (As on 31.3.2011)	Number of dugwells and piezometers	44 2	
8	**PREDOMINANT GEOLOGICAL FORMATIONS**	Granite gneiss, granites, quatrzites (Iron ore series), sandstone and arneceous shales(Gondwana Super Group), laterites and alluvial cappings and patches of recent age.		
9	**HYDROGEOLOGY**	Major water bearing formations	Granite gneiss, granites, quartzites, sandstone and arenaceous shales, laterites and alluvium.	
		Premonsoon depth to water level during 2011	Minimum 0 -2 mbgl (Dhankauda block) & maximum up to 10 mbgl (Rairajkhol block)	
		Post monsoon depth to water level during 2011	Minimum 0 & maximum 5 mbgl	
		Long term water level trend in 10 years in meters/year (2001-2011)	No perceptible change.	
10	**GROUND WATER EXPLORATION BY CGWB** (As on 31.3.2011)	Number of well drilled	EW, OW, Pz & SH	90
			Total	90
		Depth range in meters	From 28 m. (Kuchanda EW) to 200m. (Rairakhol, Maneswar & Bamlei EWs)	
		Discharge in liters per second	0.2 to 12 lps	
		Storativity (S)	$0.4x\ 10^{-3}$ to $8.6 x\ 10^{-3}$	
		Transmissivity (M^2/day)	2 to 7	
11	**GROUND WATER QUALITY** (Presence of Chemical constituents more than permissible limits)	EC F As Fe	Higher only in patches. 3.4ppm Daincha 1.7ppm Jugipali Within permissible limits. Within permissible limits.	
12	**DYNAMIC GROUND WATER RESOURCES** (In 2009 in mcm)	Annual replishnable ground water resources	525.20	
		Net annlual ground water draft	81.06	

		Projected demand for dometic and industrial uses for next 25 years	30.83
		Stage of ground water developement	15.43
13	**AWARENESS AND TRAINING ACTIVITY**	Mass awareness programmes organized Dates Places No. of Participants	One programme was organised at Sambalpur. In March 2001-02 Sambalpur 250 (Approx.)
		Water management training Programme organized Dates Places No. of Participants	Nil. N.A N.A N.A
14	**EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING**	Projects completed by CGWB (No. & amount spent)	Nil.
		Projects under technical guidance of CGWB (Numbers)	Nil.
15	**GROUND WATER CONTROL REGULATION**	Nos. of over exploited blocks	Nil.
		Nos. of critical blkocks	Nil.
		Nos. of notified blocks	Nil.
16	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	Overall quality of ground water and its occurrence is satisfactory in the district with scope for further development of groundwater resources.	

1.0 Introduction

The present Sambalpur district has geographical area of 6657 square kilometers. Administratively district is divided in to 3 sub divisions (Sambalpur, Sadar, Kuchinda and Rairakhol), 9 community development blocks namely Bamra, Dhankauda, Jamankira, Jujumura, Kuchinda, Maneswar, Naktideul, Rairakhol and Rengali with 148 Gram Panchayats and 1247 villages in it (Plate I). Almost all part of district can be traversed by state highway and other major district, gram panchayat, village and forest roads during fair weather conditions. Density of population is 158 persons/Km^2. 73% of population is rulra and agriculture is the main occupation. Net sown area is 1427.87 Km^2. Forest covers 1301.49 Km^2 of area. Khariff and Rabi are the two main crop seasons. Paddy is the main crop for Kharif. About 33% of net sown area is irrigated during Kharif season, while only 16% is irrigated during Rabi season. Gross irrigation potential from ground water sources is 12280 hactares.

Areas of the Sambalpur district are previously covered by hydrogeological surveys and ground water exploration by drilling activities of Central Ground Water Board. About 90 numbers of exploratory wells up to 200 meters below ground levels are constructed under normal exploration programme and accelerated exploratory drilling to mitigate temporary drought conditions.

Besides, monitoring of ground water regime of the district is also regularly carried out through 44 numbers of dug wells and 2 piezometers, set up as National Hydrograph Network Stations (GW), four times in a year by the central Ground Water Board.

2.0 Rainfall and Climate

South west monsoon causes rains in the district commencing from end of June and ending by September with average annual rainfall of the order of 1088 mm. Relative humitidy varies form 75% (high during rainy season) to 25 – 30% (low in summer months). Mean wind velocity varies from 3.4 to 6.8 kilometers/ hour depending upon the seasons. Potential evapotranspiration is 4.41 cms. Minimum in cold January month and maximum of the order of 32.32 cms during hot summer May month. Sambalpur district experiences tropical monsoon climate with three distinct seasons during the year, namely, winter summer and rainy seasons. Winter commencing from last week of November till February with maximum temperature of 25°C and minimum temperature of 12°C. March to June is the summer season with mean maximum temperature of 40°C and mean minimum temperature of 27°C.

3.0 Geomorphology and soil types

Sambalpur district has three common geomorphological features comprising of denudational hills, pediments and pediplains and can be divided broadly in three units as; i0 Northern hilly terrain of Bamra and Kuchinda ii South eastern plateau and ridges of Rairiakhol and iii0 South eastern valley and plains of Sambalpur Sadar sub-division. Average elevation of major parts of the district ranges from 100-300 meters above mean sea level with isolated hill peaks having height up to 600 meters above mean sea level.

Most parts of the district are drained by Mahanadi (with Harihar Jore, Surbali Jore, Karandi Jore and Jhul jore as tributaries), Ib (along with Bhedan as tributaruies) and Bramhani (with Tikara and tributary). Famous Hirakund reservoir constructed by damming Mahanadi River occupies about 250 km2 of area in Sambalpur district. Other important riveletttes of the district are Maltijor, Harrad, Kulsara, and Phuljiharan.

Mainly two types of soils occur in Sambalpur district i.e.

(1) Ultisoils consisting of red, yellow and lateritic soils &

(2) Alfisoils predominantly include red gravelly, sandy, loamy, red earth mixed with black soils. The alfi soils cover about 60% of the area and are devoid of any lime concretions with pH ranging from 6.5-7.3. These are very fertile soils.

4.0 Ground Water Scenario

4.1 Hydrogeology

Sambalpur district can divide into two major hydrogeological units, viz; (1) Consolidated formations comprising of hard rocks of Precambrian age occupying 85% of the area and (2) Semi consolidated rocks of Gondwana Super Group occurring in pockets in northern and southern eastern parts. Consolidated formations include Granite Gneisses, Khondalites, Charnockites, Schistose rocks and Epidorites. Secondary porosity forms the conduits for movement of groundwater and also act reservoir of groundwater. Groundwater occurs under pheratic conditions in upper weathered residium of rock masses at shallower depths. At deeper levels in fractured and joined rocks it occurs under semi confined to confined conditions. The hydrogeological map of the district is decipted in plate II.

Ground water regime conditions of the district are monitored through 46 National hydrograph stations for quantity and quality during January, April, August and November months.

Depth to water levels during premonsoon period (April) range from 5 to 10 meters below ground levels in most parts of the districts. Whereas in limited western canal irrigated parts shallow depth to water levels of the order of 2 to 5 meters below ground levels are also observed. A deeper water level of the order of more than 10 mbgl is observed in the southwestern part of the district. (Plate III)

During the post monsoon period (November) most parts of the district have depth to water levels in the range of 2 to 5 meters below ground levels with shallow depth to water levels of the order of 0 to 2 meters below ground levels in the same period in some limited isolated pockets in western parts having canal irrigation network. (Plate IV)

Long term water levels trend over the last ten years from 2001 to 2011 do not show any perceptible significant changes, as deciphered by the ground water regime monitoring through hydrograph stations.

4,2 Ground Water Resources

District has annually replenishable ground water resources of 525.20 mcm. Out of this 30.83 mcm is committed for drinking and industrial needs for coming 25 years based on projected population. Present draft irrigation is estimated as 56.11 mcm. Overall stage of groundwater development in this district is about 10.34. The block wise Ground Water Resource Estimation (as per March, 2009) has been given below:

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	Bamra	4475.00	791.00	212.64	1003.00	275.00	3409.00	22.41
2	Dhankauda	7454.00	392.00	774.66	1167.00	993.00	6069.00	15.66
3	Jamankira	4803.00	639.00	213.80	852.00	293.00	3871.00	17.74
4	Jujumura	7319.00	792.00	201.52	993.00	260.00	6267.00	13.57
5	Kuchinda	5068.00	787.00	210.07	997.00	288.00	3993.00	19.67
6	Maneswar	7048.00	590.00	217.21	807.00	299.00	6159.00	11.45
7	Naktideol	6080.00	631.00	146.84	778.00	192.00	5256.00	12.80
8	Rairakhol	6128.00	554.00	163.78	717.00	216.00	5358.00	11.70
9	Rengali	4145.00	435.00	357.72	792.00	267.00	3443.00	19.11
	District Total	**52520.00**	**5611.00**	**2498.00**	**8106.00**	**3083.00**	**43825.00**	**15.43**

4.3 Ground water Quality

Overall ground water quality in Sambalpur district is good for drinking, industrial and irrigational uses. All the chemical constituents, particularly electrical conductivity, fluorides, arsenic and iron are within the permissible limits. There is no instance of presence of chemical constituents beyond permissible limits in observation wells of Sambalpur district excepting some isolated instance of occurrence of higher electrical conductivity value in patches and Fluoride value of 3.7 ppm at Daicha and 1.7 ppm at Jugipalli. pH in the range of 7 to 8.5 shows ground waters of phreatic aquifers are slightly alkaline.

4.4 Status of Ground Water Development

5.0 Ground water management strategy

Ground water development in the district is traditionally done through dug wells and tube wells mainly for drinking and irrigational needs. About 9267 plus irrigational dug wells are there in the district. Besides, RWS&S has constructed about 5379 plus hand pump fitted tube wells & 124 sanitary wells and 18 piped water schemes for drinking water supplies. Approximately 52456 additional energized dug wells located 100 meters apart to avoid interference are feasible in Sambalpur district to harness ground water potential in the district as per study group.

6.0 Ground water related issues and problems

Along western border areas of Sambalpur district canal irrigation network form Hirakund Multipurpose Project causes water logging problems. The isolated pockets suffering from water logging problems cover an area of about 60 km2 particularly in low lying areas of Dhankuada and Rengali blocks. Barring these instance water logging problem is not very pronounced in Sambalpur district. Similarly both premonsoon and postmonsoon period's water levels do not show any remarkable change or decline.

6.1 Water conservation and artificial recharge

Some decline in depth to water level conditions are observed particularly during premonsoon summer season in south western part of district in Rairakhol block where premonsoon depth to water levels reaches up to 10 meters below ground levels (Map3). In such areas rain water harvesting and suitable artificial recharge techniques like roof top rain water harvesting, recharge through well, constructions of percolation tanks needs to be adopted after site specific studies.

7. 0 Awareness and training activity

Central Ground Water Board orgainsed one Mass Awareness programme in Sambalpur district in the year 2001-2002 to propagate the awareness regarding ground water resources availability, usage, conservation, recharge and protection. A large number of local government officials drawn from various departments including non-government organisations and local dignitaries attended the programme.

8.0 Areas notified by CGWA/SGWA

There are no parts or areas as 'notified area' yet in any of the blocks of Sambalpur district by central Ground Water Authority / State Ground Water Authority.

9.0 Recommendations

1. As per favorable hydrogeological setup and large ground water resources available, there is lot of scope for further development.
2. Undulating rugged topographic terrains and shallower weathered zones of granitic rocks, pyroxene granulites and meta basics with good yield potential are suitable for extensive ground

water development through dug and dug cum bore wells as shown in the ground water development possibility map. (Refer map 6)

3. Fractured granitic rocks, Granulites and Meta volcanics with deeper aquifer zones have good yield potential. After proper site selection in these parts ground water development can be accelerated by constructing tube wells up to the 150 meters depths.

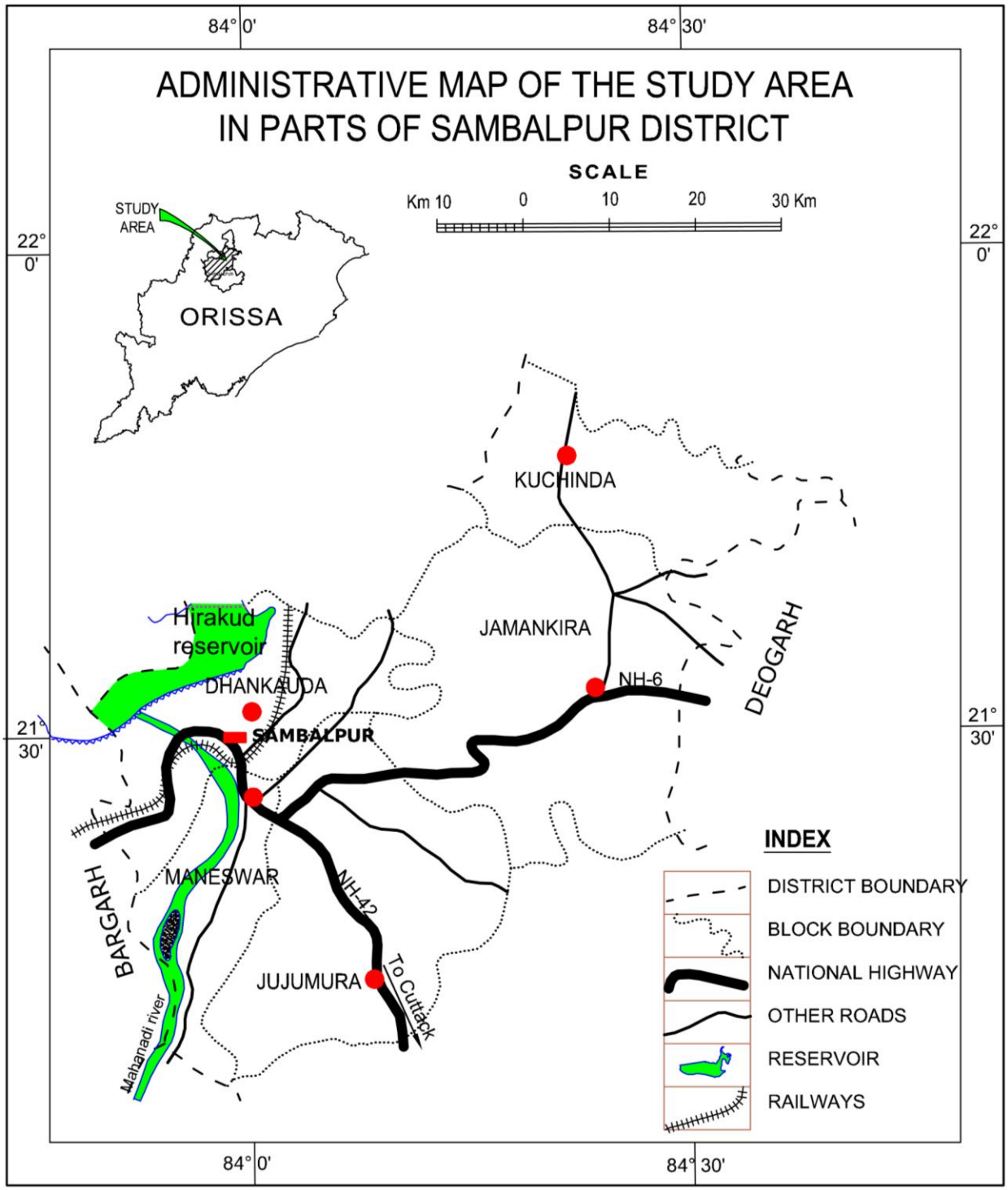
4. Parts of Dhankauda, Rengali and Maneshwar under Hirakhund canal command with shallower water table although out the year are recommended for conjunctive use of ground and surface water to bring more area under irrigation particularly during rabi season.

5. The gneisses and schistose rocks of Khodalites group and fractured quartzites generally have moderately good yielding deeper aquifers, which can be tapped by constructing tube wells of 100 meter depths careful selection of favourable sites.

6. Energisation of water extraction devices to ensure optimum utilization of ground water resources is necessary.

7. For augmentation of ground water resources in deeper water table areas artificial recharge techniques may be adopted through construction of check dams, nala/contour bunds, percolation tanks, subsurface dykes etc. at favourable sites.

PLATE No. 1

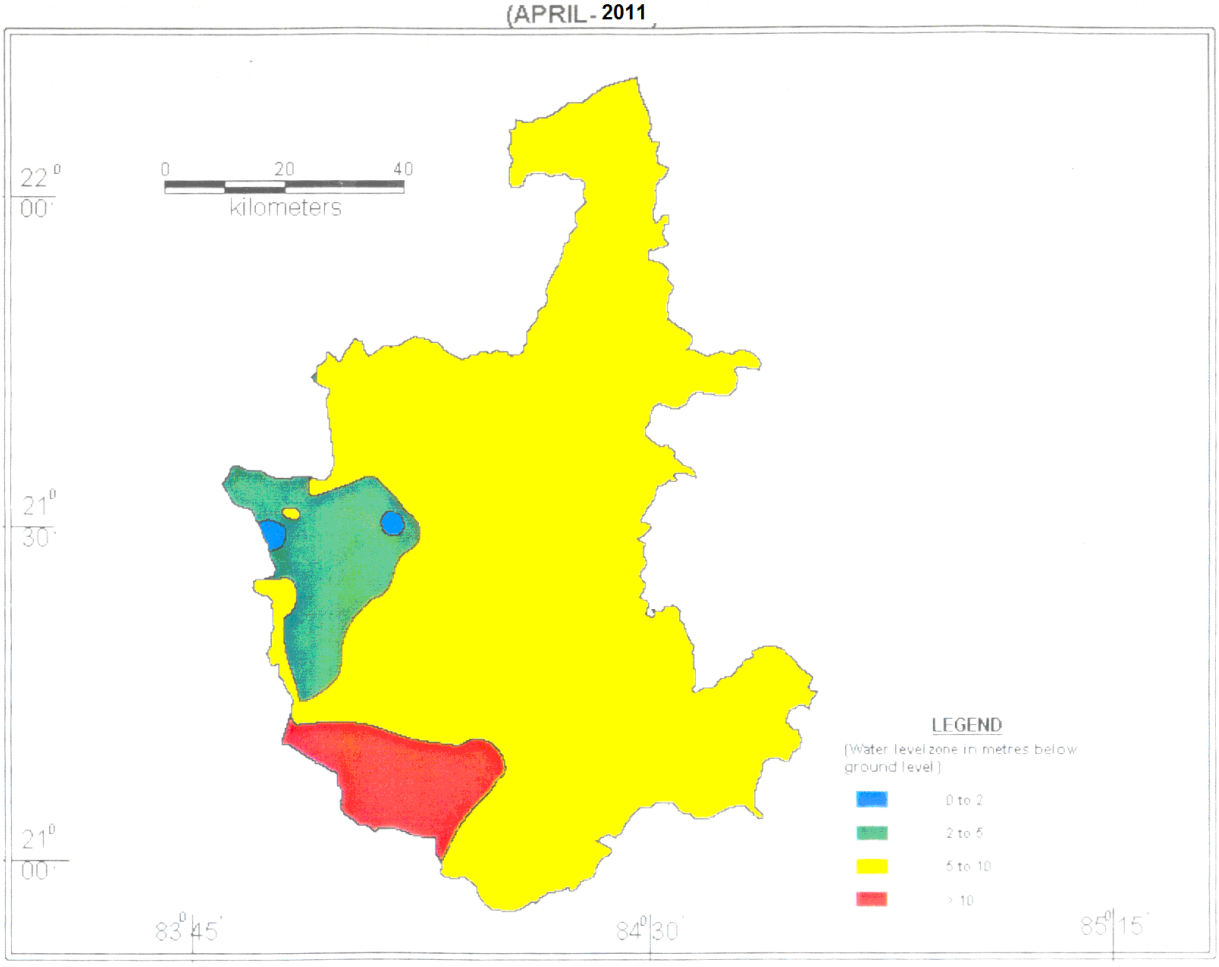


C.G.W.B, S.E.R, Drg. No.110/10(S.Prusty)

PRE-MONSOON DEPTH TO WATER LEVEL MAP OF SAMBALPUR DISTRICT, ORISSA

(APRIL- 2011)

Map :- 2



POST MONSOON DEPTH TO WATER LEVEL MAP OF SAMBALPUR, ORISSA
(NOVEMBER- **2011**

Map :- 3

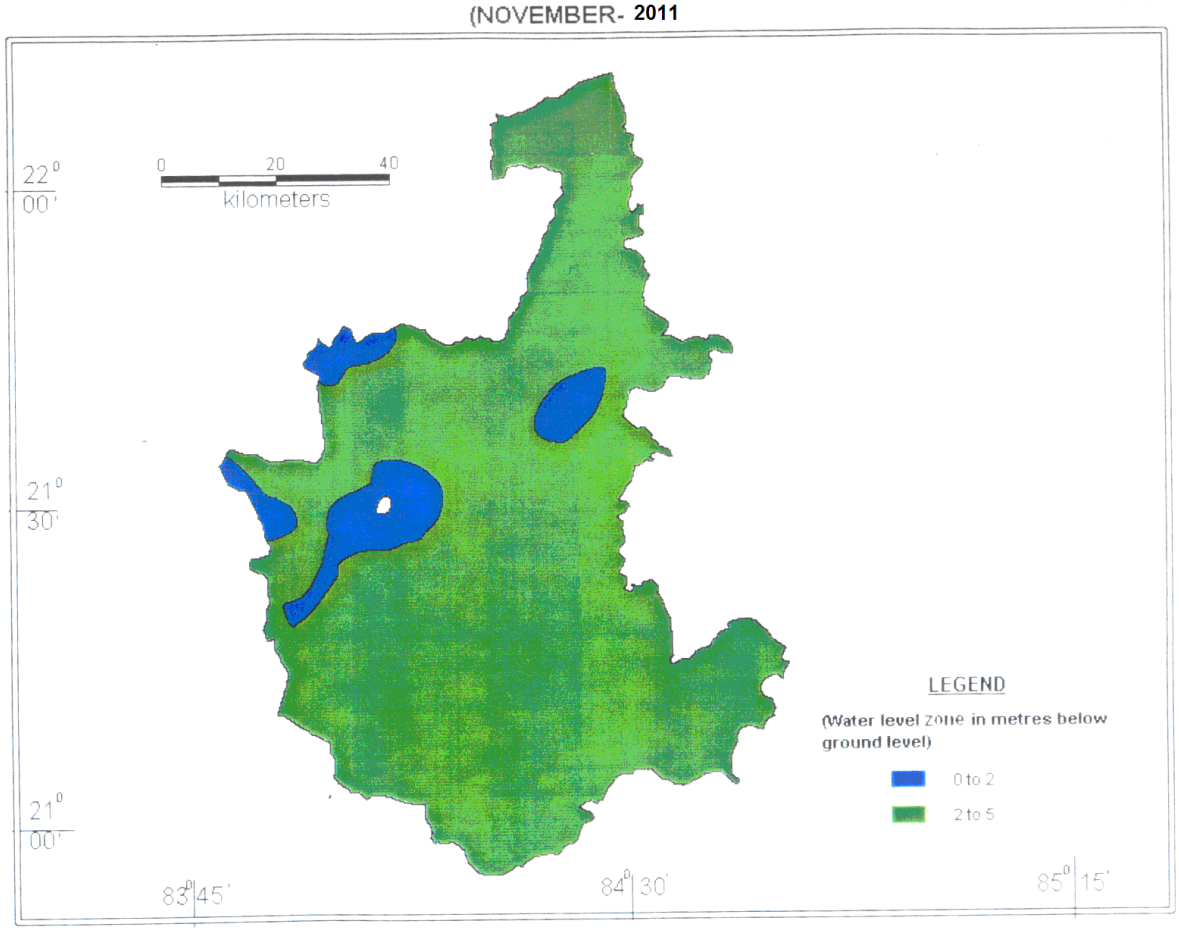
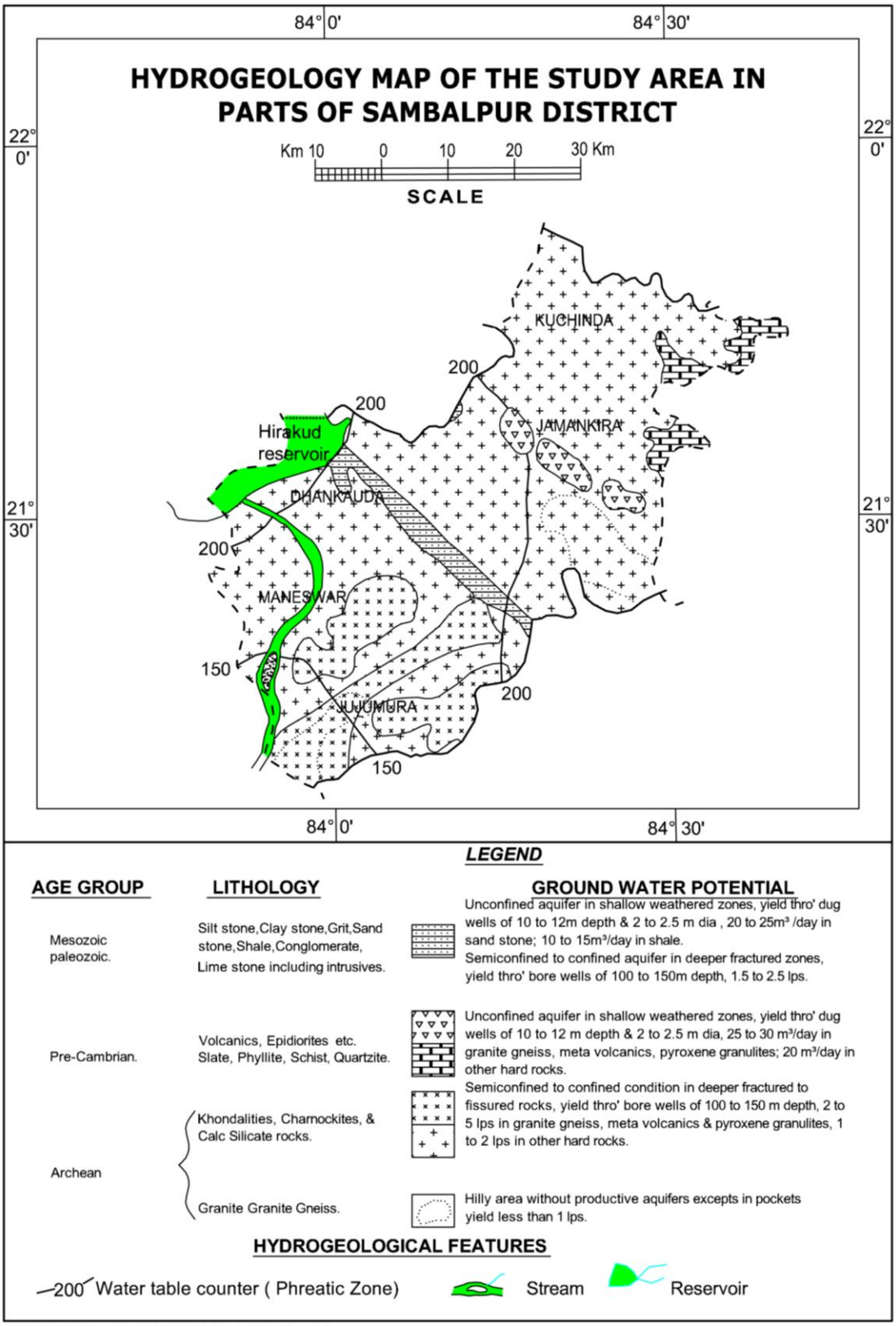


PLATE No. V



CGWB,SER,Drg.No.115/10 (R. Rout. & S. Prusty)

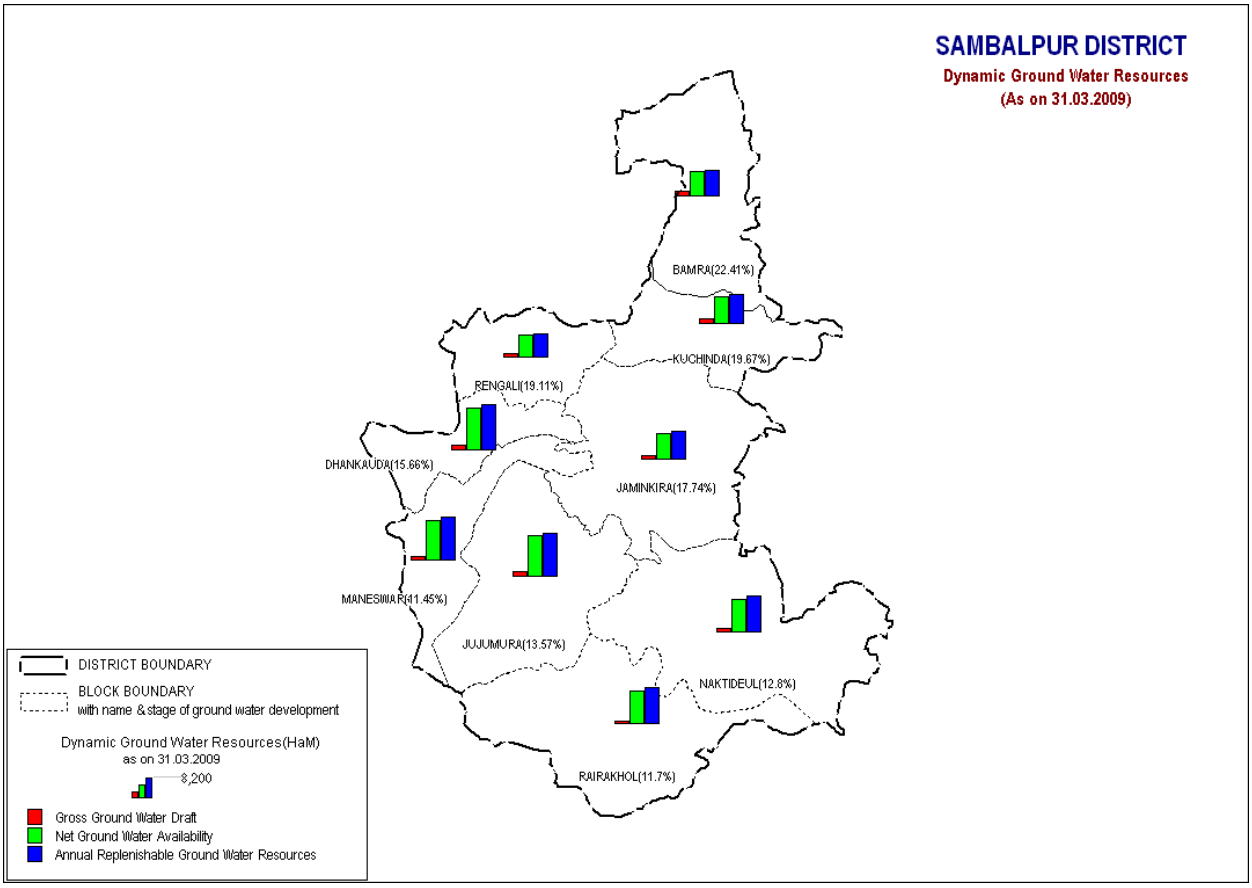

SAMBALPUR DISTRICT
Dynamic Ground Water Resources
(As on 31.03.2009)
BAMRA(22.41%)
KUCHINDA(19.67%)
RENGALI(19.11%)
DHANKAUDA(15.66%)
JAMANKIRA(17.74%)
MANESWAR(11.45%)
JUJUMURA(13.57%)
NAKTIDEUL(12.8%)
RAIRAKHOL(11.7%)
DISTRICT BOUNDARY
BLOCK BOUNDARY
with name & stage of ground water development
Dynamic Ground Water Resources(HaM)
as on 31.03.2009
8,200
Gross Ground Water Draft
Net Ground Water Availability
Annual Replenishable Ground Water Resources

PLATE No. IX

GROUND WATER DEVELOPMENT POSSSIBILITIES MAP OF THE STUDY AREA IN PARTS OF SAMBALPUR DISTRICT.

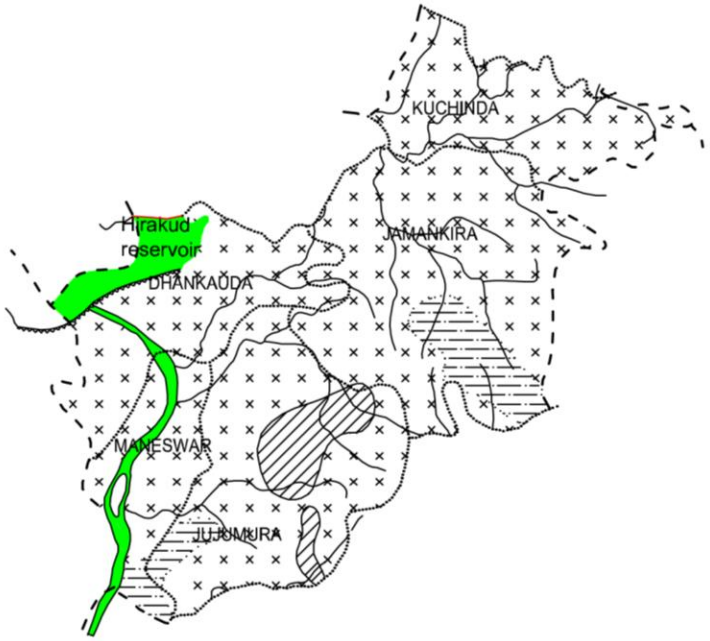
84° 0' 84° 30'

22° 0'

21° 0'

SCALE

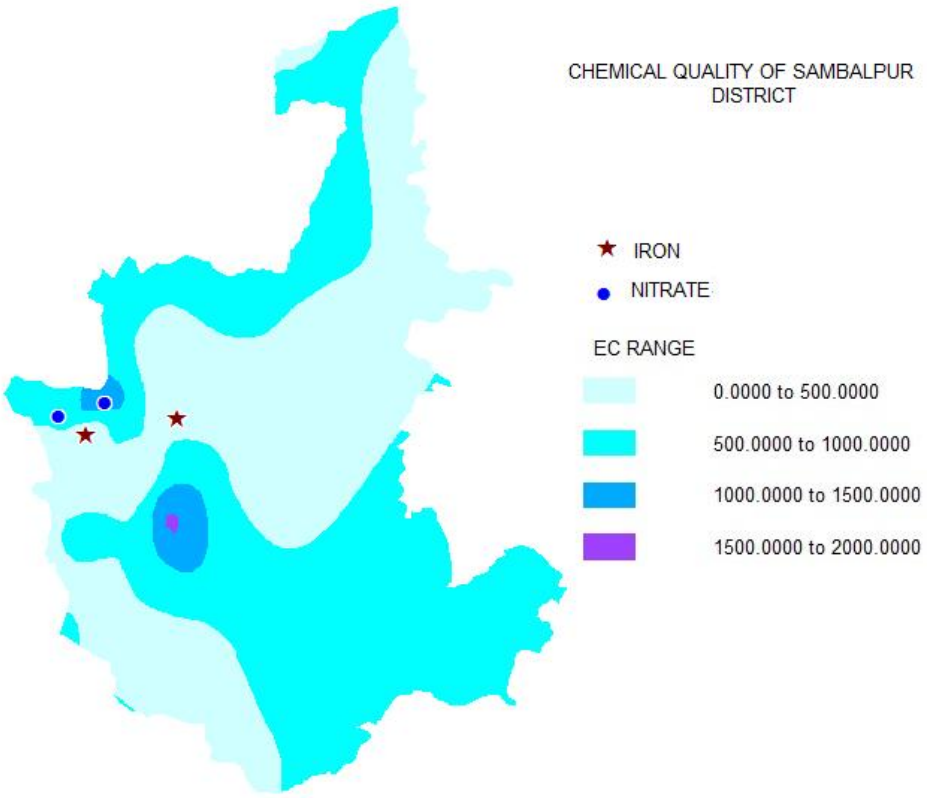
Km 10 0 10 20 30 Km.



LEGEND

STRUCTURE		DESIGN, PUMP SPECIFICATION YIELD
	Dug Well	9-12m deep ,4.5-6 m. dia, Centrifugal pump 2H.P yield 5 lps.
	Bore Well	100-150 m. deep ,15cm. dia, Submersible pump 2-3 H.P.yield 5-10 lps.
	Dug Well	10-15m deep,4.5-6 m. dia, Centrifugal / Submersible pump 2-3 H.P.yield 10 lps.
	Bore Well	100-150 m. deep ,15cm. dia, Submersible pump 2-3 H.P.yield 5-10 lps.
	Dug Well/Bore Well (Hilly Area)	Dug Well 10-15 m. deep ,4.5-6 m. dia, in pockets small Bore Well 60 m. deep, yield <1 lps.

C.G.W.B, S.E.R Drg. No.114/10 (R.Rout)


CHEMICAL QUALITY OF SAMBALPUR DISTRICT
IRON
NITRATE
EC RANGE
0.0000 to 500.0000
500.0000 to 1000.0000
1000.0000 to 1500.0000
1500.0000 to 2000.0000