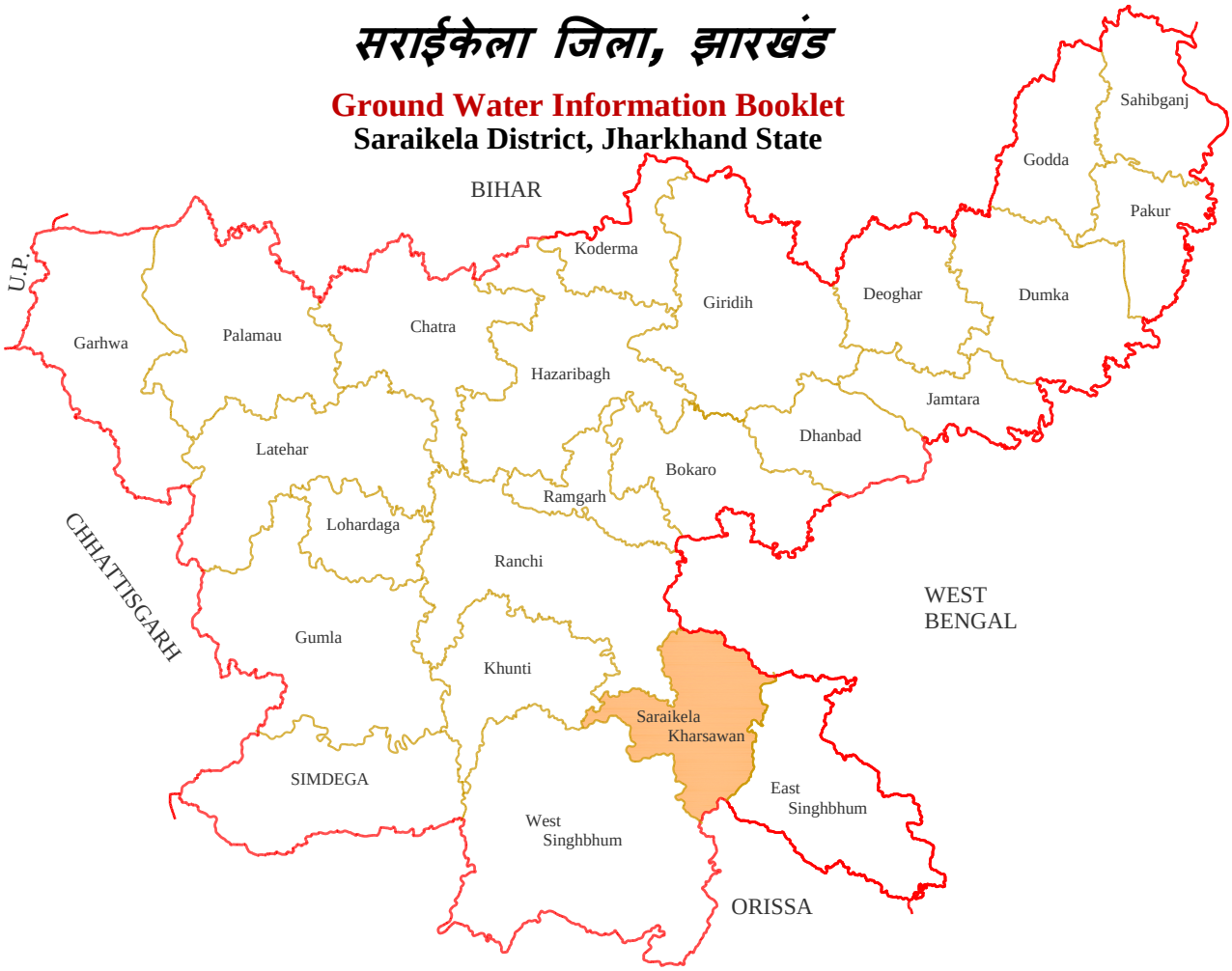
# भूजल सूचना पुस्तिका

## सराईकेला जिला, झारखंड

## Ground Water Information Booklet
## Saraikela District, Jharkhand State





केन्द्रीय भूमिजल बोर्ड
जल संसाधन मंत्रालय
**(भारत सरकार)**
**राज्य एकक कार्यालय, राँची**
**मध्य-पूर्वी क्षेत्र**
**पटना**

**Central Ground water Board**
**Ministry of Water Resources**
**(Govt. of India)**
**State Unit Office,Ranchi**
**Mid-Eastern Region**
**Patna**



सितंबर 2013
September 2013

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**Saraikela District, Jharkhand State**


Updated By

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(Scientist B)



**राज्य एकक कार्यालय, राँची**
**मध्य-पूर्वी क्षेत्र,पटना**

**State Unit Office, Ranchi**
**Mid Eastern Region, Patna**

# SARAIKELA DISTRICT AT A GLANCE

| Sl. No. | ITEMS | | Statistics | |
|---|---|---|---|---|
| 1. | GENERAL INFORMATION | | | |
| | i) | Geographical area (SqKm) | 2996 | |
| | Administrative Division (As on 2013) | | | |
| | i) | Number of Tehsil/ Block | 8 | |
| | ii) | Number of Panchayat/Villages | 172/1187 | |
| | iii) | Population (As on 2011 Census) | 10,65,056 | |
| | iv) | Average Annual Rainfall (mm) | 1351.6 | |
| 2. | GEOMORPHOLOGY | | | |
| | Major physiographic unit: | | Undulating topography marked by isolated hills and valleys | |
| | Major Drainages: | | Subarnrekha and Kharkhai Rivers | |
| 3. | LAND USE (Sq. Km) | | | |
| | a) | Forest area: | 607 | |
| | b) | Net area sown: | 798 | |
| | c) | Cultivable area: | 798 | |
| 4. | MAJOR SOIL TYPE | | Alfisols / Ultisols | |
| 5. | AREA UNDER PRINCIPAL CROPS | | | |
| 6. | IRRIGATION BY DIFFERENT SOURCES (Areas in ha and Number of Structures) ( MIP Census-2000-2001) | | Number of structures | Area (ha) |
| | Dugwell | | 17015 | 9364 |
| | Tubewell/Borewell | | 184 | 537 |
| | Tank/ponds | | 100 | 587 |
| | Canals | | 2 | 2 |
| | Other sources | | 69.50 | Bhaurna Bandh , Triveni Weir scheme and Dania weir scheme |
| | Net irrigated area | | | |
| | Gross irrigated area | | | |
| 7. | NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 31-3-2013) | | 07 | |
| | No of Dug wells | | 07 | |
| | No of Piezometers | | Nil | |
| 9. | HYDROGEOLOGY | | | |
| | Major Water bearing formation | | Chotanagpur Granite Gneiss, Gondwanas, Alluvium. | |
| | (Pre-monsoon Depth to water level during 2012) m bgl. | | 5.23-12.20 | |

| | | | | |
|---|---|---|---|---|
| | (Post-monsoon Depth to water level during 2012) m bgl. | 1.6-7.10 | | |
| | Long term water level trend in 10 yrs (2003-2012) in m/yr | --- | Rise | Fall |
| | | Pre Mon | 0.03-0.2 | 0.1-0.3 |
| | | Post Mon | 0.13-0.27 | 0.10-0.28 |
| 10. | GROUND WATER EXPLORATION BY CGWB (As on 31-07-2007) | | | |
| | No of wells drilled (EW, OW, PZ, SH, Total) | Nil | | |
| | Depth range (m) | - | | |
| | Storativity (S) | - | | |
| | Transmissivity ($m^2$/day) | - | | |
| 11. | GROUND WATER QUALITY | | | |
| | Presence of Chemical constituents more than permissible limit (e.g EC, F, As, Fe) | F and $NO_3$ | | |
| | Type of water | | | |
| 12. | DYNAMIC GROUND WATER RESOURCES(2009)- in mcm | | | |
| | Total Ground water availability | 188.59 mcm | | |
| | Net Annual Ground Water Draft | 22.10mcm | | |
| | Projected Demand for Domestic and industrial Uses up to 2025 | 17.30 mcm | | |
| | Stage of Ground Water Development | 11.71 % | | |
| 13. | AWARENESS AND TRAINING ACTIVITY | | | |
| | Mass Awareness Programmes organized | Nil | | |
| | Date: | | | |
| | Place: | | | |
| | No of participant : | | | |
| | Water Management Training Programmes organized | Nil | | |
| | Date | | | |
| | Place | | | |
| | No of participant | | | |
| 14. | EFFORT OF ARTIFICIAL RECHARGE & RAIN WATER HARVESTING | | | |
| | Project completed by CGWB(No & Amount spent) | | | |
| | Project under technical guidance of CGWB (Numbers) | | | |
| 15. | GROUND WATER CONTROL AND REGULATION | | | |
| | Number of OE Blocks | Nil | | |
| | Number of Critical Blocks | Nil | | |
| | Number of Blocks notified | Nil | | |
| 18 | MAJOR GROUND WATER PROBLEMS AND ISSUES | Fluoride and Nitrate above permissible limit in patches | | |

# SARAIKELA DISTRICT INFORMATION BOOKLET

## 1.0 INTRODUCTION

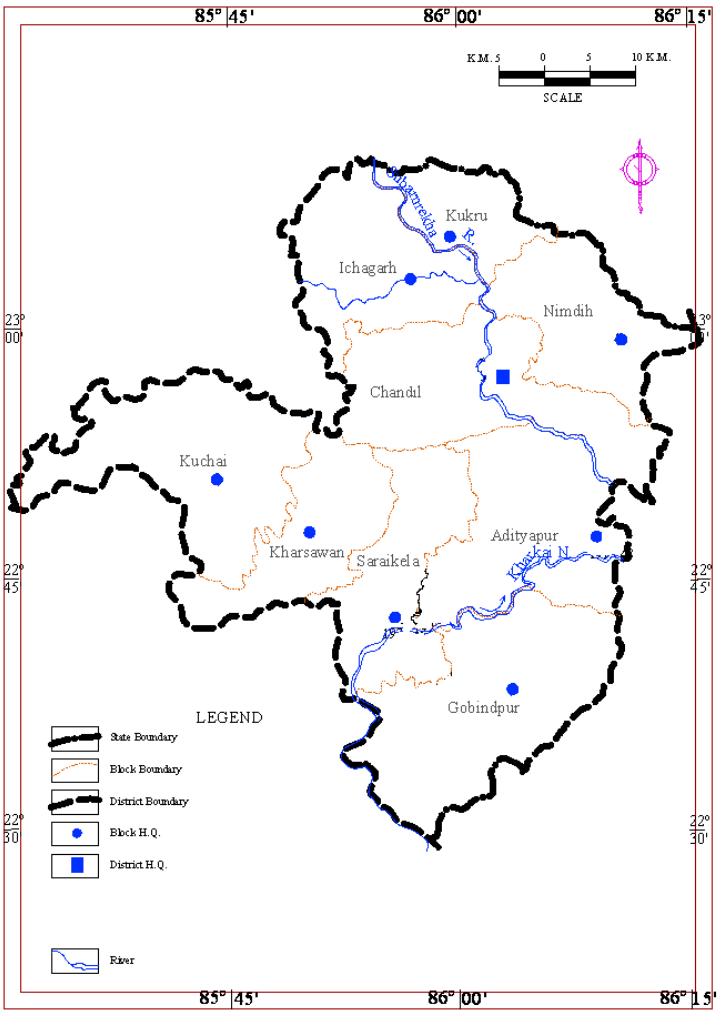
### 1.1 **Administrative Details**

Saraikela district spreading over an area of 2996 sq.km lies between North latitudes 24°43´30´´:25°20´30´´ and East longitudes 87°27´36´´:87°59´10´´ with it's district headquarter at Sraikela. The district is divided into 8 blocks namely i) Chandil ii) Gumhariya iii) Ichagarh iv) Khansowan v) Kuchai vi) Nindih vii) Rajnagar and viii) Saraikela. The district comprises of 172 numbers of panchayats and 2304 no. of villages. The total population of Saraikela district as per the 2011 census is 10, 65, 056 persons with urban population of 2,58,746 and the rural population of 8,06,310 persons.

The district is bounded in the north by West Bengal state, in the south by East and West Singhbhum districts, in the west by Khunti and Ranchi districts, in the east by East Singhbhum district.

**TABLE 1: POPULATION OF SARAIKELA DISTRICT (2011)**

| Sr. No. | Block | Total | Rural population | Urban population | Male | Female |
|---|---|---|---|---|---|---|
| 1 | Chandil | 157949 | 109854 | 48095 | 81000 | 76949 |
| 2 | Gumhariya | 309072 | 119055 | 190017 | 160931 | 148141 |
| 3 | Ichagarh | 83099 | 83099 | 0 | 42391 | 40708 |
| 4 | Khansowan | 88642 | 88642 | 0 | 45001 | 43641 |
| 5 | Kuchai | 64320 | 64320 | 0 | 32443 | 31877 |
| 6 | Nindih | 78639 | 78639 | 0 | 40327 | 38312 |
| 7 | Rajnagar | 136600 | 136600 | 0 | 67810 | 68790 |
| 8 | Saraikela | 93759 | 73125 | 20634 | 47439 | 46320 |
| | **Total** | **1065056** | **806310** | **258746** | **544411** | **520645** |




## 1.2 Drainage

The principal rivers of the district are Subarnrekha and Kharkhai Rivers. The general trend of the drainage is from NW-SE.and SW-SE. The structural features particularly the foliation and joints exert profound impact upon the drainage and control the drainage pattern of the district.

## 1.3 Studies/Activities carried out by CGWB

Central Ground Water Board has carried out hydrogeological surveys and ground water exploration in the district. Ground water regime monitoring is carried out 4 times annually from 7 HNS wells in the district. Water samples are collected during the month of May to study the changes in water quality along with monitoring of pre-monsoon water level

## 2.0 HYDROMETEROLOGY

The district falls in the rain shadow of the Santhal Pargana plateau. The average annual precipitation is 1307.6 mm and the average number of rainy days is 59. Even this meager precipitation is erratic which coupled with long interspell forces the district to suffer from drought.

## 3.0 GEOMORPHOLOGY AND SOIL TYPES

The predominant physical feature over major part of the district is the rolling topography dotted with isolated inselbergs except in the Borijore and Sundarpahari blocks. A substantial part of Borijore and Sundarpahari block is under forest cover. The altitude of the land surface increases from west to the east. The major hills are confined to the eastern part of the district comprising the Gandeshwari Pahar (238.41m) and Kesgari Pahar (268.29m) while in the western part of the district isolated hills are in the form of the inselbergs and other small hillocks.

The soil is mostly acidic, reddish yellow, light textured and highly permeable with poor water holding capacity.

## 4.0 GROUND WATER SCENARIO

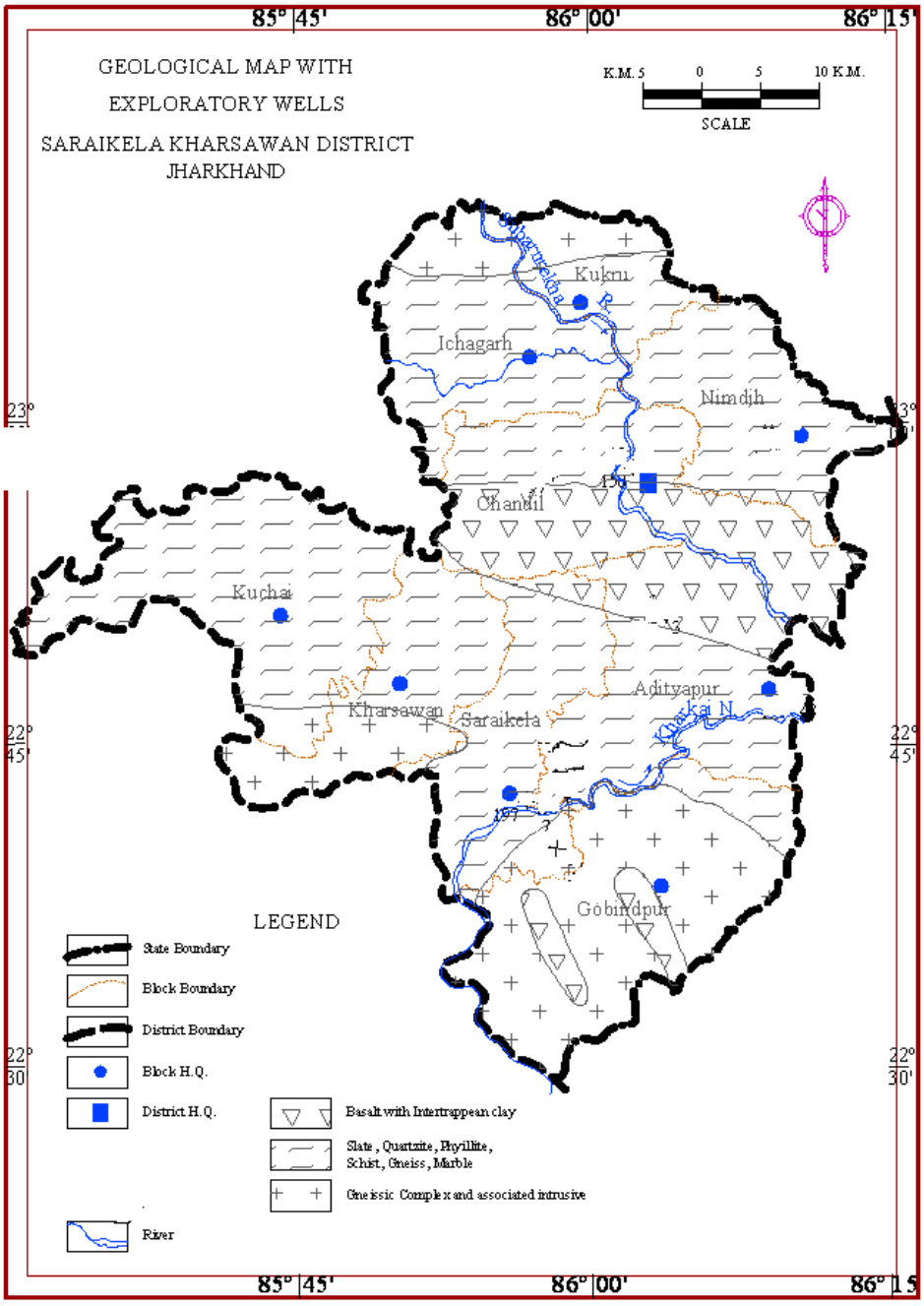
### 4.1 Hydrogeology

The southern part of the district is underlain by Granite-gneiss of Achaean age forming the basement. These occur as large batholiths and are intruded by basic rocks. In the central and northern part of the district the rocks of Barakar formation consisting of feldspathic sandstones, shales and coal seams overlying the metamorphics are exposed. In the western and northern part of the district alluvial cover of moderate thickness, caps the Archaean crystallines and the Gondwana sedimentaries.

The district is underlain by diverse geological formations with complex tectonic framework. The geological formations have been grouped under three main categories

a) The gneissic complex in the southern and the central part
b) The Rajmahal traps in the eastern and southeastern part
c) Gondwanas overlain by thin mantle of alluvial cover in the northern and central part.

Ground water occurs mostly under phreatic condition in all the lithological units within the shallow aquifers and locally under semi confined and confined condition in deeper aquifers.



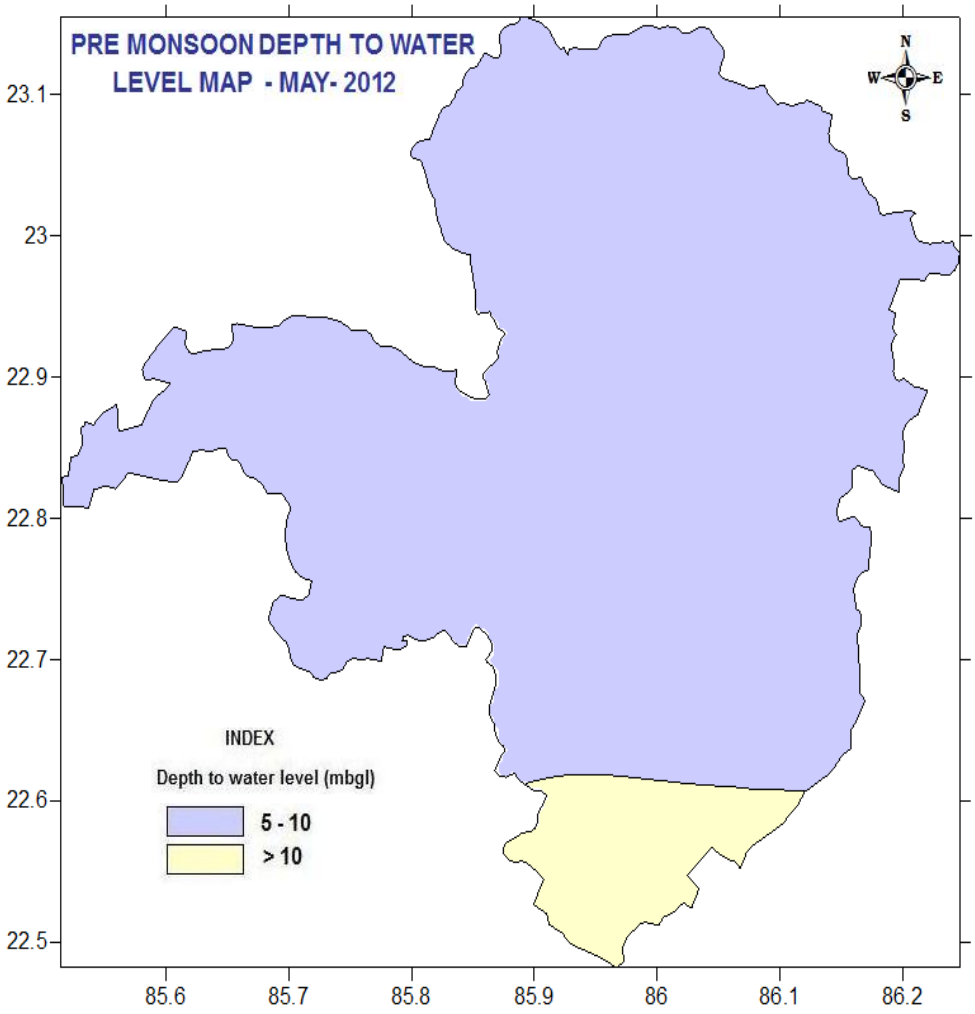
### 4.1.1 Depth to Water level

During May 2012, the depth to water levels in HNS wells tapping shallow aquifer ranged from 5.23 to 12.20 m bgl. Depth to ground water levels during the post monsoon period (November 2012) varied between 0.89 and 5.60 m bgl.

Categorization of depth to water level of pre-monsoon period (May 2012) for HNS in Saraikela district is presented below in table-1

**Table-1 Categorization of depth to water level of pre-monsoon period (May 2012)**

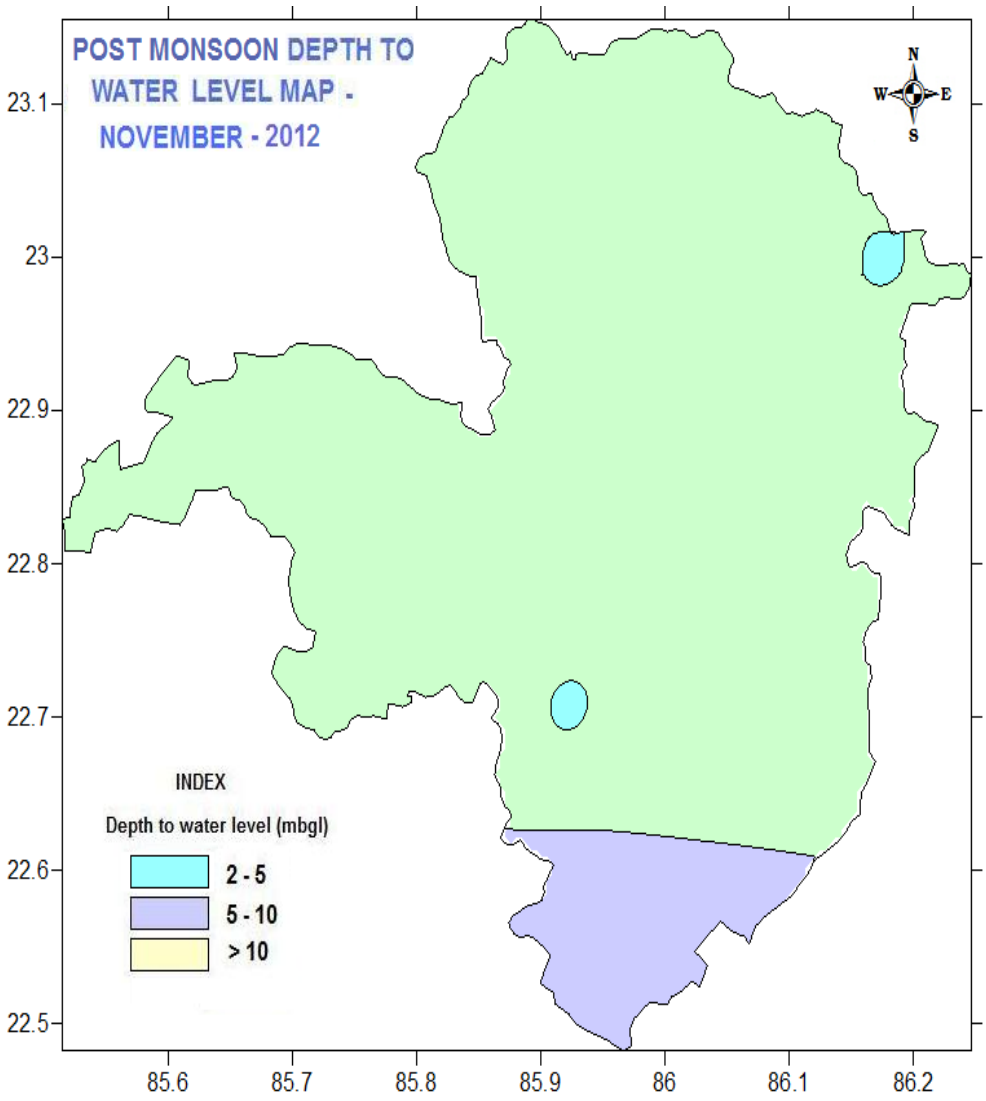
| **No. of wells measured** | **Depth to water level (m bgl)** | | 0-2 (m) | | 2-5 (m) | | 5-10 (m) | | 10-20(m) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Min** | **Max** | No. | % | No. | % | No. | % | No. | % |
| 5 | 5.23 | 12.20 | 0 | 0 | 0 | 0 | 4 | 83.33 | 1 | 16.67 |



Categorization of depth to water level of post-monsoon period (November 2012) for HNS in Saraikela district is presented below in table-2

**Table-2 Categorization of depth to water level of post-monsoon period (Nov-2012)**

| **No. of wells measured** | **Depth to water level (m bgl)** | | 0-2 (m) | | 2-5 (m) | | 5-10 (m) | | 10-20(m) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Min** | **Max** | No. | % | No. | % | No. | % | No. | % |
| 7 | 1.6 | 7.10 | 2 | 29 | 4 | 57 | 1 | 14 | 0 | 0 |



### 4.1.2 Aquifer Parameters

A total of 18 exploratory wells, 04 piezometers and 06 observation wells have been drilled down to depth of 202 m in hard rock formation to decipher the potential fracture zones. The morphotectonic analysis of crystalline formation has revealed that rocks have been subjected to several stages of deformation leading to development of deep seated tensile and shear fracture. The most potential fracture zones trend along NNE-SSW, WNW-SSE and NW-SE direction. The exploratory data reveals presence of potential fractures between 18-109 mbgl. The thickness of the weathered zone varies from 7 to 30.6.5m. The yield of the well is in the range of 2.52-27.53$m^3$/hr

Summarised hydrogeological data of exploratory drilling in the district is given in table-3 below.

**Table-3 Summarised hydrogeological data of exploratory drilling**

| Rock Type | Depth range (m bgl) | No. of fractures tapped | Depth Range of fracture Zone | Water level (m bgl) | Yield ($m^3$/hr) | Drawdown (m) | T ($m^2$/day) | S |
|---|---|---|---|---|---|---|---|---|
| Granite gneiss | 150-202 | 1-3 | 18-109 | 2.80-7.99 | 2.52-27.53 | 13.4-20.51 | 2.67-47.88 | $2.1* 10^{-4}$ - $6.1* 10^{-5}$ |

### 4.2 Ground Water Quality

Ground water in the phreatic aquifers in Saraikela district slightly alkaline in nature, which is also colourless, odourless . The specific electrical conductance of ground water in phreatic zone during May 2011 was in the range of 655 -2408 µS/cm at 25ºC. The suitability of ground water for drinking purpose has been evaluated on the basis of pH, Total hardness (T.H), Ca, Cl, F and $NO_3$. The chemical concentration of these constituents, when compared with the drinking water specification recommended by IS:10500,1991 as presented below in table-4.

Table-4 Number of samples exceeding permissible limit in the district.

| Quality | IS:10500, 1991 | No. of samples in |
|---|---|---|

| | Desirable limit | Permissible limit | the district exceeding permissible limit |
|---|---|---|---|
| pH | 6.5-8.5 | No relaxation | 1 |
| T.H | 300 | 600 | 1 |
| Ca | 75 | 200 | 1 |
| Cl | 250 | 1000 | 0 |
| F | 1.0 | 1.5 | 0 |
| $NO_3$ | 45 | 100 | 0 |

### 4.2.1 Status of Ground Water Development

In the rural areas the entire water supply is dependent on ground water. Ground water development is mainly carried out in the district through dug wells and Hand pumps. In general dug wells are of 2 m diameter and the depth ranges between 8 to 15 m depending on the thickness of the weathered zone, tapping the shallow aquifer in the weathered zone and uppermost slice of the basement. Large number of dug wells used for drinking water is under private ownership for which there is no reliable data. Over the years Mark II/ Mark III hand pumps are being drilled in large numbers for ground water development. These hand pumps have the following two major advantages i) less susceptible to contamination from surface sources and ii) tap fractures between 20-60m depth which have been found to be less affected by seasonal water level fluctuation and thus have lesser chances of failure even during extreme summer. In rural areas of Saraikela district the number of hand pumps drilled by PHED is 12311 of which 9342 are under working condition. There are 574 dug wells constructed by government departments that are under regular use.

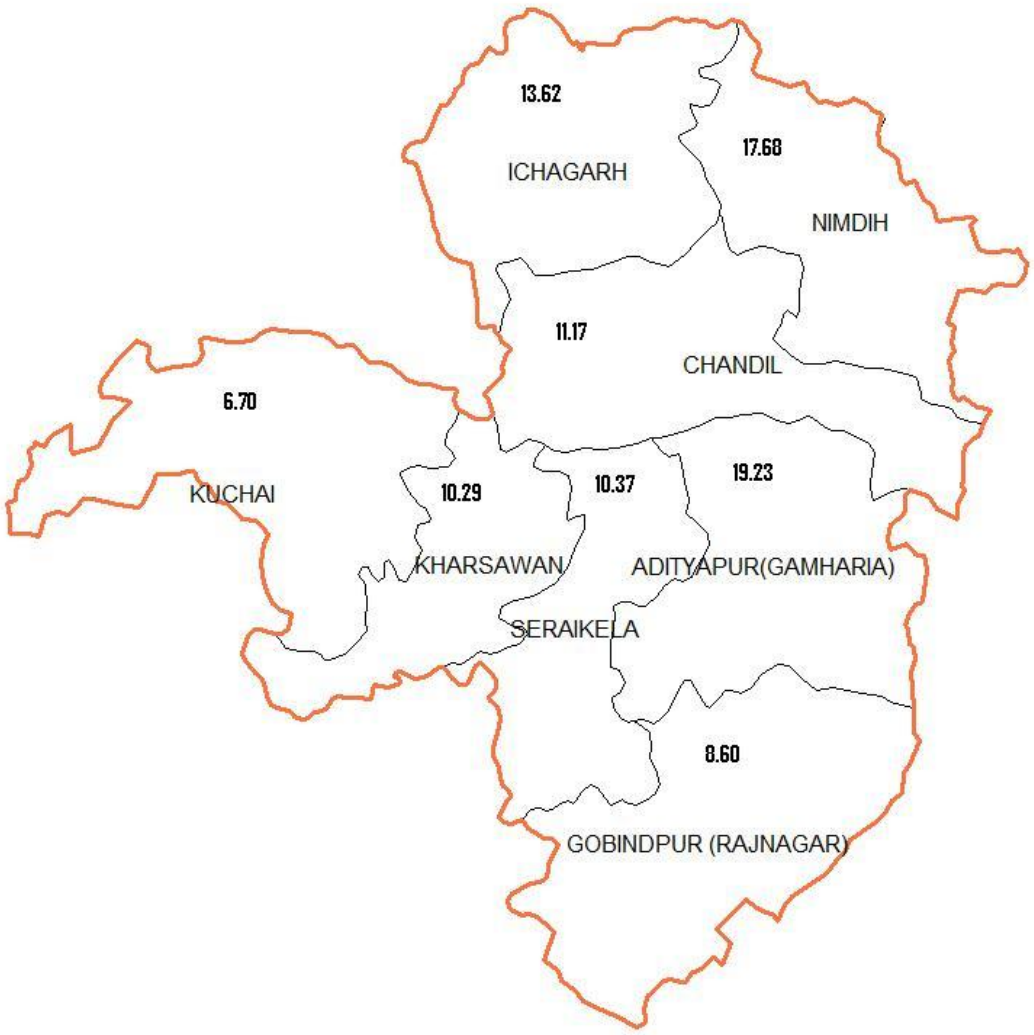
In the urban areas ground water plays a supplementary role in water supply, the major supply being made through dams, reservoirs or weirs across rivers or streams. No authentic data is available on the number of ground water structures catering the urban water supply.

As per the latest ground water resource estimation carried out adopting GEC 97 methodology, the overall stage of ground water development in Saraikela district has been found to be 11.71 % indicating enough scope for future development. The ground water resources of Saraikela district is given in the table-5.

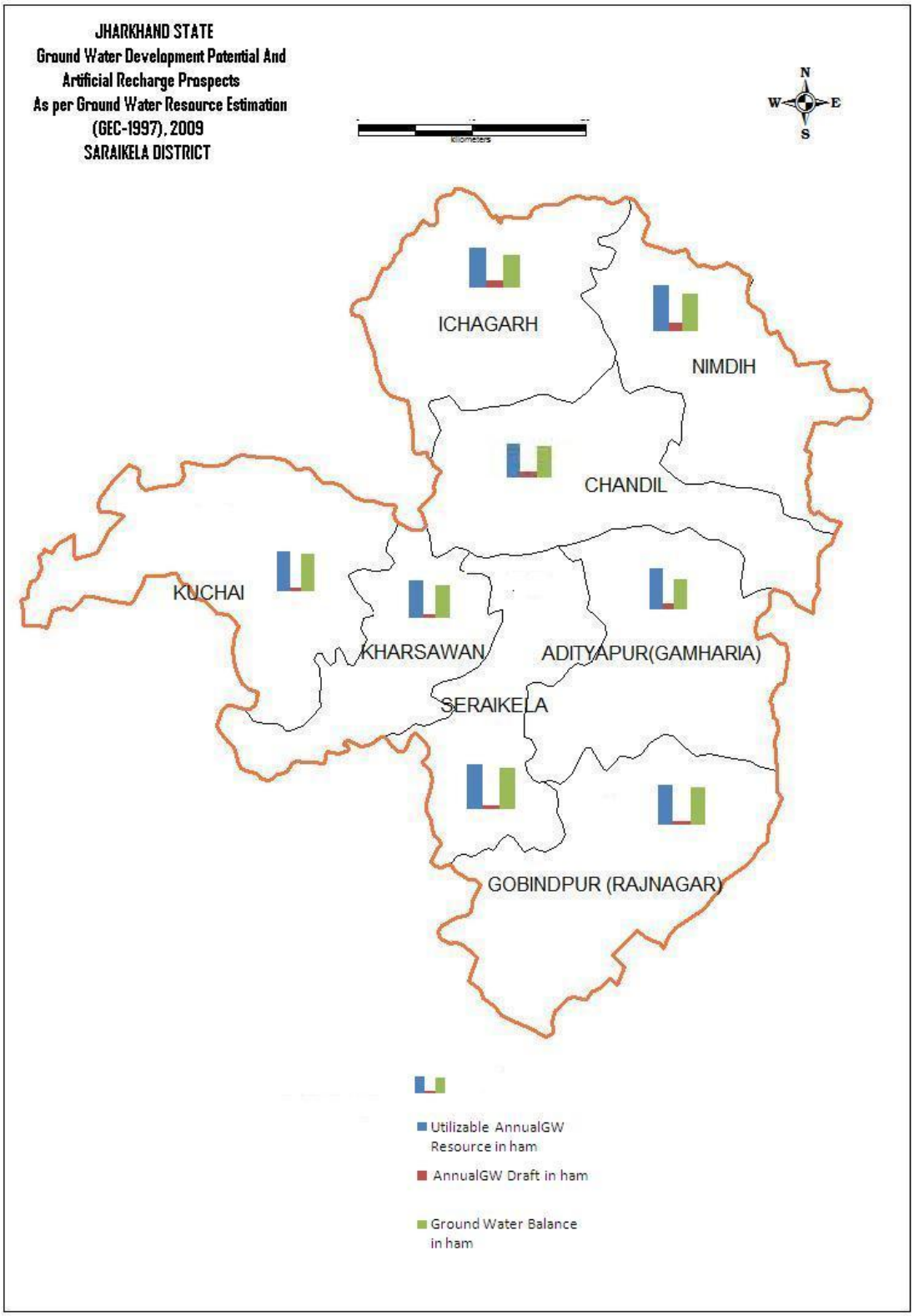
**Table-5 Dynamic Ground Water Resource of Saraikela district as on 31st March 2009 as per GEC 97 (ham)**

| | Annual Replenishable Ground Water Resource | | | | | Natural Discharge during non-monsoon season | Net Annual Ground Water Availability | Annual Ground Water Draft | | | Projected Demand for Domestic and Industrial uses up to 2025 | Ground Water Availability for future irrigation | Stage of Ground Water Development (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Monsoon Season | | Non-monsoon | | Total | | | Irrigation | Domestic and Industrial uses | Total | | | |
| Block | Recharge from rainfall | Recharge from other sources | Recharge from rainfall | Recharge from other sources | | | | | | | | | |
| Chandil | 2046.77 | 3.50 | 571.93 | 25.35 | 2647.55 | 264.75 | 2382.79 | 73.53 | 192,6 | 266.16 | 256.82 | 2052.44 | 11.17 |
| Gumhariya | 1648.36 | 2.53 | 460.60 | 27.02 | 2138.52 | 213.85 | 1924.66 | 87.894 | 282.2 | 370.07 | 376.20 | 1460.58 | 19.23 |
| Ichagarh | 2017.71 | 202.55 | 563.80 | 52.92 | 2836.98 | 283.70 | 2553.28 | 189.468 | 158.2 | 347.66 | 210.91 | 2152.90 | 13.62 |
| Khansowan | 1637.46 | 320.50 | 457.55 | 34.01 | 2449.53 | 244.95 | 2204.57 | 114.57 | 112.2 | 226.74 | 149.55 | 1940.45 | 10.29 |
| Kuchai | 2147.66 | 3.36 | 600.12 | 27.13 | 2778.26 | 277.83 | 2500.44 | 81.738 | 85.9 | 167.62 | 114.50 | 2304.20 | 6.70 |
| Nindih | 1556.03 | 2.34 | 434.80 | 48.00 | 2041.17 | 204.12 | 1837.05 | 173.394 | 151.4 | 324.77 | 201.82 | 1461.84 | 17.68 |
| Rajnagar | 2735.00 | 4.17 | 751.58 | 30.96 | 3521.70 | 176.09 | 3345.62 | 90.63 | 197.1 | 287.78 | 262.84 | 2992.15 | 8.60 |
| Saraikela | 1747.54 | 78.02 | 488.31 | 31.28 | 2345.15 | 234.52 | 2110.64 | 100.392 | 118.5 | 218.9 | 158.00 | 1852.25 | 10.37 |
| **Total** | **15536.53** | **616.96** | **4328.69** | **276.68** | **20758.85** | **1899.80** | **18859.05** | **911.62** | **1298.09** | **2209.71** | **1730.63** | **16216.81** | **11.71** |

JHARKHAND STATE
CATGORIZATION OF BLOCKS
As per Ground Water Resource Estimation
(GEC-1997), 2009
SARAIKELA DISTRICT




8.60 Stage of Ground Water Development
in percentage


JHARKHAND STATE
Ground Water Development Potential And
Artificial Recharge Prospects
As per Ground Water Resource Estimation
(GEC-1997), 2009
SARAIKELA DISTRICT
N
W
E
S
ICHAGARH
NIMDIH
CHANDIL
KUCHAI
KHARSAWAN
ADITYAPUR(GAMHARIA)
SERAIKELA
GOBINDPUR (RAJNAGAR)
Utilizable AnnualGW Resource in ham
AnnualGW Draft in ham
Ground Water Balance in ham

## 5.0 GROUND WATER RELATED ISSUES & PROBLEMS

Some of key ground water related issues are

a) Locating suitable sites for bore wells

b) Suitable design of dug wells and hand pumps

c) Taking up artificial recharge projects to augment the resource availability in Godda district

d) Optimal development of irrigation potential by developing ground water available for future uses:

e) Creating public awareness for conserving ground water through awareness camps, NGO's and mass media.

## 6.0 Awareness & Training activity

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

NIL

## 7.0 AREA NOTIFIED BY CGWB/SGWA

None

## 8.0 RECOMMENDATIONS

As the district suffers from water scarcity, it is recommended to take artificial recharge at suitable locales. On the basis of the hydrogeological criteria such as post monsoon water level below 7 m bgl indicating availability of sufficient space in the unsaturated zone to retain additional water and availability of surplus surface runoff. In the hard rock areas, pin pointing suitable sites for bore wells is always a challenge. Considering the anisotropy in distribution of fractures at deeper level, suitable sites may be selected using remote sensing techniques in association with geophysical and hydro-geological investigations.

For deriving optimal benefit from aquifers in areas under fissured formation, the dug wells should be designed to penetrate the weathered zone as well as top part (1-2 m) of

the underlying bed rock, so as to get the full benefit, from the total thickness of the shallow aquifer. For hand pumps and shallow tube wells the casing provided against the weathered zone should be slotted at the bottom so that the well can extract shallow ground water also. In urban areas use of shallow aquifers should be encouraged.

The surface run off in urban areas and its peripheral parts should be harnessed to augment the ground water resource through appropriate recharge techniques. For urban areas roof top rain water harvesting and artificial recharge is most suitable. Location and design of the structures should be guided by findings from hydrogeological and geophysical surveys. Sites for artificial recharge should be taken up at places where sufficient thickness of weathered zone as well as fracture/fracture zones are available. The depth of the recharge well should be governed by the depth of occurrence of the fractures.