2022-23

वार्षिक भूजल गुणवत्ता पुस्तिका

Ground Water Quality Year Book

केंद्रीय भूमिजल बोर्ड
उत्तर मध्य छत्तीसगढ़ क्षेत्र
रायपुर 492015 छत्तीसगढ़

Central Ground Water Board
North Central Chhattisgarh Region
Raipur 492015 Chhattisgarh

Ground Water Quality Yearbook of Chhattisgarh State

2022-23

*** * UNDER THE SUPERVISION OF * ***

Dr. Prabir Kumar Naik, Regional Director

*** * PRINCIPLE CONTRIBUTORS * ***

Rakesh Dewangan, Scientist-C and OIC (Chemical)
Dr. Rajni Kant Sharma, Scientist- C
Dr. Anita Bind, STA (Chemical)
Pramod, STA (Chemical)

Forward

Sustainable development is one of the main guiding principles for modern societies. Water and sustainable development are closely linked since the provision of water in sufficient quantities and of high quality have important impacts on our environment, society and industry as well as the wellbeing of the next generations.

Nowadays, there are several emerging problems and risks that affect the sustainable management of water resources. Pollution trends and impacts of hazardous pollutants remain uncertain. Diffuse pollution from agricultural practices emerges as a major threat. Water resources and water demands remain unbalanced at various levels. Groundwater abstraction and over-exploitation have serious environmental impacts.

Water is a solvent and dissolves minerals from the rocks with which it comes in contact. Ground water may contain dissolved minerals and gases that give it the tangy taste enjoyed by many people. Without these minerals and gases, the water would taste flat. The most common dissolved mineral substances are sodium, calcium, magnesium, potassium, chloride, bicarbonate, and sulfate. In water chemistry, these substances are called common constituents. For the Nation as a whole, the chemical and biological character of ground water is acceptable for most uses. The quality of ground water in some parts of the country, particularly shallow ground water, is changing as a result of human activities.

In the present report, the analytical results of ground water samples collected from the Chhattisgarh State during the pre-monsoon period of the year 2022 are compiled with detailed interpretation and discussion. Hope this report will best be utilised by the policy makers, water professionals, researchers, academicians etc. I express my sincere thanks to the team of Chemical Laboratory, Central Ground Water Board, NCCR, Raipur comprised with Sh. Rakesh Dewangan, Scientist C and Laboratory In charge, Dr. Rajni Kant Sharma, Scientist C and Dr. Anita Bind, STA (Chemical) for their sincere efforts made to bring the analytical results in the shape of “Ground Water Quality Year Book – 2023” for the region.

Raipur, dated the November, 2023.

Dr. Prabir Kumar Naik
Regional Director

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Raipur, dated November, 2023.

Rakesh Dewangan
Scientist C and Laboratory In charge

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Executive Summary

Chhattisgarh is the 10th largest state of India endowed with natural resources and thick forest cover. It is basically a backward, agrarian and tribal dominated state. It has been divided into 33 districts and 146 development blocks with 20306 numbers of villages and 168 towns. Demographically it is the 16th largest state of India with a total population of 2,55,40,196 comprising 50.22% male and 49.78% female population. Nearly 80 % of the total population lives in rural areas.

Physiographically, the state of Chhattisgarh can be divided into 3 distinct units namely; 1) Bastar plateau in southern part 2) Chhattisgarh Plain in central part and 3) Northern hills in northern part. These three units have their own distinctive characteristics and form part of three basins namely Ganga, Mahanadi and Godavari basins. About 66.1 % network stations fall in Mahanadi basin, 16.3 % fall in Ganga Basin, 14.7 % fall in Godavari basin. Central Ground Water Board, Central Region, Raipur has set up a network of 857 water quality monitoring wells.

During May 2022, 857 nos. of ground water samples were collected from monitoring wells and analysed for major ions, minor ions and Uranium using standard methods of chemical analysis. The results shows that ground water quality is suitable for drinking, domestic and agriculture uses in most of the locations whereas in few places instinct of contamination is observed that is due to local phenomena. Water Quality problematic areas are identified and presented in the maps for the selected parameters. To observe the changes in the ground water quality of the state over the years, trend analysis was carried out using the water quality data pertaining to the years from 2017 to 2022. No significant trend in the water quality parameters is observed for the selected period.

1. Introduction

1.1. General

Chhattisgarh has an abundance of mineral and natural forest resources. About 44% of state area is covered with the forest. The State is known as rice bowel of the India. Agricultural practices are the main profession in the State.

The quality of ground water varies from place to place depending upon the geology, hydro-geological condition, land use, rain fall pattern etc. Central Ground Water Board monitors the groundwater quality of entire country through national hydro-graph stations on yearly basis. Special studies on water quality monitoring are also conducted in the identified areas. The ground water quality monitoring stations of CGWB, NCCR, Raipur is well distributed throughout the state. The samples are collected in pre-monsoon season following the standard methods of ground water sampling and transportation. The collected samples were analysed in the NABL accredited chemical laboratory of CGWB, NCCR, Raipur for various parameters i.e., pH, electrical conductivity, carbonate and bi-carbonate, chloride, nitrate, sulphate, fluoride, calcium, magnesium, total hardness, sodium, potassium, iron and arsenic. The obtained results provide the overall existing scenario of the ground water hydrochemistry. Analytical results are discussed for the suitability of ground water for drinking and agriculture purposes.

1.2. Area

Chhattisgarh is 10th largest State by area, located in central part of the India. The State is surrounded by seven neighboring States. In north State shares the boundary with Uttar Pradesh, Northwest side with Madhya Pradesh, South west with Maharashtra, Northwest with Jharkhand, east with Odisha and Southerner direction with Andhra Pradesh and Telangana. The State situated between North latitude 17°47’ to 24°06’ and East longitude 80°14’ to 84°24’. As per census 2011 the population of the state is 25,545,198 and covers an area of 137,898.36 Sq Km. The state is administratively divided into 33 districts and further 179 blocks. These districts are - Balod, Baloda Bazar, Balrampur, Bastar, Bemetara, Bijapur, Bilaspur, Chowki, Dantewada, Dhamtari, Durg, Gariaband, Gaurella-Pendra-Marwahi, Janjgir-Champa, Jashpur, Kabirdham, Kanker, Khairagarh-Chhuikhadan-Gandai, Kondagaon, Koriya, Mahasamund, Manendragarh-Chirmiri-Bharatpur, Mohla-Manpur, Mungeli, Narayanpur, Raigarh, Raipur, Rajnandgaon, Sakti, Sarangarh-Bilaigarh, Sukma, Surajpur and Surguja. Administrative Divisions of the Chhattisgarh State are presented in Fig. – 01.

Naya Raipur is the capital of Chhattisgarh State and is one of India's planned cities. Nearly 65.90% of the total area is covered by tribal and hence it is called “tribal dominated State”. Physio-graphically, the state of Chhattisgarh can be divided into 3 distinct units namely, Northern hills in northern part; Chhattisgarh Plain in central part and Bastar plateau in southern part.

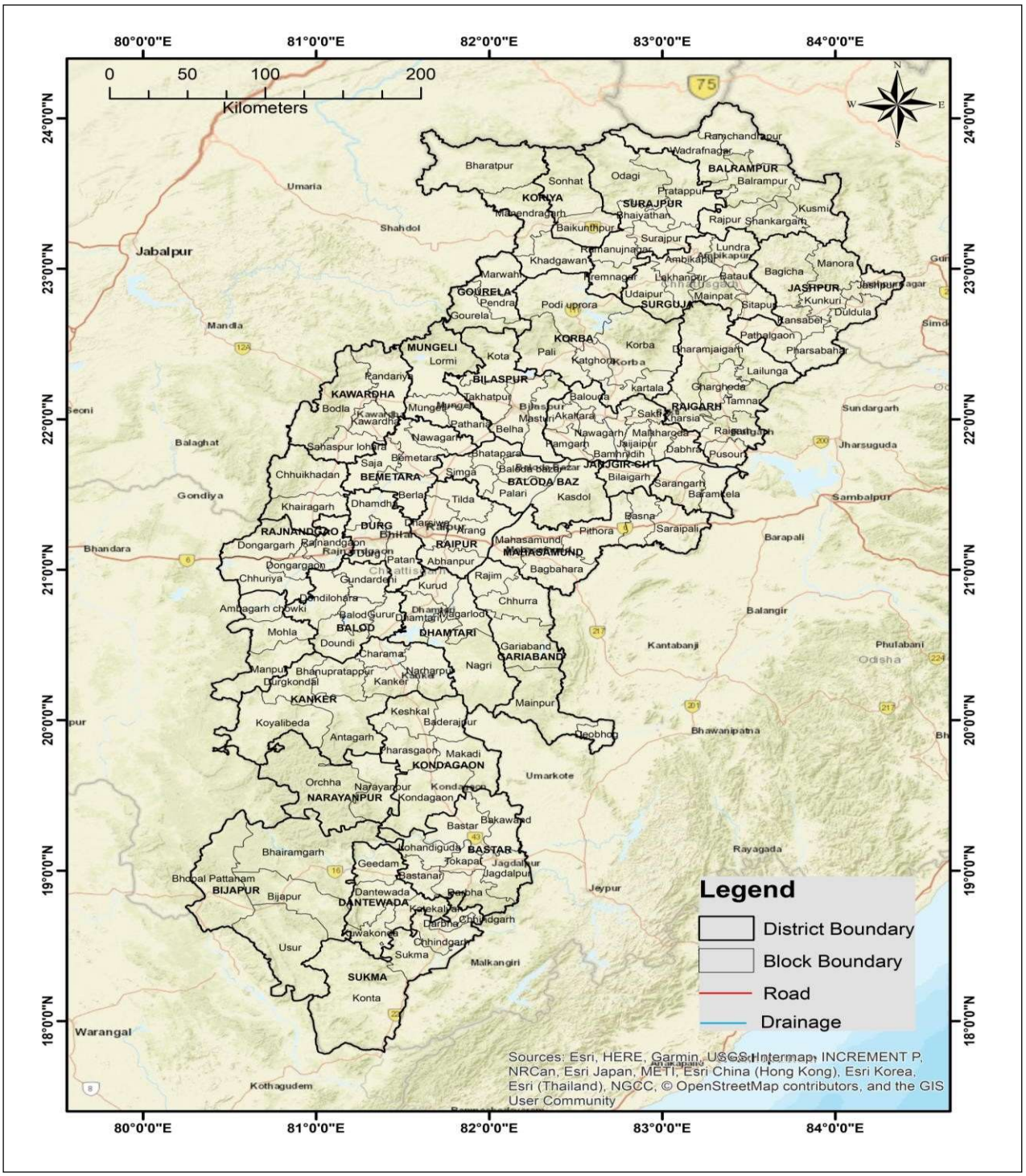

Figure 1- Administrative divisions of Chhattisgarh state.

These three units have their own distinctive characteristics and form part of three basins namely Ganga, Mahanadi and Godavari basins.

a. **Northern Region:** The districts that are part of this region (Korea, Surguja, Jashpur, Raigarh, and Korba) have similar geographical, climatic, and cultural contexts and harbour dense forests, hills and water reservoirs. It is home to several indigenous tribal communities such as Paharikorba and Pando, etc. Governed largely by tribal customs, culture and traditions, in the rural areas of the region, people are dependent largely on

agriculture and non-timber forest produce (NTFP). The level of migration from this region is comparatively limited. The urban centers are limited to Korba and Ambikapur. Korba is the largest town, and the limited industry is concentrated here. There are coalmines in Surguja and Korea districts.

b. **Central Plains Region:** Raipur, Bilaspur, Janjgir-Champa, Kabirdham, Rajnandgaon, Durg, Dhamtari, and Mahasamund are the districts that fall in the central plains. Mahanadi is the primary source of water for irrigation and domestic use. Owing to the presence of large number of indigenous varieties of rice, the central plains of Chhattisgarh are known as the 'rice bowl' of Central India. Bhilai and Durg are well known urban areas, both with large steel plants. Rural craft is well developed in the region and well known (eg. the silk weavers of Janjgir-Champa). The region is densely populated with Raipur and Durg account for almost half the total urban population of Chhattisgarh.

c. **Bastar Plateau:** The districts in this region (Kanker, Kondagoav, Bastar, Sukuma, Bijapur and Dantewada) are known for its varied and rich forests, diverse tribal population, and unique culture. These districts are bordered by nearby States of Maharashtra, Andhra Pradesh, and Orissa. The people of the region are dependent on traditional agriculture and forests for their livelihood. The Bailadila mines in Dantewada district represent the limited industry in the region.

1.3. Climate

The climate of the state is tropical, with very hot summers and cold winters, because high intense monsoon rains and the state is located nearer to the Tropic of Cancer. The South-East monsoon is principal source of the rain starts from mid-June and ends in mid-October. Rainfall is the major source of ground water recharge in the area and receives maximum (85%) rainfall during the southwest monsoon season. The winter rainfall is meager (10 - 15%). The average annual rain fall is ≈ 1200 mm and humidity reaches up to 95% in rainy season. Normally, winter starts from mid-October to mid-February and during night hours, the temperatures reached < 5 °C in many parts of the State. The summer period, normally starts from mid-April to the end of June and the daytime temperature reaches > 40°C.

1.4. Drainage

Chhattisgarh is very rich in surface water resources. A large number of perennial rivers flow in the state. The state is drained by rivers of five basins namely, Mahanadi; Lower Ganges; Godavari; Narmada and Brahmani. Mahanadi basin covers maximum and Narmada basin covers minimum area in the state. The Mahanadi River and its tributaries viz. Seonath, Hasdeo, Mand and Arpa drain part of Raipur, Durg, Rajnandgaon, Bilaspur, Raigarh and Surguja districts. The Indravati River is a tributary to Godavari River and drains the districts of Kanker, Bastar and Dantewada. Most of the Rivers are perennial in nature. In general, the drainage patterns are dendritic, parallel, angular and radial types. Son is the tributary of Ganga River and drains

part of Sarguja and Koriya districts.

1.5. Geology of the Area

Chhattisgarh is part of the Indian shield comprising of litho-units ranging in age from Archaean to Recent. Geologically, it has been further subdivided into southern Bastar province (Craton) and northern Satpura province along Central Indian Shear zone (CIS). The Bastar province (Craton) is constituted of Archaean –Proterozoic Supra crustal and platform sequence of Meso-Neo Proterozoic "Purana Basin". Satpura province consists of Archean – Proterozoic rocks, Gondwana rocks of Mahanadi Graben, Lametas and Deccan traps. Laterite and Alluvium of Recent age is sporadically developed over both these provinces. Nearly 58% of the State is covered by Crystalline and Metamorphic rocks, around 27% by rocks of Chhattisgarh Group of Basins, nearly 12% by semi consolidated Gondwana sediments and remaining 3% by Deccan traps, Lameta, Laterites and Alluvium. The varied variety and complexity in nature and composition of geological formations, geological structures and variety in geomorphological features and hydrogeological conditions have given rise to the widely varying occurrence of ground water in different parts of the state.

The geological framework of Chhattisgarh consists of both fracture and porous media. Based on the prevailing porosity type, the rocks of the state have been divided into two broad types, hard rocks and soft rocks.

A. Hard Rocks

Consolidated rocks (granite, granitic gneiss etc.) and semi-consolidated rocks (Sandstone, Shale) bearing secondary porosity are grouped under hard rock category. The rock types and their distribution along with their broad characteristics are given as under:

i. **Basement Crystalline -** The rocks of this group are dominated by basement gneiss, granulites and greenstones. Ground water in this area mainly occurs in phreatic (water table) condition along with occasional semi-confined conditions. The dug wells in the area have yield in the range of 0.23 to 2.30 lps. The bore wells have drill time discharge generally below 3 lps.

ii. **Plutonic - Volcanic and Meta Sedimentary -** The group constitutes of granites, acid and basic volcanics and Proterozoic meta-sedimentaries. Ground water in this province mainly occurs in phreatic to semi-confined condition. These aquifer groups have better potential than the basement crystalline. The bore wells in the province can yield up to 5 lps (432 m^3/day) with general discharge up to 3 lps.

iii. **Precambrian Sedimentary -** This province includes the rocks of Chhattisgarh Super Group, which are sedimentary rocks of marine origin. It consists of arenaceous-argillaceous- calcareous rocks and is dominated by limestone/dolomites and calcareous shale and ortho-quartzite. The limestone is more productive. The ortho-quartzites and shale are poor aquifers. The weathered zone is restricted to upper 30 m depth. The ground water in these formations occurs under water table, semi-confined

and confined conditions. The weathered and cavernous part of the formation constitutes the good potential aquifers in the area.

iv. **Deccan Volcanics -** This consists of basaltic lava flows and each flow is separated from other flow by intertrappean beds or red boles. The vesicular top parts of various flows and inter flow red boles form the aquifer along with weathered and fractured zones. The area is being developed through construction of dug wells and shallow bore wells fitted with hand pumps and have limited discharge. The weathered part of trap in general is converted to Laterites and can yield substantial water to the dug wells.

B. Soft Rocks

Rocks in which primary porosity dominate over secondary porosity are grouped under soft rock category. These are further classified as-

i. **Semi Consolidated Sedimentary-** The Gondwana Super Group and Lameta Group of rocks consist of sandstone, shale, clay, siltstone and coal. They possess both primary and secondary porosity, where primary porosity dominates over secondary porosity. Ground water occurs in both phreatic and semi confined to confined conditions. Shallow aquifer is phreatic to semi confined whereas deeper aquifers are generally confined, many time giving rise to flowing artesian wells. These rocks have good potential aquifer system (except the Talchir Formation), ground water development in this area is still moderate and exploitation is restricted to the upper aquifers (within 120m). Dug wells tapping the Lametas in Surguja district have yield up to 0.80 lps (70 m3/day).

ii. **Unconsolidated Sedimentary -** This formation consists of sand, silt, clay and pebbles. Ground water occurs in phreatic to semi-confined condition. Water level in this area varies between 2 to 20 m. Though isolated, shallow and small, these aquifers have good potential for ground water yield and development through dug wells, shallow bore wells and filter point wells. The dug wells in Bilaspur urban area can yield between 4.5 and 19 lps. and the safe yield for large diameter dug wells in alluvium is between 4 and 6 lps (345 and 518 m^3/day.). Laterites also occur in detached patches over various rock types. Ground water occurs in these rocks in phreatic condition, which is restricted up to the upper level of the lithomargic clays. The Ground water in this province is developed mainly through dug wells, where discharge is found up to 2 lps. The depth of dug wells in laterites in Surguja district ranges from 4 to 5 m and yield 0.46 to 0.70 lps (40-60 m^3/day)**.**

1.6. Hydrogeology

The hydrogeology of the area depends upon the local geology, drainage pattern and rainfall of the area. The ground water level varies from place to place along-with the season and use of ground water for specific activities. The depth wise variation in the ground water level is discussed as follows -

A. Pre-Monsoon

The depth to water level in the area ranges up to 10 mbgl in approximately 84.19% of the observation wells in the state. Deeper water levels ranging from 10 to 20 mbgl occur only in 15.22% of the observation wells and mostly in parts of Bilaspur, Durg, Janjgir-Champa, Korba, Koriya, Raipur and Surguja districts. The deepest water level of 25.01 m bgl was monitored in Sambalpur observation well (Shallow piezometer) of Durg district.

Only 5 wells (approximately 3.33% of the monitored wells) in the state are showing water levels between 0-2 m bgl in Dhamtari, Durg, Koriya and Janjgir Champa districts. Water levels in the range of 2-5 m bgl are recorded in about 21.66 % of the observation wells monitored. The highest percentages of wells in this range are in Dhamtari (25%), Durg (33.33%), Koriya (25%) districts. Nearly 60.91% of observation wells are exhibiting water level in the range of 5-10 mbgl in all the districts of the state.

A. Post Monsoon

In general, the depth to water level ranges up to 10 mbgl in approximately 95.43% of the observation wells in the state. Deeper water levels ranging between 10 and 20 mbgl occur only in 3.88% of the observation wells and mostly in parts of Bilaspur, Durg, Kawardha and Surguja districts. The deepest water level of 21.02 m bgl was monitored in Saroda Dadar observation well (Shallow piezometer) of Kawardha district.

Only 106 wells (approximately 24.20% of the monitored wells) in the state have water levels between 0-2 m bgl in all the districts. Water levels in the range of 2-5 m bgl are recorded in about 55.25% of the observation wells monitored. The highest percentages of wells in this range are in Bastar (72.73%), Jashpur (69.23%), Kawardha (70.59%), Koriya (61.90%), Raipur (62.26%), and Rajnandgaon (62.50%) districts. Nearly 15.98% of observation wells are exhibiting water level in the range of 5-10 mbgl in all the districts of the state.

Water Level Fluctuation – In comparison to water level of the state in May 2021, nearly 16.31% of the observation wells across the state of Chhattisgarh shows rise in water level in May 2022. Rise of water level in the range of 0-2 m is observed in 13.21% of the wells distributed in all the districts. Rise of water level in the range of 2-4 m is observed in 2.44% of the wells distributed in almost all the districts except Dhamtari, Kanker, Koriya, Mahasamund, Raigarh and Surguja districts. Rise of water level by more than 4 m is also observed in 0.65% of the monitored wells in Janjgir - Champa and Korba districts. Fall of water level is recorded in nearly 81.40% of the monitored wells. Fall of water level in the range of 0-2 m, 2-4 m and more than 4 m are observed in 51.39%, 15.82% and 14.19% of the monitored wells, respectively in the state.

1.7. Minerals Resources of the State

Chhattisgarh is a mineral rich State and verities of mineral such as Diamond, Coal, Iron ore, Lime Stone, Dolomite, Bauxite and Tin ore are naturally available in different part of the State. Abundance of minerals is changing very fast from an agricultural civilization to an industrial

civilization, so the demand for water has tremendously increased. The increasing dependence on ground water as a reliable source of water has resulted depleting quantity as well quality of the ground water.

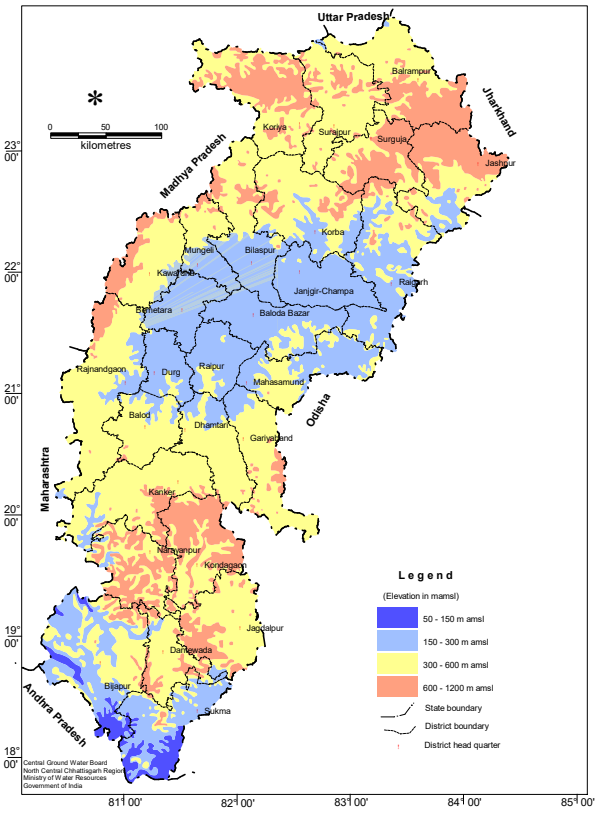

Figure 2 Physiography of Chhattisgarh State

1.8. Soil Type

The soils in the upper reaches of the drainage of the state are shallow, young and are eroding in nature. Changes in the soil properties indicate the drainage conditions, transport of eroded material and re-deposition of soil constituents. Down the slope, the soil depth, water holding capacity, ion exchange capacity, and preponderance of calcium and magnesium increases. The color changes from red to dark brown. The texture also changes from sandy loam to clayey, and sticky to very sticky.

1.9. Land use

Land use pattern is very important index of the human, social, cultural, and economic developments. According to the available statistics (Department of Statistics, Govt. of Chhattisgarh), 6352413 Ha. (46 %) of the total area in the State is covered by forests. The forests include protected forests, reserved forests, revenue forests and others.

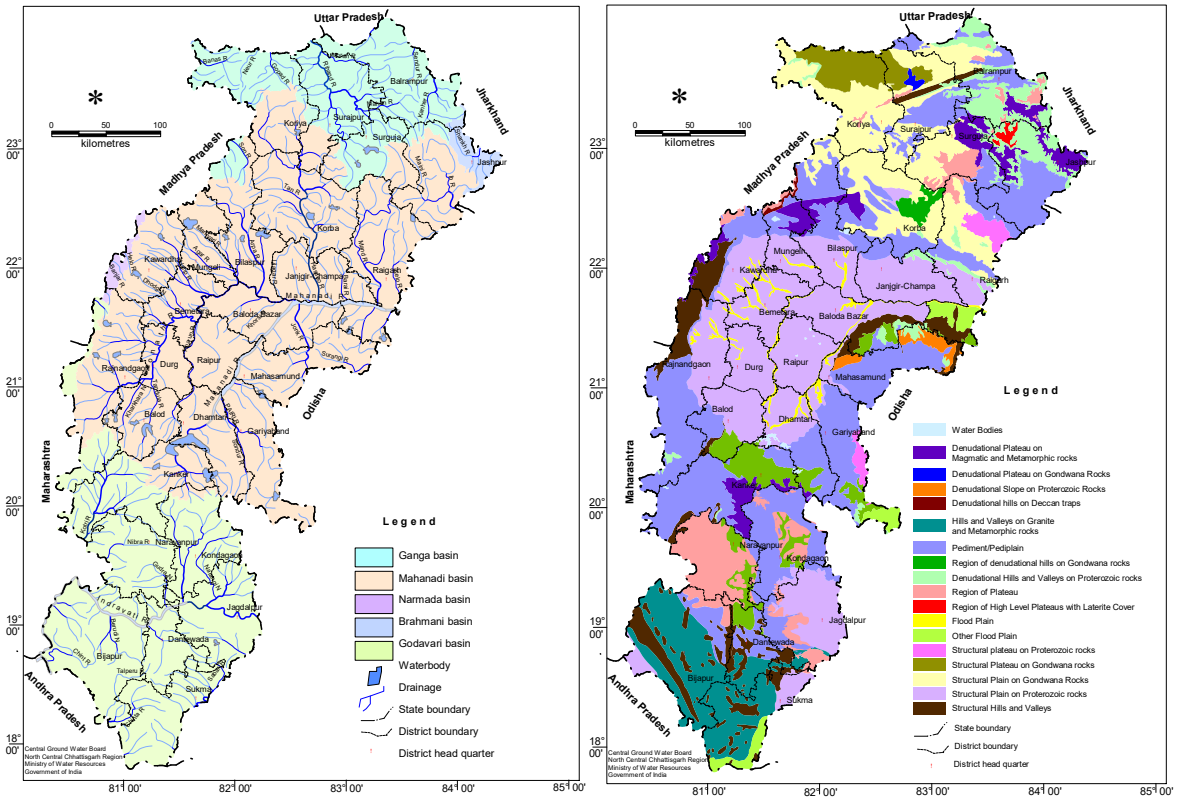

Figure 3 – Drainage - Basin map and Geomorphology map of Chhattisgarh State.

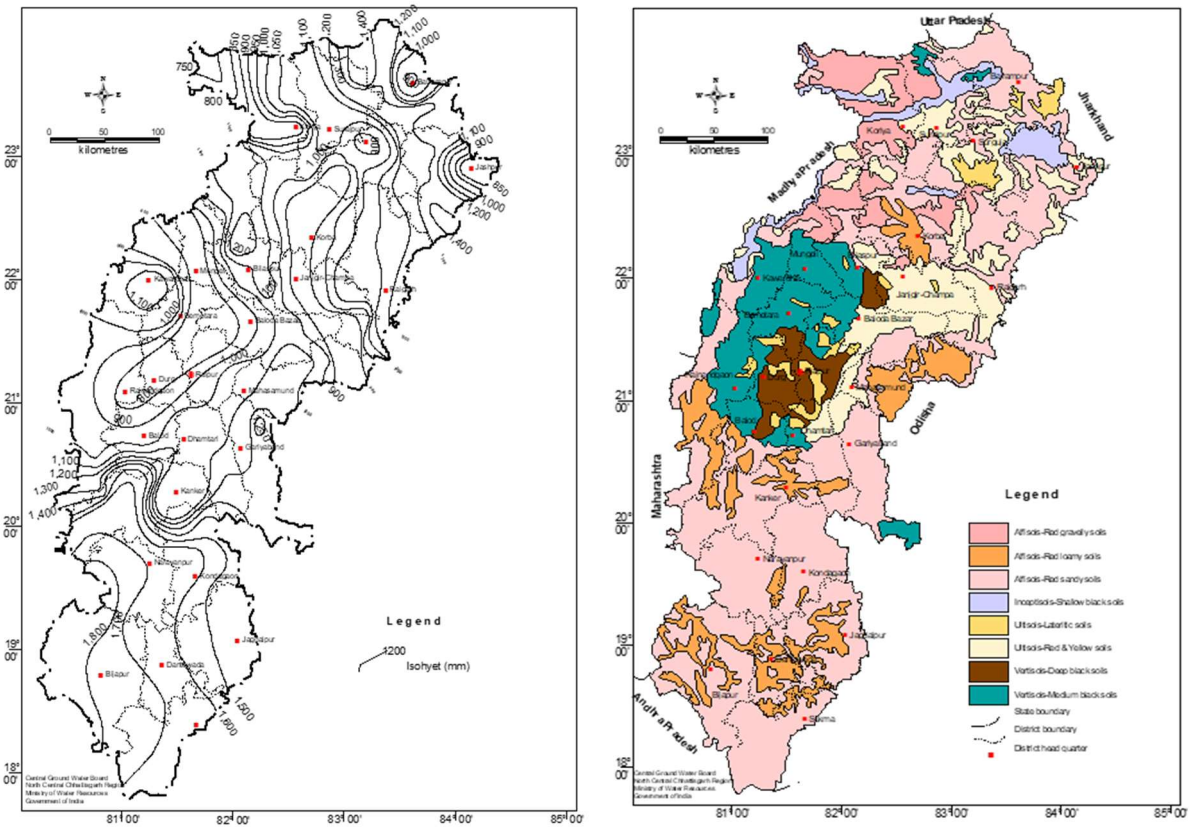

Figure 4 - Isohyets and Soil map of Chhattisgarh State

2. Hydrochemical quality evolution

As ground water moves along the flow paths in the saturated zone, it is enriched with total dissolved solids and with major ions. The shallow zone is characterized by active ground water flushing through relatively well-leached rocks has HCO_3^- as the dominant anion and is low in total dissolved solids. The intermediate zone has less active ground water circulation, andhigher total dissolved solids while sulphate is normally the dominant anion in this zone. The lower zone with very little ground water flushing has high Cl^- concentration and high total dissolved solids. The HCO_3^- content in ground water is normally derived from soil zone CO_2 and from dissolution of calcite and dolomite. There are several soluble sedimentary minerals that release SO_4^- or Cl^- upon dissolution. The process of evolution from stage to stage is controlled by the availability of minerals along the ground water flow paths. In some ground water flow system, the water does not evolve past the HCO_3^- stage or past the SO_4^-.

The notable in this regard is the increase in HCO_3^- and decrease in SO_4^- that can occur as a result of biochemical SO_4^- reduction. Large variations in major cations occur in ground water flow systems because of cation exchange process. The factors contributing to the ground water quality are the chemical composition of the rainwater, the soil types and the mineralogy of the rock formations. The geochemical processes in the soil zone and in the underlying unsaturated and saturated zones, temperature, pressure, duration of contact of the percolating water and the surrounding media, and other associated factors determine the chemical composition of the ground water. Pollution from near surface sources arising out of the human activities like industrial wastes disposal, use of fertilizers, pesticides also influence the ground water quality.

Climate and precipitation: The temperature and precipitation influence weathering, climate, vegetation, soil types and the composition of the water draining the area. The rainwater containing SiO_2, CO_2, O_2 picks up organic acids after reaching the earth's surface and reacts with the minerals, which get dissolved. In humid temperate climate the bicarbonates are predominant and are rather high in arid climate. The wet and dry climate promotes release of considerable soluble inorganic matter through weathering. Very cold climate inhibits weathering and restrict solute concentration in water.

Soil forming process: The geochemical reactions involved in the soil forming processes also dictate the chemical composition of the ground water. In soils dissolution of CO_2 and the H^+, HCO_3 CO_3^{2-} ions in percolation water control pH of water and thereby increasing its capacity to react with rocks and minerals.

Geological factors: The mineral constituents in rock influence the geochemical evolution of water passing through the rock. The mineralogical sources of major ions are listed in **Table-1.**

Table 1 -Mineralogical Sources of Major Chemical Constituents

Chemical constituents	Source Rock & Minerals
Silica	Feldspars, Feldspathoids, Amphiboles, Pyroxenes, Mica.
Iron	Pyroxenes, Amphiboles, Mica, Pyrites, Chalcopyrite, Magnetite and Haematite.
Mn	Common Mn. bearing minerals in metamorphic & sedimentary rocks as oxides, hydroxides, carbonates, silicates.
Ca	Plagioclase, Pyroxene, Amphibole, among igneous and metamorphic rocks. Limestone, dolomite, gypsum among sedimentary rocks.
Mg	Dunites, Pyrozenites, Amphibolites, Basalt, Talc, Tremolite Schists, Dolomite.
Na	Sodium salts in soils, sea water ingress, ground water, also due to base exchange reactions with clays.
K	Orthoclase, Microcline, Nephaline, Lucite, Biotite in igneous and metamorphic rocks, Evaporites in sedimentary rocks.
HCO3 & CO3	Dissolved CO2 in rains, water charged with CO2 dissolves carbonate minerals, in solid rocks to give bicarbonate.
SO4	Sulphides of heavy metals igneous and metamorphic rocks. Gypsum and hydrite in sedimentary rocks.
Cl	Atmospheric sources and sea water contamination.
F	Fluorite (CaF2). Some rocks such as fluorite, biotite, topaz, fluorapatite, cryolite hornblende, and muscovite
As	Arsenopyrite, As trisulfide Orpiment, Auripigment As_2S_3
U	Uraninite, pitchblende, Coffinite, Brannerite , Davidite , Thucholite , Saleeite , Gummite , Carnotite , Carnotite , Orbernite

Human activities*:* The untreated industrial effluents discharged through nearby streams and unlined drains may percolate underground and reaches the aquifers on the downstream side thereby affecting the quality of ground water. The migration of the pollutant to the saturated zone is considerable in sandy strata. The urban areas in India also generate substantial quantity of wastewater and find its way into the natural water courses causing contamination of surface and ground water. The solid waste dumped in low-lying areas becomes a potential source of ground water pollution.

Organic and inorganic fertilizers, pesticides, insecticides and other chemicals used in the agricultural fields are often leached to the ground water. Nitrate, potassium and phosphate are the common fertilizer used in agriculture land and are the potential pollutants in the ground water. The major contaminants associated with the waste disposal practices are summarized in **Table -2.**

Table 2 -Contaminants Associated with the Waste Disposal Practices.

Source	Possible contaminants
Landfills:	Wide variety of inorganic and organic constituents.
Municipal	Heavy metals, chlorides, sodium, calcium
Industrial	Wide variety of inorganic and organic constituents.
Hazardous waste disposal sites	Wide variety of inorganic (particularly heavy metals) and organic compounds (pesticides, priority pollutants, etc).
Liquid waste storage ponds (Lagoons, leaching ponds, compounds reaching basins)	Heavy metals, Solvents, Inorganic Compounds
Subsurface sewage disposal systems	Organic compounds (degreasers, solvents), nitrogen compounds, sulphates, sodium, microbiological contaminants.
Deep-well waste injection.	Variety of inorganic and/or organic compounds.
Agricultural activities.	Fertilizers, herbicides, pesticides.
Land application (sludge, wastewater)	Heavy metals, inorganic compounds, organic compounds.
Urban runoff infiltration.	Inorganic compounds, heavy metals, petroleum products.
Decaying activities.	Chlorides, sodium, calcium radioactivity.
Radioactive wastes.	Radioactive wastes and radionuclides.

3. Ground Water Quality Monitoring

Monitoring is a long term process the International Standard Organization (ISO) has defined monitoring as, “The programmed process of samplings, measurements and subsequent recording or signaling or both, of various water characteristics, often with the aim of assessing, conformity to specified objectives”. A systematic plan for conducting water quality monitoring is called Monitoring Programme, which includes monitoring network design, preliminary survey, resource estimation, sampling, analysis, data management & reporting.

Monitoring of ground water quality is an effort to obtain information on chemical quality through representative sampling in different hydrogeological units. Ground Water is commonly tapped from phreatic aquifers through dugwells in a major part of the country and through springs and hand pumps in hilly areas. The main objective of ground water quality monitoring programme is to get information on the distribution of water quality on a regional scale as well as lattice is to create a background data bank of different chemical constituents in ground water.

One of the main objectives of the ground water quality monitoring is to assess the suitability of ground water for drinking purpose. The quality of drinking water is a powerful environmental determinant of the health of a community. The problem of the quality of water resources in general, and groundwater resources in particular, is becoming increasingly important in both industrialized and developing nation. In developing countries like India, the essential concerns as regards water resources are their quantity, availability, sustainability and suitability. Groundwater plays a leading role because it has a fundamental importance to all living beings.

Even though water is the most frequently occurring substance on earth, lack of safe drinking water is more prominent in the developing countries. Due to increasing world population, extraction of groundwater is also increasing for irrigations, industries, municipalities and urban and rural households’ day by day. During dry season extensive withdrawal of groundwater for irrigation purpose is lowering the water table in the aquifer and also changing the chemical composition of water.

The physical and chemical quality of ground water is important in deciding its suitability for drinking purposes. Bureau of Indian Standards (BIS) formally known as Indian Standard Institute (ISI) vide its document IS: 10500:2012, Edition 3.2 (2012-15) has recommended the quality standards for drinking water. On this basis of classification, the natural ground water of India has been categorized as desirable, permissible and unfit for human consumption.

From the analytical results, it is seen that majority of water samples collected from observation / monitoring wells of CGWB in a major part of the Chhattisgarh state fall under desirable or permissible category and hence are suitable for drinking purposes. However, a small percentage of well waters are found to have concentrations of some constituents beyond the permissible limits. Such waters are not fit for human consumption and are likely to be harmful to health on continuous use.

The chemical quality of groundwater of the state is monitored by CGWB through national hydro-graph stations every year in the pre-monsoon season. Special water quality monitoring studies are also carried out in the quality sensitive area. To study the seasonal variation post-monsoon water samples were also collected from the quality sensitive area. The quality monitoring stations are well distributed throughout the state presented in Fig. 5. A total 857 number of NHNS ground water samples were analyzed during AAP 2022- 23, which includes 857 basic parameters analysis, 857 uranium and 857 heavy metals. pH, EC, Carbonate, Bicarbonate, Chloride, Total Hardness, Calcium, Magnesium, Sodium, Potassium, Sulphate, Nitrate, Fluoride, Phosphate and Silicate have been determined under basic parameteranalysis by the standard methods given in APHA. Uranium by fluorimeter and heavy metals analysis Iron and Arsenic was determined by AAS instrument.

The ground water samples were collected in good quality, cleaned and well-washed polyethylene bottles of one liter with necessary precautions. The water samples were divided in two portions. The 1st portion was used for measurement of physical parameters, cations and anions. The 2nd portion was acidified with few drops of ultra-pure acid for analysis of the iron and arsenic. The bottles were labeled with respect to collecting points, date and time in order to avoid any error between collection and analysis.

4. Methodology

The collected water samples brought to NABL accredited laboratory of the CGWB, NCCR, Raipur for determination of physicochemical parameters by the standard methods given in APHA 23rd edition, 2017. All the chemicals were used AR grade of pure quality. Ultra-pure distilled water was used for the preparation of all the reagents and solutions. The pH measured by using digital pH meter with an accuracy of ± 0.01% and Electrical Conductivity measured by digital Conductivity meter with an accuracy of ± 0.01% respectively. Total hardness and calcium were measured by EDTA complexometric titration method. Magnesium was calculated by the difference of total hardness and calcium ion concentration (TH - Ca).

The sodium and potassium were determined by flame photometer. The carbonate and bicarbonate were measured by titration method and by the obtained concentration of carbonate and bicarbonate the total alkalinity was computed and reported in mg/l as CaCO3. Chloride was measured volumetrically by silver nitrate titrimetric method using potassium chromate as indicator. Sulphate was measured by spectrophotometer method using barium chloride as precipitating agent. The nitrate was determined by UV-Visible spectrophotometer at 220 nm. Fluoride was determined by ion selective electrode using TISAB solution. The iron was determined in the acidified water samples by Atomic Absorption Spectrophotometer. Arsenic was analysed by the combination of hydride generator and AAS.

Standard techniques and procedures are adopted for collection and analysis of ground water samples. The obtained chemical analysis results are compared with BIS drinking water standards for the drinking purposes. To know the suitability of water for irrigation purposes different indices are computed and discussed in this report.

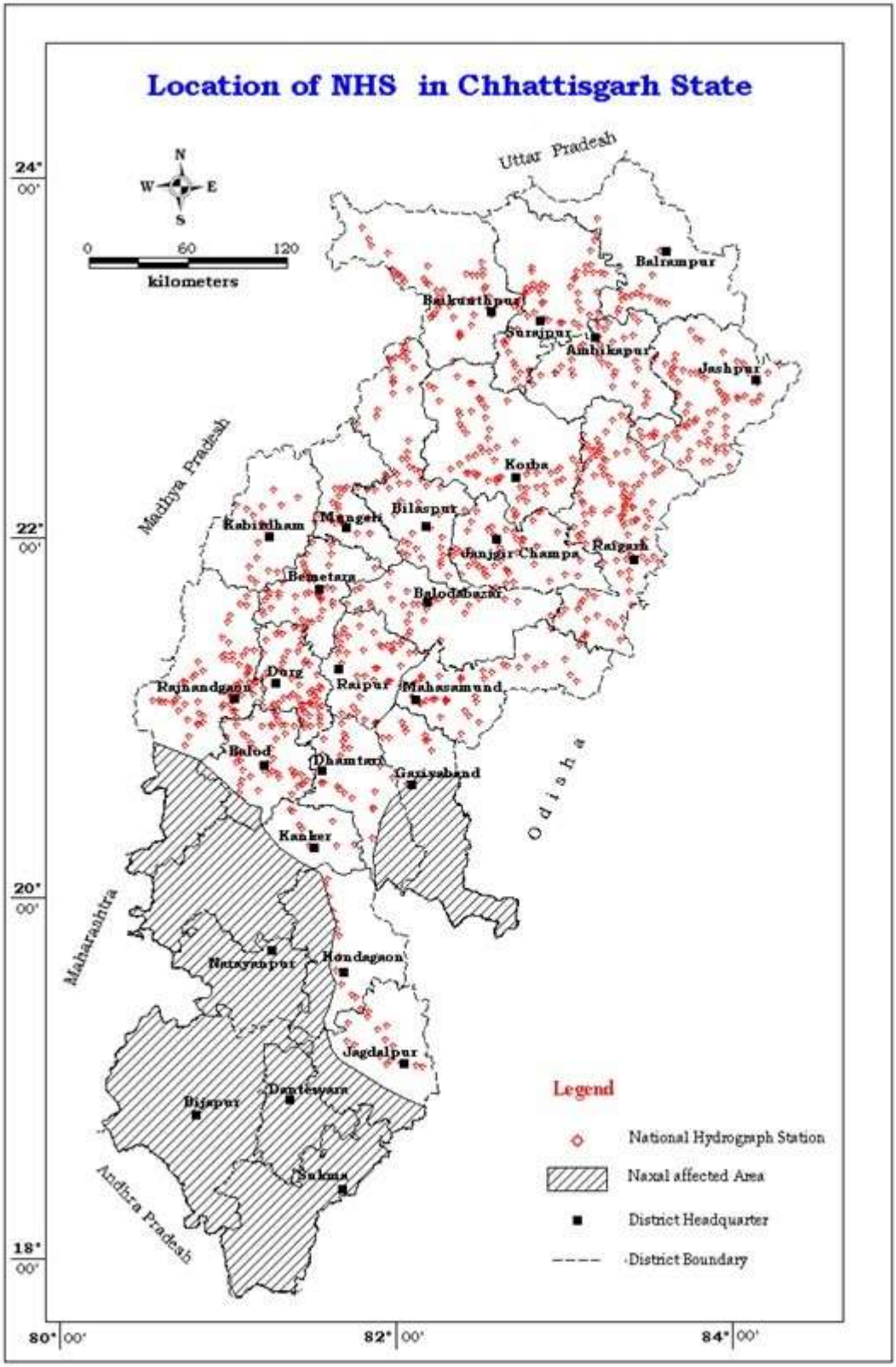

Figure 5 - Location of NHS monitoring stations of Chhattisgarh State.

4.1. Drinking water criteria

Drinking water is water intended for human consumption for drinking and cooking purposes from any source. Potable water is clear water, free from offensive smell or taste, free from chemicals that may have adverse effects on human health, free from elements that may cause corrosion of water supply system or stain clothes washed in it and free from disease causing organisms. Water quality standards were developed by health authorities and sanitary engineers when the relationship between water borne diseases and drinking water was established. In 1983 Who published a guideline for drinking water. Similarly, Bureau of Indian Standards (BIS) has published Indian standard drinking water specifications in 1983 by the with an objective to assess the quality of drinking water and to check the effectiveness of water treatment and supply. These standards are reviewed and modified periodically. In 2009, the BIS proposed the second revision of the drinking water standards (IS 10500 (2009)). The standard mentions the acceptable limit and indicates its background. It recommends implementing the 'acceptable limit'. Further it was updated in 2012 and revised in 2015, 2018 and 2021.

Table 3- Drinking water specification as per BIS-2012 (IS: 10500) with adverse effects.

Sr	Parameter	Desirable limit	Undesirable effect outside the desirable limit	Permissible limit
1	pH	6.5 – 8.5	Beyond this range water will affect mucous membrane and/or water supply system	No relaxation
Following Results are expressed in mg/l				
2	Dissolved solids	500	Encrustation in water supply structure and adverse effects on domestic use	200
3	Alkalinity	200	Beyond this limit taste becomes unpleasant	600
4	Total hardness as $CaCO_3$	300	Encrustation in water supply structure and adverse effects on domestic use	600
5	Calcium as Ca,	75	Encrustation in water supply structure and adverse effects on domestic use	200
6	Magnesium as Mg	30	--	100
7	Chlorides as Cl	250	Beyond this limit taste, corrosion and palatability are affected	1000
8	Sulphate as SO4	200	Beyond this causes gastro intentional irritation when magnesium or sodium are present	400
9	Nitrates as NO3	45	Beyond this methanemoglobinemia takes place	No relaxation
10	Fluoride	1.0	Fluoride may be kept as low as possible. High fluoride may cause fluorosis	1.5
11	Iron as Fe	0.3	Beyond this limit taste/ appearance are affected, has adverse effect on domestic uses and water supply structures, and promotes iron bacteria.	1.0
12	Arsenic as As	0.01	Beyond this, the water becomes toxic	No relaxation
13.	Uranium	0.03	Kidney disease, Carcinogenic	No relaxation

4.2. Data Validation / Data Quality Control

Groundwater quality data validation is an essential step in ensuring the reliability and accuracy of the data. Here are some of the main steps for groundwater quality data validation.

A. Checking of Data Consistency: Checking of the data for consistency by comparing the measurements of a particular parameter over time. This will help identify any changes in the groundwater quality due to measurement methodology or equipment

B. Checking the correlation between EC and TDS:

a. The relationship between the two parameters is often described by a constant (commonly between 0.55 and 0.95 for freshwaters).

b. Thus: TDS (mg/l) ~ (0.55 to 0.95) x EC (mS/cm).

c. The value of the constant varies according to the chemical composition of the water. For freshwaters, the normal range of TDS can be calculated from the following relationship:

d. 0.55 conductivity (mS/cm) < TDS (mg/l) < 0.95 conductivity (mS/cm).

C. Checking the cation-anion balance: When a water quality sample has been analysed for the major ionic species, one of the most important validation tests can be conducted: the cation-anion balance.

Sum of cations = sum of anions

Where:

Cations = positively charged species in solution (meq/l)

Anions = negatively charged species in solution (meq/l)

The Electronic charge balance is expressed as follows:

$$(\text{Electronic Charge Balance (ECB\%)} \quad = \frac{\sum \text{Cations} \; - \; \sum \text{Anions}}{\sum \text{Cations} \; + \; \sum \text{Anions}]} \text{x} 100$$

All concentrations should be in epm. Error charge balance has been computed for the chemical results of 2022-23 and analysis showing more than 10% ECB has not been accepted as it indicates that there has been an error made in at least one of the major cation/anion analyses.

4.3. Hydro-chemical facies

The piper diagram proposed by Hill and Piper in (1944) to present the hydro-chemical facie on the basis of major ions cations (calcium, magnesium and the alkali metals- sodium and potassium) and anions (bicarbonate, chloride and sulfate) present in ground water. Each cation value is then plotted, as a percentage of the total concentration (meq/L) of all cations under consideration, in the lower left triangle of the diagram. Likewise, individual anion values are plotted, as percentages of the total concentration of all anions under consideration, in the lower right triangle. Sample values are then projected into the central diamond-shaped field.

Fundamental interpretations of the chemical nature of a water sample are based on the location of the sample ion values within the central field.

4.4. Irrigation water quality indices

Suitability of ground water for irrigation can be assessed using the indices for salinity and sodicity. Apart from various indices such as Sodium soluble percentage (SSP), Residual sodium carbonate (RSC), Sodium adsorption ratio (SAR), Percentage sodium (%Na) and Kelly index (KI) besides concentration of certain soil tolerance elements. The quality criteria for irrigation water are evaluated on the basis of chemical characteristics indicative of their potential to create soil condition hazardous to crop growth and yields. The prevailing criteria of quality for irrigation are total concentration of soluble salts (Salinity), concentration of sodium relative to calcium and magnesium (sodicity), relative proportion of carbonates, bicarbonate to calcium, magnesium, and other elements that may be toxic to plant growth and yields. In 1954 The US Salinity Laboratory has developed a diagram to classifying to decide the suitability of ground water for irrigation purposes. It is a plot of SAR verses electrical conductivity in semi log scale. Conductivity (C) and Sodacity(S) are classification as C_1S_1, C_2S_2, S_2C_1, S_2C_2 etc. are extensively used and consists of 16 groups of irrigation waters suitability.

a. **Sodium soluble percentage (SSP):** Soluble Sodium Percentage (SSP) of the water is calculated by applying the equation given below in which the values are expressed in meq/l. The sodium in water replaces Ca in the soil by Base Exchange process decreasing the soil permeability. Water with less than or equal to 50 SSP value is of good quality and more than 50 is not suitable for irrigation as permeability will be very low.

$$\mathbf{SSP} = \frac{\mathbf{Na}}{(\mathbf{Ca} + \mathbf{Mg} + \mathbf{Na})} * \mathbf{100}$$

b. **Residual sodium carbonate (RSC):** The concentration of carbonate and bicarbonate also plays a very vital role for classification of irrigation water. The relative abundance of sodium with respect to excess of carbonate and bicarbonate over alkaline earth also affects the suitability of water for irrigation purpose and this excess is denoted by residual sodium carbonate (RSC) and is determined by the formula as given, where all ions in meq/l. The RSC value of < 1.25 are considered good for irrigation, where as those with in 1.25 to 2.50 are marginally suitable and samples with > 2.50 of RSC value are not suitable for irrigation (Eaton 1950, Rechards 1954).

$$\mathbf{RSC} = (\mathbf{HCO3} + \mathbf{CO3}) - (\mathbf{Ca} + \mathbf{Mg})$$

c. **Sodium adsorption ratio (SAR):** The most common measure to assess sodicity in water and soil is called the Sodium Adsorption Ratio (SAR). The SAR defines sodicity in terms of the relative concentration of sodium (Na) compared to the sum of calcium (Ca) and magnesium (Mg) ions in a sample. The SAR assesses the potential for infiltration problems due to a sodium imbalance in irrigation water. The SAR value <10 makes the

ground water quite suitable for irrigation SAR is >10 less suitable for irrigation as per Richards (1954) classification.

$$\mathbf{SAR} = \frac{\mathbf{Na}}{\sqrt{(\mathbf{Ca} + \mathbf{Mg})/2}}$$

d. Percentage sodium (%Na): Percentage sodium (%Na) is an indication of the soluble sodium content of the groundwater and also used to evaluate Na hazard. In all natural waters, %Na is a common parameter to assess its suitability for irrigation purposes since sodium reacts with the soil to reduce permeability. As Percentage sodium value increases the category of water moves form excellent to good, good to doubtful, and unsuitable for irrigation.

$$\%\mathbf{Na} = \frac{(\mathbf{Na} + \mathbf{K})}{(\mathbf{Ca} + \mathbf{Mg} + \mathbf{Na} + \mathbf{K})} * \mathbf{100}$$

e. Kelly Index (KI): Kelly's ratio (KR) introduced by Kelly, is an important parameter used in the evaluation of water quality for irrigation. This parameter is based the Na, Ca and Mg levels in the groundwater. According to this classification, groundwater with a KR value greater than one (>1) is deemed unfit for irrigation.

$$\mathbf{KI} = \frac{\mathbf{Na}}{(\mathbf{Ca} + \mathbf{Mg})}$$

f. Magnesium Ratio: Magnesium Ratio (MR) is calculated applying following equation in which the ions are expressed in meq/l.

MR = (Mg*100) / (Ca+Mg)

MR value >50 is considered unsuitable for irrigation (Lloyd and Heathcote 1985).

Table 4 -Guidelines for evaluation of quality of irrigation water

Water class	Sodium (Na) %	Electrical Conductivity: mhos/cm at 25^0C	Alkalinity hazards	
			SAR	RSC (meq/l)
Excellent	< 20	< 250	< 10	< 1.25
Good	20 – 40	250 – 750	10 – 18	1.25 – 2.0
Medium	40 – 60	750 – 2250	18 – 26	2.0 – 2.5
Bad	60 – 80	2250 - 4000	> 26	2.5 – 3.0
Very bad	> 80	> 4000	> 26	> 3.0

Table 5 -Safe Limits for electrical conductivity for irrigation water (IS:11624-1986)

Sr.	Nature of soil	Crop Growth	Upper permissible safe limit of electrical conductivity in water µs/cm at 25°C
1	Deep black soil and alluvial soils having clay content more than 30%; soils that are fairly to moderately well Drained	Semi-tolerant	1500
		Tolerant	2000
2	Textured soils having clay contents of20-30%; soils that are well drained internally and have good surface Drainage system	Semi-tolerant	2000
		Tolerant	4000
3	Medium textured soils having clay 10-20%; internally very well drained and Having good surface drainage system	Semi-tolerant	4000
		Tolerant	6000
4	Light textured soils having clay less than 10%; soils that have excellent Internal and surface drainage system.	Semi-tolerant	6000
		Tolerant	8000

In addition to problems caused by total amount of salts, some of the specific ions like sodium, boron and trace elements, if present in water in excess, also render it un-suitable for agricultural use.

5. Result and discussion

The majority of ground water samples were analyzed under NHNS category. N= 858 ground water samples of collected during NHNS 2022-23 have been mainly analyzed for basic Parameters the result presented in Table – 14. The obtained chemical analysis results are computed for statistical parameterslike minimum, maximum, average value and compared with BIS standard, the same is presented in Table - 6.

Table 6 -Statistical description of n=857 water samples collected during NHNS monitoring.

Parameters	Unit	Max	Min	Avg	Acceptable Limit	Permissible Limit
pH	-	8.64	6.74	7.86	6.5 mg/l	8.5 mg/l
EC	µS/cm	2360	25	542.87		
$CO3^{2-}$	mg/l	24	0	0.511	No Specified Limit	
$HCO3^{3-}$	mg/l	799.3	12.2	176.13	No Specified Limit	
Cl^-	mg/l	403.56	3.5	56.36	250 mg/l	1000 mg/l
$SO4^{2-}$	mg/l	537.65	0.01	29.25	200 mg/l	400 mg/l
$NO3^-$	mg/l	77	0	18.52	45 mg/l	
F^-	mg/l	1.8	0	0.39	1 mg/l	1.5 mg/l
TH	mg/l	1105	15	196.74	200 mg/l	600 mg/l
Ca^{2+}	mg/l	422	2	48.996	75 mg/l	200 mg/l
Mg^{2+}	mg/l	94.78	1.2	18.232	30 mg/l	100 mg/l
Na^+	mg/l	265.3	0.08	34.12	No Specified Limit	
K^+	mg/l	80.34	0	2.885	No Specified Limit	
Si	mg/l	78.6	0.07	14.22	No Specified Limit	
$PO4^{3+}$	mg/l	0.98	0	0.024	No Specified Limit	
U	µg/l	63.0	0	5.00	30 µg/l	

5.1. Ground Water Quality in Phreatic Aquifers of Chhattisgarh State.

Ground water of unconfined aquifers zone is widely tapped for water supply across the country therefore; its quality is very important. The chemical parameters like Electrical conductance, Chloride, Fluoride, Nitrate, sulphate, Total hardness, Iron, Arsenic and Uranium etc are main constituents defining the quality of ground water in phreatic aquifers. Therefore, presence of these parameters in ground water beyond the permissible limit in the absence of alternate source has been considered as groundwater quality problem area is discussed as follows.

5.1.1. pH

pH is measure of intensity of acidity or alkalinity of water. pH is the negative logarithm of hydrogen ion concentration. The BIS recommended pH value ranges from 6.5 to 8.5 for drinking purpose. The pH value varies from 6.7 to 8.6 with average value of 7.8 in ground water of Chhattisgarh. Mostly ground water of state is neutral to mild alkaline in nature. The abundance of the dissolution of weak acid anions carbonate and bicarbonate is more as compare to strong acid anions chloride and sulphate.

5.1.2. Electrical Conductivity

The assessment of Electrical conductance (EC) of groundwater is an essential and integral part of chemical quality study of the water. The EC of water clearly establishes the extent of mineralization of water. Electrical conductivity measures the ability of an aqueous solution to convey an electric current. This conductivity depends on the presence of ions their total concentration, mobility, valence and relative concentration and on the temperature of the liquid. More number of ions gives the high electrical conductivity whereas less number of ions gives low conductivity value.

Unit of EC is micromhos/cm or micro-seimens/cm and it changes with temperature, usually it is estimate/reported in standard temperature as 25°C (Karanth, 1987). EC of water increases with salt content (Todd, 1980). The EC of water is a measure of mineralization and could be used to predict the concentration of calcium, magnesium, sodium, alkalinity, sulphate and chloride. Thus, EC values could be used to estimate concentration of other constituents within desired precision. Changes in EC of a sample indicate changes in mineral composition of raw water, intrusion of saline water and pollution from industrial water. EC is converted to TDS by multiplying factor which varies from 0.55 to 0.95 depending upon the nature of soluble ionic components, their concentration and the temperature of water (Hem 1991). The TDS is normally analyzed in the laboratory by gravimetric dry residual method (evaporation, drying and weighing). TDS values are extensively used to assess the suitability of water for different purposes and to classify the water in to different categories and to classify the water in to different categories. The BIS has recommended a limit of 500 mg/L total dissolved solids for drinking water which is approximately equal to EC 750 μS/cm at 25^0C that can be extended to a TDS of 2000 mg/L approximately equal to EC 3000 μS/cm at 25^0C in case of no alternate source. Water having TDS more than 2000 mg/L is not suitable for drinking purpose. The Electrical conductivity of the groundwater of Chhattisgarh state varies from 25 and 2360 μS/cm with an average value of 543 μS/cm at 25°C. Around 80% of the ground water (688 samples), the EC values are found < 750 μS/cm and 19.6% of water samples (168 samples) it varies from750-2250 μS/cm. exceptionally higher EC values (>2250 μS/cm) was observed only at Amorkasa village of Balod district of Chhattisgarh. In Fig 6, the EC values (in μS/cm at 25^0C) of ground water from monitoring wells have been used to show distribution patterns of electrical conductivity in different ranges of suitability for drinking purposes. It is apparent from the map that majority of the waters having EC values less than 750μS/cm at 25^0C occur mostly in the district of Mungeli, Baloda Bazar and Raipur districts in Chhattisgarh State.

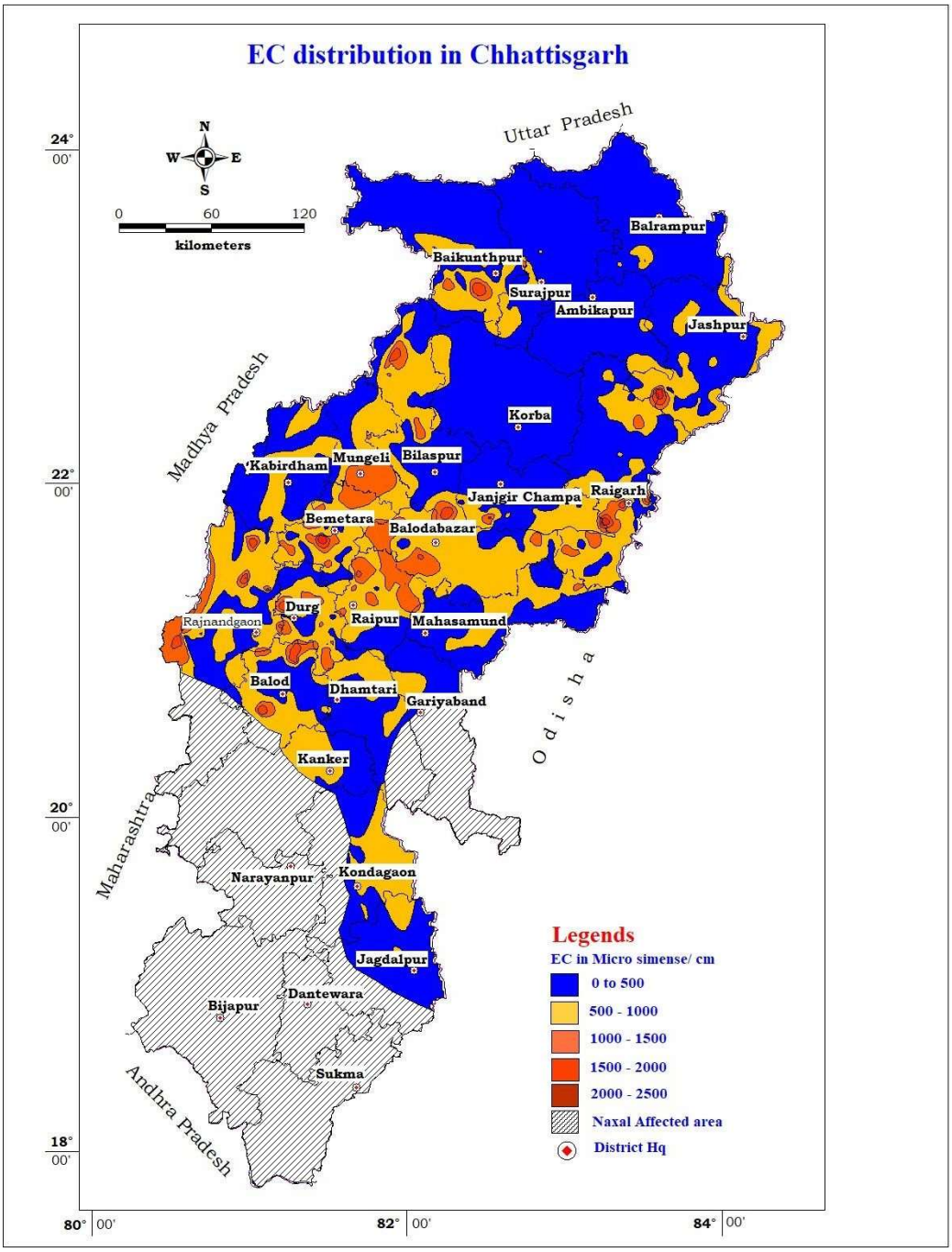

Figure 6 -EC distribution map of Chhattisgarh State.

Trend on Electrical Conductivity - The Trend Analysis is an important tool to determine whether the measured values of the water quality variables increase or decrease during the study period. The Electrical Conductivity (EC) of groundwater is contributed by all the ionic constituents dissolved into it. Therefore, EC is a measure of the total ionic content of the water. Therefore, EC parameter can be used to assess the source of inorganic pollution as most of the inorganic compounds are present as ions in the water. Hence, EC was taken to assess the trend of ground water quality in the State of Chhattisgarh. As compared to other years, the number of wells monitored during 2020 and 2021 is less due to COVID pandemic situation across the world. The percentage of wells with electrical conductivity more than 2250 µS/cm for the

period of 2017 to 2022 were compared and presented in the Table -7 and Fig -7 and observed that the percentage of samples exceed the permissible limit of 2250 µS/cm were ranging between 0.1- 1.18 % and no significant trend was noticed.

Table 7 -Percentage of wells Exceed EC>2250 µS/cm during the period of 2017-2022

Year	No. of districts affected by EC	No. of locations affected by EC	Total Number of samples analysed	% age of locations affected by EC
2017	1	1	958	0.10%
2018	4	5	939	0.50%
2019	1	2	917	0.21%
2020	6	7	590	1.18%
2021	1	3	856	0.35%
2022	1	1	858	0.10%

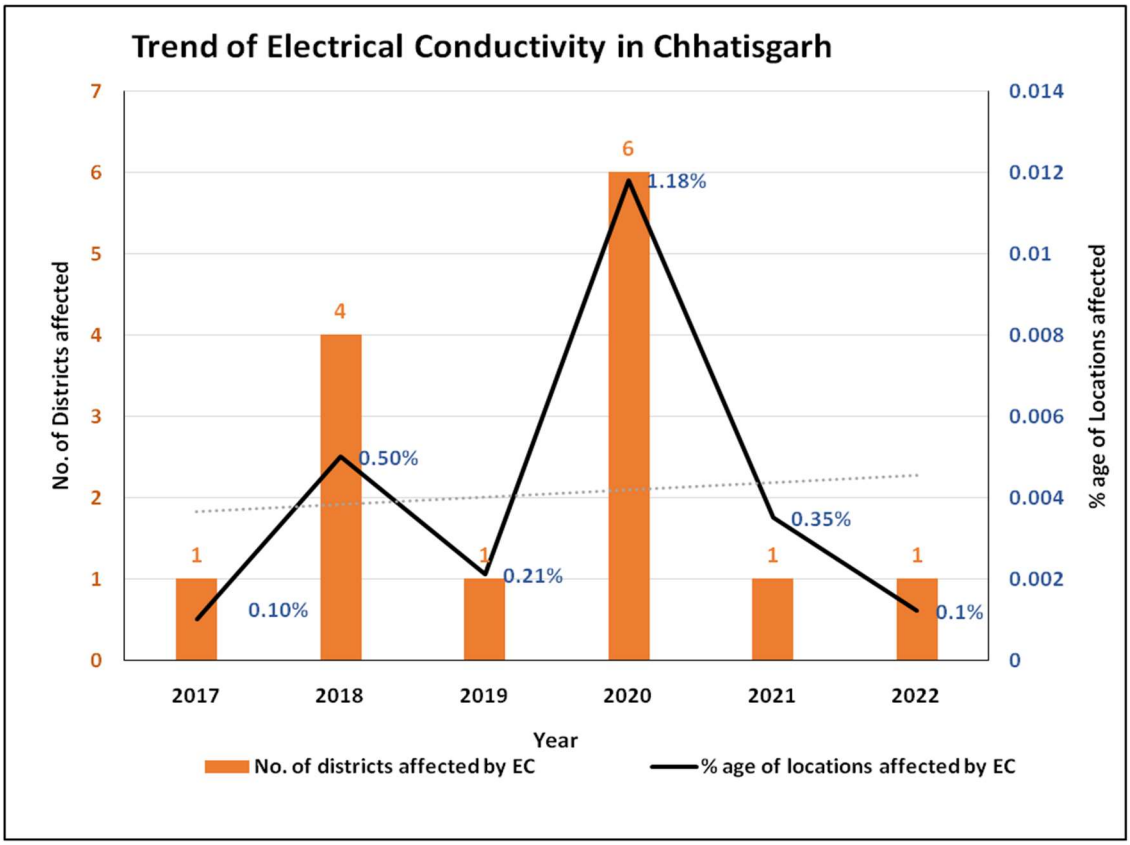

Figure 7 -Trend of Electrical Conductivity in Chhattisgarh State during last five year (2017-2022).

5.1.3. Alkalinity

Carbonate & Bicarbonate (CO_3^-&HCO_3^-) is a measure of the buffering capacity of water, that is how effective the water is at neutralizing acidity. Measuring alkalinity shows us the ability of water to resist changes in pH. Waters with low alkalinity are very susceptible to changes in pH

(e.g. from acidic rainfall or pollution). Waters with high alkalinity are able to resist major shifts in pH. Alkalinity helps to regulate the pH of a water body, and also regulate the metal content. It is generally determined by titrating with acid down to a pH of about 4.5 and is equal to the concentrations of $HCO_3 + 2\times CO_3$ (mmol/l) in most samples. The primary source of carbonate and bicarbonate ions in ground water is the dissolved carbon dioxide in rain and snow, which as enters the soil dissolves more carbon dioxide. An increase in temperature and decrease in pressure causes reduction in the solubility of carbon dioxide in water. Decay of organic matters also releases carbon dioxide for dissolution. The pH of water indicates the form in which carbon dioxide is present in water. Presence of carbonic acid is indicated when pH is less than 4.5, bicarbonate in pH between 4.5 to 8.3 and carbonate in pH over 8.2.

The carbonate concentration in the state varies from 0.0 to 24 mg/l with an average concentration of 0.5 mg/l and the bicarbonate concentration was observed from 12.2 to 799.3 mg/l with an average value of 176.1 mg/l. The carbonate alkalinity was observed only 1.2 % ground water of the state. Highest bicarbonate concentration was observed at Jangalpur village of Chhuikhadan, in Rajnandgaon district.

5.1.4. Chloride (Cl^-)

Chloride (Cl^-) is one of the most common constituents of natural waters. It is n important entity in ground water, though its presence in crustal rocks is insignificant. However, processes like evaporation, repeated evaporation and dissolution of salts, contact with evaporitic bodies, presence of entrapped water during sedimentation and sea water intrusion are few processes responsible for the high content of chloride in ground water. Chloride salts are highly soluble and free from chemical reaction with minerals of the reservoir rock and remains in sodium chloride form. However, chloride concentration may exceed than that of sodium due to base-exchange processes. Calcium and magnesium chloride rich ground water are quite rare. Abnormal concentration may due to sewage and industrial wastes. The chloride concentration in the state was observed 3.5 to 403.5 mg/l with an average of 56.3 mg/l. As per BIS guidelines the acceptable and maximum permissible limits of chloride in drinking water from 250 to 1000 mg/l respectively. The chloride concentrations were observed below the acceptable limit in 98.8% of the ground water and remaining 1.2 % of the water (11 samples) it was observed between the acceptable and permissible limit of drinking water. The chloride distribution in the ground water of Chhattisgarh State is presented in Fig. – 8.

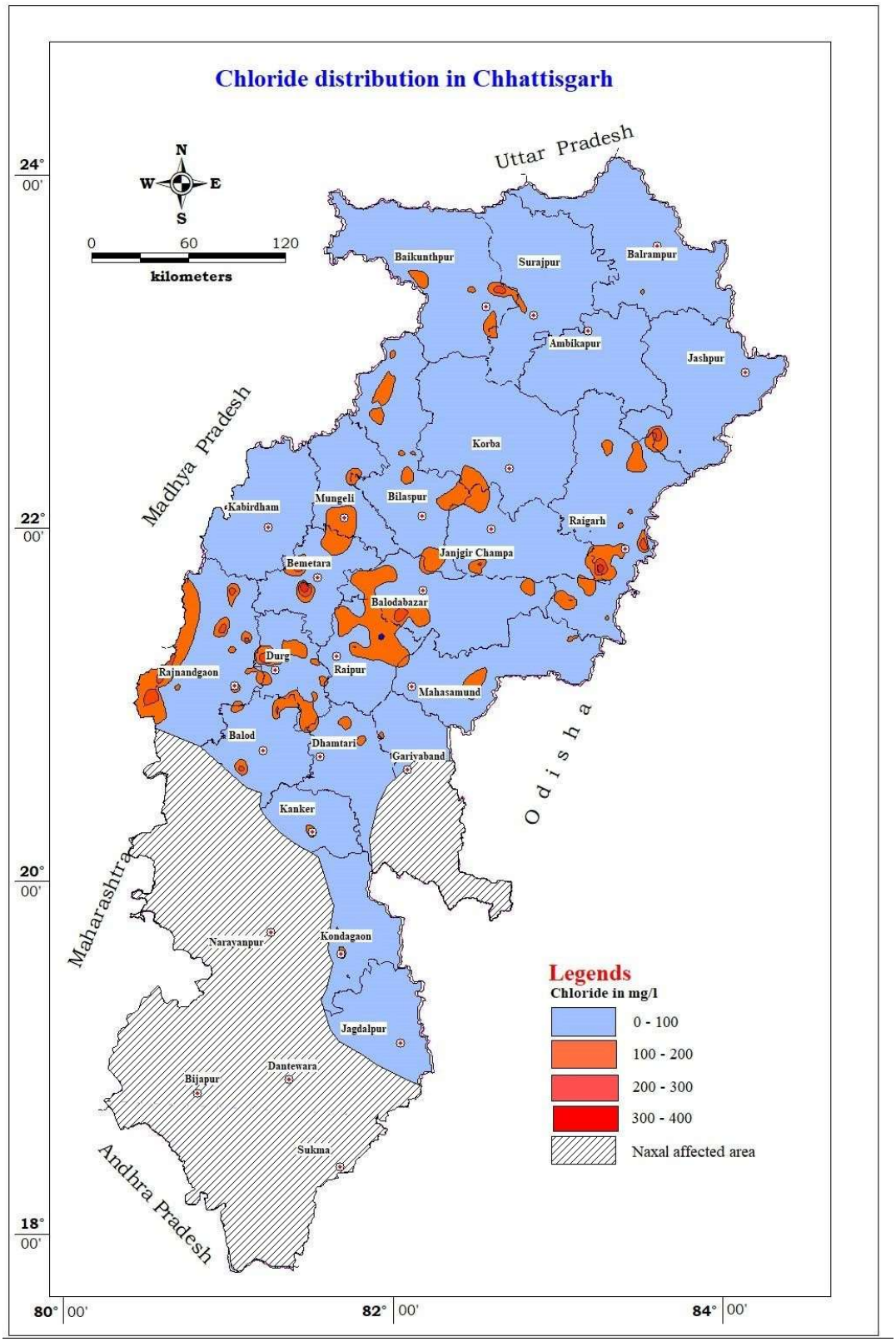

Figure 8 - Chloride distribution in Chhattisgarh State.

5.1.5. Sulphate (SO_4^{2-})

Sulphate ions occur mostly in the evaporate sediments as anhydrite and as gypsum. The sulphur content in atmospheric precipitation is only about 2 ppm, but wide range in sulphate

content is made possible in ground water through oxidation, precipitation, solution and concentration as water traverses through rocks. The primary source of sulphur is the sulphide minerals present in igneous and metamorphic rocks and gypsum & anhydrides present in sedimentary rocks. Apart from that application of fertilizer and soil conditioner also plays great role in its abundance in ground water. Reduction of sulphate by bacteria and precipitation of gypsum may also cause the removal of sulphate from ground water. Higher content of Sulphate (SO_4^{2-}) in drinking water causes gastrointestinal irritation. The sulphate concentration in the State was recorded ranges from 0.0 mg/l and 537.6 mg/l with an average concentration of 29.2 mg/l. As per the BIS (2012) guidelines the acceptable and permissible limits for sulphate in drinking water are 200 mg/l and 400 mg/l, respectively. In all the ground water of the state having sulphate concentration within the acceptable limits except Banjarid and village of Koriya district were ground water samples have sulphate concentration > 400 mg/l above permissible limit. The higher values of Sulphate parameter presented in Figure – 10.

5.1.6. Nitrate (NO_3^-)

Atmospheric Electric discharge during lightning is the main process through which nitrate enters in to the ground water cycle. The main contribution of nitrate comes from decaying of organic matters, sewage wastes and the application of fertilizers. As such high concentration of nitrate is found in localized areas. The higher concentration of nitrate (NO_3^-) in ground water is due to the anthropogenic activities (waste disposal) and it causes methemoglobinemia (Blue babies' syndrome). When levels of Nitrate are high excess of nitrite is formed which is absorbed by hemoglobin and converted to methemoglobin that renders the hemoglobin molecule incapable of transporting oxygen. Infants when ingested with high Nitrate concentrations suffer from Cyanosis (Methemoglobinemia) or blue baby. The nitrate concentration in ground water of Chhattisgarh varies from 0.0 to 77 mg/l with an average concentration of 18.5 mg/l. There is no relaxation beyond the acceptable limit (45 mg/l) of nitrate for drinking water.

In around 14% of ground water (120 samples) in the state having nitrate concentration is above the permissible limit (>45 mg/l) presented in Fig. 10. Rest of the 86% ground water (737 samples) having nitrate concentration below the permissible limit (<45 mg/l).

Trend on Nitrate - Trend analysis determines whether the measured values of the water quality variables increase or decrease during a time period. Nitrate is one of the major indicators of anthropogenic sources of pollution. Nitrate is the ultimate oxidized product of all nitrogen containing matter and its occurrence in groundwater can be fairly attributed to infiltration of water through soil containing domestic waste, animal waste, fertilizer and industrial pollution. As the lithogenic sources of nitrogen are very rare, its presence in ground water is almost due to anthropogenic activity. Hence, nitrate was taken to assess the trend of ground water quality in India due to anthropogenic activity. The percentage of well exceeds the permissible limit of 45mg/L for the period of 2019 to 2022 were compared and presented in the Table 8 and Fig 9 and observed that the percentage of samples exceed the permissible limit of nitrate (> 45 mg/L) were ranging between 4 - 21 % and no significant trend was noticed.

It is also observed that the type of waste generated is important in causing the nitrate pollution and also indicates that domestic waste leads to more nitrate problem. This could be due to the leaching of nitrate from the open sewerage lines.

Table 8-Percentage of wells Exceed Nitrate >45 mg/L during the period of 2019-2022

Year	No. of districts affected by NO3	No. of locations affected by NO3	Total Number of samples analysed	% age of locations affected by NO3
2019	16	39	917	4.30%
2020	15	128	590	21.70%
2021	23	141	856	16.47%
2022	19	120	858	13.98%

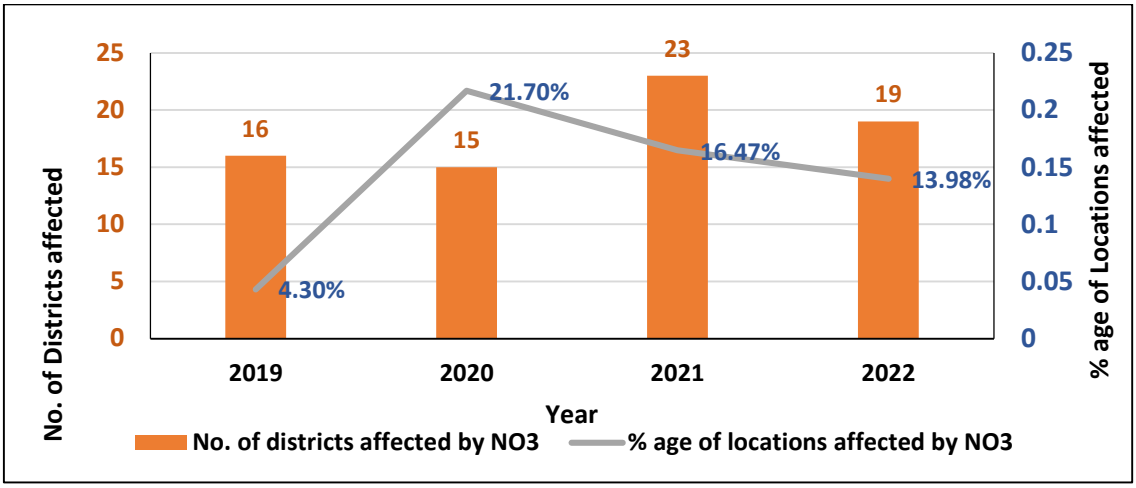

Figure 9 -Trend of Nitrate parameter in the Chhattisgarh State during last four years (2019-2022)

Districts with the locations where Nitrate concentration in the ground water has been found above the maximum permissible limits (>45 mg/l) are presented in Table - 9.

Table 9 - Locations with Nitrate concentration (>45 mg/l) in the ground water of Chhattisgarh State.

Districts	Locations
Balod	Armurkasa, chichalgondi
Balodabazar	Darchura, Udela
Balrampur	Bhadar, Karji, Wadrafnagar
Bastar	Pharasgaon, Dahikonga
Bemetra	Saja
Bilaspur	Piperkhuti, Khaira, Pandri (Dhanwari Posa), Surada, Jaroundha, Udaypur i
Dhamtari	Mega
Durg	Khati, Khurmuri.1(new well), Jeora, Ahiwara, Nahalda, Achholi, Narratola, Jeora-sirsa, Kachandur, Selud, Gunderdehi, Bodal, Karela, Khurdmudi, Marra, Motipur, Sikola, Zhit, Gatapar
Gariyabandh	Baruka, Fingeshwar, Kanekera, Kopra, Panduka
Janjgir-Champa	Baloda, Dhardei
Jashpur	Durgapara, Pandripani, Sanna, Tapkara, Jashpurnagar, Rupsera, Ludeg, Kotba, Shabdmunda, Tangargaon, Kunkuri1, Bagh Bahar, Bangaon, Pathalgaon
Kawardha	Kapada, Kui
Koriya	Mansukha, podidih, Khadgaon, Tarabahara, kailashpur, Sonhat
Mahasamund	Jalki, Pasid, Badesara
Raigarh	Auranar, Boro, Sirsinga, Bhangari, Chaple, Farkanara, Laripani, Chiraipani, Gerwani, jamgaon (Basti), Mahapalli New, Amaghat, Gare, Gohri
Raipur	Ghivera, Kanki, Narra, Ranisagar, Godhi, Devri, Chrauda, Dharsinwa, Mandirhasud, Semoriya, Biladi, Chicholi, Kharora, Math, Tarpongi
Rajnandgaon	Narmada, Rampur, Chuikhadan, Dongargaon.1, Dongargarh-d, Ghortalab, Govindpur, Lal bhadurnagar, Khairagarh, Khursipar, Rangkathera, Salgapat, Anjora, Baghera, Bhaistara, (Bhatapara), Dewada, Patharathola
Surajpur	Parasrampur, Jaynagar
Surguja	Rajpurikhurd, Rajakatel, Pratapgarh, Udaipur

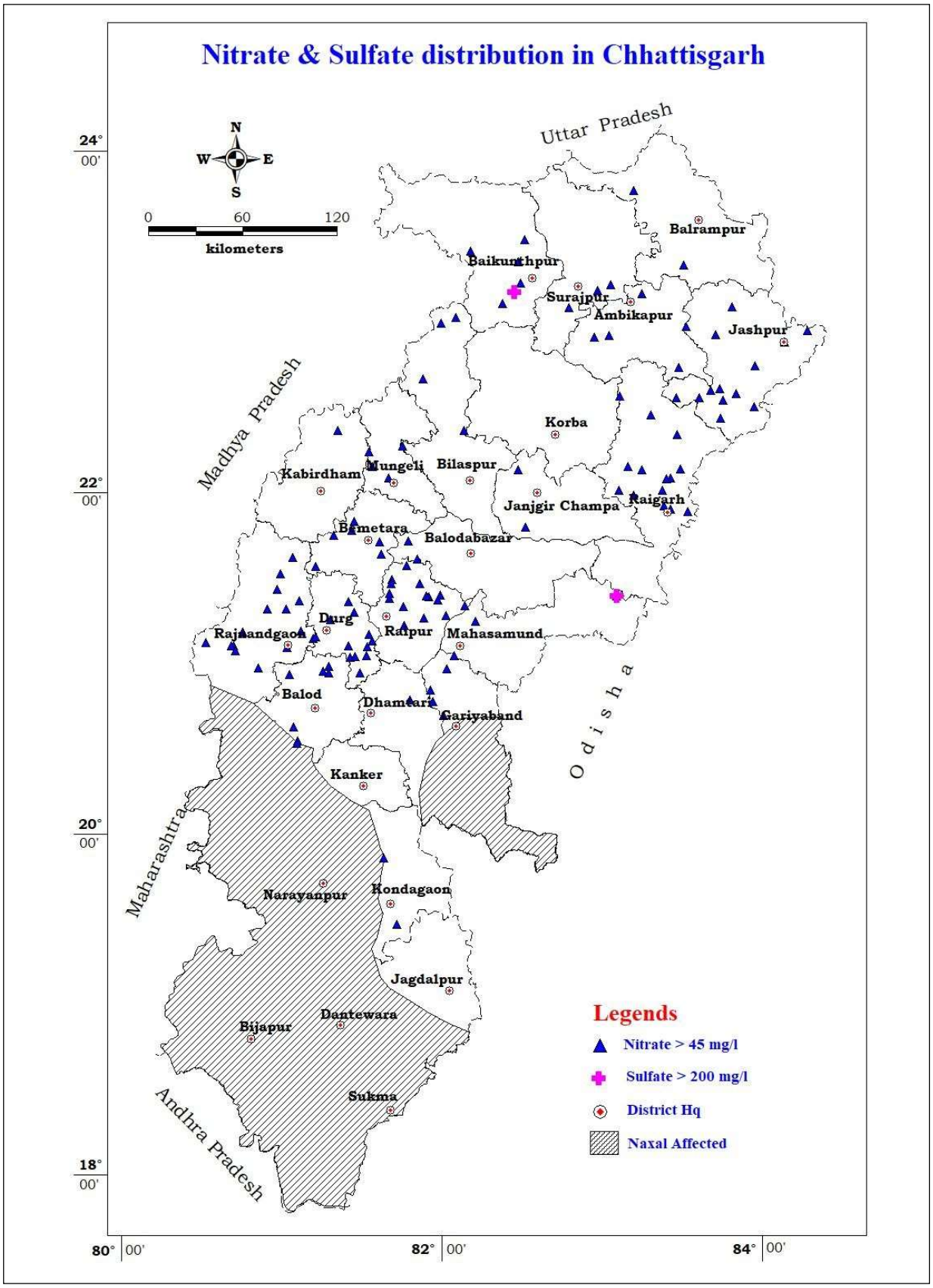

Figure 10 - Locations having Nitrate (>45 mg/l) and Sulphate (>400 mg/l) in Chhattisgarh State.

Remedial Measures for Nitrate - For removal of nitrate both non-treatment techniques like blending and treatment processes such as ion-exchange, reverse osmosis, biological denitrification and chemical reduction are useful. The most important thing is that neither of these methods is completely effective in removing all the nitrogen from the water.

a) Methods involving no treatment: In order to use any of these options the nitrate problem must be local-scale. Common methods are –

- Raw water source substitution
- Blending with low nitrate waters

This greatly reduces expenses and helps to provide safer drinking water to larger numbers of people.

b) Methods involving Treatment: They are as follows

- Adsorption/Ion Exchange
- Reverse Osmosis
- Electrodialysis
- Bio-chemical Denitrification **(**By using denitrifying bacteria and microbes)
- Catalytic Reduction/Denitrification (using hydrogen gas)

The mechanism of nitrate pollution in subsurface porous unconfined/confined aquifer is governed by complex biogeochemical processes. Apart from recharge conditions, groundwater chemistry may be impacted by the mineral kinetics of water-rock interactions. Consequently, suitable nitrate removal technologies should be selected. Nitrate is a very soluble ion with limited potential for co-precipitation or adsorption. This makes it difficult such as chemical coagulation, lime softening and filtration which are commonly used for removing most of the chemical pollutants such as fluoride, arsenic and heavy metals. According to King et al., 2012 nitrate treatment technologies can be classified in two categories i.e. nitrate reduction and nitrate removal options. Nitrate removal technologies involve physical processes that does not necessarily involve any alteration of the chemical state of nitrate ions. Bio-chemical reduction options aim to reduce nitrate ions to other states of nitrogen, e.g. ammonia, or a more innocuous form as nitrogen gas. In-situ bioremediation is also effectively used in used in nitrate treatment of contaminated groundwater. Reverse Osmosis, catalytic reduction and blending are effective methods for nitrate removal from groundwater. For nitrate removal, operating trans-membrane pressure of RO unit generally ranges from 20 to 100 bar, presented in Fig. 11.

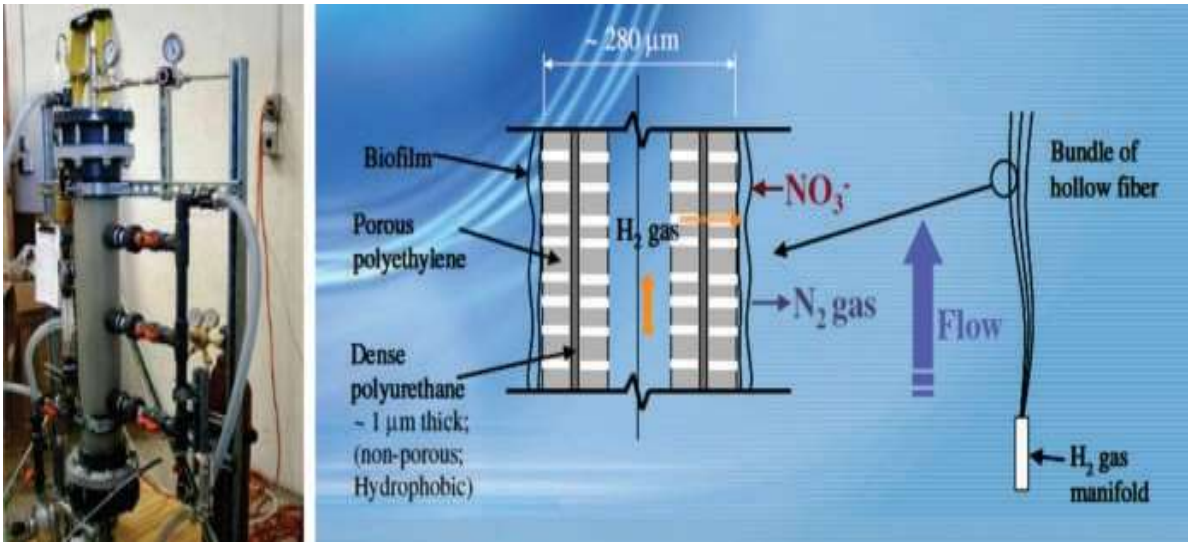

Figure 11 -Advanced Nitrate Reduction Hollow Fibre Membrane Reactor (Source: Hand Book for Drinking Water Treatment, JJM, Ministry of Jal Shakti, Gov. of India)

5.1.7. Fluoride (F^-)

Fluoride occurs as fluorspar (fluorite), rock phosphate, triphite, phosphorite crystals etc., in nature. The common accessory minerals like Hornblende, Biotite and Muscovite. Chemical weathering leads to the breakdown of these minerals and add fluoride to ground water. At low concentrations fluoride can reduce the risk of dental cavities. High values also cause dental carries and teeth decay. Very high value of fluoride in drinking water causes mottling of teeth and fluorosis. The concentration of fluoride in the state was observed from 0 to 1.8 with an average concentration of 0.4 mg/l. As per the BIS guidelines the acceptable and permissible limits for fluoride in drinking water are 1.0 mg/l and 1.5 mg/l, respectively.

93% (797 samples) of ground water having fluoride concentration is below the acceptable limit. In 5.5 % ground water (47 samples) it was observed between the acceptable and permissible range (1.0-1.5 mg/l) and only in 1.7% (16 samples) of ground water it is above the permissible limit (>1.5 mg/l). The Locations having Fluoride Concentration >1.5 mg/L in Chhattisgarh State is presented in Table-9 and Fig. 12.

Table 10 - Locations having F content >1.5 mg/l in the groundwater of Chhattisgarh.

Sr.	District	Block	Location	Long	Lat	F in mg/l
1	Balodabazar	Bilaigarh	Tundri	82.6434	21.6493	1.5
2	Dhamtari	Sihawa (Nagri)	Banspani	81.7917	20.3667	1.5
3	Surajpur	Surajpur	Deonagar	82.80333	23.24	1.5
4	Jashpur	Jashpur	Patratoli	84.1172	22.7444	1.5
5	Raigarh	Dharmajaigarh	Karigashi	83.1425	22.5147	1.5
6	Koriya	Manendragarh	Biharpur	82.24297	23.40261	1.5
7	Koriya	Manendragarh	Nagpur	82.31861	23.28167	1.5
8	Koriya	Baikunthpur	Tengni	82.73922	23.3167	1.5
9	Jashpur	Farsabahar	Jharmunda	83.8682	22.416	1.5
10	Surajpur	Surajpur	Majeera	82.9514	23.1482	1.5
11	Jashpur	Bagicha	Maini	83.5403	22.9806	1.5
12	Balrampur	Rajpur	Alkadih	83.4603	23.3908	1.5
13	Raigarh	Sarangarh	Kanakbira	83.13	21.461	1.6
14	Jashpur	Pathalgaon	Palidih	83.5069	22.5581	1.6
15	Jashpur	Kunkuri	Raikera (Kunkuri)	84.025	22.7708	1.6
16	Surajpur	Bhaiyathan	Chainpur	82.85205	23.38571	1.8

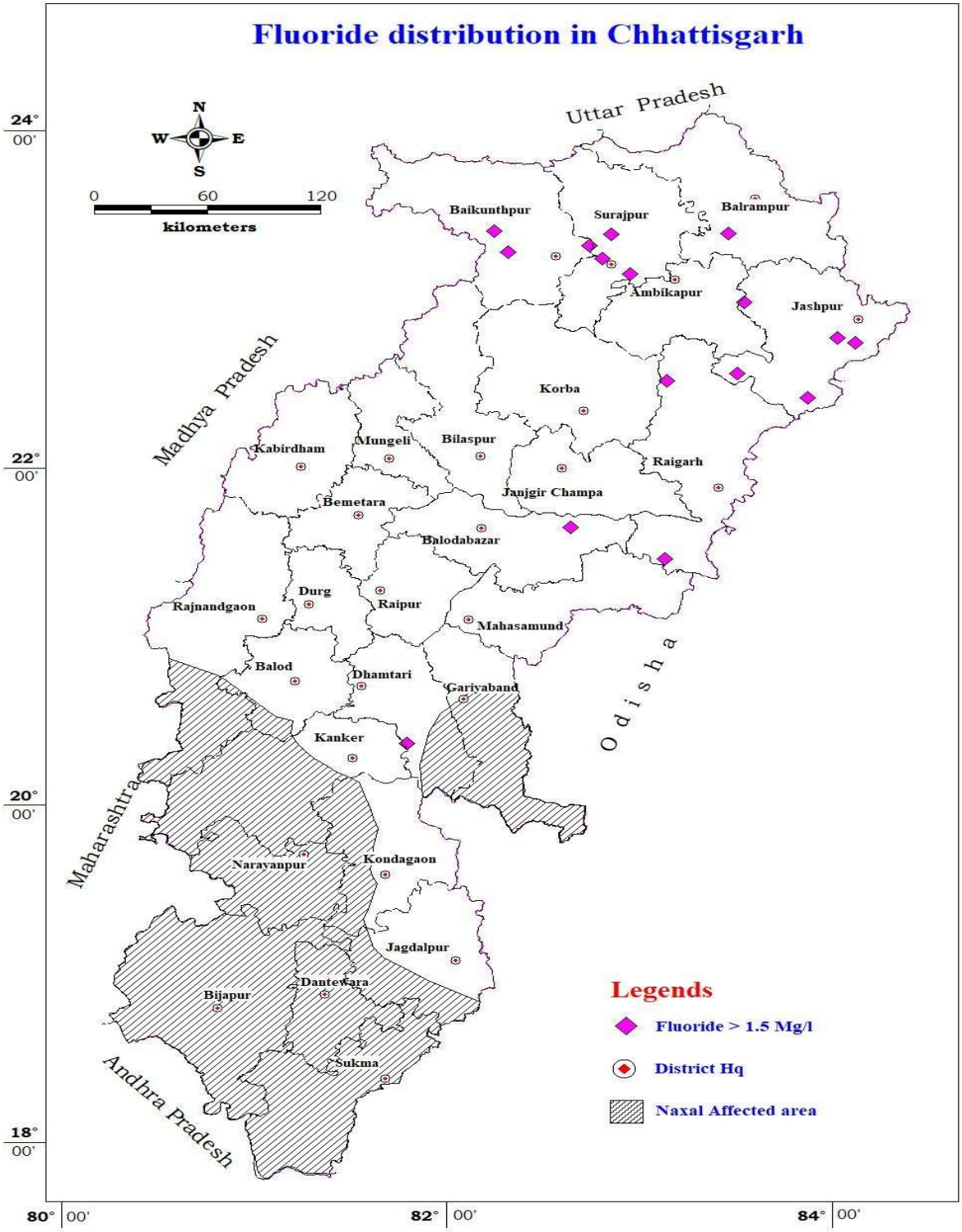

Figure 12 – Locations having Ffluoride Concentration >1.5 mg/L in Chhattisgarh State.

Trend on Fluoride - Fluorine is the thirteenth most common element in Earth's crust at 600–700 ppm (parts per million) by massThe occurrence of fluoride in groundwater is mainly due to weathering and leaching of fluoride bearing minerals from rocks and sediments. To assess the trend of ground water pollution due to geogenic contamination, the percentage of well exceeds the permissible limit of 1.5mg/L for the period of 2017 to 2022 were compared and

presented in the Table- 9 and Fig. - 13 and observed that the percentage of samples exceed the permissible limit of fluoride 1.5 mg/L were between 1.35 and 2.20% and no significant trend was noticed. The number of wells monitored in the year 2020 and 2021 is comparatively less due to COVID pandemic situation. Trend on water quality for fluoride was prepared for the state of Chhattisgarh is presented as follows.

Table 11 -Percentage of wells Exceed F >1.5 mg/l during the period of 2017-2022

Year	No. of districts affected by F	No. of locations affected by F	Total Number of samples analysed	% age of locations affected by F
2017	7	13	958	1.35%
2018	8	16	939	1.70%
2019	11	16	917	1.74%
2020	5	13	590	2.20%
2021	9	17	856	1.98%
2022	7	16	858	1.86%

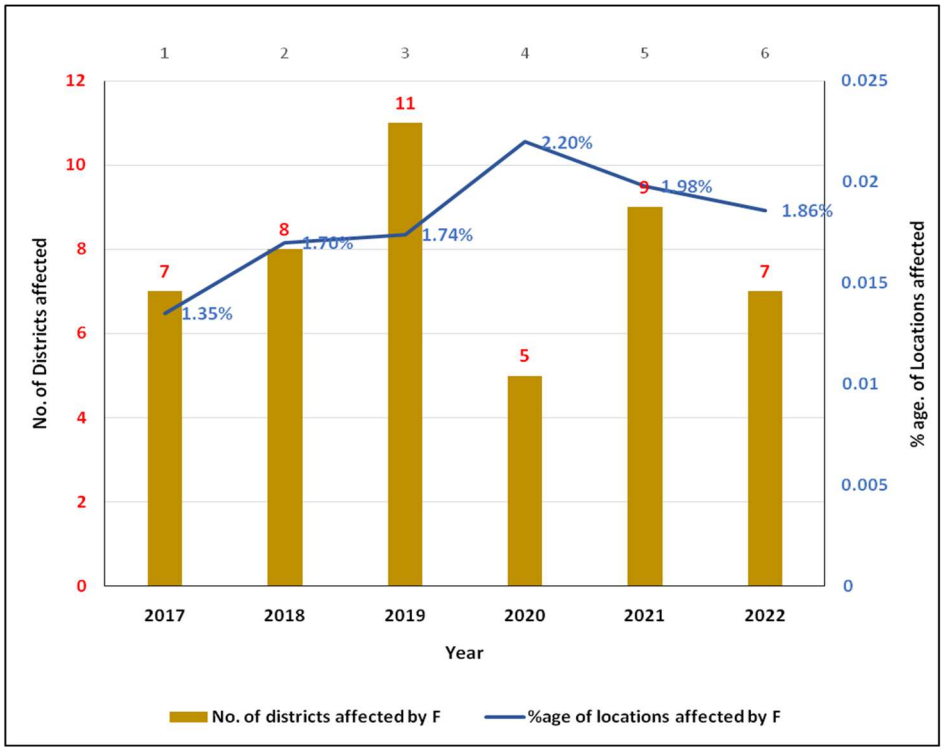

Figure 13 -Trend of Fluoride in ground water of Chhattisgarh during last six years (2017-2022)

Remedial Measures for Fluoride - The analysis of these samples gives the status of Fluoride and removal technology is summarized in table 1. Basically, three technicians have been applied for de- fluoridation discussed as below. First one is installation of defluorination column in the discharge head of the hand pump. The column is filled with activated alumina which adsorbed the fluoride.

The second technique of defluorination is Electro-de fluoridation technique. The basic principle of the process is the adsorption of fluoride with freshly precipitated aluminum hydroxide, which is generated by the anodic dissolution of aluminum or its alloys, in an electrochemical cell. The fluoride contaminated water is stored in a tank and by Electro-de fluoridation method fluoride is removed from water and it is supply for drinking purpose. In few locations reverse osmosis is also used as an effective technique for the removal of fluoride. The fluoride remedial measures broadly adopted are ex-situ techniques. They can be classified into three major categories.

A. **Adsorption and ion exchange** - This technique functions on the adsorption of fluoride ions onto the surface of an active agent such as activated alumina, red mud, bone char, brick pieces column, mud pot and natural adsorbents where fluoride is removed by ion exchange or surface chemical reaction with the solid bed matrix.

    i. **Activated alumina:** Activated alumina is a highly porous aluminium oxide exhibiting high surface area. Alumina has a high preference for fluoride compared to other anionic species, and hence is an attractive adsorbent. The crystal structure of alumina contains cation lattice discontinuities giving rise to localized areas of positive charge which makes it attract various anionic species. It also does not shrink, swell, soften nor disintegrate when immersed in water. The maximum absorption capacity of activated alumina for fluoride is found to be 3.6 mg F/g of alumina.

    ii. **Ion-Exchange resins:** Synthetic chemicals, namely, anion and cation exchange resins have been used for fluoride removal. Some of these are Polyanion (NCL), Tul-sion A - 27, Deacedite FF (IP), Amberllte IRA 400, LewatitMIH - 59, and AmberliteXE - 75. These resins have been used in chloride and hydroxy form. The fluoride exchange capacity of these resins depends upon the ratio of fluoride to total anions in water.

B. Coagulation-precipitation - Precipitation methods are based on the addition of chemicals (coagulants and coagulant aids) and the subsequent precipitation of a sparingly soluble fluoride salt as insoluble. Fluoride removal is accomplished with separation of solids from liquid. Aluminium salts (eg. Alum), lime, Poly Aluminium Chloride, Poly Aluminium Hydroxy sulphate and Brushite are some of the frequently used materials in defluorination by precipitation technique. The best example for this technique is the famous Nalgonda technique.

    i. Nalgonda Technique - Nalgonda technique involves addition of Aluminium salts,

lime and bleaching powder followed by rapid mixing, flocculation, sedimentation, filtration and disinfection. It is opined that this technique is preferable at all levels because of the low price and ease of handling, is highly versatile and can be used in various scales from household level to community scale water supply.

The Nalgonda technique can be used for raw water having fluoride concentration between 1.5 and 20 mg/L and the total dissolved solids should be <1500 mg/L, and total hardness < 600 mg/L. The alkalinity of the water to be treated must be sufficient to ensure complete hydrolysis of alum added to it and to retain a minimum residual alkalinity of 1 - 2 meq/L in the treated water to achieve a pH of 6.5 - 8.5 in treated water. Several researchers have attempted to improve the technique by increasing the removal efficiency of fluoride using Poly Aluminium Chloride (PAC) and Poly Aluminium Hydroxy Sulphate (PAHS).

C. **Membrane techniques -** Reverse osmosis, nanofiltration, dialysis and electro dialysis are physical methods that have been tested for defluoridation of water. Though they are effective in removing fluoride salts from water, however, there are certain procedural disadvantages that limit their usage on a large scale.

5.1.8. Total hardness

Hardness is caused by multivalent metallic cations. Such ions are capable of reacting with soap to form precipitates and with certain anions present in the water to form scale. The principal causing cations ar divalent cations, calcium, magensium, strontium, ferrous, and manganous ions. These cations plus the most important anions with which are associates, bicarbonate, sulphate and chloride in the order of their relative abudance in natural waters. The effect of hardness is Scale in utensils and hot water system in boilers etc. soap scum's Sources are Dissolved calcium and magnesium from soil and aquifer minerals containing limestone or dolomite. The total hardness value in ground water of Chhattisgarh varies from 15 mg/l to 1105 mg/l with an average value of 196 mg/l. Only in 1.6 % (14 samples) of the ground water having total hardness above the BIS maximum permissible limit (>600 mg/l) and around 60.9 % (521 samples) of the ground water having total hardness is within the acceptable limit whereas in 37.5 % (322 samples) of the ground water it is found between the acceptable and permissible limit which indicates that ground water of Chhattisgarh is moderately to hard in nature.

Trend on Total Hardness - Hardness in the water can result in abnormal cloudiness and scale formation. The hardness in water is derived largely from contact with the soil and rock formations. Total hardness is a measurement of the total mineral content in the water. Total hardness is predominantly caused by cations such as calcium and magnesium and anion such as bicarbonate and sulphate. Total hardness is expressed as $CaCO_3$ in mg/L. The percentage of wells with total hardness more than 600 mg/l for the period of 2017 to 2022 were compared and observed that the percentage of samples exceed the permissible limit of total hardness (>

600 mg/L) were ranging between 0.7 – 2.5 % and no significant trend was noticed, presented in Table – 10 and Fig.-14.

Table 12 -Percentage of wells Exceed TH >600 mg/l during the period of 2017-2022

Year	No. of districts affected by TH	No. of locations affected by TH	Total Number of samples analysed	% age of locations affected by TH
2017	3	7	958	0.70%
2018	7	23	939	2.40%
2019	7	17	917	1.85%
2020	7	14	590	2.37%
2021	10	21	856	2.50%
2022	8	14	858	1.63%

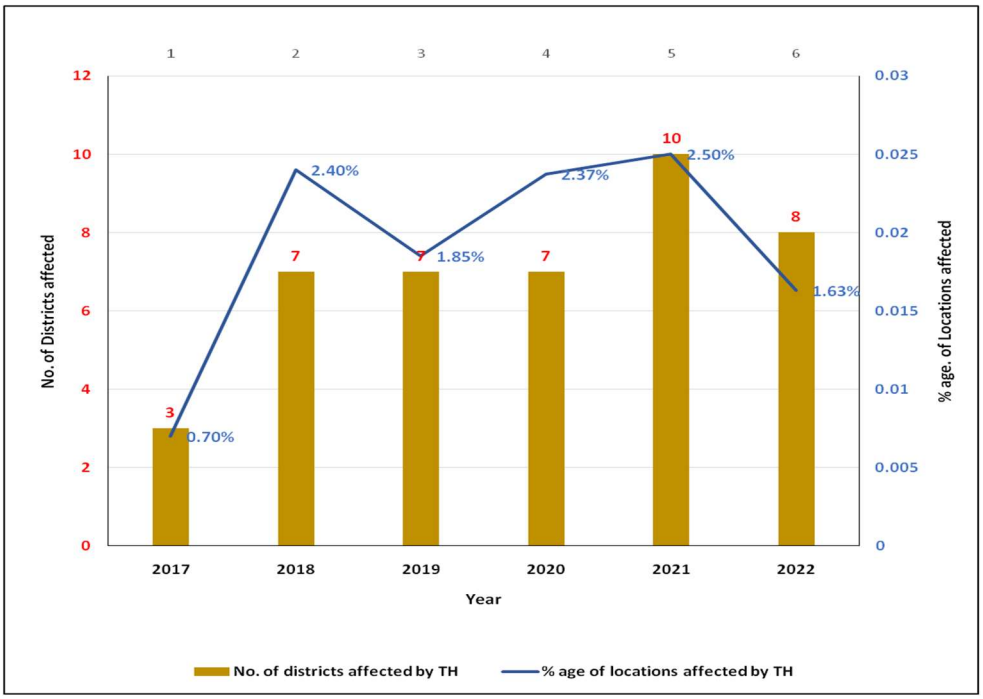

Figure 14 -Trend of Total Hardness in ground water of chhattisgarh during last six years (2017-2022)

Removal of Total hardness - Hardness in water is caused by calcium and magnesium ions resulting from water coming in contact with geological formations. The calcium and magnesium ions from solutions are removed when treated with lime (CaO) and soda ash (Na_2CO_3) by split treatment softening. This treatment consists of dividing the raw water into two portions for softening in a two-stage system. The larger portion is given excess lime treatment in the first stage by using a flocculator-clarifier, or in-line mixing and sedimentation basins. Soda ash is added to the second stage where the split flow is blended with the treated water. Excess lime used to force precipitation of magnesium in the first stage now reacts with the calcium hardness that was by passed around lime treatment. Thus, the excess lime is used

in the softening process instead of being wasted at the expense of carbon dioxide neutralization. In addition, lime treatment has the bacterial action, removal of iron, and aid in clarification of turbid surface waters.

5.1.9. Calcium (Ca^{2+})

Calcium (Ca^{2+}) is the fifth most abundant natural element. It enters the freshwater system through the weathering of rocks, especially limestone (marble, calcite, dolomite, gypsum, fluorite gypsiferous shale, apatite also contributes) and from the soil through seepage, leaching and runoff. The calcium content may range from zero to several hundred milligrams per litre, depending on the source and treatment of the water. Calcium (Ca^{2+}) was the predominant ion in the ground water of the state. It is essential for nervous and muscular system, cardiac function and in coagulation of blood Excess of Calcium results in formation of stones in Kidney and urinary tract.

The concentration of calcium in the state ranges from 2.0 to 422 mg/l with an average concentration of 48.9 mg/l. In 19.8 % (170 samples) of the ground water samples the calcium concentration was found within the acceptable limits (<75 mg/l) and only in 79 % (676 samples) of the ground water samples it was obtained between the acceptable and permissible limits (75 – 200 mg/l) and 1.2 % (11sample) samples of ground water above permissible limit.

5.1.10. Magnesium (Mg^{2+})

In the solar system, magnesium is the 8th most abundant constituent. Ignesous rocks contain average of1.76% magnesium. This is mainly confined to olivine, pyroxenes, amphiboles and dark coloured micas. In sedimentary rocks the highest percentage viz. 4.53% is the evaporates, while shales contain 1.64% and sandstones 0.81%. Mg-chlorites, dolomites and Mg-calcites are the most important in the geochemistry of magnesium. The concentration of magnesium in the state ranges from 1.2 to 94.7 mg/l with an average concentration of 18.2 mg/l. In 24 % (200 samples) of the ground water samples magnesium concentrations within the acceptable limit (<30 mg/l) and 76.5 % (656 samples) between acceptable and permissible limit and in one ground water it is belongs to Jhalam of Bemetra district was observed above the acceptable limit.

5.1.11. Sodium (Na^{+})

Sodium is the most abundant of the alkali elements in the cosmos and the earth in terms of both atomic abundance and weight percent. It is the sixth most abundant element on Earth and is widely distributed in soils, plants, water and foods. Most of the world has significant deposits of sodium-containing minerals, most notably sodium chloride (salt). Under the physical conditions prevailing in the earth's crust most of the sodium occurs in the feldspars, mica, amphiboles and pyroxene. The amounts of the sodium held in the evaporate sediments and in solution in the ocean form an important part of the total. The sodium concentration in the state varies from 0.0 mg/l to 265 mg/l with an average value of 34.1 mg/l. In water, sodium has no smell but it can be tasted by most people at concentrations of 200 milligrams per liter (mg/L) or more. The concentration of sodium affects the efficiency of the soil.

5.1.12. Potassium (K^+)

Potassium is an element commonly found in soils and rocks. In water, potassium has no smell or colour, but may give water a salty taste. Sources of potassium include weathering and erosion of potassium-bearing minerals, such as feldspar, leaching of fertilizer & sea water, in areas susceptible to saltwater intrusion is slightly less abundant than sodium in igneous rocks but in the sedimentary rocks it is far more abundant than sodium. Potassium concentration in the state varies from 0 mg/l to 80 mg/l with an average value of 2.9 mg/l.

5.1.13. Iron (Fe)

Iron is a common constituent in soil and ground water. It is present in water either as soluble ferrous iron or the insoluble ferric iron. Water containing ferrous iron is clear and colorless because the iron is completely dissolved. When exposed to air, the water turns cloudy due to oxidation of ferrous iron into reddish brown ferric oxide.

The concentration of iron in natural water is controlled by both physico-chemical and microbiological factors. It is contributed to groundwater mainly from weathering of ferruginous minerals of igneous rocks such as hematite, magnetite and sulphide ores of sedimentary and metamorphic rocks. The permissible Iron concentration in ground water is 1.0 mg/L as per the BIS Standard for drinking water. The occurrences of iron in ground water beyond permissible limit (> 1.0 mg /litre) have been shown on the maps as point sources presented in Fig 15. The concentration of iron in ground water of Chhattisgarh state was observed from <0.1 to 26.37 mg/l with an average of 1.82 mg/l. In 338 locations iron concentrations is above the permissible limit (> 1.0 mg/l) are summarised in **Table-6**. A very high concentration of iron was observed at Batati Junction (26.37 mg/l) of Korba district. Distribution of iron in the ground water of Chhattisgarh is indicates that in 35% (211 locations) of ground water having iron contents >1.0 mg/l whereas in 21% (127 locations) of the ground water it is recommended between 0.3 to 1.0 mg/l and rest of the locations it is below the BIS limit.

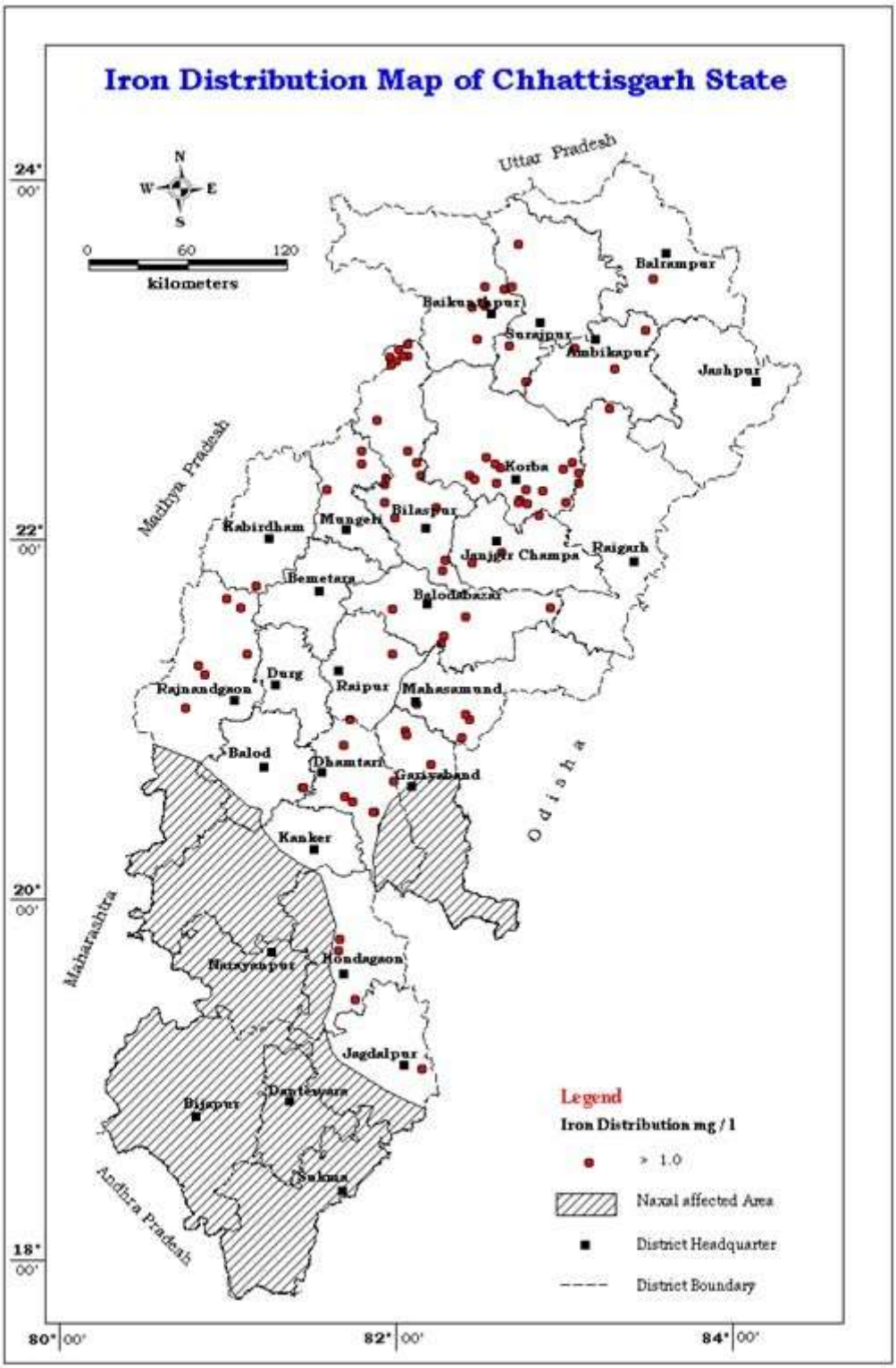

Figure 15 - Locations having Iron Concentration >1.0 mg/L in Chhattisgarh State.

Table 13 - Location of higher Iron content (>1.0 mg/l) in the ground water of Chhattisgarh State.

Sr.	District	Block	Location	Long	Lat	Source	Fe
1	Janjgir-Champa	Nawagarh	Dhurkot	82.62	21.9339	HP	1.0
2	Bilaspur	Gaurela (pendrarod) - 1	Piperkhuti	81.8833	22.6639	HP	1.0
3	Gariyabandh	Chhura	Amethi	82.0499	20.9361	HP	1.1
4	Rajnandgaon	Dongargaon	Chikohola	80.7428	21.0678	HP	1.1
5	Bilaspur	Takhatpur	Neora	81.93167	22.2125	HP	1.1
6	Janjgir-Champa	Shakti	Saliabhata	82.8477	22.1368	HP	1.1
7	Bilaspur	Masturi	Panchpedi	82.27	21.82806	DW	1.1
8	Mungeli	Lormi	Patera	81.93167	22.30944	HP	1.2
9	Bilaspur	Masturi	Malhar	82.2858	21.8914	HP	1.2
10	Gariyabandh	Gariyabandh	Malgaon	81.98072	20.66226	HP	1.2
11	Korba	Kartala	Nanbirra	82.86556	22.27083	HP	1.2
12	Janjgir-Champa	Pamgarh	vyasnagar	82.4509	21.8717	HP	1.3
13	Durg	Gurur	Jagtara	81.4425	20.62222	HP	1.3
14	Balodabazar	Simga	suhela	81.9739	21.6158	HP	1.4
15	Balodabazar	Kasdol	Temri	82.4113	21.5758	HP	1.4
16	Surajpur	Surajpur	Narayanpur	82.6353	23.39573	HP	1.4
17	Balodabazar	Kasdol	Aouri	82.26667	21.42083	HP	1.4
18	Surajpur	Pratappur	Gonda	83.05833	23.0629	HP	1.5
19	Korba	Pali	Dhaurabhata	82.2334	22.1831	HP	1.6
20	Raipur	Arang	Ghivera	81.9752	21.3691	HP	1.6
21	Dhamtari	Kurud	Kondapar	81.725	21.0042	HP	1.6
22	Korba	Korba	Bhaisma (Anjoripali)	82.7668	22.2775	HP	1.6
23	Kondagaon	Pharasgaon	Kulhadhgaon	81.661	19.7817	HP	1.7
24	Balodabazar	Kasdol	Mudhipar	82.28333	21.46667	HP	1.7
25	Korba	Kartala	Sargundia	82.73	22.22694	HP	1.7
26	Ranandgaon	Chuikhadan	Pailimeta	80.9869	21.6716	HP	1.8
27	Balodabazar	Bilaigarh	Sarsiwa	82.9167	21.625	HP	1.8
28	Kawardha	Sahaspur lohara	BijaBairangi	81.16589	21.74189	HP	1.8
29	Koriya	Sonhat	kailashpur	82.47647	23.11608	HP	1.9
30	Korba	Katghora	Gajra	82.61848	22.40498	HP	1.9
31	Mahasamund	Mahasamund	Lavra Khurud	82.1169	21.0886	HP	1.9
32	Korba	Korba	Barpali (Junadhi)	82.7259	22.2063	HP	1.9
33	Korba	Korba	Mudiyanar	82.59049	22.31415	HP	2.0
34	Bilaspur	Takhatpur	Khamharia1	81.9875	22.1222	HP	2.0
35	Korba	Kartala	Jogipali	83.001	22.2057	HP	2.0
36	Bastar	Kondagaon	Joba	81.7552	19.4449	HP	2.1
37	Korba	Korba	Shuklakhar	82.5842	22.422	HP	2.2
38	Korba	Katghora	Lakhanpur	82.53267	22.45729	HP	2.2
39	Bilaspur	Belgahana	Konchua	81.5846	22.2839	HP	2.4
40	Rajnandgaon	Chhuikadhan	Narmada	81.07236	21.62162	HP	2.5
41	Korba	Pali	Nunera	82.43	22.3561	HP	2.5
42	Surajpur	Bhaiyathan	Samouli (Bhayathan)	82.76521	22.8815	HP	2.5
43	Bilaspur	Kota	Saraipalli	81.9361	22.3417	HP	2.5
44	Bilaspur	Kota	Khaira	82.1407	22.3624	DW	2.5
45	Rajnandgaon	Khairagarh	Talagaon	80.8199	21.3019	HP	2.6
46	Bilaspur	Kota	Saudhakhurd	82.0669	22.4972	HP	2.6
47	Bilaspur	Kota	Nawapara	82.12183	22.42917	BW	2.6
48	Bilaspur	Marwahi	Marwahi	82.0694	23.02	HP	2.9
49	Korba	Pali	Nonbirra	82.46167	22.33694	HP	2.9
50	Gariyabandh	Fingeswar	Sarkada	82.05941	20.9143	HP	2.9
51	Surguja	Sitapur	Pratapgarh	83.47639	23.1649	HP	2.9
52	Bilaspur	Marwahi	Chchgohana	82.0365	23.01962	HP	3.0

Sr.	District	Block	Location	Long	Lat	Source	Fe
53	Bilaspur	Marwahi	Tikthi	82.0694	23.0844	HP	3.1
54	Bilaspur	Marwahi	Tendumuda	82.01222	23.05806	HP	3.1
55	Rajnandgaon	Dongargarh	Dhara	80.8594	21.255	HP	3.3
56	Bilaspur	Marwahi	Pandri (Dhanwari Posa)	81.99552	22.99228	HP	3.5
57	Rajnandgaon	Khairagarh	Rangkathera	81.1125	21.3672	HP	4.4
58	Surajpur	Premnagar	Fulkona	82.6672	23.08056	HP	4.6
59	Bilaspur	Marwahi	Seoni	81.9583	23.0125	HP	4.6
60	Gariyabandh	Chhura	Kaseru	82.12333	20.64861	HP	4.7
61	Dhamtari	Sihawa (Nagri)	Jabarra	81.9858	20.4956	HP	5.0
62	Dhamtari	Sihawa (Nagri)	Dugli	81.8708	20.4917	HP	5.0
63	Dhamtari	Nagri	Kouhabahara	81.8575	20.4916	HP	5.1
64	Bilaspur	Pendra road	Dharhar	81.9642	22.9761	HP	5.1
65	Surajpur	Ramanujnagar	Ramanuj nagar	82.725	23.64778	HP	5.7
66	Dhamtari	Sihawa (Nagri)	Dorgardula	81.9111	20.4056	HP	6.0
67	Mahasamund	Bagbahara	Palsipani	82.3833	20.9042	HP	6.4
68	Dhamtari	Kurud	Aouri	81.687	20.857	HP	6.5
69	Dhamtari	Nagri	Farsiya	82.03526	20.32213	HP	6.5
70	Mungeli	Lormi	Tilaidabra	81.795	22.49611	HP	6.6
71	Mahasamund	Bagbahara	Maulimuda	82.4311	21.0055	HP	6.8
72	Mungeli	Lormi	Bindabal	81.795	22.42667	HP	6.9
73	Korba	Kartala	Barpali	82.7733	22.2	HP	6.9
74	Mahasamund	Bagbahara	Bagbahara	82.4083	21.0333	BW	7.4
75	Korba	Korba	Kolga	82.99268	22.39665	HP	7.4
76	Surguja	Ambikapur	Parsa	83.2675	22.73333	HP	7.5
77	Korba	Korba	Jilga	83.0843	22.3713	HP	7.5
78	Koriya	Khadgawan	Banjaridand	82.4497	23.29111	HP	8.1
79	Korba	Kartala	Kudmura	83.07935	22.31913	HP	8.2
80	Balrampur	Balrampur	Pasta	83.525	23.45	HP	8.3
81	Korba	Podi-Uproda	kurtha (new)	22.9283	82.5397	HP	8.8
82	Bastar	Pharasgaon	Lanjora	81.6542	19.7208	HP	9.7
83	Korba	Korba	Basin	83.0448	22.42937	HP	10.4
84	Surajpur	Bhaiyathan	Dalabahara (Bhaskar)	82.68618	23.40712	HP	11.5
85	Koriya	Baikunthpur	Ghugra	82.5237	23.30122	HP	12.6
86	Koriya	Baikunthpur	Khatgori	82.52639	23.4103	HP	12.9
87	Bastar	Jagdalpur	Markel	82.1472	19.0639	HP	13.6
88	Dhamtari	Dhamtari	Shankarda	81.4492	20.622	HP	17.8
89	Gariyabandh	Chhura	Kharkhara	82.20333	20.75583	HP	18.3
90	Dhamtari	Sihawa (Nagri)	Keregaon	81.7375	20.5486	HP	18.7
91	Surguja	Mainpat	Nagdand	83.29167	22.95222	HP	20.0
92	Dhamtari	Dhamtari	Khadadaha	81.6933	20.5733	HP	38.6
93	Koriya	Sonhat	Sonhat	82.51889	23.31389	HP	58.7

Remedial Measures for Iron –

A. **Oxidation and filtration-** Before iron and manganese can be filtered, they need to be oxidized to a state in which they can form insoluble complexes. Ferrous iron (Fe2+) is oxidized to ferric iron (Fe3+), which readily forms the insoluble iron hydroxide complex Fe (OH)3. Manganese (Mn2+) is oxidized to (Mn4+), which forms insoluble (MnO2). The common chemical oxidants in water treatment are chlorine, chlorine dioxide, potassium permanganate and ozone. The dose of potassium permanganate, however, must be carefully controlled. Too little permanganate will not oxidize all the iron and

manganese, and too much will allow permanganate to enter the distribution system and cause a pink color.

Ozone may be used for iron and manganese oxidation. Ozone may not be effective for oxidation in the presence of humic or fulvic materials. If not dosed carefully, ozone can oxidize reduced manganese to permanganate and result in pink water formation as well. Manganese dioxide particles, also formed by oxidation of reduced manganese, must be carefully coagulated to ensure their removal.

A low-cost method of providing oxidation is to use the oxygen in air as the oxidizing agent. Water is simply passed down a series of porous trays to provide contact between air and water. No chemical dosing is required. This method is not effective for water in which the iron is complexed with humic materials or other large organic molecules.

Oxidation and Filtration Method for Fe and Mn Removal from Ground Water In general, manganese oxidation is more difficult than iron because the reaction rate is slower. A longer detention time (10 to 30 minutes) following chemical addition is needed prior to filtration to allow the reaction to take place. Manganese greensand is by far the most common medium in use for removal of iron and manganese through pressure filtration. Greensand is a processed material consisting of nodular grains of the zeolite mineral glauconite. The material is coated with manganese oxide. The ion exchange properties of the glauconite facilitates the bonding of the coating. This treatment gives the media a catalytic effect in the chemical oxidation reduction reactions necessary for iron and manganese removal. This coating is maintained through either continuous or intermittent feed of potassium permanganate.

Anthra/sand (also iron-man sand) are other types of media available for removal of iron and manganese. They consist of select anthracite and sand with a chemically bonded manganese oxide coating.

Electromedia is a proprietary multi-media formulation which uses a naturally occurring zeolite and does not require potassium permanganate regeneration. Finally, macrolite, is a manufactured ceramic material with a spherical shape and a rough, textured surface. The principal removal mechanism is physical straining rather than contact oxidation or adsorption. Each medium has its advantages and disadvantages. Selection of a medium and oxidant should be based on pilot testing in which all necessary design criteria can be determined.

B. Ion Exchange- Ion exchange should be considered only for the removal of small quantities of iron and manganese because there is a risk of rapid clogging. Ion exchange involves the use of synthetic resins where a pre-saturate ion on the solid phase (the “adsorbent,” usually sodium) is exchanged for the unwanted ions in water. One of the major difficulties in using this method for controlling iron and manganese is that if any oxidation occurs during the process, the resulting precipitate can coat and foul the media. Cleaning would then be required using acid or sodium bisulfate.

C. **Combined Photo-Electrochemical (CPE) Method -**Different processes, such as electrochemical (EC), photo (UV), and combined photo-electrochemical (CPE) methods are used. A cell containing aluminium electrode as anode, graphite electrode as cathode and UV lamp are used and filled with waste water enriched with iron and manganese as an electrolytic solution. A limited quantity of sodium chloride salt is added to enhance the electric conductivity through the solution. A comparison between different methods was undertaken to evaluate the applied conditions and the efficiency of Fe and Mn removal at different times and initial concentrations. The results revealed that CPE method was the best choice for the simultaneous removal of both iron and manganese in a short time < 10 min.

D. **Sequestration-** Sequestration is the addition of chemicals to groundwater aimed at controlling problems caused by iron and manganese without removing them. These chemicals are added to groundwater at the well head or at the pump intake before the water has a chance to come in contact with air or chlorine. If the water contains less than 1.0 mg/L iron and less than 0.3 mg/L manganese, using polyphosphates followed by chlorination can be an effective and inexpensive method for mitigating iron and manganese problems. No sludge is generated in this method. Below these concentrations, the polyphosphates combine with the iron and manganese preventing them from being oxidized. Any of the three polyphosphates (pyrophosphate, tripolyphosphate, or metaphosphate) can be used. Applying sodium silicate and chlorine simultaneously has also been used to sequester iron and manganese. However, while this technique is reliable in the case of iron treatment, it has not been found to be effective in manganese control.

5.1.14. Arsenic (As)

Arsenic has been recognized as a toxic element and is considered a human health hazard. Arsenic is a naturally occurring trace element found in rocks, soils and the water in contact with them.

Arsenic is one of the water quality issues in Chhattisgarh. To demark the area of arsenic an intense study was taken up and 246 acidified ground water samples were collected in and around Ambagarh Choki block of Rajnandgaon. All the samples were analysed by the standard procedure (hydride generator combined with AAS) given in APHA. The chemical analysis results revel that at 11 wells of Ambagarh Chouki block of Rajnandgaon district have Arsenic contents beyond the permissible limit set by BIS (>0.01 mg/l) for the drinking purpose. Arsenic contamination confined to N-S trending Dongargarh-Kotri ancient rift zone exclusively in volcanic rocks from Rhyolite, Rhyolite-tuff, Tuffite, Gabbro, Amphibolite, Basalt, Andesite and Granite. Arsenic is associated with pyrite mineral under the oxidizing condition releases into the ground water. The geographical distribution of high arsenic ground water is sporadic in the area. A total of five villages are found severely are Kaudikasa > Joratarai > Sonsaytola > Muletitola > Jadutola respectively in order of abundance. Even in the worst affected village in Kaudikasa not all groundwater abstraction structures are found contaminated with high values

of arsenic (> 0.01mg/l). The occurrence of Arsenic in ground water is mainly in the aquifers up to 100 m depth. The deeper aquifers are free from Arsenic contamination. The hot spots for Arsenic in ground water of Chhattisgarh state is presented in Fig. 16. The details of the locations where arsenic contamination exceed the limit of 0.01 mg/L (10 ppb) are given in the Table -11.

Table 14-Locations having Arsenic concentration >10 μg/l in ground water of Chhattisgarh.

District	Block	Location	Long	Lat	As in μg/l
Rajnandgaon	Ambagarh Chowki	Joratarai-3	80.734	20.8452	95
Rajnandgaon	Ambagarh Chowki	Kaudikasa-7	80.7377	20.7178	90
Rajnandgaon	Ambagarh Chowki	Kaudikasa	80.7347	20.7228	71
Rajnandgaon	Ambagarh Chowki	Kaudikasa	80.7342	20.7222	53
Rajnandgaon	Ambagarh Chowki	Sonsai Tola-6	80.6997	20.793	53
Rajnandgaon	Ambagarh Chowki	Sonsai Tola-4	80.6998	20.7944	50
Rajnandgaon	Ambagarh Chowki	Sonsai Tola-5	80.6994	20.7965	40
Rajnandgaon	Ambagarh Chowki	Kodu Tola-2	80.6918	20.8056	22
Rajnandgaon	Ambagarh Chowki	Meregaon-2	80.7499	20.7944	21
Rajnandgaon	Ambagarh Chowki	Jadu Tola-2	80.7129	20.8517	17
Rajnandgaon	Ambagarh Chowki	Bharri Tola-2	80.6971	20.7077	10

Remedial Measures for Arsenic -

A. **Precipitation processes-** includes coagulation/filtration, direct filtration, coagulation assisted microfiltration, enhanced coagulation, lime softening, and enhanced lime softening. Adsorption co-precipitation with hydrolysing metals such as Al^{3+} and Fe^{3+} is the most common treatment technique for removing arsenic from water. Sedimentation followed by rapid sand filtration or direct filtration or microfiltration is used to remove the precipitate. Coagulation with iron and aluminium salts and lime softening is the most effective treatment process. To improve efficiency of this method, a priory oxidation of As (III) to As (V) is advisable. Hypochlorite and permanganate are commonly used for the oxidation. Atmospheric oxygen can also be used, but the reaction is very slow. The major techniques based on this process include; Bucket treatment unit, Fill and draw treatment unit, Tubewell-attached arsenic treatment unit and Iron arsenic treatment unit.

B. **Adsorptive processes-** Adsorption on to activated alumina, activated carbon and iron/ manganese oxide based or coated filter media. Adsorptive processes involve the passage of water through a contact bed where arsenic is removed by surface chemical reactions. The activated alumina-based sorptive media are being used in Bangladesh and India. No chemicals are added during treatment and the process relies mainly on the active surface of the media for adsorption. Granular ferric hydroxide is a highly effective adsorbent used for the adsorptive removal of arsenate, arsenite, and phosphorous from natural water. In the Sono 3-Kolshi filter, used in Bangladesh and India zero valent iron fillings, sand, brick chips and wood coke are used as adsorbent to remove arsenic and other trace elements from groundwater.

C. **Ion-exchange processes-**This is similar to that of activated alumina, however, in this method the medium is synthetic resin of relatively well-defined ion exchange capacity. In these processes, ions held electrostatically on the surface of a solid phase are exchanged for ions of similar charge dissolved in water. Usually, a synthetic anion exchange resin is used as a solid. Ion exchange removes only negatively charged As (V) species. If As (III) is present, it is necessary to oxidise it.

D. **Membrane processes-** This includes nano-filtration, ultrafiltration, reverse osmosis and electrodialysis in which synthetic membranes are used for removal of many contaminants including arsenic. They remove arsenic through filtration, electric repulsion, and adsorption of arsenic-bearing compounds.

E. **Arsenic safe alternate aquifers -** This technique advocates tapping of safe alternate aquifers right within the affected areas. In India except at Rajnandgaon in Chhattisgarh state, the vast affected areas in the Gangetic Plains covering Bihar and Uttar Pradesh as well as Deltaic Plains in West Bengal is marked by multi-aquifer system. The sedimentary sequence is made up Quaternary deposits, where the aquifers made up of unconsolidated sands which are separated by clay/sandy clay, making the deeper aquifer/aquifers semi-confined to confined. The contamination is confined in the upper slice of the sediments, within 80 m and affecting the shallow aquifer system. At places, like Maldah district of West Bengal single aquifer exists till the bed rock is encountered at 70-120 m bgl.

   Detailed CGWB exploration, isotope and hydrochemical modeling carried out by CGWB along with other agencies like BARC has indicated that the deep aquifers (>100 m bgl) underneath the contaminated shallow aquifer, have been normally found as arsenic free. Long duration pumping tests and isotopic studies in West Bengal and Bihar have indicated that there is limited hydraulic connection between the contaminated shallow and contamination free deep aquifers and the ground water belong to different age groups having different recharge mechanisms. The deep aquifers in West Bengal, Bihar and Uttar Pradesh have the potential to be used for community-based water supply.

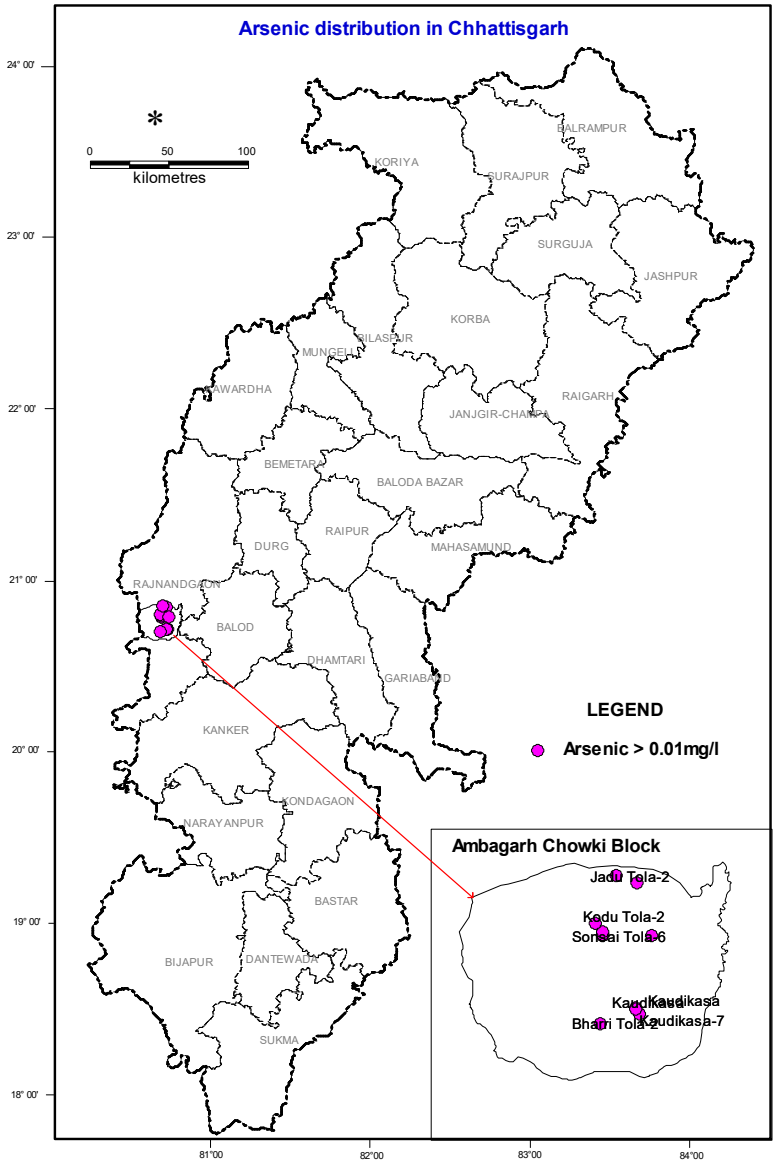

Figure 16 -Locations having Arsenic Concentration >0.01 mg/L in Chhattisgarh State.

5.1.15. Uranium

Uranium has been found in many rock types from volcanic to sedimentary. Uranium has both natural and anthropogenic source that could lead to the aquifer. Mainly due to oxidation reduction processes; it is leached from source rock containing high concentration of uranium, releases and precipitated in a host rock. In reducing condition, it may come into the water. The Hydrogeological characteristics as weathering, porosity of rocks, fault, fracture, permeability etc may control the uranium concentration in ground water. These are formed in the reducing conditions to cause the U to precipitate out of solution. Uranium is remobilized and precipitates adjacent to permeable fault and/or fracture zones. The uranium occurs with organic-rich marine-deposited phosphorites (within the apatitie) or in lignites, fly ash, the result of burning coal can increase the U concentration by burning of the carbon. Being a radioactive mineral, high uranium concentration can cause impact on water, soil and health

Uranium enters in human tissues mainly through drinking water, food, air and other occupational and accidental exposures. Intake of uranium through air and water is normally low, but in circumstances in which uranium is present in a drinking water source, the majority of intake can be through drinking water. Water with uranium concentration above the recommended maximum permissible concentration of 30 ppb (BIS, 10500:2012 revised in 2021) is not safe for drinking purposes as it can cause damage to internal organs, on continuous intake. Elevated uranium concentrations in drinking water have been associated with many epidemiological studies such as urinary track cancer as well as kidney toxicity.

In ores, uranium is found as uranite (UO_2^{2+}) and pitchblende ($U_3O_8^{2+}$) or in the form of secondary minerals (complex oxides, silicates, phosphates, vanadates). The chemical analysis result revels that in 09 locations uranium is recorded > 0.03 mg/l (30 ppb) i.e. above the recommended limit prescribed by the BIS for drinking purpose. These locations come under Kanker, Jashpur, Balod, Raighar, Jangjir-Champa, Bemetra and Bilaspur districts in Chhattisgarh State presented in Table -12. High uranium in ground water leads to renal problem finally converted in chronic kidney disease; affect the reproductivity, decline the bone growth as well as DNA and brain damage. The Uranium hot spots (>30 ppb) are presented in Fig. 17.

Table 15-Locations having the Uranium concentration > 0.03 mg/l in Chhattisgarh State.

Sr.	District	Block	Location	Long	Lat	U in mg/l
1	Kanker	Kanker	Kanker	81.49583	20.2791	0.039
2	Jashpur	Bagicha	Maini	83.5403	22.9806	0.030
3	Raigarh	Dharmajaigarh	KarraMara	83.3738	22.4739	0.038
4	Balod	Durg	Danganiya	81.2869	21.0117	0.038
5	Bemetara	saja	Mouhabhata	81.26	21.5997	0.064
6	Bilaspur	Marwahi	Kudwahi	81.98	22.8648	0.050
7	Bilaspur	Lormi	Pali(Lormi)	81.8353	22.2578	0.054
8	Bilaspur	Gaurela (Pendraroad-1)	Rupandand	81.89333	22.6975	0.035
9	Janjgir-Champa	Baloda	Baloda	82.4778	22.1333	0.057

Remedial Measures - Finding a remedy for the uranium contaminated groundwater effectively and thoroughly, has become need of day. Remediation technologies can be classified into physical, chemical and biological methods. Bioremediation is divided into plant and microorganism methods. Each method consists of both advantages and disadvantages and the appropriate mitigation techniques should be need based.

Adsorption has a high removal efficiency, but costs are also higher. The coagulation process is simple and comparatively economical, but the standard effluent concentration is hard to reach, so there is a need for follow-up treatment. Combined with adsorption, coagulation can remove 99% of U. The extraction process can remove effluent U concentrations of less than 0.05 mg / L, but it will produce a lot of sludge. Reverse osmosis is referred as a best technology, but due to its high cost it cannot be used on community scale. The evaporation method is simple and effective, the removal rate is high, but there are high costs and sludge needs that

must be dealt with.

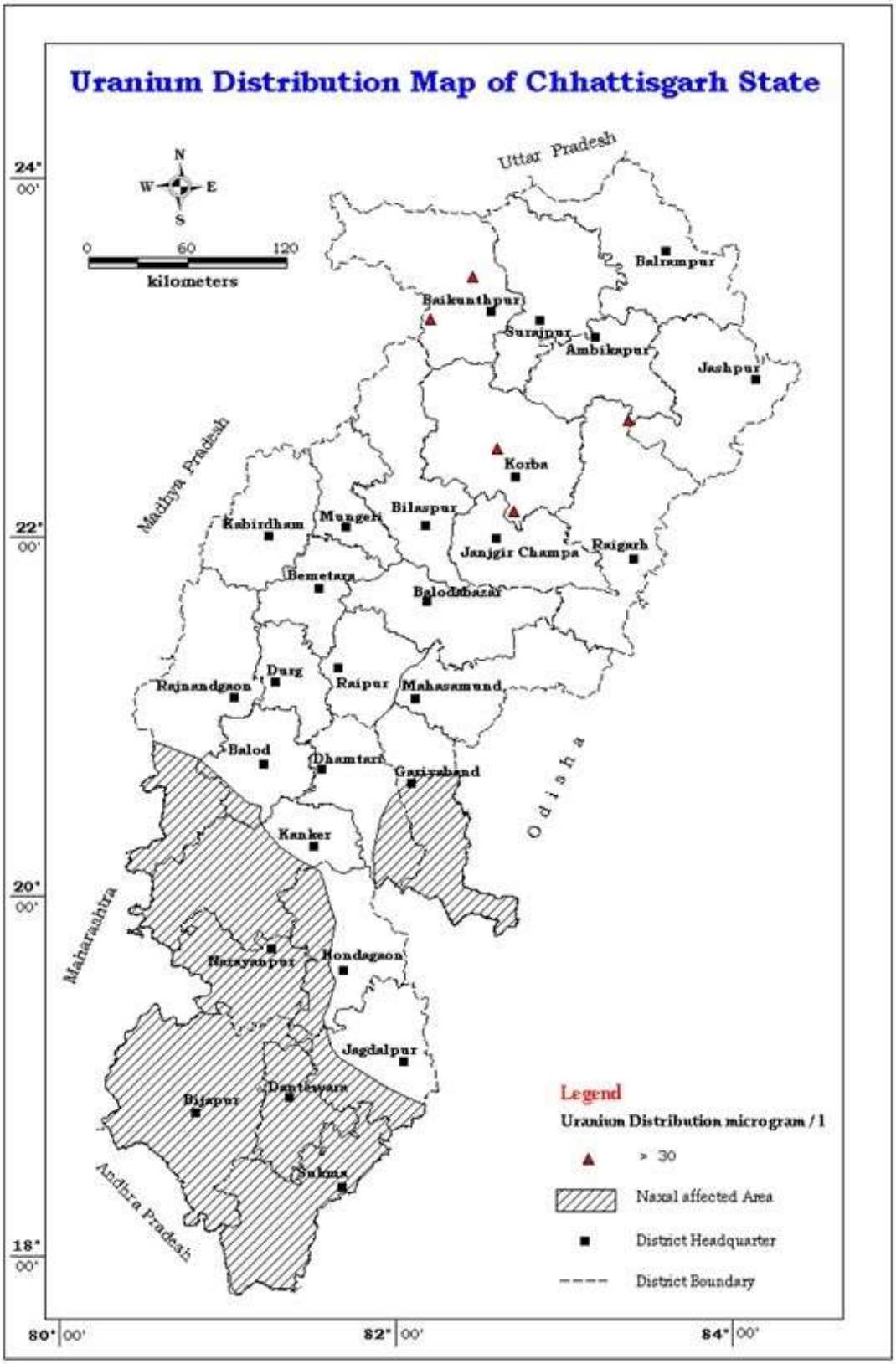

Figure 17 -Locations having Uranium (>0.03 mg/L) in Chhattisgarh State.

5.2. Hydrochemical facies

The groundwater chemistry is affected by various geochemical processes, especially the interaction with meteoric water, subsurface rocks and the chemical ion exchange processes of aquifer minerals. Piper Diagram is a widely used graphical interpolation to characterize the hydro-chemical interaction, water genesis and groundwater contamination sources (Herojeet et al. 2013). The analytical result of water samples collected in pre and monsoon are plotted in Piper Diagram presented in Fig.-18.

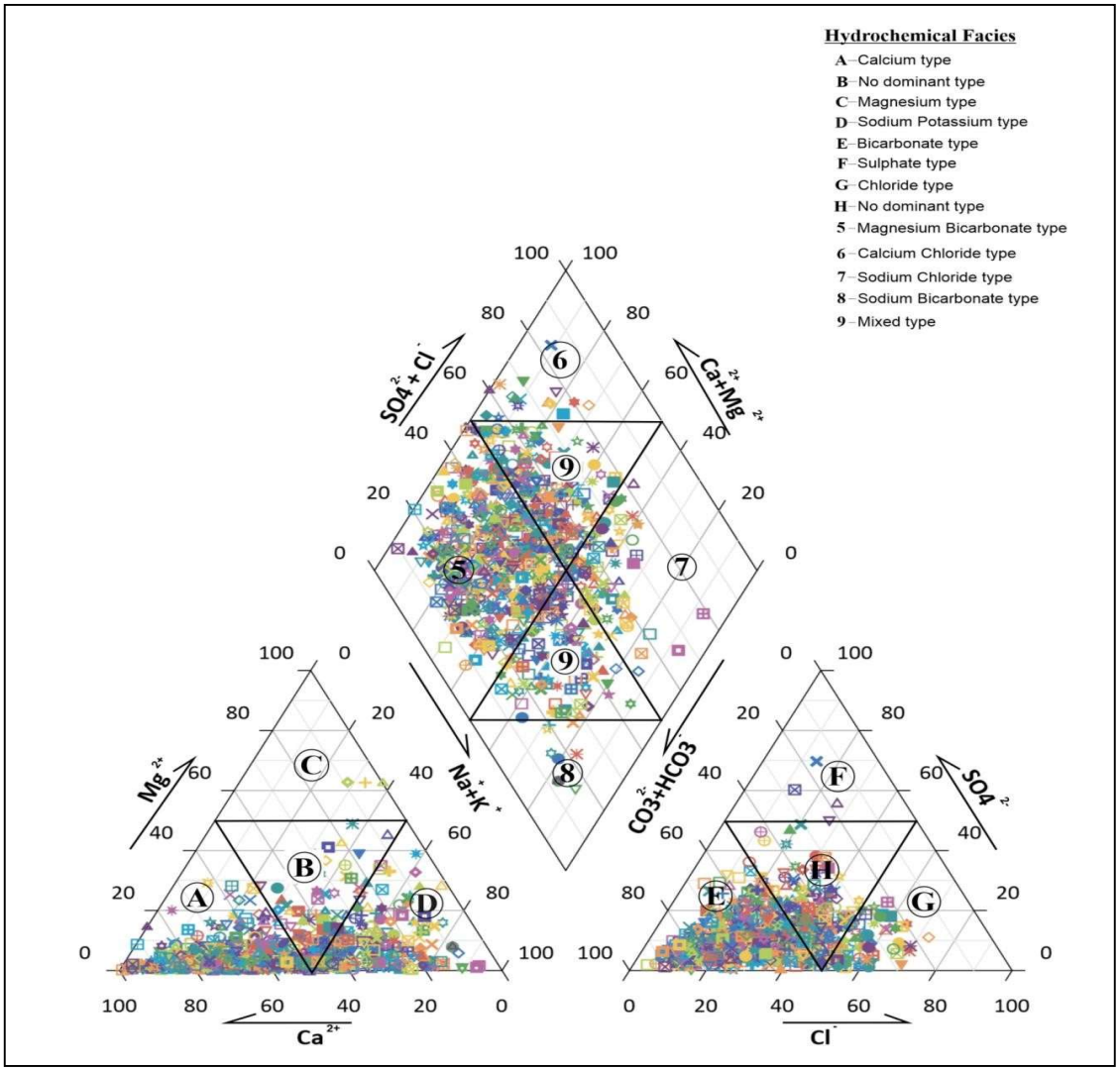

Figure 18 -The piper plot of groundwater samples collected from Chhattisgarh.

The piper plot of groundwater samples collected from Chhattisgarh exhibits majority of the groundwater is dominated by alkaline earths (Ca & Mg) over the alkalis (Na & K) and week acid anion (HCO_3^-) dominating over strong acid anions (Cl^- & SO_4^{--}). Few samples fall in the alkaline metal zone. Further the samples of the area are classified in three categories, i.e., majority in Ca^{2+} - HCO_3^- category. The second most populated zone belongs mix category zone

and rest in $Na^+ – HCO_3^-$ category.

Ca^{2+} - HCO_3^- category or water type indicates dissolution of carbonate minerals with water from surface runoff and precipitation in the subsurface aquifers. The second catogary shows mixing of recharge water and native ground water whereas $Na^+ – HCO_3^-$ category belongs to granitic train and indicating weathering process in the area. The majority of the samples belongs to mix dominating zone in cations triangle and the remaining samples belongs to Ca^{2+} and Na^+ dominating zone. In the anion's triangle, most of samples belong to HCO_3^- water type category, which indicates weathering of carbonates and silicates minerals and ion exchange processes in the groundwater. The conversion of water from Ca^{2+} - HCO_3^- to Ca^{2+} -Na^+ - HCO_3^- .

5.3. Suitability of water for irrigation purposes

Evolution of water from rain water to the ground water always contains some number of dissolved constituents; their presence affects the soil structure, permeability and aeration which ultimately affect the plant growth. The quality criteria for irrigation water are evaluated on the basis Sodium soluble percentage (SSP), Residual sodium carbonate (RSC), Sodium adsorption ratio (SAR), Percentage sodium (%Na) and Kelly index (KI) and Magnesium Ratio (MR). The maximum, minimum, average values of the above irrigation indices are compared with the irrigation water quality guidelines are surmised in Table 13.

Table 16 -Irrigation and Industrial water quality indices in ground water of Chhattisgarh.

N=858 samples	Minimum Value	Maximum Value	Average Value	Irrigation Quality Limit
SSP (%)	0.04	92.29	26.58	<50 Good >50 Un suitable
SAR	0.00	13.09	1.13	<10 Suitable 10-26- Medium >26 Un suitable
RSC	-13.16	3.11	-1.01	<1.25 Suitable 1.25-2.5 Marginal suitable >2.5 Un suitable
%Na	0.04	92.31	27.94	< 20 Suitable 20-60 Medium >60 Unsuitable
KI	0.00	11.97	0.49	< 1 Suitable >1 Unsuitable
Mg^{++}	3.95	95.60	38.97	<50 Good >50 Unsuitable

The irrigation indices table revels that the minimum, maximum and average calculated value of sodium soluble percentage are 0.04, 92.29 and 26.58 respectively. In 91% water samples the Sodium soluble percentage are < 50, are considered suitable for the irrigation and 9%

samples are consider unsuitable for the irrigation. The Sodium adsorption ratio minimum, maximum and average calculated value is 0.00, 13.09 and 1.13 respectively. 99% water samples belong to suitable category and 1% samples are unsuitable for the irrigation. The minimum, maximum and average Residual sodium carbonate values are -13.16, 3.11 and -1.01 respectively. The 95% of collected samples are suitable for the irrigation and 3.7% are marginal suitable whereas 1.2% samples belong to unsuitable category. The minimum, maximum and average Percentage sodium values are 0.04, 92.31 and 27.9 respectively. The 33% samples are suitable for irrigation, 57.9% of samples are medium suitable and 4.8% samples are unsuitable for irrigation. The minimum, maximum and average calculated value of Kelly index is 0.0, 11.9 and 0.49 respectively. The 91% of samples are suitable for the irrigation and 9% samples are unsuitable for the irrigation. The minimum, maximum and average calculated values of Magnesium Ratio are 3.9, 95.6 and 38.9 respectively. Total 75% water samples belong to suitable category whereas 25% of water samples are unsuitable for the irrigation. Most of the irrigation indices indicates that the ground water of Chhattisgarh is suitable for the irrigation.

The US Salinity Diagram developed by the US Salinity Laboratory in 1954 is an important tool to classifying irrigation water. It is a plot of SAR verses electrical conductivity in semi log scale and used to decide the suitability of ground water for irrigation purposes. Conductivity (C) and Sodacity (S) are classification as C_1S_1, C_1S_2, C_1S_3, C_1S_4, C_2S_1, C_2S_2, C_2S_3, C_2S_4, C_3S_1, C_3S_2, C_3S_3, C_3S_4, C_4S_1, C_4S_2, C_4S_2, C_4S_3 and C_4S_3 are extensively used and consists of 16 categories of irrigation waters suitability. The US Salinity diagram of the ground water samples collected from the Chhattisgarh stat is presented in Fig. 19. The US Salinity diagram of Chhattisgarh State indicates most of the samples belongs to C_1S_1 and C_2S_1 category whereas few samples belong to C_3S_1 category. The C_1S_1 and C_2S_1 category are considered good for the irrigation while C_3S_1 category is consider marginal suitable for irrigation.

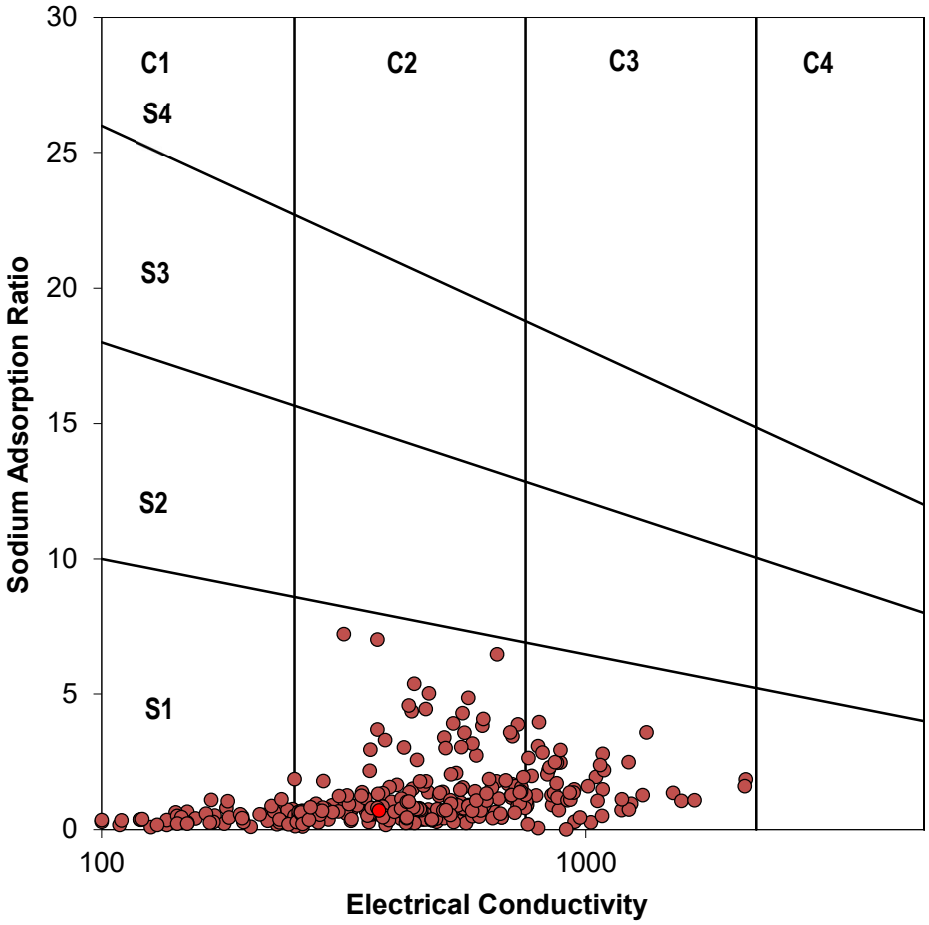

Figure 19 - US Salinity Diagram of ground water samples collected from the Chhattisgarh State.

6. Conclusion

Ground water quality of the shallow aquifers is assessed by the ground water samples collected from Hydrograph network stations fixed in the 33 districts of the state. Following are the key conclusions drawn from the analysis of data.

The ground water of the state is neutral to alkaline in nature. Ground water of the state mostly has calcium bicarbonate type and calcium magnesium chloride type whereas in few places sodium bicarbonate type and sodium chloride type of water are also recorded. Most of the basic parameters are within BIS acceptable limit except in few samples high nitrate and fluoride was observed in some local pockets. High nitrate contents have recorded in phriatic aquifers of 21 districts. Around 14% of ground water instate having nitrate concentration is above the permissible limit. High fluoride contents were recorded at 1.5% of ground water samples in the State mainly in isolated pockets of Jaspur, Koriya, Raighar, Surjuga, Bilaspur, Mahasamund, Gariyabandha, Kanker districts. Iron is a major contaminant in ground water of the state, recorded in almost in all the district, may be in traces. Very high iron contents were observed in ground water of Korba, Bilaspur, Jangjir-Champa, Mungeli, Raigarh, Jashpur and Surajpur districts. Arsenic was recorded above the permissible limits only at 11 locations of Ambagarh-Chouki block in Rajnandgaon district. High uranium content observed at 09 locations in ground water of the state mainly in Bilaspur, Jashpur, Surguja, Balod, Bemetra, Kankar and Jangjir-Champa districts. Various irrigation indices are calculated and mostly it is within safe category. On the basis of parameters analysed and discussed above, it may be concluded that the ground water in the state is safe for drinking and irrigation purposes except at few places which are having some quality concerns.

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Table 17 -Chemical Analysis Results of GRound Water Samples Colected duirn NHNS 2022-23 from the Chhattisgarh State.

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
1	Balod	Gunderdehi	chichalgondi	81.2582	20.9543	8.35	1516	24	79.3	81.4	0.08	49.9	56.1	0	65	16	6.1	101.1	4.9	13.2	0.007
2	Balod	Durg	Danganiya	81.2869	21.0117	8.06	1671	0	79.3	109.7	0.21	16.3	6.4	0	135	10	26.7	44.6	1.2	7.7	0.038
3	Balod	DondiLohara	Ghotia	81.1824	20.5881	8.15	855	0	91.5	14.2	0.73	9.1	4.1	0	30	10	1.2	34.9	1.6	10.0	0.029
4	Balod	SanjariBalod	Gujara	81.1317	20.6677	7.69	1035	0	61.0	46.0	0.45	1.2	13.2	0	40	10	3.6	35.5	0.4	9.6	0.021
5	Balod	Balod	Jatadah	80.6893	20.7954	8.07	538	0	207.5	35.4	0.22	29.1	15.9	0	170	58	6.1	33.7	5.1	11.4	0.002
6	Balod	Balod	Jagtara	81.1275	20.7395	8.15	442	0	219.7	31.9	0.88	12.3	5.4	0	215	56	18.2	18.1	2.0	13.1	0.002
7	Balod	Balod	Sankara	81.0037	20.6484	8.01	537	0	317.3	24.8	0.06	17.7	0.3	0	200	58	13.4	37.6	3.1	7.5	0.001
8	Balod	Balod	Talgaon	81.2885	20.6068	8.08	523	0	177.0	46.0	0.09	16.7	6.4	0	185	46	16.8	22.9	2.2	19.6	0.001
9	Balod	Gurur	Tarri	81.3797	20.7015	8.2	290	0	128.1	24.8	0.36	5.6	5.3	0	115	34	7.2	13.9	0.9	6.2	0.001
10	Balod	Gunderdehi	Machod	81.3169	20.9534	8.53	647	12	73.2	60.2	0.44	2.4	0.5	0	50	10	6.1	46.5	0.9	16.3	0.001
11	Balod	Gunderdehi	Jhafra	81.3969	20.9449	8.3	439	9	128.1	46.0	0.41	6.3	0.1	0	100	30	6.0	38.1	0.7	36.8	0.022
12	Balod	Gundardei	Bhardakalan	81.1354	20.9944	8.67	926	12	79.3	31.9	0.36	90.5	11.0	0	175	46	14.6	19.0	2.3	10.3	0.007
13	Balod	Doundi	Armurkasa	81.078	20.6239	7.92	2360	0	506.5	223.0	0.05	107.8	59.2	0	710	226	35.2	76.8	9.7	17.2	0.001
14	Balod	DoundiLoha ra	DoundiLoha ra	81.0535	20.7929	8.14	529	0	170.9	42.5	0.14	39.6	18.5	0	195	50	17.0	17.1	6.0	10.2	0.005
15	Balod	DoundiLoha ra	Mudhya	81.116	20.8896	8.12	280	0	109.8	14.2	0.32	12.4	9.8	0	115	32	8.5	10.3	0.6	13.5	0.002
16	Baloda Bazar	Balodabazar	Bharseli	82.1188	21.6755	7.5	527	0	256.2	28.4	0.00	18.7	14.9	0.11	240	88	4.8	18.9	1.6	13.0	0.000
17	Baloda Bazar	Bhattapara	Bhattapara-d	81.95	21.7333	7.7	1201	0	390.4	148.9	0.00	98.9	27.9	0.1	430	84	52.8	95.9	10.9	10.0	0.002
18	Balodabazar	Simgha	Hadabandh	81.8417	21.6289	7.1	1084	0	353.8	106.4	0.28	74.9	39.7	0.09	400	68	55.2	67.9	4.3	12.0	0.000
19	Balodabazar	Simga	Udela	81.85	21.6083	7.2	1186	0	353.8	148.9	0.33	73.0	56.4	0.07	540	100	69.6	38.0	2.0	11.0	0.006
20	Balodabazar	Kasdol	Temri	82.4113	21.5758	7.4	701	0	268.4	70.9	0.70	28.8	9.9	0.08	260	72	19.2	46.9	0.4	26.0	0.000
21	Balodabazar	Balodabazar	Amera	82.1781	21.5947	7.1	753	0	317.2	70.9	0.63	22.6	10.5	0.07	300	108	7.2	40.9	0.8	12.0	0.000
22	Balodabazar	Kasdol	Aouri	82.2667	21.4208	7.4	573	0	329.4	42.5	0.30	14.9	0.0	0.06	270	28	48.0	33.8	2.0	17.0	0.000
23	Balodabazar	Balodabazar	Arjuni	82.0653	21.6917	7.2	749	0	231.8	78.0	0.40	63.8	19.8	0.07	310	56	40.8	32.0	0.8	8.0	0.000
24	Balodabazar	Balodabazar	Baloda bazar	82.1667	21.6556	7	730	0	317.2	56.7	0.40	37.0	6.8	0.07	300	60	36.0	38.0	0.4	8.0	0.001
25	Balodabazar	Bilaigarh	Tundri	82.6434	21.6493	7.3	616	0	335.5	14.2	1.50	24.0	0.0	0.06	250	44	33.6	32.0	1.6	18.0	0.000
26	Balodabazar	Bilaigarh	Bhatgaon	82.8122	21.6536	7.2	1058	0	317.2	134.7	0.50	70.6	18.6	0.08	430	68	62.4	49.9	0.8	20.0	0.000

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
27	Balodabazar	Pallari	Bhatia	82.401	21.8896	7.3	572	0	207.4	42.5	0.60	31.7	16.7	0.07	215	56	18.0	29.0	0.4	11.0	0.002
28	Balodabazar	Bilaigarh	Bilaigarh	82.725	21.6375	7.1	465	0	237.9	21.3	0.40	14.9	0.0	0.08	200	64	9.6	18.9	0.4	11.0	0.002
29	Balodabazar	Simga	Damakheda	81.7597	21.7008	7.08	972	0	244.0	106.4	0.30	98.9	24.8	0.07	430	100	43.2	20.9	0.8	15.0	0.001
30	Balodabazar	Simga	Darchura	81.7903	21.7136	7.2	1240	0	305.0	134.7	0.14	102.7	63.9	0.07	470	104	50.4	47.2	22.6	9.0	0.000
31	Balodabazar	Palari	Devsundri	82.068	21.5222	7.05	1228	0	183.0	241.1	0.17	73.9	18.0	0.08	500	152	28.8	38.0	0.8	13.0	0.000
32	Balodabazar	Kasdol	Kasdol	82.4333	21.6167	7.3	702	0	256.2	70.9	0.67	28.8	9.3	0.06	250	64	21.6	46.0	0.4	26.0	0.001
33	Balodabazar	Simga	Khapri	81.9708	21.65	7.5	683	0	282.4	35.4	0.60	18.4	0.6	0.07	180	36	21.0	55.2	0.4	9.0	0.000
34	Balodabazar	Palari	Kodwa	82.0836	21.4744	7.4	1187	0	549.0	63.8	0.40	50.9	39.7	0.07	540	150	39.1	59.1	1.6	11.0	0.001
35	Balodabazar	Bilaigarh	Marban Gatadih	82.9172	21.5598	7.3	458	0	237.9	14.2	0.34	21.6	0.0	0.06	200	60	12.2	17.6	3.1	8.0	0.000
36	Balodabazar	Kasdol	Mudhipar	82.2833	21.4667	7.3	603	0	292.8	35.5	0.26	15.8	0.0	0.07	230	80	7.2	35.0	2.0	15.0	0.001
37	Balodabazar	Bilaigarh	Sarsiwa	82.9167	21.625	7.3	416	0	256.2	14.2	0.33	20.6	0.0	0.06	150	30	18.4	32.2	3.1	9.0	0.000
38	Balodabazar	Kasdol	Sel	82.4915	21.6522	7.3	253	0	102.3	21.3	0.32	7.7	0.0	0.07	120	40	4.8	7.0	2.3	19.0	0.000
39	Balodabazar	Simga	Simga	81.7042	21.625	7.4	666	0	244.0	42.5	0.36	70.6	8.1	0.1	290	56	36.0	22.5	1.2	11.0	0.003
40	Balodabazar	Palari	Sandi	82.075	21.45	7.7	751	0	305.0	70.9	0.71	21.6	0.6	0.06	270	62	27.6	48.3	2.3	13.0	0.001
41	Balrampur	Rajpur	Alkadih	83.4603	23.3908	7.62	618	0	317.2	14.0	1.53	29.5	0.0	0	180	18	32.4	61.7	0.4	11.4	0.000
42	Balrampur	Shankargarh	Bachwar	83.5756	23.3008	7.42	438	0	213.5	21.0	0.72	20.1	0.0	0	210	40	26.4	9.2	0.8	21.1	0.001
43	Balrampur	Rajpur	Bhadar	83.5086	23.3331	7.75	939	0	237.9	108.5	0.77	60.8	56.0	0	365	28	70.8	42.1	3.4	15.6	0.006
44	Balrampur	Rajpur	Ghorghadi	83.4606	23.3401	7.29	314	0	140.3	14.0	0.89	30.9	12.2	0	130	28	14.4	18.7	1.6	32.4	0.000
45	Balrampur	Rajpur	Karji new	83.352	23.3139	7.62	512	0	262.3	14.0	0.78	13.3	0.0	0	165	22	26.4	38.1	2.0	16.7	0.000
46	Balrampur	Rajpur	Makanpur	83.3233	23.4133	7.12	251	0	61.0	31.5	0.43	4.2	37.5	0	90	24	7.2	16.1	1.6	25.7	0.000
47	Balrampur	Balrampur	Pasta	83.525	23.45	7.51	464	0	146.4	42.0	0.48	31.4	35.4	0	180	36	21.6	23.9	2.7	14.9	0.001
48	Balrampur	Rajpur	Rajpur	83.4042	23.3375	7.42	385	0	128.1	28.0	0.42	25.6	26.8	0	175	34	21.6	12.9	0.5	31.1	0.000
49	Balrampur	Shankargarh	Sargaoa	83.5562	23.3071	7.54	351	0	103.7	45.5	0.46	16.0	18.2	0	145	30	16.8	20.7	1.9	12.9	0.000
50	Balrampur	Wadrafnagar	Wadrafnagar	83.1958	23.7667	7.25	442	0	42.7	73.5	0.34	10.0	51.8	0	115	16	18.0	35.1	5.3	12.9	0.002
51	Balrampur	Rajpur	Karji	83.0524	23.215	6.99	467	0	73.2	77.0	0.39	8.5	48.0	0	175	46	14.4	20.1	3.0	23.8	0.002
52	Balrampur	Rajpur	Chilamkala	83.225	23.3996	7.57	310	0	134.2	24.5	0.61	12.2	0.0	0	120	28	12.0	18.9	0.8	20.2	0.000
53	Balrampur	Rajpur	Parsagudi	83.0132	23.4005	7.35	197	0	61.0	21.0	0.61	8.7	19.2	0	60	14	6.0	17.7	1.0	21.6	0.000
54	Balrampur	Rajpur	Bario	83.1845	23.2586	7.44	295	0	115.9	21.0	0.72	22.5	9.4	0	110	26	10.8	23.6	0.3	21.0	0.000

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
55	Bastar	Makdi	Makri	81.9083	19.7733	8.32	797	3	244.0	98.0	0.32	34.3	5.7	0	185	10	38.4	95.9	1.8	15.1	0.010
56	Bastar	Keshkal	Batrail	81.5806	20.0567	8.38	442	3	152.5	56.0	0.72	19.1	1.6	0	50	16	2.4	87.3	2.0	17.1	0.011
57	Bastar	Keshkal	Keshkal	81.586	20.0723	8.4	437	3	176.9	49.0	0.96	7.5	0.1	0	65	18	4.8	80.8	2.3	11.2	0.005
58	Bastar	Baderajpur	Pharasgaon	81.6375	19.8583	8	556	0	140.3	59.5	0.60	16.0	68.6	0	70	16	7.2	82.4	3.7	4.6	0.012
59	Bastar	Pharasgaon	Jaitpuri	81.6578	19.6762	8.37	327	3	115.9	35.0	0.08	6.5	16.4	0	120	38	6.0	17.0	3.0	10.1	0.005
60	Bastar	Kondagaon	Chikalphuti	81.6652	19.5769	8.4	431	6	152.5	35.0	0.06	12.5	24.9	0	60	22	1.2	81.5	1.8	15.2	0.004
61	Bastar	Kondagaon	Dahikonga	81.7209	19.4711	8.22	871	0	207.4	129.5	0.07	14.6	62.4	0	240	74	13.2	87.8	1.1	4.6	0.003
62	Bastar	Kondagaon	Joba	81.7552	19.4449	7.76	136	0	67.1	14.0	0.22	4.5	0.2	0	70	22	3.6	3.2	0.9	29.7	0.005
63	Bastar	Bastar	Bhanpuri	81.8319	19.3306	7.61	260	0	115.9	24.5	0.17	3.6	0.0	0	130	26	15.6	2.8	0.6	33.6	0.005
64	Bastar	Jagdalpur	Bastar	81.9361	19.2014	8.23	557	0	219.6	70.0	0.16	4.2	0.0	0	170	42	15.6	46.6	1.8	33.6	0.020
65	Bastar	Bastar	Sonarpal	81.8916	19.2604	7.67	407	0	128.1	59.5	0.14	5.3	0.0	0	115	28	10.8	40.5	1.6	37.3	0.008
66	Bastar	Jagdalpur	Markel	82.1472	19.0639	8.02	356	0	176.9	17.5	0.21	12.2	0.0	0	155	36	15.6	7.9	3.8	25.7	0.010
67	Bastar	Jagdalpur	Jagdalpur	82.0278	19.0861	8.31	247	0	109.8	21.0	0.20	3.6	0.7	0	115	16	18.0	6.2	1.7	24.2	0.006
68	Bastar	Jagdalpur	Kumharwand	81.9583	19.0958	7.78	230	0	85.4	14.0	0.15	18.4	0.8	0	95	28	6.0	4.4	0.2	30.6	0.005
69	Bastar	Jagdalpur	Dewargaon	81.9171	19.1152	7.82	266	0	115.9	21.0	0.24	12.0	0.9	0	110	32	7.2	14.9	1.0	8.1	0.005
70	Bastar	Keshkal	Chhapan Bhanpuri	81.8608	19.1381	7.62	362	0	109.8	31.5	0.22	14.3	20.2	0	140	38	10.8	15.1	1.0	9.6	0.005
71	Bastar	lourdigadh	Usri bera	81.7549	19.1723	7.51	233	0	103.7	21.0	0.16	3.9	0.8	0	100	32	4.8	6.1	1.1	10.7	0.006
72	Bastar	Londigura	Chirakot	81.715	19.1971	7.71	475	0	176.9	17.5	0.23	17.1	41.5	0	175	12	34.8	21.2	4.6	9.5	0.006
73	Bastar	Bastar	Farsaguda	81.8147	19.3505	8.32	220	3	91.5	14.0	0.14	11.6	0.6	0	90	16	12.0	6.9	1.8	7.8	0.005
74	Bastar	Kondagaon	Massaukokada	81.667	19.5765	8.12	287	0	97.6	31.5	0.65	5.3	0.7	0	65	18	4.8	33.2	2.8	9.3	0.007
75	Bastar	Kondagaon	Borgaon	81.6429	19.8172	7.65	359	0	103.7	45.5	0.17	31.8	0.9	0	65	16	6.0	54.5	2.2	34.1	0.008
76	Bastar	Pharasgaon	Lanjora	81.6542	19.7208	7.71	852	0	195.2	126.0	0.20	52.9	21.5	0	340	64	43.2	38.2	3.1	33.6	0.020
77	Bastar	Kondagaon	Surkupal	81.7538	19.4622	7.62	312	0	164.7	10.5	0.25	6.1	0.3	0	120	32	9.6	18.5	0.6	10.8	0.005
78	Bemetara	Bemetara	Baba Mohtara	81.5892	21.7153	8.25	453	0	152.6	28.3	0.45	56.1	19.3	0	210	60	14.4	16.2	0.7	16.7	0.001
79	Bemetara	Bemetara	Bahera	81.4826	21.7628	8.36	450	12	128.1	49.6	0.42	17.3	2.4	0	120	34	8.5	34.1	4.8	3.8	0.003
80	Bemetara	Bemetara	Baiji	81.515	21.7624	7.91	426	0	219.7	21.2	0.48	3.1	16.9	0	150	36	14.5	26.4	0.9	29.9	0.001
81	Bemetara	Dhamdha	Barhapur	81.288	21.4588	8.54	421	6	225.8	24.8	0.11	3.2	4.2	0	125	34	9.7	43.0	0.9	52.5	0.026

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
82	Bemetara	Bemetara	Bemetara new	81.5308	21.7044	8.2	741	0	164.8	53.1	0.10	96.8	7.4	0	245	82	10.2	41.2	3.9	25.0	0.020
83	Bemetara	Bemetara	Bijabhat	81.5534	21.6589	8.15	966	0	292.9	53.1	0.83	89.3	30.4	0	360	124	11.7	40.5	1.2	14.7	0.025
84	Bemetara	Bemetara	Chilphi	81.4665	21.8757	8.03	1092	0	335.6	60.2	0.93	89.5	29.0	0	430	146	15.3	40.3	3.3	10.5	0.009
85	Bemetara	Bemetara	Dunra	81.4853	21.6896	8.01	543	0	213.6	28.3	0.01	15.7	14.4	0	110	38	3.6	57.1	1.3	41.4	0.019
86	Bemetara	Bemetara	Jewari	81.3258	21.7483	7.36	1109	0	384.4	81.4	0.03	90.7	13.8	0	495	170	17.0	32.2	1.1	16.7	0.028
87	Bemetara	Bemetara	Jhalam	81.4612	21.8409	7.79	1691	0	402.7	208.9	0.85	90.8	43.2	0	685	82	115.8	62.4	2.5	6.3	0.002
88	Bemetara	Saja	Jata	81.3053	21.6683	8.14	562	0	170.9	42.5	0.60	51.5	25.0	0	270	84	14.4	12.5	1.0	6.5	0.001
89	Bemetara	Bemetara	Khilora	81.5342	21.6804	8.02	1153	0	451.5	46.0	0.22	49.1	6.8	0	430	146	16.1	51.2	1.5	21.5	0.006
90	Bemetara	Bemetara	Kusmi	81.4272	21.7041	8.26	505	0	231.9	42.5	0.31	20.4	4.6	0	195	54	14.6	35.8	1.3	12.3	0.018
91	Bemetara	saja	Mouhabhat a	81.26	21.5997	8.01	1108	0	323.4	60.2	0.44	89.4	29.4	0	420	152	10.2	40.7	3.3	16.6	0.064
92	Bemetara	Saja	Ninwa	81.4641	21.6819	7.72	2240	0	561.4	403.6	0.65	74.4	39.4	0	1105	320	73.2	47.0	2.7	8.0	0.007
93	Bemetara	Bemetara	Pendri	81.6219	21.7088	8.18	563	0	140.3	35.4	0.71	56.1	25.4	0	240	80	9.7	11.6	1.0	18.7	0.001
94	Bemetara	Bemetara	Fari	81.3308	21.6327	8.17	401	0	244.1	28.3	0.31	5.0	5.0	0	180	62	6.1	24.2	0.9	21.2	0.002
95	Bemetara	Saja	Rakhi (Joba)	81.2983	21.4866	8.27	502	0	171.5	48.5	0.22	10.2	38.4	0	205	64	10.9	16.2	5.6	6.2	0.001
96	Bemetara	Berla	Sondh new	81.4375	21.5388	8.31	495	9	225.8	60.2	0.49	18.4	6.3	0	230	46	27.3	27.6	1.4	21.5	0.019
97	Bemetara	Saja	Suwartala	81.2411	21.6669	8.57	431	9	225.8	21.2	0.51	15.3	3.4	0	145	42	9.7	43.5	0.9	9.9	0.021
98	Bemetara	Berla	Rampur (Bhand)	81.5017	21.5226	8.2	1162	0	384.4	85.0	0.03	88.3	6.5	0	445	160	10.9	51.7	1.6	16.2	0.004
99	Bemetara	Saja	Khurusbod	81.4633	21.8147	8.19	886	0	128.1	109.7	0.14	46.8	3.0	0	40	6	6.1	110.7	3.5	70.1	0.006
100	Bemetara	Saja	KarhiBhadar	81.3065	21.6893	7.87	455	0	85.4	46.0	1.02	62.2	1.0	0	135	38	9.7	26.9	3.6	15.7	0.001
101	Bemetra	Saja	Beeja	81.3988	21.67	8.08	1129	0	73.2	28.3	0.34	91.3	13.4	0	115	40	3.6	33.9	1.1	13.9	0.003
102	Bemetra	Saja	Kanhera	81.456	21.8282	7.87	674	0	134.2	70.8	0.84	18.4	55.7	0	210	68	9.7	23.8	4.0	12.4	0.004
103	Bilaspur	Gaurela (Pendraroad -1)	Adbhar	81.5915	22.4908	8.21	318	0	91.5	35.4	1.04	17.2	18.4	0	135	30	14.6	5.7	0.7	21.3	0.002
104	Bilaspur	Masturi	Bakarkuda	82.2695	21.919	8.23	627	0	219.7	42.5	0.42	50.6	43.5	0	315	98	17.0	9.3	0.5	16.7	0.003
105	Bilaspur	Kota	Banabel	82.1078	22.4681	8.05	326	0	85.4	35.4	0.30	22.7	8.3	0	120	36	7.3	7.2	1.0	6.1	0.002
106	Bilaspur	Kota	Bansajhal	82.1167	22.3833	8.31	691	6	402.7	46.0	0.07	11.4	0.5	0	360	112	19.4	12.7	2.0	7.5	0.002
107	Bilaspur	Kota	Belgahana	82.0333	22.4333	8.23	1037	0	329.5	134.5	0.05	31.4	40.8	0	405	142	12.2	76.2	3.8	12.3	0.003

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
108	Bilaspur	Bilha	Bilaspur (Hemunagar)	82.1864	22.0533	8.06	666	0	274.6	74.3	0.08	6.8	1.2	0	335	116	10.9	9.0	0.8	9.1	0.006
109	Bilaspur	Bilha	Bilha	82.086	21.9585	8.21	122	0	30.5	21.2	0.16	0.6	14.5	0	55	8	8.5	2.0	2.2	15.6	0.002
110	Bilaspur	Bilha	Bitkuli	82.0499	21.9464	8.01	492	0	134.2	67.3	0.47	24.1	17.7	0	250	82	10.9	6.4	0.6	12.1	0.003
111	Bilaspur	Bilha	Bohardi	82.0801	21.564	7.92	1438	0	341.7	123.9	0.21	94.1	30.3	0	350	94	27.9	91.0	6.3	1.3	0.013
112	Bilaspur	Bilha	Chakarbhata	82.1247	22.0011	8.23	171	0	85.4	21.2	0.48	7.1	1.5	0	100	28	7.3	1.6	0.8	75.6	0.002
113	Bilaspur	Marwahi	Chchgohana	82.0365	23.0196	8.18	634	0	262.4	38.9	0.56	77.2	0.4	0	370	118	18.2	6.4	0.8	8.1	0.007
114	Bilaspur	Masturi	Chilhati	82.3136	21.7794	8.17	766	0	231.9	67.3	0.18	56.3	28.5	0	370	122	15.8	13.0	0.9	26.7	0.002
115	Bilaspur	Bilha	Dagauri	82.0706	21.8939	8.12	429	0	250.2	17.7	0.68	15.0	18.9	0	225	76	8.5	7.3	0.4	9.5	0.001
116	Bilaspur	Marwahi	Dhanpur	81.9861	22.8833	8.27	233	0	85.4	17.7	0.72	4.4	0.2	0	95	22	9.7	6.2	0.3	15.6	0.002
117	Bilaspur	Takhatpur	Gatori	82.1389	22.1944	8.14	95	0	30.5	10.6	0.41	8.6	1.0	0	40	2	8.5	1.9	2.3	11.1	0.002
118	Bilaspur	Gaurela (Pendraroad -2)	Gaurela	81.9111	22.7542	7.91	1592	0	567.5	134.5	0.43	107.8	7.6	0	650	226	20.7	85.8	6.8	16.9	0.017
119	Bilaspur	Kota	Ghansipur (sainik camp)	82.1379	22.3585	8.17	471	0	122.0	60.2	0.51	22.4	16.5	0	220	54	20.7	7.0	0.6	22.6	0.003
120	Bilaspur	Bilha	Hirri	82.05	21.9708	8.24	627	0	201.4	60.2	0.22	35.3	13.2	0	275	86	14.6	13.5	0.4	16.1	0.013
121	Bilaspur	Takhatpur	Jaroundha	81.5644	22.1535	8.35	471	9	140.3	60.2	0.45	8.7	50.1	0	270	96	7.3	3.8	1.2	27.6	0.002
122	Bilaspur	Kota	Jhingatpur	81.9972	22.3667	8.24	242	0	85.4	24.8	0.22	9.2	5.7	0	110	32	7.3	3.8	1.1	21.1	0.001
123	Bilaspur	Kota	Jogipur	82.075	22.2958	7.94	1143	0	329.5	159.3	0.12	41.8	5.1	0	380	118	20.7	86.2	0.9	16.2	0.003
124	Bilaspur	Mungeli	Kanteli.1	81.65	22.1528	8.22	303	0	164.8	31.9	0.16	9.6	0.5	0	160	36	17.0	5.9	0.5	37.6	0.002
125	Bilaspur	Kota	Kargi khurd	81.9586	22.2675	8.27	639	0	305.1	46.0	0.16	41.6	0.5	0	360	122	13.4	7.1	1.1	12.6	0.014
126	Bilaspur	Kota	Kenda	82.0806	22.5319	7.84	525	0	268.5	35.4	0.06	12.0	7.3	0	290	94	13.4	10.1	0.6	15.1	0.007
127	Bilaspur	Gaurela (Pendraroad -1)	Keonchi	81.7708	22.6208	8.15	424	0	201.4	35.4	1.01	3.6	3.1	0	225	76	8.5	8.1	1.0	19.6	0.002
128	Bilaspur	Kota	Khaira	82.1407	22.3624	7.81	745	0	378.3	38.9	0.24	26.1	45.7	0	355	124	10.9	15.9	0.5	17.1	0.007
129	Bilaspur	Mungeli	Khamaria	81.8435	22.0695	8.16	1163	0	512.6	81.4	0.12	22.5	13.4	0	435	130	26.7	85.1	0.3	18.9	0.010
130	Bilaspur	Takhatpur	Khamharia1	81.9875	22.1222	8.08	420	0	250.2	24.8	0.14	13.8	3.6	0	250	62	23.1	5.9	1.3	35.6	0.003
131	Bilaspur	Masturi	Koni	82.2383	21.9819	8.25	422	0	219.7	31.9	0.13	26.6	7.5	0	215	54	19.4	9.9	0.6	7.6	0.004

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
132	Bilaspur	Kota	Kota(kargi)	82.025	22.2889	8.19	348	0	140.3	31.9	0.28	20.4	0.6	0	160	38	15.8	9.1	0.6	16.5	0.014
133	Bilaspur	Belgahana	Konchua	81.5846	22.2839	8.01	304	0	134.2	21.2	0.47	15.7	0.8	0	140	34	13.4	8.3	1.4	12.1	0.003
134	Bilaspur	Marwahi	Kudwahi	81.98	22.8648	7.95	1464	0	543.1	265.5	0.51	99.2	8.3	0	960	242	86.3	11.0	3.8	16.1	0.050
135	Bilaspur	Takhatpur	Kuli	82.4161	22.1424	8.05	937	0	353.9	102.7	0.63	43.4	0.2	0	340	84	31.6	82.1	0.6	11.2	0.012
136	Bilaspur	Marwahi	Lekhani	81.978	22.909	8.01	634	0	219.7	60.2	0.17	31.1	2.4	0	290	50	40.1	13.7	0.8	15.4	0.025
137	Bilaspur	Masturi	Malhar	82.2858	21.8914	8	645	0	262.4	67.3	0.81	17.6	3.8	0	295	62	34.0	17.0	1.0	2.3	0.006
138	Bilaspur	Mungeli	Matiyari	82.2587	22.126	8.17	276	0	85.4	49.6	0.08	6.4	0.7	0	125	28	13.4	6.6	0.7	18.9	0.002
139	Bilaspur	Masturi	Masturi	82.2677	21.9913	8.19	329	0	73.2	42.5	0.02	19.3	7.4	0	125	24	15.8	8.9	1.2	9.2	0.002
140	Bilaspur	Bilha	Narmada khapri	82.1431	22.0814	8.28	219	0	48.8	31.9	0.04	9.7	0.2	0	85	20	8.5	6.9	0.4	11.1	0.004
141	Bilaspur	Kota	Nawapara	82.1218	22.4292	8.06	759	0	231.9	109.7	0.51	33.3	22.4	0	390	82	45.0	10.7	0.5	7.9	0.001
142	Bilaspur	Kota	Nawadih	81.9979	22.3939	8.17	594	0	158.7	63.7	0.21	32.2	34.4	0	270	64	26.7	11.0	0.8	2.3	0.002
143	Bilaspur	Takhatpur	Neora	81.9317	22.2125	8.09	375	0	183.1	46.0	0.20	7.4	20.5	0	185	50	14.6	17.1	1.3	19.3	0.002
144	Bilaspur	Marwahi	Nimdha	81.945	22.9469	8.14	231	0	140.3	17.7	0.13	4.4	1.3	0	110	26	10.9	10.9	0.5	16.4	0.001
145	Bilaspur	Lormi	Pali(Lormi)	81.8353	22.2578	7.92	672	0	341.7	67.3	0.25	9.1	39.4	0	370	120	17.0	16.2	0.8	12.3	0.054
146	Bilaspur	Masturi	Panchpedi	82.27	21.8281	8.15	1545	0	390.5	198.2	0.42	80.1	4.5	0	550	114	63.2	88.2	4.6	6.4	0.003
147	Bilaspur	Kota	Pandra Patha	82.0429	22.4282	8.12	555	0	225.8	77.9	0.17	11.4	2.4	0	270	74	20.7	15.8	0.9	17.9	0.004
148	Bilaspur	Marwahi	Pandri (Dhanwari Posa)	81.9955	22.9923	8.05	913	0	402.7	123.9	0.15	41.4	74.3	0	490	122	45.0	81.0	4.6	9.2	0.004
149	Bilaspur	Gaurela (Pendraroad - 1)	Piperkhuti	81.8833	22.6639	7.96	953	0	433.2	120.4	0.82	48.5	68.0	0	495	126	43.7	83.6	4.0	8.2	0.001
150	Bilaspur	Kota	Ratanpur	82.1778	22.2806	8.17	423	0	256.3	28.3	0.22	6.7	21.4	0	220	54	20.7	17.1	0.6	14.6	0.003
151	Bilaspur	Gaurela (Pendraroad -1)	Rupandand	81.8933	22.6975	8.3	590	6	292.9	77.9	0.05	18.0	39.3	0	265	70	21.9	82.1	1.5	2.3	0.035
152	Bilaspur	Kota	Saraipalli	81.9361	22.3417	8.11	815	0	390.5	106.2	0.31	31.8	25.1	0	385	86	41.3	87.3	0.8	23.4	0.002
153	Bilaspur	Marwahi	Seoni	81.9583	23.0125	8.26	91	0	24.4	24.8	0.01	1.3	12.0	0	55	4	10.9	2.1	4.7	9.2	0.003
154	Bilaspur	Marwahi	Sewra	81.9806	22.8517	8.09	194	0	48.8	42.5	0.03	11.4	3.0	0	90	16	12.2	7.9	0.4	10.6	0.001
155	Bilaspur	Marwahi	Shekhwa	82.0889	22.8417	8.25	223	0	79.3	28.3	0.17	3.1	5.5	0	90	28	4.9	15.4	0.4	17.6	0.006
156	Bilaspur	Kota	Shivtarai	81.9342	22.3489	8.19	453	0	244.1	81.4	0.05	14.4	19.3	0	200	46	20.7	82.1	1.6	2.3	0.016

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
157	Bilaspur	Kota	Shripara	82.0058	22.21	8.24	72	0	18.3	17.7	0.06	1.4	3.7	0	40	10	3.6	1.5	0.3	4.7	0.002
158	Bilaspur	Takhatpur	Sipat	82.2792	22.1458	8.1	855	0	311.2	148.7	0.07	70.8	5.8	0	390	82	45.0	81.4	6.7	27.6	0.015
159	Bilaspur	Mungeli	Surada	81.6702	22.0868	8.21	1082	0	433.2	148.7	0.08	45.6	62.6	0	535	146	41.3	86.1	6.0	6.2	0.002
160	Bilaspur	Kota	Saudhakhurd	82.0669	22.4972	8.26	115	0	36.6	14.2	0.19	3.7	10.0	0	40	8	4.9	9.1	0.3	14.6	0.001
161	Bilaspur	Takhatpur	Takhatpur	81.5139	22.081	8.02	210	0	85.4	28.3	0.21	3.8	0.3	0	80	22	6.1	13.9	0.7	17.1	0.002
162	Bilaspur	Marwahi	Tendumuda	82.0122	23.0581	8.25	109	0	42.7	24.8	0.24	1.0	6.1	0	60	10	8.5	7.4	0.4	13.6	0.013
163	Bilaspur	Kota	Tenduwa	81.8833	22.2542	8.02	533	0	189.2	60.2	0.45	12.1	11.0	0	125	28	13.4	71.3	0.9	64.5	0.010
164	Bilaspur	Marwahi	Tikthi	82.0694	23.0844	8.03	511	0	292.9	35.4	0.21	12.1	9.4	0	145	24	20.7	89.8	0.7	5.6	0.013
165	Bilaspur	Takhatpur	Udaypur	81.7544	22.2725	8.01	935	0	238.0	109.7	0.49	68.9	49.4	0	320	106	13.4	84.3	3.5	9.1	0.003
166	Bilaspur	Mungeli	Chandrakuri	81.9044	21.8388	8.49	704	9	329.5	31.9	0.22	79.8	15.5	0	265	82	14.6	92.9	1.3	27.6	0.004
167	Bilaspur	Pendra Road	DamDam	82.1392	22.8267	8.05	540	0	433.2	49.6	0.14	12.1	9.6	0	285	74	24.3	81.4	0.9	4.6	0.002
168	Bilaspur	Marwahi	Marwahi	82.069	23.02	8.24	96	0	30.5	14.2	0.05	2.5	0.2	0	40	12	2.4	1.6	0.3	12.6	0.002
169	Bilaspur	Kota	Kanchanpur	82.057	22.3711	7.95	991	0	500.4	74.3	0.01	106.8	19.4	0	500	182	10.9	89.0	1.1	18.6	0.002
170	Bilaspur	Masturi	Kohronda	82.3549	21.9276	8.45	235	9	91.5	14.2	0.16	8.9	0.4	0	90	20	9.7	16.3	0.4	6.4	0.003
171	Dhamtari	Magarload	Banraud	81.6583	20.5958	7.4	414	0	220.0	21.3	0.32	13.0	0.0	0.06	175	48	13.4	20.9	3.5	12.0	0.000
172	Dhamtari	Sihawa (Nagri)	Banspani	81.7917	20.3667	7.4	321	0	195.2	7.1	1.50	3.8	0.0	0.06	100	30	6.2	29.0	0.8	29.0	0.001
173	Dhamtari	Magarload	Baspara(Kukrel)	81.6507	20.6131	7.4	143	0	73.0	7.0	0.00	4.8	0.0	0.06	65	10	9.6	3.9	0.8	13.0	0.000
174	Dhamtari	Kurud	Bhatagaon	81.7003	20.8783	7.7	917	0	244.0	148.9	0.18	49.0	21.7	0.06	355	82	36.0	46.5	17.2	9.0	0.000
175	Dhamtari	Sihawa (Nagri)	Birgudi	81.8625	20.3222	7.3	260	0	85.4	14.2	0.95	7.2	31.0	0.06	90	28	5.4	11.7	0.4	28.0	0.000
176	Dhamtari	Magarload	Budaraon	81.9047	20.723	7.7	281	0	128.0	14.2	0.87	15.8	0.0	0.06	110	40	2.4	13.8	2.7	14.0	0.000
177	Dhamtari	Dhamtari	Marradev	81.5682	20.6295	7.6	527	0	250.0	21.0	0.32	36.0	0.0	0.06	200	44	21.6	30.8	3.9	9.0	0.000
178	Dhamtari	Dhamtari	Chhati	81.6667	20.7792	7.8	381	0	183.0	28.4	0.53	13.0	0.0	0.06	175	44	15.6	13.8	0.4	10.0	0.000
179	Dhamtari	Kurud	Dandesara	81.6317	20.8127	7.5	438	0	231.8	21.3	0.23	8.6	1.2	0.06	185	56	10.8	18.9	1.2	16.0	0.000
180	Dhamtari	Kurud	Darba	81.68	20.9615	7.7	459	0	244.0	21.3	0.50	17.8	3.7	0.06	220	64	14.4	12.9	0.4	11.0	0.000
181	Dhamtari	Sihawa (Nagri)	Dorgardula	81.9111	20.4056	7.5	279	0	109.8	14.2	0.95	6.7	31.6	0.06	110	32	7.2	16.8	0.4	35.0	0.000
182	Dhamtari	Sihawa (Nagri)	Dugli	81.8708	20.4917	7.4	427	0	170.8	42.5	0.90	13.9	9.9	0.06	180	56	9.6	19.8	0.8	29.0	0.001

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
183	Dhamtari	Dhamtari	Gangrel	81.5583	20.6346	7.4	150	0	79.3	7.1	0.00	4.8	0.0	0.06	70	20	4.8	4.1	0.8	11.0	0.000
184	Dhamtari	Sihawa (Nagri)	Gattasilli	81.8028	20.4436	7.4	309	0	170.8	14.2	1.42	2.9	0.0	0.06	105	40	1.2	29.0	0.4	27.0	0.000
185	Dhamtari	Sihawa (Nagri)	Jabarra	81.9858	20.4956	7.3	428	0	183.0	28.4	0.83	13.9	8.7	0.06	170	48	12.0	19.8	0.8	27.0	0.001
186	Dhamtari	Sihawa (Nagri)	Keregaon	81.7375	20.5486	7.2	195	0	109.8	7.1	0.00	3.8	0.0	0.06	80	20	7.2	9.9	2.3	15.0	0.002
187	Dhamtari	Dhamtari	Khadadaha	81.6933	20.5733	7	193	0	97.6	7.1	1.35	3.4	0.0	0.06	70	20	4.8	10.8	2.3	16.0	0.002
188	Dhamtari	Nagri	Kouhabahara	81.8575	20.4916	7.6	590	0	292.8	21.3	1.33	27.8	16.7	0.08	210	64	12.0	46.9	5.9	14.0	0.000
189	Dhamtari	Kurud	Kondapar	81.725	21.0042	7.7	467	0	256.2	14.2	0.38	17.8	5.6	0.11	230	76	9.6	12.9	0.4	7.0	0.001
190	Dhamtari	Kurud	Kosmarra	81.5986	20.8597	7.7	525	0	280.6	28.4	0.14	9.6	5.0	0.05	240	72	14.4	18.9	1.2	10.0	0.003
191	Dhamtari	Kurud	Kurud	81.7189	20.8275	7.6	468	0	256.2	21.3	0.60	8.6	0.0	0.06	145	40	10.8	49.0	0.4	5.0	0.000
192	Dhamtari	Nagri	Kumhada	81.577	20.5684	7.5	402	0	231.8	14.2	0.14	10.6	0.6	0.1	175	56	8.4	19.8	3.9	6.0	0.000
193	Dhamtari	Magarload	Magarload	81.8583	20.7472	7.9	282	0	146.4	14.2	0.74	13.9	0.6	0.09	120	36	7.2	13.8	3.1	8.0	0.000
194	Dhamtari	Kurud	Marod	81.6889	20.9028	7.6	929	0	231.8	134.7	0.11	42.7	26.7	0.08	330	92	24.0	46.0	12.5	6.0	0.000
195	Dhamtari	Kurud	Mega	81.8005	20.7833	7.4	944	0	280.6	113.4	0.22	37.9	58.9	0.14	340	76	36.0	57.5	9.0	8.0	0.000
196	Dhamtari	Sihawa (Nagri)	Nagri	81.9583	20.3333	7.4	258	0	146.4	28.4	0.65	8.6	2.5	0.08	140	32	14.4	15.9	0.8	19.0	0.000
197	Dhamtari	Sihawanagri	Sankra	82.0076	20.2625	7.6	607	0	268.4	56.7	0.34	18.7	1.2	0.06	260	64	24.0	26.0	3.1	8.0	0.000
198	Dhamtari	Dhamtari	Shankarda	81.4492	20.622	7.7	443	0	195.2	28.4	0.41	9.1	37.8	0.13	220	52	21.6	8.3	2.3	5.0	0.000
199	Dhamtari	Sihawa (Nagri)	Sihawa	81.9125	20.3083	7.8	258	0	97.6	14.2	0.89	7.7	37.8	0.13	105	32	6.0	15.9	0.4	25.0	0.000
200	Dhamtari	Magarload	Singhpur	81.8778	20.5819	7.7	550	0	237.9	35.5	1.40	24.0	34.7	0.18	195	44	20.4	46.9	5.9	15.0	0.000
201	Dhamtari	Nagri	Tumribahar	81.9595	20.3477	7.5	258	0	115.9	14.2	0.77	7.7	16.7	0.19	105	24	10.8	15.0	0.8	20.0	0.000
202	Dhamtari	Kurud	Aouri	81.687	20.857	7.7	454	0	256.2	21.3	0.62	7.7	1.2	0.13	145	28	18.0	49.0	0.4	6.0	0.000
203	Dhamtari	Dhamtari	Puri	81.3331	20.7385	8	358	0	183.0	21.3	0.63	7.7	0.0	0.13	155	52	6.0	15.9	0.8	5.0	0.000
204	Dhamtari	Nagri	Basin	82.1654	20.249	7.8	425	0	219.6	28.4	0.42	9.6	0.0	0.86	210	48	21.6	8.1	2.3	5.0	0.001
205	Dhamtari	Dhamtari	Dhamtari	81.55	20.7083	7.9	224	0	97.6	14.2	0.00	15.8	6.8	0.19	85	20	8.4	16.8	1.6	12.0	0.000
206	Durg	Gurur	Gurur	81.4054	20.6849	8.26	486	0	128.1	66.5	0.56	22.3	11.6	0	205	46	21.6	14.6	1.5	12.1	0.004
207	Durg	Gurur	kuliya	81.4418	20.6776	8.27	374	0	118.0	31.5	0.46	25.7	6.7	0	135	32	13.2	18.4	8.5	6.4	0.008
208	Durg	Gurur	Balodgahan	81.4717	20.6461	7.86	670	0	219.6	77.0	0.53	38.4	0.6	0	300	66	32.4	18.0	1.8	17.1	0.014

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
209	Durg	Gurur	Jagtara	81.4425	20.6222	8.56	371	6	176.9	17.5	0.77	6.2	0.5	0	45	12	3.6	56.7	2.1	11.2	0.005
210	Durg	Gurur	Markatola	81.3794	20.57	8.18	705	0	231.8	91.0	0.60	11.6	32.3	0	150	28	19.2	96.8	1.2	8.2	0.005
211	Durg	Doundi	Achholi	81.1019	20.5444	8.07	528	0	152.6	49.6	0.21	17.2	53.1	0	205	62	12.2	27.3	1.7	11.6	0.008
212	Durg	Dhamdha	Ahiwara	81.4167	21.3611	8.08	704	0	85.4	102.7	0.54	51.3	53.2	0	285	98	9.2	25.3	1.3	17.5	0.007
213	Durg	Durg	Anda	81.275	21.0667	8.19	792	0	274.6	31.9	0.22	67.1	26.1	0	265	96	6.6	50.1	1.3	24.7	0.002
214	Durg	Bemetara	Andhiyarkhor	81.5975	21.8383	7.95	509	0	170.9	46.0	0.31	19.3	18.6	0	180	56	9.7	23.0	0.6	16.0	0.002
215	Durg	Gunderdehi	Arjunda	81.2056	20.9431	8.06	378	0	128.1	35.4	0.22	12.0	19.8	0	160	54	6.1	8.7	0.5	12.9	0.002
216	Durg	Bemetara	Arasnara	81.3433	21.3114	7.93	1617	0	494.3	184.1	0.09	93.1	4.7	0	720	240	28.2	53.3	1.8	10.7	0.026
217	Durg	Bemetara	Ashoga	81.55	21.9639	8.11	674	0	189.2	67.3	0.33	24.8	13.5	0	215	70	10.0	48.5	3.4	27.5	0.007
218	Durg	SanjariBalod	Balod	81.2	20.7292	8.12	308	0	103.7	21.2	0.15	22.1	2.6	0	120	38	6.1	8.0	2.2	38.4	0.001
219	Durg	DondiLohara	Batera	81.0642	20.7806	8.2	309	0	115.9	17.7	0.09	31.3	4.4	0	125	42	4.9	10.6	1.2	14.1	0.001
220	Durg	DondiLohara	Bhalukonha	81.0531	20.7442	8.27	515	0	97.6	56.6	0.73	22.5	8.4	0	160	50	8.5	8.1	1.4	13.1	0.002
221	Durg	DondiLohara	Bharnabhat	80.9972	20.8875	7.84	798	0	195.3	95.6	0.44	46.7	41.5	0	230	76	9.7	51.9	2.8	16.4	0.002
222	Durg	Durg	Bhilai	81.4139	21.2072	8.08	444	0	158.7	35.4	0.22	42.3	18.2	0	155	50	7.2	29.1	1.2	34.9	0.003
223	Durg	Durg	Binayakpur	81.2667	21.0556	8.19	801	0	231.9	31.9	0.13	101.1	25.5	0	235	74	12.2	55.9	1.5	8.2	0.008
224	Durg	Bemetara	Bitkuli	81.6675	21.775	8.27	488	0	140.3	38.9	0.09	47.3	6.7	0	150	50	6.1	39.1	1.9	11.2	0.005
225	Durg	Saja	Bortara	81.2222	21.6417	7.88	1068	0	335.6	63.7	0.32	87.8	30.4	0	425	124	27.5	49.5	1.3	9.9	0.011
226	Durg	Bemetara	Dadhi	81.475	21.8958	8.16	310	0	115.9	24.8	0.32	25.1	10.8	0	125	38	7.3	11.5	0.5	9.1	0.002
227	Durg	Patan	Darbarmukhli	81.4874	21.0022	7.78	1145	0	256.3	145.1	0.40	47.0	12.7	0	385	106	28.2	62.6	1.9	2.2	0.013
228	Durg	Dhamdha	Dargaon	81.3944	21.4917	8.21	365	0	91.5	35.4	0.14	32.3	4.3	0	140	40	9.7	12.2	1.6	10.1	0.001
229	Durg	Doundi	DelliRajhara	81.0778	20.5861	7.9	606	0	177.0	63.7	0.31	51.2	25.2	0	245	78	12.2	21.9	1.4	26.1	0.003
230	Durg	Patan	Dewada	81.4972	21.0704	8.09	527	0	158.7	49.6	0.01	51.7	20.0	0	180	60	7.3	36.9	2.3	24.0	0.004
231	Durg	dhamda	Dhaba	81.4969	21.279	7.92	655	0	183.1	81.4	0.01	57.4	19.4	0	225	70	12.2	39.2	1.8	10.1	0.011
232	Durg	Doundi	Dondi	81.0889	20.4917	7.77	566	0	195.3	46.0	0.08	63.4	3.6	0	185	48	15.8	43.5	4.6	12.1	0.005
233	Durg	Durg	Durg	81.275	21.1917	7.97	402	0	134.2	28.3	0.19	49.5	9.1	0	160	36	17.0	13.8	1.1	15.1	0.002
234	Durg	Patan	Funda	81.4833	21.0764	7.86	776	0	122.0	120.4	0.84	78.3	23.1	0	240	72	14.4	42.8	7.2	24.1	0.004
235	Durg	Durg	Ganiyari	81.2139	21.2153	8	387	0	146.4	21.2	0.22	23.4	26.1	0	120	36	7.3	32.6	1.0	28.1	0.002
236	Durg	Saja	Gatapar	81.2139	21.5667	8.01	537	0	79.3	70.8	0.43	23.5	57.2	0	205	48	20.4	16.0	1.2	0.1	0.005

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
237	Durg	Dhamdha	Girola	81.4381	21.3917	8.04	477	0	109.8	63.7	0.51	51.5	8.5	0	170	42	15.8	27.2	1.1	8.8	0.003
238	Durg	Gunderdehi	Gunderdehi	81.2958	20.9444	7.73	1735	0	317.3	208.9	0.31	102.2	62.0	0	375	120	18.2	118.3	31.4	12.4	0.008
239	Durg	Durg	Janjgiri	81.3089	21.085	8.04	808	0	225.8	49.6	0.61	89.7	9.8	0	310	100	14.4	36.3	2.4	10.1	0.021
240	Durg	Berla	Jeora	81.6232	21.6375	7.78	701	0	115.9	95.6	0.03	37.4	56.4	0	255	80	13.4	22.7	3.0	6.5	0.007
241	Durg	Durg	Jeora-sirsa	81.3064	21.2564	7.97	833	0	97.6	131.0	0.04	58.5	47.7	0	225	76	8.5	57.1	9.2	7.5	0.008
242	Durg	Durg	Kachandur	81.2969	20.9789	7.88	1482	0	231.9	237.2	0.31	68.2	73.4	0	510	176	17.0	75.1	0.8	8.5	0.006
243	Durg	Patan	Kashi	81.4969	21.0357	8.38	469	9	73.2	28.3	0.32	98.3	23.2	0	180	54	11.3	19.1	0.6	12.1	0.006
244	Durg	Bemetara	Khati	81.4375	21.7778	7.79	1694	0	219.7	254.9	0.31	96.2	71.7	0	565	200	16.0	85.0	5.4	21.6	0.003
245	Durg	Patan	kharra	81.5469	20.9809	8.03	742	0	207.5	46.0	0.43	101.4	20.2	0	305	100	13.4	28.8	3.7	20.1	0.006
246	Durg	Bemetara	Khurmuri.1(new well)	81.6139	21.7125	8.13	1204	0	250.2	109.7	0.11	106.6	71.5	0	325	102	17.0	84.2	36.3	17.1	0.005
247	Durg	Patan	Khurdmudi	81.5343	21.0974	8.17	406	0	109.8	38.9	0.12	8.3	49.0	0	175	58	7.3	7.5	1.3	19.1	0.003
248	Durg	Dhamdha	Kodiya	81.3539	21.3586	8.12	832	0	213.6	99.1	0.08	59.4	31.5	0	290	82	20.7	50.2	1.0	12.1	0.008
249	Durg	SanjariBalod	Kusumkasa	81.0806	20.6417	7.97	1218	0	134.2	240.7	0.01	38.7	10.7	0	420	140	17.0	47.8	1.5	5.6	0.006
250	Durg	Patan	Marra	81.4583	21.0375	8.13	701	0	97.6	88.5	0.21	39.5	56.6	0	215	70	9.7	39.0	4.7	8.7	0.003
251	Durg	Patan	Motipur	81.5458	21.1667	8.09	756	0	97.6	102.7	0.18	21.4	69.4	0	200	60	12.2	32.3	10.2	7.7	0.004
252	Durg	Dhamda	Murmunda	81.463	21.3091	8.1	639	0	97.6	95.6	0.31	30.7	43.3	0	190	58	10.9	35.3	2.5	7.8	0.003
253	Durg	DondiLohara	Nahalda	81.0514	20.9333	8.07	471	0	67.1	42.5	0.88	40.4	68.4	0	165	48	10.9	19.3	1.1	30.1	0.020
254	Durg	Doundi	Narratola	81.095	20.5306	7.81	1305	0	555.3	155.8	0.95	59.6	69.3	0	720	226	37.7	52.8	4.9	5.2	0.007
255	Durg	Bemetara	Nawagarh.1	81.6083	21.9083	7.84	1311	0	231.9	162.8	0.13	107.2	16.4	0	430	140	19.4	53.6	4.6	6.1	0.025
256	Durg	Durg	Nagpura	81.2264	21.2491	7.92	1723	0	433.2	251.3	0.44	48.5	9.6	0	695	218	36.5	67.2	2.1	11.2	0.006
257	Durg	Saja	Parpoda	81.4014	21.5881	8.05	505	0	79.3	49.6	0.01	78.4	11.7	0	170	50	10.9	19.3	4.9	0.8	0.002
258	Durg	Patan	Patan	81.55	21.0333	7.78	347	0	134.2	31.9	0.25	23.2	15.2	0	125	34	9.7	16.7	11.3	0.8	0.003
259	Durg	Dhamdha	Pathariya	81.3639	21.4	7.87	698	0	152.6	95.6	0.12	55.2	17.0	0	240	60	21.9	56.9	1.4	12.1	0.010
260	Durg	Durg	Powara	81.332	21.0996	7.98	383	0	164.8	31.9	0.75	10.1	20.2	0	160	52	7.3	14.4	0.1	14.0	0.003
261	Durg	Dhamdha	Ravelidih	81.3375	21.325	7.79	1143	0	402.7	138.1	0.32	45.5	18.9	0	525	140	42.5	53.7	2.6	21.1	0.022
262	Durg	Bemetara	Sagona	81.4656	21.8131	8.16	304	0	134.2	24.8	0.10	42.3	4.4	0	90	24	7.3	38.6	1.0	12.1	0.004
263	Durg	Gunderdehi	Sankri	81.2586	20.8233	7.48	366	0	189.2	24.8	0.08	21.5	0.8	0	150	34	15.8	21.9	0.9	12.1	0.003
264	Durg	Durg	Selud	81.4194	21.1	7.75	784	0	177.0	102.7	0.03	49.4	51.2	0	210	56	17.0	92.8	4.6	10.1	0.003

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
265	Durg	Gunderdehi	Sikosa	81.2889	20.8764	8.01	304	0	73.2	28.3	0.05	50.7	14.6	0	125	34	9.7	18.2	1.1	21.6	0.005
266	Durg	Patan	Sikola	81.5283	21.0444	7.82	1084	0	323.4	184.1	0.51	8.7	53.4	0	400	102	35.2	103.0	4.9	17.9	0.016
267	Durg	Dhamdha	Tarkori	81.4533	21.5031	7.99	575	0	183.1	53.1	0.20	77.9	4.1	0	150	42	10.9	82.7	4.9	46.1	0.010
268	Durg	SanjariBalod	Umaradah	81.2472	20.7361	8.23	591	0	164.8	85.0	0.22	66.0	14.3	0	145	40	10.9	77.7	2.8	12.1	0.005
269	Durg	Durg	Utai(Adarsh nagar)	81.3889	21.1167	8.24	257	0	128.1	17.7	0.22	13.5	17.5	0	105	22	12.2	22.7	0.4	25.4	0.003
270	Durg	Patan	Zhit	81.5667	21.1292	8.19	770	0	170.9	109.7	0.16	44.4	49.3	0	205	36	27.9	96.5	1.4	21.2	0.006
271	Durg	Patan	Teligundra	81.5488	20.997	8.24	403	0	122.0	49.6	0.81	27.3	35.4	0	135	32	13.4	44.2	0.7	10.4	0.005
272	Durg	Patan	Bodal	81.4275	21.0317	7.9	993	0	256.3	162.8	1.03	21.2	51.2	0	310	62	37.7	108.5	5.1	15.6	0.009
273	Durg	Patan	Karela	81.4916	20.9411	8.01	1138	0	207.5	180.5	1.02	5.7	63.1	0	355	84	35.2	74.8	1.7	16.1	0.009
274	Durg	Patan	Kumhli	81.435	20.9824	8.38	817	12	323.4	99.1	0.88	47.0	12.2	0	270	54	32.8	109.3	10.7	15.9	0.017
275	Durg	Berla	Kharra	81.5463	21.5476	7.91	670	0	299.0	31.9	0.24	7.2	17.8	0	250	52	29.2	37.5	1.6	11.2	0.007
276	Durg	Dhamdha	Birjhapur	81.3038	21.4686	8.02	250	0	67.1	28.3	0.53	34.2	25.4	0	105	36	3.6	14.4	0.7	8.6	0.003
277	Durg	Patan	Sankara	81.5534	21.1829	8.04	702	0	268.5	95.6	0.49	34.5	16.7	0	180	30	25.5	109.0	6.5	7.9	0.006
278	Durg	Dhamdha	KaranjaBhila i	81.3237	21.2943	8.09	507	0	311.2	31.9	0.32	25.9	1.3	0	225	20	42.5	54.4	5.3	10.6	0.002
279	Durg	Bemetara	Bemetera-d	81.5333	21.7167	7.8	858	0	207.5	99.1	0.35	62.5	12.1	0	270	68	24.3	37.2	0.7	35.6	0.001
280	Durg	Patan	Bohardih	81.4347	21.0667	8.11	571	0	97.6	63.7	0.49	84.3	3.5	0	165	54	7.3	38.8	1.2	12.1	0.002
281	Durg	Patan	Bothli	81.5761	21.2172	8.34	942	6	61.0	74.3	0.21	13.2	1.8	0	65	16	6.1	45.0	7.7	17.1	0.004
282	Durg	Patan	Charoda	81.4692	21.2464	7.86	724	0	134.2	90.5	0.18	86.7	10.1	0	170	38	18.2	62.5	0.8	15.4	0.001
283	Durg	Dhamda	Ghota	81.2278	21.4236	8.02	431	0	140.3	24.8	0.54	23.2	7.9	0	115	36	6.1	30.1	1.0	1.7	0.005
284	Durg	SanjariBalod	Khairwahi S	81.2753	20.7664	8.11	415	0	85.4	42.5	0.32	19.2	9.5	0	95	24	8.5	26.0	0.8	12.1	0.006
285	Durg	DondiLohara	Koba(Pz-I)	81.1606	20.8239	8.21	344	0	115.9	38.9	0.03	24.6	6.1	0	100	34	3.6	29.8	0.6	20.1	0.006
286	Durg	Patan	Kumhari	81.5333	21.2333	8.21	938	0	91.5	141.6	0.80	43.3	0.8	0	60	10	8.5	105.8	3.6	25.6	0.002
287	Durg	Dhamda	Mohrenga	81.4697	21.4489	8.09	425	0	219.7	99.1	0.71	101.4	16.4	0	315	82	26.7	76.4	2.4	35.6	0.004
288	Durg	Patan	Pahanda	81.5361	21.2056	7.88	328	0	85.4	38.9	0.20	45.7	5.2	0	110	30	8.5	25.5	0.7	6.7	0.005
289	Durg	Patan	Pachpedi	81.45	21.1569	7.36	955	0	225.8	60.2	0.17	99.5	12.5	0	315	88	23.1	48.6	1.5	20.1	0.001
290	Durg	Berla	Ranka	81.6272	21.6158	7.45	443	0	97.6	42.5	0.12	68.1	16.2	0	190	58	10.9	11.2	0.9	10.3	0.009
291	Durg	DondiLohara	Sambalpur	81.0572	20.8208	7.81	385	0	134.2	31.9	0.06	7.8	14.5	0	145	30	17.0	6.2	0.9	7.6	0.003
292	Durg	Patan	Tarra	81.5197	21.1131	8.09	408	0	73.2	53.1	0.41	40.6	29.6	0	140	32	14.6	23.8	1.1	21.6	0.001

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
293	Durg	Patan	ManikChauri	81.4469	21.0638	7.98	585	0	140.3	31.9	0.40	47.5	18.4	0	180	50	13.4	29.1	3.4	8.5	0.007
294	Durg	Dhamdha	Pendritarai	81.4395	21.4335	8.07	348	0	67.1	28.3	0.39	13.6	41.5	0	140	36	12.2	5.5	3.0	15.6	0.004
295	Durg	Dhamdha	Thengabhat	81.4136	21.5011	7.82	917	0	128.1	99.1	0.21	107.4	29.3	0	190	50	15.8	76.4	10.2	21.9	0.003
296	Gariyaband	Chhura	Sorid	82.2081	20.8108	7.9	481	0	207.4	42.5	0.00	8.2	24.8	0.13	230	80	7.2	12.0	1.2	6.0	0.001
297	Gariyaband(Fotak para)	Fingeswar	Kirwai	81.8774	20.9595	8.1	553	0	268.4	42.5	0.37	13.0	2.5	0.19	125	24	15.6	78.0	1.2	6.0	0.000
298	Gariyabandh	Chhura	Amethi	82.0499	20.9361	7.7	490	0	256.2	28.4	0.30	12.0	0.6	0.18	230	56	21.6	13.8	0.4	8.0	0.000
299	Gariyabandh	Rajim	Kaskera	82.1438	20.9261	7.5	493	0	256.2	28.4	0.21	9.6	0.0	0.13	210	76	4.8	24.8	0.8	8.0	0.000
300	Gariyabandh	Rajim	Mudagaon	82.1704	20.8989	7.6	457	0	268.4	14.2	0.37	9.6	1.9	0.19	200	52	16.8	23.0	0.8	10.0	0.000
301	Gariyabandh	Chhura	Pond	81.7201	20.7987	7.9	354	0	183.0	7.1	0.50	8.2	0.0	0.13	160	48	9.6	15.0	0.8	9.0	0.003
302	Gariyabandh	Fingeswar	Sarkada	82.0594	20.9143	7.8	481	0	189.1	35.5	0.00	7.7	24.8	0.13	220	72	9.6	12.0	1.2	7.0	0.000
303	Gariyabandh	Chhura	Baruka	82.0114	20.6931	7.6	735	0	207.4	106.4	0.08	19.7	47.7	0.13	250	76	14.4	50.6	3.9	10.0	0.000
304	Gariyabandh	Rajim	Chhura	82.2083	20.8125	7.8	481	0	244.0	28.4	0.00	8.2	28.5	0.13	225	80	6.0	12.9	1.2	11.0	0.000
305	Gariyabandh	Rajim	Devri	81.9558	20.8828	7.6	454	0	201.4	35.5	0.00	8.2	7.4	0.13	195	44	20.4	23.9	1.6	13.0	0.000
306	Gariyabandh	Fingeshwar	Fingeshwar	82.0333	20.9667	7.1	361	0	126.4	31.4	0.00	7.2	47.1	0.18	130	40	7.2	20.9	1.2	15.0	0.000
307	Gariyabandh	Chhura	Gariaband	82.0667	20.625	7.4	196	0	72.4	11.2	0.20	9.6	3.1	0.19	85	28	3.6	5.8	0.4	9.0	0.001
308	Gariyabandh	Rajim	Kanekera	82.0792	21.0417	7.1	371	0	134.2	42.5	0.00	7.2	46.5	0.86	130	40	7.2	20.9	1.2	8.0	0.000
309	Gariyabandh	Chhura	Kaseru	82.1233	20.6486	7.6	195	0	97.6	7.1	0.00	9.1	2.5	0.13	80	24	4.8	8.5	2.3	10.0	0.000
310	Gariyabandh	Rajim	Kashi Bahara	82.1867	20.8638	7.6	415	0	185.6	21.3	0.50	9.1	1.2	0.13	170	40	16.8	23.0	0.8	8.0	0.002
311	Gariyabandh	Rajim	Kopra	81.9302	20.8427	7.5	927	0	317.2	113.4	0.12	30.7	59.5	0.13	320	88	24.0	55.9	9.0	8.0	0.000
312	Gariyabandh	Rajim	Koma	81.9369	20.965	7.8	260	0	72.8	11.3	0.12	21.6	5.0	0.13	100	32	4.8	4.8	3.9	7.0	0.000
313	Gariyabandh	Rajim	Panduka	81.9458	20.775	7.7	730	0	244.0	92.2	0.00	20.6	47.7	0.13	270	72	21.6	52.0	3.9	8.0	0.000
314	Gariyabandh	Rajim	Rajim	81.8833	20.9667	7.8	268	0	85.4	28.4	0.00	20.6	5.0	0.13	110	32	7.2	8.5	6.2	6.0	0.003
315	Gariyabandh	Rajim	Sursabandh a	81.9208	20.8806	7.6	448	0	244.0	21.3	0.18	9.1	5.6	0.13	190	48	16.8	23.9	1.6	7.0	0.000
316	Jangir-champa	Nawagarh	Negurdih	82.651	21.8155	8.23	565	0	262.4	60.2	0.22	14.1	24.8	0	290	72	26.7	15.6	0.9	12.2	0.004
317	JANJGIR CHAMPA	Dabhra	Chandrapur	83.2375	21.7083	8.07	911	0	201.3	101.5	0.73	100.9	41.9	0	455	90	55.2	0.1	0.0	12.1	0.012
318	Janjgir-Champa	Bamnidih	Afrid	82.7175	21.9864	8.19	743	0	323.4	95.6	0.25	37.5	26.6	0	320	84	26.7	86.4	0.8	10.1	0.004

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
319	Janjgir-Champa	Akaltara	Akaltara	82.4222	22.0264	8.13	115	0	24.4	14.2	0.09	2.4	18.7	0	40	12	2.4	4.0	4.1	1.2	0.004
320	Janjgir-Champa	Akaltara	Amora	82.3725	21.9697	8.05	169	0	67.1	28.3	0.02	2.9	0.2	0	65	16	6.1	12.3	0.7	2.2	0.003
321	Janjgir-Champa	Baloda	Baloda	82.4778	22.1333	8.21	628	0	219.7	120.4	0.14	11.9	61.5	0	255	80	13.4	82.7	4.9	3.1	0.057
322	Janjgir-Champa	Akaltara	Bamhani	82.4481	22.0844	8.27	474	0	268.5	38.9	0.54	11.4	15.2	0	295	82	21.9	8.4	0.8	8.4	0.010
323	Janjgir-Champa	Bamhnidih	Bamhanidihi	82.7236	21.919	8.44	331	12	183.1	24.8	0.24	6.4	0.3	0	160	38	15.8	16.7	0.4	0.4	0.003
324	Janjgir-Champa	Pamgarh	Bhaiso	82.3394	21.8832	8.13	567	0	177.0	85.0	0.63	13.4	17.8	0	290	72	26.7	14.1	0.9	9.2	0.002
325	Janjgir-Champa	Nawagarh	Budena	82.6231	21.8969	8.27	450	0	152.6	53.1	0.19	12.1	18.1	0	205	46	21.9	13.8	0.9	6.1	0.001
326	Janjgir-Champa	Bamhnidih	Champa	82.6611	22.0353	8.18	553	0	390.5	56.6	0.08	13.6	8.8	0	285	62	31.6	81.8	0.9	12.3	0.001
327	Janjgir-Champa	Dabhra	Dabra	83.0833	21.7833	8.23	704	0	256.3	74.3	0.02	35.5	35.4	0	210	46	23.1	90.3	2.6	9.4	0.005
328	Janjgir-Champa	Jaijaipur	Darra Bhata	82.8352	21.947	8.54	382	12	317.3	21.2	0.01	10.7	3.6	0	125	32	10.9	85.0	1.5	10.1	0.008
329	Janjgir-Champa	Shakti	Damau	82.8594	22.1356	7.41	79	0	30.5	7.1	0.12	14.3	0.2	0	40	8	4.9	5.9	0.1	10.3	0.002
330	Janjgir-Champa	Nawagarh	Dhardei	82.525	21.7972	7.95	1463	0	341.7	219.5	0.65	80.3	60.1	0	590	166	42.5	94.2	0.6	12.4	0.002
331	Janjgir-Champa	Pamgarh	Dongakahrod	82.4581	21.8467	8.13	535	0	219.7	49.6	0.22	12.8	4.2	0	250	62	23.1	13.3	1.4	16.2	0.012
332	Janjgir-Champa	Jaijaipur	Hasoud	82.9125	21.7514	8.25	600	0	360.0	31.9	0.35	5.8	8.7	0	345	84	32.8	19.2	0.9	17.6	0.019
333	Janjgir-Champa	Jaijaipur	Jaijaipur	82.8208	21.8333	8.21	512	0	317.3	31.9	0.05	18.4	8.3	0	260	80	14.6	33.0	0.3	3.6	0.001
334	Janjgir-Champa	Akaltara	Jairamnagar	82.34	22.0331	8.13	490	0	195.3	60.2	0.09	14.1	13.7	0	250	62	23.1	7.3	0.1	9.2	0.003
335	Janjgir-Champa	Nawagarh	Janjgir	82.5799	22.0133	8.19	416	0	146.4	35.4	1.03	8.1	24.4	0	190	58	10.9	9.1	0.1	15.6	0.006
336	Janjgir-Champa	Pamgarh	Jewara	82.3828	21.8528	8.2	581	0	177.0	67.3	0.16	1.7	33.4	0	265	82	14.6	10.1	1.3	3.9	0.002
337	Janjgir-Champa	Nawagarh	Jhulanpakariya	82.4431	21.9208	8.13	376	0	213.6	35.4	0.32	19.2	0.3	0	200	58	13.4	25.6	1.5	14.2	0.014
338	Janjgir-Champa	Balod	Kamrid	74.02	26.05	8.19	270	0	134.2	10.6	0.85	3.0	0.1	0	40	8	4.9	36.4	8.1	10.2	0.004
339	Janjgir-Champa	Nawagarh	Kera	82.7111	21.7458	8.24	241	0	164.8	14.2	0.90	3.6	0.1	0	135	40	8.5	13.2	0.8	12.8	0.011

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
340	Janjgir-Champa	Nawagarh	Khartal	82.6667	21.8	8.01	273	0	189.2	14.2	0.84	3.0	0.3	0	160	36	17.0	8.4	0.2	16.4	0.001
341	Janjgir-Champa	Akaltara	Konargarh	82.3417	21.925	8.24	851	0	195.3	113.3	0.24	7.5	3.3	0	305	100	13.4	19.7	0.4	20.1	0.004
342	Janjgir-Champa	Pamgarh	Kosa	82.3437	21.8938	7.95	362	0	195.3	35.4	0.31	18.4	1.1	0	190	58	10.9	15.1	0.4	16.4	0.021
343	Janjgir-Champa	Dabhra	Latesara	83.1919	21.7392	8.21	744	0	225.8	85.0	0.30	55.2	0.4	0	355	122	12.2	20.1	0.8	21.4	0.001
344	Janjgir-Champa	Nawagarh	Loharsi	82.5567	21.7708	8.09	414	0	146.4	38.9	0.48	12.5	23.1	0	185	40	20.7	12.4	0.3	22.3	0.002
345	Janjgir-Champa	Pamgarh	Mehandi	82.4961	21.8329	8.2	396	0	225.8	21.2	0.51	13.9	3.7	0	150	36	14.6	29.5	0.1	2.3	0.001
346	Janjgir-Champa	Pamgarh	Meubhata	82.465	21.8625	7.85	446	0	256.3	28.3	0.63	3.7	2.4	0	185	50	14.6	32.4	1.5	4.6	0.000
347	Janjgir-Champa	Pamgarh	mudpar	82.6554	21.7351	7.21	272	0	195.3	14.2	0.89	2.7	0.2	0	160	38	15.8	13.6	1.3	5.6	0.003
348	Janjgir-Champa	Akaltara	Mulmula	82.4031	21.93	7.87	528	0	323.4	67.3	0.31	3.7	15.3	0	270	62	27.9	39.4	0.8	8.2	0.003
349	Janjgir-Champa	Akaltara	Nariyara	82.405	21.948	8.15	391	0	115.9	17.7	0.01	65.4	2.1	0	160	34	18.2	15.1	0.3	78.6	0.000
350	Janjgir-Champa	Jaijaipur	Odekara	82.8548	21.8129	8.2	509	0	213.6	24.8	0.03	80.4	2.2	0	235	64	18.2	16.4	1.6	47.3	0.003
351	Janjgir-Champa	Pamgarh	Pamgarh	82.4528	21.8708	8.09	482	0	317.3	17.7	0.05	3.2	2.4	0	260	82	13.4	1.3	0.8	12.6	0.006
352	Janjgir-Champa	Shakti	Saliabhata	82.8477	22.1368	8.22	382	0	164.8	31.9	0.51	13.7	0.2	0	190	60	9.7	4.4	0.3	20.1	0.019
353	Janjgir-Champa	Bamhnidih	Saragaon	82.7542	21.9833	8.25	320	0	170.9	17.7	0.88	18.2	0.2	0	150	38	13.4	16.5	1.3	25.6	0.002
354	Janjgir-Champa	Nawagarh	Semra	82.6333	21.8611	8.08	290	0	158.7	17.7	0.79	28.2	0.2	0	160	36	17.0	3.3	1.0	55.4	0.001
355	Janjgir-Champa	Nawagarh	Seorinarayan	82.5944	21.7333	8.07	275	0	189.2	14.2	0.22	4.1	0.2	0	155	34	17.0	5.1	0.3	23.1	0.003
356	Janjgir-Champa	Janjgir	shukli	82.6111	21.965	8.42	275	9	158.7	14.2	1.01	13.7	0.2	0	165	36	18.2	9.8	0.2	12.4	0.006
357	Janjgir-Champa	Bamhnidih	Sonthi	82.6967	21.9758	8.18	282	0	195.3	17.7	0.32	10.9	0.1	0	160	28	21.9	17.7	3.3	6.4	0.015
358	Janjgir-Champa	Malkharoda	Sukda	83.0944	21.8694	8.16	490	0	286.8	17.7	1.04	23.2	4.3	0	225	70	12.2	28.1	9.5	53.1	0.003
359	Janjgir-Champa	Shakti	Thathari	82.825	21.9319	8.22	377	0	97.6	21.2	1.03	44.6	3.7	0	140	38	10.9	10.4	1.2	18.9	0.006
360	Janjgir-Champa	Pamgarh	vyasnagar	82.4509	21.8717	7.84	934	0	238.0	116.8	0.73	91.2	4.3	0	380	102	30.4	37.4	1.8	19.6	0.008

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
361	Jashpur	Pathalgaon	Amatolli	83.7442	22.4711	8.05	310	0	73.2	38.5	0.07	14.0	22.7	0	100	20	12.0	18.0	1.2	9.2	0.006
362	Jashpur	Farsabahar	Amdiha	83.955	22.466	7.76	469	0	128.1	45.5	0.01	23.6	31.7	0	210	22	37.2	16.1	1.3	11.1	0.008
363	Jashpur	Pathalgaon	Bagh Bahar	83.7564	22.54	8.3	797	0	189.1	91.0	0.02	26.0	64.6	0	360	56	52.8	2.2	1.4	15.1	0.010
364	Jashpur	Bagicha	Bagicha	83.6542	22.9764	7.79	239	0	122.0	17.5	0.25	14.8	2.5	0	110	14	18.0	13.6	1.4	7.6	0.005
365	Jashpur	Bagicha	Bahora	83.7839	23.1019	7.65	256	0	97.6	21.0	0.07	5.1	12.7	0	105	18	14.4	13.1	1.4	5.6	0.005
366	Jashpur	Jashpur	Balachhappar	84.1478	22.8494	7.48	75	0	18.3	10.5	0.57	4.9	12.7	0	20	4	2.4	10.3	1.3	1.2	0.008
367	Jashpur	Kunkuri	Bandarchuwa	83.8583	22.6861	7.96	373	0	115.9	42.0	0.06	15.8	8.5	0	150	12	28.8	15.8	1.7	6.4	0.015
368	Jashpur	Kunkuri	Bangaon 1	83.8606	22.5383	8.29	375	0	176.9	28.0	0.21	9.5	2.8	0	160	6	34.8	16.1	1.5	7.2	0.010
369	Jashpur	Pathalgaon	Bangaon	83.6792	22.6	7.16	880	0	195.2	73.5	0.38	52.0	49.0	0	305	24	58.8	28.7	1.4	15.1	0.014
370	Jashpur	Kasavel	Bataikela	83.7333	22.7333	8.08	560	0	164.7	56.0	0.14	21.7	21.2	0	225	6	50.4	20.6	2.0	12.1	0.008
371	Jashpur	Kasavel	Bewartoli	83.7504	22.9069	7.04	566	0	189.1	80.5	0.06	10.1	21.0	0	255	56	27.6	20.8	2.0	15.1	0.008
372	Jashpur	Kunkuri	Chhapartoli	83.9217	22.8094	7.16	275	0	73.2	21.0	0.02	11.5	28.4	0	110	36	4.8	13.2	1.6	6.7	0.005
373	Jashpur	Jashpur	Chiraidand	84.0753	22.7781	8.2	231	0	73.2	24.5	0.97	5.9	17.7	0	80	26	3.6	13.8	1.6	6.1	0.005
374	Jashpur	Kasvel	Dandajor	83.7783	22.6364	7.22	478	0	176.9	31.5	0.30	15.4	16.8	0	185	64	6.0	16.4	2.3	7.5	0.005
375	Jashpur	Kunkuri	Dhodidand	83.9556	22.7778	8.24	242	0	73.2	21.0	0.32	10.8	4.0	0	75	24	3.6	14.4	1.7	2.3	0.007
376	Jashpur	Kasavel	Dokra	83.8693	22.6208	8.03	275	0	115.9	24.5	0.22	9.7	11.3	0	110	42	1.2	14.8	1.5	6.4	0.006
377	Jashpur	Bagicha	Durgapara	83.5236	22.9701	7.11	670	0	189.1	59.5	0.98	25.6	69.6	0	310	40	50.4	18.0	1.8	10.1	0.004
378	Jashpur	Farsabahar	Farsabahar	83.8553	22.5089	7.57	523	0	158.6	73.5	0.02	23.9	21.4	0	240	64	19.2	18.8	1.5	12.1	0.008
379	Jashpur	Kasavel	Garaibandh	83.5415	22.578	7.4	553	0	274.5	24.5	0.62	21.4	2.8	0	255	38	38.4	18.3	1.3	17.1	0.010
380	Jashpur	Kunkuri	Ghatmunda	83.9331	22.7881	7.75	181	0	67.1	24.5	0.54	4.8	1.5	0	75	18	7.2	15.9	1.7	8.1	0.007
381	Jashpur	Jashpur	Jakba	84.2069	22.9089	7.76	227	0	54.9	17.5	0.50	5.0	43.3	0	75	6	14.4	13.3	2.0	6.4	0.006
382	Jashpur	Jashpur	Jashpurnagar	84.1389	22.8833	7.29	754	0	207.4	84.0	0.07	22.6	54.6	0	300	24	57.6	34.0	2.5	9.5	0.005
383	Jashpur	Farsabahar	Jharmunda	83.8682	22.416	7.96	424	0	152.5	28.0	1.51	28.1	5.5	0	155	34	16.8	31.4	1.2	10.1	0.010
384	Jashpur	Pathalgaon	Kachhar	83.535	22.5583	7.99	587	0	158.6	63.0	0.21	36.3	22.7	0	230	28	38.4	25.3	3.8	11.1	0.005
385	Jashpur	Farsabahar	Kandaibahar	83.9039	22.4956	7.77	382	0	128.1	24.5	0.19	23.0	16.1	0	130	40	7.2	17.7	1.3	6.4	0.009
386	Jashpur	Kunkuri	Kandora	83.9681	22.7558	7.64	277	0	73.2	24.5	0.58	41.0	16.3	0	115	36	6.0	23.2	1.3	12.1	0.011
387	Jashpur	Kasavel	Kansabel	83.7412	22.6401	7.93	488	0	146.4	52.5	0.05	25.0	26.5	0	200	44	21.6	20.6	1.9	16.1	0.004

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
388	Jashpur	Duldula	Kersai	83.9583	22.6	7.72	380	0	158.6	21.0	0.22	17.9	16.1	0	145	54	2.4	29.3	1.4	17.7	0.006
389	Jashpur	Farsabahar	Khutsera	83.8258	22.4128	7.52	550	0	189.1	56.0	0.33	27.8	11.1	0	240	22	44.4	19.8	1.2	21.1	0.008
390	Jashpur	Bagicha	Kondapara	83.7517	23.1425	7.71	150	0	79.3	7.0	0.06	5.1	0.0	0	50	12	4.8	10.6	1.1	0.6	0.011
391	Jashpur	Pathalgaon	Kotba	83.7403	22.4333	7.51	946	0	250.1	108.5	0.14	56.3	53.7	0	310	28	57.6	59.8	1.6	17.1	0.010
392	Jashpur	Duldula	Kunjara	83.9583	22.6653	7.04	352	0	128.1	38.5	0.06	7.5	0.1	0	145	52	3.6	18.0	1.5	11.1	0.010
393	Jashpur	Kunkuri	Kunkuri1	83.9542	22.7419	7.12	756	0	262.3	73.5	0.25	31.6	50.0	0	285	18	57.6	35.5	1.8	15.1	0.013
394	Jashpur	Kansabel	Lamdund	83.7167	22.617	7.23	360	0	152.5	21.0	0.50	13.1	8.7	0	145	42	9.6	22.0	1.3	9.6	0.013
395	Jashpur	Farsabahar	Lavakera	83.9819	22.3847	8.41	704	6	152.5	80.5	0.05	45.7	38.7	0	230	36	33.6	58.2	1.8	17.1	0.005
396	Jashpur	Jashpur	Loro (Bagicha)	84.1507	22.7515	8.34	260	3	89.4	24.5	0.09	6.7	18.0	0	95	24	8.4	15.3	1.7	8.8	0.008
397	Jashpur	Pathalgaon	Ludeg	83.6042	22.5542	8.02	2140	0	567.3	255.5	0.34	93.6	75.4	0	775	218	55.2	118.4	1.4	35.6	0.010
398	Jashpur	Kansabel	Mahuadih	83.6743	22.7823	7.82	168	0	42.7	21.0	0.22	7.3	13.2	0	50	8	7.2	17.6	1.4	7.6	0.012
399	Jashpur	Bagicha	Maini	83.5403	22.9806	7.94	299	0	91.5	17.5	1.52	10.3	17.7	0	95	20	10.8	20.0	1.2	6.5	0.030
400	Jashpur	Kasavel	Muskuti	83.675	22.8625	8.19	290	0	97.6	24.5	0.72	5.0	27.1	0	100	22	10.8	17.4	3.3	12.1	0.004
401	Jashpur	Kunkuri	Matasi	83.8154	22.8951	7.95	250	0	91.5	17.5	0.50	3.9	6.0	0	85	4	18.0	10.5	1.0	6.1	0.005
402	Jashpur	Kasavel	Narayanbahali	83.7814	22.6531	7.99	702	0	213.5	80.5	0.73	28.7	29.7	0	260	62	25.2	43.6	2.3	11.2	0.006
403	Jashpur	Kunkuri	Narayanpur	83.9036	22.8531	8.12	286	0	73.2	28.0	0.37	8.1	29.7	0	90	24	7.2	17.7	3.1	6.4	0.010
404	Jashpur	Pathalgaon	Nawaguda	83.4442	22.5864	8.26	327	0	152.5	31.5	0.50	10.8	0.9	0	150	36	14.4	19.6	3.9	2.3	0.011
405	Jashpur	Pathalgaon	Palidih	83.5069	22.5581	8.39	654	3	317.2	42.0	1.57	10.8	0.5	0	205	46	21.6	58.3	3.3	8.4	0.010
406	Jashpur	Bagicha	Pandripani	83.7081	22.9224	8.21	568	0	189.1	52.5	0.74	16.1	53.1	0	215	52	20.4	23.3	1.9	9.2	0.008
407	Jashpur	Pathalgaon	Pathalgaon	83.4625	22.5547	8.16	743	0	256.2	63.0	0.49	29.7	51.2	0	255	54	28.8	37.7	1.8	11.1	0.012
408	Jashpur	Jashpur	Patratoli	84.1172	22.7444	8.31	83	3	18.3	11.3	1.50	4.2	8.0	0	25	6	2.4	8.9	0.4	0.6	0.023
409	Jashpur	Bagicha	Peta	83.5983	22.9594	8.33	337	3	134.2	24.5	0.52	10.8	13.1	0	125	48	1.2	22.8	3.2	2.3	0.007
410	Jashpur	Kasavel	Phooldih	83.6306	22.9028	8.26	453	0	146.4	49.0	0.95	18.6	26.0	0	165	38	16.8	22.9	3.3	9.2	0.008
411	Jashpur	Bagicha	Raikera	83.6542	22.9347	8.27	182	0	48.8	14.0	1.07	3.6	35.5	0	55	18	2.4	17.7	0.6	6.4	0.005
412	Jashpur	Kunkuri	Raikera(Kunkuri)	84.025	22.7708	8.11	358	0	176.9	28.0	1.57	3.9	4.9	0	90	30	3.6	47.3	0.9	2.3	0.005
413	Jashpur	Bagicha	Raoni	83.6614	23.0067	8.1	490	0	189.1	35.0	1.04	23.8	5.3	0	170	46	13.2	19.1	0.6	6.4	0.019
414	Jashpur	Jashpur	Rupsera	84.2819	22.95	8	691	0	195.2	49.0	0.45	29.2	64.3	0	210	48	21.6	56.1	11.2	7.4	0.008

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
415	Jashpur	Kasavel	Shabdmunda	83.8349	22.5795	8.42	723	3	286.7	42.0	1.16	16.0	52.7	0	275	68	25.2	33.0	1.9	9.2	0.005
416	Jashpur	Bagicha	Sanna	83.8111	23.0861	8.31	716	3	219.6	73.5	0.49	5.7	76.0	0	220	42	27.6	54.2	5.5	8.2	0.015
417	Jashpur	Kasavel	Saraipani	83.6694	22.7944	8.36	261	3	103.7	24.5	1.12	3.7	16.1	0	100	6	20.4	13.7	1.5	4.1	0.008
418	Jashpur	Manora	Fathepur	84.0924	22.9102	8.02	255	0	115.9	14.0	0.38	8.4	14.6	0	105	38	2.4	12.1	3.8	2.3	0.010
419	Jashpur	Kansabel	Saraitola	83.6508	22.5708	7.46	393	0	189.1	17.5	1.04	6.2	7.6	0	115	42	2.4	38.4	1.9	3.1	0.012
420	Jashpur	Manora	Sarkardih	84.0306	22.9722	8.1	72	0	30.5	7.0	0.46	4.6	0.8	0	25	6	2.4	4.7	5.3	9.2	0.006
421	Jashpur	Farsabahar	Sirshringa	83.8036	22.5189	8.36	381	3	128.1	42.0	0.55	7.3	6.7	0	105	30	7.2	31.4	4.0	10.6	0.007
422	Jashpur	Bagicha	Sonquari	83.9426	23.0201	8.39	143	3	73.2	3.5	0.09	3.3	4.2	0	65	6	12.0	4.5	2.6	0.8	0.008
423	Jashpur	Pathalgaon	Surangpani New	83.6883	22.4111	8.04	506	0	158.6	63.0	0.13	25.5	8.0	0	160	22	25.2	40.1	0.8	2.3	0.010
424	Jashpur	Kasavel	Tangargaon	83.7324	22.6097	7.89	736	0	219.6	63.0	0.26	28.0	64.4	0	245	68	18.0	55.6	2.8	4.7	0.010
425	Jashpur	Farsabahar	Tapkara	83.95	22.5042	7.95	850	0	237.9	112.0	0.45	23.6	57.3	0	320	26	61.2	52.0	1.4	7.4	0.012
426	Jashpur	Kansabel	Budadand	83.6423	22.8905	8.21	171	0	73.2	3.5	0.65	7.0	25.9	0	70	4	14.4	9.8	0.7	6.2	0.012
427	Jashpur	Kansabel	Kuthera	83.7254	22.6868	7.94	421	0	176.9	21.0	0.88	22.0	8.4	0	80	10	13.2	62.1	1.3	4.1	0.005
428	Kanker	Charama	Ratesara(sadak para)	81.3956	20.4552	8.42	761	6	279.6	66.5	0.96	42.8	7.2	0	200	38	25.2	85.6	1.1	13.2	0.009
429	Kanker	Charama	Machandur	81.368	20.5301	8.38	572	3	197.6	66.5	0.81	13.8	7.2	0	75	18	7.2	96.5	2.1	4.6	0.010
430	Kanker	Kanker	Govindpur	81.4833	20.2833	7.08	814	0	237.9	112.0	1.31	49.4	5.6	0	225	42	28.8	97.6	4.0	17.1	0.004
431	Kanker	Kanker	Kanker	81.4958	20.2791	8.24	1084	0	256.2	154.0	0.46	70.5	0.4	0	295	58	36.0	110.0	6.7	20.1	0.039
432	Kanker	Kanker	Kulgaon	81.5069	20.175	8.44	474	6	207.4	24.5	0.53	16.3	5.1	0	50	12	4.8	81.5	0.4	25.2	0.010
433	Kanker	Charama	Tegara	81.4408	20.3711	7.92	552	0	134.2	66.5	0.46	42.5	35.6	0	220	46	25.2	33.5	3.2	11.2	0.009
434	Kanker	Charama	Lakhanpur	81.4257	20.3939	8.12	838	0	225.7	101.5	0.70	75.9	0.8	0	245	36	37.2	78.9	2.2	10.8	0.005
435	Kanker	Charama	Jhipatota	81.3723	20.4845	7.65	611	0	128.1	70.0	0.53	69.8	40.1	0	110	42	1.2	92.4	1.9	11.7	0.010
436	Kanker	Sarana (Narharpur)	Murpar	81.6447	20.2828	7.81	439	0	164.7	45.5	0.34	42.5	0.2	0	140	46	6.0	40.9	2.2	11.7	0.009
437	Kanker	Sarana (Narharpur)	Dudhawa	81.7542	20.2875	7.89	473	0	170.8	38.5	0.39	42.7	0.5	0	160	42	13.2	39.8	2.3	9.3	0.012
438	Kawardha	Bodla	Banjari	81.1121	22.1518	8.64	735	12	225.8	31.9	0.09	53.5	19.3	0	160	12	31.6	65.3	2.4	11.0	0.002
439	Kawardha	Sahaspurlohara	BijaBairangi	81.1659	21.7419	8.61	742	9	201.4	45.6	0.03	27.2	20.2	0	165	12	32.8	42.1	1.1	12.5	0.002
440	Kawardha	Sahaspurlohara	Biroda	81.1316	21.7666	8.21	429	0	225.8	35.4	0.84	7.4	18.9	0	170	32	21.9	41.9	2.2	8.5	0.003

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
441	Kawardha	Kawardha	Bodla	81.2208	22.1611	8.05	732	0	231.9	88.5	0.05	35.4	11.1	0	175	42	17.0	79.6	1.4	12.8	0.009
442	Kawardha	Sahaspurlohara	Chhuiha	81.2414	21.8101	8.16	474	0	225.8	53.1	0.15	65.4	4.6	0	200	30	30.4	44.2	5.9	24.6	0.002
443	Kawardha	Bolda	Chilpi	81.0583	22.1667	8.22	385	0	225.8	21.2	0.21	38.5	34.5	0	135	22	19.4	57.9	1.0	7.6	0.003
444	Kawardha	Kawardha	Danganiya	81.2042	21.9639	8.2	596	0	329.5	67.3	0.84	15.8	16.7	0	185	32	25.5	108.4	1.4	15.6	0.004
445	Kawardha	Pandariya	Kapada	81.5458	22.2375	7.81	859	0	238.0	95.6	0.32	47.8	65.7	0	360	46	58.3	39.1	1.6	7.1	0.009
446	Kawardha	Kawardha	Kharoda Kalan	81.3167	22.175	8.2	719	0	390.5	56.6	0.40	18.4	18.4	0	250	30	42.5	103.0	1.4	30.6	0.007
447	Kawardha	Pandariya	Kishungarh	81.4992	22.2064	8.52	818	12	347.8	31.9	0.14	31.4	10.2	0	175	18	31.6	84.3	2.6	12.1	0.005
448	Kawardha	Pandariya	Kui	81.3528	22.3639	8.21	597	0	189.2	59.6	0.84	55.5	48.4	0	205	40	25.5	74.6	1.0	14.6	0.005
449	Kawardha	Kawardha	Mudiyapara	81.2353	22.1478	8.02	836	0	378.3	31.9	0.09	54.6	12.7	0	190	14	37.7	98.3	8.1	48.6	0.006
450	Kawardha	Pandariya	Munmuna	81.3972	22.3264	8.21	468	0	213.6	35.4	0.08	39.1	29.8	0	150	30	18.2	74.7	1.9	1.7	0.004
451	Kawardha	Kawardha	Rengakharkhurd	81.2199	22.0517	8.11	658	0	231.9	63.7	0.81	44.4	13.4	0	135	24	18.2	78.9	3.2	12.1	0.006
452	Kawardha	Sahaspurlohara	Sahaspur lohara.1	81.1292	21.8333	7.83	561	0	122.0	81.4	0.24	71.6	11.7	0	150	22	23.1	55.2	1.5	15.1	0.006
453	Kawardha	Sahaspurlohara	Uriakhurd	81.1733	21.8753	7.61	542	0	274.6	46.0	0.31	71.5	26.7	0	155	26	21.9	113.9	1.9	36.4	0.006
454	Kawardha	Sahaspurlohara	Ragra	81.2892	21.8061	7.93	710	0	250.1	56.6	0.44	15.6	14.3	0	195	34	26.7	60.9	1.3	35.6	0.006
455	Kawardha	Kawardha	Bharamdeo-d	81.2083	22.0681	7.34	400	0	146.4	38.9	0.73	31.5	0.5	0	130	30	13.4	27.1	1.0	12.5	0.002
456	Kawardha	Kawardha	Kawardha	81.2353	22.0092	8.05	340	0	109.8	31.9	0.57	24.4	12.8	0	125	34	9.7	17.7	1.2	16.1	0.011
457	Kawardha	Pandaria	Pandaria	81.4181	22.2167	8.13	508	0	140.3	38.9	0.44	39.6	18.1	0	160	42	13.4	35.5	0.9	15.9	0.023
458	Kawardha		Sarodadadar	81.2083	22.0681	7.93	837	0	231.9	49.6	0.17	67.4	10.5	0	215	76	6.1	69.9	1.1	13.5	0.010
459	Kawardha	Bodla	Singhari-d	81.2825	22.2372	8.34	291	9	73.2	63.7	0.16	5.5	1.8	0	95	22	9.7	30.1	0.8	8.6	0.002
460	Kondagaon	Keshkal	Garaka	81.6009	19.997	8.38	216	6	36.6	21.0	0.81	3.9	37.7	0	80	18	8.4	10.9	1.9	35.2	0.010
461	Kondagaon	Pharasgaon	Kulhadhgaon	81.661	19.7817	8.43	260	3	122.0	24.5	0.67	1.4	0.5	0	110	28	9.6	13.5	1.3	8.9	0.008
462	Kondagaon	Kondagaon	Kondagaon	81.669	19.594	8.12	886	0	231.8	129.5	0.05	41.5	9.1	0	250	58	25.2	89.8	1.6	12.1	0.005
463	Kondagaon	Makadi	Baniyagaon(Khaspara)	81.6942	19.4968	7.65	248	0	97.6	28.0	0.23	4.8	7.2	0	100	28	7.2	17.3	0.6	9.9	0.006
464	Korba	Podi	Gurasia	82.5312	22.6566	7.96	609	0	244.0	38.5	0.55	51.9	23.3	0	165	30	21.6	64.3	2.1	14.2	0.001
465	Korba	Podi	Korbi	82.4419	22.85	7.39	437	0	219.6	21.0	0.57	14.5	0.0	0	80	18	8.4	56.7	2.5	11.7	0.000

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
466	Korba	Podi-Uproda	kurtha (new)	22.9283	82.4458	7.54	292	0	128.1	28.0	0.42	9.0	0.0	0	115	28	10.8	16.7	1.3	16.8	0.001
467	Korba	Podi-Uproda	Lamne	23.0208	82.5397	7.2	891	0	366.0	63.0	0.94	46.4	10.3	0	270	32	45.6	68.8	0.8	18.5	0.000
468	Korba	Podi	Morga	82.6603	22.754	7.57	531	0	237.9	31.5	0.88	39.8	0.0	0	195	24	32.4	31.6	0.6	25.6	0.001
469	Korba	Podi	Nawapara(Chotia)	82.4903	22.7694	6.94	195	0	18.3	28.0	0.32	5.3	44.3	0	70	16	7.2	7.8	8.0	12.5	0.000
470	Korba	Podi	Podi-Uproda	82.5569	22.5945	7.51	697	0	231.8	94.5	0.80	28.0	0.0	0	335	76	34.8	16.5	2.2	11.4	0.000
471	Korba	Pali	Banbandha	82.3806	22.3917	7.96	337	0	115.9	17.7	0.44	99.1	18.7	0	160	36	17.0	30.1	5.6	17.3	0.002
472	Korba	Pali	Bandhakhar	82.43	22.3514	8.01	1335	0	512.6	102.7	0.32	22.4	0.5	0	530	100	66.8	49.3	4.2	12.4	0.017
473	Korba	Korba	Batati Junction	82.9237	22.3542	7.95	551	0	323.4	31.9	0.39	10.5	9.0	0	285	82	19.4	25.2	2.9	15.0	0.029
474	Korba	Katghora	Chaitama	82.4333	22.4333	8.21	588	0	286.8	42.5	0.57	4.1	16.8	0	285	80	20.7	17.3	1.7	5.6	0.001
475	Korba	Kartala	Champa mode	82.9916	22.313	8.09	292	0	219.6	17.7	0.65	9.3	1.4	0	190	42	20.7	8.2	0.4	6.4	0.001
476	Korba	Korba	chachiya	83.0119	22.3415	7.58	465	0	134.2	63.7	1.03	24.0	16.3	0	225	74	9.7	16.2	0.9	14.2	0.000
477	Korba	Korba	Dhegurdih manzipara	82.8371	22.3528	8.05	520	0	268.5	38.9	0.08	60.1	8.9	0	275	80	18.2	20.1	1.0	10.1	0.003
478	Korba	Pali	Dhaurabhata	82.2334	22.1831	8.21	376	0	219.7	21.2	0.65	12.9	0.1	0	195	48	18.2	19.6	2.1	15.1	0.002
479	Koriya	Khadgaowan	Akhradand	23.2041	82.2479	7.72	1092	0	433.1	84.0	0.33	71.6	39.4	0	440	128	28.8	50.2	32.0	21.4	0.003
480	Koriya	Bharatpur (Janakpur)	Ara	81.7641	23.5936	7.23	289	0	67.1	21.0	0.34	9.9	0.1	0	85	18	9.6	5.3	3.6	10.1	0.001
481	Koriya	Bharatpur (Janakpur)	Baharsi.1	81.8542	23.6125	7.75	252	0	170.8	14.0	0.71	4.2	0.0	0	150	34	15.6	6.2	3.2	10.8	0.000
482	Koriya	Baikunthpur	Baikunthpur	82.55	23.2583	6.88	130	0	24.4	17.5	0.00	6.9	13.9	0	50	10	6.0	2.7	4.7	13.7	0.001
483	Koriya	Khadgawan	Banjaridand	82.4497	23.1725	6.92	1727	0	158.6	80.5	0.01	537.7	0.0	0	790	254	37.2	28.9	0.3	6.6	0.000
484	Koriya	Manendragarh	Belbehra	82.265	23.2911	7.51	366	0	195.2	21.0	0.02	12.3	0.0	0	130	30	13.2	29.0	0.6	18.0	0.000
485	Koriya	Manendragarh	Biharpur	82.243	23.4026	7.39	646	0	280.6	56.0	1.51	22.3	0.0	0	140	36	12.0	82.1	0.7	15.7	0.000
486	Koriya	Sonhat	Bikrampur	82.4828	23.4532	7.11	121	0	61.0	10.5	0.08	3.9	0.0	0	60	14	6.0	2.7	2.2	15.2	0.000
487	Koriya	Manendragarh	Chainpur	82.1514	23.222	7.12	110	0	36.6	17.5	0.06	6.7	0.0	0	55	12	6.0	3.2	1.5	6.9	0.000
488	Koriya	Baikunthpur	Chharcha Basti	82.3149	23.3542	6.92	338	0	97.6	35.0	0.58	38.0	5.9	0	115	32	8.4	29.5	4.3	6.6	0.000
489	Koriya	Khadgawan	Chirmiri	82.3449	23.2169	7.5	251	0	115.9	21.0	0.08	10.1	0.0	0	125	30	12.0	6.1	0.4	13.6	0.000

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
490	Koriya	Bharatpur (Janakpur)	Chutki	81.95	23.5736	7.4	303	0	115.9	42.0	0.16	4.4	0.3	0	145	42	9.6	4.9	1.5	13.2	0.000
491	Koriya	Manendragarh	Dodki	82.0057	23.4549	7.09	125	0	30.5	14.0	0.09	3.3	4.9	0	45	8	6.0	1.7	1.9	11.2	0.000
492	Koriya	Manendragarh	Garundol	82.3024	23.3776	7.31	412	0	225.7	14.0	0.27	10.9	0.0	0	175	40	18.0	16.9	3.2	10.0	0.001
493	Koriya	Baikunthpur	Ghugra	82.5237	23.4042	7.3	224	0	103.7	14.0	0.18	3.2	29.1	0	125	34	9.6	3.7	1.2	11.8	0.000
494	Koriya	Baikunthpur	Girjapur	82.717	23.3012	6.82	92	0	30.5	7.0	0.02	3.9	12.8	0	35	8	3.6	2.9	3.5	11.4	0.000
495	Koriya	Baikunthpur	Jamgahana	82.6228	23.3011	7.82	479	0	219.6	14.0	1.07	26.3	0.0	0	220	42	27.6	0.1	0.1	13.1	0.001
496	Koriya	Khadgawan	Jilda	82.4766	23.05	7.72	544	0	213.5	38.5	0.24	51.8	1.9	0	250	68	19.2	19.6	2.8	12.5	0.002
497	Koriya	Sonhat	kailashpur	82.4765	23.3522	7.59	1211	0	268.4	122.5	0.18	82.7	62.7	0	380	118	20.4	77.8	0.8	19.6	0.002
498	Koriya	Manendragarh	Kelhari	82.0486	23.4153	6.84	115	0	42.7	14.0	0.51	4.0	10.1	0	60	20	2.4	3.5	0.7	6.2	0.000
499	Koriya	Khadgawan	Khadgawan	82.3811	23.1161	6.74	104	0	30.5	7.0	0.88	3.3	19.0	0	50	10	6.0	2.9	0.5	16.3	0.001
500	Koriya	Khadgawan	Khadgaon	82.3792	23.1083	7.3	1079	0	189.1	147.0	0.44	78.4	72.6	0	340	72	38.4	87.0	3.2	48.8	0.003
501	Koriya	Baikunthpur	Khatgori	82.5264	23.3708	7.41	231	0	67.1	45.5	0.06	10.4	6.2	0	90	24	7.2	22.6	2.1	10.3	0.000
502	Koriya	Baikunthpur	Khodri	82.4827	23.4103	7.4	210	0	103.7	17.5	0.04	4.1	7.6	0	105	32	6.0	3.9	2.7	16.7	0.000
503	Koriya	Manendragarh	Manendragarh	82.2058	23.2167	6.96	161	0	24.4	21.0	0.03	60.8	3.7	0	80	8	14.4	11.0	4.8	3.8	0.000
504	Koriya	Baikunthpur	Mansukha	82.4917	23.225	7.03	739	0	170.8	66.5	0.59	93.3	66.7	0	330	90	25.2	28.6	0.4	29.9	0.000
505	Koriya	Baikunthpur	Mohra	82.6348	23.3035	7.23	772	0	256.2	91.0	0.11	45.1	15.3	0	355	62	48.0	21.6	1.6	61.8	0.000
506	Koriya	Baikunthpur	Nagar (Station)	23.3862	82.3619	7.58	749	0	225.7	80.5	0.98	56.7	1.8	0	260	60	26.4	52.2	0.9	25.0	0.000
507	Koriya	Baikunthpur	Nagar(Tilwandar)	82.4445	23.309	7.76	368	0	183.0	28.0	0.16	12.8	0.6	0	95	24	8.4	52.0	0.6	14.7	0.000
508	Koriya	Manendragarh	Nagpur	82.3186	23.2817	7.82	513	0	170.8	63.0	1.51	23.3	0.0	0	30	10	1.2	100.8	0.4	10.5	0.000
509	Koriya	Baikunthpur	Patan	81.1889	23.5043	7.47	538	0	152.5	73.5	0.18	44.8	2.5	0	185	42	19.2	38.8	5.0	41.4	0.000
510	Koriya	Baikunthpur	Patrapali	82.573	23.2211	7.36	341	0	140.3	21.0	0.21	37.7	0.1	0	145	42	9.6	16.5	0.4	16.7	0.000
511	Koriya	Manendragarh	Pendri	82.2556	23.3486	7.48	243	0	85.4	21.0	0.19	22.4	0.0	0	95	16	13.2	13.4	3.3	6.3	0.000
512	Koriya	Manendragarh	Piparia	82.2509	23.269	7.54	582	0	256.2	45.5	0.89	22.8	0.8	0	90	20	9.6	98.1	1.4	15.6	0.000
513	Koriya	Khadgaowan	podidih	23.0264	82.0859	7.93	531	0	176.9	42.0	0.61	26.0	65.4	0	215	48	22.8	31.3	1.9	21.5	0.000
514	Koriya	Khadgawan	Pouri	82.4994	23.0386	7.97	477	0	128.1	63.0	0.25	14.6	44.9	0	150	32	16.8	42.1	1.1	17.0	0.001

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
515	Koriya	Baikunthpur	Ranai	82.7028	23.2806	8.01	443	0	164.7	52.5	0.09	25.3	4.6	0	145	30	16.8	47.2	0.8	16.6	0.001
516	Koriya	Manendragarh	Rojhi	81.9715	23.4824	7.74	322	0	122.0	35.0	0.37	15.6	18.6	0	145	44	8.4	14.4	5.4	8.0	0.000
517	Koriya	Manendragarh	Sarbhoka	82.3583	23.25	8.02	566	0	311.1	21.0	0.22	11.7	0.3	0	150	36	14.4	78.4	2.7	18.7	0.002
518	Koriya	Sonhat	Sonhat	82.5189	23.4819	7.4	436	0	67.1	59.5	0.18	28.0	59.1	0	145	30	16.8	37.5	8.3	18.5	0.000
519	Koriya	Manendragarh	Tarabahara	82.1806	23.4111	7.72	941	0	176.9	133.0	0.18	68.3	58.7	0	230	56	21.6	110.4	20.0	6.2	0.000
520	Koriya	Baikunthpur	Tengni	82.7392	23.3167	7.97	1166	0	189.1	189.0	1.51	99.1	0.7	0	545	152	39.6	8.9	10.6	21.5	0.003
521	Koriya	Manendragarh	Tilokhan	81.9833	23.4833	7.84	196	0	36.6	28.0	0.01	7.5	40.3	0	60	8	9.6	24.5	2.3	9.9	0.000
522	Koriya	Manendragarh	Ujiyarpur	82.405	23.3139	8	325	0	170.8	17.5	0.12	7.0	0.3	0	100	24	9.6	29.1	0.6	6.2	0.000
523	Koriya	Manendragarh	Shripur	82.0325	23.4351	7.95	301	0	164.7	14.0	0.02	7.0	4.1	0	155	32	18.0	5.0	0.6	13.9	0.000
524	Koriya	Sonhat	Mendrakala	82.508	23.5194	7.77	102	0	18.3	31.5	0.12	3.9	0.2	0	35	8	3.6	11.9	2.2	12.4	0.000
525	Mahasamund	Saraipali	Badesara	83.09	21.3922	7.77	1514	0	292.8	157.5	1.04	225.1	66.0	0	515	110	57.6	70.1	4.7	17.1	0.005
526	Mahasamund	Saraipali	Patsenduri	83.075	21.3694	8.03	1049	0	274.5	122.5	0.65	74.3	22.0	0	360	76	40.8	84.8	3.3	13.6	0.006
527	Mahasamund	Mahasamund	Amlor	82.0838	21.3542	7.5	582	0	256.2	49.6	0.00	18.2	20.5	0.86	250	72	16.8	24.8	9.0	8.0	0.000
528	Mahasamund	Bagbahara	Bagbahara	82.4083	21.0333	7.8	624	0	244.0	63.8	0.60	19.7	24.8	0.13	250	64	21.6	38.9	0.8	20.0	0.002
529	Mahasamund	Mahasamund	Baldidih	82.6417	21.2917	7.7	713	0	268.4	92.2	0.10	17.8	1.2	0.13	310	68	33.6	24.8	0.8	17.0	0.001
530	Mahasamund	Basna	Barbaspun	82.8816	21.2908	7.8	594	0	292.8	42.5	1.48	18.7	0.0	0.13	240	40	33.6	38.0	2.3	8.0	0.001
531	Mahasamund	Basna	Basna	82.8264	21.2694	8	508	0	146.4	78.0	0.00	30.7	12.4	0.13	220	60	16.8	23.9	2.3	8.0	0.001
532	Mahasamund	Mahasamund	Belsunda	82.0271	21.1634	7.92	426	0	170.8	35.5	0.00	15.8	13.6	0.13	180	64	4.8	12.9	3.9	7.0	0.000
533	Mahasamund	Bagbahara	Bhimkhoj	82.2958	21.0681	7.87	440	0	231.8	21.3	0.90	14.9	8.1	0.19	190	44	19.2	26.0	0.4	19.0	0.000
534	Mahasamund	Bagbahara	Hadabundh	82.2183	21.0933	7.9	427	0	146.4	42.5	0.23	40.8	8.1	0.18	165	40	15.6	29.9	1.2	5.0	0.002
535	Mahasamund	Pithora	Jagdishpur	82.775	21.3333	7.7	514	0	134.2	78.0	0.00	29.8	12.4	0.13	210	68	9.6	23.9	2.3	8.0	0.000
536	Mahasamund	Mahasamund	Jalki	82.2116	21.2433	7.6	285	0	109.8	7.1	0.00	3.4	46.5	0.13	100	36	2.4	15.9	1.6	18.0	0.000

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
537	Mahasamund	Mahasamund	Jhalap	82.3831	21.2158	7.4	270	0	97.6	24.8	0.16	10.6	16.7	0.13	100	32	4.8	18.9	0.8	14.0	0.001
538	Mahasamund	Mahasamund	Jogidipa	82.2599	21.2231	7.6	235	0	122.0	14.2	1.27	2.9	0.0	0.19	80	20	7.2	23.0	0.4	5.0	0.000
539	Mahasamund	Bagbahara	Khallari	82.2972	21.0833	7.8	624	0	256.2	56.7	0.71	24.0	25.4	0.13	235	64	18.0	46.9	1.2	15.0	0.002
540	Mahasamund	Mahasamund	Kowajhar	82.1483	21.2097	7	100	0	42.7	7.1	0.00	4.8	1.9	0.13	40	8	4.8	5.1	0.8	4.0	0.000
541	Mahasamund	Mahasamund	Lavra Khurud	82.1169	21.0886	7.4	427	0	207.4	28.4	0.00	13.9	12.4	0.19	200	56	14.4	14.5	3.9	4.0	0.001
542	Mahasamund	Mahasamund	Mahasamund.1	82.0958	21.1083	7.8	431	0	146.4	42.5	0.15	41.8	8.7	0.18	160	8	33.6	29.9	5.5	5.0	0.000
543	Mahasamund	Saraipalli	Marban	83.0807	21.3876	7.9	433	0	219.6	21.3	0.53	9.6	18.0	0.13	210	48	21.6	13.3	0.8	15.0	0.000
544	Mahasamund	Bagbahara	Maulimuda	82.4311	21.0055	7.9	314	0	158.6	14.2	0.71	6.7	10.5	0.13	110	36	4.8	27.8	0.0	17.0	0.002
545	Mahasamund	Mahasamund	Pasid	82.1457	21.3374	7.7	287	0	85.4	28.4	0.00	3.8	49.6	0.13	120	40	4.8	15.9	2.0	18.0	0.001
546	Mahasamund	Basna	Saraipali	83.0083	21.3167	7.8	482	0	244.0	28.4	0.55	8.6	18.6	0.13	240	32	38.4	12.9	0.8	15.0	0.000
547	Mahasamund	Bagbahara	Suarmar	82.4958	20.9694	7.9	313	0	158.6	14.2	0.71	6.7	10.5	0.86	110	32	7.2	26.9	0.4	18.0	0.000
548	Mahasamund	Bagbahara	Tendukonda	82.4708	21.1083	7.8	776	0	183.0	134.7	0.00	15.8	36.6	0.13	270	40	40.8	52.9	0.8	15.0	0.000
549	Mahasamund	Mahasamund	Tumgaon	82.1208	21.1917	7.9	193	0	73.2	17.7	0.00	6.7	18.0	0.13	80	20	7.2	12.9	0.4	4.0	0.003
550	Mahasamund	Basna	Mandalpur	82.9228	21.4875	7.6	436	0	256.2	14.2	0.32	9.6	1.2	0.07	190	56	12.0	24.8	0.4	5.0	0.001
551	Mahasamund	Saraipalli	Deori	82.7293	21.2742	7.7	410	0	231.8	21.3	0.74	3.8	0.0	0.08	150	44	9.6	32.9	2.3	12.0	0.000
552	Mahasamund	Bagbahara	Samhar	82.478	21.079	7.7	780	0	183.0	163.1	0.10	15.8	32.9	0.09	300	72	28.8	55.0	0.8	12.0	0.002
553	Mahasamund	Mahasamund	Boriyar	82.1523	21.0764	7.8	107	0	36.6	14.2	0.47	1.9	5.0	0.06	35	10	2.4	9.7	2.0	17.0	0.001
554	Mahasamund	Mahasamund	Jamli Nawadih	82.1837	21.086	7.5	205	0	73.2	14.2	0.42	7.7	16.7	0.06	65	20	3.6	17.9	0.8	7.0	0.000
555	Mahasamund	Bagbahara	Awaradabri	82.3006	21.0847	7.8	393	0	195.2	21.3	0.82	13.0	6.8	0.08	160	48	9.6	23.9	0.4	15.0	0.000
556	Mahasamund	Mahasamund	Sirpur	82.1833	21.3431	7.5	564	0	244.0	49.6	0.13	18.7	19.8	0.08	235	68	15.6	26.0	9.0	16.0	0.001
557	Raigarh	Dharmajaigarh	Amgaon	83.2166	22.3892	8.05	320	0	115.9	38.5	0.01	13.8	9.6	0	125	32	10.8	15.1	6.7	6.4	0.007

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558	Raigarh	Dharmajaigarh	Amapali	83.2342	22.3706	8.24	96	0	30.5	14.0	0.56	4.8	0.0	0	35	10	2.4	1.9	4.1	5.6	0.010
559	Raigarh	Gharghoda	Amlidih	83.3327	22.1126	7.92	308	0	109.8	14.0	1.41	17.6	29.7	0	115	10	21.6	16.4	3.2	9.1	0.011
560	Raigarh	Dharmajaigarh	Auranar	83.1628	22.1524	7.58	179	0	30.5	24.5	0.96	4.6	45.7	0	85	22	7.2	4.6	5.7	0.8	0.008
561	Raigarh	Pusaur	Aurda	83.3884	21.812	7.66	661	0	201.3	94.5	0.76	40.8	1.9	0	245	30	40.8	40.8	1.2	4.6	0.007
562	Raigarh	Tamnar	Auraimura	83.3811	22.2022	7.97	100	0	24.4	10.5	0.76	5.7	8.5	0	35	6	4.8	3.9	5.5	12.6	0.008
563	Raigarh	Baramkela	Bade Nawapara	83.3548	21.5569	7.71	498	0	103.7	80.5	0.45	32.5	10.0	0	150	24	21.6	34.8	2.1	8.7	0.007
564	Raigarh	Dharmajaigarh	Bakaruma	83.4361	22.5125	7.97	397	0	122.0	42.0	0.02	19.7	19.6	0	135	36	10.8	27.2	5.9	6.4	0.006
565	Raigarh	Raigarh	Bangrusian	83.4752	21.9779	8.17	98	0	18.3	10.5	0.04	6.6	22.1	0	40	10	3.6	7.2	4.4	1.0	0.005
566	Raigarh	Raigarh	Bansjer	83.2174	22.4891	7.84	540	0	97.6	52.5	0.46	91.1	12.9	0	140	46	6.0	56.7	2.4	10.1	0.005
567	Raigarh	Sarai Lengha Baram	Baramkela	83.2625	21.525	8.01	327	0	146.4	24.5	0.04	5.7	0.3	0	130	38	8.4	8.6	9.7	1.2	0.006
568	Raigarh	Tmanar	Barkaspali	83.4097	22.1591	8.05	492	0	213.5	38.5	0.21	10.1	0.2	0	190	46	18.0	9.2	6.8	2.2	0.005
569	Raigarh	Dharmajaigarh	Barpali	83.2667	22.3278	8.14	203	0	85.4	10.5	0.04	12.5	5.2	0	95	22	9.6	2.1	0.8	3.1	0.006
570	Raigarh	Sarai Lengha Baram	Barpali	83.3458	21.5481	7.66	759	0	341.6	31.5	0.65	23.8	6.3	0	310	78	27.6	7.6	3.2	8.4	0.006
571	Raigarh	Dharmajaigarh	Bartapali	83.1773	22.3401	7.97	95	0	36.6	10.5	0.04	1.2	0.0	0	40	12	2.4	0.8	0.2	0.4	0.005
572	Raigarh	Sarangarh	Bataupali	83.1344	21.5356	7.68	528	0	195.2	45.5	0.12	32.2	4.7	0	215	24	37.2	19.1	1.2	9.2	0.008
573	Raigarh	Dharmajaigarh	Bayasi	83.1672	22.4353	7.33	251	0	79.3	24.5	0.57	12.1	20.7	0	125	28	13.2	3.3	0.4	6.1	0.007
574	Raigarh	Gharghoda	Bhalumar	83.3447	22.1194	7.83	126	0	67.1	21.0	0.66	8.9	10.4	0	105	18	14.4	2.1	1.1	7.2	0.006
575	Raigarh	Gharghoda	Bhangari	83.2508	22.1328	7.65	294	0	61.0	28.0	0.89	14.6	47.7	0	130	40	7.2	9.8	6.4	9.4	0.007
576	Raigarh	Dharmajaigarh	Bojia	83.1627	22.1283	7.8	415	0	122.0	45.5	0.76	20.1	32.9	0	175	44	15.6	12.1	0.8	10.1	0.008
577	Raigarh	Pusaur	Bonda	83.282	21.639	7.79	509	0	189.1	42.0	0.07	31.6	1.1	0	220	28	36.0	14.1	3.5	11.2	0.013
578	Raigarh	Dharmajaigarh	Boro	83.1119	22.5633	7.82	233	0	54.9	14.0	0.89	17.8	54.2	0	115	12	20.4	9.2	0.5	12.4	0.014
579	Raigarh	Kharsia	Chaple	83.2	21.9833	7.75	948	0	219.6	101.5	0.76	86.7	65.1	0	410	96	40.8	13.4	1.5	16.2	0.010
580	Raigarh	Dharmajaigarh	Charkhapara	83.383	22.5398	7.81	566	0	189.1	52.5	0.62	17.7	8.5	0	260	62	25.2	8.9	7.6	7.2	0.010
581	Raigarh	Dharmajaigarh	Chhal	83.1209	22.1234	8.02	243	0	109.8	21.0	0.32	8.9	0.2	0	110	28	9.6	4.7	0.8	9.2	0.006

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
582	Raigarh	Sarangarh	Chhind	83.0033	21.5958	7.61	1024	0	189.1	133.0	0.09	117.9	29.5	0	425	98	43.2	12.7	0.8	9.2	0.005
583	Raigarh	Gharghoda	Chimtapani	83.4167	22.2722	8.01	224	0	115.9	17.5	0.13	18.2	1.5	0	90	24	7.2	19.0	0.7	3.4	0.005
584	Raigarh	Raigarh	Chiraipani	83.3883	21.9218	8.1	860	0	195.2	94.5	0.65	46.8	71.7	0	290	62	32.4	52.5	10.5	3.9	0.006
585	Raigarh	Daranjaigarh	Choranga	83.463	22.4665	7.95	874	0	201.3	112.0	0.49	63.7	32.5	0	300	66	32.4	46.7	3.7	14.2	0.005
586	Raigarh	Gharghoda	Chuhkimar	83.3539	22.1411	7.78	142	0	36.6	10.5	0.38	15.6	15.1	0	40	10	3.6	9.2	6.5	1.1	0.003
587	Raigarh	Sarangarh	Damdarha	83.125	21.445	8.26	589	0	195.2	77.0	0.05	10.6	0.1	0	225	64	15.6	18.0	4.2	12.8	0.006
588	Raigarh	Dharmajaigarh	Derpani	83.2869	22.6442	8.37	555	3	183.0	66.5	0.05	17.0	7.9	0	230	28	38.4	26.8	0.9	14.6	0.011
589	Raigarh	Tamnar	Devgarh	83.4029	22.1675	8.34	462	3	115.9	80.5	0.18	17.0	7.2	0	130	10	25.2	42.5	6.3	20.1	0.006
590	Raigarh	Dharmajaigarh	Dharmajaigarh	83.2125	22.4639	8.41	275	6	48.8	24.5	0.14	8.0	44.2	0	110	22	13.2	10.0	8.3	6.4	0.004
591	Raigarh	Kharsiya	Domnara	83.0837	21.9996	7.56	833	0	256.2	87.5	0.16	70.9	6.7	0	275	38	43.2	77.4	0.6	21.4	0.004
592	Raigarh	Dharmajaigarh	Duliamuda	83.1393	22.4152	8.47	136	3	48.8	17.5	0.05	2.8	0.6	0	50	18	1.2	5.7	9.2	2.3	0.005
593	Raigarh	Gharghoda	Dumarpali	83.2786	22.2947	8.32	90	3	24.4	10.5	0.05	2.6	2.0	0	20	4	2.4	6.7	5.2	1.1	0.007
594	Raigarh	Dharmajaigarh	Durgapur	83.1596	22.4805	8.04	156	0	36.6	14.0	0.18	2.6	25.9	0	55	4	10.8	7.0	9.1	4.6	0.006
595	Raigarh	Dharmajaigarh	Edu	83.1269	22.0756	8.29	442	0	146.4	73.5	0.14	4.3	6.2	0	170	40	16.8	12.6	7.3	5.6	0.006
596	Raigarh	Kharsia	Farkanara	83.1048	22.0142	8.35	583	3	122.0	73.5	0.31	14.7	59.3	0	220	42	27.6	16.5	7.3	8.2	0.004
597	Raigarh	Lailunga	Futahamuda	83.4438	22.2975	7.41	150	0	42.7	14.0	0.04	3.9	15.4	0	60	16	4.8	4.2	8.9	0.8	0.012
598	Raigarh	Lailunga	Gosaidih	83.5716	22.3631	8.31	594	3	152.5	84.0	0.05	17.9	25.2	0	120	42	3.6	68.9	1.7	6.4	0.011
599	Raigarh	Tamnar	Gare	83.489	22.1358	8.23	527	0	128.1	63.0	0.03	20.9	59.0	0	160	38	15.6	59.1	7.3	16.4	0.005
600	Raigarh	Dharmajaigarh	Gersa	83.2347	22.3431	8.45	386	6	97.6	70.0	0.61	10.2	2.8	0	165	20	27.6	5.0	6.5	11.2	0.004
601	Raigarh	Raigarh	Gerwani	83.3751	22.0105	8.38	773	3	176.9	112.0	0.04	39.3	63.1	0	245	80	10.8	71.2	2.2	22.4	0.005
602	Raigarh	Gharghoda	Gharghoda	83.3542	22.1708	7.57	602	0	189.1	94.5	0.08	6.3	5.0	0	245	34	38.4	17.2	6.5	18.2	0.005
603	Raigarh	Kharsia	Gidha	83.1231	21.9614	7.42	650	0	158.6	91.0	0.45	30.0	5.4	0	275	66	26.4	24.3	0.7	21.4	0.006
604	Raigarh	Sarangarh	Godam	83.182	21.663	8.3	1226	3	323.3	136.5	0.01	51.1	3.2	0	315	94	19.2	101.5	21.1	52.4	0.008
605	Raigarh	Dharmajaigarh	Golabuda	83.4042	22.6306	8.29	442	0	103.7	101.5	0.52	2.8	14.4	0	210	20	38.4	12.0	3.5	6.7	0.005
606	Raigarh	tamnar	Gohri	83.4264	22.0844	8.24	1334	0	305.0	185.5	0.07	58.0	63.6	0	315	62	38.4	145.8	51.0	31.2	0.006

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
607	Raigarh	Dharmajaigarh	Hati	83.0958	22.3042	7.81	120	0	12.2	21.0	1.03	3.2	14.6	0	30	6	3.6	4.5	11.5	4.2	0.004
608	Raigarh	Sarangarh	Hirri	83.111	21.643	7.56	350	0	152.5	21.0	0.44	27.0	8.3	0	125	38	7.2	29.7	0.4	10.1	0.005
609	Raigarh	Dharmajaigarh	Jabga	83.1061	22.5322	7.58	183	0	36.6	17.5	0.31	9.3	37.0	0	75	18	7.2	8.8	6.4	12.4	0.009
610	Raigarh	Raigarh	jamgaon(Basti)	83.534	21.89	7.66	1577	0	158.6	301.0	0.04	97.0	58.6	0	625	134	69.6	60.2	1.1	25.4	0.008
611	Raigarh	raigarh	Jamga Railway station	83.558	21.861	8.11	120	0	36.6	14.0	0.38	3.6	5.2	0	50	16	2.4	6.1	1.2	5.5	0.005
612	Raigarh	Lailunga	Jegarpur	83.5388	22.3481	7.74	760	0	176.9	101.5	0.32	47.5	25.8	0	285	42	43.2	45.9	2.7	8.9	0.005
613	Raigarh	Sarai Lengha Baram	Jhikipali	83.3309	21.4207	8.01	499	0	231.8	21.0	0.53	15.7	0.5	0	135	44	6.0	36.2	2.6	2.5	0.007
614	Raigarh	Raigarh	Jorapali	83.3729	21.8724	7.71	1677	0	390.4	196.0	0.12	98.9	0.4	0	650	144	69.6	63.3	2.8	25.7	0.010
615	Raigarh	Sarangarh	Kanakbira	83.13	21.461	8.19	345	0	176.9	17.5	1.56	15.1	0.2	0	110	42	1.2	33.0	2.4	4.7	0.011
616	Raigarh	Dharmajaigarh	Kandadand	83.195	22.5367	8.26	324	0	158.6	17.5	0.21	7.5	12.4	0	105	38	2.4	22.0	6.8	3.7	0.012
617	Raigarh	Sarai Lengha Baram	Kandola	83.4351	21.6503	8.12	533	0	207.4	17.5	0.21	77.5	0.2	0	260	56	28.8	10.2	2.5	12.5	0.005
618	Raigarh	Dharmajaigarh	Kapu	83.3375	22.6708	7.95	377	0	109.8	35.0	0.24	12.1	43.8	0	140	20	21.6	23.2	3.3	3.7	0.015
619	Raigarh	Sarangarh	Kargipali (Kargidipa)	83.106	21.429	7.95	614	0	292.8	35.0	0.88	23.5	12.3	0	115	2	26.4	100.1	1.9	10.7	0.018
620	Raigarh	Dharmajaigarh	Karigashi	83.1425	22.5147	8.15	656	0	176.9	91.0	1.50	53.8	0.1	0	65	18	4.8	119.8	1.6	16.7	0.020
621	Raigarh	Dharmajaigarh	KarraMara	83.3738	22.4739	8.21	560	0	256.2	21.0	0.22	10.2	20.2	0	215	60	15.6	26.5	1.0	7.8	0.038
622	Raigarh	Pussore	Kathali New	83.3214	21.7612	7.78	1310	0	311.1	168.0	0.01	98.9	0.3	0	495	90	64.8	64.9	2.1	20.1	0.004
623	Raigarh	Dharamjaigarh	Katangdih	83.2799	22.1551	8.16	109	0	24.4	14.0	0.06	9.3	0.5	0	40	12	2.4	2.5	5.7	0.7	0.009
624	Raigarh	Sarangarh	Kedar	82.9719	21.5674	7.98	800	0	280.6	80.5	1.23	44.0	0.9	0	165	58	4.8	116.8	10.0	12.7	0.004
625	Raigarh	Raigarh	Kerajhar	83.3042	21.9611	8.11	392	0	219.6	14.0	0.02	10.2	4.5	0	180	36	21.6	10.6	1.9	4.3	0.010
626	Raigarh	Dharmajaigarh	Khadgaon	83.1167	22.3792	8.05	460	0	237.9	31.5	0.46	8.4	6.2	0	210	58	15.6	12.5	2.6	5.7	0.012
627	Raigarh	Dharmajaigarh	Khanhar	83.2517	22.5797	8.21	385	0	176.9	31.5	0.02	7.6	4.8	0	55	18	2.4	56.3	2.4	12.1	0.014
628	Raigarh	Kharsia	Kharsia	83.0986	21.9889	8.12	724	0	213.5	112.0	0.41	34.9	0.1	0	155	38	14.4	110.8	2.2	6.4	0.006
629	Raigarh	Tamnar	Koknara	83.3694	22.2056	8.26	170	0	54.9	21.0	0.56	4.3	0.0	0	55	18	2.4	4.8	5.6	17.1	0.004

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
630	Raigarh	Pusaur	Kondatarai	83.3576	21.8193	8.02	510	0	134.2	24.5	0.02	106.0	1.3	0	95	16	13.2	75.8	1.6	11.1	0.008
631	Raigarh	Raigarh	Kotarliya	83.4611	21.8903	8.49	344	3	146.4	24.5	0.41	26.3	1.8	0	115	12	20.4	30.6	2.4	12.2	0.007
632	Raigarh	Raigarh	Kotra	83.3125	21.8667	8.21	1090	0	311.1	143.5	0.81	90.0	0.2	0	380	92	36.0	98.2	2.5	6.4	0.004
633	Raigarh	Gharghoda	Kotrimal	83.3978	22.2315	8.06	436	0	189.1	28.0	0.23	12.6	9.9	0	170	22	27.6	15.2	7.6	15.2	0.004
634	Raigarh	Dharmajaigarh	Kurekela	83.1042	22.2042	8.36	328	3	140.1	14.5	0.41	17.5	6.3	0	145	40	10.8	10.5	9.1	17.1	0.005
635	Raigarh	Gharghoda	Kurmibhuna	83.3665	22.28	8.51	513	6	176.9	49.0	0.74	17.9	9.7	0	110	20	14.4	72.1	7.6	4.6	0.014
636	Raigarh	Lailunga	Lailunga	83.5833	22.3833	8.36	640	3	109.8	73.5	0.55	55.4	40.3	0	210	34	30.0	51.4	3.0	5.8	0.004
637	Raigarh	Raigarh	Lakha	83.3847	21.965	8.38	130	3	24.3	17.5	0.61	4.6	4.0	0	55	4	10.8	2.8	0.4	6.1	0.010
638	Raigarh	Dharmajaigarh	Lakshmipur	83.2137	22.5098	8.4	532	3	280.6	17.5	0.57	18.4	0.1	0	105	8	20.4	91.8	2.2	25.1	0.012
639	Raigarh	Lailunga	Laripani	83.4708	22.3375	8.22	1080	0	152.5	161.0	0.88	36.3	65.6	0	410	78	51.6	23.2	6.2	12.1	0.009
640	Raigarh	Sarai Lengha Baram	Lendhara	83.2952	21.4922	8.16	841	0	231.8	112.0	1.20	46.6	4.9	0	230	30	37.2	80.0	2.4	25.2	0.010
641	Raigarh	Dharmajaigarh	Lipti	83.3797	22.6508	8.38	250	6	97.6	10.5	0.61	11.8	1.7	0	45	10	4.8	28.6	0.8	6.7	0.004
642	Raigarh	Raigarh	Mahapalli New	83.4284	21.9001	8.33	698	3	128.1	98.0	0.07	20.7	70.6	0	110	18	15.6	86.2	2.5	14.1	0.005
643	Raigarh	Sarai Lengha Baram	Mahuapali	83.278	21.613	8.34	520	3	237.9	21.0	0.61	54.9	0.3	0	145	42	9.6	22.2	4.5	16.9	0.006
644	Raigarh	Sarai Lengha Baram	Malda (B)	83.1956	21.5589	8.19	631	0	176.9	66.5	0.45	41.9	21.0	0	180	20	31.2	57.0	3.6	17.1	0.007
645	Raigarh	Tamnar	Milupara	83.5199	22.1872	8.23	300	0	122.0	59.5	0.22	9.3	0.0	0	140	32	14.4	17.4	9.1	11.2	0.007
646	Raigarh	Dharmajaigarh	Munund	83.0892	22.2372	8.31	98	3	30.5	10.5	0.13	8.1	1.2	0	30	8	2.4	7.9	4.5	4.6	0.008
647	Raigarh	Pusaur	Nawrangpur	83.2297	21.85	8.41	790	6	140.3	147.0	1.37	30.0	0.5	0	280	18	56.4	48.2	2.6	35.6	0.007
648	Raigarh	Dharmajaigarh	Ongana New	83.2451	22.423	7.65	212	0	48.8	31.5	1.00	27.1	28.9	0	100	24	9.6	12.7	6.8	7.2	0.010
649	Raigarh	Tamnar	Padigaon	83.4841	22.0507	7.61	432	0	128.1	73.5	1.13	10.6	2.3	0	130	30	13.2	36.1	5.1	12.1	0.011
650	Raigarh	Lailunga	Pakargaon	83.6125	22.3856	7.76	372	0	91.5	66.5	1.23	5.9	3.5	0	115	22	14.4	32.4	3.3	10.1	0.005
651	Raigarh	Sarangarh	Pindri	83.1415	21.6813	7.65	1010	0	244.0	143.5	1.33	101.2	3.1	0	315	48	46.8	65.1	14.1	21.6	0.004
652	Raigarh	Raigarh	Raigarh	83.3972	21.8917	7.65	743	0	195.2	108.5	1.05	47.8	0.3	0	225	44	27.6	66.3	2.5	17.2	0.011
653	Raigarh	Lailunga	Rajpur	83.4872	22.4353	7.71	870	0	250.1	119.0	0.97	8.4	28.9	0	260	46	34.8	63.1	4.3	46.1	0.012
654	Raigarh	Sarangarh	Reda	83.097	21.6241	7.65	380	0	128.1	49.0	1.35	13.9	13.7	0	145	34	14.4	23.2	4.9	12.1	0.004

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
655	Raigarh	Pusaur	Rengelpali	83.4758	21.7633	7.03	473	0	140.3	80.5	0.95	10.9	3.3	0	185	42	19.2	22.8	1.6	15.2	0.005
656	Raigarh	Lailunga	Salkhiya	83.5365	22.4126	7.41	544	0	128.1	80.5	1.05	39.7	32.6	0	200	36	26.4	28.9	1.3	21.2	0.004
657	Raigarh	Gharghoda	Samarumi	83.3458	22.0842	7.33	68	0	18.3	3.5	0.02	2.8	13.2	0	30	8	2.4	2.1	1.2	10.4	0.006
658	Raigarh	Raigarh	Sambalpuri	83.454	21.9407	7.63	150	0	42.7	17.5	0.04	5.1	4.1	0	55	14	4.8	4.2	5.4	25.3	0.005
659	Raigarh	Raigarh	Sariya	83.405	21.62	7.72	642	0	207.4	35.0	0.08	104.8	0.2	0	285	56	34.8	16.3	2.6	16.1	0.012
660	Raigarh	Pusaur	Semra	83.2531	21.7653	7.79	2130	0	689.3	343.0	0.12	29.0	11.3	0	830	202	78.0	105.7	1.0	15.9	0.005
661	Raigarh	Dharmajaigarh	Shahpur	83.1821	22.4774	8.2	164	0	61.0	7.0	0.03	4.2	33.2	0	50	12	4.8	9.5	9.8	13.5	0.006
662	Raigarh	Dharmajaigarh	Sirsinga	83.3069	22.4556	8.05	864	0	170.8	126.0	0.01	22.2	72.3	0	240	48	28.8	88.1	11.5	8.6	0.017
663	Raigarh	Pusaur	Surajgarh	83.3853	21.6925	8.22	583	0	219.6	21.0	0.05	93.9	0.5	0	130	36	9.6	83.0	0.8	8.8	0.010
664	Raigarh	Pusaur	Tadola	83.381	21.7922	8.14	561	0	231.8	10.5	0.05	80.7	0.6	0	115	28	10.8	88.0	1.5	17.2	0.004
665	Raigarh	Tamnar	Tamnar	83.4316	22.0916	7.87	255	0	73.2	31.5	0.47	17.8	7.3	0	105	22	12.0	15.3	3.9	11.0	0.004
666	Raigarh	Tamnar	Taraimal.1	83.3539	22.0579	8.22	316	0	54.9	45.5	0.70	22.8	27.9	0	15	4	1.2	64.1	9.6	7.5	0.004
667	Raigarh	Dharmajaigarh	Taraimar	83.1829	22.451	8.39	143	3	24.4	7.0	0.46	4.4	37.5	0	45	12	3.6	7.6	8.0	8.5	0.010
668	Raigarh	Dharmajaigarh	Tendumar New	83.2319	22.4332	7.24	146	0	36.6	7.0	0.01	3.3	44.1	0	50	8	7.2	7.3	8.2	12.8	0.008
669	Raigarh	Gharghoda	Teram New	83.3444	22.2229	8.3	363	0	170.8	21.0	0.10	13.9	1.8	0	125	32	10.8	17.6	6.4	21.9	0.010
670	Raigarh	Pusaur	Tetla	83.3292	21.7917	8.23	886	0	231.8	91.0	0.04	95.6	0.2	0	215	40	27.6	98.7	2.2	7.6	0.011
671	Raigarh	Dharmajaigarh	Ududa	83.1203	22.4938	8.29	280	0	103.7	7.0	0.24	32.7	8.6	0	120	26	13.2	6.7	8.2	6.4	0.004
672	Raigarh	Kharsia	Ulda	83.0599	22.0508	7.83	371	0	189.1	21.0	0.05	0.0	2.6	0	25	8	1.2	80.6	0.7	7.1	0.004
673	Raigarh	Raigarh	Chiraipani1	83.3391	21.9427	8.31	78	3	24.4	7.0	0.11	6.0	1.6	0	35	6	4.8	2.2	0.9	35.6	0.004
674	Raigarh	Tamnar	Amaghat	83.4045	22.0799	8.16	264	0	24.4	42.0	0.04	13.0	67.9	0	100	16	14.4	15.1	6.4	12.1	0.004
675	Raigarh	Dharamjaigarh	Pordahi	83.1348	22.5114	8.34	110	3	36.6	14.0	0.33	4.6	3.5	0	45	10	4.8	5.1	2.6	17.1	0.006
676	Raigarh	Sarangarh	Kushal Nagar(Sarangarh)	83.08	21.5974	8.06	1071	0	195.2	206.5	0.49	33.6	16.9	0	330	76	33.6	99.4	1.1	0.6	0.010
677	Raigarh	Tamnar	Libra	83.5088	22.0986	8.3	525	0	128.1	56.0	0.24	52.7	32.7	0	200	46	20.4	35.1	9.9	1.7	0.011
678	Raigarh	Gharghoda	Baroud	83.3422	22.2872	8.32	167	3	67.1	14.0	0.01	6.8	2.3	0	75	18	7.2	5.1	4.0	15.1	0.010
679	Raigarh	Raigarh	Bhupdevpur	83.2525	21.9727	8.28	448	0	306.5	34.5	0.26	26.7	12.3	0	195	34	26.4	82.3	1.2	25.6	0.026

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
680	Raigarh	Tamnar	Dauranbhatha	83.5417	22.0917	8.2	382	0	146.4	42.0	0.09	16.1	0.6	0	150	34	15.6	15.1	7.6	35.6	0.010
681	Raigarh	Dharmajaigarh	Khedapali I	83.1297	22.0964	8.3	121	0	54.9	28.0	0.71	14.6	3.1	0	70	24	2.4	7.4	5.9	6.7	0.004
682	Raigarh	Dharmajaigarh	Nwapara –I	83.145	22.1167	8.24	467	0	268.4	14.0	0.70	12.4	0.8	0	65	8	10.8	82.2	5.6	25.6	0.010
683	Raipur	Arang	Umaria station	81.8667	21.2	8.04	413	0	225.7	14.2	0.40	9.6	12.4	0.08	175	64	3.6	23.9	1.2	9.0	0.001
684	Raipur	Arang	Ghodari (Ghorari)	82.025	20.168	7.6	603	0	244.0	49.6	0.20	28.8	12.4	0.06	250	84	9.6	24.8	2.0	12.0	0.000
685	Raipur	Aurang	Godhi	81.4545	21.2968	7.4	1350	0	341.6	163.1	0.00	66.7	77.5	0.05	460	116	40.8	34.7	80.3	17.0	0.000
686	Raipur	Abhanpur	Abhanpur	81.7717	21.0417	7.8	253	0	128.1	14.2	0.35	7.2	8.1	0.05	105	32	6.0	13.8	3.1	8.0	0.000
687	Raipur	Abhanpur	Bajrangpur	81.8111	20.9833	7.9	652	0	329.4	42.5	0.32	13.9	2.5	0.05	170	40	16.8	78.9	1.6	14.0	0.000
688	Raipur	Arang	Bhaisa	82.0278	21.4056	7.7	531	0	195.2	56.7	0.36	26.9	20.5	0.16	210	60	14.4	32.9	0.8	13.0	0.004
689	Raipur	Tilda	Biladi	81.7831	21.5728	7.7	765	0	292.8	56.7	0.00	5.8	62.6	0.07	320	84	26.4	26.9	1.2	16.0	0.000
690	Raipur	Tilda	Chicholi	81.865	21.4658	7.8	940	0	231.8	120.5	0.00	58.6	53.9	0.07	380	124	16.8	38.0	3.9	19.0	0.000
691	Raipur	Dharsinwa	Chrauda	81.6722	21.38	7.9	972	0	292.8	92.2	0.00	65.8	63.9	0.06	340	108	16.8	56.1	21.5	21.0	0.001
692	Raipur	Darsinwa	Devri	81.6833	21.466	7.6	1568	0	451.4	191.4	0.00	69.6	65.7	0.11	570	144	50.4	87.4	1.6	22.0	0.000
693	Raipur	Dharsinwa	Dharsinwa	81.6722	21.4083	7.7	882	0	170.8	134.7	0.00	66.7	67.6	0.07	340	96	24.0	39.3	20.7	18.0	0.001
694	Raipur	Arang	Ghivera	81.9752	21.3691	7.5	1266	0	329.4	198.5	0.00	86.9	57.7	0.08	470	116	43.2	97.3	2.3	21.0	0.000
695	Raipur	Arang	Kanki	81.992	21.4003	7.4	1360	0	378.2	156.0	0.22	73.9	46.5	0.06	550	172	28.8	42.8	2.3	22.0	0.000
696	Raipur	Tilda	Kharora	81.9208	21.3875	8	545	0	164.7	56.7	0.05	33.6	49.0	0.06	210	72	7.2	29.9	10.1	10.0	0.001
697	Raipur	Dharsinwa	Mandhar	81.7103	21.3528	7.9	633	0	231.8	49.6	0.00	41.8	36.6	0.06	285	80	20.4	22.5	1.2	15.0	0.001
698	Raipur	Dharsinwa	Mandirhasud	81.7667	21.2208	7.6	738	0	347.7	28.4	0.00	36.0	46.5	0.06	325	84	27.6	32.9	5.1	15.0	0.000
699	Raipur	Tilda	Math	81.9026	21.395	7.4	1272	0	250.1	198.5	0.00	84.0	53.9	0.08	390	120	21.6	102.8	2.0	10.0	0.001
700	Raipur	Arang	Narra	81.8889	21.2639	7.6	782	0	195.2	113.4	0.50	17.8	52.7	0.07	320	88	24.0	26.9	0.4	8.0	0.000
701	Raipur	Palari	Palari	82.1625	21.5292	7.3	1102	0	329.4	177.3	0.60	42.7	24.8	0.1	400	84	45.6	85.8	2.7	9.0	0.001
702	Raipur	Tilda	Pandan Bhata	81.6519	21.4428	7.8	395	0	183.0	28.4	0.17	7.7	20.5	0.08	200	56	14.4	7.6	1.2	8.0	0.000
703	Raipur	Arang	Piparhatta	82.1012	21.6228	7.7	671	0	231.8	56.7	0.44	38.9	32.9	0.98	250	64	21.6	35.0	6.6	11.0	0.000
704	Raipur	Arang	Ranisagar	82.0281	21.2783	7.2	1264	0	268.4	198.5	0.00	88.8	51.5	0.97	410	120	26.4	102.8	2.0	10.0	0.000
705	Raipur	Tilda	Saragaon	81.8069	21.3667	7.8	471	0	231.8	28.4	0.00	15.8	13.6	0.81	225	80	6.0	13.8	5.5	15.0	0.000

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
706	Raipur	Dharsinwa	Semoriya	81.7623	21.3302	7.2	1255	0	219.6	205.6	0.00	81.6	51.5	0.93	370	116	19.2	101.0	2.0	13.0	0.000
707	Raipur	Tilda	Tarpongi	81.6892	21.4906	7.5	1190	0	292.8	141.8	0.17	74.9	64.5	0.53	490	128	40.8	28.8	12.5	14.0	0.000
708	Raipur	Abhanpur	Nawagaon	81.7514	21.0542	7.6	383	0	195.2	14.2	0.00	4.8	6.2	0.09	140	40	9.6	23.9	0.8	15.0	0.001
709	Rajnandgaon	Rajnandgaon	Anjora	81.2144	21.1536	7.94	1285	0	238.0	184.1	0.17	22.9	69.5	0	350	46	55.9	95.8	6.8	6.7	0.007
710	Rajnandgaon	Khairagarh	Badaitola	80.9789	21.3477	7.94	680	0	347.7	21.2	0.21	49.4	13.1	0	260	28	46.2	63.6	2.3	25.1	0.007
711	Rajnandgaon	Khairagarh	Baigatola	80.8458	21.3875	7.39	560	0	61.0	74.3	0.03	40.0	16.1	0	145	40	10.9	21.3	0.9	12.1	0.003
712	Rajnandgaon	AmbagarhChowki	Bandhabazar	80.7417	20.8333	7.96	296	0	67.1	46.0	0.05	6.7	21.8	0	115	40	3.6	10.6	1.0	10.1	0.008
713	Rajnandgaon	Rajnandgaon	Bhaistara (Bhatapara)	81.0296	21.3182	7.77	831	0	140.3	123.9	0.12	68.2	51.4	0	290	82	20.7	47.0	0.9	21.6	0.009
714	Rajnandgaon	Dongargarh	Bharritola	80.7356	21.2042	8.15	402	0	195.3	46.0	0.71	6.5	9.3	0	110	22	13.4	51.7	0.9	17.2	0.003
715	Rajnandgaon	Chhuikadhan	Bhorampur	81.0132	21.5568	7.68	740	0	201.4	102.7	0.32	53.4	22.2	0	240	56	24.3	52.7	2.6	46.1	0.002
716	Rajnandgaon	Rajnandgaon	Bori	81.0589	21.1422	7.86	635	0	299.0	63.7	0.29	25.2	5.8	0	205	36	27.9	60.8	0.5	12.1	0.002
717	Rajnandgaon	Chhuriya	Chhuria	80.6333	21.0083	8.13	171	0	61.0	21.2	0.74	4.2	2.6	0	50	14	3.6	14.9	1.8	10.2	0.009
718	Rajnandgaon	Chhuriya	Chirchari	80.5875	21.0833	7.94	437	0	231.9	38.9	0.95	8.4	2.5	0	145	16	25.5	43.2	1.1	21.2	0.018
719	Rajnandgaon	Dongargaon	Chirchari	80.7796	20.9658	7.79	524	0	146.4	67.3	0.32	45.4	10.8	0	130	34	10.9	54.3	2.5	10.4	0.004
720	Rajnandgaon	Chuikhadan	Chuikhadan	80.9958	21.525	8.2	616	0	91.5	81.4	0.77	5.1	63.3	0	190	52	14.6	18.4	5.1	5.4	0.001
721	Rajnandgaon	Rajnandgaon	Dewada	81.1967	21.1458	8.29	1481	0	414.9	159.3	0.45	94.6	67.7	0	470	30	94.8	83.2	1.4	16.1	0.002
722	Rajnandgaon	Khairagarh	Dhaneli	81.0066	21.4088	8.1	580	0	256.3	56.6	1.03	11.5	17.2	0	205	66	9.7	37.0	3.5	11.9	0.003
723	Rajnandgaon	Dongargarh	Dhara	80.8594	21.255	7.74	498	0	146.4	70.8	0.84	21.5	16.0	0	170	36	19.4	29.8	0.5	13.5	0.006
724	Rajnandgaon	Dongargaon	Dongargaon.1	80.8569	20.9708	7.49	459	0	97.6	63.7	0.10	4.8	50.1	0	190	56	12.2	8.9	0.8	9.6	0.008
725	Rajnandgaon	Dongargarh	Ghortalab	80.5272	21.1201	7.98	1522	0	250.2	240.7	0.10	46.3	59.8	0	485	90	62.0	90.4	1.1	8.8	0.001
726	Rajnandgaon	Rajnandgaon	Gidhwah	81.1194	21.2717	7.51	205	0	85.4	14.2	0.17	4.2	6.7	0	80	20	7.2	5.5	0.6	10.2	0.001
727	Rajnandgaon	Dongargarh	Govindpur	80.7017	21.0998	7.96	1449	0	170.9	244.3	0.08	76.6	59.2	0	530	118	55.9	56.7	1.8	11.0	0.002

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
728	Rajnandgaon	Khairagarh	Jalbanda	81.1545	21.3648	8.02	312	0	85.4	38.9	0.44	26.6	18.8	0	115	36	6.1	17.1	0.5	9.6	0.011
729	Rajnandgaon	Rajnandgaon	Joratarai	81.1853	21.1908	8.11	675	0	201.4	102.7	0.54	43.5	0.2	0	225	34	34.0	49.2	0.9	8.5	0.001
730	Rajnandgaon	Dongargarh	kalkosa	80.7926	21.2149	8.37	327	6	128.1	31.9	0.32	6.5	9.5	0	105	22	12.2	24.9	0.8	11.8	0.002
731	Rajnandgaon	Dongargarh	Kalyanpur	80.7121	21.1457	8.37	529	9	48.8	42.5	0.22	13.6	13.2	0	105	10	19.4	14.1	0.2	21.9	0.018
732	Rajnandgaon	Khairagarh	Khairagarh	80.9708	21.4333	7.67	1803	0	170.9	258.4	0.14	106.4	69.8	0	435	98	46.2	83.6	1.4	7.9	0.006
733	Rajnandgaon	Khairagarh	Khursipar	81.3258	21.7483	7.98	719	0	85.4	109.7	0.08	47.4	65.5	0	210	58	15.8	39.7	1.6	6.4	0.009
734	Rajnandgaon	Dongargaon	Kokpur I	80.7458	20.9917	7.98	374	0	79.3	35.4	0.04	5.5	35.2	0	120	30	10.9	17.7	1.8	9.0	0.007
735	Rajnandgaon	Dongargaon	Kumarda.1	80.7686	20.8906	7.89	291	0	128.1	42.5	0.17	3.8	21.1	0	160	40	14.6	9.4	0.5	55.6	0.002
736	Rajnandgaon	Dongargarh	Lal bhadurnagar	80.6861	21.1	7.73	644	0	73.2	106.2	0.22	3.4	63.5	0	210	56	17.0	18.4	0.3	12.1	0.007
737	Rajnandgaon	Khairagarh	Madrakuhi	81.0724	21.3872	7.88	688	0	146.4	92.0	0.27	43.4	42.4	0	240	48	29.2	30.0	1.9	18.0	0.002
738	Rajnandgaon	Rajnandgaon	Maladabri	81.0295	21.3448	7.95	116	0	73.2	53.1	0.35	4.3	8.4	0	120	32	9.7	6.4	0.3	16.7	0.004
739	Rajnandgaon	Dongargaon	Mohar/Mohad	80.8162	20.9583	7.97	750	0	286.8	67.3	0.26	54.2	23.3	0	180	28	26.7	85.5	1.2	1.7	0.011
740	Rajnandgaon	Chhuikadhan	Mohgaon	80.9592	21.7069	7.67	430	0	183.1	49.6	0.14	9.2	5.4	0	170	34	20.7	20.7	0.8	12.1	0.003
741	Rajnandgaon	Rajnandgaon	Murhipar	81.1569	21.1947	7.58	879	0	256.3	120.4	0.07	32.7	31.5	0	275	46	38.9	59.2	1.0	15.1	0.002
742	Rajnandgaon	Chhuikadhan	Narmada	81.0724	21.6216	7.79	515	0	97.6	74.3	0.03	3.7	62.2	0	205	58	14.6	11.5	0.8	25.6	0.005
743	Rajnandgaon	Rajnandgaon	Nawagaon	81.1499	21.1686	8.2	529	0	146.4	67.3	0.21	29.1	20.2	0	200	26	32.8	23.5	1.7	45.6	0.018
744	Rajnandgaon	Rajnandgaon	Patewa	81.1038	21.3399	8.21	385	0	158.7	60.2	0.49	3.9	2.1	0	150	22	23.1	27.2	0.4	6.7	0.006
745	Rajnandgaon	Rajnandgaon	Patharathola	81.0321	21.0916	8	1034	0	195.3	159.3	0.58	35.4	54.8	0	320	38	53.5	69.4	0.9	25.6	0.012
746	Rajnandgaon	Dongargarh	Pipariya	80.7672	21.1378	8.02	449	0	164.8	53.1	0.37	35.8	11.9	0	155	18	26.7	39.4	0.8	12.1	0.001
747	Rajnandgaon	Dongargarh	Ramatola	80.7115	21.1256	8.01	483	0	103.7	63.7	0.88	23.4	43.8	0	190	42	20.7	16.2	1.6	10.1	0.014
748	Rajnandgaon	Chhuriya	Rampur	80.7138	21.0734	8.15	403	0	85.4	42.5	0.95	31.2	65.8	0	125	30	12.2	35.3	0.8	25.7	0.024

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
749	Rajnandgaon	Khairagarh	Rangkathera	81.1125	21.3672	7.73	1644	0	219.7	293.8	0.12	89.3	65.1	0	540	112	62.0	79.4	10.5	17.2	0.003
750	Rajnandgaon	Dongargarh	Ranitalab	80.6397	21.0831	8.36	567	6	360.0	46.0	0.08	31.4	4.6	0	210	36	29.2	86.7	1.7	14.6	0.002
751	Rajnandgaon	Rajnandgaon	Ranitarai	81.0542	20.9978	8.05	1382	0	195.3	205.3	0.75	99.6	25.2	0	295	78	24.3	110.9	2.1	12.1	0.007
752	Rajnandgaon	Rajnandgaon	Reevadih	80.9935	21.0862	7.95	322	0	128.1	42.5	0.25	29.4	15.4	0	170	38	18.2	9.5	0.7	15.2	0.002
753	Rajnandgaon	Dongargarh	Reevagaon	80.8257	21.2195	8.38	728	9	256.3	42.5	0.17	68.3	10.5	0	95	28	6.1	108.3	2.2	21.2	0.003
754	Rajnandgaon	Dongargarh	SahaspurDalli	80.8863	21.363	8.02	741	0	317.3	31.9	0.08	24.4	1.9	0	260	62	25.5	40.5	3.8	16.5	0.001
755	Rajnandgaon	Khairagarh	Salgapat	80.9125	21.3167	8.11	468	0	79.3	60.2	0.04	4.6	53.1	0	165	48	10.9	9.9	0.9	25.3	0.003
756	Rajnandgaon	Khairagarh	Salhebara	80.8875	21.3983	8.18	601	0	158.7	77.9	0.04	34.0	20.0	0	150	34	15.8	64.1	1.3	16.1	0.004
757	Rajnandgaon	Rajnandgaon	Saloni	81.1331	21.2819	8.23	866	0	201.4	123.9	0.16	65.8	16.5	0	170	30	23.1	106.3	1.1	25.6	0.001
758	Rajnandgaon	Rajnandgaon	Singhola	81.0417	21.0333	8.09	432	0	79.3	49.6	0.11	34.4	10.4	0	120	26	13.4	28.0	0.9	13.5	0.007
759	Rajnandgaon	Rajnandgaon	Somni	81.1467	21.1239	8.02	630	0	152.6	53.1	0.19	76.7	20.1	0	170	48	12.2	65.7	1.2	4.7	0.005
760	Rajnandgaon	Rajnandgaon	Talai	81.0361	21.1667	8.14	384	0	85.4	35.4	0.67	15.2	17.5	0	130	36	9.7	10.4	1.0	8.8	0.003
761	Rajnandgaon	Khairagarh	Talagaon	80.8199	21.3019	8.06	240	0	30.5	21.2	0.03	52.2	11.5	0	80	20	7.3	11.2	2.3	17.2	0.002
762	Rajnandgaon	Rajnandgaon	Uperwah	81.1403	21.2447	7.84	562	0	146.4	56.6	0.47	52.1	21.5	0	175	50	12.2	34.7	2.9	15.7	0.002
763	Rajnandgaon	Dongargaon	BijaBhata	80.8334	21.0165	7.98	729	0	274.6	49.6	0.95	32.6	11.7	0	125	40	6.1	101.2	1.7	7.5	0.002
764	Rajnandgaon	Chhuriya	Ambagarhchowki	80.7417	20.775	8.12	299	0	85.4	35.4	0.54	28.3	6.7	0	110	34	6.1	15.7	2.2	5.8	0.001
765	Rajnandgaon	Rajnandgaon	Bhatgaon	81.0689	21.2883	8.1	319	0	67.1	38.9	0.24	13.7	8.5	0	115	30	9.7	8.6	0.6	7.9	0.011
766	Rajnandgaon	Rajnandgaon	Baghera	81.1231	21.1892	8	305	0	128.1	109.7	0.25	48.2	70.5	0	275	82	17.0	33.1	1.9	12.1	0.002
767	Rajnandgaon	Dongargarh	Dongargarh-d	80.7597	21.1847	7.98	702	0	140.3	74.3	0.20	84.1	52.7	0	190	42	20.7	60.8	0.5	5.6	0.012
768	Rajnandgaon	Chhuikadhan	Gandai	81.1089	21.6639	7.45	485	0	128.1	38.9	0.11	46.0	11.5	0	130	38	8.5	36.4	1.0	21.2	0.001
769	Rajnandgaon	Rajnandgaon	Singhola	81.0333	21.0347	7.21	221	0	73.2	24.8	0.08	15.8	10.5	0	75	16	8.5	14.8	2.7	10.4	0.000

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
770	Rajnandgaon	Chhuriya	Chitratola	80.7045	21.0305	8.2	468	0	183.1	38.9	0.02	25.1	7.8	0	165	48	10.9	35.8	2.3	16.4	0.000
771	Rajnangaon	Dongargaon	Jantar	80.7594	20.9846	8.08	411	0	146.4	28.3	1.09	25.5	4.9	0	120	34	8.5	39.2	3.7	8.5	0.002
772	Rajnangaon	Dongargaon	Devkatta	80.8039	21.2284	7.89	115	0	48.8	24.8	0.08	6.6	4.6	0	65	10	9.7	6.9	0.3	12.8	0.002
773	Ranandgaon	Chhuriya	Chichola	80.6872	21.0722	8.12	399	0	109.8	42.5	0.45	13.4	6.6	0	120	26	13.4	20.7	0.8	52.5	0.002
774	Ranandgaon	Chuikhadan	Pailimeta	80.9869	21.6716	7.99	1205	0	445.4	63.7	0.24	76.1	16.5	0	515	112	55.9	36.9	1.8	7.6	0.001
775	Ranandgaon	Chhuikhadan	Jangalpur	81.0147	21.6488	7.72	1822	0	799.4	262.0	0.22	76.7	19.8	0	915	246	71.7	50.1	2.7	7.9	0.003
776	Surajpur	Prem nagar	Katarouli (Harrapara)	82.5557	22.5778	7.42	124	0	30.5	7.0	0.04	3.5	29.4	0	50	12	4.8	3.0	1.6	11.6	0.000
777	Surajpur	Premnagar	Abhaypur	82.7347	22.9097	7.37	398	0	183.0	21.0	0.03	3.5	8.1	0	170	56	7.2	4.2	8.6	17.5	0.001
778	Surajpur	Pratappur	Banshipur	82.7303	23.2487	7.42	138	0	79.3	17.5	0.21	5.6	0.0	0	85	20	8.4	2.7	3.0	14.9	0.000
779	Surajpur	Pratappur	Bhediya	83.1566	23.5854	7.6	241	0	122.0	14.0	0.04	24.5	5.6	0	115	24	13.2	16.9	1.4	16.0	0.000
780	Surajpur	Bhaiyathan	Chainpur	82.8521	23.3857	7.9	521	0	201.3	45.5	1.80	48.0	0.6	0	125	30	12.0	76.8	0.5	12.9	0.002
781	Surajpur	Bhaiyathan	Dalabahara(Bhaskar)	82.6862	23.4029	7.45	285	0	183.0	17.5	0.05	4.5	0.2	0	160	24	24.0	6.7	2.8	10.7	0.000
782	Surajpur	Pratappur	Dawankera	82.9134	23.4071	7.39	264	0	85.4	17.5	0.32	10.1	20.1	0	85	8	15.6	12.8	1.5	27.5	0.000
783	Surajpur	Pratappur	Karajwar	83.1033	23.5134	7.41	183	0	24.4	35.0	0.35	4.0	36.6	0	60	16	4.8	23.5	0.9	38.4	0.000
784	Surajpur	Bhaiyathan	Bhaiyathan	23.3543	82.6528	7.48	1765	0	500.2	266.0	0.14	49.8	0.9	0	285	52	37.2	265.3	6.9	14.1	0.003
785	Surajpur	Surajpur	Narayanpur	82.6353	23.1894	7.8	256	0	97.6	21.0	0.15	7.6	0.1	0	100	24	9.6	5.2	3.9	13.1	0.000
786	Surajpur	Pratappur	Podi	83.6237	23.3957	7.66	313	0	79.3	31.5	0.18	18.5	40.7	0	105	28	8.4	32.5	1.1	36.2	0.000
787	Surajpur	Surajpur	Surajpur	23.1775	82.3673	7.61	444	0	152.5	52.5	0.21	13.4	26.2	0	185	34	24.0	15.5	1.2	34.9	0.002
788	Surajpur	Pratappur	Dwarikanagar	83.1885	23.285	7.76	99	0	36.6	10.5	0.23	4.0	0.1	0	35	10	2.4	4.1	3.2	8.2	0.001
789	Surajpur	Ramanujnagar	Jagatpur Podipara	82.6603	23.0942	7.45	364	0	146.4	28.0	0.24	28.6	3.5	0	120	36	7.2	36.1	4.7	11.2	0.001
790	Surajpur	Surajpur	Krishnapur(kalwa)	82.8233	23.2439	7.34	318	0	122.0	31.5	0.55	6.5	25.5	0	135	42	7.2	17.9	0.6	9.9	0.001
791	Surajpur	Bhaiyathan	Samouli(Bhayathan)	82.7652	23.4244	7.41	201	0	79.3	21.0	0.21	9.9	18.4	0	75	20	6.0	22.5	0.6	8.7	0.000
792	Surajpur	Premnagar	Shivnagar	82.7882	22.8815	7.34	96	0	36.6	7.0	0.97	3.5	0.6	0	40	8	4.8	2.1	5.2	2.2	0.000
793	Surajpur	Surajpur	Badsara	82.7708	23.3444	7.36	392	0	134.2	49.0	0.21	13.5	17.6	0	175	54	9.6	17.7	1.8	10.1	0.002
794	Surajpur	Surajpur	Biharpur	82.921	23.2721	7.22	73	0	18.3	7.0	1.25	4.5	12.0	0	30	8	2.4	5.0	1.7	26.1	0.000
795	Surajpur	Surajpur	Bishrampur	82.9883	23.185	7.09	256	0	48.8	38.5	0.81	18.2	26.4	0	85	24	6.0	20.2	8.2	24.0	0.000

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796	Surajpur	Pratappur	Chandora	83.1569	23.5111	7.51	356	0	225.7	14.0	0.22	12.9	3.5	0	140	42	8.4	35.0	1.3	10.1	0.001
797	Surajpur	Pratappur	Darhora	82.8346	23.4421	7.77	321	0	109.8	28.0	0.68	19.0	23.4	0	135	38	9.6	17.4	0.8	12.1	0.000
798	Surajpur	Surajpur	Deonagar	82.8033	23.24	7.48	730	0	91.5	140.0	1.50	76.8	0.0	0	30	8	2.4	164.5	0.9	15.1	0.002
799	Surajpur	Premnagar	Fulkona	82.6672	23.025	7.3	656	0	189.1	45.5	0.02	40.1	42.9	0	290	62	32.4	4.9	1.6	24.1	0.000
800	Surajpur	Ramanujnagar	Ganeshpur	82.6353	23.0806	7.28	747	0	170.8	101.5	0.14	21.4	20.3	0	180	48	14.4	53.4	1.1	28.1	0.001
801	Surajpur	Pratappur	Gonda	83.0583	23.4292	7.48	95	0	30.5	7.0	0.71	5.8	0.0	0	35	8	3.6	2.1	2.3	0.1	0.000
802	Surajpur	Premnagar	Hanumangarh	82.6476	23.0629	7.31	290	0	128.1	21.0	0.46	12.0	9.7	0	125	24	15.6	17.7	0.5	8.8	0.000
803	Surajpur	Pratappur	Jagannathpur	83.195	23.3786	7.5	723	0	298.9	38.5	0.91	50.0	0.0	0	215	24	37.2	62.0	10.0	20.1	0.002
804	Surajpur	Surajpur	Jaynagar	82.9717	23.1847	7.68	485	0	91.5	56.0	0.91	43.4	46.7	0	200	52	16.8	9.2	3.0	10.1	0.001
805	Surajpur	Surajpur	Kaliyanpur	83.2	23.2472	7.73	150	0	30.5	28.0	0.99	5.2	20.3	0	60	16	4.8	7.1	7.5	6.5	0.000
806	Surajpur	Surajpur	Kanakpur	83.0555	23.1869	7.39	117	0	54.9	21.0	1.06	5.8	0.0	0	65	10	9.6	5.8	6.9	7.5	0.000
807	Surajpur	Surajpur	Majeera	82.9514	23.1482	7.26	145	0	54.9	24.5	1.52	9.7	1.8	0	70	20	4.8	7.7	5.7	8.5	0.000
808	Surajpur	Surajpur	Pachira	82.8013	23.1937	7.71	655	0	237.9	77.0	1.22	37.7	2.9	0	115	24	13.2	111.2	4.3	12.1	0.003
809	Surajpur	Ramanujnagar	Parasrampur	82.7939	23.0833	7.76	281	0	48.8	21.0	1.22	7.8	67.2	0	115	28	10.8	2.2	3.8	31.5	0.001
810	Surajpur	Pratappur	Pratappur	83.2028	23.4833	7.56	343	0	134.2	35.0	0.65	24.1	2.7	0	115	24	13.2	33.4	2.1	20.1	0.000
811	Surajpur	Premnagar	Premnagar	82.6958	22.9667	7.5	533	0	170.8	70.0	1.27	25.6	20.0	0	195	42	21.6	36.0	0.8	17.1	0.002
812	Surajpur	Ramanujnagar	Ramanuj nagar	82.725	23.15	7.48	529	0	183.0	66.5	0.36	19.3	2.6	0	175	42	16.8	52.4	1.0	19.1	0.001
813	Surajpur	Pratappur	Reonti	83.1764	23.6478	7.81	384	0	176.9	35.0	0.17	14.4	0.0	0	170	34	20.4	16.3	9.6	12.1	0.000
814	Surajpur	Surajpur	Sirsi	82.8631	23.3528	7.18	245	0	85.4	24.5	0.50	4.6	26.1	0	90	24	7.2	20.9	0.9	25.7	0.001
815	Surajpur	Pratappur	Songara	83.0792	23.3	7.08	102	0	18.3	17.5	0.90	4.9	23.7	0	40	10	3.6	6.3	5.6	8.7	0.000
816	Surajpur	Premnagar	Tara	82.7417	22.8417	7.23	154	0	36.6	21.0	0.03	9.6	43.2	0	80	16	9.6	7.9	8.7	7.7	0.000
817	Surajpur	Surajpur	Newara	82.5715	23.2983	7.03	195	0	79.3	17.5	0.13	7.2	22.4	0	55	14	4.8	29.8	1.7	7.8	0.000
818	Surajpur	Bhaiyathan	Satipara(Bhaingamunda)	82.6074	23.1997	7.47	793	0	73.2	189.0	0.81	39.1	0.0	0	298	78	24.7	37.6	1.2	30.1	0.000
819	Surajpur	Pratappur	Dhondha	83.1755	23.6424	7.45	651	0	219.6	98.0	0.13	4.4	1.9	0	200	38	25.2	45.4	22.0	5.2	0.004
820	Surajpur	Surajpur	Madanpur	83.0906	23.1633	7.61	99	0	24.4	7.0	0.89	4.0	23.7	0	25	8	1.2	8.9	9.4	6.1	0.000
821	Surajpur	Pratappur	Chanchidand	83.2219	23.7973	7.47	251	0	61.0	31.5	0.16	5.0	42.8	0	80	22	6.0	26.8	2.3	11.2	0.000

Sr.	District	Block	Location	Long	Lat	PH	EC	CO3	HCO3	Cl	F	SO4	NO3	PO4	TH	Ca	Mg	Na	K	Si	U
822	Surajpur	Pratappur	Dharampur	83.1985	23.2012	7.38	89	0	12.2	3.5	0.15	21.8	11.9	0	25	8	1.2	5.4	6.2	0.8	0.001
823	Surajpur	Pratappur	Durti	83.0315	23.3867	7.48	97	0	18.3	7.0	0.17	10.5	23.8	0	40	10	3.6	3.8	6.8	0.8	0.000
824	Surguja	Ambikapur	Ambikapur	83.2	23.1083	7.23	586	0	225.7	49.0	0.63	0.3	18.6	0	155	10	31.2	58.4	7.9	12.1	0.001
825	Surguja	Lundra	Amdih	83.4059	23.2265	7.68	348	0	189.1	14.0	0.52	22.6	5.1	0	190	18	34.8	5.1	0.8	14.0	0.000
826	Surguja	Lakhanpur	Amgachi	83.0084	22.95	7.47	322	0	134.2	35.0	0.36	10.5	0.2	0	110	34	6.0	28.7	2.8	21.1	0.000
827	Surguja	Mainpat	Amgaon	83.2986	22.9194	7.49	590	0	298.9	7.0	0.17	4.8	0.1	0	220	46	25.2	26.3	0.7	12.1	0.001
828	Surguja	Ambikapur	Baghima	83.3139	23.2417	7.57	387	0	183.0	28.0	0.13	14.4	1.9	0	185	38	21.6	9.5	1.9	15.1	0.001
829	Surguja	Batauli	Bandana	83.4139	22.8472	8.01	178	0	97.6	3.5	0.13	5.6	7.0	0	75	18	7.2	8.7	1.6	17.2	0.000
830	Surguja	Batauli	Batauli (Kunkurikala)	83.4125	22.972	7.86	147	0	54.9	24.5	0.17	10.0	2.5	0	65	16	6.0	13.3	0.8	13.7	0.001
831	Surguja	Batauli	Belkota	23.0208	83.3854	7.88	240	0	67.1	14.0	0.48	20.4	21.3	0	90	6	18.0	5.4	3.7	11.3	0.000
832	Surguja	Lundra	Bulga	83.3542	23.1	7.97	455	0	109.8	52.5	0.99	25.7	7.3	0	175	42	16.8	17.9	0.5	11.8	0.001
833	Surguja	Ambikapur	Chatakpur	83.2221	22.9694	7.68	291	0	54.9	17.5	0.11	20.0	36.2	0	90	2	20.4	15.1	0.4	14.9	0.000
834	Surguja	Udeypur	Dandgaon	82.8569	22.895	8.1	240	0	79.3	10.5	0.50	8.5	0.4	0	65	20	3.6	15.1	0.4	6.2	0.000
835	Surguja	Ambikapur	Darima	83.2303	23.0031	7.79	149	0	24.4	10.5	0.17	8.1	27.1	0	55	16	3.6	6.3	1.7	5.2	0.000
836	Surguja	Lundra	Dhaurpur	83.4383	23.195	7.85	395	0	128.1	10.5	0.48	9.4	9.1	0	125	14	21.6	2.7	1.7	5.7	0.001
837	Surguja	Udaypur	Jajga	82.7847	22.9362	8.06	406	0	189.1	28.0	1.01	12.3	0.5	0	90	8	16.8	47.9	0.8	10.8	0.002
838	Surguja	Mainpat	Kamleswarpur	83.2881	22.8292	7.74	165	0	54.9	14.0	0.43	6.5	2.8	0	65	24	1.2	3.5	0.3	9.3	0.000
839	Surguja	Ambikapur	Katkalo	83.2072	23.0627	7.86	416	0	97.6	38.5	0.02	20.3	22.8	0	155	16	27.6	13.6	0.6	30.7	0.001
840	Surguja	Lakhanpur	Kunni	83.0667	22.8667	7.93	332	0	79.3	21.0	0.19	6.1	33.0	0	105	18	14.4	16.5	0.4	24.6	0.000
841	Surguja	Lakhanpur	Lakhanpur	83.0403	22.9831	7.75	416	0	85.4	56.0	0.43	48.8	4.7	0	160	44	12.0	29.7	0.6	26.8	0.002
842	Surguja	Lundra	Lundra	83.4083	23.1167	7.73	275	0	54.9	21.0	0.55	19.0	22.2	0	100	16	14.4	8.7	0.7	20.0	0.000
843	Surguja	Mainpat	Nagdand	83.2917	22.8958	7.65	73	0	12.2	7.0	0.13	5.9	20.2	0	35	6	4.8	3.0	1.8	4.1	0.000
844	Surguja	Ambikapur	Nawapara	83.2639	22.9522	8.04	379	0	109.8	21.0	0.21	20.8	15.0	0	115	22	14.4	20.5	0.4	30.9	0.001
845	Surguja	Ambikapur	Parsa	83.2675	23.1878	7.79	671	0	146.4	45.5	0.11	51.5	27.1	0	240	58	22.8	14.9	0.5	23.2	0.002
846	Surguja	Sitapur	Pratapgarh	83.4764	22.7333	7.75	894	0	219.6	91.0	0.44	42.0	70.0	0	320	72	33.6	45.0	1.0	24.8	0.003
847	Surguja	Ambikapur	Rajpurikhurd	83.2465	23.1649	7.62	528	0	115.9	42.0	0.11	44.1	60.9	0	240	58	22.8	8.5	6.2	23.0	0.001
848	Surguja	Batauli	Sedam	83.2967	22.9366	7.77	211	0	73.2	24.5	0.10	9.3	20.9	0	100	26	8.4	8.2	0.3	15.6	0.000

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849	Surguja	Lakhanpur	singhitana	82.9647	23.0014	7.64	214	0	109.8	14.0	0.52	11.8	1.3	0	95	22	9.6	8.8	0.6	16.5	0.000
850	Surguja	Lundra	Sisila	83.3845	23.0323	7.7	302	0	115.9	28.0	0.21	14.0	0.5	0	130	28	14.4	15.2	0.5	23.0	0.000
851	Surguja	Sitapur	Sitapur	83.0983	22.911	7.45	510	0	109.8	73.5	0.18	27.9	7.6	0	150	32	16.8	39.5	5.5	18.4	0.001
852	Surguja	Sitapur	Sontarai (Sitapur)	83.4821	22.8026	7.64	113	0	18.3	3.5	0.10	5.8	43.5	0	40	12	2.4	8.0	0.4	26.3	0.000
853	Surguja	Lundra	Sumerpur	83.0536	22.9805	7.46	381	0	97.6	31.5	0.99	31.6	6.1	0	125	24	15.6	19.8	8.8	5.1	0.000
854	Surguja	Ambikapur	Gangapur	23.2829	83.0781	7.56	382	0	97.6	31.5	0.13	9.8	21.4	0	105	24	10.8	19.9	8.9	7.3	0.001
855	Surguja	Udeypur	Udaipur	82.95	22.9083	7.62	150	0	18.3	3.5	0.13	7.2	52.5	0	60	16	4.8	5.5	3.3	10.6	0.000
856	Surguja	Lakhanpur	Udaipur Dhah	83.1	23.0583	7.34	302	0	85.4	17.5	0.63	11.6	41.0	0	115	28	10.8	15.1	5.7	24.7	0.002
857	Surguja	Lakhanpur	Rajakatel	83.0417	22.9198	7.66	442	0	97.6	38.5	0.81	15.1	59.3	0	180	44	16.8	18.1	0.4	22.5	0.001