



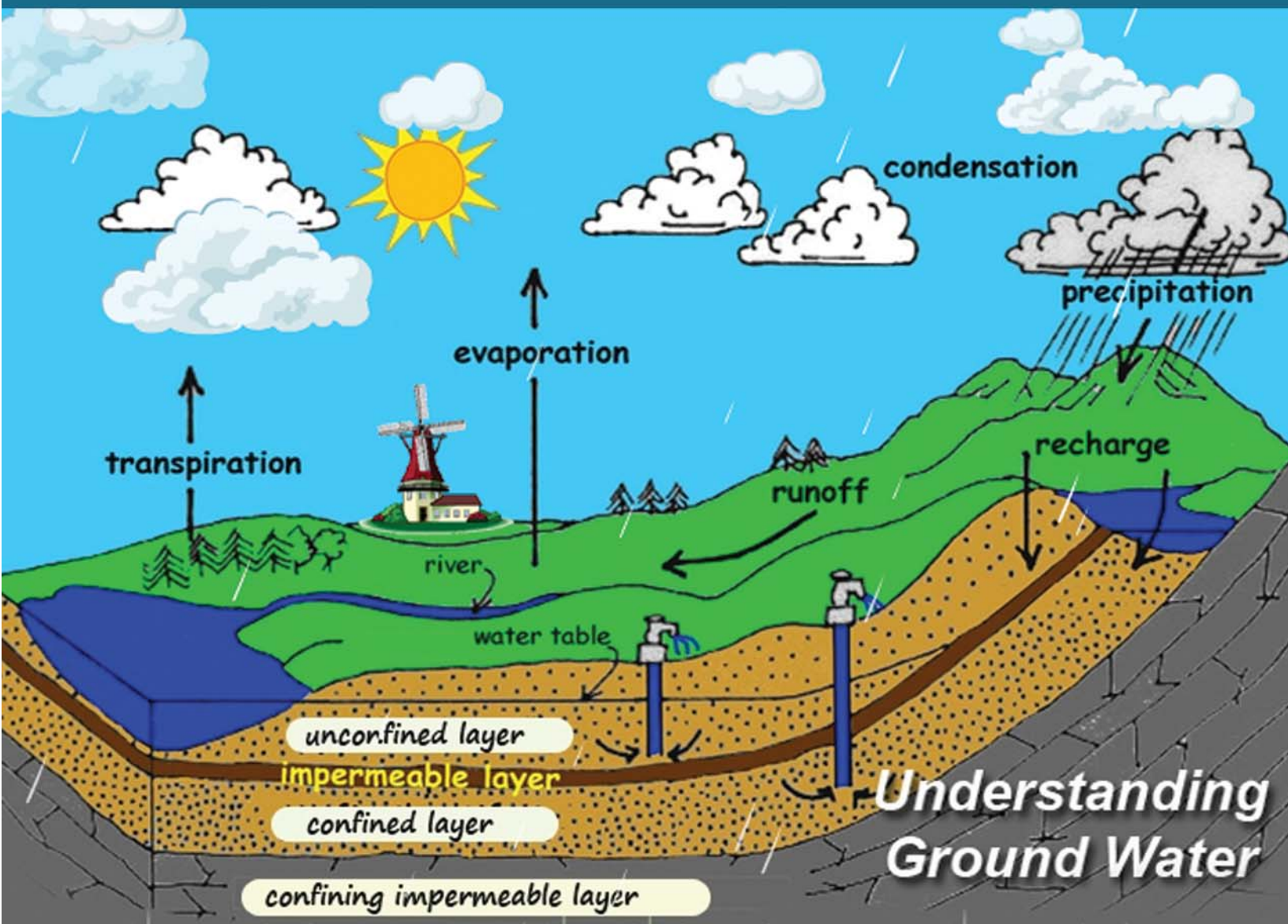
ENVIS NEWSLETTER

Centre for Environmental Studies (CES)
Dept. of Forest & Environment, Govt. of Odisha



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GROUND WATER-AN IMPORTANT NATURAL RESOURCE OF THE STATE



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From the Director's Desk...



Odisha ENVIS Centre is always trying to bring out environmental issues those are most vital in the State in newsletters. We have covered many issues of environment of the State in our previous publications. The objective is to disseminate information to the users and bring awareness among the society and policy makers.

This time we are covering an issue of **Ground Water** which is a most important natural resource of the State. I hope the information contained in the issue will be useful to users.

Dr. Sailabala Padhi, M.Phil, Ph.D., D.Sc.
Director, CES-cum- ENVIS Co-ordinator

Ground Water - An Important Natural Resource of the State

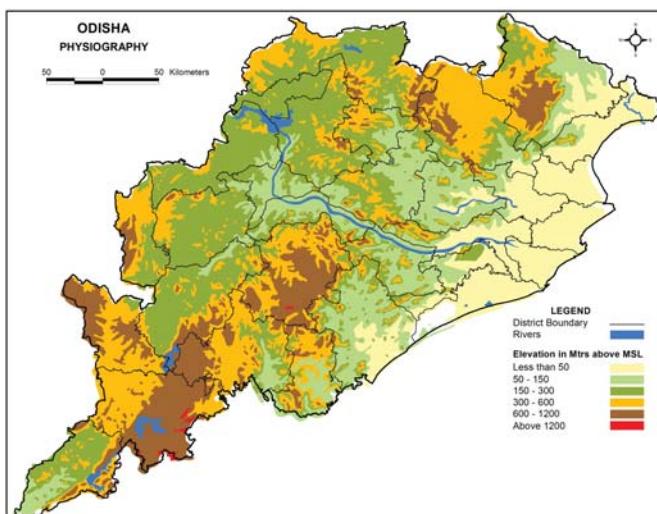
Life began in water and is sustained by water. The villages, the towns, the cities - the entire civilization have grown where water is available. Water has therefore been the focus, around which, the human destinies have taken shape. We perceive earth as a blue planet as 70 percent of the earth's surface is covered with water. However, the fact is that 97 percent of the total water on the earth is saline and only 3 per cent is available as fresh water. About 77 per cent of this fresh water is locked up glaciers and permanent snow and 11 percent is considered to occur at depths exceeding 800m below ground. About 11 percent of the resources are available as extractable ground water within 800 m depth and about 1 percent is available as surface water in lakes and rivers.

Thus the most appropriate and widely used source of drinking water in India is ground water. Ground water, which is the source for more than 85 per cent of India's rural domestic water requirements, 50 percent of its urban

water requirements and more than 50 percent of its irrigation requirements is depleting fast in many areas due to its large scale withdrawal for various sectors. There have been continued efforts in India for development of ground water resources to meet the increasing demands of water supply, especially in the last few decades. In certain high demand areas, ground water development (utilization) has already reached a critical stage, resulting in acute scarcity of the resource. Over-exploitation of the ground water resources results in declining ground water levels, shortage in water supply and intrusion of saline water in coastal areas. Geogenic contamination of ground water due to concentration of Arsenic, Fluoride and Iron in excess of limits prescribed for drinking purposes have also been observed in many parts of the country. In view of this, we feel there is need of discussion and analysis of ground water profile of the state.

Introduction:

Odisha, a state in the eastern coast of India has a geographical area of 1,55,707 sq.km and is divided into 30 administrative units and 314 blocks. Five physiographic units such as coastal plains, northern uplands, erosional plains of Mahanadi valley, south-western hilly region and subdud plateaus are observed in the state. There are eight major river basins. Most of the rivers flow easterly and south easterly. The state enjoys a humid tropical climate and the normal rainfall in the state is 1502 mm. The state is underlain by varied geological formations ranging in age from pre-cambrian to recent period.

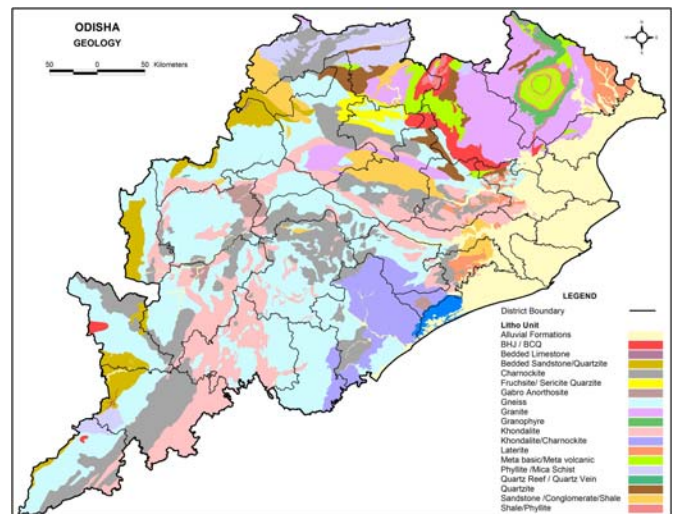
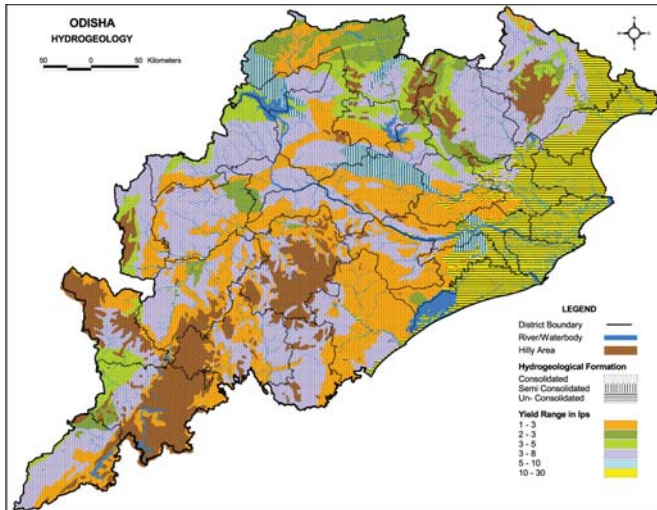


Geology & Hydrogeology:

Geological history of Orissa dates back to more than 3.5 billion years and the state is underlain by diverse lithological formations ranging in age from Precambrian Recent period. The Precambrian formations are very complex in nature lithologically, genetically and occupy around 75% of the total geographical area of the State. Besides Precambrians, fluvio-lacustrine sedimentary formations of Gondwana super group are found along the grabens developed in the river valleys. Recent to Sub-recent sediments were deposited by various river systems to build up deltas at the river mouths, which coalesced to form the narrow coastal tract.

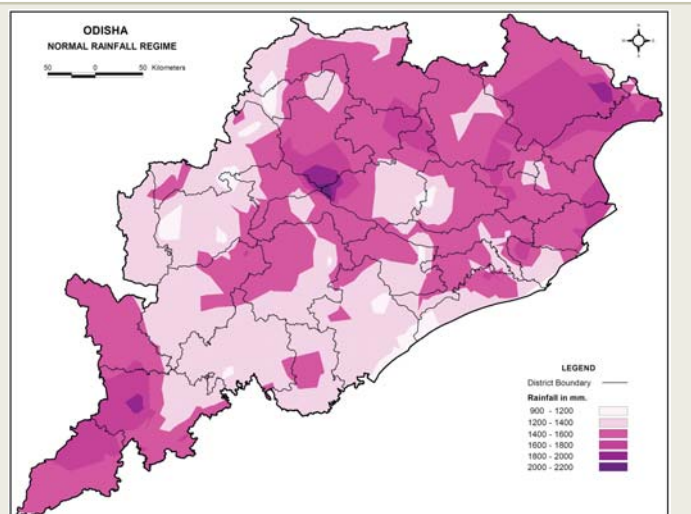
Hydrogeology of an area is mainly controlled by the geology, geomorphology and rainfall of the area. The complex geology, varied geomorphic set up and skewed distribution of rainfall both in space and time have resulted different hydrogeological set ups. Hydrogeologically, the state can be divided into (i) Consolidated unit which includes all hard crystalline rocks (Khondalites, charnockites, quartzites, granites, granophyres, gneisses, metabasics etc) of Precambrian age (ii) Semi-consolidated unit, includes sedimentary formations of Gondwana super Group (Conglomerates, sandstones, shales) and Tertiary formations of Baripada (iii) Unconsolidated unit, includes alluvial deposits (Gravel, sand, silt and clay) of coastal area and also in small patches in inland river valley areas. Ground water occurs under phreatic condition at shallow depth and under semi-confined to confined conditions at

deeper depth in the hydrogeological units. The yield of wells in consolidated and semi-consolidated units depends upon the thickness of weathered zone and the number of saturated fracture zones encountered during drilling while in unconsolidated unit the thickness of the porous zone determines the yield. Thickness of weathered zone varies from 5 to 25m.



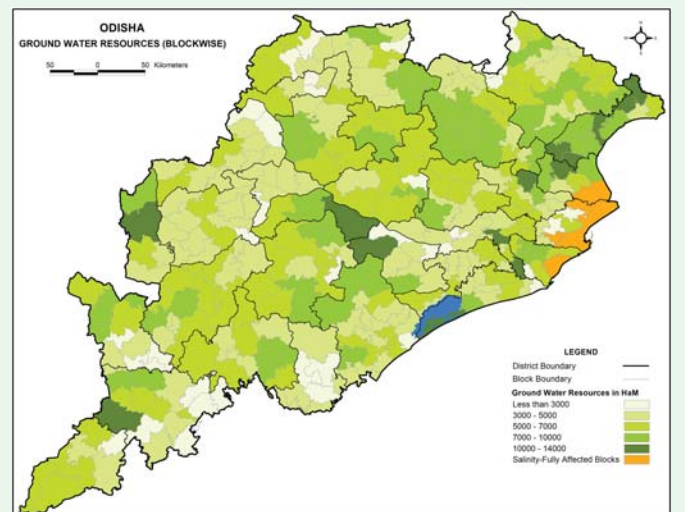
Climate and Rainfall:

The climate of the state is tropical, characterized by high temperature, high humidity, medium to high rainfall, short and mild winter. The normal rainfall is 1502 mm. Most of the rainfall received in the state is concentrated over a period of 3 months of the monsoon season.



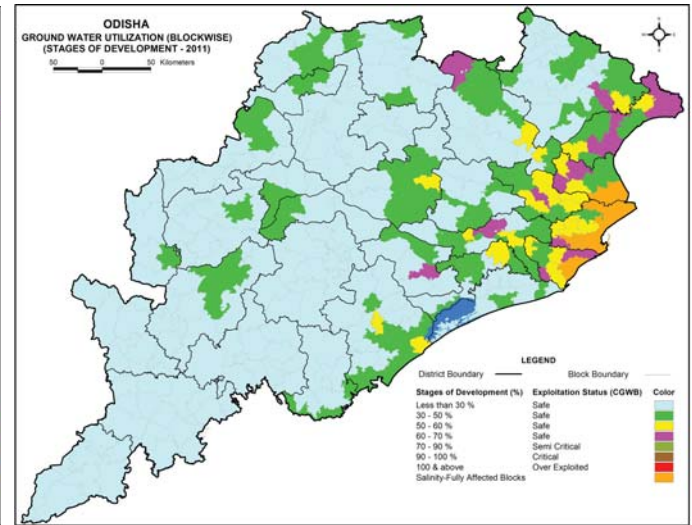
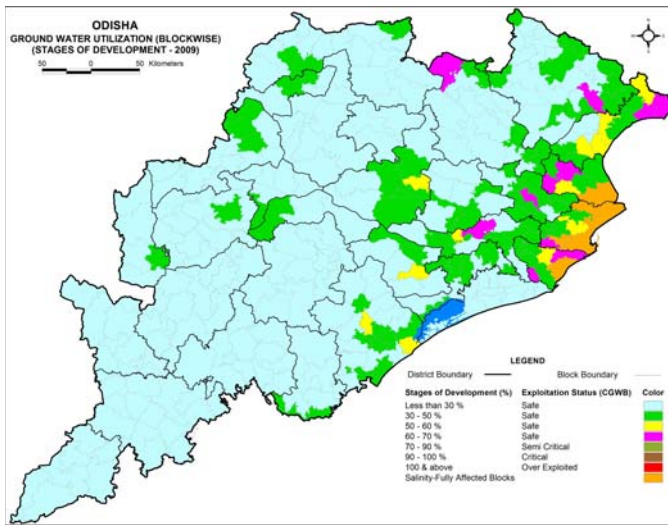
Ground water Resource of Odisha:

Annual replenishable ground water resource is 23.09 BCM. The net annual ground water availability is 21.01 BCM and annual ground water draft is 3.85 BCM. Following is the details of district wise ground water resources and its utilization as per Central Ground Water Board 2011report.



District	Annual net replenishable ground water resource in HaM	Gross annual draft for domestic, industrial & irrigation uses in HaM	Average stage ground water development in %
Angul	46077	15881	34.47
Balasore	110063	57935	52.64
Bargarh	46054	10098	27.62
Bhadrak	450409	26658	58.71
Bolangir	57656	13135	22.78
Boudh	27839	5608	20.14
Cuttack	70716	26864	37.99
Deogarh	20629	3321	16.10
Dhenkanal	44264	11520	26.03
Gajapati	22670	6220	27.44
Ganjam	114541	34840	30.42
Jagatsinghpur	45029	23204	51.53
Jajpur	56933	27703	48.66
Jharsuguda	16791	5153	30.69
Kalahandi	74911	14931	19.93
Kandhamal	70266	8864	12.59
Kendrapara	16781	9591	57.15
Keonjhar	81323	23289	28.64
Khurda	47618	15706	32.98
Koraput	69117	6770	9.79
Malkangiri	33598	3188	9.49
Mayurbhanj	148194	43743	29.52
Nabarangpur	50306	7592	15.09
Nayagarh	42682	10350	24.25
Nuapada	33686	7034	20.88
Puri	58806	12296	20.91
Rayagada	65681	9718	14.80
Sambalpur	52520	8536	16.25
Sonepur	21429	4243	19.80
Sundergarh	77325	17098	22.11

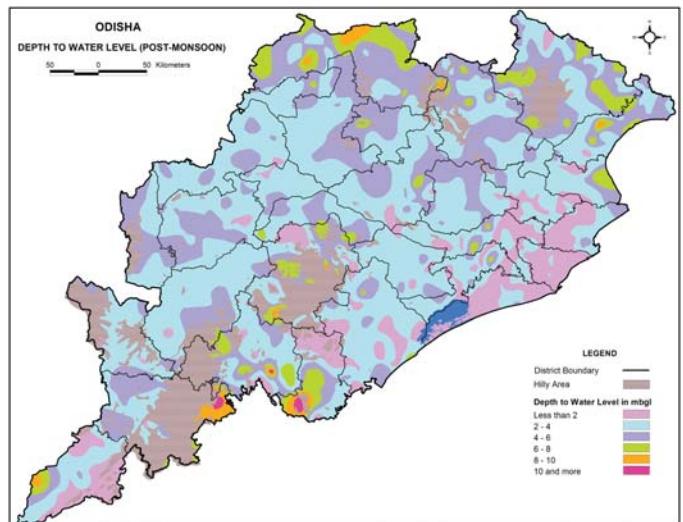
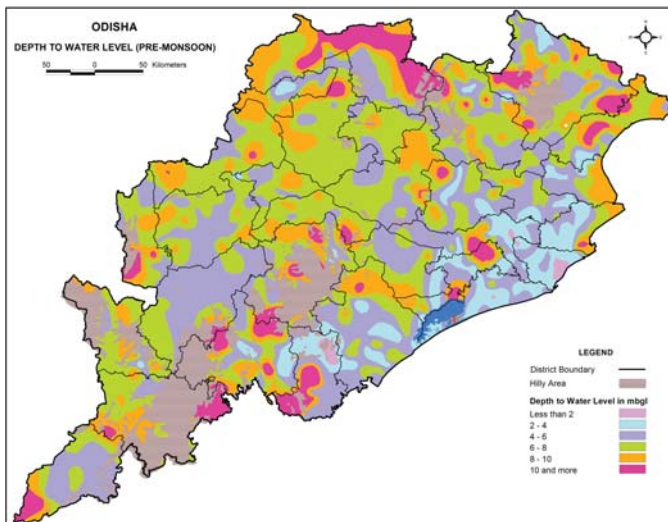
The maximum average stage of ground water development is found in Balasore, Bhadrak, Jagatsinghpur and Kendrapara districts.



The followings are details of dept to water level during pre-monsoon and post-monsoon period in 30 districts.

District	Depth to Water level during pre-monsoon period in meter below ground level (m bgl)	Depth to Water level during post-monsoon period in meter below ground level (m bgl)	District	Depth to Water level during pre-monsoon period in meter below ground level (m bgl)	Depth to Water level during post-monsoon period in meter below ground level (m bgl)
Angul	4-10	2-6	Kandhamal	4-10	4-8
Balasore	2-10	2-8	Kendrapara	4-10	Up to 4
Bargarh	6-10	4-6	Keonjhar	4-10	4-8
Bhadrak	4-10	2-8	Khurda	4-10	Up to 4
Bolangir	6-10	4-6	Koraput	4-10	4-6
Boudh	8-10	4-6	Malkangiri	6-10	4-10
Cuttack	2-10	2-6	Mayurbhanj	4-10	4-8
Deogarh	6-10	4-6	Nabarangpur	6-10	4-6
Dhenkanal	4-10	4-6	Nayagarh	6-10	4-6
Gajapati	4-10	4-10	Nuapada	8-10	4-6
Ganjam	4-10	4-6	Puri	4-6	Up to 4
Jagatsinghpur	4-6	2-4	Rayagada	4-10	4-6
Jajpur	4-8	4-6	Sambalpur	6-10	4-6
Jharsuguda	4-10	4-6	Sonepur	6-10	4-6
Kalahandi	6-8	4-6	Sundergarh	8-10	6-10

From the database one can conclude that the depth to water level is up to 10 m bgl maximum both during pre-monsoon and post-monsoon period though it varies in different districts.

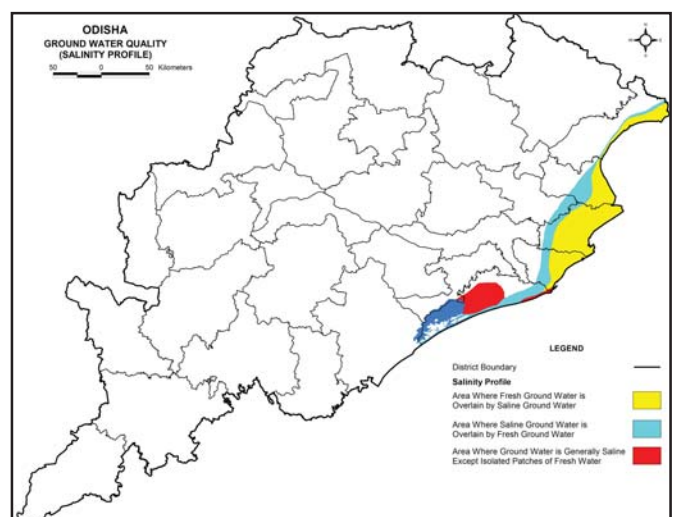


Ground Water Quality:

Quality of ground water is an important aspect to be used for different purposes. The water quality specification for drinking, agriculture and industrial purposes are different. Concentration of an element in the water more than the permissible limit is not safe. Variation of chemical composition of ground water occurs due to enrichment of different salt contents by physico-chemical interaction of water with rock and leaching of various minerals. Ground water quality of an area depends on the sub-surface geological formations. Anthropogenic activities and environmental factors also change the quality of water over time and space. Odisha state is underlain by varied rock types ranging in age from Pre-cambrian to Recent. Depending on diverse geological formations, the hydrogeological condition of the state also varies from place to place.

As per the reports of Central Ground Water Board, ground water quality problems exist for different parameters varies from district to district. Fluoride problems having quantity more than 1.5 mg/l noticed in Angul, Bolangir, Bargarh, Bhadrak, Boudh, Cuttack, Deogarh, Dhenkanal, Jajpur, Keonjhar and

Sonepur districts. Iron content exceeding 1.0 mg/l is also observed in some parts of districts namely Balasore, Bargarh, Bhadrak, Cuttack, Deogarh, Jagatsinghpur, Jajpur, Jharsuguda, Kalahandi, Kandhamal, Keonjhar, Khurda, Koraput, Mayurbhanj, Nayagarh, Puri, Rayagada, Sambalpur, Sundergarh and Sonepur. Similarly the level of Nitrate is exceeding 45 mg/l in some parts of districts like Angul, Balasore, Bargarh, Bhadrak, Bolangir, Boudh, Deogarh, Cuttack, Dhenkanal, Gajapati, Ganjam, Jagatsinghpur, Jajpur, Jharsuguda, Kalahandi, Kendrapara, Keonjhar, Khurda, Koraput, Malkangiri, Mayurbhanj, Nuapada, Nayagarh, Kandhamal, Puri, Sambalpur and Sonepur.



So far as salinity problem is concerned, the coastal aquifers in the eastern part of Balasore & Jagatsinghpur districts and most of the blocks of Kendrapara & Puri districts are affected by salinity problem.

Conclusion:

Beside surface water, ground water is an important resource for survival. It meets many requirements. Government is taking many steps for management and conservation of this resource. However, there are many problems in quality of ground water of the state in selected districts. Information contained in this issue definitely useful for research and policy decision.

For district wise map on Administrative, Physiography, Geology, Hydrogeology, Rainfall, Ground Water Resource, Ground Water Utilization, Depth to waterlevel (Pre-monsoon), Depth to waterlevel (Post-monsoon), Salinity Profile, Ground Water Quality (Fluoride), Ground Water Quality (Salinity), Ground Water Quality (Total Dissolved Solids); Kindly mail us on : ori@envis.nic.in & cesorissa@rediffmail.com

Acknowledgment

The baseline information has been collected from different sources. We are thankful to the concerned departments by which we could compile this issue on the basis of their baseline information.

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