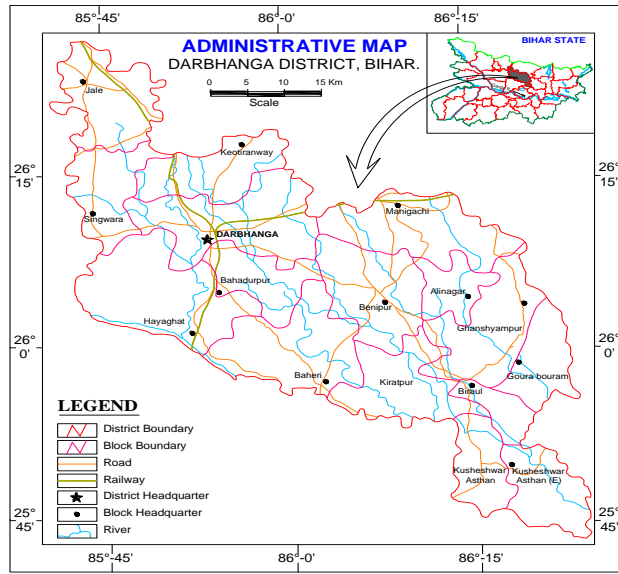




भूजल सूचना पुस्तिका

दरभंगा जिला, बिहार

Ground Water Information Booklet Darbhanga District, Bihar State



केन्द्रीय भूमिजल बोर्ड
जल संसाधन मंत्रालय
(भारत सरकार)
मध्य-पूर्वी क्षेत्र
पटना

Central Ground water Board
Ministry of Water Resources
(Govt. of India)
Mid-Eastern Region
Patna

सितंबर 2013
September 2013

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GROUNDWATER INFORMATION BOOKLET

DARBHANGA DISTRICT

DISTRICT AT A GLANCE

Sl. No.		Statistics
1.	GENERAL INFORMATION	
	Geographical Area (Sq. Km.)	2414.43 sq. km
	Administrative Divisions	Darbhanga Sadar, Benipur, Biraul
	No. of Panchayats/Villages	329/1269
	Population (As per 2011 Census)	Urban:380125 Rural: 3541846
	Average Annual Rainfall (mm)	1142.30 mm
2	GEOMORPHOLOGY	
	Major Physiographic Units	Alluvium
	Major Drainages	Baghmati, Kamla, Tiljuga
3	LAND USE	
	Forest Area	Nil
	Net Area Sown	1610.93 sq. km
	Area Sown more than once	821.17 sq. km
	Cultivable Area	1984.15 sq. km
4	MAJOR SOIL TYPES	Entisols, inceptisols
5	AREA UNDER PRINCIPAL CROPS	
6	IRRIGATION BY DIFFERENT SOURCES (Areas and Number of Structures)	
	Dugwells	61 nos.
	Tubewells/Borewells	11250 (STW), 124 (DTW) (in working condition) Covers 250.94 sq. km
	Canals	6 nos.
	Other Sources	124.16 sq. km
	Net Irrigated Area	386 sq. km
7	NUMBER OF GROUND WATER MONITERING WELLS OF cgwb (2011)	
	No. of Dugwells	07
	No. of Piezometers	Nil
8	PREDOMINANT GEOLOGICAL FORMATIONS	Quaternary alluvium
9	HYDROGEOLOGY	
	Major water bearing formations	Alluvium
	Pre-monsoon Depth to water level during 2011	1.77 – 6.09 m bgl
	Post-monsoon Depth to water level during 2011	1.70 – 2.70 m bgl
	Long term water level trend in last 10 yrs (2002 – 2011) in m/yr	No significant decline

10	GROUND WATER EXPLORATION BY CGWB (As on 31-03-2013)	
	No. of well drilled (EW,OW, PZ, SH, Total)	EW=03, OW= 02, Pz= 06.
11	GROUND WATER QUALITY	
	Presence of Chemical constituents more than the permissible limit (e.g.EC, F, As, F)	Nil
12	DYNAMIC GROUND WATER RESOURCES (as on 31st March, 2009) IN hactare meter.	
	Annual Replenishible Ground Water Resources	58726 ha.m
	Net Annual Ground Water Draft	24386 ha.m
	Projected Demand for Domestic and Industrial Uses up to 2025	12327 ha.m
	Stage of Ground Water Development	41.5 %
13	AWARENESS AND TRAINING ACTIVITY	Nil
14	EFFORTS OF ARTIFICIAL RECHARGE AND RAINWATER HARVESTING	Nil
15	GROUND WATER CONTROL AND REGULATION	
	No. of OE Blocks	Nil
	No. of Critical Blocks	Nil
	No. of Blocks Notified	Nil
16	MAJOR GROUND WATER PROBLEMS AND ISSUES	No major ground water problem

1.0 INTRODUCTION

1.1 Location, Area and Population

Darbhanga District is one of the thirty-seven districts of Bihar state with Darbhanga town as its administrative headquarter. It is situated between longitude $85^{\circ} 45'$ - $86^{\circ} 25'$ East and latitude $25^{\circ} 53'$ - $26^{\circ} 27'$ North and is bounded on the north by Madhubani district, on the south by Samastipur district, on the east by Saharsa district and on the west by Sitamarhi and Muzaffarpur districts. The district comprises of three civil sub-divisions, namely Darbhanga Sadar, Benipur and Biraul. There are 19 community development blocks, 329 panchayats, 1269 villages & 23 police stations in the district. The blocks of the district are Bahadurpur, Jale, Hayaghat, Singhwara, Benipur, Ghanshyampur, Baheri, Keoty, Manigachhi, Darbhanga, Biraul, Kusheswarsthan, Alinagar, Kusheswarsthan East, Gaura Vauram, Kiratpur, Hanuman Nagar, Tardih and Darbhanga Nagar Nigam (Figure 1). Total geographical area of the district is 2,279 sq. km. As per the 2011 census the total population of the district stands at 3921971 with the rural and urban populations of 3541846 and 380125 respectively.

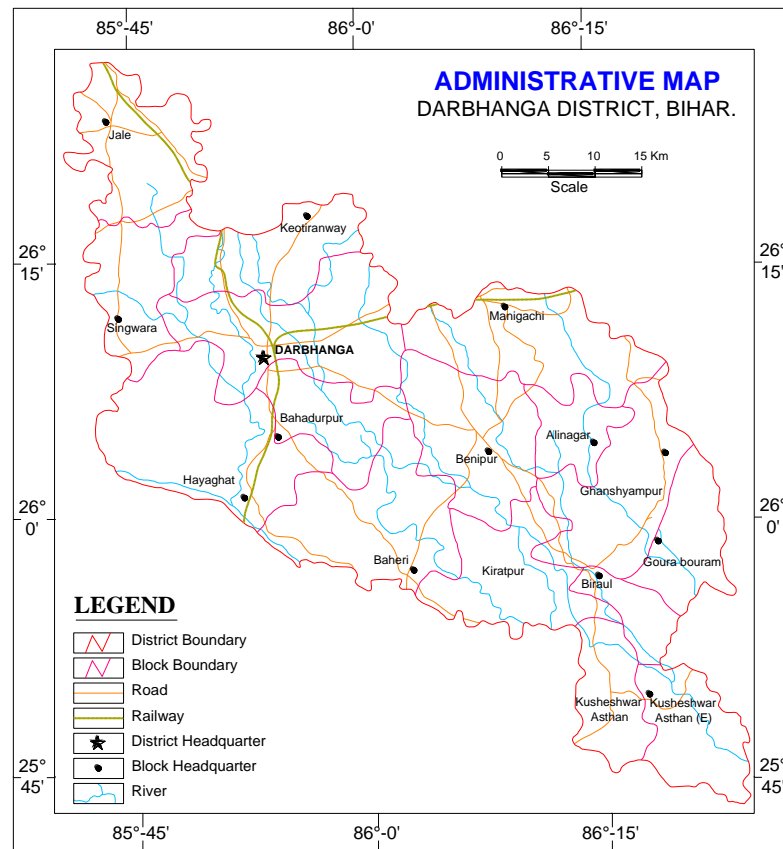


Figure 1: Administrative map of Darbhanga district, Bihar with block boundaries road (rail) networks.

1.2 Basin/Sub-Basin and Drainage

Physiographically the district Darbhanga forms a vast monotonously flat plain with low relief to the south of Tarai/Bhabhar high relief belt in Nepal Himalayas. The area is a part of the Bagmati Sub-Basin in the Ganga Basin.

The district contains four main river systems, viz, the Bagmati, little Bagmati, Kamla and Tiljuga. The Bagmati, which enters this district from Muzaffarpur, forms a natural boundary between it and Samastipur district and pursues a southeasterly course till it empties itself into the Burhi Gandak River near Rosera. The little Bagmati enters the district from Madhubani near Pali and turns past the town of Darbhanga down to Hayaghat, where the Bagmati proper joins it. The Kamla enters the district at Singar Pandaul, and flowing east of Darbhanga, joins the Tiljuga at the southeastern corner of Rosera block. The Tiljuga skirts the eastern boundary of the district.

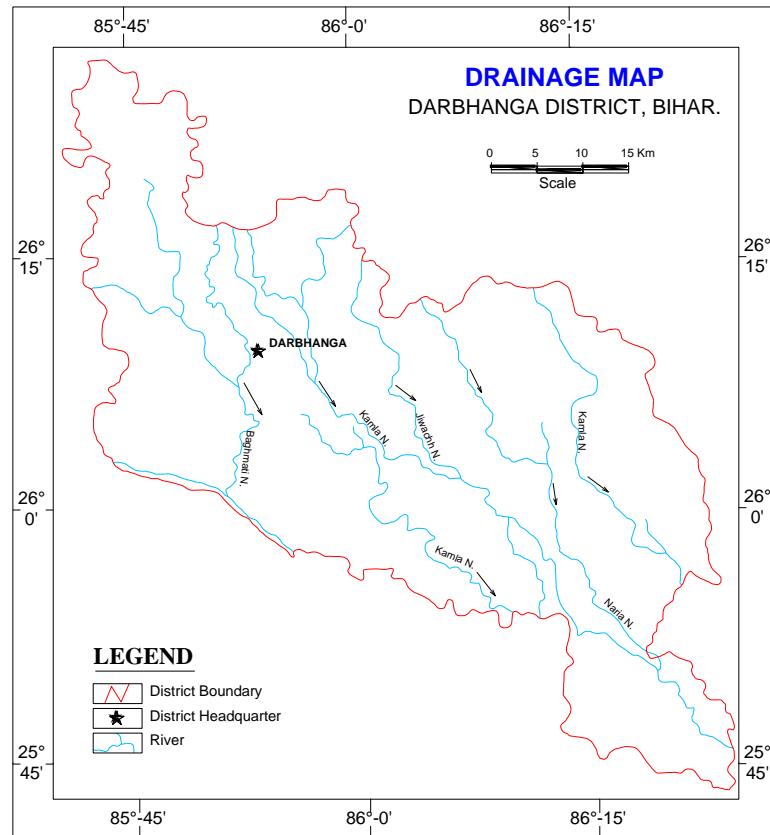


Figure 2: Drainage map of Darbhanga district, Bihar.

1.3 Land use, agriculture and irrigation practices

The soil of the district is highly calcareous and a mixture of clay & sand, which makes it suitable for rice and Rabbi, crops. The total area of the district is 241443.20 hectares, out of which 198415 hectares is cultivable, 19617 hectares is upland, 37660 hectares is medium and 38017 hectare is low land. There is 29706 hectare of Chaur areas.

Table 1 Block-wise Land Use Pattern in Darbhanga District (Data as per NIC website, Dadhanga**Unit-2007)**

SL	Block	Geographical Area (hectares)	Culturable Land	Up Land	Medium Land	Low Land	Chaur (tanks & ponds)
1.	Darbhangha	17,584.75	13,590	1,300	2,700	1,450	300
2.	Bahadurpur	15,338.89	12,205	1,750	2,620	1,750	2,630
3.	Hayaghat	21,584.08	17,610	1,500	2,250	3,000	1,880
4.	Hanuman Nagar	-	-	-	-	-	-
5.	Baheri	21,233.33	18,890	3,100	4,500	4,000	650
6.	Keoti	14,504.87	11,950	1,222	3,379	5,729	1,920
7.	Singhwara	16,348.68	12,490	600	2,500	700	4,450
8.	Jale	18,611.65	16,080	2,000	6,000	250	1,000
9.	Manigachi	21,651.75	17,320	2,030	3,105	6,110	2,005
10.	Taradih	-	-	-	-	-	-
11.	Benipur	2,11,132.16	20,960	2,515	4,306	5,128	2,051
12.	Alinagar	-	-	-	-	-	-
13.	Biraul	20,580.05	16,050	1,000	3,000	2,500	2,750
14.	Ghanshyampur	25,158.86	20,880	2,000	2,500	3,000	2,750
15.	Kiratpur	-	-	-	-	-	-
16.	Gaura Bauram	-	-	-	-	-	-
17.	K. Asthan	23,713.41	20,390	600	800	1,400	6,700
18.	K. Asthan (East)	-	-	-	-	-	-
	TOTAL	2,41,443.20	1,98,415	19,617	37,660	38,017	29,706

In the district of Darbhanga, 82.17% of the total area is cultivable. Among Kharif crops, paddy has the highest sown area (96 %), which is followed by maize (2.1 %) and oil seeds (1.5 %). During Rabi season wheat is the principal crop covering around 54 % of the area sown and is followed by pulses (21 %), maize (10 %), oil seeds (9.4 %) and potato (6 %). Vegetables are grown liberally in all the seasons. The district is full of mango orchards. Sisoo, Khair, Palm, Khajur, Jackfruit, Litchi, Pipal, Jamun, Guava trees are found near human settlements. Many ponds can be seen full of Makhan & Lotus. The district also has some tracts of grasslands.

Table 2 Statement of Land Utilization in Darbhanga District (Data as per NIC website, Dadhanga Unit-2007)

SL	Item	Area (Hectare)
1.	Geographical Area	2,41,443.20
2.	Forest	-
3.	Barren Land	1,977
4.	Land purr to Non-Agricultural Activities	39,215
5.	Permanent Water Area	8,732
6.	Seasonal Water Area	3,432
7.	Total Land of Non-Agricultural Use	51,379
8.	Cuturable Waste	665
9.	Permanent Pasture and other Grazing Land	1,310
10.	Miscellaneous Trees, etc.	12,068
11.	Other Fallow Land (2 to 5 years)	3,137
12.	Current Fallow up to 1 year	22,460
13.	Total	92996
14.	Area Fit for Agriculture	1,98,415
15.	Net Sown Area	1,61,093
16.	Area Sown more than once	82,117

The irrigation in Darbhanga district is still depends on rainfall as only 19 % of the total cultivable area has been put to irrigation sources other than rainfall. Irrigation in the district has been linked to flood control measures and drainage schemes. In the recent past considerable effort has been paid to the expansion of irrigational facilities from ground water resources and lift irrigation schemes under minor irrigation system. In the present day, out of the total irrigated area, near about 70 % is being irrigated from ground water.

Table 3 Block-wise Irrigation Facilities in Darbhanga District (Data as per NIC website, Dadhanga Unit-2007)

SL	Block	Govt.		Private		Lift		Diesel Pump Set
		Tube-Well (T)	(W)	Tube-Well (T)	(W)	Irrigation (T)	(W)	
1.	Darbhangha	22	6	746	606	6	6	852
2.	Bahadurpur	20	9	769	655	3	-	875
3.	Hayaghat+Hanuman Nagar	24	3	1,183	1,005	6	1	1,280
4.	Baheri	14	3	1,028	860	5	3	1,236
5.	Keoti	18	6	508	403	6	4	542
6.	Singhwara	37	12	738	615	4	-	670
7.	Jale	27	5	757	630	2	1	675
8.	Manigachi+Taradih	17	6	774	660	5	5	560
9.	Benipur	23	5	904	770	10	6	1,041
10.	Alinagar	4	-	66	61	-	-	-
11.	Biraul	8	2	3,264	2,816	5	1	572
12.	Ghanshyampur+Kiratpur+Gaura Bauram	1	-	1,509	1,306	4	-	891
13.	K. Asthan+K. Asthan (East)	1	1	957	805	-	-	580

(T) - Total Nos., (W) - In Working Condition

Table 4 Area Covered by Irrigation Facilities (Area in Hectares, data as per NIC website, Dadhanga Unit-2007).

SL	Block	By Govt. Tube-Well	By Private Tube-Well	By Lift Irrigation	By Other Sources	Total Expected Area
1.	Darbhangha	300	1,212	600	888	3,000
2.	Bahadurpur	450	1,310	-	1,240	3,000
3.	Hayaghat+Hanuman Nagar	150	2,010	100	840	3,100
4.	Baheri	150	1,720	300	930	3,100
5.	Keoti	300	806	400	994	2,500
6.	Singhwara	600	1,230	-	1,170	3,000
7.	Jale	250	1,260	100	1,390	3,000
8.	Manigachi+Taradih	300	1,320	300	1,080	3,000
9.	Benipur	250	1,450	600	710	3,100
10.	Alinagar	-	122	-	878	1,000
11.	Biraul	100	4,032	100	68	4,300
12.	Ghanshyampur	-	1,100	-	338	1,438
13.	Kiratpur	-	612	-	250	362
14.	Gaura Bauram	-	900	-	300	1,200
15.	Kusheshwar Asthan	50	910	-	740	1,700
16.	Kusheshwar Asthan (East)	-	700	-	600	1,300
	TOTAL	2,900	19,694	2,500	12,416	38,600

Table 5 Area and Main Crops in Darbhanga

(Data as per NIC website, 2007, Darbhanga Unit)

SL	Crop Name	Area (Hectares)	Production (MT)
1.	Bhadai Paddy	28,246	25,372
2.	Agahani	96,378	73,548
3.	Grama Paddy	1,617	1,621
4.	Wheat	55,957	84,129
5.	Garma Maize	2,092	3,867
6.	Bhadai Maize	897	1,320
7.	Barley	429	283
8.	Ragi	5,891	4,963
9.	Tur	723	1,109
10.	Gram	3,336	3,296
11.	Masoor	3,769	3,098
12.	Khesari	6,303	3,498
13.	Peas	404	168
14.	Moong	13,939	7,248
15.	Other Pulses	231	214
16.	Rape & Mustard	2,592	3,766
17.	Linseed	1,369	972
18.	Mango	4,916	46,014
19.	Guava	16	157
20.	Lichi	12	38
21.	Banana	123	723
22.	Aghani Potato	769	10,943
23.	Rabbi Potato	2,932	33,014
24.	Jack Fruit	218	10,123
25.	Cauliflower	143	1,406
26.	Aghani Brinjal	184	841
27.	Aghani Tomato	60	282
28.	Rabbi Tomato	33	181
29.	Onion	174	1,618
30.	Chilies	110	102
31.	Sugarcane	972	24,052
32.	Turmeric	18	11
33.	Mesta	282	2,171
34.	Tobacco	31	47

1.4 Activities carried out by CGWB

Ground water reappraisal study was taken up in the district in the year 1992. For monitoring ground water level, 10 number of dug wells have been set as hydrograph network stations in the district. These network stations are measured four times a year for observing the water level regime in the district.

2.0 RAINFALL AND CLIMATE

The District has somewhat dry and healthy climate. There are three well-marked seasons, the winter, the summer & the Rainy season. The cold weather begins in November and continues up to February, though March is also somewhat cool. Westerly winds begin to blow in the second half of March and temperature rises considerably. May is the hottest month when the

temperature goes up to 107 degree Fahrenheit. Rain sets in towards the middle of June. With the advent of the Rainy seasons, temperature falls and humidity rises. The moist heat of the Rainy season is very oppressive up to August .The rain continues till the middle of October. Average rainfall is 1142.3 mm. around 92% of rainfall is received during monsoon period.

Month-wise rainfall and number of days are given in the following table:

Table 6 Normal Rainfall (with days) in Darbhanga district.

SL	Month	Rain-Fall (mm)	Days of Rain-Fall
1.	July	286.50	11.80
2.	August	280.80	12.00
3.	September	188.60	8.90
4.	October	80.00	2.60
5.	November	8.20	0.40
6.	December	1.80	0.40
7.	January	12.60	1.00
8.	February	10.50	1.20
9.	March	9.90	0.90
10.	April	18.50	1.40
11.	May	59.30	3.30
12.	June	186.10	7.60
	TOTAL	1,142.30	51.30

(Latest data as per NIC website, Dabhanga Unit)

3.0 GEOLMORPHOLOGY AND SOIL TYPES

3.1 Geomorphology

The district has a vast alluvial plain devoid of any hills. There is a gentle slope from north to south with a depression on the centre. The mamimum ground elevation is 52.50 m amsl in northern part of the district and the minimum is 41.08 m amsl in the south- eastern parts, average being 47 m amsl. Levees along the stream banks, back swamps or flood basins/ chours of various sizes are the only significant features over the area.

The District of Darbhanga can be divided into four natural divisions. The eastern portion consisting of Ghanshyampur, Biraul and Kusheshwarsthan blocks contain fresh silt deposited by the Kosi River. This region was under the influence of Kosi floods till the construction of Kosi embankment in the Second Five Year Plan. It contains large tracts of sandy land covered with wild marsh. The second division comprised of the anchals lying south of the Burhi Gandak river and is the most fertile area in the district. It is also on higher level than the other part of the district and contains very few marshes. It is well suited to the rabbi crops. The third natural region is the doab between the Burhi Gandak and Baghmati and consists of the low-lying areas dotted over by chaur and marshes. It gets floods every year. The fourth division covers the Sadar

sub-division of the district. This tract is watered by numerous streams and contains some uplands.

3.2 Soils

The soil of the district is highly calcareous. It is a mixture of clay, sand and silt in varying proportions. “Bhangar” soil is found in the low lying areas. The following type of soils are found in the district:

Entisols

This soil type is developed along the kamla river and in marshy land, as well as in back swamp areas. The texture is loose and of black or dark grey in colour. It consists of sand and clay with minor silt. This soil is suitable for seasonal crops in selected patches.

Inceptisols

This soil type is developed in the central part of the district and locally known as Bhangar. It is highly calcareous in nature.

4.0 HYDROGEOLOGY

4.1 Water Bearing Formations

The water bearing formations in the district occurs within the thick pile of quaternary sediments. The thickness of these sediments is about 1000 to 2000 m in the south of the district as inferred from the geophysical survey of Geological Survey of India. There are cyclic deposits of sand, gravel and pebbles of various grades along with clay and silt. Lithological information is available to a maximum depth of 150 m bgl from the boreholes drilled by Bihar Tube well Corporation, Govt. of Bihar.

Lithology of boreholes indicates that there is persistent clay capping in the district. It is variable in thickness and becomes thinner towards south and southeast. In the upper part of the alluvial sequence, sand is fine to medium grained whereas in the lower parts those are medium to coarse with occasional association of gravels. The clay part contains sandy and silty materials. Kankars (calcareous nodules) are found in abundance in clays. A thick clay deposit of over 40 m thickness occurs in the northern part. Below this clay, a potential aquifer of about 40 m thickness occurs. In the southern part, there are predominant aquifers at the depth ranges of 40 – 67, 71 – 86, and 125 – 149 m bgl. Aquifer system in the northwestern part occurs at depth between 41 – 63, 66 – 142 and 109 – 128 m bgl. A thick aquifer system exists in the southeastern part below the 10 m thick top clay down to a depth of 86 m and below.

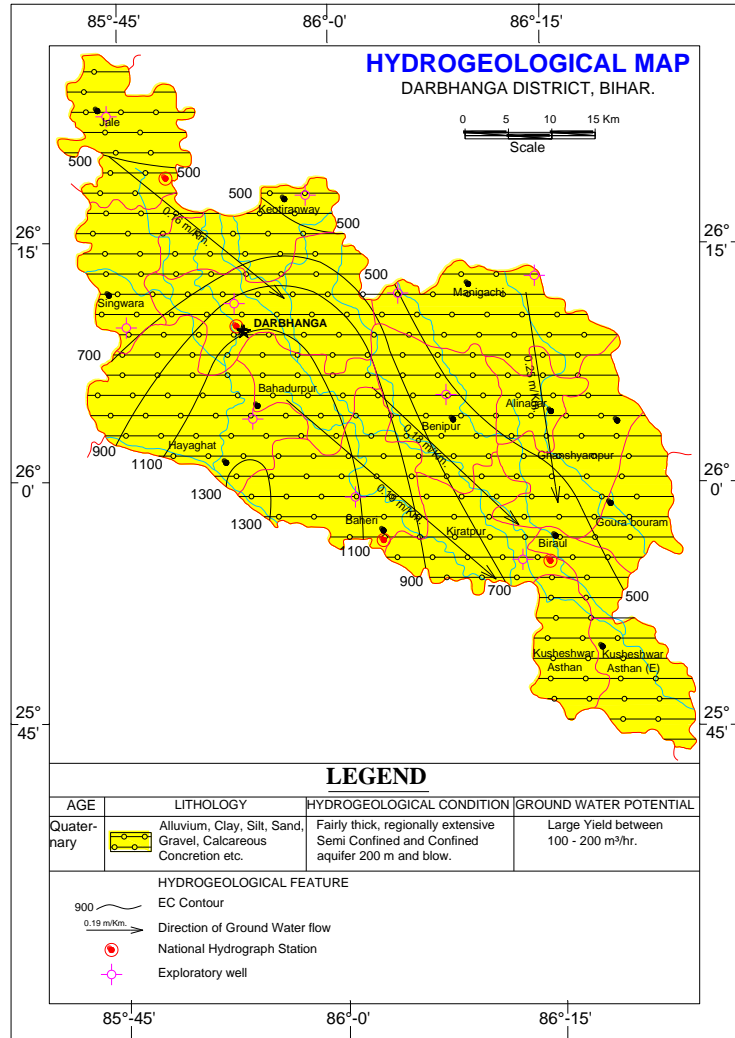


Figure 3: Hydrogeological map of Darbhanga district, Bihar showing Quaternary Alluvium with their yield potential. Electrical conductivity of groundwater has been represented by contours.

4.2 Mode of Occurrence of Ground Water

The near-surface sand, silt and clayey silt mainly support open dug wells where ground water occurs under water table (unconfined) condition. The depth of these dug wells varies from 4 m to 9 m bgl. The aquifers occurring below the top clay occur either in semi-confined or confined condition.

4.3 Hydraulic Characteristics of Aquifers

Specific capacity, discharge and draw down data are available from the tube wells constructed by Bihar Tube Well Corporation, Govt. of Bihar. The average discharge of the tube wells has been found out to be around 180 m³/hr on tapping about 25 m saturated aquifer thickness.

The specific capacity varies from the lowest 37 m³/hr/m at Abdullahpur in Bahadurpur block, to the maximum of 73 m³/ hr/ m at Gausa in Darbhanga block.

4.4 Depth to Water Level

In the Pre-Monsoon water level data (Figure 4) for the year 2011, the depth to water level ranges from 1.77 to 6.09 m bgl and in post-monsoon 2011 ranges between 1.70 to 2.70 m bgl (Fig 5).

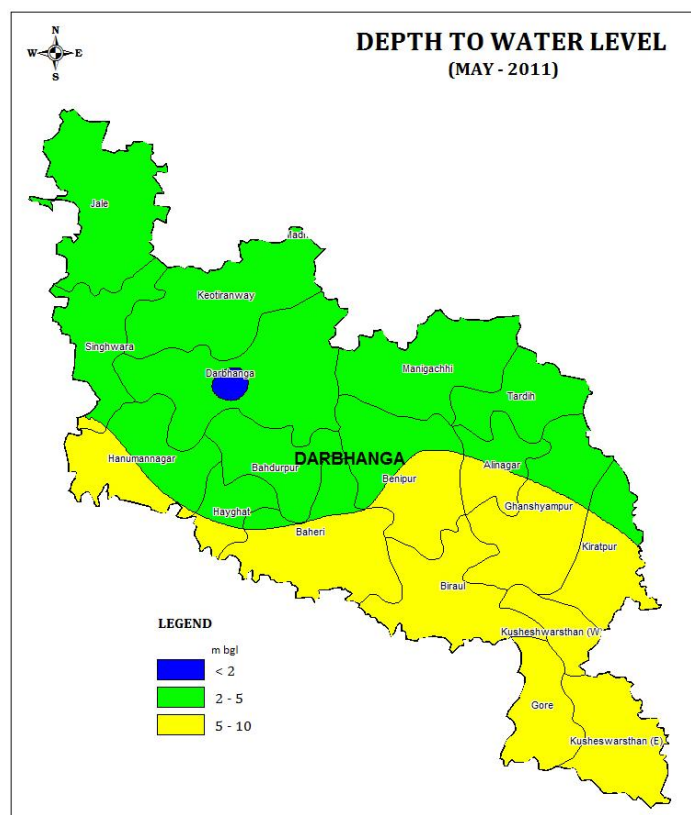


Figure 4: Pre- monsoon (2011) depth to water level contours in Darbhanga district, Bihar.

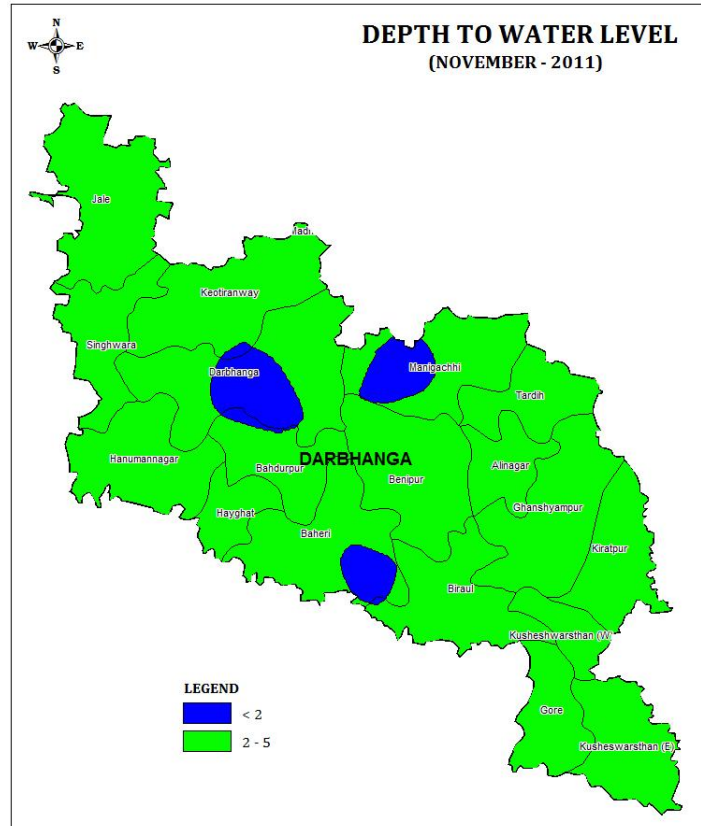


Figure 5: Post- monsoon (2011) depth to water level contours in Darbhanga district, Bihar.

4.5 Ground Water Quality

It has been found that the ground water in the district is good and suitable for both drinking as well as irrigation purposes. The following table depicts the extent of the presence of various chemical parameters in ground water in the shallow aquifers (since samples analysed were collected from shallow tube wells and dug wells only).

Table 7 Ground water quality

Chemical constituents (mg/l)	Shallow Aquifer	Drinking Water Standard (As per BIS norms)	
		Highest Desirable	Maximum Permissible
pH	7 – 8.1	6.5 – 8.5	No relaxation
E.C (Micro-siemens/cm at 25 ⁰ C	455 – 1347	500	2000
Total Hardness (CaCO ₃)	85 – 825	300	600
Bicarbonate	244 – 671	200	600
Calcium	26 – 124	75	200
Magnesium	1.2 – 28	30	100
Sodium	15 - 186		
Potassium	1.4 - 17	1.90 - 50	

Table 8: Irrigation water classified by Wilcox (1955)

Range of Specific Conductance (micro siemens/cm at 25 ⁰ C	Class of Irrigation Water
< 250	Excellent
250 – 750	Good
750 – 2000	Permissible
2000 - 3000	Doubtfull

5.0 GROUND WATER RESOURCES

As per the ground water resource estimation, 31st March-2009, for the water table aquifer, it is evident that all the blocks in the district Darbhanga come under safe category, i.e the stage of ground water development in all the blocks is below 70 % of the total replenishable (dynamic) resource (Table 9).

The block Baheri is having the highest development status of 55.9 % (Fig 6) and the block Kusheswarsthan (E) has the lowest status 27.6 % (Fig.6) of development of its total resource.

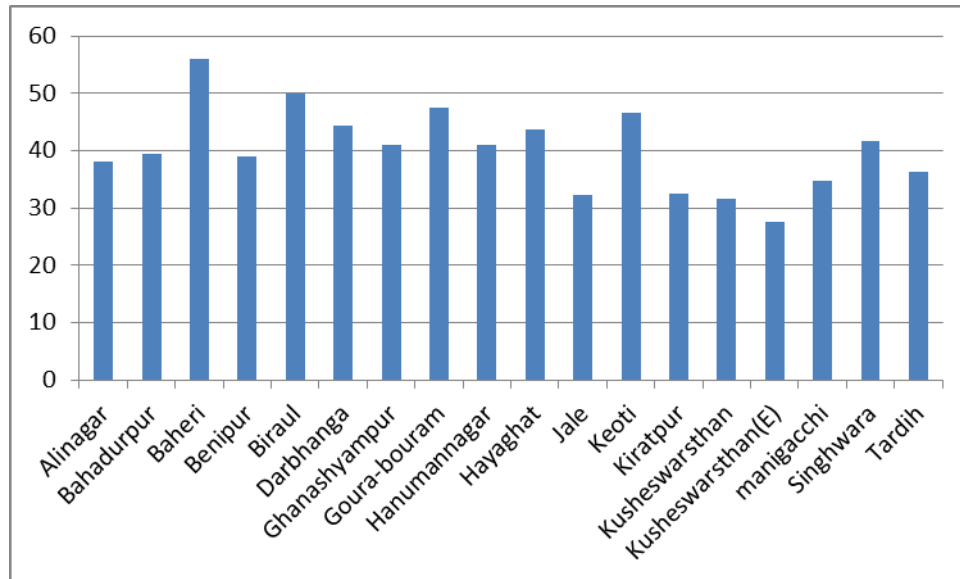


Figure 6: Map showing the Blockwise stage of ground water development of Darbhanga district, Bihar.

Table 9: Replenishable ground water resource of Darbhanga district as on 31st March- 2009.

(in hectare meters)

Sl.No	Assessment Unit/District	Net Annual Ground water Availability	Existing Gross Ground Water Draft for Irrigation	Existing Gross Ground water Draft for Domestic and Industrial Water Supply	Existing Gross Ground Water Draft For all Uses (10+11)	Allocation for Domestic and Industrial Requirement supply upto year 2025	Net Ground Water Availability for future irrigation development (9-10-13)	Stage of Ground Water Development (12/9)*100 (%)
1	2	9	10	11	12	13	14	15
1	Alinagar	1951	673	71	743	379	899	38.1
2	Bahadurpur	3976	1435	136	1570	728	1814	39.5
3	Baheri	5515	2927	157	3084	844	1744	55.9
4	Benipur	3929	1406	125	1531	668	1855	39.0
5	Biraul	4624	2166	145	2311	777	1682	50.0
6	Darbhanga	4940	1530	656	2186	2995	414	44.3
7	Ghanashyampur	2161	820	66	887	355	985	41.0
8	Goura-bouram	2894	1303	76	1379	408	1183	47.6
9	Hanumannagar	3089	1178	84	1262	453	1459	40.9
10	Hayaghat	2106	844	77	921	411	850	43.7
11	Jale	4624	1348	146	1493	781	2494	32.3
12	Keoti	3536	1497	148	1645	792	1247	46.5
13	Kiratpur	1286	375	43	418	230	681	32.5
14	Kusheswarsthan	2394	673	81	755	437	1284	31.5
15	Kusheswarsthan(E)	2421	606	61	667	330	1485	27.6
16	manigacchi	3164	980	116	1097	623	1560	34.7
17	Singhwara	4161	1584	147	1731	787	1790	41.6
18	Tardih	1954	646	61	707	328	980	36.2
	Total	58726	21992	2394	24386	12327	24406	41.5

5.1 Status of Ground Water development

The utilization of ground water for irrigation in the district can be visualized from the fact that 70 % of the total irrigated area is served by ground water structures based on minor irrigation system.

As per the MI census, on the basis of which the of ground water resource utilization has been calculated, the district is possessing 11884 shallow tube wells, 61 dug wells and 124 deep tube wells. Out of 11884 shallow tube wells, 11827 were diesel engine operated and only 58 deep tube wells were found operational out of the total 124.

6.0 GROUND WATER MANAGEMENT STRATEGY

6.1 Ground Water development

The average stage of ground water development in the district stands at only 41.5 % showing its great potential for future irrigation. All the ground water abstraction structures

present in the district have created an irrigation potential of 24386 ha.m leaving a balance of 24406 ha.m of ground water resource potential for future irrigation.

Hydrogeological conditions in the district are favourable for constructing tube wells having potential discharge of 200 m³/ hr and above. The most suitable wells would be 40 – 60 m deep in shallow aquifers and 100 – 150 m in deep seated aquifers, equipped with pumps having discharge 50 – 150 m³/ hr capacity depending upon the requirements.

6.2 Design and construction of Tube Wells

6.2.1 Sallow Tube Wells

Shallow tube wells in the depth range of 40 – 50 m are feasible in Ghanshyampur, Kusheswar Asthan, Biraul blocks and area covering parts of Hayaghat, Singhwara and Jale blocks. It is recommended that about 15 m thickness of aquifers should be tapped which would provide sufficient discharge and expected to be 40 – 50 m³/ hr for a draw down of 2.5 – 3.5 m. A well assembly of 102 mm diameter pipe with 15 m slotted pipe of 1/16” slot size should be constructed with gravel packing, as the aquifer materials are fine to medium sand. The size of the gravel should be 2 – 5 mm.

6.2.2 Deep Tube Wells

Table 10: Proposed Model of Deep Tube Wells

Sl.No.	Discharge (m ³ /hr)	Proposed Depth of well (m bgl)	Proposed Diameter of well (mm)	Assembly Length(m)
1	50	60	203 – casing pipe	20
			102 – slotted pipe	15
			102 – blank pipe	25
2	100	100	305 – casing pipe	25
			152 – slotted pipe	20
			152 – blank pipe	55
3	150 – 200	150	305 – casing pipe	30
			203 – slotted pipe	25
			203 – blank pipe	95

The slot size should be recommended depending on the grain size of the granular zones as given below;

Table 11: Slot opening size in different size of formation sand.

Fine sand	: 1/64” (0.04 cm) to 1/32” (0.08 cm)
Medium to coarse sand	: 1/16” (0.15 cm)
Gravel	: 1/8” to 1/16”

It has been seen that in most cases 1/16” slot size would be appropriate for the tube wells in the district. Both the shallow as well deep tube wells should be artificially packed with gravels

of size ranging within 2 – 3 – 4 mm and a bail plug of 2 – 5 m should be provided in order to the yield and life of the well.

6.3 Water Conservation and Artificial Recharge

No such water conservation and artificial recharge structure has been constructed in the district.

7.0 GROUND WATER RELATED ISSUES AND PROBLEMS:

No such major ground water problem exists in the district.

8.0 MASS AWARENESS AND TRAINING PROGRAMME/ RGI TRAINING:

One Tier III Training programme was held on 18&19 February, 2013. The venue was M.B.D College, Darbhanga (Singhwara Block). No. of participant was 155.

9.0 AREA NOTIFIED BY CENTRAL GROUND WATER AUTHORITY/ STATE GROUND WATER AUTHORITY

Since all blocks of the district come under safe category from ground water development point of view, hence no area is notified either by Central ground water authority or State ground water authority till date.

10.0 RECOMMENDATION

To have a detailed account of the aquifer characteristics in the study area, deep drilling along with pump test for estimation of aquifer parameter needs to be taken up. There is ample scope of large-scale ground water development in the area to meet the requirement for agriculture sector. Exploitation of ground water can be done through Shallow tube wells and bamboo boring to meet the requirement of small and marginal farmers while deep tube wells can be operated through farmers cooperative. Energisation of pump needs to be taken which can help in increasing irrigation potential and cropping intensity.