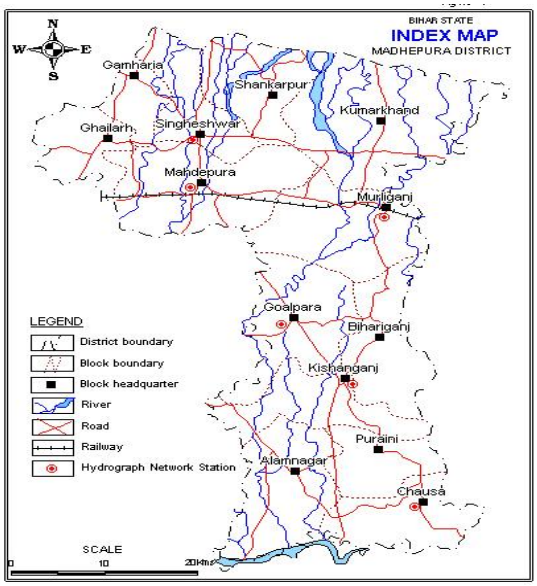
# भूजल सूचना पुस्तिका

## मधेपुरा जिला, बिहार

## Ground Water Information Booklet

**Madhepura 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**

**PREPARED BY - Sri S. Sahu Sc. C**

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# SAHARSA DISTRICT

## *DISTRICT AT A GLANCE*

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| | **I. Geographical Area (Sq. Km.)** | 1788 |
| | **Administrative Divisions** | Madhepura<br>Uda Kishunganj |
| | **II. Population (As per 2011 Census)** | Total: 2,001,762<br>Rural: 88,461<br>Urban: 1,913,301 |
| | **III. Average Annual Rainfall (mm)** | 1231 |
| 2 | **GEOMORPHOLOGY** | |
| | **Major Physiographic Units** | Younger Alluvium with Newer Flood Plains |
| | **Major Drainages** | Kosi Dhars |
| 3 | **LAND USE** | |
| | **a) Forest Area** | Nil |
| | **b) Net Area Sown** | 1020 $km^2$ (2008-09) |
| | **c) Cultivable Area** | 1455 $km^2$ (2008-09) |
| 4 | **MAJOR SOIL TYPES** | Sandy loam, Loam, silty loam |
| 5 | **AREA UNDER PRINCIPAL CROPS** | Rice-530 $km^2$, wheat-360 $km^2$ (2008-09) |
| 6 | **IRRIGATION BY DIFFERENT SOURCES (Areas and Number of Structures)** | |
| | **Dug wells** | 0 (2001 MI Census) |
| | **Tube wells/Bore wells** | 19248 (2001 MI Census) |
| | **Tanks/ponds** | - |
| | **Canals** | 220 $km^2$ (2008-09) |
| | **Other Sources** | 90 $km^2$(1998-99) |
| | **Net Irrigated Area** | 790 $km^2$ (2008-09) |
| | **Gross Irrigated Area** | 1030 $km^2$ (2008-09) |
| 7 | **NUMBER OF GROUND WATER MONITERING WELLS OF CGWB ( As on 31-03-2007)** | |
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| | **No. of Piezometers** | Nil |
| 8 | **PREDOMINANT GEOLOGICAL FORMATIONS** | Quaternary Alluvium |
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| | **Post-monsoon Depth to water level during 2011** | 2.58-3.65 m bgl |
| | **Long term water level trend in last 10 yrs (1997 –2011) in m/yr** | No Significant Decline |
| 10 | **GROUND WATER EXPLORATION BY CGWB (As on 31-03-2007)** | |
| | **No. of well drilled (EW,OW, PZ, SH, Total)** | Nil |
| | **Depth Range (m)** | NA |
| | **Discharge (m/s)** | NA |
| | **Storativity (s)** | NA |
| | **Transmissitivity ($m^2$/day)** | NA |
| 11 | **GROUND WATER QUALITY** | Fresh and potable |
| | **Presence of Chemical constituents more than the permissible limit (e.g.EC, F, As, F)** | Iron |

| | | |
|---|---|---|
| | **Type of Water** | Ca-Na-$HCO_3$ |
| **12** | **DYNAMIC GROUND WATER RESOURCES (2009) IN ha.m** | |
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| | **Net Annual Ground Water Draft** | 28238 |
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| | **Stage of Ground Water Development** | 54.6% |
| **13** | **AWARENESS AND TRAINING ACTIVITY** | |
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| | **Place** | Nil |
| | **No. of Participants** | Nil |
| **14** | **EFFORTS OF ARTIFICIAL RECHARGE AND RAINWATER HARVESTING** | Nil |
| | **Projects Completed By CGWB (No. Amount Spent)** | Nil |
| | **Projects Under Technical Guidance of CGWB (Numbers)** | 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 such groundwater issue in district other than patches of elevated iron contamination |

**Note: Latest available data may be incorporated**

*Source: Department of Agriculture and Cooperation, Govt. of India.

# 1.0 INTRODUCTION

## 1.1 Location, Area and Administrative Details

Madhepura district is one of the thirty-eight districts of Bihar state. Madhepura town is the administrative headquarters of this district. The district is a part of Kosi division. Being carved out of Saharsa district, Madhepura got the status of revenue district on 9 May 1981. Facing the onslaughts of the Kosi river, the history of Madhepura is replete with tales of owes, sorrow and sufferings. Since time immemorial, it has seen several ups and downs perpetuated by Kosi in the form of flood, famine and drought. Flood and drought has remained the regular feature of the area so much so that the then Government had to shift the Court & the Sub-divisional headquarters from Madhepura to Supaul from 1935 to 1938.

Madhepura district occupies an area of 1,788 $km^2$. Madhepura district is surrounded by Araria and Supaul district in the north, Khagaria and Bhagalpur district in the south, Purnia district in the east and Saharsa district in the West. It is situated in the Plains of Kosi River and located in the North-eastern part of Bihar at longitude between 25°. 34 to 26°.07' and latitude between 86° .19' to 87°.07'. The district has 2 sub-divisions - Madhepura and Uda Kishanganj, 13 blocks, 13 police stations, 170 panchayats and 434 revenue villages (Table 1, Fig 1).

***Table 1:*** *Administrative details of Madhepura district.*

| Sl | Sub Division | Blocks / Circles | Panchayat | Village |
|---|---|---|---|---|
| 1 | Madhepura | Madhepura | 17 | 49 |
| 2 | | Singheswar | 13 | 27 |
| 3 | | Murliganj | 17 | 45 |
| 4 | | Gamhariya | 8 | 12 |
| 5 | | Ghelardh | 9 | 16 |
| 6 | | Kumarkhand | 21 | 71 |
| 7 | | Shankarpur | 9 | 9 |
| 8 | Uda Kishunganj | Chousa | 13 | 43 |
| 9 | | Purani | 9 | 31 |
| 10 | | Gwalpara | 12 | 51 |
| 11 | | Bihariganj | 12 | 22 |
| 12 | | Udakishunganj | 16 | 44 |
| 13 | | Alamnagar | 14 | 29 |
| | | | **170** | **449** |

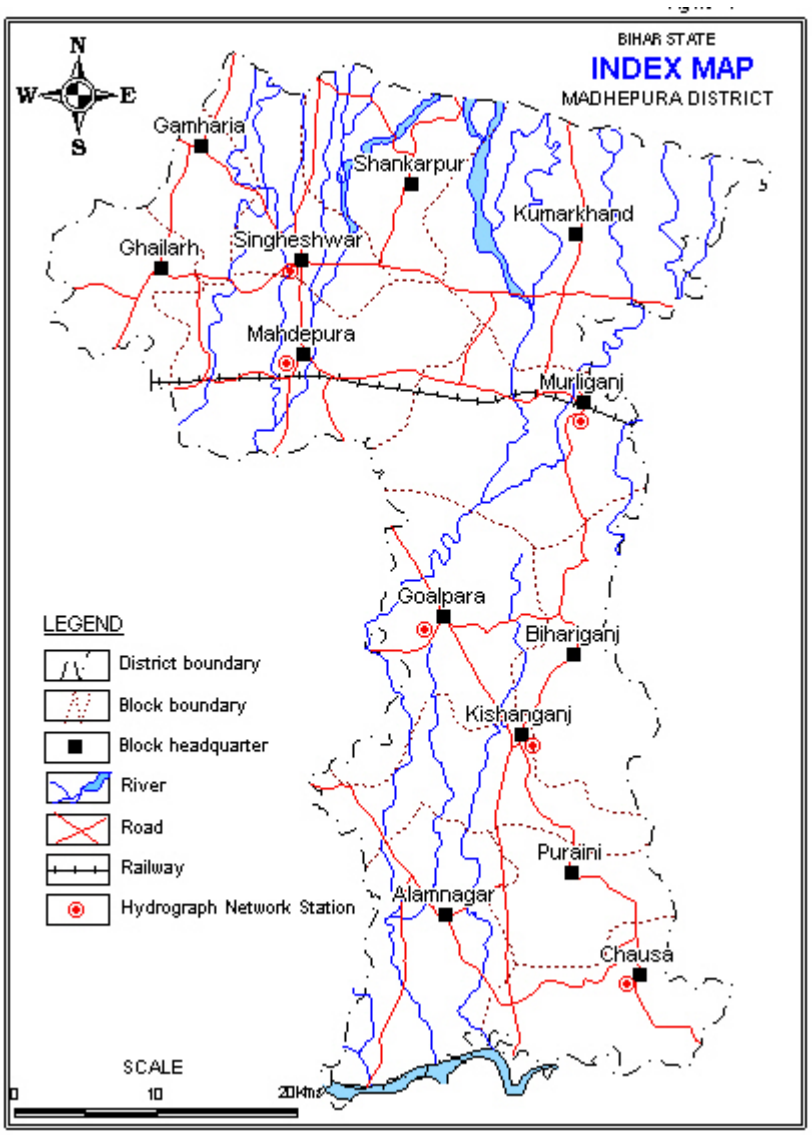


***Figure 1:*** *Index map of Madhepura district showing the administrative details.*

In 2011, Madhepura had population of 2,001,762 (Census 2011) of which male and female were 1,047,559 and 954,203 respectively (Table 2). There was change of 31.12 percent in the population compared to population as per 2001. The initial provisional data released by census India 2011, shows that density of Madhepura district for 2011 is 1,120 people per sq. km. Average literacy rate of Madhepura in 2011 were 52.25 compared to 36.07 of 2001. If things are looked out at gender wise, male and female literacy were 61.77 and 41.74 respectively. With regards to Sex Ratio in Madhepura, it stood at 911 per 1000 male compared to 2001 census figure of 915. The average national sex ratio in India is 940 as per latest reports of Census 2011 Directorate. In 2011

census, child sex ratio is 930 girls per 1000 boys compared to figure of 927 girls per 1000 boys of 2001 census data.

***Table 2:*** *Demographic details of Madhepura district.*

| Description | 2011 | 2001 |
|---|---|---|
| **Actual Population** | **2,001,762** | **1,526,646** |
| **Male** | 1,047,559 | 797,180 |
| **Female** | 954,203 | 729,466 |
| **Population Growth** | **31.12%** | **29.45%** |
| **Area Sq. Km** | 1,788 | 1,788 |
| **Density/km2** | **1,120** | **854** |
| **Proportion to Bihar Population** | 1.92% | 1.84% |
| **Sex Ratio (Per 1000)** | **911** | **915** |
| **Average Literacy** | **52.25** | **36.07** |
| **Male Literacy** | 61.77 | 48.80 |
| **Female Literacy** | 41.74 | 22.11 |
| **Literates** | **834,577** | **431,480** |
| **Male Literates** | 517,666 | 305,330 |
| **Female Literates** | 316,911 | 126,150 |
| **Child Proportion (0-6 Age)** | **20.21%** | **21.64%** |

Out of the total Madhepura population for 2011 census, 4.42% lives in urban regions (Fig 2) of district. In total 88,461 people lives in urban areas, whereas, 95.58 % population, i.e. 1,913,301, of the districts lives in rural areas of villages. Agriculture is the main livelihood of most of the population dependant on the vagaries of monsoon and a good network of canal system within Rajpur canal of Eastern Kosi Command area.

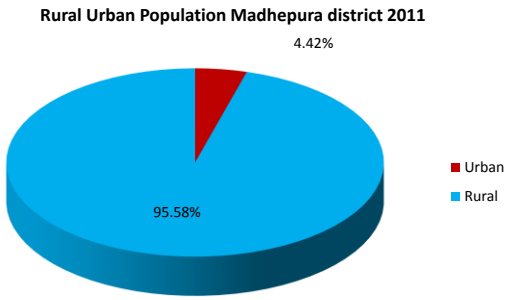


***Figure 2:*** *Pie diagram depicting the urban rural population in Madhepura district.*

## 1.2 Basin/Sub-Basin and Drainage

The Madhepura district is located at the north-eastern parts of Bihar state, which is situated in the middle parts of Ganga Basin. The district falls in the Kosi Sub-basin. Originating at an altitude of ~7000 m amsl in the Tibet Himalayas, the Kosi River form an important northern tributary of the Ganga. The Kosi is the third largest Himalayan River, after the Indus and the Brahmputra. The river has remained dynamic from historic parts and as such few palaeochannels of the river are traced in the district. Mis-fit channels (locally known as *Dhars)*, mosly occupying the palaeochannels of Kosi, flow across the district in anorth-south fashion. The rivers possess significant drainage during monsoon. The Kosi River has formed a megafan of ~13,000 km2 in Bihar state. The Madhepura district is situated at the south-eastern parts of the megafan (Fig. 3).

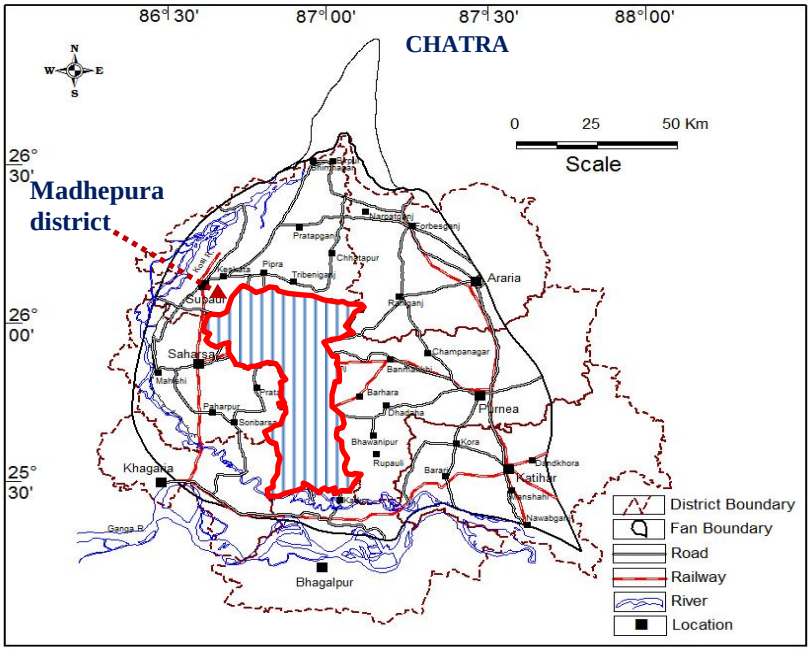


***Figure 3:*** *Map of Kosi megafan and the location of Madhepura district in it.*

The district is regularly visited by the flood water of Kosi. The flood of the year 2008 owing to breach of eastern embankment at Kusaha, was devastating in nature. This created havoc with large-scale inundation and devastation in Supaul, Saharsa and Madhepura districts, causing huge property and life loss along with the loss in agriculture.

### 1.3 Water use habits

Madhepura district has abundant surface and groundwater resources. The groundwater level remains usually shallow (Fig 4). Hand boring with one length of pipe is suffice to give adequate discharge to a 5 HP diesel pump set. The people of the district depend on groundwater for their domestic and to a great extent for the irrigation need. Earlier, dug wells were usually used as the main groundwater abstraction structure. However, now-a-days, shallow tube wells (STW) with the hand pumps fitted in are the popular groundwater abstraction structure in the region.

### 1.4 Land use, Agriculture and Irrigation Practices

There are four cropping seasons prevalent in the study area namely, 1) *Garma (March-June),* 2) *Bhadai (April/May – August/Sept.),* 3) *Aghani (June- November),* and 4) *Rabi December-March).* Bhadai and Aghani seasons are clubbed for all practical purposes as Kharif season. The staple cereal of this district is rice. The principal crops grown during different seasons are produced in the following table:

The net area put to agriculture stands at 1020 $km^2$, whereas, the gross area cultivated goes up to 1455 $km^2$ (2008-09). There is 18 $km^2$ famished land which can be used for cultivation. Barren land constitutes ~49 $km^2$ of the district. As on 1999-2000, the area under rice cultivation was at 770 $km^2$, wheat was grown in 380 $km^2$ of land, whereas, maize was in 330 $km^2$ of the area of district (Bihar through Figures, Directorate of Statistics and Evaluation, Bihar). Sugarcane was grown in 30 $km^2$ of land.

The net irrigation facilities were created for 990 $km^2$, whereas, the gross irrigated area was at 1390 $km^2$ (1998-99). During 2008-09, the status was at 790 and 1030 respectively (Directorate of Economics and Statistics, Bihar). The canal system of East Kosi Command Area facilitates irrigation in the district. As per data, during 2008-09, the gross area irrigated by the canal system was 220 $km^2$ and that by tube wells it was at 1030 $km^2$.

Ground water is exploited for irrigation mainly through shallow tube-wells and bamboo borings. Since water level remains shallow and cost of making a shallow tube well is low, people try to have their own bore well in their agriculture fields. In general, a local design of well assembly is lowered in the boreholes. Bamboo borings are of shallow depth and are extensively used for irrigation mainly due to low cost of the structures. Most of the tube wells are within a depth of 5-15 m with their tops directly fitted with 3-5 HP diesel operated pumps.

***Table 3:*** *Classification of land area in Madhepura district (district website).*

| Name of Block | Area ($Km^2$) | Cultivable area ($km^2$) | Irrigated area ($km^2$) |
|---|---|---|---|
| Madhepura | 185 | 138 | 117 |
| Singheswar | 126 | 92 | 53 |
| Murliganj | 197 | 175 | 134 |
| Gamharia | - | 43 | 32 |
| Ghailard | 96 | 67 | 38 |
| Kumarkhand | - | 241 | - |
| Sankarpur | - | - | - |
| Chausa | 137 | 106 | - |
| Puraini | 89 | 83 | 65 |
| Gwalpara | 117 | 101 | 101 |
| Alamnagar | 177 | 118 | 24 |
| | | *Source: District website, Madhepura.* | |

### 1.5 Studies/Activities carried by CGWB

Exploration activity in the district is yet to be taken up by CGWB. However, water samples are being collected from hand pumps (shallow tube wells) and dug wells at regular intervals in order to assess the development of arsenic in a response to the water table fluctuation. Water levels from some particular dug wells, known as Hydrograph Network Stations, are being taken four times in a year. These data reflect any change in ground water regime in the dug wells in a response to the monsoonal pattern (shallow aquifer) and are used to estimate the ground water resource available in the district for irrigation, drinking and industrial purposes.

## 2.0 CLIMATE AND RAINFALL

The climatic condition of the area is generally humid and tropical. There are five groups of the climate condition on an average which prevail as winter (December to February), spring (February to April), summer (April to June), monsoon (June to September) and autumn (September to December). The maximum temperature of this district ranges from 35 to 40 degree Celsius and the minimum temperature varies from 7 to 9 degree Celsius. The month of April generally experiences hot wave due to dry wind. The month of May experiences wind from east with fall of temperature gradually and thereafter the SW monsoon wave starts. The month of January is having minimum temperature of $4^0$C and experiences cold wave due to NE monsoon due to western disturbances.

The normal rainfall is 1231 mm. The rainfall during the SW monsoon i.e. months commencing from June to September, usually amounts to 80.85% of the total rainfall. The month of

July usually is the month of maximum rainfall (Fig 4) which is about 32.6% of total rainfall in the area the months of November and December are generally having scanty to free rain period. The district has also rainfall during winter due to north-eastern monsoon.

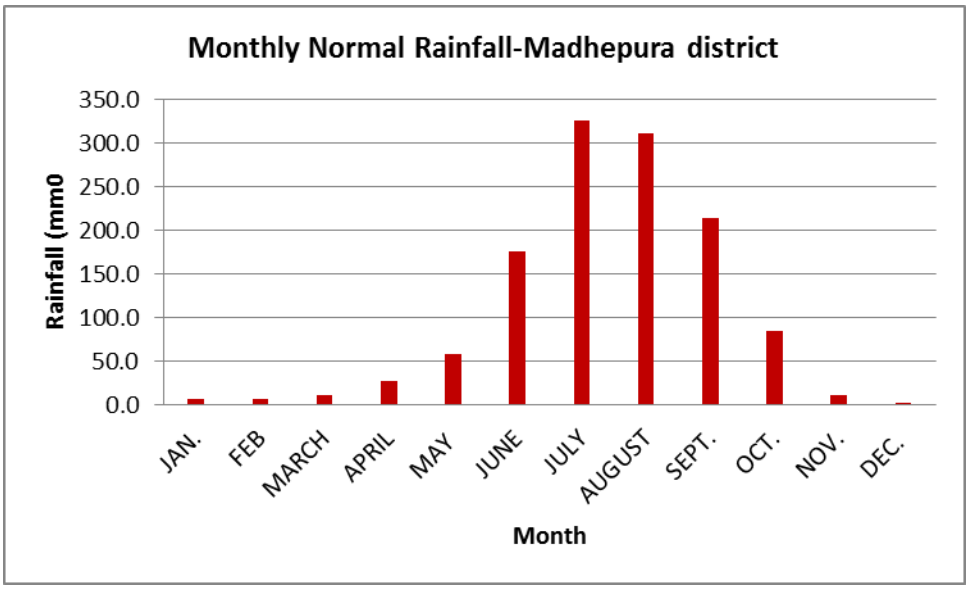


***Figure 4:*** *Monthly normal rainfall distribution in the Madhepura district.*

## 3.0 GEOMORPHOLOGY AND SOIL

### 3.1 Geomorphology

The district is forming a small segment of North Ganga Plain in Bihar within Kosi sub-basin. It has a general gentle slope from north to south along which the Kosi submits its course together with its tributaries. The land elevation of the district varies within 54m and 35 m amsl, with the average slope at ~1:4210.

Geomorphologically, the district is a part of the Kosi megafan. A number of old channel beds of Kosy are traceable in Madhepura district. The river Kosi is one of the tributaries of Ganga in the north Bihar having its own several tributaries in the fan deposits whose apical part lies in the kingdom of Nepal near Chatra. The shifting of Kosi River has taken place since pre-historic times due to the heavy sedimentational deposits brought by the river from upland of Himalaya. Number of small channels occupies the abandoned channels of Kosi. Those includes Tillash, Chillouni etc known as *Dhars*. The flow of tributaries is tectonically controlled in the N-S direction. The paleaochannels i.e. Kosi *Dhars* are ephemeral drainage channels during the monsoon exhibiting

characteristically meandering pattern. These channels are conspicuous characterized by a network of shallow interlaced stream in the flat terrain.

The Kosi river carries enormous heavy load of silt and sand during flood of monsoon, ultimately which are left over on the plain area after recession of flood. These cause shifting of the channels of Kosi *Dhars* and in the low lying areas of *Chaurs* forming the pools of stagnant water and low marshy lands causing thereby the area under water logging. Though the major river Kosi has made the regional architecture of the district, numerous interconnected minor rivers participate in carving out features of the plains by reworking and redistributing the sediments deposited by the river Kosi. These small streams (basically groundwater fed) with clayey beds mostly follow the old channels and traverse the district Madhepura in a north-south fashion.

## 3.2 Soil

The soil of the area constitutes part of large inland deltaic deposits of huge granular silt-sand grade, transported by river Kosi. The estimated probable load of silty-sand with clay is about 25 MCM/year. The soil of the area is Younger Alluvium deposited by Kosi River. The area, generally inundated by flood of Kosi, possesses the soil of sandy loam to sandy deposits. Elsewhere, the soil is of heavier texture. The soils association types-Recent alluvium, non-calcareous, non-saline is overlying the entire area, mostly high to medium textured, acidic to neutral and generally yellowish to white to light grey in colour.

## 4.0 GROUND WATER SCENARIO

### 4.1 Water Bearing Formations

The area comprises of one of most prolific aquifer system in the Gangetic alluvium of north Bihar. The Quaternary-Recent unconsolidated sediments (Fig 5) consisting of sand, gravels, pebbles constitutes the potential aquifer and having huge dynamic ground water ground water resources extending down to hundreds of meter below the subsurface (Fig 6). At places a thin veneer of clay with 3–6 m thick is seen overlying the granular zones. The area may be treated as single aquifer system down to 100 m bgl depth.

The shallow aquifer with depth of 50 m bgl is reported to yield about 150 $m^3$/hr with meagre drawdown of less than 2.0 m, inferring thereby the presence of highly potential aquifer. The water table contour drawn with the key wells data of water level during the Conjunctive Use Study in the area indicates that the hydraulic gradient varies from 0.8 to 0.25 m/km. The overall gradient is from north to south.

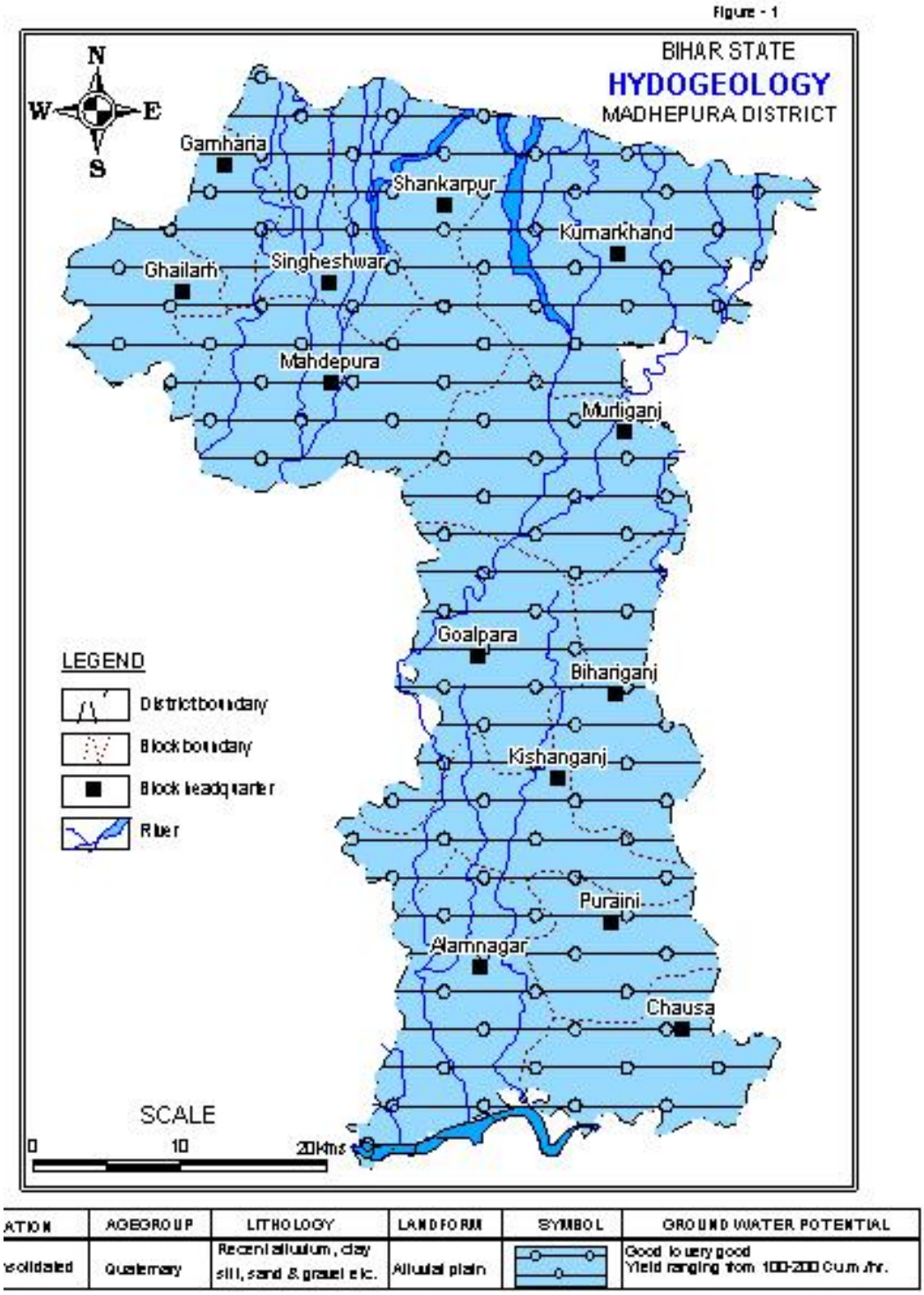


***Figure 5:*** *Hydrogeological map of Madhepura district, Bihar.*

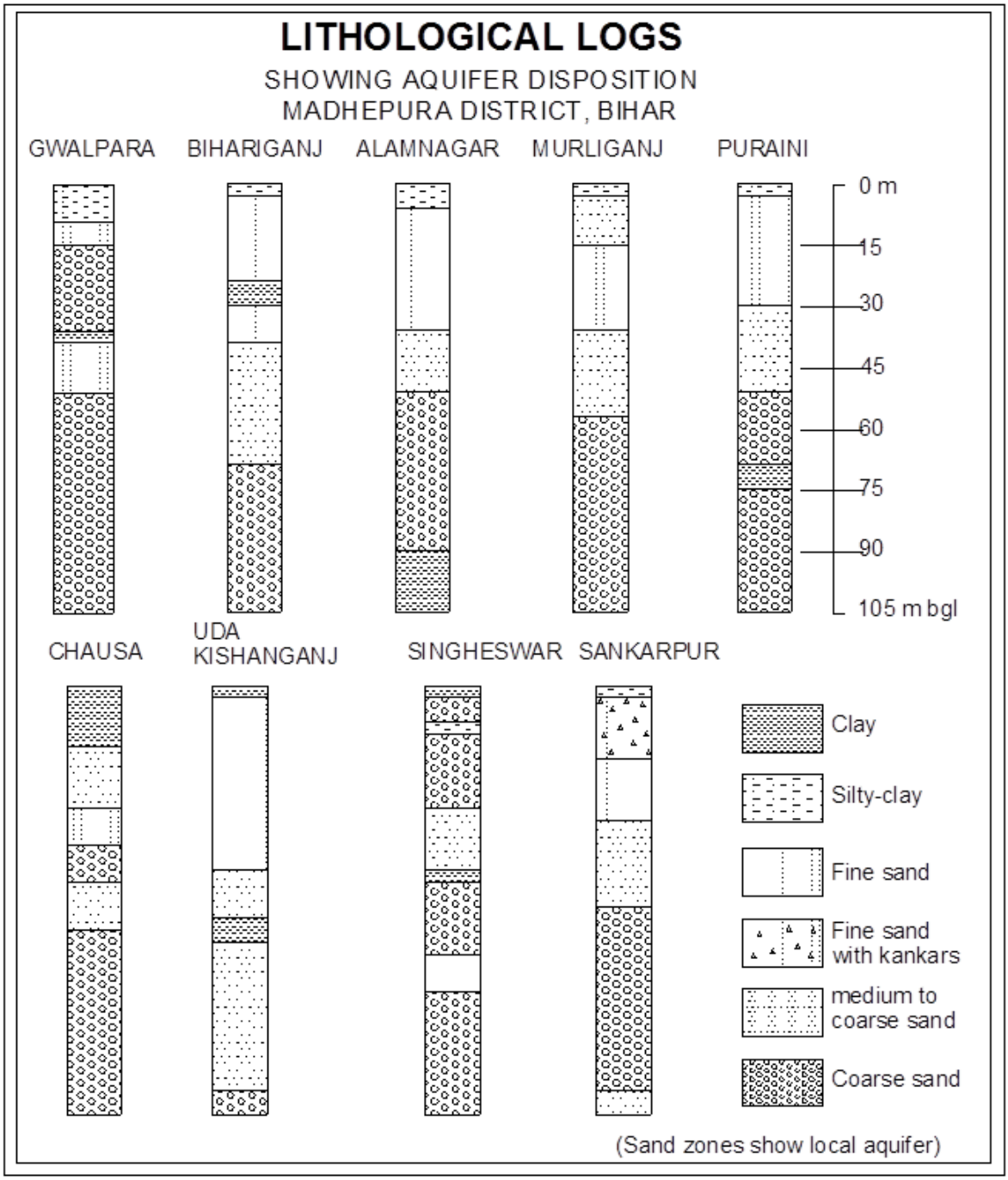


***Figure 6:*** *Lithological logs of bore holes in Madhepura district depicting the potential sand zones down to 100 m depth.*

**4.2 Depth to Water Level**

The study has been conducted in the area with an aim to use conjunctively ground water and the surface water with several key wells established to monitor the spatial and temporal behaviour of ground water. It has been shown that the water level during the pre-monsoon in the command area is well within 3.0 m bgl though deeper water levels i.e. 4–5 m bgl have also been recorded at isolated patches (Fig 7). The water level during post-monsoon varies within 2.0-5.0 m bgl (Fig 8). The long term water level trend in the area with the data collected from the HNS since 1974 has shown a general rise in the water levels (Table 4), especially within the command area. The data of water levels are given below:

***Table 4:*** *Long term water level trend in Madhepura district.*

| Station | Period | Rise (m/year) | Annual rise (m/year) |
|---|---|---|---|
| **Madhepura** | 1988-99 | 0.56 | 0.046 |
| **Singheshwar** | 1988-99 | 0.01 | 0.067 |

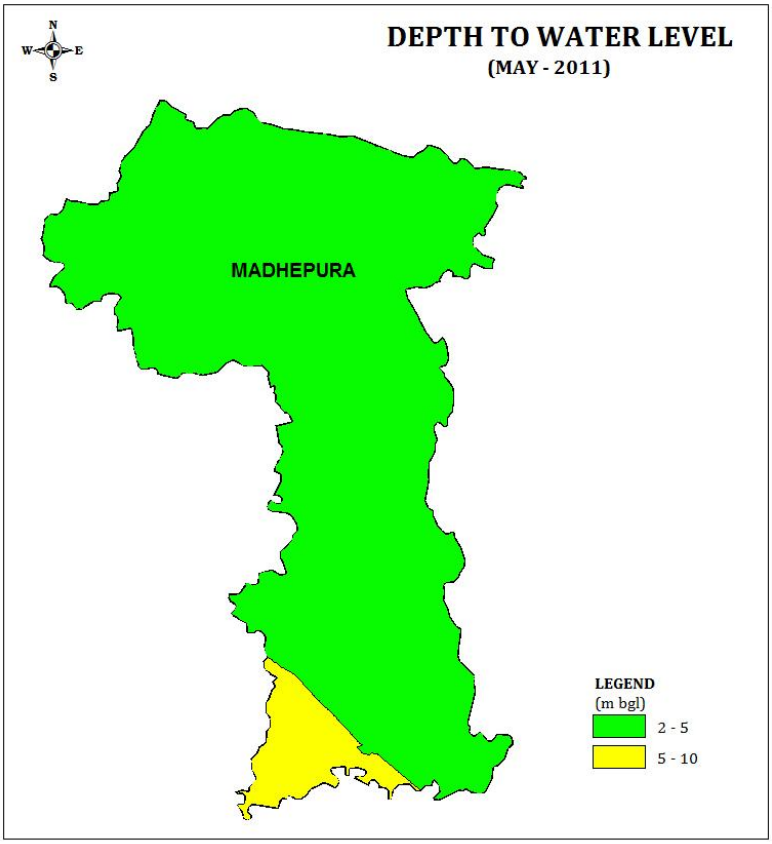


***Figure 7:*** *Pre-monsoon depth to water level for Madhepura district of Bihar (Year 2011).*

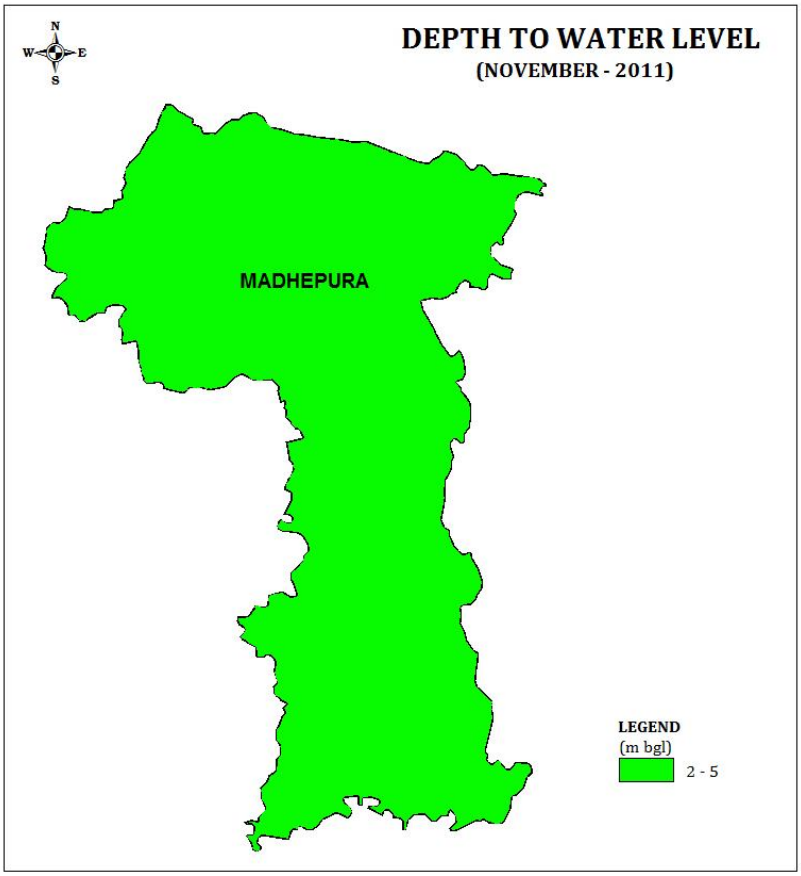


***Figure 8:*** *Post-monsoon depth to water level map for Madhepura district (year 2011).*

### 4.3 Ground Water Quality

The chemical quality of the water samples collected from the national hydrograph stations and other stations during the Conjunctive Use Study by CGWB mostly from the shallow/water table aquifers infer the details of chemical variants as follows (Table 5):

***Table 5:*** *General groundwater quality in Madhepura district.*

| Sl No. | Constituent | Range |
|---|---|---|
| 1 | pH (hydrogen ion concentration) | 7.1 to 7.4 – almost neutral in taste. |
| 2 | EC (electrical conductivity) in micromho/cm at $25^0$C | 211 to 435 – potable and soft (excellent to good quality) |
| 3 | Total hardness ($CaCO_3$) | 70 to 175 ppm – well within norms of drinking use |
| 4 | Chloride | 11 to 128 ppm – potable |
| 5 | Calcium | 20 to 25 ppm – very suitable and safe for all uses |

| | | |
|---|---|---|
| **6** | Magnesium | 4.9 to 28 ppm – very suitable and safe for all uses |
| **7.** | Carbonate | 73 to 232 – very suitable and safe for all uses |

### 4.4 Ground Water Resources

The net annual replenishable ground water resource as on 31st March 2009 works out to be 51703 ha.m. The gross annual draft for all uses works out to be 28238 ha.m. Allocation of ground water for domestic and industrial use for 25 years works out to be 4801 ha.m. The stage of ground water development is 54.6%. The stage of ground water development is highest in Uda Kishangang (67.8%) and lowest in Murligang (34%). As stages of ground water development in all the blocks are less than 70%, and there is no long-term decline in water levels, all the blocks are under safe category. The stage of ground water development is depicted in Fig. 9. The block-wise ground water resource is given in Table 6.

***Table 6:*** *Block wise Dynamic Ground Water Resource of Madhepura District (2008-09)*

| 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 | Alam nagar | 4336.1 | 1960 | 236 | 2196 | 405 | 1971 | 50.6 |
| 2 | Biharigang | 2720.7 | 1348 | 185 | 1533 | 318 | 1055 | 56.3 |
| 3 | Chausa | 3987.8 | 2358 | 212 | 2570 | 365 | 1265 | 64.5 |
| 4 | Ghailarh | 2333.5 | 1079 | 133 | 1213 | 229 | 1025 | 52 |
| 5 | Gamharia | 2036.8 | 1182 | 119 | 1301 | 204 | 651 | 63.9 |
| 6 | Gwalpara | 3108.2 | 1812 | 174 | 1986 | 298 | 998 | 63.9 |
| 7 | Kumarkhand | 6683.6 | 4157 | 342 | 4499 | 588 | 1939 | 67.3 |
| 8 | Madhepura | 4660.4 | 1700 | 512 | 2212 | 555 | 2406 | 47.5 |
| 9 | Murligang | 9839.8 | 2967 | 380 | 3347 | 589 | 6284 | 34 |
| 10 | Puraini | 2269.4 | 1203 | 142 | 1345 | 244 | 823 | 59.3 |
| 11 | Sankarpur | 2793.3 | 1378 | 151 | 1529 | 258 | 1157 | 54.7 |
| 12 | Singheswar | 2921.8 | 1601 | 186 | 1788 | 320 | 1001 | 61.2 |
| 13 | Uda Kishangang | 4011.8 | 2470 | 250 | 2720 | 429 | 1113 | 67.8 |
| | **Total** | **51703** | **25216** | **3022** | **28238** | **4801** | **21687** | **54.6** |

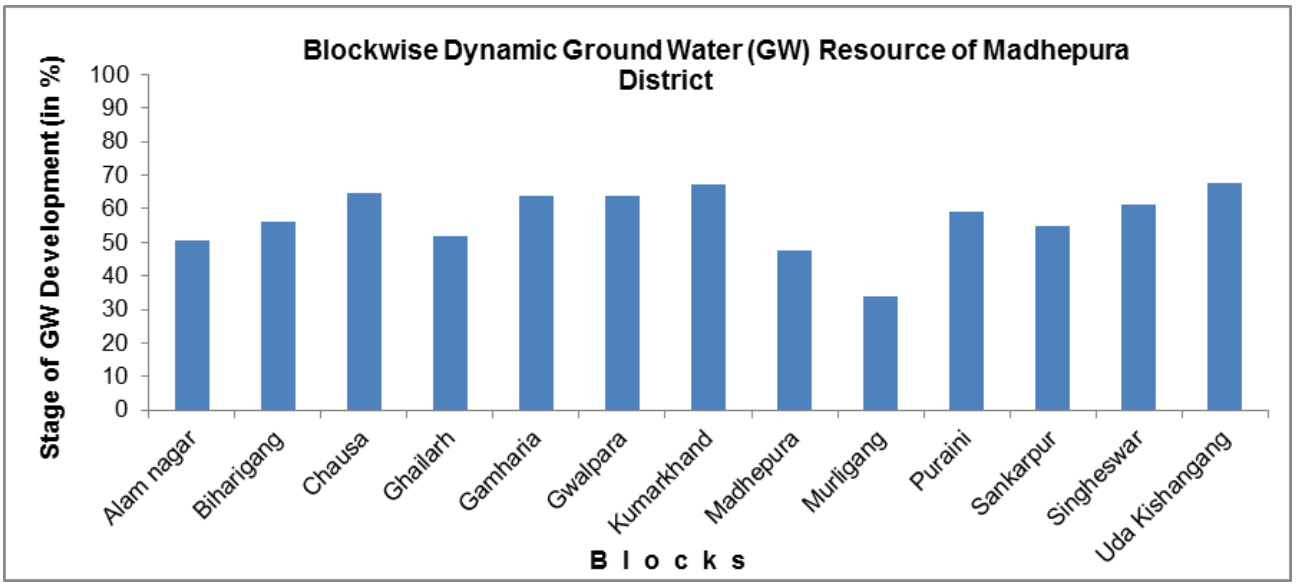


***Figure 9**: Block-wise groundwater resources and stage of groundwater development in Madhepura district, Bihar.*

## 5.0 GROUND WATER MANAGEMENT STRATEGY

### 5.1 Ground Water Development

As per the resource evaluation (31$^{st}$ march 2009) the average utilisation of ground water in the district is less than 54.6%, which means none of the blocks in the district comes under semi-critical/critical or over exploited category. The present infrastructural facilities yield only 25216 ham of groundwater for irrigation and there is a vast surplus replenishable ground water potential of 21687 ham to be tapped.

### 5.2 Design and construction of Tube Wells

#### 5.2.1 Construction and yield of wells

As per MI census 2000-2001, a total of 19248 shallow tube wells (STW) (~11 tube wells per km$^2$) and 11 deep tube wells (DTW) were in use in Madhepura district. Most of the STWs in the district are constructed within the depth range of 5-15 m. The STWs with large diameter (306 mm) can yield more than 75 m$^3$/hr. The granular zones tapped trough deep tube wells within the depth of 100 m can yield up to 200 m$^3$/hr

***5.2.1.1 Design of Tube Wells***

***(a) Sallow Tube Wells***

The district is blessed with potential mono-aquifer down to the explored depth of 100 m. The STWs in the depth range of 30–50 m bgl can yield up to 50 to 75 $m^3$/hr. A well assembly of about 76 to 102 mm diameter with about 10 to 20 m slotted pipe can be used for construction of such wells.

***(b) Deep Tube Wells***

***Table 7:*** *Proposed Model of DTWs in Madhepura district*

| Sl.No. | Discharge ($m^3$/hr) | Proposed Depth of well (m bgl) | Proposed Diameter of well (mm) | Assembly Length (m) |
|---|---|---|---|---|
| 1 | 100 | 100 | 306 – casing pipe<br>153 – slotted pipe<br>153 – blank pipe | 25<br>24<br>51 |

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

***Table 8:*** *Proposed slot openings for tube wells in Madhepura district.*

| | |
|---|---|
| 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” |

Both the shallow as well deep tube wells should be artificially packed with gravels of size ranging within 2–4 mm and a bail plug of 2–5 m should be provided in order to the yield and life of the well.

**5.3 Water Conservation and Artificial Recharge:**

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

**6.0 GROUND WATER RELATED ISSUES AND RELATED PROBLEMS**:

No such issues and problems have been reported from Madhepura district other than pockets of groundwater iron contamination.

**7.0 MASS AWARENESS AND TRAINING PROGRAMME:**

Mass awareness programme is yet to be carried out in Madhepura district.

**8.0 AREA NOTIFIED BY CENTRAL GROUND WATER AUTHORITY/ STATE GROUND WATER AUTHORITY**

Since all blocks of the district come under safe category from groundwater development point of view, no area is notified either by Central Ground Water Authority or State Ground Water Authority till date.

## 9.0 RECOMMENDATION

- There exists further scope for development of groundwater for irrigation purposes without disturbing the groundwater regime in the district. Tube wells should be installed keeping the safe operating distance of 200 m.
- To combat the water-logging problem, the status of irrigation from groundwater needs to be increased.
- Energisation of all the tube wells should be made for increasing the cropping intensity.
- Chemical quality of groundwater has been observed to be in general suitable for drinking and irrigation purpose. In areas where high iron concentration is present, domestic water supply should be made after proper treatment of groundwater. Alternate deeper aquifers, free from iron may also be found for the purpose.