

GROUND WATER INFORMATION BOOKLET
MALDA DISTRICT, WEST BENGAL
DISTRICT AT A GLANCE (MALDA)

Sl. No.	Items	Statistics
1.	GENERAL INFORMATION	
	i) Geographical Area (Sq. km.)	3733
	ii) Administrative Division (as on 2001)	
	• No. of Subdivision	2 nos.
	• No. of Blocks	15 nos.
	• No. of Municipalities	2 nos.
	• No. of inhabited villages	1798 nos.
	iii) Population (as on 2001 Census) (with density of population)	3290468 (881 per sq.km.)
	iv) Normal Annual Rainfall (mm)	1919
2.	GEO MORPHOLOGY	
	Major Physiographic Units	1. Barind 2. Diara or younger alluvial & older alluvium 3. Tal or swampy areas
	Major Drainages	River Ganga/ Padma, Mahananda, Kalindi, Tangan
3.	LAND USE (Sq.km.) (as on 2004-05)	
	a) Forest Area	16.8
	b) Net Area Sown	2275.9
4.	MAJOR SOIL TYPES	Red soil, lateritic soil, older and younger alluvial soils.
5.	AREA UNDER PRINCIPAL CROPS (Sq.km.) (As on 2004-05)	Total Cereals: 2840.0 Total Pulses: 298 Total Oilseeds: 393.0 Total Fibre: 243.0 Total Miscellaneous Crops: 83.0
6.	IRRIGATION BY DIFFERENT SOURCES (Areas & No. of Structures)	
	Tube wells	926.02 sq. km. area irrigated through 36765 STW and 70.29 sq. km. area irrigated through 329 DTW
	Surface Flow	6.82sq.km. area irrigated through 350 nos. of Surface flow .
	Surface Lift	145.61 sq. km. area irrigated through 4036 nos. of Surface Lift.
	Actual area irrigated by GW	1166.51 sq.km
	Actual area irrigated by SW	43.58 sq.km
	Total Irrigated Area	1210.09sq.km.
7.	NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB (As on 31.03.07)	42
	No. of Dug wells	26
	No. of Piezometers/ Tube wells	16
8.	PREDOMINANT GEOLOGICAL FORMATIONS	Recent and Older alluvium.
9.	HYDROGEOLOGY	
	➤ Major Water bearing formation	Quaternary alluvium
	➤ Pre-monsoon depth to water level during 2006	3.70 to 12.22 mbgl in Dug wells and 3.82 to 7.58 m bgl in piezometers
	➤ Post-monsoon depth to water level during 2006	1.64 to 6.16 mbgl in Dug wells and 2.67 to 7.13 m bgl in piezometers

NAME OF THE DISTRICT: Malda

1.0 INTRODUCTION

Administrative details

- Location and area : The total geographical area of the district is 3733.0 Sq. Km. It has 2 Subdivisions consisting of 15 blocks, 15 Panchayat samities.. The number of police station is 11. There are 146 Gram Panchayats with 1641 inhabited villages. English bazar is the headquarter of this district.
- Ground water basin : Ganga basin
- Drainage : The Ganga/or The Padma with tributaries/distributaries namely the Mahananda, the Tangon, the Kalindri, form the main drainage.
- Irrigation practices : The cultivation is done mainly by groundwater along with the surface water from canals, tanks and river.
- Studies of C.G.W.B : CGWB has completed systematic Hydrogeological survey and continuing Groundwater Management Studies. Apart from this, Groundwater Exploration has been carried out to delineate the aquifer geometry and to know the aquifer characteristics Special attention has been given to identify the deeper aquifers and construction of tubewells adopting cement sealing techniques.

2.0 Raingfall & Climate

- Rainfall : The normal rainfall is to the tune of 1485 mm.
- Climate : The district is characterised by hot and humid climate. It receives adequate rainfall from South-West monsoon, which sets in the later half of June and continues till the middle of October. Pre monsoon rains are received during March- April. Max. and Min. temp as recorded is 43 and 09 degree centigrade.

3.0 Geomorphology & Soil Types

- Geomorphology : The district can be divided into three (3) geographic units :
1.Barind
2.Diara or younger alluvial & older alluvium
3.Tal or swampy areas
- Soil Types : Depending upon the soil types the district is divided in two separated zones
a) Gangetic alluvial soil which is found in the western side of the Mahananda river and can be subdivided into three categories on the basis of soil texture. they are i) Gangetic riverine soil, ii) Gangetic flat land soil and iii) Gangetic low land soil.
b) Red soil which is found in the eastern side of the Mahananda river in the barind tract.

4.0 Groundwater Scenario

- 4.1 Geology : The geological setting of Malda district is a result of subsidence and concomitant deposition in the Garo-Rajmahal gap. large scale sedimentation by the Himalayan rivers took place during Pleistocene and Recent periods.

Older Alluvium of Pleistocene age occupies the eastern part of the district,i.e., the eastern part of Mahananda river. The older alluvium is characterised by argilaceous sediment (clay and calareous material).Lateritisation of the sediment is often observed at the surface clay.

The clays are very stiff and plastic in nature.

The area west of the Mahananda river is covered by Recent to sub recent alluvium having a good thickness of the Ganga river system. the Quarternary sediment have been deposited in and around wild deltaic flood plain.The recent fluviatile sediments consist of succession of clay,silt,sand and gravel.sand size varies from fine to coarse. The colour is light grey.The sand are highly micaceous.gavels are subrounded to rounded in shape.

4.2 Hydrogeology : Groundwater occurs in a thick zone of saturation in the alluvium deposited by the river system.The sand and gravel horizons of different textures constitute main aquifers and occur down to 90m bgl in the eastern part and 150mbgl in the western part of the district.

Groundwater in the eastern part of the Bhagirathi river occurs generally under water table conditions. Impervious clay layers which act as confining beds are rather absent,but wherever is present it is sandy clay or silty clay forming partially confining conditions.

Groundwater in the western part of the Bhagirathi river occurs under both unconfined and confined conditions. In the confined condition, the aquifers are sometimes separated by lenticular clay beds at depths and are regionally connected resulting in artesian conditions. Flowing artesian conditions are found in shallow tubewells and are seasonal in nature.

Depth to water level in premonsoon period (2006) varies from 1.14 to 19.90 mbgl whereas that to post monsoon it is from 0.35 to 14.02 mbgl.

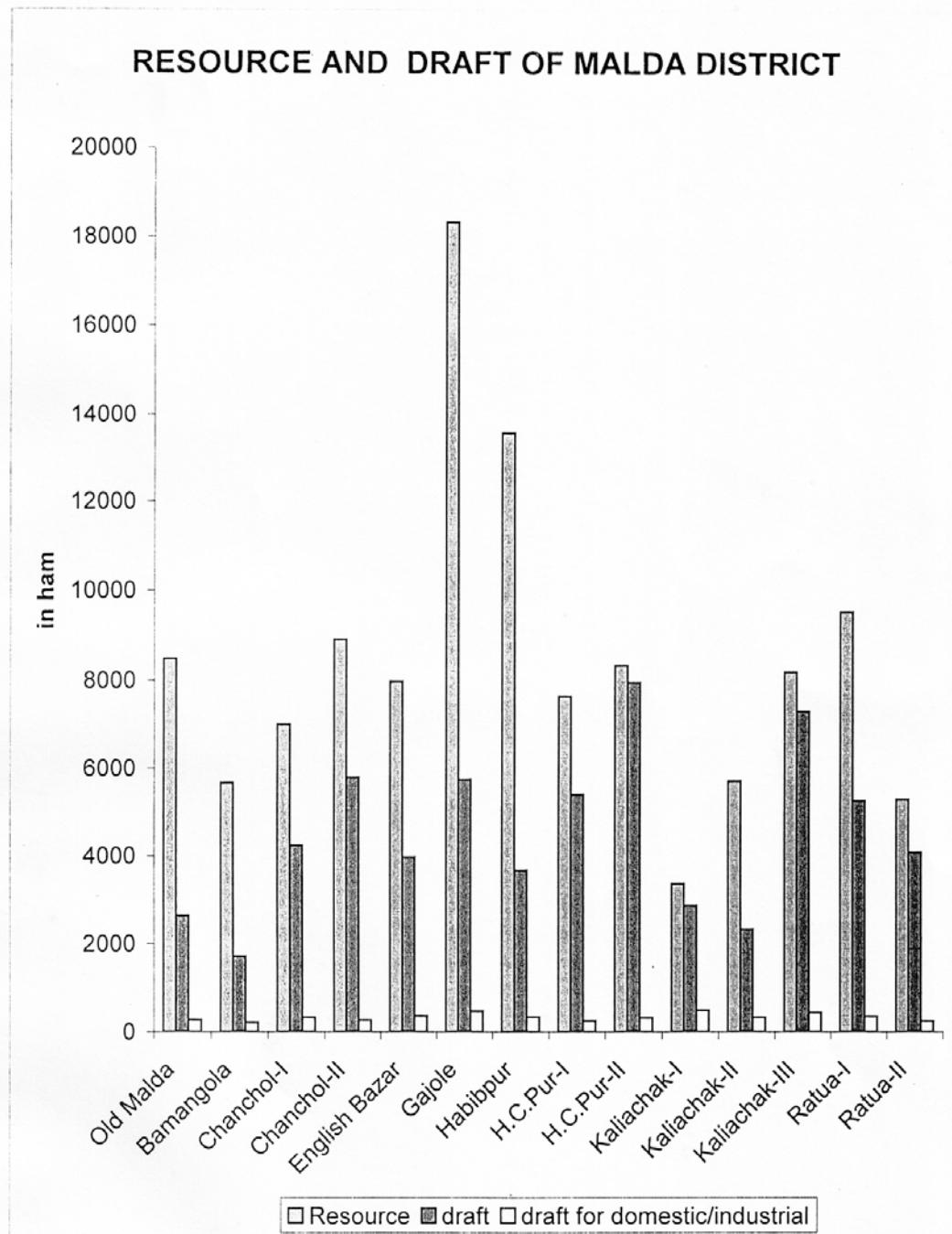
Aquifer characteristics : Tubewells in the western part of the Bhagirathi river are constructed tapping both unconfined and confined aquifers and are capable to yield 150 m /hr with nominal drawdown of 4-5m. The yield of the shallow tubewells is about 30m /hr with a drawdown less than 4m.Transmissivity values ranges from 3000-7000 m /day and the storativity ranges from 1.16×10 to 4.98×10 .

4.3 Groundwater Resources:

The dynamic ground water resources of Murshidabad district has been estimated jointly by CGWB and SWID, Govt. of West Bengal, following the norms laid down by GEC 1997 methodology and projected as on 31.03.04.

The reconciled figures are as under:

Total Ground Water Resources	:	140338 ham
Net Annual Ground Water Availability	:	127128 ham
Existing Ground Water Draft for All Uses:	:	72379 ham
For Irrigation	:	67237 ham
For domestic & industrial water supply	:	5142ham
Stage of Ground Water Development	:	56.93%
Allocation for domestic & industrial water supply requirement upto 25 yrs.	:	8278 ham
Net Ground Water Availability for future irrigation development:	51613 ham	
Categorization of blocks	:	13 nos. of blocks are categorized under 'Safe', 2 blocks are under 'Semi-critical'.



4.4 Chemical Quality:

The analysis of water samples indicate that the value of sodium adsorption ratio in general ranges from 0.23 to 4.53 falling in the category of C_2S_1 to C_3S_1 class indicating low sodium and low salinity hazard. The specific conductance is by and large within 1000 micro siemens/cm at $25^\circ C$ and therefore ground water can be grouped as excellent to good for irrigation sector. Ground water in the district is in general of calcium bicarbonate type.

In drinking water supply schemes high iron and arsenic content in some blocks poses a serious threat. Ground water in 7 blocks namely Rauta-I & II, Manikchak, English bazaar, Kaliachak- I, II & III is affected by sporadic occurrence of arsenic greater than permissible limit(0.01 mg/l) in ground water.

In Rauta-II block of Malda district tubewells within 50-70 m depth tapping recent alluvium aquifer have shown sporadic occurrence of high fluoride in ground water.

District Block sample tested $F < 1.0$, $1.0 < F < 1.5$ Max. (mg/l) Remarks

Malda	Rauta-II	155	2.59
	Bamangola	96	2.54

(Source: Report on rapid assessment of fluoride contamination in ground water.) Below is given a Table showing analytical results (2006) of water samples of Malda district

Chemical constituents	Pre-monsoon
pH	Range 7.8-8.2
EC in Micro mhos/cm at $25^\circ C$	283-1270
Total Hardness	50-410 (mg/l)
NO_3	0.2-9.3 (mg/l)
F	0.03-0.65(mg/l)
Cl	11-294 (mg/l)
SO_4	BDL-39.0 (mg/l)
HCO_3	134-458 (mg/l)
Ca	14-66 (mg/l)
Mg	14.62-87.57(mg/l)
Na	5-205 (mg/l)
K	0.6-60.0 (mg/l)
Fe	.02-9.0 (mg/l)

ARSENIC CONTAMINATION IN GROUND WATER IN ARSENIC AFFECTED BLOCKS, MALDA DISTRICT

BLOCK	Range of Arsenic (1997) (mg/l)	Range of arsenic (2005) (mg/l)
English bazaar	0.05 – 0.128	0.01—0.25
Manikchak	0.01—0.68	0.01-0.67
Kaliachak-I	0.02—0.568	0.01—0.81
Kaliachak-II	0.02—1.434	0.055—0.54
Kaliachak-III	0.03—1.43	0.011-0.998
Rauta-I		0.007—0.312
Rauta-II		0.01—0.22

4.5 Status of Ground water Development (Block wise):

Status of Ground water Development (Blockwise):

Block	Occurrence of Aquifers & its potentiality (as per data available with CGWB)	Feasibility of GW Abstraction Structures	Ground Water Resource Available, Irrigational draft Stage of GW development(SOD) & existing Structures (as on March'04)	Remarks
1.Bamangola	Main aquifer system occurs in general in the depth range of 74 -140 m bgl. Yield prospect up to 50 m ³ / hr.	Low duty (10-50 m ³ /hr) . Low duty tube wells are generally feasible.	Net GW Availability is 5676 ham Irrigation has been done through 1057 nos of STW (as per Census 2001) & the irrigation draft has been projected up to 2004 as 1725 ham. SOD is 34.28%	Safe category
2. Gajol	Multiple aquifer system occurs in general in the depth range of 43-56, 76-105 and 145-178 m bgl. Yield prospect more than150 m ³ / hr.	Heavy duty (100 - >150 m ³ /hr) tube wells are generally feasible.	Net GW Availability is 18328 ham Irrigation has been done through 3157 nos of STW & 27no of DTW (as per Census 2001) & the irrigation draft has been projected up to 2004 as 5756 ham. SOD is 34.01%	Safe category
3. Habibpur	Two aquifer system in the depth range of 48-73 and 94-110 m bgl. Discharge is about 45 m ³ / hr.	Low duty (30-40 m ³ /hr), and Heavy duty (100 - 150 m ³ /hr) tube wells are generally feasible	Net GW Availability is 13583ham Irrigation has been done through 2244 nos of STW & 1nos of DTW (as per Census 2001) & the irrigation draft has been projected up to 2004 as 3685ham. SOD is 29.67%	Safe category
4. Old Malda	Aquifers are generally found in the depth range of 30-44 and 61-99 m bgl. Yield prospect more than150 m ³ / hr. T= 2969 m ² /d	Low duty (30-40 m ³ /hr), and Heavy duty (100 - 150 m ³ /hr) tube wells are generally feasible	Net GW Availability is 8491ham Irrigation has been done through 1196 nos of STW, 40 nos of DTW (as per Census 2001) & the irrigation draft has been projected upto 2004 as 2846 ham. SOD is 36.73%	Safe category
5. Chanchol-I	Three aquifer systems i.e. 34-39, 59-71 and 104-120 are present. Cumulative Yield prospect more than150 m ³ / hr.	Low duty (30-40 m ³ /hr), and Heavy duty (100 - 150 m ³ /hr) tube wells are generally feasible.	Net GW Availability is 7009 ham Irrigation has been done through 2313 nos of STW, 21nos of DTW has been projected upto 2004 as 4244 ham. SOD is 65.33 %	Safe category
6. Chanchol-II	Mainly two aquifer systems in the depth range 28-45 and 79-102 m bgl. Yield prospect more than150 m ³ / hr.	Low duty (30-40 m ³ /hr), and Heavy duty (100 - 150 m ³ /hr) tube wells are generally feasible.	Net GW Availability is 8914 ham Irrigation has been done through 3146 nos of STW, 30 nos of DTW has been projected upto 2004 as 5805 ham.	Safe category

			SOD is 68.18%	
7.English bazar	Two aquifer systems i.e. 44-69 and 73-89. Yield prospect more than150 m ³ / hr.	Low duty (30-40 m ³ /hr), and Heavy duty (100 - 150 m ³ /hr) tube wells are generally feasible.	Net GW Availability is 7989 ham Irrigation has been done through 1752 nos of STW, 50 nos of DTW (as per Census 2001) & the irrigation draft has been projected upto 2004 as 3976ham. SOD is 54.41%	Safe category Arsenic affected in down to depth of 80mbgl. Range of Arsenic content: 0.01- 0.25 mg/l
8. Harishchandrapur-I	Three aquifers mainly 32-47, 67-79 and 84-96 m bgl. Yield prospect more than150 m ³ / hr..	Low duty (30-40 m ³ /hr), and Heavy duty (100 - 150 m ³ /hr) tube wells are generally feasible.	Net GW Availability is 7657 ham Irrigation has been done through 3122 nos of STW, 14 nos of DTW (as per Census 2001) & the irrigation draft has been projected upto 2004 as 5408ham. SOD is 74.11%	Safe category
9. Harishchandrapur-II	Aquifers are within 29-50, 7-83, 86-99 and 102-137 m bgl. Yield prospect more than150 m ³ / hr.	Low duty (30-40 m ³ /hr), and Heavy duty (100 - 150 m ³ /hr) tube wells are generally feasible.	Net GW Availability is 8336 ham Irrigation has been done through 4730nos of STW & 11no of DTW (as per Census 2001) & the irrigation draft has been projected upto 2004 as 7965ham. SOD is 99.42%	SemiCritical block, WL declining
10. Ratua-I	Aquifers are delineated within the depth range 27-31, 41-87 and 115-121 m bgl .Yield prospect more than150 m ³ / hr.	Low duty (30-40 m ³ /hr), and Heavy duty (100 - 150 m ³ /hr) tube wells are generally feasible.	Net GW Availability is 9529 ham Irrigation has been done through 2844 nos of STW, 28 nos of DTW (as per Census 2001) & the irrigation draft has been projected upto 2004 as 5269ham. SOD is 59.03%	Safe category Arsenic affected in down to depth of 80mbgl. Range of Arsenic content: 0.007- 0.312 mg/l
11. Ratua-II	Aquifers are within 61-91, 100-109 mbgl. Yield prospect more than150 m ³ / hr.	Low duty (30-40 m ³ /hr), and Heavy duty (100 - 150 m ³ /hr) tube wells are generally feasible.	Net GW Availability is 5303ham Irrigation has been done through 1936 nos of STW, 42 nos of DTW (as per Census 2001) & the irrigation draft has been projected upto 2004 as 4098 ham. SOD is 82.14%	Safe category Arsenic affected in down to depth of 80mbgl. Range of Arsenic content: 0.01-0.22mg/l
12. Kaliachak-I	Only one aquifer system in the dept range of 30-41 m bgl. Yield prospect more than150 m ³ / hr.	Low duty (30-40 m ³ /hr), and Heavy duty (100 - 150 m ³ /hr) tube wells are generally feasible.	Net GW Availability is 3381 ham Irrigation has been done through 1726 nos of STW, 8 nos of DTW (as per Census 2001) & the irrigation draft has been projected upto 2004 as 2879ham. SOD is 99.96%	Semi Critical block, Arsenic affected in down to depth of 80mbgl. Range of Arsenic content: 0.01-0.81mg/l
13. Kaliachak-II	Aquifers are found in the depth range of 18-80 m bgl. Yield prospect more than150 m ³ / hr.	Low duty (30-40 m ³ /hr), and Heavy duty (100 - 150 m ³ /hr) tube wells are generally feasible.	Net GW Availability is 5729ham Irrigation has been done through 1171 nos of STW,19 nos of DTW (as per Census 2001) & the irrigation draft has been projected upto 2004 as	Safe category Arsenic affected in down to depth of 80mbgl. Range of

			2336 ham. SOD is 46.64%	Arsenic content: 0.055- 0.54 mg/l
14. Kaliachak-III	Aquifers are found in the depth range of 17-62 and 68-78 . Discharge is about 215 m ² / hr.	Low duty (30-40 m ³ /hr), and Heavy duty (100 - 150 m ³ /hr) tube wells are generally feasible.	Net GW Availability is 8202 ham Irrigation has been done through 4136 nos of STW, 25 nos of DTW (as per Census 2001) & the irrigation draft has been projected upto 2004 as 7309ham. SOD is 94.48%	Safe category Arsenic affected in down to depth of 80mbgl. Range of Arsenic content: 0.011- 0.998 mg/l
15. Manikchak	Aquifers are within the depth range of 19-25 and 46-75 mbgl. Yield prospect more than150 m ³ / hr.	Low duty (30-40 m ³ /hr.) tube wells are generally feasible	Net GW Availability is 9001ham Irrigation has been done through 2235 nos of STW, 13 nos of DTW (as per Census 2001) & the irrigation draft has been projected up to 2004 as 3938ham. SOD is 47.8%	Safe category Arsenic affected in down to depth of 80mbgl. Range of Arsenic content: 0.01- 0.67 mg/l

5.0 Groundwater Management Strategy

5.1 Groundwater Development :

At present groundwater development in this district is mainly controlled by the shallow tubewells along with some deep tubewells which are very less in number. As per the Groundwater Estimation Committee, 1997, the total groundwater resources thus calculated is about 127128 mham. About 72379 mham is being withdrawn for different purposes which is about 56.93 %. Further development may be restricted particularly in the semi critical blocks (Kaliachakl & Harishchandrapur II).

Estimation of groundwater has been calculated based on the data of shallow tubewells only. But there are sufficient deep tubewells ~~are~~ existing in the district which are being utilised for piped water supply and irrigation also. Thus development through deep tubewells may be taken up through tubewells applying cement sealing techniques particularly in the arsenic affected blocks in the district. The design of tubewells may be followed as shown in the plate .

5.2 Water Conservation & Artificial Recharge :

No structure has been constructed by CGWB so far in this district.

6.0 Ground water related issues and problems

1. Ground water quality problem (Geogenic): Arsenic in ground water in sporadic manner has been identified in 7 blocks. A total population of 1625000 (as per 2001 census) are residing in risk zone. Arsenic concentration in ground water varies from 0.001-1.43 mg/l.

So far CGWB has constructed 8 deep tube wells in 4 blocks in their exploration programme to yield arsenic free water. Absence of persistent clay layer in arsenic affected blocks is a natural problem. Heavy-duty deep tube wells may be constructed with caution and adopting proper scientific technique in arsenic affected areas

The state as well as other organizations/ agencies has installed arsenic removal plants & domestic filters, which are producing arsenic free water in some part of the district.
Surface water is being provided by the State Govt. to the arsenic affected people.

2. Water logged areas: Water logging problems have been witnessed in parts of Manikchak, Harishchandrapur-II, Kaliachak-I,II & III blocks.

3. Areas having decline in water level: Decline of water level both during pre- and post monsoon period was witnessed in parts of English bazaar, Habibpur, Kaliachak-I, Gajole, Bamangola and Chanchol blocks.

4. Risk to natural disasters: a) Natural erosion along the banks of the Ganga river causing huge loss of agricultural and residual land specially in rainy seasons is the serious problem in the blocks along the river the Ganga.

7.0 Awareness & Training Activity

Nil

8.0 Area Notified by CGWB/ SGWA

List of area: Nil

8.0 Recommendations

1. At present district has ground water resources of 127128 mham of which gross ground water draft is 72379 mham which it self indicates that present stage of GW development is nearly 56.93%.
2. Out of 15 blocks of the district, 13 blocks are under Safe Category (Kaliachak-II & III, Englishbazar, Old Malda I&II, Gajole, Ratua-I&II, Chanchol I & II, Harishchandrapur I, Bamangola & Habibpur) where further ground water development can be done through construction of Shallow tubewell and deep tubewells; 2 blocks under Semi-critical Category(KaliachakI & Harishchandrapur II) where further ground water development can be done cautiously with close monitoring of water level through construction of Shallow tubewells and deep tubewells.
3. In arsenic infested blocks properly treated surface water may as far as possible be used as unlike other arsenic affected blocks of West Bengal arsenic affected blocks of Malda district have a predominantly singl aquifer system. Ground water if used for drinking purposes should be from arsenic free deeper aquifers and tubewells should be properly designed adopting cement sealing techniques. Ground water from contaminated aquifer may be used only after proper treatment through arsenic removal units and the same may be periodically monitored qualitatively..
4. Rainwater harvesting techniques may be adopted for artificial recharge specially in Semi critical blocks where water level is declining. In this regards Roof top rain water harvesting techniques can be followed for water conservation and in places for artificial recharge.
5. In water logged areas stress has to be given on ground water development rather than surface water. In this respect proper drainage to drain out the excess surface water to the adjacent blocks where the problem of water logging does not exist.
6. Cropping Pattern can be changed and crops with low water requirement can be adopted in Semi critical blocks.
7. Modern irrigation practice should be adopted to minimize the use of ground water especially in Semi critical blocks.