GROUND WATER INFORMATION BOOKLET
NADIA DISTRICT, WESTBENGAL
DISTRICT AT A GLANCE

Sl. no	Items	Statistics
1.	**General information**	
	i) Geographical area (sq.Km)	3927
	ii) Administrative Division (as on 2001)	
	• No. of subdivision	4 no.
	• No. of blocks	17 no.
	• No. of municipalities	8 no.
	• No. of inhabited villages	1248 no.
	iii) Population (as on 2001 census)(with density population)	4604827(1173/sq.km)
	iv) Normal annual rainfall	1474mm
2)	**Geomorphology**	
	Major physiographic units	Younger flat plain
	Major Drainages	River Ganga/Padma, Churni, Jalangi.
3)	**Land use (sq. km.)(as on 2004-2005)**	
	a) Forest area	12.2sq.km
	b) Net area shown	3108sq.km
4)	**Major soil types**	Older and younger alluvial soils
5)	**Area under principal crops(sq. km.) (As on 2004-2005)**	Total cereals: 4007 Total pulses: 568 Total oilseeds: 1090 Total fiber: 1402 Total miscellaneous crops: 11.8
6.	**IRRIGATION BY DIFFERENT SOURCES (Areas & No. of Structures)**	
	Tube Wells	921.9307sq km.area irrigated through 94789 STW and 275.8 sq km. area irrigated through757 DTW
	Surface lift (RLI)	185.52sq.km area irrigated through 371 no.s of RLI
	Surface Flow	2.449sq km area irrigated through 38 nos of surface flow.
	Actual area irrigated by GW	1197.746sq.km
	Actual area irrigated by SW	187.97sq.km
	Total irrigated area	1385.72
7	**NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB (As on 31.03.07)**	59

	No. of Dug wells No. of Piezometers/Tube wells	15 44
8	PREDOMINANT GEOLOGICAL FORMATIONS	Quaternary alluvium
9	HYDROGEOLOGY	
	> Major Water bearing formation	Quaternary alluvium
	>Pre-monsoon depth to water level during 2006	4.42 to 7.92mbgl in dug wells and 3.41 to 8.12 mbgl in piezometers
	>Post-monsoon depth to water level during 2007	2.42 to 5.97mbgl in dug wells and 1.04 to 7.32 mbgl in piezometers
	➢ Long term water level trend in 10 tears (1997-2006) in m/yr	Premonsoon fall 0.0266 to 0.0866 Premonsoon rise 0.0044 to 0.188 Post monsoon fall 0.0414 to0.091 Post monsoon rise 0.0096 to0.01531
10)	**Ground water exploration by CGWB (As on 31.03.07)**	
	No. of wells drilled	21
	Depth range (m)	Maximum depth drilled 351.51mbgl
	Discharge (lps)	1lps to 61.51lps
	Storativity(s)	$0.74x10^{-3}$ to $6.2x10^{-3}$
	Transmissivity (m^2/day)	1487.3m^2/d to8607m^2/d
11.	**Ground water quality**	
	Presence of chemical constituents more than permissible limit	Arsenic, Iron
	Type of water	Ca-Mg-HCO_3
12.	Dynamic GW resources in ham	217234
	Annual replenish able GW resources	
	Gross annual GW draft a) For irrigational use b) For domestic & industrial use	165330.02 ham 156873.8ham 8456.22ham
	Projected demand for domestic and industrial uses upto 20-25	12641.00ham
	Stage of GW development	84.56%
13.	**Awareness & training activity**	
	Number of Mass Awareness programme organized	2
	Number of water management training programme organized	Nil
14.	**Efforts of Artificial recharge and rain**	

	water harvesting	
	Projects completed by CGWB (no. and amount spent)	Nil
	Projects under technical guidance of CGWB (no.)	Nil
15.	**Ground water control & regulation**	
	No. of over exploited blocks	Nil
	No. of critical blocks	Nil
	No. of blocks notified	Nil
16.	**Major GW problems & issues**	1.Arsenic conc. in GW beyond permissible limit 2.Iron conc. in GW beyond permissible limit

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1.0 INTRODUCTION

Administrative details

Location and area: Nadia district is bounded by the latitude $22^0$25'30"N to $24^0$05'40"N and longitudes $88^0$07'30"E to $88^0$47'45"E. The total geographical area of the district is 3907 sq.km. It is situated in the eastern part of West Bengal and bounded by Murshidabad district in north and northwest, by Republic of Bangladesh in the east and northeast, byBardhaman district in the West and Hugli district in the southwest. It has got 4 subdivisions consisting of 17 blocks(17 Panchayat samtis). The total police station is 19.There are 187 grampanchayats with 1248 villages, 9 municipalities and 27 towns. The total population of the district as per2001 census is about4603756. Krishnan agar town is the district Head quarter.

Ground water basin: The district is located in the lower part of the Ganga basin.

Drainage: The Ganga/or The Padma with tributaries namely the Bhagirathi, the Jalangi, the Churni form the main drainage.

Irrigation practices: The cultivation is done mainly by groundwater along with the river lift Irrigation.

Studies of C.G.W.B: CGWB has completed systematic Hydro geological survey and continuing Groundwater management Studies. Apart from this, Groundwater Exploration is being 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 tube wells adopting cement-sealing techniques in arsenic infested areas to provide arsenic free water through state agencies.

2.0 Rainfall &Climate

Rainfall: The normal annual rainfall is of the tune of 1474mm

Climate: The district is characterized by hot and humid climate. It receives adequate rainfall from southwest monsoon, which sets in the later half of June and withdraws by the middle of October. Premonsoon rains are received during March-April. Max. and Min. temp. as recorded are 43^0C and10^0C

3.0 Geomorphology &Soil Types

Geomorphology: The district is an extensive alluvial plain possessing the characteristics of younger flood plain. Elevation ranges from 28.84m above mean sea level (near-Jairampur, block Karimpur) to 5.48m above mean sea level (near Pamila, block-Haringhata). Numerous small rivers and abandoned river causes are interspersed

throughout the district with a number of depressions meander scars, ox-Bow lakes, point bars etc.

Soil Types: Entire Nadia district is covered by alluvial soil and the parent material is Ganga alluvium. Admixture of sand, silt and clay has given rise to three broad types of soils. Coarse soil formed by sand and loamy sand, Moderately Coarse Soil formed by sandy and silty loams and moderately fine to fine soil formed by silt, clay and silty loams. Coarse soil has got minimum distribution occurring mainly in Nakasira block and other two types of soil has got more or less equal percentage of distribution in the district.

4. Groundwater Scenario

4.1 Geology: Thick Gangetic alluvium of quaternary age conceals the sub-surface geology. However, analysis of the tube wells reveals, succession fluviatile sediments. These are composed of sand of various grades, silt, clay, gravel and kankar and their various admixtures deposited by the Ganga river and its tributaries. Clay/sandy to silty clay and silt cover the top 5-34m thickness of the sediments except in the west central part of the district where fine sand and silt occur right from the top.

4.2 Hydrogeology: The entire district is covered by thick alluvial formations and the aquifers consist mostly of sand of different grades (fine to course). Gravel that is in general the most important constituent of the aquifers is not playing important role in this district. As it is observed in most of the boreholes, gravel is absent and it is present in very insignificant quantity. In general three aquifer systems have been identified. The shallow aquifer exists down to a depth of 80m, which extends up to 126 m at Tungi. The next aquifer system occurs with in the depth range of 100 to162m and the deepest one exists with in the depth range of 200m to 335m.In the northern part of the district groundwater flow direction is towards southwest, However in the extreme northern corner due the presence of ground water mound,the flow direction is towards northeast. In the western part of the districtflowdirection is easterly where as in the eastern part flow direction is westerly or southwesterly.In the southern part flow direction is south westerly.

Aquifer characteristics: The tube wells tapping the zones at shallow and intermediate depth are yielding maximum discharge and it ranges from3.21lps to62.11lps.The tube wells taping only the intermediate/deep zones generally donot yield very high discharge. The value of Transmissivity in the district ranges from1487.3m^2/d to 8607m^2/d. The pumping tests data indicate that the value of storage co-efficient ranges from0.74*10^{-3} to6.2*10^{-3}.However,at many places the top aquifers are under unconfined condition.

4.3 Groundwater Resources:

The dynamic groundwater resources of the 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	217234.01ham
Net ground water availability	1955110.63 ham
Existing Ground Water Draft for all uses	165330.02 ham
For Irrigation	156873.8 ham
For domestic &industrial water supply	8456.22 ham

Stage of Ground Water Development	84.56%
Allocation for domestic & industrial water Supply requirement up to 25 yrs	12641 ham
Net Ground Water Availability for future Irrigation development	30896.24 ham
Categorization of blocks	11no.of blocks are categorized under "Safe" 6no. of blocks are under "Semi-critical"

4.4 Ground water quality:

The chemical quality of ground water in the area in general of Ca-Mg-HCO_3 type. The Chloride content in ground water is 7.1-238mg/L. The water is mildly alkaline in nature and pH value ranges between 7.7 and 8.2. Total hardness as $CaCO_3$ ranges from 189-380mg/L. The concentration of iron & arsenic content ranges from0.02-1.9mg/L and BDL to 1.18 mg/L, the highest concentration of arsenic has been reported from Mahisbathan village. The detailed study conducted in Jompukur village where the situation of arsenic pollution in in ground water is very bad indicates that more than 80% of the shallow tube wells present in the village have been affected with high arsenic concentration is mostly confined to a depth to 20 to80 mbgl. Water samples from ponds and dug wells up to depth of 15mbgl have been found that arsenic content is below detection limit (0.005mg/L). Arsenic content in clay horizons is much more than sand horizons. Arsenic concentration of ground water from a particular tube well varies widely with time and in general it shows higher concentration during premonsoon period and least concentration during post monsoon period. Thus, the chemical quality of ground water in both shallow and deeper aquifer is good except in 17 blocks where sporadic occurrence of arsenic contamination in ground water has been noticed in shallow aquifer, which is not safe for domestic purposes

DETAILS OF EXPLORATORY WELLS CONSTRUCTED BY CGWB IN NADIA DISTRICT

S.No	Block	Location	Depth drilled (mbgl)	Well Constructed (mbgl)	Zone tapped (mbgl)	Cement Sealing (mbgl)	Discharge lps	Arsenic Concentration (mg/L)
1	Chakdah	Mondalhat	243.62	129	104-110,112-126	99-101	10	BDL
2	Haringhata	Birohi	252	250	205-210,213-222 233-238,242-248	190-192	4.5	BDL
3	Haringhata	Birohi	195	165	60-66,159-162	56-58	2.35	BDL
4	Haringhata	Birohi	60.8	46	22-25	Nil	1.25	0.007
5	Haringhata	Balinidi	250.3	132	110-126	102-105	20	BDL
6	Ranaghat- I	Magurkhali	250	243	228-240	212-215	3	BDL
7	Ranaghat- I	Magurkhali	180	173	150-170	135-137	18	BDL
8	Ranaghat- I	Magurkhali	110.79	108	88-106	Nil	9.47	BDL
9	Ranaghat- I	Taherpur -I	351.51	202	175-199	117-120	6.68	
10	Ranaghat- I	Taherpur- II	121.02	115	95-113	87-90	22	
11	Kaliganj	Dingel	269.86	269.8	254.5-268.5	234-237	3.4	BDL
12	Kaliganj	Juranpur	341.51	198	183-195	123-126	3.21	BDL
13	Hanskhali	Badkulla-I	350	337	300-312,318-324 330-333	261-264	2.85	
14	Hanskhali	Badkulla-II	198.74	162	93-99,118-127 150-159	Nil	19.16	BDL
15	Tehatta-II	Kulgachi	230.91	81	60-78	Nil	15	BDL
16	Krishnanagar	Krishnanagar	351.65	177	121-139,161-166	81-83	12.5	0.049
17	Krishnanagar	Krishnanagar	264.75	241	161-167.171-177 194-200,206-212 215-227,232-238	137-140	11.5	0.004

4.5 Status of Ground water development (blockwise)

Block	Occurrence of aquifers & its potentiality (as per Available with CGWB)	Feasibility of GW abstraction structure	Ground water resource Available, irrigational draft stage of development (SOD)& existing structures (as on March2004)	Remark.
1.Karimpur I	Average depth granular zones occurs in the range of 55-65,75-90m.T of the aquifer is about 5123.60 m^2/d and S is about $0.82x10^{-3}$	Low duty (10-40 m^3/hr) and Heavy duty (100-200m^3/hr) tube wells are generally feasible.	Net GW availability 10957.73ham GW has done irrigation through 2618numbers of STW & 42 numbers of DTW and the total irrigation draft has been projected up to 2004 as 5746 hectometer. SOD is 90.13%.	semicritical
2.Karimpur II	Average depth of granular zone, occur in depth span of 55-65 and 75-90mbgl.T of the aquifer is about 5123.6m^2/d and S is about $0.82x10^{-3}$	Low duty (10-40 m^3/hr) and Heavy duty (100-200m^3/hr) tube wells are generally feasible	Net GW availability 12070.01ham GW has done Irrigation through 3160no.of STW& 58no. of DTW and the total irrigation draft has been projected up to 2004 as 3978 hectometer. SOD is 91.33%	Semicritical
3.Kaliganj	Average depth of granular zones occurs in depth span of 30-45mbgl. T of the aquifer system is about 3496m^2/day and S is about $0.74x10^{-3}$.	Heavy duty (100-200 m^3/hr) tube wells are generally feasible	Net GW availability 16485.88ham GW has done irrigation through 5742 no. of STW&53 no. of DTW and the total irrigation draft has been projected up to 2004 as 15200 hectometer. SOD is79.78%	Semicritical
4.Tehatta I	Average depth of granular zones occurs in depth span of 65-110mbgl. T of the aquifer system is about 8000m^2/day.	Heavy duty (100-160m^3/hr) tube wells are generally feasible	Net GW availability14086.03ham GW has done irrigation through 5434 no. of STW&64 no. of DTW and the total irrigation draft has been projected up to 2004 as 14408 ham. SOD is103.72%	Semicritical

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5.Tehatta II	Average depth of granular zones occurs in depth span of 60-85mbgl. T of the aquifer system 7500m^2/day and Sis about 1.92x10-3	Heavy duty (100-160m^3/hr) tube wells are generally feasible	Net GW availability10331.58ham. GW has done irrigation through 4656 no. of STW&38 no. of DTW and the total irrigation draft has been projected up to 2004 as 11780 ham. SOD is100.67%	semicritical
6.Chapra	Average depth of granular zones occurs in depth span of 60-100mbbgl	Heavy duty (100-200m^3/hr) tube wells are generally feasible	Net GW availability12257.48ham. GW has done irrigation through 7640 no. of STW&59 no. of DTW and the total irrigation draft has been projected up to 2004 as 18359 ham. SOD is129.54%	semicritical
7.Krishnanagar I	Average depth of granular zones occurs in depth span of 75-110mbgl.T of the aquifer system 8607m^2/day and S is about	Heavy duty (100-180m^3/hr) tube wells are generally feasible	Net GW availability14490.23ham. GW has done irrigation through 5117 no. of STW&99 no. of DTW and the total irrigation draft has been projected up to 2004 as 14948 ham. SOD is 84.74%	Safe
8.KrishnanagarII	Depth span of		Net GW availability6849.95ham. GW has done irrigation through 2140 no. of STW&24 no. of DTW and the total irrigation draft has been projected up to 2004 as 5736 ham. SOD is 61.42%	Safe
9.Nabadwip	Average depth of granular zones occurs in depth span of 18-35, 60-85,90-120m bgl. T of the aquifer system 1487.3 m^2/d and Sis about 6.2x10^{-3}	Heavy duty (100-190m^3/hr) tube wells are generally feasible	Net GW availability5023.56ham. GW has done irrigation through 1824 no. of STW&17 no. of DTW and the total irrigation draft has been projected up to 2004 as 4789 ham. SOD is 62.09%	Safe

10.Krishnaganj	Average depth of granular zones occurs in depth span of 60-85,100-120mbgl.T of the aquifer system 8000 m^2/day. S is about	Heavy duty (100-180m^3/hr) tube wells are generally feasible	Net GW availability8220.19ham. GW has done irrigation through 2925 no. of STW&39 no. of DTW and the total irrigation draft has been projected up to 2004 as 7776 ham. SOD is 79.61%	Safe
11.Hanskhali	Average depth of granular zones occurs in depth span of 25-110mbgl.T of the aquifer system 8000 m^2/d S is about	Heavy duty (100-150m^3/hr) tube wells are generally feasible	Net GW availability14607.73ham. GW has done irrigation through 4471 no. of STW&76 no. of DTW and the total irrigation draft has been projected up to 2004 as 13168 ham. SOD is 89.75%	safe
12.Santipur	Average depth of granular zones occurs in depth span of 50-75,80-110mbgl T of the aquifer system 7603m^2/day. S is about	Heavy duty (100-160m^3/hr) tube wells are generally feasible	Net GW availability9859.92ham. GW has done irrigation through 2658 no. of STW&72 no. of DTW and the total irrigation draft has been projected up to 2004 as 8365 ham. SOD is 73.9%	safe
13.Nakashipara	Average depth of granular zones occurs in depth span of 25-50,60-100mbgl.T of the aquifer system 3585 m^2/day	Heavy duty (100-200m^3/hr) tube wells are generally feasible	Net GW availability17719.49ham. GW has done irrigation through 6736 no. of STW&61 no. of DTW and the total irrigation draft has been projected up to 2004 as 17326 ham. SOD is 67.66%	safe
14.Ranaghat I	Average depth of granular zones occurs in depth span of 50-75,105-200mbgl.T of the aquifer system 8811.79 m^2/day.	Heavy duty (100-200m^3/hr) tube wells are generally feasible	Net GW availability8168.38ham. GW has done irrigation through 2545 no. of STW&73 no. of DTW and the total irrigation draft has been projected up to 2004 as 8005 ham. SOD is 68.48%	safe

15.Ranaghat II	Average depth of granular zones occurs in depth span of 50-80,100-110mbgl.	Heavy duty (100-200m^3/hr) tube wells are generally feasible	Net GW availability13771.4ham. GW has done irrigation through 5914 no. of STW&74 no. of DTW and the total irrigation draft has been projected up to 2004 as 15395 ham. SOD is 76.66%	safe
16Chakdah	Average depth of granular zones occurs in depth span of 40-90,100-130mbgl.T of the aquifer system 7545.9 m^2/day.	Heavy duty (100-180m^3/hr) tube wells are generally feasible	Net GW availability12218.08ham. GW has done irrigation through 5284 no. of STW&116 no. of DTW and the total irrigation draft has been projected up to 2004 as 15260 ham. SOD is 76.04%	safe
17.Haringhata	Average depth of granular zones occurs in depth span of 25-75,100-145mbgl. T of the aquifer system 3407.2m^2/day	Heavy duty (100-180m^3/hr) tube wells are generally feasible	Net GW availability8392.99ham. GW has done irrigation through 3244 no. of STW&50 no. of DTW and the total irrigation draft has been projected up to 2004 as 8863 ham. SOD is 76.39%	safe

5.0 Ground water management strategy

5.1 Ground water development:

At present ground water development in this district mainly controlled by shallow tube wells along with some deep tube wells. As per the Ground Water Estimation Committee, 1997,the total Ground water resources thus calculated is about 217234.01 ham. About165330.02 ham is being withdrawn from different purposeswhich is about 84.56% Ground water draft is minimum in Nabadwip block and maximum in Chapra block. In most of the areas ground water does not show any decline in water level as depth to water level is shallow. Further development may be restricted particularly in the semi critical blocks, Tehatta-I & Tehatta-II, Chapra, Kaliganj, Karimpur- I Karimpur-II.

5.2Water conservation and artificial recharge: Nil

6. Ground water related issues and problems:

1.Ground water quality problem (Geogenic): Arsenic in ground water in sporadic manner has been identified in 17 blocks. A total population of 17,43,889 is residing in risk zone. Arsenic Concentration in ground water varies from BDL-1.18mg/L, maximum value reported from Mahisbathan village, Karimpur block. Occurrence of arsenic in ground water in mostly confined to a depth to 20 to 80 mbgl.

2. To mitigate the above problem CGWB have carried out ground water exploration in arseniferrous tract of West Bengal. The presence of deeper arsenic free aquifer has been established in Nadia, which are capable of yielding arsenic free water. So far 22 deep tube wells has been constructed in 8 blocks, which are handed over to state agencies to supply water.

3 Apart from this, the state govt. as well as other organizations/agencies has installed arsenic removal plants & domestic filters, which are producing, free water. In some part of the district surface water being provided by the state govt. to arsenic affected people.

7.0 Awareness &Training Activity

7.1 Mass awareness programme (MAP)

A total two no. of mass awareness programme was conducted in this district, the details are given below

Sl. No.	Place/block	Participants	Theme
1.	Kalyani	150	Ground water management & rainwater harvesting.
2.	Krishnan agar	250	Arsenic menace in ground water of Nadia district for its mitigation

7.2 Ground water management training programme (WMTP): Nil

7.3 Exhibition/Mela/Fair etc.

Sl. No.	Place/block	organizer	Objective
1.	Ranaghat	Bigyan Manch, West Bengal	Displayed various models, chart, maps prepared by CGWB to aware the common people on ground water issues.

7.4 Presentation and lectures by CGWB officers: Nil

8. Area notified by CGWB/SGWA

List of area: Nil

9.0 Conclusions & Recommendations

1.At present district has a ground water resource of 217234.01 ham, of which gross ground water draft is 165330.02 ham. In most of the areas ground water does not show any decline in water levels. It means the ground water draft, being created is getting replenished at most of the places by monsoon rainfall and also from other sources like return flow from irrigation water, seepages from ponds etc.

2.Cumulative potentiality of the shallow zones and those at intermediate depth are more than those at only deeper level.

3.In all the blocks of the district at many places shallow zones are affected by arsenic contamination and deeper zones are free from arsenic contamination.

4.Ground water contaminated by arsenic is being reported from new areas.

5.In general, apart from arsenic contamination in ground water, no other ground water quality problem has been reported.

6.Though in some blocks stages of ground water development is more than 100% but water levels are not showing any decline trend

7. Arsenic contaminated ground water may be used only for non drinking purpose and the same may be used for drinking only after filtration/by blending with arsenic free ground water/surface water.

8.Arrangement has to be made in villages to make public aware about the wells, which are yielding arsenic contaminated water.

9. Areas where ground water is contaminated by arsenic, construction of new ponds is to be encouraged for conserving rainwater and the same wherever feasible will act as a percolation tanks. Towards the down slope side of the ponds ground development structures may be constructed which will increase percolation of pond water in to ground water and it is hoped by it concentration of arsenic in ground water may reduce.

10. Whether the areas are affected by arsenic contamination or not in deep tube wells shallow zones should separated by proper sealing, if feasible and the tube wells have to be designed properly.
11. With all seriousness quality of both ground water both from shallow and deep zones and water levels should be monitored periodically.
12.Boro cultivation as far as possible is to be discouraged as huge quantity of ground water is being utilized.