



Government of the People's Republic of Bangladesh
Department of Public Health Engineering (DPHE)



Union Wise Water Supply Technology Mapping
Circle : Sylhet
District : Hobiganj



June 2018

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Circle: Sylhet
District: Habiganj

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FOREWORD

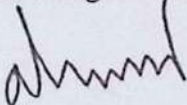
Rural water supply in Bangladesh is primarily depends on groundwater, using low cost tube well technology. The groundwater received importance for drinking purpose particularly due to its safety on microbial content. But the presence of arsenic in groundwater mostly in shallow aquifer posed a threat on the groundwater-based drinking water supply systems.

Providing safe drinking water is quite challenging in Bangladesh. Due to high variability in availability and quality of water, it is difficult to provide unique solution throughout the country. Moreover, present aquifer condition, hydrological/hydrogeological situation, different heavy metal contamination, saline intrusion, pollution etc. poses serious threat to determine safe water sources for drinking. The situation is further challenging for rural water supply systems. Therefore, suitable drinking water supply technologies need to be identified on priority basis covering the lowest administrative boundary, such as union level. Selection of union boundary as unit for determining suitable water supply alternatives will help to identify, regulate and monitor the effectiveness and efficiency of the options installed, data management and also future project planning & development.

Now that, Ground Water Circle of DPHE initiated necessary steps and identified procedures for collecting and preparing union based suitable water options with priority ranking. The outcomes of these initiatives will help to decide suitable water supply technologies for preparing project proposals. This document will be useful for decision making in WASH sector and will be a valuable reference as well. It contains the basic concepts along with advantages and constraints of different drinking water supply options available. It is also includes an outline-methodology to select alternative water supplies of different union.

I would like to express gratitude to UNICEF and Village Water Supply Project (VWSP) for providing necessary support in preparing this document. My sincere thanks to Mr. A.K.M. Ibrahim, Additional Chief Engineer (Planning), DPHE and Mr. Md. Saifur Rahman, Superintending Engineer, Ground Water Circle, DPHE who provided utmost effort in completing this task. Special thanks are also extended to Ms. Dilruba Farzana, Executive Engineer, VWSP, Mr. Md. Didarul Alam Tusher, Executive Engineer to complete the field work and data management. Mr. A.H.M. Khalequr Rahman, Executive Engineer, R&D Division and Ms. Firoza Akhter, Deputy Project Director, National Sanitation Project (Phase – III) also deserve appreciation for their involvement in preparing the documentation. Credit also goes to DPHE field-level officials for their valuable contribution in the experience sharing workshop.

Considering changed scenario with elapsed time updating and revision of this document would be obvious taking new information and field experience into account.



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Government of Bangladesh

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1.0 Introduction:

Rural water supply in Bangladesh is predominantly based on ground water. But identification of arsenic in ground water particularly in shallow aquifer causes threat on ground water based water supply system. The project emphasizes on arsenic issue for providing safe water to the community. Arsenic has been identified in 271 upazilas of which 29% tub wells are found arsenic contaminated in terms of Bangladesh standard (50ppb) (BAMWSP, 2003). Spreading pattern of arsenic is sporadic, not uniform. In one upazila, some unions are severally arsenic contaminated and some are not like that. However, arsenic contamination also varies with depth of aquifer for a particular place.

The ground water of Bangladesh is extremely complex in terms of water chemistry and geology as well. On the other hand, protected but perennial surface water source is not available in many parts of the country. So, one technology may not be suitable for the larger areas because of different hydro-geological situation. In that case the water technology is required to be identified on priority basis up to specific boundary, such as union level.

In this context, initiatives have been taken by Ground Water Circle of DPHE to prepare the technological map for different districts. The field visit and workshops were supported by UNICEF and documentation is completed with the assistance from village water supply project (VWSP).

2.0 Objective of Task:

- Identification of the union wise water supply technology based on hydro-geological situation of the particular areas.
- Preparation of the GIS mapping on union wise water options.
- Preparation of union wise technology map document for future reference and use.

3.0 Methodology:

1. Union wise basic data regarding lowest water table, arsenic contamination, iron and salinity problem available in Ground Water Circle has been furnished in a table (Union wise technology 2009 as reference).
2. Based on basic information, a desk review has been made to primarily identify union-wise technology analyzing the hydro-geological situation of that particular area. In most cases particularly in the arsenic affected unions, two or more options were identified on priority basis. The forecasting of groundwater level in year 2017 is considered as maximum water level in the area.
3. The primarily identified union wise technology list was provided to the DPHE SEs, EEs and SAEs to facilitate their participation in the workshop.

4. Circle wise workshops were held with the participation of concerned Superintending Engineer, Executive Engineer, Assistant Engineer, Sub-Assistant Engineer and Mechanics. Representatives from Ground Water Circle and from different projects were present there to facilitate the workshop.
5. The workshops discussed the experience and views of the field officer focusing on technology table prepared by DPHE Ground Water Circle and along with the policy guidelines particularly “National Policy for Arsenic Mitigation 2004 and Implementation Plan for Arsenic Mitigation in Bangladesh”.
6. Incorporating the findings of Workshop, the technology table has been send to concerned SEs, EEs and SAEs.
7. Based on the feed back from the field, technology table has been finalized, on basis of that GIS map for union-wise technology has been prepared.

4.0 Present challenges in drinking water supply:

The problems of water source have been discussed which are as follows:

- i. Lowering of water table
- ii. Arsenic contamination in ground water particularly in shallow aquifer
- iii. Salinity in ground water
- iv. Iron & Manganese in ground water
- v. Non availability of suitable aquifer or rocky/hard layer
- vi. Non-availability of protected and perennial surface water source round the year

5.0 Alternative water supply options:

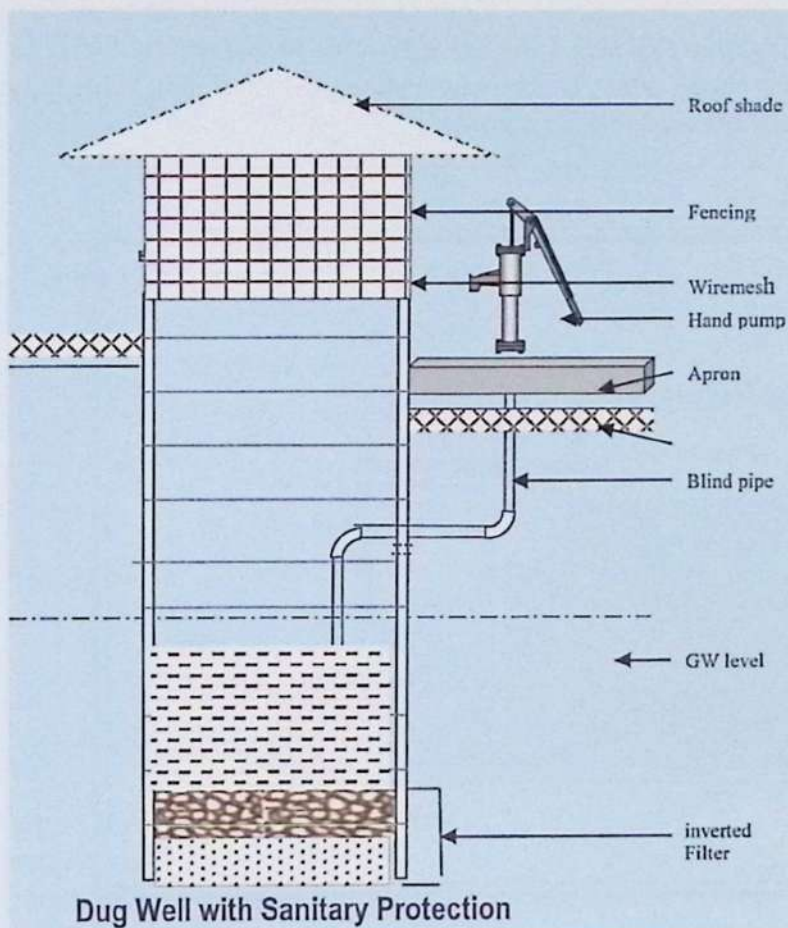
The project has given importance on arsenic mitigation approach as arsenic contamination emerges as a great concern for ground water based rural water supply system in Bangladesh. The project area and arsenic contamination is shown in Map as Annex- B. Different Arsenic mitigation options has been discussed following “National Policy for Arsenic Mitigation 2004 & Implementation Plan for Arsenic Mitigation in Bangladesh”. The mitigations options are:

- Dug/Ring Well
- Pond Sand Filter
- Deep Tubewell
- Rain Water Harvesting as promotional option and
- Arsenic Removal Technology (ART)

5.1 Different alternative water supply options:

Regarding identification of the Arsenic Mitigation Option, the criteria including the potentialities and limitation of each option were discussed in contrast with hydro-geological situation for the particular area considering the guidelines mentioned in the “National Policy for Arsenic Mitigation 2004 & Implementation Plan for Arsenic Mitigation in Bangladesh”. According to the said policy guidelines PSF and dug well will be tried first. If these technologies are found not feasible deep tubewell could be tried following the “Protocol for sinking Deep Tubewells in Arsenic contaminated areas”.

It was also advised that not only the technical aspect but O&M and user friendliness should be taken under consideration for selecting the options to make it sustainable. The main feature and basic criteria for each of the option are presented as follows:



5.1.1 Dug Well:

Dug well is the oldest method of groundwater withdrawal for water supplies. The water of the dug well has been found to be free from dissolved arsenic and iron even in locations where tubewells particularly in shallow aquifer are contaminated.

Pre-requisite criteria

- # There should be stable soil layer at the top (a clay layer is preferable)
- # Presence of sandy layer within 9 to 12 m

Not Feasible

- # Areas with the loose sandy soil
- # Areas with more than 15m consolidated clay.
- # Tidal zones of the costal belt
- # Areas of stony hills
- # Area of peaty soil should be avoided for DW as these cause an unpleasant taste and smell.

Design Requirements:

- # Concrete rings of 1.0 to 1.2 m in diameter used as lining.
- # Wells should be at least 1.0 to 1.5 m deeper than the lowest water table in the driest month.
- # Dug well should be constructed in the dry season to ensure availability of water round the year.

- The entire tube well should be installed straight and vertical.

5.1.4. Rain Water Harvesting:

Rainwater harvesting is a technology to collect rainwater for its use in drinking purposes. About 203 cm rainfall occurs annually in Bangladesh. The rain water is safe if it maintained hygienically. The main limitation of this option is non-availability of rain water round the year. But it can be widely used as supplementary source. As per "National Policy for Arsenic Mitigation 2004 & Implementation Plan for Arsenic Mitigation in Bangladesh" the government's role is mainly to conduct promotional activities for RWH.

Pre-requisite criteria

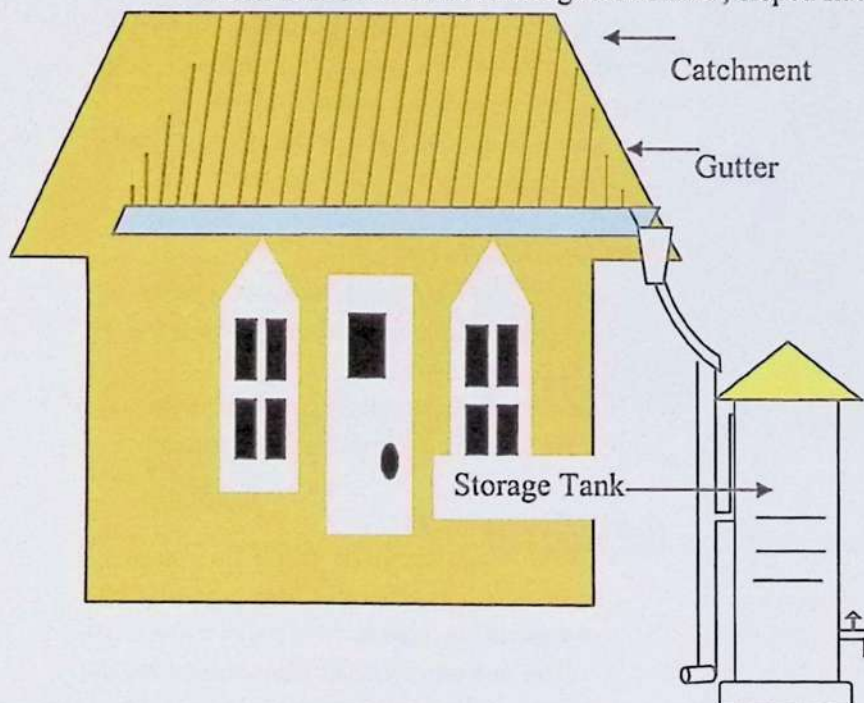
Feasible where average rainfall is 1600 mm per annum.

There should have required catchment area for rain water harvesting

Design Criteria

- Rain water has 3 basic units. 1. The catchment area (like corrugated roof top) and 2. Supporting collection system (gutter and pipe collection pipe) and 3. Storage tank.

- Catchment zone can be a corrugated tin-shed, sloped flat roof top, polythene sheet etc.



- The tank can be made of GI, ferro-cement, burned clay (motka), plastic etc.

- The collection pipe should have an exit way beyond the connection with storage tank to let the first flush flow away.

- The down pipe should have net to bar mosquitoes, flies from entering into the storage tank.

- There should be an end plug to stop flush discharge to enter water into the storage tank after flushing.

- The location should be so

selected that it allows accessibility of people.

5.1.5 Arsenic Removal Technology (ART):

ARTs are the chemical options which remove arsenic mainly using media. Four options are provisionally certified by BCSIR of which three are house hold and one is community based. These can be selected as a last effort particularly where deep tubewell and Dug well is not feasible. Filter media have to be changed after the media being clogged. The quality of raw water is specified for each technology.

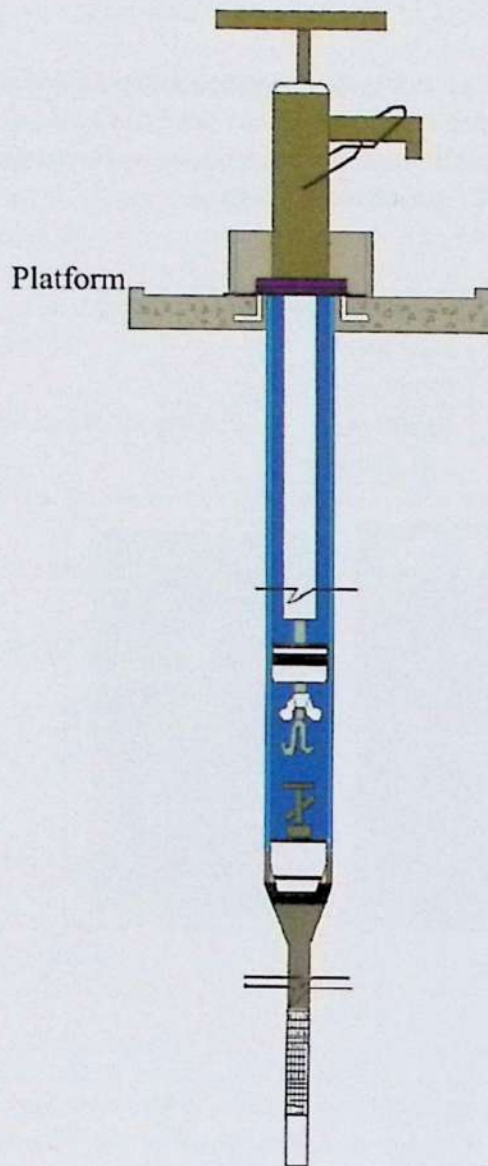
The main features of the ARTs are given below:

Name of ARTs	Filter rate	Total Treatment
Sono (House hold)	16 lit/hr	8100 liter
Alkan (House hold)	120 lit/hr	8100 liter
Read-F (House hold)	60 lit/hr	40,000 liter
SIDKO (Community)	240 liter/hr	1,21,500 liter

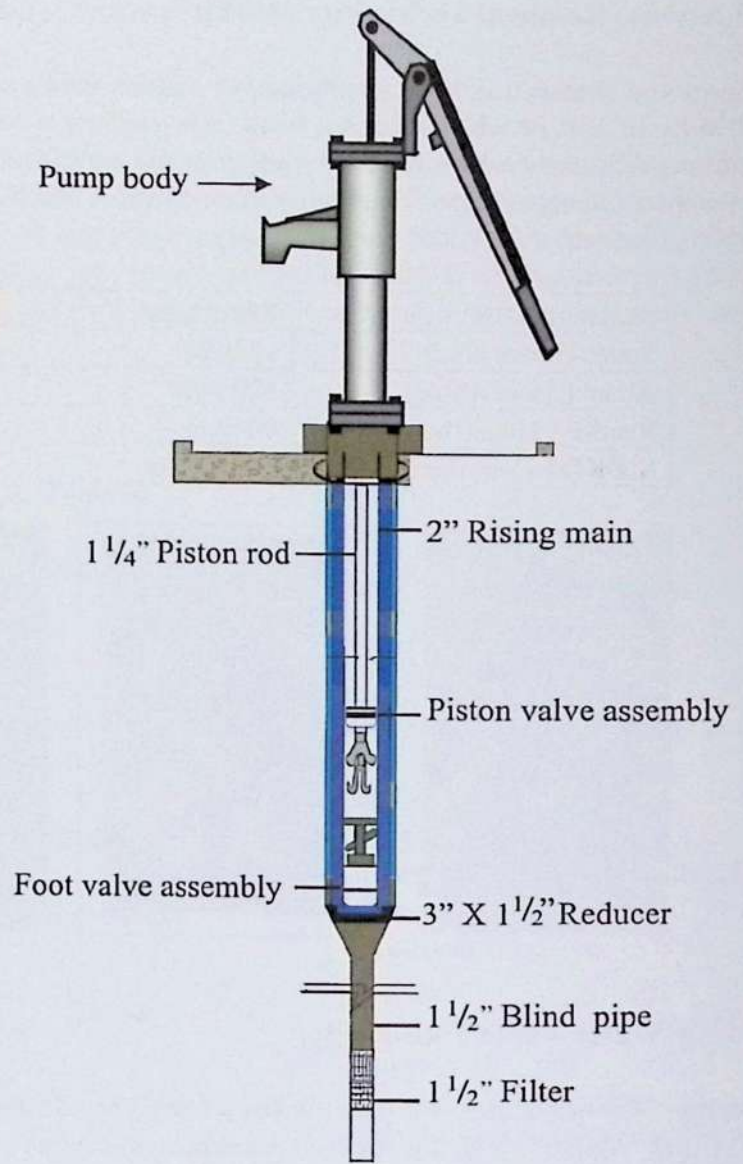


6.0 Low Water Table Technology:

Lowering of water table is big issue for the tubewell based rural water supply. In view of low cost, easy to O&M and availability in the market, suction mode number 6 pump is widely used as the tubewell technology. But its limitation is that it can not abstract water beyond the 26 ft depth of water table. In that case force mode pump has to be used. Earlier direct action pump was used. In some cases where the depth of water table is marginal, in that case Tara tube well may be given preference. Now Tara-dev head pump (lever action) is being used which can abstract water upto 80-90 ft depth of water table. The component of direct action & Tara dev pumps are shown as below:



Direct Action Tara

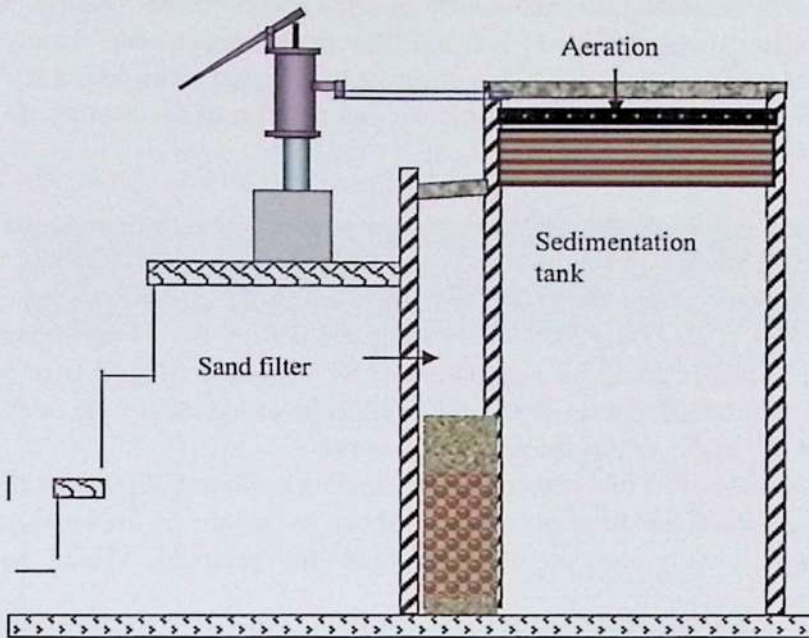


Liver action Tara with # 6 hand pump

In selecting the areas of low water table in the project upazilas, the study on forecasting groundwater level declination in Bangladesh conducted in early 1990 has been used and the delineated low water table map for 2017 is considered as the reference of maximum depth to water level. The pump technology is then selected for the union.

7.0 Iron Removal Technology:

Iron content exceeding 5mg/l will require treatment using Iron Removal Unit (IRU). It is to be mentioned



that concentration of Iron varies with different aquifer. Iron in ground water may be present in different forms and its removal can be effected by simple methods such as aeration with or without sedimentation followed by filtration. Iron from the water, thus making it acceptable for the users. Dissolved iron in water is converted into insoluble ferric form in contact with air. This form will be removed by settling in the sedimentation tank and remaining by the filtration through sand filter. The sedimentation tank is required to reduce the load on sand filter in order to minimize the frequency of filter clogging.

8.0 Salinity issues:

Salinity problem is now not limited in the coastal belt rather salinity intrusion is now expanded in the various part of the country. Deep tubewell and PSF are the best feasible option in this area. It is to be mentioned that RWH is a suitable option as average rainfall is high in the coastal belt. The VSST is also an option in the coastal belt.

9.0 Union Wise Technologies:

A set of technologies has been recommended for each union on priority basis based on the available hydro-geological information, the views of field personnel & policy guidelines. However, these technologies have to be implemented systematically ensuring the participation of communities. According to the project guidelines the water options will be selected following the community action plan ensuring the active participation of community. So proper knowledge about the option shall have to be provided to the community so that the option can meet the basic criteria of the water supply such as safe, adequate and reliable round the year. It is to be mentioned that if a technology is new for the particular area, utmost care should be taken for its implementation and replication. The experience regarding implementation of the technologies in the field will be helpful for upgrading the technological mapping and for proper application of the technologies.

10.0 Use of Union wise technology Mapping document:

It has been proved from different studied that hand pump system of water options particularly Shallow and Deep hand pump tube wells are very much popular among the community. But the arsenic contamination in groundwater compelled the implementer of water supply to switch over to different alternative water supply options in the arsenic affected areas. The technology in a union has been recommended considering the Arsenic Policy 2004 and its Implementation Plan along with other particular information of the locality. In implementing water supply options the following steps should be followed:

- a) In all cases arsenic and other required water quality parameters need to be tested before the system is bought to operation.
- b) In the villages/unions where there is presence of arsenic but the average contamination level is less than 5%, the existing technology is recommended STW. In that case, before going for installation of STW, testing of arsenic of 5 to 10 tube wells within 500 meters of the site need to be tested. If any tubewell shows arsenic >0.01 mg/L, follow the alternative option.
- c) Dug well and PSF should be investigated as the feasible option of alternative of STW. If sufficient documentation is available about its failure in the locality then Deep tubewell with modified design (following protocol) should be adopted.
- d) In case of non-successful of non chemical based option (STW, DW, PSF and DTW) chemical based option for Arsenic Removal Unit should be used as the technology.
- e) In all cases in problem areas promotional activities on RWH should be done.

List of Upazillas

Circle : Sylhet

District: Habiganj

Serial No	Name of District	Name of Upazila	No. of Union	Page No.
1	Habiganj	Ajmiriganj	5	A-1
2		Bahubal	7	A-6
3		Baniachong	15	A-11
4		Chunarughat	10	A-16
5		Habiganj Sadar	10	A-21
6		Lakhai	6	A-26
7		Madhabpur	11	A-31
8		Nabiganj	13	A-36
	Total	8	77	

District: Habiganj

Upazila:

Ajmiriganj

Bahubal

Baniachong

Chunarughat

Habiganj Sadar

Lakhai

Madhabpur

Nabiganj

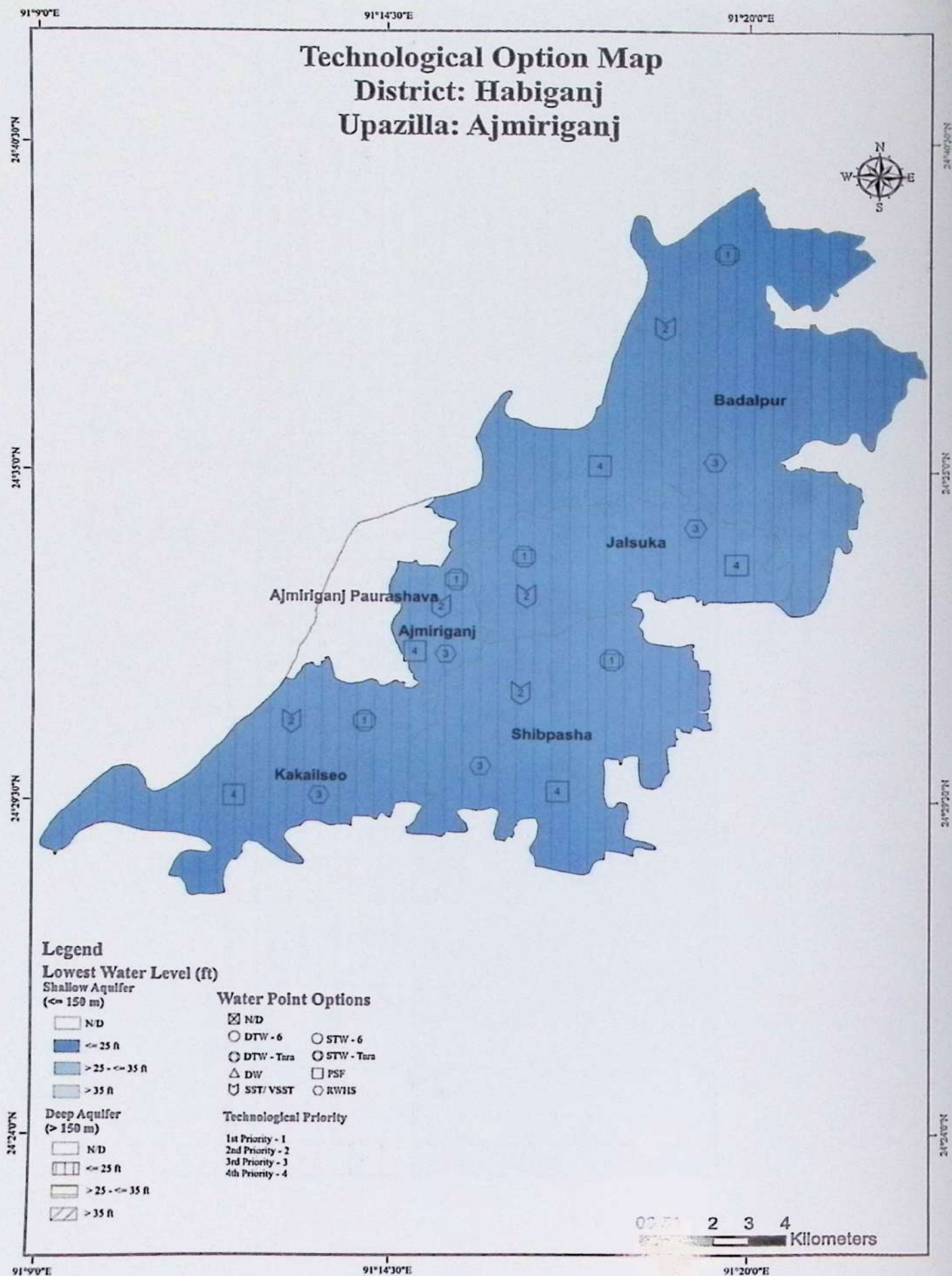
Table for mapping union wise Water Supply Technology

Ajmiriganj, Habiganj

SL	District	Upazila	Union	5		6		7		8		9		10			Average Depth of Water point, ft	Recommended Priority Options*	Remark		
				Lowest Water Table of the Union in the year 2017, ft		As contamination Status (% of Contaminated TW as per NAMIC, BAMWSP 2003)		As Contamination Status (> 50ppb) (% of affected DPHE Water Points installed during 2006-12)		Fe Problem (> 5ppm) (% of DPHE TW)		Cl Problem (>1000ppm) (% of DPHE TW)		STW	DTW	STW				DTW	DW
				STW	DTW	STW	DTW	STW	DTW	STW	DTW	STW	DTW	STW	DTW	DW					
1		3	4														11				
1				Ajmiriganj	18	24	4	0	0	0	20	0	0	0	200	780	N/D	DTW - Tara	SST/ VSST	RWHS	PSF
2				Badalpur	20	25	14	0	0	0	30	0	0	0	200	750	N/D	DTW - Tara	SST/ VSST	RWHS	PSF
3	Habiganj		Ajmiriganj	Jalsuka	20	25	6	0	0	0	20	0	0	0	200	750	N/D	DTW - Tara	SST/ VSST	RWHS	PSF
4				Kakailseo	25	24	6	0	10	20	0	0	0	0	200	750	N/D	DTW - Tara	SST/ VSST	RWHS	PSF
5				Shibpasha	25	25	14	8.7	0	30	0	0	0	0	200	750	N/D	DTW - Tara	SST/ VSST	RWHS	PSF

Note: Iron and Chloride contamination derived based on people's perception, 2014

N/D = No Data



Arsenic Contamination Map - 1

District: Habiganj

Upazilla: Ajmiriganj



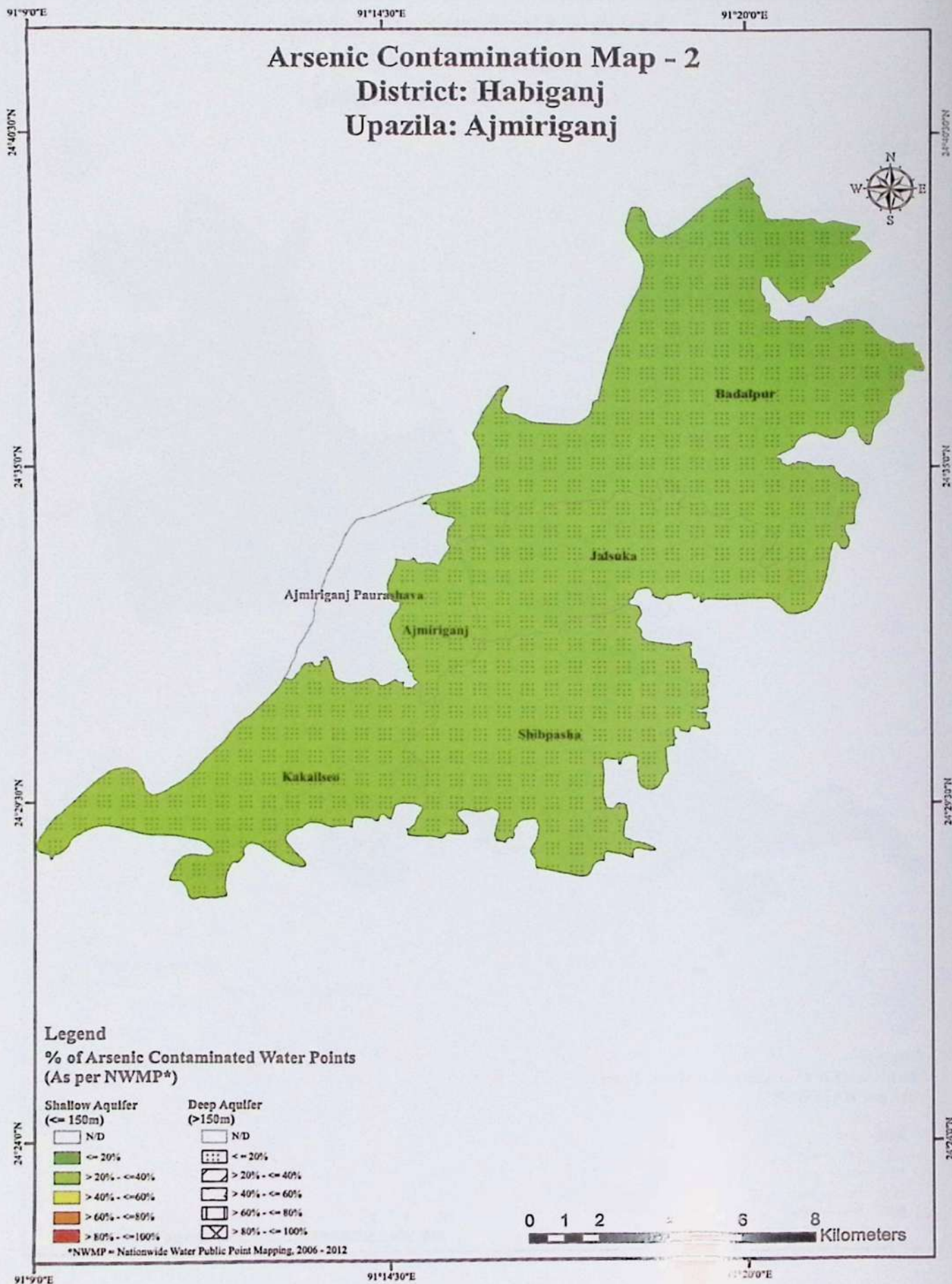
Legend

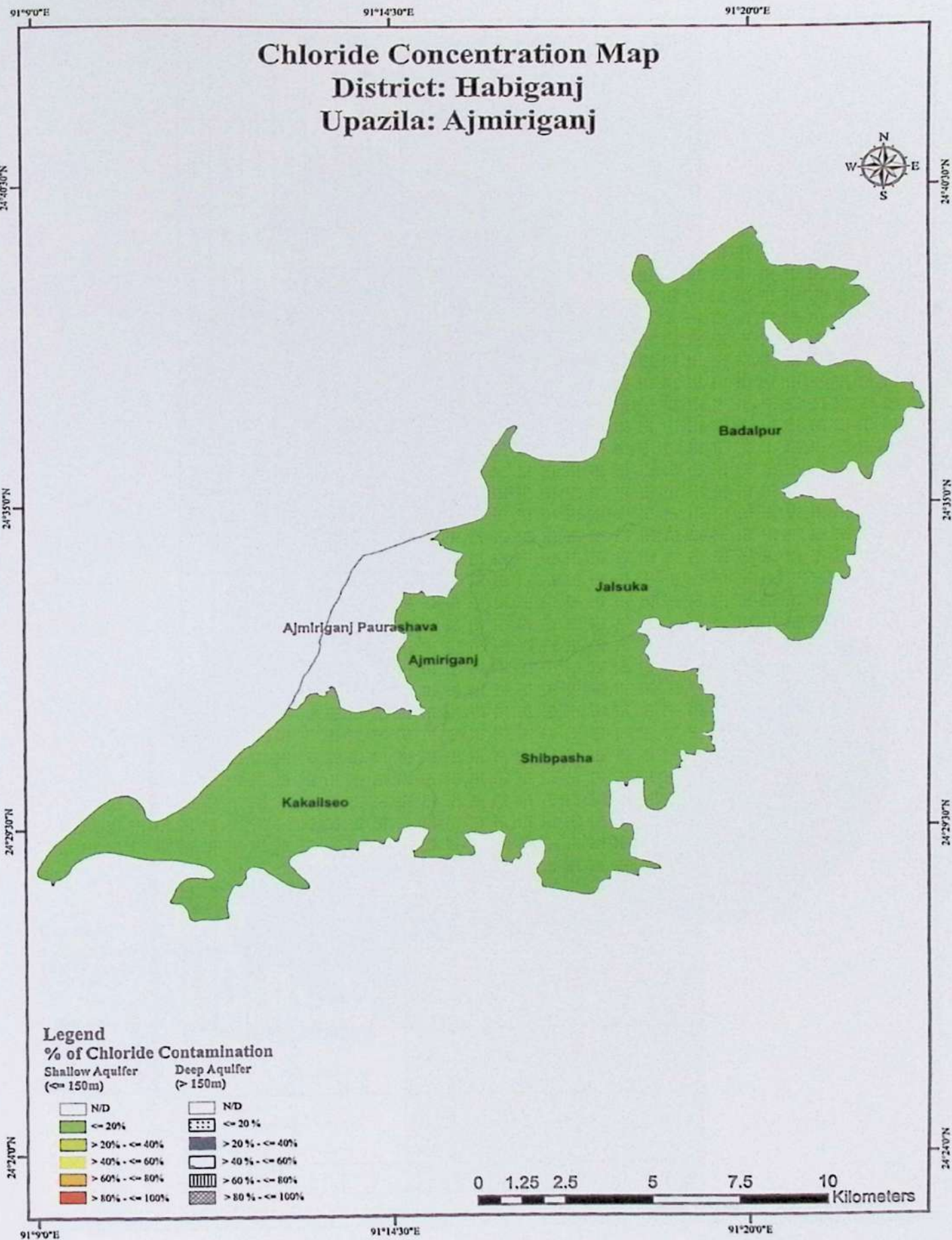
% of Arsenic Contaminated Water Points
(As per BAMWSP*)

- N/D
- $\leq 20\%$
- $> 20\% - \leq 40\%$
- $> 40\% - \leq 60\%$
- $> 60\% - \leq 80\%$
- $> 80\% - \leq 100\%$

0 1 2 4 6 8 Kilometers

*BAMWSP = Bangladesh Arsenic Mitigation Water Supply Project, 2003





Bahubal, Habiganj

Note: Iron and Chloride contamination derived based on people's perception, 2014
N/D = No Data

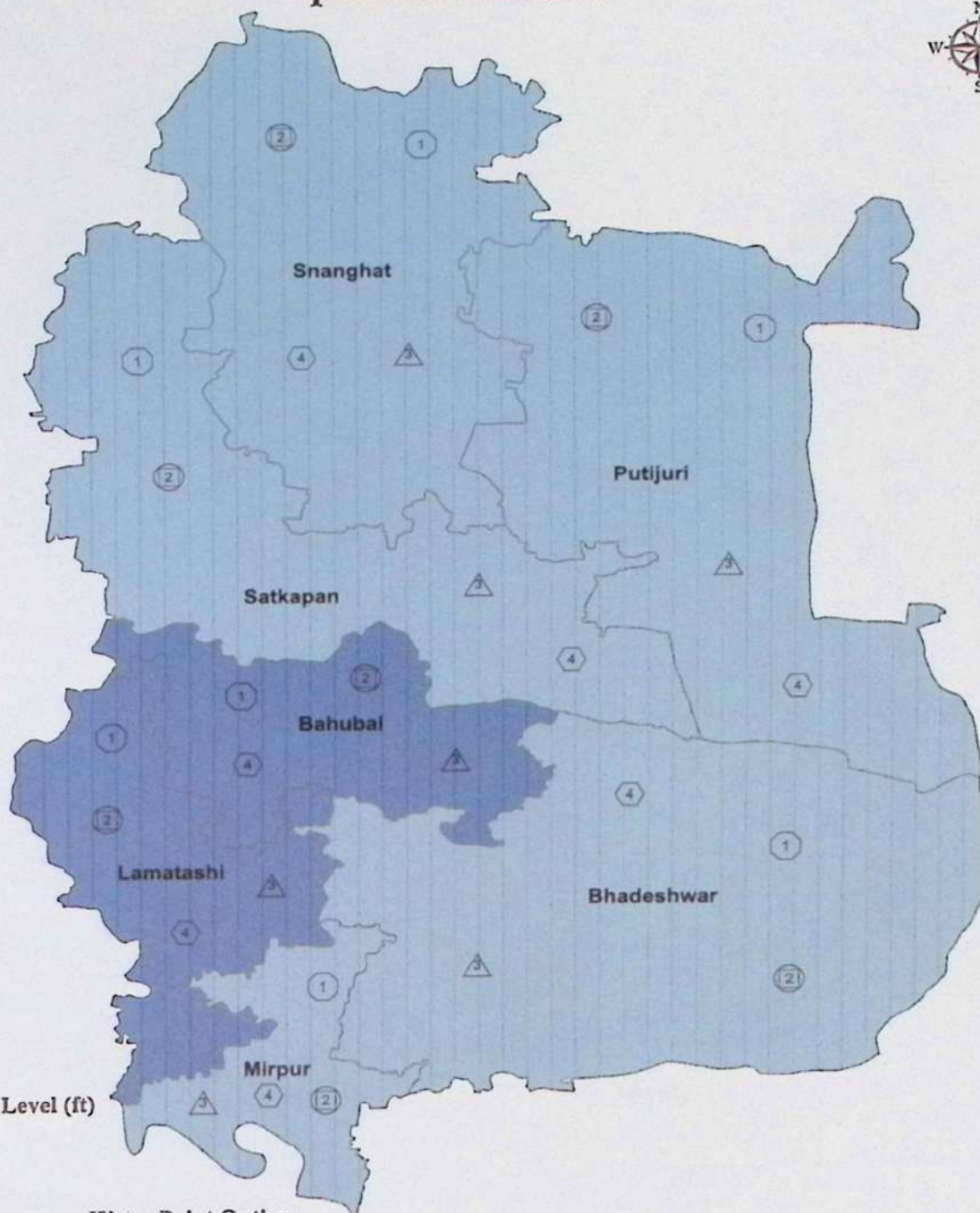
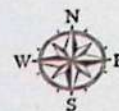
91°31'0"E

91°36'30"E

Technological Option Map

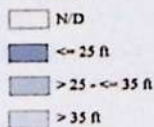
District: Habiganj

Upazilla: Bahubal

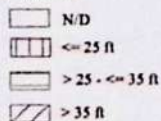


Legend

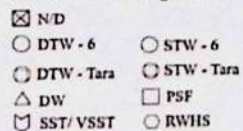
Lowest Water Level (ft)
Shallow Aquifer
(≤ 150 m)



Deep Aquifer
(> 150 m)



Water Point Options



Technological Priority

1st Priority - 1
2nd Priority - 2
3rd Priority - 3
4th Priority - 4

0 0.5 1 2 3 4 Kilometers

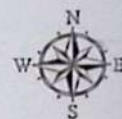
91°31'0"E

91°36'30"E

Arsenic Contamination Map - 1

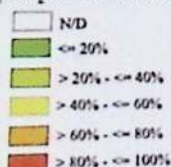
District: Habiganj

Upazilla: Bahubal



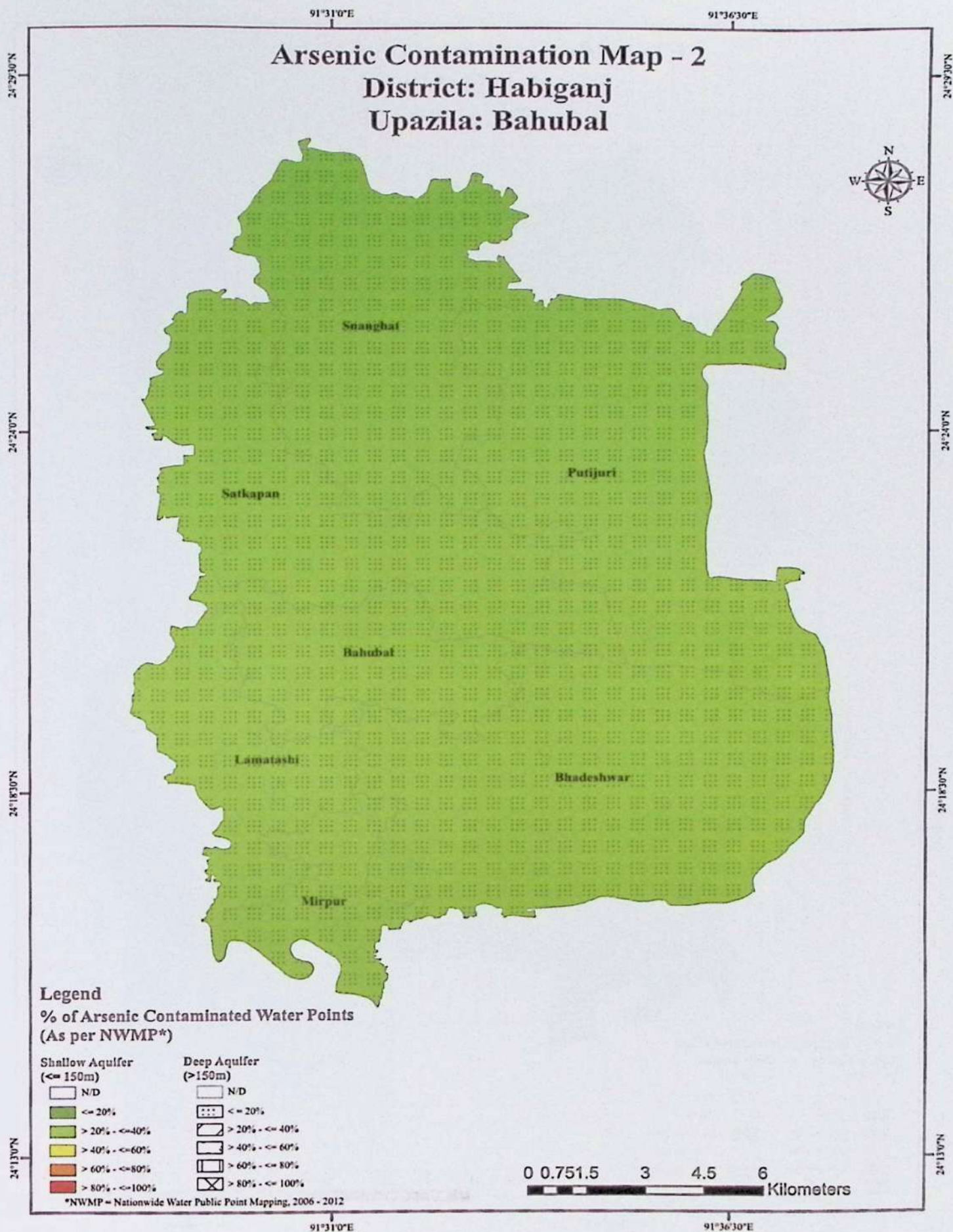
Legend

% of Arsenic Contaminated Water Points
(As per BAMWSP*)



*BAMWSP = Bangladesh Arsenic Mitigation Water Supply Project, 2003

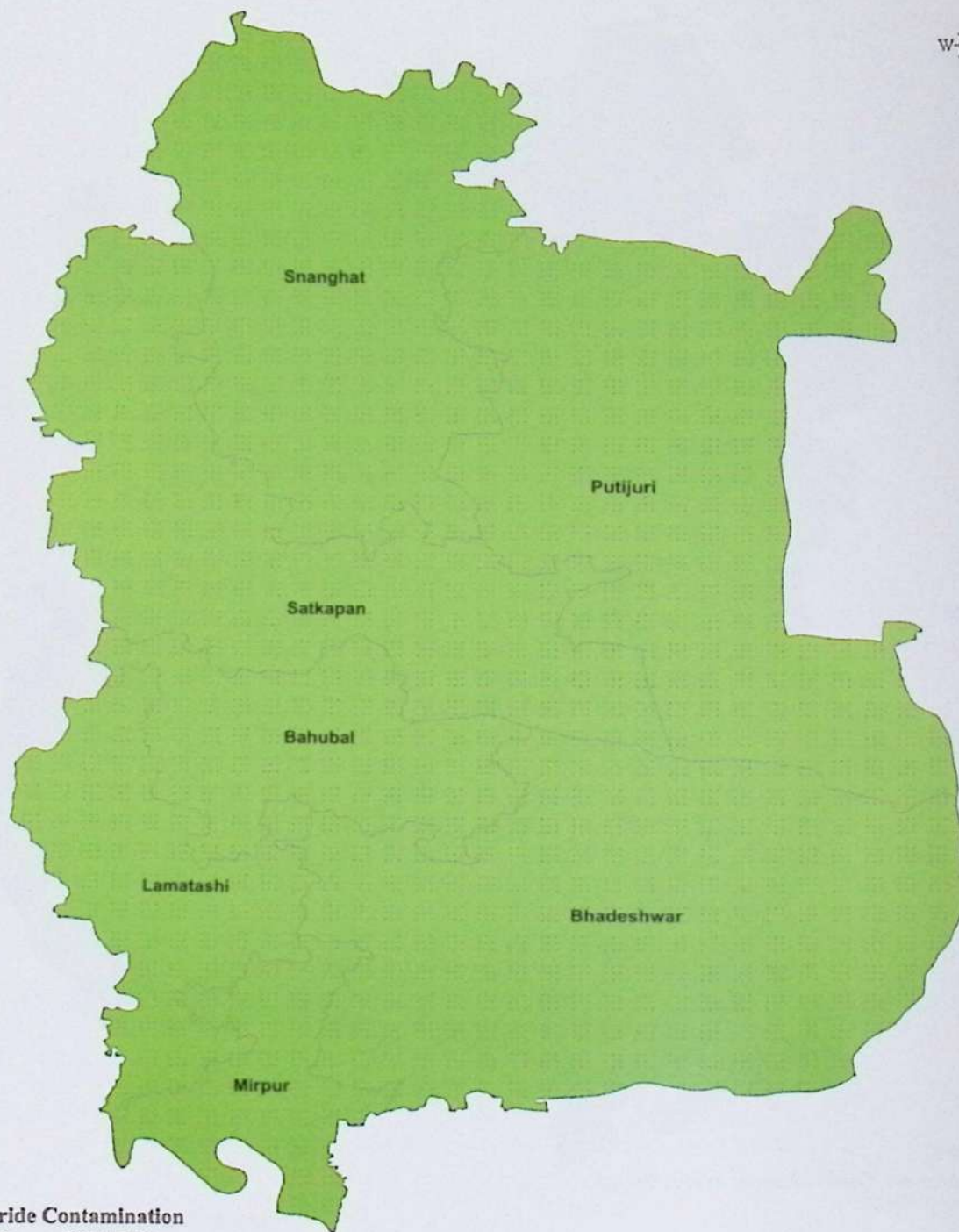
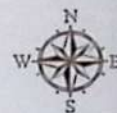
0 0.75 1.5 3 4.5 6 Kilometers



Chloride Concentration Map

District: Habiganj

Upazila: Bahubal



Legend

% of Chloride Contamination

Shallow Aquifer
($\leq 150\text{m}$)

Deep Aquifer
($> 150\text{m}$)

N/D	N/D
$\leq 20\%$	$\leq 20\%$
$> 20\% - \leq 40\%$	$> 20\% - \leq 40\%$
$> 40\% - \leq 60\%$	$> 40\% - \leq 60\%$
$> 60\% - \leq 80\%$	$> 60\% - \leq 80\%$
$> 80\% - \leq 100\%$	$> 80\% - \leq 100\%$

0 1 2 6 8 Kilometers

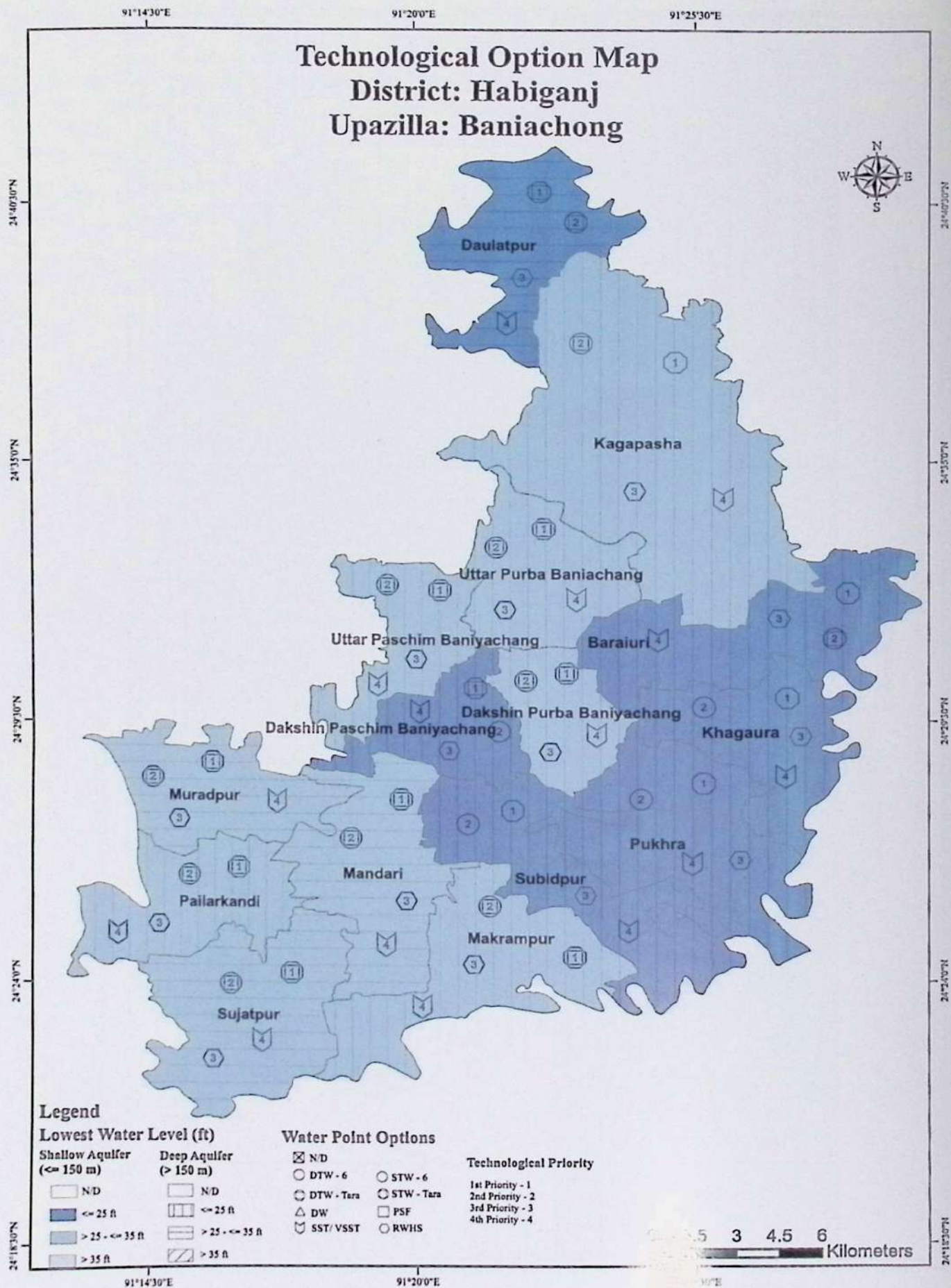
Table for mapping union wise Water Supply Technology

Baniachong, Habiganj

SL	District	Upazila	Union	5		6		7		8		9		10			Average Depth of Water point, ft	CI Problem (>1000ppm) (% of DPHE TW) of DPHE TW	Fe Problem (>5ppm) (% of DPHE TW)	As Contamination Status (> 50ppb) (% of affected DPHE Water Points installed during 2006-12)	As contamination Status (% of Contaminated TW as per NAMIIC, BAMWSP 2003)	Recommended Priority Options	Remark
				STW	DTW	STW	DTW	STW	DTW	STW	DTW	STW	DTW	DW									
1	2	3	4	11																			
1	Habiganj	Baniachong	Uttar Purba Baniachang	31	25	36	0	33.33	20	10	0	0	0	150	750	N/D	DTW - Tara	STW - Tara	RWHS	SST/VSST			
2			Uttar Paschim Baniyachang	31	23	18	0	0	20	10	0	0	0	180	740	N/D	DTW - Tara	STW - Tara	RWHS	SST/VSST			
3			Dakshin Purba Baniyachang	31	24	37	0	0	30	10	0	0	0	200	750	N/D	DTW - Tara	STW - Tara	RWHS	SST/VSST			
4			Dakshin Paschim Baniyachang	20	24	21	0	0	20	10	0	0	0	160	750	N/D	DTW - Tara	STW - Tara	RWHS	SST/VSST			
5			Daulatpur	23	29	8	0	0	30	10	0	0	0	200	750	N/D	DTW - Tara	STW - Tara	RWHS	SST/VSST			
6			Kagapasha	28	20	15	0	0	40	10	0	0	0	150	730	N/D	DTW - Tara	STW - Tara	RWHS	SST/VSST			
7			Baraluri	25	14	11	0	0	20	10	0	0	0	180	740	N/D	DTW - Tara	STW - Tara	RWHS	SST/VSST			
8			Khagaura	16	18	13	0	0	20	10	0	0	0	200	760	N/D	DTW - Tara	STW - Tara	RWHS	SST/VSST			
9			Pukhra	20	21	9	0	0	30	10	0	0	0	250	780	N/D	DTW - Tara	STW - Tara	RWHS	SST/VSST			
10			Subidpur	15	19	N/D	0	0	20	10	0	0	0	220	780	N/D	DTW - Tara	STW - Tara	RWHS	SST/VSST			
11			Makrampur	31	23	14	0	0	40	10	0	0	0	200	750	N/D	DTW - Tara	STW - Tara	RWHS	SST/VSST			
12			Sujatpur	30	31	1	0	0	20	10	0	0	0	150	730	N/D	DTW - Tara	STW - Tara	RWHS	SST/VSST			
13			Mandari	32	29	3	0	0	20	10	0	0	0	160	740	N/D	DTW - Tara	STW - Tara	RWHS	SST/VSST			
14			Muradpur	27	27	9	0	0	30	10	0	0	0	240	760	N/D	DTW - Tara	STW - Tara	RWHS	SST/VSST			
15			Pallarkandi	29	23	11	0	0	20	10	0	0	0	250	780	N/D	DTW - Tara	STW - Tara	RWHS	SST/VSST			

Note: Iron and Chloride contamination derived based on people's perception, 2014

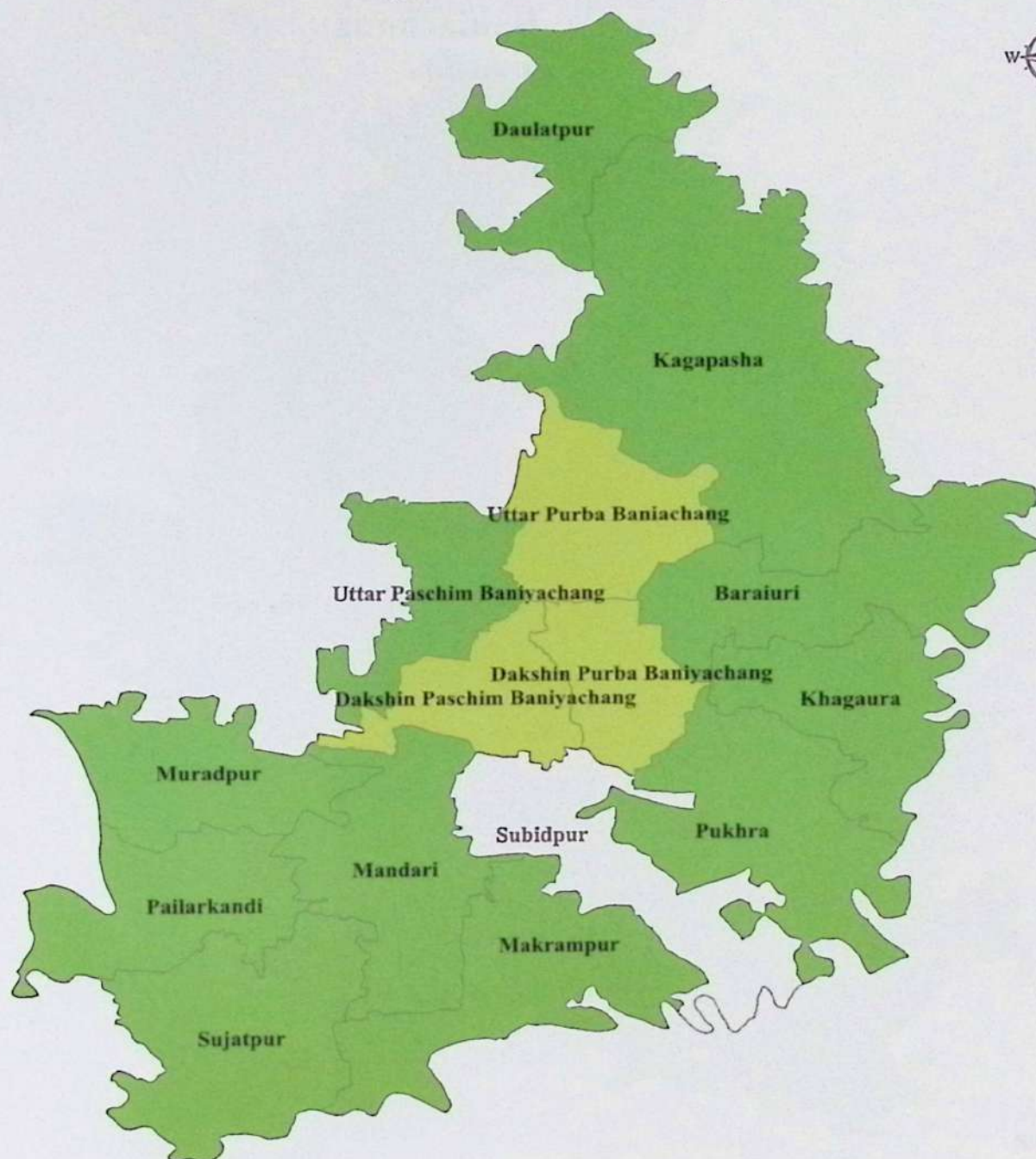
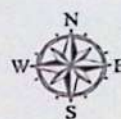
N/D = No Data



Arsenic Contamination Map - 1

District: Habiganj

Upazilla: Baniachong



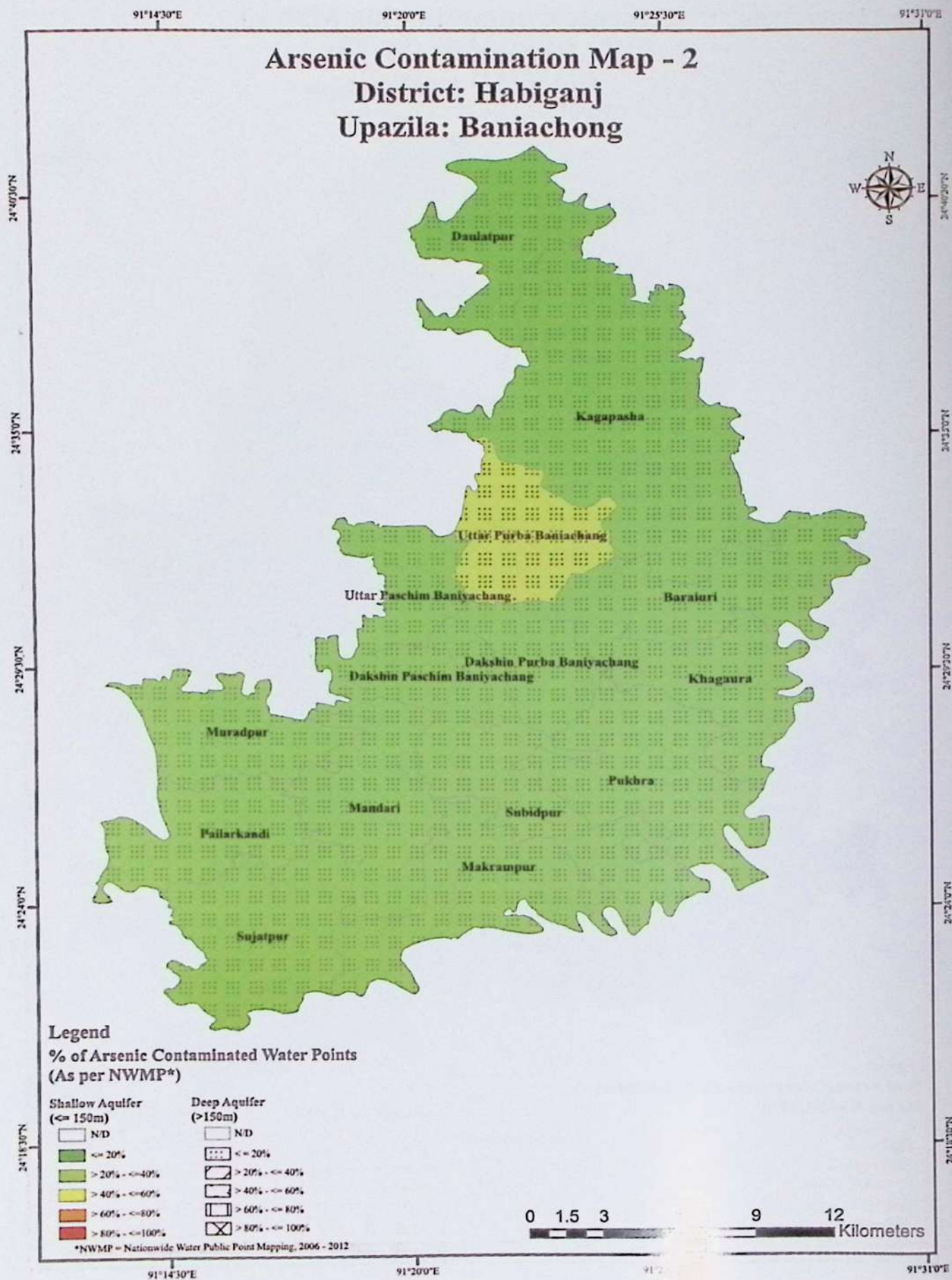
Legend

% of Arsenic Contaminated Water Points
(As per BAMWSP*)

- N/D
- <= 20%
- > 20% - <= 40%
- > 40% - <= 60%
- > 60% - <= 80%
- > 80% - <= 100%

*BAMWSP = Bangladesh Arsenic Mitigation Water Supply Project, 2003

0 1.5 3 6 9 12 Kilometers



91°14'30"E

91°20'0"E

91°25'30"E

Chloride Concentration Map

District: Habiganj

Upazila: Baniachong



24°03'0"N

24°03'0"N

24°15'0"N

24°15'0"N

24°29'0"N

24°29'0"N

24°24'0"N

24°24'0"N

24°18'30"N

24°18'30"N

Legend

% of Chloride Contamination

Shallow Aquifer
(≤ 150m)

Deep Aquifer
(> 150m)



0 1.5 3 6 9 12 Kilometers

91°14'30"E

91°20'0"E

91°25'30"E

Table for mapping union wise Water Supply Technology

Chunarughat, Habiganj

SL	District	Upazila	Union	Lowest Water Table of the Union in the year 2017, ft	As contamination Status (% of Contaminated TW as per NAMIC, BAMIWSP 2003)	As Contamination Status (> 50ppb) (% of affected DPHE Water Points installed during 2006-12)	Fe Problem (> 5ppm) (% of DPHE TW)	Cl Problem (>1000ppm) (% of DPHE TW)	Average Depth of Water point, ft				Recommended Priority Options*				Remark								
									5		6		7		8			9		10		11			
									STW	DTW	STW	DTW	STW	DTW	STW	DTW		STW	DTW	STW	DTW	1	2	3	4
1	Habiganj	Chunarughat	Gazipur	43	5	N/D	0	0	50	50	0	0	250	700	55	DTW - 6	STW - Tara	DW	RWHS						
2			Ahmadabad	38	8	N/D	0	0	50	50	0	0	250	700	55	DTW - 6	STW - Tara	DW	RWHS						
3			Deorgachh	74	5	N/D	0	0	50	50	0	0	250	700	65	DTW - 6	STW - Tara	DW	RWHS						
4			Paik Para	41	10	N/D	0	9.09	50	50	0	0	250	700	50	DTW - 6	STW - Tara	DW	RWHS						
5			Sankhola	35	14	N/D	0	0	60	50	0	0	250	700	45	DTW - 6	STW - Tara	DW	RWHS						
6			Chunarughat	27	12	N/D	0	54.55	90	50	0	0	250	750	N/D	DTW - 6	STW - Tara	DW	RWHS						
			Ubahata	29	13	N/D	0	0	90	50	0	0	250	750	N/D	DTW - 6	STW - Tara	DW	RWHS						
			Shatiajuri	28	15	N/D	0	0	40	50	0	0	250	700	55	DTW - 6	DW	STW - Tara	RWHS						
9			Ranigaon	27	11	N/D	0	0	45	50	0	0	260	700	65	DTW - 6	STW - Tara	DW	RWHS						
10			Mirahi	32	6	N/D	0	0	60	45	0	0	270	730	60	DTW - 6	STW - Tara	DW	RWHS						

Note: Iron and Chloride contamination derived based on people's perception, 2014
N/D = No Data

91°25'30"E

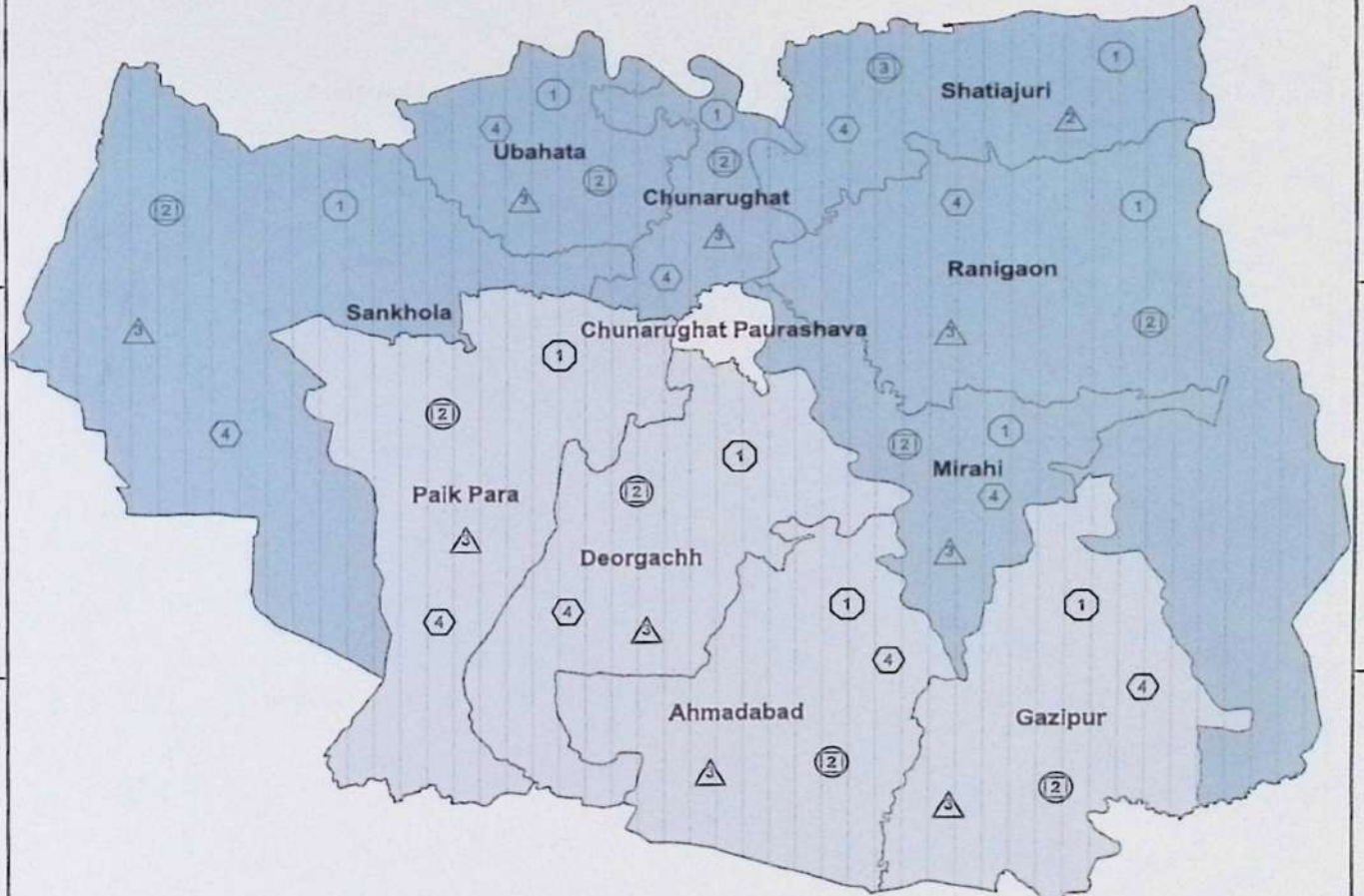
91°31'0"E

91°36'30"E

Technological Option Map

District: Habiganj

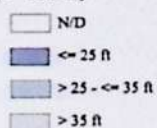
Upazilla: Chunarughat



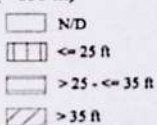
Legend

Lowest Water Level (ft)

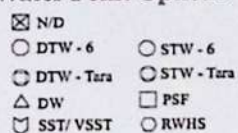
Shallow Aquifer
(≤ 150 m)



Deep Aquifer
(> 150 m)



Water Point Options



Technological Priority

- 1st Priority - 1
- 2nd Priority - 2
- 3rd Priority - 3
- 4th Priority - 4

0 0.75 1.5 3 4.5 6 Kilometers

91°25'30"E

91°31'0"E

91°36'30"E

Arsenic Contamination Map - 1

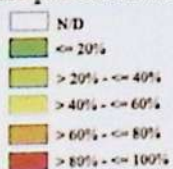
District: Habiganj

Upazilla: Chunarughat



Legend

% of Arsenic Contaminated Water Points (As per BAMWSP*)



*BAMWSP = Bangladesh Arsenic Mitigation Water Supply Project, 2003



91°25'30"E

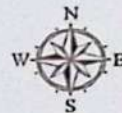
91°31'0"E

91°36'30"E

Arsenic Contamination Map - 2

District: Habiganj

Upazila: Chunarughat



Legend

% of Arsenic Contaminated Water Points
(As per NWMP*)

Shallow Aquifer
(≤ 150m)

- N/D
- ≤ 20%
- > 20% - ≤ 40%
- > 40% - ≤ 60%
- > 60% - ≤ 80%
- > 80% - ≤ 100%

Deep Aquifer
(> 150m)

- N/D
- ≤ 20%
- > 20% - ≤ 40%
- > 40% - ≤ 60%
- > 60% - ≤ 80%
- > 80% - ≤ 100%

0 1.25 2.5 5 7.5 10 Kilometers

*NWMP = Nationwide Water Public Point Mapping, 2006 - 2012

91°25'30"E

91°31'0"E

91°36'30"E

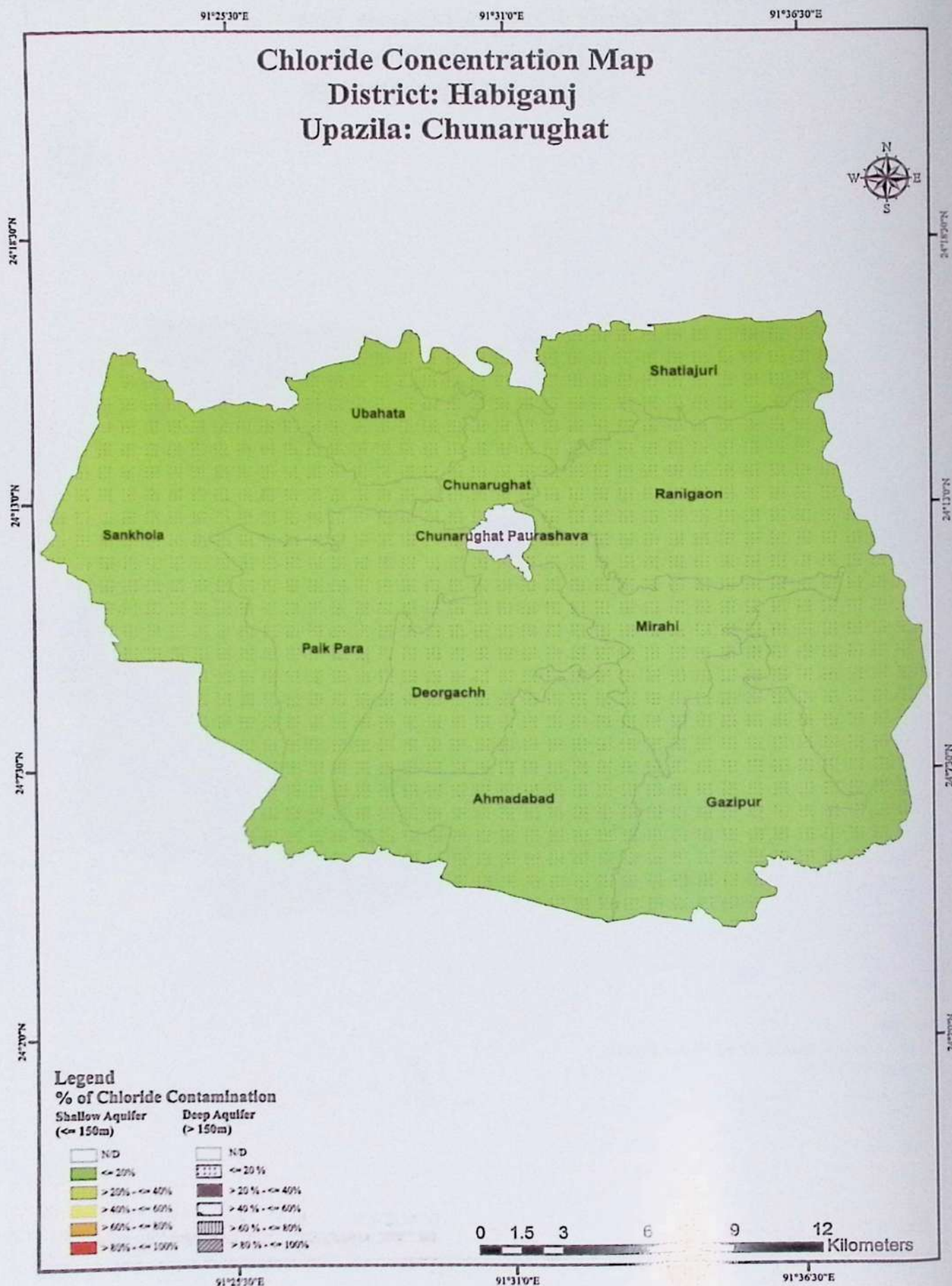


Table for mapping union wise Water Supply Technology

Habiganj Sadar, Habiganj

SL	District	Upazila	Union	5		6		7		8		9		10			Recommended Priority Options*	Remark			
				Lowest Water Table of the Union In the year 2017, ft		As contamination Status (% of Contaminated TW as per NAMIC, BANWSP 2003)		As Contamination Status (> 50ppb) (% of affected DPHE Water Points Installed during 2006-12)		Fe Problem (> 5ppm) (% of DPHE TW)		Cl Problem (>1000ppm) (% of DPHE TW)		Average Depth of Water point, ft							
				STW	DTW	STW	DTW	STW	DTW	STW	DTW	STW	DTW	STW	DTW	DW					
1	2	3	4	11													1	2	3	4	
1	Habiganj	Habiganj Sadar	Lukhra	15	9	N/D	N/D	0	0	N/D	20	0	0	250	750	N/D	DW	DTW - 6	SST/VSST	DW	RWHS
2			Richi	16	8	N/D	N/D	0	0	N/D	20	0	0	250	750	N/D	N/D	DTW - 6	SST/VSST	DW	RWHS
3			Tegharia	18	8	N/D	N/D	0	12.5	N/D	20	0	0	250	750	N/D	N/D	DTW - 6	SST/VSST	DW	RWHS
4			Poil	27	10	N/D	N/D	0	18.18	N/D	20	0	0	250	750	N/D	N/D	DTW - 6	SST/VSST	DW	RWHS
5			Gopaya	19	12	N/D	N/D	0	0	N/D	20	0	0	250	750	N/D	N/D	DTW - 6	SST/VSST	DW	RWHS
6			Razlura	28	14	N/D	N/D	0	0	N/D	20	0	0	250	750	N/D	N/D	DTW - 6	SST/VSST	DW	RWHS
7			Nurpur	37	15	N/D	N/D	0	0	N/D	20	0	0	250	750	N/D	N/D	DTW - 6	SST/VSST	DW	RWHS
8			Saistaganj	33	13	N/D	N/D	0	0	N/D	20	0	0	250	750	N/D	N/D	DTW - 6	SST/VSST	DW	RWHS
9			Nizampur	31	13	N/D	N/D	0	0	N/D	20	0	0	250	750	N/D	N/D	DTW - 6	SST/VSST	DW	RWHS
10			Laskarpur	29	13	N/D	N/D	0	8.33	N/D	20	0	0	250	750	N/D	N/D	DTW - 6	SST/VSST	DW	RWHS

Note: Iron and Chloride contamination derived based on people's perception, 2014

N/D = No Data

91°20'0"E

91°25'30"E

Technological Option Map

District: Habiganj

Upazilla: Habiganj Sadar



24°24'0"N

24°24'0"N

24°18'30"N

24°18'30"N

24°13'0"N

24°13'0"N

Legend

Lowest Water Level (ft)

Shallow Aquifer
(≤ 150 m)

- N/D
- ≤ 25 ft
- > 25 - ≤ 35 ft
- > 35 ft

Deep Aquifer
(> 150 m)

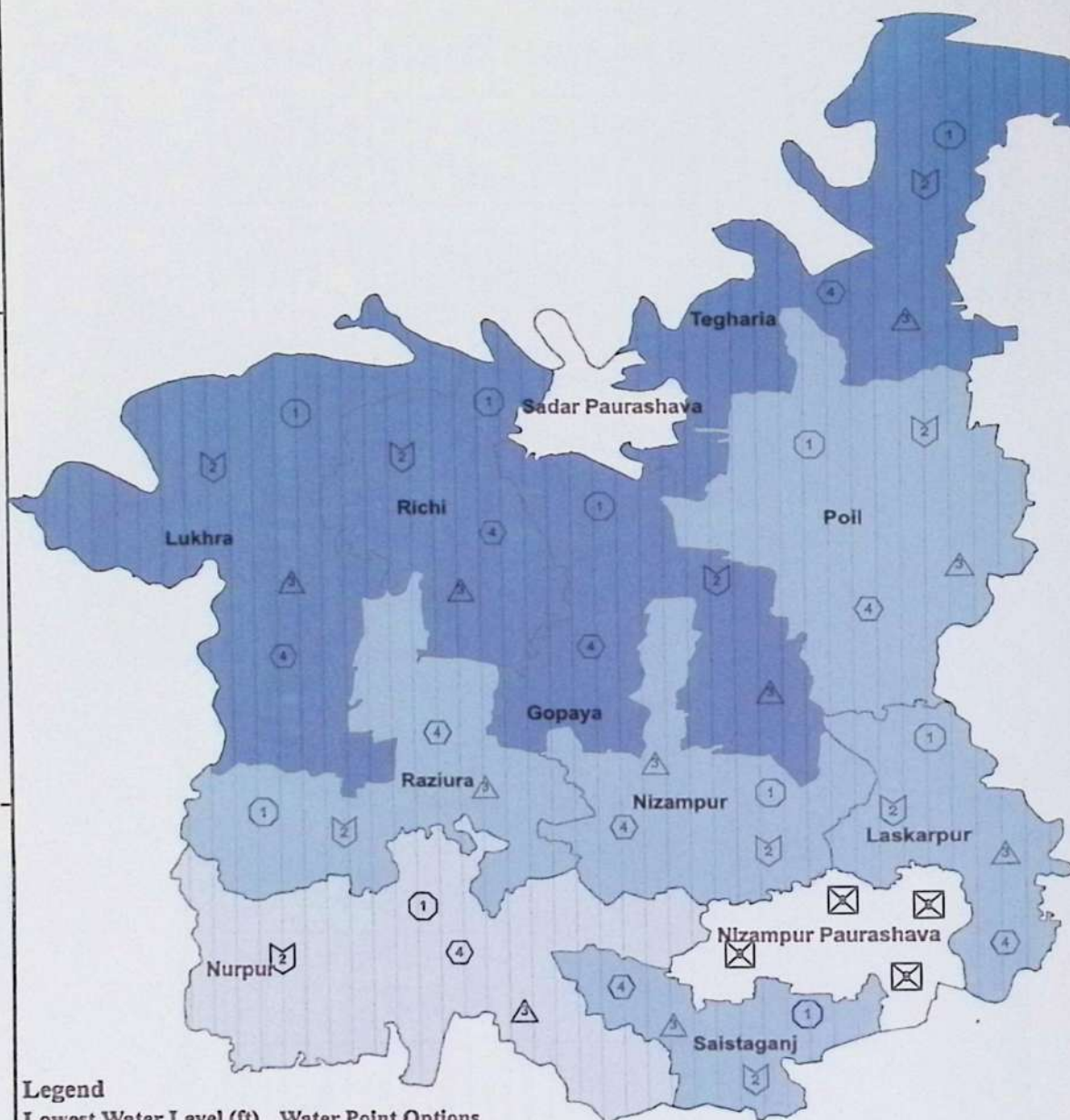
- N/D
- ≤ 25 ft
- > 25 - ≤ 35 ft
- > 35 ft

Water Point Options

- N/D
- DTW - 6
- DTW - Tara
- △ DW
- SST/VSST
- STW - 6
- STW - Tara
- PSF
- RWHS

Technological Priority

- 1st Priority - 1
- 2nd Priority - 2
- 3rd Priority - 3
- 4th Priority - 4



0 1 2 3 4 Kilometers

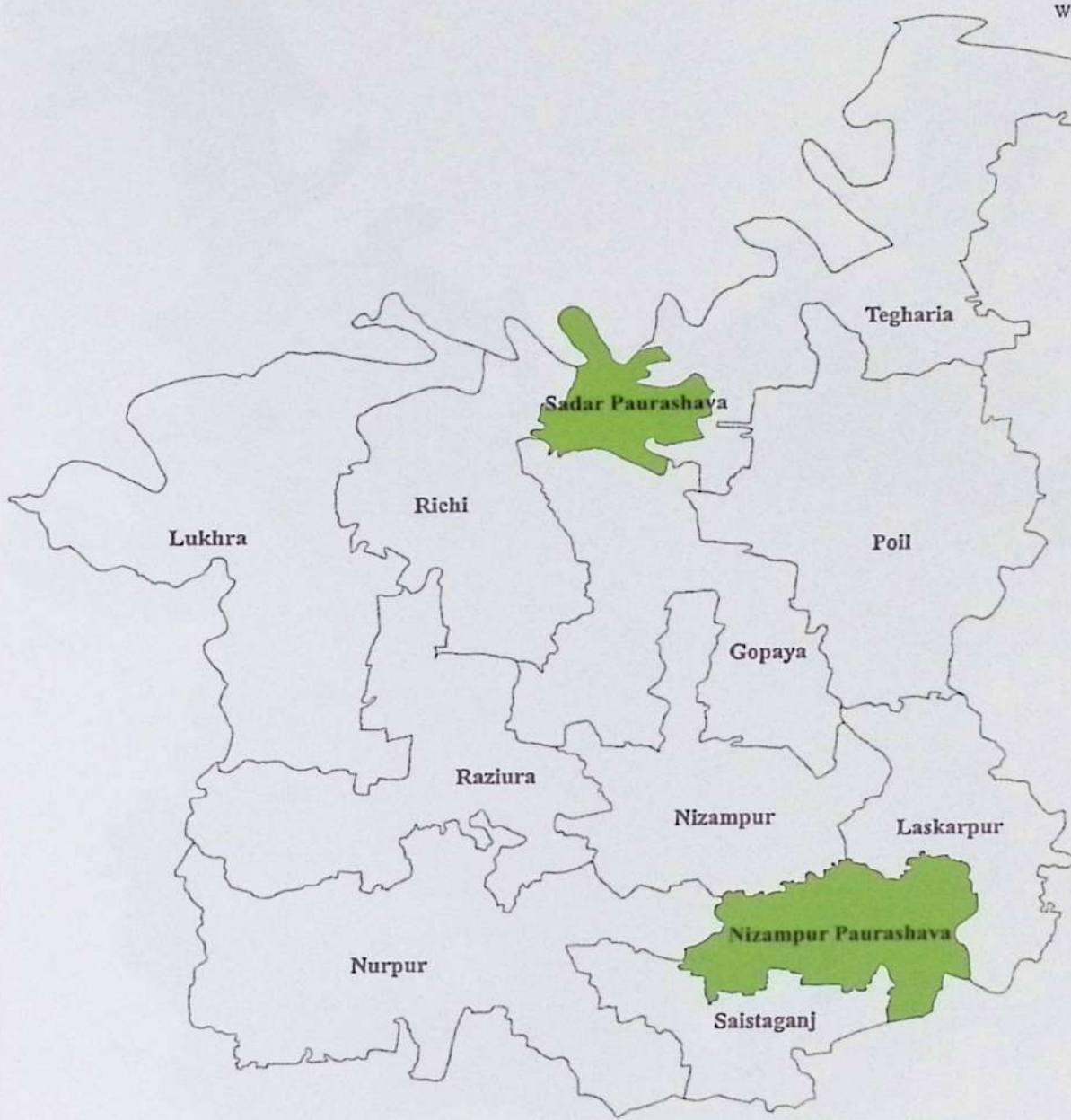
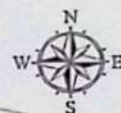
91°20'0"E

91°25'30"E

Arsenic Contamination Map - 1

District: Habiganj

Upazilla: Habiganj Sadar



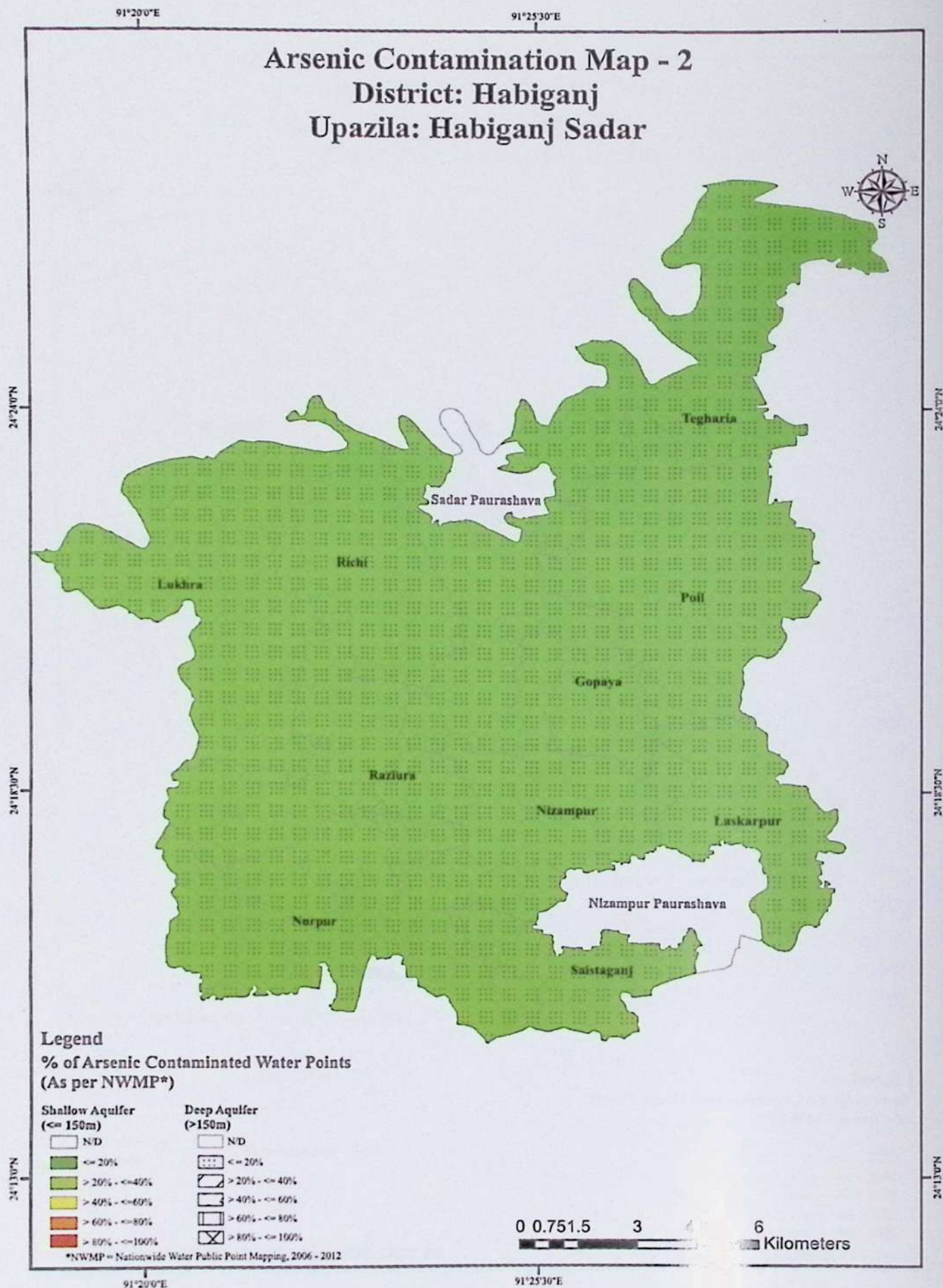
Legend

% of Arsenic Contaminated Water Points
(As per BAMWSP*)

- N/D
- <= 20%
- > 20% - <= 40%
- > 40% - <= 60%
- > 60% - <= 80%
- > 80% - <= 100%

0 1 2 4 6 8 Kilometers

*BAMWSP = Bangladesh Arsenic Mitigation Water Supply Project, 2003



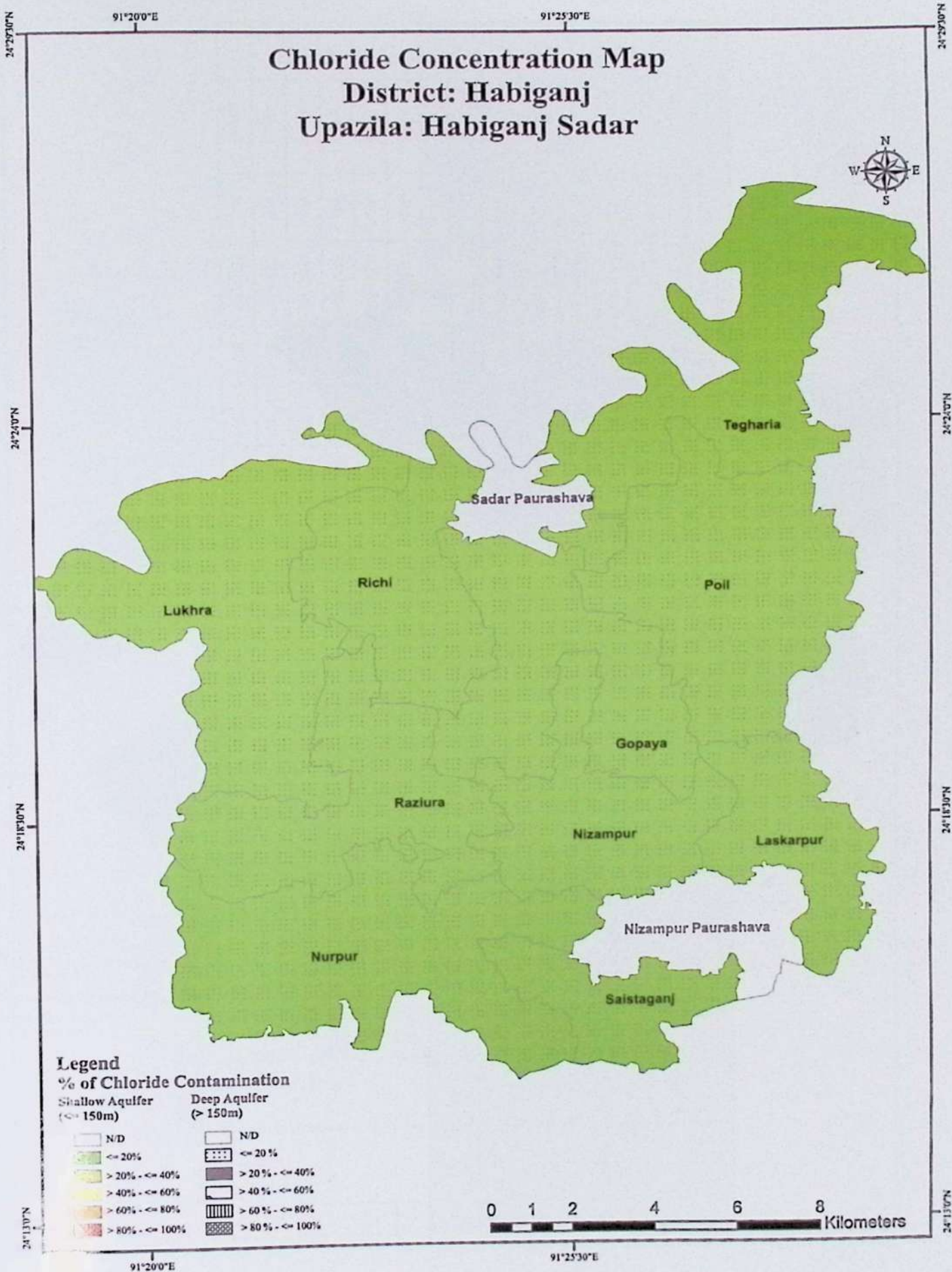


Table for mapping union wise Water Supply Technology

Lakhai, Habiganj

SL	District	Upazila	Union	5		6		7		8		9		10			11				Remark
				Lowest Water Table of the Union in the year 2017, ft		As contamination Status (% of Contaminated TW as per NAMIC, BAMWSP 2003)		As Contamination Status (> 50ppb) (% of affected DPHE Water Points installed during 2006-12)		Fe Problem (> 5ppm) (% of DPHE TW)		Cl Problem (> 1000ppm) (% of DPHE TW)		STW	DTW	Average Depth of Water point, ft	1	2	3	4	
				STW	DTW	STW	DTW	STW	DTW	STW	DTW	STW	DTW	STW	DTW	DTW	DTW - Tara	SST/VSST	DW	RWHS	
1	Habiganj	Lakhai	Lakhai	22	32	N/D	0	0	20	0	0	0	0	235	725	N/D	DTW - Tara	SST/VSST	DW	RWHS	
2			Murakari	21.5	18.5	N/D	0	0	20	0	0	0	0	235	725	N/D	DTW - 6	SST/VSST	DW	RWHS	
3			Muriauk	24	18	N/D	0	7.69	25	0	0	0	0	235	725	N/D	DTW - Tara	SST/VSST	DW	RWHS	
4			Bamai	22.5	18.5	N/D	0	0	20	0	0	0	0	235	725	N/D	DTW - 6	SST/VSST	DW	RWHS	
5			Karab	22.5	8.81	N/D	0	0	20	0	0	0	0	235	725	N/D	DTW - 6	SST/VSST	DW	RWHS	
			Bulla	23	19	N/D	0	0	20	0	0	0	0	235	725	N/D	DTW - 6	SST/VSST	DW	RWHS	

As and Chloride contamination derived based on people's perception, 2014

N/D = No Data

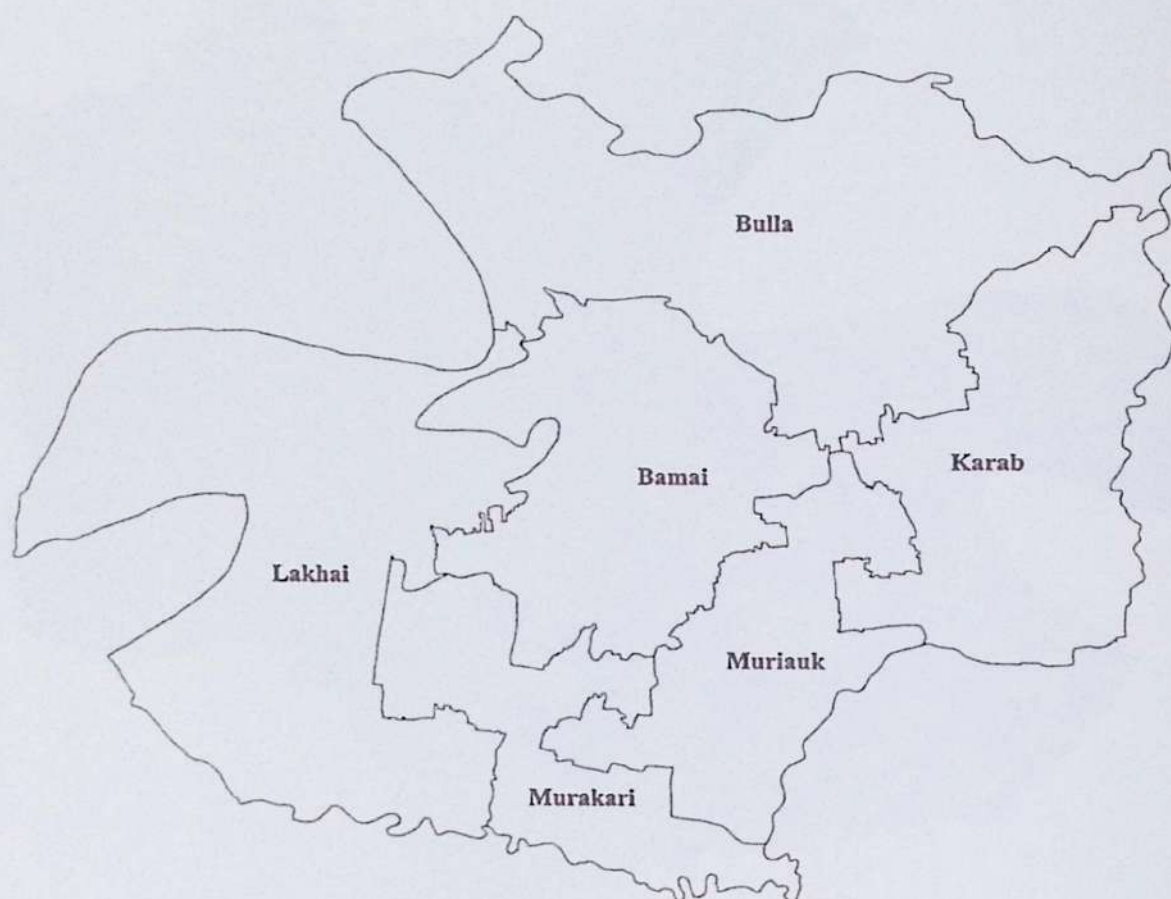
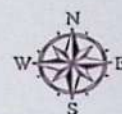
91°20'0"E



Arsenic Contamination Map - 1

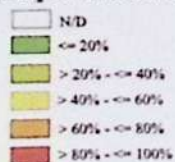
District: Habiganj

Upazilla: Lakhai



Legend

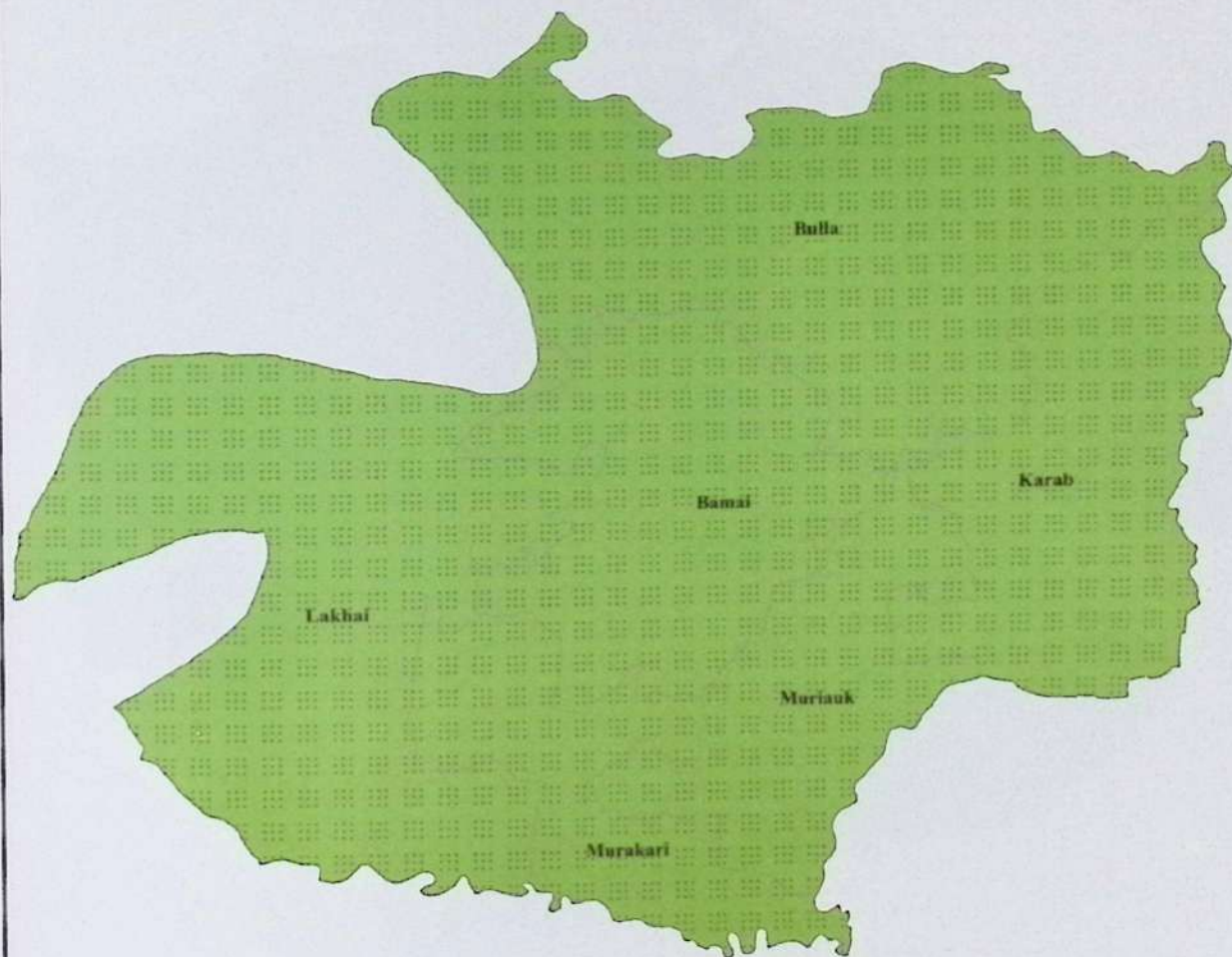
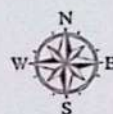
% of Arsenic Contaminated Water Points
(As per BAMWSP*)



*BAMWSP = Bangladesh Arsenic Mitigation Water Supply Project, 2003



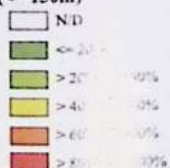
Arsenic Contamination Map - 2 **District: Habiganj** **Upazila: Lakhai**



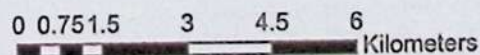
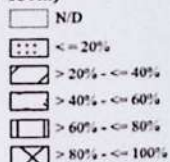
Legend

**% of Arsenic Contaminated Water Points
 (As per NWMP*)**

**Shallow Aquifer
 (<= 150m)**



**Deep Aquifer
 (>150m)**



*NWMP = National Wide Water Public Point Mapping, 2006 - 2012

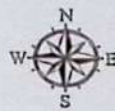
91°14'30"E

91°20'0"E

Chloride Concentration Map

District: Habiganj

Upazila: Lakhai



24°2'0"N

24°13'0"N

24°13'0"N

24°2'0"N

24°13'0"N

24°13'0"N

Bulia

Bamai

Karab

Lakhai

Muriauk

Murakari

Legend

% of Chloride Contamination

Shallow Aquifer
(≤ 150m)Deep Aquifer
(> 150m)

N/D

N/D

<= 20%

<= 20 %

> 20% - <= 40%

> 20 % - <= 40%

> 40% - <= 60%

> 40 % - <= 60%

> 60% - <= 80%

> 60 % - <= 80%

> 80% - <= 100%

> 80 % - <= 100%

0

1

2

4

6

8

Kilometers

91°14'30"E

91°20'0"E

Table for mapping union wise Water Supply Technology

Madhabpur, Habiganj

Sl.	District	Upazila	Union	5		6		7		8		9		10		11				Remark
				STW	DTW	STW	DTW	STW	DTW	STW	DTW	STW	DTW	STW	DTW	STW	DTW	1	2	
1			Dharmagar	28.5	19.5	N/D	0	0	0	60	40	0	0	150	620	40	DTW - 6	STW - Tara	DW	PSF
2				28.5	20.5	N/D	0	15.79	0	60	40	0	0	160	620	40	DTW - 6	STW - Tara	DW	PSF
3				30	17	N/D	0	20	0	60	40	0	0	225	630	40	DTW - 6	STW - Tara	DW	PSF
4				24	16	N/D	0	0	50	30	0	0	220	610	N/D	DTW - 6	STW - Tara	DW	PSF	
5				34	16.5	N/D	0	0	50	30	0	0	275	620	N/D	DTW - 6	STW - Tara	DW	PSF	
6	Habiganj	Madhabpur	Shahjahanpur	30	15.5	N/D	0	0	10	20	0	0	275	645	50	DTW - 6	STW - Tara	DW	PSF	
7			Jagadishpur	33	15	N/D	0	0	0	20	40	0	0	275	640	N/D	DTW - 6	STW - Tara	DW	PSF
8			Bulla	35	20	N/D	0	0	0	20	10	0	0	275	630	N/D	DTW - 6	STW - Tara	DW	PSF
9			Noapara	31	16	N/D	0	0	40	50	0	0	215	640	N/D	DTW - 6	STW - Tara	DW	PSF	
10			Chhatlain	30.5	20	N/D	0	0	20	30	0	0	205	650	40	DTW - 6	STW - Tara	DW	PSF	
11			Bagatura	29.5	18.5	N/D	0	0	10	20	0	0	210	640	N/D	DTW - 6	STW - Tara	DW	PSF	

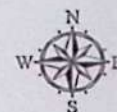
Note: Iron and Chloride contamination derived based on people's perception, 2014

N/D = No Data

Technological Option Map

District: Habiganj

Upazilla: Madhabpur



24°13'0"N

24°13'0"N

24°7'30"N

24°7'30"N

24°2'0"N

24°2'0"N

Legend

Lowest Water Level (ft)

Shallow Aquifer (<= 150 m)

- N/D
- <= 25 ft
- > 25 - <= 35 ft
- > 35 ft

Deep Aquifer (> 150 m)

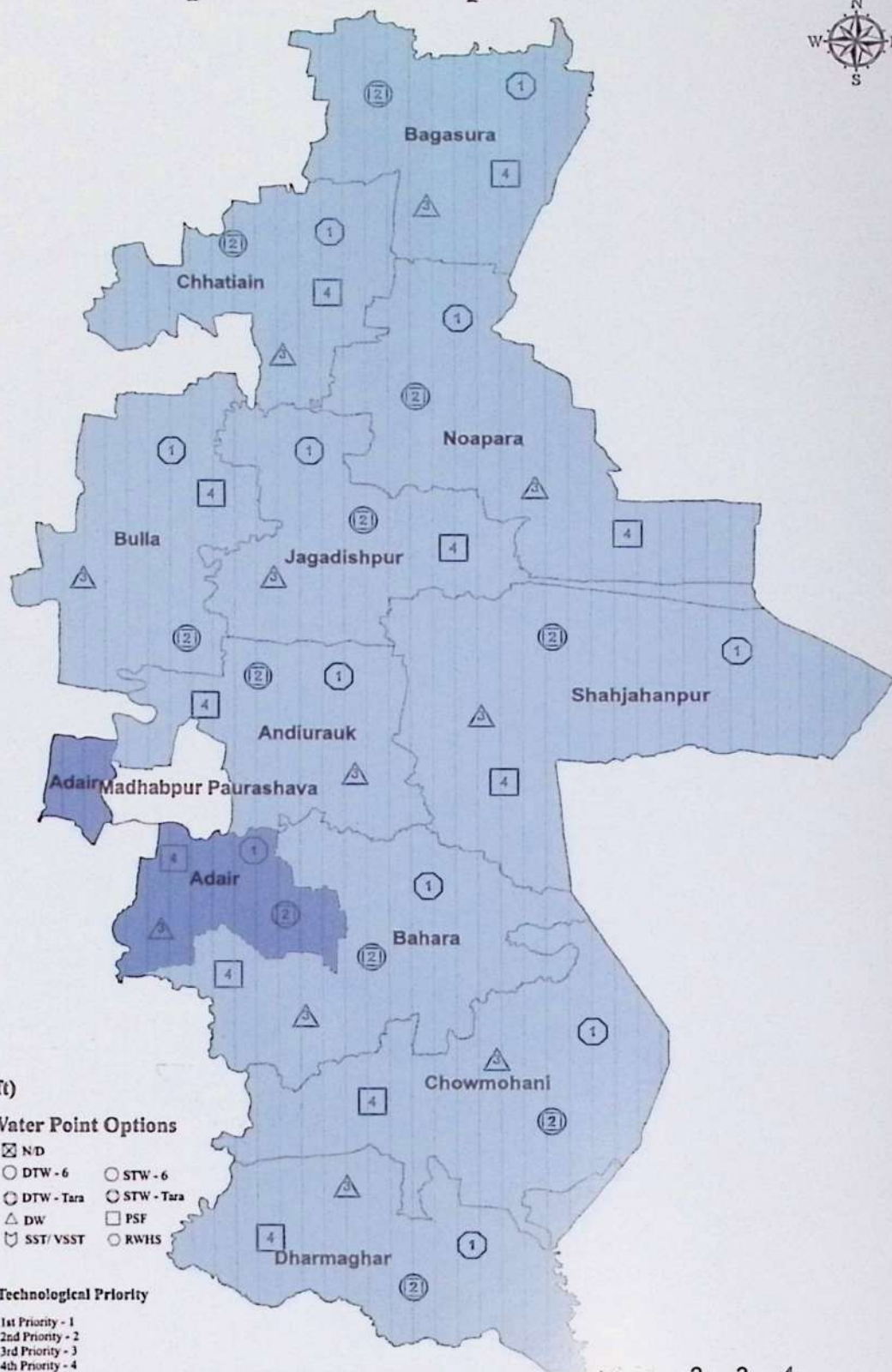
- N/D
- <= 25 ft
- > 25 - <= 35 ft
- > 35 ft

Water Point Options

- ND
- DTW - 6
- DTW - Tara
- DW
- SST/VSST
- STW - 6
- STW - Tara
- PSF
- RWHS

Technological Priority

- 1st Priority - 1
- 2nd Priority - 2
- 3rd Priority - 3
- 4th Priority - 4



Arsenic Contamination Map - 1

District: Habiganj

Upazilla: Madhabpur

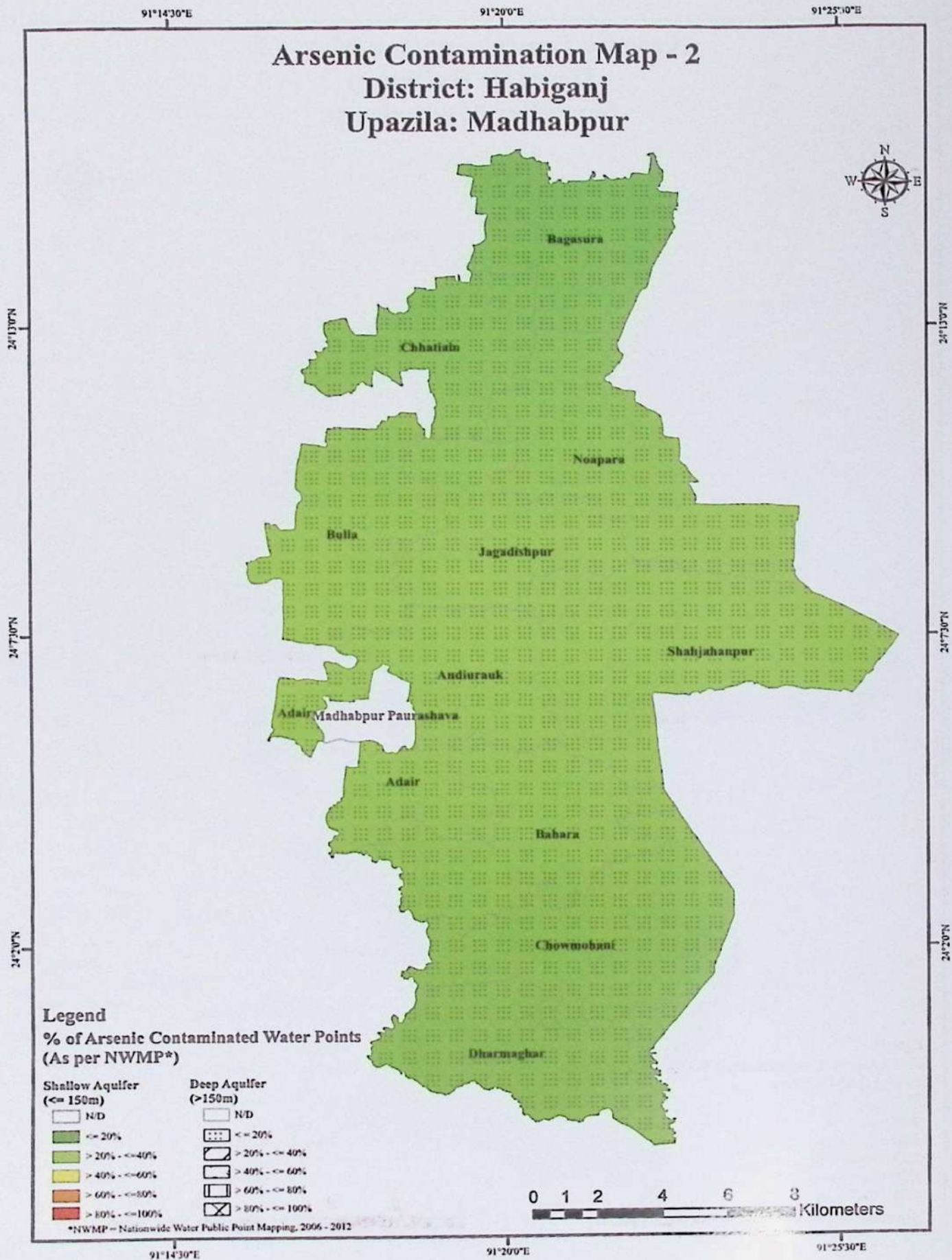


Legend
 % of Arsenic Contaminated Water Points
 (As per BAMWSP*)

- N/D
- <= 20%
- > 20% - <= 40%
- > 40% - <= 60%
- > 60% - <= 80%
- > 80% - <= 100%

0 1 2 4 6 8 Kilometers

*BAMWSP = Bangladesh Arsenic Mitigation Water Supply Project, 2003



91°14'30"E

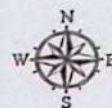
91°20'0"E

91°25'30"E

Chloride Concentration Map

District: Habiganj

Upazila: Madhabpur

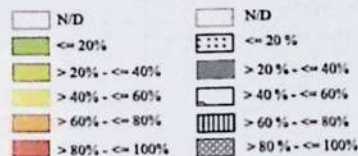


Legend

% of Chloride Contamination

Shallow Aquifer
($\leq 150\text{m}$)

Deep Aquifer
($> 150\text{m}$)



0 1.25 2.5 5 7.5 10 Kilometers

91°14'30"E

91°20'0"E

91°25'30"E

Table for mapping union wise Water Supply Technology

Nabiganj, Habiganj

Sl.	District	Upazila	Union	5		6		7		8		9		10		11				Remark			
				STW	DTW	STW	DTW	STW	DTW	STW	DTW	STW	DTW	STW	DTW	1	2	3	4				
1	Habiganj	Nabiganj	Purba Bara Bakhair	23	18	N/D	N/D	100	25	20	5	0	0	N/D	N/D	N/D	DTW - 6	RWHS	PSF	SST/VSST			
1			Paschim Bara Bhakhair	23	18	N/D	N/D	3.85	0	20	5	0	0	0	245	750	70	DTW - 6	RWHS	PSF	SST/VSST		
2			Inathganj	21.5	17.5	N/D	N/D	0	16.67	10	5	0	0	0	245	750	70	STW - 6	DTW - 6	RWHS	DW		
3			Dighalbak	24	19.5	N/D	N/D	0	27.27	25	5	0	0	0	245	750	70	STW - Tara	DTW - 6	RWHS	DW		
4			Auskandi	21.5	18	N/D	N/D	0	0	25	5	0	0	0	245	750	70	DTW - 6	RWHS	PSF	RWHS		
5			Kurshi	23	18	N/D	N/D	6.25	12.5	25	5	0	0	0	0	245	750	70	DTW - 6	RWHS	PSF	RWHS	
6			Kargaon	28	25	N/D	N/D	14.29	0	25	5	0	0	0	0	245	750	70	DTW - Tara	RWHS	PSF	RWHS	
7			Nabiganj	27.5	24	N/D	N/D	0	18.18	25	5	0	0	0	0	245	750	70	DTW - Tara	RWHS	PSF	RWHS	
8			Bausha	24	16	N/D	N/D	0	0	25	5	0	0	0	0	245	750	70	DTW - 6	RWHS	PSF	RWHS	
9			Debpura	19	14	N/D	N/D	0	12.5	25	5	0	0	0	0	245	750	70	DTW - 6	DW	SST/VSST	RWHS	
10			Gaznapur	16	15	N/D	N/D	0	0	25	5	0	0	0	0	245	750	70	DTW - 6	DW	SST/VSST	RWHS	
11			Kalair Banga	27.5	24.5	N/D	N/D	0	0	20	5	0	0	0	0	245	750	70	DTW - Tara	RWHS	PSF	SST/VSST	
12			Paniunda	19.5	18	N/D	N/D	0	0	20	5	0	0	0	0	245	750	70	DTW - 6	DW	SST/VSST	RWHS	

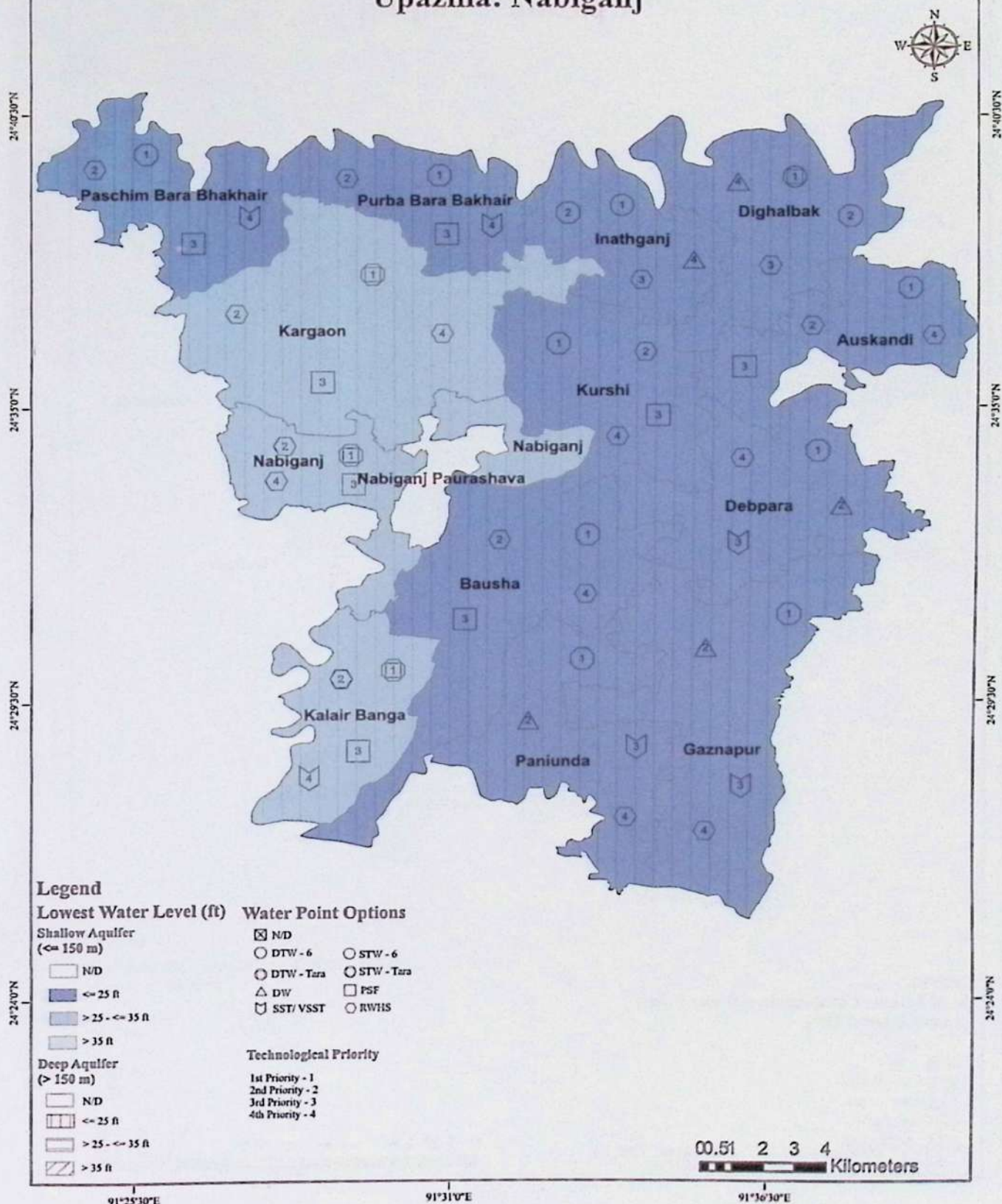
Note: Iron and Chloride contamination derived based on people's perception, 2014

N/D = No Data

Technological Option Map

District: Habiganj

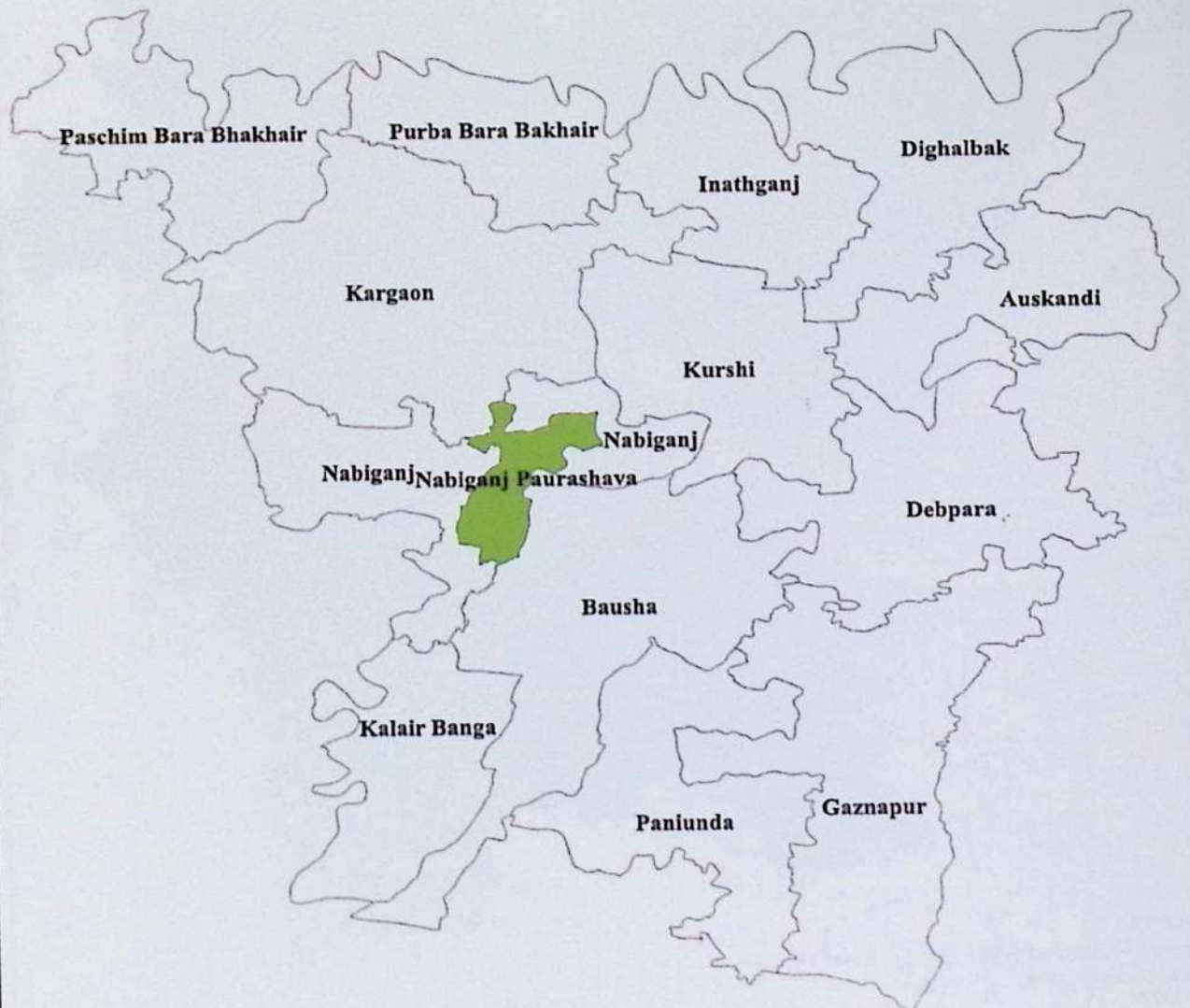
Upazilla: Nabiganj



Arsenic Contamination Map - 1

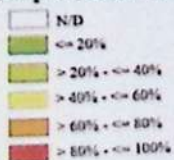
District: Habiganj

Upazilla: Nabiganj



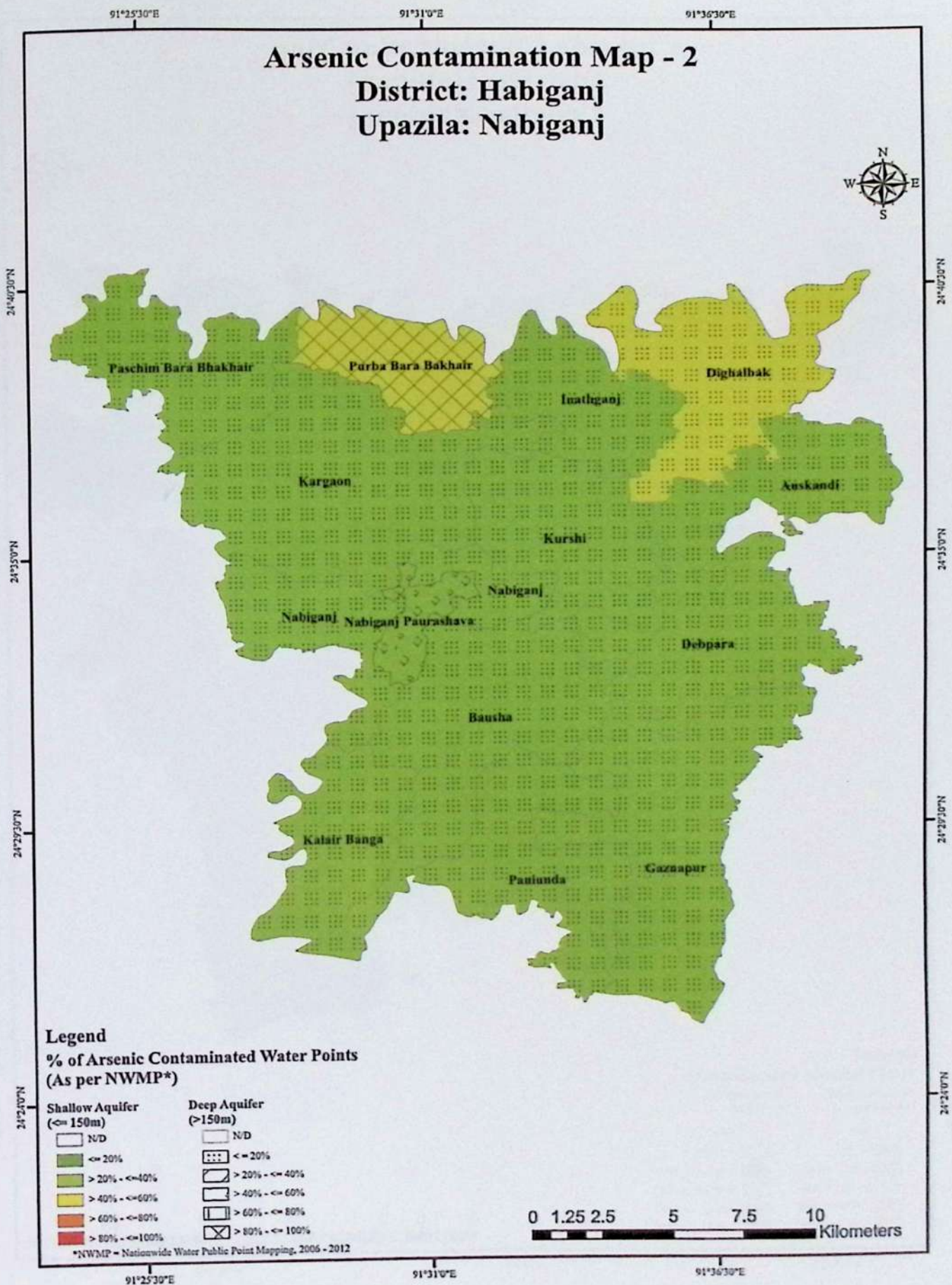
Legend

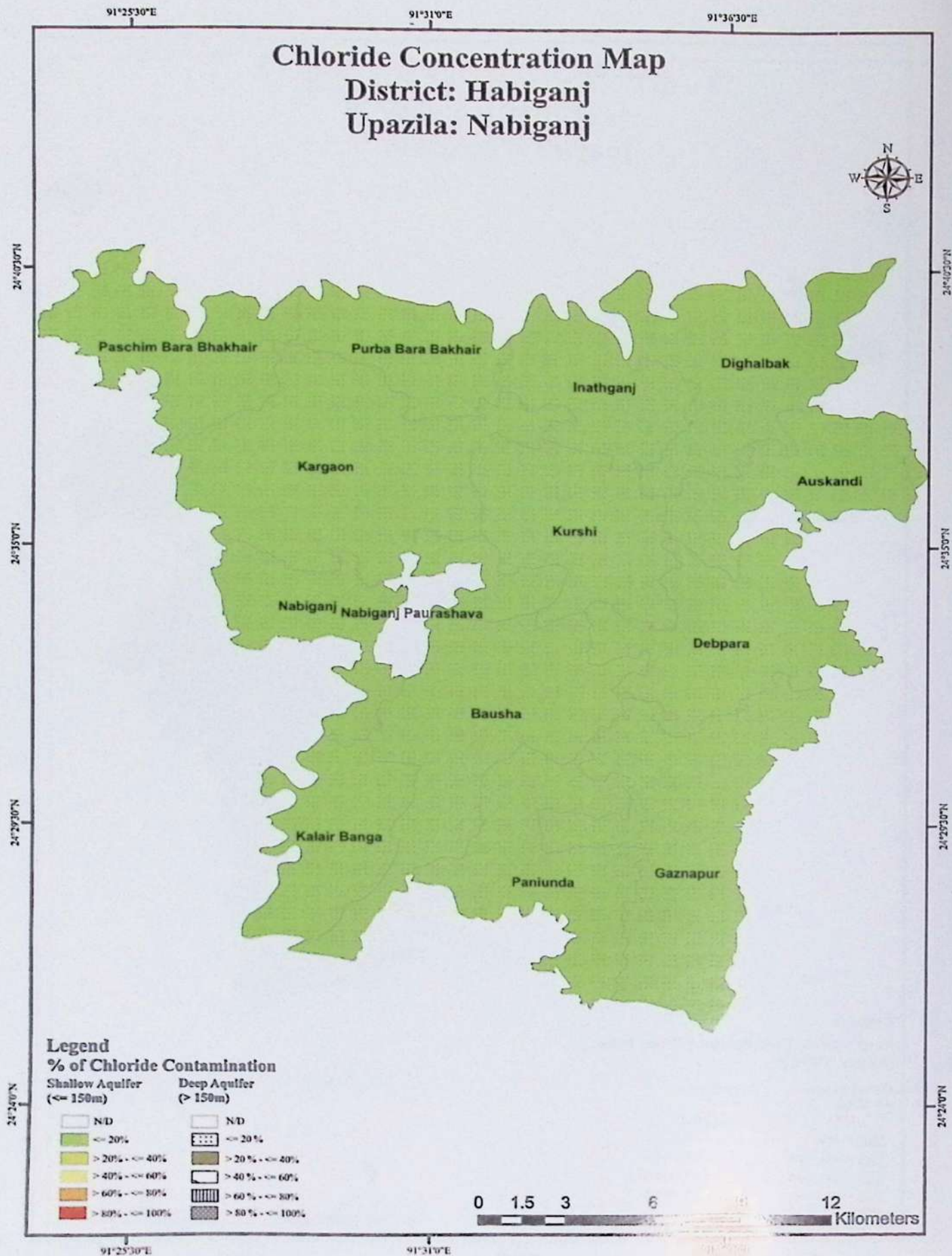
% of Arsenic Contaminated Water Points (As per BAMWSP*)

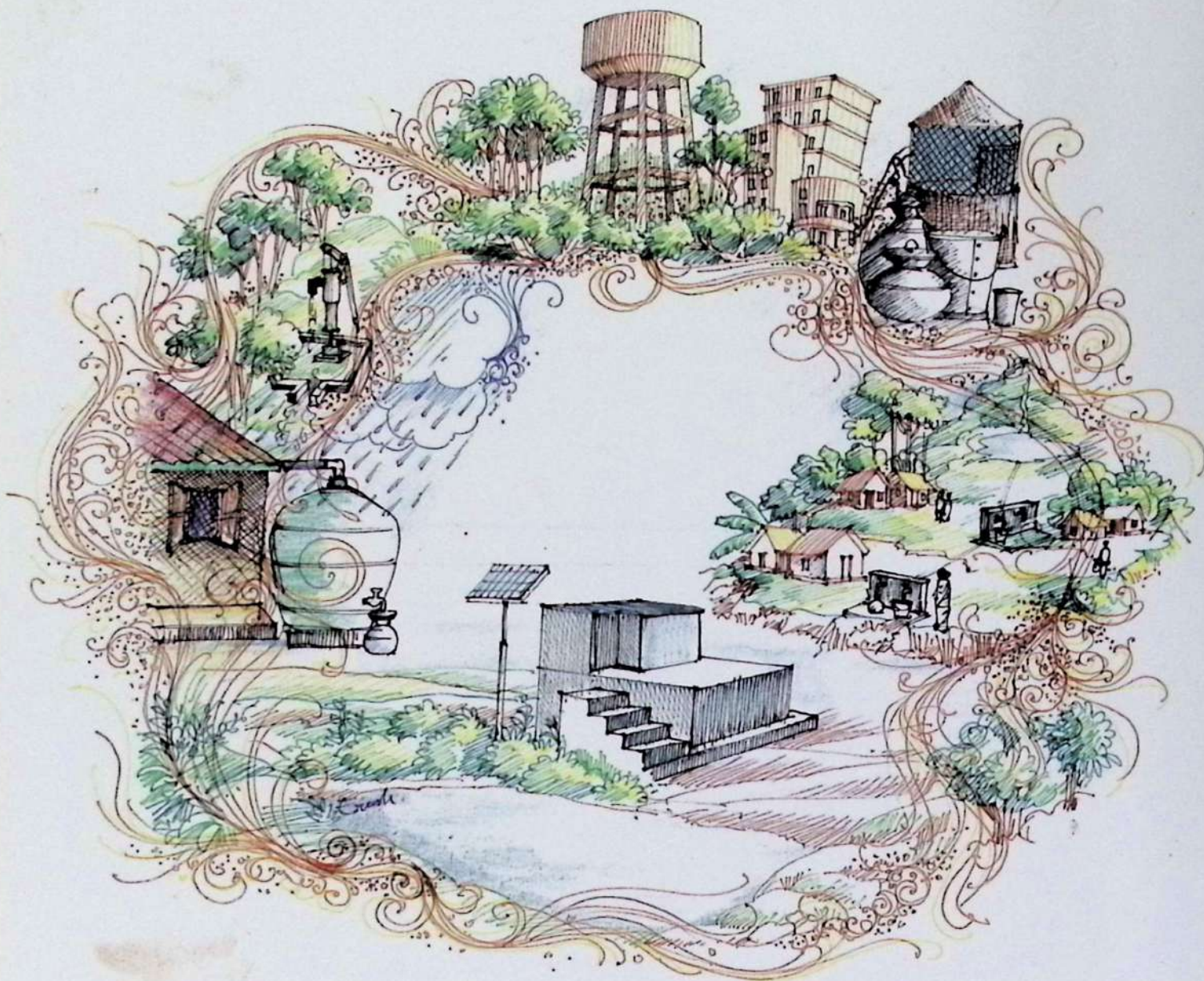


*BAMWSP - Bangladesh Arsenic Mitigation Water Supply Project, 2003

0 1.25 2.5 5 7.5 10 Kilometers







Ground Water Circle
Department of Public Health Engineering