



**DISTRICT BROCHURE OF  
NORTH WEST DISTRICT, NCT DELHI**

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**NORH WEST DISTRICT AT A GLANCE**

<b>S.No.</b>	<b>ITEMS</b>	<b>STATISTICS</b>
<b>1.</b>	<b>GENERAL INFORMATION</b>	
	i. Geographical Area (Sq. Km.)	440
	ii. Administrative Divisions (as on 31.03.2011)	
	a) Number of Tehsils	3
	b) Number of Villages	85
	c) Number of Towns	3
	iii. Population (as on 2011 Census)	
	a) Total Population	36,51,261
	b) Population Density (persons/sq. km)	8,298
	c) No. of Households	7,30,034
	iv. Average Annual Rainfall (mm)	581 (Narela)
<b>2.</b>	<b>GEOMORPHOLOGY</b>	
	Major Physiographic Units	Yamuna Flood Plain Yamuna Alluvial Plain
	Major Drainage	Yamuna River
<b>3.</b>	<b>LAND USE (Sq. Km.)</b>	
	a) Forest area	16.49
	b) Water bodies	5.22
<b>4.</b>	<b>MAJOR SOIL TYPES</b>	Sand and clay
<b>5.</b>	<b>NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 31.3.2013)</b>	
	a) Number of Dugwells	4
	b) Number of Piezometers	28

6.	<b>NUMBER OF GROUND WATER EXTRACTION STRUCTURES</b>  a) Dugwells  b) Handpumps  c) Tubewells/borewells	1033  45234  30391
7.	<b>PREDOMINANT GEOLOGICAL FORMATIONS</b>	Quaternary Alluvium consisting mainly of fine sand, silt, clay with kankar
8.	<b>HYDROGEOLOGY &amp; AQUIFER GROUP</b>  Major water bearing formation  Pre-monsoon Depth to water level during May'2012  Post-monsoon Depth to water level during Nov'2012  Long term water level trend in 10 years (2003-2012) in m/yr	Alluvium  Sand and Kankar  2.23 to 16.32 mbgl  1.32 to 17.21 mbgl  Pre monsoon : Fall (Range 0.11 – 3.51) Post monsoon : Fall (Range 0.02 – 3.70)
9.	<b>GROUND WATER QUALITY</b>  Presence of Chemical constituents more than permissible limit (e.g. EC, F, Fe)  Type of water  Fresh/Saline Interface	EC (225-13340 $\mu$ S/cm at 25°C)  Iron :15 mg/l, Fluoride -15.3 mg/l  Na-Cl, Ca-Cl  22-70 m
10.	<b>DYNAMIC GROUND WATER RESOURCES (2011)- in MCM</b>  Annual Replenishable Ground Water Resources  Gross Annual Ground Water Draft  Stage of Ground Water Development  Number of OE Tehsils	86.31  90.15  112.36%  2

	No. of Semi Critical Tehsils	1
<b>11.</b>	<b>GROUND WATER CONTROL AND REGULATION</b>	The entire district has been notified by the Government of Delhi
<b>12.</b>	<b>GROUND WATER EXPLORATION BY CGWB (AS ON 31.3.2011)</b>  No. of wells drilled (EW, OW, PZ, SH, Total)  Depth range (m) drilled/constructed  Depth of Bedrock (m)  Discharge (liters per minute)	  EW-25, PZ-30, SH-2  52 - 350/ 24 – 178  Not Encountered  150-2816
<b>13.</b>	<b>MAJOR GROUND WATER PROBLEMS AND ISSUES</b>	Ground water in deeper zones is saline. Depletion of ground water levels is attributed to over exploitation of ground water. Higher Fluoride content at Rohini Sector-26 and higher Iron content at Palla.

**DISTRICT BROCHURE**  
**NORTH WEST DISTRICT, NCT DELHI**

**1.0 INTRODUCTION**

**1.1 ADMINISTRATIVE DETAILS**

North West District is bounded by the Yamuna River on the northeast and Ghaziabad District of Uttar Pradesh state across the Yamuna, by the North & West districts of Delhi on the east and south respectively, Jhajjar and Sonapat districts of Haryana state on the west and north respectively. The district has largest geographical area of 440 sq. km. It is the largest district in Delhi in terms of the area. The district is divided into three tehsils namely Saraswati Vihar, Narela and Model Town for administrative convenience.

The total population of the district is 36,51,261 as per the census, 2011, which is the highest in Delhi. average population density is 8,298 persons per Sq. Km.

**1.2 BASIN/SUB-BASIN:**

The district falls in Yamuna sub-basin and forms part of the Ganga basin. The entire district is covered by Yamuna River water shed.

**1.3 DRAINAGE:**

The river Yamuna bordering north east part of the district, controls the entire drainage system. The North West district is characterized by Western Yamuna Canal and prominent drainage systems like Mundka drain, Mungespur drain, Najafgarh drain and Budanpur drain. The Western Yamuna Canal running in the centre of the district divides the district into two parts forming an important feature of landscape.

**1.4 LAND USE:**

North-West Delhi has planned residential areas such as Ashok Vihar, Saraswati Vihar, Pitam Pura, Shalimar Bagh etc. Rohini Sub city, a residential project also lies in this district. The district also has planned industrial areas at Wazirpur, Lawerence Road, & Mangol Puri. The forest cover of the district is 16.49 Sq. Km. The protected forest area of Shalimar Bagh falls in this district. It is a historical garden of Mughal period. The area under water body in the district is 5.2 sq. km.

**1.5 STUDIES /ACTIVITES OF CGWB:**

Central Ground Water Board had covered the entire district under Systematic Hydrogeological Surveys. Based on the Re-appraisal Hydrogeological survey carried out in 1983-84, CGWB, NWR had brought out a consolidated report on Hydrogeological conditions and Ground Water Development Potential of Union Territory of Delhi in 1989. In 1996 and 2009, reports highlighting development and augmentation of Ground Water Resources of the State were published by CGWB. The Dynamic Ground Resources of the district have been estimated in 2011 for understanding of ground water scenario. CGWB, SUO Delhi is also carrying out water level and quality monitoring regularly from the existing National Hydrograph Network Stations. The district was covered under Ground Water Exploration by Central Ground Water Board (CGWB) in 1973. A total of 25 exploratory wells, 30 piezometers/ observation wells and 2 slim holes have been drilled in the district. Salient features of ground water exploration in the district are furnished in Table 1.

Table 1: Salient features of ground water exploration

Type of well	No.	Depth drilled (m)	Depth constructed (m)	SWL (m)	Discharge (lpm)	Drawdown (m)	Sp. Capacity (lpm/m)	T (m <sup>2</sup> /day)	S	EC (μS/cm at 25°C)
EW	25	52.5-350	26-55.5	1.32-11.77	160-1050	3.76-17.23	15.50-173	14.55-530	2.46*10 <sup>-4</sup> – 0.2*10 <sup>-3</sup>	532-31220
PZ/OW	30	70-253.58	24-178	1.25-11.05	150-2816	0.72-6.2	75-525	210-703	-	837-34800
Slim Hole	2	1973-1986	152.39-201.1	-	-	-	-	-	-	3986

## 2.0 RAINFALL & CLIMATE

### 2.1 RAINFALL:

The average annual rainfall of the district is 581 mm at Narela. About 81% of the annual rainfall is received during the monsoon months of July, August and September. The rest of the rainfall is received as winter rain and as thunderstorm rain in the pre and post monsoon months. The variation of rainfall from year to year is large. On an average, rain of 2.5 mm or more falls on 27 days in a year, of which, 19 days are during the monsoon months. Two to three days in June are rainy. In other months, except in November and in first half of December when it is practically rainless, rain falls on a day or two only in each month.

### 2.2 CLIMATE:

The climate of district is mainly influenced by its inland position and prevalence of air of the continental type during major part of the year. Extreme dryness with intensely hot summer and cold winter are characteristics of the climate. The cold season starts towards the latter half of November when both day and night temperatures drop rapidly with the advance of the season. January is the coldest month with the mean daily maximum temperature at 21.3°C and the mean daily minimum temperature at 7.3°C. May and June are the hottest months. In May and June, maximum temperature may sometimes reach 46 or 47°C.

## 3.0 GEOMORPHOLOGY & SOIL TYPES

### 3.1 GEOMORPHOLOGY:

North West district is under Yamuna Alluvial Plain and small part of the area is under Yamuna Flood Plain.

### 3.2 SOIL TYPES:

Major soil types of the district are sand and clay.

## **4.0 GROUND WATER SCENARIO**

### **4.1 GEOLOGY:**

The area is characterized by unconsolidated Quaternary alluvium deposits belonging to Middle to Late Pleistocene Age. The area comprises of silt, clay mixed with kankar in varying proportions.

### **4.2 HYDROGEOLOGY:**

#### **Water Bearing Formation:**

Hydrogeological map of North West district is presented in Plate 1. Subsurface geological cross sections of the district are presented in Plate 2. Thick pile of alluvium over the basement rock possesses alternate layers of sediments of varying nature. Nearly fine to medium sand and silt grade sediment are frequent up to the depth of 50 m along with buff coloured clayey bed admixed with coarse Kankars. On the other hand, after the depth of 50 m, silty –clay and clay (light yellow) beds with Kankars increase with depth. The semi-plastic and plastic clay beds are also common at deeper depths i.e. 80 to 250 m bgl. The granular zones (fine sand and silty –sand) at deeper depth are not as frequent as in the shallower depth.

#### **Depth to water level:**

Ground water monitoring wells established in the district are being monitored four times in a year. Pre-monsoon and post-monsoon water level data are collected during May and November months respectively. The pre monsoon water level in the district varies from 2.23 to 16.32 mbgl and post monsoon water level varies from 1.32 to 17.21 mbgl. Water levels are in the range of 5-10 m in major part of the district. Deeper water levels are observed in the northern part of the district (Plates 3 and 4).

#### **Seasonal Water level fluctuation:**

Seasonal water level fluctuation has been computed from the water level data obtained from the ground water observation wells monitored in the area during pre-monsoon and post-monsoon period. Fluctuation in water level is outcome of mainly the amount of rainfall received by the area and ground water withdrawal. The seasonal fluctuation in water level between pre and post monsoon shows rise in water level from 0.07 to 1.26 m and fall of 0.09 to 1.51 m.

#### **Long Term Water level trend:**

The long-term trend in depth to water level in the district over the last 10 years period shows

- i) a fall of 0.11 to 3.15 m during the pre-monsoon period and
- ii) a fall of 0.02 to 3.70 m during the post-monsoon period.

### **4.3 GROUND WATER RESOURCES:**

Tehsil wise ground water resources as estimated using GEC, 1997 methodology by CGWB as on 31.03.2011 are given in Table 2. Total annually replenishable ground water resources of the district have been assessed as 8630.7 ham, out of which net annual ground water availability has been assessed as 8023.771 ham. Total annual ground water draft for all uses has been estimated to be 9015.2 ham with overall stage of ground water development at 112.36%. Out of 3 tehsils, 1 tehsil is falling under semi critical category whereas 2 fall under over exploited category.



Table 2: Tehsil wise ground water resources of North West district (As on 2011)

S.No.	Tehsil	Annual ground water recharge (ham)	Net annual ground water availability (ham)	Existing annual gross ground water draft for irrigation (ham)	Existing annual gross ground water draft for domestic and industrial uses (ham)	Existing annual gross ground water draft for all uses (ham)	Stage of ground water development (%)	Category
1.	Model Town	528.63	475.767	70.45	777.47	847.92	178.22	Over-exploited
2.	Narela	5115.07	4859.3165	1972.67	1749.08	3721.75	76.59	Semi Critical
3.	Saraswati Vihar	2987	2688.687	1238.76	3206.77	4445.53	165.34	Over-exploited
	Total	8630.7	8023.771	3281.88	5733.32	9015.2	112.36	Over-exploited

#### 4.4 GROUND WATER QUALITY:

Salinity of water increases with depth and there is no fresh water aquifer at deeper depths. Maximum reported value of Iron is 15 mg/l at some places. The general ranges of various important chemical constituents in ground water samples collected from the district are given in Table 3.

Table 3: General ranges of various chemical constituents in ground water

Chemical Constituents	Range
pH	7.3-9.47
EC ( $\mu$ S/cm at 25°C)	225-13340
Bicarbonate (mg/l)	70.15-604.69
Chloride (mg/l)	28.43-3101.28
Nitrate (mg/l)	2.74-470
Sulphate (mg/l)	33-2120
Fluoride (mg/l)	0.08-15.3
Calcium (mg/l)	15.51-782.2
Magnesium (mg/l)	12.51-583.92
Total Hardness as CaCO <sub>3</sub> (mg/l)	0-4212.55

Sodium (mg/l)	0.79-2619
Potassium (mg/l)	0.4-755.4
Iron (mg/l)	15

Electrical Conductivity in the district has been found to vary from 225 to 13340  $\mu\text{S}/\text{cm}$  at 25°C (Plate 5). EC in excess of 3000  $\mu\text{S}/\text{cm}$  at 25°C has been reported from the district except south eastern and north western parts. Higher Fluoride content is observed at Rohini Sector-26 and higher Iron content of 15 mg/l is reported at Palla. Nitrate concentration in the district is observed to be varying in the range of 2.74 to 470 mg/l (Plate 6). Nitrate concentration is within the permissible limits in northern and south eastern parts. Remaining areas in the district have problem of nitrate concentration.

#### **4.5 STATUS OF GROUND WATER DEVELOPMENT**

At present level of ground water development is maximum (178.22%) in Model Town and is minimum (76.59%) in Narela as indicated in table 2 above. The district as a whole is categorized as over exploited with ground water development at 112.36%.

#### **5.0 GROUND WATER MANAGEMENT STRATEGY**

##### **5.1 GROUND WATER DEVELOPMENT:**

As stated above, the district as a whole is categorized as over exploited with stage of ground water development at 112.36%. This indicates the reality that the ground water resources of the district are stressed. In view of increasing extraction of ground water and consequent adverse environmental impacts, sustainable management of this precious natural resource is extremely important.

##### **5.2 WATER CONSERVATION AND ARTIFICIAL RECHARGE:**

In view of the depleting ground water levels in the district, it is essential that artificial recharge measures may be implemented on large scale. Recharge structures suitable in the area are shaft/trench with recharge well and recharge pit with/without bore in the alluvium area.

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

##### **6.1 WATER LOGGING:**

A considerable part of the district faces problem of water logging due to shallow water levels during pre and post monsoon period.

##### **6.2 DEPLETING GROUND WATER LEVEL & QUALITY:**

The wells located in this district show decline trends during pre and post monsoon period which is attributed to over exploitation of ground water.

Analysis of seasonal and long term water level data indicates a very gradual declining trend of water levels.

Depth of fresh-saline water interface also varies greatly in entire area. All along the western Yamuna Canal and along Yamuna Flood Plain it is deeper which is 40 to 70 m deep, whereas in rest of the area it is 22 to 40 m deep.

Higher concentration of Iron is found at some places in Palla and Singhola. Higher Fluoride content is reported from Rohini Sector 26.

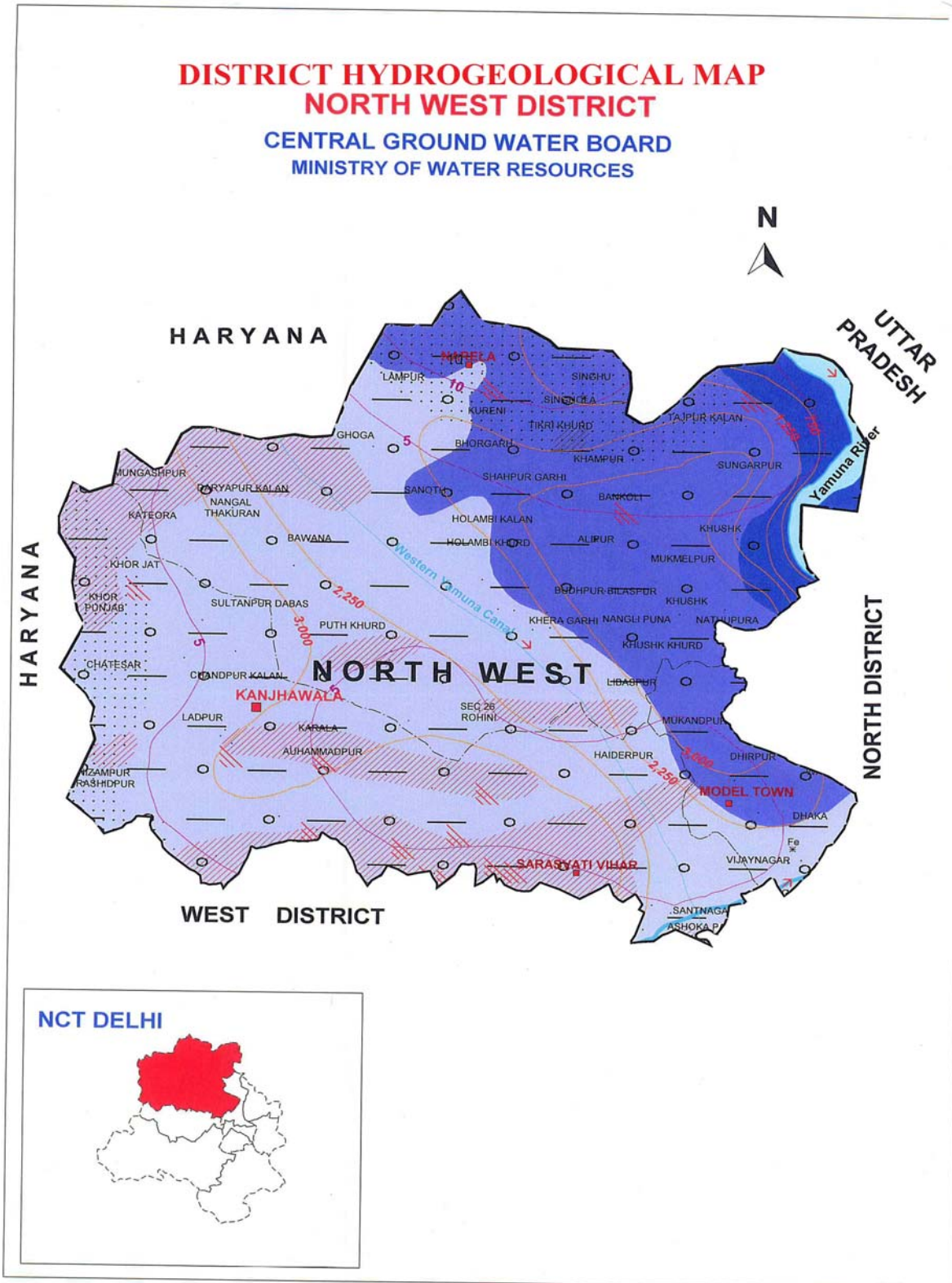
## **7.0 AREA NOTIFIED**

The entire district has been notified by Hon'ble Lt. Governor of Delhi for regulation of ground water development.

## **8.0 RECOMMENDATIONS**







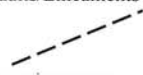










1. Efforts should be made to arrest the declining ground water levels by preventing indiscriminate withdrawal of ground water and adopting roof top rain water harvesting and artificial recharge.
2. Regular monitoring of water levels and chemical quality is essential.
3. Areas receiving drinking water supply from ground water sources should be monitored rigorously for quality consideration. The contaminants, if in the manageable range, should be removed by various techniques.
4. In areas prone to water logging, development of ground water should be encouraged.

Plate 1: District Hydrogeological Map



## NORTH WEST DISTRICT

### LEGEND

	Wells feasible	Rigs suitable	Depth of Well (m)	Discharge (lpm)	Suitable Artificial Recharge Structures **
	Tube Wells	Reverse / Direct Rotary	30-65*	1200-2400	Not Feasible
	Tube wells	Reverse /Direct Rotary	25-45*	900-1500	Shaft/Trench with recharge well, Recharge Pit with/without bore
	Tube Wells	Reverse / Direct Rotary	25-40*	240-600	Shaft/Trench with recharge well, Recharge Pit with/without bore
Depth to Water level in m (Pre-monsoon Decadal mean, 2003-2012 ) 		Electrical Conductivity (Micro mhos/cm at 25° C) 		Major river / Drain 	Faults/Lineaments 
Fluoride > Permissible limit (1.5 ppm) 	Nitrate > Permissible limit (100 ppm) 	Iron > Permissible Limit (1.0 ppm) / * Fe 			
State boundary 	District boundary 	Tehsil boundary 			
Tehsil head quarter 	Over exploited block 	Area feasible for Artificial Recharge structures 			
District head quarter 					

\* Depth of the well is restricted to the availability of fresh water. \*\* Feasible in areas where depth to water level is more than 8 m below ground level. In soft rock formation recharge well may be constructed where water level is more than 15 m. bgl (meter below ground level).

### OTHER INFORMATION

Name of State	Delhi
Name of District	North west
Geographical Area	440 Sq.Km.
Major Geological Formation	Soft Rock Younger/Older Alluvium
Major Drainage System	Yamuna
Population (as on 2011)	36.51 lakhs
No. of Tehsils	3, Narela, Saraswati Vihar and Model Town
Replenishable Ground Water Resources (MCM)/ Draft (MCM)/ Stage of Ground Water Development (%)	Model Town-5.29/8.38/176 Narela-51.15/37.13/76 Saraswati Vihar-29.87/44.12/164
Average Annual Rainfall	Alipur - 449 mm, Badali -516 mm, Narela - 581mm
Range of Mean Daily Temperature	18-31°C
Tehsil Showing Intensive Ground Water Development	Model Town and Saraswati Vihar



Plate 2: Sub-surface geological cross section North West District

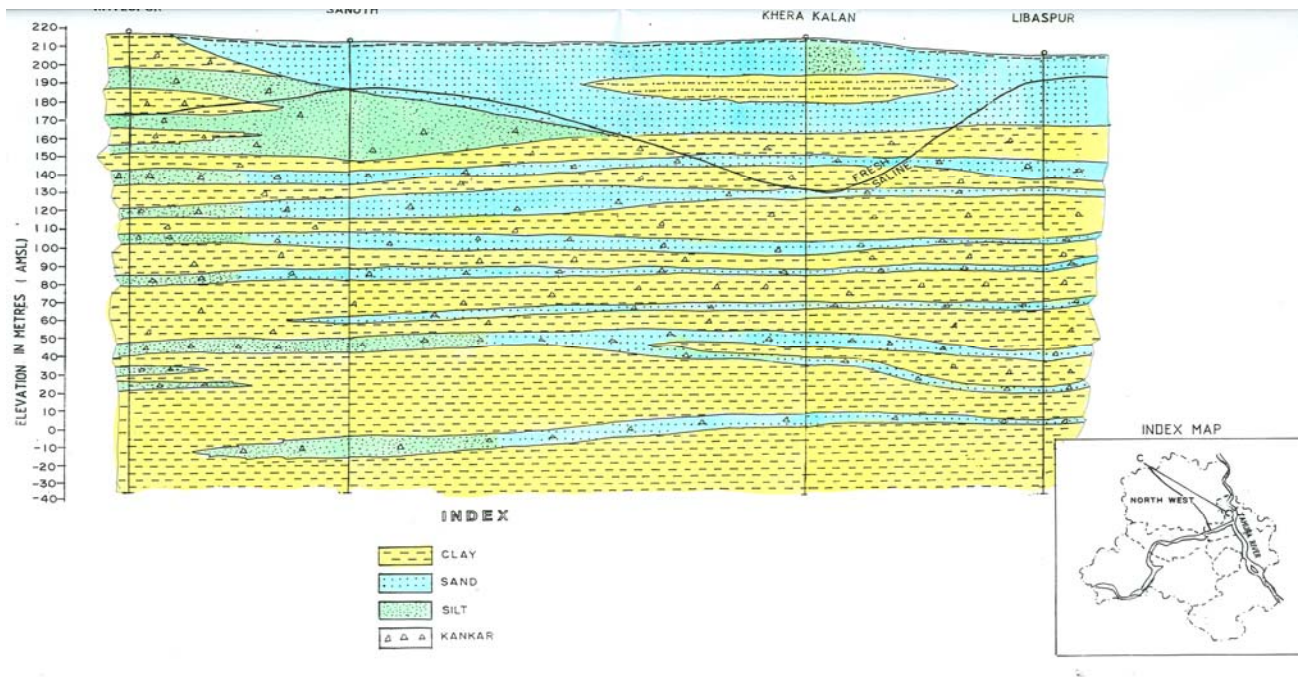
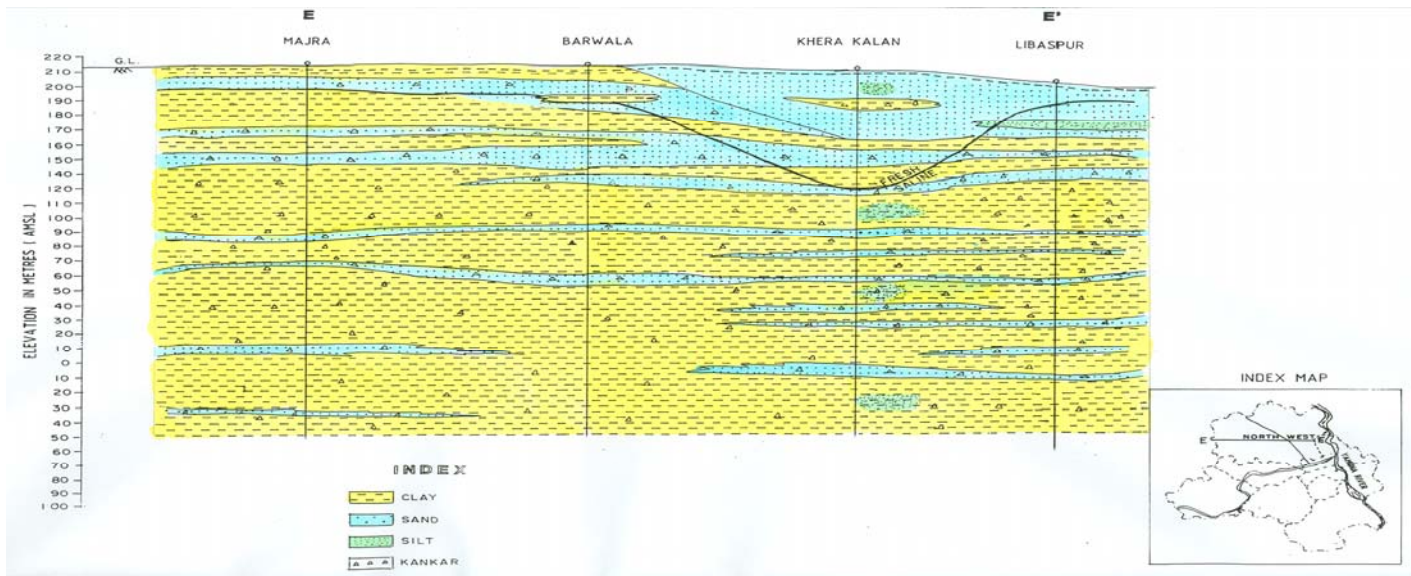


Plate 3: Depth to Water Level Map during Pre-monsoon (May, 2012)

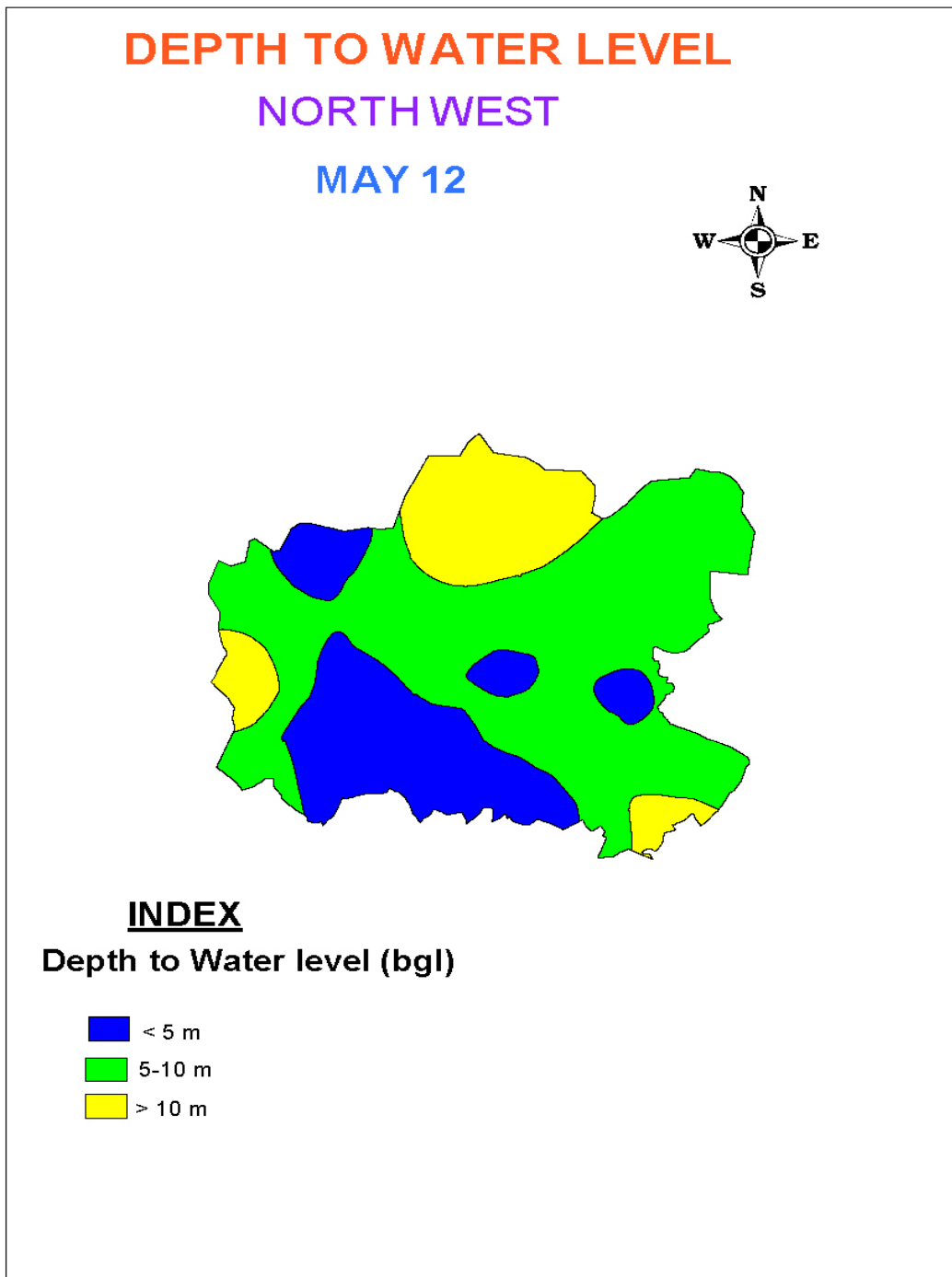


Plate 4: Depth to water Level Map during Post-monsoon (November, 2012)

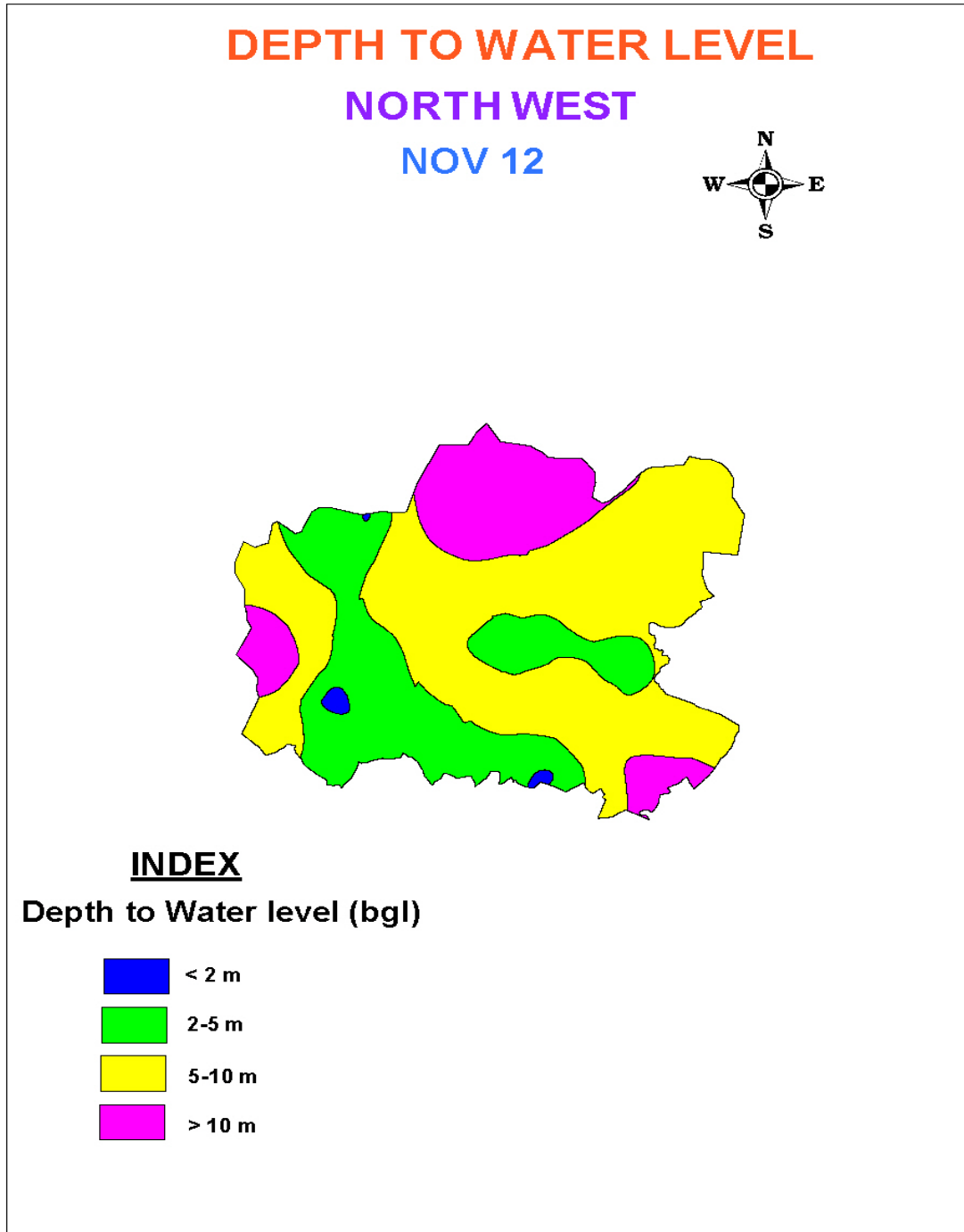




Plate 5: Electrical Conductivity Map (May, 2012)

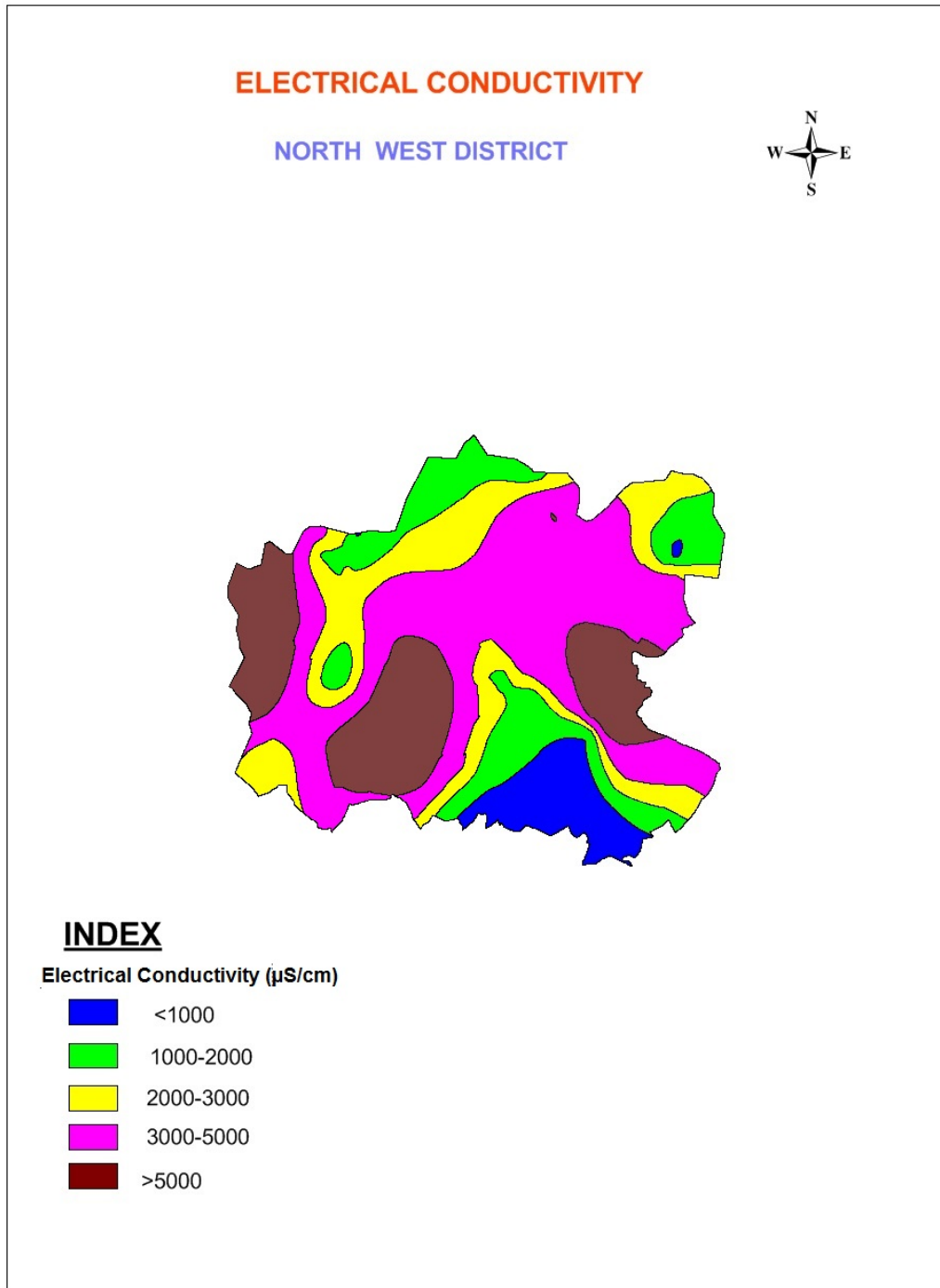


Plate 6: Nitrate distribution map (May, 2012)

