GROUND WATER YEAR BOOK
2014-15
National Capital Territory, Delhi

GOVERNMENT OF INDIA

CENTRAL GROUND WATER BOARD

MINISTRY OF WATER RESOURCES

STATE UNIT OFFICE

NEW DELHI

OCTOBER-2015

FOREWORD

Ground Water Year Book is based on the information generated by monitoring of ground water observation wells of NCT-Delhi during the field Season of 2014-15. The data has been analyzed by a team of Officers of State Unit Office-Delhi and presented in the report. The reports, annexures and maps have been generated using GEMS Software, Version-2.1 developed indigenously by Central Ground Water Board.

Depiction of ground water conditions in Delhi state provides information on availability in terms of quantity and quality, development prospects and management options. I am happy to note that the scientific information in this report is presented in a simplified form. I sincerely hope this report will be of immense help not only to planners, administrators, researchers and policy makers but also to the common man in need of such information to make himself aware of the situation and help in formulating development and management strategy.

The untiring efforts made by **Shri Sanjay Kumar Naik,** Asstt. Hydrogeologist, **Smt. Sonia Kapur,** Asstt. Geophysicist for bringing out this report is highly appreciated. Apart from this the contribution made by Sh. N. Jyothi Kumar, Scientist-C, and Sh. Rajesh Chandra, Scientist-C is duly acknowledged.

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Ministry of Water Resource

New Delhi,
OCTOBER-2015

EXECUTIVE SUMMARY

GROUND WATER YEAR BOOK 2014-15
NCT DELHI

National Capital Territory (NCT) of Delhi occupies an area of 1483 Sq. Km. and lies between 28^0 24' 15'' and 28^0 53' 00'' N latitudes and 76^0 50'24" and 77^0 20' 30" E longitudes. The total population of NCT Delhi, as per the census 2011 is 167.53 lakhs with a density of 11297 persons/Sq. km area.

The normal annual rainfall of NCT Delhi is 611.8mm. The rainfall increases from the South-West to the North-West. About 81% of the annual rainfall is received during the monsoon months July, August and September. The rest of the annual rainfall is received in the form of winter rain.

The ground water availability in the territory is controlled by the hydrogeological conditions characterized by occurrence of different geological formations namely Delhi Quartzite, Older & Younger Alluvium. Central Ground Water Board (CGWB) has established 116 hydrograph monitoring stations, out of which 20 are dug wells and 96 are Piezometers till March 2015. The ground water monitoring stations are spread over both Alluvial as well as quartzitic area. Nearly 11 stations fall in Delhi quartzite and 105 stations fall in alluvial area including Yamuna Flood Plain.

District wise distribution of hydrograph network stations is highly uneven and varies from one monitoring station per 1.4 Sq. Km in New Delhi district to one monitoring station per 30 Sq. Km in North East district. Considering this un-evenness, Central Ground Water Board is striving to increase the number of monitoring stations for better monitoring of the ground water regime in the diverse hydrogeological terrain.

The depth to water level recorded in NCT Delhi during **May-2014** ranges from 1.19 to 74.41 m.bgl (below ground level). 53% wells of South district show more than 40 m.bgl water level and 18% wells have 20 to 40 m.bgl water level. In New Delhi and South-West districts 10 to 20 m.bgl water level is shown by 64% and 28% wells respectively. The depth to water level in North East, East and North-West districts have 50%, 40% and 45% wells in the range of 5-10 m.bgl whereas in East, North, North-East, North-West, and West districts 30%, 57%, 50%, 31% and 44% of wells show water level in the range of 2 to 5m water level respectively; the entire Yamuna flood plain is also falling in the 2 to 5m category.

The fluctuation of water level between **May-2013** and **May-2014** of Delhi state shows rise in water level in the range of 0.10 m to 4.53 m in the district of Central, New Delhi, North, South, North-West, South-West and West. Whereas rest of the districts like East, North-East, West, South and South-West shows fall in the range of 0.04 to 3.34 m. *The overall data indicates that in South and South-West districts the water levels are showing maximum fall.*

When the data of **May-2014** was compared with **10 year mean of May** water level, it shows that 47% of wells show a fall in the range of 0.16 to 8.99 m. In East, New Delhi, North, North-West, West and South-West districts 60% of wells show a rise in water level varying from 1.09 to 4.19 m. *The maximum fall has taken place in North-West, South and South-West districts (i.e. 2.36 to 8.99 m).*

The depth to water level recorded in NCT Delhi during **Aug-2014** ranges from 1.09 to 76.00 m. bgl. In which 53% wells of South district show more than 40 m.bgl water level and 12% wells have 20 to 40 m.bgl water level. In New Delhi and South-West district 64% and 26% wells have shown 10 to 20 m.bgl water level, respectively.

The fluctuation of water level between **Pre-monsoon (May-2014)** and **August-2014** for Delhi indicates that 70% wells show fall in the range of 0 to 2 m and 25% depict a fall ranging from 0.01 m to 5.60 m.

The hydrograph analyses of **August-2013** and **August-2014** water level reveals that 87% of wells show fall in the range of 0.03 to 8.52 m while in few districts like New Delhi, North West, South and South West show localized rise in ground water level in the range of 0.23 to 2.38 m. In totality 13% wells show a rise in water level.

The depth to water level recorded in NCT Delhi during **November-2014** ranges from 1.82 to 63.63 m. bgl. 50% wells of South district shown more than 40 m. bgl water level and in 12% of the wells the water level varies between 20 to 40 m. bgl. In South-West district 35% and 38% wells fall in the water level category of 10 to 20 and 20 to 40 m. bgl respectively. The depth to water level of East, North-East, North West and West districts show 40%, 50%, 45% and 22% in the range of 5 to 10 m. bgl whereas in East, North, North East, North West and West districts the water level are in the range of 2 to 5 m. bgl in 30%, 57%, 25%, 34% and 44% respectively. In the entire Yamuna flood plain the water level are falling between 2 to 5 m. bgl during this period.

The fluctuation of water level between **Pre-monsoon (May-2014)** and **Post Monsoon (Nov-2014)** of Delhi state shows 0.02 to 4.53 m fall in 81% of the wells. Few wells of New Delhi, North West, South and South-West district shows rise in the range of 0 to 4 m.

When the data of **Nov-2014** was compared with **10 year mean of Nov.** it shows that in 82% of the wells a fall of water level in the range of 0.03 to 9.82 m.

The depth to water level recorded during **January-2015** ranges from 1.66 to 64 m. bgl, South district alone shows 50% wells in the category of more than 40 m depth to water level and 19% in the range of 20 to 40m depth to water level. 35% and 50% wells in South-West and New Delhi districts have water levels in the range of 10 to 20 m respectively. A few patches of 20 to 40 m water level are also seen in these districts. Rest of the districts fall under the category of 2 to 10 m water level. Some of *the monitoring stations viz. Palam, Godaipur, Sultanpur, Jaunapur and PushpVihar show depth to water level in the range of 53 to 64 m, which is maximum in Delhi state.*

The fluctuation of water level between **Pre-monsoon (May-2014)** and **January-2015** of Delhi state reveals that 81% wells of North West, South, South West and West Districts fall in the range of 2.51 to 4.12 m and 22% wells show rise in the range of 0.12 to 4.06 m in East, New Delhi, North-West & South West districts.

When the data of **January-2015** was compared with **10 year mean of January,** It has been observed that 74% of monitoring stations of New Delhi and North West districts show a fall in water levels, the maximum fall is 4.42 m and 5.85 m respectively. The same conditions prevail in South and South West districts where 63% of the wells show fall in water level where the maximum fall is 9.07 m and 6.95 m respectively. East and North East districts

have also shown decline in water table in the range of 4.39 to 4.17 m. *The overall observation of the state shows that the southern districts of Delhi state are showing declining condition.*

GROUND WATER YEAR BOOK

NCT DELHI

2014-15

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Chapter - 1

INTRODUCTION

1.1 - GENERAL INTRODUCTION

National Capital Territory of Delhi occupies an area of 1483 Sq.km. and lies between 28° 24' 15'' & 28° 53' 00''N latitudes and 76° 50'24" & 77° 20' 30" E longitudes. Area is covered under Survey of India Toposheet Nos. 53D and 53H.For administrative purposes; NCT Delhi is divided into 11 districts and 33 Tehsils/Sub-divisions. NCT Delhi has three Statutory Towns, viz., the Municipal Corporation of Delhi (MCD), New Delhi Municipal Council (NDMC) and Delhi Cantonment Board (DCB), 110 Census Towns and 112 Villages as per the census of 2011. Population of Delhi has increased at a rate of 2.1% per annum during the decade 2001-2011. Considering the same growth rate for the present decade, it is estimated that the population of Delhi in 2019 will be about 184 lakhs and it would be about 188 lakhs in 2021, 208 lakhs by 2031. In order to evaluate the changes in ground water regime effect due to ever growing demand for ground water and the increasing numbers of abstraction structures in the city, CGWB has been continuously monitoring the water level variation with its own network stations spread over the entire area of NCT Delhi.

1.2 - GROUND WATER REGIME MONITORING

Monitoring of ground water regime is an effort to obtain information on variation in ground water levels and chemical quality through representative sampling both in time and space. The important attributes of ground water regime monitoring are:

a) Ground Water Level

b) Ground Water Quality and

c) Temperature.

The primary objective of establishing the ground water monitoring network stations is to record the response of ground water regime to the natural and artificial conditions of recharge and discharge with reference to geology, climate, physiography, land-use pattern and hydrologic characteristics. The natural conditions affecting the regime involve climatic parameters like rainfall; evapo-transpiration etc. and the artificial conditions include pumpage from the aquifer, recharge due to irrigation system and other man made causes like waste disposal etc. The database generated can form

the basis for ground water development and management programme. The objectives of the Ground Water Observation Network may be broadly summarized as below:

Collection of basic data on ground water conditions for:

- Study of inter-relationship between ground water and climatic parameters,
- Study the influence of geology, topography, land-use on ground water regime,
- Understanding the role of ground water in the hydrologic cycle and influence of the recharge on ground water storage changes, chemistry and temperature.

Application of ground water monitoring data for:

a. Reference purposes

b. Prediction measures

c. Environmental evaluation

d. Estimation of resources

Monitoring may come under two categories:

i) Background monitoring to characterizing the initial stage of a system,

(*Background monitoring commences with inventory of existing information like land-use, topography, extent, thickness, structure of the geological units and their hydraulic properties. Based on the analysis of the data, different ground water systems can be identified.)*

ii) Specific monitoring to deal with systems, where significant changes have taken place. This functions as an early warning system and provides information for remedial actions.

GROUND WATER LEVELS:

The configuration of the water table depends upon topography, geology, climate, water yielding and water bearing properties of rocks in the zones of aeration and saturation which controls the ground water recharge. The upper surface of the zone of saturation is the **Water Table**. In case of wells penetrating confined aquifers, the water level represents the pressure or **Piezometric Head** at that point.

Hydrograph network planning is basic to ground water assessment and development programme. The ground water, being subterranean resource can only be assessed through indirect reflection in the form of water level changes. The systematic and regular monitoring of ground water levels can bring out the changes taking place in the regime. The data so generated is of immense help for regional ground water flow modeling to serve as a ground water management tool and to provide the necessary advance information to the user agencies to frame contingency plans in case of un-favorable ground water recharge situation. The data also has immense utility in settling the legal issues arising out of conflicting interests of ground water users.

BASIC ACTIVITY

The NCT Delhi covers an area of 1483 Sq. Km. Delhi state is divided into 11 districts and 33 sub-divisions. Geologically, Delhi state is occupied by Quartzite interbedded with Mica-Schist belonging to Delhi Super Group, un-conformably overlain by unconsolidated Quaternary to Recent sediments. The ground water availability in the territory is controlled by the hydrogeological situation characterized by occurrence of alluvial formation and quartzite hard rocks. The hydrogeological set up and the following distinct physiographic units influence the ground water occurrence: -

1. Alluvial plain on eastern and western sides of the ridge.
2. Yamuna flood plain deposits.
3. Isolated and nearly closed Chattarpur alluvial basin.
4. NNE-SSW trending Quartzitic Ridge.

The basic activities pertaining to monitoring well design and construction are as follows:

a. Suitable locations for installation of piezometer, working out optimal depth and diameter of piezometer.

b. Appropriate drilling technique and suitable drilling rig for piezometer construction.

c. Installation of suitable well assembly to tap the aquifer proposed to be monitored, i.e. casing, screen etc.

d. Maintenance of well.

It is essential to have a complete understanding of aquifer disposition

and geometry in the area before the piezometers are designed and installed. The hydrogeological mapping in the area may indicate the disposition and inter-relationship of the aquifers spatially and depth wise. The information generated from ground water surveys and exploration would enable one to decide grouping of interrelated aquifers into one aquifer system for the purpose of monitoring. The decision to install piezometers monitoring phreatic and deeper confined aquifers would be dependent on the nature of aquifer system viz., alluvial aquifers or hard rock aquifers.

Alluvial aquifers:

In Delhi state, alluvial areas are characterized by occurrence of number of sand zones constituting the aquifers, it may not be essential to install piezometers for each sand zone. Based on inter-relationship and behavior, these aquifers are grouped into major aquifer systems and piezometers have been installed accordingly.

In National Capital Territory of Delhi and adjoining, the hydrogeological mapping and ground water exploration indicates the presence of three distinct potential aquifer groups within the depth of 450 m below ground level. Each of these aquifer groups comprises of number of individual sandy horizons. The grouping of aquifers was done as follows:

Aquifer Group I - **Down to 65 m. below ground level (Un-confined)**

Aquifer Group II- **Between 65 to 200 m. below ground level (Confined/ Semi-Confined)**

Aquifer Group III- **Between 200 to >300 m. below ground Level (Confined)**

Separate piezometers were installed, tapping the two aquifer groups, the first one in the phreatic zone, deep enough to accommodate long term fluctuation (i.e. up to 65 m deep) and the other one tapping the middle parts of the aquifer groups II lying between 65 to 200 m. The Aquifer group III is not being monitored at present.

Hard rock aquifers*:*

The hard rock area of NCT Delhi is being monitored through piezometric nests, which are installed in a single borehole tapping the weathered and fractured aquifers composedly. Generally, the depth of the well goes up to 80 m, but in some cases it goes up to 140 m.

1.3 - DISTRIBUTION OF HYDROGRAPH NET WORK STATIONS

Central Ground Water Board has established 116 hydrograph monitoring stations (Plate-1), out of which 20 are dug wells and 96 are piezometers till March, 2015. District wise details of National Hydrograph Network Monitoring Stations for the last four years are given in following Table 1.1.

Table-1.1

Status National Hydrograph Monitoring Stations in NCT, Delhi

Name of the district	Total No. of NHNS as on 31-3-2012	Total No. of NHNS as on 31-3-2013	Total No. of NHNS as on 31-3-2014	Total No. of NHNS as on 31-3-2015
North-West	33	32	30	29
North	10	08	08	07
North-East	07	05	04	04
East	14	09	10	10
New Delhi	18	16	15	14
Central	02	01	01	01
West	13	13	11	09
South-West	39	33	29	26
South	26	22	17	16
Total	**162**	**139**	**125**	**116**

Central Ground Water Board is striving to increase the number of monitoring stations in NCT, Delhi to monitor and have close observation in the diverse hydrogeological domain. In the recent years Delhi is facing rapid decline in ground water levels, which calls for attention and close watch through monitoring. The establishment of Peizometer in metropolitan city of Delhi is very hard due to non-availability of space. However, the establishment of monitoring station is in progress gradually for the precise observations of ground water conditions.

District wise distribution of hydrograph network station is highly uneven and varies from one monitoring station per 2.50 Sq. Km in the New Delhi

district to one monitoring station per 25 Sq. Km in the Central district. Table-1.2 shows the density distribution of hydrograph stations in NCT Delhi.

Table-1.2
Density distribution of NHNS in NCT Delhi

Name of the district	Area in Sq. Km	No. of NHNS	Density Sq. Km per well
North-West	440	29	15.17
North	60	07	8.57
North-East	60	04	15
East	64	10	6.4
New Delhi	35	14	2.50
Central	25	01	25
West	129	09	14.33
South-West	420	26	16.15
South	250	16	15.62
Total	**1483**	**116**	**12.78**

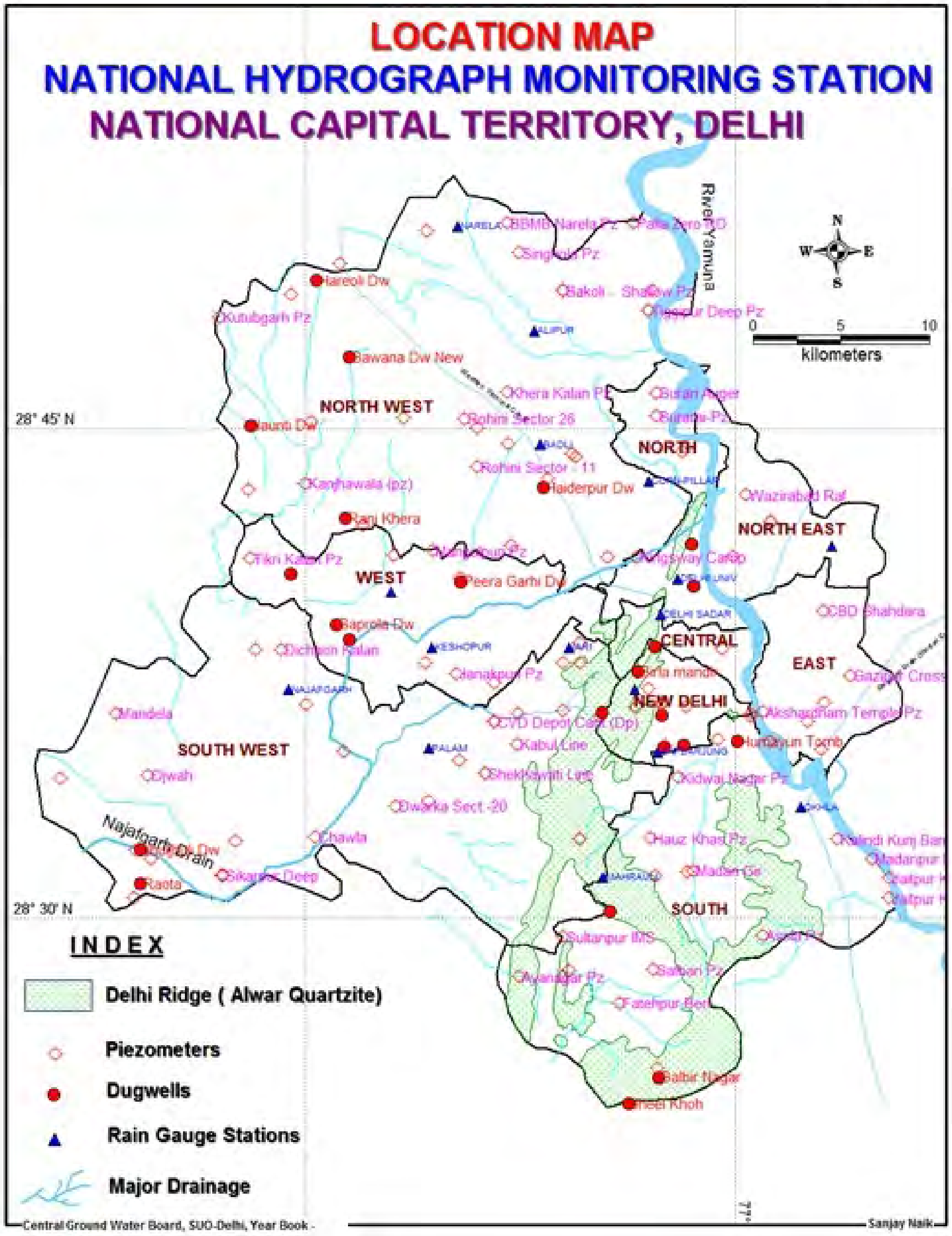
1.4 - PERIODIC ANALYSIS:

Analysis is normally done immediately after each phase of ground water monitoring; viz. May, August, November and January. The water level data generated are utilized to prepare the depth to water level maps and also fluctuation maps, to bring out the prevailing status of ground water regime. The depiction of the data through maps on district wise basis can be made as follows:

1. ***DEPTH TO WATER TABLE MAP****:*

Depth to water table maps usually presented for Delhi State on appropriate scale bringing out suitable depth ranges say; 0-2 m, 2-5 m, 5-10 m, 10-20 m, 20-40 m &>40 m. The depth ranges are categorized considering prevailing water levels, depth zone of water logging, depth zone of prone to water logging centrifugal pumping depths etc.

Plate No. -


LOCATION MAP
NATIONAL HYDROGRAPH MONITORING STATION
NATIONAL CAPITAL TERRITORY, DELHI
River Yamuna
N
W
E
S
0
5
10
kilometers
28° 45' N
28° 30' N
NORTH WEST
NORTH
NORTH EAST
WEST
CENTRAL
EAST
NEW DELHI
SOUTH WEST
SOUTH
Najafgarh Drain
Hareoli Dw
Kutubgarh Pz
Bawana Dw New
Khera Kalan Pz
Rohini Sector 28
Rohini Sector - 11
Haiderpur Dw
Kanjhawala (pz)
Rani Khera
Peera Garhi Dw
Baprola Dw
Janakpuri Pz
CVD Depot Cant (Dp)
Kabul Line
Dwarka Sect -20
Mandela
Dhansa
Chawla
Raota
Wazirabad Raf
CBD Shahdara
Akshardham Temple Pz
Humayun Tomb
Kidwai Nagar Pz
Hauz Khas Pz
Sultanpur IMS
Ayanagar Pz
Satbari Pz
Fatehpur Beri
Balbir Nagar
Bhati Khoh
ALIPUR
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Piezometers
Dugwells
Rain Gauge Stations
Major Drainage
Central Ground Water Board, SUO-Delhi, Year Book -
Sanjay Naik

2. ***WATER LEVEL FLUCTUATION MAPS:***

The ground water level fluctuation usually depicted through a set of maps showing the status of the water levels under observation as compared to the levels of the same period of the previous *year* and to the decadal mean water levels etc. These maps can be drawn as:

a. Fluctuation map comparing the water levels monitored with the corresponding water levels in the preceding *year.*

b. Fluctuation maps comparing the Post-monsoon water level monitored with Pre-monsoon water level of the same water *year.*

c. Fluctuation maps comparing the water level monitored with the mean water levels of the period *for* at least a decade. This map would bring out departures *from* normal ground water storage situations during the period under consideration.

3. ***GROUND WATER QUALITY MAPS:***

The ground water quality maps usually prepared are based on the frequency of ground water sample collection. As the ground water quality regime does not show marked variations sample collection is done once in a *year.* Only major constituents analyzed are used in preparation of the maps. The maps to be prepared are:

I. Map showing EC variation in the ground water

2. Map showing Nitrate distribution in the ground water

3. Map showing high point values of Fluoride, Nitrate and other pollutants.

4. ***STATUS* OF *GROUND WATER REGIME:***

After each measurement, a comprehensive report is prepared, which include the following:

a. Brief write-up supported by water level data, maps of depth to water, and rise and fall of ground water levels and ground water quality maps etc.

b. Effects of various factors on ground water regime like rainfall, ground water pumpage, irrigation practices etc.

c. Departure in the normal behavior of water levels bringing out the factors responsible.

The report and maps are of immense help to the planners and ground water users to chalk out the development strategy.

Chapter - 2

CLIMATE AND RAINFALL

CLIMATE:

The climate of NCT Delhi is mainly influenced by its inland position and the prevalence of air of the continental type during the major part of the year. Extreme dryness with the intensely hot summer and cold winter are the characteristics of the climate. Only during the three-monsoon months July, August, and September does air of oceanic origin penetrate to this state and causes increased humidity, cloudiness and precipitation. The year can broadly be divided into four seasons. The cold season starts in late November and extends up to the beginning of March. This is followed by the hot season, which lasts till about the end of June when the monsoon arrives over the state. The monsoon continues to the last week of September. The two post monsoon months October and November constitute a transition period from the monsoon to winter condition.

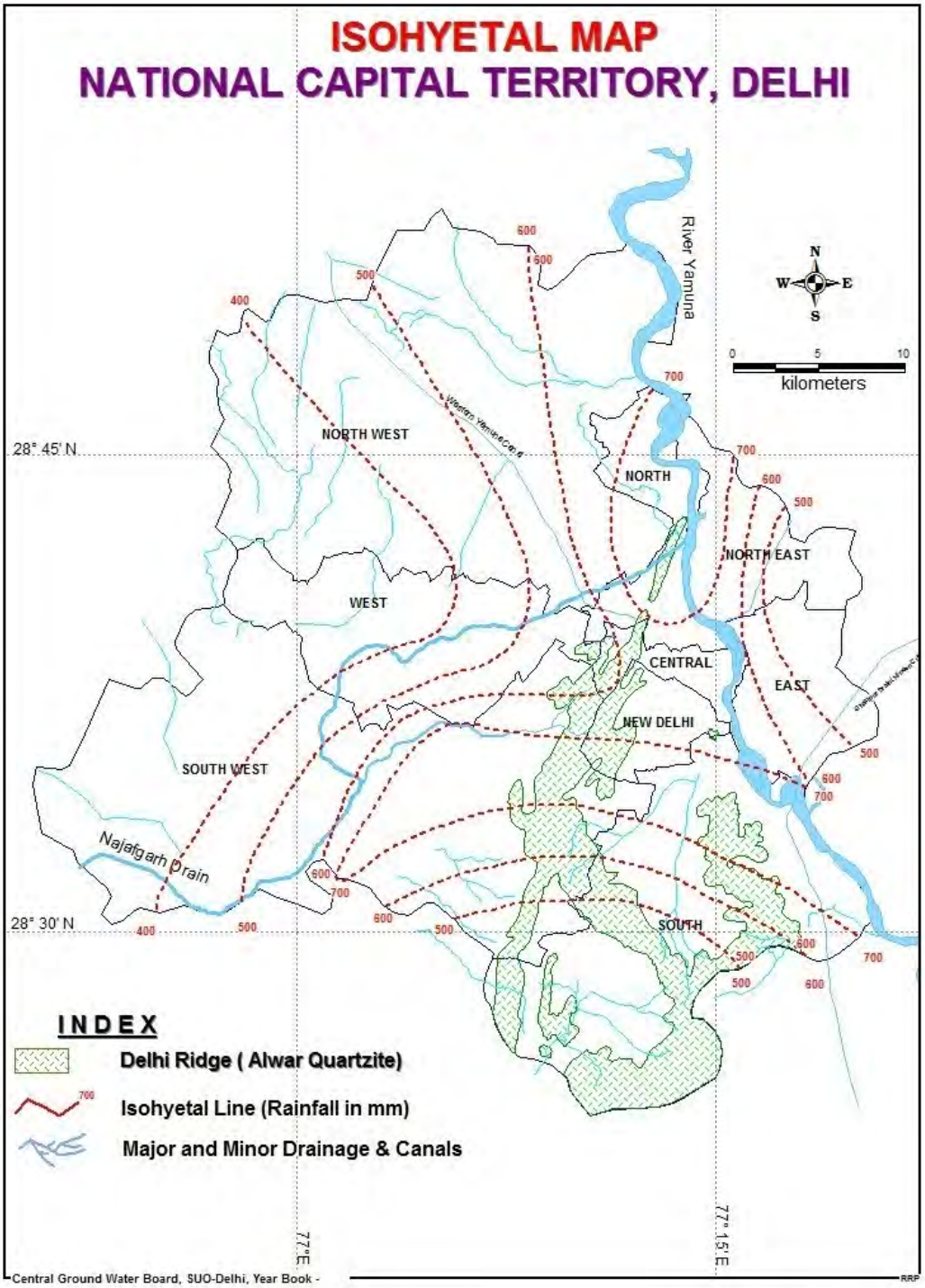
Table-2.1
Seasons in NCT, Delhi

Season	Begin	End
Cold/Winter	End of November	Middle of March
Summer	Middle/End of March	End of June
Rainy season	Early July	September

RAINFALL:

For calculation of normal rainfall of NCT Delhi, rainfall records from 1930-1980 for 13 stations (Table-2.3) were considered. The normal annual rainfall in NCT Delhi is 611.8 mm. The rainfall in NCT Delhi increases from the southwest to the northwest (Plate-2). About 81% of the annual rainfall is received during the monsoon months July, August and September. The rest of the annual rainfall is received as winter rains and as thunderstorm rain in the pre and post monsoon months. The variation of rainfall from year to year is large.

Plate - 2


ISOHYETAL MAP
NATIONAL CAPITAL TERRITORY, DELHI
River Yamuna
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W
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0 5 10
kilometers
28° 45' N
28° 30' N
77° E
77° 15' E
NORTH WEST
NORTH
NORTH EAST
WEST
CENTRAL
EAST
NEW DELHI
SOUTH WEST
SOUTH
Najafgarh Drain
400
500
600
700
INDEX
Delhi Ridge (Alwar Quartzite)
Isohyetal Line (Rainfall in mm)
Major and Minor Drainage & Canals
Central Ground Water Board, SUO-Delhi, Year Book -

Table-2.2: Annual rainfall and deviations from Normal Rainfall i.e. 611.8 mm

State	2011		2012		2013	
	Annual rainfall in mm	Deviation from Normal rainfall	Annual rainfall in mm	Deviation from Normal rainfall	Annual rainfall in mm	Deviation from Normal rainfall
NCT Delhi	604.2	-1.24%	321	-47.53%	708.9	+15.87%

A perusal of rainfall data from 2011 to 2013 shows that NCT Delhi received deficient rainfall of -1.24% in 2011 and -47.53% during 2012 and year 2013 has surplus rainfall of 15.87%. Comparison of annual rainfalls of 2011, 2012 and 2013 has been done with that of Normal rainfall of NCT Delhi and presented in Table-2.2. The details of the Normal and the Extreme Rainfall are tabulated in Table-2.3.

Rainfall in Delhi is thus highly variable with deviations from –47.53% to +15.87% from normal rainfall which in urn affects the natural recharge to ground water from year to year.

Month-wise Normal Rainfall with Rainy days and Evaporation losses are given in Table-2.4. The average annual evaporation losses are 2224 mm.

Table 2.3 - Normal and Extremes of Rainfall

Stations	No. of Years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	HIGHEST ANNUAL AS % OF (YEARS)**	LOWEST RAINFALL NORMAL &	HEAVIEST RAINFALL In 24 HOURS * Amount (mm)	Date
Chandrawal (obsy)	20	a	8.5	15.3	16.7	5.5	18.2	47.6	329.8	308.4	102.3	14.4	8.2	11.6	886.5	163 (1977)	64 (1969)	171.0	1976 Aug 08
		b	0.6	1.2	1.2	0.5	1.5	2.2	10.5	10.4	3.9	0.9	0.2	0.8	33.9				
New Delhi (Safd)	79	a	20.5	20.1	13.3	7.8	12.5	62.2	203.2	202.2	137.6	21.7	3.1	8.0	712.2	215 (1933)	43 (1905)	495.3	1875 Sep 09
		b	1.8	1.5	1.2	0.8	1.4	3.6	9.2	9.5	5.1	1.0	0.2	0.7	36.0				
Delhi (University obsy)	29	a	20.7	18.3	19.1	5.1	16.4	62.2	281.6	263.5	147.4	41.6	4.1	7.6	887.6	209 (1957)	52 (1974)	250.0	1963 Sep 16
		b	1.6	1.4	1.5	0.7	1.5	2.8	10.3	10.5	5.2	1.6	0.2	0.8	38.1				
New Delhi Palam	22	a	14.7	14.1	9.3	6.1	18.9	54.2	241.1	284.3	119.4	16.8	6.4	8.6	793.9	164 (1967)	51 (1965)	265.8	1972 Jul 09
		b	1.3	1.5	1.0	0.6	1.5	3.5	10.9	10.7	4.9	1.4	0.2	0.6	38.3				
Okhala (obsy)	21	a	9.6	11.9	14.7	2.6	17.1	66.9	212.5	296.3	124.6	23.2	5.7	7.3	792.4	159 (1964)	66 (1974)	190.0	1967 Aug 26
		b	0.9	1.3	0.9	0.3	1.4	3.4	9.3	10.7	5.1	0.9	0.3	0.6	35.1				
Mahruali	33	a	13.9	10.1	7.3	9.4	3.6	28.3	159.9	152.5	98.7	11.5	1.5	2.3	499.0	197 (1944)	42 (1954)	177.8	1911 Sep 28
		b	1.1	0.7	0.6	0.6	0.3	1.5	5.8	5.9	3.0	0.3	0.2	0.3	20.3				
Delhi Sadaer	38	a	22.6	17.5	13.0	8.8	9.6	44.8	184.3	180.0	132.3	26.1	3.5	5.1	647.6	194 (1964)	42 (1903)	224.8	1942 Sep 05
		b	1.9	1.4	1.4	0.6	0.9	2.4	7.6	8.9	4.7	1.0	0.3	0.6	31.7				
Nangloi	25	a	8.5	4.6	1.1	4.0	2.4	19.8	100.3	121.6	69.0	5.0	0.4	0.5	337.2	246 (1964)	21 (1950)	120.0	1964 Aug 14
		b	0.8	0.3	0.2	0.2	0.3	1.1	4.6	5.4	3.1	0.4	0.0	0.0	16.4				
Sahadra	12	a	15.5	17.9	5.6	5.3	2.8	24.8	170.7	125.8	74.9	7.9	0.0	0.6	451.9	206 (1944)	42 (1948)	129.5	1944 Sep 04
		b	0.7	0.8	0.7	0.3	0.5	1.4	6.1	5.0	2.8	0.3	0.0	0.1	18.7				
Najafgarh	23	a	8.9	8.2	4.7	4.2	3.0	25.1	122.0	122.8	75.9	21.7	0.5	1.8	398.9	171 (1942)	10 (1959)	139.7	1954 Oct 01
		b	0.8	0.7	0.2	0.4	0.4	1.3	5.5	5.6	3.2	0.8	0.0	0.2	19.1				
Badli	23	a	13.7	8.6	9.6	3.6	1.4	21.8	154.2	181.3	88.2	32.9	0.8	0.0	516.1	257 (1961)	37 (1951)	205.7	1962 Jul 17
		b	1.0	0.7	0.6	0.4	0.2	1.1	5.8	6.4	3.7	0.8	0.0	0.0	20.7				
Alipur	21	a	11.7	10.6	3.3	3.6	6.0	26.7	146.1	137.1	87.7	13.7	1.3	1.1	448.9	202 (1961)	12 (1959)	162.1	1961 Jul 17
		b	1.3	0.7	0.4	0.4	0.4	1.5	4.7	6.0	2.9	0.7	0.1	0.1	19.3				
Narela	19	a	19.9	14.5	10.6	4.9	7.2	20.6	184.7	190.4	111.2	14.8	1.1	1.4	581.3	196 (1961)	29 (1965)	184.1	1947 Sep 15
		b	1.5	0.9	1.1	0.6	0.4	1.6	6.4	8.2	4.0	0.5	0.1	0.2	25.3				
Delhi (District)		a	14.5	13.2	9.9	5.5	9.2	38.8	191.6	197.4	105.3	19.3	2.8	4.3	611.8	251 (1933)	44 (1951)		
		b	1.2	1.0	0.8	0.5	0.8	2.1	7.4	7.9	4.0	0.8	0.1	0.4	27.0				

(a) Normal rainfall in mm.

(b) Average number of rainy days (i.e. days with rainfall of 2.5 mm or more)

* Based on all available data up to 1980.

** Years given in brackets.

Table 2.4 Rainfall and Evaporation Losses

Month	Jan	Feb	Mar	Apr.	May	Jun	July	Aug	Sep	Oct	Nov.	Dec.	Annual
Rainfall (in mm)	14.5	13.2	9.9	5.5	9.2	38.8	191.6	197.4	105.3	19.3	2.8	4.3	611.3
Rainy days	1.2	1.0	0.8	0.5	0.8	2.1	7.4	7.9	4.0	0.8	0.1	0.4	27.0
Evaporation (in mm)	71	101	177	300	400	333	233	133	147	149	102	78	2224
Source: Indian Meteorological Department													

Temperature:

The cold season starts towards the latter half of November when both day and night temperature drop rapidly with the advance of the season. January is the coldest month with the mean daily maximum temperature at 21.3ºC and the mean daily minimum at 7.3ºC. In the winter months during cold waves which affect the district in the wake of western disturbances passing across north India, minimum temperatures may sometimes go down to the freezing point of water. From about the middle of March, temperature begins to rise fairly rapidly. May and June are the hottest months. While day temperature is higher in May the nights are warmer in June. From April the hot wind known locally as 'loo' blows and the weather is unpleasant. In May and June maximum temperature may sometimes reach 46 or 47ºC. With the advance of the monsoon into the area towards the end of June or the beginning of July day temperatures drop appreciably while the night temperatures remain high. In October the day temperatures are as in the monsoon months but the nights are cooler.

Humidity:

The air over Delhi is dry during the greater part of the year. Humidity is high in the monsoon months. April and May are the driest months with relative humidity of about 30% in the morning and less than 20% in the afternoons.

Cloudiness:

During the monsoon especially in July and August skies are heavily clouded and often overcast. In the rest of the year skies are clear or lightly

clouded. But in the months January, February and early March skies become cloudy and overcast when the district is affected by western disturbances.

Winds:

Winds are generally light during the post monsoon and winter months. They strengthen during the summer and monsoon months. Except during the monsoon months, winds are predominantly from a westerly or northwesterly direction and tend to be more northerly in the afternoon. Easterly and southeasterly winds are more common in the monsoon months.

Chapter - 3

Hydrogeological Framework of Delhi

3.1 - PHYSIOGRAPHY

The union territory of Delhi has four distinct physiographic units; these are as follows:

1- **Delhi (Quartzitic) Ridge**

2- **Older alluvium on both side of the Delhi Ridge**

3- **Younger Alluvium –All along Yamuna Flood Plain**

4- **Alluvium Deposits of Chattarpur Enclosed basin**

The quartzitic ridge enters the area from the South-Eastern part and passes through the Eastern part extending up to the western bank of river Yamuna near Wazirabad. The rocky ridge has a length of about 35km and trends in a NNE-SSW direction. Isolated exposures of the quartzite are also found in the Western part of the area. The elevation of the crest of the ridge varies from 213 to 314 m above mean sea level with an average elevation of 40 m from the surrounding plain. The land surface on the Eastern side of ridge slopes towards the river Yamuna with a general gradient of 3.3 m/km. On the West side of the ridge the ground slopes towards the Najafgarh *Jheel* in the South-West.

The alluvial plain in the area is almost flat and is interrupted by cluster of sand dunes and quartzite ridges. The sand dunes which are more prominent in the western part of the area are of varying dimensions and have North-East to South-West trend. The crests of these dunes generally lie between 3 to10 meters above the surrounding plains. The dunes in the area are more area less fixed with vegetation on them. The dunes are mostly longitudinal in nature.

The nearly closed alluvial basin of Chattarpur (28^0 25' 30 '' to 28^0 32' 30'' N and 77^0 07 ' 30'' to 77^0 13' 00'' E) in South Delhi occupies an area of about 78 km^2. This is a closed inland basin, the boundary of which is marked by the quartzite ridges. The general slope of the land is towards the center of the basin from the surrounding ridges. The slope in the southern part of the basin is towards south. The maximum land altitude in the basin is about 259 m MSL whereas the land at the ridges is about 274 m MSL.

Younger alluvium (Flood Plain) deposits are confined all along the river Yamuna, which are presently demarcated by embankment on both sides of the river. Virtually, this is an active flood plain domain covering an area of nearly 97 sq. km, characterized by granular deposits with shallow depth to water level. Presently, the entire flood plain area is protected by constructing embankment running all through Dahia Border to Badarpur border on Western bank and Loni border to Mayur Vihar border on the Eastern bank of Yamuna River within National Capital Territory. The depth to water level varies from 3 to 6 m. bgl in active flood plain.

The river Yamuna is the only perennial river flowing in the Southerly direction. Either side of the river Yamuna is marked by the extensive alluvial flood plain. The aerial extent of the active flood plain in NCT Delhi is 97 sq. km. The flood plains towards the North falls in Narela and Civil-lines tehsils of North District, the Central parts fall in North-East district and Daryaganj tehsil of Central district and the Southern most part falls in Saidabad and Kalkaji tehsil of South district. In general, the alluvial flood plain slope is towards South. The average slope of the Yamuna River bed from North to South is 0.4 m/km. Eastern and Western Yamuna Canal and Agra Canal are the three major canals originating from the river with Bawana, Rajpur and Lampur distributaries. A dense network of lined canals system exists in the North-Western part of the state.

A number of micro watersheds originate from the quartzite ridge. The drainage on the East of the ridge enters river Yamuna, whereas on the West, it enters natural depressions located in Najafgarh Tehsil of South-West district. The geographical area of NCT Delhi, is broadly divided into seven drainage basins, ultimately discharging into the Yamuna – (I) The Najafgarh Drain is about 39 Km long, flows North-Easterly and joins Yamuna River at Wazirabad in North Delhi. (ii) Supplementary drain, (iii) Barapullah drain. (iv) Wild life sanctuary area, (v) Drainage of Shahadra area, (vi) Bawana drain basin, (vii) Otherdrains directly out falling into river Yamuna on right bank. Swamp areas are common along the flood plains of Yamuna.

3.2 - GEOLOGY:

The rock formations exposed in the National Capital Territory of Delhi are mainly quartzite of the Alwar series of the Delhi Supergroup that are interbedded with thin micaceous schist bands. Srivatava et al. (1980) grouped these rocks of Delhi area as the Alwar formation of Delhi Super group while Kachroo and Bagchi (1999) have classified them as Barkhol formation of the Ajabgarh Group of the Delhi Supergroup. Proterozoic rocks occur along the ridge, extending from Harchandpur (Haryana) in the South to Wazirabad (Delhi) in the North. Quaternary sediments directly overlie the Proterozoic rocks. The Stratigraphic succession of these rocks reviewed by Kachroo and Bagchi (1999) is given in Table 3.1.

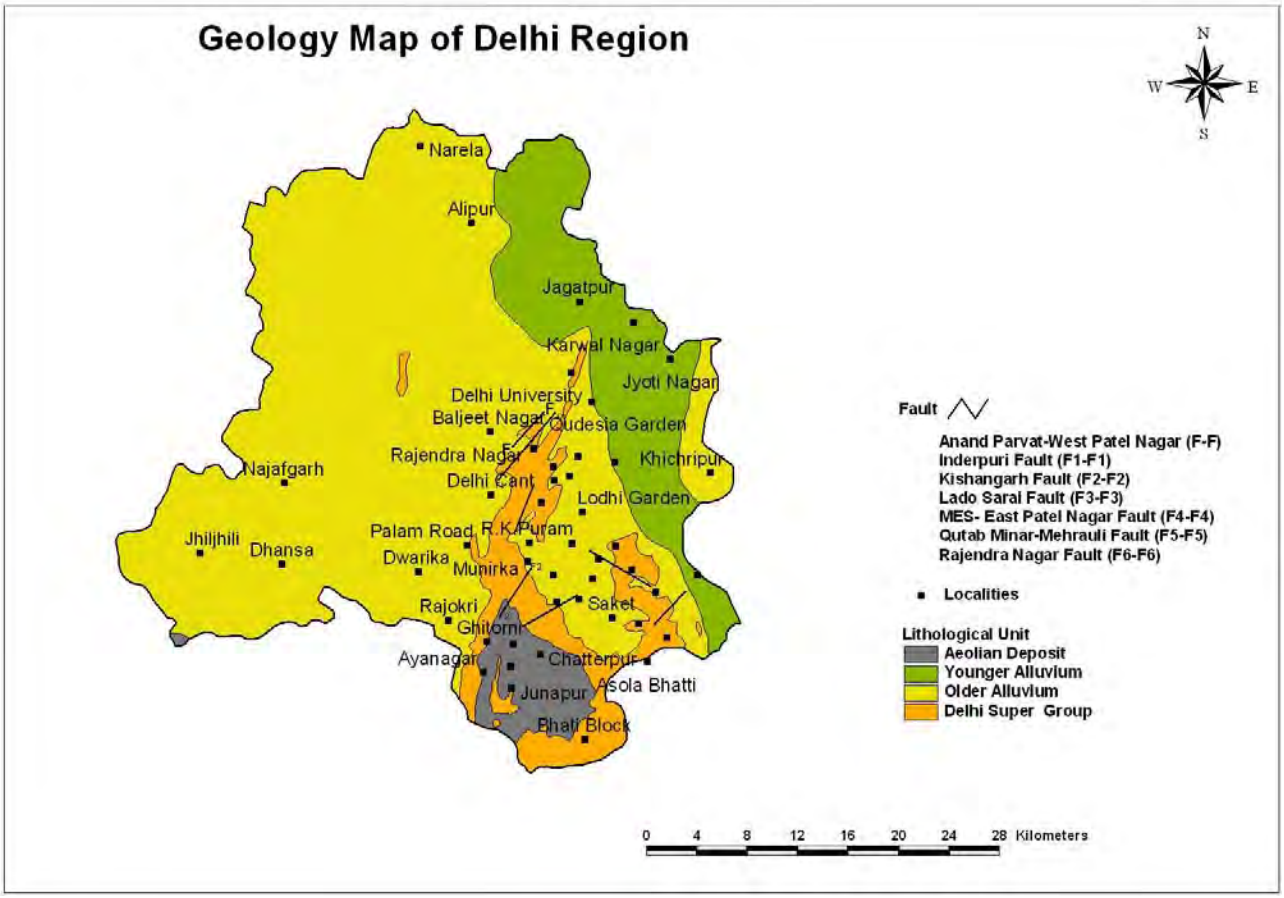
Table 3.1: Stratigraphic succession of rocks in Delhi area (modified after Kachroo and Bagchi, 1999).

Holocene	Yamuna channel alluvium	Grey, fine to medium sand, grit with coarse sand, silt and clay	Point bars, channel deposits
	Yamuna Older Flood Plain & Terraces	Grey sand, coarse grit, pebble beds and minor clays	Palaeochannels, meander scrolls, ox-bow lakes
	Older Alluvium	Sequence of sand-silt-clay with yellowish brown medium sand with silt, kankar with brown Aeolian sand	Abandoned channels, meander scrolls
		Unconformity	
Neoproterozoic	Post Delhi Intrusives	Pegmatitic, tourmaline-quartz veins and quartz veins	
Mesoproterozoic	Delhi Supergroup	Ajabgarh Group – Bharkol Formation	Quartzite with minor schist, tuff and ash beds

Srivastava et al. (1974) and Kachroo and Bagchi (1999) have carried out systematic geological and geomorphological mapping of Delhi and identified three distinct surfaces. The highest is the erosional surface forming the top of denudational hills. The second surface is Older Alluvial plain and the third is depositional Younger Alluvial plain (Yamuna). The geomorphologic features have undergone changes due

to widespread and uncontrolled urban activity. The geological map of Delhi after Kachroo and Bagchi (1999) is shown in Plate -3

Plate - 3



The Delhi Quartzite ridge acts as the recharge zone. The Quaternary deposits in the form of aeolian and alluvial deposits constitute the major repository of ground water in the area. In the East of the ridge, the thickness of unconsolidated sediments gradually increases away from the ridge, with the maximum reported thickness being 170m. In the Southwestern, Western and Northern parts of the area, the thickness of sediments is more than 300 m except at Dhansa where the bedrock has been encountered at 297 m below land surface. In Chhattarpur basin, the maximum thickness of sediments is 116 m. The aeolian deposits are mainly comprised of loam, silty loam and sandy loam. The bedrock is overlain by these deposits. Older alluvial deposits consist mostly of interbedded, lenticular and inter fingering deposits of clay, silt, and sand along with kankar. These deposits overlay the aeolian deposits

and are in turn overlain by the newer alluvium, which occurs mostly in the flood plains of river Yamuna.

The rocks of Delhi system have undergone multiple folding and different phases of metamorphism with time (Naha et al., 1984 and 1987 and Roy, 1988). Three generations of folding have been found in the rocks of Delhi (Gangopadhyay and Sen, 1968). The fold axes of first generation folds follow the trend of main ridge i.e. NNE-SSW, the second generation folds trending NE-SW are observed at Tughlaqabad - Mehrauli area, and third generation fold trending NW-SE is observed at Anand Parbat. The rocks are highly jointed and two sets of conjugate vertical to sub-vertical joints have been reported (Kachroo and Bagchi, 1999). These are NNE-SSW and WNW-ESE joints conforming to the older and newer structural trends. Srivastava et al. (1980) have inferred a number of faults trending NNE-SSW, NE-SW and WNW-ESE.

3.3 - BASEMENT TOPOGRAPHY

The basement topography of NCT, Delhi is highly uneven depicting the presence of sub-surface ridges and valleys because of folding of the geological formations during the Pre-Cambrian and subsequent periods. The thickness of unconsolidated sediments towards east of the ridge gradually increases away from the ridges, with the maximum reported thickness being 170 m. In the South-Western, Western and Northern parts of the area, the thickness of sediments is more than 300 m except at Dhansa where the bedrock has been encountered at 297m below land surface. In Chattarpur basin, the maximum thickness of sediments is 116 m.The nature of bedrock topography in different parts of NCT, Delhi is rendered uneven due to existence of sub surface ridges. Thickness of alluvium overlying the quartzites increases away from the outcrops. The thickness of alluvium is 300 m or more in most parts of South West, West and North West districts. The depth to bed rock is within 30 m on the east side of the ridge with a gradual downward slope towards river Yamuna. On the west of ridge near Mall road and Vikramaditya Marg, the depth to bed rock varies from 1 to 30 m. bgl. Further west of it and East of Najafgarh drain, there is a sudden increase in depth to 100 m. Near Sabjimandi, Rani Jhansi Road, Aram bagh, Paharganj, ChandaniChowk and Sadar Bazaar areas, thickness of alluvium is of the order of 10 to 20 m whereas near Roshanara Garden the thickness is about 200 m.

In the Central part of the city area near Dayabasti railway station, Karanpura, Patel Nagar Railway Station, the bedrock occurs within 30 m depth. But a little east of Karanpura, in DCM Chemical works, the bedrock has not been touched down to a drilling depth of 182.88 m. Such sharp and sudden change in thickness of alluvium may be due to faulting. In the Irwin Hospital, Delhi Gate, Daryaganj, Vijay Chowk and Pusa road areas the depth to bedrock varies from 5 to 10 m.bgl. In LalQuila and Rajghat areas the depth to bedrock varies between 40 to 60 m.bgl. In Shantivan area bedrock is encountered at a depth of 23 m.bgl. In NanglaMachi and Zoo complex, bedrock exposures are present on surface. In Okhla village bedrock is exposed on surface within the Jamia Milia Islamia campus. The thickness of alluvium is about 30 m at rail Bhawan and is about 100 to 150 m around India Gate. In Trans Yamuna area the thickness of alluvium varies from less than 20 (near Kailash colony) to more than 150 m away from Yamuna. In Usmanpur area bedrock is encountered at a depth of about 60 m. In Sonia Vihar area bedrock is encountered at a depth of 50 m.bgl. In Chattarpur basin of Mehrauli block, the alluvial thickness varies from a few meters near periphery to 115m around Satbari bund.

3.4 - SUBSURFACE CONFIGURATION AND AQUIFER DISPOSITION

Central District:

Central district of NCT Delhi is located in hard rock terrain of Delhi quartzite at one end while alluvium is underlain by Delhi quartzite at another end. Nearly 25 Sq. Km area covered in the district which is extending east to west, where eastern part is just terminating along Yamuna Flood Plain. Depth to bedrock in the eastern part is ranging from 10 to 60 m.bgl. In the western part some of the rock exposures of Delhi ridge are also seen, sporadically covering 1.91 Sq.km area. Quaternary alluvium is comprised of fine sand, silt, clay along with the occurrence of kankars. The sub surface geology comprise of top soil which is silty clay and sand, sand which is medium grained, sub-angular to sub rounded, grey in colour, composed of quartz grains and mica flakes which occurs as massive as well as fractured, admixed with calcareous matters and mica schist, alternate bands of light greyish to whitish in colour. The aquifer system consists of sand which is fine to medium grained, yellowish in colour, kankars medium to high grade. The depth to water level varies from 2 m to 7 m. The quality of water down to 31 m.bgl is found to be fresh.

North District:

North District of NCT Delhi just lying all along Yamuna River covering 60 Sq.Km areas. Its 40% area is under Yamuna Flood Plain. The Southern part of the District have a thin veneer of alluvium cover over quartzitic rock which is an extention of Delhi Ridge (Strike-SSW to NNE), near Wazirabad Barrage. The slope of the surface in the district is towards south by 0.40 m/km, but at the place of concealed Delhi Ridge it gets elevated. Due to this reason it forms a depression at the northern part of the upland area of the ridge leading to water logging conditions. Some of the exploratory wells Drilled by CGWB falling in this area are Delhi University, Dhirpur and Jagatpur encountered with bed rock at the depth of 32 m, 28 m and 167 m respectively. The alluvium covers are dominant with the clayey-silt followed by buff coloured semi plastic clay and on the margin of bedrock angular gravels with fine to coarse sand occur. The bedrock encountered have suffered moderate to high weathering in this area. The borehole logs of the Yamuna Flood Plain are characterized by the granular zones consisting of fine to medium Yamuna sand. The Percentage of Silt and Clay in flood plain are in lower side than sand.

East District:

East district of Delhi is located in the East of Yamuna River and extends up to the borders of Gaziabad and Noida ares of Uttar Pradesh. Covering a total area of 64 Sq. Km. Virtually, East district of NCT Delhi is a domain lying in between two rivers i.e. Yamuna in the West to Hindon in the East (6 Km eastward from the Delhi border).

The sub-surface material along yamuna flood plain and along eastern border (proximity of Hindon River) shows thick fine sand and sandy-silt strata at shallower depth i.e. up to 60 m.bgl. The finer sediments like clayey-silt, silty-clay and buff coloured clay along with Kankars also do exists, as parting between granular zones. The deeper zones beyond 60 m depth are characterized by fine material and lacking in granular zone. The basement rock condition in East district area is moderately uneven with gentle slopping towards East. It is unlike from western flank of NCT Delhi. At Ghazipur, Kalyanpuri and Mayur Vihar a mound like basement rock prevails in the depth range of 54 to 79 m. bgl. The basement rock situation around Yamuna flood plain in East Delhi District is ranging from 28 to 204 m.bgl. Especially around Akhsardham temple it ranges from 88 to 120 m.

The depth to water level in this district varies from 5 to 8 m.bgl and the discharge of tube well in Flood Plain is in the range of 600 to 1800 LPM and in the rest of the area it is 300 to 900 LPM with a draw-down of 6 to 13 m.

The Fresh–Saline water interface in Yamuna Flood Plain is ranging from 32 to 50 m whereas in rest of the area it is ranging from 25 to 38 m.

New Delhi District:

New Delhi district is located centrally in the state occupying an area of 35 Sq. Km. with varied surface altitude due to Delhi Ridge. Nearly 10 sq. Km. area falls within ridge area having a height of 225 to 255 m Above Mean Sea Level (AMSL). The surface is sloping gradually towards east up to the Yamuna river course where altitude is 210 m AMSL. The sub-surface configuration of New Delhi is different at various places, the western part which is adjoining to Delhi ridge is characterized by marginal alluvium of 0 to 30 m thickness overlain on weathered and fractured quartzite rocks (Delhi Ridge). The alluvium consists with clay, silt and fine to medium sand. A substantial amount of *Kankar*s also admixed with the clayey-silt below 20 m depth. This is the main aquifer material found in these areas. The top soil zone is predominantly consists of silty-clay material followed by thin partings of clayey-silt, sandy-silt and clay layers alternatively. Sandy-silt strata behave as favorable aquifer zone with a substantial discharge. In the western part of New Delhi district covering area of RashtrapatiBhavan, Chanakyapuri, Shantipath, South and North Avenue and

Connaught Place, tubewells are tapping both prevailing formation i.e. alluvium as well as hard rock, whereas in the eastern part only alluvial aquifers are tapped with yield ranging from 200 to 500 LPM. The extreme eastern part of New Delhi District bounded by river Yamuna where a domain of Yamuna Flood Plain exists in a linear fashion along river Yamuna .The potentiality of Ground water in this formation is relatively high i.e. ranging from 500 to 1600 LPM.

Ground water in the area occurs both under water table as well as under semi-confined conditions in the alluvium. The depth to water level in the district ranges from 5 to 25 m below ground level. The depth to water level varies widely depending upon the topographic elevation; it varies from 5 to 8 m in Yamuna flood plain and increases to 10 to 25 m towards the Delhi ridge. The tubewells usually tap *kankar* zone admixed with clayey-silt and sandy-silt aquifer zone. These aquifer zones are generally encountered alternatively below the depth of 20 m.bgl and onward up to the basement rock.

North-East District:

North-East district is located east of Yamuna River and bordering to Gaziabad district in the east and Merrut district in the north of Uttar Pradesh. It covers 60 Sq.Km of area. Virtually, North-East district of NCT Delhi is a domain lying in between two rivers i.e. Yamuna in the west to Hindon in the east (6 Km eastward from the Delhi border).

The sub-surface material along Yamuna flood plain and along eastern border (proximity of Hindon River) shows thick fine sand and sandy silt strata at shallower depth i.e. up to 60 m.bgl. The finer sediments like clayey–silt, silty-clay and buff coloured clay along with Kankars also do exists, as parting between granular zones. The deeper zones beyond 60 m depth are characterized by fine material and lacking in granular zone. Basement rock condition along the Yamuna Flood Plain in this district is shallower because Delhi central ridge which is running NNE to SSW diminishes at Wazirabad Barrage and protruding further in the same direction resulting to shallower depth of basement condition in sub-surface–horizon. In this district the depth is ranging from 54 m.bgl (Mandoli) to 67 m.bgl (Ushmanpur). Further east the depth of basement rock increases.

The depth to water level in this district is 5 to 8 m.bgl and the discharge of tube well in Flood Plain is in the range of 600 to 1800 LPM and in the rest of the area it is 300 to 900 LPM with a draw-down of 6 to 13 m.

The Fresh –Saline water interface in Yamuna Flood Plain is ranging from 32 to 50 m whereas in rest of the area it is ranging from 25 to 38 m.

North-West District:

The North-West district of NCT Delhi covers 440 Sq. km. area characterized by unconsolidated quaternary alluvium deposits. So for 250 m depth has been explored without encountering bed rock. The expected depth of bed rock is about 300 m or beyond. Thick pile of alluvium over the basement rock possesses varied sediment strata in an alternate fashion of geological setting. Nearly fine to medium and silt grade of 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 increases with depth. The semi-plastic and plastic clay beds are also common at deeper depth i.e. 80 m.bgl to 250 m.bgl. The granular zone (Fine sand and silty–sand) at deeper depth are not so frequent as in the shallower depth.

In large part of the district the water levels are shallow ranging from 2 to 8 m.bgl, whereas in a limited area towards the northern border (Narela) the water levels are somewhat deeper ranging from 6 to 12 m.bgl.

The line of fresh-saline water interface also varies greatly in entire area. All along the western Yamuna Canal and along Yamuna Flood Plain it shows deeper existence that is between 40 to 70 m, whereas in rest of the area it is at 22 to 40 m deep. It was also observed from the exploratory well data that salinity of water increases with depth and there are no fresh water aquifers in between the saline zone.

South District:

The South district of NCT Delhi covers 250 Sq. Km. of area of which 45.2 Sq. Km area shows mountainous undulating terrain exposed with Delhi quartzite. The district is also characterized by a saucer shaped vast alluvium field in the central part of the district popularly known as Chattarpur Basin. Virtually this is valley fill deposit, the alluvium thickness varies from 0.0 m to 140.00 m.bgl (Satbari village), below which quartzitic basement rock prevails. Some of the villages like Chattarpur, Gadaipur, Mandi, Ghitorni, Ayanagar, FatehpurBeri and Satbari fall within this area. The overburden composed of unconsolidated clay, silt, sand and varying proportions of Kankars. In the deep basin area, depth zone of 38 m to 55 m is characterized as prominent gravel zone admixed with silt and fine sand followed by clayey-silt and fine sand with occasional kankar nodules. Near to basement somewhat medium sands and angular gravels (ferruginous and gritty typesquartzites) are also encountered. At some places viz.Aya Nagar &FarehpurBeri at depth near to the basement rock, lenses of sticky yellowish clay also are encountered. The area across southern Delhi

Ridge which falls in South District namely Hauj-khas, Saket, Khanpur, Pushpvihar, Lal-kunwa and Saritavihar are underlain by marginal alluvium deposits with a thickness ranging from 60 m to 94 m below which Quartzitic basement rock prevails.

The bore hole constructed in Quartzites (Jaunapur, Asola, MandiTughlakabad) reveals that moderately fractured zones are prevalent in the depth of 30 m to 90 m and their fractured density gradually decreasing as depth increases. The weathered zone is found at every place above hard rock but their thickness varies from place to place.

The depth to water level varies widely in this district and is ranging from 8 m to 65 m. In the eastern tract of the district where Yamuna Flood Plain occur, depth to water level varies from 8 m to 22 m.bgl but in rest of the area it ranges from 30 to 65 m.bgl. The fresh/Saline water interface depth varies from 75 m to 100 m. The thickness of the fresh water zone varies from 30 m to 85 m.

South-West District:

The South-West district of NCT Delhi covers 420 Sq. km. Majority of the area characterized by unconsolidated quaternary alluvium deposits and about 18 Sq. Km area is covered by denudation hills especially in the eastern part of the district. Exploration upto a depth of 302 m was done to study the hydrogeological condition. The bed rock was encountered at different depth i.e. in Dhansa (297 m), Pindwalakala (300 m), Toghanpur (298 m) and Jhul-jhuli(251 m) Thick pile of alluvium over the basement rock possesses varied nature of sediment strata in an alternate fashion of geological setting. Nearly fine to medium and silt grade of 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 50m, silty–clay and clay (Light yellow) beds with Kankars increases with depth. The semi-plastic and plastic clay beds are also common at deeper depth i.e. 80 m .bgl to 250 m.bgl. The granular zone (Fine sand and silty–sand) at deeper depth are not so frequent as in the shallower depth.

In major part of the district the depth to water level ranges from 5 to 28 m.bglwhere as in rocky area which are lying in the eastern part of the district (Central Delhi Ridge) the depth to water level is in the range of 22 m to 50 m.

The line of Fresh-Saline water interface also varies greatly in entire area. All along the Najafgarh Drain and Two Depression (GumanheraVill.&PindwalanKalan) possesses somewhat deep fresh water layer i.e. up to 35 m.bgl but on the other hand rest of the area is having thin layer of fresh water i.e. up to the depth 25 to 28 m.bgl

only. In the Eastern rocky area the fresh–saline Interface lies at greater depths i.e. around 80 to 90 m.bgl.

West District:

West district is occupied by unconsolidated Quaternary alluvium underlain by Precambrian meta-sediments of Delhi System. Quaternary alluvium comprises of sand, clay, silt, gravels/pebbles, kankars. The aquifer system include sand fine to coarse grained admixed with kankars with little amount of clay and silt. Clay is sticky and plastic in nature, light grayish in colour, admixed with a little sand and kankars, fine to medium grained. The depth of water level varies in the district, 2 m to 15 m. The depth of fresh saline interface also varies from 25 m to 50 m at different places. The depth of fresh water zone varies from 10 m to 45 m.

Chapter-4

WATER LEVEL BEHAVIOR OF HYDROGRAPH STATIONS DURING 2014-15

4.1. MAY- 2014:

Depth to water level:

The Depth to water level recorded in NCT Delhi during **May-2014** ranges from 1.19 to 74.41 m. bgl. The total 116 stations of Delhi state have been analyzed district wise where 53% wells of South district shown more than 40 m.bgl water level and 18% wells have 20 to 40 m.bgl water level. In New Delhi and South-West district 64% and 28% of the wells show water levels ranging from 10 to 20 m.bgl, (Plate-4, Annexure-I, Table- 4.1). In 50%, 40% and 45% of the wells in North East, East and North West districts the water level ranges from of 5 to10 m.bgl respectively. The entire Yamuna flood plain the water levels are between 2 to 5 m.

Annual Fluctuation:

The fluctuation of water level between **May-2013** and **May-2014** of Delhi state shows rise in the range of 0.01 to 4.53 m nearly 71% of wells with respect to the previous year water level. The overall data indicates that South and South–West districts are showing a continuous fall in comparison to other areas. (Plate- 8).

Decadal Fluctuation:

When the data of **May-2014** has compared with **10 year mean of May** water level 47% of the wells indicate fall in the range of 0.16 to 8.99 m. Only 55% wells of the East, New Delhi, North and North-West have been observed to show rising condition in the range of 0 to 2 m. The maximum fall has taken place in district of South and South-West (i.e. 6.19 to 8.99 m) (Plate- 13, Table-4.1)

PLATE- 4

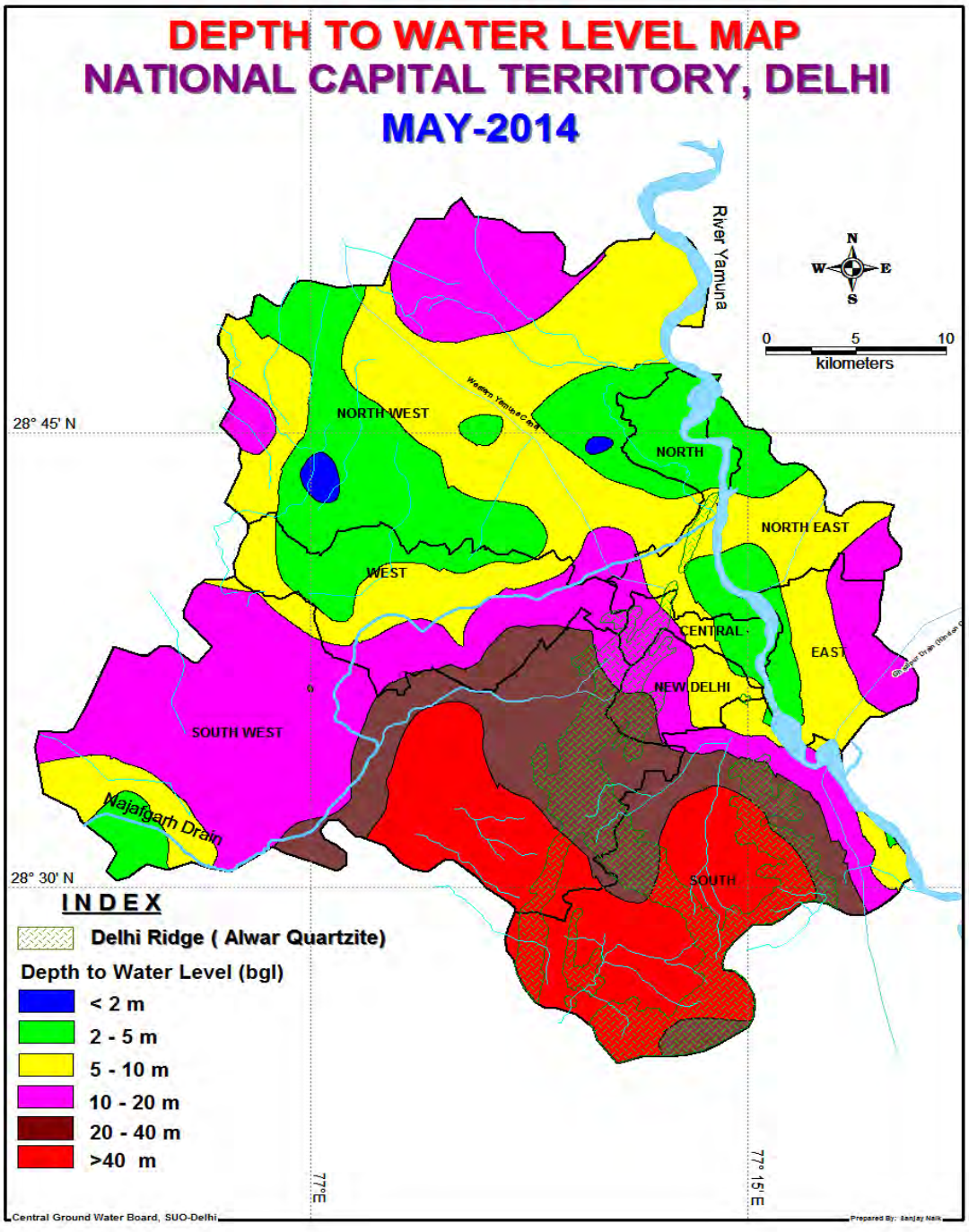

DEPTH TO WATER LEVEL MAP
NATIONAL CAPITAL TERRITORY, DELHI
MAY-2014
River Yamuna
N
W
E
S
0
5
10
kilometers
28° 45' N
NORTH WEST
NORTH
NORTH EAST
WEST
CENTRAL
EAST
NEW DELHI
SOUTH WEST
SOUTH
Najafgarh Drain
28° 30' N
INDEX
Delhi Ridge (Alwar Quartzite)
Depth to Water Level (bgl)
< 2 m
2 - 5 m
5 - 10 m
10 - 20 m
20 - 40 m
>40 m
77° E
77° 15' E
Central Ground Water Board, SUO-Delhi

PLATE - 5

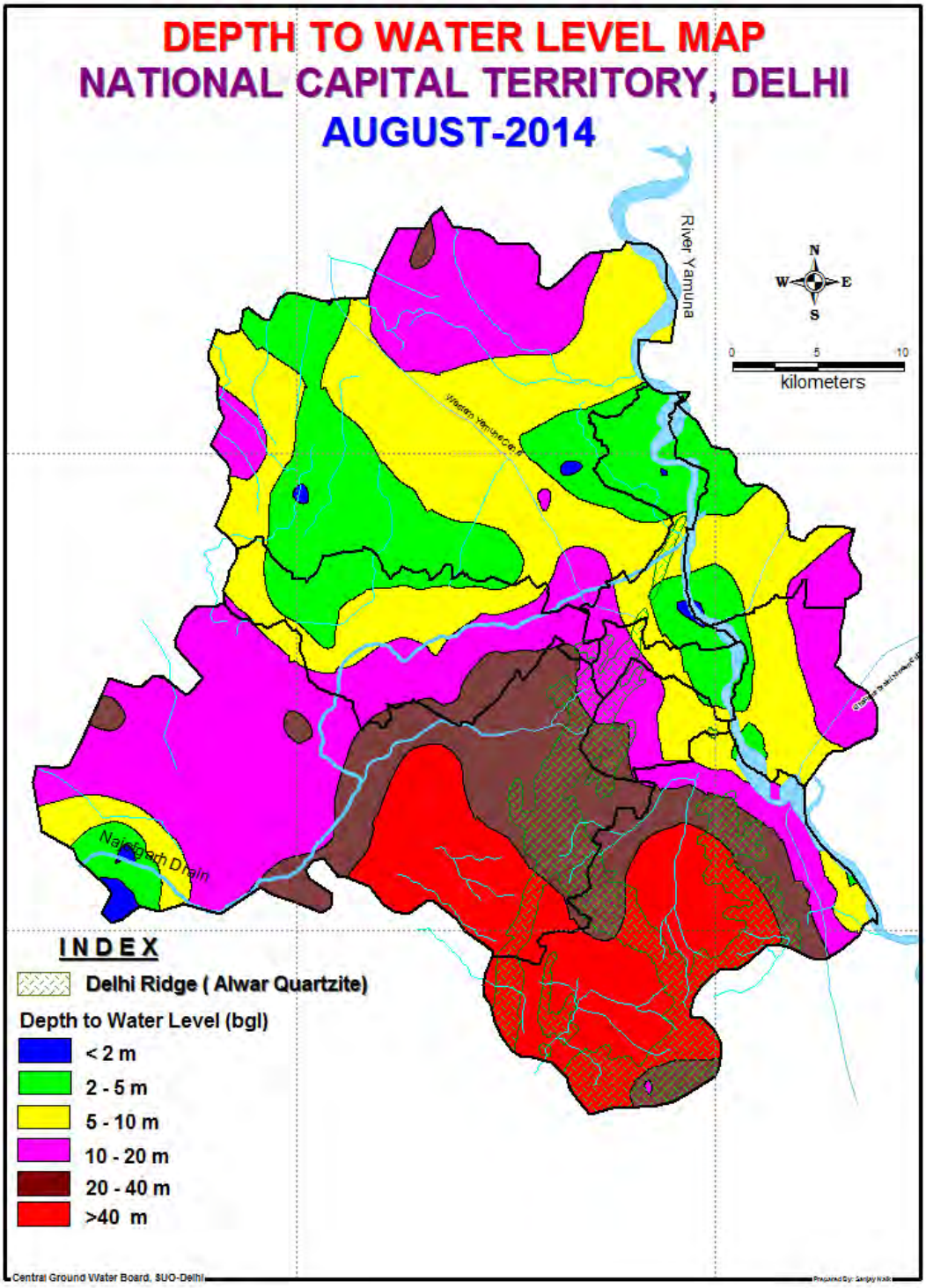

DEPTH TO WATER LEVEL MAP
NATIONAL CAPITAL TERRITORY, DELHI
AUGUST-2014
River Yamuna
N
W
E
S
0
5
10
kilometers
Najafgarh Drain
INDEX
Delhi Ridge (Alwar Quartzite)
Depth to Water Level (bgl)
< 2 m
2 - 5 m
5 - 10 m
10 - 20 m
20 - 40 m
>40 m
Central Ground Water Board, SUO-Delhi

PLATE- 6

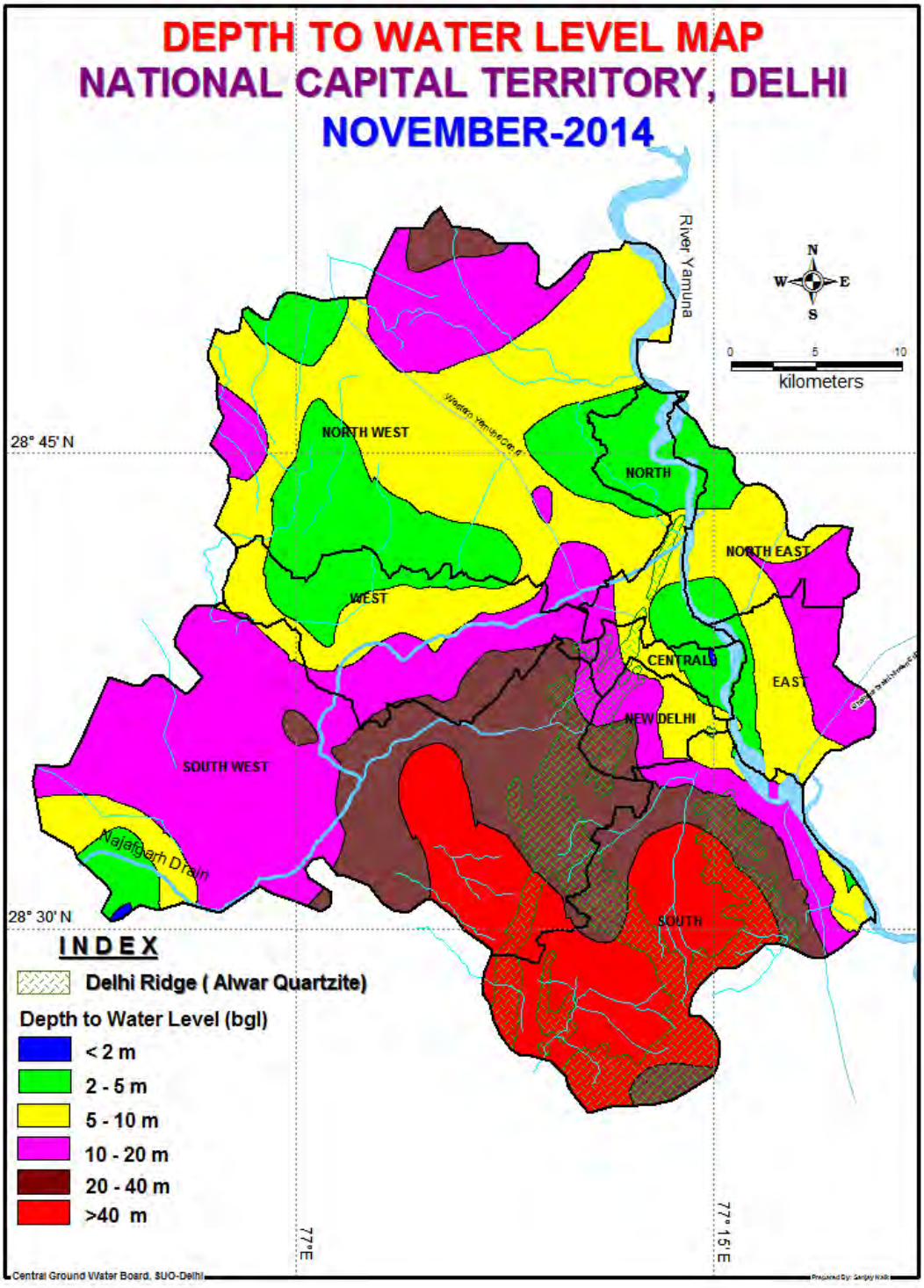
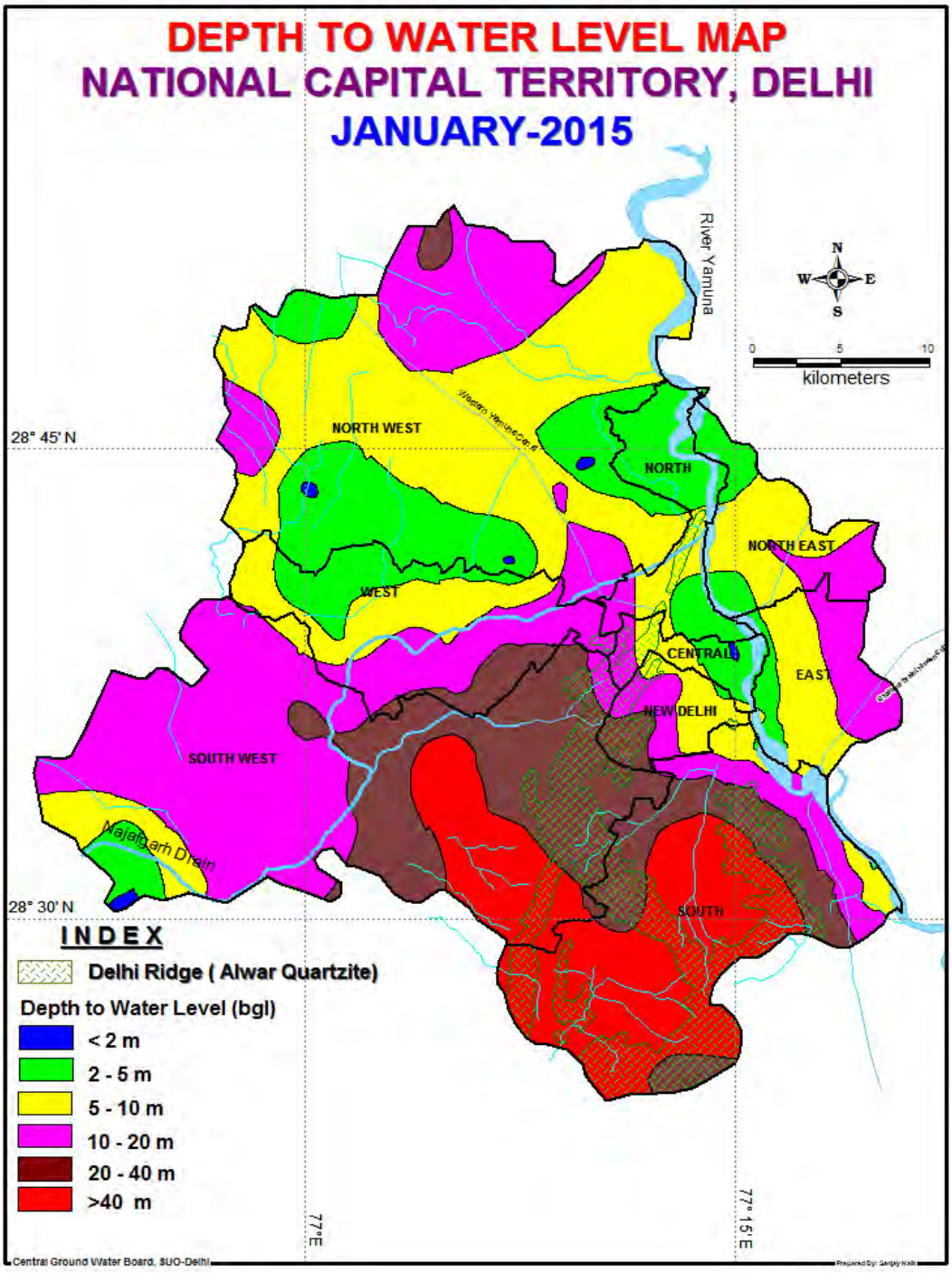

DEPTH TO WATER LEVEL MAP
NATIONAL CAPITAL TERRITORY, DELHI
NOVEMBER-2014
River Yamuna
N
W
E
S
0
5
10
kilometers
28° 45' N
28° 30' N
NORTH WEST
NORTH
NORTH EAST
WEST
CENTRAL
EAST
NEW DELHI
SOUTH WEST
SOUTH
Najafgarh Drain
INDEX
Delhi Ridge (Alwar Quartzite)
Depth to Water Level (bgl)
< 2 m
2 - 5 m
5 - 10 m
10 - 20 m
20 - 40 m
>40 m
77°E
77° 15' E
Central Ground Water Board, SUO-Delhi

PLATE- 7


DEPTH TO WATER LEVEL MAP
NATIONAL CAPITAL TERRITORY, DELHI
JANUARY-2015
River Yamuna
N
W
E
S
0
5
10
kilometers
28° 45' N
NORTH WEST
NORTH
NORTH EAST
WEST
CENTRAL
EAST
NEW DELHI
SOUTH WEST
SOUTH
Najafgarh Drain
28° 30' N
INDEX
Delhi Ridge (Alwar Quartzite)
Depth to Water Level (bgl)
< 2 m
2 - 5 m
5 - 10 m
10 - 20 m
20 - 40 m
>40 m
77°E
77° 15' E
Central Ground Water Board, SUO-Delhi

Area wise analysis of water level data of *May, 2014 for* 125 stations is shown in the following table:-

Table-4.1
Area under various Depth to Water Level in NCT Delhi

Depth to water Level in m	Area in Sq. Km.	Locations	Districts
0-2	5	Raj Ghat, Jagat Pur-2, Kanjawala, Balswa Lake	Central, North, North West
2-5	270	Jagat Pur-1, Nangli Rajapur, Burari, Auchandi, Majra Dabus, Deorala, Peeragarhi etc.	East, North, NW, SW, West
5-10	401	Indiagate, Chilla, Bakoli, Palla etc	New Delhi, East Delhi &N-W
10-20	383	Birla Mandir, Kichner Road, Shram Shakti Bhavan, Dwarka, Daulatpur etc.	S-W, New Delhi,
20-40	195	Mahavir Banasthali, Nehrupark, JamaliKamali etc.	S-W, South, New Delhi
> 40	229	PushpVihar, Bhatti, Asola Jaunapur, Satbari Ayanagar etc	South District

4.2. AUGUST 2014:

Depth to water level:

The Depth to water level recorded in NCT Delhi during **Aug-2014** ranges from 1.09 to 76 m. bgl. Total 118 stations have been analyzed district wise, 53% wells of South district shown more than 40 m.bgl water level and 12% wells have 20 to 40 m. bgl water level. In South-West district water levels in 41% of the monitored wells range between 20 to 40 m.bgl. In New Delhi district 64%of the wells have 10 to 20 m.bgl water level. (Plate-5, Annexure-I). The depth to water level in East and North-West district range between 5 to 10 m. bgl in 40% and 50% of the district whereas in East, North and West district the water levels in 30%, 43%, and 33%wells range between 2 to 5 m. bgl respectively, the entire Yamuna flood plain is also falling in this category.

May – August Fluctuation:

The fluctuation of water level between **Pre-monsoon (May-2014)** and **August-2014** indicate that 69% wells shows fall in the range of 0 to 2m, 6% in the range of 2 to 4m and the rest show a rise in water level. The fall condition has been observed in South West, South, North West, New Delhi and East district. The maximum fall of 3.62 and 8.86 observed in the district of North West and South West respectively. This may be the result of heavy withdrawal locally during the period. (Annexure-I)

Annual Fluctuation:

The variation of water level from **August-2013** and **August-2014** reveals that there is a rise in the range of 0 to 2m in nearly 14% of the wells (only in pockets). In the districts like New Delhi, South-West and South district the range of fall in water level in between 4.05 to 8.52 m. In totality 87% wells shows fall in the range of 0 to more than 4 m. The fall of more than 4m is recorded in New Delhi, South and South West districts. The overall analysis indicates a falling situation in the state (Plate-9).

Decadal Fluctuation:

The water level data of **August-2014** when compared with **10 year mean of August** indicate that in 73% of the wells the water levels are falling in the range of 0.02 to 10.32. In the districts like East, New Delhi, North East, North West, South and South-West 70% of the wells show decline in water level behavior (Plate-14).

4.3. NOVEMBER 2014:

Depth to water level:

The Depth to water level recorded in NCT Delhi during **November-2014** ranges from 1.82 to 63.63 m. bgl. The data from 116 stations (Plate-6, Annexure-I) has been analyzed district wise. 50% wells of South district shown more than 40 m. bgl water level and 12% wells have 20 to 40 m.bgl water level. In South-West district 38% wells have water level between 20 to 40 m. bgl. The depth to water level of East, North-East and North-West districts are in the range of 5-10 m.bgl in 40%, 50% and 45% respectively whereas in North and South districts 57% and 6% wells are in the range of 2-5 water level respectively. The water levels of entire Yamuna flood plain are in the range of 2 to 5 m. bgl.

Pre-Post Monsoon Fluctuation:

The fluctuation of water level between **Pre-monsoon (May-2014)** and **Post Monsoon (Nov-2014)** of Delhi state shows 0.02 to 4.53 m fall in 81% of the wells. Few wells of New Delhi, North West, South and South West district show rise in the range of 0 to 2 m. An analysis of the data indicates that the declining trend is continuing in the South and South-West districts. (Plate-12, Annexure-I).

Annual Fluctuation:

The hydrograph analyses of **Nov-2013 and Nov-2014** water levels of 114 wells reveals that 92% of the wells shows fall in the range of 0 to more than 4m whereas rest of the wells show rise in water level. The fall of more than 4 m are recorded only in New Delhi, North West, West and South districts. The overall analysis indicates a falling situation in the state (Plate-10).

Decadal Fluctuation:

When the data of **Nov-2014** was compared with **10 year mean of Nov.** it shows that the water levels in 82% of the wells have recorded a fall in the range of 0.03 to 9.82 m. Only 23% wells of the New Delhi, North West and South West districts have a rising condition in the range of 0 to 2m (Plate-15).

PLATE- 8

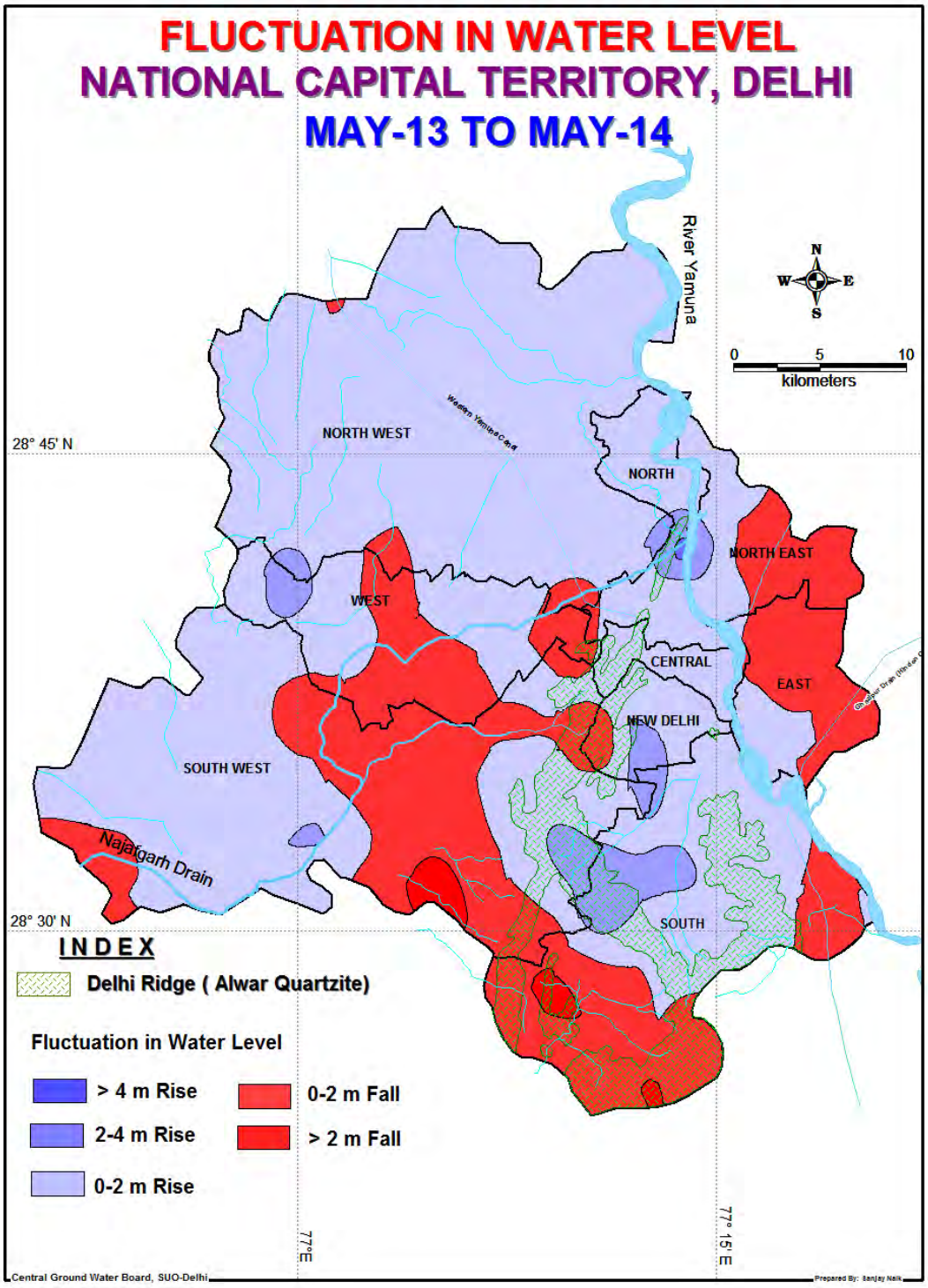

FLUCTUATION IN WATER LEVEL
NATIONAL CAPITAL TERRITORY, DELHI
MAY-13 TO MAY-14
River Yamuna
N
W
E
S
0
5
10
kilometers
28° 45' N
NORTH WEST
NORTH
NORTH EAST
WEST
CENTRAL
EAST
NEW DELHI
SOUTH WEST
Najafgarh Drain
SOUTH
28° 30' N
INDEX
Delhi Ridge (Alwar Quartzite)
Fluctuation in Water Level
> 4 m Rise
2-4 m Rise
0-2 m Rise
0-2 m Fall
> 2 m Fall
77°E
77° 15' E
Central Ground Water Board, SUO-Delhi
Prepared By: Sanjay Naik

PLATE - 9

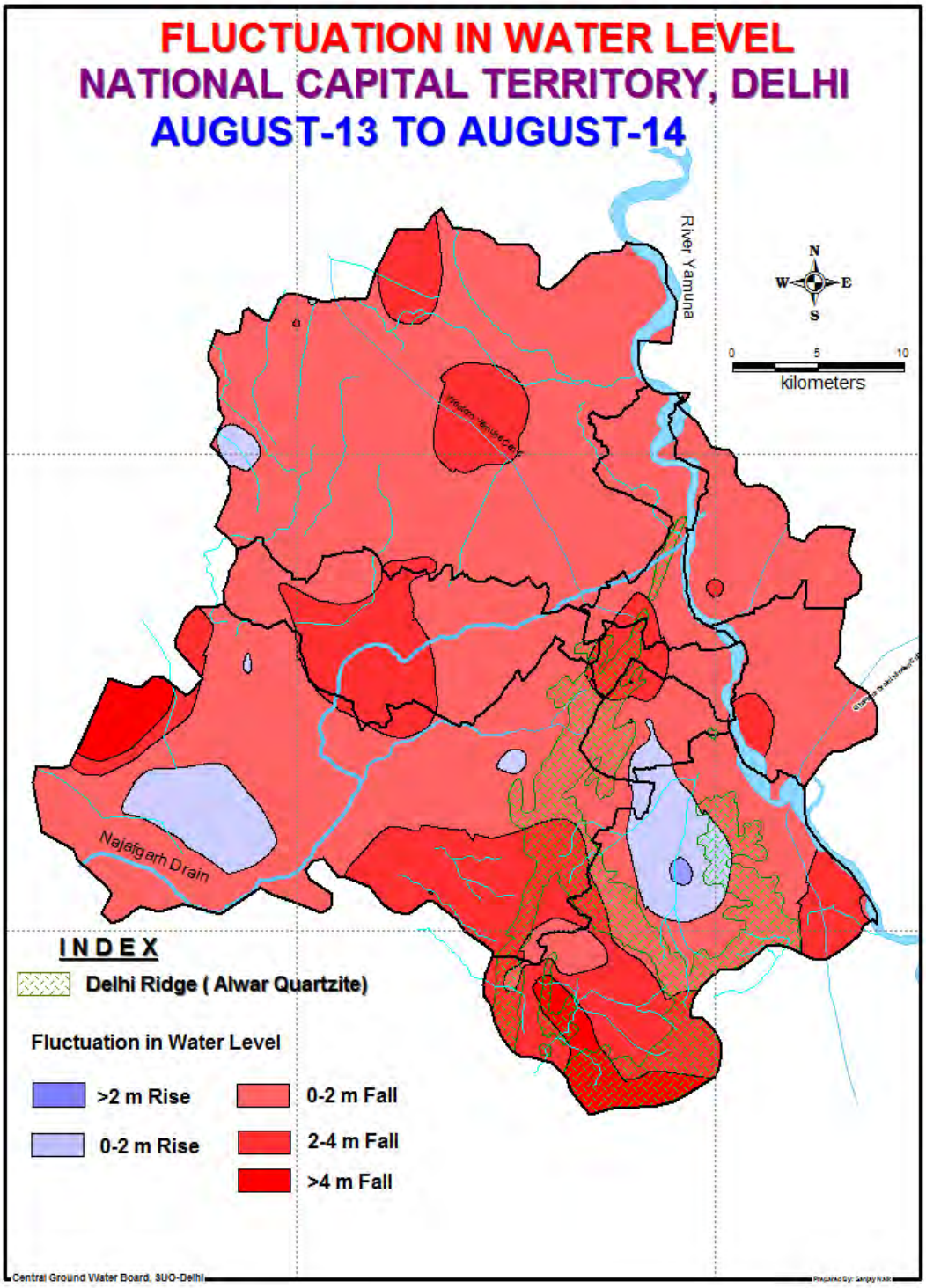

FLUCTUATION IN WATER LEVEL
NATIONAL CAPITAL TERRITORY, DELHI
AUGUST-13 TO AUGUST-14
River Yamuna
N
W
E
S
0
5
10
kilometers
Najafgarh Drain
INDEX
Delhi Ridge (Alwar Quartzite)
Fluctuation in Water Level
>2 m Rise
0-2 m Rise
0-2 m Fall
2-4 m Fall
>4 m Fall
Central Ground Water Board, SUO-Delhi

PLATE - 10

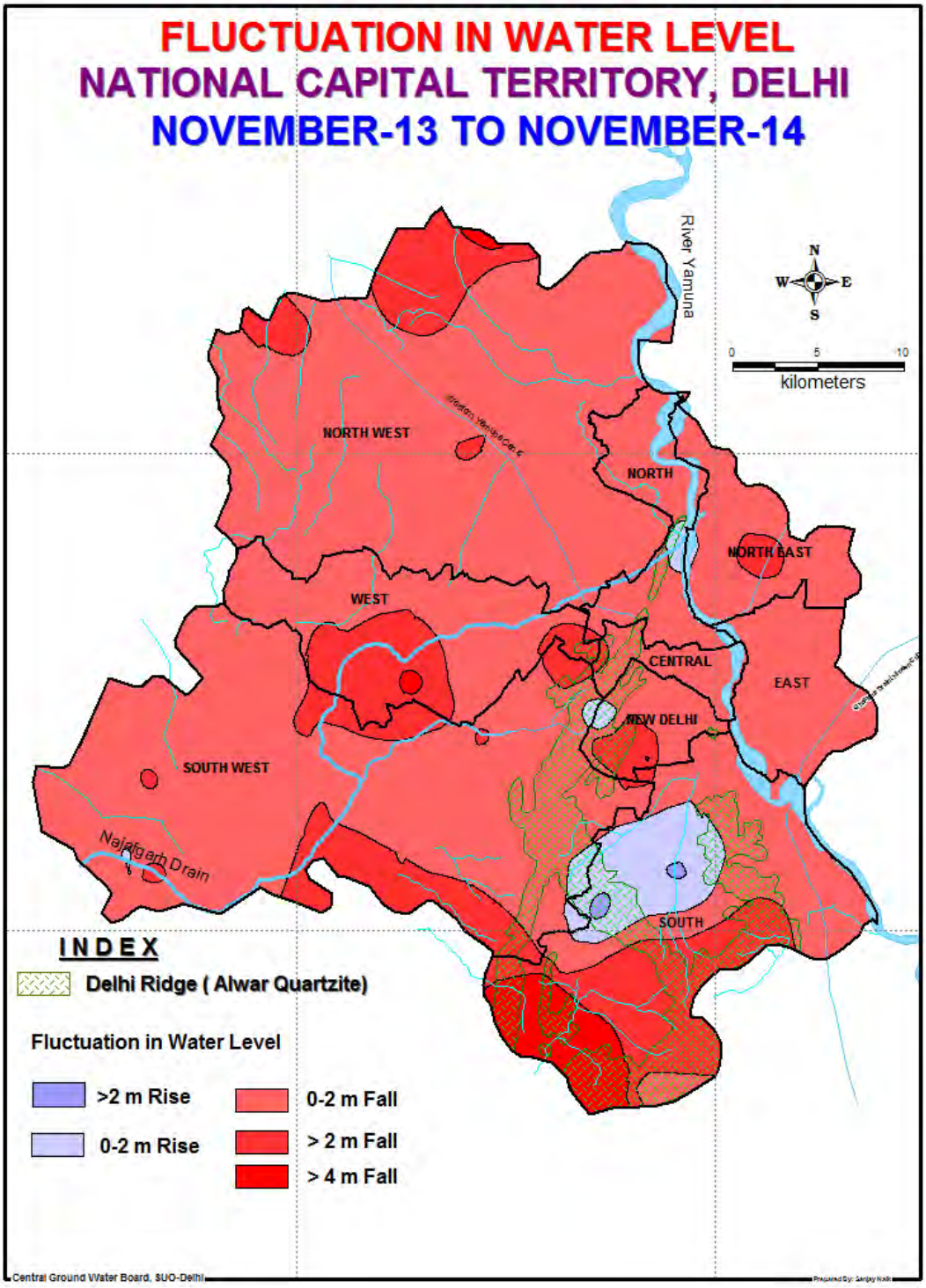

FLUCTUATION IN WATER LEVEL
NATIONAL CAPITAL TERRITORY, DELHI
NOVEMBER-13 TO NOVEMBER-14
River Yamuna
N
W
E
S
0
5
10
kilometers
NORTH WEST
NORTH
NORTH EAST
WEST
CENTRAL
EAST
NEW DELHI
SOUTH WEST
SOUTH
Najafgarh Drain
INDEX
Delhi Ridge (Alwar Quartzite)
Fluctuation in Water Level
>2 m Rise
0-2 m Rise
0-2 m Fall
> 2 m Fall
> 4 m Fall
Central Ground Water Board, SUO-Delhi

Plate – 11

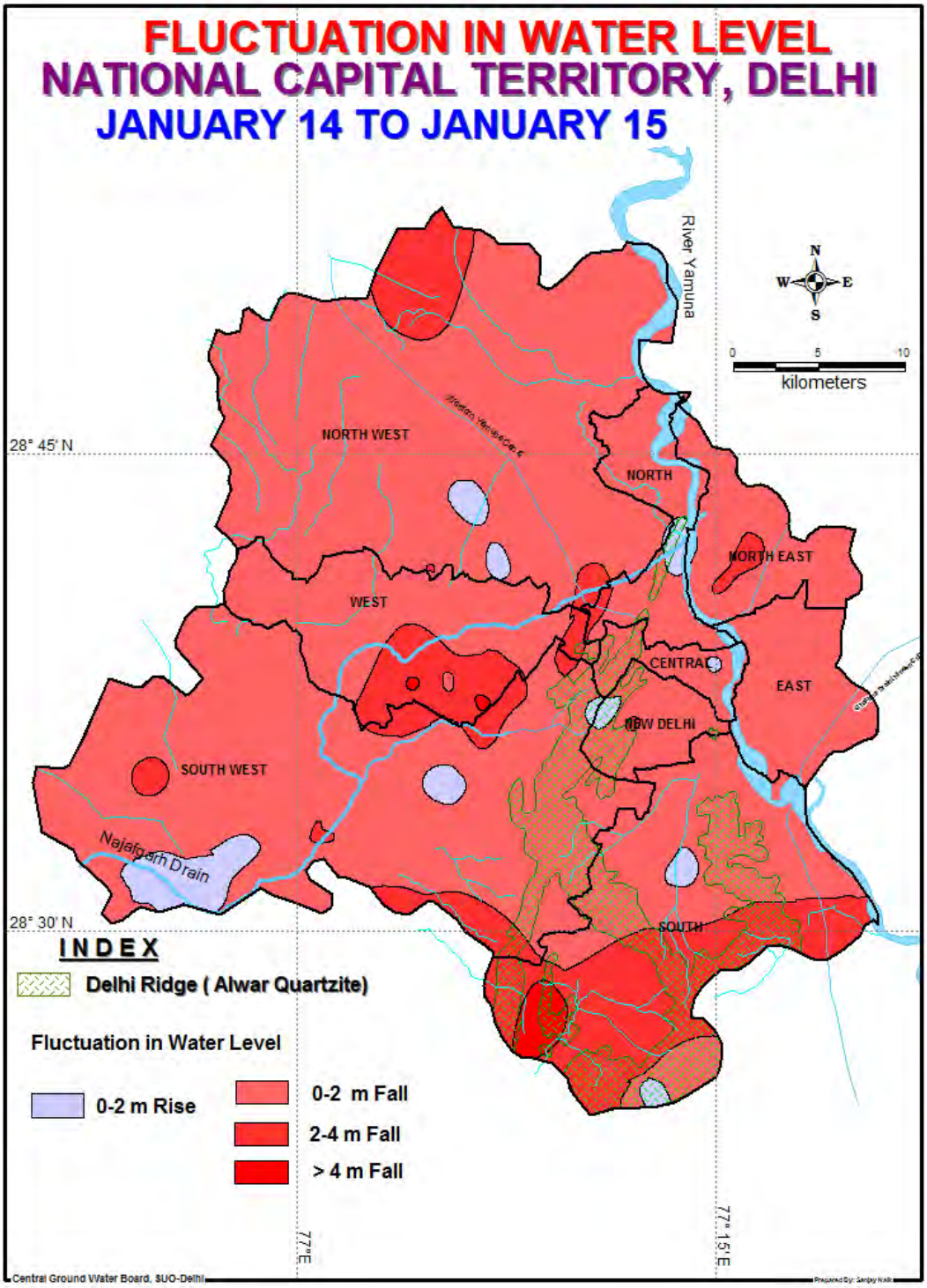
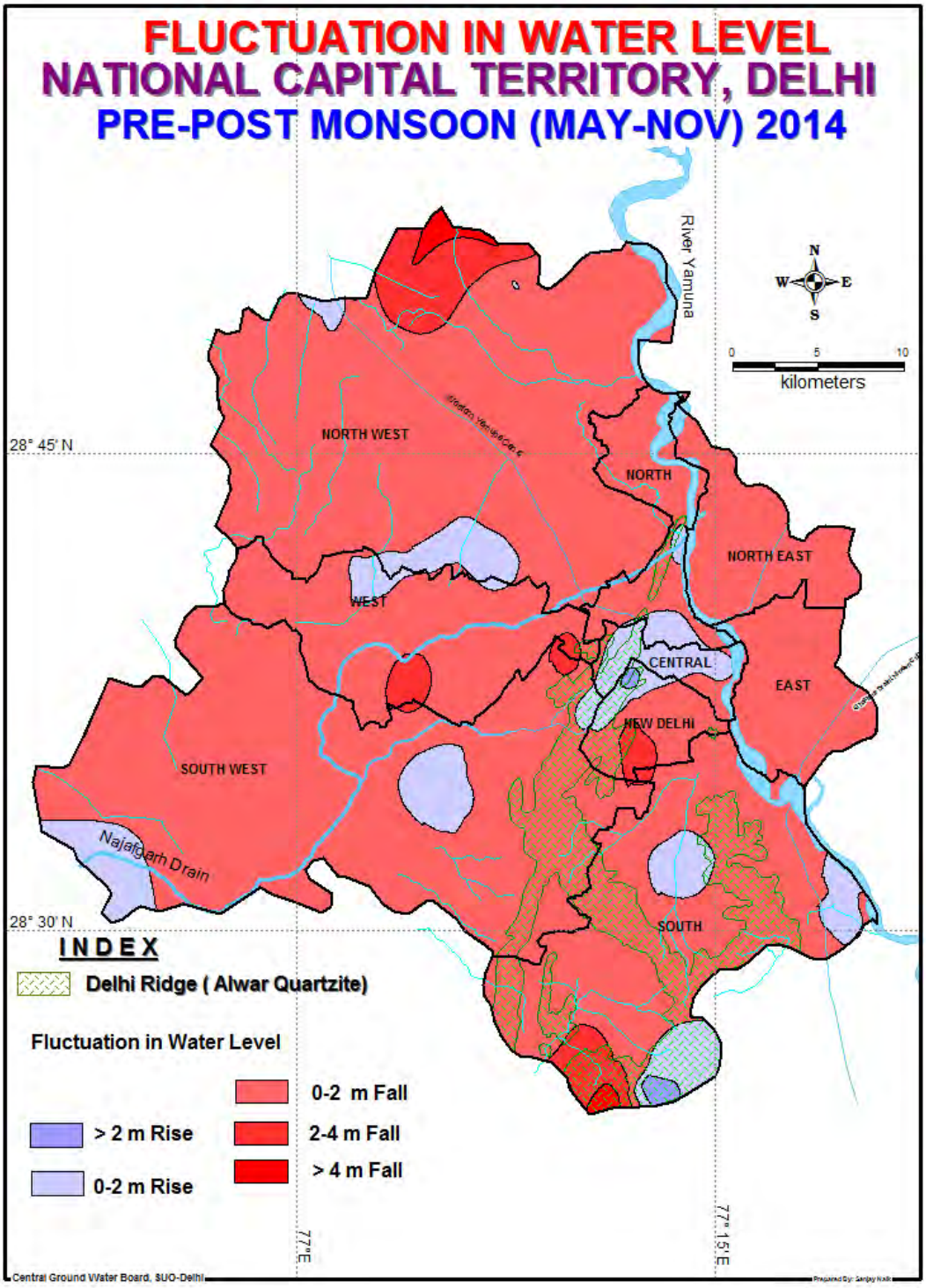

FLUCTUATION IN WATER LEVEL
NATIONAL CAPITAL TERRITORY, DELHI
JANUARY 14 TO JANUARY 15
River Yamuna
N
W
E
S
0
5
10
kilometers
28° 45' N
28° 30' N
NORTH WEST
NORTH
NORTH EAST
WEST
CENTRAL
EAST
NEW DELHI
SOUTH WEST
SOUTH
Najafgarh Drain
INDEX
Delhi Ridge (Alwar Quartzite)
Fluctuation in Water Level
0-2 m Rise
0-2 m Fall
2-4 m Fall
> 4 m Fall
77° E
77° 15' E
Central Ground Water Board, SUO-Delhi

Plate - 12


FLUCTUATION IN WATER LEVEL
NATIONAL CAPITAL TERRITORY, DELHI
PRE-POST MONSOON (MAY-NOV) 2014
River Yamuna
N
W
E
S
0
5
10
kilometers
28° 45' N
NORTH WEST
NORTH
NORTH EAST
WEST
CENTRAL
EAST
NEW DELHI
SOUTH WEST
Najafgarh Drain
SOUTH
28° 30' N
INDEX
Delhi Ridge (Alwar Quartzite)
Fluctuation in Water Level
0-2 m Fall
2-4 m Fall
> 4 m Fall
> 2 m Rise
0-2 m Rise
77°E
77° 15'E
Central Ground Water Board, SUO-Delhi

4.4. JANUARY 2015:

Depth to water level:

The Depth to water level recorded in NCT Delhi during **January-2015** ranges from 1.66 to 64 m.bgl. A total of 115 stations have been analyzed district wise. An analysis of the data reveal that in South district 50% of the wells have water levels of more than 40 m. bgl and 19% in the range of 20 to 40 m. bgl. The water levels in the districts like South-West and New Delhi are in the range of 10 to 20 m. bgl in 40% of the area and a few patches of 20 to 40 m. bgl water levels are also observed in New Delhi, South and South-West districts. In rest of the districts the water level is between of 2 to 10 m. bgl indicating that only in 51% of the State the water levels are below 10 m. bgl (Plate-7, Annexure-I) covering entire Yamuna Flood Plain and East, North East, North West and North districts. Maximum water levels in the states are observed in the monitoring wells at Godaipur, Jaunapur, Palam, and Pushp Vihar ranging between of 53 to 64 m. bgl.

May 14 – January 15 Fluctuation:

The fluctuation of water level between **Pre-monsoon (May-2014)** and **January-2015** have been analyzed for 113 wells in which it has been found that 78% wells fall in the range of 0.01 to 4.12 m mostly in North West, South and South West districts and 21% area show rise in the range of 0.01 to 4.06 m in whole state. (Annexure-I).

Annual Fluctuation:

The hydrograph analyses of **January-2014 and January-2015** reveals that in 89% of the wells the water level is falling and in 11% wells show rise in the range of 0 to 2 m. The overall data indicates that New Delhi, North-West, South and South–West districts are sharing a continuous fall in comparison to other areas (Plate-11).

Decadal Fluctuation:

When the data of **January-2015** has compared with **10 year mean of January,** it has been observed that 74% of monitoring stations of New Delhi and North West show a fall in water level where the highest fall is 4.42 m and 5.85 m respectively. The same condition prevails in South and South West District in 62% of the area where the highest depletion is 6.95 m and 9.07 m respectively. North East and East have also suffered depletion of water table in the range of 4.17 to 4.39 m. The overall observation of water levels in the state indicates that the southern district facing maximum declining condition (Plate-16).

Plate - 13

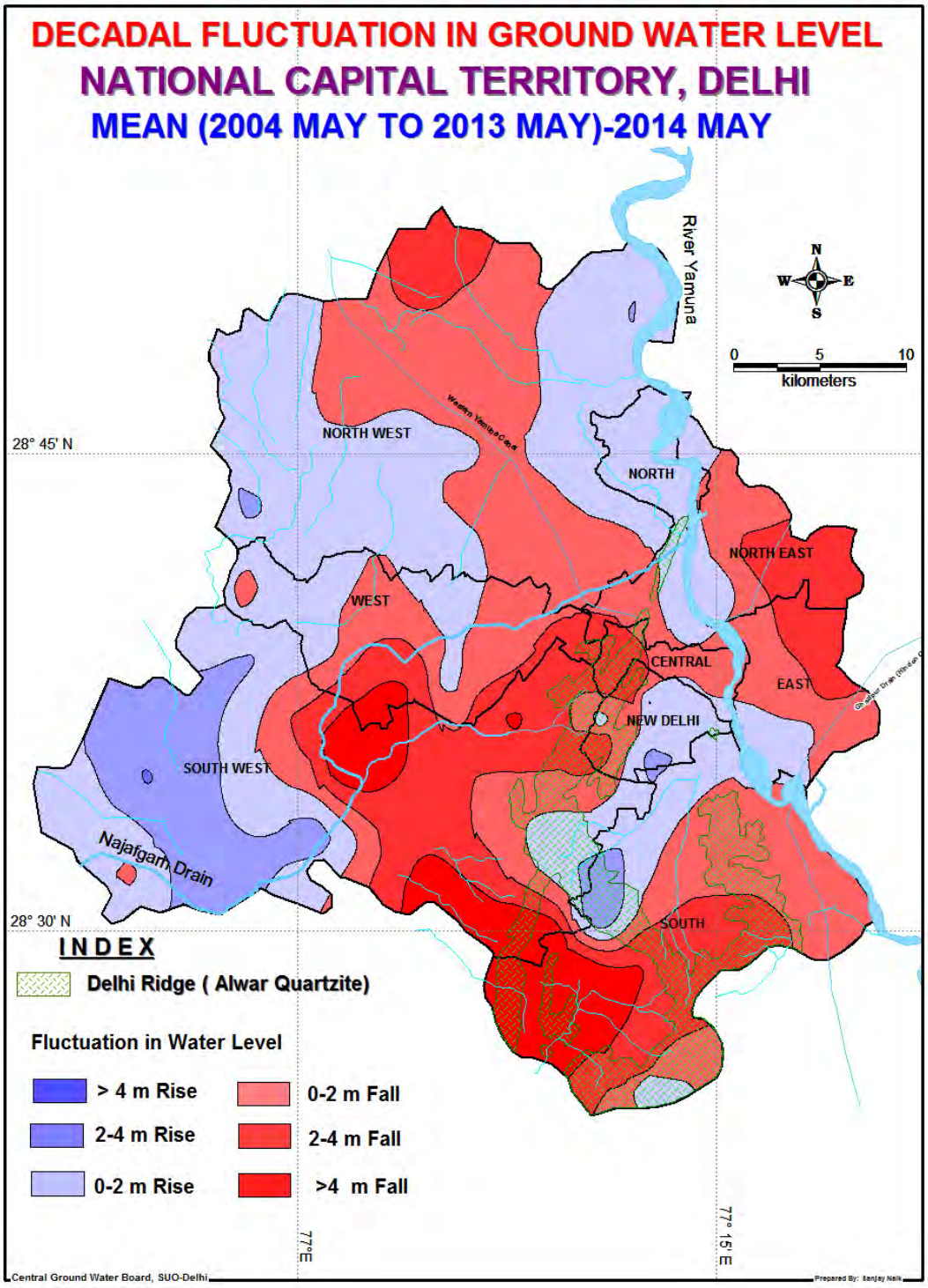

DECADAL FLUCTUATION IN GROUND WATER LEVEL
NATIONAL CAPITAL TERRITORY, DELHI
MEAN (2004 MAY TO 2013 MAY)-2014 MAY
River Yamuna
N
W
E
S
0
5
10
kilometers
28° 45' N
NORTH WEST
NORTH
NORTH EAST
WEST
CENTRAL
EAST
NEW DELHI
SOUTH WEST
SOUTH
Najafgarh Drain
28° 30' N
INDEX
Delhi Ridge (Alwar Quartzite)
Fluctuation in Water Level
> 4 m Rise
2-4 m Rise
0-2 m Rise
0-2 m Fall
2-4 m Fall
>4 m Fall
77°E
77° 15' E
Central Ground Water Board, SUO-Delhi

Plate - 14

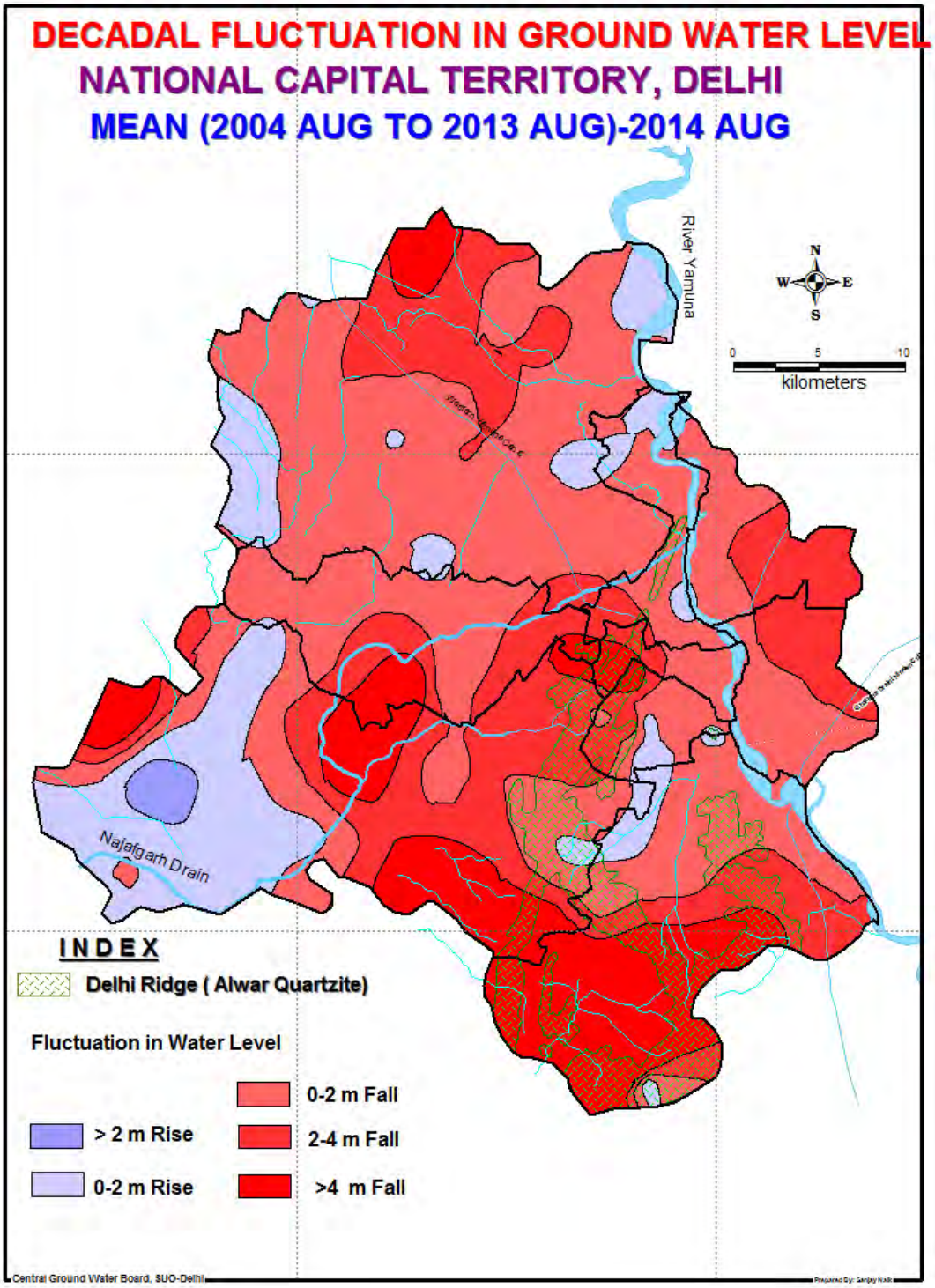

DECADAL FLUCTUATION IN GROUND WATER LEVEL
NATIONAL CAPITAL TERRITORY, DELHI
MEAN (2004 AUG TO 2013 AUG)-2014 AUG
River Yamuna
N
W
E
S
0
5
10
kilometers
Najafgarh Drain
INDEX
Delhi Ridge (Alwar Quartzite)
Fluctuation in Water Level
> 2 m Rise
0-2 m Rise
0-2 m Fall
2-4 m Fall
>4 m Fall
Central Ground Water Board, SUO-Delhi

PLATE - 15

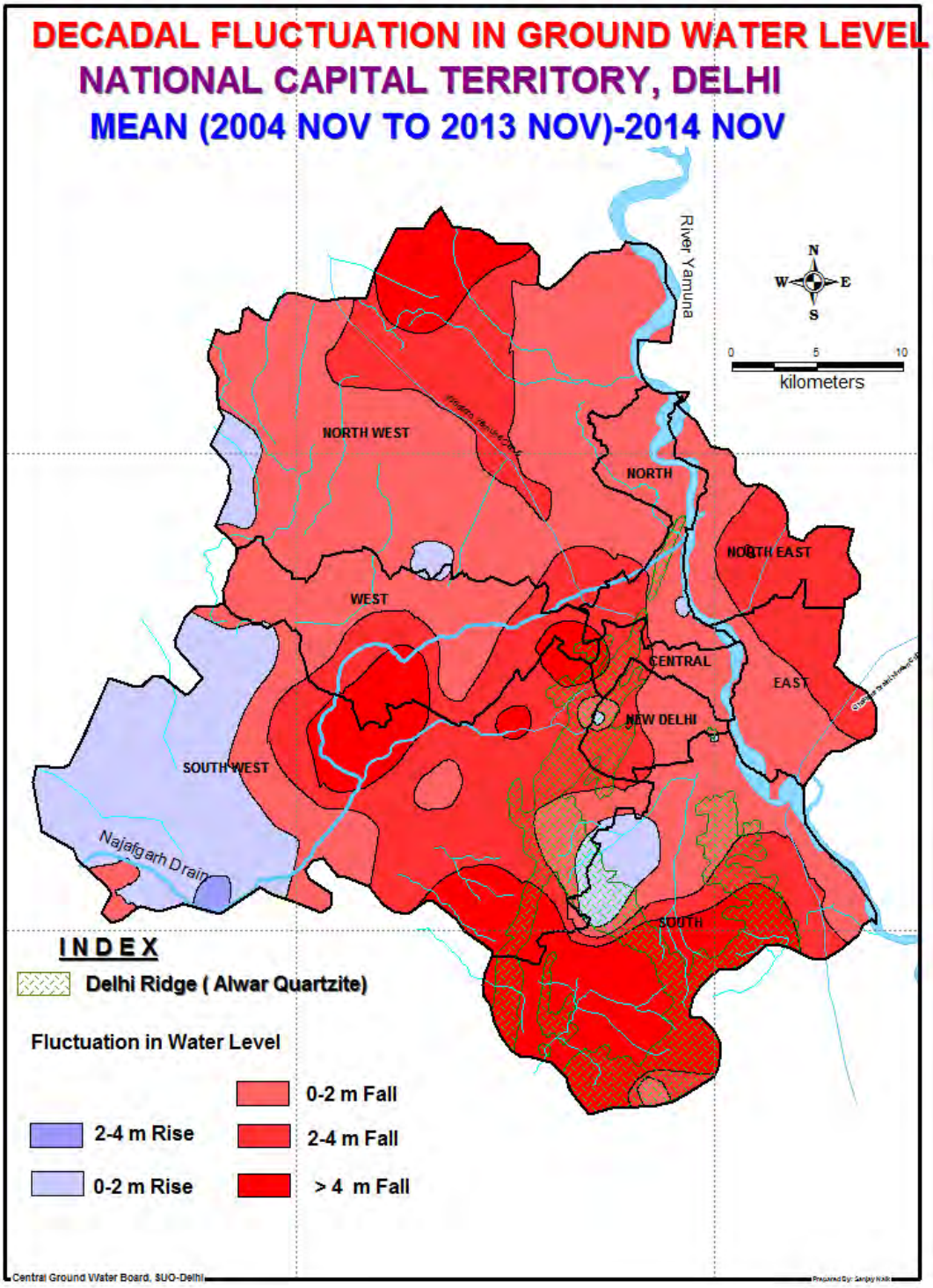
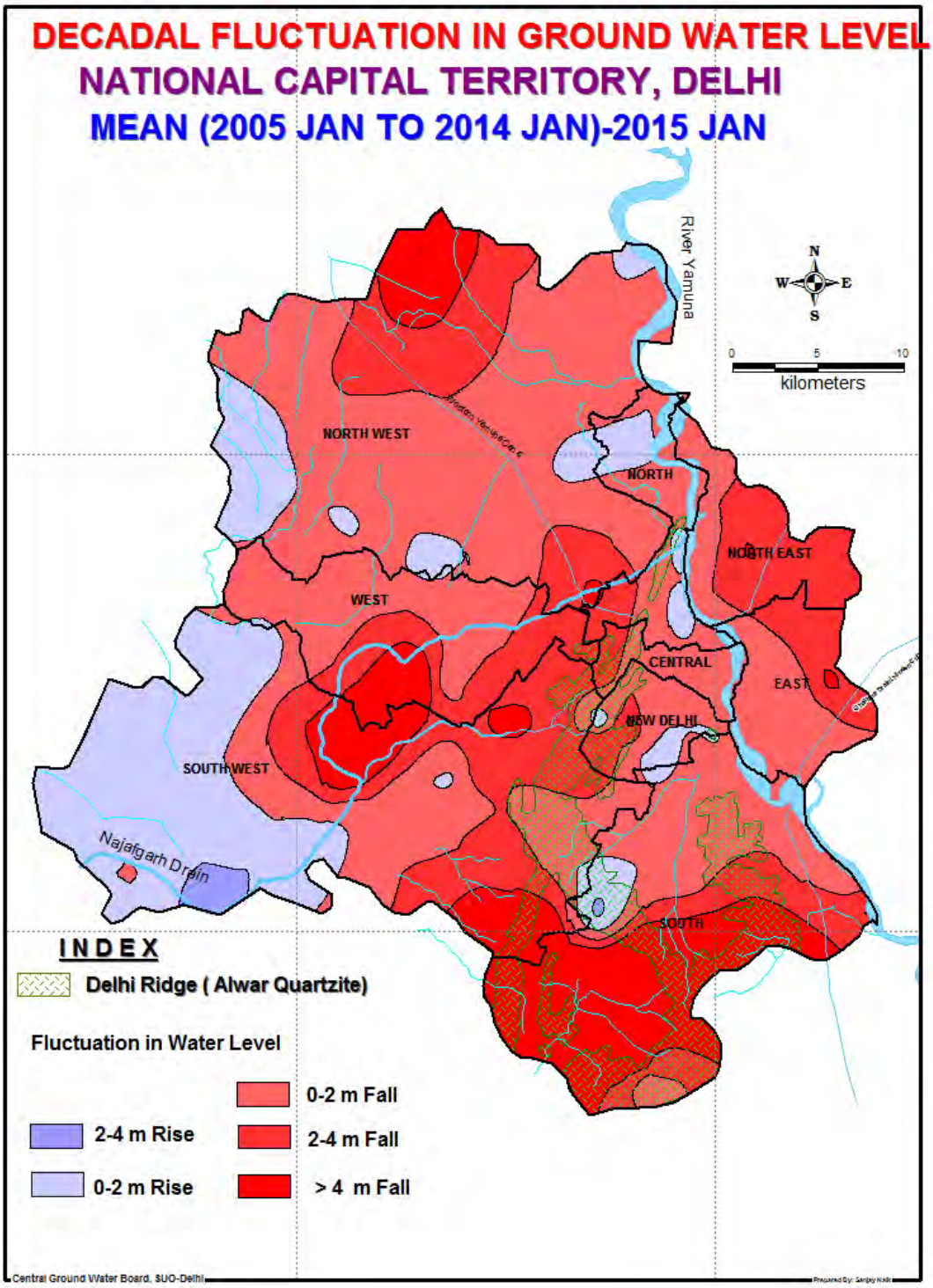

DECADAL FLUCTUATION IN GROUND WATER LEVEL
NATIONAL CAPITAL TERRITORY, DELHI
MEAN (2004 NOV TO 2013 NOV)-2014 NOV
River Yamuna
N
W
E
S
0
5
10
kilometers
NORTH WEST
NORTH
NORTH EAST
WEST
CENTRAL
EAST
NEW DELHI
SOUTH WEST
SOUTH
Najafgarh Drain
INDEX
Delhi Ridge (Alwar Quartzite)
Fluctuation in Water Level
0-2 m Fall
2-4 m Rise
2-4 m Fall
0-2 m Rise
> 4 m Fall
Central Ground Water Board, SUO-Delhi

PLATE - 16


DECADAL FLUCTUATION IN GROUND WATER LEVEL
NATIONAL CAPITAL TERRITORY, DELHI
MEAN (2005 JAN TO 2014 JAN)-2015 JAN
River Yamuna
N
W
E
S
0
5
10
kilometers
NORTH WEST
NORTH
NORTH EAST
WEST
CENTRAL
EAST
NEW DELHI
SOUTH WEST
SOUTH
Najafgarh Drain
INDEX
Delhi Ridge (Alwar Quartzite)
Fluctuation in Water Level
0-2 m Fall
2-4 m Rise
2-4 m Fall
0-2 m Rise
> 4 m Fall
Central Ground Water Board, SUO-Delhi

Annexure - 1

DEPTH TO WATER LEVEL / FLUCTUATION DATA OF NCT-DELHI

State : Delhi

	Depth to Water Level									Water Level Fluctuation w.r.t 2014/May			Annual Fluctuation of May-2014 w.r.t May-13
	2013/May (mbgl)	2013/Aug (mbgl)	2013/Nov (mbgl)	2014/Jan (mbgl)	2014/May (mbgl)	2014/Aug (mbgl)	2014/Nov (mbgl)	2015/Jan (mbgl)	2015/May (mbgl)	2014/Aug (mbgl)	2014/Nov (mbgl)	2015/Jan (mbgl)	
District : CENTRAL													
1 Rajghat Pz	2.09	1.57	1.77	1.88	1.99	2.12	1.88	1.8	2	-0.13	0.11	0.19	0.1
District : EAST													
2 Akshardham Temple Pz	4.94	2.87	4.52	3.66	5.05	6.05	5.34	5.46	6.77	-1	-0.29	-0.41	-0.11
3 Cbd Shahdara Pz	9.8	9.48	8.95	9.85	10.42	10.45	10.44	10.3	10.79	-0.03	-0.02	0.12	-0.62
4 Chilla Regulator	8.19	7.31	7.39	7.64	8.23	8.63	8.71	8.53	9.05	-0.4	-0.48	-0.30	-0.04
5 Chillasaroda Pz	8.95	8.1	7.76	7.78	8.11	8.97	9.2	9.26	9.72	-0.86	-1.09	-1.15	0.84
6 Ghazipur Crossing Pz	17.66	17.78	17.81	18.02	18.4	18.97	19.18	19.04	19.68	-0.57	-0.78	-0.64	-0.74
Kondli					12.88	13.18	13.09	13.48	14.11	-0.3	-0.21	-0.60	
7 Mayur Vihar B Block, Ph-II	6.46	6.25	6.44	6.53	6.69	7.07	6.94	6.64	7.9	-0.38	-0.25	0.05	-0.23
8 Nagali Rajapur Pz	3.79	1	2.29	2.63	3.16	3.15	3.47	3.38	3.99	0.01	-0.31	-0.22	0.63
9 Nizamuddin Bridge-1	4.55	0.9	4.15	2.93	3.69	4.13	4.29	4.31	4.73	-0.44	-0.60	-0.62	0.86
10 Nizamuddin Bridge-2	4.12	0.71	3.66	2.66	3.24	3.58	3.82	3.84	4.26	-0.34	-0.58	-0.60	0.88
District : NEW DELHI													
11 Birla mandir	14.86	8.48	9.01	9.2	13.3	12.53	10.78	9.24	13.5	0.77	2.52	4.06	1.56
12 India gate	7.46	5.38	5.24	5.23	5.98	6.07	6.88	5.47	7.44	-0.09	-0.90	0.51	1.48
13 Kitchner road		17.73	18.3	17.95	17.71	18.61	16.41	16.75	18.7	-0.9	1.30	0.96	-17.71
14 Lodhi Garden (D)	10.25	8.74	7.82	7.38	8.6	8.67	8.72	8.03	7.92	-0.07	-0.12	0.57	1.65
15 Lodhi Garden (SH)	10.06	8.37	7.52	6.95	7.9	8.34	8.47	7.73	7.55	-0.44	-0.57	0.17	2.16
16 Lodhi Graden Dw	13.6	12.28	11.49	10.98	11.36	12.04	12.61	11.6	12.1	-0.68	-1.25	-0.24	2.24
17 Mahabir Vansth	25.92	26.06	25.63	25.51	26.97	27.43	27.79	27.3	27.08	-0.46	-0.82	-0.33	-1.05
18 Nehru Park Dw	22.68	21.35	19.05	20.74	20.57	21.53	22.36	23.23	24.12	-0.96	-1.79	-2.66	2.11
19 Presidents Estate-1	20.57	17.59	17.93	18.26	18.37	19.67	20.49	20.56	21.05	-1.3	-2.12	-2.19	2.2
20 Presidents Estate-2	12.89	11.34	12.46	12.79	12.84	12.59	13.03	13.14	13.31	0.25	-0.19	-0.30	0.05
21 Safdarjung tomb	17.95	15.01	13.92	13.67	14.25	14.4	18.01	14.47	14.86	-0.15	-3.76	-0.22	3.7
22 Shram Shakti Bhawan 1	15.38	13.81	13.47	12.69	13.97	14.5	13.83	14.06	14.58	-0.53	0.14	-0.09	1.41
23 Shram Shakti Bhawan 2	14.87	12.82	12.5	12.49	12.95	11.48	13.72	13.9	14.11	1.47	-0.77	-0.95	1.92
24 Shram Shakti Bhawan 3	15.8	12.82	13.4	13.23	13.84	14.78	14.91	15.14	14.97	-0.94	-1.07	-1.30	1.96
District : NORTH													
25 Burara-Pz	3.98	1.69	2.47	3	3.31	3.53	3.66	3.81	3.8	-0.22	-0.35	-0.50	0.67
26 Burari Auger Pz	3.68	1.42	2.56	3.11	3.14	2.97	3.44	3.53	3.26	0.17	-0.30	-0.39	0.54
27 ISBT (Kashmiri Gate) Dw	2.58	0.66	2.39	2.46	2.56	1.71	2.63	2.57	2.65	0.85	-0.07	-0.01	0.02
28 Jagatpur Pz-1	2.74	0.87	1.73	1.96	2.3	2.25	2.51	2.42	2.48	0.05	-0.21	-0.12	0.44
29 Jagatpur Pz-2	2.13	0.47	1.21	1.32	1.68	1.56	1.82	1.68	1.82	0.12	-0.14	0.00	0.45
30 Kingsway Camp Police Ground	6.64	4.55	5.49	5.95	6.17	6.46	7.29	7.33	7.73	-0.29	-1.12	-1.16	0.47
31 Majanu Ka Tila Dw	12.8	6.35	8.61	7.98	8.27	7.6	8.11	7.42	8.17	0.67	0.16	0.85	4.53
District : NORTH EAST													
32										0	0.00	0.00	0
33 Gokulpuri E Pz	7.95	8.19	7.9	8.06	8.73	9.05	10.22	10.27	11.29	-0.32	-1.49	-1.54	-0.78
34 Gokulpuri W Pz	7.71	7.93	7.65	7.81	8.41	8.77	9.97	10.08	11.12	-0.36	-1.56	-1.67	-0.7
35 Ushmanpur Pz	3.88	0.25	2.73	2.05	2.89	2.41	4.01	4.19	4.77	0.48	-1.12	-1.30	0.99
36 Wazirabad Raf	4.45	4.26	3.97	4.09	4.25	4.77	5.04	5.55	4.72	-0.52	-0.79	-1.30	0.2

District : NORTH WEST													
37 Ashok Vihar - IV	12.48	12.3	12.12	12.21	12.47	12.93	13.14	14.58	15.43	-0.46	-0.67	-2.11	0.01
38 Auchandi Pz	3.92	0.98	1.11	1.89	2.56	3.02	3.5	3.76	3.02	-0.46	-0.94	-1.20	1.36
39 Bakoli - Shallow Pz	9.27	10.61	8.78	8.81	8.68	11.91	9.85	9.43	9.51	-3.23	-1.17	-0.75	0.59
40 Bakoli- Deep Pz	9.29	11.15	8.79	8.92	8.7	12.17	9.86	9.5	9.57	-3.47	-1.16	-0.80	0.59
41 Balsawa Landfill	6.73	6.1								0	0.00	0.00	6.73
42 Balswa Lake	2.23	0.75	1.66	1.07	1.61	1.62	2.16	1.68	1.2	-0.01	-0.55	-0.07	0.62
43 Bankner-Pz	17.97	17.94	17.13	17.1	16.6	20.33	20.63	20.72	19.65	-3.73	-4.03	-4.12	1.37
44 Barwala Pz	5.62	4.96	5.59	5.32	5.38	5.61	6.03	6.36	6.39	-0.23	-0.65	-0.98	0.24
45 Bawana Dw New	7.57	5.1	6.35	6.96	6.85	6.78	7.16	7.53	7.64	0.07	-0.31	-0.68	0.72
46 BBMB Narela Pz	17.03	17.74	16.79	16.64	16.98	18.76	21.03	18.1	18.63	-1.78	-4.05	-1.12	0.05
47 Delhi College of Engineering	5.88	3.73	4.54	5.08	5.72	6	6.38	6.35	6.82	-0.28	-0.66	-0.63	0.16
48 Haiderpur Pz	10.27	9.32	9.38	9.28	9.86	10.49	10.84	10.53	10.95	-0.63	-0.98	-0.67	0.41
49 Hareoli Dw	4.58	3.94	2.49	3.31	3.87	3.71	3.41	4.3	4.73	0.16	0.46	-0.43	0.71
50 Jaunti Dw	12.97	12.63	11.9	11.7	11.84	12.43	12.42	12.37	12.77	-0.59	-0.58	-0.53	1.13
51 Kanjhawala (pz)	1.97	0.36	0.92	1.3	1.19	1.74	2.8	1.7	2.42	-0.55	-1.61	-0.51	0.78
52 Khera Kalan Pz	6.12	3.45	4.05	4.88	5.52	6.1	5.92	6.09	6.9	-0.58	-0.40	-0.57	0.6
53										0	0.00	0.00	0
54 Majara Dabas	3.87	2.29	2.62	3.15	3.27	3.29	3.94		4.01	-0.02	-0.67	3.27	0.6
55 Mangolpuri Pz	3.4	0.77	1.49	0.7	2.76	2.95	2.71	2.82		-0.19	0.05	-0.06	0.64
56 Mubarakpur	3.68	5.12	2.22	2.67	3.08	3.51	3.13	3.83	3.1	-0.43	-0.05	-0.75	0.6
57 Nizampur	7.64	6.59	6.57	6.94	7.03	7.23	7.56	7.77	7.95	-0.2	-0.53	-0.74	0.61
58 Palla Temple	5.63	5.15	5.27	5.13	5.29	5.81	7	7.04	5.98	-0.52	-1.71	-1.75	0.34
59 Palla Zero RD	7.64	6.96	6.68	6.8	6.93	8.26	7.81	7.78	6.66	-1.33	-0.88	-0.85	0.71
60 Qutlupur Pz	2.35	0.56	1.32	1.46	2.54	1.82	2.01	2.14	2.64	0.72	0.53	0.40	-0.19
61 Rani Khera	3	1.8	2.65	2.89	2.58	3.28	3.71	3.6	3.9	-0.7	-1.13	-1.02	0.42
62 Rohini Sec-28	5.22	2.12	3.39	3.79	4.43	6.05	5.64	5.35	5.94	-1.62	-1.21	-0.92	0.79
63 Rohini Sector - 11	7.06	6.06	6.28	6.5	6.26	6.2	6.37	6.05	7.27	0.06	-0.11	0.21	0.8
64													
65 Sainik Vihar Pz	2.81	0.7	1.64	1.88	2.3	2.03	2.02	1.7	2.59	0.27	0.28	0.60	0.51
66 Singhola Pz	14.14	13.64	14.01	13.98	14.11	14.12	14.03	14.06	14.11	-0.01	0.08	0.05	0.03
67 Tiggipur Deep Pz	8.32	7.77	7.13	7.63	8.02	9.46	8.81	8.78	8.61	-1.44	-0.79	-0.76	0.3
68 Tiggipur Shallow Pz	6.7	5.71	5.82	6.05	6.3	6.98	6.9	6.91	6.78	-0.68	-0.60	-0.61	0.4
District : SOUTH													
69 Asola Pz	50.17	49.08	47.83	48.28	49.72	50.3	50.62	50.86	51.83	-0.58	-0.90	-1.14	0.45
70 Ayanagar Pz	44.8	45.39	45.34	44.91	45.72	47.32				-1.6	45.72	45.72	-0.92
71 Balbir Nagar	20.4	11.16	19.15	23	22.79	17 19	19.77	22.23	22.83	5.6	3.02	0.56	-2.39
72 Bhatti-Pz	47.98	45.81	44.68	45.42	48.07	48.18	48.16	48.05	49.18	-0.11	-0.09	0.02	-0.09
73 Fatehpur Beri Pz	50.63	50.45								0			50.63
74 Gadaipur Pz	56.43	56.7	56.9	56.33	57.37	57.99	58.38	58.25	48.55	-0.62	-1.01	-0.88	-0.94
75 Hauz Khas Pz	35.15	34.93	34.39	33.69	33.37	34.82	33.97	35.44	34.54	-1.45	-0.60	-2.07	1.78
76 Humayun Tomb	6.4	5.55	5.49	5.75	6.2	6.87	6.93	6.9	7.4	-0.67	-0.73	-0.70	0.2
77 Jaitpur Khadar RD-2600	4.7	2.65	4.57	4.3	5.4	5.54	5.1	7.6	5.46	-0.14	0.30	-2.20	-0.7
78 Jaitpur Khadar RD-3500	6.6	4.5	5.46	6.11	6.26	6.36	6.38	8.95	6.65	-0.1	-0.12	-2.69	0.34
79 Jamali Kamali	30.2	28.54	30.01	27.3	27.2	30.75	27.65	27.51	30.25	-3.55	-0.45	-0.31	3
80 Jasmapur DJB	55.15	53.78	54.89	55.19	58.49	59.34	59.63	59.54	60.6	-0.85	-1.14	-1.05	-3.34
81 Jheel Khoh	50.02	49.53	49.88	50.64	50.56	54.18	55.09	52.92	52.66	-3.62	-4.53	-2.36	-0.54
82 Kalindi Kunj Barrage Pz	4.74	0.56								0	0.00	0.00	4.74
83 Madan Gir	53.56	52.46	52.58	52.82						0	0.00	0.00	53.56
84 Madanpur Khadar	4.4	2.41	3.83	4.44	4.59	4.64	4.46	4.58	4.8	-0.05	0.13	0.01	-0.19
85 Pusp Vihar Pz	66.22	66.08	65.81	64.35	63.97	63.7	63.63	64	62.66	0.27	0.34	-0.03	2.25
86 Saket D Block Pz	56.38	56.33	56.88							0	0.00	0.00	56.38
87 Satbari Pz	45.2	44.73	43.07	43.97	45.25	46.95	46.6	47.64	47.78	-1.7	-1.35	-2.39	-0.05
88 Sultanpur IMS	54.33	54.58	55.05	55.4	55.75	56.19	56.48	56.59	56.97	-0.44	-0.73	-0.84	-1.42
89 Sundar Nursery Pz	7.75	6.77	6.71	6.84	7.25	7.48	7.62	7.65	7.94	-0.23	-0.37	-0.40	0.5

District : SOUTH WEST													
90 Chawla	14.82	12.91	11.94	11.35	12.53	13.68	14.13	13.42	14.74	-1.15	-1.60	-0.89	2.29
91 CVD Depot Cant (Dp)	20.5	20.62	19.89	19.97		21.67	22.06	22.31	22.57	-21.67	-22.06	-22.31	20.5
92 CVD Depot Cant (Md)	21.95	20.4	19.58	19.85						0	0.00	0.00	21.95
93 CVD Depot Cant (Sh)	21.23	20.72	19.88	20.08						0	0.00	0.00	21.23
94 Daryapur Khurd	4.49	2.46	1.65	5.15	4.01	3.48	3.98	4.5	4.02	0.53	0.03	-0.49	0.48
95 Daulatpur Pz	16.98	16.12	15.42	16.53	15.48	15.49	15.54	16.18	16.85	-0.01	-0.06	-0.70	1.5
96 Deorala Pz	2.11	1.02	1.51	1.48	2.24	1.09	1.85	1.66	2.14	1.15	0.39	0.58	-0.13
97 Dichaon Kalan	11.94	10.88								0			11.94
98 Dwarka Sec-16 (Tp)	18.42	18.81	18.72	19.04	19.48	20.03	20.39	20.68	21.46	-0.55	-0.91	-1.20	-1.06
99 Dwarka Sect -20	14.28									0	0.00	0.00	14.28
100 Issapur Khera Pz	10.01	9.86	9.73	10.08	9.97	9.89	10.1	10.35	10.3	0.08	-0.13	-0.38	0.04
101 Jharoda Kalan Pz	14.23	13.95	13.77	13.71	13.89	13.85	14.1	14.2	14.56	0.04	-0.21	-0.31	0.34
102 Jhuljhuli Dw	2.16	0.75	2.13	2.05	2.47	1.2	2.06	2.21	2.2	1.27	0.41	0.26	-0.31
103 Jhuljhuli Pz	3.05	2.56	2.88	3.11	3.53	2.97	2.85	2.96	3.38	0.56	0.68	0.57	-0.48
104 JUN Pz-13 Upstreem	37.48	29.08	33.71	34.19	35.29	35.1	36.38	37.62	35.97	0.19	-1.09	-2.33	2.19
105 JUN Pz-3 (D) Downstream	29.7	27.35	29.14	27.82	27.04	26.88	26.84	27.9	27.02	0.16	0.20	-0.86	2.66
106 Kabul Line Pz	26.9	26.86	26.23	25.55	26.02	26.52	26.75	26.72	27.17	-0.5	-0.73	-0.70	0.88
107 Kirbi Place Pz	24.19	22.87	23.47	23.82	24.69	24.22	25.21	25.37	26.31	0.47	-0.52	-0.68	-0.5
108 Mandela Khurd Pz	13.3	12.05	11.55	12.33	11.71	20.57	11.98	12.94	12.46	-8.86	-0.27	-1.23	1.59
109 Najafgarh Town	19.78	19.4	18.83	19.16	20.16	20.89	20.88	21.02	21.64	-0.73	-0.72	-0.86	-0.38
110 Nicolsan Range Pz	13.5	12.5								0			13.5
111 Ojwah Pz	15.43	14.48	12.57	13.59	13.45	14.06	14.69	15.96	14.84	-0.61	-1.24	-2.51	1.98
112 Palam Signal Camp Pz	54.22	53.52	53.91	54.36	55.01	54.18	54.07	53.92	54.92	0.83	0.94	1.09	-0.79
113 PUSA (NRL)	19.17	20.6	20.01	18.87	20.19	22.17	23.11	21.15	23.1	-1.98	-2.92	-0.96	-1.02
114 PUSA (WTC)	20.65	20.14	19.42	19.64	20.32	21.33	21.78	21.51	22.15	-1.01	-1.46	-1.19	0.33
115 PUSA Indrapuri Gate	23.44	22.3	21.45	21.6	22.67	23.86	23.24	23.07	24.25	-1.19	-0.57	-0.40	0.77
116 Raota	2.71	1.37	1.85	2.13	2.69	1.92	2.23	2.15	2.61	0.77	0.46	0.54	0.02
117 Shekhawati Line Pz	40.41	41.12	41.48	40.13	40.07	40.39	40.62	40	40.45	-0.32	-0.55	0.07	0.34
Sikarpur Deep						12.7	11.45	11.05	11.88				
118 Sikarpur Shallow	12.07	12.37	9.66	10.96	10.35	12.9	11.22	10.76	10.68	-2.55	-0.87	-0.41	1.72
119 Tagore Garden Pz	9.82	9.25	9.38	9.52	9.93	10.51	10.47	10.6	11.12	-0.58	-0.54	-0.67	-0.11
District : WEST													
120 Baprola Dw	3.85	1.45	2.1	2.73	3.76	4.32	4.49	4.46	5.48	-0.56	-0.73	-0.70	0.09
121 Hiran Kudna Dw	5.53	0.72	1.98	2.44	2.19	2.77	2.88	3.4	2.84	-0.58	-0.69	-1.21	3.34
122 Janakpuri Pz	9.52	9.66	9.56	9.93	10.47	10.97	11.59	11.7	12.02	-0.5	-1.12	-1.23	-0.95
123 Mayapuri Pz	35.54	35.61	35.51	32.12	35.68	36.19	36.63	36.52	36.91	-0.51	-0.95	-0.84	-0.14
124 Nangloi Pz	3.53	2.24	2.83	3.03	4.36	4.23	4.08	3.9		0.13	0.28	0.46	-0.83
125 Peera Garhi Pz	5.71	4.37	4.16	4.28	4.64	5.15	5	5.25	7.1	-0.51	-0.36	-0.61	1.07
126 Tikri Kalan Pz	8.62	8.37	8.21	8.31	8.56	8.61	8.68	8.7	8.8	-0.05	-0.12	-0.14	0.06
127 Tilangpur Kotla Dw	8.09	5	5.35	6.55	7.36	7.73	7.41	7.17	7.3	-0.37	-0.05	0.19	0.73
128 Vikashpuri Pz	12.78	12.64	12.87	13.35	14.3	16.22	17.24	17.59	17.67	-1.92	-2.94	-3.29	-1.52

Depth to Water Table
Distribution of Percentage of Observation Wells
2014/May

State : Delhi

District	No. of Wells Analysed	Depth to Water Table (mbgl)		No. / Percentage of Wells Showing Depth to Water Table (mbgl) in the Range of					
		Min	Max	0.0 - 2.0	2.0 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	> 40.0
CENTRAL	1	1.99	1.99	1 100.00%	0	0	0	0	0
EAST	10	3.16	18.40	0	3 30.00%	4 40.00%	3 30.00 %	0	0
NEW DELHI	14	5.98	26.97	0	0	3 21.43%	9 64.29 %	2 14.29%	0
NORTH	7	1.68	8.27	1 14.29%	4 57.14%	2 28.57%	0	0	0
NORTH EAST	4	2.89	8.73	0	2 50.00%	2 50.00%	0	0	0
NORTH WEST	29	1.19	16.98	2 6.90%	9 31.03%	13 44.83%	5 17.24 %	0	0
SOUTH	17	4.59	63.97	0	1 5.88%	4 23.53%	0	3 17.65%	9 52.94%
SOUTH WEST	25	2.24	74.41	0	5 20.00%	2 8.00%	7 28.00 %	8 32.00%	3 12.00%
WEST	9	2.19	35.68	0	4 44.44%	2 22.22%	2 22.22 %	1 11.11%	0
Total	116	1.19	74.41	4	28	32	26	14	12

District Wise - Fluctuation and Frequency Distribution From Different Ranges from One Period to Other

From Year: 2013/May - **To Year:** 2014/May

State : **Delhi**

District Name	No. of Wells	Range of Fluctuation (m)				No. of Wells/Percentage Showing Fluctuation						Total No. of Wells	
		Rise		Fall		Rise			Fall			Rise	Fall
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4		
CENTRAL	1	0.10	0.10	-	-	1 100.00%	0	0	0	0	0	1	0
EAST	9	0.63	0.88	0.04	0.74	4 44.44%	0	0	5 55.56%	0	0	4	5
NEW DELHI	13	0.05	3.70	1.05	1.05	7 53.85%	5 38.46 %	0	1 7.69%	0	0	12	1
NORTH	7	0.02	4.53	-	-	6 85.71%	0	1 14.29%	0	0	0	7	0
NORTH EAST	4	0.20	0.99	0.70	0.78	2 50.00%	0	0	2 50.00%	0	0	2	2
NORTH WEST	29	0.01	1.37	0.19	0.19	28 96.55%	0	0	1 3.45%	0	0	28	1
SOUTH	17	0.20	3.00	0.05	3.34	5 29.41%	2 11.76 %	0	8 47.06%	2 11.76%	0	7	10
SOUTH WEST	25	0.02	2.66	0.11	2.62	12 48.00%	3 12.00 %	0	9 36.00%	1 4.00%	0	15	10
WEST	9	0.06	3.34	0.14	1.52	4 44.44%	1 11.11 %	0	4 44.44%	0	0	5	4

Total	114	0.63	0.10	0.00	3.34	69	11	1	30	3	0	81	33

District Wise - Fluctuation of Water Level with Mean and Selected Period

10 Years Mean (2004 May - 2013 May) - 2014/May

State : Delhi

District Name	No. of Wells	Range of Fluctuation				No. of Wells/Percentage Showing Fluctuation						Total No. of Wells	
		Rise (m)		Fall (m)		Rise (m)			Fall (m)			Rise	Fall
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4		
CENTRAL	1	-	-	0.50	0.50	0	0	0	1 100.0 %	0	0	0	1
EAST	10	0.03	1.25	0.73	3.59	6 60.00 %	0	0	2 20.00%	2 20.00 %	0	6	4
NEW DELHI	14	0.53	4.19	1.45	3.60	6 42.86 %	3 21.43%	1 7.14%	1 7.14%	3 21.43 %	0	10	4
NORTH	7	0.40	1.09	0.92	0.92	6 85.71 %	0	0	1 14.29%	0	0	6	1
NORTH EAST	4	0.90	0.90	0.79	2.61	1 25.00 %	0	0	1 25.00%	2 50.00 %	0	1	3
NORTH WEST	29	0.30	2.17	0.17	2.36	15 51.72 %	2 6.90%	0	11 37.93%	1 3.45 %	0	17	12
SOUTH	17	0.30	3.69	0.16	8.99	4 23.53 %	1 5.88%	0	5 29.41%	2 11.76 %	5 29.41%	5	12
SOUTH WEST	25	0.11	4.10	0.84	6.19	6 24.00 %	6 24.00%	1 4.00%	2 8.00%	7 28.00 %	3 12.00%	13	12

WEST	9	0.57	1.24	0.46	3.74	4 44.44 %	0	0	3 33.33%	2 22.22 %	0	4	5
Total	116	0.90	0.90	0.16	8.99	48	12	2	27	19	8	62	54

Depth to Water Table
Distribution of Percentage of Observation Wells
2014/Aug

State : Delhi

District	No. of Wells Analysed	Depth to Water Table (mbgl)		No. / Percentage of Wells Showing Depth to Water Table (mbgl) in the Range of					
		Min	Max	0.0 - 2.0	2.0 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	> 40.0
CENTRAL	1	2.12	2.12	0	1 100.00%	0	0	0	0
EAST	10	3.15	18.97	0	3 30.00%	4 40.00%	3 30.00 %	0	0
NEW DELHI	14	6.07	27.43	0	0	3 21.43%	9 64.29 %	2 14.29%	0
NORTH	7	1.56	7.60	2 28.57%	3 42.86%	2 28.57%	0	0	0
NORTH EAST	4	2.41	9.05	0	2 50.00%	2 50.00%	0	0	0
NORTH WEST	29	1.62	20.33	3 10.34%	7 24.14%	11 37.93%	7 24.14 %	1 3.45%	0
SOUTH	17	4.64	63.70	0	1 5.88%	4 23.53%	1 5.88 %	2 11.76%	9 52.94%
SOUTH WEST	27	1.09	76.00	3 11.11%	2 7.41%	1 3.70%	7 25.93 %	11 40.74%	3 11.11%
WEST	9	2.77	36.19	0	3 33.33%	3 33.33%	2 22.22 %	1 11.11%	0
Total	118	1.09	76.00	8	22	30	29	17	12

District Wise - Fluctuation and Frequency Distribution From Different Ranges from One Period to Other

From Year: 2013/Aug - **To Year:** 2014/Aug

State : Delhi

District Name	No. of Wells	Range of Fluctuation (m)				No. of Wells/Percentage Showing Fluctuation						Total No. of Wells	
		Rise		Fall		Rise			Fall			Rise	Fall
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4		
CENTRAL	1	-	-	0.55	0.55	0	0	0	1 100.0 %	0	0	0	1
EAST	9	-	-	0.82	3.23	0	0	0	5 55.56%	4 44.44%	0	0	9
NEW DELHI	14	0.03	1.34	0.18	4.05	5 35.71%	0	0	7 50.00%	1 7.14%	1 7.14%	5	9
NORTH	7	-	-	1.05	1.91	0	0	0	7 100.0 %	0	0	0	7
NORTH EAST	4	-	-	0.51	2.16	0	0	0	3 75.00%	1 25.00%	0	0	4
NORTH WEST	29	0.20	0.23	0.14	3.93	2 6.90%	0	0	21 72.41%	6 20.69%	0	2	27
SOUTH	17	0.11	2.38	0.71	6.03	1 5.88%	1 5.88 %	0	7 41.18%	5 29.41%	3 17.65%	2	15
SOUTH WEST	26	0.10	0.73	0.03	8.52	6 23.08%	0	0	17 65.38%	0	3 11.54%	6	20
WEST	9	-	-	0.24	3.58	0	0	0	5 55.56%	4 44.44%	0	0	9

Total	114	1.20	0.08	0.00	4.40	13	0	0	79	19	3		13	101

District Wise - Fluctuation and Frequency Distribution From Different Ranges from One Period to Other

From Year: 2014/May - **To Year:** 2014/Aug

State : Delhi

District Name	No. of Wells	Range of Fluctuation (m)				No. of Wells/Percentage Showing Fluctuation						Total No. of Wells	
		Rise		Fall		Rise			Fall			Rise	Fall
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4		
CENTRAL	1	-	-	0.13	0.13	0	0	0	1 100.0 %	0	0	0	1
EAST	10	0.01	0.01	0.03	1.00	1 10.00%	0	0	9 90.00%	0	0	1	9
NEW DELHI	14	0.25	1.47	0.07	1.30	3 21.43%	0	0	11 78.57%	0	0	3	11
NORTH	7	0.05	0.85	0.22	0.29	5 71.43%	0	0	2 28.57%	0	0	5	2
NORTH EAST	4	0.48	0.48	0.32	0.52	1 25.00%	0	0	3 75.00%	0	0	1	3
NORTH WEST	29	0.06	0.72	0.01	3.73	5 17.24%	0	0	21 72.41%	3 10.34%	0	5	24
SOUTH	17	0.27	5.60	0.05	3.62	1 5.88%	0	1 5.88%	13 76.47%	2 11.76%	0	2	15
SOUTH WEST	25	0.04	1.27	0.01	8.86	11 44.00%	0	0	12 48.00%	1 4.00%	1 4.00%	11	14
WEST	9	0.13	0.13	0.05	1.92	1 11.11%	0	0	8 88.89%	0	0	1	8

Total	116	0.48	0.01	0.01	8.86	28	0	1	80	6	1	29	87

District Wise - Fluctuation of Water Level with Mean and Selected Period

10 Years Mean (2004 Aug - 2013 Aug) - 2014/Aug

State : Delhi

District Name	No. of Wells	Range of Fluctuation				No. of Wells/Percentage Showing Fluctuation						Total No. of Wells	
		Rise (m)		Fall (m)		Rise (m)			Fall (m)			Rise	Fall
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4		
CENTRAL	1	-	-	1.13	1.13	0	0	0	1 100.0 %	0	0	0	1
EAST	10	-	-	0.57	3.21	0	0	0	7 70.00%	3 30.00 %	0	0	10
NEW DELHI	14	0.08	1.75	0.27	5.24	6 42.86 %	0	0	4 28.57%	3 21.43 %	1 7.14%	6	8
NORTH	7	0.33	0.46	0.02	1.80	2 28.57 %	0	0	5 71.43%	0	0	2	5
NORTH EAST	4	-	-	0.64	3.08	0	0	0	2 50.00%	2 50.00 %	0	0	4
NORTH WEST	29	0.04	0.95	0.03	4.79	9 31.03 %	0	0	11 37.93%	8 27.59 %	1 3.45%	9	20
SOUTH	17	0.33	1.15	1.09	10.32	3 17.65 %	0	0	4 23.53%	2 11.76 %	8 47.06%	3	14
SOUTH WEST	27	0.17	3.14	0.65	6.63	9 33.33 %	3 11.11%	0	3 11.11%	7 25.93 %	5 18.52%	12	15

WEST	9	-	-	0.25	5.42	0	0	0	6 66.67%	2 22.22 %	1 11.11%	0	9
Total	118	0.46	0.33	0.02	10.32	29	3	0	43	27	16	32	86

Depth to Water Table
Distribution of Percentage of Observation Wells
2014/Nov

State : Delhi

District	No. of Wells Analysed	Depth to Water Table (mbgl)		No. / Percentage of Wells Showing Depth to Water Table (mbgl) in the Range of					
		Min	Max	0.0 - 2.0	2.0 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	> 40.0
CENTRAL	1	1.88	1.88	1 100.00%	0	0	0	0	0
EAST	10	3.47	19.18	0	3 30.00%	4 40.00%	3 30.00 %	0	0
NEW DELHI	14	6.88	27.79	0	0	3 21.43%	8 57.14 %	3 21.43%	0
NORTH	7	1.82	8.11	1 14.29%	4 57.14%	2 28.57%	0	0	0
NORTH EAST	4	4.01	10.22	0	1 25.00%	2 50.00%	1 25.00 %	0	0
NORTH WEST	29	2.01	21.03	0	10 34.48%	13 44.83%	4 13.79 %	2 6.90%	0
SOUTH	16	4.46	63.63	0	1 6.25%	4 25.00%	1 6.25 %	2 12.50%	8 50.00%
SOUTH WEST	26	1.85	54.07	1 3.85%	4 15.38%	0	9 34.62 %	10 38.46%	2 7.69%
WEST	9	2.88	36.63	0	4 44.44%	2 22.22%	2 22.22 %	1 11.11%	0
Total	116	1.82	63.63	3	27	30	28	18	10

District Wise - Fluctuation and Frequency Distribution From Different Ranges from One Period to Other

From Year: 2013/Nov - **To Year:** 2014/Nov

State : **Delhi**

District Name	No. of Wells	Range of Fluctuation (m)				No. of Wells/Percentage Showing Fluctuation						Total No. of Wells	
		Rise		Fall		Rise			Fall			Rise	Fall
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4		
CENTRAL	1	-	-	0.11	0.11	0	0	0	1 100.0 %	0	0	0	1
EAST	9	-	-	0.14	1.49	0	0	0	9 100.0 %	0	0	0	9
NEW DELHI	14	1.89	1.89	0.36	4.09	1 7.14%	0	0	9 64.29%	3 21.43%	1 7.14%	1	13
NORTH	7	0.50	0.50	0.24	1.80	1 14.29%	0	0	6 85.71%	0	0	1	6
NORTH EAST	4	-	-	1.07	2.32	0	0	0	2 50.00%	2 50.00%	0	0	4
NORTH WEST	29	-	-	0.02	4.24	0	0	0	25 86.21%	3 10.34%	1 3.45%	0	29
SOUTH	16	0.42	2.36	0.53	5.21	1 6.25%	2 12.50 %	0	8 50.00%	3 18.75%	2 12.50%	3	13
SOUTH WEST	25	0.03	2.30	0.12	3.10	3 12.00%	1 4.00 %	0	13 52.00%	8 32.00%	0	4	21
WEST	9	-	-	0.47	4.37	0	0	0	5 55.56%	3 33.33%	1 11.1%	0	9

Total	114	1.89	0.50	0.02	5.21	6	3	0	78	22	5		9	105

District Wise - Fluctuation and Frequency Distribution From Different Ranges from One Period to Other

From Year: 2014/May - **To Year:** 2014/Nov

State : Delhi

District Name	No. of Wells	Range of Fluctuation (m)				No. of Wells/Percentage Showing Fluctuation						Total No. of Wells	
		Rise		Fall		Rise			Fall			Rise	Fall
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4		
CENTRAL	1	0.11	0.11	-	-	1 100.00%	0	0	0	0	0	1	0
EAST	10	-	-	0.02	1.09	0	0	0	10 100.0 %	0	0	0	10
NEW DELHI	14	0.14	2.52	0.12	3.76	2 14.29%	1 7.14 %	0	9 64.29%	2 14.29%	0	3	11
NORTH	7	0.16	0.16	0.07	1.12	1 14.29%	0	0	6 85.71%	0	0	1	6
NORTH EAST	4	-	-	0.79	1.56	0	0	0	4 100.0 %	0	0	0	4
NORTH WEST	29	0.05	0.53	0.05	4.05	5 17.24%	0	0	22 75.86%	0	2 6.90%	5	24
SOUTH	16	0.13	3.02	0.09	4.53	3 18.75%	1 6.25 %	0	11 68.75%	0	1 6.25%	4	12
SOUTH WEST	24	0.03	0.94	0:06	2.92	7 29.17%	0	0	16 66.67%	1 4.17%	0	7	17
WEST	9	0.28	0.28	0.05	2.94	1 11.11%	0	0	7 77.78%	1 11.11%	0	1	8

Total	114	0.28	0.11	0.00	4.53	20	2	0	85	4	3	22	92

District Wise - Fluctuation of Water Level with Mean and Selected Period

10 Years Mean (2004 Nov - 2013 Nov) - 2014/Nov

State : Delhi

District Name	No. of Wells	Range of Fluctuation				No. of Wells/Percentage Showing Fluctuation						Total No. of Wells	
		Rise (m)		Fall (m)		Rise (m)			Fall (m)			Rise	Fall
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4		
CENTRAL	1	-	-	0.73	0.73	0	0	0	1 100.0 %	0	0	0	1
EAST	10	-	-	0.68	3.61	0	0	0	7 70.00%	3 30.00 %	0	0	10
NEW DELHI	14	0.24	0.83	0.03	4.24	2 14.29 %	0	0	7 50.00%	4 28.57 %	1 7.14%	2	12
NORTH	7	0.22	0.22	0.08	2.70	1 14.29 %	0	0	5 71.43%	1 14.29 %	0	1	6
NORTH EAST	4	-	-	1.71	4.17	0	0	0	2 50.00%	0	2 50.00%	0	4
NORTH WEST	29	0.12	0.60	0.05	6.51	4 13.79 %	0	0	18 62.07%	5 17.24 %	2 6.90%	4	25
SOUTH	16	0.11	1.58	0.26	9.82	3 18.75 %	0	0	6 37.50%	0	7 43.75%	3	13
SOUTH WEST	26	0.20	3.13	0.15	6.83	10 38.46 %	1 3.85%	0	5 19.23%	6 23.08 %	4 15.38%	11	15

WEST	9	-	-	0.31	6.14	0	0	0	6 66.67%	2 22.22 %	1 11.11%	0	9
Total	116	0.22	0.24	0.03	9.82	20	1	0	57	21	17	21	95

Depth to Water Table
Distribution of Percentage of Observation Wells
2015/Jan

State : Delhi

District	No. of Wells Analysed	Depth to Water Table (mbgl)		No. / Percentage of Wells Showing Depth to Water Table (mbgl) in the Range of					
		Min	Max	0.0 - 2.0	2.0 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	> 40.0
CENTRAL	1	1.80	1.80	1 100.00%	0	0	0	0	0
EAST	10	3.38	19.04	0	3 30.00%	4 40.00%	3 30.00 %	0	0
NEW DELHI	14	5.47	27.30	0	0	4 28.57%	7 50.00 %	3 21.43%	0
NORTH	7	1.68	7.42	1 14.29%	4 57.14%	2 28.57%	0	0	0
NORTH EAST	4	4.19	10.27	0	1 25.00%	1 25.00%	2 50.00 %	0	0
NORTH WEST	28	1.68	20.72	3 10.71%	6 21.43%	13 46.43%	5 17.86 %	1 3.57%	0
SOUTH	16	4.58	64.00	0	1 6.25%	4 25.00%	0	3 18.75%	8 50.00%
SOUTH WEST	26	1.66	53.92	1 3.85%	4 15.38%	0	9 34.62 %	11 42.31%	1 3.85%
WEST	9	3.40	36.52	0	3 33.33%	3 33.33%	2 22.22 %	1 11.11%	0
Total	115	1.66	64.00	6	22	31	28	19	9

District Wise - Fluctuation and Frequency Distribution From Different Ranges from One Period to Other

From Year: 2014/Jan - **To Year:** 2015/Jan

State : Delhi

District Name	No. of Wells	Range of Fluctuation (m)				No. of Wells/Percentage Showing Fluctuation						Total No. of Wells	
		Rise		Fall		Rise			Fall			Rise	Fall
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4		
CENTRAL	1	0.08	0.08	-	-	1 100.00%	0	0	0	0	0	1	0
EAST	10	-	-	0.11	1.80	0	0	0	10 100.0 %	0	0	0	10
NEW DELHI	14	1.20	1.20	0.04	2.49	1 7.14%	0	0	11 78.57%	2 14.29%	0	1	13
NORTH	7	0.56	0.56	0.11	1.38	1 14.29%	0	0	6 85.71%	0	0	1	6
NORTH EAST	4	-	-	1.46	2.27	0	0	0	1 25.00%	3 75.00%	0	0	4
NORTH WEST	28	0.18	0.45	0.08	3.62	2 7.14%	0	0	23 82.14%	3 10.71%	0	2	26
SOUTH	16	0.35	0.77	0.14	4.35	2 12.50%	0	0	7 43.75%	6 37.50%	1 6.25%	2	14
SOUTH WEST	25	0.13	0.65	0.02	3.43	6 24.00%	0	0	14 56.00%	5 20.00%	0	6	19
WEST	9	-	-	0.39	4.40	0	0	0	7 77.78%	0	2 22.22%	0	9

Total	116	0.20	0.23	0.03	8.52	14	1	0	73	21	7	15	101

District Wise - Fluctuation and Frequency Distribution From Different Ranges from One Period to Other

From Year: 2014/May - **To Year:** 2015/Jan

State : Delhi

District Name	No. of Wells	Range of Fluctuation (m)				No. of Wells/Percentage Showing Fluctuation						Total No. of Wells	
		Rise		Fall		Rise			Fall			Rise	Fall
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4		
CENTRAL	1	0.19	0.19	-	-	1 100.00%	0	0	0	0	0	1	0
EAST	10	0.05	0.12	0.22	1.15	2 20.00%	0	0	8 80.00%	0	0	2	8
NEW DELHI	14	0.17	4.06	0.09	2.66	4 28.57%	0	1 7.14%	7 50.00%	2 14.29%	0	5	9
NORTH	7	0.85	0.85	0.01	1.16	1 14.29%	0	0	5 71.43%	0	0	1	5
NORTH EAST	4	-	-	1.30	1.67	0	0	0	4 100.0 %	0	0	0	4
NORTH WEST	28	0.05	0.60	0.06	4.12	4 14.29%	0	0	22 78.57%	1 3.57%	1 3.57%	4	24
SOUTH	16	0.01	0.56	0.03	2.69	3 18.75%	0	0	9 56.25%	4 25.00%	0	3	13
SOUTH WEST	24	0.07	1.09	0.31	2.51	6 25.00%	0	0	16 66.67%	2 8.33%	0	6	18
WEST	9	0.19	0.46	0.14	3.29	2 22.22%	0	0	6 66.67%	1 11.11%	0	2	7

Total	113	0.85	0.12	0.00	4.12	23	0	1	77	10	1	24	88

District Wise - Fluctuation of Water Level with Mean and Selected Period

10 Years Mean (2005 Jan - 2014 Jan) - 2015/Jan

State : Delhi

District Name	No. of Wells	Range of Fluctuation				No. of Wells/Percentage Showing Fluctuation						Total No. of Wells	
		Rise (m)		Fall (m)		Rise (m)			Fall (m)			Rise	Fall
		Min	Max	Min	Max	0 to 2	2 to 4	>4	0 to 2	2 to 4	>4		
CENTRAL	1	-	-	0.38	0.38	0	0	0	1 100.0 %	0	0	0	1
EAST	10	-	-	0.36	4.39	0	0	0	7 70.00%	2 20.00 %	1 10.00%	0	10
NEW DELHI	14	0.24	1.09	0.03	4.42	5 35.71 %	0	0	6 42.86%	2 14.29 %	1 7.14%	5	9
NORTH	7	0.05	0.51	0.39	2.21	5 71.43 %	0	0	1 14.29%	1 14.29 %	0	5	2
NORTH EAST	4	-	-	2.11	4.17	0	0	0	0	2 50.00 %	2 50.00%	0	4
NORTH WEST	28	0.11	0.75	0.01	5.85	6 21.43 %	0	0	18 64.29%	2 7.14 %	2 7.14%	6	22
SOUTH	16	0.07	2.14	0.34	9.07	1 6.25 %	1 6.25%	0	5 31.25%	2 12.50 %	7 43.75%	2	14
SOUTH WEST	26	0.16	3.81	0.48	6.95	12 46.15 %	2 7.69%	0	1 3.85%	9 34.62 %	2 7.69%	14	12

WEST	9	-	-	0.48	6.74	0	0	0	6 66.67%	2 22.22 %	1 11.11%	0	9
Total	115	0.51	0.24	0.01	9.07	29	3	0	45	22	16	32	83