



# UNDERSTANDING WATER HARDNESS IN DELHI NCR

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**Abstract**—Delhi/NCR Delhi has the lowest score of any major city in India for water quality to supply locals, according to a report by the “Centre for Testing conducted by the Bureau of Indian Standards (BIS) on the Bureau of Food Consumer Affairs”. Water here is hard water which impacts the everyday lives of consumers. Literature Review here examines the current hardness of water quality in Delhi/NCR region covering cities like Delhi, Ghaziabad, Noida, Greater Noida, Faridabad, Sonipat & Panipat Areas.

**Keywords**—Hard Water, Delhi NCR, Water Hardness

## I. INTRODUCTION

### A. Water

Water is an inorganic compound with the chemical formula H<sub>2</sub>O. It is a transparent, tasteless, odorless, and nearly colorless chemical substance, and it is the main constituent of Earth's hydrosphere and the fluids of all known living organisms. Water is made up of 2 Hydrogen Atoms and 1 Oxygen atom.

### B. States of Water

Before we delve into hardness, let's briefly explore the different states of water:

1. Solid (ice): At low temperatures, water freezes and forms ice.
2. Liquid: The most common state, where water flows freely.
3. Gas (Vapor): At high temperatures, water evaporates and becomes vapor.

### C. Water Pollution and TDS

#### WATER POLLUTION

Delhi faces a severe water crisis due to declining groundwater recharge and excessive extraction. Pollution from industrial discharges, sewage, and agricultural runoff further exacerbates the situation.

## TYPES OF WATER POLLUTION

### Chemical Pollution:

Chemical pollution is the unwelcome addition of unnatural chemicals to the environment. These man-made toxins, often from industrial processes, contaminate water and harm ecosystems.

### Biological Pollution:

Biological pollution is a naturally occurring form of water contamination. Microorganisms such as bacteria, protozoa, and viruses can infiltrate water supplies and cause diseases

### Physical Pollution:

Problems related to the contamination of water on physical properties are color contamination, offensive odors, corrosiveness (pH), and turbidity.

### Total Dissolved Solids (TDS)

TDS represents the total concentration of dissolved substances in water. It includes minerals, salts, and other impurities. The maximum desirable TDS level, according to the Bureau of Indian Standards (BIS), is 300 milligrams per liter.

### Water Hardness

Water hardness refers to the concentration of dissolved minerals in water, primarily calcium and magnesium ions. These minerals come from geological formations and soil as water flows through the earth. The hardness of water affects its taste, suitability for household use, and impact on appliances and plumbing.

According to NCBI (National Center for Biotechnology Information) In general, water with less than 60 ppm can be considered soft, water with 60-120 ppm moderately hard, and water with greater than 120 ppm hard.

Water	Milligrams per liter (mg/l)
Soft	0-60
Moderate	61-120
Hard	121-180
Very hard	>180

Fig. 1. Water Hardness Criteria

**How does water become hard?**

As water percolates through rocks and soil, it dissolves minerals like calcium & magnesium carbonates, and bicarbonates. This is how groundwater naturally becomes hard. In Delhi, the source of the hardness is likely due to the geological composition of the underlying aquifers.

**Problems Caused by Hard Water:**

Hard water can lead to several problems, including:

- Reduced cleaning efficiency: soap and detergents don't lather well in hard water, making it difficult to clean dishes, clothes, and ourselves effectively.
- Mineral buildup: Hard water can cause scale buildup in pipes, and appliances like kettles and geysers, reducing their efficiency and lifespan.
- Skin and hair problems: Hard water can make skin feel dry and itchy, and hair can appear dull and frizzy.

**Relationship Between TDS and Hardness**

TDS includes the minerals responsible for hardness. Therefore, higher TDS levels often correlate with harder

water. However, hardness specifically refers to the calcium and magnesium content.

**Removing Hardness Processes for Softening Water**

1. Ion Exchange: Water softeners replace calcium and magnesium ions with sodium ions.
2. Reverse Osmosis (RO): RO systems remove minerals, including hardness ions.
3. Lime-Soda Process: Adding lime and soda ash precipitates calcium and magnesium, making them insoluble.

**II.FINDINGS**

Using TDS Meter & Hardness Solution Kit (Hardness Reagent B(20 drops per test), Hardness Reagent R(as per requirement to test) & Reagent A- 1 scoop – 1-2 gm) for testing 5ml Water as sample; we have analyzed TDS & Hardness of various areas of Delhi/NCR. The stated figures vary basis locations in the said area and are an estimated average around those areas.



Fig .2. Delhi NCR map with district wise TDS/Hardness

Area wise TDS & Hardness is depicted below basis actual tests conducted as mentioned above.



S.NO	AREA	BOREWELL TDS	BOREWELL HARDNESS
1	BURARI	1500-2000	700-1100
2	MODEL TOWN	700-900	400-600
3	CIVIL LINE	500-800	300-500
4	RUPNAGAR	500-800	300-500
5	ASHOK VIHAR	600-800	350-650
6	SHALIMAR BAGH	600-800	350-650
7	PRITAMPURA	600-800	350-650
8	ROHINI	600-800	350-650
9	PUNJABI BAGH	700-1000	400-800
10	KRITI NAGAR	700-1000	400-800
11	RAJOURI GARDEN	700-1000	400-800
12	DWARKA	1000-1400	600-1000
13	JANAKPURI	1000-2000	600-1400
14	KAROL BAGH	600-800	300-600
15	RAJINDER NAGAR	600-800	300-600
16	NARAINA	400-700	250-450
17	DELHI CANTT	800-1200	500-900
18	ANAND NIKETAN	800-1000	400-700
19	MEHRAULI	1000-1400	500-800
20	VASANT KUNJ	800-1200	500-800
21	ANAND LOK	400-700	250-450
22	SAKET	400-600	200-400
23	SOUTH EXENTION	400-800	200-400
24	LAJPAT NAGAR	400-800	200-400
25	DEFENCE CALONI	400-800	200-400
26	GREAT KALESH	400-800	200-400
27	NEW FRIENDS CALONY	450-850	250-450
28	OKHLA	1000-1400	500-800
29	SHAHDARA	700-1000	300-800
30	OLD DELHI	400-600	200-400
31	CONNAUGHT PLACE	400—600	200-400
32	PREET VIHAR	400-600	200-400
33	SARITA VIHAR	800-1200	500-800
34	GHAZIABAD	600-800	300-500
35	SAHIBABAD	1000-1500	700-1200
36	NOIDA	800-1500	600-900
37	GREATER NOIDA	350-800	200-600



38	FARIDABAD	1000-1500	700-1200
39	GURUGRAM	300-600	200-400
40	KUNDLI	800-1400	600-1100
41	SONIPAT	800-1400	600-1100

### III.CONCLUSION

Delhi's water hardness poses challenges, but awareness, conservation, and effective treatment can mitigate its impact. Let's prioritize sustainable water management to secure our future!

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