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PHYSICOCHEMICAL ASSESSMENT OF DRINKING WATER SOURCES IN JORHAT TOWN, ASSAM: A ZONAL AND SOURCE-WISE STUDY

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Abstract

Water quality is an important determinant of public health and environmental sustainability, particularly where groundwater, surface water and piped water are used for domestic purposes. The present study evaluates selected physicochemical characteristics of drinking-water sources in Jorhat Town, Assam, through a zonal and source-wise assessment. Twelve water samples were collected from East, West, North and South zones, with groundwater, surface water and tap water represented in each zone. TDS, pH, iron, total hardness and chloride were measured using the procedures documented in the project report. TDS ranged from 47–277 mg/L, pH from 6.57–7.81, hardness from 46–138 mg/L and chloride from 5.67–61.68 mg/L; these remained within the selected reference limits. Iron ranged from 0.22–1.95 mg/L. Five samples exceeded the acceptable iron limit of 0.3 mg/L and four groundwater samples exceeded the permissible limit of 1.0 mg/L. Groundwater showed substantially higher mean iron than surface and tap water. The results identify groundwater iron as the principal concern within the measured parameters and demonstrate the value of localized zonal and source-wise monitoring.

Keywords: Drinking water quality; Jorhat Town; groundwater; surface water; tap water; iron; TDS; pH; hardness; chloride

1. Introduction

Water is one of the most essential natural resources required for human survival, domestic activities, agriculture and economic development. The suitability of water for a particular purpose depends on its physical, chemical and biological characteristics. For drinking purposes, water must satisfy prescribed quality requirements because contamination or excessive concentrations of certain constituents can affect health, taste, appearance and water-supply performance.

Water-quality analysis involves measurement of selected physical, chemical and biological parameters and comparison of measured values with established standards. Regular monitoring is important for determining whether a source remains suitable for its intended use and for identifying changes that may require treatment or management.

1.1 Need for the Study

Water-quality conditions may vary with source, location, geology, human activities and distribution characteristics. A source that appears satisfactory at one location may not have the same characteristics elsewhere. A zonal assessment therefore provides useful localized information.

1.2 Objectives

• Collect representative samples from different parts of Jorhat Town.

• Assess groundwater, surface-water and tap-water sources.

• Determine TDS, pH, iron, hardness and chloride.

• Compare results with drinking-water standards.

• Identify zonal and source-wise variation.

• Identify parameters requiring treatment or continued monitoring.

2. Review of Literature

2.1 Drinking-Water Quality Assessment in Jorhat

Earlier work around Jorhat has demonstrated variation among drinking-water sources and identified the need for physicochemical and bacteriological monitoring.

2.2 Groundwater Quality in Western Jorhat

Published groundwater investigations in western Jorhat have identified iron as an important water-quality concern, providing regional context for the present findings.

2.3 Research Gap

The present investigation contributes a four-zone, three-source comparison using 12 samples from East, West, North and South regions of Jorhat Town.

3. Materials and Methods

3.1 Study Area and Sampling Design

The study covers four zones—East, West, North and South. The project report identifies sampling areas including Chengeli Gaon/Kenduguri, Gondhia Gaon/Pulibor, Dichoi Nagar/Potiagaon and Birinasayek/Titabor.

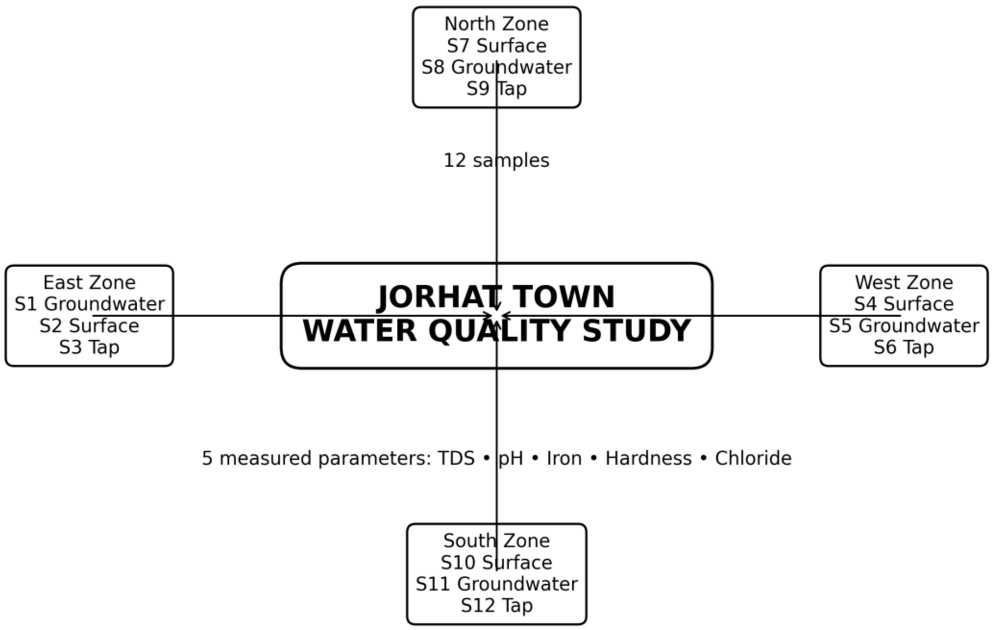

Figure 1. Schematic representation of the four-zone sampling design and measured parameters.

3.2 Sampling and Source Classification

Sample	Zone	Source	Parameters
S1	East	Groundwater	TDS, pH, Fe, hardness, chloride
S2	East	Surface	TDS, pH, Fe, hardness, chloride
S3	East	Tap	TDS, pH, Fe, hardness, chloride
S4	West	Surface	TDS, pH, Fe, hardness, chloride
S5	West	Groundwater	TDS, pH, Fe, hardness, chloride
S6	West	Tap	TDS, pH, Fe, hardness, chloride
S7	North	Surface	TDS, pH, Fe, hardness, chloride
S8	North	Groundwater	TDS, pH, Fe, hardness, chloride
S9	North	Tap	TDS, pH, Fe, hardness, chloride
S10	South	Surface	TDS, pH, Fe, hardness, chloride
S11	South	Groundwater	TDS, pH, Fe, hardness, chloride
S12	South	Tap	TDS, pH, Fe, hardness, chloride

Table 1. Sample identification and source classification.

3.3 Analytical Methods

Five parameters were quantitatively analyzed: TDS, pH, iron, total hardness and chloride. TDS and pH were measured using meters; iron was determined by phenanthroline colorimetry; hardness by EDTA titration; and chloride by argentometric titration. The original report contains theoretical material on additional parameters, but the numerical laboratory dataset used here is restricted to these five.

3.4 Reference Limits

Parameter	Acceptable	Permissible*
TDS	500 mg/L	2000 mg/L
pH	6.5–8.5	No relaxation
Iron	0.3 mg/L	1.0 mg/L
Total hardness	200 mg/L	600 mg/L
Chloride	250 mg/L	1000 mg/L

Table 2. Reference limits adopted for interpretation. *Permissible limit in the absence of an alternate source.

4. Results and Discussion

Sample	Zone	Source	TDS	pH	Iron	Hardness	Chloride
S1	East	Groundwater	139	6.59	1.95	96	17.73
S2	East	Surface	107	7.81	0.37	130	5.67
S3	East	Tap	217	7.51	0.93	138	9.21
S4	West	Surface	47	7.35	0.41	46	16.30
S5	West	Groundwater	107	7.02	1.52	102	9.21
S6	West	Tap	242	7.02	0.29	116	29.78
S7	North	Surface	63	6.96	0.22	48	18.43
S8	North	Groundwater	193	7.13	1.77	76	12.05
S9	North	Tap	92	7.43	0.34	78	61.68
S10	South	Surface	140	6.57	0.29	70	35.45
S11	South	Groundwater	277	7.39	1.56	108	9.92
S12	South	Tap	128	7.66	0.30	110	13.47

Table 3. Complete laboratory dataset used for analysis.

4.1 Total Dissolved Solids (TDS)

Total dissolved solids represent the combined concentration of dissolved inorganic salts and small amounts of organic matter present in water. TDS is useful as a broad indicator of the dissolved ionic character of a source.

TDS ranged from 47 to 277 mg/L. The highest value was S11 groundwater from South and the lowest was S4 surface water from West. All samples were below the adopted acceptable limit of 500 mg/L.

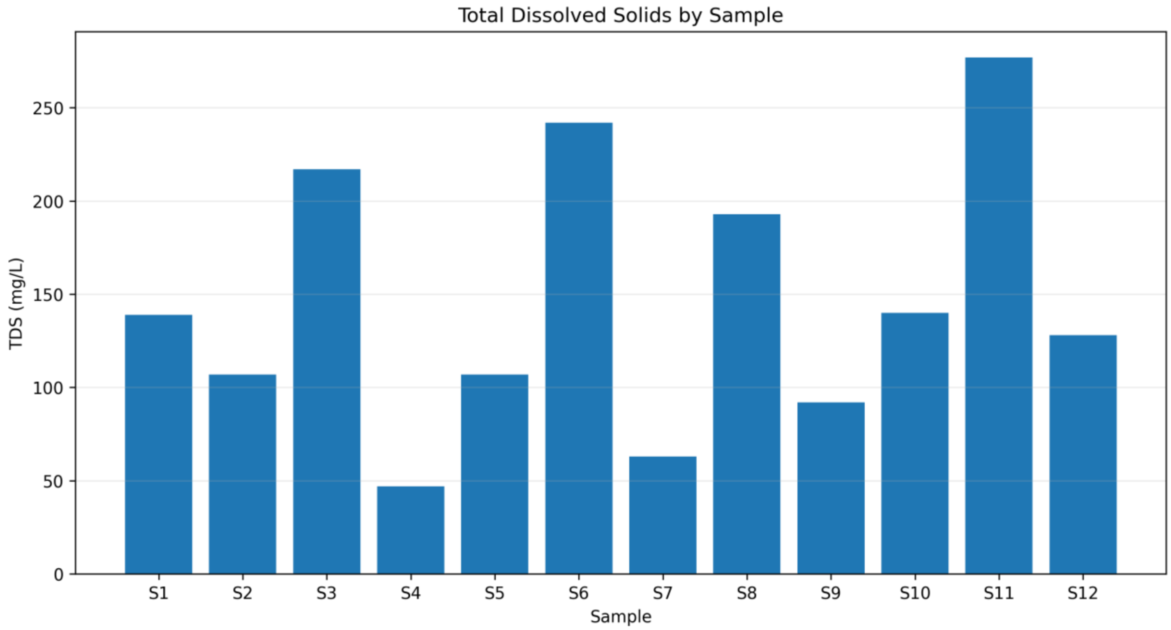

Figure 2. TDS concentration by sample.

4.2 pH

pH indicates the acidic or alkaline character of water and influences corrosion, scaling, chemical reactions and treatment performance.

pH ranged from 6.57 to 7.81. All samples were within the adopted 6.5–8.5 range, indicating generally near-neutral conditions.

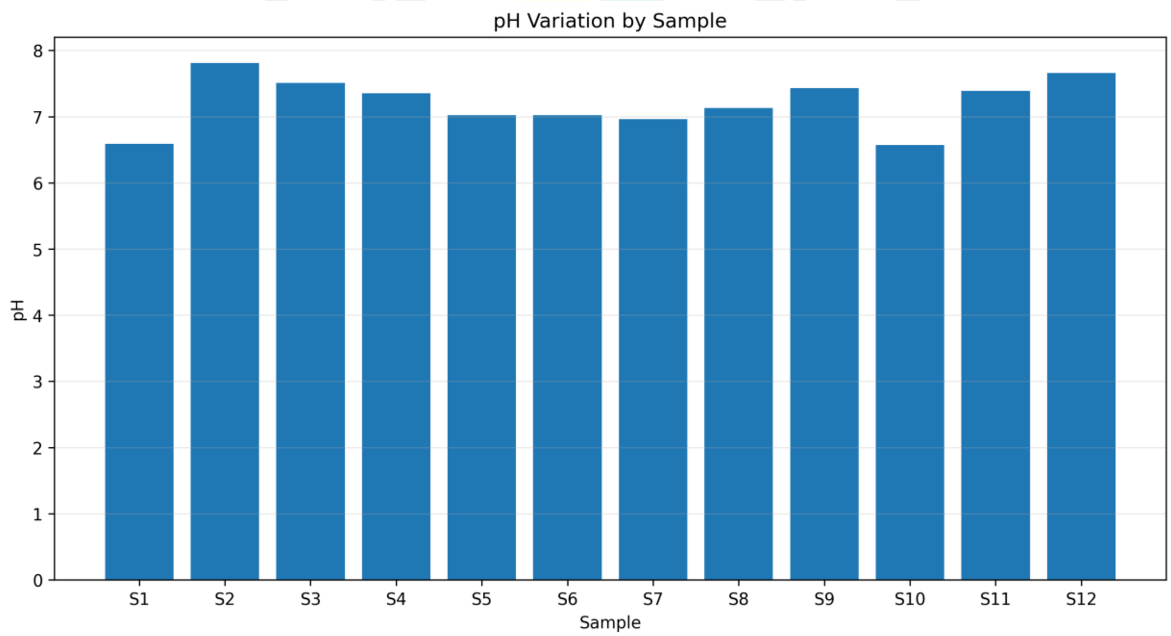

Figure 3. pH variation by sample.

4.3 Iron

Iron can occur naturally in groundwater through interaction with iron-bearing minerals. Elevated iron may cause colour, metallic taste, staining and operational problems.

Iron ranged from 0.22 to 1.95 mg/L. Five samples exceeded 0.3 mg/L and four groundwater samples exceeded 1.0 mg/L. S1 had the maximum value of 1.95 mg/L.

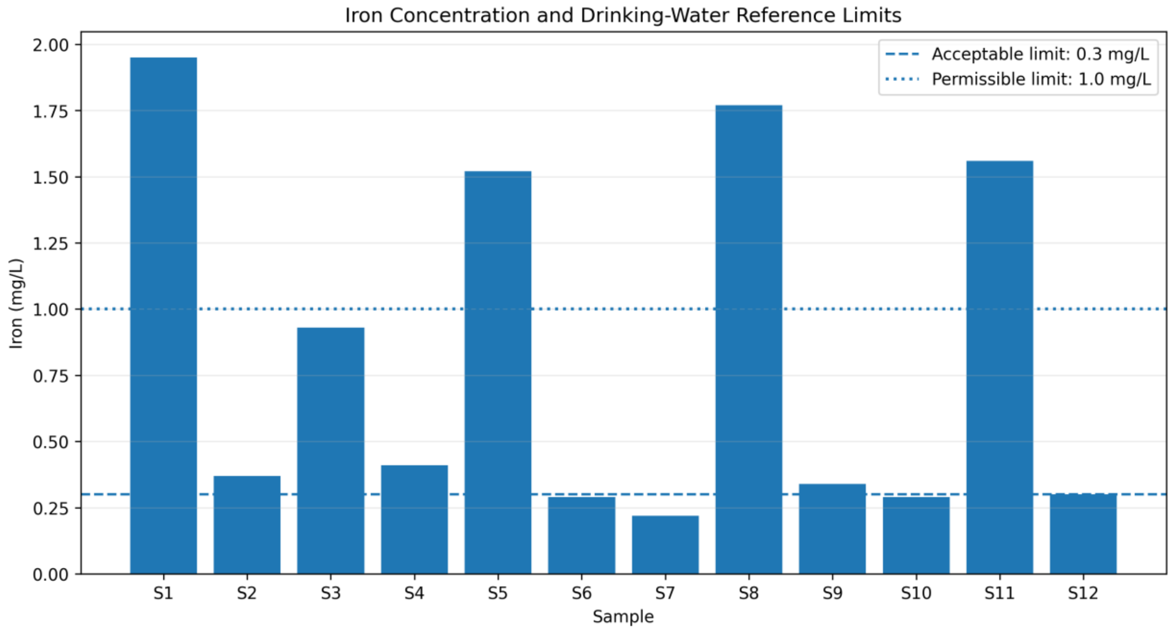

Figure 4. Iron concentration with reference limits.

4.4 Total Hardness

Total hardness is mainly associated with calcium and magnesium ions and affects soap consumption, scaling and the general character of domestic water.

Hardness ranged from 46 to 138 mg/L as $CaCO_3$. All samples were below the adopted acceptable limit of 200 mg/L.

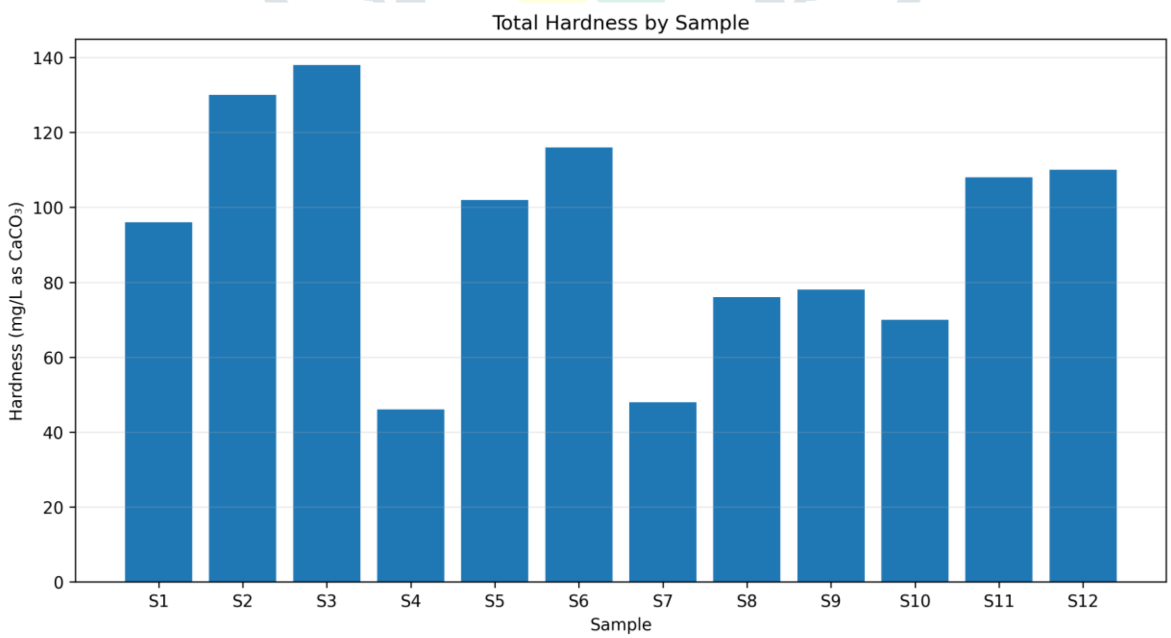

Figure 5. Total hardness by sample.

4.5 Chloride

Chloride is a naturally occurring major ion that can also reflect domestic wastewater, agricultural or other anthropogenic inputs. High chloride can affect taste and corrosion.

Chloride ranged from 5.67 to 61.68 mg/L. The maximum occurred in S9 tap water from North, but remained far below the adopted acceptable limit of 250 mg/L.

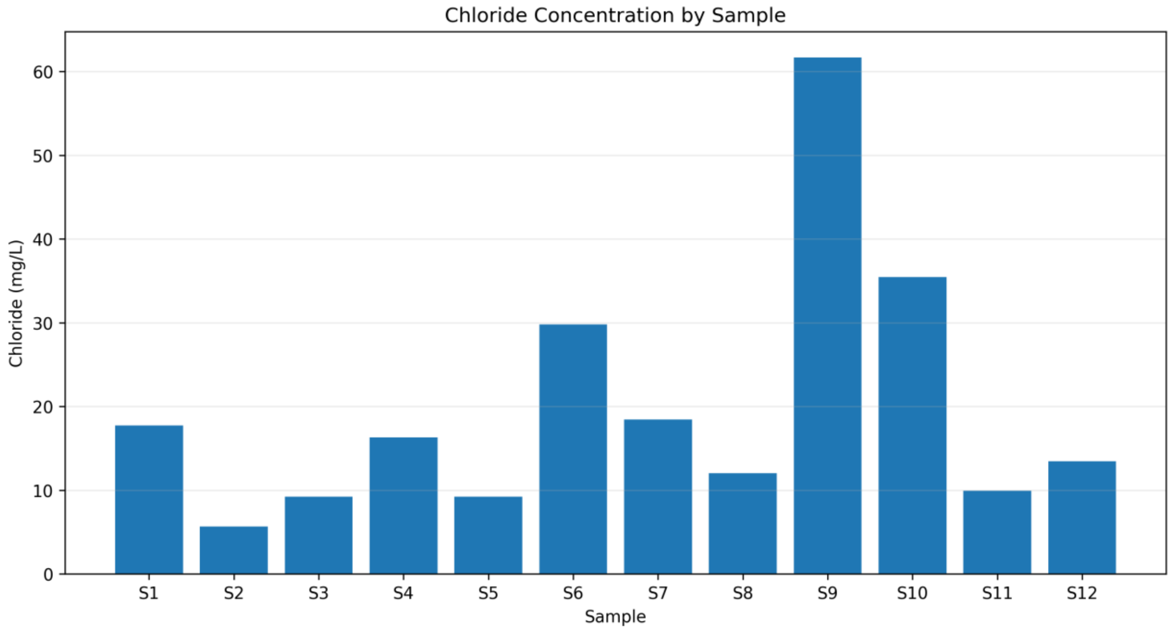

Figure 6. Chloride concentration by sample.

5. Zonal Comparison

Zonal means were calculated from the three samples representing each zone. Because every zone contains all three source categories, the zonal means represent combined geographical-source profiles.

TDS zonal means: East=154.33, West=132.00, North=116.00, South=181.67.

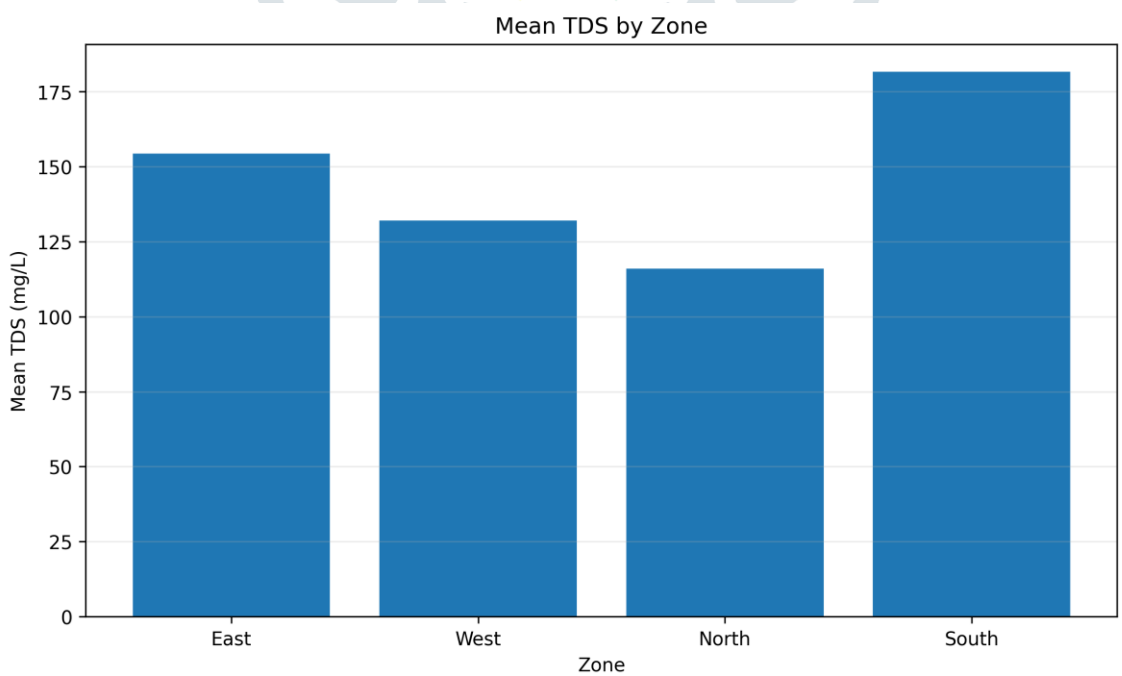

Figure 7. Mean TDS by zone.

pH zonal means: East=7.30, West=7.13, North=7.17, South=7.21.

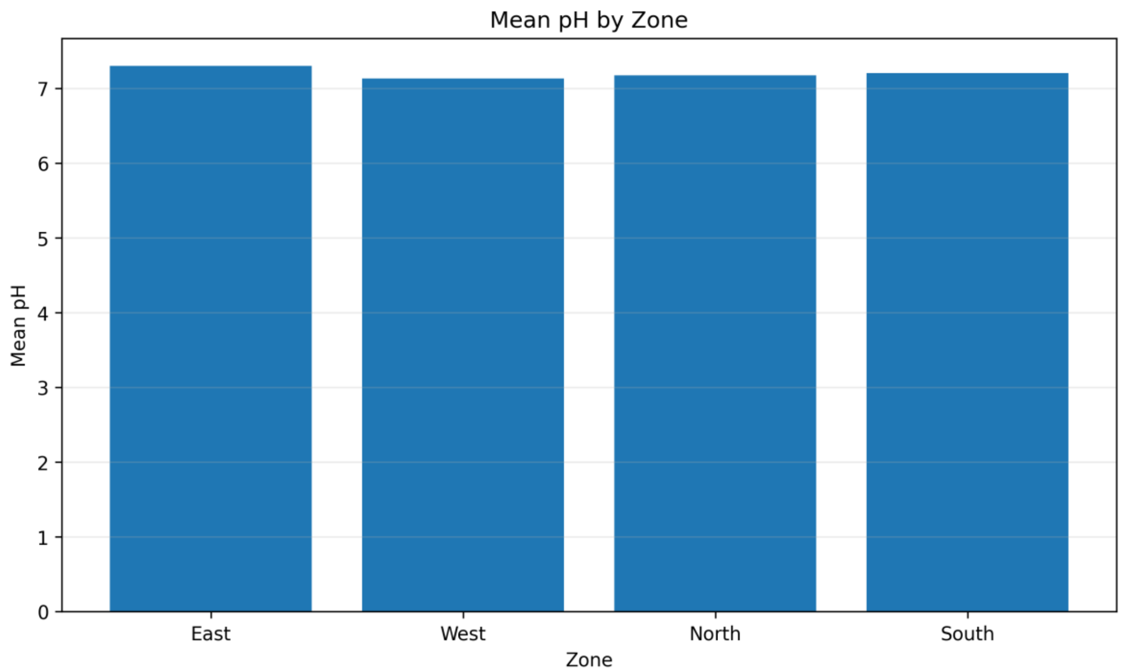

Figure 8. Mean pH by zone.

Iron zonal means: East=1.08, West=0.74, North=0.78, South=0.72.

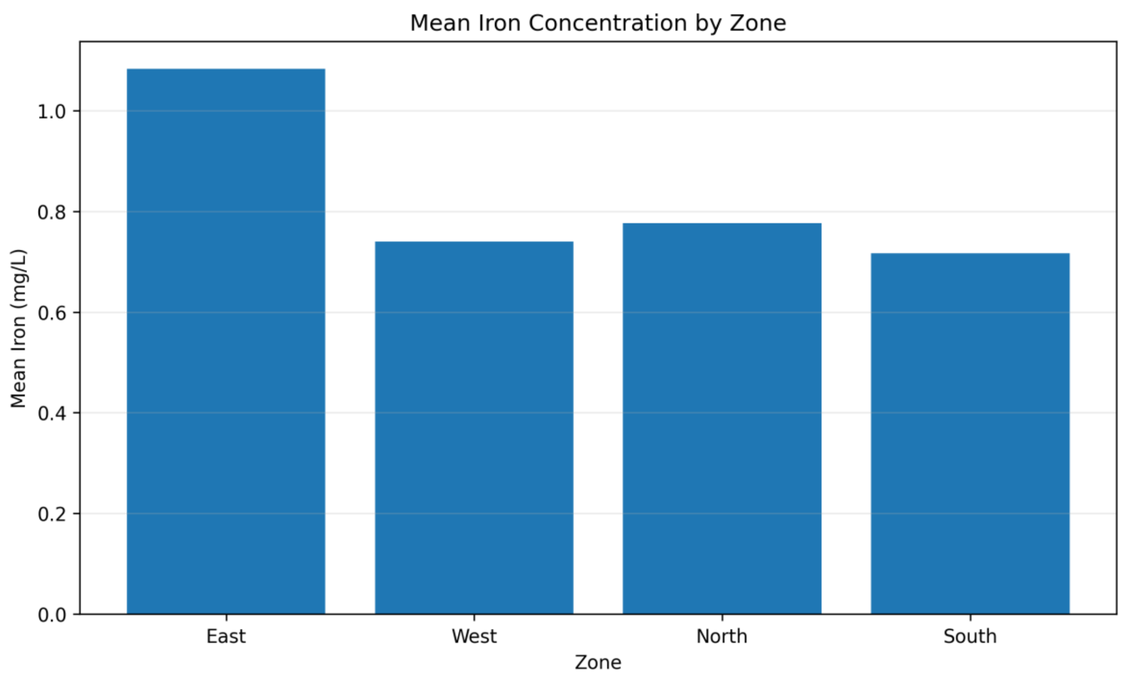

Figure 9. Mean iron concentration by zone.

Hardness zonal means: East=121.33, West=88.00, North=67.33, South=96.00.

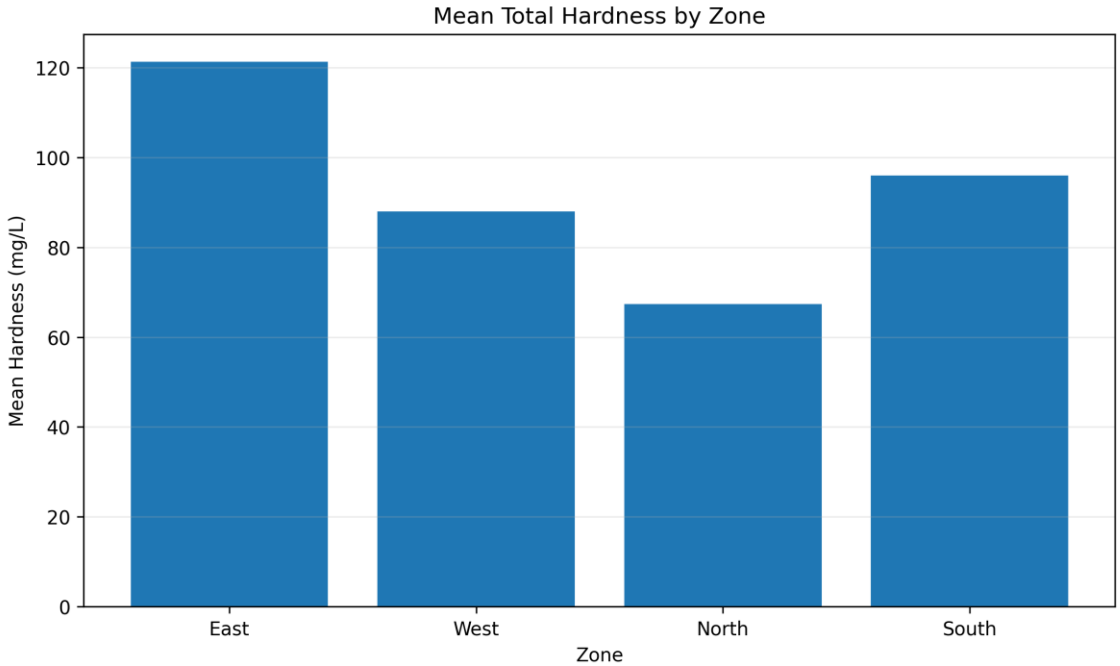

Figure 10. Mean total hardness by zone.

Chloride zonal means: East=10.87, West=18.43, North=30.72, South=19.61.

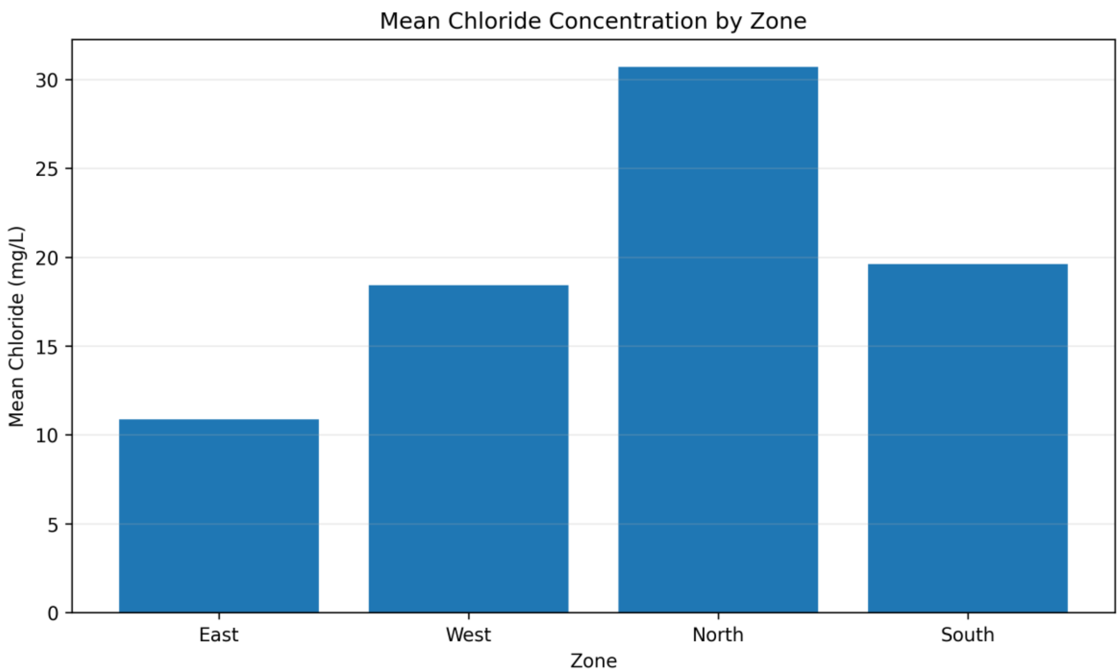

Figure 11. Mean chloride concentration by zone.

The East zone had the highest mean iron concentration (1.08 mg/L). The South zone had the highest mean TDS (181.67 mg/L), largely influenced by S11. North had the lowest mean hardness (67.33 mg/L), while S9 had the highest individual chloride value.

6. Source-wise Comparison

Source-wise comparison provides a clearer indication of whether differences are associated with water origin.

Mean TDS: Groundwater=179.00, Surface=89.25, Tap=169.75.

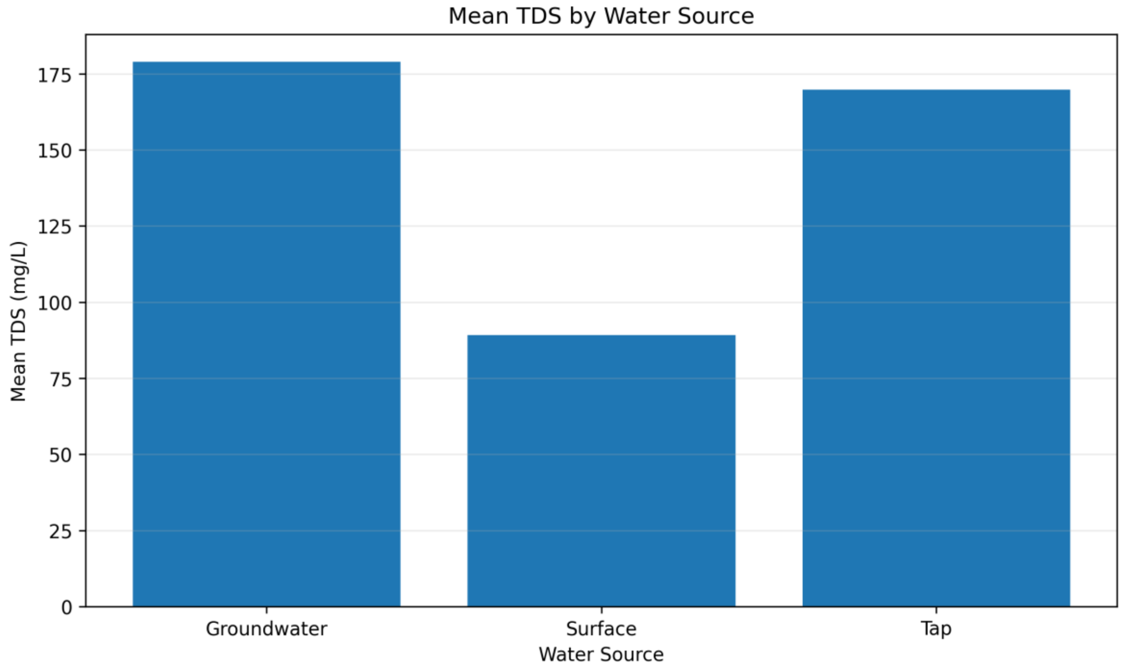

Figure 12. Mean TDS by water source.

Mean Iron: Groundwater=1.70, Surface=0.32, Tap=0.47.

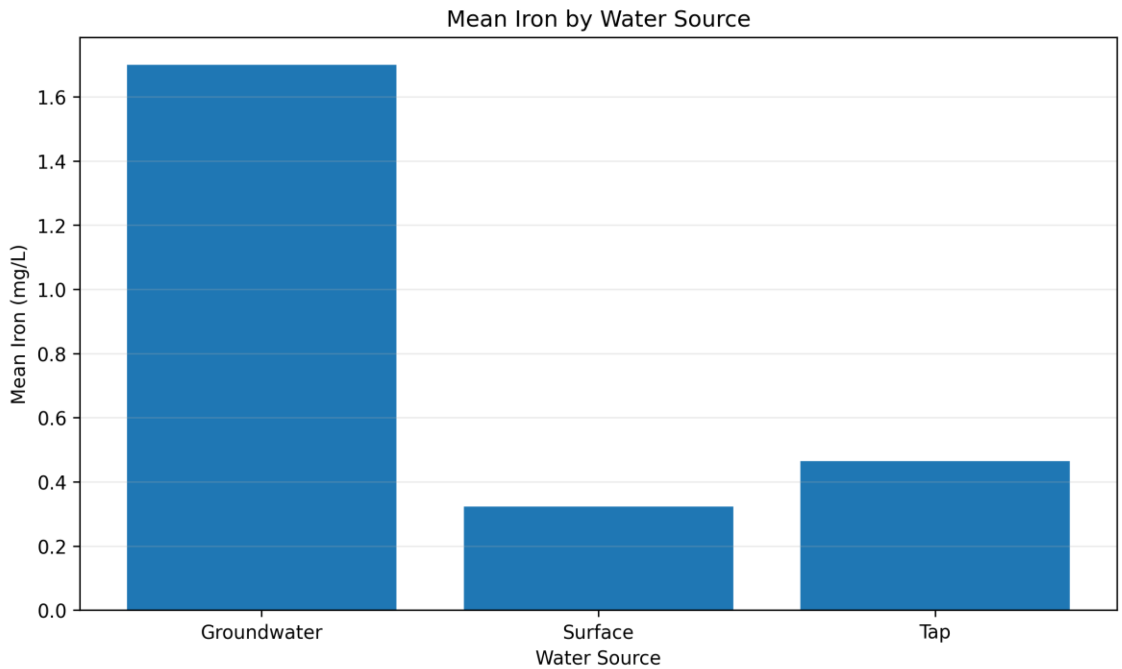

Figure 13. Mean iron concentration by water source.

Mean Hardness: Groundwater=95.50, Surface=73.50, Tap=110.50.

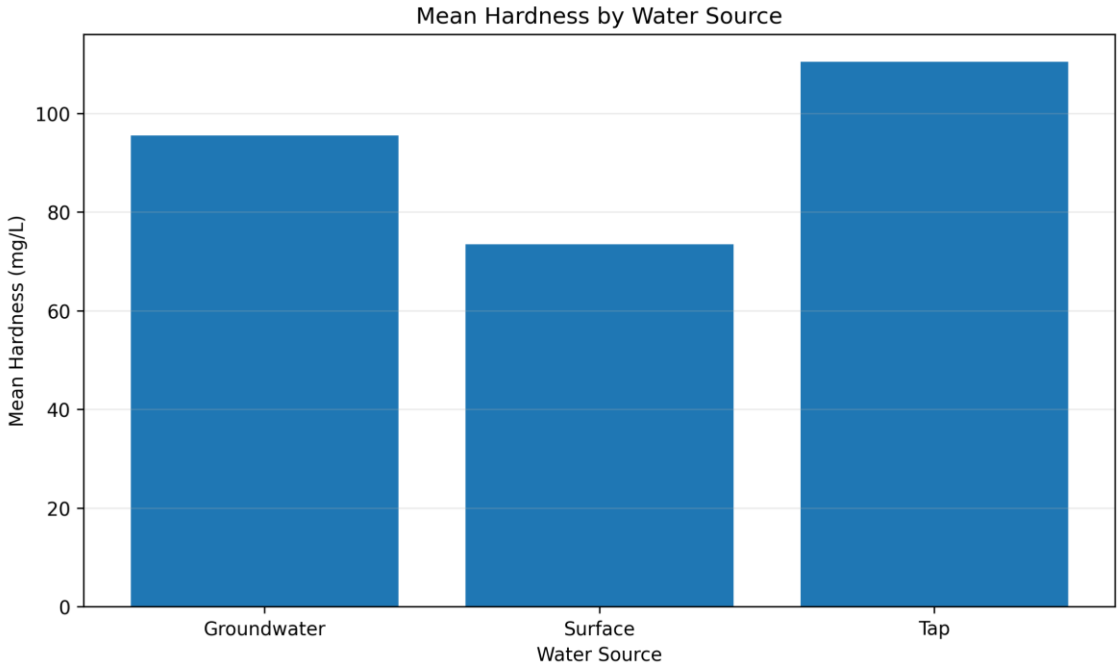

Figure 14. Mean hardness by water source.

Mean Chloride: Groundwater=12.23, Surface=18.96, Tap=28.54.

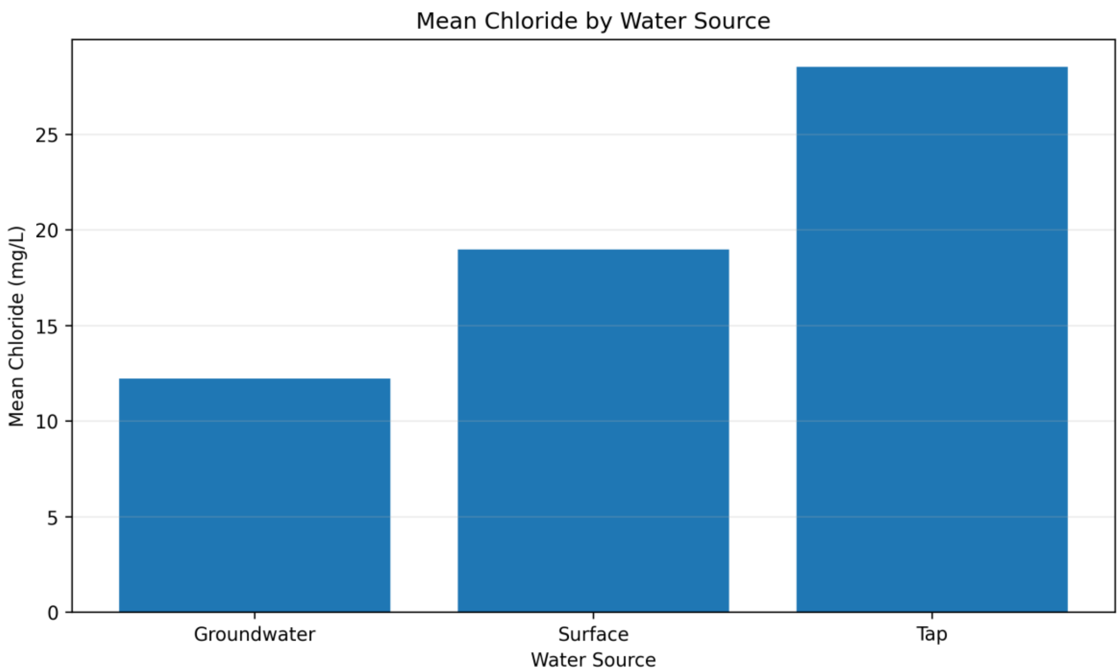

Figure 15. Mean chloride concentration by water source.

Groundwater showed the strongest iron-related concern, with mean iron of approximately 1.70 mg/L compared with 0.32 mg/L in surface water and 0.46 mg/L in tap water.

7. Integrated Water-Quality Profile

Because the parameters have different units and scales, a normalized profile is used only for visual comparison of relative variation among zones; it is not a substitute for standard-limit assessment.

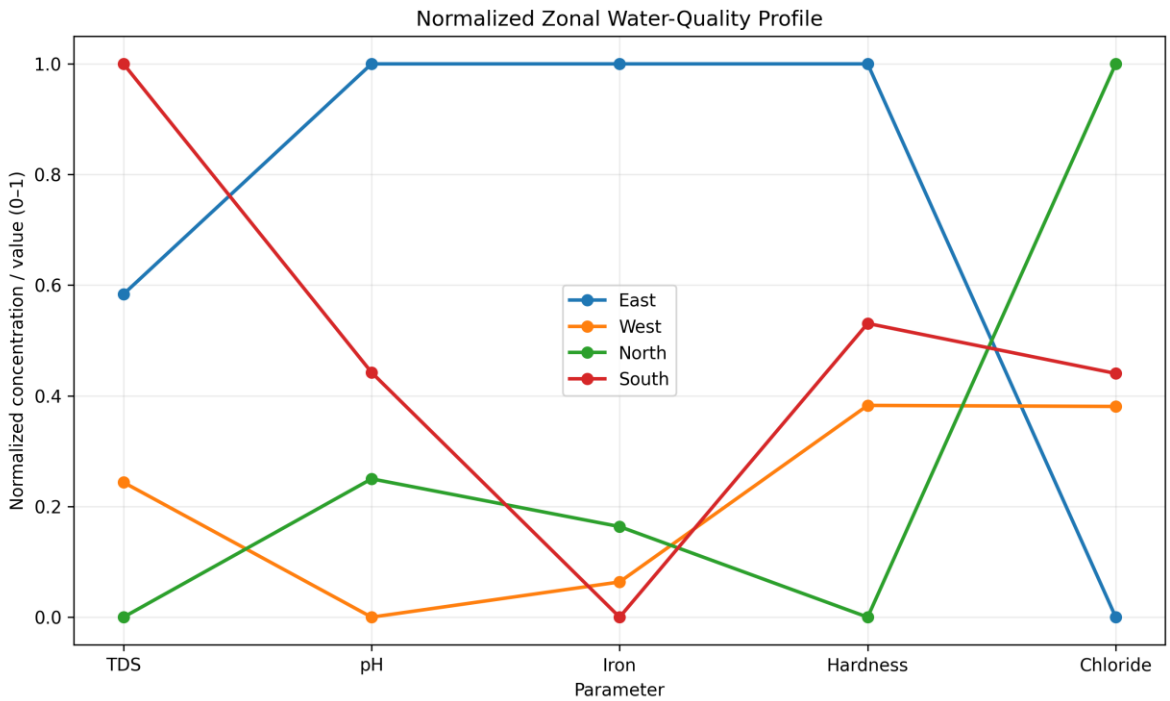

Figure 16. Normalized zonal water-quality profile.

8. Overall Assessment

Parameter	Observed range	Assessment
TDS	47–277 mg/L	All samples within adopted acceptable limit
pH	6.57–7.81	All samples within adopted range
Iron	0.22–1.95 mg/L	Major concern; groundwater shows elevated values
Hardness	46–138 mg/L	All samples within adopted acceptable limit
Chloride	5.67–61.68 mg/L	All samples within adopted acceptable limit

Table 4. Overall interpretation of measured parameters.

The sampled water sources were generally satisfactory with respect to TDS, pH, hardness and chloride. Iron is the principal parameter requiring attention. Parameters discussed theoretically in the original project but not supported by consistent numerical laboratory tables are not treated as measured results in this paper.

9. Relevance to Jal Jeevan Mission

The Jal Jeevan Mission emphasizes access to safe drinking water, water-quality monitoring, source sustainability and community participation. The present study supports the monitoring objective by demonstrating that water characteristics can vary with both location and source. Elevated groundwater iron indicates the need for periodic quality verification and, where necessary, source-specific treatment.

10. Limitations of the Study

• The 12-sample dataset is a localized assessment rather than a complete representation of Jorhat Town.

• Only five parameters have documented numerical laboratory results.

• Single-period sampling does not establish seasonal variation.

• Physicochemical measurements alone cannot establish microbiological safety.

• Larger sampling and precise geographic coordinates would strengthen spatial interpretation.

11. Recommendations and Future Scope

• Periodic groundwater monitoring for iron.

• Site-specific assessment of iron-removal treatment.

• Pre-monsoon, monsoon and post-monsoon sampling.

• Expanded chemical and microbiological parameter coverage.

• Larger sampling network.

• Water Quality Index and GIS-based mapping.

• Source-to-consumer distribution assessment.

12. Conclusion

The study assessed 12 water samples from four zones of Jorhat Town and three source categories. TDS, pH, hardness and chloride remained within the selected reference limits. Iron ranged from 0.22 to 1.95 mg/L; five samples exceeded the acceptable limit of 0.3 mg/L and four groundwater samples exceeded the permissible limit of 1.0 mg/L. Groundwater therefore represents the principal source category requiring attention for iron control. The study demonstrates the value of zonal and source-wise monitoring, while future work should incorporate seasonal, microbiological and additional chemical analyses.

Acknowledgement

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Conflict of Interest

The authors declare that there is no conflict of interest associated with this study.

Data Availability

The numerical water-quality data used in this study were obtained from the laboratory observations documented in the project report.

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