Proceedings of College of STEM Symposium

PROC(05ACSS2026)004
Clayton State University
03/2026

Preliminary Assessment of Water Quality Parameters at Reynolds Nature Preserve

Clint E. Edmunds[1*], *Vivian* Padín-Irizarry[1], and *Paul* D. Melvin[1]

[1]College of STEM, School of Sciences, Clayton State University, Morrow, GA 30260 USA

Abstract. Freshwater quality in the United States is taken for granted compared to many regions worldwide. This study evaluated key water quality parameters in a freshwater stream at Reynolds Nature Preserve in Morrow, Georgia. Using a commercial testing kit, researchers analyzed 17 water quality parameters from four sources (n = 6 replicates/source): stream water from two locations along the stream, distilled water (control), and tap water. Significant differences were detected among treatments in total dissolved solids (P < 0.05). These findings highlight a measurable variation in basic water chemistry across common freshwater sources. Future work will incorporate larger sample sizes to improve analytical robustness and will examine how these chemical parameters correlate with microbiological data collected from the same site.

1 Introduction

Freshwater quality plays a critical role in protecting ecosystem health, supporting biodiversity, and ensuring safe water resources for human use [1]. In the United States, water quality monitoring is essential for maintaining the chemical, physical, and biological integrity of streams and rivers as outlined by the Clean Water Act [1, 2]. Regular assessment of key parameters—such as pH, dissolved oxygen, alkalinity, nutrients, and dissolved solids—provides insight into watershed conditions and helps identify potential sources of contamination which can have widespread impacts on public health [2, 3].

Reynolds Nature Preserve in Morrow, Georgia, serves as an ideal location for baseline freshwater quality monitoring to support long-term ecological studies. Evaluating foundational chemical parameters in this pilot phase allows researchers to establish initial benchmarks and compare stream water with controlled sources such as distilled and tap water. Understanding these baseline differences will guide future work, including linking chemical profiles to microbiological indicators and expanding sampling efforts for more robust environmental analysis.

2 Materials and Methods

2.1 Water Sample Collection

Environmental water samples (50 mL) were collected from two locations (Reynolds 1 and 2, respectively) along Angel Creek within Reynolds Nature Preserve and placed into labeled sterile conical tubes. Distilled water and municipal tap water were collected as controls. All samples were refrigerated at 4°C until analysis.

2.2 Water Quality Analysis

Water quality parameters were evaluated using a commercial Varify® testing kit, which utilizes paper-based chemical analyses, along with a digital TDS meter. A total of seventeen parameters were evaluated per replicate per source, including pH, hardness, heavy metals, nutrients, alkalinity, and dissolved solids. Units for water quality analysis were either parts per million (ppm) or parts per billion (ppb). Values reported in Table 1 are LS Means for each source.

*Corresponding Author: cedmunds@clayton.edu

2.3 Statistical Analysis

Data was analyzed using one-way analysis of variance (ANOVA) in SAS. Mean separation was only considered if the main effect *p*-value for the associated parameter was less than 0.05 Statistical significance was declared at $P < 0.05$. Parameters that were not detected in any sample were reported but excluded from further statistical interpretation.

Table 1. The effect of water source on water quality parameters (n=6/treatment). No measurable H_2S, Fe, Mn, NO_2 in any sample.

Treatment	Distilled	Tap	Reynolds 1	Reynolds 2	SEM	*P*-value
pH	6.42	6.67	6.25	6.33	0.14	0.19
Hardness (ppm)	33.33	43.33	62.50	29.17	11.90	0.23
Copper (ppm)	0.07	0.13	0.07	0.07	0.04	0.61
Lead (ppb)	1.67	0.42	1.67	1.67	0.82	0.63
Total Chlorine (ppm)	0.00	0.17	0.04	0.04	0.06	0.26
Mercury (ppm)	0.0000	0.0002	0.0002	0.0002	0.00	0.80
Nitrate (ppm)	0.00	0.00	0.00	1.67	1.67	0.41
Sulfate (ppm)	200.00	108.33	250.00	416.67	77.21	0.07
Zinc (ppm)	3.75	4.17	5.00	3.75	0.80	0.66
Fluoride (ppm)	1.67	2.00	1.33	1.33	0.76	0.91
Sodium Chloride (ppm)	0.00	116.67	0.00	0.00	39.61	0.12
Total Alkalinity (ppm)	6.67	20.00	26.67	0.00	8.69	0.15
TDS (ppm)	1.33^{d}	157.67^{a}	49.00^{b}	29.33^{c}	4.09	$0.01^{\dagger}$

3 Results

There were no significant differences observed in any water quality parameters (Table 1; $P > 0.05$) except for Total Dissolved Solids (TDS) concentration. Total Dissolved Solids differed across treatment (Table 1; $P < 0.01$), with tap water having the most TDS concentration and distilled water having the lowest TDS concentration. Both samples obtained from Reynolds Nature Preserve had TDS values that were significantly decreased (Table 1; $P < 0.05$) compared to tap water and significantly increased compared to distilled water (Table 1; $P < 0.05$). TDS data is presented graphically in Figure 1 with error bars representing the standard deviation.

4 Discussion

The significant differences seen in TDS concentration across treatment sources follow a well-documented pattern seen in many freshwater systems. Tap water usually contains increased dissolved ions due to numerous treatment processes and distribution mechanisms [4].

No additional differences observed were a positive note for the water samples, but this was to be expected for the most part. Researchers aim to sample these areas within the Reynolds Nature Preserve to monitor longitudinal freshwater quality over time. Researchers would like to collect some samples from additional locations along the stream beyond the two locations represented in the current proceedings, as only sampling from two locations limits conclusions due to small sample size. Sampling from additional stream locations would increase the robustness of the conclusions presented. In addition, researchers hope to correlate water quality parameters with microbiological parameters to see if there are any significant connections.

---

† Double asterisk denotes ($P < 0.01$)

$^{a\text{-}d}$ LS Means within a row that do not share a letter superscript differ significantly ($P < 0.05$)

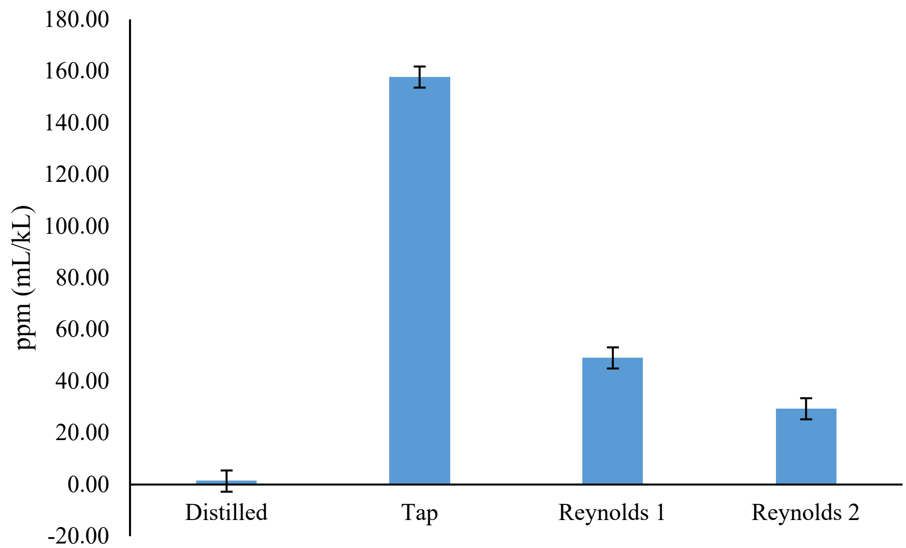

Figure 1. The effect of water source on water total dissolved solids (n=6/treatment). All treatments differ significantly from one another ($P < 0.05$). Error bars represent standard deviation.

Acknowledgements

The authors thank Dr. Boey Khem Tan for laboratory support and technical guidance throughout this project.

References

1. U.S. Geological Survey, D. N. Myers, "Why monitor water quality?" USGS Office of Water Quality, 2014. [Online]. Available: https://water.usgs.gov/owq/WhyMonitorWaterQuality.pdf
2. U.S. Environmental Protection Agency, "Water Quality Standards: Regulations and Resources," EPA, Dec. 4, 2025. [Online]. Available: https://www.epa.gov/wqs-tech
3. A. M. Nahlik et al., "National Aquatic Resource Surveys (NARS): the foundation for long-term aquatic monitoring data across the United States," Environmental Monitoring and Assessment, vol. **197**, no. 1291, Nov. 2025. [Online]. Available: https://link.springer.com/article/10.1007/s10661-025-14629-8
4. M. Kang, D. Perrone, Z. Wang, S. Jasechko, and M. M. Rohde, "Base of fresh water, groundwater salinity, and well distribution across California," Proc. Natl. Acad. Sci. U.S.A., vol. **117**, no. 51, pp. 32302–32307, Dec. 2020. doi: 10.1073/pnas.2015784117.