# ASSESSING THE PRESENT WATER QUALITY OF DSC LAKE

**Submitted By**

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A Thesis Submitted to the Department of Civil Engineering, Daffodil International University

In Partial Fullfillment of the Requirements for the Degree of

**BACHELOR OF SCIENCE IN CIVIL ENGINEERING**


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DAFFODIL INTERNATIONAL UNIVERSITY

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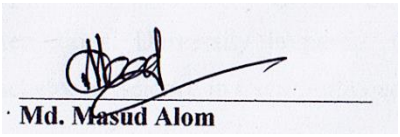

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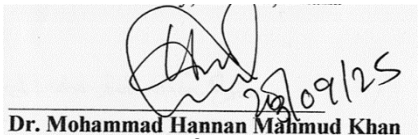

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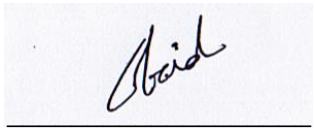

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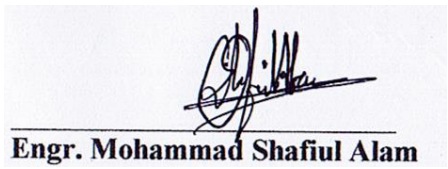

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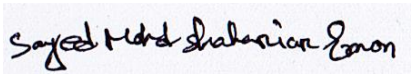
# DECLARATION

This is to certify that this Project and Thesis entitled "ASSESSING THE PRESENT WATER QUALITY OF DSC LAKE " is done by the following student under my direct supervision and this work has been carried out by them in the laboratories of the Department of Civil engineering under the Faculty of Engineering of Daffodil International University in partial fulfillment of the requirements for the degree of Bachelor of Science in Civil Engineering on September 2025.



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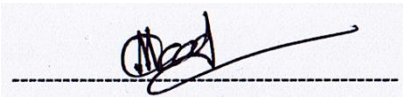

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# DEDICATIONS

Parents, Family and Honorable Teachers

# ABSTRACT

Water is undoubtedly the most natural resource after air. Whether or not the water is usable depends on its quality. Lake with good water quality is important for drinking water and sustaining ecosystem, including Fisheries and Irrigation. The health of every organism that lives in aquatic habitats is impacted by the quality of the water, and water quality influences the water's suitability for irrigation. I have collected samples from various station of DSC Lake. The primary data regarding this water's quality was obtained by means of a number of physical tests, including DO, temperature, pH, turbidity, TDS, TSS, and BOD. By studying the test results, I have shown the water's quality level and how suitable this water is for use. The DO, pH, temperature, and TDS levels in this lake's water are all within acceptable limits and meet water quality standards. Additionally, the lake's ecosystem is being directly impacted by the excess turbidity and TSS, which have decreased light penetration into the water. Due to low penetration of light, this has a direct impact on BOD and has caused an increase in BOD levels. Provided this lake's condition, it has been established that the water is contaminated and polluted. The More testing and routine monitoring are required to assess the lake's level of pollution. In addition to being an indicator of degradation in the environment, this lake's poor state represents a hazard to the ecosystem.

# ACKNOWLEDGEMENT

First of all, I am grateful to Allah Ta'ala for his blessings, protection, and wisdom in every aspect of my life. I also give gratitude of Allah for completing this thesis.

I would like to use the opportunity to thank Md. Masud Alom, Assistant professor in the Department of Civil Engineering, who supervised my thesis and were significant in motivating, supporting, and mentoring me during the entire process. Without his helpful advice and assistance, this project would not be possible. I also want to thank you for giving me the opportunity to select this project.

I would like to thank our faculty members and as well as all of our staff of the Daffodil International University in the Department of Civil Engineering for their invaluable assistance in finishing my thesis. My family and friends have been really patient and supportive throughout my program, and I must sincerely thank them for their help and support.

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# Chapter 01

# Introduction

## 1.1 General Concept

Water is an important natural resource for both the environment and people. Surface water and groundwater composed the majority of water resources. Surface water constitutes a variety of water types from various sources, including lakes, rivers, ponds, lakes, oceans, and so on. Among the many water sources, the lakes are also considered important water resources and ecosystems that are essential for water supply, climate management, flood control, and biodiversity preservation.

The Earth content is 97.2% ocean water, 2.15% glaciers and other ice, 0.61% groundwater, 0.009% freshwater lakes, 0.008% inland seas, 0.005% soil moisture, 0.001% atmospheric water, and 0.0001% river water. Surface water is the most often used source of drinkable water since it is much easier to access. Every day, humans use over 321 billion gallons of surface water. The amount of groundwater consumed daily is around 77 billion gallons. Water is found in many different forms and many different places.

A lake is a body of water; bit it is much more than that. Around the world, lakes are significant environmental features in continental basins. All of them are important to our society, whether they are man-made or natural. They have significant impacts on paleoclimate research, economic activity, and water supplies. They supply drinking water, irrigate agriculture, offer recreational opportunities, and play a significant role in protecting biodiversity. Other water resources are interconnected with the lake. A large portion of the water in lakes comes from groundwater and streams.

This study looks into the water quality of DSC Lake, identifying issues, possible solutions, and ways to make the water quality better, and focuses on physical, chemical, and biological characteristics of DSC LAKE to assess its health and suitability for different uses.

## 1.2 Lake Water-Quality Standards

The amount of water entering the lake and the change in lake area are closely related to lake function. The size of the lake's surface can be used to describe its ecological function. In the relation curve of lake water level and water surface area change, the lake surface area and its change rate increase with the increase of water level. Water quality controlling standards are explained in terms of receiving water standards or effluent standards. The quality of the waste or used water that is to be released at a specific location is known by effluent standards, while the quality of the waters into which the wastewater is discharged is addressed by receiving water standards.

The required water quality is determined in terms of the limiting values of the various constituents or specific properties and depends on the many uses for water. The recommended surface water criteria for selected beneficial uses are typically set by state or tribal water quality standards (Dougal, 1970).

Several parameters used in worldwide to determine water quality standard like pH, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Turbidity, Total Dissolved Solids (TDS), Suspended Solids (SS), Total Alkalinity, Electrical Conductivity (EC), Chloride and Salinity etc.

Bangladesh frequently refers to the water quality norms provided by the World Health Organization (WHO). The total dissolved solids (TDS) content should not be more than 1000 mg/L of chlorides, according these recommendations. Water's pH should be kept between 6.0 and 9.0, and its alkalinity should be higher than 20 mg/L. permissible water temperature for Bangladeshi is between 20-30 ° C. Recommended minimum (DO) level is 6 mg/L for aquatic life to be healthy. The ideal turbidity level is 10 Nephelometric Turbidity Units (NTU), but lower levels are better, particularly when disinfection is used. Only 59% of the population's superior water sources are free of E. coli contamination, even though 99% of them are accessible. The main obstacle to obtaining safely regulated drinking water is low water quality. The recognition that "Water quality is the greatest challenge to achieving safely managed water in Bangladesh" is in according to the results of the 2019 Multiple Indicator Cluster Survey (MICS), which was carried out by the Bangladesh Bureau of Statistics (BBS) and UNICEF.

## 1.3 Objective

1. To observe the quality of water in DSC Lake

# Chapter 2

# LITERATURE REVIEW

## 2.1 Concise Overview of DSC Lake

Daffodil International University is located in Daffodil Smart City, Birulia, Savar, Dhaka, Bangladesh. The university was founded on January 24, 2002, in accordance with the Private University Act of 1992. The campus spans around 360 acres of land Wikipedia). It is the largest private university campus in Bangladesh. This campus merges with the landscape. DIU received the 'Beautification Award' in 2006 from the Honorable Prime Minister of Bangladesh. Tree planting, vegetation, a biogas plant, solar energy use, bicycles, carbon gas reduction and a rainwater harvesting plant are just a few of the many tasks the authority has finished to make the campus more aesthetically pleasing and environmentally sustainable. As part of this project, the lake was created to make the campus environmentally friendly and beautiful. DSC lake is s located within Daffodil International University is. The lake, running from behind the Shadinota sommelon kendro to the Nalakadi Bridge, is surrounded by flora. This lake is attractive and pleasant because of the design. To establish a connection with the nature, a large number of trees have been planted along the banks of the lake. This lake's to keep perfect to maintain its health and environmental friendliness, management gives students very clear directions. This lake's water quality is unsuitable for human consumption, but it is suitable for fish and other aquatic life, as well as for plants and irrigation. This water can be used for a number of different purposes with proper planning and management

## 2.2 Background

The living water: From waste to worth "As a way to improve the campus's aesthetics and the environment, plans were established in 2020 to create a lake. In the past, this lake was somewhat widened from beneath the Nalkadi Bridge. There were several different kinds of pollutants present and was small amounts of water were here but it was also sewage-filled and polluted. Non-biodegradable materials, polythene, and other pollutants were removed by the start of 2020. In 2021, excavation and structural work got moving forward. After all of the debris had been cleared around 2022, construction on one side of the building's landing stage started. In 2023, the lake is now complete and Places to sit in the refreshing

shade have been established. Then started tree planting and beautification projects. The project was finished in 2024. Additionally, it was changed into a beautiful lake that melds with the natural surroundings. The development of this lake was done in perfect harmony with the environment, which remains pollution-free. New ecosystems take place and water quality is maintained so that aquatic plants and organisms including fish can survive.


Fig 2.1: DSC Lake Progressive Transformation from 2020 to 2025 Project of "The living water: From waste to worth”

## 2.3 Human Impact

The natural ecosystem of a lake is frequently changed by human-caused disturbances. Lake ecosystems are greatly impacted by human activity through various kinds of processes like Pollution, eutrophication, acidification, UV radiation, the introduction of foreign species, climate change, and many other topics are covered. Around Daffodil International University, there are lot of industries and clothing garment so the water quality in this DSC lake may be impacted by their dangerous chemicals and contaminated air. This lake's habitat and water quality are positively impacted by the huge number of trees and forests surrounding it. A great deal of attention is paid to making sure that no artificial pollutants are discharged into the water or the area surrounding the lake.

## 2.4 Management

DSC lake Management is responsible for a number of tasks, including monitoring the lake's water quality, maintaining its structure, ensuring aquatic life, keeping the coastal trees and vegetation in good condition, and handling problems like invasive species. Management each step is made to keep the lake and its surroundings clean, and no contaminants are allowed to enter. The management is keeping careful monitoring on everything to make this lake even better. The water quality of the current lake needs to be further improved, and for this, many more programs management need to be completed.

# Chapter 3

# METHODOLOGY

## 3.1 General

Methodology is a way to systematically solve the problem. Both field and lab data were analyzed for this investigation. The methods and processes used to find and analyze data on a particular topic are referred to as methodology. It is a method by which the study is designed to accomplish goals with the chosen tools. It covers every significant facet of the subject, such as the design, collecting data methods, data analysis techniques, and the overall framework. According to the aforementioned, methodology has various facets, and methods are an aspect of methodology. Methodology has a wider scope than methodology itself. So, when we talk about methodology, we are not only talking about methods but also considering the rationale behind the methods we use in the context of our study and explaining why we are using a particular method or technique and why we are not using others so that the results can be evaluated by the himself or by others. When discussing methodology related to a problem or study, many related questions are typically addressed, such as why a study is conducted, how the study problem is defined, how and why the hypothesis is formulated, what data is collected and what specific method is adopted, why specific techniques of data analysis are used, and many more. In this section, the approach for characterizing the water quality of DSC lake is explained. The Methodology flow chart is provided below.

## 3.2 Work Flow

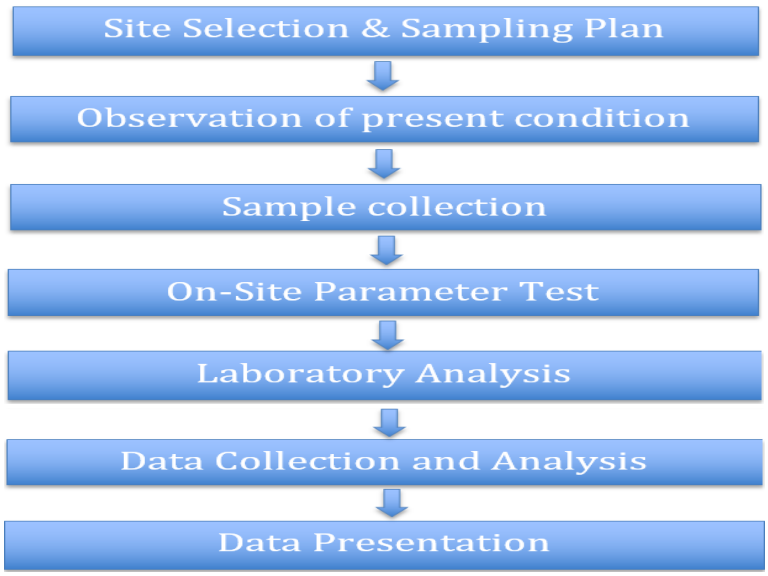


Fig 3.1: Flow diagram of Methodology

## 3.3 Study Area

DSC Lake (23°52′39″N and 90°19′29″ E) It is located within Daffodil International. The lake is lies around 34 meters south of the DIU admissions office. (Google Earth). This lake is surrounded by Nolakadi Bridge, Bonomaya, Rowshan Ara Scholar Garden-1 and Shadhinota Shommelon Kendro.

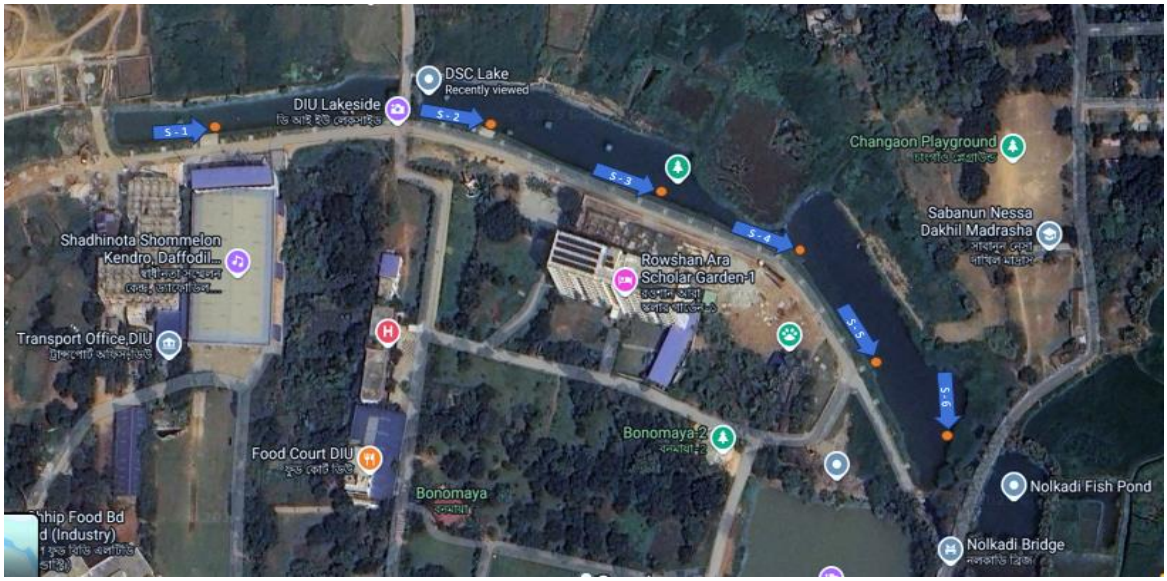


Fig 3.2: Sampling Location in DSC Lake

## 3.4 Sampling Site

On May 28, 2025, I collected 06 separate water samples from 06 different point within DSC Lake and placed them in 500 ml sample collecting bottles. Bottles were thoroughly cleaned and washed properly to the collection of water samples. First, I evaluated DO and temperature directly by bringing the equipment to the location and samples were then promptly taken to the laboratory for measurements and analysis of the water quality parameters.

Table 3.1: Location of the water sampling point of DSC lake

| Sampling point | | | | |
|---|---|---|---|---|
| **Point No** | **Date** | **Latitude** | **Longitude** | **Google Link** |
| 1 | 28-04-2025 | 23°52'46.0"N | 90°19'13.4"E | https://maps.app.goo.gl/yH6rJ2MrQTbQMXct6 |
| 2 | 28-04-2025 | 23°52'46.5"N | 90°19'16.2"E | https://maps.app.goo.gl/UUGCFF82yPXnU17y9 |
| 3 | 28-04-2025 | 23°52'45.9"N | 90°19'18.9"E | https://maps.app.goo.gl/GXjmrwsB1dqfzNDT8 |

| | | | | |
|---|---|---|---|---|
| 4 | 28-04-2025 | 23°52'44.6"N | 90°19'22.7"E | https://maps.app.goo.gl/FKtFuR5z47GBLWVSA |
| 5 | 28-04-2025 | 23°52'44.4"N | 90°19'23.6"E | https://maps.app.goo.gl/Xiu43WnPNQSzfpDf6 |
| 6 | 28-04-2025 | 23°52'41.7"N | 90°19'25.7"E | https://maps.app.goo.gl/hbxGqiH9m7vcBoyb8 |

Water samples were carefully collected from the lake. Samples were taken from different point to ensure accurate representation of the water quality.

Sample 1 Sample 2 Sample3

Sample 4 Sample 5 Sample 6

Fig 3.3: Water sample collection from DSC Lake in several points.

## 3.5 Water Quality Parameter

After air, water is the most essential element for life to exist. Water quality has therefore been well described in the scientific literature. "It is the physical, chemical, and biological characteristics of water" is the most widely used definition of water quality. The state of the water in relation to the needs of one or more biotic species and/or any human need or purpose is known as water quality. The water quality test's parameters are listed below:

Table 3.2: List of water quality parameters and their test methods

| s. no. | Parameters | Unit | Methods | Instruments |
|---|---|---|---|---|
| 1 | DO | mg/l | Winkler titration | DO meter |
| 2 | Temperature | °C | Thermometry | Mercury- Thermometer pH meter |
| 3 | pH | | | pH meter |
| 4 | Turbidity | NTU | Nephelometric | Turbidity meter |
| 5 | TDS | mg/l | | Evaporation |
| 6 | TS | mg/l | | Evaporation |
| 7 | TSS | mg/l | | Evaporation |
| 8 | BOD | mg/l | | |

## 3.6 Sampling Method

Sampling method involves collecting representative portions of the water for analysis in order to accurately determine the water's quality. Different tests are conducted utilizing different devices. The amount of oxygen dissolved in a body of water is known as dissolved oxygen (DO), and it serves as an indicator for the water's quality and capacity to sustain a balanced aquatic ecosystem. Also, when describing natural water bodies, temperature is a crucial factor. It has an impact on the chemistry of the water, including the concentration and saturation of dissolved gases, particularly oxygen. According to the Vant Hoff rule, chemical reactions typically proceed more quickly at higher temperatures. In addition, temperature controls the kind of organisms that may survive in the lake and influences biological activity. The seasonal variations in air temperature are the most evident cause of temperature changes in lakes. Temperature controls the sorts of aquatic life, controls the water's maximum dissolved oxygen content, and affects the rate of chemical and biological reactions, making it a crucial environmental and water quality characteristic. Direct measurements of temperature and DO were taken at the lake sampling location using a Mercury Thermometer pH meter and a DO meter. Initially, distilled water and buffer solution were used to calibrate the DO meter. For at least five minutes, the DO meter was placed in the lake's sample side. Then DO reading was collected from the DO meter and recorded in a notebook.

pH is a very important factor that must be considered to determine for water quality. A water body's pH is a measurement of the concentration of hydrogen ions on its surface, or pH is an indicator that quantifies how acidic or alkaline a substance is that dissolves in water. The pH meter was first calibrated using buffer solution and purified water. A 100 ml sample was then placed in a clean beaker and immersed in the pH meter, and allowed to sit for at least five minutes. After then, the pH reading was taken from the meter and entered into a notepad.

The quantity of inorganic salts and minerals dissolved in water is measured by a water quality measure called total dissolved solids (TDS). Because high TDS can alter taste and hardness and may also signal the presence of contaminants like heavy metals, it is an essential indication of water quality. First, distilled water is used to clean the beaker. After that, the beaker is oven-dried for half an hour. Then beaker is subsequently taken out and allowed to cool. After that, the beaker is numbered and its weight is determined. Collected 100 ml filtered sample and it is oven-dried for one day at 105° Celsius. After that, the beaker is removed from the oven and allowed to cool. Next, the beaker's weight is determined. The TDS value is obtained by minus the previous value from the next TDS value. In the same process as TDS, the value of TS is also applied. The primary difference is that a non-filtered sample is used to obtain the value in this case. Since TS = TDS + TSS, the value of TSS is calculated by deducting TDS from TS.

The amount of oxygen needed by aerobic bacteria to break down organic matter in a water sample is known as BOD (Biochemical Oxygen Demand). One of the most important and often used parameters for assessing contaminants and biodegradable organic compounds in wastewater is this one. The BOD test method includes placing a sample in a sealed container and keeping it in an incubator set at 20°C for five days. Both before and after a five-day incubation period. The initial (sample taken from the site) and final levels of dissolved oxygen (DO) are measured both before and after a five-day incubation period. At 20°C, the BOD test is conducted. The initial DO is subtracted from the final DO to get the biochemical oxygen demand (BOD).

Since COD is used to measure the amount of organic contaminants in surface water or wastewater, it is thought to be a helpful indicator of water quality. Total suspended solids, or the percentage of total solids that a filter retains, and total dissolved solids, or the percentage that flows through a filter, are both included in total solids. Total dissolved solids are defined as the sum of all dissolved solutes and silica in a body of water.

## 3.7 Analytical Method

There are various ways to define analytical methodologies, and there are various ways to conduct analysis. Among these, I used several kinds of devices to measure the overall water quality of DSC Lake and then analyzed the results according to Environment Conservation Rules (ECR). Water quality criteria on water sources are used to determine water quality in accordance with the Management of Water Quality and Water Pollution Control, which is the basis for environmental quality evaluation. For this analysis, I developed a water quality index (WQI) and conducted an appropriate analysis of the data. The water quality index (WQI) can be defined as a single value, which reflects the overall water quality related to its input constituent parameters. It simplifies complex data by combining various indicators—such as pH, biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), nutrients (like nitrogen and phosphorus), and sometimes heavy metals—into a single index value. This index helps in assessing the effectiveness of wastewater treatment processes, monitoring pollution levels, and determining the potential environmental impact of wastewater discharge.

## 3.8 Comparison with standards

Lake water quality evaluation is important for maintaining sustainable water use, human health, and aquatic environment protection. pH, dissolved oxygen (DO), turbidity, biochemical oxygen demand (BOD), total dissolved solids (TDS), nutrient levels, and microbial contamination are important markers used to assess the quality of lake water. To determine whether water was suitable for particular uses, we compared the quality and behavior of samples collected from various locations with WHO and national water quality criteria, such as the Bangladesh Conservation Rules (ECR’ 23).

# Chapter 4

# RESULT AND DISCUSSION

## 4.1 General

For water quality improvement programs to be implemented effectively, timely and accurate information on water quality is required. These results obtained from analysis of water samples of DSC Lake. The stated figures are the results of water samples that were taken at various points around the lake. According to the findings, there are significant regional variations in water quality. A summary of the results is provided below.

## 4.2 Result

Table 4.1: Water parameter results from different point and mean & standards value

| Parameters | Unit | Sample 1 | Sample 2 | Sample 3 | Sample 4 | Sample 5 | Sample 6 | Mean value | Standard value |
|---|---|---|---|---|---|---|---|---|---|
| DO | mg/l | 6.89 | 7.27 | 5.24 | 7.45 | 6.46 | 8.23 | 6.9 | 6 |
| Temperature | °C | 30 | 29.8 | 28.8 | 29.4 | 29.9 | 31.1 | 29.83 | 20-30 |
| pH | -- | 7.55 | 7.77 | 7.69 | 7.76 | 7.79 | 7.91 | 7.75 | 6.5-8.5 |
| Turbidity | NTU | 38.1 | 38.5 | 37.7 | 52.0 | 51.6 | 67.1 | 47.5 | 10 |
| TDS | mg/l | 310 | 230 | 290 | 300 | 310 | 330 | 295 | 1000 |
| TSS | mg/l | 40 | 80 | 50 | 60 | 50 | 40 | 53.33 | 10 |
| BOD | mg/l | 22.8 | 17.7 | 21.3 | 26.7 | 36.6 | 55.8 | 30.15 | 0.2 |

### 4.2.1 Dissolved Oxygen (DO)

DO is an acronym for dissolved oxygen in water. It refers of how much oxygen gas is in the water, which is necessary for aquatic life to survive. Both the atmosphere and aquatic plants' photosynthesis provide oxygen to the water. Dissolved oxygen is necessary for high-quality water. Without oxygen, no living thing can survive. In order to develop aerobic life, the natural stream filtration system needs sufficient oxygen levels. Out of the six samples in the study area, the middle point (S3) had the lowest DO value 5.24 mg/l, while the last (S6) point had the highest DO 8.23 mg/l. Also, the mean concentration of dissolved oxygen was 6.9 mg/l. This lake's DO value needs to be improved even further. Department of

Environment (DoE) Bangladesh established the Water and Wastewater Quality Standard Guidelines for Selected Parameters for Various Uses in Bangladesh. A recommendation for dissolved oxygen for the best health of aquatic life, 6 mg/liter (ECR'23) of dissolved oxygen is advised. In DSC Lake dissolved oxygen is suitable for survival of aquatic life and Irrigation.

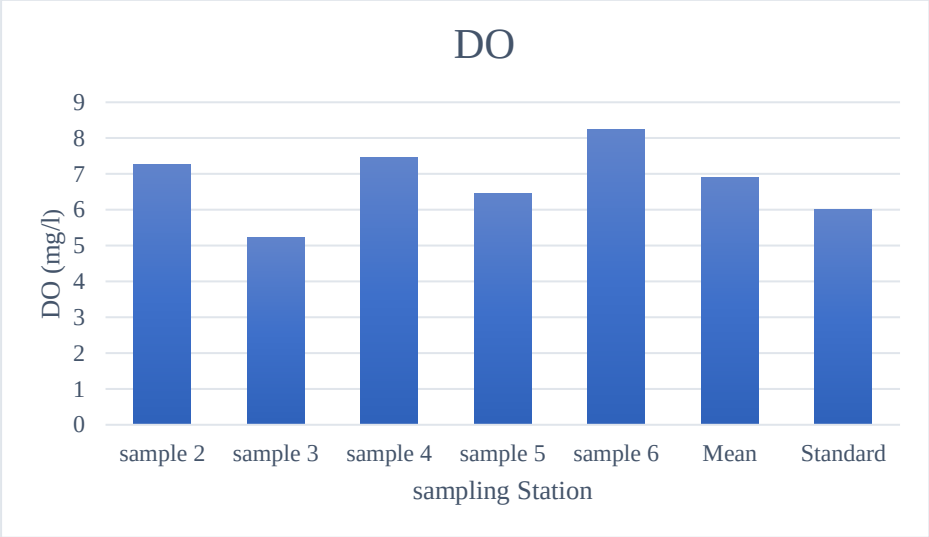


Fig 4.1: Comparison of DO in different sample with mean value and standard value

### 4.2.2 Temperature

Temperature is very important for water quality management. It is the cause of every alteration in the physicochemical characteristics of water. Six samples' values were taken from DSC Lake's west to east. The middle at (S3) point had the lowest recorded temperature of 28.8°C, while the end (S6) point of the lake close to Nolakadi Bridge had the highest recorded temperature of 31.1°C. Furthermore, the sample was contaminated at that end. At high temperatures, chemical reactions typically proceed more quickly. The temperature of the lake water depends on many key factors like wind speed, atmospheric temperature, solar radiation etc. However, the lake's water temperature complemented a number of biological and chemical activities inside the aquatic environment. All of the samples had normal temperatures, with the exception of sample (S6), which was a bit warmer than the national average. The entire mean value is 29.83°C, which is within the permitted range for the water standard. Acceptable levels in accordance with Environment Conservation Rules

(ECR'23) regulations, which state that the ideal temperature range is between 20°C and 30°C. As a result, the study area's water temperature was suitable to maintain aquatic, irrigation and providing drinking water. The study site's temperature is shown in Fig:

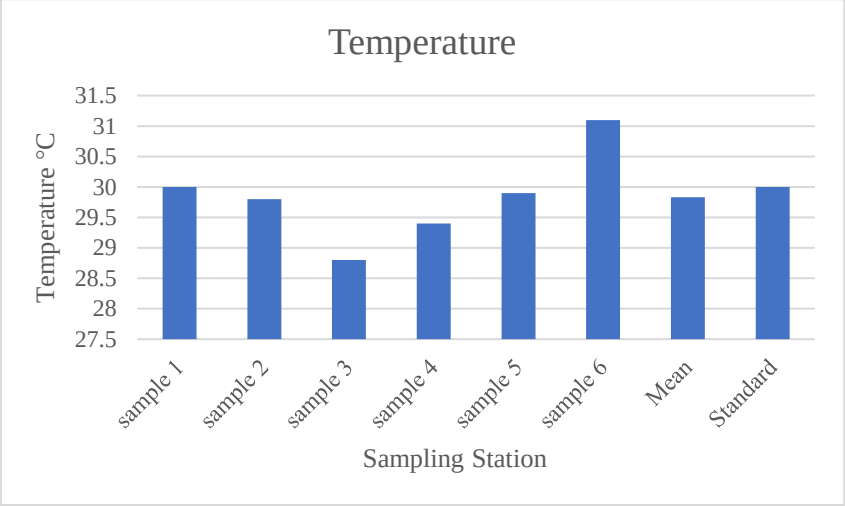


Fig 4.2: Comparison of Temperature in different sample with mean value and standard value

### 4.2.3 pH

The term of pH is the negative logarithm of H+ ion activity, and it ranges from 0 to 14. pH meter uses a glass electrode to measure pH; this electrode generates a potential difference linearly with the pH of the solution in which it is immersed (WHO, 2011). Given its significant influence on the biological and chemical processes occurring inside the water body, pH is a crucial factor for assessing the quality of the water (Ahmed et al. 2011). Water taken from several locations within the study area had pH values ranging from 7.55 to 7.91. While the first (S1) point had the lowest pH, the last (S6) point had the highest pH. pH value is greater near the end (S6) of the sample near Nalakadi Bridge because it is more contaminated. However, the mean pH value is found to be 7.75. All these pH values were within the permissible limits. According to Environment Conservation Rules (ECR'23), the pH value should be between (6.5-8.5). Since the optimum pH level around 6.5-8.5 in this lake. DSC lake is suitable for aquatic life, irrigation and ecosystem due to which biodiversity is seen in this lake.

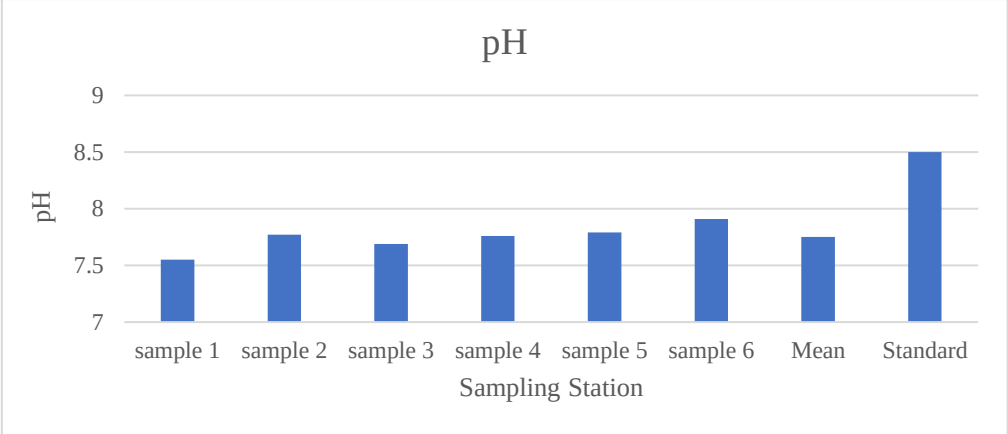


Fig 4.3: Comparison of PH in different sample with mean value and standard value

### 4.2.4 Turbidity

The cloudiness of water caused on by suspended particles like silt and clay, chemical precipitates like iron and manganese, and organic particles like organisms and plant waste is referred to as turbidity. Drinking water safety is demonstrated by achieving low turbidity, which is an indicator of pathogen elimination. Each sample's turbidity is measured, and an increase in impurities and turbidity is observed as one moves from the lake's west to east of DSC lake. At the middle (S3) point lake's turbidity is lowest 37.7 NTU, whereas at the End (S6) points value is highest 67.1 NTU. This lake's excessive turbidity value has made the water unsuitable for human consumption and aquatic life. This lake has an average turbidity of 47.5 NTU. According to Environmental Conservation Rules (ECR'23) and WHO permissible drinking water turbidity is 10 NTU. Because of its high turbidity, this water has high impurity content, making it cloudy or opaque. This can have several of harmful effects on the ecology and water quality. The water in this lake is completely unsafe for drinking, low light penetration, aquatic life, irrigation and complicates the water treatment process.

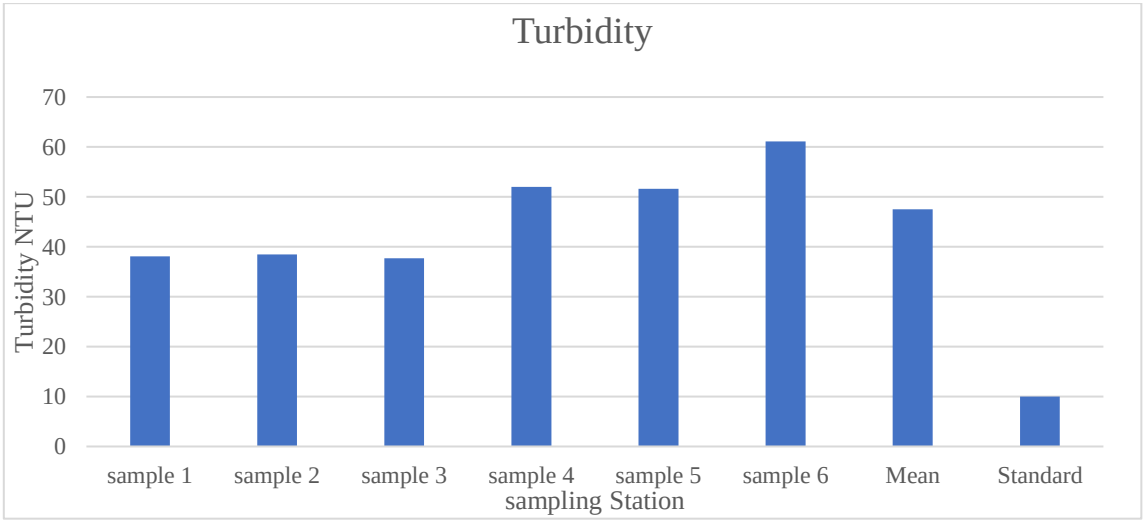


Fig 4.4: Comparison of Turbidity in different sample with mean value and standard value.

### 4.2.5 Total Dissolved Solid (TDS)

The term "total dissolved solids" (TDS) describes the total amount of minerals, organic matter, inorganic salts, and other dissolved materials found in water. Calcium, magnesium, salt, and potassium are examples of minerals that can be found in TDS, along with compounds and heavy metals. TDS values of the six spots were quite underneath. In this study are (S2) point the lowest TDS, which is 230 mg/l, while highest TDS in (S6) point, which is 330 mg/l, mean TDS value is 295 mg/l which is rather low in this lake water, indicating a positive trend. Because high TDS in water may taste bitter, brackish, or salty. Low TDS may result in flat-tasting water. While moderate TDS levels are often preferred for taste, high TDS can also cause water hardness, scale formation, and staining. Elevated TDS and magnesium, sodium sulfates are chloride directly impact aquatic life (including macro invertebrates, fish and amphibians) and human health. According to Environment Conservation Rules (ECR' 2023), the standard value of TDS is 1000 mg/l. So, the TDS value of DSC lake water is acceptable for aquatic life, irrigation and ecology.

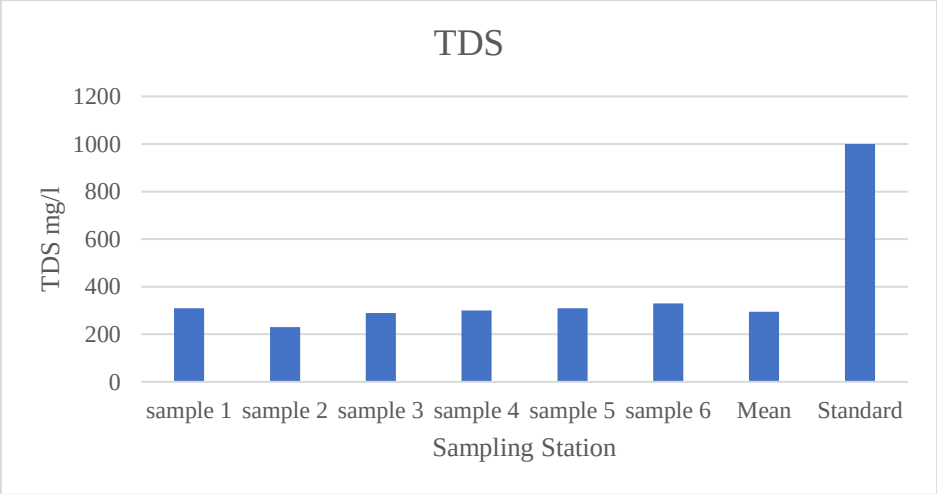


Fig 4.5: Comparison of TDS in different sample with mean value and standard value

### 4.2.6 Total Solids (TS)

Aquatic life and water quality can be adversely affected by total solids TS in the water. High TS levels harm aquatic plants and animals by reducing light penetration and impeding photosynthesis. TS can also affect water clarity and the ecosystem's general health by increasing turbidity and decreasing dissolved oxygen. The mean TS value of the lake water we tested 348. Highest value 370 mg/l found in (s6) point and the lowest value 310 mg/l being in (S2) point. This lake's water is appropriate for the ecology because it meets the TS standard.

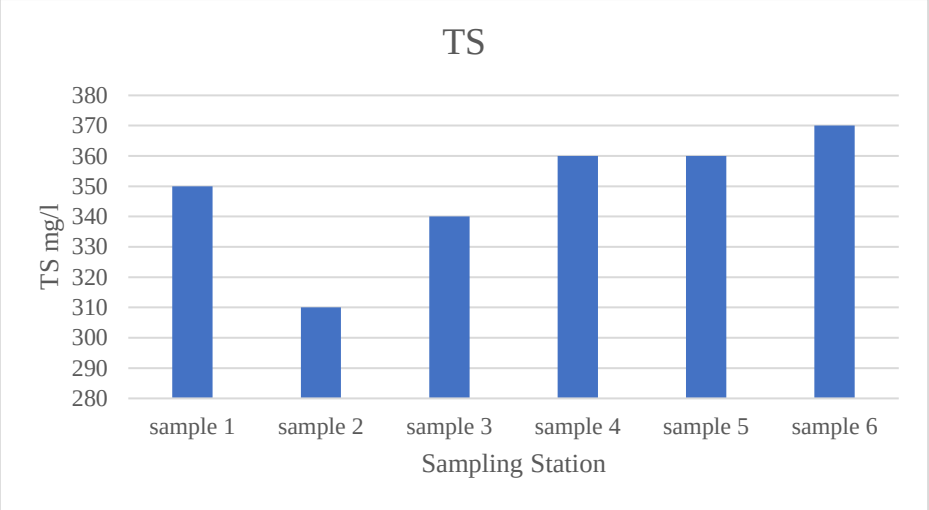


Fig 4.6: Comparison of TS in different sample

### 4.2.7 Total Suspended Solids (TSS)

TSS is one of the physical parameters that determine the quality of water. Because of the sediment and erosion caused by TSS, lakes may experience silting-up, mudflats, sandbar movements, or bed sediment washout. Changes in oxygen saturation, nutrition route alteration, and light attenuation and primary generation are other factors. Testing of the samples taken from the study area revealed that the TSS value is lowest in (S1) point and (S6) point is 40 mg/l, and highest in (S2) point is 80 mg/l. This lake's mean TSS value is 53.33 mg/l, not falling within permissible limits. High TSS levels are known to reduce photosynthetic activity and raise the water's surface temperature, which lowers the amount of oxygen provided by aquatic plants and kills fish and other freshwater species. According to Environmental Conservation Rules (ECR'23), the water at DSC Lake is not suitable for the aquatic life, irrigation and ecology as the standard TSS for wastewater is 10 mg/l.

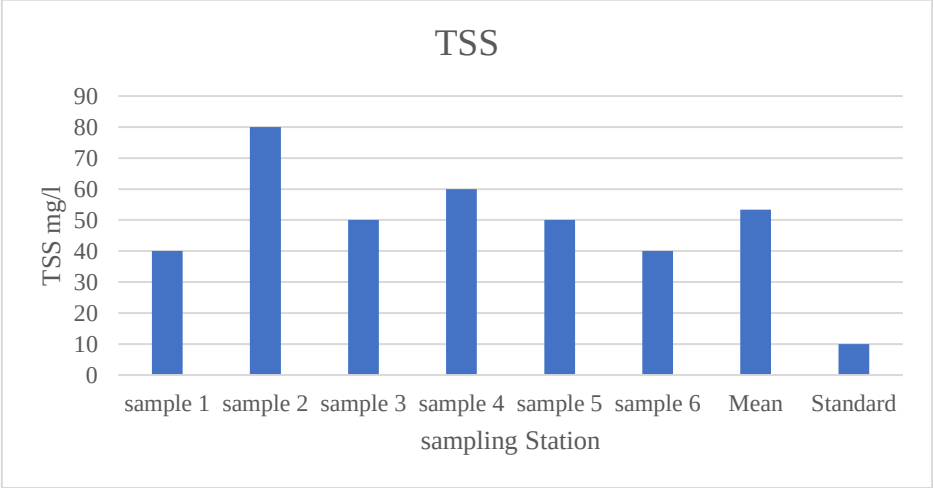


Fig 4.7: Comparison of TSS in different sample with mean value and standard value.

### 4.2.8 Biological Oxygen Demand (BOD)

BOD, or biochemical oxygen demand, is a chemical process that calculates how much dissolved oxygen aerobic biological organisms in a body of water require breaking down organic matter in a sample of water at a particular temperature over a certain period of time. The type of organic and inorganic material in the water, temperature, pH, and the presence of specific microbes all has an impact on the rate of oxygen consumption. Between 17.7 mg/l and 58.8 mg/L was the range of DSC Lake's biochemical oxygen demand. Station (06) had the highest BOD level, measuring 58.8 mg/L, while Station 02 had the lowest BOD level, measuring 17.7 mg/l. The oxygen depletion rate increases with the value. This implies that higher aquatic organisms have less oxygen available to them. Similar to low dissolved oxygen, excessive BOD causes stress, suffocation, and death in aquatic life. This lake has an average BOD of 30.15 mg/l. This lake has an extremely high BOD value, which is bad for aquatic life. At the lake's edge, where the water is most contaminated, the BOD level is extremely high, which is never acceptable. Although the analyzed water's BOD level is not suitable for human consumption, preserving the aquatic ecosystem and irrigation. Environment Conservation Rules (ECR'2023) states that permissible drinking water BOD is 0.2 mg/l and 30 mg/L is the standard BOD value for wastewater quality. This water will be considered wastewater.

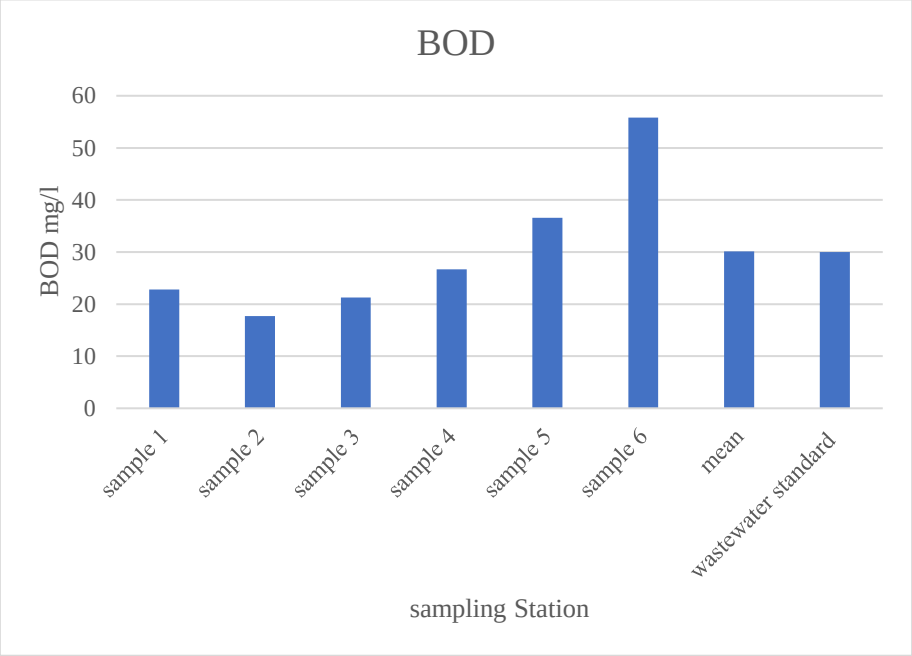


Fig 4.8: Comparison of BOD in different sample with mean value and wastewater standard value.

## 4.3Biological Aspect

The biological aspects of a lake include the living organisms within it and their interactions with each other and the environment. These contain plants, animals, and microorganisms that are all a part of a complex ecosystem that depends on the physical and chemical conditions of the lake as well as one another. From the basin to the lake, the flow of chemical sediments, particles, and many organisms is usually unidirectional. A lake and its watershed are often considered to be a single ecosystem (Likens, 1985). DSC lakes' effects on biodiversity have resulted in slight ecological impacts. All of the physical and chemical features of that particular lake, including its morphology, sediment conditions, nutrient concentrations, light availability, pH, and temperature, connect to form an ecological frame and an arena. Sunlight raises the lake's surface water's temperature in the summer. And it is considered; deeper water has a lower temperature. DSC Lake has a deep depth and takes advantage of this. Above the lake, a warm surface layer known as the 'epilimnion' is produced by surface air movement. The 'hypolimnion' is a zone of uniformly cold water that is located at the bottom. When the summer and winter stratified lakes mix from top to bottom in spring and autumn It is called 'turnover'. In DSC lake exchanges among all lake habitats. Nutrients and dissolved organic carbon molecules released by macrophytes where they are used by algae and bacteria. The organisms in these lakes are interconnected through food chains or webs, whereas producers (phytoplankton) transfer energy to consumers (fish, zooplankton, etc.). Managing fisheries has become a tool for controlling phytoplankton biomass in lakes (Carpenter and Kitchell, 1993). This DSC lake's water has a well-balanced PH, TDS, DO and other properties that are ideal for aquatic plants and animals. But turbidity, TSS and BOD value is higher which is not comfortable for aquatic life, irrigation and ecology. Additionally, the forestry, vegetation, and surroundings have contributed to the development and beauty of this lake's ecosystem.

## 4.4 Water Quality Index (WQI)

The water quality index (WQI) is a single number that represents the overall quality of wastewater in relation to the characteristics of its input constituents. A single dimensionless value that represents the overall water quality under particular time and place conditions based on many water quality criteria. Understanding the degree of pollution in wastewater, identifying treatment requirements, and tracking the effectiveness of wastewater treatment

are all made easier with its assistance. Comparing various sources or treatment stages is made simpler by WQI's thorough analysis of wastewater quality. WQI can be done in a various method but we will derive the value in Weighted Arithmetic Index Method. A Weighted Arithmetic Index Method is a numerical evaluation tool that assigns weights to various criteria according to their relative relevance. It makes it simpler to comprehend and compare the quality of the water at various places or periods by providing a single value that represents the entire water quality. Water quality criteria are converted into sub-indices, each of which is given a weight, and the weighted sub-indices are combined to determine the WQI. Three steps in this method are given below.

$$Q_n = 100 \times \frac{V_n}{S_n}$$

$$W_i = \frac{K}{S_n}$$

$$WQI = \frac{\sum(Q_n \times W_i)}{\sum W_i}$$

I have separated this lake is into two sections here. I took three samples from the eastern side, which is underneath the Nalakadi Bridge, which was a little more contaminated, and three samples from the western side, which is relatively less polluted. The water quality index (WQI) for the two portions have been computed individually, and a comparison between them is shown below.

Table4.2: WQI result on the Western side of DSC Lake (Fishery purpose)

| Parameters | Standards Value (Fishery Purpose) $S_n$ | $\frac{1}{S_n}$ | $\sum \frac{1}{S_n}$ | $K = \frac{1}{\sum \frac{1}{S_n}}$ | $W_i = \frac{K}{S_n}$ | Mean Value ($V_n$) | $\frac{V_n}{S_n}$ | $\frac{V_n}{S_n} \times 100 = Q_n$ | $W_i Q_n$ |
|---|---|---|---|---|---|---|---|---|---|
| DO | 5 | 0.2 | 0.848 | 1.17924528 | 0.23584905 | 6.47 | 1.294 | 129.4 | 30.51887 |
| Temperature | 25 | 0.04 | 0.848 | 1.17924528 | 0.04716981 | 29.53 | 1.1812 | 118.12 | 5.571698 |
| pH | 7.5 | 0.133333 | 0.848 | 1.17924528 | 0.15723270 | 7.67 | 1.02266 | 102.266666 | 16.07966 |
| Turbidity | 10 | 0.1 | 0.848 | 1.17924528 | 0.11792452 | 38.1 | 3.81 | 381 | 44.92925 |
| TDS | 1000 | 0.001 | 0.848 | 1.17924528 | 0.00117924 | 276.67 | 0.27667 | 27.667 | 0.032626 |
| TSS | 25 | 0.04 | 0.848 | 1.17924528 | 0.04716981 | 56.67 | 2.2668 | 226.68 | 10.69245 |
| BOD | 3 | 0.333333 | 0.848 | 1.17924528 | 0.39308176 | 20.6 | 6.86666 | 686.666666 | 269.9161 |

After calculation WQI result is 377.75.

Table4.3: WQI result on the Eastern side of DSC Lake (Fishery purpose)

| Parameters | Standards Value (Fishery Purpose) $S_n$ | $\frac{1}{S_n}$ | $\sum \frac{1}{S_n}$ | $K = \frac{1}{\sum \frac{1}{S_n}}$ | $W_i = \frac{K}{S_n}$ | Mean Value ($V_n$) | $\frac{V_n}{S_n}$ | $\frac{V_n}{S_n} \times 100 = Q_n$ | $W_i Q_n$ |
|---|---|---|---|---|---|---|---|---|---|
| DO | 5 | 0.2 | 0.848 | 1.179245 | 0.235849 | 7.38 | 1.476 | 147.6 | 34.81132 |
| Temperature | 25 | 0.04 | 0.848 | 1.179245 | 0.04717 | 30.13 | 1.2052 | 120.52 | 5.684906 |
| pH | 7.5 | 0.13333 | 0.848 | 1.179245 | 0.15723 | 7.82 | 1.0426667 | 104.266666 | 16.39413 |
| Turbidity | 10 | 0.1 | 0.848 | 1.179245 | 0.11792 | 56.9 | 5.69 | 569 | 67.09906 |
| TDS | 1000 | 0.001 | 0.848 | 1.179245 | 0.00117 | 313.33 | 0.31333 | 31.333 | 0.036949 |
| TSS | 25 | 0.04 | 0.848 | 1.179245 | 0.04717 | 50 | 2 | 200 | 9.433962 |
| BOD | 3 | 0.33333 | 0.848 | 1.179245 | 0.39308 | 39.7 | 13.233333 | 1323.3333 | 520.1782 |

After calculation WQI result is 653.64.

Table4.4: Overall WQI result of DSC Lake (Fishery purpose)

| Parameters | Standards Value (Fishery Purpose) $S_n$ | $\frac{1}{S_n}$ | $\sum \frac{1}{S_n}$ | $K = \frac{1}{\sum \frac{1}{S_n}}$ | $W_i = \frac{K}{S_n}$ | Mean Value ($V_n$) | $\frac{V_n}{S_n}$ | $\frac{V_n}{S_n} \times 100 = Q_n$ | $W_i Q_n$ |
|---|---|---|---|---|---|---|---|---|---|
| DO | 5 | 0.2 | 0.848 | 1.179245 | 0.235849 | 6.9 | 1.38 | 138 | 32.54717 |
| Temperature | 25 | 0.04 | 0.848 | 1.179245 | 0.04717 | 29.83 | 1.1932 | 119.32 | 5.628302 |
| pH | 7.5 | 0.13333 | 0.848 | 1.179245 | 0.157233 | 7.75 | 1.0333333 | 103.3333333 | 16.24738 |
| Turbidity | 10 | 0.1 | 0.848 | 1.179245 | 0.117925 | 47.5 | 4.75 | 475 | 56.01415 |
| TDS | 1000 | 0.001 | 0.848 | 1.179245 | 0.001179 | 295 | 0.295 | 29.5 | 0.034788 |
| TSS | 25 | 0.04 | 0.848 | 1.179245 | 0.04717 | 53.33 | 2.1332 | 213.32 | 10.06226 |
| BOD | 3 | 0.333333 | 0.848 | 1.179245 | 0.393082 | 30.15 | 10.05 | 1005 | 395.0472 |

After calculation overall WQI result is 515.784.

Table4.5: Rating of the waste water quality for corresponding level of WQI (khudair et al. 2018)

| WQI Value | Rating of Water Quality |
|---|---|
| <50 | Excellent |
| 50-100 | Good |
| 100-200 | Poor |
| 200-300 | Very Poor |
| 300-400 | Polluted |
| >400 | Very Polluted |

WQI result has been calculated for fishery purposes. On the eastern side, the water is more contaminated. Where WQI result is 653.64 which is very polluted. With a value of 377.75, the water on the western side is relatively less contaminated. Overall WQI vale is 515.784, which indicates very polluted. Thus, we could deduct that this lake's water is not suitable for aquatic life.

Table4.6: WQI result on the Western side of DSC Lake (Irrigation purpose)

| Parameters | Standards Value (Irrigation Purpose) $S_n$ | $\frac{1}{S_n}$ | $\sum \frac{1}{S_n}$ | $K = \frac{1}{\sum \frac{1}{S_n}}$ | $W_i = \frac{K}{S_n}$ | Mean Value ($V_n$) | $\frac{V_n}{S_n}$ | $\frac{V_n}{S_n} \times 100 = Q_n$ | $W_i Q_n$ |
|---|---|---|---|---|---|---|---|---|---|
| DO | 4 | 0.25 | 0.848 | 1.17924528 | 0.29481132 | 6.47 | 1.6175 | 161.75786 | 47.685731 |
| Tempera-ture | 25 | 0.04 | 0.848 | 1.17924528 | 0.04716981 | 29.53 | 1.1812 | 118.12543 | 5.5716981 |
| pH | 7.25 | 0.13793 | 0.848 | 1.17924528 | 0.16265452 | 7.67 | 1.05793 | 105.793103 | 17.207726 |
| Turbidity | 25 | 0.04 | 0.848 | 1.17924528 | 0.04716981 | 38.1 | 1.524 | 152.4123ll5 | 7.1886792 |
| TDS | 1500 | 0.00066 | 0.848 | 1.17924528 | 0.00078616 | 276.67 | 0.18444 | 18.4446666 | 0.0145005 |
| TSS | 50 | 0.02 | 0.848 | 1.17924528 | 0.02358490 | 56.67 | 1.1334 | 113.342344 | 2.6731132 |
| BOD | 10 | 0.1 | 0.848 | 1.17924528 | 0.11792452 | 20.6 | 2.06 | 206 | 24.292452 |

After calculation WQI result is 104.63.

Table4.7: WQI result on the Eastern side of DSC Lake (Irrigation purpose)

| Parameters | Standards Value (Fishery Purpose) $S_n$ | $\frac{1}{S_n}$ | $\sum \frac{1}{S_n}$ | $K = \frac{1}{\sum \frac{1}{S_n}}$ | $W_i = \frac{K}{S_n}$ | Mean Value ($V_n$) | $\frac{V_n}{S_n}$ | $\frac{V_n}{S_n} \times 100 = Q_n$ | $W_i Q_n$ |
|---|---|---|---|---|---|---|---|---|---|
| DO | 4 | 0.25 | 0.848 | 1.17924528 | 0.2948113 | 7.38 | 1.845 | 184.52323 | 54.392688 |
| Temperature | 25 | 0.04 | 0.848 | 1.17924528 | 0.0471698 | 30.13 | 1.2052 | 120.52323 | 5.6849056 |
| pH | 7.25 | 0.13793 | 0.848 | 1.17924528 | 0.16265452 | 7.82 | 1.07862 | 107.86206 | 17.544253 |
| Turbidity | 25 | 0.04 | 0.848 | 1.17924528 | 0.04716981 | 56.9 | 2.276 | 227.63454 | 10.735849 |
| TDS | 1500 | 0.0006 | 0.848 | 1.17924528 | 0.00078616 | 313.33 | 0.20888 | 20.88866 | 0.0164219 |
| TSS | 50 | 0.02 | 0.848 | 1.17924528 | 0.02358490 | 50 | 1 | 100 | 2.3584905 |
| BOD | 10 | 0.1 | 0.848 | 1.179245283 | 0.11792452 | 39.7 | 3.97 | 397 | 46.8160374 |

After calculation WQI result is 137.54.

Table4.8: Overall WQI result of DSC Lake (Irrigation purpose)

| Parameters | Standards Value (Fishery Purpose) $S_n$ | $\frac{1}{S_n}$ | $\sum \frac{1}{S_n}$ | $K = \frac{1}{\sum \frac{1}{S_n}}$ | $W_i = \frac{K}{S_n}$ | Mean Value ($V_n$) | $\frac{V_n}{S_n}$ | $\frac{V_n}{S_n} \times 100 = Q_n$ | $W_i Q_n$ |
|---|---|---|---|---|---|---|---|---|---|
| DO | 4 | 0.25 | 0.848 | 1.179245 | 0.294811 | 6.9 | 1.725 | 172.58976 | 50.85495 |
| Temperature | 25 | 0.04 | 0.848 | 1.179245 | 0.04717 | 29.83 | 1.1932 | 119.32765 | 5.628302 |
| pH | 7.25 | 0.137931 | 0.848 | 1.179245 | 0.162655 | 7.75 | 1.068966 | 106.896517 | 17.38721 |
| Turbidity | 25 | 0.04 | 0.848 | 1.179245 | 0.04717 | 47.5 | 1.9 | 190 | 8.962264 |
| TDS | 1500 | 0.000667 | 0.848 | 1.179245 | 0.000786 | 295 | 0.196667 | 19.6666667 | 0.015461 |
| TSS | 50 | 0.02 | 0.848 | 1.179245 | 0.023585 | 53.33 | 1.0666 | 106.667659 | 2.515566 |
| BOD | 10 | 0.1 | 0.848 | 1.179245 | 0.117925 | 30.15 | 3.015 | 301.564655 | 35.55425 |

After calculation overall WQI result is 120.918.

WQI result has been calculated for irrigation purposes. On the eastern side, the water is more contaminated, where WQI result is 137.54 which are poor. With a value of 104.63, the water on the western side is relatively less contaminated so this side water is in better condition than the water on the western side. Overall WQI value is 120.918, which indicates poor. However, this lake's water quality is suitable for Irrigation but the quality of water for irrigation needs to be improved a little more.

Waste Water Quality Index (WQI) gave a summary of the DSC lake's water quality. Since the rating is more than 400, the water of this lake is polluted. This lake water is not suitable for aquatic life like fish. Because of The majority of the sample parameters value are adequate but BOD, Turbidity, TSS levels were so high, it is discovered that the water is poisoned. These are dangerous and not suitable for aquatic life and ecology and they are not suited for drinking and present certain health hazards to the general populace. We Tested water quality parameters of the DSC Lake such as temperature, pH, Do, turbidity, TS, TDS, TSS and BOD, but the microbiological parameters were not tested in this lake. In DSC lake WQI result is suitable for irrigation, but the quality is poor. Even at present this lake water is suitable for irrigation because most of the sample parameters have values that are adequate, but others have values that are a little bit excessive.

## 4.5 Discussion

This discussion section provides an in-depth explanation and analysis of the results of the study, going beyond the presentation of the results. The water temperature of DSC Lake is 29.83◦C whereas Bangladesh Standards for Water (ECR 23) is 20-30◦C, so the water temperature of DSC Lake is within the acceptable range. The pH of DSC Lake is 7.75 whereas Bangladesh Standards for Drinking Water and Aquatic Life are 6.5-8.5(ECR 23) and WHO guideline values are the same, the DO of this lake is 6.9 mg/l whereas Bangladesh Standards for Water (ECR 23) is 6.0 mg/l and WHO guideline values, 1993 is 5.0mg/l, so the DO of this lake is within the acceptable range and is also good for aquatic life and ecosystem. The turbidity of DSC Lake water is very high at 47.5 NTU. This means that this water is very turbid and is more than the ECR 23 standard. So the turbidity of this lake is not within the acceptable range for aquatic life and irrigation. The high turbidity in DSC lake water has reduced the penetration of light, which has led to a significant decrease in oxygen levels, making it difficult for fish and other aquatic animals to survive. If

turbidity increases further, this high turbidity can suffocate fish or disrupt the development of their eggs and larvae. The BOD5 content of DSC Lake water is 30.15 mg/l whereas Bangladesh's standard for drinking water (ECR 23) is 0.2mg/l and for the fishery and irrigation purpose are 3mg/l and 10 mg/l and the acceptable standard for waste water is 30 mg/l so the BOD5 content of DSC Lake water is not within the acceptable range. High BOD indicates that the water in this DSC lake is extremely contaminated because microorganisms, particularly bacteria, use a lot of oxygen to break down organic materials in the water. This oxygen consumption has substantially reduced the lake's dissolved oxygen content, making it unsuitable irrigation and difficult for aquatic life to survive. The TDS content of this lake is 295 mg/l. The acceptable standard for TDS in Bangladesh is 1000 mg/l (ECR 23) and the WHO standard is also 1000 mg/l. So, the TDS content of this water is within the acceptable range. The high levels of total suspended solids (TSS) in this lake water are harming aquatic life and water quality, as well as probably threatening the health of aquatic life. It is damaging aquatic life by decreasing light penetration, altering photosynthesis and oxygen levels, and raising water temperatures. Heavy metals and microorganisms are among the pollutants present at this high TSS. Because of the raised TSS levels, they are unsuitable for irrigation and aquatic life.

# Chapter 5

# Conclusion and Recommendation

## 5.1 Conclusion

Water quality assessments show that while parameters such as temperature, pH, and dissolved oxygen fall within safe limits, others like turbidity, total dissolved solids (TDS), total suspended solids (TSS), and biochemical oxygen demand (BOD) exceed acceptable levels. The average TSS is 53.33, and the average turbidity measures 47.5 NTU, which can harm aquatic life. The BOD reading of 30.15 categorizes the water as unsuitable for aquatic environments and irrigation purposes. In conclusion, the Water Quality Index assesses the quality of the lake's water as poor, rendering it inadequate for fisheries and only marginally suitable for irrigation purposes and is considered as poor.

## 5.2 Recommendation

1. To improve the study of this lake, it is essential to collect more samples. This is because having additional data points allows for superior assessments, resulting in more trustworthy predictions and greater accuracy in decision-making.
2. To maintain a healthy ecosystem in this lake, it is essential to focus on biological water quality, turbidity levels, biochemical oxygen demand (BOD), and total suspended solids (TSS). Improving aeration and prioritizing the setup of effective water treatment systems are crucial for bettering the lake's water quality.
3. Management must keep a vigilant eye on the situation to guarantee that polluted water from external sources does not contaminate the lake.

**Reference**

Dick Gray, Founder Freshwater Society. Guide lake protection and management 2014.

Krishan P. Singh. Lake Restoration Methods and Feasibility of Water Quality Management in Lake of the Woods 1982.

Pingyu Lu1, Junxi Chen1, Huihuang Luo and Qingrui Yang Research on ecological water demand of lakes 2021.

W. Wesley Eckenfelder, Jr. Department of Environment and water Resource Engineering Vanderbilt University. Principles of Water Quality Management 1991.

Md. Masud Alom. Daffodil International University journal of science and technology,2020.

A. B. M. Kamal Pasha. Department of Environmental Science and Disaster Management (ESDM), Daffodil International University (DIU), Analysis of Water Quality of Hatirjheel Lake, Dhaka, Bangladesh 2022.

Antara Bhattacharya and Anugya Shandilya Department of Architecture and Planning, MANIT Bhopal, (Madhya Pradesh), INDIA. Lake Water Pollution and Treatment 2017.

B. F. Jones and D. M. Deocampo. Geochemistry of Saline Lakes.

Surface And Ground Water Quality Report 2021. Department of Environment Ministry of Environment, Forest & Climate Change Government of the People's Republic of Bangladesh.

Horne, A.J. and C.R. Goldman. McGraw-Hill Co. New York. Lake Ecology Overview 1994 (2nd edition)

Christer Brönmark and, Lars-Anders Hansson. The biology of lake and ponds 2005 (second edition).

Nelson G Hairston Jr, Cornell University, Ithaca, New York, USA and Gregor F Fussmann, McGill University, Montreal, Quebec, Canada. Lake Ecosystems may,2014.

The United States Geological Survey (USGS).

National Ground Water Association (NGWA). Volume 63, Issue 3 May/June 2025.

The World Health Organization (WHO). Guidelines for drinking-water quality, 4th edition, incorporating the 1st addendum

Environment Conservation Rules (ECR'23) developed by Department of Environment (DoE) Bangladesh.

The United Nations Water (UN Water)

The International Water Management Institute (IWMI)

UNESCO. World Water Development Report (WWDR) 19 March 2024.

Bangladesh MICS 2019: Water Quality Thematic Report Department of Natural Resources offers Environmental Partnership Grants.

Jane Njeri Ndungu. Assessing Water Quality in Lake Naivasha (27th June 2014).

F.A Samiul Islam. Determination of Water Quality Parameters and Identify Pollution Sources of Uttara Lake and Gulshan Lake in Dhaka City of Bangladesh (January 2022).

Phyllis Weber Scannell and Laura L. Jacobs. Effects of Total Dissolved Solids on Aquatic Organisms (June 2001).

Tajmunnaher, Dr. Mohammad Aktarul Islam Chowdhury. Assessment of Water Quality Parameters of Kushiyara River, Bangladesh (2016).

Simplified Laboratory Procedures for Wastewater Examination, Third Edition 1985. Published by the Water Pollution Control Federation, 2626 Pennsylvania Avenue NW, Washington, DC 20037.

Parul Baranwal, Mansi Tripathi, S.K. Singal. Water Quality Analysis of Lake – A Case Study 2013.

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