NO WATER, NO LIFE, NO GREEN, NO BLUE – Sylvia Earle

4.1 SOURCES OF FRESHWATER IN THE INSTITUTE

Water is the most important component that sustains life on this planet. Despite its abundance, access to clean and safe drinking water remains a challenge in many parts of the world. Water scarcity and contamination can induce severe impacts on human health, environment and economic development.

6. What are the sources of water in the Institute? Locate the point of entry and point of exit of water in the Institute.

Table 6a - Sources of Freshwater in the RIE campus, Bhubaneswar

	Description	Nos.	Locations
1.	PHD Water supply	1	Near Homibhabha Hostel
2.	Borewells	2	Near Gopabandhu Hostel
		1	Near Asutosh Hostel
		1	Near Cycle stand of DM School

Table 6b - Point of Entry and Exit of Water in the Institute

	Description	Nos.	Locations
1.	Point of Entry	2	PHD Water supply Borewells
2.	Point of Exit	1	Through water drainage system

Fig. 10a – Borewell near D.M.School Cycle Stand; Fig. 10b – Photograph of overhead tank which supplies water in the Institute

4.2 WATER USAGE IN THE CAMPUS

7. List uses of water in the Institute.

Table 7 – Details of Water Usage in the Institute on Daily Basis

Sl.No.	Description	Amount
1.	Drinking	20 kL/day
2.	Gardening and Agricultural field	30 kL/day*
3.	Kitchens and toilets (Canteen, Administrative, Dispensary)	60 kL/day¶
4.	Laboratory Usage	10 kL/day¶
5.	Hostels	250 kL/day¶
6.	Quarters	200 kL/day¶
7.	Cleaning purposes (Toilets and Corridors)	100 kL/day
8.	Construction purposes**	200 kL/day (approx.)
9.	Total	870 kL/ day

*(*Variable as per seasonal changes, ¶- variable on the basis of academic calendar)*

[The above data is documented on the basis of maximal usage of water during peak period]

4.3 WATER STORAGE CAPACITY OF THE CAMPUS

8. How does the Institute store water?

Table 8 – Details of Water Storage in the Institute

S.No	Description	Number		Capacity	Location
1.	Sump (Underground)	1		1895 L/ 1.895 kL (500 gallons)	Near Homibhabha Hostel
2.	Overhead Tank	1		3062.32 kL (8,08,000 gallons)	Near Gopabandhu Hostel
3.	Subtanks	Academic building -	17	1500 L	In each section, blocks and quarters
		Hostels & Guest houses	32		
		Canteen	2		
		Dispensary	2		

9. Is there any water recycling system?

Currently, we don't have the water recycling system. However, the Institute is planning to set up a recycling plant in near future.

4.4 RAINWATER HARVESTING SYSTEM OF THE CAMPUS

10. Does the Institute harvest rain water?

Yes, 5 rainwater harvesting system of 100 kL capacity has been constructed in the Institute to recharge the groundwater table inside the campus

Fig.11 – Rainwater Harvesting Inside the RIE campus, Bhubaneswar

4.5 WATER AND SOIL QUALITY TESTING AND ANALYSIS REPORT

Water samples of the Institute were collected and sent to Central Laboratory, State Pollution Control Board for analysis. The details of the parameters analysed are recorded in the table below.

Fig.12a – Collection of Water Sample from the Borewell for Water Quality Testing, 12b- Soil and Water Samples Packed and Labelled as per the Instructions by the SPCB, Odisha

INTEPRETATION OF WATER TEST RESULTS

Water quality of the borewell and the aquaguard are nearly equal. This concludes that the underground water is free from chemical as well bacterial contamination and is safe for drinking purpose.

For Drinking

The pH value of water was found to be 6.3 which is slightly acidic but it lies within the permissible range of 6.0-8.5 for drinking water set by Bureau of Indian Sandards (BIS). The total alkalinity is 20 mg/L of calcium carbonate is within the recommended range of 20-200 mg/L for drinking water. The total hardness, total solids, low counts of total coliform and faecal coliform counts are very low, indicating that the water is safe for drinking. However, the elevated electrical conductivity of 151 µS/cm indicates the presence of dissolved salts which may affect the taste of water.

For Agriculture and gardening

The pH of 6.3 is within the acceptable of 6.0-7.5 for most crops. The total alkalinity of 20 mg/L as calcium carbonate is relatively low, which may require additional buffering for some crops. The EC of 151 µS/cm is within the recommended range of 100 to 700 µS/cm for irrigation water, but the presence of salts in the water may require additional soil management practices as leaching.

Table 9 – Results of Water Quality Testing of Drinking Water sample Collected from Aquaguard and Groundwater Samples Collected from Borewells

Sl No	Parameter	Unit	Drinking Water	Borewell Water	Remarks
1.	pH	-	6.3	6.4	Under permissible range
2.	Electrical Conductivity (EC)	µS/cm	151.0	177.0	Under permissible range
3.	Turbidity (Turb)	NTU	1.6	1.2	Under permissible range
4.	Dissolved Oxygen (DO)	mg/L	7.6	7.3	Under permissible range
5.	Total Alkalinity as $CaCO_3$	mg/L	20.0	32.0	Under permissible range
6.	Total Hardness as CaCO3	mg/L	32.0	44.0	Under permissible range
7.	Total Solids (TS)	mg/L	120.0	124.0	Under permissible range
8.	Acidity	mg/L	8.0	8.0	Under permissible range
9.	Total Coliform (TC)	MPN/100 ml	< 1.8	< 1.8	Under permissible range
10.	Faecal Coliform (FC)	MPN/100 ml	< 1.8	< 1.8	Under permissible range

The turbidity of 1.6 NTU (Nephelometric Turbidity Units) is within the recommended range of less than 5 NTU for irrigation water, but high turbidity levels may cause clogging of irrigation systems and reduce water availability to crops.

The dissolved oxygen level of 7.6 mg/L indicates that the water is relatively well aerated and can support aquatic life. The low levels of total coliform and fecal coliform indicate that the water is relatively free from harmful microorganisms. However, the high turbidity of 1.6 NTU may affect light penetration in the water, which can negatively impact

aquatic plants and animals. The presence of salts in the water due to elevated EC may also affect the water quality and availability for some aquatic organisms.

INTEPRETATION OF SOIL TEST RESULTS

Methodology:

Soil Testing – Soil sample from two different sites were collected from the Institiute premises by sterilized containers provided by the SPCB, Bhubaneswar on 08.02.2023 by quadrat method. Soil was deposited for analysis in the Central Laboratory, SPCB, Bhubaneswar, Odisha.

Table 10 – Results of Soil Quality Testing of Soil Samples Collected from Rose Garden and Agricultural Field.

Sl.No.	Parameter,Unit	Test Method	Sample 1	Sample 2
1.	pH (1:5 ratio)	(Ref: IS 2720 (P-26) 1987 Reaffirmed 2016)	6.3	5.2
2.	Conductivity (µS/cm) (1:5 ratio)	(Ref: IS 14767:2000)	85.49	48.90
3.	Moisture content (%)	(Ref: IS 2720 (P-2) 1973 Reaffirmed 2015)	6.71	8.84

I. Soil sample- 1 (Garden Soil)

Agricultural context

The pH of the soil sample 1 collected from the garden site is found to be 6.3. It is known that for agricultural context, the optimal range for most of the crops lies between 6.0 -7.0. Hence, the observed pH of the soil is found in accordance with the optimal range. Therefore, the soil sample can be considered to have a good pH for plant growth.

The conductivity of 85.49 µS/cm indicates that the soil has a moderate amount of nutrients, which lies in between the admissible range of EC having a range of 11- 570µS/cm. This indicates that the soil is non- saline and is not excessively rich in nutrients, which will not lead to over fertilization and pollution of water resources.

The moisture content of the soil is found to be 6.71%, which falls within the permissible range of 5-20%. This value is considered optimal for most crops, indicating that the soil has adequate water availability for the growth of plants.

Conclusion

From the above analysis, it may be concluded that the soil parameters possess optimal range of values for overall indicator of soil fertility.

Environmental Context

In the environmental context, pH 6.3 of soil sample indicates that the soil is slightly acidic, which is typical value of natural soils without any contamination of pollutants. The conductivity of 85.49 suggests that the soil has a moderate level of soluble salts, which doesn't has a concern for environmental toxicity. The moisture content of 6.71% suggests that soil is not over wet or dry, which could affect its stability.

II. Soil sample- 2 (Agricultural Field)

Agricultural Context

The pH value of the second sample collected from Agricultural field is found to be 5.2 which lies below the permissible range of 6.0-7.5. This indicates that the soil is acidic in nature and suitable for growth of crops that prefer a slightly acidic to neutral pH range of 6.0 to 7.5. However, the acidophilic crops like potatoes, sweet potatoes, tomatoes, cucumber, carrot, onion, radish, berries etc. which flourish in acidic soils may be considered suitable for cultivation. Therefore, the soil sample can be considered suitable for other crops as well after some agricultural interventions.

The conductivity of soil sample from the agricultural field was analyze to be 48.90 µS/cm which is quite low in reference to the permissible range of EC for soils. Therefore, it can be concluded that the soil has low nutrient levels which can limit plant growth and productivity.

The moisture content of 8.84% is within the optimal range of 5-20% for most crops, indicating that the soil has adequate water availability.

Environmental context

The pH of 5.2 indicates that the soil is highly acidic. Acidic soils can cause nutrient imbalances, and the solubility of metals and other contaminants may increase, leading potential environment as it reduces the risk of salinization and water pollution. The moisture content of 8.84% is not enough to draw conclusions about the quality of soil as it depends on the specific ecosystem and its water balance.

Suggestions:

Soil pH adjustment:

If the soil pH is not optimal for the specific type of plant that are targeted on above soil quality, the soil pH can be adjusted using amendments such as lime to raise the pH or sulfur to lower pH. However, it is important to carefully follow the recommended application rates to avoid over-acidification and over-alkalization of the soil.

Soil Nutrient Management:

If the nutrient levels are low, it is advisable to apply organic and inorganic fertilizers to provide the necessary nutrients to the soil. However, excessive fertilizer application can lead to nutrient imbalances, over-fertilization and environmental toxicity. Therefore, it is important to determine the nutrient requirements of the specific plants and soil type and apply fertilizers accordingly.

Soil Organic Matter Addition:

Adding organic matter to the soil can improve the soil structure, water holding capacity, and nutrient availability. This can be done by adding compost, animal manure, or other organic materials to the soil

Soil Water Management:

Maintenance of proper soil moisture levels is crucial for plant growth. If the soil moisture content is too low, drip or sprinkler irrigation systems may be used to provide water to the plants.

Crop Rotation

Planting different types of crops in a sequence can help to maintain soil fertility, reduce pest and disease pressure, and improve soil structure. This is because different crops have different nutrient requirements and root systems which can help to break up soil compaction and improve soil structure.

4.6 MANAGEMENT OF WATER IN THE INSTITUTE

11. What happens to the water used in the laboratory? Whether it gets mixed with groundwater?

The contaminated water from the concerned laboratories like Chemistry and Zoology is not allowed to contaminate the groundwater. However, it is drained through closed sewer lines connected to the main sewer line under Bhubaneswar Municipal Corporation City Management Plan.

12. List the numbers of Water purifier installed.

The Institute has provision of drinking water by installing water purifiers in the academic building, canteen, dispensary, hostels etc. The quarters have separately installed purifiers.

Table 11 – Number of Water Purifiers Installed in the RIE Campus,Bhubaneswar

Sl.No.	Description	No. of Water purifier
1.	**Academic Building**	4
2.	**Canteen**	1
3.	**Dispensary**	1
4.	**Hostels**	12

13. List the number of washrooms in the Institute

Table 12 – Number of Washrooms in the RIE Campus,Bhubaneswar

Sl.No.	Description	No. of washrooms
1.	**Academic Building**	18
2.	**Canteen**	2
3.	**Dispensary**	2
4.	**Hostels**	139

14. Are there any water saving techniques followed in the Institute?

- Overflow of water is controlled with the help of automatic valves
- Frequent checks of all the faucets, pipelines are being conducted to keep an eye on the leakage
- Leakage taps are removed immediately
- All the students, staffs and faculty members are aware of the unnecessary use of water and its conservation

➢ ***If there is water wastage, specify why and how can the wastage be prevented /stopped? Write down few ways that could reduce the amount of water used in your locality***

There is no wastage of water in the Institute

- Closing the tap after use or when not necessary
- Maintenance of water closing valves to avoid leakage
- Water conservation awareness for new comers
- Reuse of RO discarded water and AC condensed water

Fig.13 - a, b, c & d- Photos for Awareness, Signages in the RIE Campus Toilets Displaying Quotes on Water Conservation.

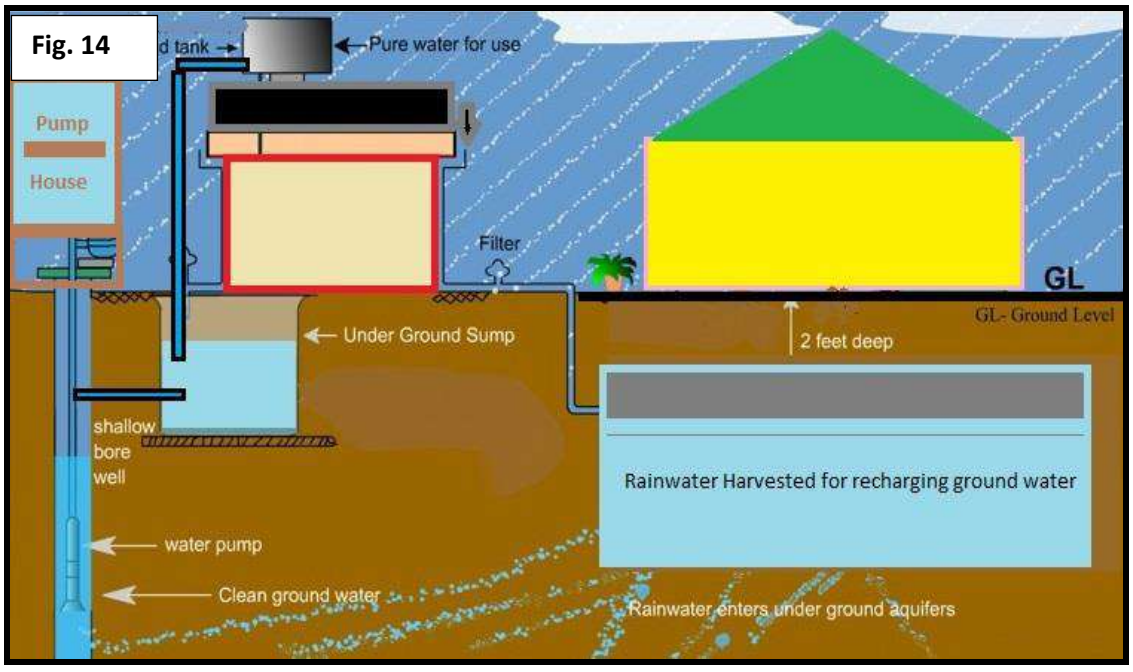

Fig. 14 - Water Circuit Diagram of the Borewell and Rainwater Harvest Utilization in RIE, Bhubaneswar