An investigation on the Water Quality of Water Sources in Phak Mai Subdistrict Huai Thap Than District, Sisaket Province

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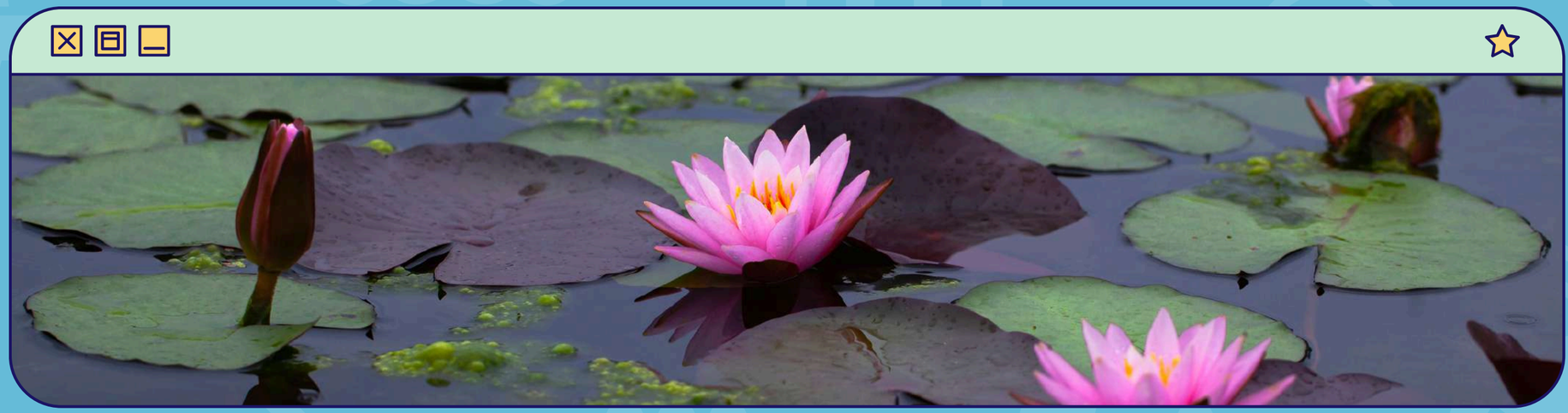
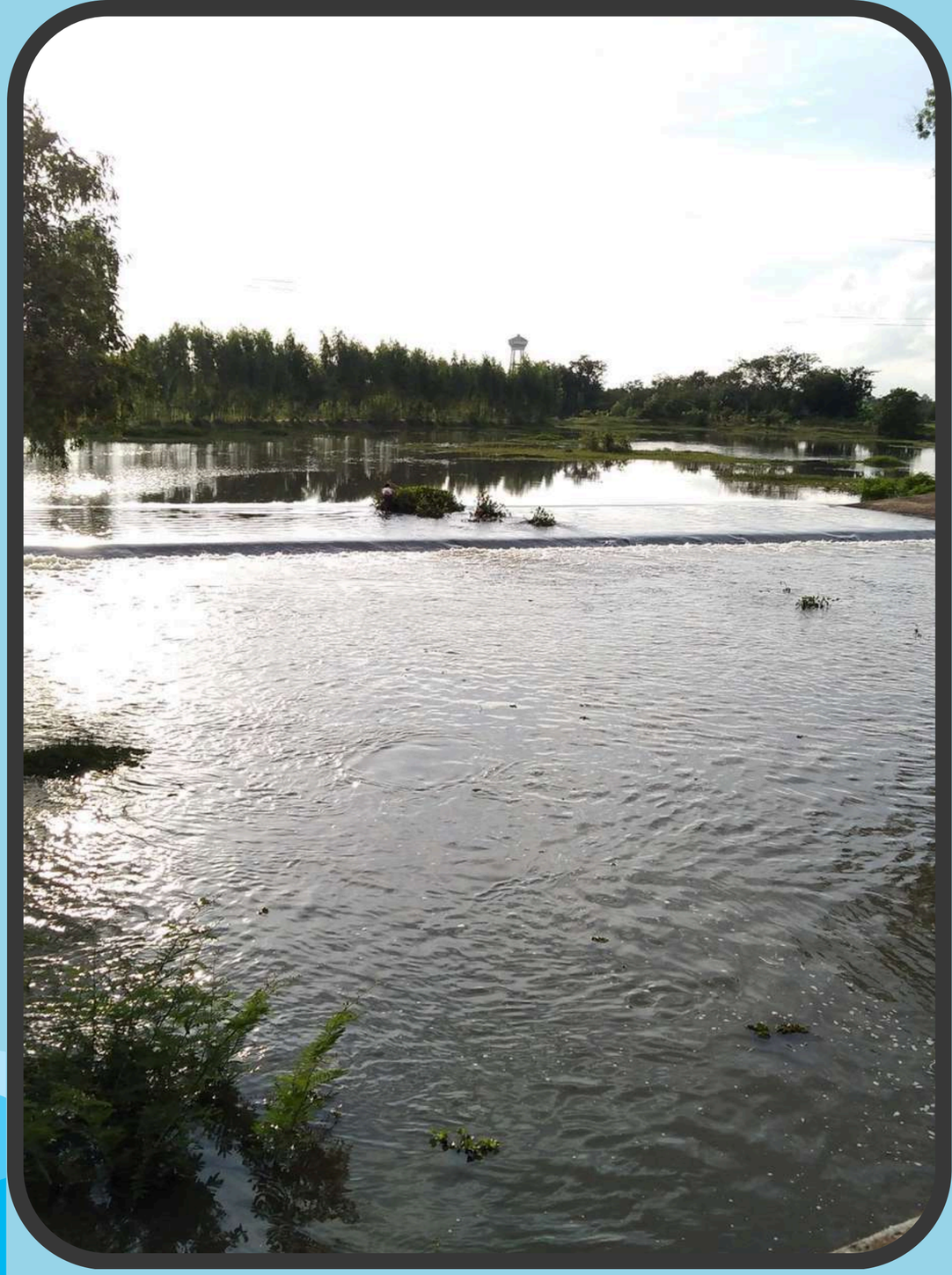
Introduction

The study focuses on the water quality in the communities of Hi Yai-Hi Noi Village, Phak Mai Yai's water supply well, and Phai Phanao's water supply well. These locations are situated in areas where the Huay Wai River flows through and is used as a water source for the production of tap water for the consumption and daily use of the local population. Since the water from the Huay Wai River is used, there is a risk of contamination and deterioration of water quality. Additionally, the study examines the impact of physical and chemical factors that could affect water quality and develops a water management plan for the community to ensure the water quality is appropriate for the production of tap water and its sustainable use in various aspects.



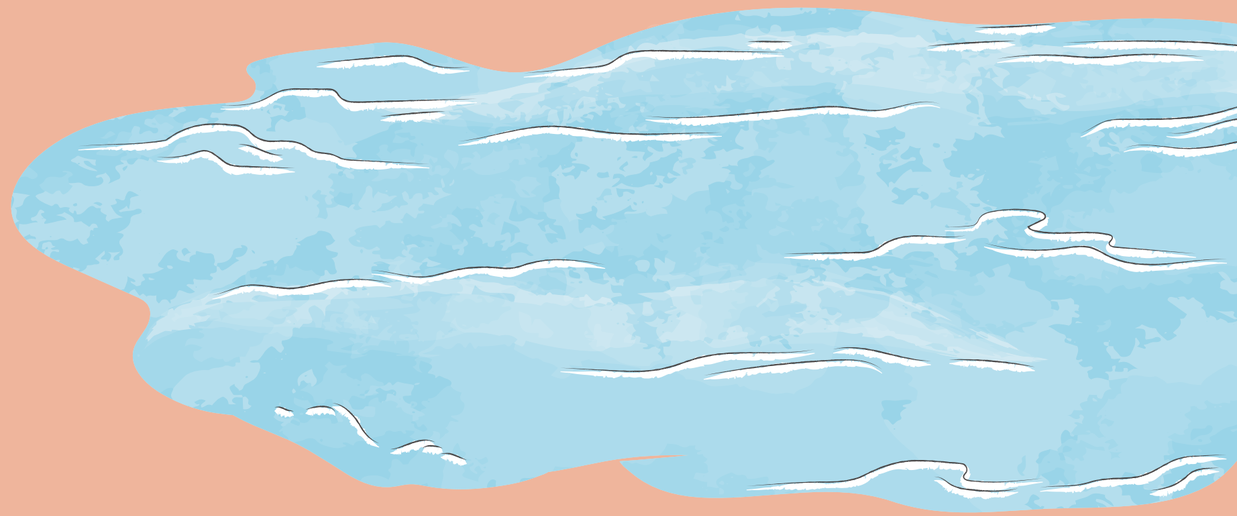
Research Question ???

What is the water quality of the water sources at each study site in Phak Mai Subdistrict, Huai Thap Than District, Sisaket Province?



Research Objective

To study the water quality of the water sources at each study site in Phak Mai Subdistrict, Huai Thap Than District, Sisaket Province.

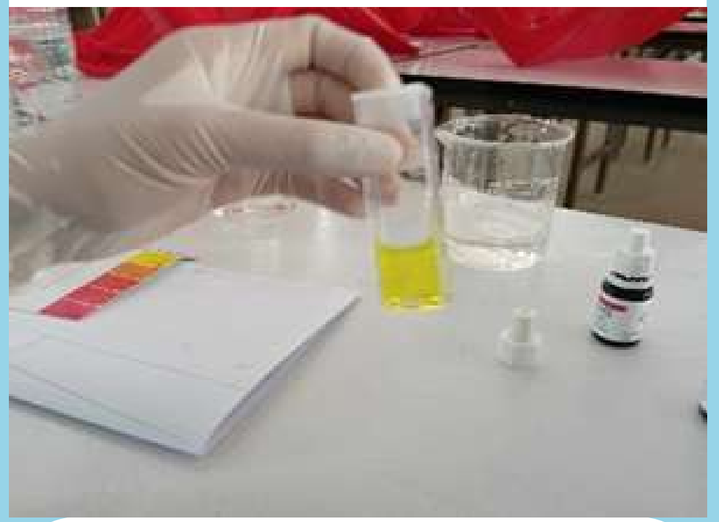


The variables

INDEPENDENT VARIABLE

The water sampling sites such as Ban Hai Yai-Hai Noi, Ban Phak Mai Yai, and Ban Phrai Phanaeo.

DEPENDENT VARIABLE



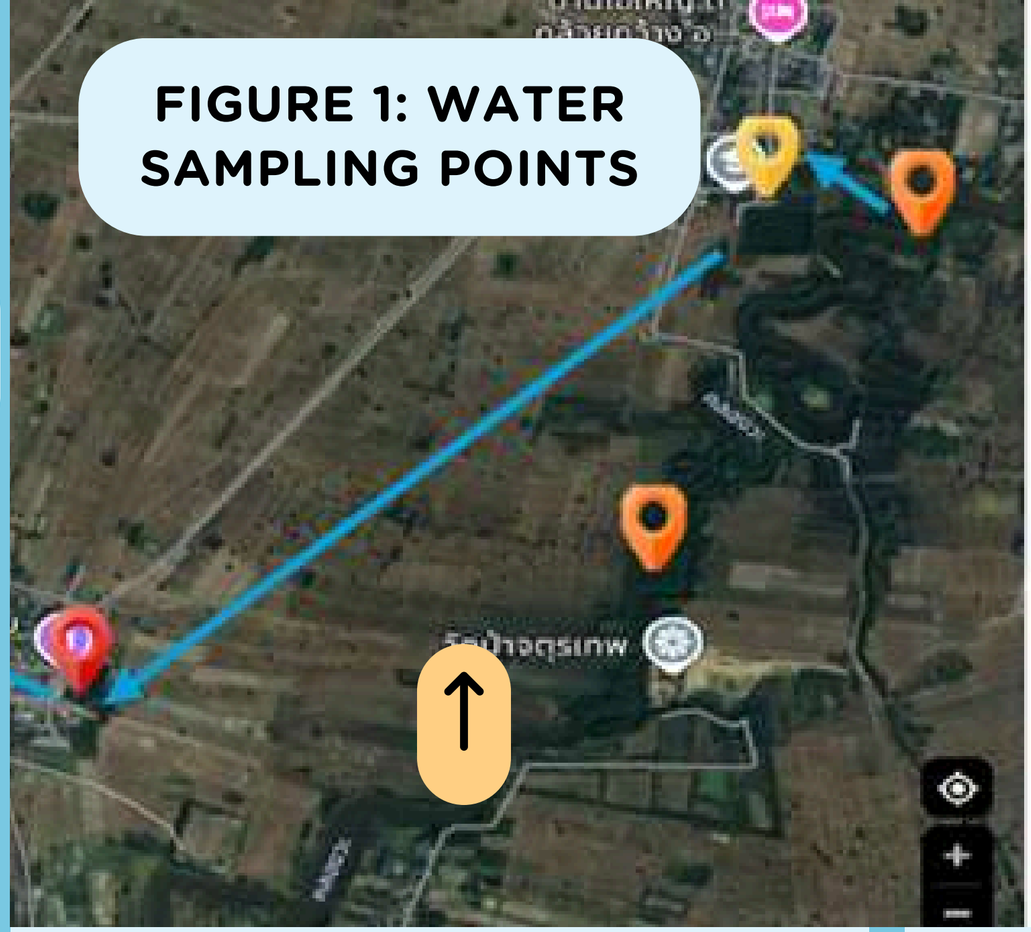
The water quality at each study site.

CONTROLLED VARIABLES

The water sampling method at each study site, the sampling time period, the type of experimental set used for water sampling, and the equipment used to measure water quality.

- **Materials Equipment, and Research Procedures**

FIGURE 1: WATER SAMPLING POINTS



Ban Phrai Pha Nao

Ban Phakmai Yai

Ban Hai noi yai

Lam Nam Huai Wa

#1

Define the study sites. Three study sites were selected in Phak Mai Subdistrict, where water sources from the Huai Wa stream are used for producing tap water.

Point 1: Village Water Supply Well in Hai Yai - Hai Noi
Phak Mai Subdistrict, Huai Thap Than District, Si Sa Ket Province

FIGURE 2: WATER SAMPLING POINTS IN HAI YAI - HAI NOI VILLAGE

Point 2: Supply Well in Phak Mai Yai
Phak Mai Subdistrict, Huai Thap Than District,
Si Sa Ket Province

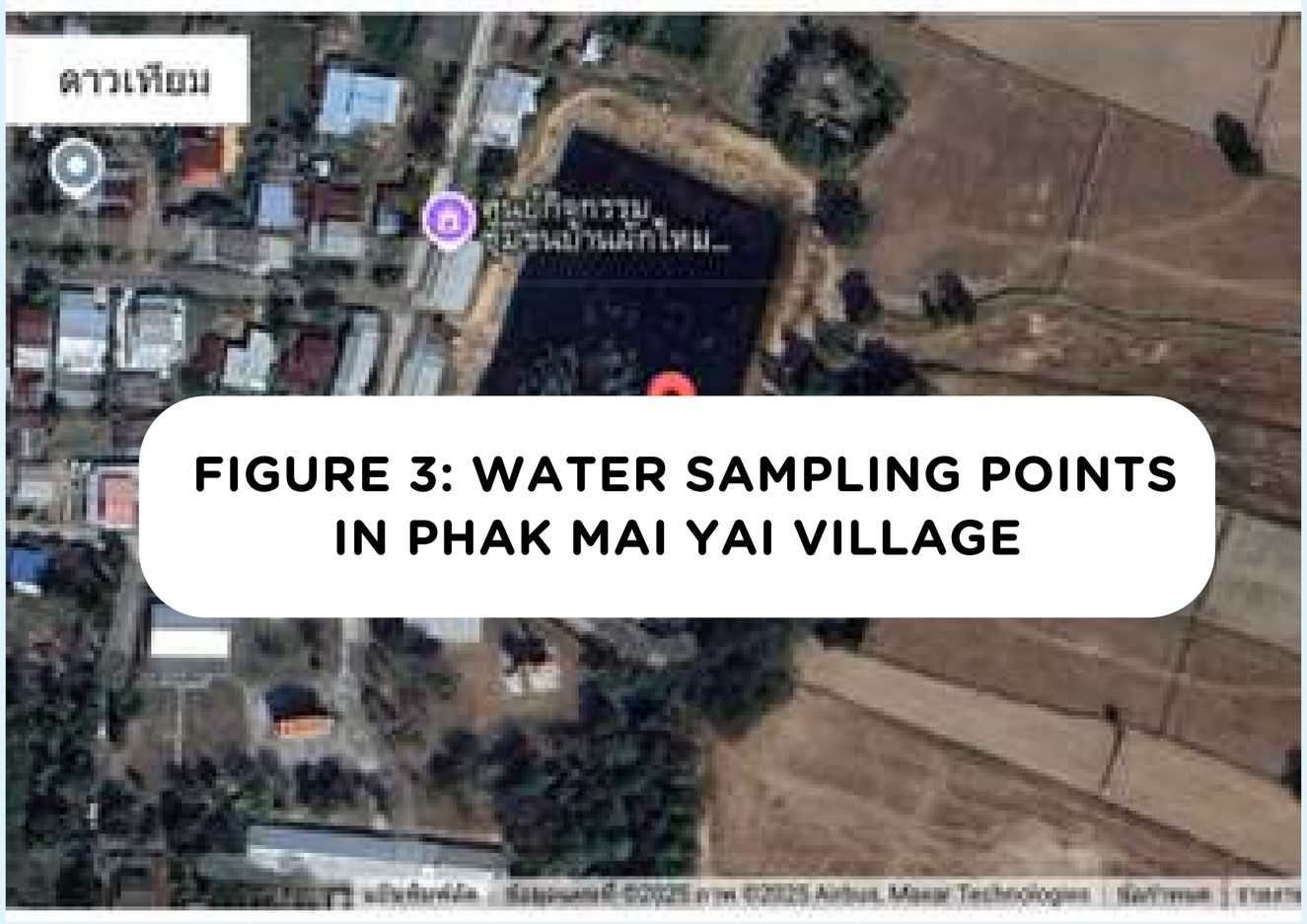
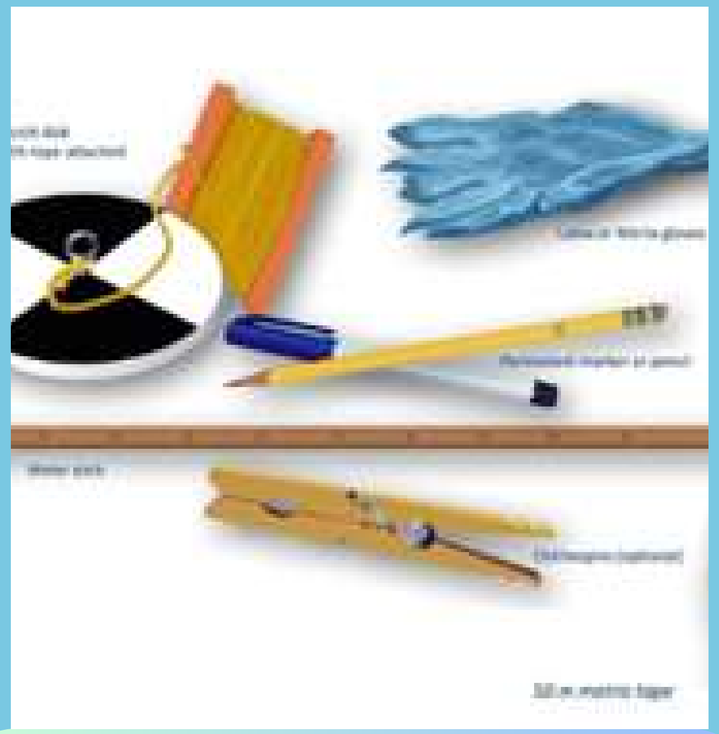


FIGURE 3: WATER SAMPLING POINTS IN PHAK MAI YAI VILLAGE

Point 3: Supply Well in Phrai Phanao
Phak Mai Subdistrict, Huai Thap Than District,
Si Sa Ket Province

FIGURE 4: WATER SAMPLING POINTS IN PHRAI PHANAO VILLAGE

Materials, Equipment, and Chemicals



1. Secchi Disk Set (or Water Transparency Measuring Set)

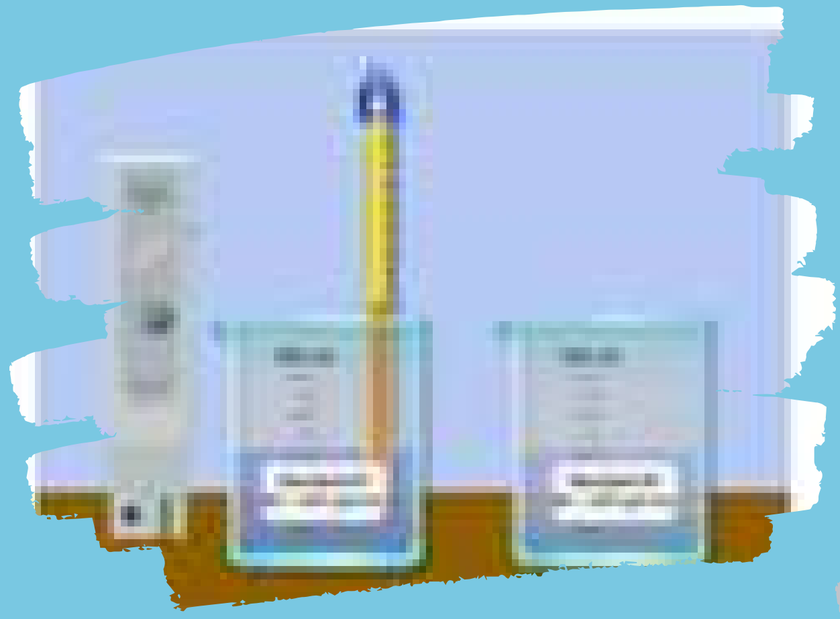
2. Sensor Thermometer
3. Alcohol Bulb Thermometer

Materials, Equipment, and Chemicals

4. Dissolved Oxygen (DO) Test Kit

5. Electrical Conductivity (EC) Meter

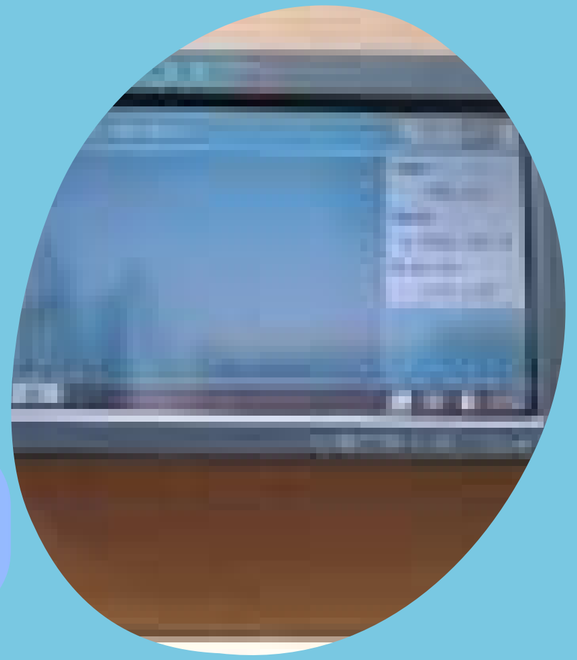
6. Total Dissolved Solids (TDS) Meter



Materials, Equipment, and Chemicals

7. pH meter

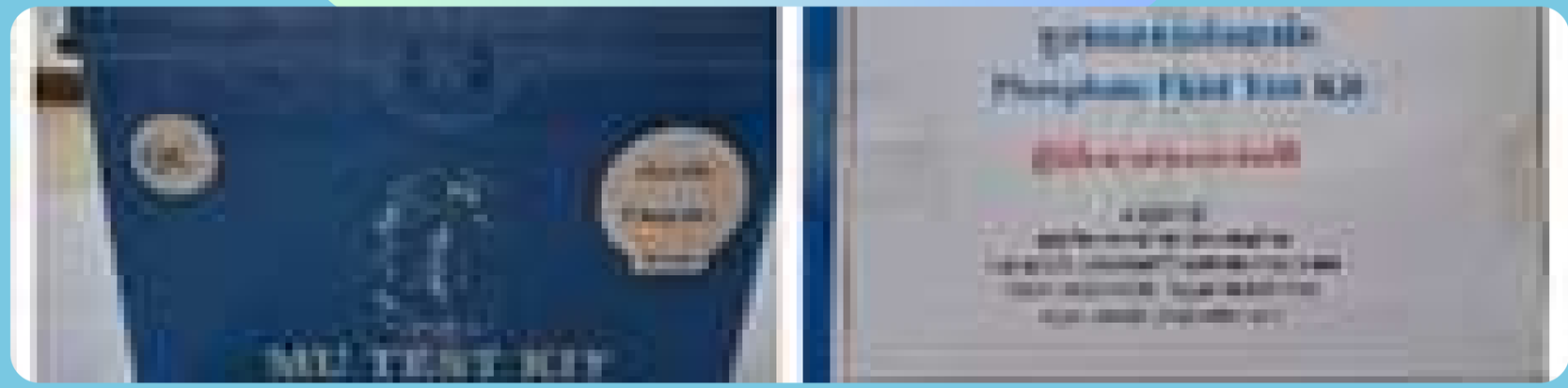
8. LabQuest Sensor for measuring temperature, pH, and relative humidity of the air.



Materials, Equipment, and Chemicals

9. Nitrate Test Kit for Water

10. Phosphate Test Kit



11. Digital Hygrometer

Materials, Equipment, and Chemicals

12. Google Sheet
13.Google slide
14. Canva
15. cell phone
16.camera
17. Document for Recording
18. Google map
19. google earth
20. pencil/pen
21. scissor
22. Medium Test Tube
23. Dropping Pipette
24. Measuring Cylinder
25. Beaker
26.Test Tube Rack
27. Water Sample Bottle
28. Stopwatch
29. Measuring Tape
30. Distilled Water

The Scope of Study

1. Content

Study on water quality in terms of:

- Physical properties: Water transparency and water temperature.
- Chemical properties: Acidity-alkalinity (pH), dissolved oxygen (DO), nitrate concentration, electrical conductivity, and phosphate levels.

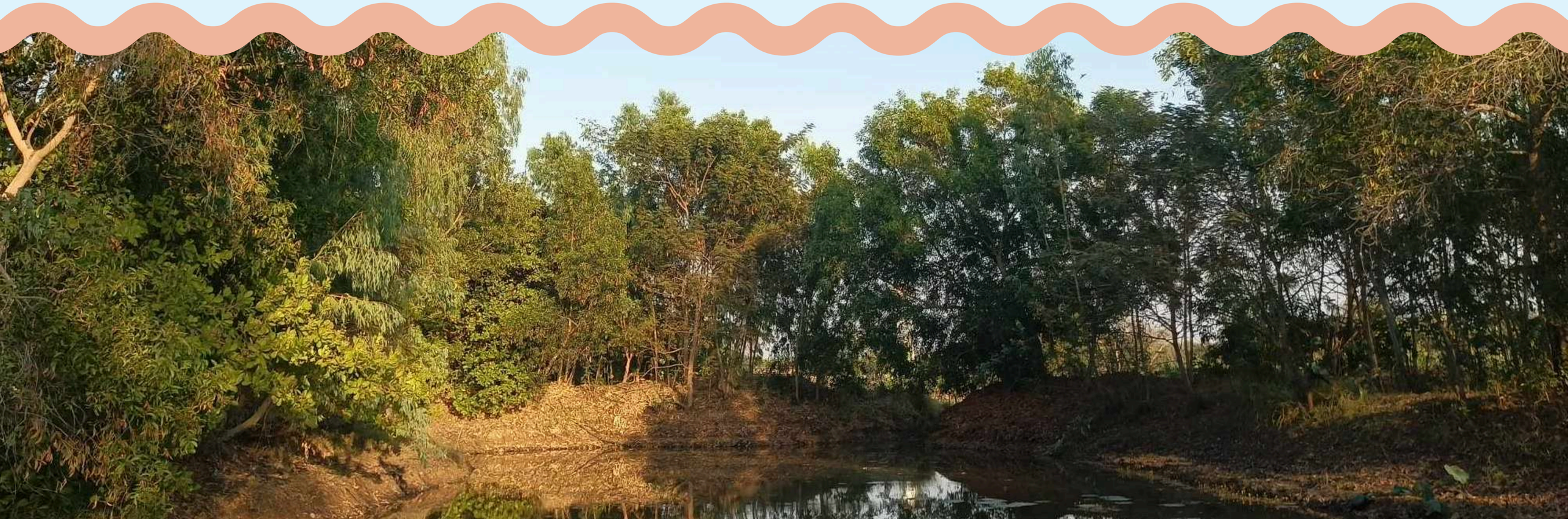
2. Scope of Location

Three study locations were designated:

Point 1: Village water supply well in Hai Yai - Hai Noi.

Point 2: Village water supply well in Phak Mai Yai.

Point 3: Village water supply well in Phrai Phanao.



3. Scope of Time

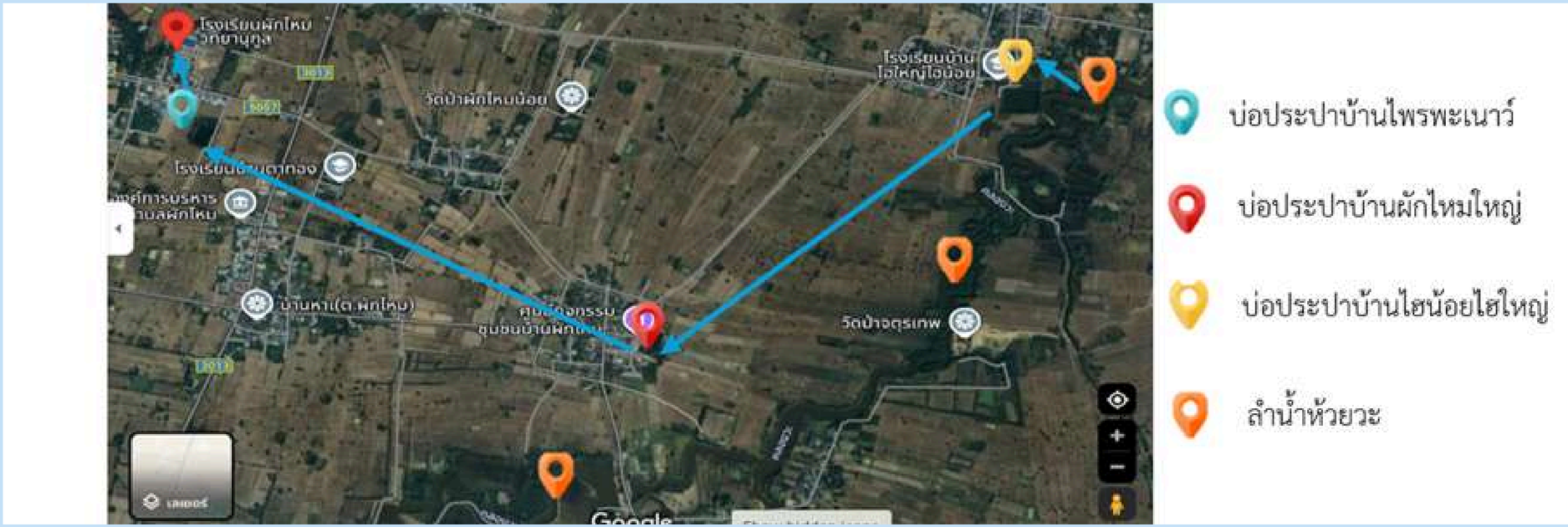
Water samples will be collected once a month on the 2nd of each month for a duration of four months:

- First collection: November 2, 2024
- Second collection: December 2, 2024
- Third collection: January 2, 2025
- Fourth collection: February 2, 2025

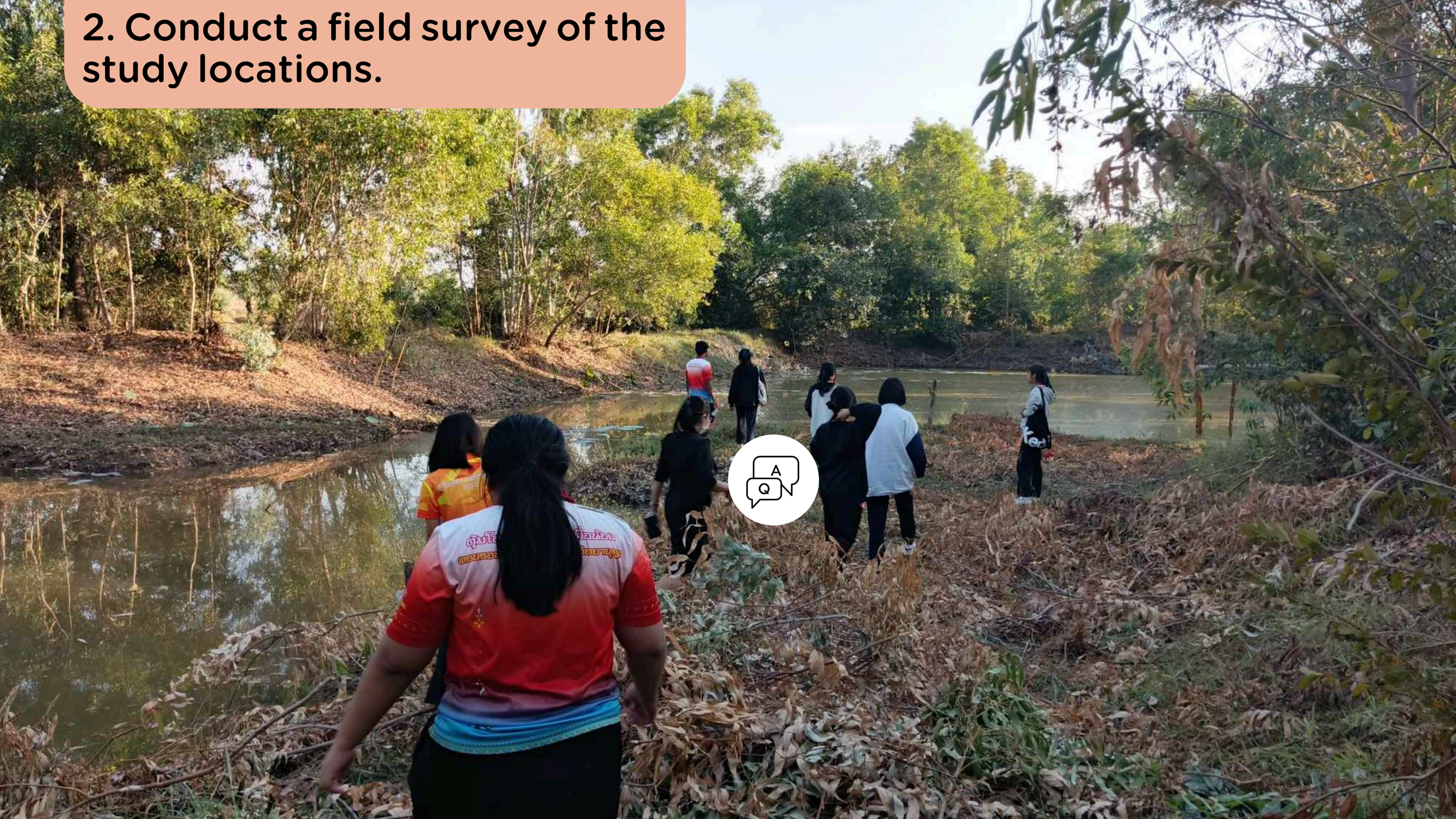
RESEARCH METHODOLOGY

1. Define the study locations:

- Point 1: Village water supply well in Hai Yai - Hai Noi.
- Point 2: Village water supply well in Phak Mai Yai.
- Point 3: Village water supply well in Phrai Phanao.



2. Conduct a field survey of the study locations.

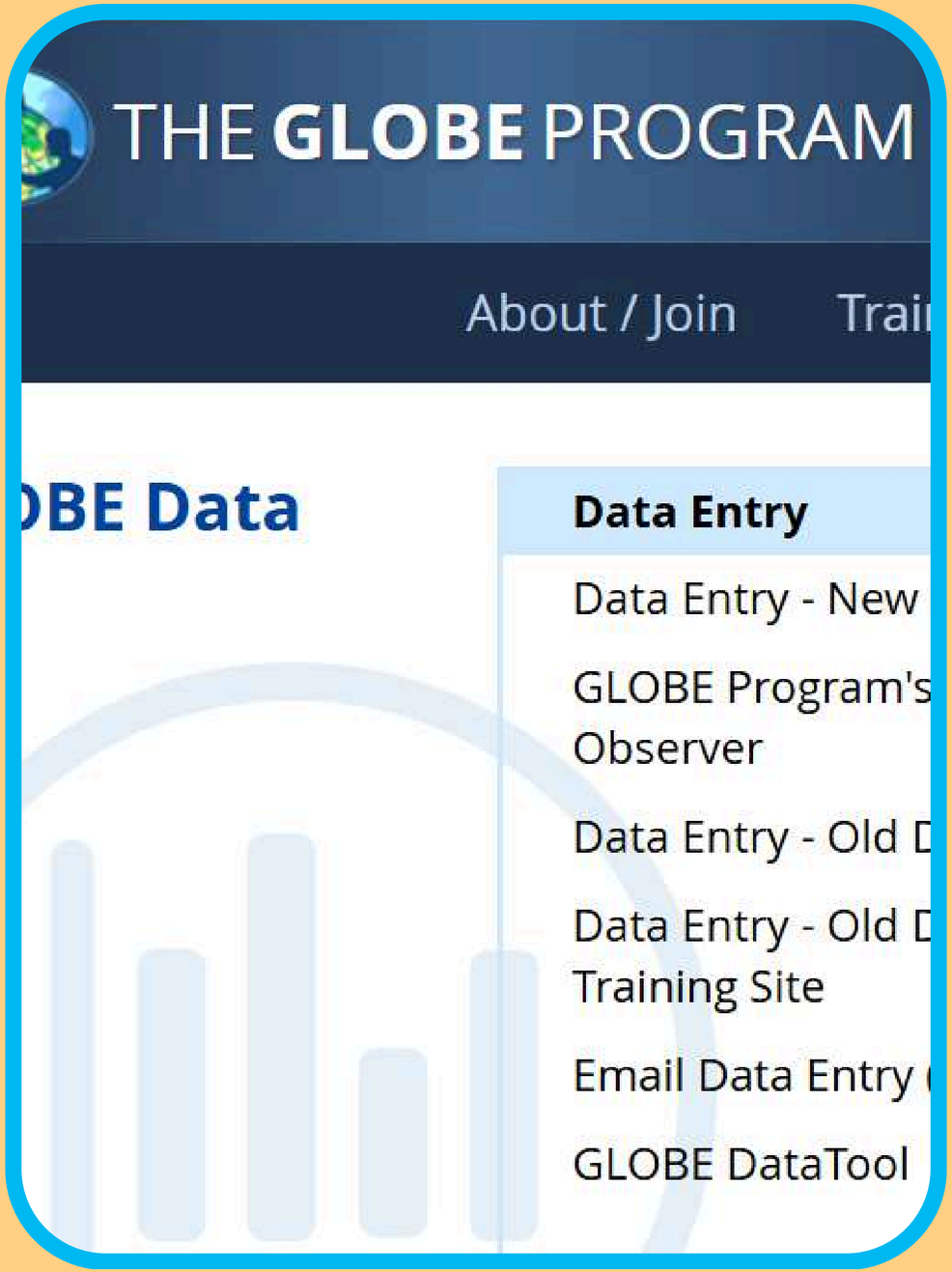


-3. Collect water samples from all three locations to analyze water quality based on GLOBE methodology in two aspects:

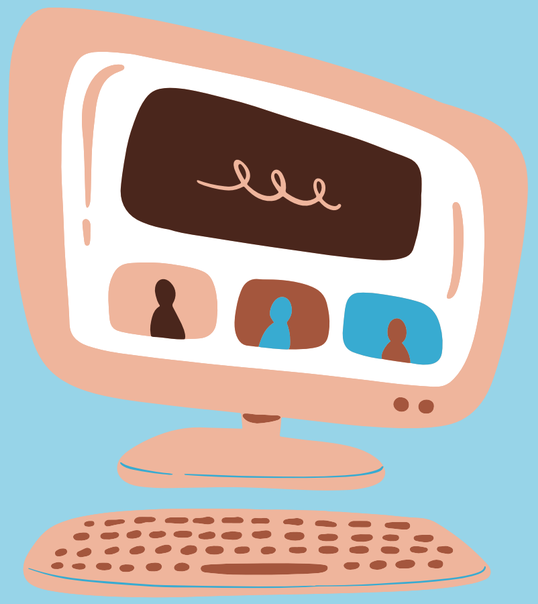
- Physical properties: Water temperature and water transparency.
- Chemical properties: pH level, dissolved oxygen (DO), electrical conductivity (EC), nitrate concentration (NO_3^-), and phosphate concentration (PO_4^{3-}).

The results will be compared with surface water quality standards to assess water quality, evaluate the impact of physical and chemical factors, and develop a water management and conservation plan.

4. Input data into the program. https://www.globe.gov in Data Entry



Research Findings



From the water sampling and analysis of the three study locations, samples were collected once a month on the 2nd of each month for four months, from November 2, 2024, to February 2, 2025. The results were then compared with surface water quality standards, yielding the following findings.

Table 1: Water Temperature at the Three Study Locations in Phak Mai Subdistrict, Huai Thap Than District, Si Sa Ket Province

Locations	Water Temperature Measurement (°C) at Study Locations				
	Round 1	Round 2	Round 3	Round 4	Average
1	32	34	31	28	31.25
2	32	31	30	28	30.25
3	30	32	30	26	29.50
Average	**31.33**	**32.33**	**30.33**	**27.33**	**30.33**

From Table 1, it was found that the water temperature at all three locations varied according to the weather conditions each month and did not differ significantly between locations. The temperature showed an increasing trend in the second collection and then decreased in the third and fourth collections. The highest recorded temperature was 32.33°C, while the lowest was 27.33°C, with an average temperature ranging between 29.50°C and 31.25°C.

Table 2: Water Transparency Measurements at the Three Study Locations in Phak Mai Subdistrict, Huai Thap Than District, Si Sa Ket Province

Locations	Water Transparency (cm) at Study Locations				
	Round 1	Round 2	Round 3	Round 4	Average
1	70	68	67	65	67.50
2	80	87	88	90	86.25
3	78	75	73	72	74.50
Average	**76.00**	**76.67**	**76.00**	**75.67**	**76.08**

From Table 2, it was found that the water transparency varied across the three locations.

- Water from Point 1 had the highest transparency, with an average ranging between 65 – 70 cm, as it is the clos to the Huai Wa stream.
- Water from Point 2 had the lowest transparency, with an average ranging between 80 – 90 cm, due to the presence of surrounding trees and its proximity to agricultural areas more than the other locations.

Table 3: Electrical Conductivity (EC) of Water at the Three Study Locations in Phak Mai Subdistrict, Huai Thap Than District, Si Sa Ket Province

Locations	Water Electrical Conductivity (EC) (µS/cm) at Study Locations				
	Round 1	Round 2	Round 3	Round 4	Average
1	185	190	195	200	192.50
2	99	100	102	105	101.50
3	80	85	87	96	87.00
Average	**121.33**	**125.00**	**128.00**	**133.67**	**127.00**

Locations	Water Electrical Conductivity (EC) (µS/cm) at Study Locations				
	Round 1	Round 2	Round 3	Round 4	Average
1	185	190	195	200	192.50
2	99	100	102	105	101.50
3	80	85	87	96	87.00
Average	121.33	125.00	128.00	133.67	127.00

From Table 3, it was found that the electrical conductivity (EC) of water in all supply wells showed a similar trend, with a noticeable increase over time.

In early November, which marks the end of the rainy season, occasional rainfall still occurred, causing rainwater to dilute the water sources. As a result, the concentration of dissolved substances was lower compared to the period from December to February.

The location with the highest average electrical conductivity (EC) was Point 1 (Hai Yai – Hai Noi water supply well), with an average of 192.50 µS/cm, while the lowest was Point 3 (Phrai Phanao water supply well), with an average of 87.00 µS/cm.

Table 4: pH Measurement of Water at the Three Study Locations in Phak Mai Subdistrict, Huai Thap Than District, Si Sa Ket Province

Locations	pH Measurement of Water at Study Locations				
	Round 1	Round 2	Round 3	Round 4	Average
1	7.50	7.60	7.80	7.90	7.70
2	9.10	9.30	9.30	9.40	9.28
3	7.30	7.50	7.70	7.90	7.60
Average	**7.97**	**8.13**	**8.27**	**8.40**	**8.19**

From Table 4, it was found that the pH levels of water at each location were neutral to slightly alkaline. In most cases, the pH value was greater than 7.60, indicating the acidity and alkalinity levels of the water at each site. Point 2 had the highest alkalinity, with an average pH of 9.28.

Table 5: Dissolved Oxygen (DO) Levels at the Three Study Locations in Phak Mai Subdistrict, Huai Thap Than District, Si Sa Ket Province

Locations	Dissolved Oxygen (DO) (mg/L) at Study Locations				
	Round 1	Round 2	Round 3	Round 4	Average
1	10.20	10.30	10.40	10.50	10.35
2	9.80	8.80	8.50	7.50	8.65
3	9.50	8.80	8.60	8.50	8.85
Average	**9.83**	**9.30**	**9.17**	**8.83**	**9.28**

From Table 5, it was found that the dissolved oxygen (DO) levels at each study location had an average range of 8.68 – 10.35 mg/L.

Based on the analysis, the DO levels did not exceed the water quality standards set by the National Environmental Board Notification No. 8 (1994). Therefore, it can be concluded that the water at all study locations is suitable for sustaining aquatic life.

Table 6: Nitrate Concentration in Water at the Three Study Locations in Phak Mai Subdistrict, Huai Thap Than District, Si Sa Ket Province

Locations	Nitrate Concentration in Water (mg/L) at Study Locations				
	Round 1	Round 2	Round 3	Round 4	Average
1	0.15	0.2	0.2	0.2	0.19
2	0.35	0.35	0.4	0.4	0.38
3	0.25	0.28	0.3	0.3	0.28
Average	**0.25**	**0.28**	**0.30**	**0.30**	**0.28**

From Table 6, it was found that the nitrate concentration in water at all study locations did not exceed 1 mg/L.

The highest nitrate concentration was observed at Point 2 (Phak Mai Yai water supply well), with an average of 0.38 mg/L.

The lowest nitrate concentration was recorded at Point 1 (Hai Yai - Hai Noi water supply well), with an average of 0.18 mg/L.

Table 7: Dissolved Phosphate Concentration (mg/L) at the Three Study Locations in Phak Mai Subdistrict, Huai Thap Than District, Si Sa Ket Province

Locations	Dissolved Phosphate Concentration (mg/L) at Study Locations				
	Round 1	Round 2	Round 3	Round 4	Average
1	0.1	0.09	0.06	0.05	0.08
2	0.6	0.58	0.28	0.25	0.43
3	0.45	0.4	0.27	0.25	0.34
Average	**0.38**	**0.36**	**0.20**	**0.18**	**0.28**

From Table 7, it was found that the dissolved phosphate concentration was highest during November to December and began to decrease from January to February.
The highest phosphate concentration was observed at Point 2 (Phak Mai Yai water supply well), with an average of 0.43 mg/L.
The lowest phosphate concentration was recorded at Point 1 (Hai Yai – Hai Noi water supply well), with an average of 0.08 mg/L.

Table 8: Summary of Water Quality Measurements at the Three Study Locations
Measurements were conducted once a month on the 2nd of each month for four months, from November 2, 2024, to February 2, 2025.

Parameter	1	2	3	Average	Water Quality Standards
Temperature (°C)	31.25	30.25	29.50	30.33	Meets Standard
Water Transparency (cm)	67.50	86.25	74.50	76.08	Meets Standard
Water Electrical Conductivity (EC) (µS/cm)	192.50	101.50	87.00	127	Meets Standard
pH Value	7.70	9.28	7.60	8.19	Meets Standard
Dissolved Oxygen (DO) (mg/L)	10.35	8.65	8.85	9.28	Meets Standard
Nitrate Concentration (mg/L)	0.19	0.38	0.28	0.28	Meets Standard
Phosphate Concentration (mg/L)	0.08	0.43	0.34	0.28	Meets Standard

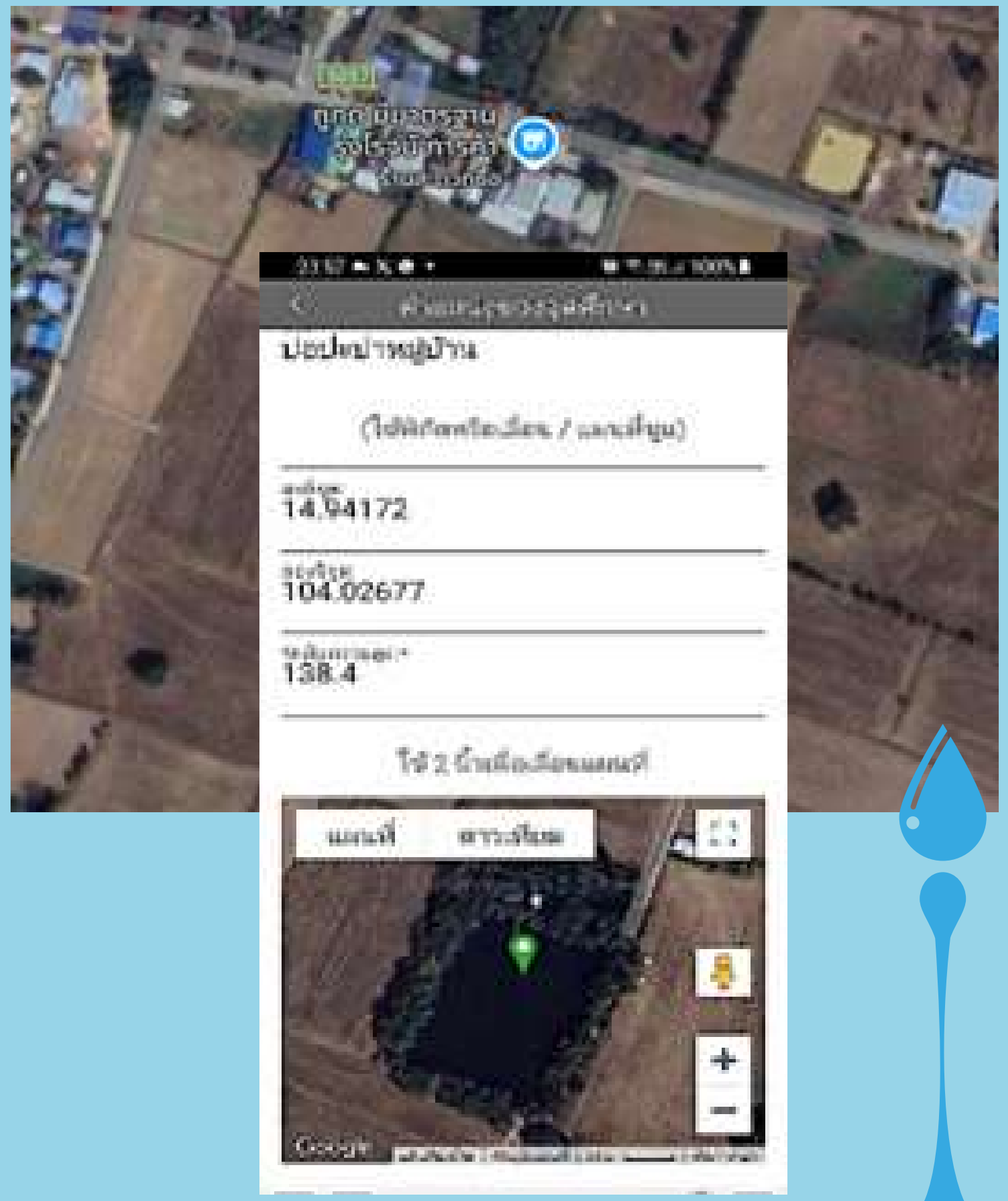
From Table 8, the summary of water quality measurements at the three study locations shows that Point 1 (Hai Yai - Hai Noi village water supply well) had the following average values:

- Water temperature: 31.25°C
- Water transparency: 67.50 cm
- Electrical conductivity (EC): 192.50 µS/cm
- pH value: 7.70
- Dissolved oxygen (DO): 10.25 mg/L
- Nitrate concentration: 0.18 mg/L
- Phosphate concentration: 0.08 mg/L

Point 2 (Phak Mai Yai village water supply well) had the following average values:
Water temperature: 30.25°C Water transparency: 86.25 cm Electrical conductivity (EC): 101.25 µS/cm pH value: 9.28 Dissolved oxygen (DO): 8.65 mg/L Nitrate concentration: 0.28 mg/L
Phosphate concentration: 0.42 mg/L

Point 3 (Phrai Phanao village water supply well) had the following average values:

- Water temperature: 30.33°C
- Water transparency: 76.08 cm
- Electrical conductivity (EC): 127 µS/cm
- pH value: 8.19
- Dissolved oxygen (DO): 9.28 mg/L
- Nitrate concentration: 0.28 mg/L
- Phosphate concentration: 0.28 mg/L



Conclusion and Discussion

The study on water quality in three locations within Phak Mai Subdistrict, Huai Thap Than District, Si Sa Ket Province was conducted over four months. Water samples were collected once a month on the 2nd of each month, with the first collection on November 2, 2024, the second on December 2, 2024, the third on January 2, 2025, and the fourth on February 2, 2025.

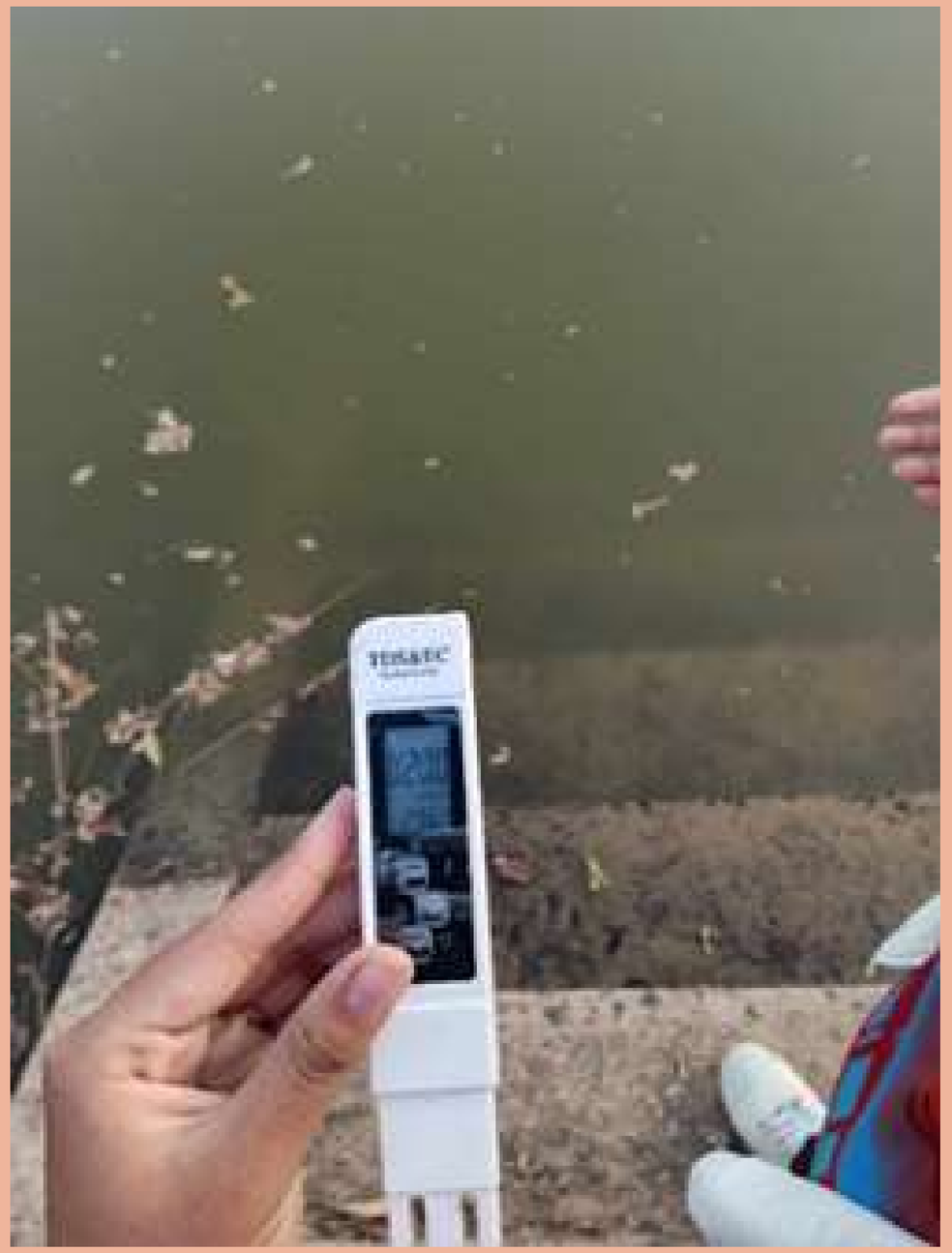
The study examined seven water quality parameters, including:

1. Water temperature
2. Water transparency
3. Electrical conductivity (EC)
4. Dissolved oxygen (DO)
5. pH (acidity and alkalinity)
6. Nitrate concentration
7. Phosphate concentration

The results are as follows:

1. Water quality measurement at Point 1 (Hai Yai - Hai Noi village water supply well) showed the following average values:

- Water temperature: 31.25°C
- Water transparency: 67.50 cm
- Electrical conductivity (EC): 192.50 µS/cm
- pH value: 7.70
- Dissolved oxygen (DO): 10.25 mg/L
- Nitrate concentration: 0.18 mg/L
- Phosphate concentration: 0.08 mg/L



2. Water quality measurement at Point 2 (Phak Mai Yai village water supply well) showed the following average values:

- Water temperature: 30.25°C
- Water transparency: 86.25 cm
- Electrical conductivity (EC): 101.25 µS/cm
- pH value: 9.28
- Dissolved oxygen (DO): 8.65 mg/L
- Nitrate concentration: 0.28 mg/L
- Phosphate concentration: 0.42 mg/L

3. Water quality measurement at Point 3 (Phrai Phanao village water supply well) showed the following average values:

- Water temperature: 30.33°C
- Water transparency: 76.08 cm
- Electrical conductivity (EC): 127 µS/cm
- pH value: 8.19
- Dissolved oxygen (DO): 9.28 mg/L
- Nitrate concentration: 0.28 mg/L
- Phosphate concentration: 0.28 mg/L

4. Based on the experiment, the water quality measurements from all three locations classify the water as Type 2 according to the Notification of the National Environmental Board No. 8, B.E. 2537 (1994) on Surface Water Quality Standards. This indicates that the water quality is suitable for agricultural use, consumption, and conservation of aquatic life. Additionally, it meets the standards required for municipal water supply production.

5. Based on the experiment, the water quality at Point 1 (Hai Yai - Hai Noi village water supply well) was better than at Points 3 and 2, as it had the highest dissolved oxygen (DO) levels. The next highest DO levels were observed at Point 3, followed by Point 2, which had the lowest.

Suggestions

1. Caution should be taken during site surveys and data collection, especially when collecting water samples. Safety considerations should be prioritized.
2. Water samples brought to the laboratory should be tested immediately to prevent data inaccuracies.
3. Additional data should be collected throughout the year to assess water quality across all seasons.

Acknowledgements

We would like to express our gratitude to the Institute for the Promotion of Teaching Science and Technology (IPST) for providing us with the opportunity to conduct this environmental science research. Our sincere thanks also go to Mr. Praphas Songphim, the Director of Phak Mai Witthayanukul School, and the Faculty of Science, Ubon Ratchathani University, for their invaluable support in this research project.

We are especially grateful to Dr. Amorn Tetsakulwong from Ubon Ratchathani University for his guidance, technical advice, and continuous support throughout the study. Additionally, we would like to thank the students participating in the GLOBE program, as well as their parents, for their dedication and care, which contributed to the successful completion of this research.

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