

**Report Paper No. 1**

**WATER QUALITY MONITORING IN LAKE BUHI,  
BUHI, CAMARINES SUR**

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## INTRODUCTION

Lake Buhi is a natural inland body of water with a surface area of 16,500,000 m<sup>2</sup> or covering an area of 1,800 hectares based on the International Lake Environment Committee (<http://www.ilec.or.jp/database/asi/dasi20.html>). This lake provides major livelihood source through fishery although other usage includes navigation, reservoir for irrigation, hydroelectric power and for recreation purposes (<http://www.ilec.or.jp/database/asi/asi-20.html>). Lake Buhi is also the home for the smallest commercial fish locally known as “sinarapan” (*Mystichtys luzonensis*) The lake is located between two ancient volcanoes, Mt. Asog (Mt. Iriga) and Mt. Malinao. Lake Buhi is one of three lakes in the province of Camarines Sur.

In the last quarter of 2011, massive fishkill events occurred and devastated the fish production of the municipality of Buhi. In an effort to arrest further degeneration of the water quality of the lake, the local government took actions and engaged various stakeholders to a massive campaign to save the lake. Buhi is a partner municipality of the Ateneo de Naga University in its social involvement program. Thus the INECAR was engaged and did a preliminary scientific investigation on the cause of the fishkill events on November 25, 2010 (see attachment A). The result showed that the possible cause of the fishkills were the fish cages that covers almost 80% of the lake together with excess feeds, oxygen depletion and the hydraulic control structure among others. After a few months of deliberation of the local government of Buhi, the INECAR was again requested to set up baseline information regarding the physico-chemical characteristics of the lake prior to the dismantling of the fish cages, hence this report.

The objectives of this undertaking are:

1. To provide baseline data on the various physico-chemical parameters that can be measured by INECAR (transparency, air temperature, water temperature, salinity, pH, conductivity, dissolved Oxygen (DO), total dissolved solids and resistivity)
2. To provide toxic alert level by use of phytoplankton count, and
3. To continue monitoring the lake for several times until June 2012.

Seven months after the initial investigation, the INECAR conducted the first field sampling for the Water Quality Monitoring in Buhi.

The report is composed of two parts. Part I discusses the first field sampling done last June 28, 2011. The physico-chemical parameters measured during the said sampling were transparency, air temperature, water temperature, salinity and pH. Moreover, plankton sampling was done to determine the toxicity level of the Lake.

Part II discusses the second field sampling conducted on July 8, 2011. For this sampling, conductivity, salinity, total dissolved solids, and dissolved oxygen (in percent saturation and in milligram per liter).

**PART I**

**June 28, 2011  
Water Quality Monitoring  
Field Sampling 1  
Before the Dismantling of Fish Cages by the Buhi LGU**

## METHODOLOGY

On June 28, 2011, the INECAR Team went to Buhi Camarines Sur to conduct a Water Quality Monitoring (Field Sampling 1) before the dismantling of fish cages in Buhi Lake. The team collected samples from the 14 established sampling stations by the Lake Development Office (see Attachment B).

The physico-chemical parameters measured were:

<b>Parameter</b>	<b>Measuring Tool</b>
Transparency	Secchi dish
Air Temperature	Lab. Thermometer
Water Temperature	Lab. Thermometer
Salinity	Refractometer
pH	pH Meter

All of the parameters were measured on site except for salinity and pH. For the two, the researchers collected water samples using a horizontal water sampler. The samples were put in an ice box with ice for preservation. When the researchers went back on shore at the Buhi Municipal Hall, the salinity and pH were measured from the 14 samples.

The lake toxicity level was determined using phytoplankton. A horizontal water sampler was used together with the plankton net for plankton sampling. The water samples were collected from seven strategic sampling sites for the identification of the phytoplankton that will help determine the Toxic Alert Level of the Lake (see Attachment C1-C2). The samples were brought to the INECAR laboratory for further processing. The planktons were counted under the microscope using a Sedgewick-Rafter Counting Chamber.

## RESULTS AND DISCUSSION

### Physico-chemical Parameter

Below is Table 1 showing the result of the Physico-chemical testing done on the water samples last June 28, 2011.

**Table 1. Result of the Physico-chemical Test**

**Date: June 8,2011**

**Location: Buhi Lake**

**Water Quality Monitoring (Field Sampling 1)**

**Before the Dismantling Activity of the Local Government of Buhi**

PARAMETER	SAMPLING STATIONS													
	1/A	2/B	3/C	4/D	5/E	6/F	7/G	8/H	9/I	10/J	11/K	12/L	13/M	14/N
Transparency (cm)	50	57	47	54	47	45	45	51	42	48	44	46	47	46
Air Temp (°C)	37.0	38.0	37.5	36.5	38.0	38.0	36.0	35.0	36.0	40.0	36.5	35.0	36.0	37.0
Water Temp (°C)	32.0	32.5	31.5	32.5	33.0	33.0	32.0	33.5	32.0	32.0	32.5	33.0	33.0	32.0
Time	10:34	11:09	11:33	11:46	11:55	12:06	12:17	12:30	12:43	12:53	01:07	01:22	01:34	01:41
Salinity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
pH	7.6	7.7	7.9	8.0	8.0	7.9	7.8	7.8	7.8	8.0	8.0	8.2	8.2	8.2
	7.6	7.7	7.8	8.0	8.0	8.0	7.8	7.8	7.8	8.0	8.0	8.2	8.2	8.2
	7.6	7.8	7.8	8.0	8.0	7.9	7.8	7.9	7.8	8.0	8.1	8.1	8.2	8.2
Average pH	7.6	7.7	7.8	8.0	8.0	7.9	7.8	7.8	7.8	8.0	8.0	8.2	8.2	8.2

### Transparency

The range of the transparency from the 14 sites is 42-57 cm as shown in Table 1. It means that the water in the lake is turbid or less than the standard transparency values which should be greater than one (1) meter. Light penetration is one of the limiting factors in the productivity of the lake. Microscopic phytoplankton, which serves as the base of the food chain in the aquatic ecosystem, needs sunlight to photosynthesize. High turbidity means high siltation and with silt and other solids blocking sunlight, the photosynthesis by phytoplankton will be limited.

### Salinity

For salinity, the result was zero for all of the sampling stations which is expected for freshwater ecosystems.

### Temperature

Table 1 above also shows the range of the air temperature during sampling as 35.0°C-40.0°C while the range of the water temperature during the sampling is 32.0°C-33.5°C. All within range of a tropical lake ecosystem

### pH

The pH range of the 14 sampling sites is 7.6-8.2 which according to the Water Quality Criteria and Standards for Freshwater and Marine Aquaculture (PHILMINAQ, 2008) is still at the desirable range for fish production (see table 2 below).

**Table 2. pH tolerance levels and its effects on aquaculture**

<b>pH levels</b>	<b>Effects on warm water pond fish</b>
<4.0	Acid death point
4.0-5.0	No production
<b>6.5-9.0</b>	<b>Desirable range for fish production</b>
9.0-11.0	Slow growth
>11.0	Alkaline death point

Source: Lawson 1995, Tarazona and Munoz 1995 cited in Water Quality Criteria and Standards for Freshwater and Marine Aquaculture (PHILMINAQ)

Compared to the result of the Initial Investigation (see Attachment A), the result of the testing for Transparency in this first field sampling showed a little improvement. From the transparency range of 39-47 cm in the Initial Investigation, the measured Transparency range is now 44-57 cm. Moreover, there is not much difference in the range of pH values from the Initial Investigation and this sampling. The pH range measured in the Initial Investigation is 7.8-8.0 while in this sampling, the range is 7.6-8.0. It is important to note that this sampling was done before the dismantling of the fishcages in Lake Buhi.

### Phytoplankton

**Table 3. Phytoplankton Count**

Station		Plankton count	Toxic Alert Level
1	N 13° 26' 25.4" E 123° 31' 16.1"	4, 498	II
2	N 13° 26' 29.0" E 123° 31' 28.1"	5, 192	II
3	N 13° 26' 37.7" E 123° 31' 35.7"	3, 785	II
4	N 13° 26' 34.0" E 123° 31' 31.7"	3, 529	II
5	N 13° 27' 45.1" E 123° 30' 53.3"	6, 809	II
6	N 13° 28' 34.0" E 123° 30' 50.3"	5, 254	II
7	N 13° 28' 14.2" E 123° 30' 06.6"	4, 461	II

In the plankton counting, it was found out that all of the seven sampling stations for phytoplankton collection were in Toxic Alert Level II. It means that the water is unsafe for human consumption. Toxic phytoplankton is not eaten by fish.

On the other hand, of the six sampling stations, Station 5 had the highest toxic phytoplankton count followed by Stations 6, 2, 1, 7, 3, and lastly, Station 4.

**Table 4. Guide in determining the toxic alert levels based on algal cells counted.**

Alert Levels	Cell Concentration/mL	Description
I	500-2,000	Not considered a direct threat, but may be in rapid growth and soon pass with Alert Level II
II	2,000-15,000	Unsafe for human consumption
III	Greater than 15,000	Unsafe for stock watering and domestic use

Source: Waterwatch Tasmania Organization (2003)

$$\frac{\text{Number of Cells counted} \times 1000}{200} / 100$$

\*Plankton Counting done by Ms. Rochelle Reyes, Research Assistant in INECAR

It is found that both in the Initial Investigation and in this first sampling that the Toxic Alert Level in the lake is in Level II. Moreover, it is also important to look at the number of the toxic plankton counted which determines the toxic alert level of the Lake. The range of the toxic phytoplankton counted in the Initial Investigation is 2,244-4,864 while in this sampling, it is 3,529-6,809. It shows that there are more toxic phytoplankton in the Lake during this sampling than during the sampling for the Initial Investigation.

## SUMMARY OF FINDINGS

On June 28, 2011, a baseline sampling activity for the water quality monitoring in Lake Buhi before the dismantling of fishcages was conducted in Lake Buhi.

It has been found out that the:

1. Lake is turbid as shown by the low transparency
2. The lake has zero salinity which is normal for freshwater ecosystems
3. The pH range from the 14 stations is at the desirable range for fish production
4. All of the sampling stations for phytoplankton are in Toxic Alert Level II.

Seven months after the massive fish kills last November 2010, the physico-chemical parameters of the Lake, except for turbidity, had reached the normal range. This may be attributed to the natural ability of the Lake to recuperate especially that the fish stocks in the cages had already been dead, harvested or not renewed, causing for decreased amount of fish feeds being deposited in the water hence lesser pollutant inputs into the lake.

However, the Lake is still turbid. This means that there are a lot of suspended solid particles in the Lake (silt, soil from erosion, particulate matter, unconsumed fish feeds and some plankton). According to the US-EPA, higher concentrations of suspended solids can serve as carriers of toxins, which readily cling to suspended particles.

Lastly, the water in the Lake is unsafe for human consumption as shown by Toxic Alert Level II in all of the seven stations in the lake. There is more toxic phytoplankton in the Lake than its non-toxic phytoplankton. It is important to note that fishes do not eat toxic phytoplankton so even if they are so many, they have no use for the fishes.

## **PART II**

**July 08, 2011**  
**Water Quality Monitoring**  
**Field Sampling 2**  
**Dissolved Oxygen Measurement and Depth Survey**  
**During the dismantling of fish cages by the Buhi LGU**

## METHODOLOGY

On July 08, 2011, the INECAR Team went to Buhi Camarines Sur to conduct the second Field Sampling for the Water Quality Monitoring of Lake Buhi.

The team conducted an on-site measurement of physico-chemical parameter especially for the Dissolved Oxygen from the 14 established sampling stations by the Lake Development Office. For this sampling, the INECAR Team used their multi-parameter tester. The physico-chemical parameters measured were:

<b>Parameter</b>	<b>Unit used in this Study</b>
Conductivity	Micromhos per cm is equal to microSiemens per cm ( $\mu\text{mhos/cm} = \mu\text{S/cm}$ )
Salinity	Parts per million is equal to milligram per liter ( $\text{ppm} = \text{mg/L}$ )
Total Dissolved Solids	Parts per million is equal to milligram per liter ( $\text{ppm} = \text{mg/L}$ )
Dissolved Oxygen in Percent Saturation	Percent (%)
Dissolved Oxygen in mg/L	Milligram per liter (mg/L)

Moreover, the team also conducted a Depth Survey of the cross-section of the Lake as intersected through the 14 stations. The team used the Garmin Depth Finder, Chart Plotter and Fish Finder for this survey. For the result of this Depth survey, please see Attachment D.

## RESULTS AND DISCUSSION

### Conductivity

Conductivity is the ability of a solution to conduct an electric current and is related to the concentration of dissolved salts (ions) in water (Waterwatch Tasmania Reference Manual, 2003). According to the United States Environmental Protection Agency, conductivity is also affected by temperature: the warmer the water, the higher the conductivity. For this reason, conductivity is reported as conductivity at 25 degrees Celsius (25 °C). Moreover, the range for inland fresh waters indicates that streams supporting good mixed fisheries have a range between 150 and 500 $\mu$ hos/cm or  $\mu$ S/cm. Below is Table 1 showing the Adjusted Conductivity Values.

Table 1. Adjusted Conductivity Values at 25°C			Date of Sampling: July 08, 2011
STATION	Actual reading ( $\mu$ S)	Temp (°C)	Adjusted Value at 25 °C
1	103.2	28.4	90.85
	103.4	28.4	91.02
	103.3	28.4	90.93
2	103.2	28.4	90.85
	103.4	28.4	91.02
	103.4	28.4	91.02
3	103.2	28.7	89.90
	103.6	28.5	90.88
	103.4	28.6	90.38
4	102.9	29.1	88.40
	103.5	28.8	89.84
	103.4	28.8	89.76
5	103.3	29.0	89.05
	103.7	28.8	90.02
	104.0	28.8	90.28
6	104.0	28.9	89.97
	104.6	28.7	91.11
	104.5	28.7	91.03
7	102.3	29.1	87.89
	104.1	28.8	90.36
	104.2	28.8	90.45
8	102.8	29.2	88.01
	103.3	29.0	89.05
	103.5	28.9	89.53
9	99.7	29.0	85.95
	103.4	29.0	89.14
	103.4	29.0	89.14
10	103.5	29.0	89.22
	103.7	28.9	89.71
	104.0	28.9	89.97
11	103.3	29.2	88.44
	104.3	28.9	90.22
	104.6	28.9	90.48
12	107.5	28.8	93.32
	108.0	28.7	94.08
	107.8	28.7	93.90
13	108.3	28.5	95.00
	108.3	28.4	95.33
	108.3	28.5	95.00
14	103.6	28.6	90.56
	104.1	28.4	91.64
	104.1	28.4	91.64

The values gathered for conductivity with corresponding temperature makes comparison and analysis difficult. With this, for the researchers to analyze and interpret the data, using ratio and proportion, the values were converted at their equivalent values at 25 °C.

The range of conductivity values measured in the Lake (as adjusted to 25°C) is 88.01-95.33  $\mu\text{S}/\text{cm}$ . It is way below the standard of the US-EPA for conductivity with a range between 150 and 500 $\mu\text{S}/\text{cm}$  at 25°C. According to US-EPA, studies of inland fresh waters with conductivity outside this range could indicate that the water is not suitable for certain species of fish or macro invertebrates.

The range of Salinity values is 105.1-114.7 ppm which is lower for the established higher limit for ions which is 350 ppm as cited in the study Characterization of Water and Lake Sediments in Laguna de Bay (R. Sugcang et. al, 2011), hence acceptable.

### **Total Dissolved Solids**

Total dissolved solids (TDS) values simply give a general indication of the level of dissolved solids in the stream or lake and are much closely related to conductivity. Moreover, the values were adjusted to find their proportional counterpart at 25°C like in the case for conductivity to facilitate easier analysis. Table 2 follows showing the adjusted TDS values.

**Total Dissolved Solids**

Table 2. Adjusted TDS Values at 25°C		Date of Sampling: July 08, 2011	
Station	µS	Temp (°C)	Value at 25 °C
1	127.4	28.4	112.15
	127.8	28.4	112.50
	127.6	28.4	112.32
2	127.4	28.4	112.15
	127.7	28.4	112.41
	127.7	28.4	112.41
3	128.6	28.6	112.41
	128.6	28.6	112.41
	128.6	28.6	112.41
4	130.1	29.0	112.16
	129.8	28.8	112.67
	129.7	28.8	112.59
5	130.3	28.9	112.72
	130.2	28.8	113.02
	130.4	28.8	113.19
6	130.7	28.8	113.45
	130.7	28.7	113.85
	130.6	28.7	113.76
7	129.6	29.0	111.72
	130.5	28.8	113.28
	130.6	28.8	113.37
8	130.6	29.1	112.20
	130.6	29.0	112.59
	130.6	29.0	112.59
9	126.1	29.0	108.71
	130.6	29.0	112.59
	130.6	29.0	112.59
10	130.9	29.0	112.84
	130.6	28.9	112.98
	131.0	28.9	113.32
11	131.0	29.0	112.93
	131.3	28.9	113.58
	131.7	28.9	113.93
12	134.8	28.7	117.42
	134.9	28.7	117.51
	134.7	28.7	117.33
13	134.2	28.5	117.72
	134.2	28.5	117.72
	134.2	28.5	117.72
14	128.7	28.5	112.89
	128.6	28.4	113.20
	128.6	28.4	113.20

The range of TDS values that the researchers had measured from the 14 stations is 108.71-117.72 ppm at 25°C. According to a water quality monitoring activity document from the University of Alberta,

Canada, the expected TDS values of lakes and streams fall at 50-250 ppm. This shows that the TDS values gathered in Buhi Lake is also within the expected range.

**Dissolved Oxygen**

Below are Tables 3-A and 3-B showing the Dissolved Oxygen values measured from the 14 sampling stations around Lake Buhi in percent saturation.

**Date: July 08, 2011**

**Location: Buhi Lake**

**Water Quality Monitoring (Field Sampling 2)**

**Dissolved Oxygen Measurement and Depth Survey**

<b>Table 3-A. Dissolved Oxygen in Percent Saturation at their Prevalent Temperature</b>													
Sampling Stations													
<b>1</b>		<b>2</b>		<b>3</b>		<b>4</b>		<b>5</b>		<b>6</b>		<b>7</b>	
<b>DO %</b>	<b>Temp (°C)</b>	<b>DO %</b>	<b>Temp (°C)</b>	<b>DO %</b>	<b>Temp (°C)</b>	<b>DO %</b>	<b>Temp (°C)</b>	<b>DO %</b>	<b>Temp (°C)</b>	<b>DO %</b>	<b>Temp (°C)</b>	<b>DO %</b>	<b>Temp (°C)</b>
87.4	28.4	87.2	28.4	87.2	28.6	94.7	28.9	101.2	28.9	103.2	28.7	107.9	28.9
87.5	28.4	86.6	28.4	86.3	28.6	95.9	28.8	100.8	28.9	103.0	28.7	106.9	28.9
87.6	28.4	87.3	28.4	88.4	28.6	95.2	28.8	101.4	28.9	102.7	28.7	108.3	28.9

<b>Table 3-B. Dissolved Oxygen in Percent Saturation at their Prevalent Temperature</b>													
Sampling Stations													
<b>8</b>		<b>9</b>		<b>10</b>		<b>11</b>		<b>12</b>		<b>13</b>		<b>14</b>	
<b>DO %</b>	<b>Temp (°C)</b>	<b>DO %</b>	<b>Temp (°C)</b>	<b>DO %</b>	<b>Temp (°C)</b>	<b>DO %</b>	<b>Temp (°C)</b>	<b>DO %</b>	<b>Temp (°C)</b>	<b>DO %</b>	<b>Temp (°C)</b>	<b>DO %</b>	<b>Temp (°C)</b>
106.6	29.1	106.9	29.0	103.9	28.9	102.2	29.1	99.9	28.7	100.5	28.5	95.9	28.5
107.2	29.0	106.0	29.0	106.0	29.0	101.5	29.0	99.3	28.7	100.0	28.5	95.8	28.5
106.8	29.0	105.8	29.0	103.3	28.9	102.5	29.0	98.5	28.7	100.1	28.5	94.7	28.4

**Dissolved Oxygen**

Below are Tables 4-A and 4-B showing the Dissolved Oxygen values measured from the 14 sampling stations around Lake Buhi in milligram per liter.

**Date: July 08, 2011**

**Location: Buhi Lake**

**Water Quality Monitoring (Field Sampling 2)**

**Dissolved Oxygen Measurement and Depth Survey**

<b>Table 4-A. Dissolved Oxygen in Milligram per Liter at their Prevalent Temperature</b>													
Sampling Stations													
1		2		3		4		5		6		7	
DO in mg/L	Temp (°C)	DO in mg/L	Temp (°C)	DO in mg/L	Temp (°C)	DO in mg/L	Temp (°C)	DO in mg/L	Temp (°C)	DO in mg/L	Temp (°C)	DO in mg/L	Temp (°C)
6.74	28.4	6.75	28.4	6.77	28.6	7.29	28.9	7.78	28.9	7.95	28.7	8.31	28.9
6.64	28.4	6.66	28.4	6.71	28.6	7.26	28.8	7.78	28.9	7.96	28.7	8.27	28.9
6.81	28.4	6.71	28.4	6.80	28.6	7.34	28.8	7.78	28.9	7.89	29.0	8.29	28.9

<b>Table 4-B. Dissolved Oxygen in Milligram per Liter at their Prevalent Temperature</b>													
Sampling Stations													
8		9		10		11		12		13		14	
DO in mg/L	Temp (°C)	DO in mg/L	Temp (°C)	DO in mg/L	Temp (°C)	DO in mg/L	Temp (°C)	DO in mg/L	Temp (°C)	DO in mg/L	Temp (°C)	DO in mg/L	Temp (°C)
8.22	29.0	8.24	29.0	8.02	28.9	7.82	29.0	7.73	28.7	7.74	28.5	7.46	28.5
8.24	29.0	8.12	29.0	8.14	29.0	7.84	29.0	7.64	28.7	7.79	28.5	7.44	28.5
8.19	29.0	8.27	29.0	8.01	29.0	7.89	29.0	7.61	28.7	7.71	28.5	7.33	28.4

The range of DO from the 14 sites (as shown in the table above) is 86.3%- 107.2%. In the percent saturation of DO values, one can observe that some measurements exceeded the 100% saturation. The phenomenon is called supersaturation. It temporarily happens when more oxygen molecules have dissolved in the water than it is capable of holding at a current temperature. It occurs when there is turbulence in the body of water and on sunny days when large number of plants in the lake produce oxygen, through photosynthesis, faster than oxygen is released back into the atmosphere.

For the DO values in mg/L, the standard by the US EPA for 0°C-29°C is 14.60mg/L to 7.67mg/L. The range of DO values measured from the 14 sites at 28°C-29°C is 6.66 mg/L to 8.29 mg/L which is suitable for aquatic organisms dependent to the dissolved oxygen in the Lake.

In comparison with the DO range measured by the Bureau of Fisheries and Aquatic Resources (BFAR) included in the Initial Investigation, the DO range (in mg/L) measured during the second field sampling shows improvement in the level of dissolved oxygen in the Lake. From 1.6-2.7 mg/L measured during the Initial Investigation, the DO range is now 6.66 mg/L to 8.29 mg/L. It is helpful to know that the second sampling happened seven months after the Initial Investigation and during the dismantling of the fishcages which may have allowed the lake to recuperate.

## SUMMARY OF FINDINGS

On July 08, 2011, the INECAR Team conducted the second field sampling for the Water Quality Monitoring in Lake Buhi. The activity aimed for Dissolved Oxygen Measurement and Depth Survey.

It has been found out that the:

1. The range of Conductivity measured from the 14 stations around the Lake is 88.01-15.33  $\mu\text{S}/\text{cm}$ .
2. The range of the Salinity measured is 105.1-114.7 ppm.
3. The range of the Total Dissolved Solids is 108.71-117.72 ppm.
4. The range of Dissolved Oxygen in Percent Saturation is 86.3-107.2%.
5. The range of Dissolved Oxygen in Milligram per Liter is 14.60-7.67 mg/L.

The Conductivity of the Lake is lower than the Standard, which is 150-500  $\mu\text{S}/\text{cm}$ , set by the US-EPA for rivers and lakes.

It is expected for the Salinity of the lake to be in the normal range for it is a Freshwater Ecosystem while the Total Dissolved Solids is also at the normal range.

During the field sampling, the day was hot and sunny- the perfect condition which allowed the supersaturation of the Dissolved Oxygen in the Lake as shown by the value in Percent that is more than a hundred.

Lastly, the Dissolved Oxygen in mg/L is at the normal range which allows the aquatic organisms to normally function and be productive.

## RECOMMENDATION

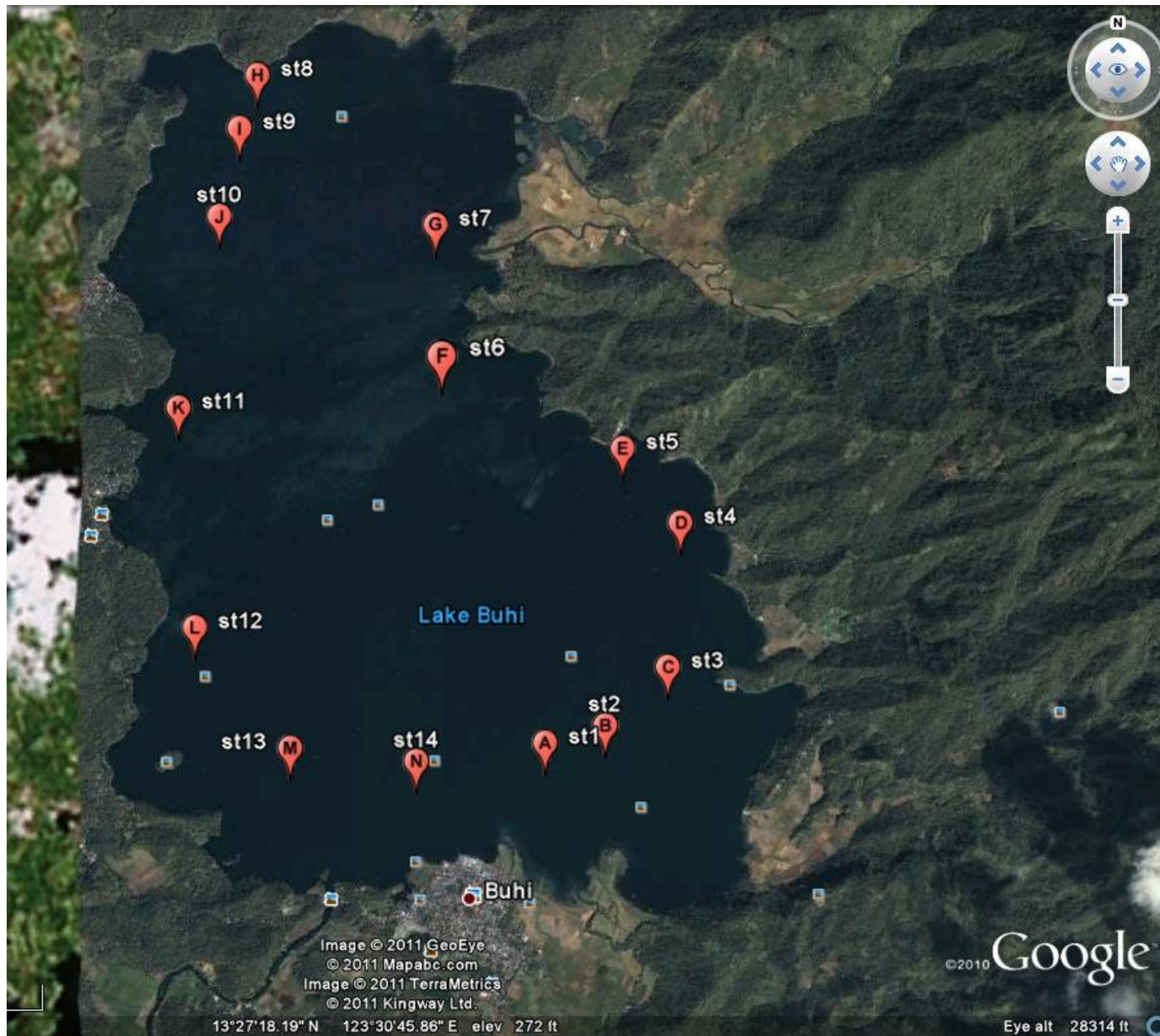
- Relocate the Fish Sanctuary towards the center of the Lake to discourage fishermen from fishing in the Sanctuary.

### Prepared by:

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**ATTACHMENT B-2. Location of the Stations for Water Sampling During the First Field Sampling (June 28, 2011)**

**Date: June 28, 2011**

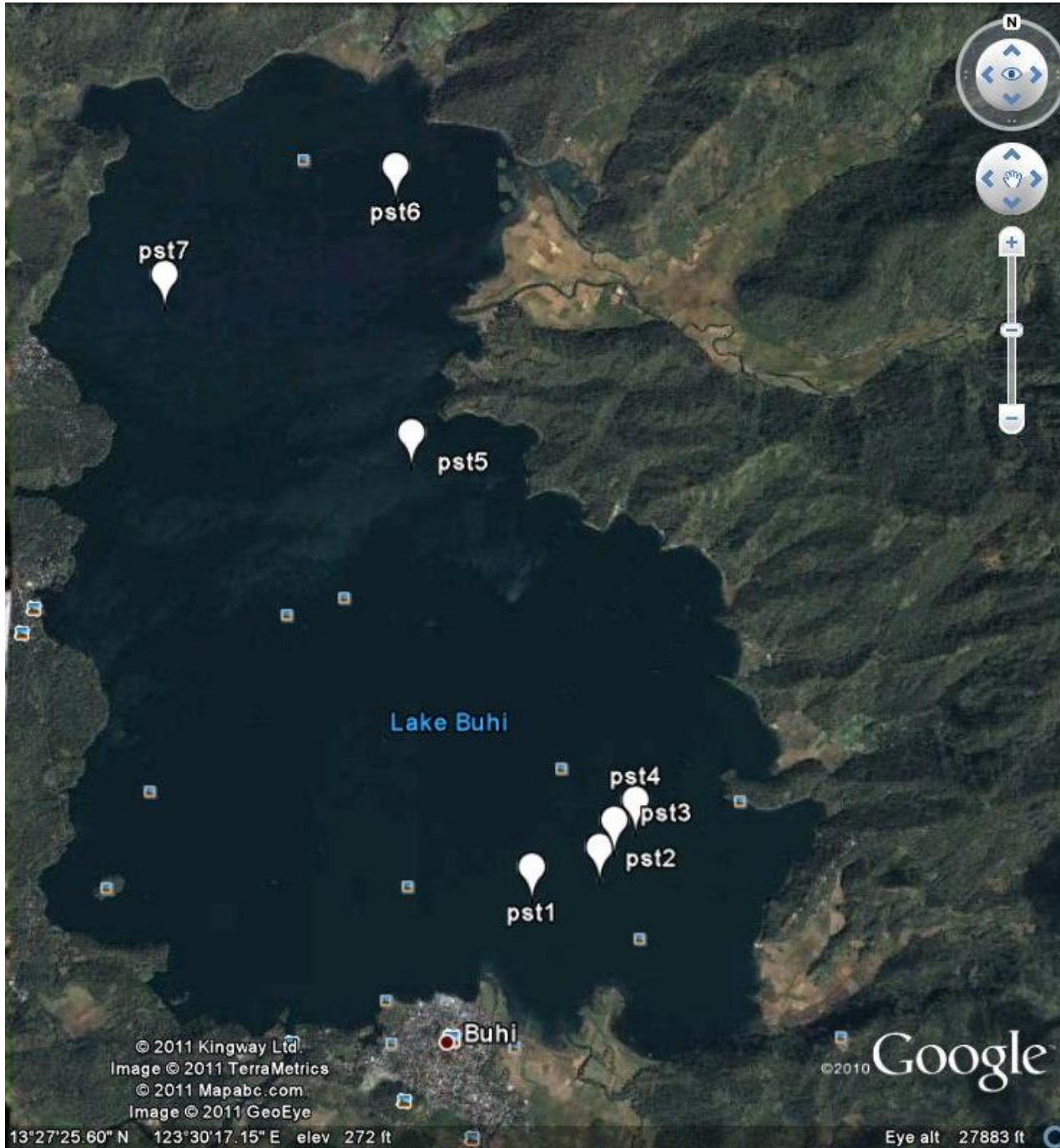
**Location: Buhi Lake**

**Water Quality Monitoring (Field Sampling 1)**

**Before the Dismantling Activity of the Buhi LGU**

<b>Sampling Site</b>	<b>Map Legend</b>	<b>Location</b>	<b>Description</b>
<b>1</b>	<b>A</b>	N 13° 26' 25.4" E 123° 31' 16.1"	San Buena
<b>2</b>	<b>B</b>	N 13° 26' 29.0" E 123° 31' 28.1"	Santa Cruz
<b>3</b>	<b>C</b>	N 13° 26' 41.4" E 123° 31' 42.2"	Ipil Baybay
<b>4</b>	<b>D</b>	N 13° 27' 11.0" E 123° 31' 44.9"	Ipil Centro
<b>5</b>	<b>E</b>	N 13° 27' 26.4" E 123° 31' 32.6"	Ipil Sitio Ongaw
<b>6</b>	<b>F</b>	N 13° 27' 44.3" E 123° 30' 54.1"	Iraya, Navigation Line
<b>7</b>	<b>G</b>	N 13° 28' 12.7" E 123° 30' 52.8"	Ibayugan
<b>8</b>	<b>H</b>	N 13° 28' 43.7" E 123° 30' 14.9"	Boundary Itbog, Ibayugan, Sitio Paskang,
<b>9</b>	<b>I</b>	N 13° 28' 32.7" E 123° 30' 11.1"	Tambo
<b>10</b>	<b>J</b>	N 13° 28' 14.5" E 123° 30' 06.8"	Tambo Centro
<b>11</b>	<b>K</b>	N 13° 27' 34.8" E 123° 29' 58.1"	Cabatuan
<b>12</b>	<b>L</b>	N 13° 26' 49.3" E 123° 30' 01.6"	Salvacion
<b>13</b>	<b>M</b>	N 13° 26' 24.3" E 123° 30' 21.9"	Santa Clara
<b>14</b>	<b>N</b>	N 13° 26' 21.6" E 123° 30' 48.7"	Santa Elena

**Table 1. Location of the Sampling Sites for the Water Sampling**



**ATTACHMENT C-2. Location of the Stations for Water Sampling During the First Field Sampling (June 28, 2011)**

**Date: June 28, 2011**

**Location: Buhi Lake**

**Water Quality Monitoring (Field Sampling 1)**

**Before the Dismantling Activity of the Buhi LGU**

**Table 2. Location of the Sampling Sites for the Phytoplankton Sampling**

<b>Sampling Site</b>	<b>INECAR Code</b>	<b>BUHI Code</b>	<b>Description</b>
<b>1</b>	<b>1</b>	<b>1</b>	N 13° 26' 25.4" E 123° 31' 16.1"
<b>2</b>	<b>2</b>	<b>2</b>	N 13° 26' 29.0" E 123° 31' 28.1"
<b>3</b>	<b>4</b>	<b>2</b>	N 13° 26' 37.7" E 123° 31' 35.7"
<b>4</b>	<b>6</b>	<b>2</b>	N 13° 26' 34.0" E 123° 31' 31.7"
<b>5</b>	<b>9</b>	<b>6</b>	N 13° 27' 45.1" E 123° 30' 53.3"
<b>6</b>	<b>12</b>	<b>7-8</b>	N 13° 28' 34.0" E 123° 30' 50.3"
<b>7</b>	<b>14</b>	<b>10</b>	N 13° 28' 14.2" E 123° 30' 06.6"



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## **Field Sampling Team Composition**

**June 28, 2011**

**Field Sampling 1**

**Physicochemical Testing and Phytoplankton Sampling  
Water Quality Monitoring in Lake Buhi**

### **INECAR Team**

Team Leader: Shane B. Bimeda  
Admin/Research Assistant

Field Assistants:

Rochelle C. Reyes  
Niño Cañaverál  
Rondel Aspe

**July 08, 2011**

**Field Sampling 2**

**Dissolved Oxygen Measurement and Depth Survey  
Water Quality Monitoring in Lake Buhi**

### **INECAR Team**

Team Leader: Joanaviva Caceres-Plopenio  
Deputy Director

Field Assistants:

Shane B. Bimeda  
Rochelle C. Reyes  
Niño Cañaverál

**Emelina G. Regis Ph.D.**

**Director  
INECAR**

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