Lake Mainit

Philippines

EAAF NETWORK SITE CODE FOR OFFICE USE ONLY:

E	A	A	F	1	5	8

Site Information Sheet on

East Asian-Australasian Flyway Network Sites

(SIS) – 2017 version

Available for download from https://eaaflyway.net/about-us/the-flyway/flyway-site-network/

Categories approved by Second Meeting of the Partners of the East Asian-Australasian Flyway Partnership in Beijing, China 13-14 November 2007 - Report (Minutes) Agenda Item 3.13

Notes for compilers:

1. The management body intending to nominate a site for inclusion in the East Asian - Australasian Flyway Site Network is requested to complete a Site Information Sheet. The Site Information Sheet will provide the basic information of the site and detail how the site meets the criteria for inclusion in the Flyway Site Network. When there is a new nomination or an SIS update, the following sections with an asterisk (*), from Questions 1-14 and Question 30, must be filled or updated at least so that it can justify the international importance of the habitat for migratory waterbirds.

2. The Site Information Sheet is based on the Ramsar Information Sheet. If the site proposed for the Flyway Site Network is an existing Ramsar site then the documentation process can be simplified.

3. Once completed, the Site Information Sheet (and accompanying map(s)) should be submitted to the Secretariat. Compilers should provide an electronic (MS Word) copy of the Information Sheet and, where possible, digital versions (e.g. shapefile) of all maps.

1. Name and contact details of the compiler of this form *:

Compiler 1

Full name:

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2. Date this sheet was completed *:

DD/MM/YYYY

27/05/2025

3. Country *:

Philippines

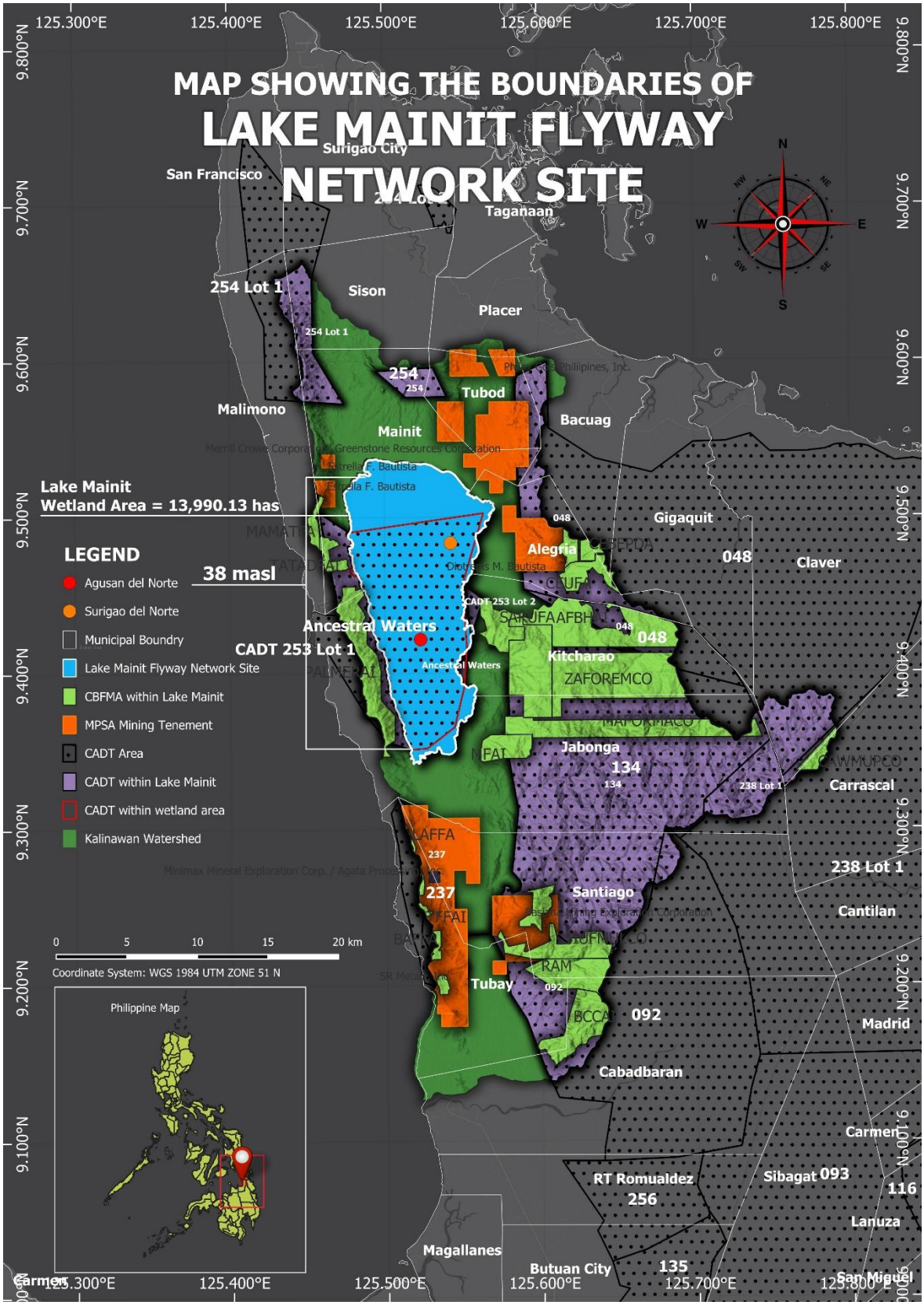
4. Name of the Flyway Network site *:

Accepted English transcription of the Site's name.

Lake Mainit

5. Map of site *:

The most up-to-date available and suitable map of the wetland should also be appended to the SIS (only in digital format and shape file). The map must clearly show the boundary of the site. Please refer to the "Digitising Site Boundaries in Google Earth" file linked here.



6. Geographical coordinates (latitude/longitude, in decimal degrees) *:
Provide the coordinates of the approximate centre of the site and/or the limits of the site. If the site is composed of more than one separate area, provide coordinates for each of these areas.

9°29.18'N 125°31.093'E

9°25'57"N. 125°31'22"E

7. Elevation *: (in metres: average and/or maximum & minimum)

38 masl

8. Area *:
The total area of the site, in hectares. If the areas of discrete site units are known, please also list each of these together with the names (or labels) used to identify and differentiate these units.

13,990.13 hectares

9. General overview of the site *:
A brief (two sentences) summary of the site, mentioning principal physical and ecological functions, and its importance for migratory waterbirds.

In Northeastern Mindanao, Lake Mainit is a shared resource between the provinces of Agusan del Norte and Surigao del Norte. It is bounded by eight municipalities that constitute the Kalinawan River Watershed.

Lake Mainit, being part of the Mt. Hilong-hilong Key Biodiversity Area (KBA) and the fourth largest and deepest lake in the Philippines, serves vital hydrological functions such as groundwater recharge, flood control, and sediment trapping while supporting diverse aquatic and forest ecosystems. It is an important resting and feeding site for migratory waterbirds along the East Asian–Australasian Flyway, especially Tufted ducks *Aythya fuligula* which has the highest count recorded in the year 2022 with 54,605 individuals, contributing to regional and global biodiversity conservation.

10. Justification of Flyway Site Network criteria *:
Please provide waterbird count information (with year of latest count) that demonstrates that the site meets the criteria of the Flyway Site Network (Annex 1). That is:

- it regularly supports > 20 000 migratory waterbirds; or,
- it regularly supports > 1 % of the individuals in a population of one species or subspecies of migratory waterbird; or,
- it supports appreciable numbers of an endangered or vulnerable population of migratory waterbird
- it is a "staging site" supporting > 5 000 waterbirds, or > 0.25% of a population stage at the site.

A listing of the populations of migratory waterbirds covered by the East Asian – Australasian Flyway Partnership and the 1% thresholds is attached (Annex 3).

The “staging site” criterion is particularly difficult to apply and application of this should be discussed with the Secretariat. Also note that some species have several populations that are very difficult to distinguish in the field.

Criterion: it regularly supports > 20 000 migratory waterbirds.

YEAR	2021	2022	2023	2024	2025	Average count 2021-2025
Waterbird count	**52,956**	**60,238**	**55,483**	**14,267**	**35,936**	**43,776**

NAME OF SPECIES	Scientific Name	Range	2021	2022	2023	2024	2025	Average Annual Count for 5 years
Little Egret	*Egretta garzetta*	Resident, Migrant	842	1172	759	1038	885	
Intermediate Egret	*Ardea intermedia*	Resident, Migrant	705	818	677	522	801	
Great Egret	*Ardea alba*	Resident, Migrant	66	22	46	12	72	
Cattle Egret	*Ardea coromanda*	Resident, Migrant	107	61	119	76	134	
Grey Heron	*Ardea cinerea*	Migrant	9	4	14	5	12	
Tufted Duck	*Aythya fuligula*	Migrant	48,906	54,605	50,835	10,700	32,297	
Common Moorhen	*Gallinula chloropus*	Resident, Migrant	196	317	567	102	225	
Common Coot	*Fulica atra*	Migrant	0	0	5	1	3	
Common Tern	*Sterna hirundo*	Migrant	458	249	396	471	598	
Whiskered Tern	*Chlidonias hybrida*	Migrant	1,521	2,890	1,847	1329	765	
Marsh Sandpiper	*Tringa stagnatilis*	Migrant	15	0	1	0	2	
Pacific Golden Plover	*Pluvialis fulva*	Migrant	0	0	15	3	1	
Common Sandpiper	*Actitis hypoleucos*	Migrant	36	100	168	4	42	
Swinhoe's Snipe	*Gallinago megala*	Migrant	39	0	0	0	0	
Black-Winged Stilt	*Himantopus himantopus*	Migrant, Resident	0	0	5	0	62	
Wood Sandpiper	*Tringa glareola*	Migrant	0	0	3	4	0	
Common Redshank	*Tringa totanus*	Migrant	3	0	0	0	0	
Common Greenshank	*Tringa nebularia*	Migrant	2	0	0	0	0	
Common Snipe	*Gallinago gallinago*	Migrant	51	0	26	0	35	
Whimbrel	*Numenius phaeopus*	Migrant	0	0	0	0	2	
TOTAL WATERBIRD			**52,956**	**60,238**	**55,483**	**14,267**	**35,936**	**43,776**

Criterion: it regularly supports > 1 % of the individuals in a population of one species or subspecies of migratory waterbird.

Species	Biogeographic Population	1% Threshold	Population Count (AWC FROM CY 2021 TO 2025)					
			2021	2022	2023	2024	2025	Average count 2021-2025
Tufted duck (*Aythya fuligula)*	E & SE Asia (non-breeding)	2,400	48,906	54,605	50,835	10,700	32,297	**39,469**

11. Wetland Types *:

List the wetland types present (see Annex 2). List the wetland types in order of their area in the Flyway Network site, starting with the wetland type with the largest area.

O - Permanent freshwater lakes

12. Jurisdiction *:

Include territorial, e.g. state/region, and functional/sectoral, e.g. Ministry of Agriculture/Dept. of Environment, etc.

Country: Philippines
Region: Caraga Region
Municipalities: Alegria and Mainit**; Province:** Surigao del Norte
Municipalities: Kitcharao, Jabonga; **Province:** Agusan del Norte

Functional/ Sectoral jurisdiction:
Department of Environment and Natural Resources (DENR)
Bureau of Fisheries and Aquatic Resources (BFAR)
National Commission on Indigenous People (NCIP)
National Irrigation Administration (NIA)
Local Government Unit (LGU) Jabonga
Local Government Unit (LGU) Kitcharao
Local Government Unit (LGU) Alegria
Local Government Unit (LGU) Mainit
CADT 253

13. Management authority *:

Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland and the title and/or name and email address/phone number of the person or persons in this office with direct responsibility for managing the wetland.

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Indigenous Peoples Mandatory Representative, CADT 253
Jabonga, Agusan del Norte

14. Bibliographical references *:

A list of key technical references relevant to the wetland, including management plans, major scientific reports, and bibliographies, if such exist. Please list Web site addresses dedicated to the site or which prominently feature the site, and include the date that the Web site was most recently updated. When a large body of published material is available about the site, only the most important references need be cited, with priority being given to recent literature containing extensive bibliographies.

Department of Environment and Natural Resources. (2020). *Protected Area Suitability Assessment CY 2020*

Department of Environment and Natural Resources. (2020). *Annual Waterfowl Census Consolidated Report CY 2016*.

Department of Environment and Natural Resources. (2020). *Annual Waterfowl Census Consolidated Report CY 2017*

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Department of Environment and Natural Resources. (2022). *Annual Waterfowl Census Consolidated Report CY 2022*

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Department of Environment and Natural Resources. (2024). *Consolidated Report on Annual Asian Waterbird Census CY 2024 DENR Caraga Region.*

Department of Environment and Natural Resources. (2025). Annual Waterfowl Census Consolidated Report CY 2025,

Department of Environment and Natural Resources (DENR). (2021). *Wetland Site Management Plan for Lake Mainit CY 2022-2026*.

Department of Environment and Natural Resources (DENR). (2023). *Lake Mainit Wetland Management Plan 2024-2028*.

Department of Environment and Natural Resources (DENR). (2023). *Kalinawan River Watershed Characterization Report. 2024*.

Vedra S., Elnor R., Jeanette S., Ruth G., Rey R. Rustan E., Geralyn D., Marissa S., Michael James B., and Melchor R. (2023). *Environmental Quality of Lake Mainit as a Habitat of Indigenous Goby, Glossogobius giuris (Hamilton, 1882) in Northeastern Mindanao, Philippines*.International Journal of Science and Management Studies (IJSMS), Volume 6.

Laudino F., Rhenzlyn A., Joycelyn J., Mayuko F., Marlon E. (2024). *Assessment of Contamination and potential ecological risk of heavy metals in the bottom sediments of Lake Mainit, Philippines.* Journal of Hazardous Materials Advances.

Wilfredo H. Uy, Asuncion B. De Guzman, Rodrigo E. Acuña and Rey L. Roa. *Aquatic Biodiversity of Lake Mainit, Southern Philippines.* Mindanao State University at Naawan, 9023 Naawan, Misamis Oriental, Philippines. Journal of Environment & Aquatic Resources.

Cris Gel Loui A. Arcadio, Frank Paolo Jay B. Albarico, Shu-Ling Hsieh, Ya-Ting Chen, Hernando P. Bacosa. *Microplastic distribution in the surface water and potential fish uptake in an oligotrophic lake (Lake Mainit, Philippines*). Journal of Contaminant Hydrology, Volume 273, 2025, 104603, ISSN 0169-7722, https://doi.org/10.1016/j.jconhyd.2025.104603.

(https://www.sciencedirect.com/science/article/pii/S0169772225001081)

De Guzman, Asuncion B., Alita E. Openiano, Marilou M. Ologuin and Jeanette J. Samson. *Socio-Economics, Institutional Support, and Intervention Programs Toward Sustainable Fisheries Management in Lake Mainit, Philippines*. Mindanao State University at Naawan, 9023 Naawan, Misamis Oriental. Journal of Environment & Aquatic Resources. December 2015. DOI: 10.48031/msunjear.2015.03.02

15. Physical features of the site:

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

Lake Mainit, the fourth largest and deepest lake in the Philippines, is located in the Caraga Region, spanning Agusan del Norte and Surigao del Norte. It is a natural tectonic lake formed along a fault line, with a surface area of approximately 13,990.13 hectares and a maximum depth of 223 meters. Surrounded by volcanic and sedimentary hills, the lake's basin features clay loam and silty clay soils prone to erosion.

The lake is fed by over 28 tributaries and drains into Butuan Bay through the Kalinawan River. Based on the observation, the water level is fluctuating due to the presence of hydroloectric power plant that allegedly cause the receding of water, and other uses of the lake such as fishing ground, aquaculture and irrigation. The inflow of the Lake is from its tributaries from the upland area of the watershed and its outflow is in Kalinawan River going to Tubay River. Water quality is generally Class B, though localized nutrient loading is a concern. The area experiences a tropical monsoon climate with high annual rainfall (2,500–3,000 mm) and average temperatures around 26–27°C.

Lake Mainit plays a vital role in regional ecology, hydrology, agriculture, and fisheries, making it a key natural resource in northeastern Mindanao.

16. Physical features of the catchment area:

Describe the surface area, general geology and geomorphological features, general soil types, and climate (including climate type).

Kalinawan River Watershed was formerly known as Lake Mainit Watershed covers a total area of 99,231.8 hectares located in Caraga Region in Mindanao, Philippines, encompassing three (3) provinces of Caraga Region namely, Surigao del Norte, Agusan

del Norte and Surigao del Sur. It lies between 9°25’ 57” N Latitude and 125° 31’ 22” E

Longitude covering portions of Cabadbaran City, and Municipalities if Tubay, Santiago, Jabonga and Kitcharao, all in the province of Agusan del Norte and some parts of Alegria, Bacuag, Mainit, Placer, Sison, Tubod, Claver, Gigaquit, Malimono, all in Surigao del Norte and within portion of Carrascal, Surigao del Sur. It was listed as one of the 131 Priority Critical Watershed supporting National Irrigation System.

The said watershed is characterized as mountainous terrain with rugged and uneven topography to flat plains, with the highest elevation of 1,600 meters above sea level (masl). In terms of vegetative cover, the watershed has a good forest cover which makes the watershed still biologically diverse. This part of the watershed is located at the Municipalities of Santiago and Jabonga, Agusan del Norte. Meanwhile, the lowest elevation is described as even with the sea level or 0 masl, situated at the coastal area downstream of Tubay, Agusan del Norte. It has a slope ranging from 0% to 50% up and

about 26% or 25,741.7 hectares has above 50% slope. Its slopes are moderately sloping, moderately undulating to steeply sloping, steeply sloping to hilly and steep hills to severely steep or mountainous zones.

It lies along the Philippine Fault Zone, with geology composed of volcanic and sedimentary rocks. Soil types are mainly clay loam and silty clay, fertile but erosion-prone.

Its climate type belongs to the Climate Type II category which means that it has no pronounced dry season but very pronounced maximum rainfall from November to January, with a mean daily temperature of 28°C in the lowlands and 21°C in higher elevation. Since the distribution of plants is limited by temperature, altitude likewise sets the boundary of species distribution.

17. Hydrological values:

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

Water from the surrounding basin is collected by the 28 river tributaries that supply Lake Mainit. This input of water, especially on rainy days, can help recharge groundwater since some surface water penetrates through the soil and bedrock into subterranean aquifers.

As a natural reservoir, the lake itself holds a considerable volume of water. The lake's water level varies according to rainfall and runoff, which may have an impact on the rate of groundwater recharge. The lake's discharge, mostly via the Kalinawan River, is monitored in order to avoid sudden water surges that can result in flash floods in the settlements that surround it.

Regarding sediment trapping, river tributaries that bring sediment and other resources from nearby watersheds to the lake. Furthermore, pollutants like heavy metals and agricultural runoff that are attached to the sediment particles are removed with the help of this trapping mechanism.

The aquatic and coastal plants along the edges of Lake Mainit have a major impact on shoreline stabilization. Plants strengthen the soil's connection and make it more resistant to erosion by waves and currents due to their extensive root systems. They also minimize direct erosion by reducing the impact of waves on the shore.

These functions support biodiversity, protect communities from flooding, and contribute to climate resilience and sustainable water management in the lake.

18. General ecological features:

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Flyway Network site, and the ecosystem services of the site and the benefits derived from them.

Lake Mainit is classified as the deepest and fourth largest lake in the Philippines, with a maximum depth of 223 m and a surface area of 13,999.13 hectares (Kalinawan River Watershed Characterization Report, 2024). The lake is regarded as an essential communal resource and a rich natural resource with significant ecological importance.in the provinces of Surigao del Norte and Agusan del Norte (Demetillo et al., 2015 cited in

Laudino et al., 2024). Moreover, based on the same study, it supports almost equally a wide range of populations bounded by 31 lakeshore barangays from the municipalities of Jabonga, Kitcharao, Mainit, and Alegria (De Guzman et al., 2008) that are highly dependent on food and livelihood (Apdohan et al., 2021).

An ecological study by Tumanda, et al. (2006) as cited in Uy (2015) et al. describes Lake Mainit as an oligotrophic lake with high transparency and sufficient nutrient supply to support high productivity. Lake Mainit is regarded as one of the cleanest lakes in the Philippines and offers excellent freshwater that is well-oxygenated for domestic use.

Lake Mainit hosts different kinds of species and a diversity of flora and fauna. According to Uy et al. (2015), a total of 41 species of fish, 5 crustaceans, 8 mollusks and 14 species of aquatic plants were identified and documented in the lake. These different kinds of species living in the Lake Mainit have a huge factor in maintaining the good quality of the lake and its biodiversity, this difference in species diversity across time could be attributed to a number of factors.

Based on PASA Report, 2020, a total of 46,481 individuals of wetland birds sighted and recorded belonging to seven order, eight families, 19 genera, and 26 species. Of the 26 species observed, 16 species were widespread residents, four species were migrants, and six species were resident-migrants. The two (2) species were eagles namely, *Halieastur indus* (Brahminy kite) and *Haliaeetus leucogaster* (White-bellied sea eagle) both were least concerned and resident species. The two (2) king fishers comprised the Family Alcedinidae which are least concerned and resident species. Family Anatidae yielded three (3) species namely, *Anas platyrhynchos domesticus* (Mallard)*, Aythya fuligula* (Tufted duck)*,* and *Dendrocygna arcuata* (Wandering whistling duck), all were least concerned species. The *A. platyrhynchos domesticus* and *D. arcu*ata were both residents. Six (6) egrets, five (5) herons, and one (1) bittern belong to Family Ardeidae, of which, migrant *Egretta eulophotes* (Chinese egret) was the only species recorded as vulnerable. Only one species, *Hirundo rustica* (Barn swallow) belongs to Family Hirundinidae and *Sterna hirundo* (Common tern) of Family Laridae. Both species were least concerned and resident waterbirds. The Family Rallidae comprised four least species namely, *Amaurornis phoenicurus* (White-breasted waterhen)*, Amaurornis cineria* (White browed crake)*, Gallinula chloropus* (Common moorhen), and *Porphyrio porphyria* (Western swamphen). Migrant *Himantopus himantopus* (Black-winged stilt) was the only species belonging to Family *Recurvirostridae*.

Moreover, another study conducted by Uy (2015) et al. cited that a total of fourteen (14) species of aquatic plants classified into six (6) submersed and eight (8) floating and emergent plants are found in Lake Mainit. All submersed plants form extensive underwater meadows with the exception of the duck lettuce *Ottelia alismoides* (Duck-lettuce). A common aquatic plant is Vallisneria sp., locally called “lusay” similar to the marine eelgrass, which is found growing in clear water along the shore together with *Hydrilla verticillata* (Waterthymes), *Najas graminea* and Ceratophyllum sp., Hydrilla, known locally as “dugman”, *Nelumbo nucifera*, locally known as “pagusè”.

Aside from its biological component, Lake Mainit also provides economic upliftment to local fisheries and livelihoods. It serves as a significant resource for local communities, supporting fisheries, agriculture, and domestic water use. It is estimated that approximately 107,103 people from six municipalities (De Guzman et al., 2015, cited in Arcadio et al., 2025) depend on the lake for their livelihood, including fishing,

aquaculture, and tourism-related activities. Its most abundant and commercially valuable fish species, the tank goby (*Glossogobius guiris*), or "pijanga," is commonly dried and sold locally or even exported.

Other ecosystem services offered by Lake Mainit are rich in the culture of the Philippines and establish a connection with nature. It is the ideal retreat for families, adventurers, and those seeking relaxation because of its breathtaking scenery, variety of activities, and peaceful atmosphere. Lake Mainit guarantees an unforgettable experience with activities like swimming, kayaking or boating, picnicking along the shore, and birdwatching.

19. Noteworthy flora:

Provide additional information on particular species and why they are noteworthy indicating, e.g., which species/communities are unique, rare, endangered or bio geographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the SIS.*
(Please add here the species which do not come under sec no 14)

Lake Mainit is home to diverse flora. Based on the biodiversity assessment conducted under the Biodiversity Partnership Project (BPP), the keystone species considered comprised all the threatened species such as critically endangered, endangered, vulnerable and ten other threatened species. Important floral species found were *Pterocarpus indicus* (Narra), *Petersianthus quadrialatus* (Toog)*, Afzelia rhomboidea* (Tindalo)*.*

Moreover, PASA Report, 2020 also revealed various species documented in Kalinawan River Watershed. Among the 244 plant species recorded in the ten sampling sites in Lake Mainit KBA, 41 species or 17 % were accounted as conservation priority species. These comprise four critically endangered species, nine endangered species, 17 vulnerable species, and ten other threatened species. A critically endangered, endangered, and vulnerable species is facing extremely high risk, very high risk and high risk of extinction in the wild, respectively (www.iucnredlist.org). Based on the study of Demetillo and others (2015) on the plant diversity in the eight sampling sites in Lake Mainit watershed, Santiago obtained the highest diversity index. The area of Santiago was considered as a secondary old growth forest to a pristine forest with higher altitude.

20. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 10. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the SIS.*
(Please add here the species which do not come under sec no 14)

A total of 55 waterbird species were recorded with a total individual count of 36,606 individuals (AWC 2025). The Tufted duck (*Aythya fuligula*) had the highest number of individuals with 32,297 count, followed by the Little Egret (*Egretta garzett*e) with 885 individuals. The result showed a significant increase in 2025 which is 151.03% from the previous year with a total waterbird count of 14,582. However, it is notable that the highest count of Tufted ducks recorded was 54,605 in the year 2022.

Moreover, there were 56 species of birds (AWC 2025) observed and identified in Lake Mainit including the Philippine endemics namely, Philippine magpie robin, Philippine

coucal, Philippine bulbul, Philippine hawk eagle and Philippine green pigeon. These species were observed over the past five (5) years during the Annual Waterbird Census (AWC). The other bird species found in the lake is the Brahminy kite which has the greatest number of individuals with an utmost 64 count over the past years of AWC.

21. Social, economic and cultural values:

a) Describe if the site has any general social, economic and/or cultural values e.g., fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values:

The lake supports a number of important fishery activities as it is an important source of economic activity for local communities. Based on the Socio-Economic Assessment and Monitoring System (SEAMS) (2020) study, fisher folk communities around Lake Mainit and environs have diversified livelihoods which could clearly be a response to depleted incomes from fishing. Fisherfolks are fishing both endemic and invasive species. Some are selling it directly to the local market but some are processing it into dried fish. For full-time fishers, fishing in Lake Mainit and Kalinawan River is the main source of income (85%), followed by farming (12%). Other minor income-generating activities are operating a sari-sari store, engaging in small-scale mining and many others. For part time fishers, farming is the main source of income supplemented by fishing and other livelihood options especially in Jabonga and Santiago. A total of 1,754 fishers depend on the fisheries resources of Lake Mainit and Kalinawan River.

According to the same study, the most common fish species and other fishery resources of the Lake and Kalinawan River where large proportion of income are derived are “Bangkok”, “Carpa”, “Catfish”, “Gourami”, “Haluan”, “Kasil”i, “Pijanga”, “Tilapia”, “Uwang”; Freshwater fishes are usually caught by the fishing gears such as “Skylab”, “Surit”, “Taan”, “Pontak”, “Pukot”, “Sapang”, “SapyawSarapSin-sin”, “Pana”, “Pante-anod”, “Pante-taan”, “Laya” , “Mosket”, “Palaksuhan”, “Palangre”, “Palutaw Timing/screen”, “Baling”, “Kuryente”, “Lambat”, “Bantak”, “Bingwit m Buldos”, “Bungsod m Buso”, “Darak”, and “Dompil”. The largest CPUE (Caught per Unit Effort) of all the fishery products is Tiplapa with a mean of 370407.40 CPUE and followed by combination varieties of Tilapia, Haluan, Carpa and Pedjanga.

The lake is also utilized as one of the tourism destinations. The lake provides a picturesque view used by the LGU for the advertisement of their locality. Recreational activities for the community like birdwatching and boating, fishing, swimming and photography.

It is a source of renewable energy as there is an existing hydropower plant operating in the area and potential for wind energy.

b) Is the site considered of international importance for holding, in addition to relevant ecological values, examples of significant cultural values, whether material or non-material, linked to its origin, conservation and/or ecological functioning? (Double-click the checkbox to check and choose “Checked” under “Default Value” from “Check Box Form Field Options” window)

Yes. While Lake Mainit hosts various migratory bird species, DENR has been conducting annual AWC and CEPA activities on wildlife conservation in the nearby communities to

educate them on the importance of the conservation of waterbirds and other bird species. Also , they were involved during the annual AWC in the lake.

Significant cultural values include at least 19 types of traditional and ingenious modifications of fishing gears that are used for fishing as their livelihood source according to De Guzman et. al., 2015 by more than 4,000 fishers dependent on the said wetland ecosystem.

If yes, tick the box ❑ and describe this importance under one or more of the following categories:

I. Sites which provide a model of wetland wise use, demonstrating the application of traditional knowledge and methods of management and use that maintain the ecological character of the wetland:
II. Sites which have exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetland:
III. Sites where the ecological character of the wetland depends on the interaction with local communities or indigenous peoples: ✓
IV. Sites where relevant non-material values such as sacred sites are present and their existence is strongly linked with the maintenance of the ecological character of the wetland:

22. Land tenure/ownership:

a) Within the Flyway Network site:

Lake Mainit is within the Certificate of Ancestral Domain Title (CADT) 253. 68.30% of the total area of the wetland is covered by this CADT with 9,556.13 hectares while the remaining area covers 31.69% with 4,434 hectares.

b) In the surrounding area:

In the surrounding area of the lake, a total of four (4) tenurial instruments cover the Lake Mainit such as the Community-Based Forest Management Agreements (CBFMA) with 18,320.36 hectares, Certificate of Stewardship (CSC) with 1,661.51 hectares, Mineral Production Sharing Agreement (MPSA) with 6,976.45 hectares.

Moreover, it is important to note the ownership of Indigenous People (IP) in the watershed. A total of four (4) Certificates of Ancestral Domain Title (CADT) were issued within the surrounding area of Lake Mainit namely, CADT 254, CADT 253, CADT 134 and CADT 048 with 53,585.44 hectares covering portions of Kalinawan River Watershed

23. Current land (including water) use:

a) Within the Flyway Network site:

The lake has designated protected fish sanctuaries, fishing ground, tilapia production (aquaculture), source of irrigation, hydroelectric power plant, and ecotourism zone.

b) In the surroundings/catchment:

The specific land uses present adjacent to the lake include built-up area, commercial area, residential area, institutional area, industrial area, parks, playgrounds and tourism, infrastructure utilities, agricultural area such as rice production area, protection and production forest, sand and gravel collection, mining areas, agroforestry, greenbelts and tourism areas.

24. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land (including water) use and development projects:

a) Within the Flyway Network site:

1. **Water Quality Deterioration.** Lake Mainit experienced a massive fish kill for 3 weeks in CY 2015 as reported by the local community. Water quality investigation results indicate that the tributaries were considered “rather dirty to average”. Likewise, total coliform counts build up to 2,534 MPN/100mL which exceeds the limit of DENR standards. There is also a study which says that there is presence of heavy metals within the lake.
2. **Dominance and emergence of invasive species.** This poses a significant threat to biodiversity by altering ecosystem processes to decrease native species abundance and richness thus changing community structure. 50% of macrophytes in Lake Mainit are listed as invasive species. 48% of the freshwater fish species are introduced but most of these have economic importance to the local.
3. **Increasing trend of population.** Increase of population means increase of demand for food while sources are finite. This also demands space for occupation resorting to encroachment to lake shore resulting in the presence of settlement nearby lakeshore as well as agricultural expansion.
4. **Improper waste management.** Solid waste management is also a challenge in the site as improper waste disposal is often observed during AWC. Domestic wastes were dumped in areas near the lake shore. This may affect the aquatic environment through oxygen depletion and nutrient enrichment.
5. **Unregulated resource extraction and degradation such as intensive agriculture, unregulated small scale mining operation.** These socio-economic activities have interconnected impacts to the whole lake ecosystem ranging from soil erosion to water pollution.
6. **Wildlife poaching.** During AWC, there were some locals who were observed to have been carrying poached waterbirds like common moorhen and whistling ducks. If not controlled, this may affect the population of the species in the wild.

b) In the surrounding area:

1. Forest Cover Decline
2. Disturbance of Critical habitats for endemic and threatened species;
3. Commercial and industrial areas
4. Tourism and recreation areas
5. Unplanned/poorly planned development
6. Annual and perennial non-timber crops resulting to conversion
7. Land conversion
8. Agricultural and mining effluents
9. Household/domestic waste

25. Conservation measures taken:

a) List national and/or international category and legal status of protected areas, including boundary relationships with the Flyway Network site:

In particular, if the site is partly or wholly a World Heritage Site and/or a UNESCO Biosphere Reserve, please give the names of the site under these designations.

While Lake Mainit is not currently designated under international conservation categories, significant national and local efforts are in place to protect its ecological integrity and promote sustainable use of its resources. Specifically, it is part of the Mt. Hilong-hilong Key Biodiversity Area (KBA).

On the other hand, one of the municipalities surrounding Lake Mainit namely, LGU Alegria, Surigao del Norte issued ordinances for the conservation, protection and management of Lake Mainit, as follows:

- Municipal Ordinance No. 2020-014, "An Ordinance declaring the 87.037 hectares marshland in Barangay Pongtud, Alegria, Surigao del Norte, as Local Conservation Area and Wildlife Sanctuary of the Municipality of Alegria, and for Other Purposes". Under the said ordinance, there be no cutting, gathering and extraction of flora and fauna within the area regardless of the species, except for some scientific purposes. Biodiversity enhancement is rather hereby imposed simultaneously with the conservation and protection of species endemicity.
- Municipal Ordinance No. 2020-12 series of 2020, "An Ordinance declaring the Mainit Lakeshore Easement within the Municipal Boundary of the Municipality of Alegria as a Wildlife Protected Area"
- Municipal Ordinance No. 01 series of 2002, "An Ordinance Declaring a 15-hectare Lake Area Between Barangays San Juan and Pongtud as Municipal Fish Sanctuary of the Municipality of Alegria, Province of Surigao del Norte"
- SB MSN Municipal Ordinance No. 2003-06, "An Ordinance Amending Zone 1-A Outer Portion of Magpayang River to Ayasangan Creek and Zone 1-B Outer Portion of Tag-ayan Creek to Mayag River and Declaring as Fish Sanctuary All of the Municipality of Mainit, Province of Surigao del Norte"

b) If appropriate, list the IUCN (1994) protected areas category/ies which apply to the site (tick the box or boxes as appropriate, see Annex 3):

Ia ; Ib ; II ; III ; IV ; V ; VI ; N/A

c) Does an officially approved management plan exist; and is it being implemented?:

Yes. There are two existing wetland management plans for Lake Mainit covering the Agusan del Norte and Surigao del Norte. In order to have one holistic plan of Lake Mainit, one of the activities proposed under General Appropriations Act FY 2026 (GAA) as well as the GEF 8 Philippines Flyway Project is the plan formulation for the said lake to be conducted in CY 2026.

If yes, is it being implemented? If no, is one being planned?

Yes

d) Describe any other current management practices:

The Department of Environment and Natural Resources Caraga Region has been conducting the Annual Asian Waterbird Census (AWC) and implementing its site wetland management plans for conservation and sustainable management of the area in partnership with the partner LGUs, academe and other stakeholders.

26. Conservation measures proposed but not yet implemented:

e.g. management plan in preparation; official proposal as a legally protected area, etc.

- Kalinawan River Watershed, formerly known as Lake Mainit Watershed, was proposed as protected area under NIPAS Act (activities for PA Establishment such as PASA,SEAMs and Initial PA Management Plan formation have been undertaken)
- To be listed as Ramsar Site under GEF 8: Philippine Flyway Project
- Collaborative efforts on tree growing activities were conducted in the lakeshore
- Proposed formulation of unified fishery code for the four (4) municipalities;
- Crafting or Amendment of zoning ordinance for fishing and easement

- Reactivation of Lake Mainit Development Alliance (LMDA)
- Strengthen Lake Mainit management and enforcement
- Construction of a Wildlife Monitoring Station cum Visitor and Educational Center

27. Current scientific research and facilities:

e.g., details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

An Annual Asian Waterbird Census has been conducted by the DENR as part of the regular target. Moreover, a total of 21 AWC stations were established in Lake Mainit covering 11 Barangays in the Municipalities of Jabonga and Kitcharao and 10 barangays in the Municipalities of Alegria and Mainit.

Microplastic distribution in the surface water and potential fish uptake in an oligotrophic lake (Lake Mainit, Philippines). Journal of Contaminant Hydrology. https://doi.org/10.1016/j.jconhyd.2025.104603. The research study is about analyzing microplastic distribution patterns in freshwater ecosystems providing critical insights into pollution sources and accumulation zones, contributing to ecosystem health and functioning. Here, the surface water of Lake Mainit, an oligotrophic body of water in the Philippines, and the potential ingestion by *Glossogobius giuris* (15), a local fish species inhabiting the lake, were investigated.

28. Current communications, education and public awareness (CEPA) activities related to or benefiting the site:

e.g. visitors' centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

- Celebration of Annual World Wetland Day
- Bird Watching Observatory Area in Brgy. Alipao, Alegria, Surigao del Norte
- Feedbacking of AWC Results to LGU Alegria and Mainit, all in Surigao del Norte, and LGUs Jabonga and Kitcharao, all in Agusan del Norte
- Distribution of AWC advocacy shirts during census

29. Current recreation and tourism:

State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

Kitcharao Water Recreational Services is operating with their water sports activities such as jetskiing and banana boating.

Local tourists used to do swimming activities in the northern part of the lake. Previously, there were floating cottages on site but were devastated during typhoon Odette.

30. Threats *:

Which of the following threats is present historically – when the threat stopped but the effects are still there (H), currently (C) or potentially (P)?

	Historically	Currently	Potentially
Residential and commercial development			
housing and urban areas		**C**	

commercial and industrial areas		C	
tourism and recreation areas			P
Agriculture and aquaculture			
annual and perennial non-timber crops		C	
wood and pulp plantations		C	
livestock farming and ranching		C	
marine and freshwater aquaculture			P
Energy production and mining			
oil and gas drilling			
mining and quarrying		C	
renewable energy		C	
Transportation and service corridors			
roads and railroads			
utility and service lines			P
shipping lanes			P
flight paths			
Biological resource use			
hunting and collecting terrestrial animals		C	
gathering terrestrial plants		C	
logging and wood harvesting	H		
fishing and harvesting aquatic resources		C	
Human intrusions and disturbance			
recreational activities		C	
war, civil unrest and military exercises	H		
work and other activities			P
Natural system modifications			
fire and fire suppression			
dams and water management/use		C	
other ecosystem modifications			P

Invasive and other problematic species and genes		
invasive non-native/alien species	**C**	
problematic native species		**P**
introduced genetic material		**P**
Pollution		
household sewage and urban waste water	**C**	
industrial and military effluents		**P**
agricultural and forestry effluents	**C**	
garbage and solid waste	**C**	
air-borne pollutants		
excess energy		
Geological events		
volcanoes		**P**
earthquakes/tsunamis		
avalanches/landslides		**P**
Climate change and severe weather		
habitat shifting and alteration	**C**	
droughts		**P**
temperature extremes		**P**
storms and flooding	**C**	

Please write here any additional threats and comments/queries you have on the threats.