Information Sheet on Ramsar Wetlands (RIS)

Categories approved by Recommendation 4.7, as amended by Resolution VIII.13 of the Conference of the Contracting Parties.

Note for compilers:
1. The RIS should be completed in accordance with the attached *Explanatory Notes and Guidelines for completing the Information Sheet on Ramsar Wetlands*. Compilers are strongly advised to read this guidance before filling in the RIS.

2. Once completed, the RIS (and accompanying map(s)) should be submitted to the Ramsar Bureau. Compilers are strongly urged to provide an electronic (MS Word) copy of the RIS and, where possible, digital copies of maps.

1. Name and address of the compiler of this form:

FOR OFFICE USE ONLY.
DD MM YY

Designation date | Site Reference Number

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2. Date this sheet was completed/updated:
5th August 2005

3. Country:
Republic of Kenya

4. Name of the Ramsar site:
Lake Naivasha

5. Map of site included:
Refer to Annex III of the *Explanatory Note and Guidelines*, for detailed guidance on provision of suitable maps.

a) hard copy (required for inclusion of site in the Ramsar List): *yes* √ -or- *no* □

YES: Contour map 1:250,000 showing the lake and most of the catchment.

b) Digital (electronic) format (optional): *yes* √ -or- *no* □

6. Geographical coordinates (latitude/longitude):
Longitude 36° 22′E
Latitude 0° 46′S

7. General location:
Include in which part of the country and which large administrative region(s), and the location of the nearest large town.
Lake Naivasha lies on the floor of Rift Valley, 80 km northwest of Nairobi. The Lake is within Nakuru District of Rift Valley Province with the Naivasha center as the nearest town.

8. Elevation: (average and/or max. & min.)
1890 m above sea level.

9. Area: (in hectares)
30,000 ha
The area enclosed by Moi North Lake Road, the Moi South Road and the Railway line

10. Overview:
Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

Lake Naivasha is a shallow freshwater lake in Kenya's southern Rift Valley. It is fringed by Acacia woodland. The lake is considered to be of recent geological origin, and is ringed by extinct or dormant volcanoes. Naivasha's water is supplied by the permanent Malewa and Gilgil Rivers that drain the Aberdare Mountains in central Kenya. Although the lake has no visible outlet, its water is fresh. It is thought that a combination of underground outflow and sedimentation of salts keeps the lake fresh, unlike other endorheic lakes in eastern Rift Valley. Papyrus *Cyperus papyrus* fringes much of the shore, with variable areas of submerged macrophytes such as *Potamogeton* spp., and floating rafts of the exotic Water Hyacinth *Eichhornia crassipes*. Lake Naivasha is a highly significant national freshwater resource in an otherwise water deficit area that supports a diverse waterbird community and many large mammals. Apart from the invaluable freshwater it also supports large and vitally important economic activities – mainly flower growing, fishing and geothermal power generation. The Lake and its surrounds are fragile with dynamic ecosystems and a yet uncertain water balance in a basin surrounded by intensively irrigated agricultural land and a fast growing township

11. Ramsar Criteria:
Circle or underline each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11).

1 • 2 • 3 • 4 • 5 • 6 • 7 • 8

12. Justification for the application of each Criterion listed in 11. above:
Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

Criteria 1: *A wetland should be considered internationally important if contains a representative, rare or unique example of a natural or near-natural wetland type found within the appropriate bio-geographical region.*
Lake Naivasha is a shallow endorheic freshwater lake (pH of 7.9-8.1) in the semi arid zone in the Eastern Rift valley of Kenya, where most of the lakes are saline. It varies from season to season. This site has three chemically distinct water bodies, a deeper fresh water Crater Lake, sodic Sonachi Lake and slightly alkaline Lake Oloidien, and infringing swamps all supporting unique habitats particularly the fringing papyrus swamp and associated freshwater biodiversity. River Malewa draining into Lake Naivasha has its catchment in the Aberdares escarpment to the east. This is a reliable Permanent River with a large volume of water. This river in combination with underground recharge and discharge play a major role in the biological and physical-chemical characteristics of a freshwater lake Naivasha. The river supports a lot of biodiversity and many ecological functions in the lake, which are very important locally and nationally. The depth has been decreasing over the years due to reduced precipitation, water diversion/abstraction and siltation. The sources of water for the lake include precipitation, river flow and underground seepage. The Site is an important source of water for irrigation, industry, domestic, recreation (tourism) and livestock watering and supports diverse and nationally important economic activities, such as cut-flower production, fishing and geothermal power generation.

Criteria 2: *A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.*
The woodland within the Ramsar Site provides habitat for the globally threatened Grey-crested Helmet-shrike *Prionops poliolophus* (Red List: NT). Another globally threatened bird found in the site is the Basra Reed Warbler *Acrocephalus griseldis* (Red List: EN) a winter visitor and passage migrant whose exact status is unknown. There are regionally threatened species both as regular visitors and residents e.g. Great Crested Grebe *Podiceps cristatus* (critical), Maccoa Duck *Oxyura maccoa* (endangered), African Darter *Anhinga rufa*, Great Egret *Casmerodius albus*

(CITES Appendix III), Saddle-billed Stork *Ephippiorhynchus senegalensis* (CITES Appendix III), White-backed Duck *Thalassornis leuconotus*, Baillon's Crake *Porzana pusilla obscura* and African Skimmer *Rynchops flavirostris* (all vulnerable). Poor fishing methods have damaged and thus reduced the extent of littoral macrophytes and diving birds such as the African Darter. Populations of Hippo *Hippopotamus amphibious* (CITES App. II) are also present at the site.

***Criteria 3**: A wetland is considered of international importance if it supports populations of plant and/ or animal species important for maintaining the biological diversity of a particular biogeography region.*

The riparian, papyrus and littoral macrophyte zones of the site provide safe haven, foraging and breeding ground for many resident and migrant bird species, as well as other wildlife such as the Hippo *Hippopotamus amphibius*, Waterbuck *Kobus defassa* and Buffalo *Syncerus caffer*. The lake itself supports a diverse waterbird community, with more than 80 waterfowl species (over 400 total avian species) regularly recorded during censuses. The fish in the lake form an important food source for piscivorous birds.

***Criteria 4:** A wetland is considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.*

Lake Naivasha is a stopover and a wintering ground for palearctic migrant birds. It has high avifauna diversity including globally important species such as Great Crested Grebe *Podiceps cristatus* (critical), Maccoa Duck *Oxyura maccoa* (endangered), African Darter *Anhinga rufa*, Great Egret *Casmerodius albus*, Saddle-billed Stork *Ephippiorhynchus senegalensis*, White-backed Duck *Thalassornis leuconotus*, Baillon's Crake *Porzana pusilla obscura* and African Skimmer *Rynchops flavirostris* (all vulnerable). The riparian, papyrus and littoral macrophyte zones of the site provide safe haven, foraging and breeding ground for many resident and migrant bird species, as well as other wildlife such as the Hippo *Hippopotamus amphibius* and Buffalo *Syncerus caffer*. In the past the site hosted over 20,000 water birds species, including 21,744 in 2001. it is possible that with further counts criterion 5 may be applied in future.

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13. Biogeography (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation):

Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

a) Biogeographic region: The Lake is representative of a natural or near natural freshwater lake in an otherwise arid area with no significant outlet in the Rift Valley region of Kenya.

b) Biogeographic regionalisation scheme (include reference citation): Its representative of the dispersal area for Red-knobbed Coot *Fulica cristata* and other waterbird species in Kenya's southern Rift Valley.

14. 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.

Origin: It is part of the formation of the Gregory Rift Valley, formed by the Rift Valley tectonic movements.

Geology and Hydrology (geomorphology): Lake Naivasha is situated in a high altitude depression of the Eastern or Gregory Rift Valley- Kenya. There are 3 main geomorphological units in Naivasha, the Mau Escarpment to the west, the Kinangop Plateau (leeward of the Aberdares Mountains) to the east and the Rift Valley plains between the highlands. The upper Pleistocene Gamblian sediments of the Naivasha area are indicative of a larger lake and a wet episode in the history of the region when Lakes Nakuru, Elmenteita and Naivasha were joined as one lake. The shallow closed basin is dominated by Tertiary and Quaternary pyroclastic

and lacustrine deposits. Mixed basalt/trachyte lava flows, pyroclastic, ash and pumice cover the volcanic plain. Obsidian and pumice are abundant in the area around the lake. Sandy clays and clay loams eroding from the wider catchment enter the lake basin from the River Malewa.

The lake level fluctuates considerably and it was only a stagnant pool in the 1880's. The maximum depth of the main basin is 8m on average, but the deepest section, which is part of the Crescent Island lagoon (a crater), is 16m. The water of the Naivasha basin is a solution of predominantly sodium carbonate and bicarbonate. Several factors combine to keep the lakes' water fresh. These include a large percentage of the water being supplied from dilute rivers and rainfall, loss of water and solutes via groundwater seepage, and exchanges with near and offshore sediments and sedimentation of particles to remove solutes. Basic physical-chemical parameters are presented below (main lake):

Water Quality (physical-chemical characteristics)

EC μs cm^{-1}	pH	DO mg l^{-1}	Alkalinity mg l^{-1} $CaCO_3$	Surface temp. ^oC	Secchi (cm)
200 – 350	8.5 – 9.0	5.6 – 8.2	150 – 185	19.5 – 23 (≤ 16)	5 - 150

Weak thermal stratification can occur in the morning but is usually broken by the wind. Visibility is lowest in the north swamp area where suspended sediment is brought in by the rivers. Algal blooms have been observed, albeit infrequently.

The lake is moderately fertile. Concentrations of chlorophyll-a have increased from around 30μg l^{-1} in 1982 to 110 μg l^{-1} in 1988, and reached 178 μg l^{-1} in 1995. Total phosphorus in the lake water appears to have increased slightly to around 100μg l^{-1} since the early 1980s. A long-term trend of nutrient enrichment is likely. The inflowing Rivers Malewa and Gilgil contribute the main part of the external nutrient supply, but sewage effluent from the Naivasha sewage treatment works contributes a significant input as well.

Soil types and Chemistry: The wetland soils are mainly sediments of a former large lake and are influenced by the volcanic origins of the basin rocks and soils. It has been observed that the deposited silt and mud is rich in debris from vegetation and animal material, which show a slow process of sedimentation. The sediment load in the rivers determines the rate of sedimentation. The soils are basically volcanic.

Climate: The Lake occurs within the arid and semi arid climate, with mean maximum temperatures of 26.5^{o}C., and mean minimum temperatures of 16.4^{o}C. per annum. Average rainfall is 600mm per annum. Agro-ecological class Climate influenced by ITCZ with two distinct wet seasons.

15. Physical features of the catchment area:

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

The lake's catchment area is around 2,800 km^2. It receives drainage water from two perennial streams: River Malewa, draining the Nyandarua (Aberdares) Mountains and the Kinangop Plateau (drainage area 1,739 km^2), and the smaller River Gilgil draining the Rift Valley floor from the north (drainage area 420 km^2). River Malewa contributes about 90% of all surface inflows. River Karati is a seasonal source that enters the lake on about 100 days each year, and there are several other ephemeral streams, mostly along the southern shore, that carry storm runoff into the lake.

Other than the water received by two perennial streams (River Malewa and River Gilgil, see below) the sources of water input for the lake include rainfall that occurs directly over the lake and surface runoff. Hydrologically the lake is also a seepage lake with significant input via groundwater. The outflow from the lake is thought to be via underground seepage mainly from the southwestern part of the main basin. Other outputs from the lake are direct evaporation, transpiration from the swamp and water extraction for human use and horticulture.

16. Hydrological values:

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

i. Lake Naivasha is an important reservoir of freshwater that sustains diverse habitats as well as the human activities around it.

ii. The papyrus swamp in the River Malewa delta is very important for reducing the influx of sediments into the lake from the upper catchment particularly during times of flood.

iii. The papyrus fringe around the lake and at the delta is also vital in taking up nutrients from terrestrial or riverine sources thereby minimizing eutrophication and algal blooms.

iv. Shoreline vegetation and papyrus also helps to prevent erosion of the lake edge.

17. Wetland Types

a) Presence:

Circle or underline the applicable codes for the wetland types of the Ramsar "Classification System for Wetland Type" present in the Ramsar site. Descriptions of each wetland type code are provided in Annex I of the *Explanatory Notes & Guidelines*.

Marine/coastal: A • B • C • D • E • F • G • H • I • J • K • Zk(a)

Inland: L • M • N • O • P • Q • R • Sp • Ss • Tp • Ts • U • Va •

Vt • W • Xf • Xp • Y • Zg • Zk(b)

Human-made: 1 • 2 • 3 • 4 • 5 • 6 • 7 • 8 • 9 • Zk(c)

b) Dominance:

List the wetland types identified in a) above in order of their dominance (by area) in the Ramsar site, starting with the wetland type with the largest area.

1. O; 2. M ; 3. Q ; 4. Tp ; 5. L; 6. W ; 7. Ts

18. General ecological features:

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site.

The littoral zone is inhabited by macrophytes that provide suitable habitats for fish feeding and breeding, and mulch for invertebrates. The dominant floating species are *Cyperus papyrus, Pistia stratiotes, Wolffia arrhiza* and *Nymphaea* (water lilies). Submerged plants include *Potamogeton schweinfurthii, P. pectinatus, P. octandrus, Najas pectinata, N. caerulea, Ultricularia reflexa,* and *U. gibba.* The areas of submerged macrophytes vary considerably. Water lilies almost disappeared in the 1980s and this was caused by crayfish and coypu, both introduced. *Salvinia* was a major ecological problem in the 1970s when it covered most of the lake, but biological control by use of *Cyrtobagus salviniae* effectively reduced the weed to insignificant levels by the early 1990's. Water hyacinth was noted on the lake in 1988, but the conditions on the lake are not conducive to its rapid spread. Two host specific biological control agents, *Neochetina bruchii* and *N. eichhornia,* have been introduced and been effective in controlling the weed.

The papyrus is considered the most important plant of Lake Naivasha. It occurs in the shallow water of the lake edge and on land where sub-surface soil is saturated. It almost completely surrounds the lake, forms floating islands on the lake and can be found up to 5 kms up the Malewa River. It acts as an efficient silt and nutrient filter and is capable of recycling excess nutrients. It also supplies large amounts of fixed nitrogen. It forms an important habitat for fish and wildlife such as birds, hippo and buffalo. The amount of papyrus in the lake has varied tremendously as a consequence of fluctuating water levels, fires, and, in some cases, human encroachment.

One hundred and forty three (143) phytoplankton taxa are recorded on the lake. The main zooplankton genera are Cladocera, Copepoda and Rotifera. Twenty eight taxa of invertebrates have been recorded associated with macrophyte beds. *Micronecta scutellaris* is an important component of the diet of fish. The present fish population

is made up of introductions by man: the large-mouth bass (*Micropterus salmoides)*, introduced 1927, 1951 and 1956, *Tilapia zillii* and *Oreochromis leucostictus* (1956), *Gambusia, Poecilia* and *Lebistes*, and occasionally rainbow trout (*Onchorhynchus mykiss*) and *Barbus amphigramma* from the Malewa River. The Louisiana red swamp crayfish (*Procambarus clarkii*) was introduced in 1970 as food for the bass. The fish are a source of food for numerous piscivorous birds such as the fish eagles and cormorants, and also support an important fishery.

The Naivasha Thorn, or Yellow Fever Tree (*Acacia xanthophloea*) is the dominant terrestrial tree species and forms the woodland around the lake. It is an important habitat for birds and other wildlife such as the hippopotamus, waterbuck, buffalo and giraffe.

19. Noteworthy flora:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 12. Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS*.

(i) Papyrus (*Cyperus papyrus*). This the most important plant in the lake ecosystem. It dominates the plant-water ecotone and maintains the ecological character of the lake, through nutrient and silt filtration, and is also an important wildlife habitat.

(ii) Water lily (*Nymphaea caerulea*) used to be a characteristic floating plant on the lake but due to grazing pressure by the crayfish, tilapia and coypu (all introduced) it has been greatly reduced.

(iii) Naivasha thorn (*Acacia xanthophloea*). This yellow-barked tree is the most characteristic feature of the Naivasha area in and around the Site. It also forms an important habitat for the African fish eagle and the grey-crested helmet-shrike and giraffe among other wildlife.

20. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 12. Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS*.

(i) Red-knobbed coot *Fulica cristata*. The lake has been inhabited by thousands of the coot in the past, and it has been the most populous bird species. However due to decline in the extent of submerged plants (which are its source of food), there has been a marked decline in coot population.

(ii) African Fish Eagle *Haliaeetus vocifer* is another characteristic species of Lake Naivasha, but whose population has declined in the recent past due to habitat disturbance and lower transparency of the lake water. The lake acts as a reservoir for Fish Eagles for other areas.

(iii) Pied kingfisher *Ceryle rudis*. It is the only species of Kingfisher that fishes from the hover rather than always from a perch.

(iv) Grey-crested helmet shrike (*Prionops poliolophus*). Globally threatened. Its habitat is almost exclusively the acacia woodland within the site.

(v) Lily trotter/African Jacana *Actophilornis africanus*. Population declined with the reduction of the water lily but it has successfully taken over the water hyacinth although the numbers are lower then previously.

(vi) African darter (*Anhinga rufa*). Regionally threatened. Severely reduced by gill-netting in the lake, it survives in very small numbers.

(vii) Hippopotamus (*Hippopotamus amphibius*). Lake Naivasha contains a relatively isolated hippo population spread throughout the lake, swamp and Malewa River areas. Pressure on the hippo is increasing with developing agriculture, increasing human population and variable lake levels.

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21. Social and 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.

Biodiversity conservation and tourism: Most of the riparian land on the site is reserved for biodiversity conservation, and is an important feeding and breeding area for wildlife and birds. The wildlife takes advantage of the undisturbed papyrus belt and acacia woodland. Some of the larger undisturbed tracts with plenty of wildlife have been made into wildlife sanctuaries. Tourism and recreational facilities in the site are an important foreign exchange earner and employer. The area is popular with weekenders from nearby Nairobi City. There are tourist class hotels, campsites and wildlife sanctuaries. There are boating facilities, sport fishing, bird watching and general pleasure; the bird species richness of the lake is world-famous, and the black bass provides good sport fishing. There is easy access to Hell's Gate and Mt. Longonot National Parks.

Horticultural production: there is considerable intensive irrigated greenhouse floriculture. Kenya is currently the leading exporter of cut flowers (mostly roses and carnations), and Naivasha supplies about 75% of these. There are also numerous vegetable farms supplying both export and domestic markets. The sector employs thousands of Kenyans and contributes significantly to the country's foreign exchange earnings.

Beef and dairy production has historically been a key sector in the area. There are many livestock ranches within the site which utilize the lake's resources for water and grazing.

Fishing: the fisheries sector employs about 1000 Kenyans and provides a source of protein for area residents and others in nearby towns. The important fishery species are *Oreochromis leucostictus*, black bass and crayfish. Over 150 tonnes are harvested annually; it is thought that the catches can be improved by introducing new fish species to exploit untouched niches.

Water supply and sewerage: the thousands of people living around the lake depend on the lake for supply of freshwater for domestic consumption, either directly from the lake or through the urban supply system. The Naivasha Municipal Council draws its water from boreholes and hence from the lake's aquifer. The municipal sewage treatment works is located within the Site and discharges its treated effluent into the lake.

Education and scientific research: Since the 1920s the lake and its catchment have continued to attract individuals and institutions for scientific research because of its freshwater status in a semi-arid area surrounded by alkaline lakes. In particular, the Earthwatch/Leicester University Lake Naivasha Research Project (limnology and ecological studies) has continued annually since 1984, while the ITC of the Netherlands has been studying aspects of hydrology and geology in the lake's catchment since 1996. There are many local and foreign researchers and students who have studied various aspects of the lake and there is also an increasing interest in the Site by school and youth groups. This latter has been pioneered by the Elsamere Field Study Centre which sponsors visits and training for school children and teachers from around the catchment. A number of conservation groups have formed in the area, and their members study the ecosystem structure and particularly the birdlife.

Geothermal power: the Kenya Power Generating Company (KenGen) operates a geothermal power plant to the south of the lake and utilizes the lake's water for drilling and cooling. This plant contributes 45MW to the national grid and employs hundreds of Kenyans. It is in the process of expanding and intends to put a further 64MW into the National Grid in 2002.

Pastoral livestock: for years the nomadic Maasai herdsmen have brought their livestock to the Lake for water when they are in the area enroute to their alternate pasture regions. There is severe erosion along the livestock routes to the lake, and also destruction of the riparian/littoral habitat through grazing and trampling.

Residential: There are many private residences around the lake and also community residential areas, such as the KenGen housing estate and Kasarani trading centre, as well as employee residential areas constructed by the

floriculture/horticulture firms. Many people wish to live near the lake because of the natural beauty thereby increasing the value of the land.

22. Land tenure/ownership:

(a) within the Ramsar site:

The lake and the adjoining riparian land is state owned, but is under the custody and management of the local community that own land contiguous to the riparian area. All land in the Ramsar Site above the 1892.8 m asl (6210 ft) contour is in private ownership. Much of it has been converted into irrigated farmlands, particularly for cut flower and vegetable production for the export market.

(b) in the surrounding area:

The surrounding area is privately owned.

23. Current land (including water) use:

(a) within the Ramsar site:

a. Principal human activities in the Ramsar Site (in order of prominence)

Irrigated floriculture and horticulture. This is the most prominent, particularly greenhouse floriculture. Water is mainly pumped directly from the lake although borehole water is also used. Irrigated agriculture is carried out in private land within and outside the site.

Commercial livestock production (beef and dairy): this sector utilizes natural and cultivated pasture, and lake water for watering. There are 2 milk processing factories in the area.

Biodiversity conservation and tourism. Most of the riparian land around the lake is preserved as wildlife habitat, and a number of landowners have established wildlife sanctuaries. There are many other tourist attractions and recreational facilities, such as tourist hotels, lodges, campsites, boating facilities and a yacht club. Many domestic and foreign tourists visit the area.

Fishing. There are three commercial fish landing beaches on riparian land. Non-motorized canoes and gill nets are used for the commercial fishery.

Residential: Many Kenyans have homes on the private land within the site, either as private, community or company staff residences. The human population living within the Ramsar Site can be estimated at 15,000-20,000. There are many thousands (approximately 40,000) more who work within the Site during the day (particularly in floriculture) but have their homes outside it (within 1 or 2 km).

(b) in the surroundings/catchments:

Small-scale agriculture: mostly small-scale (small-holder) commercial and subsistence cultivation of crops such as potatoes, maize and vegetables. Much of the food supply to the capital city Nairobi comes from this area. Irrigation from the rivers has not been widespread but is increasing. In the middle catchment there are larger (irrigated) commercial farms specializing in vegetables for export and urban supply.

Livestock production: most small-scale farmers in the catchment maintain a few head of cattle, chickens, sheep and goats for domestic and commercial purposes. A lot of milk is produced in the area. In the middle catchment there are larger livestock ranches (both beef and dairy).

Urban developments: there are a number of townships (including Naivasha town itself, Gilgil and Engineer) and other smaller trading/residential centers such as Karagita, Karati and Wanjohi.

Forestry: there are large tracts of state land preserved as both natural and plantation forests, particularly within the Aberdares Forest block and Bahati Forest. These two areas form a very important water catchment area for

the lake, for both surface and groundwater flows. Eburru Forest is another catchment area to the west of the Site, though there is no permanent surface flow to the lake, it is thought that there is subsurface inflow.

The lake's catchment is very large and its population can be estimated at 600,000.

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 Ramsar site:
The Lake and its surrounds are fragile with dynamic ecosystems and a yet uncertain water balance in a basin surrounded by intensively irrigated agricultural land and a fast growing township. Much of the land in the Ramsar Site is in private ownership and has been converted into irrigated farmlands, particularly for cut flower and vegetable production for the export market. It is unusual that such intensive farming is carried out within a Ramsar Site, utilizing the lake's fresh water for irrigation. Water is mainly pumped directly from the lake although borehole water is also used. Increasing human pressures are the major threat to Lake Naivasha. In the last decade the area has seen an extraordinary explosion of horticulture and floriculture for the European export markets. The overuse of water by irrigation farms around the Lake has contributed to the decrease in water volume, as rainfall has not been reliable around the Lake. Intensified cultivation and removal of fringing swamps, the lake's natural water filter has reduced causing increased amount of sediments and nutrients to the lake.

(b) In the surrounding area:
Agriculture and water off-take in the catchments has intensified greatly. Based on observations in recent years, water extraction in the catchments may now exceed replenishment, although no adequate water budget is available. Deforestation in the catchments of the two rivers draining to Lake Naivasha has intensified in recent years. This has significantly reduced the water flow to the Lake. Livestock productions is not a major issue of concern in the catchments, but unplanned stocking rates due to the poor performance of agriculture in the catchments could be a major issue of concern in the near future.

25. Conservation measures taken:

List national category and legal status of protected areas, including boundary relationships with the Ramsar site; management practices; whether an officially approved management plan exists and whether it is being implemented.

Lake Naivasha Riparian Association (LNRA) has been at the forefront in finding lasting solutions to land use conflicts in collaboration with Kenya Wildlife Service (KWS) and other relevant government departments. The Association's membership primarily comprises landowners around the lake, and its objective is to ensure sound environmental management of the lake's natural resources, particularly the need to maintain the quality and quantity of the lake water.

Through the efforts of the LNRA, the Lake Naivasha Management Plan has been developed to guide the conservation of the lake's resources. It has already been approved by government as the official management plan for the Ramsar Site. This plan is dynamic and incorporates sectoral codes of conduct for each of the economic sectors, to ensure that economic production is in harmony with environmental health and safety. The plan is implemented by the LNRA through the Lake Naivasha Management Implementation Committee (LNMIC), which brings together the LNRA and other crucial stakeholders (KWS, Agriculture, Water, Fisheries, Naivasha Municipal Council, KENGEN, Lands, Environment and local administration). The LNRA also initiated and obtained government support for the listing of Lake Naivasha as a Ramsar site (1995). The Association has employed a Monitoring Officer to assist the LNMIC in the implementation of the Management Plan. The conservation strategies currently employed by the LNMIC along the requirements of the Management Plan are:

(i) Preservation of the riparian (shoreline) strip as a critical habitat (ongoing). In particular this involves regular surveys of the state of the papyrus zone, and disallowing the construction of structures or other form of clearance of natural vegetation.

(ii) Use of safe, degradable pesticides, as per the guidelines of the Lake Naivasha Grower's Group and Kenya Flower Council Codes of Conduct (ongoing). This is effected through farm audits.

(iii) Enhanced (collaborative) fishery management. The LNMIC works with the Fisheries Department to monitor fish stocks and help to prevent illegal fishing methods. Currently there is a fishing ban

imposed on the lake to allow for regeneration of the fish stocks.

(iv) Control of introduced species, through information dissemination and networking amongst residents.

(v) Monitoring important environmental indicators (water quality, biodiversity, and weather) in collaboration with Kenya Marine & Fisheries Research Institute, Earthwatch/Leicester University, ITC and Water Dept.

(vi) Forest conservation (ongoing). The LNMIC works with the communities surrounding the forests with the aim of empowering them to take care of the forest as their own.

(vii) Enhancing water use efficiency, particularly by adopting drip irrigation.

(viii) Rehabilitation of the Sewage Treatment Works (ongoing) together with the local council.

(ix) Implementation of the new Environmental Management and Co-ordination Act (1999) within the site, in particular the requirement for environmental impact assessments (EIAs).

26. Conservation measures proposed but not yet implemented:

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

(i) Control of water uptake, first by getting to know how much is abstracted from the lake, rivers and aquifer, and by working closely with the Water Dept.

(ii) Minimizing fertilizer use (promoting organic farming, composting, crop rotation)

(iii) Promoting sustainable tourism (eco-tourism)

(iv) Promoting proper urban planning and development on the part of the Municipal council, as relates to solid waste management, water supply and sewerage, and storm water.

(v) Conservation of the important Aberdares Forest catchment. Being very expansive and in a different administrative region, this has been difficult to implement.

(vi) Encouraging appropriate cultivation practices in the catchment, specifically on-farm soil conservation and agroforestry, terracing on steep slopes, and riverbank protection

(vii) Incorporation of the lake's management plan as an annex of the Environment Act, in order that it can be the legal document guiding the conservation of the lake and its catchment.

(viii) An award scheme for landowners within the Site recognizing adherence to the management plan and good farming and conservation practices.

The LNRA is working on the above but has been hampered by lack of finances. The LNRA's plan initially focused on the Ramsar Site but is developing an appropriate catchment-scale conservation process. Awareness and active participation of residents all around the catchment is an important prerequisite towards the success of the whole process.

27. Current scientific research and facilities:

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

The Earthwatch/Leicester University Lake Naivasha Project has been running since 1984, and currently runs five expeditions annually comprising Scientists, Earthwatch volunteers and post-graduate students (local and international). This project has been studying ecological and limnological aspects of the Site and its catchment. Some of the areas they are interested in include water quality and nutrient dynamics, plankton, invertebrates, macrophytes, fish ecology, birds, terrestrial (Hell's Gate Park) ecology, human influences on the ecosystem and interactions between the surface inflow waters and the lake. This project is ongoing. The lake inventory is largely as a result of their work.

M.Sc. and Ph.D. students from ITC - the Netherlands come out every year for their thesis research, particularly on hydrology and geology of the lake and its catchment. This work is also ongoing.

The LNRA carries out routine monitoring of basic climatic and water quality parameters such as rainfall, river-flow and lake level records, visibility, DO, pH and EC, and occasionally samples for nutrient and pesticide analysis. This work is carried out in collaboration with the Water and Fisheries Departments and Kenya Marine and Fisheries Research Institute (KMFRI). The LNRA has its own weather station and an equipped laboratory has been donated by Royal Dutch Shell.

KMFRI currently has a one-year expedition studying fish stocks, water quality and socio-economic aspects of the fishery in Lake Naivasha. Students from Kenyan universities especially Moi and Nairobi Universities undertake

their thesis research in the Site, but they (universities) do not have a comprehensive research arrangement on the lake (except where researchers and students are allied to Earthwatch). The KWS Training Institute is becoming increasingly interested in the Site as they expand into new training programmes, particularly on wetland management.

The Site has been studied extensively but it is necessary to compile all this information to get the historical trends and the current status of the site in an integrated format. LNRA is the best placed to continue with the monitoring programme. However financial constraints have meant that the programme is not as comprehensive as would be liked.

28. Current conservation education:

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

The Elsamere Field Study Centre sponsors visits by school children to learn about the lake and its catchment and conservation in general. The centre also organizes training workshops for teachers from all over the catchment. The LNRA participates in this process by teaching about the lake's ecology and conservation issues. The LNRA in collaboration with Elsamere Field Study Center organizes field days for schools to mark World Wetlands Day, Environment Day and Water Day annually, and are starting to make school visits to promote the formation of environment clubs. There are several youth conservation groups in the area and the LNRA is working with them to promote education and awareness and enhance their effectiveness in conservation in their areas. There is need to develop and implement a more comprehensive strategy to promote conservation education and awareness, considering the large catchment area and financial constraints.

Kenya Wildlife Service Training Institute has been offering specialized training on wetland management and conservation

29. Current recreation and tourism:

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

The wetland is a very important recreation and tourism area nationally and internationally. The natural beauty of the Site and its biodiversity, particularly birds, are a big attraction to domestic and foreign tourists. There are about three tourist class hotels/lodges and several campsites and home stays. There are at least eight boating facilities around the lake and visitors can go out onto the lake for sport fishing, bird watching, sailing and just for pleasure. Hell's Gate National Park is another attraction to the area. The area is a popular weekend destination for many Nairobi City residents because of easy access. Major recreation being therefore: -

- Campsites.
- Picnic sites:
- Hotels.
- Boating
- Water skiing
- Bird watching
- Scenic beauty

30. Jurisdiction:

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

a. **Territorial jurisdiction.** The Government of Kenya has overall jurisdiction over Lake Naivasha and its riparian land (considering that all other land in the Site is privately owned). Regionally, the provincial administration (the District Commissioner, Nakuru District and his local representative, the District Officer, Naivasha Sub-District) represent the government. The site falls within Naivasha Municipality and therefore Naivasha Municipal Council has local authority jurisdiction.

b. **Functional jurisdiction.** There is no one single government agency with overall jurisdiction over the Ramsar Site. A number of government departments are in control of their sectoral issues: Kenya Wildlife Service (Ramsar, wildlife), Fisheries, Water, Agriculture, and Forest Departments. The Government has delegated jurisdiction to the Lake Naivasha Riparian Association (LNRA). LNRA therefore manages the lake

in partnership with KWS at the national level, and at the regional level in collaboration with KWS, Naivasha Municipal Council and relevant government departments.

31. 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. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the wetland.

Lake Naivasha Riparian Association
PO Box 1011, Naivasha, 20117, Kenya
Tel: (254) 057 21008 Fax: (254) 057 21009 Email: kijabe@net2000ke.com

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scientific/technical references only. If biogeographic regionalisation scheme applied (see 13 above), list full reference citation for the scheme.

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