

## PART - 1

### CHAPTER – I

#### **1.0 SUMMARY OF FACTS**

#### **1.1 INTRODCUTION:**

The Gudavi Bird Sanctuary is located in Soraba Taluk of Shimoga District in the state of Karnataka and is one of the most picturesque and well-known bird sanctuaries of India. It is situated 13 Km away from Soraba town and about 0.50 Km from Gudavi village. The Gudavi Bird Sanctuary was initially notified on 10.07.1989 and subsequently it took its birth as an independent Bird Sanctuary upon final notification on 04.09.2000. The total notified geographical area of the Gudavi Bird Sanctuary is 73.68 ha, of which the sanctuary possesses the water spread area of about 33 ha and is surrounded by moist deciduous forest, interspersed with grassy patches. Gudavi bird sanctuary lies between North Latitude 14° 25' 59 " to 14° 26' 41" and East Longitude 75° 6' 43" to 75° 1' 28 ". In this sanctuary, there are two ponds separated by an earthen bund, which are called as Vaddakere and Gudavi ponds. The catchment area for this sanctuary is mainly agriculture land and other wooded areas. The water from the main catchment area is collected in Vaddakere, from which its overflow goes to Gudavi pond; the excess water from there is used for irrigation at down stream crop lands.

According to the 1971 Ramsar Convention of the IUCN, **wetland** is defined as "areas of marshes, fens, peat lands or water, whether natural or artificial, permanent or temporary with water i.e. static or flowing fresh, brackish or salt, including areas of marine water". India is one of the signatories to the 1971 Ramsar Convention of the IUCN, which has formulated the National Survey of Waterfowls and Wetland Management Policy, 1976 according to which wet land is defined as "areas that are wet for long enough periods such that the plants and animals living in them are adapted to, and often dependent on living in wet conditions for at least part of their life cycle". Wetlands are classified as follow:

- Inundated with water on a temporary or permanent basis.
- Inundated with water that is usually slow moving or stationary.
- Inundated with water that is shallow.
- Inundated with water that may be fresh, brackish or saline.

Birds are the major components of natural ecosystem. They are warm-blooded animals and have reptilian ancestry. Bird bodies are perfectly adapted for flying. They have highly developed eyesight and hearing power, but unable to recognize the smell and perfect taste. Birds are useful in various ways either directly or indirectly to mankind, by controlling harmful insects and cleaning of the wastes. They act as pollinating agents and some birds are used as food. Their guano is an excellent fertilizer. They are the good indicators of ecological status of any given ecosystem.

The study on the diversity of birds inhabiting the Vaddagere and Gudavi ponds, suggests that the physico-chemical and biological parameters of their habitat are the major regulating forces of their population density. It was observed that the seasonal changes in the population of avifauna of the ponds are caused by a complex interaction of some extrinsic factors. The species of 16 orders of birds have been found associated with these ponds. Out of them Ciconiformes, Falcoformes and Passeriformes contribute substantially to the avian diversity of the ponds through out the year. The Anseriformes and Charadriiformes are migratory species who utilize the ponds as foraging ground during winter months. However, the local migrants are found widespread though out the wetland, moving to and fro utilizing the best resources available to them. The Gudavi Bird Sanctuary is known for its bird abundance and diversity. Raghunatha *et al* (1992) recorded 191 bird species. However, Hossetti and *et al* (2004-05) recorded 217 bird species in the Sanctuary and they have been classified into seven groups based on their food preference. Among these bird species 99 were insectivorous, 26 omnivorous, 17 carnivorous, 17 piscivorous, 8 nectarivorous, 21 frugivorous and 19 graminivorous birds.

## **CHAPTER – II**

### **2.0 THE RESOURCE**

#### **2.1 LOCATION:**

The Sanctuary is situated in Gudavi village which is 13 Kms away from Sorab Town of Shimoga district in the State of Karnataka. The nearest town is Sagar which is 41 Kms away and the nearest city is Shimoga which is 115 Kms away. An Airport is coming up in Shimoga city which will be operationalised in a couple of years. The Sanctuary lies between latitude 14° 25' 59 " to 14° 26' 41" and longitude 75° 6' 43" to 75° 1' 28 ".

#### **Distance of places from Gudavi bird sanctuary**

Soraba: 13km

Sagar:41km

Shimoga:115km

Bangalore:375km

Mangalore: 270 km (Present nearest Airport)

#### **2.2 BOUNDARIES:**

The **Gudavi Bird Sanctuary** was preliminary notified vide Government notification No. AHFF-262-FWL-86 Dtd: 10.07.1989 of Government of Karnataka and finally Notified vide Government notification no. FEE-220-FWL-99 Dtd: 04.09.2000. The boundaries of the sanctuary are as follows.

**NORTH:** Tank bund and Hiduvaly Sy.No. 199, 201, 211, 71 & 204 of Gudavi Village.

**EAST** : Gudavi Road and Hiduvaly Sy.No. 55 and 64 of Kallambi village.

**SOUTH** :Sy.No. 54 & 55 of Kallambi village, fenced with stone pillars and barbed Wire.

**WEST** : Hulemardi Road & Hiduvaly Sy.No. 182 fenced with barbed wire & stone Pillars.

### **2.3 GEOMORPHOLOGY:**

The area is plain. Out of the total area of 73.68 Ha of the Sanctuary, 30 Ha is the water spread area. Remaining area is covered by moist deciduous forest species interspersed with grassy patches.

### **2.4 GEOLOGY AND CLIMATIC FEATURES:**

#### **a. Soil:**

Soil is deep and lateritic in origin .The climate is generally tropical.

#### **b. Rain fall:**

The South West monsoon brings most of the rains, commencing in June with interruption and continues till September. The average rainfall of the area is 1500 mm.

#### **c. Wind:**

The two monsoonal winds which blow over the sanctuary are:

South Westerly wind during June to September.

North Easterly wind during September to December.

#### **d. Temperature:**

Three distinct seasons are prevalent in the sanctuary viz. dry, wet and cold seasons. The cold season start from December and lasts up to February. The hot season starts from March and lasts up to May. The minimum and maximum temperature recorded in the sanctuary area 15° C and 38° C respectively.

### **2.5 NATURE AND DISTRUBUTION OF SOURCE OF WATER:**

The source of water impounding the sanctuary's water tank is from the monsoonal run off from the surrounding catchments areas. The average annual rainfall in the area is about 1500 mm. The Western portion of the Tank in the Sanctuary gets dried up due to evapo-transpiration during summer and the eastern portions get dried up only when the water is drained out for Agriculture purpose. A project proposal is on pipeline for lifting water from Varadha, river to

the tank and then channeling the excess water for irrigation purpose, but the proposal has yet to take a final shape.

Since major amount of the stored water in the tank is drained out by the farmers for irrigation purpose, the upper Vaddekere pond gets dried up in the month of February itself. The lower Gudavi tank has some water even during April and May months.

The Gudavi wetland vegetation comprises marshy plants, and microphyte biota, which are the attraction for the migratory birds. The trees and shrubs which are partially submerged provide best trends in wildlife biodiversity conservation and management due to suitable nesting grounds for birds. These nesting sites also provide the highest security from the predators. Usually four species of the marsh plants are commonly noticed. They are *Vitex leucoxylon*, *Kirganelia reticulata* and *Phyllanthus polyphyllus* and *Terminalia sp.*

## **2.6 SOURCE OF INFLOW AND OUTFLOW OF WATER IN QUANTITATIVELY TERMS:**

The source of inflow and out flow of the water as per the minor irrigation department is as follows.

Ach cut	-	58.29 Ha.
Waste weirs	-	2 Nos.
Main channel	-	2 Nos- lengths 2 Km, Achcut -38.29 ha.
Sub channel-		(Feeder channel) 0.50 Km., Achcut - 20.00 Ha.
Storage capacity of the tank	-	9.14 MC Ft.

## **2.7 COMPOSITION AND CONDITION OF THE VEGETATION:**

### **Flora:**

The sanctuary was, once a part of vast extent of the dense moist deciduous forest. However, the forest cover has now been cleared in low lying areas to make way for paddy cultivation. At present the sanctuary is surrounded on its eastern and southern sides with open moist deciduous forests. *Vitex leucoxylon* and *Phyllanthus polyphyllus* bushes are the most dominant vegetation types, contributing to nearly 95%

of the plants found in the water spread areas. The birds use five major varieties of plants for nesting. They are as follows.

1. *Vitex leucoxydon*.
2. *Kiranganelia reticulata*.
3. *Phyllanthus polyphyllus*
4. *Ficus lacur*.
5. *Terminalia spp.*

### **Fauna:**

### **Birds:**

About 191 species of birds were sighted by a bird watchers study team which included 63 species of birds that are totally or partially dependent on wetlands. Out of these, 20 species were observed breeding in this Bird sanctuary. Among these, 10 bird species breed in the heronry. Three more species breed in and around the sanctuary area.

### **2.8 CHANGES IN THE BIRD SPECIES COMPOSITION:**

The number of species observed at Gudavi Bird Sanctuary showed changes in different months. The highest number of species is observed during October, with the least no of species in July. However, the maximum number of birds is observed in monsoon only. The main bird species that nest here are White ibis, Egrets, Cormorants, Snake birds (Darters), Spoon bills, Herons and Ducks which gather in thousands during the period. August to September is the ideal season for visitors.

### **2.9 SEASONALITY OF NESTING AT HERONRY:**

Nesting commences with the onset of monsoon i.e. during June and the activity continues till November. Egrets, Cormorants, Darters and Purple Heron are the first to construct their nests in the month of June , followed by White ibis and Night heron in July and lastly by Spoon bills in the month of September. By the end of November

nesting of all the birds ceases and by the end of first week of December all the birds are found to abandon the heronry. By the end of December none of the breeding birds are to be seen at the upper part of Gudavi Bird Sanctuary.

Winter visiting birds, start arriving at the sanctuary during August and leave during May onwards. Common sand piper is the first to arrive during August and Stern gold plover is the last to arrive during April.

**a. Fishes:**

There are varieties of fishes that exist in the Gudavi bird sanctuary which are yet to be enlisted and studied. Apart from fishes, several invertebrate fauna serve as food for birds.

**b. Reptiles:**

There are many turtles, Lizards, Snakes and other varieties, existing in the tank, which are yet to be enlisted and studied.

**c. Mammals:**

Hares, Deer, Wild boar, jackal and Rats the mammals existing in the bird sanctuary.

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## CHAPTER – III

### **3.0 BACKGROUND INFORMATION:**

#### **3.1 Legal status:**

Gudavi Bird Sanctuary was notified vide Government OrderNo.AHFF:262 /FWL: 86 Dated 10.07.1989 under section 18 of Wildlife protection act 1972 (**Annexure – IV**). The total area of the Sanctuary is 73.68 Ha, out of which about 30 Ha is covered with water, i.e., Gudavi tank. Previously, it was under the management of Irrigation Department. The remaining area is with sparse growth of moist deciduous tree species. The final notification was issued vide GO. No. FEE 220 FWL 99 Dated 04.09.2000 as “**Gudavi Bird Sanctuary**”(GBS).

#### **3.2 Regional Analysis:**

Gudavi Bird Sanctuary is surrounded by paddy fields on North, West and Southern sides and dry land on North and Eastern sides. There are three adjacent villages to GBS, namely Hullemaradi, Gudavi and Kallambi with a population of about 3000. Majority of the population are agriculturists. The Sanctuary water, particularly in Gudavi tank is being used for Agriculture, washing cloths and bathing of animals. Grass and firewood collection is banned in the Sanctuary. The Vadagere tank is having 95 % of the bird population.

#### **3.3 External Threats:**

##### **a. Encroachments:**

About 8.00 ha of the Sanctuary area has been encroached upon. Action is being taken to evict the encroachment. To avoid further encroachment, the protection measures proposed are discussed in detail under the future activities section.

##### **b. Flood and wildlife:**

Although, the general breeding season is from June to November still some individual variations are recorded sometimes. Among the mortality factors floods takes the major toll of all the nests and the eggs. Species particularly, susceptible to flood damage are the Egrets which nest very low. Although, the Black headed

Ibis and Night Herons nest low, they escape the extensive mortality due to floods because of its protracted breeding season. Another problem is predating of eggs by the monkeys and the major victims are the Black headed Ibis and Egrets.

**c. Denudation of catchments area leading to siltation:**

It is felt desirable to de-silt the tank, so that more quantity of water is being stored. The quantum of desiltation has been discussed in detail under the future activities plan.

**d. Prolific growth of obnoxious aquatic weeds:**

There is a need to remove the aquatic weeds in the wetland. There are floating and other kinds of weeds existing in the tank, which have to be removed periodically, so as to keep the water clean. The following varieties of aquatic weeds exist in the wetland.

<b><u>Species</u></b>	<b><u>Habitat</u></b>
<i>Caldesia arnesifolia</i>	Open water
<i>Pistia storiotos</i>	Open water
<i>Najas Indica</i>	Open water
<i>Nymphoides interrupta</i>	Open water
<i>Symphoides cristata</i>	Open water
<i>Aponogeto echinatus</i>	Open water
<i>Marselia quadripartite</i>	Open water
<i>Salvia species</i>	Open water
<i>Azolla species</i>	Open water
<i>Lemna species</i>	Open water
<i>Asterocantha longifolia</i>	Water edge
<i>Limnophila graviorodes</i>	Water edge
<i>Nymphia nouchalir</i>	Water edge
<i>Chyptocoryne spiredis</i>	Water edge
<i>Polygonum plebejum</i>	Water edge
<i>Crinum asiatica</i>	Water edge

e. **Gully control:**

Rill and sheet erosions are noticed in the Sanctuary. To control soil erosion it would be expedient to construct series of gully checks coupled with planting of Agaves, grass and other soil binding vegetation.

f. **Bunding:**

To establish habitat diversity, a bund across the Gudavi tank is necessary to create a second heronry. The purpose of the second heronry is to improve and supplement the carrying capacity of the first heronry, as there is pressure during peak season on the first heronry. The existing trees may be maintained and improved upon. Some more local species plants may be planted that are useful to birds for nesting and breeding. The existing bund may be maintained and improved on regular basis.

**3.4 Past History:**

The Actual date of construction of the tank is not known. According to the villagers, it could be more than 200 years old. A stone inscription on the bund indicates that the strengthening of the bund was done during 1940. Previously, capturing of birds and collection of eggs were rampant and were sold in the local markets. Now, with the status of Bird Sanctuary this practice has been stopped.

**3.5 Timber Harvesting:**

Villagers were collecting fire wood and small timber previously from this area. But it has been stopped now after the area is declared as Bird Sanctuary.

**3.6 Tourist and Tourism Development:**

The **Gudavi Bird Sanctuary** though small in size and located at a far of distance from the main cities is one of the best bird sanctuaries in the State. It has been rated as one of the best ten heronries in the country. The Sanctuary attracts visitors from all walks of life, but main visitors are the students, scientific

community and nature lovers. The nature and season of bird nesting and breeding in the Sanctuary is confined for about six months i.e. from end May to end of November unlike other sanctuary wherein the tourist flows round the year. However, the annual flow of tourists or visitors is about 5000 which is a considerable number. The total annual revenue of the bird sanctuary is about Rs 25,000.00. The conservation of birdlife and its habitat are the primary objective of the Sanctuary. Although, it is strongly felt that such conservation measures need to be publicized for creating awareness among people and with the improvement of infrastructures in the Sanctuary, the number of general visitors as well as the eco-tourists will shoot up which will thereby increase the number of people who will appreciate such efforts apart from higher revenue collection.

The Sanctuary offers ample opportunity to tourists specially bird watchers and nature lovers. The bird sanctuary is at a distance of 15 Kms from Sorab town. The road connecting the sanctuary of 15 Kms is asphalted and local buses also ply regularly. The bus timings are written and fixed in front of the main gate for the knowledge of the visitors.

In GBS, three Paragolas and four Manchans have been constructed for accommodating visitors for their rest and bird watching. A small Canteen building is also constructed. A bore well for Drinking water supply is made for the visitors. Thus, all the basic amenities are provided to all the visitors and bird lovers. Five small watch shelters have been erected by the department for bird watching. Boating facility is provided for the visitors in the buffer and peripheral zone without disturbing the visiting birds. There is a camping facility also which needs to be upgraded. There are five tent bases in the public utility area of GBS which needs to be improved for stay of students and researchers. An Interpretation center has been constructed which will have the information on the wetland birds visiting Gudavi as well as the flora of the area.

### **3.7 HYDROLOGICAL MEASURES:**

There is a tank near by Kallambi village which is the main water source to the wetland. The Kallambi tank gets filled with rainwater and excess water flows to the wetland. The route of these water courses from Kalambi village to Vade gere tank along with the other water courses have to be strengthened by constructing gully checks, and revetment. Planting of Agave and Khus grass will also help to control the gully formation and silting of the wetland.

### **3.8 POLLUTION CONTROL MEASURES:**

There are no Industries in and around the wetland. Paddy fields and Areca gardens surround the wetland. Since the wetland is situated away from the major townships and major roads, industrial pollution is not noticed. However, the paddy growers and areca nut growing farmers in the catchment area use pesticides and fertilizers the residue of which flows in to the tank and contaminates the water, which influences the aquatic plants, fishes and birds also. Hence, there is a necessity of study of these pollutants. The faecal matter of the birds, rich in organic matter and phosphates is also responsible for water pollution.

### **3.9 SOCIO- ECONOMIC DEVELOPMENT THROUGH COMMUNITY PARTICIPATION:**

In order to enable community participation in the management of GBS it is proposed to form an eco development committee in Gudavi Village. The local people will be involved in Eco-tourism during the season. Interested educated youth will be encouraged and trained in hospitality and as guides for explaining the tourists about the birds and the wetland ecosystem. They will also be encouraged to run the existing canteen during the tourist season with some initial support from the department as seed money.

### **3.10 MONITORING AND EVALUATION:**

No studies have been made on the water quality and pollution by any agency till today. The scientific research studies on these factors coupled with environmental impact analysis, with correction measure factor will be done with assistance of Applied Zoology Wildlife Science, and Environmental Science of Kuvempu University, B.R. Project.

### **3.11 PATROLLING AND SURVEILLANCE:**

At present there is no permanent Forest guard post in the GBS. A post needs to be created for GBS so that the daily maintenance and management becomes easy. There is one day and one night watchmen present who have been kept on daily wage basis. During season a boat driver is hired on daily wage basis from the Gudavi village for running the pedal boat. These daily wage staff patrols in the area and keep a vigil on the nesting birds.

### **3.12 PUBLIC AWARENESS AND EDUCATION:**

Nature Camps and Awareness camps are conducted in the Gudavi Bird Sanctuary for general public and school and college students periodically. The importance of birdlife, environment and ecosystem is explained to the participants along with audio-visual display and distribution of brochures and posters. Local NGO's, peoples representatives etc are also involved for this purpose.

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## CHAPTER - IV

### **4.0 SANCTUARY ADMINISTRATION**

#### **4.1 STAFF:**

At present there is no permanent staff in the bird sanctuary. The sanctuary is being managed by one day and one night daily wage watchers under direct supervision of Range Forest Officer, Kargal Wildlife and Assistant Conservator of Forests, Sharavathi Valley Wildlife Sanctuary Sub-Division, Kargal. For better protection of the habitat and population of birds & Wildlife in the Sanctuary the services of at least one Forest Guard is required.

#### **4.2 BASIC AMENITIES TO STAFF:**

There is a watchers house in the GBS. The area has electricity connection and a bore well has been dug for the water supply in the utility area. There is a Ticket counter cum watchman shed at the entrance of the bird sanctuary.

#### **4.3 FUNDING:**

At present the financial help for GBS is availed from State/Central Government funds only through centrally sponsored schemes. However, during 2008-09 the tourism department has supported some of the developmental activities for GBS. Part of the total allocation from tourism department is expected to be released during 2009-10 also.

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## PART – 2

### **CHAPTER – V**

#### **5.0 GENERAL PLANNING**

**Gudavi Bird Sanctuary** (GBS) is one of the important bird sanctuaries of Karnataka, which attracts a large number of inland and migratory birds. The Sanctuary has a big Water-basin (Tanks) which has suitable tree species for birds' habitation. In spite of severe biotic pressures the sanctuary is able to provide habitation to a very huge bird population.

Desilting and bund consolidation work has to be carried out to improve the habitat further for birds and to make bird-watching more convenient for visitors. Special attention needs to be given, for de-weeding of Vaddagere tank on an annual basis. Weeding of both Vaddagere and Gudavi tanks has to be done along with consolidation of many more islands. The local plant species preferred by the birds for nesting like Vitex leucoxydon, Kiragnelia reticulata and Phyllanthus polyphyllus need to be planted on the islands. Publicity and more facilities like logistic, transport, Nature camps, information material, books etc., are to be provided. Since some birds depend on fish in the tanks for their food, leaving fish fingerlings in the tank helps in additional food source for the birds.

#### **5.1 SPECIFIC AREA OBJECTIVES :**

The specific objectives of the management for the sanctuary are;

- a. To protect the sanctuary to the fullest extent possible, so that many endangered and endemic flora and fauna inhabiting in the area are adequately protected and propagated.
- b. To create awareness among the people, regarding the need to protect nature in general and the bird sanctuary in particular.

- c. To maintain and develop the bird sanctuary, to the extent considered necessary, for tourism, recreation, and more importantly education and scientific exploration.

## **5.2 BOUNDRIES DEMARCATION:**

The Sanctuary is surrounded by private lands on three sides and tank bund on one side. The farmers adjacent to sanctuary grow paddy, arecanut, Ananus crops. The boundary of the sanctuary has been demarcated and boundary stones are fixed. Most part of the Bird sanctuary boundary is covered by chain link mesh.

## **5.3 ORGANISATION AND ADMINISTRATION:**

The Gudavi Bird Sanctuary is headed and managed by Deputy Conservator of Forests, Wildlife Division, Shimoga. It forms part of the Kargal Wildlife Sub-division and Kargal Wild lifeRange.

The Statement showing the existing and proposed staff pattern of Gudavi Bird Sanctuary is given below.

S.No.	Staff	Existing Staff	Proposed staff
1	Assistant Conservator of Forests.	1	1
2	Range Forest officer	1	1
3	Forester	-	-
4	Forest Guard	-	1
5	Permanent Forest Watcher	-	1
6	Daily wage watchers	2	4 (2 Day and 2Night)

#### **5.4 Buildings:**

The buildings present at GBS are watchers quarter, two RCC watch towers and one iron watch tower, an interpretation building, two pergolas, a canteen building, two common toilet blocks and five tent bases. An RCC foot bridge has been constructed for a going round the heronry in a circuit as during monsoons the area gets inundated with water.

It is proposed to construct a residential quarter for a guard if posted or sent on deputation. A new RCC watch tower for better bird viewing and a small ticket counter at the other entry from Chandragutti side road is required and will be proposed in future plan. There is a need of a small inspection hut as the area is far away from the office head quarter.

The five tent bases need to be upgraded. A dormitory tent is also proposed for bird watcher groups. There is a need to form a parking area, children activity area and a dining pergola. Provision of outdoor benches and waste bins needs to be made. The interpretation building needs to be furnished with information.

#### **5.5 Vehicles, Arms and Ammunitions:**

There is one jeep under the control of Assistant Conservator of Forests, Kargal and one jeep with Range Forest officer, Kargal.

For effective prevention of poaching activities in the sanctuary, arms and ammunition need to be provided to the Range Forest Officer. It is proposed to provide Arms and Ammunitions as below.

Sl. No.	Particulars	Total requirement	Present requirements
1	Riffles	1	1
2	D.B.B.L.	1	1
3	Cartridges	100	100
4	Wireless	2	2

## **5.6 Roads:**

The sanctuary has 14 Km approach road connecting the public road between Soraba and Chandragutti. The roads need to be metalled and asphalted for better communication. A length of 6.5 Km of road has been formed within the sanctuary. Few farmers are presently using the sanctuary road and passing through the middle of the sanctuary utility area. Proposal to make an alternate road on the boundary will be made in the plan.

## **5.7 HABITAT MANAGEMENT OBJECTIVES:**

Aquatic plants and trees support a greater diversity of birds. The diversity of bird is directly related to the aquatic plant diversity, which provides a very large number of roosting, nesting, feeding and breeding sites. The natural vegetation is getting depleted due to the increased agricultural activities around the Sanctuary. The submerged, emergent, floating macro-phytic vegetation plays an important role in supporting the wetland avifauna. However, the gradual usage of water for agricultural field is causing some damage to wetland and wetland dependent birds. Hence, the following short and long term objectives have been set for managing the Gudavi Bird Sanctuary.

### **5.7.1 SHORT TERM OBJECTIVES:**

The short term objectives are listed as follows.

- a) Eviction of encroachment.
- b) Desilting of tank so that more water can be stored.
- c) Removal of aquatic weed, to improve the quality of water.
- d) Protection measures for poaching of birds, stealing of eggs, causing disturbance to birds, etc.
- e) More facilities to the visitors, such as Signage's, canteen facility, toilet facility, watch towers, parking, children activity area, outdoor benches, waste bins etc.
- f) Proper Chain link fencing all-round the periphery.

- g) Providing an alternate road for the villagers to go to their fields and closing their movement from inside the public utility area of the sanctuary.

The above requirements are essential for the improvement of the existing wetland management.

### **5.7.2 LONG TERM OBJECTIVES:**

1. The tropical status of the wetland could be assessed by evaluating its physico-chemical characteristics.
2. The data obtained on physio-chemical characteristics would help to formulate the control measures and monitor the impact of human activities on biological diversity of the water body.
3. The study is helpful to find out the source of pollution, and inter-relationship between different chemical parameters.
4. Formulate the measures based on the study to improve the condition of the water bodies to make them pollution free and to restore them for wetland birds.
5. To study the present status and diversity of wetland water fowls.
6. To study the impact of physico-chemical parameters on water fowls.
7. To identify the aquatic plants which are helpful to aquatic birds.
8. To identify and conserve plants, where the water birds build their nest.
9. To identify the anthropogenic impacts, such as reclamation of wetland for different uses and over exploitation of wet land resources.
10. To give the necessary suggestion for the better habitat management of the wetland birds.
11. To study of possible methods of harvesting the aquatic weeds and suggestion for the potential uses for harvested materials.

## **5.8 STRATEGIES FOR ACHIEVING THE OBJECTIVES:**

### **5.8.1 Management action plan:**

#### **a. Survey and demarcation:**

Survey, demarcation and consolidation of boundary have been done during the year 2003-04. Boundary stones were erected all along the boundary. Digitization of the map of GBS needs to be done.

#### **b. Removal of encroachment:**

There are about 8.00 ha of encroachment made by the local farmers inside the sanctuary. The encroachment has been shown in the map and action has been initiated to evict the encroachment.

#### **c. Fencing:**

Boundary consolidation work has been completed by erecting the stone pillars. About 240 mtrs of chain link mesh has been fixed in the western side of the sanctuary, with the available funds. There is still balance area to be covered by chain link fencing which is proposed in this plan.

### **5.8.2 Watershed Management:**

#### **a. Vegetative control bunding:**

Soil erosion has to be controlled by construction of gully checks. Series of gully checks are proposed to avoid soil erosion. Planting of Agave and grass are proposed.

#### **b. In situ and ex-site conservation of threatened species:**

After the scientific studies carried out by the experts and institutions and based on their recommendation, the program for in-situ and ex-situ conservation of threatened species has been taken up. A nursery has

already been started to propagate the locally available plant species preferred by the birds for nesting.

**c. Integrated conservation strategies for management:**

The integrated conservation approach shall be taken in the line involving all the allied departments like Panchayat Raj Institution for improvement of approach road, minor irrigation department for recharging and replenishing of the Sanctuary's water bodies, veterinary and animal husbandry department for the development of cattle and animal health etc.

**d. Developing appropriate bio-technologies for utilization of biodiversity components, which are ecologically sound and economically sustainable:**

Systematic study and investigation of any biological resources, use of biological system, living organisms or derivatives thereof in the Sanctuary to make or modify products or processes for any use and development of appropriate biotechnologies and their application shall be made with the participation of the reputed institutions and local persons. Fair and equitable benefit sharing will be made among the conservers of biological resources, their byproducts, creator and holder of knowledge and information relating to the use of such biological resources, innovations and practices associated with such use and application in a manner that is ecologically sound and economically sustainable without frustrating the present and future generation.

**e. Identifying indicator species to assess the health of wetland conservation:**

The sanctuary was, once a part of vast extent of the dense moist deciduous forest. However, the forest cover has now been cleared in low lying areas to make way for paddy cultivation. At present the sanctuary is

surrounded on its eastern and southern sides with open moist deciduous forests. *Vitex leucoxylon* and *Phyllanthus polyphyllus* bushes are the most dominant vegetation types, contributing to nearly 95% of the plants found in the water spread areas. The birds, for nesting, use five major varieties of trees/shrubs. They are as follows.

*Vitex leucoxylon.*

*Kiranganelia reticulata.*

*Phyllanthus polyphyllus*

*Ficus lacur.*

*Terminalia spp.*

**f. Profile growth of aquatic weeds:**

The weed species are abundant in Gudavi Bird Sanctuary. The two major floating weeds species viz. *Pistia storiotis* and *Salvinia natans* are causing problems in the water tanks and require frequent removal so as to maintain quality of the wetland. Weeding should not be complete and in entire area because such an effort may also be detrimental to the nesting birds for their feeding and breeding. This should be done in patches considering the extent of area that has been infested with these weeds.

**g. Water quality:**

Gudavi bird sanctuary comprises two wet lands connected in series. They are Vaddakere and Gudavi proper. The out flow of water from Vaddakere enters in to Gudavi, from there it is used for crop irrigation at the down stream crop lands. The evaluation of water quality has revealed that the Vaddagere water is slightly polluted. Such polluted water from Vaddagere and Gudavi pond being economically exploited for irrigation has been already in practice in the area. The study has also revealed that the Gudavi pond water is not suitable for domestic consumption.

**h. Temperature:**

The water temperature was around 25.8° C in Vaddakere and Gudavi. It was always 1° less than ambient temperature, the temperature around 15° to 30° C is found to be suitable for algal productivity. The prevailing temperature in the ponds studied, triggered the growth of algal photosynthesis, which in turn enhances, the fish productivity in these ponds. The fishes are the main food for most of the birds of the sanctuary.

**i. pH :**

The pH values varied around  $7.2 \pm 0.2$ , and  $7.4 \pm 0.2$  in Vaddakere and Gudavi water samples respectively. The water is found acidic during September and October in the ponds Vaddakere and Gudavi. However it remains alkaline in later parts. Since the enzymes are pH dependent, most metabolic activities are influenced by pH variations. Hence, it is essential to maintain alkaline pH or around neutral to support sustainable productivity.

**j. Dissolved Oxygen (DO):**

Dissolved oxygen is a vital factor used in qualifying water quality. Carps will not survive if the DO falls below 4mg/L, but presently DO was found always above 5mg/L, the DO values supported all types of fishes and food sources for birds. The reduced DO level in Vaddakere ponds reveals that the water is polluted by oxygen demanding materials. i.e. bird number in more than 14000 reside in Vaddakere. They discharge their excreta, due to which uric acid and other organic substances present in the bird excreta might be responsible for the depletion of DO.

BOD or biological oxygen demand is an indirect measure of organic load present in any aquatic system. At present, the study of BOD values is 25.2 and 9.9 mg/L respectively. The highest pollution in Vaddakere pond is due to discharge of fecal matter by large no of birds. Comparatively high

BOD in Gudavi tank may be due to reason that the water from Vaddakere enter in to Gudavi tank and gets diluted and hence, low BOD is recorded. Another reason is that human activity like washing and bathing in Gudavi pond is also responsible for the increased BOD values. The study on BOD level on the water sample of the two tanks revealed that, it is necessary to reduce the BOD level by artificial management. This can be done by removing the sediments during summer months. Another way is to manage the retention time of the water in the pond.

**k. CO<sub>2</sub>:**

The carbon dioxide level was 58.7 and 41.5 mg/L recorded in the wetland. Highest CO<sub>2</sub> was recorded in the pond when the water was acidic in the months of September 1999 to October 1999 in Vaddakere and Gudavi ponds. Relatively higher amount of CO<sub>2</sub> is recorded in all the ponds. This indicates that, there is no proper aeration in these ponds. It also indicates that, these ponds are filled with large amounts of sediments. The bacteria and fungi living in these sediments under take decomposition process and are responsible for the production of high amount of CO<sub>2</sub>. CO<sub>2</sub> is also produced during decomposition of organic substances and by respiration of organisms.

**l. Chlorides:**

Chlorides are generally considered as nutrients. Presence of high level of chlorides indicates that the water is polluted. The chloride level was 57.4 and 62.9 mg/L respectively. In drinking water chloride is around 20mg/L. In contrast to this, the two ponds showed chloride three times more than drinking water levels. Such high levels of chloride, perhaps originated from agricultural activity. Large amount of fertilizer and manures used in agriculture might have percolated in these ponds. The faecal discharge of birds is responsible for the increase in chlorides in Vaddakere. Chlorides are antibiotic in nature and presence of large amount of chloride is lethal

to pathogenic bacteria and chloride around 20mg/L is considered to be favorable for fresh water community. However, chloride itself along with phosphate and nitrates makes the water eutrophic.

**m. Calcium:**

Calcium was 23.0 and 23.9 mg/L respectively. The levels of calcium in all these ponds are comparable. Under high chloride levels the impact of calcium ions is yet to be studied. In fresh water ponds relatively high levels of calcium in all the ponds may be originating from the soil. Calcium is a micronutrient required for all organisms for metabolic activities.

**n. Phosphates:**

These are important macronutrients essential for plant growth. It was 2.70 and 1.16 mg/L recorded respectively. It was within irrigation standard in Gudavi and it was very high in Vaddakere pond. Higher level of phosphates is originating from excreta, discharged by the birds. Due to this particular reason the Vaddakere pond became eutrophic. The eutrophic nature of the pond is evidenced by large growth of floating hydrophytes. Due to availability of plenty of phosphates and other nutrients, the hydrophytes grow and occupy large surface area in the pond. Due to this reason the light penetration is obstructed, and a low level of oxygen was recorded in such place in Vaddakere tank.

**5.9 ECO-TOURISM MANAGEMENT:**

In the present scenario, the eco-tourism is one of the fastest growing segments in tourism industry which can contribute substantially in creating awareness among people about the environment conservation. Eco-tourism is a responsible travel to natural areas that conserves the environment and sustains the well-being of people. The basic **Eco-tourism** should enshrine **Eco-education** and **Eco-development**.

The following are the objectives of tourism management in the sanctuary.

1. To spread the message regarding the need to preserve all forms of fauna and flora mainly birds to enable the public to see and appreciate the rich heritage of the sanctuary.
2. To educate and seek cooperation of the people living nearby sanctuary area regarding the need to maintain such sanctuary.
3. To influence on the minds of the children to love all forms of birds and Wildlife and need for conservation of natural resources.
4. General Tourism to be minimized and visitors to be oriented towards concern for nature conservation and bird watching.
5. Projecting eco-Tourism as an eco-education tool.

#### **5.10 PUBLICITY:**

To popularize eco-tourism, publicity and propaganda has to be carried out in a systemic and well planned manner. Publicity material like brochures, posters etc., need to be printed. Attractive Signage's need to be put at strategic places for inviting tourists to GBS. A calendar of programs for conducting nature camps and study tours to be prepared and implemented. An international standard documentary film needs to be made which will help in spreading the message of conserving such beautiful feathered gifts of nature.

#### **5.11 PEOPLE AWARENESS PROGRAMME:**

To achieve the objectives of Wildlife management, it is necessary to involve the people and enlist their co-operation and active support for the purpose of protection and development of sanctuary. Nature education camps and study tours will be conducted for school children, rural youth and teachers. Conducting video and film shows at villages and schools about birds and Wildlife to improve the knowledge of the students and youth about nature conservation.

#### **5.12 FIRE PROTECTION:**

Fire protection works are being taken up in the sanctuary every year. Fire line clearance will be carried out in and around the sanctuary. A strict vigil will be kept

through engaging fire watchers during the fire season so that no incidence of fire occurs in the area.

**5.13 FUNDING:**

Funds are being received in the GBS through the centrally sponsored schemes, Lake Development Authority and state Tourism department. As such there is no scarcity of funds and the sanctuary can be managed well if funds keep flowing from the above schemes regularly. The budget planning for management of GBS is enclosed.

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