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Natural Wetland Study
Draft Combined Task 2 & 3 Report
Wetlands International -China
EDAW

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Ningbo Water and Environment Project
Management Office

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TABLE OF CONTENT

1. INTRODUCTION 5

2. PROJECT DESCRIPTION AND MANAGEMENT PLAN..... 7

3. PROPOSED ENVIRONMENTAL EDUCATION AND RESEARCH CENTRE22

4. INSTITUTIONAL ARRANGEMENTS 27

5. FINANCE 30

**ANNEX 1. CONCEPTUAL DESIGN FOR THE ENVIRONMENTAL EDUCATION AND
RESEARCH CENTRE 33**

ANNEX 2 LIST OF PURCHASING EQUIPMENT 34

**ANNEX 3: FRAMEWORK TOR FOR GEF CONSULTANT CONTRACT: CENTRE
MANAGEMENT CONTRACT 35**

Summary

This final report, prepared by Wetlands International-China in partnership with EDAW and in collaboration with Ningbo Water and Environment Project - Project Management Office (NWEPPMO), examines the current conservation value of and assesses the potential conservation opportunities for wetlands on the southern coast of Hangzhou Bay, focusing on the western part of the designated study area, described as Section A. In particular this report delivers outputs for Task 2 and 3 described in the TOR.

The dramatic expansion of the human population has led to strong demand for more space and the study area, which formerly consisted of extensive mudflats and coastal wetlands, has been consistently reclaimed for over a thousand years. This land reclamation continues today and has been hugely successful in terms of providing highly productive land for agriculture, good environment for building human shelter, and excellent conditions for industry. However, this reclamation has come at a cost: it has caused the shrinking or disappearance of tidal mudflats and some of the inter-tidal zone, resulting in the extensive loss of coastal marine habitats and species that live in them. Some of these species are highly desirable products for human consumption (e.g. clams, crabs, near-shore fishes). The reclamation has also reduced the buffer zone between the land and the ocean, an area of marshes that acts as a biological filter. Because this filter is not functioning effectively, nutrients from farmland and pollutants from industry, notably nitrates and phosphates, are being released directly into the ocean, and the resulting eutrophication has been a severe problem in Hangzhou Bay, causing outbreaks of toxic phytoplankton (red tide) and, especially since 2000, catastrophic losses to fisheries as well as degradation of the environment in the surrounding region.

The predominant vegetation of Section A is composed of emergent plants and scrub vegetation; agriculture consists mainly of cash crops such as cotton. However, in parts of the marine area, especially Lot A3, there is extensive crab and shrimp aquaculture and, judging by the number of people working on the mud flats, there are considerable natural marine resources in the inter-tidal zones, which are providing important livelihoods. However, the extent and economic value of these resources have not been quantified systematically.

Similarly, there are no authentic records of other fauna, and recent ornithological surveys indicate that the area is not currently of great importance for birds, which is unexpected as the location is on the key Asia Pacific migratory flyway. The area is nonetheless designated as being of National Importance. There are anecdotal reports, from as recently as 20 years ago, of large numbers of migratory waterbirds, including some rare species, and highly productive inshore and tidal fisheries.

The study proposes the management plan as a conservation area stated in the TOR. The study identifies core zones within the designated area that are critical for biodiversity or that would become significant if suitably landscaped and managed. Lot A5 is considered the most critical area for passage shorebirds, and Lot A1 the key area for habitat recreation that would greatly increase the overall wildlife carrying capacity of the whole area.

As this zoning agreed, Lot A1 would also provide an exceptional opportunity for environmental education and educational recreation and could be a focal point for scientific research for the region. This comes at a time when China is keen to realize such opportunities in terms of a better popular understanding of sustainable development and of the importance of wetlands in particular.

The study proposes that an environmental education and research centre be constructed, located in the southeast corner of Lot A1. The consultants' extensive experience of the establishment of wetland centre deems these to be exceptionally appropriate locations. The report includes indicative designs for both the centre and the landscape of the proposed 'conservation areas', which makes up 90% of Lot A1, although the actual visitor numbers, which to some extent dictate the way the facilities would be designed, remain speculative. Very careful attention is given in the proposals to the interactions between wildlife and human visitors in terms of minimizing disturbance and optimizing the 'visitor experience'. The centre would target school parties but is also likely to have a high uptake of tourists who seek out recreational opportunities after crossing the Hangzhou Bridge. Because of the centre's unique location, the potential numbers of visitors may not yet have been fully appreciated.

The study recognizes that the extent of outdoor interests for visitors will vary with the seasons, and therefore the centre should be a visitor attraction in its own right, and of interest at all times of year. An ecologically friendly building is proposed, which will serve as a much-needed demonstration model for 'green' urban and industrial development, in line with Cixi City Government's development policies.

Cixi City Government has nominated the Construction Bureau to be the implementing agency for the Environmental education and research centre, and this study recognizes the positive significance of the multi-sectoral approach being taken to the planning, implementation and long-term management of this project. It is also pointed out that combining landscape design and land and water management for wildlife with public access requires experience and specialized skill sets, and that is imperative that key persons implementing these proposals and future staff of the Centre receive training as soon as possible.

An indicative budget for the implementation of the proposals proposed in this study suggests that that costs will be in the region of RMB 71,742,615 (USD8,967,826) and that counterpart costs will also be required. Cixi City Government has adequate financial resources to cover some counterpart costs, but it would like to emphasize that GEF considers the project to be a joint effort between the Cixi City Government and Ningbo Municipal Government and would expect some symbolic financial support for the project.

The study emphasizes that the construction of a centre and a research facility are not viable in the terms conceived unless the proposed conservation zoning and the wider land-use planning for the entire study area regarded and implemented as a single, integrated plan.

1. INTRODUCTION

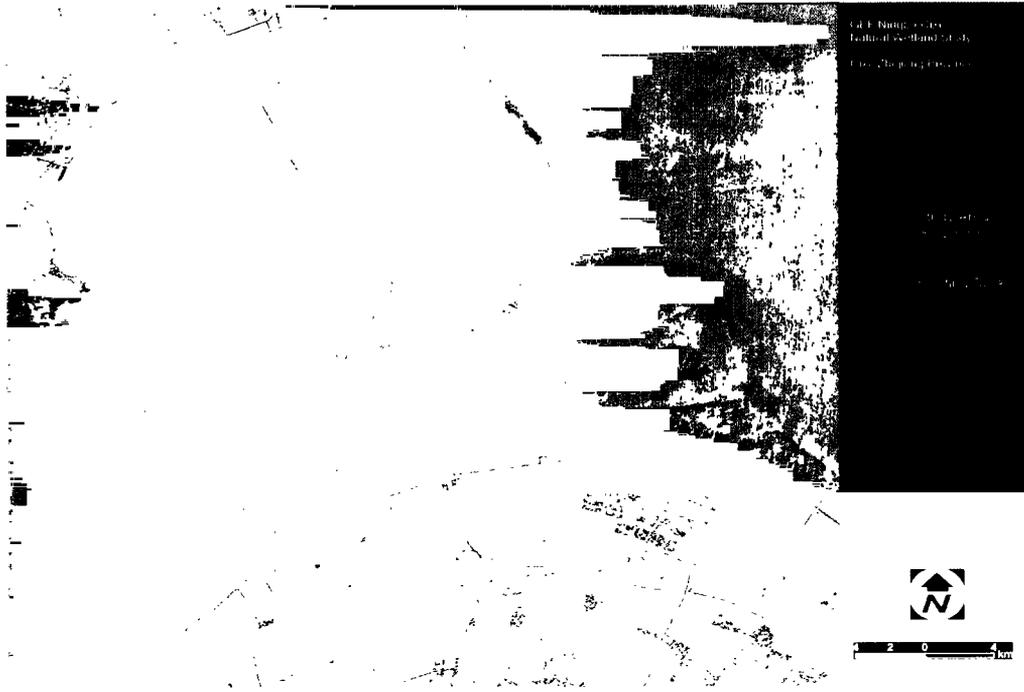
China's economic advances in the last two decades have contributed markedly to the well-being of its people, but in many instances, the cost of growth has been at the cost of environmental degradation. The environmental services provided by wetlands, which include coastal wetlands, river basins and natural and artificial lakes are critical to water supply and pollution control. Wetlands provide a multitude of livelihood goods, whether through natural harvests, aquaculture or irrigated farmlands. Human well being relies on wetlands. Agriculture, industrialization and urbanization on reclaimed wetland areas has come at the cost of a loss of the natural functions of wetlands. Pollution entering wetland systems from land-based activities are of great concern to China's development planning authorities. Central government has made, considerable progress towards the implementation of its international and internal commitment to move towards sustainable development partly in response to the Rio Declaration and Agenda 21. Managing wetlands sustainably is not a constraint on economic growth if the true economic value of environmental services provided by wetlands is taken into account.

The GEF Ningbo project preparation grant, Natural Wetland Study component, aims to help conserve and create new natural habitats along the Cixi coastline. The designated wetland area will preserve or enhance existing natural habitats for benthos, vegetation, and migratory and indigenous waterfowls. The study led by Wetlands International-China is a demonstration project which will assist local government make environmentally sound land reclamation decisions while conserving wetland areas with ecological significance. The Project Leading Group, composed of heads of municipal leaders of Ningbo and Cixi relevant authorities together with the Ningbo Water and Environment Project - Project Management Office (NWEP-PMO) under the Ningbo Municipal Development and Reform Commission (hereafter referred as the 'PMO') are the agencies assigned to implement the components under the preparation grant funds. A stated commitment of the Project Leading Group and PMO to pay full attention to the environmental aspects of its economic development as is evident in their willingness to establish green controls on development and to set aside a conservation site that in part balances economic development with environmental preservation. The PMO along with the Ningbo and Cixi authorities have chosen to incorporate the principles of sustainable development in its future planning in the realization that this is the only way of ensuring that economic growth continues.

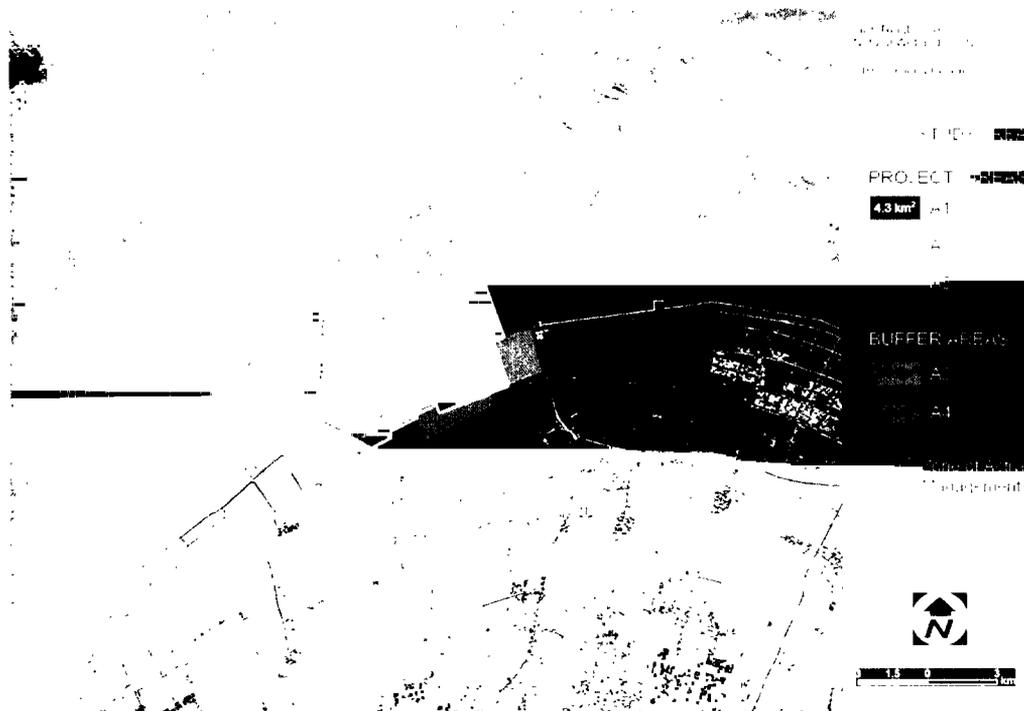
Wetlands International in partnership with EDAW is currently carrying out a Wetland Study along the Cixi coastal zone since August 15, 2005. Based on limited survey carried out mid September and early October 2005 and collected information from various stakeholders a baseline study (Task 1) was submitted on October 31, 2005. Based on this first study, task 2 and task 3 have also been carried out. This final report combines Task 2 phase II and Task 3. It includes management plan of the environmental education and research centre and the associated natural wetlands and a conceptual design of the proposed environmental education and research centre. Task 2 and 3 are closely inter-linked, and both relate closely to the way the site can be utilized to maximize the potential for environmental education, research and recreational enjoyment in a setting that greatly enhances the wildlife value of this part of the Cixi coast. Though this report focuses on the area defined as the District 'A',

the present and future uses of Districts B and C have also been taken into account. The benefits of both the conservation zoning and controlled visitor access proposed in this report are intended to have a much wider influence on coastal land use policies and practices.

The **Study Area** is the area outlined in green in Exhibit 1: Regional Location. It consists of Lots A1 to A5, as well as the existing fish pond and reservoir west of Lot A4. The seaside boundary has been revised so that it follows the more rounded edge of the mudflats in accordance to suggestions by Cixi government. The Study Area is roughly 45 sq km in size.



The actual **GEF Wetland Project Area**, shown in Exhibit 2: Study Area, is the designated conservation area. It consists of Lot A1: the Freshwater Wetland Zone, Lot A3: the Saltwater Tidal Zone, and Lot A5: the Island Preserve.

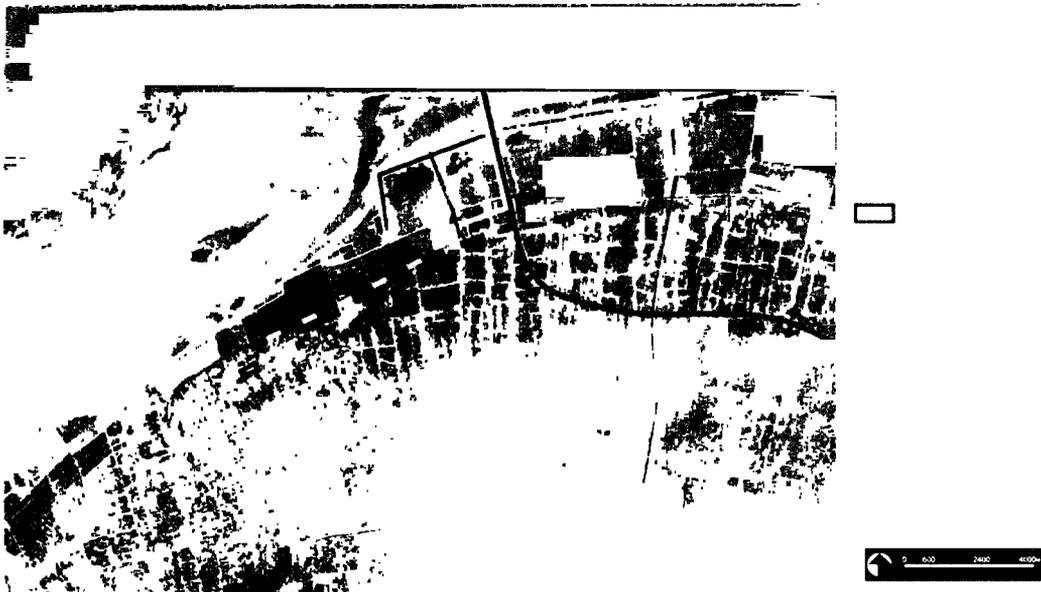


Finally, Lots A2 and A4 are designated as **Buffer Areas** for the above GEF Wetland Project Area. Refer to Exhibit 3: Development Context for an overview of existing and proposed development immediately surrounding the Project Area.



2.2 Regional Circulation

The major regional thoroughfare, the planned Hangzhou Bay Bridge, runs along the eastern border of Lot A2. (See Exhibit 4: Regional Circulation) The bridge is scheduled to open to traffic in 2009. The closest approved highway exit is approximately 2 km south of Lot A2, and will be linked to the Wetland Project Area via an access road.



In light of the suggestion by Cixi government, an additional local road is proposed. This road will run south of the existing eco-farm along the southern edge of Lot A4 to link the access road (mentioned above) with areas west of the Project Area. This will reduce local traffic that will

pass by the main wetland areas. There will also be one branch road from this additional road, to link with the existing dock site.

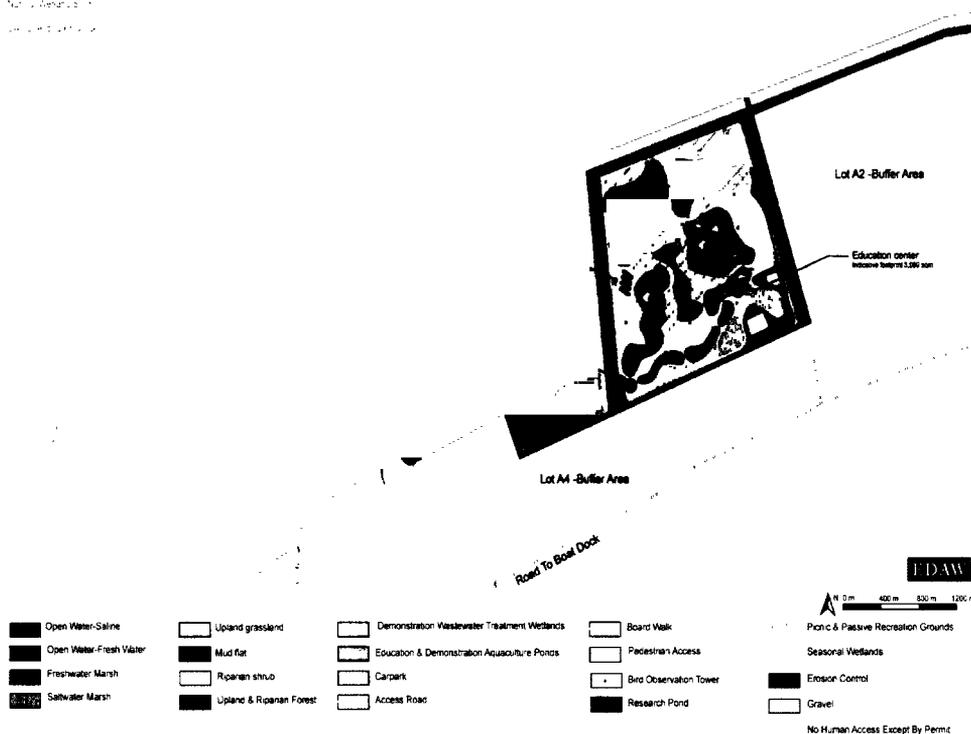
An existing dock on the western end of the Study Area can potentially serve as a landing for people arriving by sea. It can also serve as a launch site for patrol and visitor boats.

2.3 Program for the Freshwater Wetland Zone (Lot A1)

The Freshwater Wetland Zone (see Exhibit 5: Preferred Alternative Plan) contains four major program components: the education and research centers, the wetlands systems, the forest and upland buffers, and site circulation systems. The following is a detailed description of each.

Exhibit 5: Preferred Alternative Plan

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2.3.1 The Education and Research Centers

There are two primary hubs of human activities in the Freshwater Wetland Zone: the *Visitor and Education Center*, and the *Field Lab and Research Center*. These facilities are central components for realizing Objectives B and C. The Field Lab and Research Center is optional, and may be included in future to achieve long term research goals.

The Visitor and Education Center is located in the south-east corner of Lot A1. This allows for:

- Good solar orientation for views across the wetlands towards Hangzhou Bay;
- Buffer between the more active recreation program and ecologically sensitive areas, and
- Car parking areas in the south-eastern corner of the site, minimizing distance to the main entrance.

To the north of the Education Center a **Constructed Wetland** for wastewater treatment (10.7 ha) is proposed to polish pretreated wastewater from the Education Center. The treated water from this constructed wetland will be discharged directly into the large canal east of Lot A1. The

interpretive trail will pass through this area to allow visitors to learn about this process and encourage greater appreciation for the value of wetlands as "nature's kidneys".

To the west of the Education Center a large area is nominated for **aquaculture demonstration ponds** where visitors can observe and participate in traditional sustainable aquaculture farming practices. This area will allow the public to see first hand how both ecologically and economically productive the wetlands can be.

The optional **Field Lab and Research Center** is located in the western part of Lot A1, in order to provide easy access to the most ecologically sensitive parts of the Freshwater Wetlands Zone (north-west area) and outer conservation areas at Lots A3 and A5. The Research Center will consist of a building containing field lab and supporting facilities. There will also be several research ponds near the Research Center for field experiment purposes.

Access to the Research Center will be limited to researchers, school groups and eco-tourists interested in learning about the site in greater detail.

2.3.2 Wetlands Systems

The wetlands systems is the key component of the Freshwater Wetland Zone. Four different wetland systems are planned on site: Treatment Wetlands, Wildlife Wetlands, Mudflat Wetlands, and Seasonal Wetlands.

2.3.2.1 Treatment Wetlands

The 12.4 hectare **Treatment Wetlands** are located along the southern boundary of the Freshwater Wetlands Zone. The wetlands, consisting of a system of three treatment cells (2a, 2b, 2c) separated by weirs, receive and treat water pumped from the canal west of Lot A1. The Treatment Wetlands will be designed specifically for treatment of BOD, COD, ammonia (NH₃), nitrates (NO₃⁻), total phosphates, and total suspended solids, and contain minimal open water to maximize treatment capacity. The treated water will be discharged into the Wildlife Wetlands near the Education Center. As these wetlands are designed specifically for the purpose of water treatment, they are not as ecologically sensitive as the Wildlife Wetlands. An interpretive trail from the visitor center is planned through the area. The Treatment Wetlands system should not be confused with the Constructed Wetland north of the Education Center, which exclusively treats wastewater from the Education Center. However, these two treatment wetlands, along with the natural purifying capacity of the Wildlife and Mudflat Wetlands, help to collectively realize project Objective D, to control water pollution.

2.3.2.2 Wildlife Wetlands

The **Wildlife Wetlands** (75.7 ha), consisting of a system of four large wetland cells, occupy the core section of the Freshwater Wetlands Zone. The Wildlife Wetlands receive water pumped in from the surrounding canals, and at the end of the fourth wetland cell (3d), the water is discharged into the Mudflat Wetlands. The Wildlife Wetlands are designed specifically to attract species which utilize freshwater marsh habitats. Surrounding each of the four cells are anti-predator and bypass trenches. (Please see cross section details provided by Dr. Horne.) There are areas of open water within the Wildlife Wetlands, and bird loafing strips are designed to provide shelter and nesting habitat for waterfowls and shorebirds. Several small areas of higher grounds are planted with riparian shrubs, further increasing the diversity of habitats.

It should be noted that the size of the lakes in the original version of Option 1, being a collective concern shared by stakeholders and specialists, have been vastly reduced. Dr. Horne, an ecological engineer and wetlands specialist, pointed out that it would be infeasible to supply (i.e. pump) enough water to fill the central pond as was originally designed. Furthermore, wetland habitats that can be created along the shores of a big pond are much smaller compared to wetlands that can be created along the shores of several smaller ponds. Finally, he saw difficulties in regulating water levels in the original plan. The Cixi government also voiced concern over the excessive pond size in the original plan, advising further reductions to the

amount of water in the ponds. The final design as presented above has been refined accordingly, and a system of ponds and lakes in the original design is now modified to include larger marsh areas where open water is only a minor element.

Wildlife habitats are ecologically sensitive areas, and visitor access would be restricted in the Wildlife Wetlands except for guided tours. There will, however, be sections especially on the periphery where boardwalks cross the wetland cells, allowing visitors the opportunity to fully immerse in the wetland environment. Visitors on pedestrian trails can also view birds through **bird blinds** placed at strategic locations throughout the trail systems, or climb one of the six **observation towers** built in the periphery of the Wildlife Wetlands for an elevated view of the wetland habitats.

2.3.2.3 Mudflat Wetlands

Water from the Wildlife Wetlands will eventually discharge into the two **Mudflat Wetlands** located in the northern section of the Freshwater Wetlands Zone. The Mudflat Wetlands consist of two mudflats with similar design, where each contains a ring of open water surrounding mudflats that gradually slope upward to relatively higher grounds emergent marsh in the center. The water level in the Mudflat Wetlands will fluctuate according to wildlife management needs- for example draw down can coincide with high tide or storm events to expose sufficient mudflat grounds for shorebirds to rest when coastal mudflats outside the Freshwater Wetlands Zone are flooded. As the water level is drawn down, new sections of the mudflat are exposed, providing fresh feeding and resting grounds for shorebirds.

The water from the Mudflat Wetlands will be discharged into the canals to the north of Lot A1. More detailed information on the water levels of the surrounding canals is necessary to determine whether the water will be discharged by pumping or by gravity flow.

For more detailed information concerning the proposed hydrology in the site, refer to section 4: Hydrologic Changes.

2.3.2.4 Seasonal Wetlands

The **Seasonal Wetlands** are man-made depressions that are naturally flooded by rainwater and groundwater. They are not connected to the managed water flow path system that links the Treatment, Wildlife and Mudflat Wetlands. However, overflow from the Seasonal Wetlands during large storm events will drain into the Treatment, Wildlife and Mudflat Wetlands mentioned above. There are ten Seasonal Wetlands that are scattered throughout the Freshwater Wetlands Zone; besides increasing the diversity of habitats, ecosystem productivity is actually higher in seasonal wetlands than in permanently flooded wetlands because in waterlogged environments decomposition is hampered. Higher productivity translates into more biomass for the ecosystem and the ability to support higher concentrations of wildlife. The Seasonal Wetlands will be planted with facultative wetland species.

2.3.3 Forest and Upland Buffers

The strip of upland areas surrounding the eastern, southern and western boundaries (below the Research Center) of the site is designated as an ecological and aesthetic buffer between the sensitive conservation areas and the active agriculture and aquaculture uses of the land (including an eco-farm) to the south and east of the Project Area. These strips will be planted with trees, essentially creating a forest buffer.

In the original plan for Option 1, extensive areas of forest buffer were provided around the south, west and eastern boundaries of Lot A1. However, as Dr. Horne commented, trees form an ideal habitat for birds which prey on the target wading bird population. Indeed, trees are unnatural in shoreline habitats in most parts of the world, which is a major reason why the shore birds flock to these areas.

Nevertheless, for this particular site, small trees and shrubs will serve as an effective buffer to more intense land uses. Therefore, the forest buffer around the eastern, and southern boundaries is retained, though narrowed in the final plan.

The interpretive trails will occasionally pass through the upland buffer areas.

2.3.4 Site Circulation System

The site circulation system in the Freshwater Wetlands Zone has been carefully designed to minimize disruption by unnecessary traffic, especially through sensitive ecological areas.

There is one main entrance into the Freshwater Wetlands Zone, located at the southeastern corner. Since most of the vehicular traffic will head towards the Education Center, a southeastern entrance will result in the shortest drive and consequently the smallest impact to the conservation area by minimizing distance most vehicles have to travel. There are two carparks proposed for the Education Center. One is the regular carpark while the other serves as the overflow. Impact is minimized by their location on the conservation area's periphery and inclusion in the forest and upland buffers.

A service road in the Freshwater Wetlands Zone branches near the entrance to access the Research Center, as well as to the Saltwater Tidal Zone (Lot A3). The road follows the periphery near the border, which minimizes impact to the core wetlands. There are no other vehicular roads in the Freshwater Wetlands Zone; consequently, there will only be a total of 3.3 km of paved vehicular road in the Freshwater Wetlands Zone.

A system of pedestrian trails is designed for use by visitors and researchers. The 5.1 km-long trail system links the Education Center with the Research Center, passing through the education and demonstration aquaculture ponds, the demonstration Constructed Wetlands, the forest buffer, and Seasonal and Wildlife Wetlands. Bird blinds and view points for bird observation are proposed at opportune vantage points. The trail system will consist of boardwalks and porous paved trails. The entire trail system is accessible to handicapped visitors. To avoid undue disturbances, trails will not extend into the core wetlands conservation area.

2.4 Program for the Saltwater Tidal Zone (Lot A3)

Across the canal west of the Freshwater Wetlands Zone, the Saltwater Tidal Zone at Lot A3 (see Exhibit 5: Preferred Alternative Plan) consist of mudflats, existing and restored saltwater marsh, fishing and aquaculture production exhibitions, and boardwalks for visitor access.

2.4.1 Mudflats and Saltwater Marshes

The **Saltwater Marsh**, roughly 134 hectares in size, will provide valuable natural habitats for birds and other native species in the area. A portion of these marshes particularly towards the south end of Lot A3 will be restored from aquaculture ponds by removing blockages to the tidal channels that allowed the aquaculture ponds to form. The salt marsh gives way to extensive coastal mudflats to the north of Lot A3. Within the Saltwater Tidal Zone, visitors will be restricted to the **Docent Center and Ranger Station** at the eastern edge of the Zone and the boardwalk, which allows visitors to walk through the salt marsh habitats to a **Viewing Deck** overlooking the mudflats.

While some stakeholders expressed concern that restoring tidal channels would be infeasible due to high sediment loads, the presence of functional channels on a large part of the existing site implies that restored channels are a feasible goal. There are many examples of restored salt march habitats where functional tidal channels have been successfully restored. Sediment transport modeling will be required to determine the correct size of any restored channels.

2.4.2 Fishing and Aquaculture Production Exhibitions

An important principle of eco-tourism is building environmental and cultural awareness and respect for the locality.¹ While the majority of the existing aquaculture ponds are removed in the Saltwater Tidal Zone, some aquaculture ponds- those in the southeastern corner- are preserved as cultural exhibits introducing visitors to the traditional fishing and aquaculture techniques in the region. Preserving the area's cultural resources would only complement the Project Area as a destination for wildlife observation, increase diversity to visitor experience in the area, and educate visitors how natural and human processes interact and affect each other. The total area of the cultural exhibition district will be 3.7 hectares.

2.4.3 Dock

There is an existing dock roughly 2.5 km west of the Saltwater Tidal Zone. While not technically within the Study Area, this dock could be used as a point of departure for patrol, research or guided tour boat trips to the surrounding area. However, due to the sensitivity of the area, boat trip numbers should be limited to avoid undue disturbances to the marine habitats.

2.4.4 Site Circulation

The entrance to the Saltwater Tidal Zone is along its eastern border between the Freshwater Wetlands Zone and the Saltwater Tidal Zone. An existing paved road leads to a small carpark that services the Docent and Ranger Station. Access to the dock can be provided by a separate road originating from the proposed new road south of Lot A4.

2.5 The Island Preserve (Lot A5)

Lot A5, an island 2 km off the coast from Lot A3, is to be designated as an **Island Preserve** off-limits to visitors, uninhabited and untouched except for restoration projects (see Exhibit 5: Preferred Alternative Plan).

The habitats on the island will include aquaculture pond remnants, providing attractive habitats for ducks, cormorants, and egrets; restored bulrush marshes, which can attract parrotbills; and mudflats, which will attract gulls and snipes. Some coastal engineering work will be necessary to prevent erosion on the western coast of the island.

2.6 Site Boundaries

It is noticed fencing the mudflat along the sea dyke and bouys in the open water areas are proposed in November Aide memoire to control people from harvesting and expect to protect wetlands resources along the coastline. It is suggested to work really hard on a voluntary practice code backed up by local laws that restrict access. This needs to be combined with a continual awareness campaign and suitably trained rangers. It is a crucial that the environmental education and research centre play an important role in improvement public awareness especially the decision makers while strengthening law or regulations reinforcement to control the exploitation of natural resources. There should be a programme of local engagement with local people and in particular jobs created by the centre should be given to local people. Such jobs might range from demonstrating local fishing methods to serving in the restaurant etc. This project needs to demonstrate job creation. A 3-meter high fence will be constructed along the southern boundaries of the Freshwater Wetlands Zone and the Saltwater Tidal Zone, in order to keep trespassers and predators out of the sensitive ecological areas. This fence will be adequately disguised by perimeter trees so it will not become an aesthetic intrusion to the visitor's natural experience. There will also be also ranger stations to be located near the visitor center in the Saltwater Tidal Zone and key access to A1 to help with managing and patrolling the conservation areas and regular patrolling especially in the migratory waterbirds season is encouraged around the site. The coastal and sea boundaries of the conservation zone will be marked with bouys and patrolled by a ranger boat. Or setting up artificial barriers such as moats or ditches is helpful. The long objective of wise use of natural resources and biodiversity conservation will be achieved.

¹ International Ecotourism Society, <www.ecotourism.org>, accessed 15 Feb 2006.

3. Land Use Modifications

3.1 Lot A1

The natural landform of lot A1 has been significantly modified. A sea dyke runs along the coast, and marshes on the landward side have been largely drained and canal channels dredged. There are also abandoned aquaculture ponds and scattered freshwater marsh communities currently provide moderate quality habitat. Mudflats exist on the seaward side of the sea dyke, where locals engage in intensive harvesting operations of shallow water marine organisms. Unfortunately, these mudflats are disappearing at an alarming rate due to wave induced erosion.

To fulfill the objective on restoring and protecting the natural estuarine habitat, Lot A1 is to be restored into a Freshwater Wetlands Zone. Significant land form modification is required. The entire site will need to be regraded to recreate a series of marshes, open water and mudflats along with accommodating the proposed education and research centers. Mudflat harvesting activities and aquaculture production will be banned or severely restricted to ensure that the estuarine environment is able to regenerate into a healthy ecosystem that will attract local and migratory birds. Erosion control measures should be taken immediately to prevent the further loss of mudflat habitat. A qualified coastal engineer should be consulted to design appropriate methodology.

3.2 Lot A2

Similar to Lot A1, the natural landform of Lot A2 has also been significantly modified, with marshes largely drained and navigation channels dredged. Existing land use on land inward from the dyke is mostly agricultural; the main crop is cotton. Locals engage in intensive harvesting operations of shallow water marine organisms on the mudflats seaward of the sea dyke.

Lot A2 has been designated as a buffer area to protect the core conservation area from incompatible uses. The general guideline is that only open space, low intensity uses and low density developments are suitable in the buffer area. Furthermore, within the buffer area itself, relatively higher intensity uses should be kept as far away as possible from the border to the core conservation area. Recommended land uses include agriculture, low density residences and urban parks. Land uses that are clearly not suitable include industrial, and high density commercial and residential developments.

Resettlement of residents is not necessary in the buffer areas.

3.3 Lot A3

Originally a natural salt marsh, aquaculture ponds have been created in Lot A3 by truncating and blocking natural tidal channels. Water in the aquaculture ponds is generally brackish or fresh. The aquaculture ponds within Lot A3 are still actively used. Locals have also built shacks in the area as simple residences and field shelters. Mudflats along the shores of Hangzhou Bay are used for harvesting shallow water marine organisms.

Lot A3 has been designated as the Saltwater Tidal Zone where the natural salt marshes and mudflats should be restored but where some existing aquaculture activities would be preserved for education purposes. To achieve this, some earthworks will be necessary. The intense exploitation of shallow marine organisms within the natural mudflats will be eliminated. Except for about 15% of the aquaculture ponds which would be selected and preserved for exhibition purposes, others will be removed. This may involve involuntary resettlement of local farmers, which should be carried out in accordance with GEF policies on involuntary resettlement. The walls and berms that truncated the natural tidal channels will be breached to allow salt water into the core of the A3 area to facilitate regeneration of salt marsh and mudflat areas. Some revegetation in this area may be necessary.

3.4 Lot A4

The habitat value of Lot A4 has largely been degraded by cultivation activities. Again the area has been drained and dredged to create canals. Currently, the primary land use is agriculture and forestry; Lot A4 contains primary farmlands, an eco-farm, and a municipal nursery for salt-resistant plants. There are also some local residences on site.

Like Lot A2, Lot A4 has also been designated as a buffer area. Again, the general guideline is that only open space, low intensity uses and low density developments are suitable in the buffer area, and within the buffer area itself, relatively higher intensity uses should be kept as far away as possible from the border to the core conservation area. Recommended land uses include agriculture, low density residences and urban parks. Land uses that are clearly not suitable include industrial, high density commercial and residential developments.

Resettlement of residents is not necessary in the buffer areas.

3.5 Lot A5

Lot A5 is an island offshore of Lot A3. It is the least disturbed lot in Section A, naturally consisting of salt marsh communities and intertidal mudflat habitats. Currently, the principle land use on the island is aquaculture. The locals have created numerous aquaculture ponds on the island, and built shacks as simple residences. Locals also harvest shallow marine organisms in the mudflats.

Lot A5 is recognized as an important feeding and roosting area for migratory shorebirds, and is consequently designated as an Island Preserve where access should be limited and aquaculture operations prohibited. Therefore, most (but not all) aquaculture ponds will be removed and restored into salt marshes through regrading and planting. Fish stock could still be kept in the remaining aquaculture ponds, which would become open fresh and brackish water habitats and forage grounds for ducks and egrets. Bulrush should be planted around the remnant ponds on the western edge of the islands on grounds that are over 2.5 m in elevation. Bulrush marshes would help attract a diversity of birds, especially parrotbills. Shacks on the island will be removed and the heavy exploitation for shallow water marine organisms will be eliminated. This may involve involuntary resettlement of local farmers. In general, the regeneration of the island's vegetation cover would naturally occur from the natural growth of the bulrush community and the existing vegetation on the island. Finally, erosional control in the form of bank stabilization and wave energy reduction will occur at the western end of the island where erosion was observed during a site visit.

4. Hydrologic Functional Changes

Creating the Freshwater Wetlands Zone, the Saltwater Tidal Zone, and the Island Preserve will involve a variety of hydrologic changes to Lots A1, A3 and A5.

4.1 Freshwater Wetlands Zone

The Freshwater Wetlands Zone requires the greatest hydrologic changes. The Zone's functioning depends on creating an artificially managed water flow path on site. The Zone is fed by water from the surrounding canals using a pump system. The pumping station at the southwest of the site draws the canal water and discharges the water, untreated, into the **forebay pond**.

From the forebay ponds, the water can follow one of two paths. A portion of the water is released directly to the wildlife wetlands. The bed slope of the Wildlife Wetlands should be between 0 and 0.00075, equivalent to a 75 cm drop per linear kilometer of wetland. The vertical drop from one cell to the next at the weir will be about 15 cm to allow for accurate flow measurements. Water flows through the wetlands by gravity, without the need for mechanical assistance. The flow rate through the Wildlife Wetlands is estimated to be 45,000m³/day. This would provide an approximate residence time of ten days.

A portion of the water will be released to the treatment wetlands, where the water will flow through three treatment cells, each also separated by weirs and with similar slopes as the

wildlife wetland cells above. The water treated by the treatment wetlands will be discharged into the third wildlife cell, where the two water flow paths will rejoin. The flow rate through the treatment wetlands is estimated to be 7,000 m³/day. This would provide an approximate residence time of ten days.

Water from the fourth wildlife wetland cell (3d) will flow into one of the two mudflat wetlands. There is an approximately 1 m vertical drop between the wildlife wetland cell and the mudflat wetlands. This drop is a natural feature of the existing site.

Unlike the treatment and wildlife wetland cells, where the water levels in the cells remain essentially stable throughout the year, the water levels of the mudflat wetlands will be carefully managed for flooding or draw down as appropriate for the target wildlife species. The gradual draw-down of the water levels will expose the mudflats surrounding the ponds, where waterfowls can easily forage for benthic organisms.

Whether the water from the Freshwater Wetlands Zone will be discharged by gravity flow or by mechanical pumping is undetermined. More details on site topography and canal water levels is required. The flow rate of the pump system has also not yet been determined, and will need further attention in the detailed design phase.

4.2 Saltwater Wetlands Zone

The main hydrologic change to the saltwater wetlands zone is the removal of the small berms that block the natural tidal channels that created the aquaculture ponds. Once eliminated, seawater will once again be able to reach deep into the saltwater wetland zone, aiding the regeneration of the saltwater marsh.

4.3 Island Preserve

There is little hydrologic changes to Lot A5 besides the removal of a majority of existing aquaculture ponds and reversion of those to saltwater marshes.

5. Wildlife Target Species and Proposed Restoration Actions

The major habitats to be found in the restored GEF Project Area are salt marsh, freshwater marsh, mudflats and open water. The wildlife target species are those which utilize these habitats within the Hangzhou Bay area.

The primary target species for the GEF Project Area are migratory and resident shorebirds waterfowls which utilize the marshes and the mudflats. Of highest conservation values are water birds and wading birds of the Charadriidae, Scolopacidae and Anatidae orders. According to the Task 1 report, 45 species of birds have been observed in the two surveys conducted in March and September 2005, including near threatened and rare species listed in the national register. However, this diversity is much less than expected, especially when compared to what has been observed on similar habitats on Chongming Island, at the mouth of Yangtze River. Furthermore, the numbers of bird sightings have substantially decreased over the years. An example is the Cormorant (*Phalacrocorax carbo*), which used to be common in the area, but is now rarely sighted. Therefore, **it may be unrealistic to expect substantial increases in the number of bird species observed in the first two years after the GEF Project Area is restored;** However, birds species and the population will be increased with the habitats improvement and management plan to be taken. rather, **a more appropriate goal would be to halt the decline and stabilize the number and variety of birds that frequent the area.** While attracting endangered, rare and vulnerable species such as the blackfaced spoonbill (*Platalea minor*) and the Tundra swan (*Cygnus columbianus*) is desirable, the likelihood that a stable population will become established in the area within the near future may be low and not in proportion to the effort required to achieve such results.

The target species list based on the 2005 site surveys, and should include:
Anatidae (found in open water)

Spot-billed duck (*Anas poecilorhyncha*)
Falcated teal (*Anas falcate*)
Common teal (*Anas crecca*)

Charadriidae (found on mudflats, and prefers the edge of tidewater)

Snowy plover (*Charadrius alexandrinus*)
Little ringed plover (*Charadrius dubius*)
Mongolian plover (*Charadrius mongolus*)

Scolopacidae (found on mudflats, and prefers the edge of tidewater)

Black-tailed godwit (*Limosa limosa*)
Eurasian curlew (*Numenius arquata*)
Whimbrel (*Numenius phaeopus*)
Terek sandpiper (*Tringa cinerea*)
Spotted redshank (*Tringa erythropus*)
Common greenshank (*Tringa nebularia*)
Green sandpiper (*Tringa ochropus*)
Marsh sandpiper (*Tringa stagnatilis*)
Redshank (*Tringa tetanus*)
Red-neck stint (*Calidris ruficollis*)
Dunlin (*Calidris alpina*)

Phalacrocoracidae (found on mudflats and sometimes roost on trees, but forages where fish is plentiful)

Great cormorant (*Phalacrocorax carbo*)

Muscicapidae (found in reed communities)

Reed parrotbill (*Paradoxornis heude*)

Maintenance of healthy populations of benthic organisms is also important as they are the primary food source of the primary target species.

In order to help attract the wildlife target species above, several restoration actions have been proposed.

Mudflat creation using the pond draw-down mechanism

Proven to be successful in other projects, for example in Newport Bay, California, the control and occasional draw-down of the pond water level is **effective in creating habitat and foraging grounds for wading shorebirds**. If managed properly, the lowering of water levels in the ponds to expose mudflats can coincide with migration periods as well as high tides or storm events to provide a haven during those times. Plovers and sandpipers (of the Charadriidae and Scolopacidae orders, respectively) especially benefit from this restoration method. Mudflat creation is important as mudflats along the shore of the Study Area are now eroding due to the strong impacts of waves and storms following the construction of the seawall. Creating mudflats in the wetlands conservation area partially mitigates for this loss.

Restoring salt marshes

Salt marsh, important habitats for many species of shorebirds, will be restored in Lots A3 and A5. Some small-scale coastal engineering works outside of sea dike will be necessary to prevent erosion of existing salt marsh, and facilitate sedimentation. Fishery activity will be prohibited in at least the migratory seasons. Nets, toils and traps will be strictly prohibited to avoid accidentally injuring or killing of birds.

Restoring freshwater marshes

The wetland conservation area in Lot A1 involves an extensive restoration of existing farms and shrublands into an intricate system of freshwater marshes. The restoration process has been discussed in great detail in Sections 2, 3 and 4. Various wetland types will be valuable habitats

for the wildlife target species. Bulrush communities should be planted, as they are the major habitat and foraging grounds for the reed parrotbill. A diversity of wetland vegetation is important to increase the diversity of birdlife attracted to the area.

Other facilities that would help attract target species

Bird houses- provide interim nesting places for birds before the vegetation in the site matures, to be strategically placed throughout the project area.

Loafing strips- these are gravel strips constructed in open water in the Wildlife Wetlands in the Freshwater Wetlands Zone, which provide isolated places for birds.

Osprey platforms- tall posts with 1 m² platforms may attract this large raptor species that preys on fish.

Whilst food resources in the key 'public' areas are important if there are numbers of birds. The protected areas will not be able to produce enough food especially in the winter months. It should be appreciated that the waterbirds are likely to feed outside of the area but will be attracted for shelter, 'loafing' and roosting or breeding in the summer. Drinking freshwater is also important.

The main source of food generation in the protected areas will be produced by controlling the water levels-letting them dry out and then flooding them.

A lot can be done by planting food plants, though again, in winter these will disappear quickly.

A measure of artificial feeding is also an option but needs to be considered very carefully.

Monitoring plan

Annual monitoring plan will be conducted to gauge the process of habitat development. For a more detailed discussion of the monitoring plan, please refer to Section 7, Management and Monitoring Objectives and Methods Appropriate to the Proposed Project.

6. Information and Planning Needs

Site Hydrology

Precise hydrologic data still needed include typical seasonal and yearly water surface elevations of the surrounding canals, site topography, and groundwater table elevations. This information is necessary to determine the difference between the surface elevations of the Mudflat Wetlands at the end of the water flow path in the Freshwater Wetlands Zone, and the canal water outside the site. This will in turn decide whether the water from the Freshwater Wetlands Zone can be discharged using gravity flow, or whether a pump will be needed. This information will also be important in establishing the timing of the hold and release of water in the conservation area. Water table elevation data will be required to determine the depth of the depressions needed to create the seasonal wetlands.

Tidal Flow Information

Tidal flow information is required for the restoration of Lot A3's salt marshes. This will determine the precise grading of the existing site necessary for flooding the core of the A3 area to facilitate regeneration of salt marsh and mudflat areas. As previously mentioned, a sediment transport model may be required to successfully restore the salt marsh area.

Mudflat and Island Erosion Control

Erosion of the existing mudflat outside of Lots A1 and A2 and along the western edge of A5 is a grave concern. While some concepts for erosion control have been suggested through communications, a detailed erosion control plan should be undertaken immediately by a qualified coastal or ecological engineer.

Detailed Local Bird Sighting Surveys and Bird Migration Pathways

Information is also needed on bird migration pathways and local bird sighting surveys for individual species. This information will be invaluable for refining the target species list, and on improving the restoration methods to help attract target species.

Program Details for Infrastructure in the Wetlands Conservation Area

The precise program elements for the visitor center are undetermined. The specific types of attractions that will be featured will depend on the targeted visitor groups, and the number of visitors expected.

List of Existing Species and Species to be Planted in the Restoration

A comprehensive and carefully selected list of plant species is necessary for successful restoration in all of the restoration areas, whether the goal is to recreate saltwater and freshwater marshes, riparian or upland habitats. The list should include a survey of existing plant species as well as species to be planted.

Stakeholder Responsibilities

Finally, it remains unclear which stakeholders have the responsibility to fund and operate the project area. Clear responsibility will be crucial to the successful realization of the project's objectives and the long term running of the conservation area.

7. Management and Monitoring Objectives and Methods

7.1 Management Objectives

Naturally, the overall management objective would be to ensure that the project objectives introduced in the beginning are successfully met.

Specifically, the two fundamental management objectives for the proposed project should be:

- to maximize wildlife value, and
- to maximize visitor experience

The challenge, as always, lies in finding a balance between the two.

To maximize wildlife value, an important pre-requisite is to control human activities in the conservation areas through implementing appropriate policies. An example is prohibiting fishing and aquaculture activities in the conservation areas for the first few years in order to allow for the ecosystem to recover, and when the ecosystem is healthy, fishing could be allowed by permit. Another principle to maximize wildlife value is to ensure that the habitats remain of high quality, for example through policies requiring frequent inspection of hydrologic equipments, including weirs and pumps.

To maximize visitor experience, it is important to offer comprehensive and well-maintained supporting facilities to facilitate all activities, especially bird watching. This includes bird blinds, observation towers, and boardwalks leading to good vantage points. Visitor experience and appreciation of the conservation areas can also be enhanced by guided tours and advanced announcements to members of upcoming events, including the predicted or observed arrivals of migratory birds.

Staffing Recommendations

The following are some recommendations on staffing.

For patrolling duties: 3 rangers

For staffing the visitor center and offering guided tours: 8 guides

For inspection and maintenance works around the conservation areas: 10 maintenance workers.

For data collection and analysis: 2 research staffs

7.2 Monitoring Objectives

In order to gauge the success of the project and to regularly refine the approaches to improve the wetland operations, monitoring objectives must be set. The following are proposed monitoring objectives of the project:

Water Quality

Water quality monitoring is important to ensure that a healthy environment is maintained for the wildlife and visitors, to gauge the water treatment performance of the treatment wetlands and the Wetlands Zone as a whole.

Water should be tested for COD, BOD, ammonia, nitrate, total phosphate and total suspended solids. Samples should be taken from the inlet where water is to be pumped into the Freshwater Wetlands Zone, the outlet where water is discharged into the canal, at the inlet and outlet of the Treatment Wetlands System, as well as the inlet and outlet of the Wastewater Treatment Wetlands. Water should also be tested for heavy metals and organics once a year; if unacceptable concentrations are found, a comprehensive toxicity test should be administered.

In addition to the water tests above, simplified tests for coliform and water clarity should be administered at spot locations.

Bird Population Diversity/ Density/ Health

Annual monitoring plan will be conducted to gauge the process of habitat development. The plan will include bird counting, benthos survey, and landscape analysis. Habitat preferences of different birds are expected and will be useful to work within the Study Area and other coastal restoration projects of Hangzhou Bay.

Vegetation Health

Monitoring for vegetation health throughout the project area, especially during the first two years, is important for the success of the project. As the vegetation establishes, problem areas where the vegetation has not established, can be identified and replanted as necessary.

Hydrology

Monitoring for hydrologic conditions immediately after a restoration effort is important to gauge the effects that the particular restoration project has on the area's water flows, water table levels, erosion and sedimentation patterns. This monitoring is most important for the first few years, and would provide valuable knowledge for the management of the conservation and restored areas.

3. PROPOSED ENVIRONMENTAL EDUCATION AND RESEARCH CENTRE

The establishment of conservation zoning in the study area would not only be a conservation asset but, if carefully designed and integrated into the site, the construction a environmental education and research centre that provides for public recreation and facilitates environmental education and scientific research would make a significant contribution to an understanding of the importance of the Cixi wetland ecosystem. Such a centre could be a flagship to demonstrate the principles of sustainable development, which is an overriding objective of the planning authorities.

Opportunities

The proposed environmental education and research centre can provide many opportunities for environmental education for school groups and the general public, such as:

- Close viewing local wildlife and natural communities
- Guided nature tours
- Field trips for school children
- Learning about ecology, wildlife, the interactions of nature with human beings, and sustainable development through interpretative displays and learning by seeing and doing
- Classes in a natural environment, such as an outdoor amphitheater
- Research on restoration ecology and succession ecology at the site, and green industries in the region
- Community involvement (e.g., school groups, neighbors) to help with the restoration of the site, through plantings and maintenance of the plantings
- Docent volunteer program to lead tours or staff environmental education and research centre

Research could be undertaken in the short and long-term on, for example:

- Restoration ecology and ecological succession at the site
- The assimilative capacity of wetlands for nitrate removal
- Avian disease
- Behavior and ecological impacts of the non- indigenous plant species such as *Spartina alterniflora*
- Migratory bird movement tracking and banding

Constraints

The major constraint to providing opportunities for public access is that increased disturbance would be counterproductive to increasing the attractiveness of the area to wild birds.

In addition, the recommendations of this report are made cognizant of the fact that since late 2003 there have been outbreaks of Highly Pathogenic Avian Influenza (HPAI) (subtype H5N1), which are historically unprecedented in their geographical scope and virulence, and that there could be (though this is not proven) a transfer of the disease between wild migratory birds and domestic poultry.

The proposals for the Cixi Centre follow the most up to date international recommendations on control of APAI inter ala Resolution IX.23 of the 9th Meeting of the Conference of the Parties to the Convention on Wetlands (Ramsar, Iran, 1971) made in November 2005, in which the Chinese delegation played a leading role. The report further notes China's immediate and detailed response to the possible spread of HPAI and the importance it places on monitoring migratory birds.

For both the above reasons, the landscaping and management of the conservation area is designed so that there is no contact between wild and domestic birds (and humans) with the intent that wild birds will be attracted to the conservation area rather than distributed into

adjacent agriculture areas, where contact with domestic poultry might be possible. Landscape techniques, screening, ditching and banking, can make a clear separation between visitors and wild birds that do not diminish the 'visitor experience'.

The proposed research facilities in the conservation area will provide the Government with an important monitoring and research facility at a time when it is most needed.

3.1. PROPOSED LOCATION OF THE CENTRE

3.1.1. THE ENVIRONMENTAL EDUCATION AND RESEARCH CENTRE

Lot A1 provides an exceptionally good opportunity for an environmental education and research centre linked to a wild life conservation area, if it is positioned in the southeastern corner of the site (the proposed location). This location is optimal for minimizing visitor impacts while providing opportunities to learn about the natural environment.

Lot A1 forms an integral part of the proposed broader conservation Area A (see plan in Task 2). In ecological terms it is associated with the adjacent marine areas and Lot 3, and could be linked by a 'green corridor' to the proposed core conservation zone A5. The wetland landscape of A1 needs to be skillfully modified and a hydrological management regime put in place so as to optimize its attractiveness to wildlife and maximize its carrying capacity for wildlife, in a natural setting, undisturbed by visitors to the centre. This provides the opportunity to demonstrate wetland, and wetland habitat creation within reclaimed land. This demonstration could be replicated in other reclaimed shorelands in China.

At present, A1 is mainly composed of river canal, fish pond and agricultural land (crops eg. cotton resistant to salt). This area belongs to wetlands nature reserve with a total area of 413.3 ha. The natural vegetation includes reed and willow communities (*Phragmites communis*, *Tamarix chinensis*) with typical features of wetlands. Shorebirds and waterbirds are dominant and the scrub vegetation is also important for resident and migratory passerines and raptors.

There is currently no heavy human activity in the 300 ha of A1. There are some fish and shrimp ponds, which would be relocated but the majority of this area should be landscaped and managed as the conservation area. About 33 ha of A1 should be used for the environmental education and research centre.

The canal buffer zone between A1 and A2 and the 'natural' buffer provided by the forestry research nursery to the south are fortuitous. Vehicular access and general disturbance that would be created at the site by visitors and maintenance work could be contained away from key areas designated for wildlife (A5, A3, and portions of A1) by locating site access, the entrance, car park, toilets, picnic area and noisier recreation areas in the proposed location. There is an existing roadway that provides vehicular access to this location.

An essential consideration in locating facilities for public viewing is to be able to view the landscape from a southeast to northwest orientation. In this way, visitors have the clearest viewing of the area and birds (in particular) are not so easily disturbed because they are looking into the sun.

3.1.2. RESEARCH STATION

It is proposed that a research station or field laboratory should be separated from the main environmental education and research centre. This would provide scientists with closer access to the marine areas and enable discreet research activities (such as bird banding) out of public gaze. An excellent location for the field laboratory is on the northwest side of Lot A1 to provide access to the mudflats and separate research and recreation activities. When appropriate, accompanied school groups could walk from the environmental education and research centre to the laboratory making use of the existing sea dyke without disturbing the main wetland conservation areas.

One further benefit of separating the field laboratory from the public Environmental education and research centre is that it could be constructed and utilised very quickly. A research base is an essential component of the Cixi wetland management plan and immediate Government plans such as research on avian health.

3.2. CONCEPT AND INDICATIVE DESIGN OF CENTRE

3.2.1. INTRODUCTION

The primary purpose of the proposed environmental education and research centre is as a centre of excellence for increasing and sharing knowledge of wetlands in China and especially in relation to Cixi's coastal wetlands. High attention has been given on wetlands conservation by the government in China especially in Zhejiang Province, where the first wetland park pilot was established in Hangzhou, and which has been approved by the State Forestry Administration in February 2005. And more parks are planned to be developed nationwide. However, the pressing need is to improve the awareness of the public and decision makers about the need for sustainable wetland conservation and management. With this priority agenda, now is the right time to establish an environmental education centre along the Cixi coastal wetlands to demonstrate a good development environment not only at the local level but also at the national and regional level. The newly started construction of the Hangzhou Bay Bridge is seen by Cixi as a new opportunity to integrate Cixi into the Yangtze River Delta region and will strengthen Cixi's economic development. Cixi City government has taken this chance to improve the city's environment, living and competitiveness. The city has set its objective to become an "environmentally and nature friendly city". It is expected more tourists and 'eco-tourists' from Shanghai, including organized school visits and international tourists will be attracted when the bridge is ready. The local government hopes this bridge construction will catalyze the local economic development especially the tourism.

3.2.2. THE OBJECTIVES OF THE CENTRE

The Centre will help create awareness of the historical, present and future importance and functions of Hangzhou natural coastal system and Cixi wetlands in particular and will encourage industry in Cixi (and elsewhere) to adopt the principles of sustainable development.

The Centre will demonstrate the importance of the wetland habitat for the environmental services it provides especially the provision of natural resource foods, which is of great interest to Chinese people as well as the intrinsic significance of wetland biodiversity.

The centre will also demonstrate how reclaimed land can provide multi-functional uses that, when well designed and managed, provide both for wildlife and sustainable development.

3.2.3. VISITOR PROFILE

The statistics from the local tourism bureau showed about 25,500 visited some historic sites or development zones of Cixi from 1-7 October, but 3,000 people on 1st October only in 2005. It is possible that as many as 250,000 visitors a year may visit the centre especially when Hangzhou Bay Bridge is completed. During long public holidays it is anticipated that up to 4,000 people could visit the centre. The tour to Hangzhou Bay Bridge is a new tourism site opened to public and will attract many more people. It is important to note that March, April, July, August, October and November over half of visitors are expected.

Increasingly tourists will travel by private car though marketing to the centre should encourage access by coach. The potential visitor numbers that will visit the site once the new bridge is opened is hard to predict, and a study is required. Similarly, the industrial and urban development of the Cixi-Ningbo complex suggests a very high potential for visitors. It is provisionally estimated that a car park with a capacity of 200 cars and 10 coaches should be provided with substantial parking-overflow areas. Both the car and coach parks will be carefully landscaped to minimize their visual impact, and the overflow area will be grassed and

landscaped so that it can be used as a recreational area for visitors during the majority of the year.

The centre will target school groups. The provision of services for the general public could be described as 'educational recreation' rather than purely recreational. However, children's play areas and 'educational' toys should also feature. The centre wants to encourage the ill-informed public but must provide a knowledge base for learning.

Distribution of visitors across the year is also taken into account; there need to be attractions at all times of year. In the summer vacation more students from primary, high schools should be targeted for summer camps. Winter will provide better bird viewing, but is generally a less attractive time of year for outdoor visits. More people from urban areas will be attracted in the public holidays (1-7 May and 1-7 October). At any time, groups of students might stay for short term-field courses.

3.3.INDICATIVE DESIGN OF THE CENTRE AND ITS SURROUNDS

In recent years, wetland centres have been established at many key wetlands sites around the world including Hong Kong. The Centre at Cixi should be designed with its own unique identity, adopting the basic principles of wildlife-visitor interaction learned at other sites but establishing its own character. This might include traditional design or traditional design incorporated in a modern style. Or the use of traditional materials, like bamboo but using bamboo as a contemporary building material with an eye to the future of sustainably produced construction materials. The centre itself will be a model of ecological integrity; a 'green' building that will serve as an example to industry in Cixi (Annex 1).

3.3.1.BUILDINGS AS A PART OF THE LANDSCAPE

The challenge is to mix innovation with a more simplistic conservation landscape. The building has to provide good viewing facilities, without disturbing wild birds or interrupting flight lines, but it also must also accommodate shops and food halls, educational facilities cloakrooms and toilets as well as enabling access to able bodied and disabled people alike. Service maintenance is also a primary consideration.

Yet the landscape too can serve both a human and wild life purpose. Waste water treatment in reed beds would be one example. Buildings act as sound and site screens.

Based on guesstimates of predicted visitor numbers, the proposed landscaped area will occupy some 10,000m², which is the area currently designated as wetlands nature reserve and approximates to the area covered by the existing ponds, agricultural land. Thus areas designated will continue to be dedicated to conservation.

The design philosophy of the A1 site has been to consider it as an environmental and ecological whole. All features will radiate out from the existing, essential feature of the site, the open water space varying the depth of water level.

The aim is to provide a series of exceptional wetland and other habitats, suitable for a wide variety of wildlife, but especially wildfowl.

Between these will be walkways, board walks, birds watching houses etc, which will take visitors through managed wetland habitats and give views over areas of wild habitat, which will remain undisturbed from human intrusion.

3.3.2.THE BUILDING

The Centre can be divided into parts: service zone and main building. It is planned to have two storied building. The main building will be 5000 m² and rest space for service zone. The service zone could be separated off from the main public. Shop and retail catch people on the way out and can be acceded without people coming into centre itself. It is ideal to put the main visitor toilets near the car parking for when those people arrive and last thing before depart, apart

from disturbance. In the service zone, parking area (200 cars and 10 coaches) together with toilets nearby in one side and on the side there will be a restaurant (set beside the pond to have a better view), shops and retails beside it.

The main building will include lobby, displays, information desk, shopping area, projection room, offices, storage room and toilets on the first floor.

On second floor, there will be lecture hall with 100 seats, electronic library, view gallery for birds or coast, tea house or coffee, labs, offices and small-sized meeting room and so on.

Key educational Kit:

In the environmental and education centre, the following information will be shown to the public. The key category will be broken into the following in the different zones:

- Basic knowledge of the wetlands, including the functions of wetlands, values etc.
- Brief introduction of biodiversity in Hangzhou Bay
- Cixi coastal mudflat and reclamation history
- waterbirds recorded in the coastline
- Fish species
- Cixi bethons
- Cixi flora
- Allien species invasion
- WB-GEF project background
- 'green' building an example in Cixi
- List the sponsorships for the establishment of the centre if any.

3.3.3. THE LANDSCAPE

At this stage, the landscape is not detailed. Nearly 300 ha (c 90%) of A1 it is proposed to be seen as an openspace water area though in fact it will comprise smaller interlinked and controllable water bodies in which water levels can fluctuate. Different bird species require different water depths and this requirement is often very precise. Management of an artificial hydrological regime (flooding and draining) is both a science and an art and requires proven management skills. Even the physical and ecological requirements of a high water roost for shore birds (as proposed in A1), may vary from species to species.

Other features on site might include a wooded area, which creates an excellent buffer zone, and provides audio screening to minimize disturbance and visual screening to provide closer access to view water bodies. Many waterbirds, for example, herons, storks, egrets, ibis (some of the biggest and most spectacular water birds) roost and nest in trees. Many raptors also nest in trees and perch in trees. Raptors are often the most spectacular and visible birds in wetlands. An osprey catching a fish and even nesting at the site would be a good visitor draw and conservation learning tool. Well placed trees on the site are very important. It is proposed to plant trees to the east and south of the site, where they will not interrupt flyways but would provide shelter from wind, which can be a great attraction to birds in exposed coastal sites.

The inter-tidal marsh areas of A3 and A5 also need to be included in these considerations as the foraging areas are balanced by roosting and loafing areas. A3 and A5 plots are also important since they will act as a nucleus for repopulating the mudflats and marshes outside the new seawall. The availability of shellfish and other marine organisms would provide food for birds and help the tidal mudflat ecosystem recover from the damage caused by the current over-harvesting. In addition these areas together with the water pumped through the 300 ha wetland in A1 will have the added value of removing much of the pollution in the inland drains and, to a lesser extent, replace the tidal wetlands that are now behind the new sea wall. This water reaches the inshore Hangzhou Bay via the sea gates.

Some remodeling of A3 and the island of A5 may improve the wildlife carrying capacity, though the implementation of a management plan may be more critical.

In the areas immediately surrounding the environmental education and research centre it would be appropriate to include a pedestrian only precinct to the environmental education and research centre, which would provide the main walkway for visitors from the car parks and passes through artificial ponds and perhaps some sculptures. Visitors also spend a lot of visit time in or in the vicinity of their parked car, so the car parks must be included to meet the overall design criteria and not be regarded as a separate entity.

Some land near the education facilities should be developed as demonstration aquaculture and organic farm plots. This would be of great interest to children and adults alike.

Recommendations on the demonstration of the clean energy.

On 16, January 2006, Cixi PMO and Wetlands International-China held a meeting and exchanged ideas regarding the current work progress before the World Bank pre-review mission. In order to demonstrate 'Green' concept by the Cixi Environmental Education and Research Centre, it is suggested to establish a multifunctional power tower using local potential wind energy except for the solar energy. The proposed multifunctional tower will play the following functions or roles: 1) provide clean power to the centre; 2) control and prevent from the forest fire; 3) provide visitors with birdwatching especially those shorebirds habitat along the mudflat by the lift; 4) last but the most important function is for patrolling, which makes contribution to the management of Cixi coast the and control the over harvesting along the mudflat. The proposed multifunctional tower will be installed in A1.

It is also discussed to set up a biogas pond to provide electricity in the centre to demonstrate the clean development mechanism in a different way.

3.3.4. MANAGEMENT PLANNING AND SKILLS TRAINING

The wetland landscape is dynamic and a conservation management plan for the whole area and specifically for A1 needs to be prepared alongside the landscape design. Water regimes need to be worked out in advance, as do planting and maintenance procedures. Landscape planning for wildlife requires a skill sets than those learned by most employees in urban or commercial landscape sectors and training of senior managers should start as soon as this development receives the go ahead.

4. INSTITUTIONAL ARRANGEMENTS

Cixi Government has established a Project Leading Group for the project under the direction of Mayor Hong and Vice Mayor Hu. The Project Leading Group includes representatives from various Cixi City agencies. In addition to this Group, Cixi City government has also established an Technical Expert Group. The World Bank mission in November 2005 suggested the group of technical experts be expanded to include relevant Ningbo Municipal Government agencies, including the Forestry Bureau (responsible for wetlands), Environmental Protection Bureau (responsible for water quality), Water Resources Bureau (responsible for reclamation), Agriculture Bureau (responsible for fishing, crab-farming, shell fish collection etc.), Land Resources Bureau (responsible for land uses), and Planning Bureau (responsible for land-use planning).

Cixi City Government has nominated the Construction Bureau to be the implementing agency for the Centre. The Construction Bureau has good expertise in project management and construction. This would be an unprecedented demonstration of inter-sectoral sustainable development in which construction interests positively demonstrate their concern for the natural environment and environmentally friendly technologies. However, the Bureau understandably does not have the necessary ecological expertise necessary to manage an Environmental Education and Research Centre which should be taken into consideration.

A management fund for a consortium of non-governmental organizations (NGOs) and universities to participate in the detailed design and management of the environmental education and research centre would be essential. A consortium could bring the energy and expertise of the academic and NGO communities, and perhaps bring additional funding and lower overall costs. Some innovative approaches such as voluntary work and state and private enterprise involvement (including sponsorship) are also possible in the construction and running of the centre.

The future management of the wetland conservation area should be well thought of in advance. It is very important that future manager(s) of the centre and its wetland habitats receive specialist training as soon as the project is approved. These managers should also have a role in the design, landscaping and construction of the centre. On-the-job training can also be undertaken combining the theoretic learning and study tours to some domestic and overseas education or environmental education and research centre.

In order to strengthen the natural wetlands conservation of the Cixi coast and management of the Environmental Education and Research Centre, three initial options for the wetlands management mechanism have been proposed at the pre-review meeting of the World Bank mission from 23-26 of January 2006. The three options include: Option 1. To designate an institutional agency responsible for daily management of the natural wetlands and the environmental education centre; Option 2: Management is conducted by the local government; Option 3: to organize an independent consortium of non-governmental organizations (NGOs) and universities to manage the natural wetlands and the centre under the support of the Cixi government. An analysis of the advantages and disadvantages among the options will be made in the following aspects such as the nature of the institution, funding, welfare, public participation and working efficiency etc.

Option 1. An independent enterprise/institution will be designated to be responsible for the natural wetlands and the daily operation of the centre. Obviously, the centre will be managed according to the market as their focused is based on the profit. The management will be flexible but random. The operational cost of the centre can be guaranteed in the early 4 years under the financial support by the Global Environment Facility. However, follow-up funding will probably not be secured. The staff welfare will not be guaranteed and the working staff especially senior technicians or managers will not be kept long-term. Therefore, the scientific researchers and environmental programmes will not work in a sustainable manner. The sustainable mudflat management and activities in the public environmental awareness arena can not continue without sufficient technical support and public participation. This model of the management will be hard to implement at the current stage.

Option 2. Local governmental agency will directly manage the centre and wetlands areas designated. Under the leadership of the Cixi government, a public institution will be established with fixed staffing and be responsible for the daily work of the centre and the natural wetlands management. The some fixed staffing will be registered in the government agency. The follow-up operational cost will be available. The staff wages and their welfare will be confirmed. However, it should be noted that this management model is lacking in technical support from the universities, institutes and wide participation from local communities. The information source is also very limited with this option. Their working effectiveness and efficiency may be low due to the governmental complicated procedures and associated red tape.

Option 3. An independent consortium of non-governmental organizations (NGOs) and universities will be organized to manage the natural wetlands and the centre under the support of the Cixi government.

The consortium will jointly manage the coastal wetlands and the education centre working with related universities, NGOs and societies. The consortium will support wide public participation, and technical input from related professional backgrounds. They will have clear tasks, support each other and utilise their professional knowledge. The centre will strictly enforce the Long-term Mudflat Management Plan of Cixi Coast. The Consortium will fully use their potentials for fund raising. The key staff will registered and have a fixed salary, and other technical inputs will be encouraged from societies, universities and voluntary work in particular. The consortium will obtain a lot of information with public participation and technical support and social impact will be significant due to efficient and flexible work. The consortium will provide more opportunities to attract universities, institutes and NGOs to undertake public awareness campaigns by media or seminars and workshops.

Therefore it is proposed that a multi-stakeholder committee consisting of governmental sectors, professional bodies and environmental NGOs be set up to give guidance and decision making capacities for the management of the centre and natural wetlands. The consortium will be in charge of the daily work. It is suggested six divisions will be established: Environmental Education, Public Liaison, Office, Finance and Research. The detailed responsibilities and tasks are outlined as below:

Environmental Education: Responsible for the development of the annual workplan for the environmental education programme and implementation of the wetland management plan. Design and update the public materials in the centre. Organize the training, workshops and develop the public materials and training module, guide summer camping and field practice for the primary schools, junior and senior schools and university. Provide guidance for the co-mangement of the local communities. Responsible for the education about environmental laws, regulations and policies.

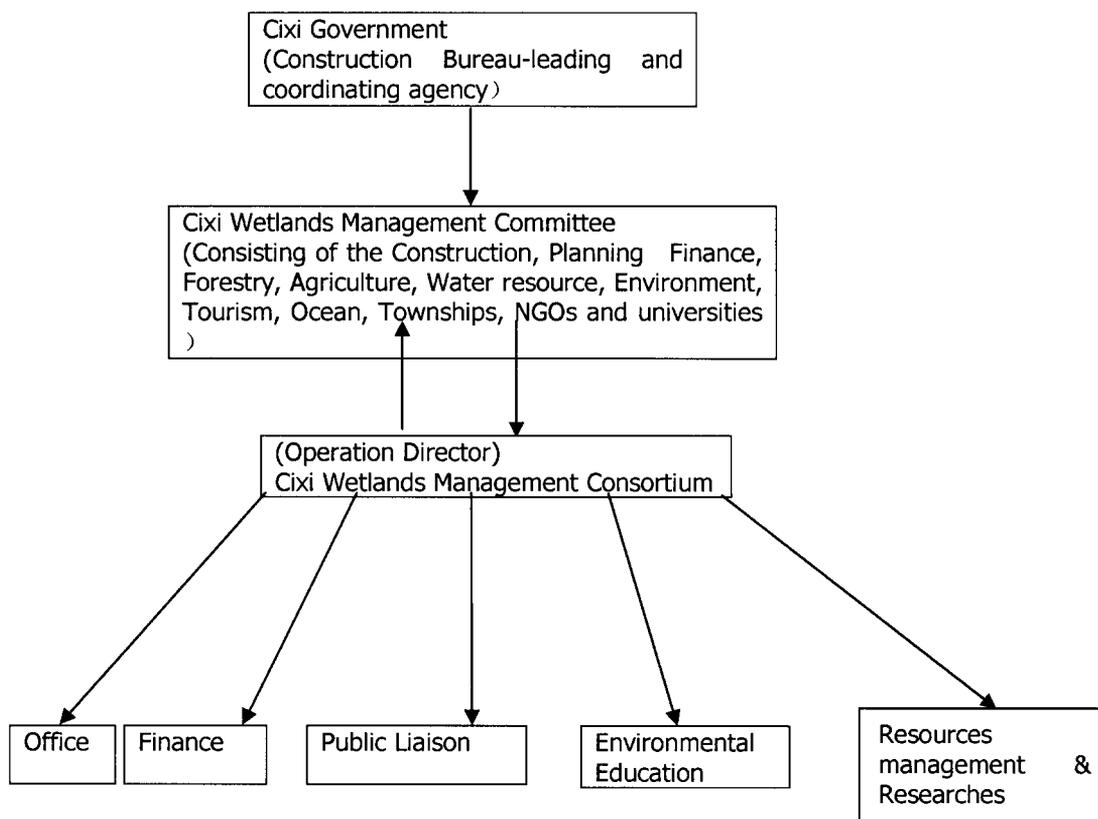
Public Liaison: Responsible for the development and implementation of foreign affairs working regulations; Support other divisions to organize key reception activities. Establish a close linkage with international organizations and civil societies. Make arrangements for attending domestic and overseas workshops and programme exposure to the public.

Office: Responsible for administrative affairs and logistics including administration, filing and personnel resources, volunteers recruiting, on-job training and continued education.

Finance: Responsible for financial management and equipment procurement. One of key tasks is to raise funds from different sources, seeking for donation or sponsorship from social bodies, enterprises;

Resource management and Research: Responsible for the development and implementation of the management plan and research programme. Contribution to the introduction, extension and exchange of the latest scientific research outcomes. Conduct regular surveys on the wildlife and mudflats, monitoring and databases will be made. Working together with fishery, forestry, environment and water resource sectors for the ecological conservation and especially the monitoring of avian flu and migratory waterbirds along the Cixi coastal area; Organize scientific study tours, bird watching and scientific knowledge extensions. Give guidance to local communities for wise use of wetlands resources.

Institutional Diagram (Option 3)



5. FINANCE

5.1 Cost estimate

The maximum GEF grant is most likely to be close to US\$ 5 million. Cixi City Government has adequate financial resources to cover all counterpart costs. Preliminary capital and operational cost estimate are shown in the tables below.

Table 1 Cost estimates of the Cixi Environmental Education and Research Centre

No.	Items	Size	Number	Unit Price	Total
1	Centre civil construction	m ²	10,000	1,500	15,000,0000
2	Indoor decoration	m ²	10,000	500	5,000,000
3	Office equipment	18,000			
4	Facilities for the Centre(see lists)	4,135, 947			
5	Exhibit boards, showcase, public materials	300,000			
6	Furniture for the Centre	300,000			
7	Books, reference books, software, media	500,000			
8	Apparatus, facilities for lab	250,000			
	Total				RMB 25,503,947 USD 3,187,993

Auxiliary facilities for A1

Items	Width	Length (m)	Total area (m ²)	Unit price/ (m ²)	Total
Access Rd (5m wide)	5	500	2,500	120	300,000
Pedestrian Path(Gravel and Boardwalk)	1	3,000	3,000	185	555,000
Parking area	3	5	1,500	100	150,000
Items	No	Area (m ²)	Total area (m ²)	Unit price/ (m ²)	Total
Bird observation	5	20	100	1,500	150,000
Restaurant	1		150	1,5000	225,000
Watch tower	1				300,000
Total					RMB 4,245,000 USD530,625

Table 2 Cost Estimate of Ecological Restoration and Engineering (Cixi Wetlands Development Option 1)

Items	No	Total Area (sqm)	Size Ha	Unit Price RMBp/sqm	Total
Permanent Water body (earth moving + pumps and piping)	9	860,890	86	12	10,330,680
Ephemeral Water Areas	1	706,960	71	8	5,655, 680
Treatment Wetland Beds	1	130,292	13	35	4,560,220
Islands (earth moving, shaping and planting)	18	163,710	16	30	4,911,300
Planting (around main visitor area)	1	500,000	50	5	2,500,000
Comprehensive 10%		2,795,788			
Total		RMB 30,753,668			USD 3,844,209

Table 3 Operational costs for the Cixi Environmental Education & Research Centre

No.	Items	Numbers	Unit price	Total
1	Staff salary	12	4,000	576,000/year
2	Public awareness activities			300,000/year
3	Communication cost			30,000/year
4	Public facilities maintenance			500,000/year
5	Equipment maintenance			50,000/year
6	Other overheads (training, travel, workshops, study tours)			400,000/year
7	Office stationary and supplies			30,000/year
8	Water and power			300,000/year
9	Part-time staff	15	1,800	324,000/year
10	Centre logistic management			300,000/year
	Total			RMB 2,810,000x4years=11,240,000 USD1,405,000

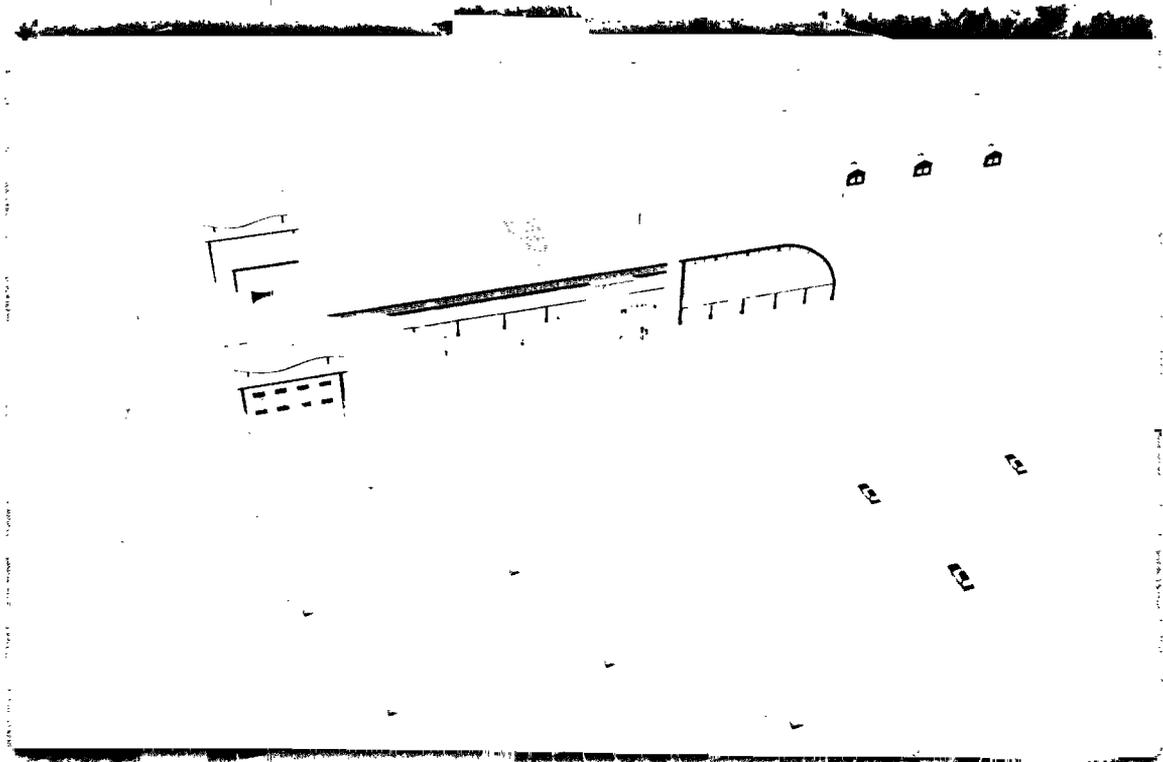
5.2. Financing plan

GEF considers the project to be a joint effort between the Cixi City Government and Ningbo Municipal Government and expects some measures of symbolic financial support for the project. The Centre is important for both Cixi City and Ningbo Municipal Government, and both parties would benefit from a strong partnership and the recognition that would accrue from a successful project. This project has to be listed into the 2006 fiscal year of Cixi government and the Ningbo Municipal Government provide partial funding on a grant basis to Cixi for costs related to the Environmental Centre facilities. Therefore some counterpart funds will be available to guarantee the success of the project.

It is very important to provide a demonstration platform for environmental friendly technologies and best practice so as to establish a link between the centre and Cixi business interests. Therefore more enterprises are encouraged to sponsor the environmental education and research centre. It is also important to pay special attention and provide support for a conservation zone and management plans, for wildlife, livelihoods and coastal protection.

It is also crucial to attract academic institutions or universities to conduct scientific researches or field surveys. The centre would provide some locations and some simple equipment in the field laboratory for their researches which better attract some scientific funds and upgrade Cixi recognition at national and regional level.

Annex 1. Conceptual Design for the Environmental Education and Research Centre



Annex 2. List of Purchasing Equipment

Item	Brand	Type	No.	Unit price	Total
Computer	Dell	GX620	20	10,799	215,980
Server	Dell	1850	1	18,888	18,888
Projector	EPSON	7800-3500	1	40,500	40,500
Digital Video	SONY	HVR-A1P	1	125,000	125,000
Digital camera	Nikon	D200	1	15,500	15,500
Scanner	Cannon	9950F	1	4,980	9,960
Copy machine	Cannon	NP3300	1	20,000	20,000
Printer	HP	LaserJet 1020	1	1,799	1,799
Printer (color)	HP	5550	1	46,000	46,000
Fax machine	Panasonic	KX-FC973CN	1	2,300	2,300
Telescope	Nikon		6	12,000	72,000
Car	Toyota	ACR30L-MFSEK Previa (STD) 2005	1	200,000	200,000
Bus (13seats)	Toyota	TRH224L-LEMNK HIACE 2.7 AT	1	420,000	420,000
Hovercraft	Home-made	Order-made	1	80,000	480,000
Pump	Home-made		1	20,000	20,000
Control gate	Home-made		1	100,000	100,000
Elevator	Home-made		1	200,000	200,000
Wind power 6000w	UK	Proven	1	153,000	153,000
Solar Panel	Home-made	200WP	250m 2	8,000 /m2	2,000,000

RMB4,135,947 **(USD) 516,993**

Note: 1. Hovercraft will be order-made at the price of each seat. It costs 80,000 per seat. Electric devices will be equipped based on the client requirement. Price can be negotiated.

Annex 3. Framework TOR for GEF Consultant Contract: Centre Management Contract

Framework TOR for GEF Consultant Contracts: Center Management Contract

Consultant Terms of Reference
GEF Ningbo-Cixi Wetland Project
Management Framework of the Environmental Center
March, 2006

1. Background

East Asia's rapid economic growth has been accompanied by significant environmental degradation. Land-based pollution and its impact on the region's rivers, lakes and other wetlands is one of the most severe environmental problems resulting in severe degradation of coastal wetlands, estuaries and marine ecosystems. To help littoral states address this problem, the GEF and World Bank have agreed to establish a Pollution Reduction Investment Fund for the Large Marine Ecosystems of East Asia (the Fund), the objective of which is to scale-up investment in land-based pollution reduction the region's coastal areas and major river basins. The Fund will finance activities related to World Bank pollution reduction investment projects that are innovative and can be replicated in other areas.

As the first project financed by the Fund, the GEF Ningbo-Cixi Wetland Project is associated with the Cixi City component of the World Bank-financed Ningbo Water and Environment Project (NWEP), which started in early 2005. The NWEP Cixi component includes: i) two wastewater treatment plants, one located in the north of Cixi (100,000 m³/day) and one in the east (50,000 m³/d); ii) associated collection system mains and link sewers (230 km of pipe and 58 pump stations). The GEF project will fund two components: i) constructed wetlands associated with the two WWTPs in Cixi; ii) natural wetland component, including development of an environmental education and research center in a large internationally recognized International Migratory Bird Wetland (IMBW) of about 25 km² to the east and north of the New Bridge landfill in Cixi.

Cixi City, located north of Ningbo Municipality on the shore of Hangzhou Bay, has a population of around one million people and one of the most dynamic county level economies in the country in terms of capacity and competitiveness. The newly started construction of Cixi-Shanghai Bridge across the Hangzhou Bay is seen by Cixi as a new opportunity to integrate Cixi into Shanghai and Yangtze Delta Region and therefore will further strengthen Cixi's economy. Millions of visitors are expected to visit or stop by at Cixi and Ningbo through the new Bridge to southeast coastal area of China. Cixi City Government has taken opportunity for further improving the city's environment, livability and competitiveness. In the meantime, Cixi new city area on both sides of the Bridge along the Bay is being planned, nature conservation for wetlands in Hangzhou Bay area is being initiated, and control of water pollution is expected through the implementation of the newly approved NWEP. The city has set its objective to become an "environmentally and ecologically friendly" city, and sees this as the approach to its sustainable development.

For the preparation and implementation of this GEF project, the Cixi Government has established a Leading Group and an Expert Group in 2005. The Leading Group is headed by Mayor Hong Jiaxiang and Vice Mayor Hu Liming and consists of directors of twelve bureaus. The Expert Group is headed by Prof. Chen Jiakuang from Fudan University, and consists of two other outside experts and experts from seven Cixi bureaus (additional experts from Ningbo Bureaus). The Cixi Government has nominated the Cixi Construction Bureau as the Lead

Agency responsible for the implementation of the GEF project. As the constructed wetland and natural wetland components are closely related and have complementary activities, the Cixi Government has decided that the design of the Environmental Center, the enhancement of natural and constructed wetlands will be completed by one engineering consultancy contract. To give full play of the educational purpose of the Environmental Center and the ecological values of the enhanced wetlands, the Cixi Construction Bureau has decided to contract a consultant-consortium (the Consortium) to advise on the detailed design, construction and implementation of the Education and Research Center and its associated IMBW, and to development long-term ecological and operational Management Plans for the entire site. The Consortium will also work with all parties during the construction period and be responsible for managing the Education and Research Center and IMBW in the initial years that it is hoped the site may be opened to the public and for scientific research in late 2008. It is expected that the Consortium will comprise non-governmental organizations (NGOs) and universities or possibly international advisors with experience in this field... This TOR specifies qualifications and tasks to be undertaken under this contract.

2. Objectives

The GEF Project expects that the Consortium bring the energy and expertise of the academic and NGO communities to the design and operations of the Environmental Center (Cixi Wetland Center (CWC)) and its associated natural wetland. It is also expected that the Consortium leverage additional funding and lower overall costs for the operation of the CWC. In particular, the Consortium is expected to achieve the following objectives in four years.

To provide ecological and technical advice for the detailed landscape and architectural design of the CWC that will ensure that the CWC realizes its full potential for pollution reduction of inland and coastal waters of the Cixi coastal wetlands, maximizes the opportunities for wetland conservation, research, and environmental education, and demonstrates the value of the CWC at an international level;

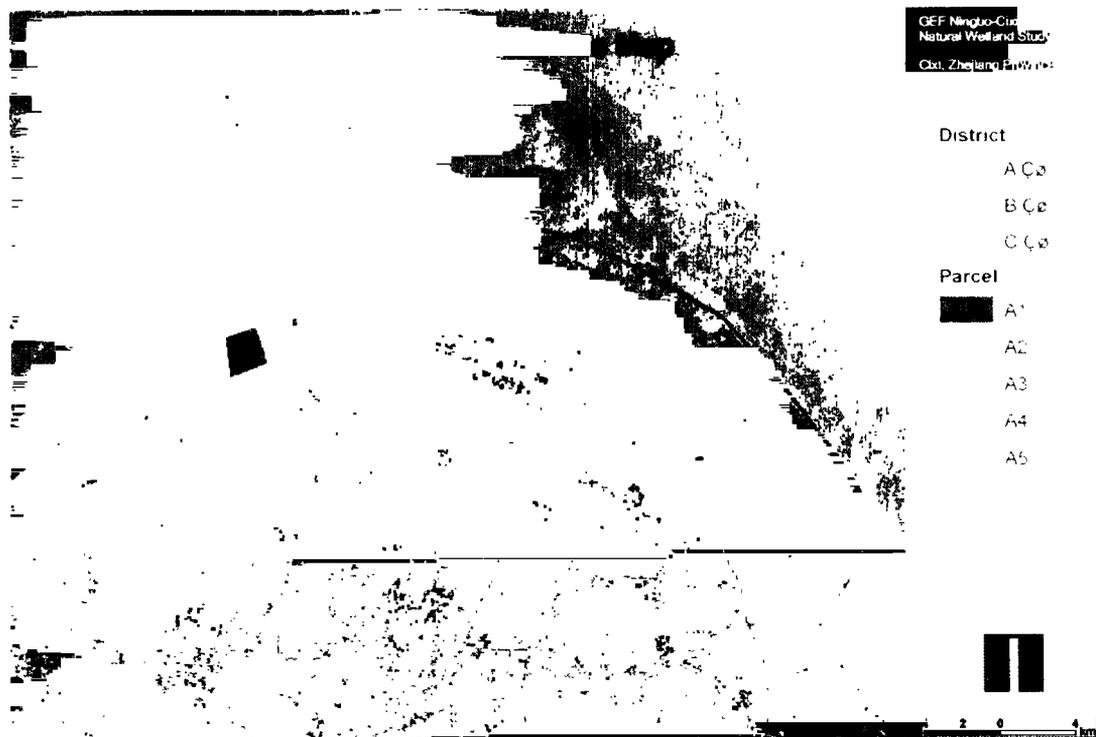
To identify and implement appropriate management practices that help the natural wetland evolve to a high quality habitat for international migratory birds (or, an international migratory bird wetland, IMBW) and for continuous repopulation of over-exploited coastal resources;

To develop a business plan and appropriate financing mechanisms for the sustainable operations of the CWC in the long-term; and

To establish operational management systems and mechanisms to monitor the CWC in the longer term.

3. Proposed Use of the Natural Wetlands

The Cixi City Government has decided to develop an environmental education and research center on the periphery of a restored wetland that it hopes will become of international importance. The designated wetland will cover east and north of the New Bridge landfall in Cixi (see District A on the map for details of the project area). The area is mostly shallow water, mudflats and tidal channels and encompasses the above high tide plots A1, A3, and A5. Plots A1, A3 and A5 will form an integrated landward whole for the IMBW with flight paths for birds flying to and from the sites at high and low tides. It has been agreed that the intertidal marsh areas of A3 and the island of A5, which are currently used for agriculture and small scale fisheries and crab farming should be landscaped so as to improve their ecological integrity; the zones would be regarded to give natural slopes and permit tidal ebb and flow. The few crab and fish farms there would be re-located. A boundary fence along the entire lower seawall from of the reserve (together with an awareness campaign) will control human access to the marshes and mudflats to fish or collect clams and crabs.



Map. Project Area indicating Details of Section A of Cixi Coastal Areas

In A1 plot, the Cixi City Government has decided to designate ~ 300 ha (~90%) which will be freshwater with controlled fluctuating levels, wildlife lagoons and ponds. These would be suitably planted with trees to provide shelter and nesting areas as well as screening people from the waterbirds. Any tree planting would also comply with government regulations for coastal protection. Any farming activities would be tightly controlled and detailed with in the Management Plan. Of prime importance in the landscape design is the way that screening with embankments, planting and water barriers will separate the wild areas from the visiting public so that the wildlife can be easily seen without disturbance. Control of any disturbance is a key factor in attracting and holding birds in the IMBW. A series of floating buoys have been suggested to be placed in the shallow offshore area to restrict boat access to only those visiting the site for ecological purposes. Access to the International Migratory Bird Wetland should be limited to bird watchers who could use A1 seawalls or the canals in group tours using buses and tour boats. The remaining 10% of A1 (~ 33 ha) will be used for the the Environmental Center focusing on bird watching, general and recreational education of the public (including exhibits of sustainable ecosystems), wetland research, and other activities. An important focus of the centre could be to emphasise the importance of wetlands as sources of food, medicines and livelihoods for local people. An ecologically seafood restaurant could play the dual role of informing the public as well as earning revenue.

A3 and A5 will act as a nucleus for repopulating the mudflats and marshes outside the new seawall. The availability of shellfish and other marine organisms would provide food for birds and help the tidal mudflat ecosystem recover from the damage currently resulting from over-harvesting. (This is of increased concern as the Bridge opens up this area for greater public access. In addition these areas together with the water pumped through the 300 ha wetland in A1 will incidentally remove considerable water pollution and to some extent replace the tidal wetlands that are now behind the new sea wall. This water reaches the inshore Hangzhou Bay via the sea gates. Overall the entire IMBW will reduce the ecological risks to the inshore coast of Hangzhou Bay that inevitably occurred when the new sea wall enclosed ~ 90% of the existing tidal marshes in the Cixi coastal region. Suitably engineered, the area could also process the inevitable pollution resulting from the new highway and its associated development.

4. Scope of Work

The Consortium is expected to perform the following four tasks.

Task 1: Participation in Ecological Design of the Environmental Center and its Associated Wetland

The detailed ecological design for the Environmental Center and enhancement of the natural wetlands associated with the Environmental Center will be carried out by an Ecological Engineering Consultant during the implementation of this GEF project. The Consortium shall participate in the detailed ecological design processes of all three activities. The following services should be provided:

- Advise on enhancement of the natural wetlands associated with the Environmental Center:
- Advise on modifying the land use around the education center
- Advise on designing and reconstruction of the wetland (e.g. the routes for water flow, demonstration of polluted water treatment, etc)
- Advise on the hydrological regime to create a freshwater or saline wetland, and the creation of diverse habitats that will enable water and other birds to feed, roost and breed
- Advise on improving local vegetation to attract wild animals, including migratory birds in different seasons
- Advise on development bird watching infrastructure (bird watching hut, tower)
- Advise on constructing the paths and roads and screening within wetlands area, to enable visitors to experience the wetlands closely without causing disturbance
- Support for the ecological design of education center, to achieve the three expected functions: environmental education, wetlands research, bird watching as well as visitor facilities for example a retail shop, restaurant, and toilets
- Recommend an appropriate location and size for the education center
- Recommend appropriate facilities (for education, office running, etc) for the center
- Contribute professional knowledge and skills to design the center
- Determine specific zoning of the building with their own functions
- Layout of access arrangements, ticketing, carpark, picknick areas etc.

Task 2: Development of Management Plan

The Consortium shall prepare an overall wetland management plan for the CWC. This will consist of 5 linked plans:

- (1). The ecological status of the Cixi wetlands and guidelines for its sustainable management and an overview pointing to concerns that require particular attention.
- (2). A Management Plan for the Cixi Wetland Centre. The major management tool for the CWC restored wetlands providing a current biodiversity statement (for use as a monitoring tool) and description of land and water management on an annual basis, specific requirements for specific habits. It would include descriptions as to how people are managed around the site.
- (3). The Cixi Coastal research plan. Identifying research needs in relation to pollution management, migratory birds, and wetland restoration.

The management plan shall clarify the objectives of site management, identify factors that affect (or may affect) the key features of the natural wetland, propose actions required to achieve the management objectives, estimate the cost of the action required, and specify monitoring requirements. During the management planning process, the Consortium should consult a broad range of stakeholders so that a mechanism for conflict resolution can be formulated and commitments from all stakeholders can be established.

As the natural wetland associated with the Environmental Center is closely linked with the rest of wetland areas east to the New Bridge, it is suggested that the Consortium study the current and planned uses of these wetlands. Based on broad stakeholder consultation, the Consortium

shall prepare an overall Cixi Coastal Environmental Management Plan for the sustainable uses of these wetlands.

Specification

The proposed natural wetlands and the environmental education and research centre has the following roles:

- Demonstrate the baseline of ecosystem of Cixi mudflat
- Maintain biological diversity
- Provide natural laboratory for scientific research
- Functions as the classroom for public education
- A site for people's recreation
- Conserve water resources and reduce the pollution along the East China coastline
- Demonstrate the sustainable use of natural resources
- Promote the international cooperation and exchange

The management plan is a special document and is used for guiding and manipulating protection, management and wise use of the natural resources. The management plan is to help the managers to effectively make use of the existing resources and address the main problems of the natural wetlands. The management plan can also help the higher authorities or external donors to learn the priority areas of the natural wetlands in Cixi.

General Introduction of management plan

The management plan is consisted of four parts: 1) Description of the natural wetlands site. It is to provide an objective basis for the follow up actions to be taken around the natural wetlands site. It will include natural condition, biological resources, protection target, culture, and history, social and economic aspects, management structure and operation; 2) Analysis and review. Based on the current situation of the wetlands site, comparing with the overall objectives, to justify the importance of the natural wetlands; to find out the problems or difficulties existing to address; to prioritize the problems and solve in the coming years. 3) Measures and actions. In order to realize the management objectives and decide the appropriate actions, illustrating each action's goal, approaches, budget and time; 4) Action plan and budget. The actions need to be prioritized. It is the basis for making the timetable for all the actions to be taken during the implementation. The whole budget of the management plan is prepared in light of the each action.

Methodology

The development of the management plan needs a series of methodologies. The procedures and approaches will include the following items: 1) Establishment of organization, selection of key managers and identifying responsibilities; 2) Collection of the baseline information by surveys or second hand; 3) Analysis and review and prioritizing the problems; 4) Discussion approaches to solve the problems; 5) Propose countermeasures and programme to eliminate the factors and restrictions; 6) Development of the management plan; 7) Circulate the management plan to the stakeholders for their comments; 8) Revision the plan based on the feedback from different stakeholders.

Implementation of the management plan

The management plan once has been approval by the Board or steering committee concerned. It is entry into force. The annual workplan including the detailed activities, budget, monitoring will be produced and a coordination mechanism established among the different stakeholders. The management plan will be modified or improved based on the implementation. After the management plan is implemented for some time. Evaluation will be made on the effectiveness and efficiency of the implementation.

The research centre is an essential and needs to be started up as soon as possible. Cixi especially Hangzhou Bay really needs this coastal wetlands research centre. It is also the basis for the decision making.

Visitors management

Apart from strengthening the resource and environmental protection as well as scientific researches, the center should aim to be self supporting in the future. Ecotourism and field trips will be main programme to improve people's awareness for environment. The Center should attempt to educate the visitors in two ways: near site for casual visitors and longer term for the mainly bird watchers who have traveled specifically for the site. The needs of the casual visitor are primarily educational and outdoor experience. A set of teaching dioramas or similar in the center and small ponds and wetlands with easy boardwalk access over the water and marshes is a good idea. For the serious bird watchers trips by car, bus or boat along a path close to A2 or the sea wall and drainage canals to a series of bird blinds overlooking the A1 fluctuating freshwater wetlands or the tidal wetland of A 3 and A5 could be considered. For the bird watchers the focus should be on the migratory birds.

The consortium defines tourism season, targets and routes in light of their local situation and develop measures to guide the tourism activities and undertake some appropriate management of those visitors who enter into the natural wetlands and centre. The main components of the visitors management include:

- Professional visit
- Non-professional visits
- Training of guides
- Designating of tourist routes
- Erection of road marks and interpretative boards
- Special arrangements for children and handicapped
- Production and provision of public materials; and
- Treatment and removal of trash

Thus the use of items for sale such as T-shirts and the location of a restaurant of some kind should be considered.

This item should be coordinated with the nearby development of the area A2 with the Bridge Company. It is important to have easy access to the visitor center so again coordination with the Bridge Company to have a special off-ramp from the bridge to A2 and the Visitor Center is essential.

The format of the management plan, as recommended in these guidelines, should comprise five main sections, reflecting the main steps in the management planning process: i) Preamble/policy; ii) Description; iii) Evaluation; iv) Objectives; and v) Action Plan. Note that the steps of this process are repeated several times through the plan - they are applied to ecological character, socio-economic interests, cultural values, and any other features of interest. In general, it is good practice to begin with ecological character, but there is no implied hierarchy. The recommended structure and content of each of these sections is further described below and illustrated in Figure 1.

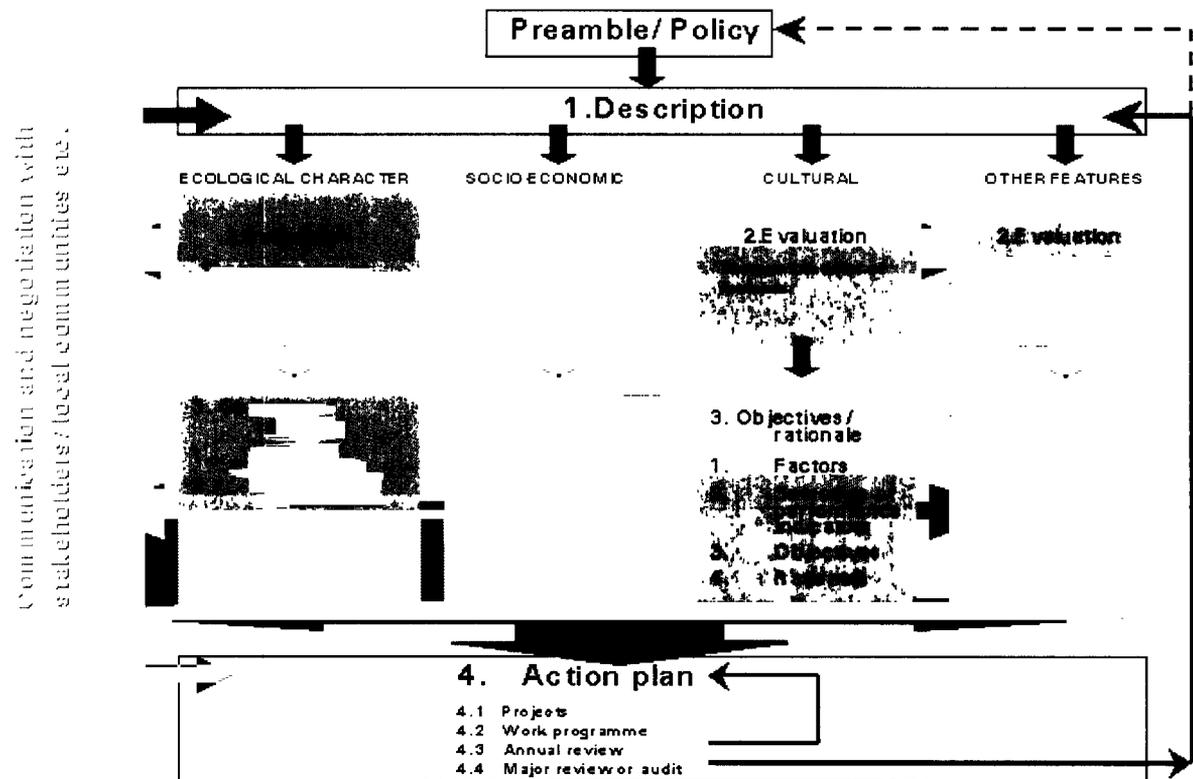


Figure 1. Recommended Structure and Content of a Management Plan

Task 3: Development of a Sustainable Financing Mechanism

The sustainable operation of the Environmental Center and its associated natural wetlands is dependent on sustainable financing available to the Center. In addition to using the Environmental Center and its associated IMBW to attract visitors and thus to generate revenues, the Consortium should also explore other financial sources for support. Possible sources include but not limited to: i) donation from domestic and international private business; ii) grant from national and local governments and other public institutions; iii) grant from domestic and international foundations; iv) grant from international organizations; and v) individual donation. Moreover, the Consortium should explore other cost saving options such as using of volunteers. The Consortium is encouraged to explore innovative fundraising and operational strategies. It is expected that the Consortium develop a sustainable financing mechanism after three or four years' operation.

Other options will be considered:

- (1) Cooperate with some universities and institutes on scientific researches on the paid-service by providing site or apparatus; Or share the data and research results with them.
- (2) Attract school students and provide biological class;
- (3) Produce green aquatic products such as rare sea food with high additional values and get some revenues;
- (4) Name some enterprises for the centre to increase income; Or enterprises donate their products at the beginning of the construction of the centre. Their names of donors will highlighted in the centre to attract more sponsorship.
- (5) Sales for some souvenirs from wetlands (reed/bulrush nettings, local gifts), postcards, stamps to get more funds;
- (6) Possibly establishment of foundations based on experiences or lessons learned from the first two years implementation supported by GEF and foundations will give consideration of funds operation in a commercial manner;

It is very important for the consortium to develop the business plan before the centre is opened. The business plan will show how it moves towards financial sustainability.

Task 4: Operations of the Center for Four Years

Recognizing that China has very limited experience in managing environmental centers and natural wetlands of this sort, the GEF project has decided to fully fund the operation of the Environmental Center and its associated natural wetland for four years. And staff needs to be trained before the site is open to the public. In these four years, the Consortium will manage the operations of the Center and the natural wetlands, and its basic operational costs will be covered by the GEF grant. The environmental performance of the Consortium will be measured by key monitoring index, such as number of visitors, number of migratory birds in migrating season etc. The economic performance of the Consortium will be measured by actual operating costs of the Consortium, revenues generated from environmental education and bird watching, and funds raised by the Consortium.

The Centre will help create awareness of the historical, present and future importance and functions of Hangzhou natural coastal system and Cixi wetlands in particular and will encourage industry in Cixi (and elsewhere) to adopt the principles of sustainable development.

The Centre will demonstrate the importance of the wetland habitat for the environmental services it provides especially the provision of natural resource foods, which is of great interest to Chinese people as well as the intrinsic significance of wetland biodiversity.

The centre will also demonstrate how reclaimed land can provide multi-functional uses that, when well designed and managed, provide both for wildlife and sustainable development.

All tasks to be accomplished are to encourage people to visit the coastline and appreciate its wide range of flora and fauna. These tasks encourage research and other educational activities. The Consortium is involved with study bird migration etc.

(1). Identify position arrangement, include the Environmental Centre Board , Director of Operations, Advisory Board, other positions for operation of the center.

(2). Develop a business plan (to be approved by the board) for the operation of center once the center is opened. The operation plan will show how, once the center is opened, it moves towards financial sustainability and independence from GEF in the first two years of operation. There should not be an emphasis on fundraising (in the donor sense) but on business planning and business sponsorship.

(3). Develop and carry out a series of programs focusing on public awareness and education
A series of open days featuring guest speakers prominent in their field.
General interpretation, displays and regular lectures.
Educational opportunities for schools and students. An education resource kit for schools is available on request. Through a variety of programs, include the "muddy feet" students can obtain a deeper understanding of ecological concepts and natural interrelationships.
A series of field courses, outdoor exhibits and a "field class room" run every year.
A regular newsletter, website and publications are published for general public, especially for the board members.

(4). The Consortium actively promotes field research into the natural coastal wetland ecosystem including monitoring, bird banding and surveillance of avian bird flu etc.

(5). Develop a fundraising plan and operate a series of fundraising programs such as rental facilities and selling goods. The center offer indoor and outdoor settings, meeting rooms with presentation equipment, electronic library, books and picnic areas--each with a view of the surrounding areas and birdwatching. Food and drink service can be arranged through the center.

(6). Enhance community involvement in the center management, and provide volunteer opportunities because volunteers are valuable personnel of the center partnership; they provide their skills and energy to the reforestation effort, clean-up projects, school programs, maintenance of public facilities, trail construction, office work, and wildlife monitoring.

During the operations, the Consortium should adjust its management plan based on the monitoring of the enhanced wetland and the operation situation of the Environmental Center. Figure 2 shows an adaptable management cycle.

This adaptable approach enables the Consortium to I) learn through experience; ii) take account of, and respond to, changing factors that affect the features; iii) continually develop or refine management processes; and iv) demonstrate that management is appropriate and effective.

ADAPTABLE MANAGEMENT

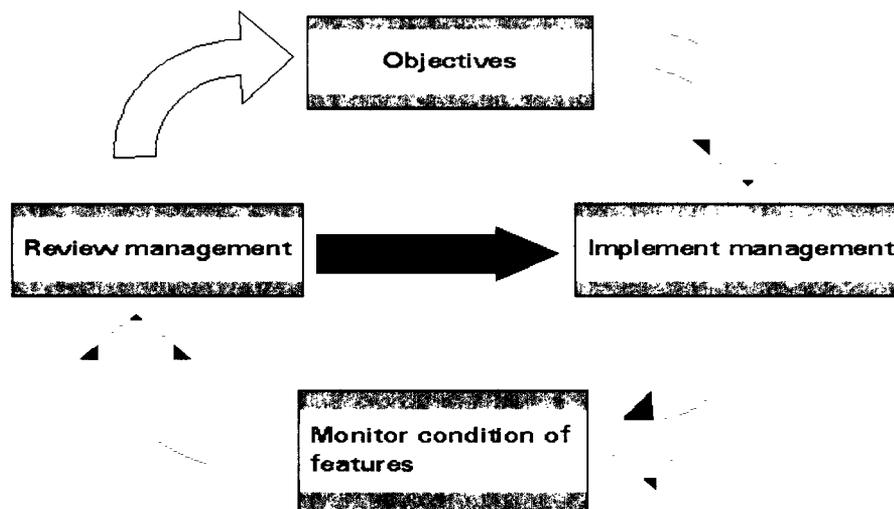


Figure 2: Adaptable Management Cycle

5. Consortium Staffing and Qualifications

The Consortium shall have members from universities, research institutes, environmental NGOs and individual experts on wetland conservation, environmental education and bird watching. For members of universities and research institutes, they should have a proven record of successfully managing the following types of projects: i) wetland research projects; ii) natural conservation projects; and iii) environmental education. Experience working on issues related to Hangzhou Bay is preferred. For members of environmental NGOs, they should have a proven record of successfully organizing or participating in the following types of activities: i) wetland research projects; ii) natural conservation projects; and iii) bird watching; iv) fundraising; v) environmental education. For individual experts, they should have a combination of experience in above mentioned projects or activities.

Director of Operation: The Director of Operation should have at least ten years of demonstrated experience managing ecological research and natural conservation projects, and have experience working on issues related to Hangzhou Bay. An advanced degree in environmental management or science is required. International experience related to wetland conservation, from study visits, research or study abroad, etc. and working knowledge of English is preferred.

Wetland Ecologist: The wetland ecologist should have at least eight years of practical experience in wetland research and conservation. An advanced degree in environmental sciences or ecology is required.

Environmental/Urban Planner: The planner should have at least eight years practical experience in environmental management and/or urban planning. An advanced degree in environmental management or urban planning is required. The planner is qualified to oversee the ecological design of the building. These positions can be short term and relate to the design phase.

Environmental Education Specialist: The specialist should have at least eight years experience in developing educational materials and exhibits related to environmental management, and in particular wetlands, outdoor exhibits and a 'field class room' need to be incorporated. The specialist needs to be in post in the design phase. The experience can be obtained through teaching ecology or environmental science classes at the university level, and preparation of exhibits for museums, visitor centers, etc. An advanced degree in ecology, environmental science, or education is required.

Habitat manager needs to be appointed as an administrative support to the Director of Operation. She/he should be in position from the start and oversee the design, development and implementation of the landscape-which may need modification as it goes along the more data is gathered from the site.

Development Specialist: The development specialist should have at least eight years experience in fundraising for conservation projects. Previous fundraising experience in international NGOs will be preferred.

Hydraulic engineer/pollution controller needs to be there in the design phase. But this is not a full time position.

Volunteers: Volunteers recruited by the Consortium should have basic understanding of wetland conservation, bird watching and environmental education. These volunteers should be capable of guiding touring groups and perform simple tasks of the daily operations at the Environmental Center and its natural wetlands.

6. Reporting and Schedule

The assignment is expected to start in August 2006. The reports should be in Chinese and English and ten copies should be provided to the PMO, as well as the electronic version. The schedule is as follows:

Inception Report: September 1, 2006

Task 1: Progress report, December 2006

Task 2: Management Plan: March 1 2007

Task 3: Report on Sustainable Financing Mechanism, September 2010

Task 4: Semi-Annual Management Report, end of June and December for 2007, 2008, 2009 and 2010

7. Local Services and Facilities to be provided by Client and Consultant

The NWEPMO and the Cixi Construction Bureau should provide necessary information to the Consortium so that the Consortium can participate actively in the detailed design of the Environmental Center and its natural wetland. The Consortium will also be invited to participate in stakeholder workshops and meetings related to the design and management of the Environmental Center and the enhanced natural wetland, and development of Section B and plot A2 and A4 of Section A. After the completion of the Environmental Center and its enhanced natural wetland, the Cixi Construction Bureau should transfer the management of all facilities

on site to the Consortium. The Cixi Construction Bureau and the NWEF PMO will also provide necessary assistance at the request of the Consortium.

8. Indicative Inputs and Contract Arrangements