CHAPTER 6

PART III ENVIRONMENTAL MANAGEMENT PLAN

CHAPTER 6 FRAMEWORK OF THE ENVIRONMENTAL MANAGEMENT PLAN

6.1 Overall Concept

6.1.1 Justification of Environmental Management Plan (EMP)

(1) Prospected Issues on Environmental Management in the Study Area

Considering the current situation of LWC, the following seven issues could be prospected from the view point of environmental management of the study area. These issues express that there exist institutional, administrative and financial problems to be solved toward the proposed EMP's implementation.

1) Insufficient initiative on regional spatial development planning from central to local government
2) Weak coordination between environmental protection sector and other development sector
3) Unclear coordination system to cope with conflicts between environmental protection and interests of the local people
4) Poor capability on regional development and management planning
5) Not sufficient environmental monitoring system and performance, especially on biodiversity, landscapes, and game refuge
6) Lack of dissemination activities of environmental information, environmental education
7) Limited financial resources and budget shortage of the regional agency responsible for environmental management

(2) Justification of EMP

The development of a comprehensive EMP for LWC is acutely needed, and it is justified by its ecological importance, the political and problematic background of LWC, and the strong intention of Latvian people concerned. LWC has been known as an important habitat for migrating birds including rare species, and the International Council for Bird Preservation (one of international NGOs in Europe) identified LWC as an important bird area in Europe and recommended its conservation in the early 1990s. It is natural that a movement to apply LWC for a Ramsar site arose among the concerned people.

Based on the great concerns on conservation of LWC and legal initiatives of LEP, several broad discussion meetings led by the Rezekne and Madona Regional Environmental Board (REBs) were held in 1996 with participation of regional officers of forestry and fishery, academic groups, and local residents. It resulted in the approval by the Cabinet Ministers

for 11 nature protection areas of about 360 km^2 in LWC in 1999. The participants also recognized that there were a lot of issues to be solved and clarified related to organization, hydrology, agriculture, fishery, nature conservation, and research works, and unanimously agreed to continue further efforts for conservation of LWC and formulation of EMP through a series of discussions.

(3) Overall Concept

EMP for LWC should envisage a direction of regional development and land use because the current economic depression in the region would affect effectiveness and efficiency of actual implementation of EMP. It means that a concept of "Wise Use" must be substantial for EMP of LWC as shown below. Therefore, a comprehensive EMP consisting of the following six elements is prepared for LWC.

a) Wetland Conservation Plan,

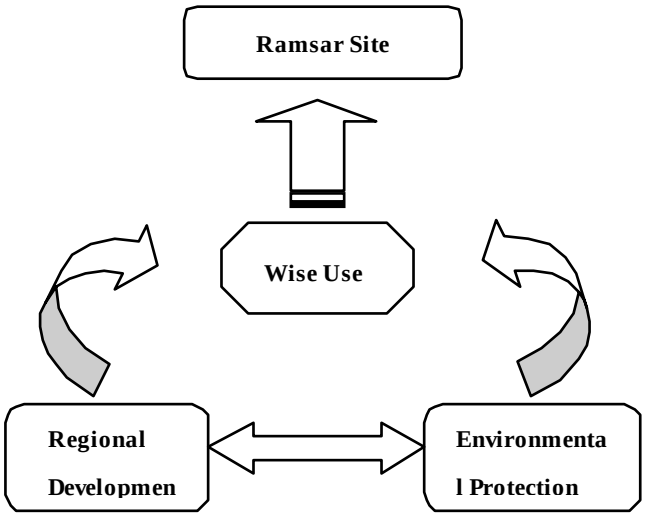
b) Eco-tourism Development Plan,

c) Guideline for Environmental Information Management System,

d) Water Level Management Plan,

e) Guideline for Regional Development, and

f) Directions for Land Use Planning



The EMP indicates the implementation program, the relation with the local development plans, and the environmental benefit of the local society as much as possible. Thus, the EMP should lead the people concerned to contribute and participate in wise use of natural

resources, and should guide the direction of environmental conservation in regional development plans by giving common environmental goals and targets of LWC.

6.1.2 Vision and Goals of EMP

The fundamental vision of the EMP for LWC is set as:

" Wise Use of the Lubana Wetland Complex".

The goals to attain this vision are to be set (1) Conservation of Natural Environment and (2) Sustainable Use of Natural Resources. The general concept of vision, goals, and major strategies is shown in Figure 6.1.1.

(1) Conservation of Natural Environment

LWC is one the most important wetlands for habitat of fauna both in Latvia and in Europe, and has been nominated for a Ramsar wetland. Its fairly good natural environment has been kept due to low development in the current economic depression. However, it does not have enough social and legal frame for protection in the future. Therefore, it needs no words to put a top priority for conservation of the natural environment in LWC. This goal must give a way for designation to the Ramsar site in the future.

(2) Sustainable Use of Natural Resources

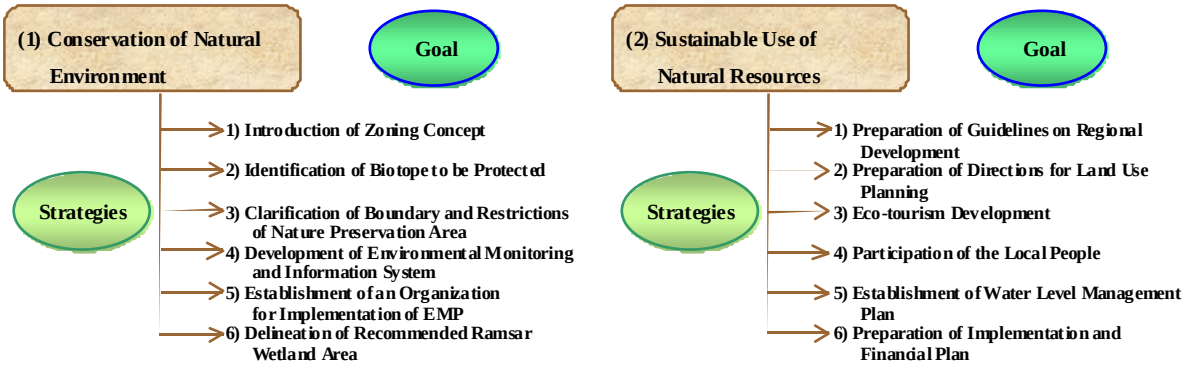
The land of LWC is rich in natural resources such as trees, fish, and peat, and has high development potentials using its valuable natural environment and landscape especially for fishery, forestry, and eco-tourism. These natural resources are ecologically vulnerable, and can be lost forever by careless use, exploitation, and consumption. Moreover, the condition of land tenure is complicated in LWC. There are a lot of private landowners and their number will be increased in progress of the national land returning policy. Thus, it is required to seek a way for sustainable use of natural resources for nature conservation and regional development.

6.1.3 Target Area and Year of EMP

Although the proposed EMP will be comprehensive consisting of six basic components which have different planning scales and dimensions, the vision of EMP is focalized to the Wise Use of LWC. Therefore, the target area of EMP should be the whole LWC (about 810 km^2) including Lake Lubana, which is the same as the study area. The target year of the EMP is set at 2010 in accordance with the agreed Scope of Work (S/W) of the current JICA Study.

6.1.4 Strategies of EMP

In order to attain the vision and goals of EMP for LWC, it is necessary to set strategies which will guide actual components and projects in EMP. Since the goals of EMP are set as (1) Conservation of Natural Environment and (2) Sustainable Use of Natural Resources, the following 12 strategies for the respective goal should be taken for EMP.

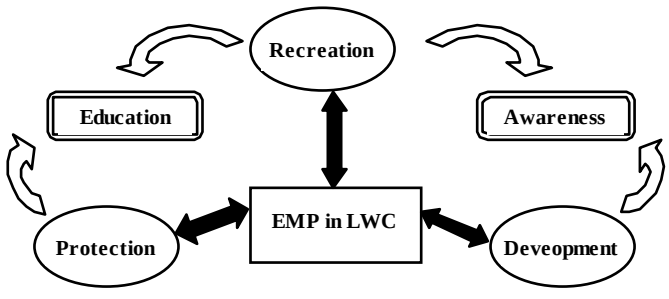


6.2 Environmental Zoning

6.2.1 Zoning Category

(1) Roles of EMP in LWC

Considering the vision of EMP for LWC, the EMP area should envisage the wise use of LWC by harmonizing nature conservation and regional development. This means that EMP in LWC should have substantial roles of 1) Protection of natural environment, 2) Recreational use of natural resources, and 3) Development of regional socio-economy. These roles are ultimately connected to "the Environmental Education" and "the Public Awareness" as shown below and Figure 6.2.1. Therefore, the environmental zoning of LWC should be strategically designed for fulfillment of these roles.



Roles of EMP

(2) Zoning Concept

The EMP area was once fully developed especially for agricultural production. Only the current sluggish economy allows LWC to keep the rich and valuable natural environment. This compound circumstance characterizes LWC because unregulated development could surely exhaust natural resources and the vulnerable nature would be lost forever. Thus, the EMP area should be divided into 3 zones, namely Nature Preservation Zone (NPZ), Active Management Zone (AMZ), and Development Zone (DZ).

1) Nature Preservation Zone (NPZ)

NPZ is defined as a nature preservation oriented area in LWC. This zone should be delineated by priority evaluation of biotopes for preservation of wetland vegetation and important habitats of fauna. NPZ includes the most important natural environment from various viewpoints, so it corresponds to the strict protection quarters representative for unchanged and vulnerable nature, endangered wild species, and unique and beautiful landscapes, stipulated in the Latvian regulations under LEP. NPZ should ensure the protection of the invaluable natural environment even after retrieving a vital situation of regional economy as it was.

2) Active Management Zone (AMZ)

A creation of AMZ is indispensable to attain the vision of EMP for sustainable use of natural resources of LWC. It is impossible to achieve sustainable protection of natural environment without any understanding and cooperation of the local people. Thus, the rich natural resources should be materialized for economic and educational activities with the wise use manner as the Ramsar Convention explicitly stated. AMZ is not so strictly restricted as NPZ, but any socioeconomic activities must be developed without affecting natural environment in NPZ. In other words, AMZ should be a buffer area of NPZ. So, this zone could be a potential eco-tourism development area with wise use of natural resources in LWC. Eco-tourism in LWC itself has its own affording capacities related to number and type of tourists and facilities based on the magnitude of negative impacts to the natural environment.

3) Development Zone (DZ)

DZ is oriented for development of industries such as agriculture, forestry, fishery, and tourism in LWC. This zone is rather free for development and land use unless affecting NPZ and AMZ, and violating national and regional regulations. It means that the ecologically friendly regional development and socioeconomic activities are recommended in this zone.

(3) Implication of Environmental Zones with EMP

The EMP consists of six plans and guidelines, and these components require different functions to the environmental zones as shown in Figure 6.2.2.

The environmental zone will show the direction and intensity of actual measures of the wetland conservation plan. "Preservation" should be a principal direction in NPZ, "Protection" and "Conservation" is in AMZ, and "Restoration" mainly in DZ. The eco-tourism should be developed in AMZ, and its development plan should envisage an environmental education and recreational use of natural resources to contribute public awareness and regional economy.

The water level management plan will propose effective and efficient operational rules of water level control facilities based on the requirement of the wetland conservation plan. In NPZ, a modification should be applied because of its preservation approach. In AMZ and DZ, however, a rehabilitation and reconstruction should be applied for protection, conservation, and restoration of natural environment.

The guideline for EIMS will use NPZ and AMZ for scientific research and environmental monitoring to evaluate effectiveness of conservation measures and to decide additional measures. It will also use AMZ and DZ mainly for environmental education and public awareness. While, the guideline for regional development and the directions for land use plan gives a way of regulatory approach both in restriction and activation of human activities.

6.2.2 Environmental Zoning in LWC

(1) Delineation of Environmental Zones

The zoning delineation is carried out in accordance with the consideration of nature protection, eco-tourism, and land use for development.

All the biotopes identified as the strict nature protection area are zoned as NPZ. AMZ is demarcated by selecting the regular and seasonal nature protection quarters which are the biotopes mostly for eco-tourism. All the fishery area proposed in the spatial land use map are included into AMZ. Rural tourism, agriculture, forestry and fishery are also allowed in AMZ as long as these development activities hardly affect the existing natural environment which is essential to eco-tourism development.

The rest of LWC is naturally selected as DZ, where restriction on development is weak. But development activities and land use should be harmonious with and friendly to environment so that DZ can have a buffering function for NPZ and AMZ. Rural tourism, agriculture and forestry are to be implemented in DZ. Any inundated lands exclusively for agriculture and also for rural tourism in DZ should be protected with water control measures for stable agricultural products.

In addition, 11 nature protection territories in LWC have been approved by the Cabinet Ministers in 1999. Detailed regulations are planned to be set by the Government in each protection territory. At present, the detailed regulations have been prepared only for 3 territories, namely the Lubana depressions (No.6), Parabaine (No.8), and Pededze river lower stretch (No.9). By adopting a functional zoning approach, these regulations clarify allowed and/or prohibited human activities. A strict protection quarter defined in these

regulations is considered to correspond to NPZ, and regular and seasonal protection quarters are to AMZ compared with the concept and definition of zoning categories of EMP. The environmental zoning procedure of LWC is summarized as Figure 6.2.3.

(2) Zoning Map

Figure 6.2.4 depicts the conclusion of environmental zones in LWC in accordance with the delineation approach mentioned above, and the table below shows zoning areas by biotope classification. NPZ surrounded by AMZ is located in the center of LWC. DZ is mostly scattered close to LWC's borderlines and is surrounding AMZ.

The areas of each zone are 186 km^2 (23% of the total LWC area) for NPZ, 261 km^2 (32%) for AMZ, and 367 km^2 (45%) for DZ. About 50% of the total NPZ is covered by the raised and transitional bogs which have high ecological values in wetland, followed by the coniferous forests (34%). As for AMZ, it is occupied by the wide areas of the water bodies (80 km^2) and the deciduous forests (65 km^2). It should be noted that the most part of the fen and inundated grassland is concentrated in this zone. In DZ, the dry grassland and agricultural land occupies a large area (193 km^2), followed by the deciduous forest (100 km^2) and the coniferous forest (56 km^2) mainly due to activities of forestry.

Zoning Area by Biotope

(Unit: km^2)

Biotope Classification	NPZ (%)	AMZ (%)	DZ (%)	Total (%)
1) Raised and Transitional Bogs	93.2 (50)	3.5 (1)	3.3 (1)	100.0 (12)
2) Fens	2.6 (1)	12.0 (5)	0.7 (~0)	15.2 (2)
3) Inundated Grasslands	5.4 (3)	35.6 (14)	11.5 (3)	52.5 (7)
4) Coniferous Forests	63.1 (34)	31.1 (12)	55.7 (15)	150.0 (19)
5) Deciduous Forests	19.5 (10)	64.6 (25)	99.5 (27)	183.7 (23)
6) Broad-leaved Forests	1.1 (1)	1.1 (~0)	~0.0 (~0)	2.2 (~0)
7) Dry Grasslands and Agricultural Lands	0.5 (~0)	5.3 (2)	192.7 (53)	198.5 (24)
8) Lake, Rivers and Canals	0.9 (1)	80.4 (31)	1.1 (~0)	82.6 (10)
9) Fishponds	0.0 (0)	26.9 (10)	0.4 (~0)	26.9 (3)
10) Urban Area	0.0 (0)	0.0 (0)	2.4 (1)	2.4 (~0)
Total	186.3 (100)	260.5 (100)	367.3 (100)	814.0 (100)

6.2.3 Conservation Criteria by Environmental Zone

The next table summarizes definition, present features, conservation criteria, allowable development and inundation control for each environmental zone. Considering the EMP's direction, vision and goals emphasizing wise and sustainable use of LWC, the following criteria for each zone's conservation are qualitatively proposed:

a) In NPZ, environmental quality levels at present should be maintained or improved by preserving biodiversity, ecosystem functions, and landscapes;

b) In AMZ, there should be no occurrence of negative impacts due to human activities which damage natural environment of NPZ and potential eco-tourism resources in AMZ itself; and

c) In DZ, environmental buffering functions should be established and maintained to prevent negative impacts of LWC's surroundings on ecological values in NPZ and AMZ, by means of development approaches harmonious with and friendly to LWC's ecosystem.

The conservation criteria set below should be achieved by the well combination of a facility plan and a regulatory plan to be described in the next section.

Conservation Criteria and Other Characteristics for Environmental Zone

Environmental Zone Type	Nature Preservation Zone (NPZ)	Active Management Zone (AMZ)	Development Zone (DZ)
Definition	Area for strict nature preservation	Area for restricted human activities	Area for further development
Present Features	- Unchanged and vulnerable nature - Endangered or important flora and fauna - Unique and beautiful landscapes	- Developed area for agriculture, forestry and fishery - Potential natural resources for eco-tourism - Less naturalness than NPZ	- Developed area for agriculture and forestry - Less biodiversity and ecological value than AMZ
Conservation Criteria	Preservation of the present levels of biodiversity, ecosystem functions and landscapes	No occurrence of negative impacts to natural environment in NPZ and to eco-tourism objects in AMZ	Maintenance of buffering function for NPZ and AMZ to prevent adverse impacts on wetland ecosystem from the outside
Allowable Development and Inundation Control	No development and no artificial inundation control	- Eco-tourism - Commercial fishery harmonized with eco-tourism - Restricted agriculture, rural tourism and forestry with environmental protection measures - No additional inundation control - Water level control of the lake and ponds	- Agriculture and rural tourism with inundation control - Forestry development and land use harmonious with and friendly to environment

6.2.4 Regulatory Plan

(1) Current Regulations for Nature Protection Territory

At present, the detailed regulations for three nature protection territories in LWC approved by the Cabinet Ministers are available as shown in Table 6.2.1. These territories are divided into three functional zones, a strict protection area, a regular protection area, and a seasonal

protection area. A strict protection area has relatively strict regulations in kind and in degree compared with other areas. The regulations are not uniform by each zone and territory because of fully reflecting of site specific conditions. So, the contents and descriptions of prohibited and allowable activities are quite different from each other.

(2) Land Tenure

In terms of ownership, land in LWC is categorized into state land, township land, and private land (owned by physical persons or legal entities). An important aspect to manage LWC based on the environmental zoning is the right for private land owners to be compensated when imposing environmental requirements on their land use, especially for NPZ and AMZ. It is also concern for state and local authorities responsible for carrying out conservation according to the existing laws and international obligations, because the right to be compensated might obstruct the possibility to establish a protected area like NPZ and AMZ in Latvia with scarce economic resources.

According to the Law on Land Use & Survey (1991) and the Law on Specially Protected Nature Territories (1993), private land owners have the right to demand compensation from the local government for financial losses resulting from the legal restrictions and obligations on their land. Tax exemption is one compensation form available. The central or local government has the right to purchase private land within a protected area. The problem is a lack of legal principles for compensation and how to consider private interests when establishing a protected area and determining environmental restrictions/requirements. Therefore, it is appropriate to delineate NPZ as public land such as state land and township land because the nature preservation must be the first in this zone.

The next table shows the present land ownership in LWC by the proposed environmental zone, calculated based on the land tenure map as Figure 6.2.5. It indicates that the land ownership issue above mentioned will not occur in NPZ which is not owned by the private. While, AMZ of which private land occupies 18 % would require some negotiation and agreement with the local land owners to set an actual regulatory plan for this zone.

Present Land Ownership of LWC

Ownership	NPZ		AMZ		DZ		Total by Ownership	
	Area (km^2)	%	Area (km^2)	%	Area (km^2)	%	Area (km^2)	%
State Land	178	96	178	68	112	30	468	57
Township Land	8	4	34	14	13	4	55	7
Private Land	0	0	48	18	243	66	291	36
Total by Zone	186	100	260	100	368	100	814	100

(3) Proposed Regulations in LWC

A regulatory plan must be simple and understandable both for decision makers and users. Too much as well as too weak regulations will lead a distortion of its effectiveness and efficiency. It is crucial that the effective environmental management can not be achieved

only by the regulatory plan. Well harmonized application of the regulatory plan and the facility plan is indispensable for implementation of EMP.

Since the regulatory plan for EMP needs to cover all types of proposed protection territories in LWC, it must be applicable for preparation of a site specific regulation of each protection territory. The major activities to be restricted in LWC are 1) Physical activities, 2) Pollution activities, 3) Ecological disturbance, and 4) Other activities.

Physical activities:

Physical activities cause direct impacts to the environment. The magnitude of impacts depends on scale, location, and duration time. Most impacts usually affect natural environment seriously and some are irreparable. With regard to wetland conservation, change of regime on land and water should be paid careful attention, so the physical activities in NPZ should be strictly prohibited in principle. The permission oriented restriction would be suitable for AMZ because it includes 18% of private lands. In DZ, the notification oriented control could be appropriate for effective management of LWC.

Pollution activities:

Pollution activities usually bring about indirect impacts to the environment through deterioration and degradation habitats of fauna and flora. Possible pollution activities are wastewater discharge, waste dumping, and spraying of harmful substances and agri-chemicals. A damage caused by these impacts is not likely serious at first, but it could extend affected areas spatially and continue gradual contamination for a long time. Therefore, any pollution activities need to be strictly controlled in NPZ, and require a permission in AMZ and a notification in DZ. An environmental impact assessment system of these activities would be useful for effective and efficient decision on management of LWC.

Ecological disturbance:

Ecological disturbance causes direct impacts to fauna and flora, and wet land ecosystem. Possible activities vary from economic to recreational and educational purposes. These activities are normally site specific and small scale, and somewhat linked with culture of the local society except for a large scale forestry and fishery. Thus, it could be appropriate to apply the permission oriented restriction in principle. A commercial based large scale forestry and fishery, however, should be prohibited in NPZ.

Other human activities:

Some human activities such as land use change, entrance, intrusion, and recreation which are not specified to wetland, should be regulated for conservation of nature and for wise and sustainable use of natural resources in LWC. These activities should be strictly prohibited in NPZ, and permission required for in AMZ.

Considering the characteristics of LWC mentioned above, a regulatory plan by environmental zone in LWC is proposed as shown in Table 6.2.2. This plan must be a base for preparation of a concrete plan for each protection territory. It should be noted that the

contents and methods adopted in the regulatory plan needs to be revised and modified based on the monitoring data and information related to the effectiveness of regulatory and facility plan in order to prepare more workable plan for effective implementation of EMP.

6.3 Organization and Institution for EMP

6.3.1 Organization for EMP

(1) Functional Frame

In accordance with the goals and strategies, EMP has the following seven major functions in line with the envisaged outputs. All these EMP's functions are closely connected to each other.

a) Establishment of conditions for Ramsar site registration,

b) Biotope conservation,

c) Environmental information management and monitoring,

d) Environmental education,

e) Integrated water level management,

f) Eco-tourism promotion, and

g) Baseline for development and land use of LWC.

(2) Organization Frame

The EMP includes broad management components which will require high capabilities of coordination and actual management practice. The current official agencies concerned to EMP of LWC extend widely, such as the Rezekne and Madona REBs under MEPRD responsible for natural environmental, the Department of Planning under the District Council of four districts, and the Aiviekste Land Reclamation System Administration (ALRSA) under MOA responsible for operation and maintenance of water level control facilities. However, the current management system is lacking a core organization having the initiative, and this has caused difficulties for decision making and for taking aggressive actions. Therefore, to establish independent responsible organizations with clear right and power is considered to be suitable for actual implementation of EMP of LWC.

The EMP needs to cope with rather broad and complicated functions as mentioned above. It will require integration and well coordination among official agencies and the local people concerned. Therefore, an establishment of the Implementation Committee (IC) and the Environmental Management Center (EMC) is proposed for actual implementation of EMP for LWC. The IC is a management authority of EMP which deliberates, authorizes, and coordinates substantial matters related to EMP, and the EMC is a site specific organization for actual implementation of EMP as shown below. These two organizations should be established before implementation of EMP because they will be required a lot of preparatory works including application of available soft (low interest rate) loan.

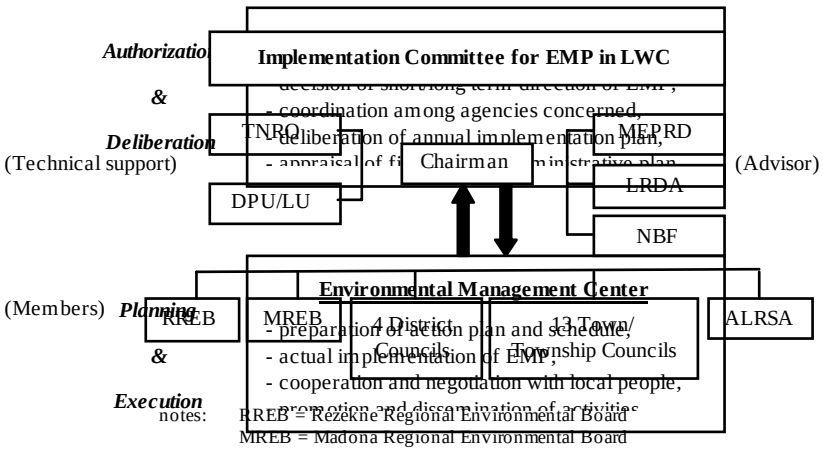
Overall Organization Frame of EMP

(3) Implementation Committee (IC)

Since a drastic institutional and organizational change might bring about some confusion in the current administrative system, the creation of an ad hoc Implementation Committee (IC) consisting of the agencies concerned can be practical for the time being. Its organization is proposed in the next figure. The IC should provide necessary physical, administrative and financial resources to EMC described below, and supervise its activities.

The IC consists of the regular committee members and the advisory group from MEPRD, NBF, and LRDA. In addition, IC requires scientific and technical supports of DPU, University of Latvia (LU) and TNRO. The regular committee members will consist of representatives from the local municipalities and sector agencies concerned with environmental conversation and development of LWC. A committee chairman is to be selected from among these members.

MEPRD will require a strong initiative to establish IC and to make it on right orbit with leading key members such as District councils and REBs. It should be, however, noted that the establishment of a new management authority is recommendable for actual implementation of EMP in the long term.



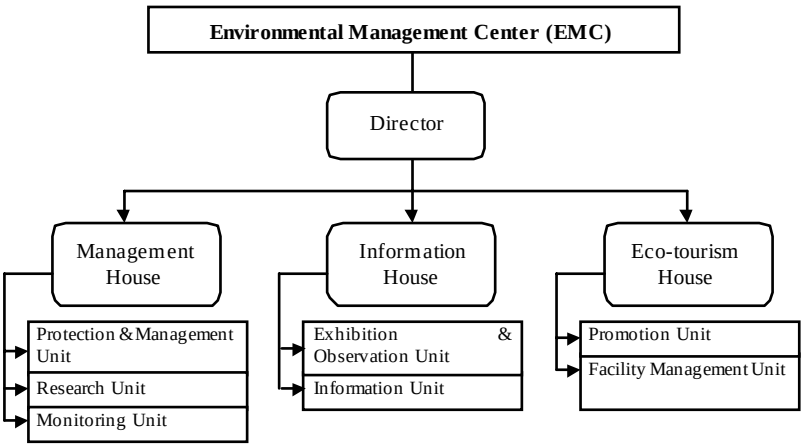
notes: RREB = Rezekne Regional Environmental Board
MREB = Madona Regional Environmental Board
LRDA = Latgale Regional Development Agency
NBF = National Board of Fishery
DPU = Daugavpils Pedagogical University, LU = University of Latvia
ALRSA = Aiviekste Land Reclamation System Administration of MOA
TNRO = Teici Nature Reserve Office

Organization Structure of IC

(4) Environmental Management Center (EMC)

The EMC has a role of actual implementation of EMP under the supervision of IC. EMC consists of three sections (tentatively named "House" in this report) which correspond to the components of EMP, namely the Management House, the Information House, and the Eco-tourism House. Each house has several units for actual implementation of responsible activities as shown below. Since some difficulties could be expected to actualize necessary actions in line with decisions made by committee members at the beginning, IC would be required to support EMC's concrete actions.

The Management House is responsible for a) biotope conservation including water level management, b) research of wetland ecosystem and its conservation, and c) monitoring and patrol. The Information House is responsible for preparation and dissemination of environmental information, and the Eco-tourism House is for promotion of eco-tourism and management of facilities to be used for eco-tourism. A building which has enough space and facilities should be provided for EMC, and its location would be the Idena area in Nagli township from a strategic management viewpoint.



Organization Structure of EMC

6.3.2 Institutional Frame

In order to effectively and steadily implement the programs and projects proposed under EMP, the following five major institutional roles should be set up to realize wise and sustainable use of LWC and to manage the existing institutional difficulties.

(1) Initiative Role for Local People's Participation

A future figure of LWC fully depends on the will of the local people. It should create incentives for the local people to follow the EMP's directions and to be actively involved in its implementation in order to effectively implement EMP. Thus, the proposed organizations should incorporate opinions of the local people and the interest groups concerned to formulate the plan and to reflect their intentions on environmental conversation and future development in a harmonious manner. For this purpose, the organizations must arrange opportunities for public hearing meetings and publication on EMP, in association with NGOs and NPOs.

(2) Coordination Role between Environmental Side and Development Sector

The present economic disturbance in Latvia has given advantages on the natural environment of LWC, not adversely affecting them with little development progress. There is thus a risk that LWC will be fully used for economic activities and very few natural environment will remain as the regional economy goes on well in the future. Therefore, the organizations should have a power to coordinate between environmental and development incentives under the EMP's goals. But it is important that they are coordinated on the basis of due agreement among the various stakeholders related to LWC. For instance, the on-going land privatization can generate conflicts between further development and natural conservation in LWC. Any restrictions on land use and economic activities for nature protection require an agreement of landholders giving some incentives to them.

(3) Enforcement and Technical Role on Implementation

The concerned district and township councils have little knowledge and experiences in the development and conservation activities, and have limited enforcement capability to realize action programs as well as technical methods to actually implement them. It easily brings about more indifference and distrust to the EMP implementation among the stakeholders. The organizations should have rigorous and stable enforcement power and practical methodologies required for implementation of EMP.

(4) Environmental Monitoring Role for LWC

Scientific and technical information is required for effective implementation of EMP. The organizations should have a monitoring system consisting of periodic monitoring stations, systematic monitoring programs, monitoring technology, hard/software equipment, and skilled personnel. A well developed monitoring system will prove quality assurance and control procedures applied in the steps of the monitoring program. It is necessary to prepare an appropriate environmental monitoring program in LWC with the national and international standards.

(5) Environmental Education Role for Residents and Visitors

Pressures on the natural environment by economic activities of the people lacking in environmental awareness reduce the environmental quality of LWC. The general level of environmental awareness of the local people is relatively low in and around LWC. In order to accomplish the goals of EMP, it is therefore essential to raise environmental awareness of people not only using environmental resources in but also visiting LWC. The environmental education role of the organization ranges from training of environmental experts and eco-tourism guides, environmental orientation to local residents, visitors and school children, to dissemination of environmental information on a national and even an international level. Accumulated data and information through the EMP implementation including the environmental monitoring will be important sources to prepare educational materials.

Table 6.2.1 Summary of Latvian Nature Protection Territory

Name of Protection Territory	Lubana depressions (No.6)			Parabaine (No.8)			Pedegze river lower stretch (No.9)		
1. Major protection target	a)Natural environment, b)Habitat of rare and protected species c)Landscape and biotope of coastal area of Lake Lubana			a)Wetland complex (fungus, lichen, plant, animal), b)Habitat of rare and protected species c)Inundated grassland			a)Wet and decidious forest, b)Landscape and biotope		
2. Functional zones									
1) Strict protection area (St- A)	Restriction of human activities especially forestry			a)Protection of vulnerable and rare bird, b)Restriction of forest works			Protection of vulnerable and rare species And forest stands		
2) Regular protection area (Re-A)	Habitat protection of rare and protected species			Restriction of human activities (exploitation, bio-technical & recreational			Minimization of impacts caused by human activities		
3) Seasonal protection area (Se-A)	-			a)Gomelis area, b)Spring migration period of birds (ice melt season -			Nesting sites of Greater Spotted Eagle		
3. Area (ha)	5,905			9,822			4,150		
4. Restrictions	St-A	Re-A	Se-A	St-A	Re-A	Se-A	St-A	Re-A	Se-A
I. Prohibited activities									
1)Tree cutting	●	-	-	-	-	-	-	-	-
2)Any forest activity	●	-	-	●	-	-	●	●	-
3)Cutting trees from edge to center	●	●	-	-	●	-	-	●	-
4)Large scale deforestation of state land	●	●	-	-	-	-	-	-	-
5)Clear and selective zone tree cutting	●	●	-	-	-	-	-	-	-
6)Reforestation & cranberry planting	-	-	-	●	-	-	-	-	-
7)Damaging biotope, fauna & flora, and habitat	●	●	-	●	-	-	●	●	-
8)Capture & collection of fauna & flora	-	-	-	●	-	-	-	●	-
9)Introduction of exotic species	-	-	-	●	-	-	-	-	-
10)Hunting water birds applying toxic shell	-	-	-	-	●	-	-	-	-
11)Damaging landscape	●	●	-	●	-	-	-	●	-
12)Land use change	-	-	-	●	-	-	-	●	-
13)Construction of drains, roads, power transmission linse, and buildings	●	●	-	●	-	-	-	●	-
14)Application of fertilizers, pesticids and chemicals	●	●	-	●	-	-	-	●	-
15)Grass cutting	●	●	-	-	-	-	-	●	-
16)Construction of educational trails and view sites	-	-	-	●	-	-	-	-	-
17)Waste dumping	-	-	-	●	-	-	-	●	-
18)Change of surface & groundwater level	-	-	-	●	-	-	-	●	-
19)Mining & quarries	-	-	-	●	-	-	-	●	-
20)Activities causing soil erosion	-	-	-	●	-	-	-	-	-
21)Recreation and sports use	-	-	-	●	-	-	-	-	-
22)Driving by water motorbike	-	-	-	-	●	-	-	-	-
23)Dwelling	-	-	-	-	-	●	-	-	●
24)Driving (Apr. 1- Sept. 1)	-	-	-	-	-	-	-	-	●
II. Allowed activities									
1)Hunting (except Common Snipe)	◎	◎	-	-	-	-	-	-	-
2)Hunting complying relevant laws	-	-	-	◎	◎	-	◎	-	-
3)Conservation activities	◎	◎	-	◎	◎	-	-	-	-
4)Visits for protection & research	◎	◎	-	-	-	-	◎	-	-
5)Visits for recreation	-	◎	-	-	-	-	-	-	-
6)Visits for education	-	◎	-	-	◎	-	◎	-	-
7)Picking berries & mushrooms	◎	◎	-	◎	◎	-	◎	-	-
8)Fishing & angling complying relevant laws	-	-	-	◎	◎	-	◎	-	-
9)Grass cutting	-	-	-	-	◎	-	-	-	-

note: ●：Prohibited activity, ◎：Allowed activity, -：No description

source: Regulations on Nature Protected Areas (June 1999), Regulations of the Cabinet Ministers No.212/1999

Table 6.2.2 Regulatory Plan by Environmental Zone

Activities	Environmental Zone		
	NPZ	AMZ	DZ
I. Physical Activity			
1) Building & facility construction	●	○	X
2) Land development and topographical change	●	○	X
3) Mining & quarring	●	○	X
4) Reclamation	●	○	X
5) Road construction	●	○	X
6) Cultivation	●	○	X
7) Telecommunication and transmission line	●	○	X
8) Change of water level	●	○	X
9) Dredging & water drainage	●	○	X
10) Navigation	●	○	X
II. Pollution Activities			
1) Wastewater discharge	●	○	○
2) Solid waste dumping	●	○	○
3) Storage of pollutants and harmhul substances	●	○	○
4) Spraying agri-chemicals & harmful substanc	●	○	○
III. Ecological Disturbance			
1) Capture & collection of fauna	○	○	-
2) Collection of trees and forest products	○	○	-
3) Research and monitoring	○	X	-
4) Educational use	○	X	-
6) Tree cutting and planting	○	X	-
7) Grass cutting and planting	○	X	-
8) Introducing & Stocking endemic species	○	○	-
9) Hunting	○	○	-
10) Angling & fishing	○	○	-
11) Commercial forestry	●	○	X
12) Commercial fishery	●	○	X
IV. Other Human Activities			
1) Land use change	●	○	-
2) Dwelling	●	○	-
3) Intruding on foot (exept for carnberry pickin	●	-	-
4) Intruding by car and motorbike	●	○	-
5) Intruding by motorboat	●	○	-
6) Burning	●	○	-
7) Camping & firing (except for designated pla	●	○	-
8) Other recreational use	●	○	-
9) Agriculture and Pasturing	●	○	-

note: ●：Strictly prohibited, ○：Permission required, X： Notification required, -：No restriction

NPZ: Nature Preservation Zone, AMZ: Active Management Zone, DZ: Development Zone

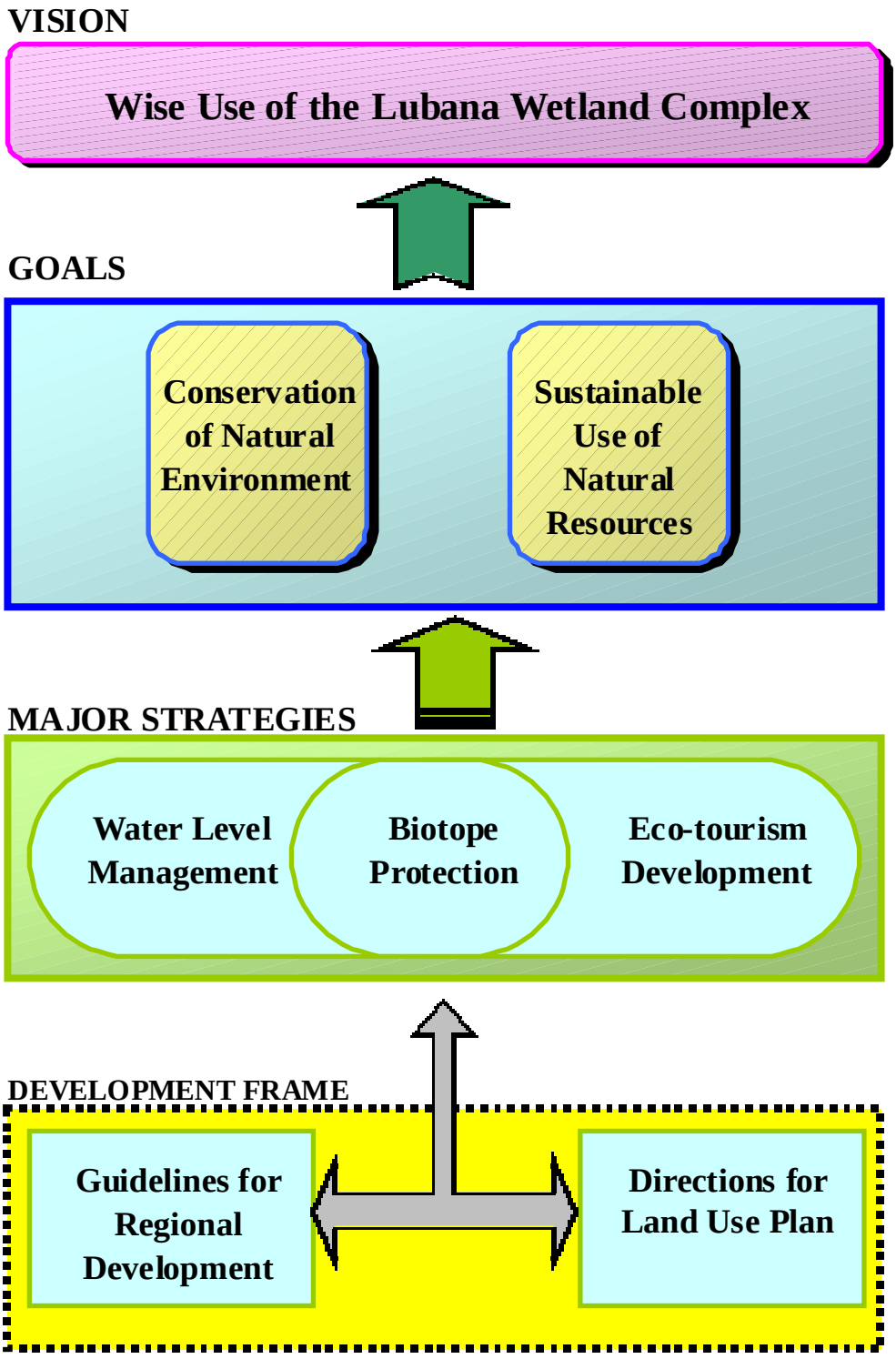


Figure 6.1.1 Concept of Vision and Goals of the Environmental Management Plan

The Study on Environmental Management for Lubana Wetland Complex in the Republic of Latvia

JAPAN INTERNATIONAL COOPERATION AGENCY

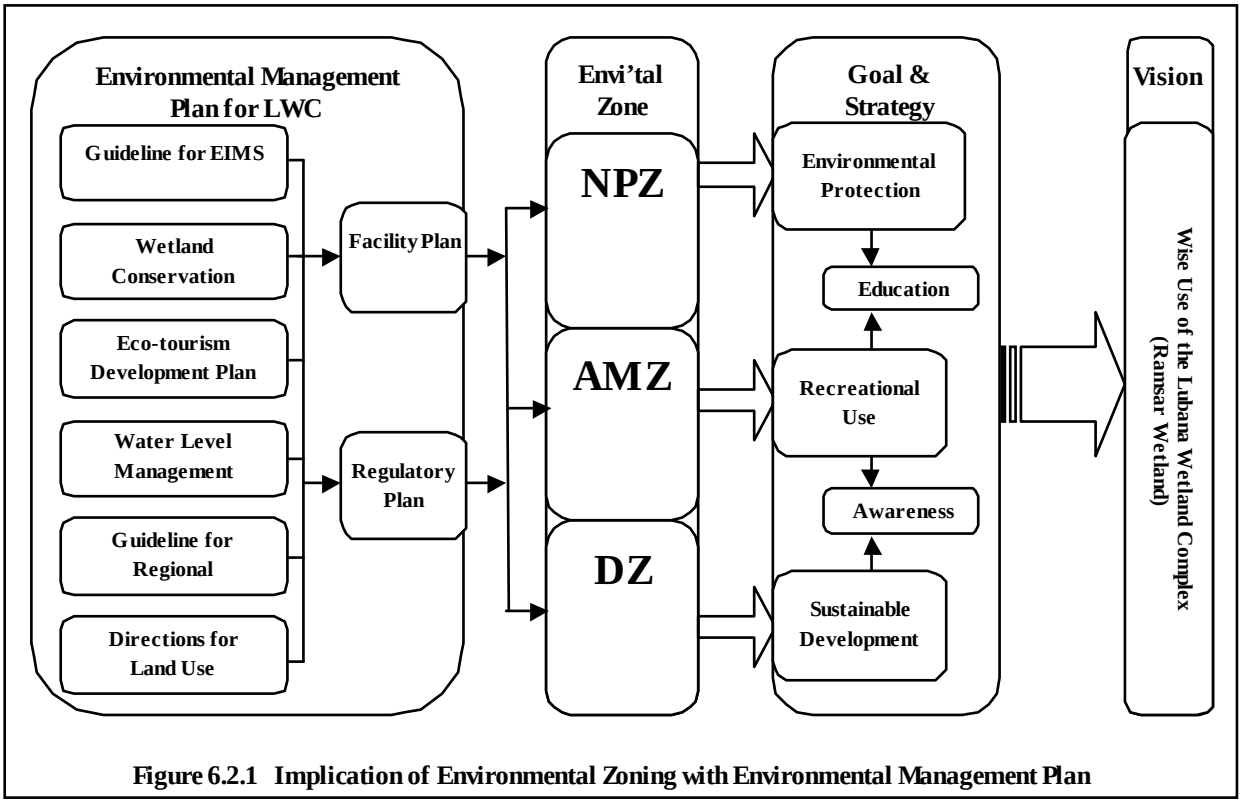


Figure 6.2.1 Implication of Environmental Zoning with Environmental Management Plan

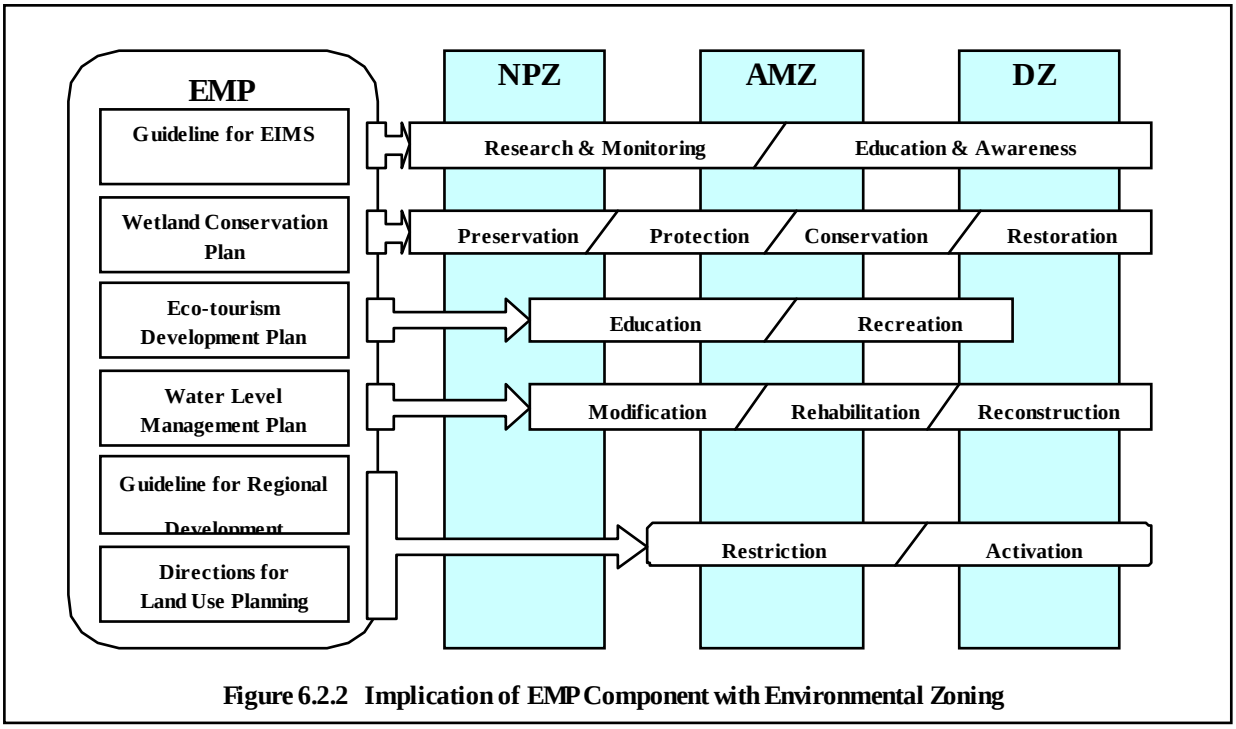


Figure 6.2.2 Implication of EMP Component with Environmental Zoning

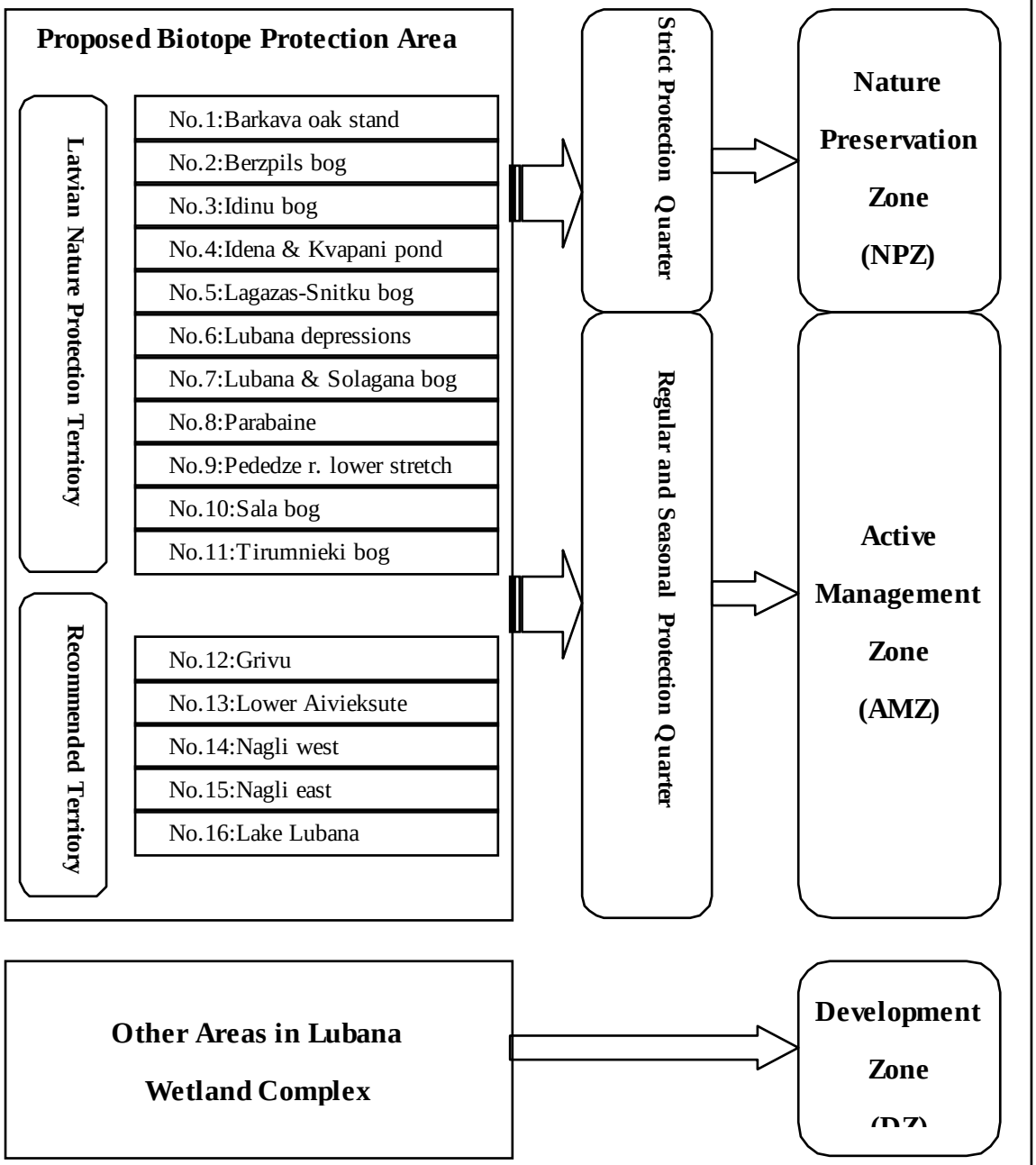


Figure 6.2.3 Environmental Zoning in LWC

The Study on Environmental Management for Lubana Wetland Complex in the Republic of Latvia

JAPAN INTERNATIONAL COOPERATION AGENCY

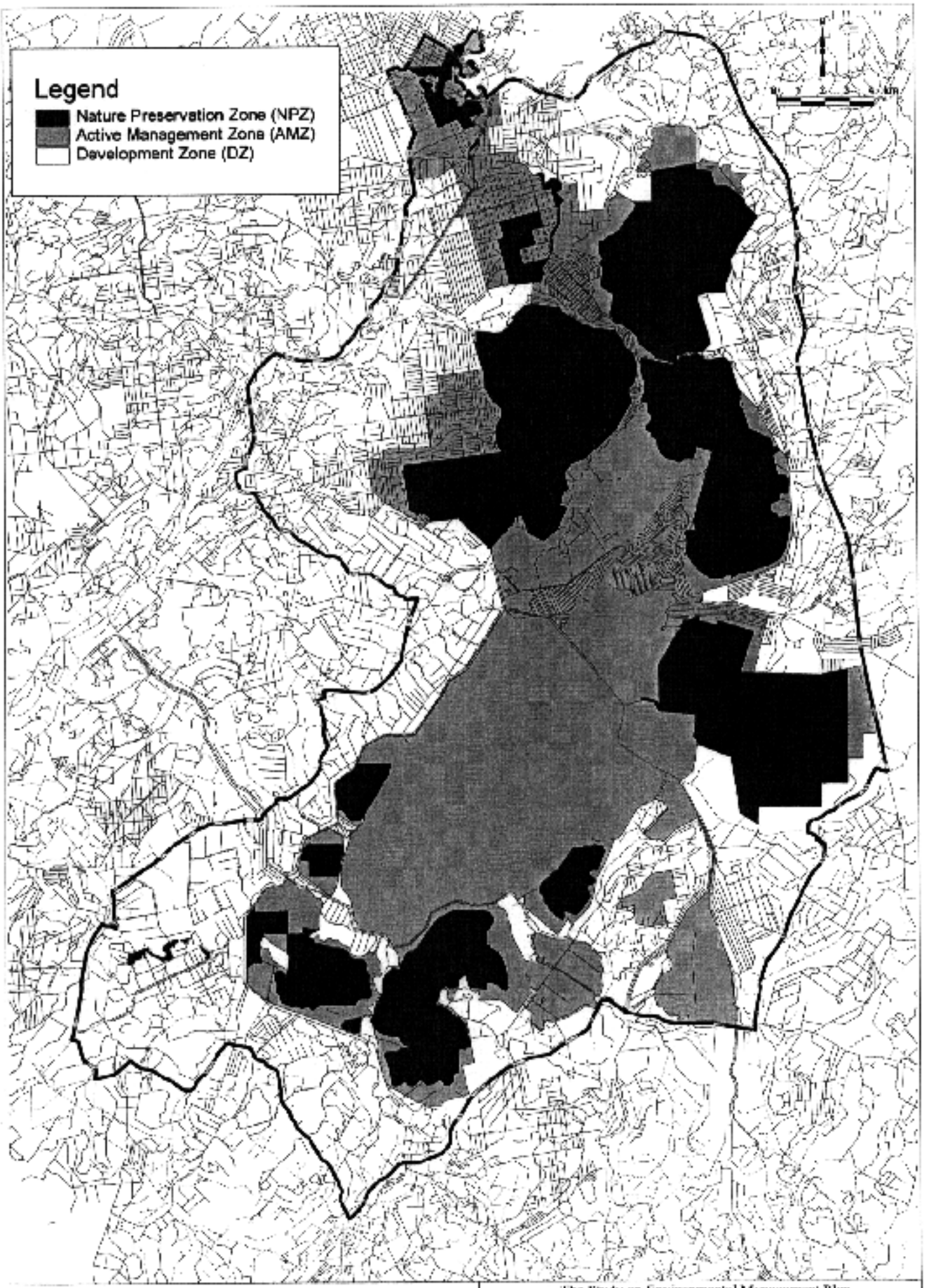


Figure 6.2.4 Environmental Zoning Map

The Study on Environmental Management Plan for Lubana Wetland Complex in the Republic of Latvia

JAPAN INTERNATIONAL COOPERATION AGENCY

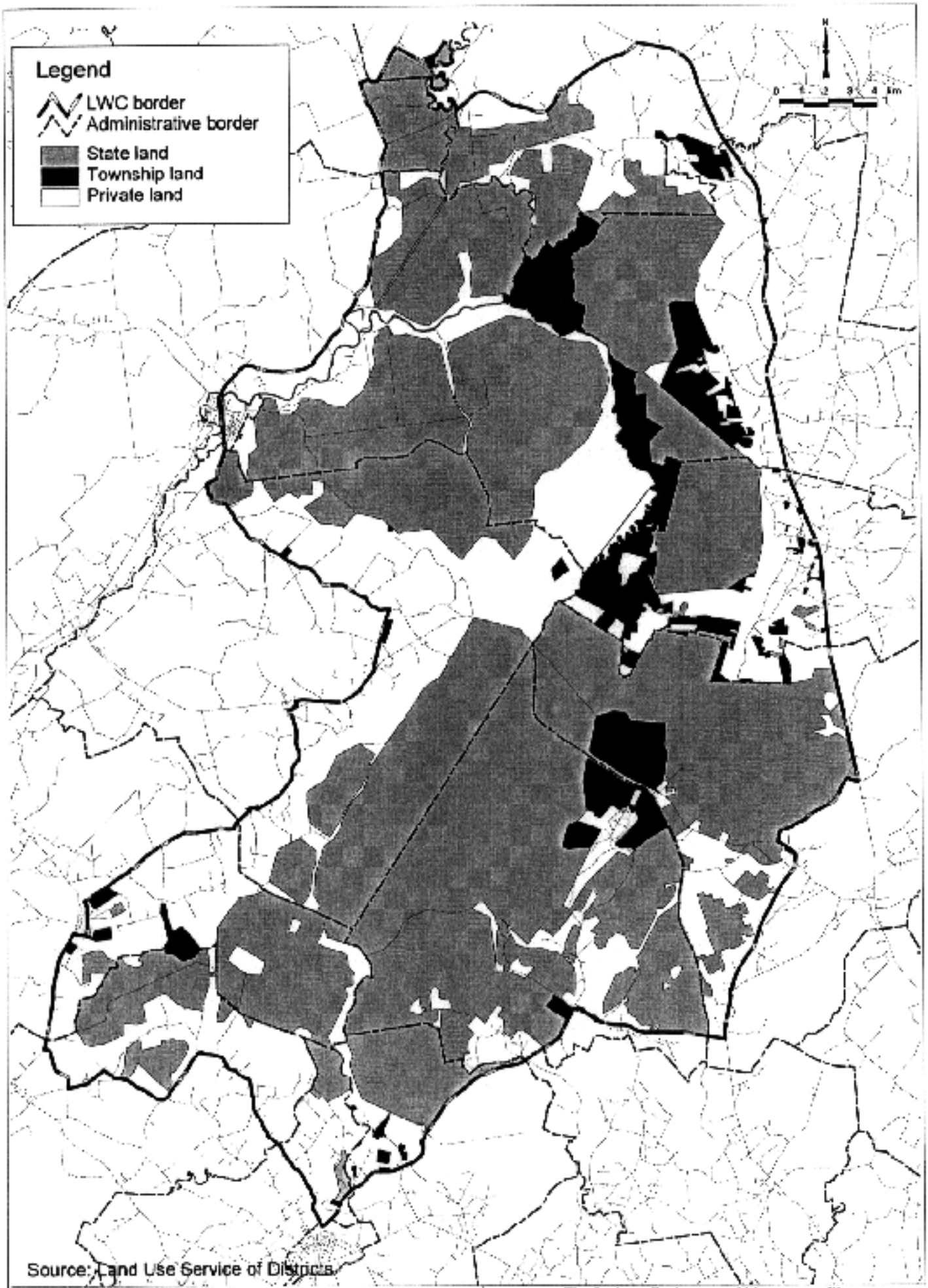


Figure 6.2.5 Land Tenure Map

CHAPTER 7

CHAPTER 7 WETLAND CONSERVATION PLAN

7.1 Overall Frame

7.1.1 Approach and Strategy

Since LWC has been used for production, it is not appropriate to apply only the restriction of human activities for nature conservation. Therefore, the following approaches should be taken for the Wetland Conservation Plan (WCP) of LWC.

(1) Biotope oriented approach

Basic approach of the wetland conservation in LWC is to protect respective biotopes by establishing protected territories. Depending on the level of required conservation, each territory is divided into strictly protected quarter, regularly protected quarter, and seasonally protected quarter. Detailed conservation regulation is to be formulated by each territory based on the requirements on conservation and economic usage.

(2) Species oriented approach

Because of bio-geographical location of Latvia, its nature is composed of less number of biological species compared to that of tropical area, and therefore, there is enough reason why each species should be protected at large cost. In LWC there are endangered species such as raptors that needs species-specific protection measures. Because of their endangered status, a restriction of human activities is never enough, and positive and urgent restoration measures are required. For example, nesting place protection has to be promoted regardless of places they are found.

(3) Awareness oriented approach

The nature conservation cannot be successful unless the local people are educated so as to appreciate the value of nature and have sufficient knowledge for wise use of natural resources. In this WCP, conservation of pastures, crop fields and commercial forests are promoted by awareness of local people and capacity building of relevant administration sectors. This approach is also necessary for promoting eco-tourism. Giving people opportunities to experience varied biotopes is especially important. For example, large raised bogs are normally surrounded by forests and it is difficult for even local residents to observe them.

(4) Strategies for LWC

The Cabinet of Ministers accepted the strategy of the National Program on Biological Diversity (NPBD) in February 2000. The strategy covers nature protection, sustainable use of natural resources, environmental policy instruments, and prerequisites of introduction. Many items in NPBD have close relevance with the environmental management of LWC,

and therefore, WCP should be formulated in conformity with the strategies of NPBD. The main strategies taken for LWC are:

- to emphasize the biodiversity in rivers and lake,
- to preserve fragile the wetland vegetation,
- to strengthen the function of forests,
- to manage game animals and birds through hunting,
- to promote eco-tourism for sustainable resource use, and
- to focus on environmental education and public awareness

(5) Mitigation strategy

Latvian NEPP and NPBD aims at maintenance and protection of existing biodiversity and landscape characteristics. Lake Lubana at present, however, is already degraded due to large-scale dyke work. Since the work is largely contributing to flood prevention, it is not appropriate to bring back the lake to a natural wetland what it used to be half a century before. Therefore, e*x situ* mitigation measures such as upgrading neighboring fish ponds as alternative waterfowl habitat is sought. This does not contradict with the concepts of the Ramsar Convention as it admits to compensate for any loss of wetland resources (when they are lost in urgent national interest), either in the same area or elsewhere, of an adequate portion of the original habitat.

7.1.2 Biotopes to be Protected

(1) Definitions and justification of biotope types

LWC is divided into 9 biotope types. To enable comparison between different classification system, the table indicates the relevance of biotope classification in this JICA study with that of the EU Directive and the Classification System for Wetland Type in the Ramsar Convention. Biotope types are determined by types of vegetation and wildlife distribution. Since distributions of most animal species are bound by vegetation types, terrestrial biotopes of LWC is delineated by modifying vegetation map from the viewpoint of animal distributions. Aquatic biotopes were classified based on values as fish habitat.

(2) Implication of habitat requirements with water level

After dyke construction around Lake Lubana, flood area is almost limited to inundated grassland along Aiviekste river. Surface water level at flooding time seems not a decisive factor for land use planning in other areas of LWC. It is important, however, to monitor and control groundwater levels at bogs and peat woodlands, because vegetational succession is taking place by desiccation along drainage ditches.

Artificial alterations of LWC biotopes during the last three-quarters of the twentieth century were mostly related to water levels. Drainage works affected on forests, bogs, fen

and inundated grasslands, and dyke construction mainly on lake and inundated grassland. The following tables indicate water level requirements of respective mammal and bird species.

1) Mammals

Water levels of Lake Lubana and other water bodies are not so important for mammals because they mostly remain on the shores of water bodies. If water level change leads to decrease of hiding places on shores, it is a negative factor for them. Large and medium size mammals can escape from inundated areas. Although small mammals like moles may not be able to survive at inundated areas, they are mostly common species and have high reproduction rates.

Habitat Requirements of Water Levels for Mammals

Mammals that live in LWC		Habitat requirements
Aquatic mammals	Otter	Abundance of prey fish and frogs. Hiding places near water shores. Long total length of water ways due to large home range.
	European beaver	Existence of water bodies in forested areas.
	Muskrat	Shores of gentle or still water bodies.
	American mink	Abundance of fish and frogs for food.
Insectivore	Hedgehog and Mole	Habitat being safe from inundation.
Lagomorpha	Brown hare and Blue hare	Habitat being safe from inundation.
Arboreal species	Red squirrel and Pine marten	Not relevant
Terrestrial carnivores	Raccoon dog, Wolf, Brown bear, Lynx and Badger	Habitat being safe from total inundation (but tolerant to partial inundation of their large home ranges).
Artiodactyla	Wild boar, Roe deer, Elk, and Red deer	Habitat being safe from total inundation (but tolerant to partial inundation of their large home ranges).

2) Birds

Many bird species require shallow waters for feeding. Large wading birds need water depth less than approximately 50 cm deep. Small waders like snipes require much shallower places. Water birds such as ducks and geese that depend on underwater foods, will not be able to catch bottom foods if water depth becomes higher than about 3 m. Water depth has little importance as resting sites of water birds. LWC is used as breeding sites for many bird species, and those sites should be safe from inundation during the breeding season. For example, great snipe that breeds only at inundated grassland is directly affected by flooding, and the flooding period is more important than the flooding level. Prolonged inundation is also not favorable for birds having their home ranges in such places.

Habitat Requirements of Water Levels for Birds

Bird species that breed in LWC		Habitat requirements
Diurnal raptors	Osprey	Shallow waters less than 60 cm deep is desirable for catching fish.
	Golden eagle	Its home range seems not affected by water level.
	White-tailed eagle	Because of its fish-eating habit, water level should be controlled so that prey fish is abundant.
	Spotted eagle	Because it breeds near inundated grassland and preys on waterbirds, water level should be kept to allow waterbird abundance.
	Lesser spotted eagle	It mainly prey on terrestrial animals, and seems not affected by water level.
	Short-toed eagle	Since its present breeding site is located near inundated grassland, long flooding seems unfavorable for securing hunting areas.
Colonial water birds	Grey heron	Shallow water is necessary for feeding while wading. Its colony at an island in the lake should be safe from inundation.
	Cormorant	Water level should be controlled so that prey fish is abundant. Its colony on an island in the lake should be safe from inundation.
Wading water birds	Black stork	Shallow water is necessary for feeding while wading.
Anatidae water birds	Underwater food Eaters and fish eaters	Water level of less than about 3 m is necessary for feeding foods under the water. Open water area is necessary for resting. Breeding sites near waters should be safe from inundation especially at breeding season.
	Land food eaters	Open water area is necessary for resting. Breeding sites near waters should be safe from inundation especially at breeding season.
Inundated grassland birds	Great snipe	As it breeds only at inundated grasslands, prolonged inundation period that overlaps with breeding season should be avoided.
Forest birds		Habitat should be safe from inundation especially in breeding season.
Fen and Bog birds		Habitat should be safe from inundation especially in breeding season.
Dry land birds		Their habitats are not affected by water level.

Lake Lubana has a very flat bottom. At its lakeshore the elevation is 91.5 m above sea level and 90.1 m at the deepest part. This means that the lake water depth is 1.0-1.4 m at normal water level (92.5 m). As far as the lake water level is regulated within the planned range of 91.2 - 95.3 m, most areas surrounded by the dyke is filled with water. This means that the lake can serve as a huge resting place for water birds, but not suitable as breeding places. Colonies of gray heron and cormorant on an island in the lake (93.2 m) will be also susceptible to water level increase. The lake water depth is acceptable as a feeding site for diving waterfowl, but it is too deep for waders. However, for securing abundant fish, benthic animals and weeds, lowering of water level below 91.2 m should be avoided as it leads to shrinking of water area like the case happened in 1995-1996.

Differently from the lake, shallow water levels of fishponds are suitable even for small waders, and there are many suitable breeding places near water shores. For resting, many water birds prefer small ponds to large lakes, and fishponds are appropriate places in this sense, too. These are reasons why breeding of water birds is limited to fishponds and does not occur at the lake. After the construction of dykes in 1983, flooding in LWC is mostly limited to inundated grasslands along the Aiviekste river. Prolonged inundation period, particularly in breeding season, is not favorable for some birds like great snipe that breed and feed at inundated areas. Bird species in the other areas, however, do not seem affected by water level.

3) Fishes

As far as the lake water level is regulated within the planned control range of 91.2 - 95.3 m, water depth will be sufficient for adult fishes. Although death of carp species by freezing has been reported at shallow waters, many fish species can survive the season by becoming inactive and burying themselves in the mud. Research results on necessary water depth for this is not available. Although water depth at Lake Lubana is sufficient for spawning of most fishes, it is questionable whether there are suitable spawning places endowed with aquatic plants, stony beds, and other substratum to which spawns stick. The importance of Lake Lubana as a spawning place is not clear. Productivity of fish resource is highly related to abundance of zooplanktons and zoobenthos. Shrinkage of open water area that occurs every several years at Lake Lubana is unfavorable for securing weeds and benthos. Some fishes catch insects that have fallen into water, but such does not take place frequently at large lakes but at waters in forested areas.

Habitat Requirements of Water Levels for Fishes

Fishes found in LWC	Distribution in LWC	Habitat requirements
Spiny loach	lake and rivers	Spawning place shallower than 1 m.
Perch	lake and rivers	Not particularly.
Verkhovka	lake and rivers	Not particularly
Ide	lake and rivers	Passages to allow migration. Submerged plants for food.
Carp	lake and rivers	Passages to allow migration.
Crucian carp	lake and rivers	Not particularly.
Ruffe	lake and rivers	Not particularly.
Pike	lake and rivers	Abundance of food fish and frogs.
Tench	lake and rivers	Not particularly.
Bream	lake and rivers	Passages to allow migration. Existence of submerged plants at spawning place (if it breed at LWC).
White bream	lake and rivers	Passages to allow migration.
Rudd	lake and rivers	Submerged plants for living place, food and spawning.
Chub	lake and rivers	Submerged plants for living place.
Silver carp	lake and rivers	Submerged plants for food and spawning.
Burbot	lake and rivers	Passages to allow migration. Shallow spawning place (< 50 cm) with submerged plants (if it breed at LWC).
Bleak	lake and rivers	Not particularly.
Pike-perch	lake and rivers	Passages to allow migration. Abundance of food fish. Shallow (< 30 cm) spawning place with stone bed (if it breed at LWC).
Eel	lake and rivers	Passages to allow migration to the sea for spawning.
Dace	rivers	Passages to allow migration. Spawning place shallower than 1.5 m (if it breed at LWC).
Asp	rivers	Passages to allow migration.
Sheat-fish	rivers	Spawning place capable of making ‘nest’ (if it breed at LWC).

4) Vegetation

The water level conditions in LWC will affect deciduous and coniferous forests at low elevation as well as fen and inundated grassland. According to the preliminary inundated maps, raised bog, transitional bog, dry grassland, and agricultural land seem to be not so much influenced by snow-melting flood in LWC. The vegetation of bogs and peat land forests are rather sensitive to drainage activities.

(3) Problems for biotope conservation

The following problems have been pointed out as factors of environmental degradation in and around LWC:

- water level control unfavorable for waterfowl,
- reduction of fish breeding and consequent transformation of the fishpond area,
- reduction of haymaking on floodplain meadows and consequent overgrowing,
- peat extraction is a potential threat for raised bogs,
- drainage of bogs and forests around the lake, and
- intensification of tree cutting damaged on mammal and bird fauna especially those on raptors.

7.1.3 Delineation and Description of Protection Area

The Cabinet of Ministers of the Republic of Latvia on June 15, 1999 (Regulations No. 212/199) approved 11 nature protection areas in LWC that belong to the category of "Nature Reserves". According to the Latvian legislation system, each areas need specific protection plans such as zonings and lists of prohibited activities. Among the 11 nature protection areas, management plans presently exist at 3 areas, - Pededze River Lower Stretch, Parabaine and Lubana Depressions.

Based on the results of field survey and the evaluation of biotope, the 16 biotopes to be protected are selected, and their locations are shown in Figure 7.1.1. Out of 16 biotopes, 11 areas (from No.1 to No.11) coincide with the existing "Nature Reserves". Additional 5 are located in the central part of LWC to prevent fragmented distribution of protected areas. In view of the overall management policy of LWC that aims at "protect while using", areas that are used for economic activities are included like the case of Lake Lubana and fishponds. Details of each biotopes are described below by each area.

List of Biotopes to be Protected in LWC

Biotope		Present status	Biotope values and possible use
Name	Area (ha)		
1. Barkava oak stand	62	○	- Forest conservation
2. Berzpils bog	3,319	○	- Raised bog conservation
3. Idinu bog	818	○	- Raised bog conservation, Eco-tourism
4. Idena and Kvapani ponds	1,116	○	- Waterfowl habitat, Eco-tourism, Aquaculture
5. Lagazas-Snitku bog	3,386	○	- Raised bog conservation
6. Lubana depressions	5,905	○	- Wildlife corridor, Forest conservation, Raised bog conservation, Eco-tourism
7. Lubana and Solagala bogs	2,899	○	- ditto
8. Parabaine	approx. 9,822	○	- Inundated meadow, Wildlife conservation, Raised bog conservation
9. Pededze river lower stretch	4,177	○	- Wildlife conservation
10. Sala bog	3,862	○	- Raised bog conservation
11. Tirumnieki bog	266	○	- Raised bog conservation, Eco-tourism
12. Grivu	approx. 930	●	- Habitat for wildlife
13 Lower Aiviekste	approx. 1,950	●	- Habitat for fish and grassland birds
14. Nagli west	approx. 970	●	- Waterfowl habitat, Eco-tourism, Aquaculture
15. Nagli east	approx. 830	●	- ditto
16. Lake Lubana	approx. 7,700	●	- Waterfowl habitat, Fishery Water level control

Notes : ○ = Presently designated as Nature Reserve ; ● = Proposed by the JICA study team

7.1.4 Conservation and Management Criteria

(1) Chronological change of biotopes in LWC

In the past 75 years, LWC has been exposed to large works such as bog desiccation, afforestation, and flood control measures. Therefore, present fauna and flora of LWC are not what they had been for centuries. Although a long term goal of the National Environmental Policy Plan (NEPP) of Latvia is “maintenance and protection of existing biodiversity and landscape characteristics”, only maintaining present status is not sufficient for the case of LWC. Restoration measures may also be sought for setting a long term conservation target, which needs research and discussion among stakeholders.

Based on the topographical maps in 1916, 1931, 1966, and 1981, noteworthy changes are summarized in Table 7.1.1. In the past, large areas surrounding Lake Lubana were fen and inundated grassland, and the largest change took place in such biotopes. Fen has kept desiccating and shrinking, and is now fragmenting. Inundated grassland has been drained intensively since the 1970s. Fishponds appeared in the 1970s by converting wet meadows. They are now taking on aspects as semi-natural wetlands. Before dyke construction open water areas of the lake had covered Gomelis and Kvapani, and the water level fluctuated largely. Present water level is kept higher than that before dyke construction. Considering these chronological changes of biotopes, it is concluded that the conservation criteria should be determined not only for preserving the present status but also retrieving old status as much as possible.

Meanwhile, the current situations would bring about some apprehensions in the future of biotopes in LWC when no conservation measures are taken. Raised and transitional bogs could be generally safe, but invasion of trees will advance by desiccation. Fen and inundated grassland will keep shrinking and will be totally changed. Fishponds may totally lose water and turn into wet meadows if pond waters become not managed. This case, the importance of LWC for water birds will be lost. Even when water level is maintained, trees and bushes along pond ridges and canals will grow thicker, the number of vegetated patches in the ponds will increase, and water shore lands will be covered with reed and other plants. Although many migratory birds can still utilize those ponds as temporal visitors, value as breeding habitats of waterfowl will be lost. The results of quick assessment of future biotope change in LWC indicate that active restoration measures should be taken on inundated grassland, fen, lakes, and fishponds.

Lakeshore Trees Dead by Water Level Rise

(2) Management criteria

The plan aims at achieving naturalness of LWC to a level what it used to be around 1930. At the same time, ecologically meritorious nature alterations like fishponds for waterfowl are maintained. Conservation standards and approach methods are shown in Table 7.1.2. This does not mean abandoning all the construction works here. It should be admitted that dyke works has positive function to prevent economic damage by flooding. Drains are also contributing to forestry in some areas as well as preventing flooding of agricultural areas.

With regard to desirable water levels at respective biotopes, raised bogs should be preserved as an irreplaceable biotope and protected from any flooding. Although a raised bog in the western part of the Lubana Depressions could be influenced by water level rise of Lake Lubana once per 10 years, this bog is considered to be a transitional one and to be preserved at present condition. Fen is kept waterlogged almost throughout the year every year. Areas that are maintained as natural inundated grassland should be flooded at least every two years for about a month. Forested areas may allow inundation once every several years, and keeping their normal groundwater level deeper than 1 m (at least 0.5 m) is desirable to facilitate growth of roots. Water levels of fishponds are artificially controlled mainly for water birds, details of which are mentioned in the conservation measures. The desirable water level of Lake Lubana from mid June is 91.2 m so that more shallow water zone (depth of 0.5m) is created in about 65% of the lake, but more shrinking should be avoided for fish protection. In winter, fish wintering place at Kvapani should maintain water depth more than 2 m to prevent them from freezing, but the lake water level should be regulated with priority to prevent floods.

(3) Conservation criteria by plant and animal groups

1) Mammals

Maintaining present condition is necessary. For detailing conservation criteria, cataloguing of mammal fauna and their status is indispensable. Influence of newly emerging threats such as road-kill should be accessed. Construction of corridors will be among effective measures.

Presently, hunting of game mammals and water birds is permitted with seasonal limitation. It is incompatible, however, with bird watching type eco-tourism because birds at hunting

areas quickly become very shy of people. For pest animals like beavers, population control is necessary in extreme cases. But scientific statistics are indispensable since such damages tend to be exaggerated.

2) Birds

Decrease of bog birds occurred mainly in raptors, and some of those species are no more than a few to several pairs. For those species, increasing the population close to the carrying capacity should be sought.

Waterbirds

Efforts for maintaining present population and further increasing them should be sought. Keeping fishponds in good conditions is necessary for them. For feeding and resting of waterfowl and waders, sufficient shallow water areas should be secured. For breeding of waterfowl, increase of non-vegetated water shore is indispensable. Keeping water level of Lake Lubana about 92.0 m is most desirable for feeding of water birds because large fluctuation of water level hampers development of ecotone flora and benthic invertebrate fauna. Because they are migratory, international cooperation scheme is necessary for formulating long term protection.

Inundated grassland birds

Preventing bog desiccation is indispensable, and this is achieved by closing drainage ditches. Continuation of mowing at inundated grassland by subsidizing farmers will be among directions for conservation of the latter group. For inundated grassland species, present population should be maintained by securing breeding places.

Raptors

The basis of their conservation is to secure appropriate hunting places and increase biomass of prey animals. Bogs and abandoned agricultural field are appropriate hunting places for them. Increasing prey animals needs comprehensive upgrading of their habitat. Many raptors are quite sensitive to human disturbances, and they easily abandon nesting places without noticeable reasons. Keeping out people from nesting areas is absolutely necessary. Such measures have to be paralleled with monitoring activities. Construction of artificial nest platforms is an effective practice.

3) Fishes

For fishes, water level of the lake should be kept between 91.5-92.5m. Deep wintering places should be secured in the lake. As a preventive measure, intended and unintended introduction of exotic fish species should be avoided for safeguarding natural fauna. Eutrophication should also be avoided. Fishway between lake and rivers has few effects as the river migration has been blocked downstream.

4) Vegetation

Raised bogs should be protected as top priority through measures to prevent desiccation. Inundated grasslands should also be given special attention as a unique wetland type.

Old sturdy trees are apparently scarce in LWC and mainly confined to riverine forests. Preservation of old trees is necessary for not only securing nesting sites of raptors but also protecting themselves, because centuries of time is necessary for their regeneration. Individual old trees should be protected.

Judging from animal habitat preference, various ecotones have importance. Littoral zones between land and waters such as lakes and rivers have crucial importance for many water bird species, fishes and aquatic mammals. Fringing areas between forests and open lands such as bogs, pastures and abandoned farmlands, are good habitats for many mammal species and consequently good hunting places for raptors. Inclusion of ecotones is an important criterion for conservation area zoning. Conservation criteria of respective biological groups are mentioned in Table 7.1.2.

(4) Monitoring criteria

Because the major purpose of monitoring is to judge whether the site is managed wisely, not only faunal and floral information but also socioeconomic information needs to be collected from different sectors. Strengthening of socioeconomic information seems necessary for the wetland inventory work at national level, too. The table below indicates necessary monitoring items for environmental management of LWC. Some natural environmental items need initiating regular monitoring because foregoing studies on fauna and flora of LWC are mostly sporadic except for census of migratory birds. By getting cooperation of relevant governmental institutions, most socioeconomic data can be retrieved from statistics that are possessed by those sectors without dissemination.

Monitoring in LWC should be made in accordance with items in the Ramsar Information Sheet as well as national data management system. Monitoring data should be stored at national level like the Latvian Environment Data Center and sent to the electronic database of the Ramsar Bureau that is retrievable through Internet.

Monitoring Items and Places for Environmental Management

Monitoring items		Monitoring places
Hydrological features	Water quality	Lake and major rivers
	Water level	Lake
	Groundwater level	Bogs and fens
	Flooded areas	LWC
Fauna and flora	Respective endangered species	LWC
	Migrating water birds	Lake and fishponds
	Other birds	LWC
	Fishes	Lake and fishponds
	Mammals	LWC
	Vegetation	Wetlands
	Old trees	LWC
Economic activities	Land use	LWC
	Recreation / Tourism	LWC
	Agriculture	LWC
	Other industries	Protected areas
Educational and research use	Educational use	LWC
	Scientific research	LWC
Conservation measures	Affecting factors	LWC
	Status of conservation measures	Protected areas
	Administrative statistics	LWC

7.2 Wetland Conservation Plan

7.2.1 Projects and Programs for Wetland Conservation

In addition to the regulations of protected areas, biodiversity of LWC is protected by the following active measures as a potential Ramsar site. The Ramsar Convention at present aims at a comprehensive wetland biodiversity convention with extended focus such as basin management and securing fishery resources. All the following projects and programs for wetland conservation for LWC are based on the existing technology, managerial capability as well as local construction materials so that their implementation works would be easy and feasible in Latvia.

(1) Environmental Management Center Construction Project

The Wetland Conservation Plan (WCP) would include concrete projects and programs to be implemented in line with EMP. It is necessary to establish a base for actual implementation of the proposed activities, so the construction of the Environmental Management Center (EMC) is proposed at Idena.

The buildings for EMC should be facilitated a) main building (560m^2, brick wall 2 stories) for actual works, b) sub building (300m^2, brick wall 2 stories) for lodging of group visitors, c) garage (140m^2, brick wall 1 story). The main building consists of the rooms for administration, research and monitoring, meeting, training, aquarium, display hall, and canoe/cycling service. The required staff number for administration and maintenance would be 12-15 people for permanent bases.

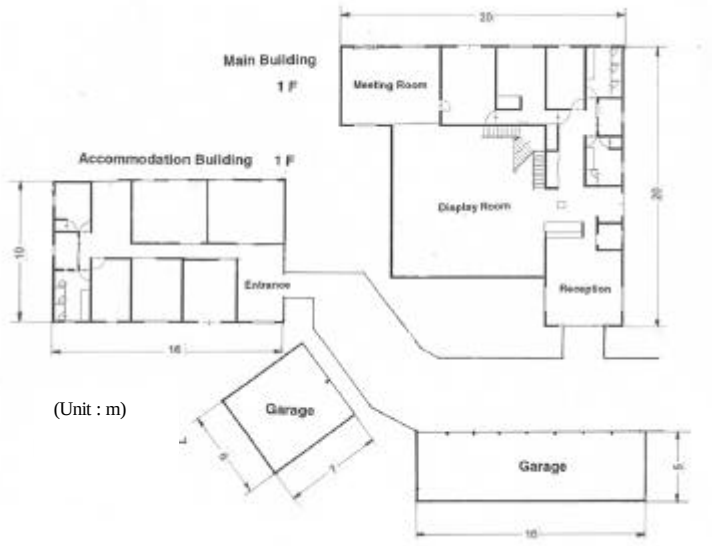


Image of EMC with Main Building (Upper), Accommodation Building (Left) and Garage

(2) Biotope conservation program

1) Bird conservation subprogram

This subprogram is mainly for waterfowl conservation.

Mitigation of Lake Lubana degradation with fishponds

The Latvian University Institute of Biology has continued long-term waterfowl monitoring at Lake Lubana, and the results are reflected in the reports of the institute such as "Importance of Lake Lubana and surrounding fish ponds in hunting waterbirds" (1999), "Changes in waterfowl habitat in Lake Lubana and surrounding areas 1970 - 1999" (1999) and "Dynamicas of nesting waterfowl number in fishponds close to Lake Lubana 1975-1999" (1999). According to these reports, Lake Lubana in the 1960s before dyke construction had a large marshy area, and the area was an ideal habitat for waterfowl. Although the present waterfowl population that mainly occurs at fishponds is still abundant to satisfy the Ramsar criteria 5 and 6, waterfowl population might have been more in the past. For waterfowl conservation purpose it would be the best solution to lower the lake water to a level before dyke construction. One important point in the present Lake Lubana is that it is contributing downstream flood mitigation. EMP is intended to maintain flood control function of the lake although it is an artificially added function to the lake. For flood mitigation Lake Lubana has to retain much water during and after flooding period in April-May. This means difficulty in lowing the lake water level at breeding season that starts from May. Moreover, the intensity of flooding differs year by year.

Taking the advantage that present waterfowl population mainly concentrate at fishponds, this plan aims at mitigation of Lake Lubana degradation with improvement of fishponds. This does not mean that Lake Lubana improvement is forgotten. By improving the sluice operation manual, lake water is lowered as low as possible to a level consistent with flood control and fishery.

Current situation of fishponds

Lots of improvement is necessary, however, to make the ponds ideal for duck moulting and feeding. One of the problems is the overgrowth of vegetation. Almost all ponds in the Nagli fish farm were relatively open during the first years of operation in 1980s. Mainly fodder grasses grew on natural islands, and recently formed tufts of above-water plants did not formed wider homogeneous massifs. Some small artificial islands were made by accident in several ponds during their construction. Generally that created very favorable conditions for nesting of waterfowl species. Each island rapidly overgrew with bushes, trees and reeds year by year. Wide reed stands forms around these islands. Initial mosaic-type tufts of above-water plants spread more and more and create homogenous massifs in many places. Due to excessive water level rising in last years these tufts are torn off from the bottom and compacted by the wind along shore zone. Due to these factors nesting ducks and waders decreased significantly during the last years.

Fishponds are also meritorious for waterfowl from the point that direct human impact to them in the ponds is significantly less than in most of natural water bodies. Birds living in the ponds have created special behavior. At least during nesting period they get used to personnel and equipment carrying out regular feeding. Behavior of birds changes radically just when the hunting season has started, then they get fearful or leave their initial living places at all.

Future of fishponds

This study revealed that there is no bright future for carp aquaculture at fishponds, and fishponds have possibility to be closed in the future. If the ponds are abandoned or sold to private sectors and used for other purposes than water-filled pond, it is obvious that ponds lose the value as waterfowl habitat. EMP is aimed at preventing such disastrous situation by using the ponds for tourists, recreational, educational and conservational purpose. Under EMP, it would be more fitting to call them 'conservational pond' rather than 'fish pond'. In the case when aquaculture of the ponds is abandoned in the future, the ponds need to be managed for conservation purpose including water level control. Costs for water level and habitat maintenance have been appropriated in the conservation budget of EMP. Management of the ponds as public property may also be sought.

Although cooperation of fishpond owners is indispensable for EMP, it is an urgent concern that fishpond privatization plan is in progress. If privatization starts without any agreements on the use of ponds, it would jeopardize EMP. Suspending privatization till go-ahead of EMP and allowing privatization in ways to guarantee habitat conservation are necessary.

Concrete Actions

a) Improvement of natural breeding place for waterfowl

The purpose is to secure more breeding places for waterfowl. To eliminate reed and reed mace growths around the islands, trees, and bushes on existing islands in fishponds should be cut with priority on the Nagli fishponds. Cutting bushes and trees along dykes between fishponds can also decrease predation pressures of carnivorous animals for waterfowl. The total area of grass cutting is about 15 ha and maintenance work is to be continued regularly.

b) Artificial breeding islands and nests for waterfowl

For the same reason with the above, 100 artificial islands are constructed at the Nagli, Kvapani, and Idena fishponds. Priority of the Nagli west is lower than the Nagli east because each pond area is smaller. Earth island of 5 x 10 x 1.5 m (0.5m over the water level) with wooden frame to protect from being washed away be waves. The construction work is made at ponds without water as mentioned in the water level control activities. Exact places and shapes should be decided by observing bird behavior.

To build and locate artificial nests such as wooden cages and special hay roles designed for waterfowl nesting in those islands and adjacent forests further facilitates the effect.

Presently Trees and Reeds Overgrow at Fishponds (left) and Natural Breeding Places for Waterfowl (right) are not Sufficient

Cutting Trees and Bushes and Preparation of Artificial Islands

c) Water level control of fishponds for waterfowl breeding

Water level is an important factor determining distribution of migrating birds. In case fishponds are filled up in the autumn, they could be used by most waterfowl in the next spring just when ice has melted. Because of the large area, filling up usually takes about a week. At the beginning of filling process large areas with shallow water and small pools appear. This serves as excellent feeding places both migrating and local waterfowl and waders. It is very important to finish filling process at least until May l5, before the beginning of mass nesting season of waterfowls.

Ponds that have been with no water during previous season attract most migrating and local waterfowls because they provide intensively developed plants above water level after filling up. These plants are important hiding places for molting birds at the second half of summer. It is observed that ducks, which have nested in the pond that is left dry for one summer, find nesting place in another pond, but return for nesting to the previous pond in the following years.

Water level rising or significant lowering during nesting period would cause loss of nests of waterfowls and waders. When fill up is delayed, almost all waterfowl nests are drowned except species that build floating nests. When ponds are filled only in summer, wader nests that were located in the dry area of the pond before filling up are drowned completely. Crucial is also drainage of the pond during nesting period as most of waterfowls leaving their nests in such cases.

Month	J	F	M	A	M	J	J	A	S	O	N	D
Water fill-in (hatched period) and retaining periods												
Pond A												
Pond B												
Pond C	(no water all year round)											
Avoid water level fluctuation												
Avoid excessive water level												
Relevant Natural Phenomena												
Freezing Period												
Waterfowl Breeding Season												
Waterfowl Molting Season												
Waterfowl Migrating Season												

Water Level Control of Fishponds Favorable for Waterfowl

Therefore, each section of the fishponds should have three different types of water level scheme that are applied by rotation. That is, filling of some ponds should be started in spring not later than in April and should be finished at least till May 15. Other ponds are filled up already in autumn after fish forward but a part of ponds. Remaining ponds are left without water for a year. This is desirable even when aquaculture is abandoned at the ponds.

Fishpond Filled with Water (left) and Without Water Condition (right)

d) Artificial nesting places and feeding for raptors

This is mainly for raptors conservation. Insufficiency of sturdy tall trees suitable for nesting is a limiting factor of raptor populations such as White-tailed Eagle, Golden Eagle, and Osprey. Since it takes tens of years to wait for the growth of those trees, supply of artificial nesting platform is needed. Because it is difficult to locate their preference for nesting places, 100 wooden platforms are placed in various areas of LWC with emphasis on tall trees at fringe of large forests and forest belts between bogs and grassland. In such ecotones, prey animals are abundant. They are regularly monitored and repaired.

Breeding success rate of raptors largely depends on their nutrition conditions during winter. Basically this should be improved by enriching prey animals in their habitat. In view of their endangered status, however, artificial feeding is carried out only during cold

freezing season at two open places, one at an island of a fishpond and the other at a bog area. Sufficient care is necessary for predatory animal and poachers.

e) Protect natural nesting places and increase prey animals for raptors

Protection of old trees is a long-term measure for securing their nesting places. Monitoring of old trees is realized in the monitoring program, and their protection is achieved through awareness activities to the forestry sector. Their food conditions are also improved by securing rich prey animals and hunting places. Activities in bog and inundated grassland conservation subprogram are meritorious also for this purpose.

f) Maintain grassland habitat for great snipe

In LWC great snipes mate and breed at least 9 places and at least 109 males are mating. This accounts that at least 1/3 of all Latvian population is breeding here, as number of mating males in Latvia is evaluated to be 200-300 individuals. They choose mating and breeding places in inundated grasslands, especially those located close to river mouths. To prevent their habitat from overgrowth, trees and bushes are cut at breeding places in Verdes Sala, in the Aiviekste river water-meadows from the Ica river mouth to the Abaine river mouth. Drainage ditches of those areas are also closed.

g) Cormorant population control

Presently there are no other effective measures to prevent their damage than direct population control. Setting up strings over the pond is proved to be effective to prevent landing of large number of birds on the water, but this is not realistic in the case of large ponds. Primitive but a sure way is to shoo away them by stationing watchmen. Due to marketing price situation, however, present fish forward from the ponds in LWC is only a part of the amount that is actually produced, and the rest is left unused. This may benefit food conditions of cormorants and thus causing a vicious spiral to their population increase. Although it will be irritating for fishermen to see cormorants steal their fish, loss by cormorants seems not accelerating the decrease of fish forward. Not producing excessive fish will be a long-term measure to decrease cormorants. At present, cormorant is not listed on the game birds, and it is not possible to hunt them even for pest control purpose. Change of hunting regulations is necessary so that population control become possible in the extreme damage cases, but it have to be done based on exact monitoring and scientific cost and benefit analysis.

2) Mammal conservation subprogram

This subprogram is for conservation and population control of forested mammals including the following activities.

Wildlife corridor construction

Large mammals often have home ranges larger than respective protected territories, and therefore it is necessary that each protected territory be not fragmented. In LWC forested areas in the northern part of LWC are connected with outer forest areas. Those of southern areas, however, rather isolated from others. By creating a wildlife corridor along the

western shore of Lake Lubana (4 x 0.2 km), all the forested areas that surround Lake Lubana are connected. Presently the area is swampy and a series of bushy islands are lining irregularly along the shore. By filling soil that was produced from dredging work of the fish conservation subprogram, this area turns into a habitat that large mammals can pass by. In the long run, it is expected that trees grow naturally along the dyke and lakeshore.

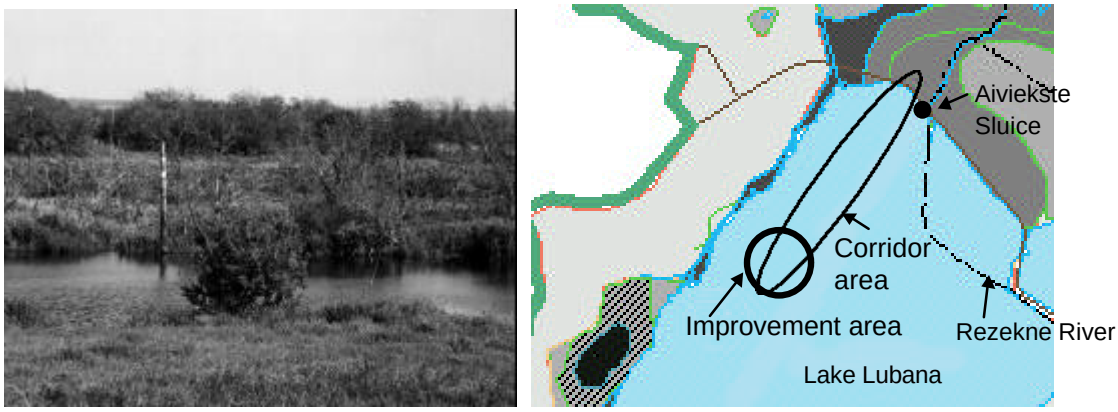


Photo of Lake Lubana Western Shore (left) and the Place of Habitat Improvement by Landfill

Enrichment of forest-meadow ecotone

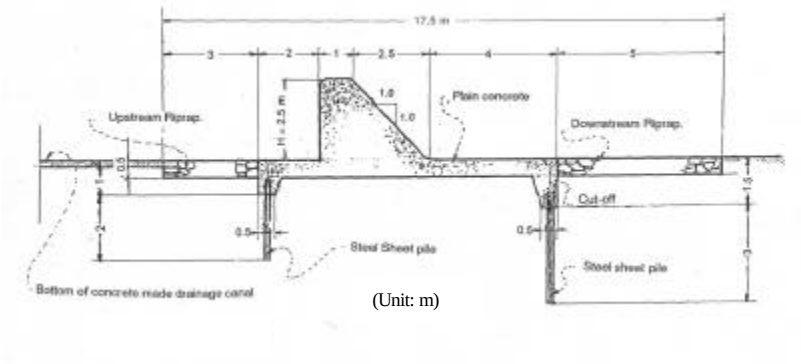
The richest diversity and density of mammals are often found in such ecotones as land-water and forest-meadow where different biotopes are neighboring. In LWC ecotones between forests and meadows are not so rich compared to land-water type. The Grivu's inundated grassland conservation measures also aim at enriching habitat of mammals.

3) Bog and inundated grassland conservation subprogram

Raised bog, inundated grassland and fen are the characteristic biotopes of LWC, and water level management is commonly crucial for their conservation.

Raised bog conservation

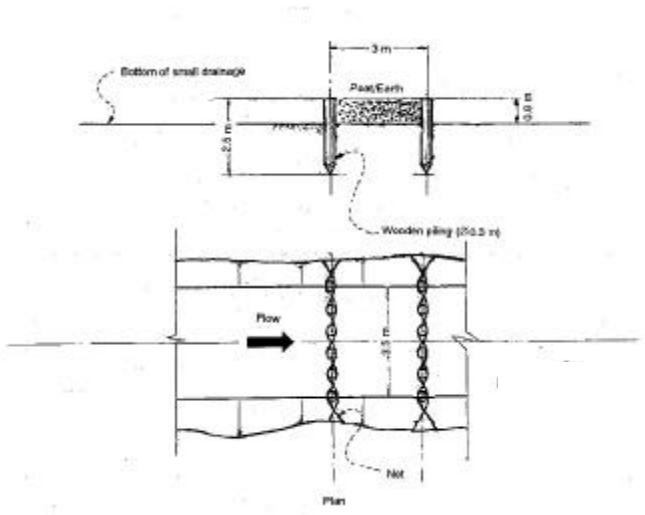
To prevent lowering the grounwater level of raised bogs, large drains penetrating into the bogs are to be closed by constructing 20 RC dams (7m wide x 3m high) at the exit points from bogs of the Snitku, Berzpils, Sala, Lubana, Solagala, and Lubana depressions (refer to Figure 7.2.1). The Parabine bog is already facing many small drainage ditches, and is protected by closing those ditches with 40 small wooden dams (3.5 m wide x 0.8 m high).



Typical Longitudinal Section of Concrete Dam

Inundated grassland conservation

Inundated grassland vegetation is maintained by annual flooding that prevents growth of trees and bushes. Although the frequency of flooding decreased after the dyke construction, the vegetation can still be maintained in areas of low elevation. At areas where they still have potential as natural inundated grassland, restoration measures should be taken with priority to the Verdes Sala area. Densely developed drainage ditches in Verdes Sala and surrounding areas along the Aiviekste river are closed by about 160 earth dams mentioned above. Average catchment area of each dam is about 7.5 ha (750 m x 100 m). At the same time, bushes growing along ditches are to be cut. Patchily distributed private lands in the Verdes Sala area are procured for coordinated management. Other potential inundated grassland areas are protected by recommending and subsidizing grass cutting for hay making. Areas of higher elevation that are flooded only once every two years or less, retention of original vegetation seems difficult. It is appropriate to allow natural succession to bushes and forests in those areas. The Grivu area are to be protected by 90 earth dams for drainage closing, and is managed as natural succession due to its elevation (refer to Figure 7.2.1).



Typical Longitudinal Section of a Wooden Weir

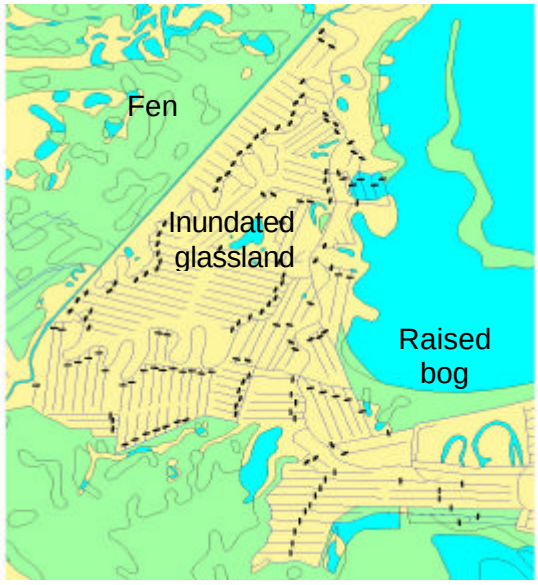


Image of Small Wooden Dam Arrangement at Verdes Sala for Drainage Closure

Fen conservation

To protect shrinking of fen in the Baltie Klani area, the water level is maintained by closing a culvert and constructing a submerged bridge at the outlet to the Aiviekste river.

Culvert (left) at Fen Area (right).

4) Fish conservation subprogram

Wintering place

To prevent fish death by freezing, it is necessary to secure a deep wintering place in Lake Lubana. An area of the lake near Kvapani has depth of 4 m that was created by previous dyke construction works, and is suitable for such a purpose. Access of fishes from other part of the lake to the deep area during low water period, however, is blocked by abandoned dykes of the Rezekne river that remain in the lake. This is improved by cutting out some part of the abandoned dyke.

Patrolling

To protect fishes from illegal commercial fishing and angling, patrol on the lake and major rivers in LWC should be reinforced.

Restocking of native fish species

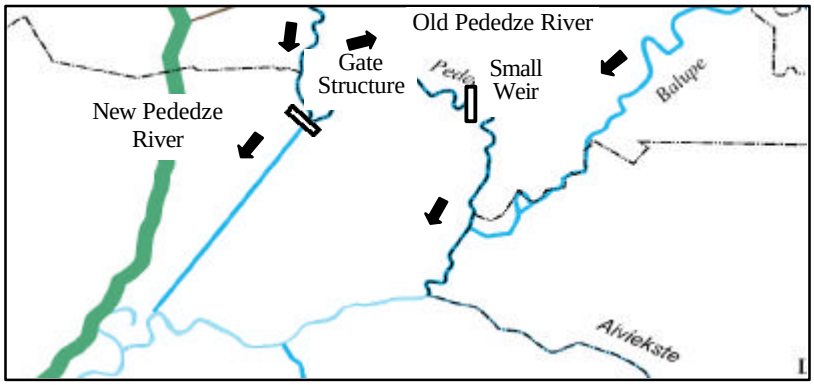
To increase pike resources, stocking of pike is conducted by using fry of native gene group.

Spawning place

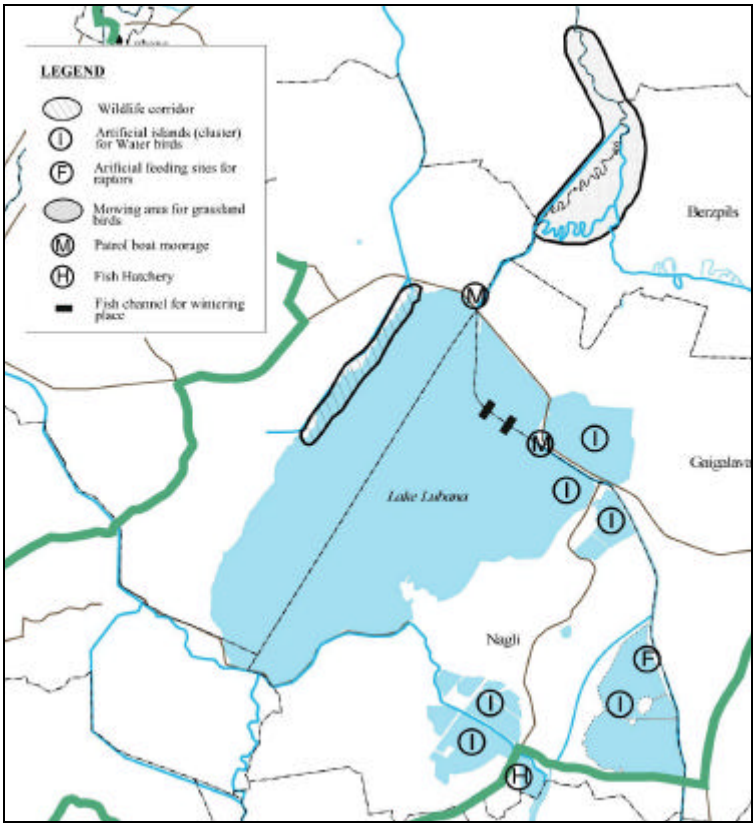
Measures to protect inundated grassland of the Verdes Sala area are also beneficial to protect fish spawning places, because old meandering rivers remaining in the area is serving not only as habitat for aquatic mammals like otters but also serving as good spawning place for fishes.

River water level control as fish habitat

Existence of stagnant water and hiding places in a river system are indispensable for spawning and growth of fish fries. Together with the meandering part of the Aiviekste river at Verdes Sala, lower stretch of the Pededze river between the Pededze canal and the Balupe river mouth has a potential for such a habitat. Presently, however, this area has little water flow due to diversion to the Pededze canal. It is recommended to restore small water flow for the above purpose. Revival of the original large flow that caused inundation of Grivu Sala is not necessary for this purpose. The proposed gate structure and its indicative cost are mentioned in the Water Level Management Plan.



Water Supply to Old Pededze River



Places of Conservation Activities of Mammals, Birds and Fishes

7.2.2 Monitoring Plan

(1) Environmental research

As exemplified by increase of cormorants and beavers, ecological change sometimes occurs rapidly and flexible management becomes necessary. To cope with such emerging issues, research ability to indicate management directions within a few years is necessary. Research in EMC is for management purpose, and pure scientific researches are limited only when they are closely linked with management. Not only conducting own research,

EMC can provide opportunities of research for domestic and foreign researchers on following research topics:

- influence of desiccation in bogs and inundated grasslands,
- carrying capacity of eco-tourism and recreational activities,
- beaver population control,
- water level regulation scheme of fishponds,
- inventory work of fauna and flora,
- fish resources,
- ecological function of pastures and crop fields, and
- telemetric study of migrating birds

(2) Environmental monitoring

For scientific environmental management, especially for early warning, monitoring of natural environment as well as socioeconomic activities is indispensable. In line with the items that are required to the Ramsar information sheet, the following items should be monitored in LWC and related areas. Dissemination of the results through EIMS in the form of annual report is strongly recommended. Original monitoring is limited mainly to faunal and floral items. Other items are collected by cooperation of other organizations.

Fauna and flora: Bird population in LWC has been monitored over a quarter century. Status of unique or bio-geographically important species, rare or endangered species and exotic species (when and why) should be monitores as well. Combined with research activities, special attention should be paid to the population of waterfowl and raptors, vegetation changes of bog, fen, and inundated grassland.

Water-related items: It should include water quality of rivers and lakes (various parameters including turbidity, trophic status and salinity), ground water level at raised bogs, water level fluctuation at Lake Lubana and major rivers, inflow and outflow rivers, changes that took place in the catchment area. Effects of newly constructed dams for desiccation prevention under this WCP should be intensively monitored.

Socioeconomic statistics: It should include fishery, agriculture, forestry, recreation and tourism, status of development projects (including those in planning stage), changes in human population, land tenure and land use.

Environmental and educational activities: It should include conservation measures taken, hunting activities, pollution (urban, industrial and agricultural), waste dumping, newly published bibliographical references, scientific research projects, historical and archaeological sites, NGOs and business/community groups that cooperated in monitoring, awareness and management.

7.2.3 Environmental Education and Public Awareness Promotion Program

By using facilities installed by the EIMS subprogram and the Environmental Education subprogram, the following activities are proposed for promotion of wetland conservation:

(1) Mobile EMC

The diversity of biotopes of LWC is a precious educational value that cannot be found at other places of Latvia. Not only local sectors but also national levels should utilize the value. Because of its less known location, however, it seems difficult for EMC to have many visitors if it is a passive center just waiting for visitors to come. Environmental education and public awareness functions of EMC becomes fully operational when the center actively attracts visitors and bring services to requested places. As a program under the annual schedule, EMC organizes the following activities in close collaboration with schools and administration. Bus and accommodation facility of the center is fully utilized. Operation cost is borne by the center, but meals and accommodation are borne by visitors at cost.

Target: Major target group is school children around 10 years old. School teachers, officers and decision-makers of national government and municipalities, NGO staff, community leaders, representatives of business associations and media people should be given similar opportunities. EMC invites those groups nationwide, but priority groups are those in and around LWC. Group visitors (each 30-50) experience 2 days 1 night or 3 days 2 nights field tour under the guidance of experienced staff members. EMC is capable of organizing maximum 200 trips. By 2010, at least one member of every house hold near LWC gets to participate in EMC activities.

Activities: This activity aims at introducing varied biotopes of LWC to many visitors. At EMC they learn the wise use concept. Tool kits produced by the Ramsar Bureau can serve as teaching materials. In the field they experience varied biotopes of LWC (refer to Figure 11.3.2). Birds are observed in fishponds. Wildlife observation including nocturnal and small mammals are carried out by visiting fen and inundated grassland via boat trip on the Aiviekste river. Since the nature of LWC has a clear timetable as shown below, visiting places are combined flexibly. Trips may include the Krustkalnu reserve and Teici reserve that have different biotopes. In autumn, each species has its hunting season. Because hunting seasons often coincide with bird migration seasons, hunting at observation sites should be prohibited for security.

Month		J	F	M	A	M	J	J	A	S	O	N	D
Field Education and Awareness					■	■	■	■	■				
Major Hunting Season	Waterfowl									■	■	■	
	Large Mammals								■	■	■	■	■
Relevant Natural Phenomena	Freezing Period	■	■	■								■	■
	Spring Flooding				■	■							
	Waterfowl Breeding					■	■	■					
	Waterfowl Migration				■	■				■	■		

Proposed Wetland Observation Period and Related Phenomena

(2) Baltic Ramsar Center

For promoting international cooperation in wetland conservation such as migratory bird conservation, it is necessary to exchange information and learn each other's experiences in conservation activities. Since miscellaneous information in Latvia is printed in Latvian, information sources for non Latvian-speaking people in limited to those written in international languages and this never enough. Latvian people may also feel similar difficulties on the contrary. Translation of wetland related materials between Latvian and English/Russian/other Baltic languages is promoted by using EIMS facilities and disseminated through the Internet. Though such a function can be placed in other parts of Latvia, this is beneficial so that LWC is well known to the world, and this work can be done on the Internet by cooperation of volunteers all over the country. Because of seasonal field activities of EMC, this Project should be mainly promoted during the off season in winter.

(3) On-the-job capacity building

EMC should accept at least two seconded staff from educational and administration sectors at around one-year rotation term. One is for bringing up experts in nature observation program and the other to incorporate wise use concept in development administration.

(4) Training and seminar

Due to geographic location, transporting facilities of the center should be fully utilized to bring participants to the center. When necessary, dispatch of lecturers and materials should be sent actively to requested places. Since field projects of WCP mainly consist of those targeted at water-related biotopes, conservation of dry lands should be achieved training and awareness of forestry and agriculture sectors.

7.2.4 Cost Estimation for Projects and Programs for WCP

The total cost for WCP is indicatively estimated about 2.3 million LVL including O/M costs up to 2010 as shown in the next table. The cost for the EMC construction project is about 375,000 LVL including necessary indoor and outdoor facilities. The cost for the Biotope Conservation program which consists of 4 subprograms is about 796,000 LVL. The costs for the Environmental Research and Monitoring program and the Environmental Education and Public Awareness program are 166,000 LVL and 107,000 LVL, respectively.

Estimated Costs for Wetland Conservation Plan

(Unit:1,000 LVL)

Projects, Programs and activities	Cost	Type
1. Environment Management Center Construction Project	**375**	-
- Construction of EMC buildings	237	B
- Indoor and outdoor facilities of EMC	138	E
2. Biotope Conservation Program	**796**	-
2-a. Bird conservation subprogram	114	-
- Removal of overgrown grasses at fishponds for waterfowl	63	C
- Construction of artificial islands for waterfowl at fishponds	34	C
- Nesting places for raptors and grassland birds and others	17	C
2-b. Mammal conservation subprogram	19	C
2-c. Bog and inundated grassland conservation subprogram	208	-
- RC dam construction to prevent drain from bogs	172	C
- Small wooden dam construction to close drains (290 dams in total)	21	C
- Land acquisition and others	15	C
2-d. Fish conservation subprogram	455	C
- Fish wintering place	390	C
- Fish habitat conservation of the old Pededze river	65	C
3. Environmental Research and Monitoring Program	**166**	-
- Equipment for water-related wetland monitoring	20	E
- Equipment for aquatic environmental monitoring	53	E
- Equipment for fishing control and patrol	93	E
4. Environmental Education and Public Awareness Promotion Program	**107**	-
a. EIMS subprogram	74	E
b. Environmental Education subprogram	33	E
Total Initial Cost	1,444	-
O/M Cost up to 2010	879	-
Grand Total	**2,323**	-

Note: B= building work; C= civil work; E= equipment.

7.2.5 Organization and Institution

(1) Wetland conservation functions of EMC

In EMC, the Wetland Conservation Plan is borne by the Management House and Information House. The former deals with ecosystem oriented approach and species oriented approach, and the latter is in charge of awareness oriented approach.

The Management House is composed of three sections, that is, the Protection and Management unit, Research unit and Monitoring unit. The Protection and Management unit deals with the Biotope Conservation program. Field activities are mainly entrusted to the local communities, and the EMC's administrator is in charge of contracts and negotiations. The Research and Monitoring unit literally deals with those activities mentioned in the Environmental Research and Monitoring program.

The Environmental Education and Public Awareness Promotion program is borne by two sections of the Information unit in the Information House. The Exhibition and Observation unit is in charge of both indoor and outdoor education and training.

Construction and maintenance activities such as trimming of roadside trees for visibility improvement and construction of bog observation tower are entrusted to the Protection and Management unit in consultation with the Eco-tourism House. The Exhibition and Observation unit mainly targets at group visitors for educational purpose. The Eco-tourism House receives individual and small group tourists. Those two sections should keep close contact to avoid bureaucracy. The Information unit is for EIMS. The unit compiles monitoring data into a database and dissemination. Website activities and publication are borne by this unit.

(2) Collaboration with other organizations

Because resources of EMC are limited, these activities have to be promoted in close collaboration with relevant organizations as shown for the following.

Office of State Nature Reserve Teici:

The office manages neighboring Teici and Krustkalnu reserves. Although human activities in those reserves are not allowed and the approach is somewhat different from those in LWC, the office has excellent expertise in management and research. Foregoing researches on waterfowl and raptors in LWC were borne by the researchers of the office. Therefore, natural environmental research and monitoring of EMC should be conducted jointly with the office as far as possible. Collaboration in field education activities may also be sought.

Universities:

Universities are also important research partner. Particularly the Daugaupils Pedagogical University (DPU) and Latvia University has accumulation of bird research in LWC over a quarter century. For training of resource wise use, not only natural science professors but also those in socioeconomic field are necessary. University students can be involved in EMC activities in various ways such as intern for field activities, volunteers for translation work and trainees of education activities. EMC can also accept graduate students for conducting their studies.

MEPRD:

The ministry's major role resides in the Implementation Committee (IC), but they may be consulted frequently in the process of activities. In particular, database of EMC have to be linked with those at national level, and international activities are basically in charge of MEPRD. Cooperation of REB Laboratories is also indispensable for water quality monitoring. Since EMC has no wet-laboratory, water quality analytical equipment under the Environmental Research and Monitoring program is to be placed in the former laboratory.

District Governments and Municipalities:

Capacity building of those staff members is a crucial point for promoting decentralized environmental management. In particular, a wise use concept should be understood by them not only as a theory but also as actual success and failure stories. In addition to seminars, acceptance of a limited number of on-the-job trainees at their cost is desirable. It is also important that even administration officers get field experience.

Schools:

Latvian education system obliges a certain period of field experiences to school children. Field observation activities of EMC should be incorporated in such program. In the initial stage, however, priority target should be teachers because the number of teachers who can serve as excellent interpreters in the field is limited. Like the case of government officers, acceptance of a limited number of teachers as on-the-job trainees as leaders field activities

is desirable. Schools adjoining LWC are expected to participate in environmental monitoring such as meteorological data and simple measurements of river water quality.

NGOs:

Ornithological and nature NGOs in Latvia have largely contributed to wetland inventory and monitoring works. For example, their cooperation is indispensable in the census of many migratory birds.

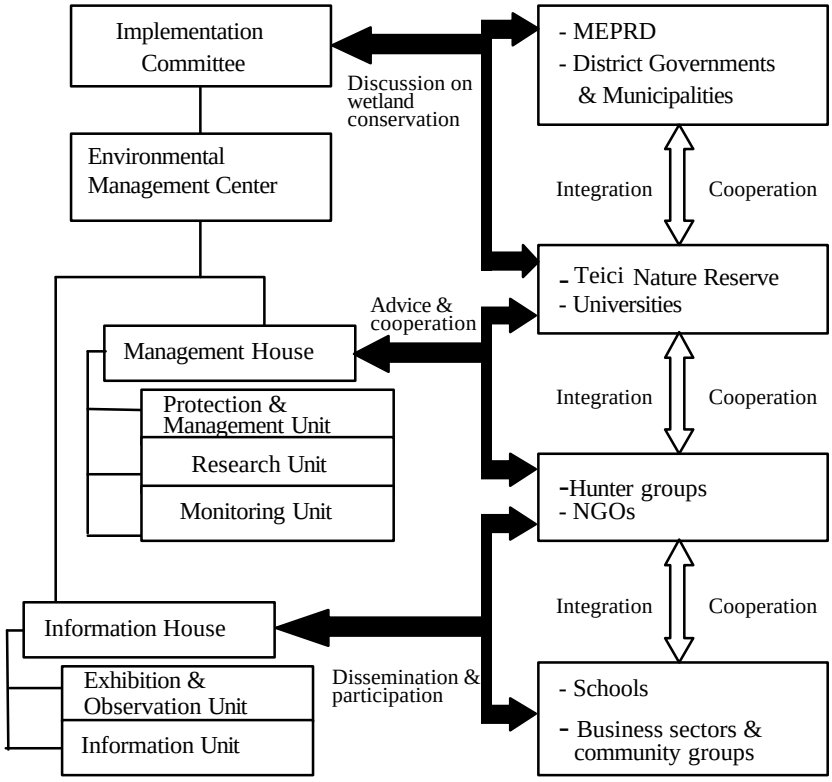
Business sectors and community groups:

These sectors in and around LWC are mainly linked with wetlands through forestry, agriculture and fishery. The biotopes can not be protected without their understandings. They are targets of awareness and training. Receiving miscellaneous reporting from them benefits environmental monitoring.

Hunter groups:

This group is worth particular mention as collaborators of participatory environmental management. In Latvia, hunting is a very popular recreation deeply rooted in its culture. There exists sufficient number of hunters, and they are already involved in wildlife management through reporting system of wildlife population and control of hunting numbers. With forestry administration that is responsible for hunting, EMC can cooperate them through 1) joint research to make population reporting system more accurate, 2) providing training opportunities to them before issuing hunting licenses, 3) expanding hunters' interests from large game animals to wider species by education on wildlife ecology.

In any case of the above collaboration, especially when it is on voluntary basis, their responsibility should be made clear and names of collaborators as well as the mode of their cooperation should be credited on the outputs. This is a key point for long-lasting cooperation.



Organizational Relations for Wetland Conservation

7.3 Application to Ramsar Wetland

7.3.1 Proposed Ramsar Site

This proposed site is internationally important as bog areas, habitats for waterbirds, and inundated grassland which is not represented in other Ramsar sites in Latvia. Bog areas are represented by the Berzpils bog, the Idinu bog, the Lagazas-Snitku bog, the Lubana depressions, the Lubana, and Solagala bogs, the Sala bog, and the Tirumnieki bog. Habitats for waterbirds are represented by the Idena and Kvapani ponds, the Nagli fishpond (west), the Nagli fishpond (east), and Lake Lubana. Large inundated grassland is represented at Verdes Sala in Parabaine along the Aiviekste river.

Since LWC fulfills the criteria, it is proposed to register those territories collectively as a Ramsar site (refer to Figure 7.3.1.) at the commencement point of EMP. Collective registration is necessary to prevent fragmentation of conservation areas. Only Barkava oak stand, however is excluded from the Ramsar site because it has few wetland components in its biotope and fragmented from the main area.

There are following merits for designation: 1) monitoring is obliged, 2) the result is shared worldwide by the Ramsar Bureau, 3) local people can easily understand the wetland values, and 4) meritorious for attracting tourists.

7.3.2 Action Plan for Application

(1) Adaptability of LWC to Ramsar criteria

Chapter 2 of the Ramsar Convention requests contracting parties to designate suitable wetlands for inclusion in a List of Wetlands of International Importance. Latvia is a signatory of the Ramsar Convention and three wetlands have been registered including neighboring the Teici nature reserve.

The status of LWC with relevance to the criteria for Ramsar registration is shown in Table 7.3.1. LWC satisfies the Criterion 1 as representative rare or unique wetland type, because existence of large inundated grassland can not be seen in other part of Latvia. LWC also satisfies Criteria 2, 3, 5, 6 and 8 on biological diversity. It supports 20,000 or more water birds and 1 % of the individuals in a population of one water bird species. Linked with the State Nature Reserve Teici, another Ramsar site, conservation value of LWC is increased. Compared to bogs of surrounding areas that are no more natural bogs due to intensive peat extraction, large high bogs in LWC is a typical biotope that retain high quality of naturalness. LWC is also characterized by containing most biotope diversities that are seen in inland areas of Latvia.

Anseriforms Species of Lake Lubana related to Ramsar Criteria 5 and 6

Latin Name	English Name	No. of counted individuals	1% of global population	Conformity with Criterion 6
Cygnus olor	Mute Swan	253	1,800	X
Cygnus cygnus	Whooper Swan	2,433	250	◎
Cygnus columbianus	Bewick's Swan	940	170	◎
Anser fabalis	Bean goose	800	800	○
Anser albifrons	White-fronted Goose	3,000	3,000	○
Anas penelope	Wigeon	8,560	7,500	◎
Anas crecca	Teal	1,866	4,000	X
Anas platyrhynchos	Mallard	2,542	50,000	X
Aythya ferina	Pochard	810	3,500	X
Aythya fulgila	Tufted Duck	1,006	7,500	X
Bucephala clangula	Goldeneye	137	3,000	X
Mergus albellus	Smew	364	150	◎
Total		22,711	-	-

Note: ◎ = criteria satisfied, ○ = barely satisfied, X = not satisfactory

The present number of water birds is supported by fishponds. Before construction of fishponds, those areas were seasonally flooded wet meadows, and not suitable habitats for waterfowl. Probably, Criteria 5 and 6 had not been satisfied in the past. Dyke construction also prevented migration of fishes between the lake and rivers though it seems not a decisive impact on the fish abundance.

If no conservation measures are taken in LWC, Criteria 5 and 6 will not be satisfied because inundated grassland will lose its original vegetation by desiccation and cessation of mowing. Fishpond will also soon lose its function as good bird habitat. By implementing Environmental Management Plan, however, these problems will be solved and LWC will be able to accommodate more water birds. WCP will also serve to improving habitat for fishes and mammals.

(2) Adaptability of WCP to the main text of the Ramsar Convention

Table 7.3.2 indicates relevance of WCP with the main text of the Ramsar convention. All the relevant items of the main text are satisfied by WCP.

(3) Adaptability of WCP to the Ramsar Strategic Plan 1997-2002

The Ramsar Convention had been a treaty for waterfowl conservation. Presently, the Convention is putting more emphasis on overall wetland ecology including hydrological issues, and the directions are clearly shown in the Ramsar Strategic plan 1997-2002. As shown in Table 7.3.3, promotion of wise use of wetland, raising awareness, reinforcing the capacity of institutions, increasing the number of Ramsar sites and mobilizing international cooperation are among emphasis points of the Convention to date. Those points are also emphasized in WCP.

It is a prerequisite for registration as a Ramsar site that the area satisfies the above-mentioned criteria and that a plan to promote the conservation of wetlands is formulated and implemented. For registration, the administrative authority (MEPRD for Latvia) fills out 'Information Sheet on Ramsar Wetlands', and submits it attached by appropriate maps to the Ramsar Bureau along with an official letter. Upon the receipt, the bureau starts internal procedure for its inclusion in the List of Internationally Importance, but it does not include screening process.

Table 7.1.1 Chronological Change of Biotopes in LWC

Biotope type	1916	1931	1966	1981	1998
Raised/ Transitional bog	- No change	- No change	- Lubana depressions surrounded by channels	- Drainages intrude Lubana depressions	-
Fen	- Fen at Baltezeri had large open water area - Zvidze river was larger than the present status	- Fen at Baltezeri had large water area - Zvidze river was apparent	- Shrinkage of open water areas Baltezeri - Upstream area of Zvidze river desiccated by canal construction	- Open water areas Baltezeri shrank	- Open waters at Baltezeri scarcely visible - One of outflowing ponds of Zvidze river almost disappeared
Inundated grassland	- Both Grivu Sala and Verdes Sala are water-logged	- Grivu Sala was drier than Verdes Sala	- Drainages still scarcely seen	- Verdes Sala and Grivu Sala covered by dense drainages	-
Coniferous forest	- No drainages	- Main drainages appear at western half of Parabine	- Drainages extend to eastern-half of Parabine	- Drainage became denser at most areas	-
Small-leaved deciduous forest	- No drainages	- Main drainages appear at western side of Pedezne river	- Drainage become denser	- Lowlands near Balkava became forested	-
Agricultural land	-	- Western lakeshore was still a wetland	- Western lakeshore becomes agricultural land	-	- Western lakeshore becomes abandoned
Lake	- Open water area extends to Gomelis and Kvapani	- Open water area extends to Gomelis and Kvapani	- Dyke construction at western half completed - Open water area largely shrinks	- Dyke construction and diversion of Malta river completed	-
River and Canal	-	-	- Diversion canals of Aiviekste and Pedezne rivers appear	- Old Pedezne river shrank	-
Fish pond	- Kvapani was a part of the lake	- Kvapani was a part of the lake	- Mostly wet meadows with a pond at Kvapani	- Fishponds appeared except for Kvapani	-
(Information)	(Hand-written map)	(Map of 1:200,000)	(Map of 1:100,000)	(Map of 1:100,000)	(LANDSAT imagery)

Table 7.1.2 Conservation Criteria and Approach Methods in LWC *1

Target groups			Environmental Zones		
			NPZ	AMZ	DZ
Flora	Raised/Transitional bog		- Preserve spaces and biodiversity of existing bogs together with fringing ecotones - Prevent succession of bog vegetation caused by deccicasion	- Preserve spaces of present bogs and fringing forests - Prevent vegatational succession of bogs by deccicasion	does not exist
	Fen		- Maintain present space and biological diversity	- Maintain present space and biological diversity	- Admit conversion to other land type
	Inundated grassland	Regularly inundated area *2	- Maintain biotope quality by not using	- Restore typical 'Inundated grassland' vegetation at selected areas - Maintain net areas of this biotope type - Maintain biotope quality by either artificial mowing or natural succession	does not exist
		Used-to-be inundated area *3	does not exist	- Admit succession from grassland to natural bushes/forests - Admit conversion into commercial forestry at abandoned agricultural lands	- Admit conversion to other land types
	Coniferous forest	Non commercial forest *4	- Maintain existing areas and biodiversity	- Maintain net areas and biodiversity	- Admit conversion to other land types
		Commercial forest	- Prohibited	- Admit forestry under regulations of respective territories	- Admit conversion to other land types
	Small-leaved Deciduous forest	Non commercial forest *4	- Maintain existing areas and biodiversity	- Maintain net areas and biodiversity	- Admit conversion to other land types
		Commercial forest	- Prohibited	- Admit forestry under regulations of respective territories	- Admit conversion to other land types
	Broad-leaved forest		- Preserve spaces and biodiversity of existing forests	- Preserve spaces and biodiversity of existing forests	does not exist
	Dry grassland		- Prohibit agriculture	- Admit agricultural and other ecological use	- Admit conversion to other land types
	Agricultural land		- Prohibit agriculture	- Admit agricultural and other ecological use	- Admit conversion to other land types
	Lake/River/Canal		- Preserve riverine forests	- Preserve old riverine forests	- Admit alteration for improvement works
	Fish pond		does not exist	- Create vegetation favorable for waterfowl	does not exist
	Overall areas		- Preserve trees older than 200 years (D.B.H. >60 cm approximately)		
Fauna	Mammals	Game species	- Prohibit hunting	- Maintain present population through habitat conservation and hunting control - Control population if necessary	-
		Other species	- Promote inventory work	- Promote inventory work	- Promote inventory work
	Birds	Raptors	- Increase population numbers by habitat protection and active measures.	- Increase population numbers by habitat protection and active measures.	-
		Waterfowl, Waders, Gulls	- Prohibit hunting	- Secure 20,000 or more waterbirds - Allow population control for harmful birds	-
		Other endangered birds	- Take measures to rehabilitate disappeared species - Maintain present population through habitat conservation	- Maintain present population through habitat conservation	-
		Forest birds	- Maintain present diversity through habitat conservation	- Maintain present diversity through habitat conservation	-
		Village birds	-	- Maintain present biodiversity through awareness	- Maintain present diversity through awareness
	Fishes		- Maintain present diversity through habitat conservation	- Increase population numbers through protection and upgrading of their habitat	-
	Other animals		- Maintain present diversity through habitat conservation - Promote inventory work	- Maintain present diversity through habitat conservation - Promote inventory work	- Promote inventory work
Human association with nature			-	- EMC has at least 10,000 nation-wide visitors annually	- at least one member of every household in and around LWC gets to participate in EMC programs - Provide all relevant officers with training opportunities on wise use methodologies

Note: *1 National and regional regulations already enforced are not included, *2 Inundated at least every 2 years under present water control scheme,
*3 Inundated only spontaneously, *4 Forests without maintenance.

Table 7.3.1 Status of LWC with Relevance to Criteria for Ramsar Registration

Criteria Group	Criteria and examples of relevant attributes	Past LWC without dyke/fish pond	Present LWC	Future LWC without EMP	Future LWC with EMP
A: Sites containing representative, rare or unique wetland types	**Criterion 1:** It contains a representative/rare/unique example of a natural or near-natural wetland type within the appropriate biogeographic region.	○	○	△	○
	70-i: natural control, amelioration or prevention of flooding	○	×	×	×
	70-ii: seasonal water retention for wetlands or other areas of conservation importance downstream.	×	×	×	×
	70-iii. recharge of aquifers.	×	×	×	×
	70-iv. form part of karsts or underground hydrological or spring systems that supply major surface wetlands.	×	×	×	×
	70-v. major natural floodplain systems.	◎	○*1	○	○
	70-vi. hydrological influence on regional climate regulation or stability.	×	×	×	×
	70-vii. maintaining high water quality standards.	×	×	×	×
B. Sites of international importance for conserving biological diversity	**Criterion 2:** It supports vulnerable, endangered, or critically endangered species or threatened ecological communities.	○	○	○	○
	74-i. support a mobile population of a species at different stages of its	×	×	×	×
	74-ii. support a population of a species along a migratory pathway or	○	○	×*6	○
	74-iii. providing refuge areas to populations.	○	○*2	△*7	○
	74-iv. adjacent to other wetlands included in the Ramsar List.	×	○*3	○	○
	74-v. hold a high proportion of the population of a dispersed sedentary species that occupies a restricted habitat type.	×	×	×	×
	75-i. include significant areas having certain communities, particularly where these are of high quality or particularly typical of the	○	○*4	○	○
	75-ii. are sites which have rare communities.	×	×	×	×
	75-iii. include ecotones and communities which exemplify particular	×	×	×	×
	75-iv. have communities that can no longer develop under	×	×	×	×
	75-v. have communities of a long developmental history.	×	×	×	×
	75-vi. have communities that are functionally critical to the survival of other perhaps rarer communities or particular species.	×	×	×	×
	75-vii. contain communities which have been the subject of significant decline in extent or occurrence.	×	×	×	×
	Criterion 3: It supports populations of plant/animal species important for maintaining the biological diversity of a particular biogeographic region.	○	○	△	○
	78-i. are "hotspots" of biological diversity and are evidently species-	×	×	×	×
	78-ii. are centres of endemism or otherwise contain significant numbers of endemic species.	×	×	×	×
	78-iii. contain the range of biological diversity including habitat types occurring in a region.	○	○*5	△*7	○
	78-iv. contain a significant proportion of species adapted to special environmental conditions.	×	×	×	×
	78-v. support particular elements of biological diversity that are rare or particularly characteristic of the biogeographic region.	×	×	×	×
	Criterion 4: It supports plant/animal species at a critical stage in their life cycles, or provides refuge.	-	×	×	×
	Criterion 5: It regularly supports 20,000 or more waterbirds.	×	○	△*8	◎
	Criterion 6: It regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.	×	○	△*8	◎
	Criterion 7: It supports a significant proportion of indigenous fish subspecies, species or families.	×	×	×	×
	Criterion 8: It is an important source of food for fishes, spawning ground, nursery and/or migration path.	○	×	×	○

Note: Criteria and attributes are those in the Resolution VII.11 (1999) of the Ramsar Convention.

◎: satisfactory, ○: applicable, △: questionable, ×: not applicable; -: no information.

*1: Existence of large inundated grassland, *2: Bogs for raptors and lake and fishponds for waterfowl,

*3: Neighboring Teici Ramsar Site, *4: Existence of large high bogs, *5: Varied biotopes exist in LWC,

*6: Loss of Great Snipe habitat for example, *7: Possible loss/degradation of high bogs,

*8: Future of fishpond habitat are not clear.

Table 7.3.2 Relevance of Wetland Conservation in LWC with the Main Text of the Ramsar Convention

Type of requirements	Relevant texts in the Ramsar Convention	Measures to be taken in the Plan
Establishment of Ramsar site	Article 2-1: Contracting Party shall designate suitable wetlands. Wetlands should be selected for the List on account of their international significance.	LWC satisfy criteria for Ramsar registration, and establishment of a Ramsar site is proposed.
International responsibility	Article 2-6: Contracting Party shall consider its international responsibilities for the conservation, management and wise use of migratory stocks of waterfowl.	International cooperation with countries on migratory routes is promoted through EMC activities such as 'Baltic Ramsar Center.
Planning	Article 3-1: The Contracting Parties shall formulate and implement their planning so as to promote the conservation of the wetlands included in the List, and as far as possible the wise use of wetlands in their territory.	This plan itself satisfies this condition. Wise use is emphasized in the rules of protected territories. Educational use of wetlands is among wise use measures.
Monitoring	Article 3-2: Contracting Party shall arrange to be informed at the earliest possible time if the ecological character of any wetland has changed, is changing or is likely to change as the result of technological developments, pollution or other human interference.	'Early Warning' is realized through monitoring program.
	Article 4-1: Promote the conservation of wetlands and waterfowl by establishing nature reserves on wetlands, whether they are included in the List or not, and provide adequately for their wardening.	Research is conducted in collaboration with other organizations, and educational activities are linked with other nature reserves.
Reporting	Article 3-2: Information on changes (in Article 3-2) shall be passed without delay to the responsible organization or government.	Environmental Information Management System includes reporting system.
Mitigation	Article 4-2: Where a Contracting Party deletes or restricts the boundaries of a wetland included in the List, it should as far as possible compensate for any loss of wetland resources, and in particular it should create additional nature reserves for waterfowl and for the protection.	This plan mainly aims at conservation on the existing site, and mitigation concept is not emphasized.
Research	Article 4-3: Contracting Parties shall encourage research and the exchange of data and publications regarding wetlands and their flora and fauna.	This is reflected in the research and monitoring activities.
Waterfowl augmentation	Article 4-4: Contracting Parties shall endeavor through management to increase waterfowl populations on appropriate wetlands (whether they are included in the List or not).	Improvement of fishponds and Lake Lubana as waterfowl habitat is a major part of the plan.
Training	Article 4-5: Contracting Parties shall promote the training of personnel competent in the fields of wetland research, management and wardening.	Capacity building of governmental sectors is emphasized.

Table 7.3.3 Relevance of the Wetland Conservation Plan with the 'Ramsar Strategic Plan 1997-2002'

Major objectives of the Strategic plan	Action-level strategies that are relevant to LWC	Relevant activities in the Plan
1. To progress towards universal membership of the Convention.	・Not relevant.	・Not relevant.
2. To achieve the wise use of wetlands by implementing and further developing the Ramsar Wise Use Guidelines.	・Formulation/implementation of national environmental strategies. ・Integrated land/water planning ・Publication of reference materials on wiseuse. ・Enactment/enforcement of environmental laws (such as those on EIA, water use, and pollution). ・Introduction of wetland economic valuation techniques. ・Establish wetland restoration / rehabilitation programmes ・Ensuring participation of local communities/private sectors/NGOs. ・Introduction of incentive/disincentive measures.	・Wetland Conservation Plan is formulated in accordance with such strategies as National Environmental Action Plans and National Programme on Biological Diversity. ・Publication of wise use materials is realized in the awareness part. ・The Plan is formulated based on effective environmental laws. ・Economic valuation method was examined in the preparation process of the Plan. ・Lake and fishpond restoration is proposed. ・Involvement of varied sectors are proposed.
3. To raise awareness of wetland values and functions at all levels.	・Education and public awareness focus on wetlands. ・Inclusion of wise use principle in educational curricula.	・Education and public awareness is a component of the Plan. ・Recommendation to the school curricula is described in the Plan.
4. To reinforce the capacity of institutions to achieve conservation and wise use of wetlands.	・Institutional coordination mechanism. ・Training activities.	・Proposed Environmental Management Center has a coordinating function. ・Training is included in the activities.
5. To ensure the conservation of all sites included in the Ramsar List.	・Establishment of management plan ・Monitoring scheme	・This plan itself is the management plan. ・Monitoring scheme is also proposed.
6. To designate for the Ramsar List those wetlands, especially wetland types still under-represented in the List and transfrontier wetlands.	・Promote inventory work including loss/ conversion of wetlands	・Inventory work is dealt both in research and monitoring part. ・Inundated grassland is a type of under-represented wetland.
7. To mobilize international cooperation and financial assistance for wetland conservation and wise use in collaboration with other conventions and governmental/ non-governmental agencies.	・Promote international cooperation projects ・Promote international exchange programmes	・Already realized as Latvia-Japan cooperation. ・International exchange is already realized by the above cooperation and promoted through eco-tourism.
8. To provide the Convention with the required institutional mechanisms/resources.	・Not relevant.	・Not relevant.

Note: Ramsar Strategic Plan 1997-2002 which was adopted at COP6 (1996) of the Convention, includes 8 General Objectives, 28 Operational Objectives, and 125 concrete actions to be taken.

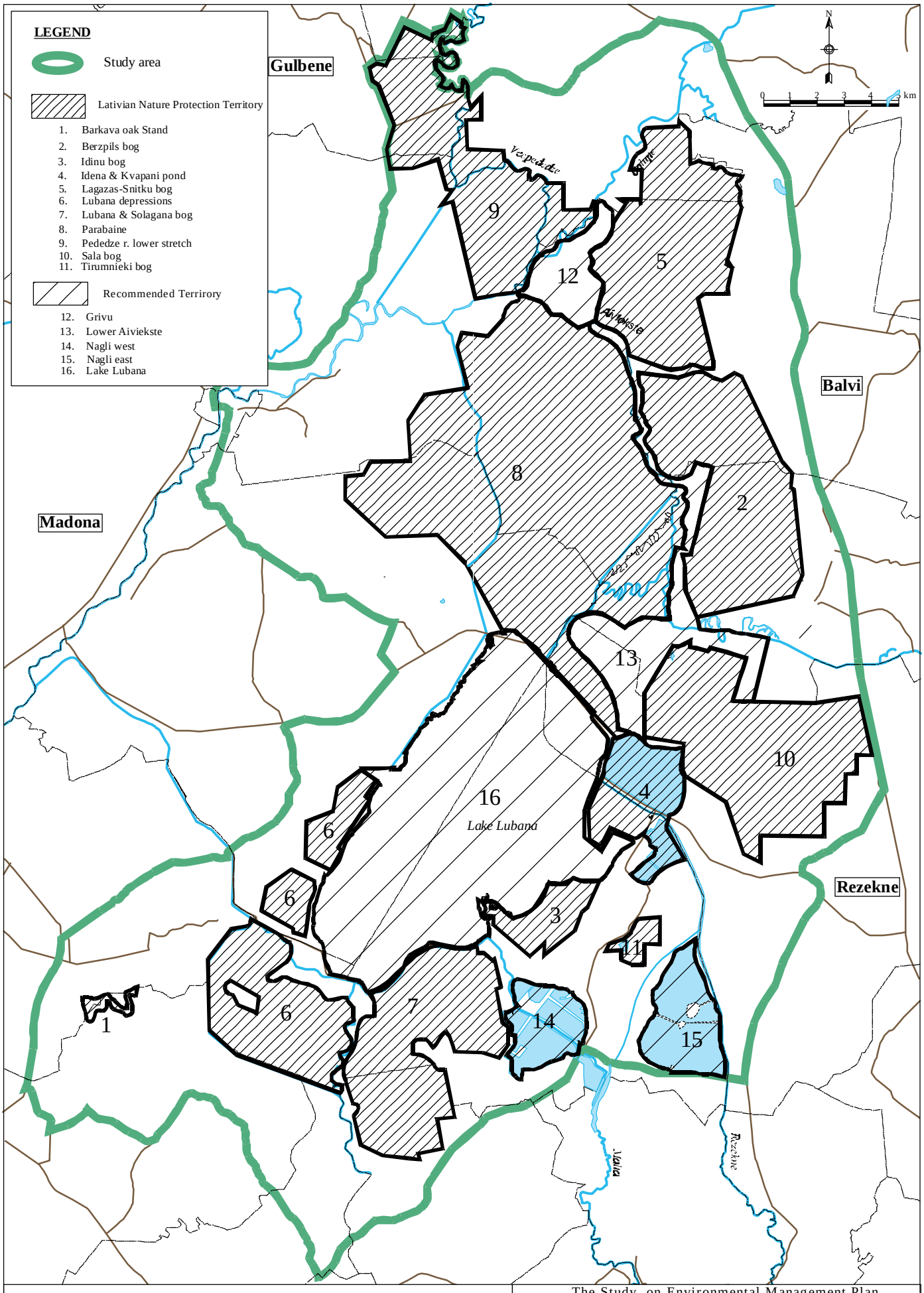


Figure 7.1.1 Proposed Biotopes for Conservation

The Study on Environmental Management Plan for the Lunaba Wetland Complex in the Republic of Latvia

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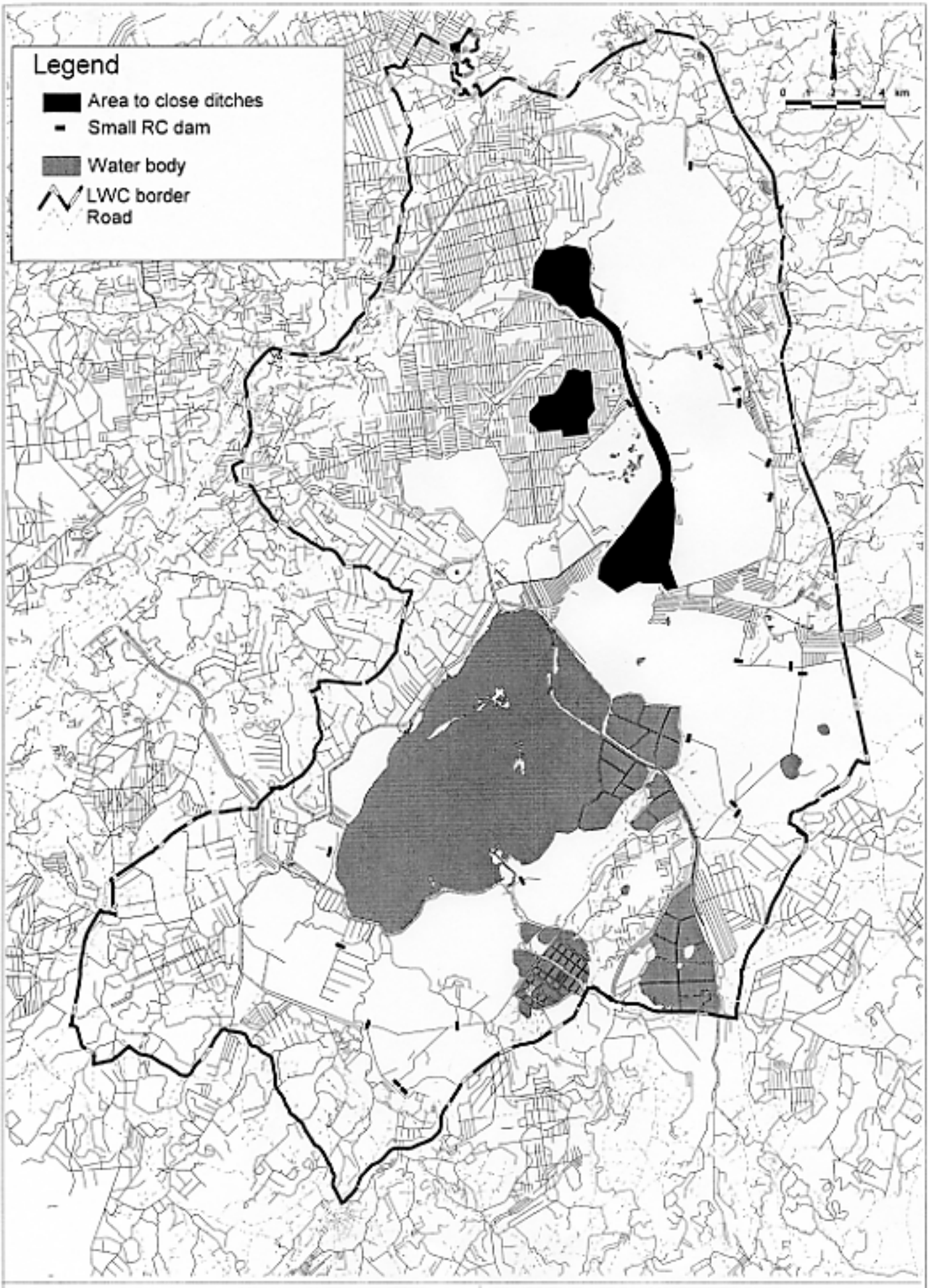

Figure 7.2.1 Points and Area to Close Drainages

The Study on Environmental Management Plan
for Lubana Wetland Complex in the Republic of Latvia
JAPAN INTERNATIONAL COOPERATION AGENCY

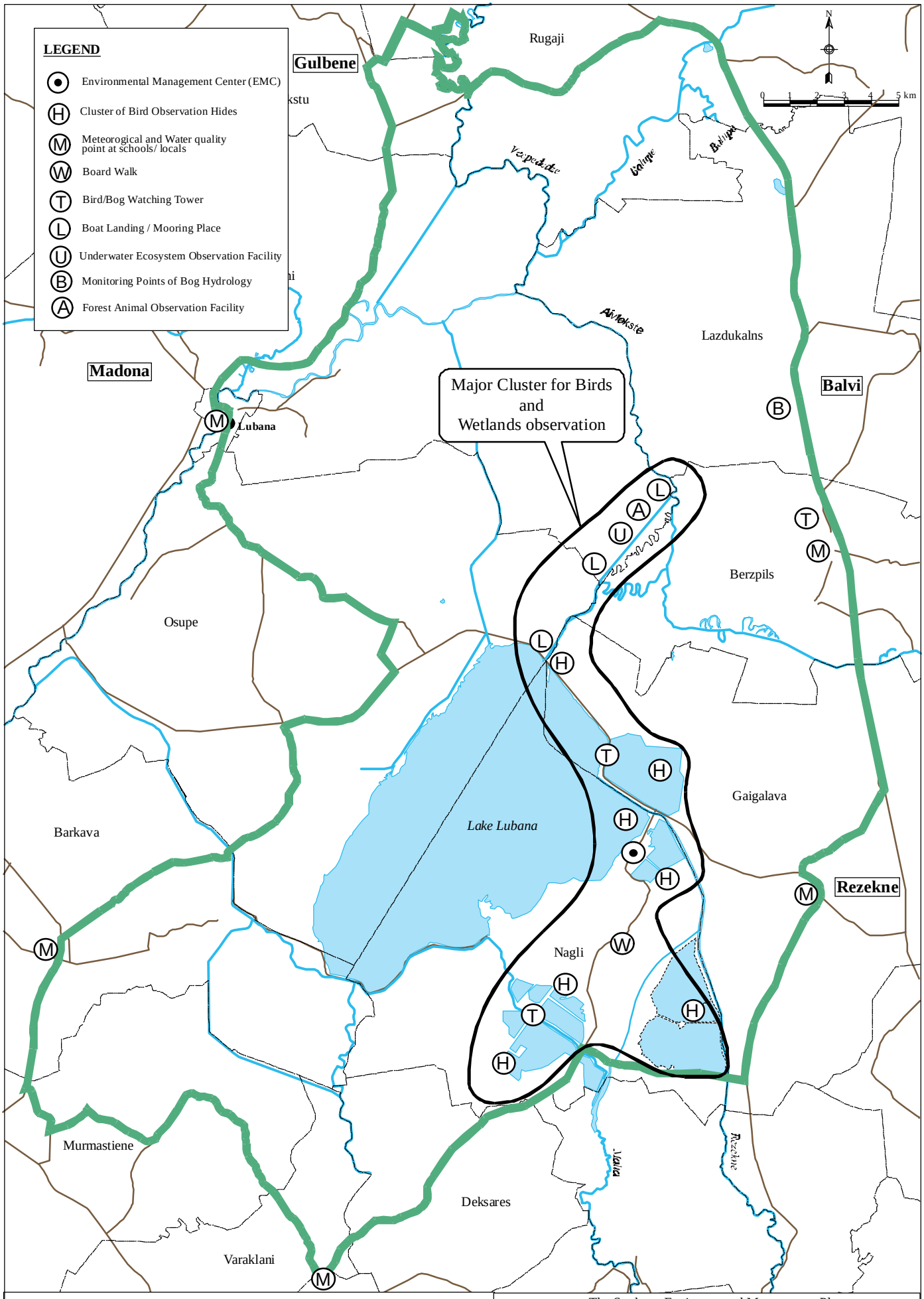

Figure 7.2.2 Facilities of Nature Observation and Monitoring

The Study on Environmental Management Plan for Lubana Wetland Complex in the Republic of Latvia

JAPAN INTERNATIONAL COOPERATION AGENCY

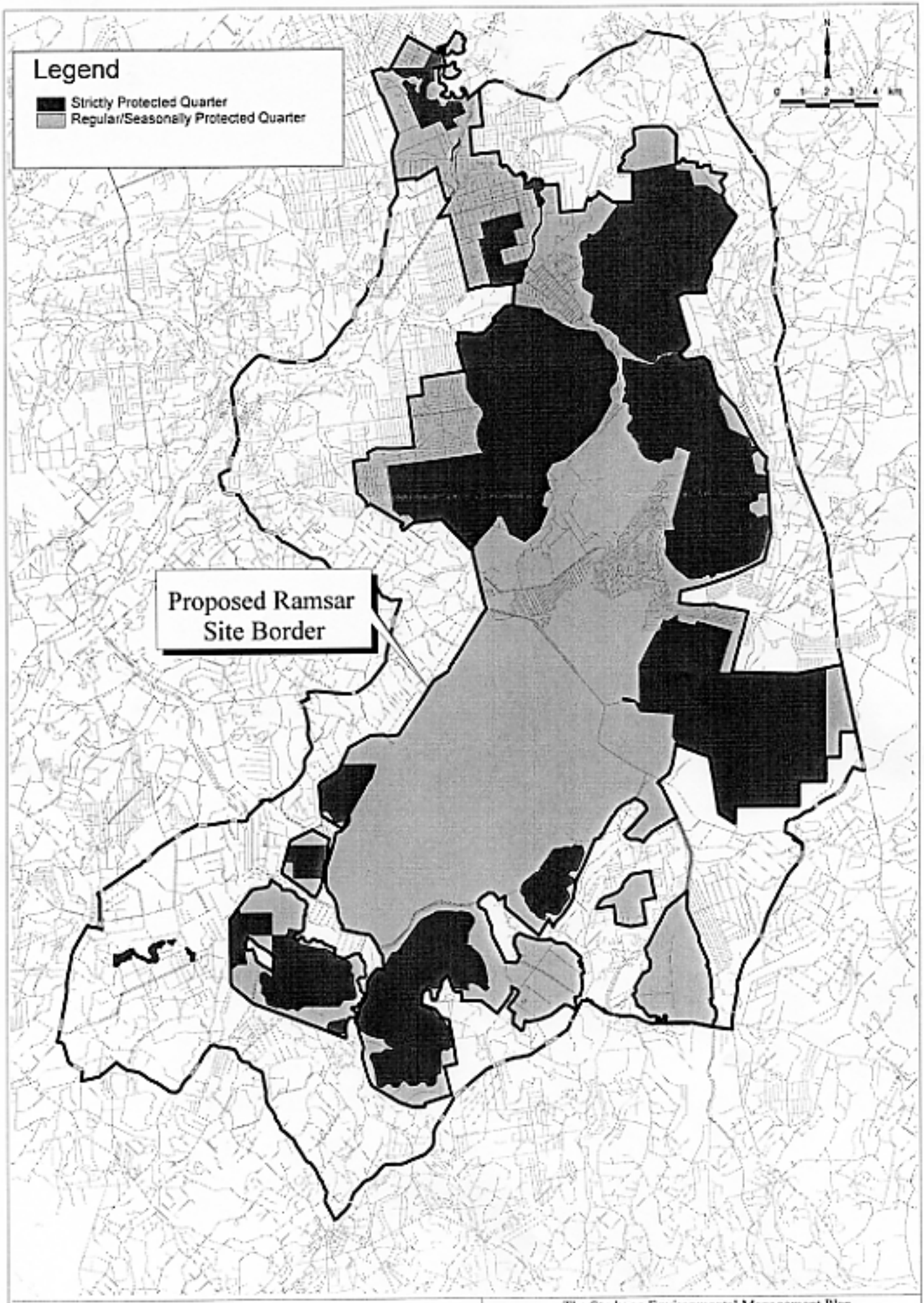

Figure 7.3.1 Proposed Ramsar Site

The Study on Environmental Management Plan for Lubana Wetland Complex in the Republic of Latvia

JAPAN INTERNATIONAL COOPERATION AGENCY

CHAPTER 8

CHAPTER 8 GUIDELINE FOR ENVIRONMENTAL INFORMATION MANAGEMENT SYSTEM (EIMS)

8.1 ENVIRONMENTAL INFORMATION MANAGEMENT SYSTEM (EIMS)

8.1.1 Overall Frame of EIMS

The objectives of EIMS are summarized into five categories: 1) decision-making, 2) monitoring, 3) environmental education, 4) public awareness, and 5) science promotion. The overall framework of EIMS is shown in Figure 8.1.1 with the EIMS objectives and outputs.

(1) Decision-making with EIMS

The introduction of EIMS improves clarity, accountability, applicability, and integrity of the decision-making on conservation management, water level management, education plan, regional development, water quality management, and facilities plan. The decision-making process of EIMS is presented in Figure 8.1.2.

1) Specification of decision items and target areas

The first step of decision making specifies the decision items and target areas to be focused on. The management types for decision-making are mainly categorized into six: 1) conservation management, 2) water level management, 3) educational plan, 4) regional development, 5) water quality management, and 6) eco-tourism development plan (see Table 8.1.1). The decision items are specified for each management type, and decision-makers need to select one of them to specify the necessary decision item for the time being. The necessary GIS data (layers) is marked with "x" in Table 8.1.1 to clarify which data is used to make thematic maps for decision-making. The geological areas to be focused on should be also specified by the Implementation Committee of EMP in accordance with the decision-making items. Current environmental zones, administrative units (townships or districts), nature protection territories, or biotopes could be targeted for the purpose of decision-making. The information on both the decision items and target areas is directed to the policy analysts of EMC for further process of decision-making.

2) Specification of data Arrangement and detailed researches

The policy analysts of EMC specify the data arrangement and researches to be detailed to obtain the necessary information based on the decision items and necessary GIS data matrix specified by the Implementation Committee. Digital or analog maps and data essential for decision-making should be arranged in the formats in which decision items are clearly focused on and easily readable on thematic maps. Making the best of the GIS technologies, information interpretation on a digital screen is a replacement for hard copying of thematic maps. The scope of selection of information and data is expanded by means of the highly developed GIS technologies. Scientific researches should be carried

out in accordance with the decision items specified by the Implementation Committee. The policy analysts give their directives to science-based analysts to conduct further researches to fill in as much information as possible to make decisions.

3) Interpretation of outputs and decision making

Based on the analyses of distribution and overlaid maps, the policy analysts interpret the information on the maps to focus on the decision items, to clarify the meanings of overlapping areas of more than two layers of GIS data, and to calculate the area where overlapping takes place. This process needs a high standard of analysis to avoid misinterpretation of the information.

(2) GIS and remote-sensing usage for decision-making

1) Advantages of GIS and remote-sensing

GIS forms a digital database in which the commonly used spatial coordinate system in Latvia (LKS-92) is made fit for geological reference. GIS is used as a means of a) data input from maps, aerial photos, satellites, and surveys, b) data storage, retrieval, and query, c) data transformation, analysis, modeling, and spatial statistics, and d) data reporting such as maps, reports, and plans. The advantages of GIS ensue from its functions as the decision-making, data integration, and statistic analysis tools. GIS technologies enrich accuracy and continuity attributed to the necessary data and information. In addition, GIS software provides analytical tools to calculate area and a query system in which necessary information is automatically returned.

EIMS is proposed to utilize GIS aiming at construction and management of environmental information database in association with the environmental monitoring of LWC, which is also useful for environmental education. The purpose of environmental management itself with an active use of GIS in the study area is to monitor and evaluate the land conditions. In line with these purposes, GIS functions within the EIMS framework as technological tool to monitor the land cover related situations, to update and manage the monitored data, to provide necessary maps for environmental conservation, and to prepare materials for environmental education to visitors, local residents, and the other Latvians.

2) Information created by GIS and remote-sensing

The GIS data inputted by the JICA study team in collaboration with RDC includes environmental zones, biotope map, nature protection territories, land use, educational & eco-tourism resources, topography, land tenure, inundation, and water quality. A soil map and facility plan can be digitized by GIS in the future depending on the future needs. The information produced with remote-sensing technologies includes 1) water quality distribution (turbidity and chlorophyll-*a*), 2) water temperature distribution, and 3) 3D simulation of water level conditions. Decision-makers and policy analysts can use these data to make decisions for the six management types.

3) Limitations of GIS and remote-sensing

As GIS technologies require experienced know-how to deal with spatial data and query tools, training courses should be arranged for GIS and IT engineers at the local level. Though GIS software is installed in the local agencies' information systems, purchasing remote-sensing technologies might be expensive for them. Financial arrangements for remote-sensing technologies are necessary to give an impetus for technological upgrade at the local level. Coordination between the local institutions should be promoted to exchange their data/information and know-how on digital data processing. Special attention should be put on networking for the local GIS and remote-sensing engineers since little cooperation has been made between the local institutions. The fact that DPU has a great deal of experience in GIS data processing paves the way to a possible solution for technological advancement at the local level.

4) Usage of biotope maps

The biotope map can be used for the policy making on nature protection. First, scientists and science-based analysts make a biotope map describing which part is important in terms of biodiversity and the protection of endangered species in cooperation with GIS engineers. Then, each biotope is evaluated based on the necessity of protection by the scientists. Finally, policy analysts and decision-makers determine how to protect the biotopes which are highly rated by the scientists. A biotope which has not yet been designated as a Latvian nature protection territory might be specified as one if decision makers feel the importance of the designation and agree with the scientists. In other words, decision-makers can focus their efforts to address the most critical areas of conservation and mitigation efforts.

(3) Monitoring with EIMS

1) Guideline on monitoring

Monitoring is one of the main pillars of EIMS to collect, analyze, and deliver the information necessary for conservation management, water level management, education plan, regional development, water quality management, and eco-tourism development plan. The Information Sheet of Ramsar Convention that elaborates the necessary information and data to be collected for wetland conservation worldwide could be a basis for the monitoring system of EIMS. Data collection should be conducted in cooperation with data source authorities that monitor the necessary information in LWC to minimize monitoring costs and to maximize data reliability. Data should be analyzed using GIS and remote-sensing technologies to posses accurate and visualized information for clear and accountable decision-making. Data should be delivered at minimum costs making the best of the Internet or WWW services. When it comes to monitoring, user needs are to be kept in mind to decide which information or data is more necessary and how often it should be collected.

2) Monitoring items and information sheet of Ramsar Convention

The necessary monitoring items are categorized into six with regard to the Information Sheet specified by the Ramsar Convention. Monitoring needs and human resources should not be missed since the optimal usage of limited human and financial resources to monitor and collect the information is a critical issue in environmental management. The more demanded the information is, the more attention should be given to it. Table 8.1.2 shows the necessary monitoring items, their locations, frequencies, and collaborating organizations relevant to data collection.

Physical features: The physical features consist of geology (soil types, altitude), hydrogeology including groundwater level, air temperature, and water quality. The data of altitude has already been inputted in the GIS database by using the Soviet topographical maps made in 1973 before the dyke construction around Lake Lubana. Amelioration of the contour lines inputted will be needed in the course of the implementation of EMP. Air temperature is for the snow-melting model, while the water quality monitoring covers biological and chemical substances to check dissolved oxygen, BOD/COD (indicator of saprobic conditions), and T-N/T-P (indicator of eutrophication). Though the State Hydro-Meteorological Agency (SHMA) has been downsizing its capacity of monitoring, the organization is recommended to resume monitoring in Lake Lubana. RREB and MREB need to expand their capacity to regularly monitor the water quality in the rivers within LWC.

Hydrological values: For the water level simulation model, daily flow rates in the upstream rivers, daily water level in Lake Lubana, and rainfall in the catchment area are collected in cooperation with SHMA and ALRSA. Lake Lubana's retention time is used to extrapolate the lake's self-purification capacity. The fact that any wetland has its role in flood control and cleaning of water should be clearly mentioned to promote public awareness on wetland conservation.

Ecological features and noteworthy fauna and flora: The ecological features include botany (vegetation types), zoology (important mammal species including aquatic mammals, and game mammals), ornithology (raptors, waders, gulls, and other important birds), and ichthyology (typical fish species). Noteworthy fauna and flora is anticipated to be selected for the proof of the wetland's peculiarity. Description of seasonal variations and long-term changes enriches the monitoring and analysis of ecological features. The monitoring of the ecological features by the Latvian Fund for Nature, the Latvian Ornithological Society, Teici Nature Reserve, and the Institute of Limnology, DPU is highly recommended due to their long-standing experiences in LWC.

Educational and eco-tourism resources: The main goal "Wise Use of LWC" is attained through the monitoring of educational and eco-tourism resources found in LWC. The area in and around the Kvapani fishpond has the high potential to attract many schoolchildren and tourists due to its biodiversity and educational value. The Teirumniku bog can be an educational resource. If a proper conservation measure is taken, the raised bog can be

introduced to the public. The Pededze river is rich in beavers' dams and suitable for canoeing routes full of wildness. The Orenisi fishpond provides a beautiful scenery for eco-tourists with bird watching opportunities. The staff of EMC is obliged to prevent these attractive educational and eco-tourism resources from disappearing by visitors' misconduct. The help of the Center for Nature Research and Environmental Education at DPU can provide the information on the educational and eco-tourism resources.

Current land use and socioeconomic data: For the purpose of regional development and optimal natural resources allocation, land use planning is conducted in consideration of LWC's socioeconomic conditions. Currently, the production yield of the forestry sector shows an upward tendency, while the fishery and agricultural sectors are faced with a severe economic condition. The land use planners are to analyze the current and future conditions of the primary industry and determine which sector should be expanded or downsized. Townships and the forestry company can provide the necessary information on the current land use.

Monitoring needs and human resources: The names, positions, organizations, and motivations of the scientists and administrators interested in LWC give the information on how to use the monitoring data collected. The publications and references on LWC help to understand the scientific and social value of LWC. Monitoring should not be a useless activity but should be valuable to the public. Monitoring needs in the society gives a rationale of environmental management activities in LWC.

3) Monitoring collaboration system and data sources

Figure 8.1.3 shows the collaboration framework for data monitoring and collection. The organizations currently engaging in the monitoring of necessary data for EMP are listed. Each collaboration organization has the right to access and obtain the data stored in the server of EMC in exchange for the effort to monitor/collect/deliver its information. Access to the documents, models, GIS/remote-sensing data, and other monitoring data is exclusively limited to the collaborating organizations registered by EMC. Any scientific, administrative, and non-governmental organizations have a chance to register in this collaboration system. The collaboration system should contain a mechanism in which scientific networking is promoted as a result of the collaboration.

4) Monitoring and evaluation system of conservation measures

Monitoring of conservation measures should never be despised. Following the conservation criteria, activities in NPZ and AMZ are constantly monitored to avoid prohibited hunting for game species and to preserve such precious vegetation as raised bogs. To monitor illegal commercial activities in the forests of the strictly nature protected territories contributes to protect natural resource management. The monitoring of conservation measures evaluates the rationality of the measures and is expected to feedback to conservation management. The evaluation system decides if any other regulations or guardian systems are necessary or not.

(4) Environmental Education with EIMS

The functions of EIMS for environmental education include: 1) introduction of the proposed environmental education and training (EE&T) activities, 2) evaluation and feedback system for EE&T, 3) publication of EE&T award winners, and 4) information dissemination through an education center on the Internet. EIMS makes schoolteachers actively involved in EE&T activities. Success in EE&T depends on the level of computer and information technologies of the local schoolteachers and children.

Figure 8.1.4 shows the site map of EMC for EE&T. The proposed EE&T activities should be evaluated and revised regularly while minimizing cost. The most efficient way is to feedback through the WWW home page of EMC if most schoolteachers are informed of the feedback system. The cooperation between EMC and the local education agencies is crucial to succeed in the dynamic environmental education implementation. Through the evaluation system, award winners of sophisticated and creative EE&T activities are selected to promote school activities for nature protection. The evaluation system takes into account candidates' experiences, knowledge, creativity, and performances when selecting.

The WWW site of EMC is created to cover the topics related to environmental education including the supporting for teachers trying to carry out EE&T activities, the proposed EE&T activities, education program development hints, the educational resources in LWC, technical supports from CNREE at DPU, the environmental themes and explanations, comments to be collected, and the contact list. The activities proposed by the plan of EE&T are supplied on the Web site to enable the local schoolteachers to access them and to feedback their experiences to EMC through the Internet. A prize is to be given to schools or classes which have shown their efforts to deepen the knowledge and change their behavior by proposed or invented EE&T activities. The evaluation is conducted through the feedback system on the Web site. The fact that RDC has started to provide the Internet services to every public school in 2000 makes the Education Center on the WWW quite feasible. Organic relationship between the local schools and EMC is expected by the help of the Internet.

(5) Public Awareness

1) Promotion of Public Awareness

EIMS is to promote public awareness on sustainable development and wise use of wetland. EIMS specifies the activities of public awareness at the local, regional, national, European, and international levels. The strategy is based on the idea that the value and importance of LWC means differently to each level. Direct involvement in public awareness promotion focuses on the eco-tourism development in LWC. The local people can easily understand the importance of nature protection, if efforts to conserve the environment make benefits. The local people should be directly involved in the activities provided by EMC for wetland management of LWC. For tourists and NGOs, eco-tours and public awareness programs

are organized and developed by EMC. Indirect involvement focused on the people at the regional, national/Baltic and international levels uses mass media and publications prepared by EMC as a primary medium for public awareness. EIMS enables the staff of EMC to clearly systemize and to easily repeat the activities aiming at public awareness promotion.

2) Strategy and Target Groups

Public awareness on sustainable development and nature protection is promoted by focusing on each geographical level as a matter of convenience. The awareness of the primary sector, anglers, hunters, and eco-tourism developers at the local level is promoted by the seminars/workshops, discussion meetings, training programs, and reconnaissance to LWC. The awareness of the tourists and NGOs at the regional, national, and international levels is encouraged by the help of advertisements, eco-tours, and special activities created by EMC. Direct involvement by the staff of EMC stimulates people's participation in its activities.

The awareness of people at the regional, national/Baltic, and European/international levels is assisted through the use of mass media. A frequent contact with concerned newspaper, TV, radio, Internet companies is a key to success in the public awareness promotion. The Environmental Film Studio established by MEPRD in 1996 is specialized in production of wildlife and environmental issues documentaries including the films on Lake Lubana taken in November 1999 and on the Nagli fishpond in October 1999. They regularly broadcast their products as a 15- to 30-minute documentary on the national TV programs. A close relationship should be constructed between the EMC and the Environmental Film Studio.

DPU has a sophisticated multi-media center to deal with CD and video creation for images. The know-how of DPU is applied to the promotion of public awareness through vivid images of LWC. DPU has also been engaged in TV program development in collaboration with the Latvian TV (LTV1) and their programs are broadcast for several minutes everyday. A close relation and technical support are crucial from DPU to promote public awareness on LWC.

3) Activities for Public Awareness

Local level:

The activities for the forestry sector include seminars on the regulations within a protected nature territory to inform foresters of their obligations to abide by the rules. Particularly, some strictly nature protected quarters in LWC are designated as places where any forestry activities are prohibited. Broad-leaved forests are considered to be precious by many botanists, while raised bogs are easily damaged by the careless and random drainage construction. As the forestry sector is the most potential economic activity in LWC, one might consider the importance of sustainable development. For the fishery sector, natural resource management is quite an adequate topic to provide. To maintain their businesses

the fishery sector should realize that the only way of surviving is to develop eco-tourism nearby their fishponds. The agricultural sector needs to understand harmful pesticides cause the destruction of ecology in and around Lake Lubana. For eco-tourism developers, training programs are provided by EMC to promote sustainable development.

Regional and national level:

Eco-tours, activities in EMC become the main activities to promote public awareness for tourists and visitors from the regional, national, international levels. Advertisement on the regional, national newspaper, and the Internet activates the public participation in the eco-tours. NGOs are expected to actively participate in the program development for EE&T activities and to improve them by their creative ideas and experiences. Publication activities initiated by EMC help NGOs obtain the know-how to participate in public awareness promotion. Direct involvement from Latvian Fund for Nature and the NGO Center is essential to promote awareness among NGOs.

European and international level:

At the European and international levels, the Internet is the most powerful tool to promote awareness at the minimum cost. Cost-effective information technologies should be fully used. EIONET provides a lot of links to the European information sources on environmental management. When it comes to the Internet, DPU has already developed the home page of LWC. With the technical support from DPU, an informative home page will be posted up on the WWW. The site map of the EMC's home page includes 1) explanation of wetlands, the Ramsar Convention, and the environmental management in LWC, 2) actual examples of wise use and eco-tourism in LWC, 3) the virtual Education Center on the WWW page to promote environmental education and provide the proposed EE&T activities for schoolteachers, 4) the Information Sheet of Ramsar Convention to open the monitoring results to the public, 5) science network & partnerships to encourage the registrations from scientific and administrative organizations, 6) contacts & links to make contact with the staff of the EMC an link to the relevant institutions, and 7) comments & feedback to squeeze any constructive comments from the public and revise the home page to make the more user-friendly home page.

(6) Science Promotion

EIMS has a scientific value with a view to sharing the information on ecology of LWC. The effective use of EIMS makes it possible to connect a variety of scientific institutions to promote science and to augment its achievements. Latvian Fund for Nature (LFN) is an experienced non-governmental organization (NGO) and has been engaged in scientific research to demarcate the nature protection territories within LWC. LFN, Latvian Ornithological Society and Teici Nature Reserve have conducted a lot of ornithological research to understand ecological biodiversity and features in LWC have close relations with each other to promote science. The Institute of Limnology has been one of the main

institutions to conduct ecological research in wetlands including Lakes Razna and Lubana. The Center for Nature Research & Environmental Education (CNREE) at DPU is proposed to take a responsible role in environmental education due to its long-standing experience in the field. All the scientific institutions concerned are expected to have close relations and promote scientific researches in LWC through the proposed networking system.

8.1.2 EIMS Working Plan

(1) Institutional setting for EIMS

Figure 8.1.5 illustrates the institutional framework of EIMS that is under the jurisdiction of the Management House of EMC. The director of the house is in charge of the analysis of policy-making entrusted by the directing board of the Implementation Committee of EMP. Three system engineers relevant to GIS data input, public awareness promotion, and environmental education promotion should be staffed to activate the evaluation/feedback and monitoring systems provided by EIMS. In addition, an ornithologist, a botanist, and a hydrologist will be manned in accordance with the conservation needs.

The TORs for the three system engineers and the three science-based analysts are described in Figure 8.1.5. One system engineer will be responsible for GIS/remote-sensing data input, monitoring data collection, home page design/construction, data analysis, computer networking, and technical support for information management. Another system engineer will be in charge of publication of the annual reports of EMP for LWC, comments collection from the public through the Internet, bibliography making of the relevant scientists' researches, advertisement of EMC activities and eco-tourism products through mass media, and registration of the newly admitted collaborating organizations. The last system engineer will be necessary to provide technical support for the proposed EE&T activities and program development for schoolteachers and NGOs, to evaluate school activities, to develop NGO training programs and courses at EMC, to form constant relations with the local municipalities, NGOs, and CNREE at DPU.

The biologist will take the responsibility of monitoring raptors, waterfowls/waders/gulls, other important birds, important mammals, game mammal species, other mammals, and typical fish species, making biotope maps, and contacting LFN, LOS, TNR, and the Institute of Limnology at DPU. The botanist will assume full responsibility for botanical subjects including the monitoring of raised bogs, fens, inundated grasslands, and broad-leaved forests. The hydrologist will collect the hydrological dada, carry out runoff analyses, conduct the water level simulation modeling, make inundation maps, and provide the water level analyses for the policy analyst.

(2) Training for EIMS construction

1) Training for system engineers

The GIS/IT engineers of the local agencies have quite a potential to implement EIMS if financial resources are fully ensured. Engineering training courses for EIMS are formulated taking into consideration IT/GIS engineers' skills and potential. In MREB, one IT engineer is voluntarily making its WWW home page. In RDC, one expert on GIS cooperated with the JICA study team. These facts vividly illustrate the possibility of potential development of GIS/IT engineers at the local level. As the technical level of the local engineers is highly evaluated, the main focus of the engineering training should be placed on applications and improvement of EIMS for their convenient use. Training of the basic skills of GIS/remote-sensing and IT is rather a matter of supplemental courses. In other words, the main focus should be the role of EIMS and system engineers' roles in environmental management.

For environmental education and public awareness, the local skills and know-how require more experience. The systematic EE&T has to be fully taken into consideration to develop the training courses for the system engineers responsible for environmental education and public awareness. The principles and educational goals, the evaluation/feedback system through the Internet, and the formulation of the proposed EE&T activities should be the contents of the training courses for the system engineer in charge of environmental education. The system engineer for public awareness promotion will be required to master how to contact mass media, cooperate with the local NGOs, and teach the regulations relevant to nature protection. The eco-tourism development plan also should be fully understood by the system engineers.

2) Training for science-based analysts

The main topic of the training for a biologist, botanist, and hydrologist is the objectives of environmental management in LWC. They are not scientists but science-based analysts for environmental management. Only collecting data is not worthwhile. The objectives of EIMS include science promotion and decision-making. Science promotion will be completed only through strenuous efforts devoted by science-based analysts. The training should emphasize socialized communication skills required for the networking of scientific and administrative networking. Teici Nature Reserve can provide the training courses for a biologist and a botanist based on their scientific experience.

(3) Systems structuring for EIMS

Hardware and software necessary for EIMS are shown in Table 8.1.3. All equipment can be procured in Latvia and will not require special knowledge for operation. The grand total for the hardware and software is about 74,000 LVL. Monthly salaries are 100 LVL/month for 6 engineers and analysts, 300 LVL/month for one director. The annual labor cost for EIMS is, therefore, 10,800 LVL/year.

8.2 Environmental Education and Training (EE&T) Plan

8.2.1 Overall Frame of EE&T

The framework of the EE&T Plan is elaborated in Figure 8.2.1, which clarifies the players, tasks, and outputs of EE&T at the national, EMP, and regional/school levels.

(1) Framework

At the national level, MEPRD and MES are recommended to have a close relationship to coordinate each policy on environmental education and to avoid overlapping activities and politic difference in the national government. The main policies related to environmental education are NEPP and the national guideline on education, both of which state the importance of education for sustainable development and nature protection. The EE&T Plan is formulated based on the directives and principles stipulated in the national policies on environmental education.

As no intention to formulate an education plan can be seen at the regional level, it is advisable to integrate the EE&T Plan formulated by EMP for LWC into the national guideline on education and NEPP through MEPRD, a component of the Implementation Committee of EMP for LWC. Following the national guideline on environmental education, the regional education authorities and local schools can arrange their classes for environmental education. Integrating the EE&T Plan successfully clearly depends on the well-established coordination between the two ministries concerned. Nothing can be done and proceeded without their cooperation and coordination in the field of EE&T. DPU, which has a lot of experience in programs development of EE&T, could be a driving force to bring LWC into use as an environmental education resource.

(2) Implication of EMP with regional education

In Latvia, autonomy is generally given to the regional level. The EE&T Plan formulated by EMP is expectedly used by the local schools with full support of the Rezekne, Madona, and Balvi District Councils. All the district councils are proposed to be the members of the Implementation Committee, which makes the EE&T Plan implemental and feasible in the districts. Particularly, as the Latvian education system is faced with financial difficulties such as underpaid teachers and unsatisfactory educational facilities and materials, to make the plan applicable to each district, educational benefits should be maximized and expenses for education minimized by EMP. Then it can be integrated into regional school education with utmost support from the education sector of the districts. At the school level, each school should have an access to the Internet by the year 2010 which enables information distribution on LWC to the public. Each teacher can obtain information on the proposed EE&T activities and send the evaluation results of their programs to the Environmental Information Management System (EIMS). The database of EIMS is fully utilized by the local schools and NGOs.

(3) Principles and educational goals of EE&T

Taking into consideration the national policies, the principles and the educational goals of EE&T are set as follows:

1) Principles of EE&T

Wise use of LWC: The first-priority principle is concerned with the basic vision of the EMP "Wise use of LWC". Environmental education is not only for nature protection but also for ability development with help of natural resources. LWC has an educational value and should be optimized by the local people, with the help of the eco-tourism sector.

Step-by-step education: Each grade has its specific and limited ability to learn. Sensibility, developed at the early ages, is an ability to feel the nature as it is, while analytical ability is required more at older ages. Education should follow the process in which learners can develop their ability gradually through the use of natural resources in LWC.

Holistic and interdisciplinary education: An action to protect the nature should not be drastic or extreme. Children are required to have a holistic point of view taking into consideration natural, artificial, technological, social, aesthetic, political, economic, cultural, and scientific factors in dealing with environmental issues abundant in LWC. Interdisciplinary education is recommended.

Long-term vision formation: As a short-term vision often leads the people to think little of the value of natural resources, formulation of a long-term vision is crucial for sustainable development in LWC from generation to generation. One is requested to focus on the past, the present, and the future situations with a historical view of point.

Information technologies (IT) education: Information technology is getting cardinal for education. Skills of information processing and collecting make schoolchildren competitive enough to deal with the information society. An information system that is an integral part of EMP should be incorporated into the guideline on EE&T.

Analytical ability development: To foster problem-solving and analytical ability is essential to live through the society. Natural and artificial resources in LWC that stay on the balance sensitive to human activities play a big role in providing complicated issues to be solved.

Lifetime education: Lifetime education is necessary as situations change all the time when it comes to environmental issues. From childhood to adulthood one should have appropriate education according to his/her ability and educational level.

Empirical education: Instead of only accumulating knowledge, experiencing in the nature of LWC gives a chance to realize how closely the nature relates to a human life. Empirical and practical education leads to a fruitful result for children with a help of direct participation in environmental issues.

Environment and development: To learn a complicated issue of economic development harmonious with environmental protection in LWC gives learners a chance to balance their vision on human activities. Children full of future are expected to decide which way to go according to their balanced vision on environment and development.

Domestic and international cooperation: To solve and prevent environmental issues, regional, national, and international cooperation is essential. The deeper the understanding on the nature, the wider the scope of vision.

2) Educational goals of EE&T

The objective of environmental education is not limited to environmental protection. The main pillar of education is learning with the help of natural resources. Educational goals include promotion of sensibility, knowledge, conscience, clarification ability, creativity, analytical ability, persuasion skills, evaluation ability, self-control, responsibility, evaluation skills, teaching skills, voluntary participation, and leadership. The details of respective abilities and their proper stage of learning are presented in Table 8.2.1.

Education with environmental resources and themes helps human beings develop their own abilities with which they can live through in the real society. One is required to attain every goal through lifetime education according to his/her ability. Sustainability of human activities is accomplished only through human development meant to be creation of highly inspired and well-balanced human resources in the society.

8.2.2 EE&T Working Plan

(1) LWC Nature School

Room for a Nature School in the Environmental Management Center (EMC) is proposed to provide environmental education for schoolchildren, local people, and tourists. The objectives of the nature school are: 1) for grade 1 to 3 to learn biodiversity, 2) for grade 4 to 6 to perceive the relationship between fauna and flora, and 3) for grade 7 to 12 to understand the causality between human impacts and the nature and to behave themselves wisely. For the local people and tourists, the activities for promotion of public awareness are arranged.

In the Latvian system, every grade has to have a one-week field visit organized by each school, and the regional education authority mentioned the possibility of using this field visit activity for environmental education in the nature school. Aiming at education of sustainable development, the nature school should develop education programs based on the natural and artificial resources in LWC. The nature school is equipped with a couple of computers to deal with EIMS that visually and briefly shows visitors how LWC looks like, and a telescope to watch the twinkling stars at night. The nature school plays an important role as a lifetime education and self-learning place.

(2) Educational resources in LWC and eco-tourism development

Table 8.2.2 shows how unique and important LWC is. Compared with the two other nature reserves of Latvia, LWC embraces both natural and artificial resources for educational purposes. The purpose of EE&T "learning of sustainable development" can be easily achieved in LWC which is abundant in educational resources. One of the purposes of the EE&T Plan formulation is to clarify the educational resources in LWC that correlate to eco-tourism development. In Figure 9.2.2, the bird-watching routes surrounding Lake Lubana and the fishponds, and the canoeing route along the Aiviekste river are proposed. The southwestern part of the Tirumnieku bog can be seen by schoolchildren and visitors if special attention is provided with proper conservation measures. These ecologically valued natural resources can be shared by the eco-tourism sector, while artificial ditches and dykes become the educational targets to explain human impacts. The archeological sites scattered in and around LWC have a potential as an educational resource, particularly for history. The camping sites are used for nature observation places for visitors. Star watching helps visitors understand that human beings live in the context of the nature and the universe.

(3) Subject planning for environmental education

The Standards and Programs of Basic and Secondary Schools (the Standards) designated by MES states the main tasks and goals of basic and secondary education and specifies the numerical requirements of each subject. Each teacher decides how many classes for each subject are taken within the standard requirements and formulates detailed programs based on the Standards. The Standards clearly mentions that environmental education should be integrated into every program. The subjects particularly related to environmental education in basic schools are: nature studies (1 lesson/week for grade 1 to 4), biology/zoology/anatomy (2 l/w for grade 6 to 9), health education (1 l/w for grade 5), history (2 l/w for grade 5 to 9), art (1 to 2 l/w for grade 1 to 9), and ethics (1 l/w for grade 7). Geography, basic economics, civil science, chemistry, computer, and handicraft might supplement the contents of environmental education. For secondary education, nature studies (8 l/w), biology (6 l/w), health education (2 l/w), and ethics (2 l/w) are the elective subjects highly related to environmental education, while compulsory basic economics, computer, and chemistry might enhance environmental education. Sophistication of the Latvian education system is detected from the fact that nature studies is incorporated into basic education as a compulsory subject and into secondary education as an elective subject.

The environmental themes to be discussed should be specified for promotion of awareness. About ten themes are considered: (1) environmental & development, (2) correlation and coexistence with the nature, (3) biotope and habitat, (4) water balance, (5) conservation (nature protection), (6) carrying capacity, (7) renewable natural resources, (8) environmental education, (9) water quality and pollution control, (10) information dissemination. These themes are to be incorporated into the proposed activities.

The subject plan matrix is presented in Table 8.2.3. It illustrates each activity's attainability of the educational goals and the environmental themes to be discussed, and shows which subject is related to a specific activity and which grade is appropriate for it. EMP presents the proposed activities for environmental education as a part of the EE&T Plan. The local teachers, schools and NGOs can easily arrange their educational programs based on the subject plan clarified by EMP. They can select a specific activity by choosing an educational goal or an environmental theme which learners are required to achieve based on the subject plan for environmental education. The priority principle "Environmental education is not only for nature protection but also for ability development with the help of natural resources" should be strictly cohered and consistent.

(4) Proposed activities

The list of proposed activities is presented in Table 8.2.4. Each activity is given its objectives to achieve the set principles and goals, and general/overall methodologies and natural/artificial resources necessary for each activity are described. To recognize and explain a problem, to collect and analyze information, to evaluate a situation, and to develop and implement a solution are the core part of the EE&T activities proposed. Each activity should be thought out according to the educational goals to be achieved for each grade. Teachers are to select the most appropriate activities for children's ability development. The local governments and NGOs choose an activity satisfying the environmental theme to be discussed. All the recommended activities deriving from LWC are listed up along with the subjects incorporated in Table 8.2.3.

From kindergarten to grade 3, the activities focusing on experience in the nature and wildlife promisingly develop sensibility. The five senses of feeling, seeing, hearing, smelling, and tasting to observe the nature get maturated at these ages. It takes at least two years to reach the level at which classification and comprehension of spatial relations are possible. Another main goal for these ages is to realize conscience to embrace natural wonders. From grade 3 to 6, understanding information gets developed gradually. A recognition level deepens as knowledge accumulates. From grade 7 to 9, the ability to plan and implement gets widened. The ability to analyze, to apply, and to integrate starts to be intensified based on the sensibility and knowledge developed at younger ages. For step-by-step ability development, EE&T activities should be well taken shape.

(5) Program development and evaluation/feedback system for EE&T

Figure 8.2.2 describes the process of program development and evaluation/feedback system for EE&T with connection to EIMS. Teachers, local schools, and NGOs who decide to achieve the educational goals through EE&T or to discuss the environmental themes related to LWC pick up a set of activities proposed by EMP in accordance with the subject plan. The activities selected are materialized into programs with the more precise objectives, contents, and materials to be covered. A teaching strategy is prepared in an attempt to include the desired principles and educational goals. A teacher, if possible as a

group of teachers, or an NGO implements the programs developed by them. The organizers of the programs should take care of the responses from schoolchildren or trainees.

An evaluation and feedback system is fully connected to EIMS. EIMS should be integrated to improve the effectiveness and efficiency of EE&T for the local schools and NGOs. A simple questionnaire on a WWW page tells how the public changes by environmental education and what they can recommend for more creative environmental education. A direct participation makes the public well motivated and informed, and they feel close to ad hoc environmental issues. Policy makers are able to reflect the results from the evaluation/feedback system on their decision-making. If model schools or classes of environmental education are introduced on the WWW page, a motivation of making efforts is satisfied by being famous for the committed field. Though unique activities are to be shared by as many schools as possible, information kept in private and out of order is difficult to approach. The database formation by EIMS makes the information on EE&T available to the public through the open-to-the-society database of unique activities for environmental education.

(6) Training program for local people, teachers and NGOs

CNREE at DPU provides courses and programs of environmental management for local people, teachers and NGOs in cooperation with MEPRD. The Ecological Laboratory of DPU also has been engaged in a series of research to clarify the natural resources of LWC. The fact that DPU is an adviser of the proposed Implementation Committee of EMP makes it feasible to have environmental education training programs for local people, teachers and NGOs through DPU. CNREE obtains its financial resources from Latvian Environmental Protection Fund, Soros Foundation, UNDP, NGO Center, several private companies, and so forth. Technical support from DPU is essential to implement EE&T programs.

The Center for Environmental Science and Management (CESAMS) of the University of Riga aims at academic and professional training of environmental policy, planning and management skills. CESAMS has several courses on environmental management including environmental impact assessment, problem solving, decision making, and public awareness raising for the officials of MEPRD, local authorities. CESAMS has developed the interdisciplinary database containing the inventory of specialists, scientific institutions and universities that deal with environmental management and education, the education database including the information on the training programs and lecture courses on environmental science and management at the Latvian universities.

The University of Latvia Ecological Center (ULEC) is an independent and registered NGO working for training and curricula design in EE&T for environmental NGOs and schoolteachers. PHARE has supported two projects focusing on public participation in decision-making on environmental issues and public access to environmental information.

More than one-third (39%) of about 60 environmental NGOs active in Latvia dedicate themselves to environmental education. It is advisable that a part of the state budget for environmental protection and environmental education is directed towards NGO or schoolteachers training by specialized NGOs. CNREE, CESAMS, ULEC, Children' Environmental School of WWF, and other experienced NGOs have a potential to expand their capacity and train the other NGOs if they have enough financial background from the state government, the international aid organizations, and private supporters. The expansion of the existing programs of the specialized NGOs is the main strategy of the training programs for local people and teachers. Some incentives such as financial support should be given to NGOs to promote EE&T in LWC.

Table 8.1.1 Decision Items and Necessary Data Matrix

Management Type	Decision Items	Environmental zones			Current biotope map															Nature protection territories			Current land use map						Current land tenure map					Education and eco-tourism resources map						Inundation map			Soil map			Topographical map			Current eco-tourism plan						Water quality								
		NPZ	AMZ	DZ	raised/transitional bogs	fens	inundated grasslands	broad-leaved forests	coniferous forests	small-leaved deciduous forests	other forests	habitat of important mammals	habitat of game mammals	habitat of important birds	habitat of fish	adverse human impacts	strictly protected quarters	regularly protected quarters	seasonally protected quarters	forestry development area	potential development area for forestry	fishery development area	agricultural development area	abandoned arable land	state forests	state land	township land	private land	public land under privatization	eco-tour routes	beautiful landscape sites	bird-watching sites	archeological sites	camping sites	10% probability	20% probability	50% probability	land productivity	sandy soil	pesticides use	drainage conditions	rivers and lakes	contour lines	facility allocation	access roads	underground pipes and cables	electrical network	night-soil and waste collection network	water temperature	DO	turbidity	chlorophyll a	COD	NH4	coliform bacteria	T-N, T-P	
(1) Conservation Management	important mammal species protection											X					X													X																									
	game mammal species protection												X				X	X													X																									
	important bird species protection													X			X	X	X												X		X																							
	fish species protection														X																																							
	raised bog preservation				X												X	X																																					
	inundated grassland conservation						X										X	X					X																															
	broad-leaved forest preservation							X									X	X		X	X																																	
	other forest preservation and restoration								X	X							X	X		X	X																																	
	environmental zoning				X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																										
(2) Water Level Management	for nature conservation				X	X	X					X	X	X	X																				X	X	X																	
	for eco-tourism																													X	X	X	X	X	X	X	X						X	X	X	X	X								
	for agriculture																						X												X	X	X																	
	for forestry																			X	X														X	X	X																	
	for fishery																					X															X																	
(3) Education Plan	education routes				X	X	X	X								X	X	X	X									X		X	X	X		X								X											
	archeological routes																											X		X			X									X											
(4) Regional Development	agricultural development			X																			X	X				X									X		X	X		X		X										
	forestry development			X				X									X	X		X	X				X												X			X		X		X										
	fishery development		X	X																		X																													X	X				
	eco-tourism development		X	X													X	X	X											X	X	X	X	X								X	X	X	X	X					X			
	Construction material excavation		X	X												X	X	X	X																								X										
(5) Water Quality Management	DO control																					X																											X				
	hygienic conditions																																						X											X	X	X		
	eutrophication control																																																				X
(6) Eco-tourism Plan	facilities plan																X	X	X					X	X	X	X	X	X	X	X	X	X								X	X	X	X	X								
	sanitation management																																										X	X			X								
	land acquisition	X															X	X	X							X	X	X							X	X	X					X	X	X	X	X								
Data format	polygon data	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X						X	X	X	X	X	X		X	X											
	line data																												X											X	X		X	X	X	X								
	point data															X					X	X	X	X							X	X	X	X								X		X	X	X	X		X	X	X	X	X	X
	raster data																																																	X		X	X		
	others																																																				

Note: Data necessary to make a management decision is marked with "X".

Table 8.1.2 Monitoring in LWC

Monitoring Component	Monitoring Item	Detailed Item	Unit	Monitoring Location														Frequency						Data Collection Collaborating Organizations															Note
				catchment area	all LWC	raised/transitional bogs	fens	inundated grasslands	coniferous forests	deciduous forests	broad-leaved forests	dry grasslands	lake	fishponds	Reezkne, Malta, Aiviekste rivers	Pededze river, Idena canal	daily	weekly	monthly	seasonal	yearly	randomly	Town/ Townships	Nagli fish firm	Relevant Districts	Madona Regional Environmental Board	Rezekne Regional Environmental Board	State Hydro-meteorological Agency	Aiviekste Land Reclamation System Administration	Latvian Fund for Nature	Latvian Ornithological Society	Institute of Limnology, DPU	Center for Nature Research & Environmental Education at DPU	Teici Nature Reserve	
(1) Physical features	geology/ air	soil types	-		X																	X															for agriculture, forestry
		altitude	m		X																	X															for water level simulation
		groundwater level	m			X	X										X																				for flood control
		air temperature	℃	X													X																				for snowmelt model
	water quality	water temperature	℃										X	X	X	X	X							X		X	X	X										mainly for fishery, remote-sensing data is available
		pH	-										X	X	X	X			X							X	X	X										
		DO	mg/l										X	X	X	X		X	X					X		X	X	X										mainly for fishery
		turbidity	NTUs										X		X				X									X										indicator for eco-tourism, remote-sensing data
		EC	μ S/cm										X		X				X									X										
		Hardness	CaCO3mg/l										X		X				X									X										
		SS	mg/l										X	X	X	X			X							X	X	X										
		CODcr	mg/l										X	X					X							X	X	X										indicator of lake saprobity
		BOD_7	mg/l												X	X			X							X	X	X										indicator of river saprobity
		N/NH_4	mg/l										X	X	X				X							X	X	X										
		N/NO_2	mg/l										X	X	X	X			X							X	X	X										
		N/NO_3	mg/l										X	X	X	X			X							X	X	X										EU Directive puts emphasis on nitrate
		total N	mg/l										X	X	X	X			X							X	X	X										indicator of eutrophication
		P/PO_4	mg/l										X	X	X	X			X							X	X	X										indicator of eutrophication
		total P	mg/l										X	X	X	X			X							X	X	X										indicator of eutrophication
		pesticide	ng/l										X						X									X										
		oil	mg/l										X						X									X										
		coliform bacteria	MPN/100ml										X	X	X	X			X									X										indicator for eco-tourism
		minerals	mg/l										X						X									X										
		SO_4	mg/l										X						X									X										
(2) Hydrological values	hydrology	flow rate	m3/s												X	X	X											X										for water level simulation
		water level (in Lake Lubana)	m										X				X												X									for water level simulation
		groundwater level	m		X												X												X									for inundation control
		precipitation (rainfall, snow/fall)	mm/day	X													X											X										for water level simulation
(3) Ecological features and Noteworthy Fauna & Flora	botany	raised/transitional bogs	-			X																X							X		X						prevent succession by deccicasion
		fens	-				X															X							X		X						maintain present space
		inundated grasslands	-					X														X							X		X						maintain regularly inundated grasslands
		broad-leaved forests	-								X											X							X		X						preserve limited space
		other types of forests	-						X		X											X							X		X						maintain non-commercial forests
	zoology	important mammal species	-				X	X	X	X	X		X	X	X	X						X							X		X		X				maintain present population
		game mammal species	-			X	X	X	X	X	X	X			X	X						X							X		X		X				prohibit hunting in NPZ
		other mammals	-		X																	X							X		X		X				promote inventory work
	ornithology	raptors	-										X	X						X									X	X		X				increase population
		waterfowls, waders, gulls	-		X																	X							X	X		X				prohibit hunting activities in NPZ
		other important birds	-		X																	X							X	X		X				maintain present population
	ichthyology	typical fish species	-																			X		X													increase population in AMZ
(4) Educational & eco-tourism resources	education & eco-tourism	archeological sites	-		X																	X											X				preserve present sites
		allowable high bogs	-			X																X											X				Sala bog adjacent to Kvapani fishpond
		beautiful landscapes	-			X	X	X						X								X											X				Gomelis marshy grassland, fishponds
		bird-watching sites	-										X	X								X											X				especially fishponds
		schools active in environmental education	-																			X											X				through EIMS
(5) Current land use & Socio-economic features	general	population	persons		X																X		X														
		average annual income	LVL/year		X																X		X														
		unemployment rate	%		X																X		X														
		land tenure	ha		X																	X	X														
		persons with secondary education	-		X																X		X														
	forestry	annual yield	t/year		X																X		X														for forestry development
		forestry area	ha		X																X		X														for land use planning
		retail prices of forestry products	LVL/kg		X														X				X														for forestry development
		forestry productivity	m3/ha/year		X																X		X														for land use planning
	fishery	annual fish catch	t/year		X																X		X														monitoring pike development potential
		aquaculture area	ha		X																X		X														for land use planning
		retail prices of fish products	LVL/kg		X															X			X														for fishery development
		fishery productivity	kg/ha/year		X																X		X														for land use planning
	agriculture	annual yield	t/year		X																X		X														for agricultural development
		agricultural area	ha		X																X		X														for land use planning
		retail prices of agricultural products	LVL/kg		X															X			X														for agricultural development
		agricultural productivity	t/ha/year		X																X		X														for land use planning
	eco-tourism	number of tourists	persons		X														X																		for eco-tourism development
		popular sites	-		X														X																		for eco-tourism development
		popular eco-tourism menu	-		X														X																		for eco-tourism development
(6) Monitoring needs & Human resources	needs in general	monitoring needs in the society	-																			X	X		X	X	X										to optimize human/financial resources
		administrators interested in LWC	-																			X	X		X	X	X										administrators' names, positions, organizations, motivations
		NGOs interested in LWC	-																			X																hearing from NGOs
	needs in science	scientists interested in LWC	-																			X								X	X	X	X	X			scientists' names, positions, organizations, motivations
		list of bibliographies	-																			X								X	X	X	X				authors, year, page, contents

Note: Relevant item is marked with "X".

Table 8.1.3 Hardware and Software for EIMS

Item		Specifications	Unit Price (LVL)	Quantity	Total (LVL)
Hardware	PC for Server	CPU : Pentium III Xeon 700MHz, Dual Processor	23,000	1	23,000
		RAM : 512MB			
		HDD : 4x18GB (Hot swap)			
		CD-ROM : 14/32x Speed SCSI			
		CD-RW : HP CD-Writer Plus 9210i SCSI Retail			
		FDD : 3.5"1.44MB			
		IBM Netfinity Server RAID 3HB Ultra 2 SCSI Adapter			
		IBM Netfinity 42URack-includes front/rear doors			
		Network : 10/100 EtherLink PCI Server Adapter by 3Com			
		Monitor : T55 15" Flat Panel Color Monitor (Stealth Grey)			
		Netfinity Flat Panel Monitor Rack Mount Kit			
		Keyboard : Black Track Point Spacesaver keyboard - English			
		Netfinity Power Cable (required for server, monitor, console switch, devices)			
		UPS 3000 VA RACK MOUNTED - Black			
		42U Rack Lockable Side Covers			
		4 Port Videa Switch - required to switch one or more servers			
		Console Cable Set (one per server)			
		Mouse : Logitec System Mouse 2button			
	PC for Client (sutable for system engineers)	CPU : Pentium III Xeon 550MHz or more	7,000	3	21,000
		RAM : 512MB			
		VIDEO: 80Mb			
		HDD : 2 x 9.1 GB			
		CD-ROM : 50xSpeed SCSI			
		CD-RW : SCSI			
		FDD : 3.5"1.44MB			
		Slot : 1PCI, 1ISA, 1shared			
		Network : Integrated 3 Com 10/100 Mbit			
		Monitor : 21"			
		Keyboard : IBM 105-keyboard			
		Mouse : Microsoft			
	PC for other staff	CPU: Pentium III 500MHz or more	800	4	3,200
		RAM : 64MB			
		VIDEO: ATA 66 8Mb			
		CD - ROM: 40x			
		FDD : 3.5"1.44MB			
		Network : Integrated 3 Com 10/100 Mbit			
		Monitor :17"			
		Keyboard : IBM 105-keyboard			
	Network Equipment	15 port Micro HUB/ dural serial router	1,800	1	1,800
		Jack RJ-45			
		Cable RJ-45 UTP 5 Category			
		Installation of the network and cabling			
	Scanner	Input size : up to A3	900	1	900
		Quality : optical 600-2400, 9600dpi-max			
	Plotter	Quality : 600dpi-black, 300dpi-colour (line drawings)	2,000	1	2,000
		Aoutput size: up A0			
		4MB			
	Digitizer	Input size : 914mm x 1219mm	2,000	1	2,000
	Copy Machine	Size : up to A3	3,000	1	3,000
		Speed : 16ppm(A4), 9ppm(A3)			
		Including printer, scaner			
		Zoom : 50-200%			
	Uninterruptible Power Supply	APC 500	70	7	490
Software	GIS software	ESRI ArcView GIS 3.2	1,500	1	1,500
		3D Analyst	2,000	1	2,000
		Spatial Analyst	2,500	1	2,500
	Remote Sensing	ERDAS Imagine	5,400	1	5,400
	Other software	Windows Advanced Svr 2000 Intl CD 25 Clt	3,000	1	3,000
		MS Ofiice Pro.	300	7	2,100
Grand Total					**73,890**

Table 8.2.1 Educational Goals

Step	Educational Goals	Descriptions and Hints	Grade at which the goal attained												Relevant Educational Resources in LWC (marked "X")														
			1	2	3	4	5	6	7	8	9	10	11	12	raised bogs and buffer areas	inundation	commercial forests	protected forests	idle arable lands	Lake Lubana	fishponds	bird-watching sites	feeding places for migrating birds	storks' nesting places	dykes	drainage systems	quarry	sluice control	conservation measures
1	**Sensibility development**	- to develop the five senses of seeing, hearing, smelling, tasting, and touching are developed - to embrace and feel the nature profoundly	■	■	■										X		X	X				X	X	X					
2	**Conscience nourishment**	- to change human attitudes towards environmental friendly - to nurture common sense ruling human attitude - to intuitively judge good or evil based on ethics	■	■	■	■	■	■	■	■	■	■	■	■			X	X							X	X			
3	**Knowledge enlargement**	- to enlarge knowledge through experience - to enlarge views to protect and wisely use natural resources - to hold visions to embrace the future generations			■	■	■	■	■	■	■	■	■	■	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	**Clarification ability**	-to distinguish facts from presumptions - to avoid any prejudices and stereotype ideas - to attain sufficient communication skills				■	■	■	■	■	■	■			X	X	X	X	X				X	X	X	X	X	X	X
5	**Creativity development**	- to advance curiosity - to participate in as many exciting activities as possible - to combine many ideas and see the results				■	■	■	■	■	■	■	■	■			X	X								X			X
6	**Analytical ability promotion**	- to find relevant facts - to analyze relations between the facts - to think of the results of the matter in question							■	■	■	■	■	■			X	X							X	X		X	X
7	**Persuasion skills**	- to make people understand what you are talking about - to logically persuade - to visually explain							■	■	■	■	■	■			X	X							X	X		X	X
8	**Self control**	- to avoid adverse impacts on others and the nature - to understand that preventive measures spare natural resources							■	■	■	■	■	■			X	X								X	X	X	X
9	**Responsibility fulfillment**	- to become a leader for sustainable development - to take care of the results from what you do or did - to take action with precautious minds							■	■	■	■	■	■			X	X							X	X	X	X	X
10	**Evaluation ability advancement**	- to evaluate feasibility and applicability of ideas and solutions - to develop sensibility, knowledge, conscience, analytical and persuasion abilities obtained beforehand.										■	■	■	X	X	X	X	X				X	X	X	X	X	X	X
11	**Teaching skills promotion**	- to endure repetitive processes - to embrace others' mistakes - to realize what others' do not understand and why										■	■	■	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
12	**Voluntary participation encouragement**	- to act and participate in solving actual problems - to be based on never-dying conscience - to strengthen responsibility that leads to a prospectus solution										■	■	■			X	X								X			X
13	**Leadership attainment**	- to play a leading part in solving a problem - to encourage others' to act more - to persuade others of the benefits of sustainable development												■			X	X										X	X

Note: This table shows the educational step-by-step process which every child or person goes through. Though the order of the steps is generally followed from top to bottom, all the steps are related to each other and at all the educational steps one should have all the ability more or less.

Table 8.2.2 Educational Resources in LWC

Biotope type/ Human activity		Noteworthy points to observe	Observation places*		
			LWC	Teici Reserve Observation House	Krustkalnu Reserve Observation House
Natural Vegetation Types	Raised bogs	- long history for bog formation - succession by deccication - bog birds	A	A	C
	Inundated grasslands	- role of flooding for vegetation formation - succession by deccication - role of agriculture for maintenance of vegetation - natural flood control function	A	C	C
	Fens	- role as fish spawning place	A	C	C
	Coniferous forests	- peat swamp forest - inorganic soil forest - importance of old trees for wildlife - forest birds	A	A	A
	Small-leaved deciduous forests	- forest birds - habitat for beaver	A	A	A
	Broad-leaved deciduous forests	- only small parts in LWC	B	C	C
	Dry grasslands	- grassland birds	A	A	A
Natural Water Types	Rivers	- mammal foot prints along river shore. - fish ecology	A	B	B
	Lake	- comparison of habitat with fishponds (LWC only) - fish ecology (LWC only)	A	C	A
Human Activities	Aquaculture development	- carp aquaculture is the main activity of the fishponds around Lake Lubana - abundant in waterfowls	A	C	C
	Forestry development	- forestry is not restricted in some areas of LWC	A	C	C
	Agricultural land	- between the Idena fishponds agricultural land can be seen	A	A	C
	Dyke construction	- dyke construction has changed biological and hydrological patterns around Lake Lubana - Gomelis marshy grasslands hydrologically changed after the construction of the dyke in	A	C	C
	Canal/drainage system construction	- water is directed to the Aiviekste river through the Merani canal built in the 1970s - ecological change by deccication	A	C	C
Overall characteristics as field observation sites			- Varied biotope types - Abundant waterfowls - Economic development	- Mainly bog biotope	- Mainly forest biotope

Note: Shown above are biological diversity and artificial structures that can be easily observed within walking distances (about 2 km) from respective observation facilities.

*A means highly visible, B means slightly visible, and C means not visible

Table 8.2.3 Subject Plan Matrix

	Proposed Activity	Subjects to be taught												Target Groups						Educational Goals*1														Environmental Themes*2									
		nature studies	biology	health study	history	art	ethics	geography	basic economics	civil science	chemistry	computer	handicraft	grade 1-3	grade 4-6	grade 7-9	grade 10-12	NGO	local government	1	2	3	4	5	6	7	8	9	10	11	12	13	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
A	Footsteps of wildlife	X											X							X	X												X	X								
B	Drawing or taking a picture of the nature					X														X	X																		X		
C	Tree planting	X											X							X	X											X						X			
D	School biotopes	X	X					X				X										X	X	X									X	X							
E	Check quality of rivers and lakes	X		X							X											X	X		X							X							X		
F	What happened to them?	X	X				X														X	X	X		X								X			X	X				
G	Archeological field trip				X																	X	X										X								
H	Information for the nature	X										X										X		X													X			X	X
I	Let's contact experts on nature conservation through Internet	X										X										X		X						X							X			X	X
J	How do others' opinions effect yours on environmental management?	X					X			X													X		X	X	X									X					
K	Cause and consequence	X	X				X			X											X		X		X	X										X					
L	Eco-tourism development	X						X	X															X	X	X						X						X			X
M	Water levels								X			X											X		X	X	X					X			X						
N	Scoring of nature protection measures	X								X													X		X	X			X							X			X		
O	Land use planning for humans and wildlife																						X		X	X				X						X		X			
P	Environmental auditing																						X		X	X		X	X		X								X		
Q	Decision-making process																						X	X	X	X		X	X			X			X	X	X	X	X	X	X

Note: Relevant activity is marked with "X".

*1) the figures are corresponding to Table 9.3.1

*2) The figures are corresponding to Section 9.4.3

Table 8.2.4 List of Proposed Activities

	Proposed Activity	Preparation in Advance	Visit to Environmental Management Center	Field Trip to LWC	Educational Resources	Critical Questions to Children
A	**Footsteps of wildlife**	-list up animals -check names and pictures of animals	optional	recommended	-beaver dams -bird-watching sites -LWC nature museum in Varaklani	-What do animals eat? -Where do they live?
B	**Drawing of or taking a picture of the nature**	-mapping and scheduling of field trips	optional	recommended	-nests of storks -Kvapani and Orenisu fishponds	-What are the natural elements depicted in your drawings and pictures?
C	**Tree planting**	-contact with the local forestry authorities	optional	recommended	-commercial forests -broad-leaved forests -artificial ditches	-How do trees grow? -How water levels affect trees?
D	**School biotopes**	-get consltancy from science and biology teachers	optional	optional	-biotope maps made by EMP -nature around schools	-What are biotopes? -Where are habitats for wildlife?
E	**Check quality of rivers and lakes**	-contact with regional environmental boards	optional	optional	-portable water quality measures	-What affect water quality in rivers and lakes?
F	**What happened to them?**	-list up reference books and materials	optional	optional	-Red Data Book -research reports on LWC	-What are the endangered species? -Why are they endangered?
G	**Archeological field trip**	-contact with archeological specialists	optional	recommended	-archeological sites in LWC -archeological amusement park in Indrani	-Why the ancient Latvians chose LWC as a living place?
H	**Information for the nature**	-check homepages related to LWC	optional	optional	-Internet -video tapes taken by Environmental Film Studio	-How important is information for environmental management?
I	**Let's contact experts on nature conservation through Internet**	-checkhomepages related to nature protection in Latvia	optional	optional	-Internet	-What are the motivations of nature protection by scientists?
J	**How do others' opinions effect yours on environmental management?**	-list up possible opinions	optional	optional	-laws and regulations related to environmental protection	-Who will be affected by the laws and regulations?
K	**Cause and consequence**	-list up reference books and materials	recommended	recommended	-development histroy on LWC -scientific researches on LWC	-What are relations between development and nature?
L	**Eco-tourism development**	-make appointments with eco-tourism developers	recommended	recommended	-eco-tourism development maps	'-How can you develop eco-tourism in LWC?
M	**Water levels**	-reading regulations on water level management	recommended	recommended	-water level simulation models -water level regulations	-Who will be affected by high water levels or low?
N	**Scoring of nature protection measures**	-understanding of conservation measures	recommended	recommended	-conservation plan formulated by EMP	-Why are conservation measures necessary?
O	**Land use planning for humans and wildlife**	-collect basic information	optional	optional	-GIS data on land use	-How to use land for society?
P	**Environmental auditing**	-understand backgrounds of the related organizations	optional	optional	-Nagli fish firm -local eco-tourism enterprises -government offices -schools	-What the necessity of environmental auditing?
Q	**Decision-making process**	-understand hot issues in terms of decision-making	recommended	recommended	-reports on EMP -GIS data for EMP	-How can you persuade your decisions?

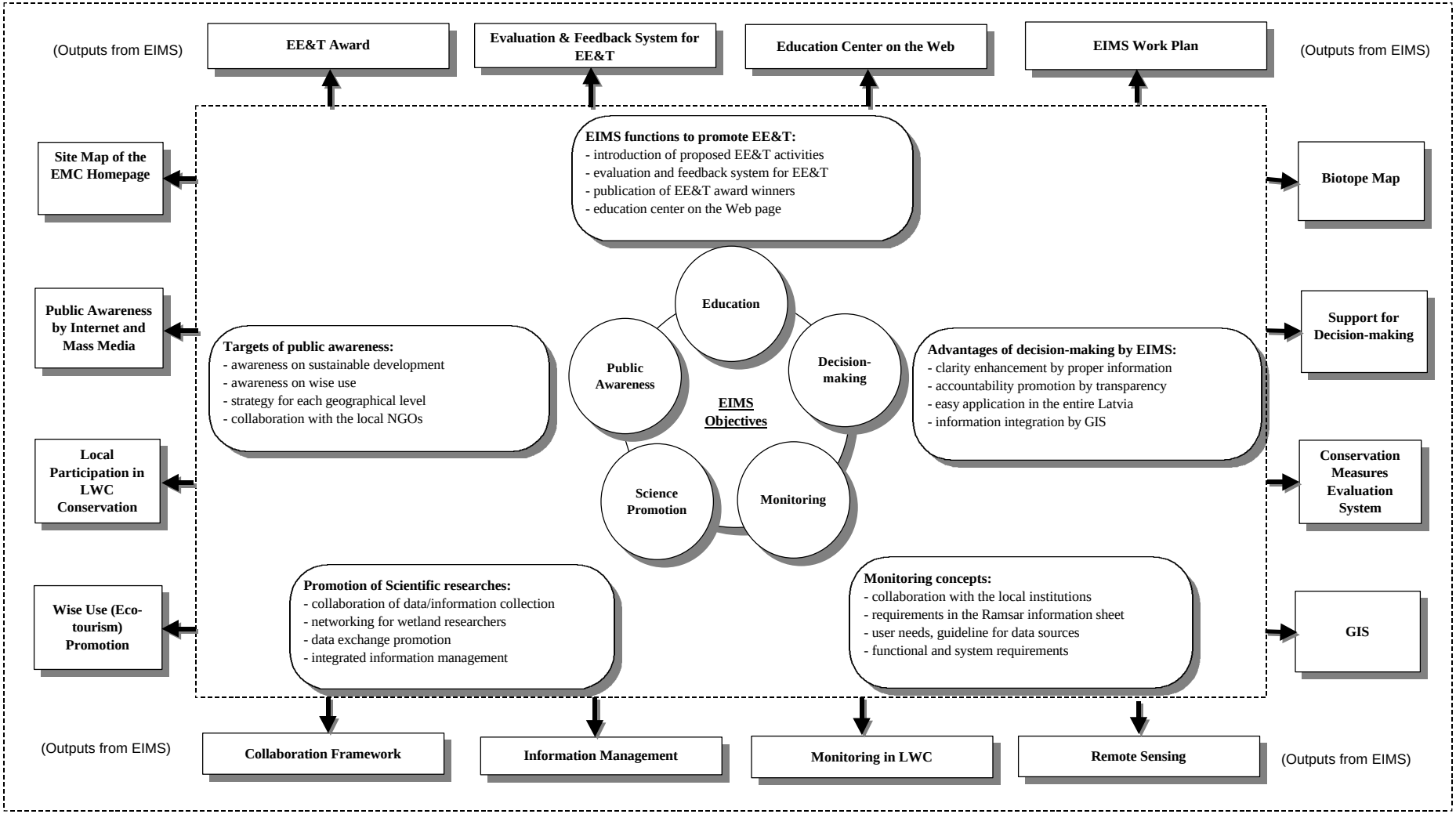

Figure 8.1.1 EIMS Framework

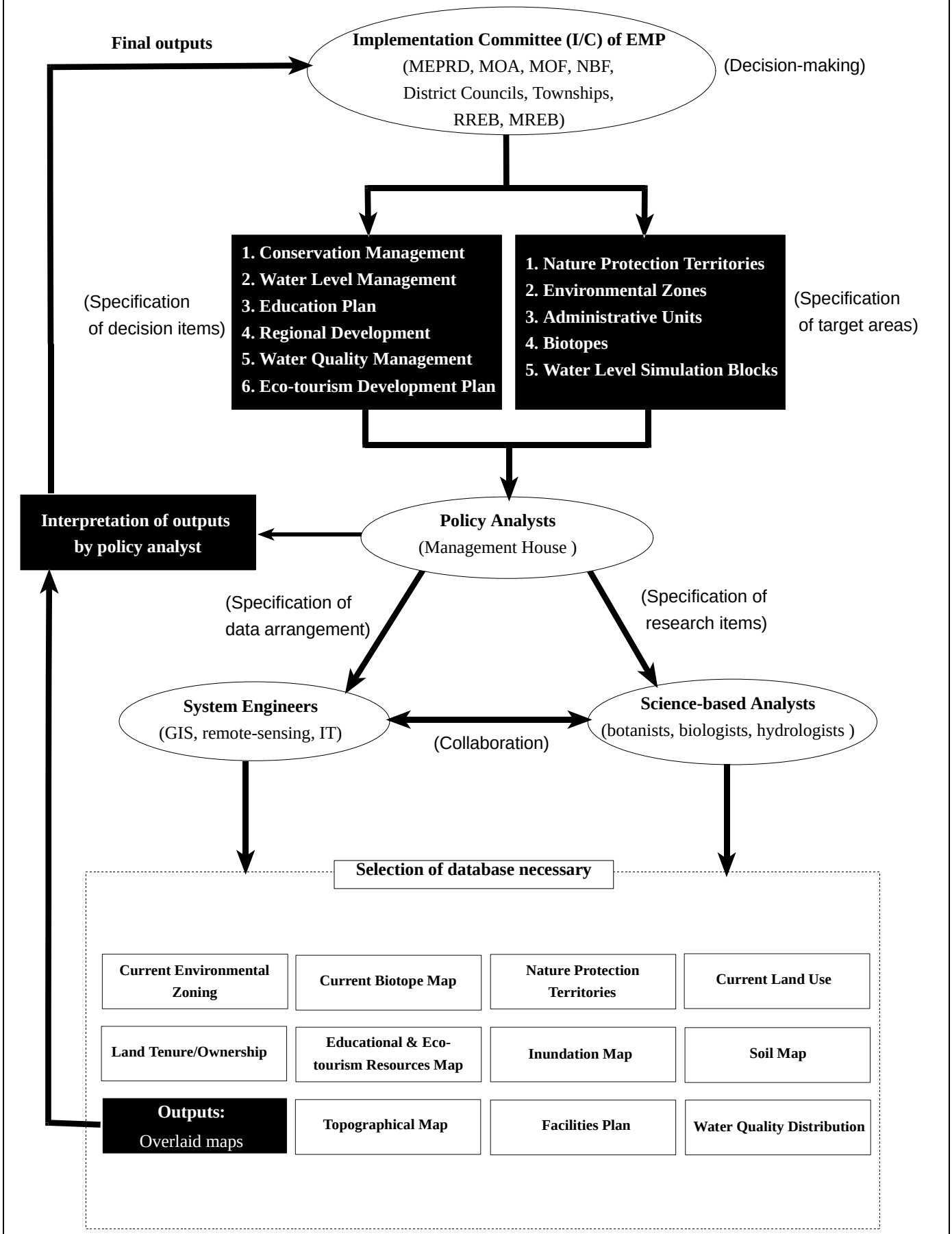

Figure 8.1.2 Decision-making Process with EIMS

The Study on Environmental Management Plan
for Lubana Wetland Complex in the Republic of Latvia

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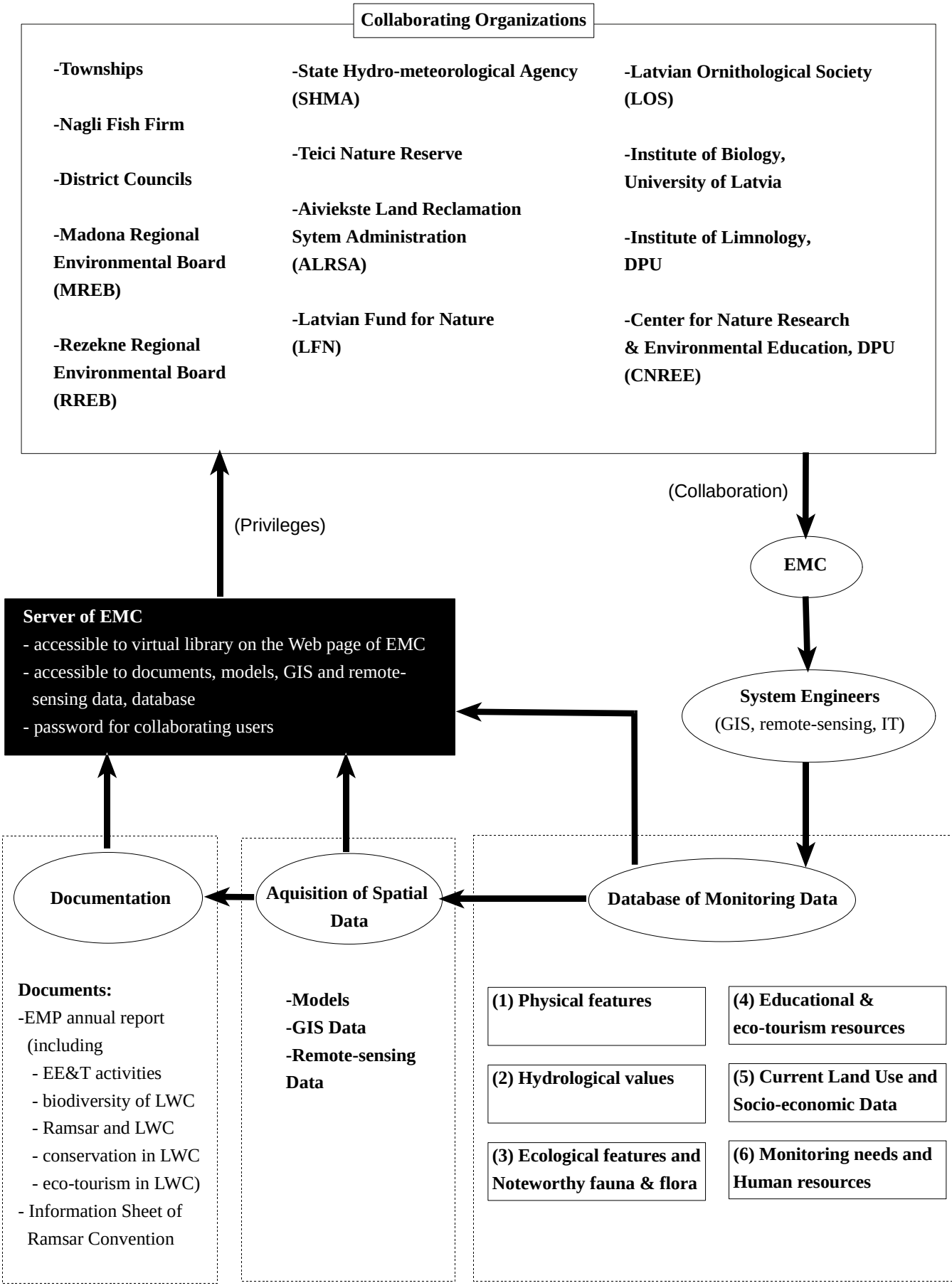

Figure 8.1.3 EIMS Collaboration Framework for Monitoring Data

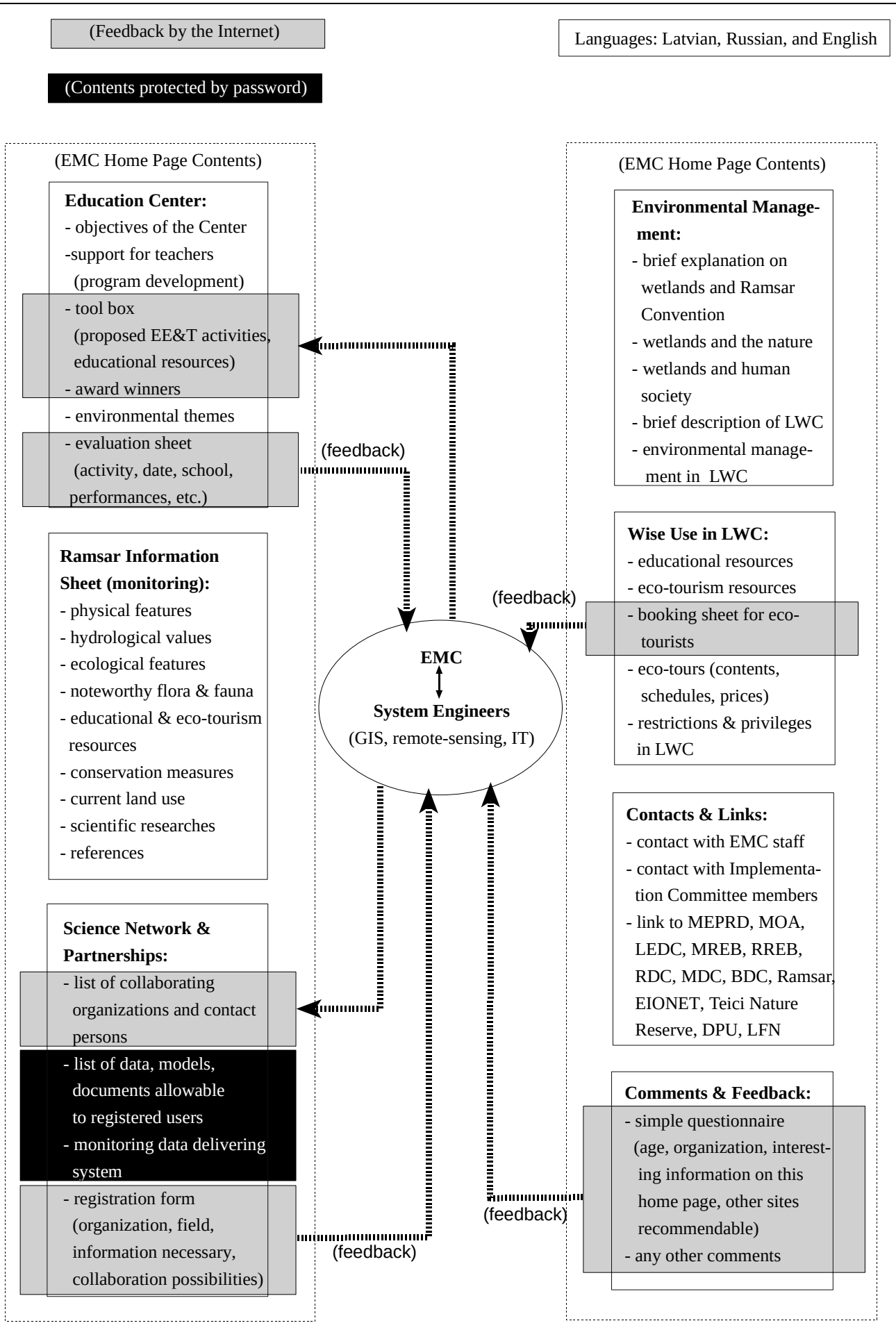

Figure 8.1.4 Site Map of EMC Home Page & Feedback System

The Study on Environmental Management Plan for Lubana Wetland Complex in the Republic of Latvia

JAPAN INTERNATIONAL COOPERATION AGENCY

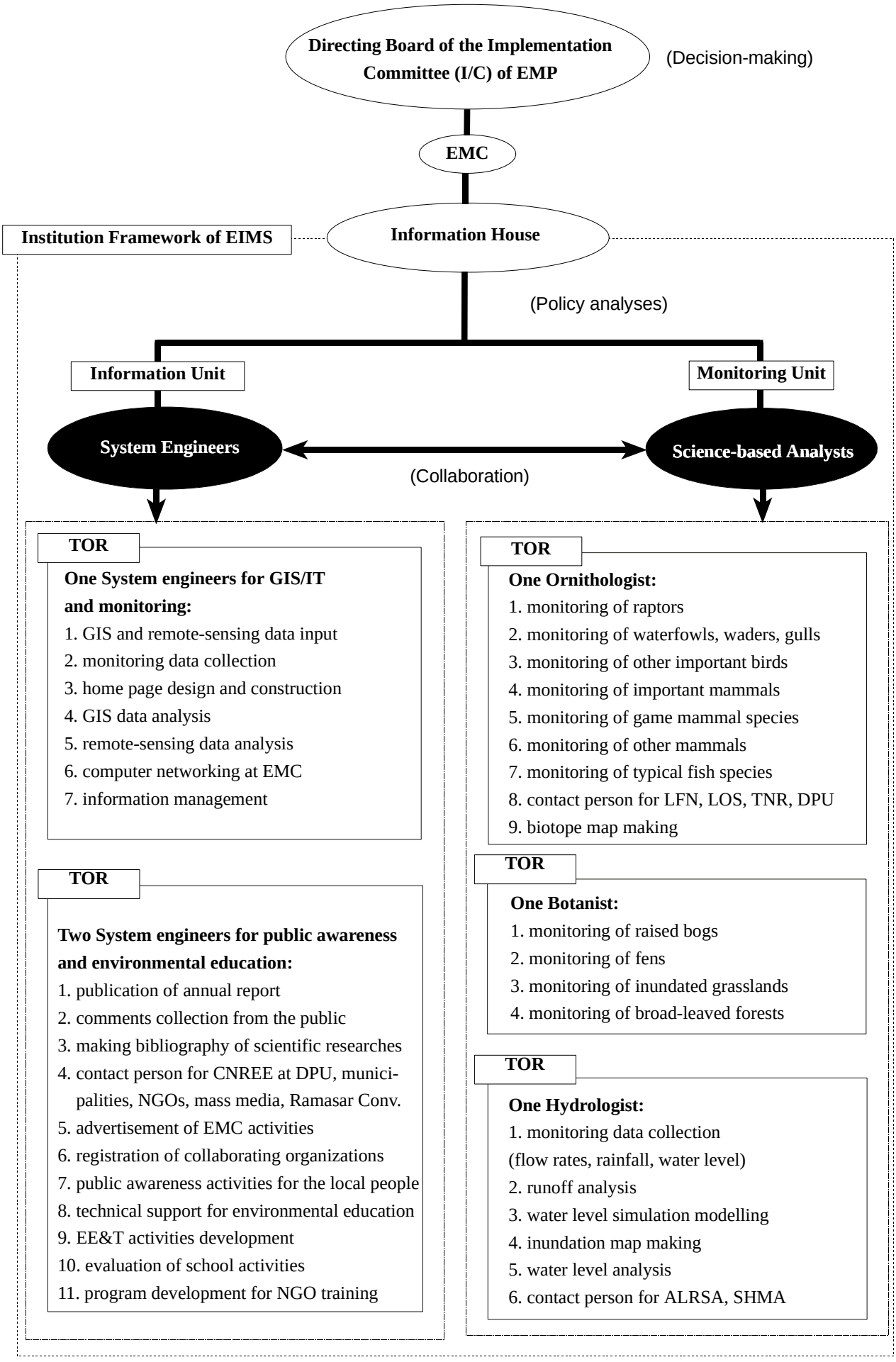

Figure 8.1.5 Institutional Setting for EIMS

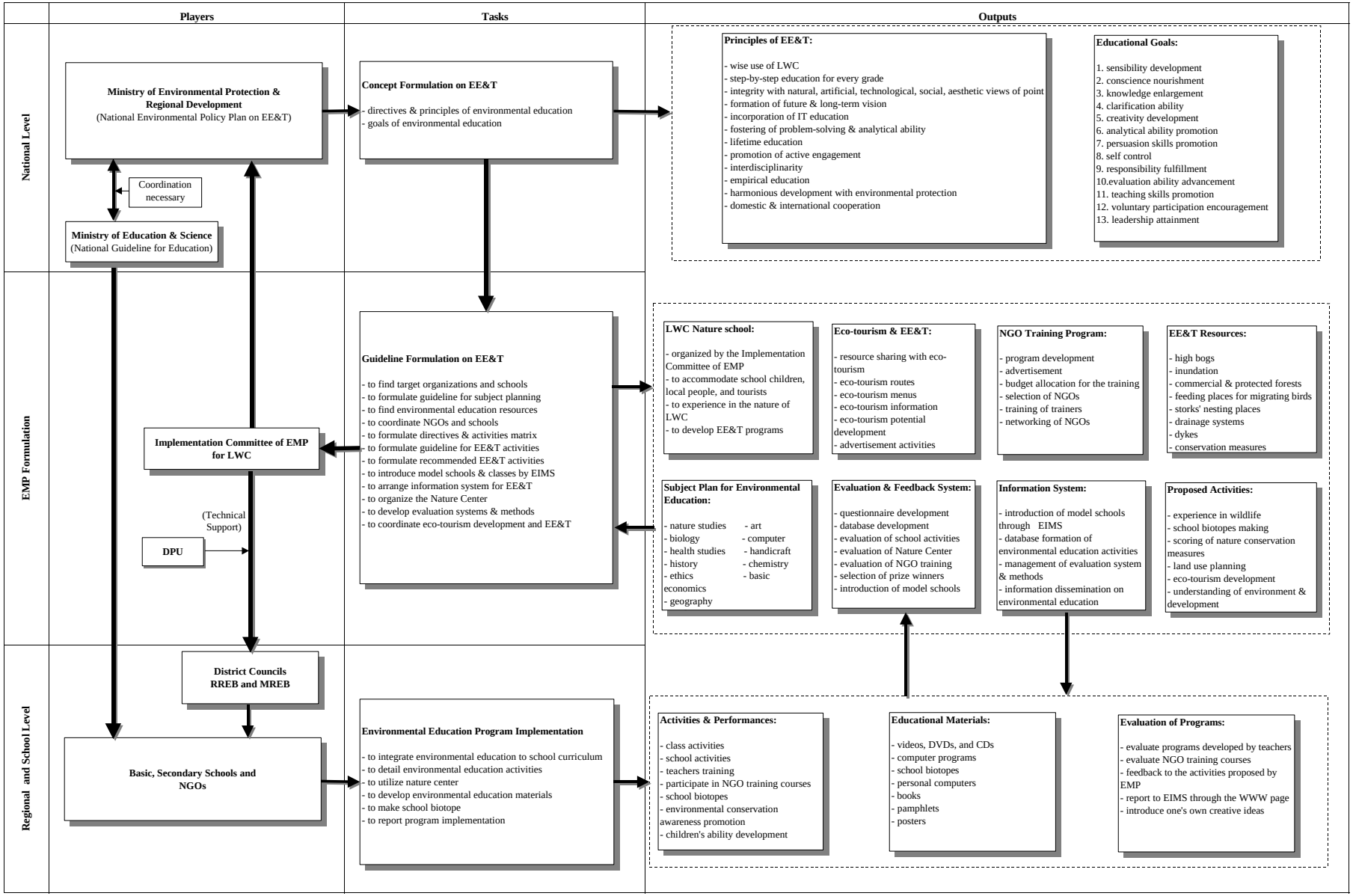

Figure 8.2.1 Framework of Environmental Education & Training (EE&T) Plan

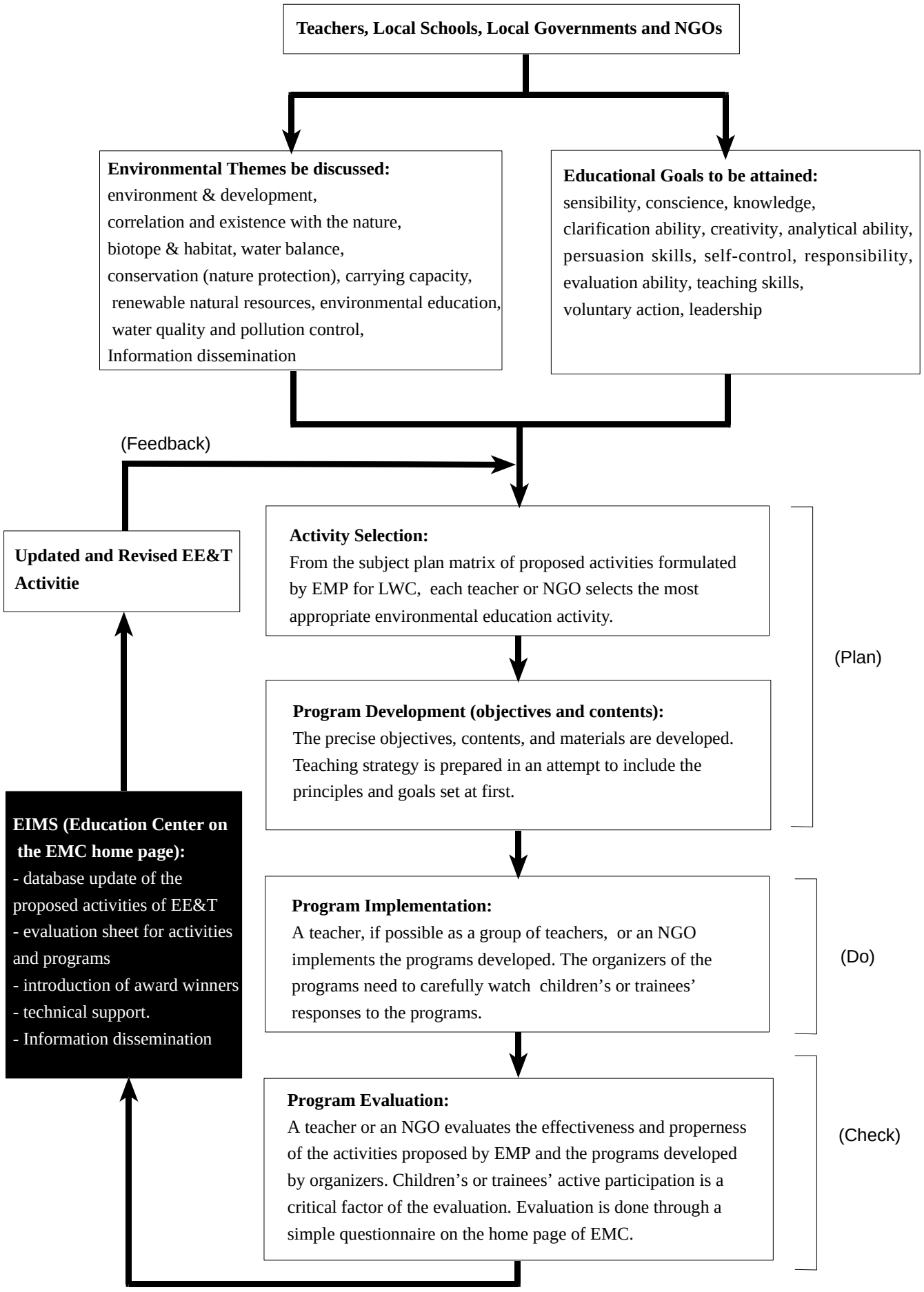

Figure 8.2.2 Process of Program Development and Evaluation & Information System