CHAPTER 9

CHAPTER 9 ECO-TOURISM DEVELOPMENT PLAN

9.1 Trend and Potential of Eco-tourism

9.1.1 Trend in Eco-tourism

Tourism is one of the leading industries in Latvia as well as Europe in terms of production and employment. The Strategy for Tourism Growth beyond 2000, which intends to develop the Latgale region including LWC as the second tourism cluster in Latvia following Riga, was proposed by the Latgale Regional Development Agency (LRDA) considering unique and outstanding natural environment and cultural assets. It also recommended that the **Lakeland** concept could be excellent as type of tourism reflecting what the region can offer, such as recreation, camping, fishing, and hunting. In this context, LRDA decided to promote a rural tourism through discussion of the regional development strategy in line with the Pilot Regional Development Plan for the Latgale Region financed by the EU Phare in 2000. LRDA is now under preparation of the Rural Tourism Development Target Program especially focusing on the eco-tourism in the region. Thus, the environmentally friendly products of eco-tourism are essential in the region, and LWC could be a model of wise use of its abundant resources.

While, the Latvia's Tourism Development Concept clearly mentions that natural and cultural/ historical heritage must be maintained and protected, and that the maintenance, protection and development biological diversity must be promoted. Some Baltic Sea countries have an evaluation system for sustainable development. The Finnish Tourism Board launched a project applying the eco-audit, in which tourism enterprises are to decrease negative environmental impacts caused by their operations. In Denmark, the concept "Green Tourist Destinations" is under consideration. To be granted the status of a green destination, an area must achieve sustainability. A trend is heading for more emphasis on environmental protection. The eco-tourism in LWC should take into consideration the establishment of green records which enable tourists and environmental management authorities to evaluate the performances of eco-tourism developers and operators. Sustainability is a key word for the evaluation.

9.1.2 Development Potential

(1) Natural and historical resources

LWC is rich in natural and historical resources. From 1974 to 1999, 224 bird species (among them 185 species are breeding), 23 mammal species, and 21 fish species are found in LWC. Among the bird species, Spotted Eagle, Corncrake, White-tailed Eagle, and Great Snipe are very rare. In addition, LWC is famous for duck hunting though its population has been decreasing since 1985. Hunting wild boar, roe deer, elk, red deer, wolf and lynx is popular in LWC. Beavers dams along the Idena canal and the Pededze river are quite an

ecological attraction for Europeans who have missed them in their home countries. Angling bream, pike, roach, and pikeperch is very popular in and around Lake Lubana.

As for rare vegetation, a part of the Teirumnieku, Berzpils, and Idena bogs is possible to use mainly for educational and scientific purposes. Particularly, as the Teirumnieku bog is located along the road connecting Idena and Nagli, the bog is ideal for eco-tourism. Broad-leaved forests along the Pededze river are potential for eco-tourism due to an easy access to them. Inundated grasslands are approachable near the Aiviekste sluice.

In the Neolithic period (B.C. 4500-1500), the most populated was LWC in Latvia. More than 20 settlements inhabited from the Mesolithic period (B.C. 7700-4500) until the Bronze period (B.C. 1500-500) have been found in LWC. Among all, the Zvidze settlement (Mesolithic) and the Abora settlement (Neolithic) are famous. Neolithic differs from Mesolithic in the life style which was transformed from collecting to producing. Clay dishes and stone tools started to be produced in Neolithic. Amber produce was also famous in LWC. The Abora settlement located in Indrani had 10 ancient houses. Historical resources can be promoted for educational purposes.

(2) Infrastructure and transportation

Access roads are essential for eco-tourism, and safety should be prioritized. Possible eco-tourism activities can be conducted in consideration of infrastructure including electricity, water supply, communications lines, wastewater and solid waste management. The Kvapani and Orenisi fishponds alike are ideal for bird-watching since the two have the abandoned facilities with electricity to be easily reconstructed for eco-tourism. Roads within LWC paved with gravel not asphalt are well prepared for eco-tourism. Alteration of habitats for wildlife should be minimized. Electricity lines are furnished where necessary for eco-tourism. Provision of drinking water is an issue for some proposed eco-tourism facilities. Pumped well construction is essential.

A possible access point from Riga is ideally Lubana town since transportation from Riga to Lubana town is provided by twice-a-day bus services. From Rezekne city, Nagli and Gaigalava are the candidates for the access point to LWC. Roads from Riga to the access points of LWC are well paved by asphalt. However, access roads close to LWC should be more paved in Rezekne district. As the rail service from Madona to Lubana town recently ceased, the Madona, Gulbene, and Rezekne stations are the closest to LWC. Railroad transportation seems rather unfavorable.

(3) Human resources

Though economic stagnation in LWC is obvious, dozens of people are really interested in eco-tourism development not as bystanders but as responsible identities. Gaigalava, Nagli, Indrani, and Lubana townships show their interest in eco-tourism development. The Teici Nature Reserve, Latvian Fund for Nature, and Institute of Biology at Latvian University can provide help in nature protection. The Institute of Limnology at Daugavpils Pedagogical University (DPU) can afford information technologies. The Madona Tourism

Information Center and the Latgale Tourism Association show their support in the tourism development in LWC. Some private landowners and companies have started building eco-tourism facilities in the Kvapani fishpond, along the Idena canal, and the Aiviekste river.

Clear statements by the municipalities in LWC on promotion of eco- and rural- tourism, and support systems such as the EU Special Action Program for Agriculture and Rural Development in Latvia (SAPARD) would exploit new entrepreneurs among the local people who will provide tourism products and accommodations. Although many youths move out to such bigger cities as Riga in LWC, the attractive sustainable development is essential to help the local youngsters remain proud of their locality.

(4) Marketing possibilities

Marketing possibilities depend on political, geographical, and social atmosphere. Politically, Latvia seeks EU membership, that means quality of eco-tourism is essential. Geographically, Latvia is advantageously located in the center of the Baltic Sea Region (from Denmark to St. Petersburg). Socially, tourism is not well developed in Latvia.

The number of foreign tourists in Latvia increased from 1.76 million in 1996 to 1.80 million in 1998, whilst that of Estonia grew overwhelmingly from 1.6 million in 1993 to 2.9 million in 1998. The Estonian advantage position is partly due to efforts of the tourism sector. Eco-tourism in Estonia is more developed than in Latvia. The Estonian Ecotourism Association collects and provides information on eco-tourism, promotes the idea of eco-tourism, develops due strategies for eco-tourism, participates in domestic and international networking, organizes training programs, and initiates nature conservation activities. One can check homepages related to the Estonian eco-tourism very easily.

According to the Central Statistical Bureau of Latvia, 128,000 Finnish, 86,000 Swedish, 71,000 Germans, 24,000 Americans, and 16,000 Danish visited Latvia in 1998. Average stays are 9.4 nights (Americans), 5.0 nights (Danish), 3.7 nights (Swedish), and 3.2 nights (German). If due efforts are made in Latvia, eco-tourism can be more developed. Foreign potential are Finland, Germany, Sweden, USA, and Denmark. Finnish do not stay long (0.8 night). Locally, anglers can be seen frequently in LWC all year round. The local hunters are active during the season. The local people enjoy swimming in mid summer. Making efforts to access to these potential markets is essential.

(5) Social background

Eco-tourism will never be successful without due cultural concerns. According to the questionnaire survey conducted by the JICA study team, 56% of the local people answered yes to tourism development in LWC. What's more, more than 85% responded positively to tourism development in Nagli and Lubana townships. And, about 65% of the local people expressed their will to cooperate with tourism development. The local original eco-tourism ideas are fully included in this eco-tourism development plan, so that the eco-tourism development plan will be acceptable for the local people.

According to the survey, the positive impacts derived from tourism development were job creation, upgraded infrastructure, nature protection for the local people (33%, 28%, and 37%, respectively). Traditionally, the local people understand the necessity of nature protection and feel the nature as a part of their lives. And, the negative impacts expected included problems caused by outsiders, nature destruction, landscape desolation, increase of car accidents (48%, 21%, 10%, and 8%, respectively). The local people are generally hospitable and tender. LWC is a quiet area with little disturbance from outside.

9.1.3 Possible Scale of Eco-tourism Development

Possible scale of eco-tourism in LWC is figured out by the estimation of the number of eco-tourists who will probably visit LWC. Since there is quite limited available information and data regarding the number of visitors to LWC, this estimation is only a rough idea.

The estimation of the future number of tourists to LWC is made on the bases of two assumptions. One is the current number of tourists to LWC, and the second is the annual increase rate of the tourists. According to the tourism statistics in Latvia tourists who stayed in hotels, guest houses and motels in 1998 are tabulated as in the next table.

Number of tourists stayed in hotels, guesthouses and motels (1998)

	No. of visitors		%		of which foreigners		%	
Total	394,389		100		219,258		100	
Riga City	253,749		64		180,549		87	
Rezekne District	8,697	15,412	2.2	3.9	1,883	2,340	0.85	1.0
Balvi District	1,696		0.4		167		0.08	
Gulbene District	2,676		0.7		223		0.1	
Madona District	2,343		0.6		67		0.03	

Source: Statistical bulletin, Tourism in Latvia

In 1998, the total number of foreign tourists in Latvia is 1,801 thousand, among which 220 thousand stayed at hotels, guesthouses and motels. And 2,340 (0.13%) tourists came to stay in the districts of the study area. There are other kinds of accommodations, e.g. sanatorium, besides hotels, guesthouses and motels in LWC area, but no foreign tourist stayed there according to the statistics. The number of foreign tourists in Latvia increased from 1,713 thousand in 1996 to 1,801 thousand in 1998, which is approximately 2.5% increase per year. In the whole world the number of international tourists increased from 457,647 thousand in 1990 to 612,835 thousand in 1997, which is approximately 4.3% increase per year according to the WTO's data. In Estonia the number of foreign tourists increased from 1.6 millions in 1993 to 2.9 millions in 1998, which is about 12.7% per year increase according to the data of the Estonian Tourist Board. In Lithuania it increased from 3.4 millions in 1996 to 4.3 millions in1998, which is about 11% per year increase according to the data of the Lithuanian State Department of Tourism.

Considering 2.5% increase p.a. in Latvia during the last 2 years, The future increase may not go up so high as 11% of Lithuania or 12.7% of Estonia in a short period of time, but it would be possible to go up not less than the world average, considering Latvia is rather

new in the world tourism market. So it is assumed here that the increase rate of foreign tourists in Latvia will be 4.5% to 10% per year for future projection. The number of eco-tourists visited LWC are recently said to be around 20 mainly from Sweden. It is not quite meaningful to estimate the future number of eco-tourists based on this figure. Since this figure is rather accidental, and 20 persons is too small to be a base figure of the future projection. There is no exact statistics about the rate of eco-tourists among general tourists. However, the rate of eco-tourists among general tourists is said to be somewhere between 3% to 7% in the U.S.A. Applying this rate for the assumption of number of eco-tourists, within 2,340 foreign tourists who came to the four districts of the study area, there will be 117 potential foreign eco-tourists by assuming 5% of foreign eco-tourist rate. And there will be 308 potential domestic eco-tourists among 15,412 tourists who came to stay to the same area by assuming 2% of domestic eco-tourist rate. Lower rate for the domestic eco-tourist rate is based on the assumption that Latvians are used to their environment and will show less enthusiasm to LWC eco-tourism resources.

Based on the above assumption the potential eco-tourists to LWC will be around 425 persons. And it will increase to around 700 to 1,000 persons in 10 years time provided that LWC is well improved in terms of information, advertisement, access to the site, tourism facility, and tourism management.

9.2 Eco-tourism Development Plan

9.2.1 Development Strategy

The eco-tourism is defined that “the promotion of environmentally sensitive tourism and the provision of facilities and environmental education so that tourist will visit, understand, appreciate and enjoy natural and cultural areas without causing unacceptable impacts or damage to their ecosystem or to local culture”. Thus, the strategies of eco-tourism development can be set as follows reflecting the specific situations in and around LWC.

- sustainable natural resources management,
- local community driven development process,
- entrepreneurship promotion,
- full support by local government and public institutions,
- collaboration between public and private sectors,
- small scale eco-tourism and long-term benefits,
- supply-oriented management,
- differentiation and diversification of eco-tourism, and
- focusing on the most potential areas.

9.2.2 Eco-tourism Resources

Considering the viewpoints of wilderness and naturalness, uniqueness, beauty, applicability, availability, sustainability, accessibility, and safety of potential eco-tourism resources in LWC, the following 20 eco-tourism resources and activities are proposed so far to enhance eco-tourism in LWC. Key points of the proposed eco-tourism resources are summarized below, and those typical figures are shown in Figure 9.2.1.

Eco-tourism Resources and Proposed Activities

No.	Resources/Activities	No.	Resources/Activities
1	Boating and Angling along the Aiviekste	11	Bird Watching Tower
2	Taking Sauna and Cottage	12	Bird Watching in Kvapani
3	Beautiful Inundation	13	Campfire and Sports Activities
4	Watching Rare Broad-leaved Forests	14	Beach along Lake Lubana
5	Canoeing along the Pededze	15	Angling
6	Archeological Experience	16	Experience in Habitat Management
7	Walking around Teirumniku Bog	17	Animal Watching
8	Canoeing and Boating in Idena Canal	18	Agriculture Experience
9	Camping along the Idena Canal	19	Stork Watching
10	Lodge in Orenisi	20	Museum of Nature

9.2.3 Eco-tourism Development Projects

Taking the locations and characteristics of eco-tourism resources into account, the following two eco-tourism development projects are proposed as shown in Figures 9.2.2 and 9.2.3.

- Indrani and Lubana Eco-tourism Development Project, and
- Nagli and Gaigalava Eco-tourism Development Project

(1) Facility and sanitation plan

Building facilities should take a consistent strategy to differentiate the eco-tourism in LWC from others. Local-style, small, and nature-contained facilities should be obtained in LWC. Considering impacts on the ecosystem of LWC and the scale of local economy, the facilities for eco-tourism should not be too grand nor too costly, but should be simple and effective. However, environmental protection measures should be installed even if they might be a little costly.

Accommodations should be local-style, and combination with saunas is quite attractive. The local materials including wood are cheap and sometimes free. Building a sauna with the local wood and labor costs from 1,000 to 5,000 LVL. Saunas can be used as party places if they have furnaces, but should not be concentrated in one area to avoid forests destruction due to excessive wood use for saunas. Parking spaces should not be asphalted but paved with gravel. Small-scale parking spaces from 5 to 20 cars are recommended in order not to disturb the nature. The present conditions and future plan of electricity and water supplies and telephone lines should be checked carefully prior to make a detailed plan of a facility.

The proposed facilities for the eco-tourism development in LWC are grouped into two. One is in Lubana and Indrani township area. The other is in Nagli and Gaigalava township area. The main facility for eco-tourism is accommodated in EMC building together with other facilities like wild life management.

The following are proposed facilities plan. In these facilities water is supplied from their own deep wells. Cooking fuel is provided by propane gas. Septic tanks are of combined type for toilet and miscellaneous wastewater. Electricity is available for most parts, but some extensions of power cables are necessary.

Lubana and Indrani township area

1) Tourist information center

Most visitors from Vidzeme region approach Lubana and Indrani to get guidance and information on the eco-tourism in LWC. A reception room in the information center provides pamphlets, brochures and guide maps introducing eco-tourism resources in LWC. There must be a room to exhibit stuffed birds, mammals, flora, archeological features found in LWC. The exhibitions should be explained in both Latvian and English. Flush toilet is preferred. Visitors can rent a bicycle. A storage room is equipped to store bicycles and canoes during the off season. Transportation vehicles and a car park are provided, too.

2) Accommodation lodge

Visitors can stay overnight and observe birds and mammals. This includes bedrooms with a shower room, flush toilets and a simple kitchen. Meal is not served here. This lodge has a reception desk, a small shop, a car park, and a sauna which is also available for outsiders.

3) Canoe terminal and canoe station

Rental canoes are available in the canoe house located at the canoe terminal. Visitors are transported to and from a canoe station. The canoe house has a reception desk, a room for staff, a canoe shed during a season, a changing room with shower and flush toilet. Canoe stations are simply marked by signposts. These are of temporary structure during a season only, since the area will be flooded in spring. Car parks and transportation vehicles are equipped here. Simple wooden piers for canoeing and boating are also prepared at these stations.

4) Camping site

Two camping sites are proposed in this area. One in Lubana town and the other at the end of the Pededze canal. Visitors should register before camping in the tourist information center. Camping fees are collected there. A camping tent, camping car, fuel and food should be brought by visitors, but simple materials are available in a small shop in the center. The camping site is provided with parking, drainage, cooking, dishwashing, and laundering facilities, and toilets.

5) Information board and signposts

An information board is placed in front of the tourist information center and along the boundary road of LWC. This bears a guide map of LWC, information and instructions on eco-tours in LWC. Signposts are installed to indicate what tourists see or characteristics of the area or direction of eco-tours, telephone numbers, the e-mail and Web site address of the LWC administration. In the flood areas, signposts are removed during the off season.

Nagli and Gaigalava area:

1) EMC

Environmental Management Center (EMC) is proposed in Idena, Nagli. EMC is the center for the environmental management in LWC as a whole, which includes eco-tourism/rural tourism activities among other wild life management activities. Here is the central information office for eco-tourism. Visitors can get information, guidance and lectures about eco-tourism in LWC and watch slides and videos shown by trained guides and experts. Visitors are told what they can expect to see and experience, what they should do, and what they should not in LWC. For instance, board walkers should pay attention to bogs in order not to give irrevocable damages to precious high bogs. Visitors can see an exhibition of stuffed birds, mammals, flora which can be seen in LWC. These should bear Latvian and English explanations.

Visitors can rent canoes, boats, and bicycles here. They should register for camping and angling here as well, and get an instruction for canoeing and other activities before going to the site for safety. For canoeing and boating, visitors are transported to the starting points from here. They will be picked up at a terminal where visitors can change clothes and take shower. Canoes, boats and bicycles are stored here during the off season. There are accommodations for overnight stay in order to observe birds and mammals in the evening, at night and early in the morning. The arrangement for staying in a country house will be done here upon request. Bird watchers are transported to a starting point. They may be picked up upon request at their destinations, and also rent bicycles for bird watching. Guides for eco-tourism will be trained here partly from the wildlife researchers who engage in LWC wildlife conservation.

In order to have these activities, such facilities are planned in EMC as a reception room with a information counter, an office room for tourism, EMC office, a classroom and training room, a room for slide and video show, an exhibition hall, canteen, a small shop, bed rooms with shower and toilet, sauna, a reception room for canoeing, boating, cycling and angling, a changing room with shower and toilet, storage for canoes, boats and bicycle, flush toilet for visitors and staff.

2) Facilities

In location of Kvapani fishpond area tourists facilities are planned, partially utilizing two old abandoned buildings. One is renovated to a tourist house. This tourist house has a

dining room, kitchen, a small hall for gathering, bed rooms with shower and flush toilet, self-cooking places and a garage. In this place new summerhouses are planned to be constructed. A camping site, an observation hut, a boat pier, an information board are planned. In another place old pump house will be converted to a bird observation house with a car park. Visitors can stay here and enjoy watching many birds.

In Orenisi island of the Nagli fishponds is a little elevated calm and beautiful place. An accommodation lodge is planned for bird watchers or tourists simply to spend nice quiet days in a wonderful atmosphere. An observation tower and a car park are planned.

Observation hut and towers where visitors can watch birds or mammals from a little higher level covered with roof. Since LWC is flat area in general, towers are useful for watching birds and mammals. Huts can be used for hides and shelters for visitors. These are of wooden constructions. Spotting scopes are available at the information office.

Boardwalk is a device to give an opportunity for eco-tourists to walk through bog area, but protect environmentally sensitive bog from human steps. Boards are made by natural wood (red pine). Concrete is not used to prevent the negative effect of an alkali constituent of boards. These boards are removable for off-seasons. One-km board walk is planned in Teirumniek.

Renting a canoe or a boat should be managed at tourism office in EMC. Visitors can be transported to a canoe station or a boat pier where they start canoeing or paddling a boat. Canoes are brought here EMC, but boats are moored here during a season. two canoe stations together with boat piers are located along the Idena canal. Visitors can enjoy canoeing watching and listening to birds twittering along the Idena canal or they can canoe in near by Lake Lubana. Canoe and boat piers are simple ones of wood.

3) Camping sites

There are three camping sites. Two of them are located close to two canoe stations along the Idena canal. Another one is in Kvapani fishpond little north of EMC. A registration to use a camping site should be done at a tourism office in EMC. A camping tent or camping car should be brought by visitors. Simple camping materials are available at a small shop in EMC, but visitors are advised to bring fuels and food with them. The camping sites are provided with parking, drainage, cooking, dishwashing and laundering facilities, and toilets.

4) Information boards

Information boards are placed in front of EMC building and at Kvapani tourist house area besides along boundary road of LWC (refer to Figure 9.2.4). The board is similar to the one in Lubana, informing visitors how to arrange the camping and parking places. It also bears a simple guide map of LWC, information and instructions on eco-tour in LWC. This shows a guide map of LWC eco-tourism. Signposts are installed in specific points to indicate what visitors see or characteristic of an area or direction of eco-tour. Signposts are removed during the off-season in a flood area. These are written both in Latvian and

English. In the flood areas these signposts are temporary ones which are removed during the off-season.

5) Sanitation

Besides these facilities for eco-tourism in Nagli and Gaigalava area, other facilities are conceivable like a horse track. But this sort of facility which requires a considerable amount of investment will be sought after in a later stage.

Flush toilets are necessary for tourists. The use of septic tanks (combined treatment type), which treat both sewage and domestic miscellaneous wastewater, are highly recommended for the above mentioned facilities. Domestic miscellaneous wastewater is a heavier pollution source than sewage. (BOD of domestic miscellaneous wastewater is 27g/p.day, while BOD of sewage is 13g/p.day.) A septic tank may be a little costly, but it should be worth to spend money for sustainable eco-tourism.

A wastewater treatment plant which is generally used for a city or a town is not only too large and costly but also technically inappropriate in case of the above mentioned small facilities. Unfortunately the use of industrially manufactured compact septic tanks are not common in Latvia, yet. It is quite a useful device to treat small-scale wastewater. It may be an idea to subsidize the cost of a septic tank installation for a household, which is the case in Japan.

Solid waste management is a long-term issue which local governments have to plan for developing tourism. The amount of solid wastes from tourism activities is not small, when many tourists begin to flow in LWC. There are many well-known tourist destinations which are seriously suffering from solid waste discarded from tourism activities. The damage is becoming so serious that a former tourism town is hard to attract tourists anymore. This was due to a lack of solid waste management plan of a municipality. The collection of solid waste should be done regularly during a season. Recycling of usable goods promotes the value of eco-tourism in LWC.

(2) Cost Estimation

The necessary facilities and indicative costs for the two proposed projects are tabulated in Table 9.2.1 and Table 9.2.2. The total cost for the eco-tourism project in Gaigalava and Nagli is about 242,000 LVL, while that for Indrani and Lubana is 279,000 LVL.

The cost estimation was made just to give a rough idea of the magnitude of the proposed projects based on generally available local cost. Materials for constructing buildings and facilities like observation huts and towers are made of locally available materials as much as possible. Costs of the land acquisition are not included because the project sites are provided by either municipalities or local people who are willing to develop their sites for eco-tourism activities.

The cost of wastewater treatment facilities for environmental protection may be comparatively large in proportion with other parts of building costs. An industrially

manufactured septic tank is costly here. But the performance of treating wastewater is much better than a local device. In this project those septic tanks are used for most of the buildings and facilities where it is appropriate. In order to economize the cost and to utilize available resources as much as possible, a tourist house and an observation house in the Kvapani fishponds are renovations of old buildings which have been left in dilapidated conditions.

Financial resources are scarce for the rural businesses. Eco-tourism development is not fully potential without a possible financial resource. As LWC remains rich in eco-tourism resources, financial supports become crucial. More than 15% interest rate hinders promotion of small- and middle-sized businesses nationwide. The local governments also lack sufficient financial resources. Inexpensive financial resources for small-scale projects are much needed for the development of eco-tourism projects.

(3) Evaluation from technical and financial viewpoints

The above two proposed projects consist of several small components such as a tourist information building, lodges, observation towers and huts. The construction of those facilities does not require a specially high foreign technology. Instead, these facilities are planned to use local methods of constructions and local materials as much as possible. For instance, locally available wood will be used for bird watching towers, huts and most of the houses. Local people have their own traditional know-how of constructing log houses. Local people know how much extent they can rely on them, and how to keep maintenance of them. Besides by doing this, local people have good chances of involving in the projects. The use of a factory-made compact septic tank may not be so familiar in LWC yet. However, there are several manufacturers in Riga. The use of a combined type septic tank is necessary for environmentally conscious projects, though it cost more than a local traditional device of treating wastewater.

Financial matters are quite crucial for the implementation of the project. Several families who have already started tourism business by their own efforts have been found during the study. It was a big discussion among local people if it is worth spending money to renovate their houses to accept tourists. They worry if there will be enough tourists to come to recover their investments.

Regarding the government role in financial matters of the tourism development, the Latvian government is advised to put more budget in the tourism sector. At present, the budget for the tourism sector is too small in Latvia in comparison with neighboring counties.

9.2.4 Implementation Schedule

(1) Project preparation

The implementation of the tourism projects should be coordinated with other projects proposed by the study. For instance, the tourist information building is a part of EMC.

Therefore, it should be planed and constructed at the same time with a good coordination. Bird watching towers, huts and a board-walk facility will be used for wetland conservation program as well as eco-tourism.

The phasing plan of implementation is an important part of the project preparation. Namely deciding project sites, designing facilities, construction of facilities, procurement of equipment. In parallel with these activities capacity building should be done. The maintenance should not be forgotten. This phasing plan should be well coordinated with other projects of EMP.

(2) International cooperation

In tourism the international cooperation is an important source of exports, foreign currency gains and tax revenues. The European Union gives priority to tourism as the creator of jobs of numerous qualification requirements and as the driving force of regional development. Cross border cooperation is an important element for tourism development both on regional and local levels. It is quite useful for the development of tourism in Latvia to have international cooperation with surrounding countries. So far LWC has only one example of international cooperation in eco-tourism. It is between the Ecological Society of Latvia and its Swedish counterpart.

Looking at the tourism situation in general, in Latvia the number of foreign tourists increased from 1,760,000 in 1996 to 1,801,309 in 1998. The increase rate was 2.3% in 2 years. On the other hand in the neighboring country of Estonia the number of foreign tourists has increased during the last five years by 75% from 1.6 million in 1993 to 2.9 million in 1998 or an average 12.7% increase per year. Among those tourists, Latvians are the second largest (325,000) after Finland (1,813,380). There are even 5,900 Japanese tourists in 1998. (source: Estonian Tourist Board). The demand for guesthouses, campsites, holiday homes and holiday villages has increased significantly. Their scenario of tourism development projected that foreign tourists in Estonia will increase up to 3.7 million in year 2003.

In Lithuania the number of foreign tourists arriving has increased by 22.6% during the last two years from 3,497,000 in 1996 to 4,287,000 in 1998. Here too, Latvians are the second largest of 1,089,234 tourists only after CIS (2,357,390). In 1998 expenditures of foreigners in Lithuania accounts for 9.9% of total Lithuanian export of goods and other services. (source: Lithuania tourist statistics)

Looking at these situations, tourism seems to be a fast growing industry in neighboring countries. Although at present Latvian tourism is not doing so well, Latvia will have a good possibility of increasing the number of foreign tourists. This means that Latvia should take a sound step to develop international tourism in cooperation with neighboring countries.

The first step of the international cooperation is to exchange information on eco-tourism. It is to create a network on eco-tourism basic data and other information like attractive image of the region. Brochures and pamphlets will be distributed internationally. Then it is

an important strategy to form packaged tours with destinations of neighboring countries for the further development of Latvian tourism and especially for eco-tourism. This can be one of the first examples for international cooperation for eco-tourism development in Latvia. The benefits of the cooperation with other destinations to LWC are firstly a broader opportunity to attract tourists, and secondly broader publicity through media of cooperating countries.

Regarding eco-tourism, Estonia is seemingly more developed and better-known among eco-tourism societies. The cooperation with Estonia's counterpart could be a breakthrough and one of the first examples for Latvian eco-tourism for the international cooperation. Swedish tourism agency says that more and more travelers are searching for new outdoor experiences in an open, unspoiled and well protected natural environment, which LWC is fortunate with. Because the Ecological Society of Latvia has a connection with Sweden counterpart, Swedish ecological tourists have come to visit LWC. This can be extended to other Scandinavian countries.

In terms of financial arrangement for the implementation of the projects, the international donors are valuable. The OECD/DAC policy emphasizes on assistance for environmental sector as well as the past donors' technical and financial cooperation to Latvia. Considering eco-tourism as a part of rural tourism in broader sense, EU Phare fund are available for renovating a farm house for a tourist lodge. Japanese government may be able to assist for providing soft loan to the projects provided with a proper executing body is formed.

(3) Financial feasibility

At this stage of the study it is rather difficult to state about financial feasibility of the project. Because presently estimated number of tourists to visit LWC are small. But since available data and information are quite limited, there seems to be no other appropriate way of projection at this stage. However, when considering financial feasibility, the following facts should be taken into considerations:

- facilities like a tourist house and an observation house in Kvapani pond have already been in a state of partially constructed,
- some family in Lubana and Indrani are already in a process of renovating their property for tourism purposes,
- sign posts and information boards are basic things which are necessary without considering the cost recovery,
- most facilities in the project are very basic for eco-tourism, and
- only few viable industries to promote in LWC for sustaining precious ecological resources.

9.3 Management Actions for Eco-tourism Development

9.3.1 Visitor Management

Based on the concept "carrying capacity", visitor management deals with regulations and zoning to protect the nature, licensing for hunters and anglers, warden patrols by EMC, and access controls of approachable locations, seasons, activity types, number of visitors.

(1) Carrying capacity

Carrying capacity is categorized into three: physical, biological, and social. Physical carrying capacity is related to the acceptable numbers of eco-tourists in terms of facilities' and accommodations' capacities often determined by water and electricity supplies and limited spaces. Biological carrying capacity deals with the numbers of game birds and animals, and fish to be hunted or caught and the allowable level of access to rare vegetation. Lastly, social carrying capacity means the local people's capacity to accept visitors especially from foreign countries. Eco-tourism has to keep in mind all these capacities in dealing with visitor management.

(2) Regulations

The eco-tourism development should be subject to the environmental zoning and its regulatory plan. No eco-tourism activities are allowing in NPZ, and the proposed eco-tourism activities are limited in AMZ and DZ. For example, the angling with a boat in Lake Lubana, the Aiviekste and Rezekne rivers are prohibited from March 15 to May 30 according to the Angling Regulation, No. 223 to avoid breeding season. Angling with a boat in the designated fish wintering area in Lake Lubana and the Rezekne river is only allowed from May 30 to September 1. Every eco-tourism developers and operators should comply with the current and proposed regulations.

(3) Licensing

Angling and hunting need the specific licenses to be allowed in Latvia. A specific angling card system is proposed for angling in the used-to-be fishponds of LWC. The private owners own some fishponds and they plan to develop recreational areas there. Licensing is a tool to restrict angling and hunting activities, then controls animal and fish populations.

(4) Warden patrols and access control

EMC or the Madona and Rezekne REBs should provide the services to patrol NPZ and AMZ and to watch hunting and angling activities in LWC. Showing patrols by wardens provides a warning effect to illegal hunters and anglers as one of visitor management activities. To limit an access to a sensitive area is essential to preserve the nature. An access point to the Teirumniku bog can be established from the major road connecting Idena and Nagli. Other access points might cause much damage to the educationally important bog. The Lodani bog should not be disturbed by boating and camping activities along the Idena

canal. Camping places should be strictly limited in several points which have signboards and fences. Along the Pededze river, eco-tourism activities should be limited only in the river. Beaver dams and broad-leaved forests can be an attraction but should not be disturbed. Landing stations should be limited only in several spots along the Pededze river.

9.3.2 Inventory Preparation and Monitoring

Information collection often forms an obstacle to eco-tourism developers. The Environmental Information Management System (EIMS) of EMP provides technical supports to easily collect the necessary information on eco-tourism resources, social conditions, facilities, water quality and sanitation, and customers.

Eco-tourism Resources: Besides the major eco-tourism resources, the local people hold a big festivals on Midsummer Celebration every June staying up all night to enjoy friendship and family love. LWC attracts the local people to celebrate the national festivals.

Social Conditions: Necessary social conditions are land use and tenure, economic conditions, financial resources, and tax incentives. The two Nagli fishponds, which have eco-tourism resources as bird watching sites and beautiful landscapes are owned by the state but under privatization. The privatization should be carefully managed in order not to lose eco-tourism resources. Unemployed workers need to be engaged in the construction of eco-tourism facilities in LWC. Possible financial resources of low interest rates should be emphasized. Tax incentives might help eco-tourism developers take the first step of eco-tourism businesses.

Facilities: The locations of present accommodations and facilities, services, transportation and infrastructure provide necessary information on possibility of eco-tourism. Developers should prepare as good facilities and services as the present ones to survive.

Water Quality and Sanitation: Surface and groundwater quality should be monitored regularly. Particularly, surface water in the Idena canal, the northeast of Lake Lubana, the Pededze and Aiviekste rivers, the Kvapani and Orenisu fishponds.

Customers: EIMS also provides the customers' inventory origins and popular activities to help eco-tourism developers select possible activities. A system to select honorary guests of LWC is an idea to promote the eco-tourism in LWC. Honorary guests are who have visited LWC, showed their eagerness to conserve the nature in LWC, gotten high scores in information sheet recording, etc.

9.3.3 Use of Information Technologies (IT)

The Internet has changed the information system worldwide. Connecting to the Internet provides customers with a 24-hour open window to any information. The number of the Internet users has been increasing in Latvia, and IT has been a necessity in the Western Europe. Efforts should be concentrated on management and marketing using IT. The functions include inventories making, introduction of regulations, provision of hunting and angling information, introduction of honorary guests, dissemination of evaluation

results and green records, condition of facilities, training programs, promotion of advertisement and education.

For eco-tourism promotion, information dissemination on the regulations is the key to keep the eco-tourism values of LWC. The regulations on nature protection should be open to the public. Hunting rules and regulations are somewhat complicated, so it is convenient to obtain seasons, places, prices, and availability for foreigners from the Internet.

With great efforts to protect the nature, green records should be open to the public to promote green credentials and to add a value to eco-tourism. Particularly, eco-tourism developers and operators, guides, and hosts who get highly-evaluated green records should be introduced on the Internet. Competition should be maintained and supported by EIMS.

Advertisement using IT is one of the most important for eco-tourism development. Pictures of the nature, voices of birds, descriptions and prices of eco-tourism activities, possible accommodations and public transportation should be contained in the ads. Booking should be arranged on the Internet. Credit card payment is preferable. Booking sheet is useful. Moreover, customers and eco-tourists who have visited LWC for many times should be honored properly on the Internet. Their motivations, affiliations, and interesting places in LWC should be detailed on the homepage of EMC.

9.3.4 Evaluation System and Green Records

(1) Objectives and scheme

The objectives of the evaluation of eco-tourism activities are nature and culture protection, promotion of green credentials, eco-tourism needs finding, and education.

The concept of green credentials is famous in Estonia. The more nature values, the higher eco-tourism is evaluated. Performances highly rated in evaluation then feeds back to the promotion of eco-tourism resources of LWC for well-educated and concerned eco-tourists. Promotion of green credentials helps the local communities with eco-tourism development by putting emphasis on nature protection efforts. Developers understand their protection efforts might cause profits.

To avoid environmental destruction by eco-tourism activities, mostly developers and guides should be checked up over their eco-tourism plans and activities by eco-tourists and environmental management organizations including EMC and the Rezekne and Madona REBs. Generally, eco-tourists are getting keen on if eco-tourism activities are really suitable for nature protection or not. Eco-tourists' needs should be promptly caught by developers. Otherwise, LWC will lose its value as an eco-tourism site. Wilderness and uniqueness of the nature, reasonable fees for activities, and quality of services are the matter of strenuous efforts.

(2) Evaluation items

In Table 9.3.1, the evaluation items and the relevant criteria are shown. The criteria of evaluation are 1) wilderness and naturalness, 2) uniqueness of eco-tourism activities, 3) reasonable fees for the activities, 4) quality of services, 5) knowledge level, 6) appropriateness of management, and 7) sustainability.

Eco-tourists prefer wilderness and naturalness of the nature and scenery to just following guides' explanations. An eco-tourism activity using information sheet, which makes visitors close to environmental management in LWC, would be quite unique. Every activity is evaluated in terms of rationality of fee levels and quality of services.

Eco-tourism activities in LWC anyway should be much cheaper than those in European countries, especially Estonia. Price comparisons with Estonian similar eco-tourism products should be a monitoring item to take advantage of low labor costs in Latgale. Evaluated services are hospitality, food, drinks, communications, language skills, songs and dances, quality of guides, and transportation.

Knowledge levels of EMC and REBs are evaluated in biological carrying capacity and conservation measures, while those of eco-tourism associations, the local governments, developers, guides and hosts are assessed in their knowledge on sustainable development, green credentials, natural and cultural history in LWC. Appropriateness and sustainability of conservation management, regulations, and sanitation management are to be judged by eco-tourists, EMC, and REBs.

9.3.5 Management and Marketing

(1) Management

Essential for management of eco-tourism are 1) accommodations and facilities, 2) services, 3) green records, 4) networking, 5) finance, and 6) planning.

Management of accommodations and facilities should be based on the sense of beauty. Eco-tourism facilities should be small-scale and local-style. Eco-tourists enjoy environmentally friendly buildings with little disturbance on the nature. Designing of architecture should take into account that buildings made of wood provide the smell of the locality of LWC, following the local regulations. Trees and water bodies along accommodations make beautiful scenery from inside. Painting should be careful since it causes separateness of buildings from the nature.

Management of services includes food, hospitality, languages, safety, and knowledge on natural and cultural history. Though the local soups and deserts have a variety of choices, the local main dishes are rather monotonous. The traditional Latvian food should be provided more. Hospitality is a treasure for most Latgalians. English should be learned more because most Europeans speak English and many other potential markets are English-spoken countries. Safety issues must be a priority for eco-tourism and any activity should take into consideration possible measures in case of emergency. Tourists enjoy the

local people's knowledge on natural and cultural history in their accommodations, having dinner or lunch. Eco-tourism developers, guides, and hosts are to keep an eye on the information on the local nature and culture.

Green credentials are given to well-managed eco-tourism. Increasing demand for more environmentally friendly tourism is a trend worldwide. Developers should not miss any chance to advertise their eco-tourism products to well-educated and well-experienced customers. As quality of eco-tourism can be only maintained by the efforts of developers, they should know what items are evaluated, who evaluate, what criteria are imposed, and for what reasons evaluation is necessary.

Networking is also a big management issue. Benefits arisen from networking are transportation improvement, financial advantages, and collective marketing. Collaboration with eco-tourism associations helps developers collect information and prepare lump-sum money available. Collateral and credit of associations might be evaluated more than those of small-sized businesses.

Calculation of profits and costs is crucial. As tourism usually depends on foreign tourists and weather, expectations are relatively unstable. Excessive investments should be avoided. Collaboration caused from networking provides experienced know-how and avoids miscalculation.

Entrepreneurship is developed through the planning scheme. Planning fosters the use of IT and communications with EMC, eco-tourism associations, and the local governments, and then expands their capacity gradually. Self-sustaining education is an intention.

(2) Marketing

Marketing issues include 1) packaging, 2) IT, 3) advertisement, 4) booking system, and 5) transportation. Packaging of the eco-tourism either in or outside of LWC is crucial. One example in the summer for a family with two adults and one child from abroad:

> *On the first day, move from Riga to Lubana (4 hours, 10 LVL), take a canoeing lessen in the Aiviekste (2 hours, 6 LVL), have traditional dinner (2 hours, 10 LVL), take a sauna (included in overnight), stay overnight at the cottage (40 LVL).*
>
> *On the 2nd day, take a canoe for 3 to the Pededze (3 hours, 15 LVL, transportation included), have lunch at a camping place (1 hour, 3 LVL), take a tour to an archeological experience (3 hours, 6 LVL), have dinner (2 hours, 10 LVL), take a sauna again and stay (40 LVL).*
>
> *On the third day, bird watching and take lunch (3 hours, one guide 5 LVL, lunch 3 LVL), take a boat and angling (4 hours, 6 LVL), have fish for dinner (3 hours, 8 LVL), take a sauna and stay overnight at a cottage (40 LVL).*
>
> *On the forth day, cycling (2 hours, 4 LVL), see the Teirumniku bog (2 hour, 4 LVL, transportation included), shop local crafts, pottery and other souvenirs(25 LVL), arrive at Idena, stay overnight at a cottage in Idena (40 LVL).*

On the last day, take a bus to Riga (4 hours, 10 LVL). In total, 285 LVL for 4 nights excluding air plane tickets.

Packaging with such eco-tourism sites as Lake Engre and Lake Razna should be also promoted to make more attractive and interesting eco-tourism products. Transportation, accommodations, schedules, guides availability are to be carefully arranged.

IT including the Internet has a high potential due to its low cost of information updating. Online reservations and payment by credit cards should be developed by the help of academic institutions such as DPU. Low cost advertisement on the homepages of transportation companies could be possible if negotiations are done well.

Advertisement should show reliable and precise product description, the faces of the local people, small-scale products, wilderness and uniqueness of the nature, transportation possibilities, reasonable prices and comparisons, the homepage addresses, contents and schedules of eco-tourism activities, and booking methods. Media include TV, radio, newspaper, LCTA, Tourism Information Centers, and the Internet.

Booking is essential for tourism. Developers should find as many booking systems as possible from the Internet to telephone booking. The number of possible booking locations decides that of tourists to come. For the purpose of booking, developers should contact the tourism organizations such as Tourism Information Centers as often as possible.

The public transportation available from Riga to Lubana town is twice-a-day bus services. Collective action to improve frequency of buses and quality of seats is necessary according to the real needs, and non-stop services should be provided if appropriate.

9.3.6 Planning and Implementation

The procedure of eco-tourism planning and implementation is shown in Figure 9.3.1. The purposes of planning are 1) entrepreneurship promotion, 2) improvement of eco-tourism activities and services, and 3) consistent monitoring of eco-tourism.

Eco-tourism activities and services should be regularly improved by the systematic evaluation and feedback system to attract more visitors and prevent inappropriate activities for nature protection. As an administrative organization, EMC needs to monitor eco-tourism activities if they meet the regulations. The eco-tourism developers and operators need to take the following steps.

(1) To recognize zoning and regulations/restrictions

First, eco-tourism developers and operators recognize the environmental zoning. Each zone has regulation describing prohibited and restricted activities. Every eco-tourism developer or operator is required to know if and how hunting, fishing, educational activities are prohibited or allowed in a target area. The meaning of active management should be clearly understood, too.

(2) To identify natural and cultural resources and land tenure for eco-tourism

Inventories related to eco-tourism resources and activities, cultural and historical attractions, water quality monitoring data, and land tenure are provided by the information system of EMC. Eco-tourism developers find what activities are possible and where.

(3) To take into account the local cultural values and concerns

The local people are basically cooperative with eco-tourism. Forerunners of eco-tourism development have to be concerned about the possibility of the eco-tourism activities preferred by the local people.

(4) To identify similar eco-tourism activities

Eco-tourism is very popular in some European countries including Estonia which can provide the useful information on eco-tourism. Eco-tourism activities chosen are compared to the similar activities operated somewhere to understand an available season, reasonable prices, possible customers, safety issues, transportation, and sanitation management.

(5) To acknowledge responsibilities as eco-tourism operators

Developers acknowledge legal and institutional responsibilities to develop eco-tourism. Crucial are hunting, fishing, nature protection regulations. Developers also are greatly recommended to join the local eco-tourism associations to network the eco-tourism sector and promote more attractive activities.

(6) To make facilities plan

Eco-tourism facilities include accommodations, parking spaces, cottages, saunas, an archeological amusement park, balloon landing places, piers for canoeing and boating, resting houses in beaches, and houses for hunters and anglers. Where to build facilities, how to decide the sizes, how much are the reasonable prices, and how to provide water and electricity supplies are the issues to be answered prior to sanitation, marketing, management, financial planning. Pumped wells provide a feasible option for water supply in LWC.

(7) To make sanitation plan

Wastewater management includes types of toilets, treatment methods, and municipal and private services. Septic tanks provide a feasible option to collect wastewater from facilities. Solid waste management is connected to the 500- project. A possible new landfill site in Ludza will collect waste from Nagli and Gaigalava. Sanitation planning should be conducted with the advice from the local governments.

(8) To make marketing plan

Strong collaboration with EMC and eco-tourism associations is necessary for developers to get accurate information on the needs in eco-tourism, get possible finances, and improve transportation. To be addressed are when marketing activities should start, to whom the eco-tourism products should be informed, what points should be emphasized especially, and who will be arranging advertisements. Seasonal or annual marketing goals should be set, too.

(9) To understand management requirements

Management of eco-tourism is almost identical to understanding needs in eco-tourism. Necessity of accommodations, facilities, services should be carefully listed up. Managing information using personal computers is crucial since information plays a big role in marketing. Financial sustainability can be achieved by eco-tourism developers' creative ideas and long-standing hospitality.

(10) To make financial plan

Checking available loans from the local governments or national government, eco-tourism developers find investment possibilities. The information on tax incentives should be provided by the local governments.

(11) To make training programs for staff

To achieve the marketing goals set by developers, training for the local staff of eco-tourism businesses should be arranged. EMC and eco-tourism associations are to provide training courses to promote eco-tourism. Developers check the list of the training and decide which courses are necessary.

(12) To implement the eco-tourism plan

Facilities and sanitation plans should be implemented at the same time. Marketing and financial plan should be realized before the implementation of training programs.

(13) To evaluate the eco-tourism activities

Using green records, developers can evaluate such necessary items as preservation of the nature, properness of wastewater and solid waste management, collaboration in visitor management, customers' satisfaction with services provided by eco-tourism operators.

(14) To feedback

Each developer is recommended to report evaluation results to eco-tourism associations, EMC and the local governments to improve eco-tourism activities, to sustain the local economies, and to preserve the substantial eco-tourism resources.

9.3.7 Networking of Eco-tourism Sector

(1) Objectives

Due to excruciating experiences in the Soviet times, the local people are generally reluctant to form cooperatives. However, the Indrani township mayor succeeded in founding the business association. It means that a networking of eco-tourism sector is feasible if the local people are persuaded of the importance of associations. Indrani has its own unique natural resources, whilst Nagli and Gaigalava have their peculiarity in their territories. Combined and packaged eco-tourism activities of uniqueness and wilderness will surely attract many tourists. The Latgale Tourism Association is very active in making tourism products.

Financial problems soften due to networking. Small-scale entrepreneurs often face difficulty in obtaining funds through formal banking institutions. Banks reduce risk by lending to well-established operations with proven track records. Through networking of small-scale eco-tourism businesses, comprehensive business plans, suitable guarantees, and commercial viability become feasible.

(2) Networking steps

Expanding the association takes the following steps:

1) Choosing facilitators and finding key organizations and persons

Facilitators should take the initiative to networking voluntarily. Otherwise, forced formation of associations will fail with no exception. Candidates can be the local leaders in Indrani, Lubana, Gaigalava, and Nagli townships. The business association in Indrani, the Latgale Development Agency, townships, the Madona and Rezekne Tourism Information Centers, the Teici Nature Reserve, the Daugavpils Pedagogical University are key organizations. The owners of the Kvapani fishpond, the Orenisu fishpond, wood-processing companies can be the key parties.

2) Expanding communications between key parties

Communications between key parties are almost dead except between Indrani and Lubana town, and between Gaigalava and Nagli. EIMS will hopefully help expand the communications by providing the information sharing opportunities between the concerned parities.

3) Sharing information

The more information is shared, the more cooperation is available. Collaboration happens when necessary information is obtained. Information sharing is a key to the success of the formation of eco-tourism associations. Without the consistent philosophy, nothing can be combined. The basic idea of sustainability should be shared constantly by the help of the

facilitators. Competition should be an issue with Estonians and other Latvians, not with developers in LWC.

4) Marketing and training by groups

Marketing can be done by collective action. To obtain information from the homepages on the Internet by oneself requires much more energy and time than by groups. To advertise eco-tourism activities is possible with a bunch of money collected by associations. Benefits also come up from training arrangements by associations. Each developer can provide his/her expertise and know-how. Sharing information is possible through training activities.

5) Collective action to governments and the financial sector

Financial credibility increases when borrowers can show high financial sustainability and business feasibility. Eco-tourism is financially sustainable only with increased and shared creativity provided by associations.

6) Evaluating benefits of networking

Through formal or informal discussions, benefits from networking are fully evaluated in terms of increased information, understanding on sustainable development, successful marketing and advertisement, organization of training programs, increased financial possibilities, transportation improvements. Enlargement of associations is only a result of the previous steps.

9.3.8 Capacity-building and Training

(1) Objectives

The most crucial fact to hinder economic development in Latgale is that the old people seem to be tamed by the Soviet system in which everything was provided for free and efficiency and creativity were abandoned. Mentally, most of them are not ready to take action to improve their living standard. Self-independence combined with optimism is a fundamental issue to be solved to promote entrepreneurship. Meanwhile, the capacity-building and training strategy is not meant to exclude the local people's potential. What's more, the eco-tourism development plan should be focused on the local key persons and parties. Eco-tourism training and education programs should be based on both the key people's efforts and new ideas from outside.

(2) Training and education programs for eco-tourism

Training programs are classified into 1) basics, 2) eco-tourism activities, 3) management, 4) services, 5) marketing methodologies, 6) finance, and 7) nature protection as depicted in Table 9.3.2.

The training initiatives should be taken by forerunning eco-tourism developers who deal with eco-tourism in the Kvapani fishpond and township mayors who have found the business association for eco-tourism for Indrani and Lubana town. The essence of the basics equals to how to empower the local people endogenously with a stress on sustainable development.

(3) Implication with EIMS and EE&T

Capacity-building and training for eco-tourism is a part of Environmental Management Information System (EIMS) and Environmental Education and Training programs (EE&T). It should be considered as an integral part of training programs. EIMS and EE&T are described in previous chapters in detail. Eco-tourism resources in LWC can be at the same time good resources for education materials and opportunities for children's environmental education which makes eco-tourism development in LWC sustainable.

9.4 Organization and Institution

9.4.1 Role of Government and Environmental Management Center (EMC)

A number of obstacles need to be overcome by the help of the national and local governments. Bureaucratic system, insufficient educational opportunities, and unreasonable fiscal policies could hinder a healthy development of eco-tourism. Governments should facilitate economically viable entrepreneurship providing financial, technical, regulatory, institutional, and physical supports for the private sector. Although the small scale is one of the strategies, some initial investment is required for the eco-tourism development. Thus, the public sector investment is indispensable in the first phase and then, its operation and management should be gradually handed over to the private sector.

(1) Financial supports

In Latvia, financial supports are usually difficult to obtain for small-sized businesses located in the rural communities. Interest rates are not less than 15%, which makes borrowing money quite infeasible not only for entrepreneurs but also for small business owners and operators. Considering getting financially less burdened loans such as soft loans, which provides low interest rates for the Latvian government, might be helpful to the Latvian government if its fiscal policies are permitting.

The role of local governments has become more important under the decentralization policies, because they are expected to incubate and nurse private sector in each region. Incentives must be more focused on than restrictive controls by governments. Financial supports from the international society and national government should be positively provided to environmentally friendly municipalities where green credentials are well kept and open to the public through information disclosure efforts. The national government

should encourage and assist financial institutions to ensure their recognition of sustainable development as a criterion for financing.

(2) Technical supports

Technical supports include eco-tourism development planning, management and marketing, environmental education, training programs, inventories and monitoring. Planning methods enables systematic and consistent planning, evaluation, and feedback. Information technologies (IT) using the Internet should be provided as a result of the EMP implementation to make marketing easy for the private sector. Environmental education is essential to promote public awareness on nature protection which is the basis for eco-tourism businesses. The guideline on training programs is prepared in EDP which is used for development of detailed training programs for the eco-tourism businesses. Inventories of eco-tourism and financial resources and monitoring of water quality and sanitation should be furnished in the course of the implementation of EMP.

(3) Regulatory and institutional supports

Environmental regulations and monitoring are essential for eco-tourism. Due consideration of the importance of nature preservation, EDP should not be exploited in NPZ, but AMZ and DZ. Not all eco-tourism activities are allowed even in AMZ, and some conservation measures will be required to reduce negative impacts caused by them. The proposed actual regulations on prohibited and allowable activities with environmental zoning are described in the Environmental Zoning. In addition, detailed regulations especially on hunting and angling should be clearly understood by the local eco-tourism operators and guides. Both Madona and Rezekne REBs should take the initiative to deal with the institutional formation in collaboration with the local eco-tourism associations. For effective and efficient management, the basic information on environmental monitoring on water quality, game bird and mammal species, typical fish species, archeological sites, allowable raised bogs, beautiful landscapes, and bird-watching sites should be provided by the Environmental Information Management System (EIMS).

To avoid overlapping, conflicting, and contradictory measures for natural resources management, the Environmental Management Center (EMC) needs to be established as an actual administrative and operative body under the Implementation Committee (IC) of EMP. For education and training of eco-tourism, EMC is proposed to prepare and arrange a variety of training programs in cooperation with the local eco-tourism associations. Under the supervision by IC, EMC should be a bridge of the administrative gaps among the townships concerned with eco-tourism development in LWC. For the success of attractive packaged eco-tourism activities, equal and arduous cooperation among the townships and businessmen should be formed by coordination efforts provided by EMC.

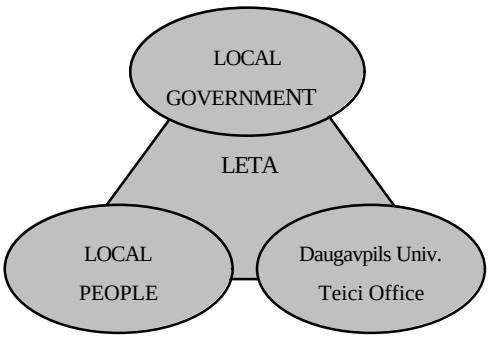
(4) Physical supports

Transportation, infrastructure provision, water and electricity supplies, wastewater and solid waste management form the main physical supports from the local governments. Presently, foreign eco-tourists fly to Riga. Buses and cars are the only transportation options from Riga to the access points to LWC since the rail service from Madona to Lubana town ceased a few years ago. Transportation options should be widened from more frequent buses to trains, and preferably airplanes. The Rezekne airport might be possible in future depending on the local economic development.

Bird-watching towers, piers for canoeing and boating, public rest houses and parking spaces for swimmers in Lake Lubana, and facilities in boat and canoe stations need to be constructed from the public funds to provide the basic infrastructure for a variety of eco-tourism activities. Although eco-tourism developers are basically to make the best use of existing wells and electricity supply networks, physical infrastructure should be well prepared by the local governments. Along the proposed horse trekking routes in Nagli, one dumping site degrades the beautiful scenery. In line with the 500- project to reduce the number of small and scattered dumping sites across Latvia, Nagli township should close the dumping site and transfer its solid waste to bigger and more well treated landfill in Ludza in the near future.

9.4.2 Proposed Organization for Eco-tourism Development

For the purpose of materializing eco-tourism development projects of a) Gaigalava and Nagli and b) Lubana and Indrani, it is proposed to form the LWC Eco-tourism Association (LETA). This LETA consists of interested local governments, interested local people groups supported by academic institutes. Possible local governments which are active in promoting these projects are Gaigalava, Nagli, Lubana, Indrani and other interested townships. Possible academic institutes which will support the eco-tourism projects are DPU, the Teici State Nature Reserve Office and other interested institutions which are willing to support LWC eco-tourism from the academic capability. Such cross-sector cooperation can be depicted as the next picture. This LETA will be placed under the Eco-tourism House which is one of the functions in EMC.



Cross-sector Cooperation for the Projects

The function of LETA includes:

- coordination among local governments, local people ,and academic institutes,
- coordinating the construction of the facilities,
- planning project facilities and fund raising,
- managing eco-tourism activities for the project including sustainability,
- training of guides including language training,
- public relations giving advice to local people to start eco-tourism related business,
- coordinating with the Vidzeme Tourism Agency, the Latgale Tourism Agency, and other local governments, and
- coordinating with other sections of the Eco-tourism House in EMC.

These functions are all important for the implementation of LWC eco-tourism development. Figure 9.4.1 shows organizational relation between LETA and EMC with necessary financial procedure. Considering the people s capability, the crucial part seems to be mainly the fund raising necessary for preparing the facilities which require budgets to implement. LETA makes easier for the project receiving a soft loan from outside the country. Although Latvian government guarantees the return of a loan to a loan institution, it is essential to have a main implementation body which directly involves in the project. Then, necessary budgets are provided to LETA through the Ministry of Finance (MOF) and the district councils concerned, which are in positions to endorse and financially supervise the LETA activities. In order to carry out the two eco-tourism development projects, LETA is divided into two implementation groups consisting of interested household members such as farmers, fishermen, and foresters. The loan is repaid to the donors by MOF, since the eco-tourism projects will generate little profits at their initial stage.

Table 9.2.1 Eco-tourism Project for Nagli and Gaigalava

Facilities		Location	Specifications	Costs (LVL)	Type
1. Kuvapani complex (A)	Tourist house, summer house, camping site, carpark observation hut	Kuvapani ponds	Renovation of old structure, local timber house drainage toilet facilities	77,000	B, C
2. Kuvapani complex (B)	Observation house	Kuvapani ponds	Renovation of existing structure	7,000	B
3. Orenisi island complex	Lodge,observation tower carpark Camping site	Orenisi island in Nagli fish pond	Local wooden structure	37,700	B, C
4.Observation tower	Observation tower	refer to Fig. 14.3.4	Wood frame structure (10m)	8,000	B
5. Observation hut	Observation hut	Nagli	Wood frame structure raised floor	2,500	B
6. Camping site	Camping site	refer to Fig. 14.3.4	Drainage, toilet facilities	20,000	C
7. Board walk	Board walk	Teirumnik	Wood board, 1 km	5,000	B
8. Canoe station	Simple pier	Idena canal	Simple wooden structure	600	B
9. Information board	Indicating guide route map, instruction	Refer to Fig. 14.3.5	wooden board with posts written in Latvian & English	4,800	B
10. Sign post	Indicating site characteristics	Refer to Fig. 14.3.5	Metal board with wooden post, written in Latvian & English	700	B
11. Equipment	(1) Vehicle	EMC Eco-tourism office	a) 4WD (5 passengers)	40,000	E
			b) Pick-up (1 ton)	10,000	E
	(2) Canoe & canoe trailer		w/paddles, life jackets	7,000	E
	(4) Boat & boat trailer		Row boat w/paddles	4,600	E
	(6) Bicycle		Cycling bicycle	1,200	E
	(7) Camera & projector		w/ exchange lens	3,000	E
	(8) Video, monitor		8 mm video & monitor	3,000	E
	(9) Spotting scope		w/ lens	9,000	E
	(10) Personal computer		Server & monitor	1,500	E
	Subtotal			79,300	-
Total				242,600	-

Note : B=building, C=civil works, E=equipment

Table 9.2.2 Eco-tourism Project for Lubana & Indrani

Facilities		Location	Specifications	Cost (LVL)	Type
1. Tourist Information Building	Reception and Information, office room, exhibition room & carpark	Lubana town	Renovation of old building, Wooden structure w/ heating & septic tank	108,800	B, C
2. Lodge	Accommodation lodge, Sauna & carpark	Lubana town	Local wooden structure, heating & flush toilet	54,800	B, C
3. Canoe house	Canoe house w/ carpark & pier	Lubana town	Wooden structure w/shower & flush toilet	11,500	B, C
4. Canoe station	Signpost and simple pier	Jaunpededze canal	Wooden simple structure,	600	B
5. Camping site	Camping site (2 sites)	Lubana town,and Jaunpededze canal	Drainage, toilet	40,000	C
6. Information board	Indicating guide route map, instruction,	refer to Fig.14.3.5	wooden board with posts written in Latvian & English	2,800	B
7. Sign post	Indicating site characteristic	refer to Fig.14.3.5	Metal board with wooden post, written in Latvian & English	600	B
8. Equipment	(1) Vehicle	Tourist information building in Lubana	a) 4WD (5 passengers)	20,000	E
			b) Pick-up (1 ton)	10,000	E
	(2) Canoe & canoe trailer		w/paddle, life jacket	7,000	E
	(4) Boat & boat trailer		Row boat w/paddle	4,600	E
	(6) Bicycle		Cycling bicycle	1,800	E
	(7) Camera,		w/ slide projector	3,000	E
	(8) Video camera		8 mm video w/ monitor	3,000	E
	(9) Dummy		Full size dummy for exhibition	6,000	E
	(10) Archeological equipment		Shovel, scoop, covering sheet, hoist	3,000	E
	(10) Personal computer		Server & monitor	1,500	E
	Subtotal			59,900	
Total				279,000	

Note : B=building, C=civil works, E=equipment

Table 9.3.1 Evaluation of Eco-tourism and Green Record

Types	No.	Evaluation Items	Seasons				Places							Criteria							Objectives						Evaluators			Evaluation Targets						Note
			spring	summer	autumn	winter	Gaigalava	Nagli	Berzpils	Lubana Town	Indrani	Daukstu	in and around LWC	wilderness and naturalness	uniqueness	reasonable fee	services	knowledge level	appropriateness	sustainability	environmental protection	culture preservation	green credentials	eco-tourism needs finding	education	tourists	EMC or REBs	eco-tourism association	EMC/REBs	eco-tourism association	townships	developers/ operators	guides	hosts	
Eco-tourism Activities	1	boating and anglisng along the Aiviekste		x	x					x	x					x	x							x							x	x		piers construction are necessary
	2	taking saunas and cottages	x	x	x	x				x	x					x	x						x		x							x		x	accomodation improvements
	3	beautiful inundation	x								x			x	x	x	x						x		x							x	x		only during inundation period
	4	watching rare broad-leaved forests										x		x		x	x						x		x							x	x		bogs, broad-leaved forests, inundated grasslands
	5	canoeing along the Pededze	x	x	x						x	x		x	x	x	x				x		x		x	x						x	x		in the Pededze and the Aiviekste
	6	archeological experience	x	x	x	x					x				x	x	x					x	x	x	x						x		x		unique experience with the staff of EMC
	7	horse trekking	x	x	x			x								x	x						x		x							x	x		potential in Gaigalava
	8	walking around Teirumniku bog	x	x	x	x		x							x	x	x				x			x	x	x	x						x	x		educational resource
	9	boating along the Idena canal		x	x			x						x		x	x							x		x							x	x		in Lake Lubana
	10	camping		x	x			x								x	x							x		x							x	x		along the Idena canal
	11	youth hostel	x	x	x	x		x							x	x	x							x	x	x							x		x	provides beautiful scenery
	12	bird-watching in Orenisi	x			x		x						x	x	x	x				x			x	x	x	x						x	x		bird-watching from tower
	13	bird-watching in Kvapani and Gomelis	x			x	x							x	x	x	x				x			x	x	x	x						x	x		mainly in Gomelis, Kvapani, Idena, Nagli
	14	campfire and sports activities	x	x	x		x									x	x							x		x							x		x	affiliated attraction
	15	swimming in Lake Lubana		x			x									x	x							x		x							x		x	water quality monitoring necessary in Lake Lubana
	16	angling in the fishponds		x	x	x	x	x								x	x							x		x							x			angling licenses necessary
	17	habitat management	x	x	x	x	x	x							x	x	x				x			x	x	x			x							unique experience with the staff of EMC
	18	animal-watching		x	x		x	x						x	x	x	x							x		x	x						x	x		courtship of experienced guides necessary
	19	hunting			x	x							x	x		x	x							x		x	x						x	x		hunting licenses necessary
	20	balloon adventure	x	x	x	x							x		x	x	x							x		x							x			scenery over LWC is wonderful
	21	agriculture experience		x	x								x			x	x							x		x							x			cranberry, strowberry
	22	stork watching	x	x									x			x	x							x		x							x	x		whilte storks are rich
	23	visiting nature museum	x	x	x	x							x			x	x							x	x	x	x							x	x	voluntarily operated in Vilani
Knowledge	24	sustainable development																x					x			x							x	x		priority issue in green credentials
	25	eco-tourism resources																x					x			x				x	x	x	x	x		necessity to protect the nature
	26	green records																x					x			x				x	x	x	x	x		role of green records
	27	safety issues																x					x			x				x	x	x	x	x		increase safety knowledge
	28	natural history of LWC																x					x			x				x	x	x	x	x		wetland formation and habitat
	29	cultural history of LWC																x				x	x			x				x	x	x	x	x		archeology and inundation control
	30	financial sustainability																x								x				x	x	x		x		management issue
Habitat Management	31	biological carrying capacity improvements																x	x	x	x		x			x			x							to increase eco-tourism resources
	32	conservation measures																x	x	x	x		x			x			x							both for fauna and flora
	33	grass-cutting and burning																x	x	x	x		x			x			x							to increase habitats for birds
	34	artificial islands																x	x	x	x		x			x			x							to increase habitats for birds
	35	water level management																x	x	x	x		x			x			x							to increase habitats for birds
	36	predator control																x	x	x	x		x			x			x							to increase habitats for birds
Visitor Management	37	nature protection territories and zoning																x	x	x	x		x			x			x							main nature protection activities
	38	regulations and prohibited/restricted activities																x	x	x	x		x			x			x							appropriateness of regulations is a hot issue
	39	improvement of physical carrying capacity																x	x	x	x		x				x			x	x					number of accomodations, facilities
	40	social/cultural carrying capacity improvements																x	x	x	x	x	x				x			x	x					local capacity to accept tourists
	41	wastewater management																x	x	x	x		x				x					x		x		to avoid pollution
	42	solid waste management (recycling)																x	x	x	x		x				x					x		x		to avoid pollution

Note) relevant item is marked with "x".

Table 9.3.2 Eco-tourism Training / Education Programs

Classification	No.	Eco-tourism Training/Education Programs	Target					Qualification	Program Duration					Responsible Organizations					Fee Range (per participant)				Note
			developers /operators	guides	hosts	technical staff (IT)	accountants	program required to be taken in advance	a few hours	one day	a few days	one week	more than 1 week	EMC	Eco-tourism associations	Town/Townships	District Councils	Madona and Rezekne REBs	free	0-1 LVL	1-5 LVL	5-10 LVL	
Basics	1	sustainable development	x	x	x	x	x		x					x					x				key theme of eco-tourism development
	2	confidence, self-independence, and optimism	x	x	x	x	x		x						x				x				to change negative way of thinking
	3	entrepreneurship	x		x				x						x				x				basis for management and marketing
	4	collaboration and association	x	x	x	x	x		x						x				x				basis for networking
	5	necessity of evaluation and green credentials	x	x	x	x	x		x					x					x				basis for green records
	6	ethical principles	x	x	x	x	x		x					x					x				
Eco-tourism Activities	7	eco-tourism resources and activities	x	x	x				x					x					x				overall picture of LWC
	8	hunting in LWC	x	x	x			7	x					x							x		seasons, places, game animals and birds, licenses
	9	fishing in LWC	x	x	x			7	x					x							x		seasons, places, typical fish species
	10	bird- and animal- watching	x	x	x			7	x					x					x				seasons, places, bird species
	11	rare vegetation in LWC	x	x	x			7	x					x					x				Teirumniku, Berzpils bogs, broad-leaved forests
	12	canoeing and horse trekking	x	x	x			7	x					x					x				the Abora, Zvidze settlements
Management	13	management of eco-tourism	x					3		x				x	x				x				general guidance
	14	necessary facilities and planning	x					7		x					x					x			using GIS
	15	green records	x	x	x	x	x	5		x				x					x				using IT
	16	networking of eco-tourism businesses	x		x	x		4		x					x				x				using IT
	17	eco-tourism planning scheme	x								x			x							x		refer to Figure
Services	18	services and hospitality	x	x	x						x				x				x				food, accommodations, transportation
	19	communication skills		x	x							x			x						x		kindness and openness to tourists
	20	language skills (English, German)		x	x	x		19					x		x							x	prerequisite to attract foreign tourists
	21	safety issues		x	x				x						x				x				medicine, hunting, boating, hiking
	22	natural and cultural history of LWC		x	x					x				x					x				
	23	folk songs and dances		x	x							x			x						x		folk songs and dances
marketing	24	marketing methodologies	x			x		3		x				x	x					x			overall guidance on marketing
	25	information technologies for eco-tourism (computer skills)				x		16			x			x							x		IT usage
	26	advertisement and booking				x		16			x			x							x		IT usage
	27	eco-tourism in Estonia	x			x			x						x				x				useful reference of Estonian examples
	28	transportation improvements	x					4	x							x	x		x				necessity of collaboration and association
Finance	29	book-keeping					x					x			x						x		focused on tax incentives
	30	loan management	x				x					x			x	x	x				x		available loans, procedures, interest rates
	31	financial sustainability	x				x		x					x					x				how to get financial sustainability
Nature Protection	32	physical carrying capacity	x	x				1	x					x					x				number of tourists, facilities, activities
	33	biological carrying capacity	x	x				1	x					x					x				to avoid over hunting and fishing
	34	social/cultural carrying capacity	x	x				1	x					x					x				local capacity to accept tourists
	35	conservation measures	x	x				1	x					x				x	x				two types of conservation
	36	habitat management	x	x				1	x					x				x	x				to increase biological carrying capacity
	37	visitor management	x	x				1	x					x				x	x				to increase social/cultural carrying capacity
	38	zoning and regulations/restrictions	x	x				1		x				x				x	x				prohibited activities
	39	wastewater management	x		x			5		x								x	x				appropriate treatment of wastewater
	40	solid waste management	x		x			5		x								x	x				recycling, waste collection
	41	honorary guests of LWC	x		x				x					x		x			x				collaboration with townships

Note) relevant item is marked with "x".

1. Bird Watching in Kvapani

- Eco-tourists can enjoy bird watching at the top of the building located in the Kvapani fishpond (left).
- The best season is from March to the beginning of May (right).
- Accommodation can be provided.

2. Bird Watching

- In the middle of the Orenisi fishpond, a bird watching tower can be constructed (left).
- Building cottage and sauna is possible if the private landowner agrees.

3. Stork-watching

- Storks which make their nests close to human houses are quite popular in Latvia (left and right).
- LWC is rich in white stork and scarce in black stork.

4. Animal-watching

- Beavers are watched at night in Nagli.
- Otters' habitats are rich in LWC.
- Roe deer, red deer, elk, wolf, lynx, fox, wild boar can be seen (left and right).
- Coordination with hunters is necessary.
- Hunting seasons should be avoided.

5. Watching Rare Broad-leaved Forests

- English oak, black alder, birch can be seen near Upesmala (left).
- Big trees can be seen along the Pededze river (right).

Figure 9.2.1 (1) Eco-tourism Resources and Activities

6. Walking around Teirumniku Bog

- Floating bog is unique enough to be an educational resource (left).
- Boardwalks should be carefully arranged to prevent visitors from damaging bogs (right).
- Nature School can be located near this Bog.

7. Beautiful Inundation

- The inundated area in LWC is quite unique and provide a potential eco-tourism resource in spring.
- Indrani has an access point to see the only vast inundation area in Latvia.
- Motor boats are allowed with permission.

8. Canoeing along the Pededze

- Wild scenery is found along the Pededze river (left).
- Beaver dams can be seen along the Pededze river (right).
- No motor engine may be used in order not to disturb the nature.

9. Canoeing and Boating

- A Canoe/boat station can be located at the beginning of the Idena canal (left).
- Eco-tourists can enjoy wilderness and hear birds singing along the canal (right).
- A house for hunters and anglers is located at the end of the canoeing route.

10. Boating and Angling along the Aiviekste

- Piers construction is necessary along the Aiviekste.
- Boats can be used as transportation for sauna and cottage (left).
- Angling is popular along the Aiviekste.

Figure 9.2.1 (2) Eco-tourism Resource and Activities

11. Camping along the Idena canal

- Camping places can be found along the Idena canal (left).
- Combined with boating and canoeing, summer camp is suitable.
- The water quality of the Idena canal should be improved.

12. Camping and Sports Activities

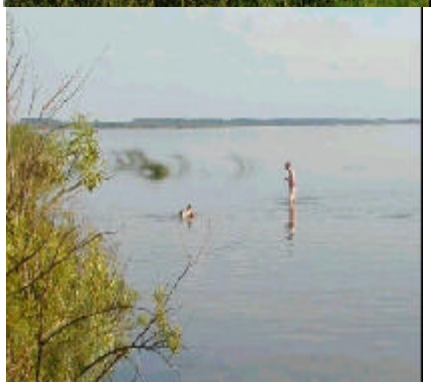
- Next to the Kvapani fishpond, the place for campfire is provided (left).
- Several sports activities including volleyball, badminton are popular.
- Staying in a cottage for hunters/bird-watchers is an exotic experience (right).

13. Lodge in Orenisi

- The orenisi fishpond provides one of the most beautiful sceneries in LWC (left).
- Construction of a lodge is recommended.

14. Swiming in Lake Lubana

- A beach full of white granular sand is located in the northeast coast of Lake Lubana (left).
- Water quality should be regularly monitored during the summer season.
- Parking space (for 20 cars) can be placed near the beach.



15. Angling

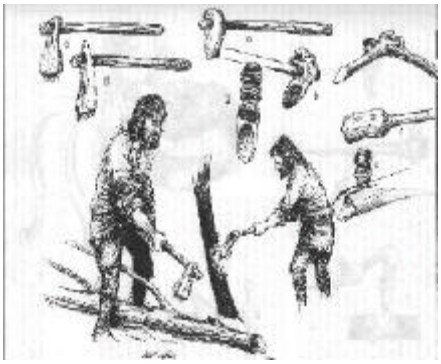
- Pike and pikeperch are available in and around Lake Lubana (left).
- Winter fishing is very popular in Lake Lubana (right).
- Accommodation and proper fish resource management are necessary.

Figure 9.2.1 (3) Eco-tourism Resource and Activities

16.Taking Sauna and Cottage

-Along the Aiviekste, there are several saunas (left).

- Unique cottages can be tourists' attraction in Indrani (right).
- Holiday and summer houses can be operated by the local people.



17. Archeological Experience

- Mesolithic (B.C. 7700-4500) period in the Zvidze settlement (left).
- The Abora settlement is famous for Neolithic (B.C. 4500-1500).
- Making poultry can be an attraction for eco-tourists in reconstructed ancient buildings (right).

18. Museum of Nature

- Animals living in and around LWC are exhibited in a private museum in Varaklani (left and right).
- The museum has an educational value for schoolchildren.
- The exhibition makes bird-watching more interesting.

19. Agriculture Experience

- Cranberry picking is popular in wetlands (left).
- Dairy can provide wonderful experience for children (right).
- Organic agriculture is an attraction for urban dwellers.

20. Experience in Habitat Management

- Burning grasslands is one way of habitat management to increase the number of rare birds (left).
- Visiting EMC and discussions with its staff expands visitors' knowledge.
- Information Sheet of Ramsar provides knowledge enlargement chance (right).

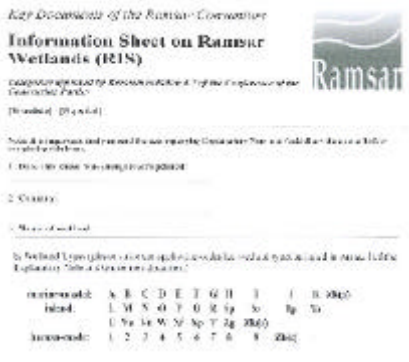


Figure 9.2.1 (4) Eco-tourism Resource and Activities

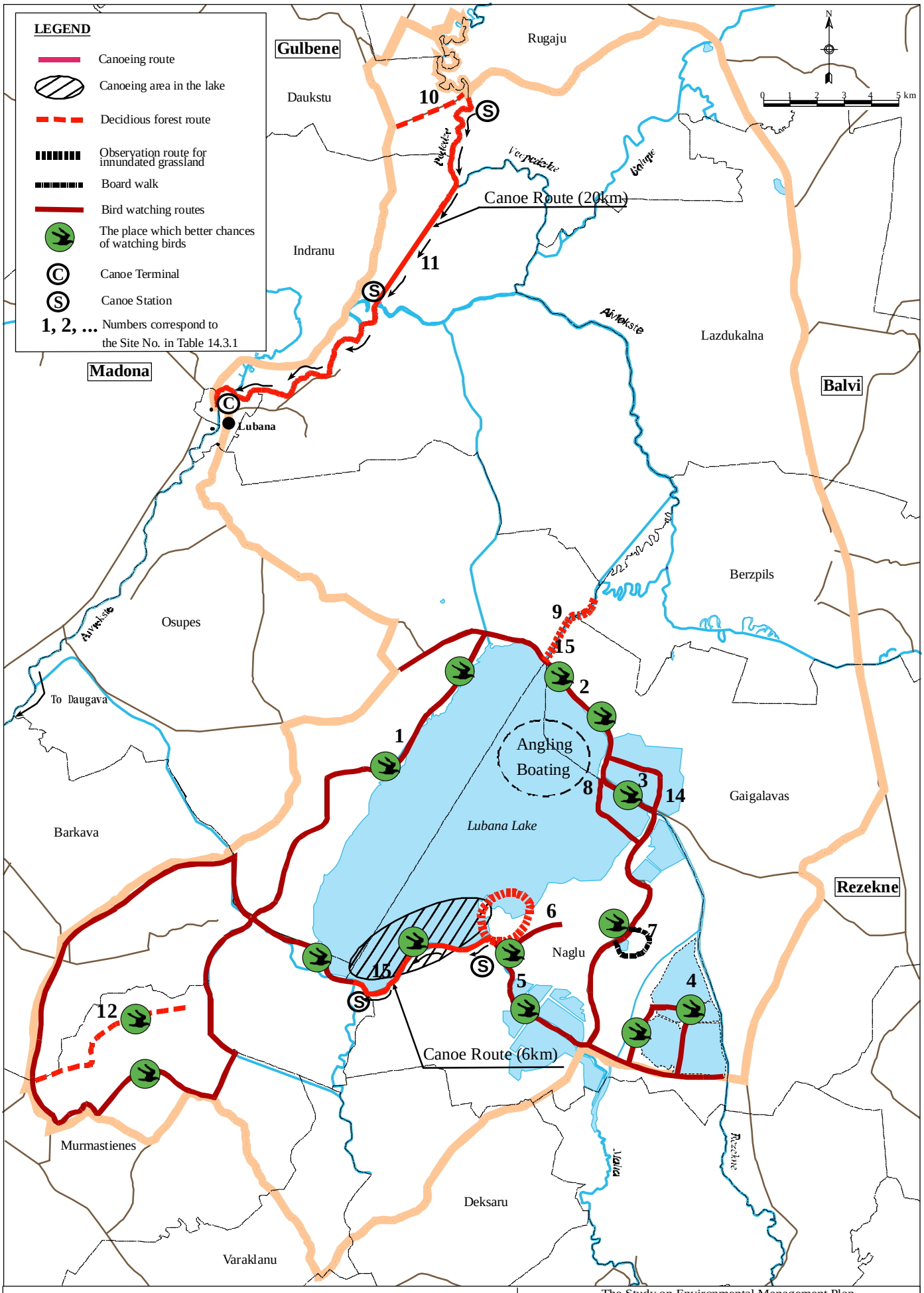


Figure 9.2.2 Proposed Eco-Tourism Activities

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

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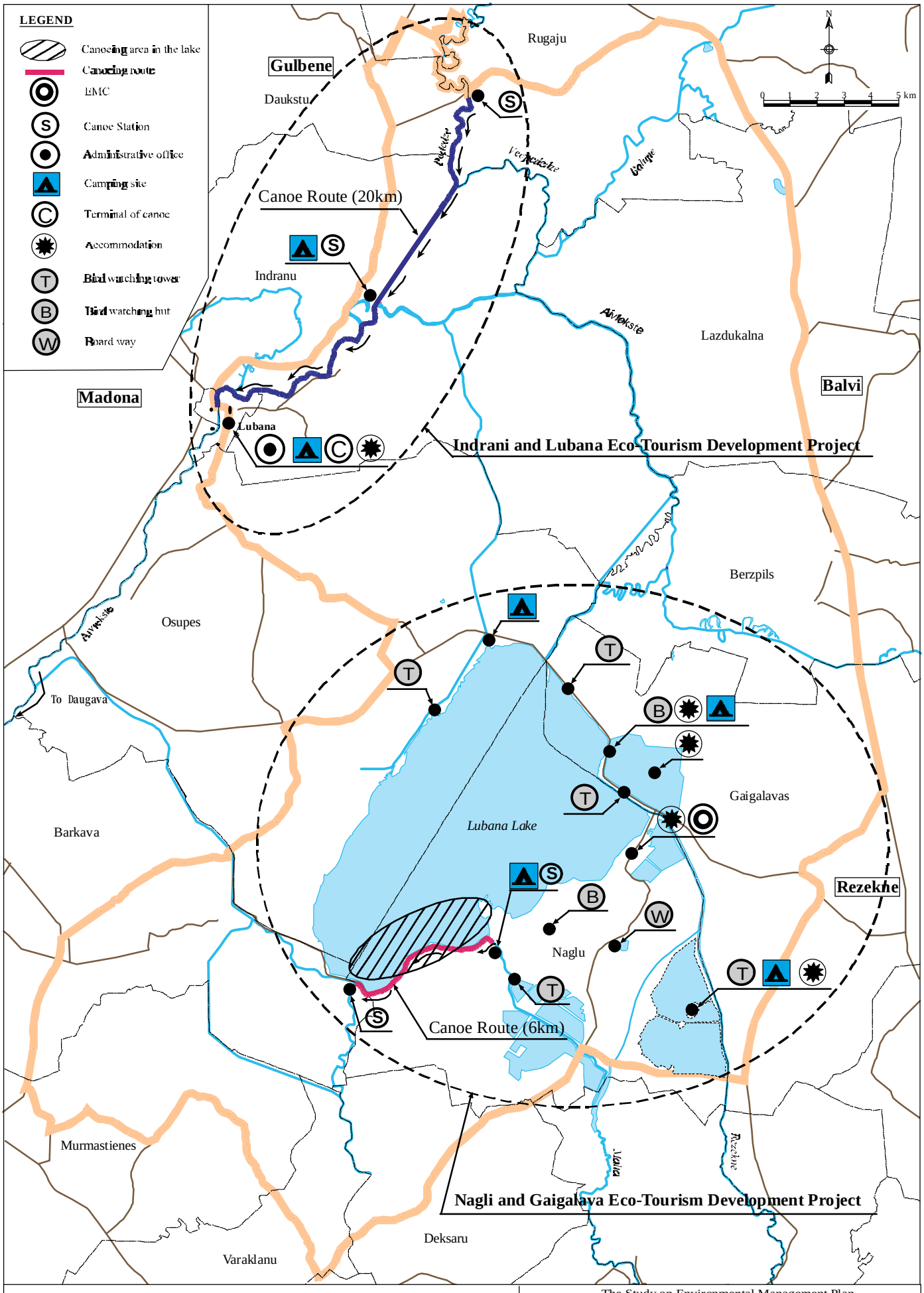

Figure 9.2.3 Proposed Eco-Tourism Development Project

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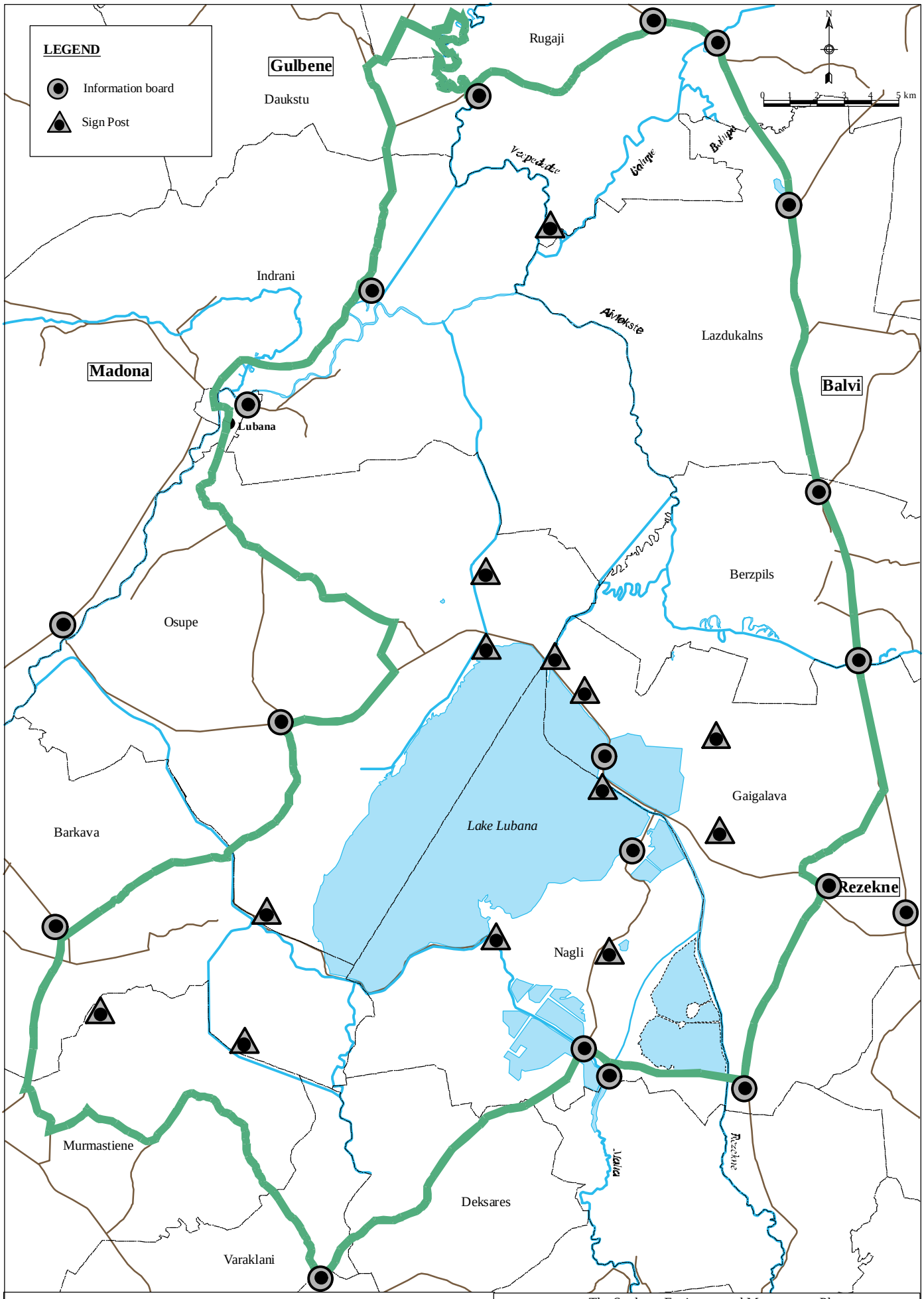

Figure 9.2.4 Location of Information Board & Sign Post

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

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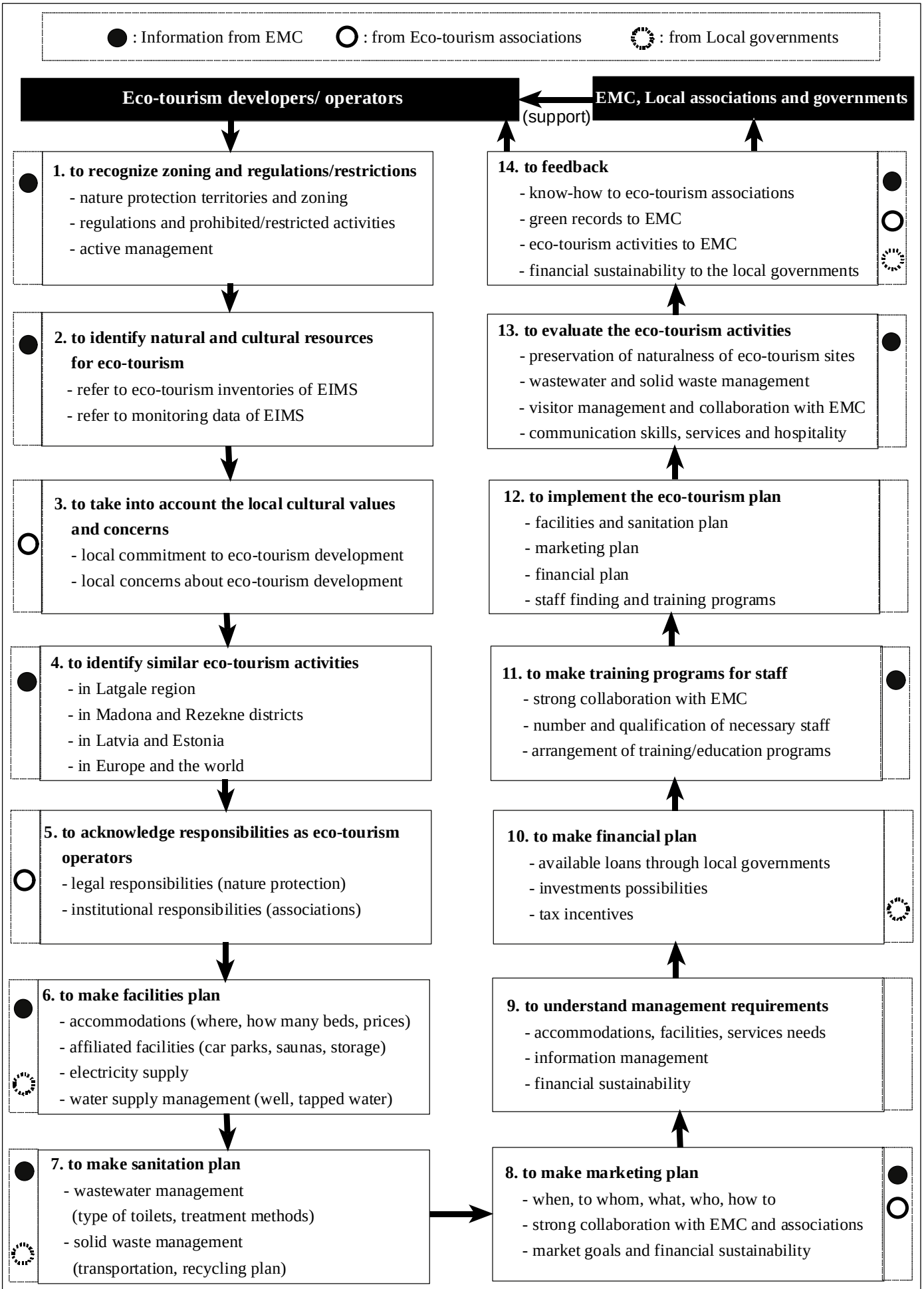
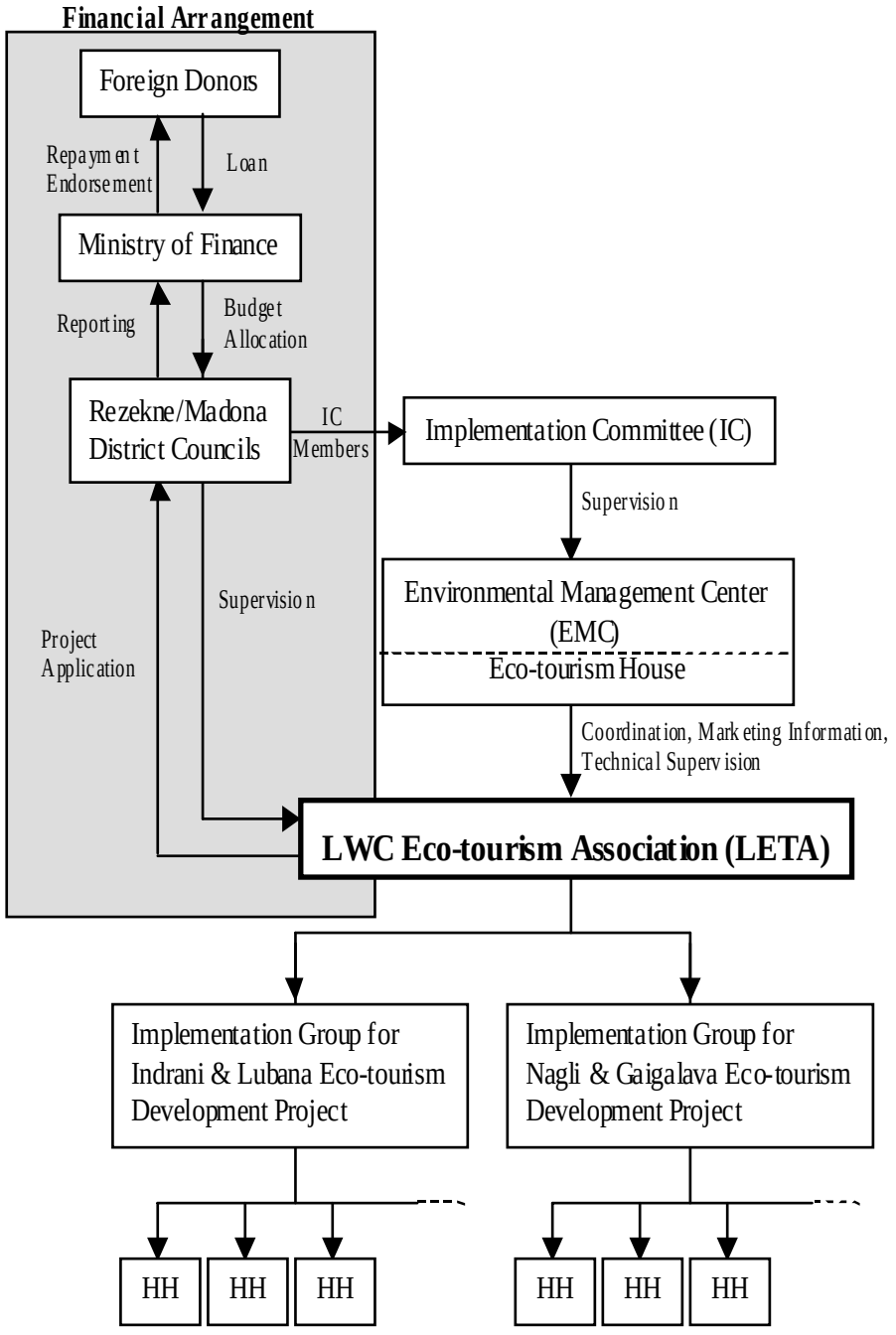


Figure 9.3.1 Eco-tourism Planning and Implementation Scheme



Note: HH - Local Household such as farmers, foresters, and fishermen

Figure 9.4.1 Organizational Structure and Financial Procedure for Eco-tourism Development in LWC

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

JAPAN INTERNATIONAL COOPERATION AGENCY

CHAPTER 10

CHAPTER 10 WATER LEVEL MANAGEMENT PLAN

10.1 Hydrology and Water Level Control

10.1.1 Hydrological Analysis

The Pededze, Balupe, Liede, Piestina, and Ica are major rivers that flow into LWC from the northern wetland. The Malta and Rezekne rivers flow into Lake Lubana directly and the Aiviekste originates from Lake Lubana. The Teici, Liesina, and other small rivers from southern wetland flow into the Aiviekste river at the outside area of LWC through the Meirani canal. The area rainfall is converted into these river discharges in the hydrology analysis.

(1) Rainfall analysis

The data recorded at the meteorological station in a river basin cannot be applied to the whole basin as it is. In case a meteorological station is far from a region in a basin, it is suitable to use the data recorded at a near station located in an outside basin for estimate of rainfall amount in a region. Therefore, rainfall amount in a basin is calculated as an average rainfall corresponding to the commanding areas' ratio between two or more stations.

The Thiessen polygon method as a common method is applied for the estimate of average rainfall. The determined Thiessen polygon and each ratio (weight factor) to calculate the average rainfall are illustrated in Figure 10.1.1.

The correlation between rainfall and the river discharge is low especially in summer and autumn seasons. The observed data shows that a single storm rainfall event with rather big amount of around 40 mm/day does not always cause a rise of a river water level. As one of the causes, it is considered that the flat topographic condition and a lot of lakes with various sizes mitigate a runoff by a storm rainfall.

(2) Selection of a runoff analysis technique

Various kinds of runoff analysis techniques have been developed. A suitable technique for the runoff analysis, which uses the daily records, is a series tank model method. In the study area, available records for the runoff analysis are rainfall, air temperature, evaporation, river discharge and water level, which are observed on a daily basis. The series tank model prepares the hydrograph to each river and forecasts the size of spring flood caused by snowmelt.

Estimation of snowmelt is crucial for prediction of discharge in the spring flood season. In this study, an empirical equation shown below is adopted considering the meteorological elements such as average temperatures and precipitation.

$$V = m^* Ti + Ti * Pi / 80$$

Where V : daily snowmelt in depth (mm)
m : constant
Ti : average daily temperature(°C)
Pi : daily precipitation (mm)

(Reference: Technical Standard of Investigation for River Improvement and Erosion Control, Japan River Association/Ministry of Construction of Japan, 1986)

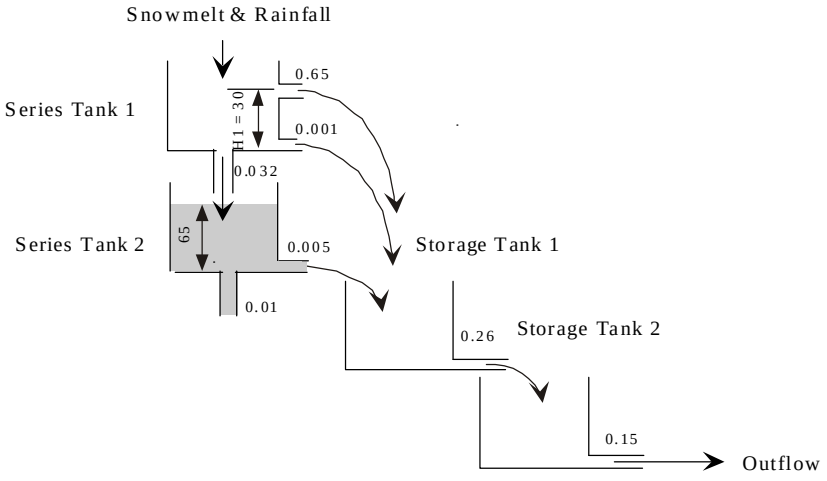
Constant ‘m’ is decided on a trial basis to match the date of actual snow disappearance to the date of that in the calculation. The constant "m" takes the value ranging from 3 to 6, which is affected by the meteorological condition of each year. Average constant ‘m’ in each meteorological station is summarized below.

Average Constant ‘m’

Meteorological Stataion	Estimated Average constant 'm'
Aluksne	4.5
Gulbene	4
Rezekne	4.5
Dagda	5
Zilani	5

(3) Serial tank model for the northern wetland

The discharge data is available only in the Pededze river in the northern wetland. Therefore, the established tank model of the Pededze river is applied to all the rivers in the northern wetland because of lack of data on the other rivers. The rivers in this region show different runoff characteristics every year with a fluctuation of runoff volume, in addition to a seasonal fluctuation of runoff ratio. That is, the year with a lot of river discharge has a tendency of a high runoff ratio and the year with little river discharge has a tendency of a low runoff ratio. Since the analysis of flood water level is important in this study, using meteorological and hydrologic data of three years from 1985 to 1987, which shows relatively high runoff ratio, forms the model. The coefficients of the model are decided by the trial and error method with repeated calculation as shown below.

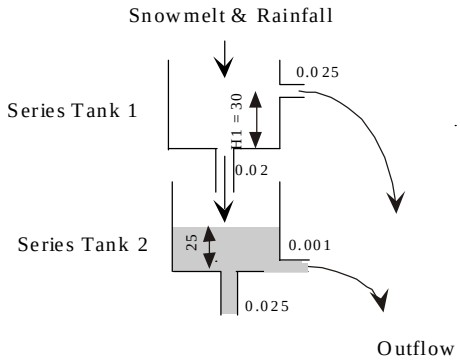


Tank Model for Northern Wetland

(4) Serial tank model for Lake Lubana and southern wetland

The gauging records are not available from the rivers in the southern wetland except for the Rezekne river. Therefore, the southern model is simulated by using the data of the Rezekne river of the same observation period of three years from 1985 to 1987 as the northern model. This model is applied to the runoff forecasting of the Teici and Malta rivers. However, applying the model to the rivers without a lake may result in an inaccurate forecasting of the runoff.

Since Lake Razna is located in the upper reaches of the Rezekne river, the runoff of the river is delayed by the discharge adjustment function of the lake. Applying the model of the Rezekne river to the Teici and Malta rivers basins without a lake may result in an inaccurate forecasting of the runoff in spring season. The coefficients of the southern model are as shown below.



Tank Model for Lake Lubana/Southern Wetland

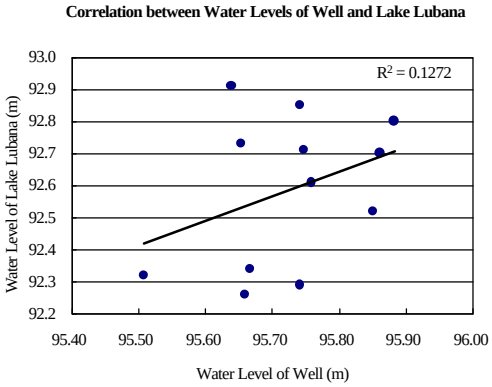
(5) Groundwater level

There is no station for groundwater level monitoring in and around the study area. A few farmers had observed the groundwater level privately near the lake before constructing the dyke system in the northern part of Lake Lubana, but the records were lost. Therefore, a groundwater level was measured using an electronic self-recording type measuring device from November 11, 1999 to May 24, 2000, in order to examine the influence of water level change in Lake Lubana on the surrounding areas. One existing well in a farmland near the western lakefront was selected for the measurement.

The influence of water level change is examined by making a comparison between the water level records of groundwater and the lake. The figure below shows the correlation between 10-day average of groundwater and the lake water levels.

Water Level Record of Every 10 Days' Average

	Well	Lake
Jan.1	95.66	92.26
Jan.2	95.74	92.29
Jan.3	95.51	92.32
Feb.1	95.67	92.34
Feb.2	95.85	92.52
Feb.3	95.76	92.61
Mar.1	95.65	92.73
Mar.2	95.88	92.80
Mar.3	95.86	92.70
Apr.1	95.75	92.71
Apr.2	95.74	92.85
Apr.3	95.64	92.91



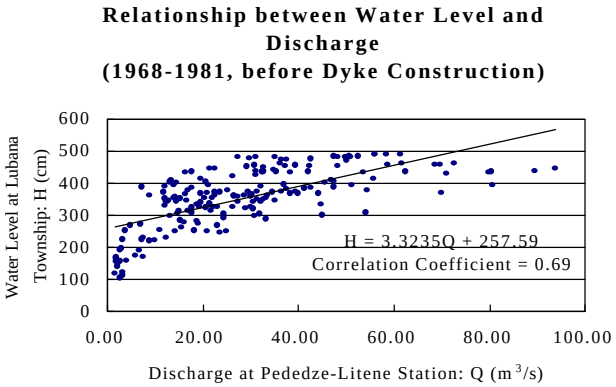
As shown in this figure, it is concluded that there is no relation between the lake water level and the groundwater level. A possible reason for this is that the drainage canal, which lies between the lake and farmland, collects infiltration water from the lake and consequently the lake water level does not influence the groundwater level.

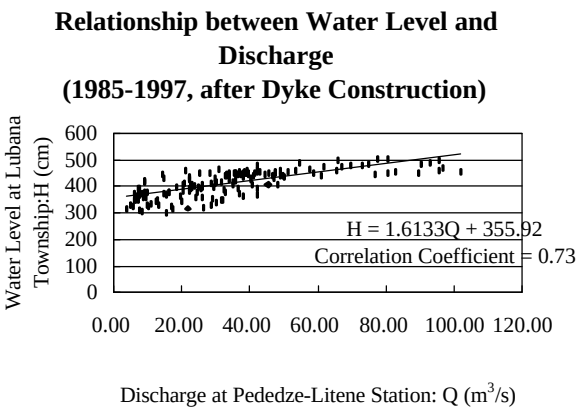
10.1.2 Effectiveness Verification of Dyke System against Flooding

Before the flood analysis with the selected flooding scales, effectiveness of the existing dyke system surrounding Lake Lubana, especially for the northern dyke system, is examined herewith considering relationship between the water level at Aiviekste-Lubana (Lubana town) and the inflow volume to the northern wetland. The flood water level at Lubana town after the dyke construction has been assumed to be decreased because the dyke is effective on the flood mitigation. For the verification of the assumption, the next data are studied:

- Flood discharge data : Pededze-Litene station
- Water level data : Aiviekste-Lubana

Data in the period of 1982-1983 is excluded to avoid the influence by the dyke construction works. The time lag until the water at Pededze-Litene influences the water level at Aiviekste-Lubana is considered. The correlation between discharge and water level is examined and illustrated in the following figures. The correlation coefficient between two data in each case is about 0.7.





The following table calculates the water level corresponding to each discharge with certain probability by using the above-mentioned equations. As shown in the table, water level that corresponds to a certain discharge decreased by 4 to 158 cm after the dyke construction. Figures 10.1.2 and 10.1.3 are the simulation results in flood scale of once per 100-year with and without the northern dyke, respectively. They show that Lubana town and some agricultural lands are severely damaged by flooding without the northern dyke. The northern dyke system surely contributes to the flood mitigation. The proposed Water Level Management Plan therefore regards the existing dyke system as an essential condition.

Water level to Each Discharge with Statistical Probability under Before and After Dyke Construction Conditions

Item	Equation	Probable Discharge : Pededze-Litene				
		Once2-year	Once 5-year	Once 10-year	Once 50-year	Once 100-year
		60 m^3/s	86 m^3/s	103 m^3/s	140 m^3/s	150 m^3/s
Before Construction	H =3.3xQ +257.6	456 cm	541 cm	598 cm	720 cm	756 cm
After Construction	H=1.6xQ +355.9	452 cm	493 cm	521 cm	580 cm	598 cm
Effect on flood mitigation by dyke		4 cm	48 cm	77 cm	140 cm	158 cm

10.1.3 Flood Analysis and Flood Damages

(1) Spring flood

A spring flood event usually starts in April and continues for several weeks unlike a flood by a storm. For the environmental conservation in LWC, the hydrological study for a prediction of the duration and the inundated water depth caused by a spring flood is more important than the peak flood analysis in summer and autumn seasons.

The flood situation was greatly mitigated in LWC after construction of the flood prevention facilities done from the 1950s to the beginning of the 1980s. Therefore, it is necessary to analyze flood scale in LWC based on the river discharge and water level records collected around LWC after 1983. The scale can be decided based on the maximum discharge of the inflow rivers, the maximum water level of Lake Lubana, and the total river discharge during flood rising period. However, these values are not necessarily corresponding with each other, because a flood continues for several weeks, and the water levels in the lake can be managed during the flood period.

(2) Floods in Summer and Autumn

It is said that the flood damages sometimes occur in summer or autumn. In 1998, the flood damage was also reported in the summer. However, there are no recorded flood damage data such as inundated area. As long as the river discharge data showed, the high water levels like the spring flood did not occur. There is a possibility that summer or autumn floods occur by different mechanism from spring floods.

On the other hand, the 5-day rainfall event in the summer of 1998 was an occurrence level of once per 10-year. There was a possibility that rain caused a regional water logging

problem. Consequently, summer-autumn flood is a problem of poor drainage facilities rather than a flood problem.

Statistical Analysis of 5-day Rainfall Events

Probability	Rezekne 1998=69.8mm	
	Log Piason III	Gumbel
1/50	82.9mm	87.4mm
1/25	77.1mm	78.2mm
1/20	75.2mm	75.3mm
1/10	69.1mm	71.1mm
1/5	22.9mm	63.7mm
1/2	52.5mm	52.6mm

Source: Rainfall data from 1968 to 1998, State Meteo-Hydrological Agency

10.1.4 Historical Review of Water Level Control Methods and Facilities

Many efforts against flood problems in LWC started in the 19th century. However, it was necessary to wait until the 1950s for the comprehensive flood control measures. In the middle of the 1950s, a comprehensive flood protection plan was formulated in order to protect the lands from inundation and to reduce the inundation periods. In line with these principles, the construction works started in the middle of the 1950s.

First Stage in the 1950s:

The 25 km-length Meirani canal with dykes and sluices was constructed. After the construction of the canal, flood flows from the small rivers in the southern area were diverted directly into the Aiviekste river through the Meirani canal.

Second Stage in the 1960s:

During this stage, the 15 km-length Zvidzinenas canal with dykes was constructed in the western part of Lake Lubana to protect agricultural lands of 9,800 ha.

Third Stage from 1965 to 1967:

In this stage, the 21 km-length Idena canal with sluices, the southeastern protection dyke system, the Malta-Rezekne canal, and the riverbanks along the Rezekne and the Malta rivers were constructed. These systems were designed to protect the area of 8,100 ha.

Fourth Stage in the 1980s:

In the 1980s, the dyke system on the northern edge of Lake Lubana and the sluice way were constructed to control water levels in the lake. In addition, dredging of the Pededze lower reaches of 9.7 km in length was executed. After construction of the dyke system, the inundation duration in the northern part of the wetland decreased. Main features of these facilities and Lake Lubana are tabulated in Table 10.1.1. and the locations are shown in Figure 10.1.4.

10.1.5 Current Water Level Control and Constraints

(1) Current water level control of Lake Lubana

The Aiviekste Land Reclamation System Administration (ALRSA) is responsible for operation and maintenance of water level control facilities in the study area except a sluice near Nagli village. The Nagli state fish firm operates the Nagli sluice. ALRSA with 63 staffs maintains the drainage facilities in Madona district including LWC. ALRSA operates the two sluices in the dykes of Lake Lubana according to the gate operation rules. The organization chart of the gate operation is illustrated in Figure 10.1.5.

(2) Operation rules for Lake Lubana

The first operation rule was prepared and officially approved in 1983. In 1989, the Institute of Biology evaluated influence of the reclamation activities on the ecology system in Lubana wetland. As a result of the evaluation, the necessity of revision of the first operation rule was recognized.

In 1992, ALRSA started review work and concluded with the "Lake Lubana Hydro-technical Building Operation Rule, Revised". The revised operation rule was approved and the operation activities based on this rule have been continued since August 1993.

In the rule, water level at the beginning of the spring flood is to be kept at the level of 91.20m when the extreme flood with total volume of 2×10^8 m^3 or more is forecasted. For this operation, the hydro-meteorological agency is scheduled to warn ALRSA about the possible flood with the forecasting period from February 1 to the end of spring floods. In addition, there is a regulation about special discharge for the northern wetland in the low water period. When the water level in the northern wetland becomes less than 91.20m, the clause 3.3.2 of the rule guarantees the water amount of $1.5 m^3/s$ for conservation of eco-system in the wetland.

(3) Operation rule of intake structure on the Malta river

The intake structure on the Malta River at Nagli was constructed in 1963, and the current operation rule titled "Exploitation rule of water-reservoir on the Malta river" has been applied since 1989. The intake structure consists of a weir with two water level controlling gates, intake gates, dykes on the Malta riversides, and a cross drain structure under the riverbed of the Malta river which was constructed for the drainage of the Rezekne river. The Reservoir exploitation service is the responsible organization of which the staffs are the technical staffs of the Nagli fish farm.

(4) Actual management in Lake Lubana

The water levels of Lake Lubana and the opening heights at both sites of both the Aiviekste and Kalnagala gates have been recorded since 1983. Judging from the records, ALRSA operates the gates according to the operation rule. However, the water levels in winter season have been kept rather higher levels ranging from 91.7m to 92.2m as shown

in Figure 10.1.6. These higher water levels than rules' levels have been kept to reply to strong demands from fishermen in the lake.

(5) Actual operation of the gate on the Malta river

The actual operation can not be clarified because the exploitation service, which is the "Nagli fish farm" actually, has not recorded the water levels. According to the inquiry survey to the responsible person of the Nagli fish farm, the service operates properly the gates based on the operation rule.

10.1.6 Constraints on Water Level Control

(1) Deterioration and breakdown of water level control facilities

a) Aiviekste sluice

The sluice is constructed in 1981 in order to control outflow from Lake Lubana. This sluice structure with three fixed wheel type gates needs frequent repair because of its inadequate structural design, insufficient quality of guide frame materials, irregular bottom elevation of a culvert portion, and scouring of the downstream apron.

b) Meiranu sluice

This sluice has a hinged type gate installed in the 1950s. Although the gate can still work, the gate leaf changes its shapes and the concrete structures such as an operation deck, side walls and transition walls are seriously deteriorated.

(2) High water level in the Aiviekste river in spring

The water level of the Aiviekste river rises above the water level of the lake for a certain period. Therefore, drain from the lake is obstructed, which invites the rise of the water level of the lake.

(3) Requirements from fishery sector

Although the operation rules stipulate the water level in winter season, the operation records show that the water levels were not decreased below 91.75m to meet the request from fishermen. Such a high water level of more than 92.00m may cause dyke breakdown by an expected extreme flood.

(4) Poor data information system for water level control

To predict a spring flood scale, meteorological data is inevitable. However, the required data cannot be collected appropriately, because of a delay in preparation of digitized data and poor communication between the organizations concerned.

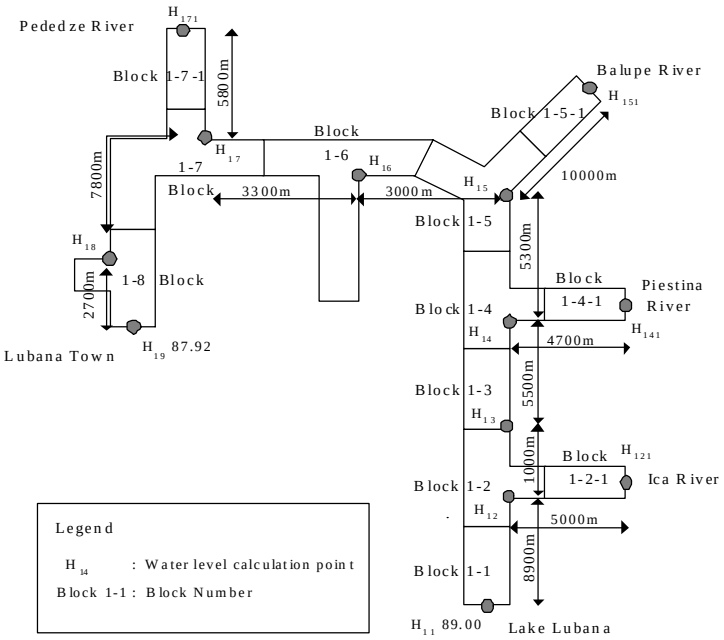
10.1.7 Water Level Simulation Model

(1) River and drainage system for water level simulation

The river and drainage system in the LWC is divided into three subsystems from the viewpoint of water level simulation. There are the northern wetland system, the Lake Lubana system and the southwestern wetland system (see Figure 10.1.7).

(2) Northern wetland system model

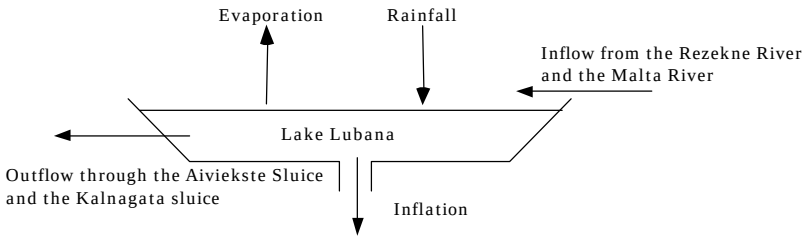
The model for the inundation analysis is made for the section from the Aiviekste river source to Lubana town on the Aiviekste riverbank. In this model, the study area is divided into 12 blocks. The water level for a certain discharge in one block is calculated using the uniform flow or non-uniform flow formulas in order to correspond to the water levels in upstream and downstream blocks. The schematic drawing which shows the relations among blocks is as shown below.



Schematic Diagram of Blocks in the Northern Wetland

(3) Lake Lubana system model

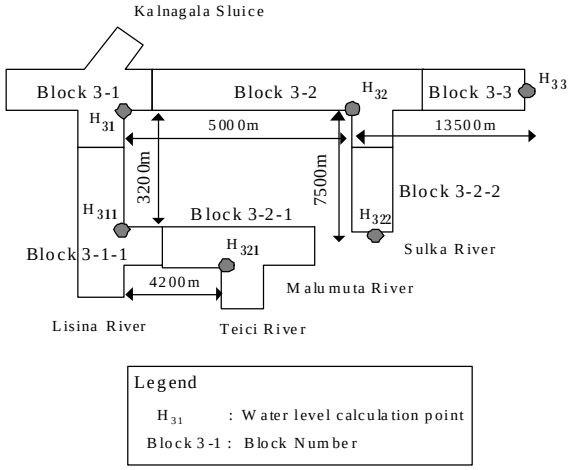
The water level of Lake Lubana is obtained through the daily water balance calculation among the inflow from the Rezekne and the Malta rivers, rainfall on the lake, outflows from two sluice structures, amount of evaporation from the lake surface, and infiltration from the bottom of the lake.



Lake Lubana System Model

(4) Southern wetland system model

The basic model of the southern wetland is the same model as the northern wetland. The Meirani canal, which is the major stream in this wetland, is divided into 6 blocks setting up mathematical equations in each block.



Schematic Diagram of Blocks in the Southern Wetland

(5) Methodology and verification

<u>Northern and southern wetland system model</u>

The following mathematical model is made to analyze the phenomenon of inundation in each block and to express the reverse flow between the upstream and downstream blocks. Basic formulas for the model are as shown below. The difference of discharges in the "i" block and the next "j" block is equal to the storage volume change in the "j" block.

$$\frac{dV_j}{dt} = Q_i - Q_j$$

Where, dV_j : change of storage volume in the block “j”
dt : unit time
Q_i, Q_j : discharge from the blocks “i” and “j”

The hydrological materials to be used for the modeling are the water level records observed at the source of the Aiviekste river since 1983 and the water level and discharge recorded at Lubana town for the last 30 years.

The calculation results of series tank models are used as flood discharge from each river, which flows into the Aiviekste river in spring. When a flood water level exceeds the river bank elevation, a storage section is considered in addition to flow area section.

<u>Lake Lubana model</u>

The water level of Lake Lubana is obtained through the daily water balance calculation using the following basic equation.

$$V = I + P - (Q_1 + Q_2) - E - F$$

where,
- V : storage volume (m^3)
- I : inflow (m^3/s)
- P : precipitation (mm/day)
- Q : outflow (m^3/s) $Q = Q_1 + Q_2$
- E : evaporation (mm/day)
- F : infiltration (mm/day)

The inflow is a total amount of the daily discharge from the Rezekne and the Malta rivers. The outflows from the Aiviekste and Kalnagala sluices are calculated by the following equation.

$$Q_1 = C * B * h\sqrt{2gH}$$

where,
- Q_1 : outflow (m^3/s)
- C : flow coefficient
- B : width of gate (m)
- h : opening height of gate (m)
- g : gravity acceleration (9.8)
- H : upstream water depth (m)

The amount of the rainfall is that of the Rezekne station. When the existing data is not suitable for applying to the calculation, the daily rainfall pattern and amount is estimated based on the rainfall data in 1968, which correspond to the maximum rainfall year in last 10 years.

The amount of evaporation from the lake surface is the mean value of the daily evaporation recorded at the Zoseni meteorological station for the last 30 years. The amount of the infiltration is obtained through the daily water balance calculation.

Verification

The accuracy of the model is examined by the comparison of difference between the observed and calculated discharges or water levels.

The correlation coefficient "J_0" is suitable for evaluation of relative correlation between the observed and estimated discharges. The "J_1" value of the relative standard and the "J_2" value of the χ^2 standard are evaluated to examine the agreement between observed and calculated discharges.

As a result of the verification of the models, it can be said that there is enough accuracy since the "J" values of the models prepared in this study exceeds the value of the standard.

Standard Value of "J"

	$J_0 = 0.7$	$J_1 <= 0.25$	J_2
Tank Model			
Northern Wetland Model	0.8 - 0.9	0.12 - 0.26	0.12 - 3.0
Lubana and Southern Wetland Model	0.8 - 0.9	0.13 - 0.26	0.12 - 1.5
Water Level Simulation Models			
Northern Wetland Model	0.8 - 0.9	0.25	1.5
Lake Lubana Model	0.8 - 0.9	0.15	1.0
Southern Wetland Model	0.8 - 0.9	0.25	1.5

10.1.8 Flood Scale and Water Level in Each Block

(1) Flood scale and inundated area

The competitive water level problems between flood water level and Biotope are examined through comparison studies between each Biotope category and inundation situations with flood scale of 1/2, 1/5, and 1/10.

Scales of spring flood fluctuate every year, and their peak flows usually occur in April, but they occur earlier than usual in February in some years. Flood scale and its occurrence time are different between northern and southern wetlands. Hydrographs, which show the change in water levels according to the passage of time, are also different in each year. It is difficult to estimate a hydrograph with a certain probability. Then, the flood water levels in each probability are determined by selecting reference years, which have almost the same peak discharge as the calculated one through the probability process, for the northern and southern wetlands from existing hydrological data. Following table summarizes the selected reference years. The reference year is a year that has almost the same peak discharge as the calculated one through the probability process.

Reference Years for Study

Probability	Northern Wetland	Southern Wetland and Lake Lubana
Once per 2years	1987	1987
Once per 5years	1983	1986
Once per 10years	1994	1994

(2) Study block for the water level analysis

The study area is divided into 21 blocks (including Lake Lubana as a block) with the same geographical and hydraulic character to evaluate the influence of the flood water level on the ecosystem and the production sectors. The water level at each block is calculated using the water level simulation model. Figure 10.1.7 illustrates the location map of study blocks.

(3) Water level in each block

The flood water level in each block is estimated by the flood scale of once in 2-year, once in 10-year, and the maximum flood scale by which flood damage is not caused in the study area. The flood scale of once in 2-year corresponds to the normal flood scale, and that of once in 10-year corresponds to the scale which is commonly used for the agricultural development plan. The study period of the northern and southern blocks is three months from March to the end of May when the flood usually occurs. In Lake Lubana block, the water level is calculated for nine months from March to November, when the simulation of the water level is needed for the fishery sector. The maximum water level of each flood scale in each block is tabulated as follows.

Estimated Flood Water Level

(Unit: m)

Block		Probability		
		50%	10%	Max
Northern Wetland				
Block	1-1	93.3	93.8	94.9
	1-2	93.1	93.6	94.8
	1-2-1	93.2	93.7	94.8
	1-3	93.0	93.6	94.7
	1-4	92.9	93.5	94.6
	1-4-1	93.0	93.5	94.6
	1-5	92.8	93.3	94.4
	1-5-1	93.0	93.5	94.5
	1-6	92.7	93.3	94.4
	1-7	92.7	93.2	94.3
	1-7-1	92.7	93.2	94.3
	1-8	92.5	93.0	94.1
Lubana Lake				
Block	Lake	93.7	94.7	95.5
	2-1	93.7	94.7	95.5
	2-2	93.7	94.7	95.5
Southern Wetland				
Block	3-1	92.7	93.1	93.4
	3-1-1	93.0	93.4	93.7
	3-2	92.7	93.1	93.4
	3-2-1	93.0	93.4	93.7
	3-2-2	93.0	93.4	93.7
	3-3	92.7	93.1	93.4

10.1.9 Effectiveness of Current Water Level Control Facilities

Current water level control facilities are only two sluices in Lake Lubana. In the northern part and southern part wetlands, there is no water level control facility.

The water level control facilities lower the water level of Lake Lubana by the operation rule. The amount of the decrease of the water level a day is limited to 2cm or less from the viewpoint of the safety management of the dyke system according to the operation rule. It corresponds to 1,670,000m^3 (or 19.3m^3/s in the maximum) when the water level is converted into the amount of storage volume of the lake. Even existing sluice facilities have enough capacity of more than 30 m^3/s to drain excessive amount of storage volume. However, it is necessary to rehabilitate or replace the facilities because of their deterioration.

10.1.10 Display of Calculation Result

The calculation result using the hydrological model and water level simulation model will be used in various fields such as the flood protection and the conservation of ecosystem. Therefore, the result should be presented in such a way that all the people with various technological backgrounds could understand them easily. For easy understanding, this study proposes a visual display system of the calculation result.

The display system prepares the homepage with the contents of 2 dimensional (2D) maps and a 3 dimensional (3D) movie. User can access various information from the homepage.

Homepage

It is necessary to prepare the homepage for the future use in the Internet. The sample homepage is prepared for the use of the Internet. All users can accesses various information from this page.

Inundation Area Map of 2D

This is an image map in which the inundation area is drawn on the satellite image.

Flood Water Depth Map of 2D

This is a map with 200m x 200m meshes that display the inundated water depth at intervals of 50cm.

Inundation Area Movie of 3D

This movie displays the image which sees "the inundation area map of 2D" from the airplane.

The above-mentioned example of display is as shown in Figure 10.1.8.

10.2 Water Level Management Plan

10.2.1 Approach and Strategy

The principal purposes of the water level management plan are to sustain the current ecosystem, to maintain suitable water level for the activities of agriculture, fishery, and forestry, and to protect towns and villages against floods.

It is preferable not to change an existing water level for the existing ecosystem. Especially, the influence on the fish and birds should be avoided in and around Lake Lubana. However, the water level management for existing industries such as agriculture, the fishery, and forestry is vital to activate the production activities. In addition, the altitude of the Lubana town of around 94.5m is so low that control of flood water level is necessary to prevent any flood damage.

First of all, it is necessary to identify the problem between the water levels in competitive relation. For the identification of the problem, comparative study of water levels in each block is conducted. Second, a competitive water level problem will be examined whether it is possible to solve or not. When it is considered that the problem can be solved, the basic project components such as cost, effect and influence on the environment are examined to formulate necessary countermeasures.

It is important to formulate the water level management plan from the viewpoint of the easiness and low cost for construction, operation, and maintenance activity, and the conservation of natural environment, when taking the natural environmental characteristics and serious local finance situation into consideration. So the strategy is to formulate a water level management plan which can minimize not only the initial

investment cost but also the operation and maintenance cost, and which brings minimum influence on the natural environment in the surrounding.

10.2.2 Required Water Level and Competitive Analysis

(1) Biotope conservation

Required water levels for Biotope conservation is summarized as follows.

Required Water Level for Biotope Conservation

Biotope category	Relation to the spring flood	Notes
1) Bog	Any flood (1/2, 1/5, 1/10 flood scale) is not acceptable.	Precipitation : only one source Surface water : not acceptable
2) Fen	Annual flood is required, but not necessary every year.	Precipitation : major source Surface water : keeping water level longer time Groundwater : keeping high level
3) Inundated grassland	Annual flood (1/2 flood scale) is required in early spring.	Surface water : major source Groundwater : keeping high level to prevent propagation of tree species
4) Forest	Annual flood (1/2, 1/5, 1/10 flood scale) is acceptable.	Surface water : shorter inundation period is desirable. Groundwater : necessary to keep low level (about 1m from ground).
5) Dry grassland and agricultural land	Annual flood (1/10 flood scale) is not acceptable..	Surface water : flood protection of 1/2 and 1/5 flood scale.

(2) Fishery and fish conservation

The focal point on fishery and fish conservation is to maintain desirable water level for fish in Lake Lubana within its required flood protection capacity. Thus, the following water level management in Lake Lubana for fish conservation and fishery development should be considered.

- to keep water depth of 2.5m or more to ensure fish wintering places,
- to make water level of 91.7m in Lake Lubana at least in autumn and winter seasons for spring flood protection,
- to keep water level same or increasing levels from March to June to provide favorable spawning and living conditions for fish, and
- to discharge the lake water continuously from the Kalnagala sluice for improvement of water quality in the southern part of the lake during spring season.

(3) Agriculture and forestry

An agriculture development plan is usually prepared taking the flood probability of 1/5 into account. So, the existing and proposed agricultural lands will require a lower water level of 1/5 flood scale. This means that control measures are required to the areas which would be inundated by the 1/2 and 1/5 flood scales. Although the forestry does not require a specific water level, the shorter inundation period is desirable for forestry.

(4) Flood protection and maintenance flow of Lake Lubana

It is necessary to consider required seasonal water levels from the viewpoint of flood mitigation, fishery development, and biotope conservation in Lake Lubana. Serious floods which damaged Lubana township and areas along the Aiviekste river in the 1920s and

1950s, have not occurred since the construction of the northern dyke system. The problem of the flood will not occur as long as the dyke system in Lake Lubana with a capacity for the flood scale of once per 100 years' probability exists. So, the water level of the lake is required low level of 91.75 or 91.20m in winter to protect the spring floods, though fishes require deep-water depth of 2.5m for wintering. While the water level of 94.5m starts to affect the bog area in the west-south lakefront. This will require to keep the lake water level below 94.5m or to implement protection measures.

(5) Water level of fishponds

The Kvapani and Idena fishponds, once functioned using pumped-up water from the Rezekne river in the Soviet era, are leased to a private sector at present and there is no specific restriction for their use. These fishponds will be used as ponds for angling because various building works for the anglers are being advanced in Kvapani. The ponds can receive water in spring when the water levels of outside rivers and drainage channels are higher than that of ponds. So, there is no specific problem on water level management at present.

As for the Nagli fishpond, there would be no problems on water level management because of existence of water level control facilities. If there is a problem, it is a deterioration problem of facilities, since they were constructed in the 1950s. The lowering water level is easier in the Nagli fishpond through operations of drain sluices. On the other hand, the operation for high water level is limited to 97.0m or less because of the operation rule of the upstream reservoir water level in the Malta river.

(6) Water level of the southern wetland

The Idena canal which runs along the southern edge of Lake Lubana from Idena township to the junction point of the Meirane canal, has an important role of a drainage canal in the southern wetland and of a canal for an emergency spillway of Lake Lubana. There is a slide gate at the end of the canal which controls water level of the canal and its inundated area. The gate opens when the water level of the canal is higher than that of the Meirane canal as an outlet canal. However, the water level is usually lower than the Meirane canal, so the gate is under closed condition. Some water remains in canal and downstream lowland possibly forms the inundated grassland. It seems that this water level condition will not change in future without frequent operation of the control gate.

Four (4) major rivers flow into the wetlands from the outside of the study boundary. The Licina and Meirane canals, which were constructed and improved in 1950's, make an enough drainage condition in the southern wetland. The riverbanks of these canals protect the riverside farmlands from flooding, and the inundation problems of the other two rivers are not serious at present. The agriculture, forestry, fishery, and ecosystem conservation sectors do not require specific water levels in this wetland.

(7) Competitive water level problem in the northern wetland

<u>Inundated dry grassland</u>

The dry grassland area, which is located along the right bank of the Pokratena river of one tributary of the Balupe river northeast of the area, has a possibility for inundation by spring floods. The area, which is located between Ergala village and Lubana township along the Aiviekste river, has also a possibility for inundation. If positive use of this dry grassland is proposed, some measures are necessary.

Dryness problem in the bog, inundated grassland and fen areas

The ditches accelerate the expansion of creating a dryness problem in the inundated grassland and fen after annual floods. The dryness problem also threatens the existence of bog area with drainage ditches and canals, which are dug in and around the area. These bog, fen and inundated grassland areas with importance characterize the wetland, and their conservation against making to dryness should be done by necessary measures. Detailed for conservation measures of this problem are discussed in the Wetland Conservation Plan.

Fish habitat conservation of the old Pededze river

Serious dryness problem also happens along the old Pededze river. The Pededze river flows into the new river section, which was excavated as one of the flood protection project to divert spring flood, and the old river section was completely closed by embankment of the new river section.

(8) Competitive water level problem in Lake Lubana

Fishery development and fish conservation

Fishery development and fish conservation require seasonal water level management. In autumn and winter, they require the water levels of 91.7m or more, and from March to June, they require the same or rather increasing water levels. The existing operation rules and actual operation fulfill these required water levels. However, it is necessary to consider counter measures for the requirements of continuous discharge from the Kalnagala sluice for water, and of keeping the water depth of 2.5m or more for fishes wintering place.

The location map of the competitive problem is shown in Figure 10.2.1.

10.2.3 Countermeasures and Cost Estimation

(1) Fish habitat conservation of the old Pededze river

Measures

Construction of a gate structure in the embankment of the Pededze river left bank at the junction point of the old Pededze river will be the fundamental solution. In addition to the gate structure, one small dam on the old Pededze river near Mierini village to keep water level high in the river section will be necessary. The amount to be diverted from the Pededze river should be estimated in consideration of water volume needed for the eco-tourism plan.

Cost

The gate structure of slide type with 1m width and 1m height is proposed. The cost is estimated at 45,000 LVL indicatively. The small dam made of massive concrete with length of 25m will cost about 20,000 LVL. Proposed dimensions are as below:

Pededze River Gate Structure

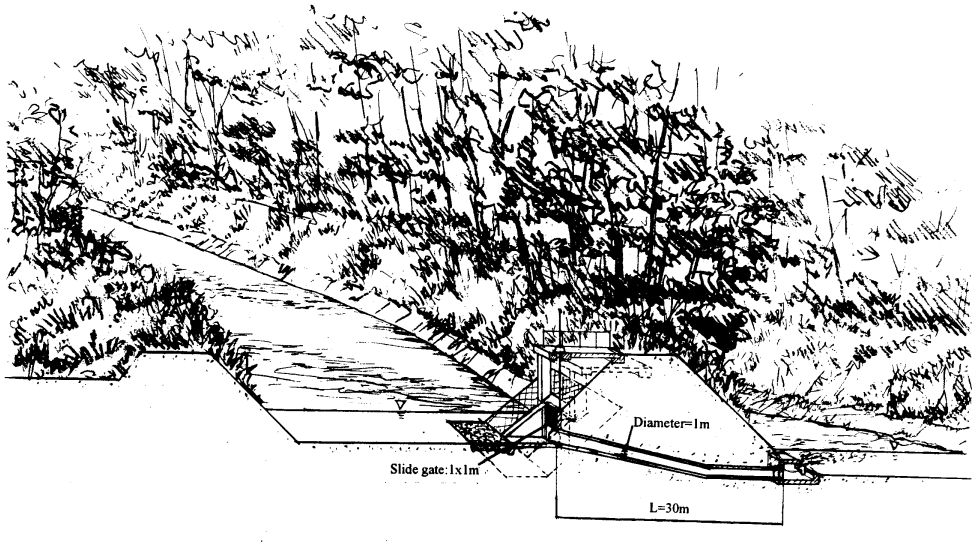
Gate type: Slide gate 1m x 1m x 1 nos. with manual operation

Conduit: Precast concrete pipe with concrete protection, Diameter=1m, Length=30m

Weir Structure

Type: Concrete fixed type

Dimension: Length = 30m, Height = 0.5m (above the river bed)



Cross Section Image of Gate Structure

The discharge through the gate is determined by the difference between the upstream water level on the Pededze river and the downstream water level on the old Pededze river. The following table shows the estimated discharge at each water level condition.

Estimated Discharge Table

Difference of water levels between upstream and downstream sides (m)	Estimated Discharge (m^3/s)
0.1	0.7
0.5	1.6
0.8	2.0
1.0	2.3

As shown in this table, it is possible to discharge the water volume of about 1.5-2.0 (m^3/s) through the gate. This accounts for about 50% of the discharge of the Pededze river in summer without a weir as shown in the table below. Therefore, one gate with 1 m size is suitable for intake water.

Monthly Average Discharge: Pededze-Litene

(m^3/s)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average	9.1	7.1	10.0	20.6	9.1	6.0	4.2	5.2	4.8	6.3	8.3	8.1
50%	4.5	3.6	5.0	10.3	4.5	3.0	2.1	2.6	2.4	3.2	4.2	4.0

(2) Preparation of wintering place for fish

Water depth of 2.5m or more is required in the lake in order to ensure the wintering of fish. The possible countermeasures for the wintering place are: heightening of dyke bank, excavation of lakebed, excavation of fish channel, and excavation of canal system in the lake. The JICA study team carried out preliminary survey of the lake bottom level to clarify the present topographic conditions in the lake in order to examine these alternatives. The data shows existence of deep areas with total area of approximately 40 ha. In addition, the data shows the existence of high bank areas along the old Rezekne river in the lake. The location map of survey points is shown in Figure 10.2.2.

As a result of study for these alternatives, it seems that alternative of the excavation of fish channel is the best solution for this problem from the viewpoint of the cost and the eco-system conservation. The following table shows estimated costs for each alternative.

Estimated Cost for Each Alternative

Alternative Measures	Estimated Cost (1,000 LVL)	Remarks
1) Heightening of dyke	31,450	Total length =50km, bank top width=6m
2) Excavation of Lake bed	2,032	80 ha, bottom level = 88.7m
3) Excavation of fish channel	384	Width=100m, Length=500-700m, bottom level = 90.0m
4) Excavation of canal system	6,100	Latvian plan

(3) Improvement of water quality in the southern part of the lake

Continuous outflow from the Kalnagala sluice is considered one of the effective solutions to improve water circulation. Total volume of the possible amount for outflow from the Kalnagala sluice is summarized in Table10.2.1. It revealed that at least 3.0 m^3/s of water can be discharged from the Kalnagala sluice in spring and summer. If the discharge from the sluice is limited to 1.5 m^3/s of river maintenance flow at the Aiviekste sluice, possible amount will reach to 6.5 to 16.5 m^3/s. It is possible to control these discharges by revising the existing operation rule of the lake. Therefore, there is no need to estimate special cost except rehabilitation cost of sluice gate structures.

10.2.4 Current and Proposed Operation Manual

(1) Lake Lubana

The existing operation manual for Lake Lubana was prepared for flood mitigation and fishery conservation, and the agency concerned has operated control facilities according to the manual. No special problem to the operation manual has occurred so far.

However, the water level management based on the existing manual will not be effective against the water quality deterioration problem which might be serious in the future especially in the southern part of the lake. Utilization of the Kalnagala sluice in the southern part will be crucial to prevent the water quality from deterioration. In this context, partly change of the existing manual is proposed to use the Kalnagala sluice for prevention of water quality deterioration.

Moreover, for conservation of the ecosystem in the northern wetlands, it is also necessary to supply the same amount of river water as before constructing the northern dyke system as much as possible by using the existing water level management facilities during the flood recession period. But, it is necessary to follow the existing manual for safety in the region during the flood rising period.

For the revision of the existing manual, important points to be considered are the influence of desiccation to the northern wetland by the volume change of outflow through the Aiviekste sluice and the influence to fish conservation. Therefore, proposed manual is prepared taking note of the following points. Proposed distribution plan for discharge water from Lake Lubana is summarized in Table 10.2.1.

- Utilize the Kalnagala sluice as much as possible to improve water quality.
- Basically, the proposed operation rule is based on the existing one.
- Discharge from the sluice should be the same amount as the inflow from two rivers as much as possible.
- Water level should keep at the level of 91.75 m or more for the fish conservation.

Proposed Operation Rules

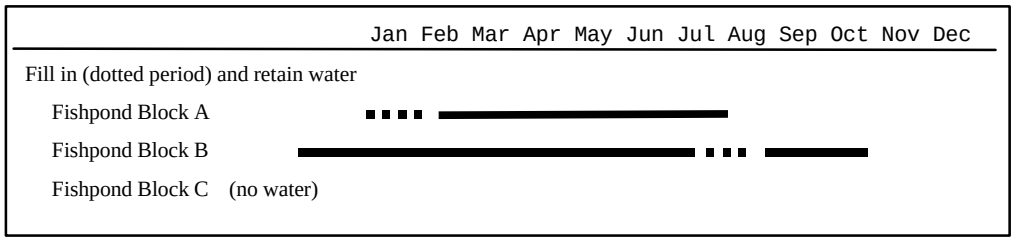
Season	Target of operation	Operation rules
Aug.20–Oct.19	Reduction of water level of the Lake to 91.75m, for the purpose of making storage capacity for spring flood	Aiviekste Sluice: Open until water level becomes 91.75m Kalnagala Sluice: Open until water level becomes 91.75m
Oct.20–Beginning of Spring Flood	Keeping of water level of 91.75m in normal condition or 91.2m in case of extreme flood condition	Aiviekste Sluice: Open until water level becomes 91.75m or 91.2m Kalnagala Sluice: Open in case water level exceeds 91.75m or 91.2m
Spring flood	Evacuation of a flood in the northern part	Aiviekste Sluice: Close Kalnagala Sluice: Close
Extreme flood	Prevention of dyke breaking	Aiviekste Sluice: Open Kalnagala Sluice: Open In case of outside water level is lower than that of the Lake.
End of Spring flood	Keeping water level not to exceed the level of 93.0m	Aiviekste Sluice: Open Kalnagala Sluice: Close, in case of 91.75m
May-August	Keeping constant water level	Aiviekste Sluice: Open to preserve water level in the Aiviekste river. Kalnagala Sluice: Open to discharge for improvement of water quality. Close, in case of 91.75m (Lake Lubana) or close in case of 91.20m (Aiviekste river)

Note: “Extreme flood” means floods in 1/10 or larger scale.

(2) Proposed operation rule for the Intake structure on the Malta river

Fishponds play an important role in providing various and suitable habitat conditions for waterfowls. The following figure proposed in Wetland Conservation Plan shows the favorable water level control of fishponds for waterfowls. The fishponds blocks should have three different types of water level schemes in the rotation use. Aiming at the realization of the rotation use, additional operation rule related to the distribution of intake water through the structure on the Malta river is necessary.

Water Level Control of Fishponds Favorable for Waterfowl



The Idenas canal, which acts as a drainage canal for fishponds, cannot be used as a resource for the eco-tourism projects proposed in the Eco-tourism Development Plan (EDP), because of unsuitable water quality in the canal. Therefore, it is necessary to improve the water quality in the canal for encouragement of the eco-tourism. For the improvement of water quality in the canal, utilization of surplus water produced by the rotation use is proposed.

The distribution plan of the water to the fishponds is proposed as tabulated below in order to improve the water quality of the Idena canal and to meet the request of the Wetland Conservation Plan.

Proposed Water Distribution Plan for Nagli Fishpond

(Unit: m^3/s)

Distribution Place	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Fishpond Block A	-	-	-	7.5	7.5	0.5	0.5	0.5	0.275	0.275	-	-
Fishpond Block B	-	-	-	0.5	0.5	0.5	0.5	0.5	0.275	0.275	-	-
Fishpond Block C	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-
Idena Canal	-	-	-	4.0	4.0	0.5	0.5	0.5	0.0	0.0	-	-
Total	-	-	-	12.0	12.0	1.5	1.5	1.5	0.55	0.55	-	-
Existing Rule	0.55	0.55	0.55	12.0	12.0	1.55	1.55	1.55	0.55	0.55	0.55	0.55

Note: "-" means that water is not supplied because of freezing. This rule is for permitted intake volume from the Malta river.

10.2.5 Organization and Institution

(1) Proposed organization

It is proposed that the future organization for the water level management should be set up in the existing ALRSA as one section. ALRSA will receive requirements and provide information related to water level management and operation through the Implementation Committee (IC). ALRSA, which has long experience in water management in the LWC, will be requested to cooperate for conservation and development of LWC through the water level management services shown below.

- to collect and analyze hydrological and meteorological data ,
- to forecast a flood on a temporal basis,
- to collect warnings and information about spring flood from the Meteo-hydro Agency in MEPRD,
- to evaluate requirements on water level management from EMC,
- to give a technical advice and information to EMC about flood and water level,
- to prepare an annual water management schedule based on the operation manual, current water level situation and the requirement from EMP,
- to decide necessary operation in case of emergency like extreme flood, and
- to operate gates and other facilities related to water level management.

(2) Transmission of data and information

According to the operation rule, ALRSA is scheduled to receive flood information from Meteo-hydro agency during spring flood season from February 1 to the end of flood. However, ALRSA usually receives it after the spring flood season. The received information is not useful for flood control due to a transmission delay. Simultaneous transmission and sharing of flood information or warnings between the organizations concerned is indispensable especially in case of the extreme flood. In this connection, it is necessary to improve the existing system of transmission to more speedy and easy one to access to necessary data. The proposed organization chart is shown in Figure 10.2.3.

(3) Measures for capacity building on water level management

Although some of these services have been already done by ALRSA, it is necessary to reestablish the system for collecting data and to improve the facilities for water level management.

1) Data collection

ALRSA observes water levels at two sluices points. However, there is no hydrological station in the river, which flows into the northern LWC and the lake except the Pededze, and Rezekne rivers.

At least four hydrological stations are necessary to estimate the flood water volume in the Balupe and Ica rivers for northern wetland and in the Malta and Rezekne rivers for the lake as shown in Figure 10.2.4. An automatic data-collection system on an electronic basis is recommendable. In addition, one thermometer is necessary to estimate roughly the starting date of snow melting.

Four hydrological stations and one mother station should be established for collection of necessary data related to water level management. The hydrological station is equipped with an automatic water level gauge, water-conveyance pipes and a storage box for a device. The mother station collects data observed at the hydrological stations through periodical observation. One note book type computer for collecting data and one computer with electric data processing program is necessary at the mother station. The indicative cost for establishment of the hydrological stations is about 10,000 LVL.

2) Improvement of water level management facilities

The major water level management facilities are the Aiviekste and Kalnagala sluices. The Aiviekste sluice was constructed in 1981 and the Kalnagala sluice with a hinged type gate installed in the 1950s. Especially the Aiviekste sluice as the essential facility for water level management requires frequent repair works because of its deterioration. The most deteriorated portions are the gate leaves, their guide frames, and the culvert portions under the dyke.

Malfunctioning of gate leaf portion will be an obstacle for smooth operation especially in an emergency. Irregular bottom elevation of culvert portions under the dyke will cause water leakage. The leakage water flows out with the dyke materials and consequently the dyke breaking might occur.

The service life of the Kalnagala sluice has finished already, and the rehabilitation is indispensable for utilization of this gate to improve water quality in the lake. The proposed improvement works are as follows.

Aiviekste sluice

Replacement of the whole structure is necessary including gate leaves, gate frames, culverts, inlet and outlet structures. One gate type structure is recommendable for smooth operation and simplified discharge control. The cost of the gate leaf is 18,000 LVL and those for earth and structure works are 120,000 LVL. The total cost of rehabilitation of the Aiviekste sluice is about 138,000 LVL.

Kalnagala Sluice

The rehabilitation works of this gate structure consist of rehabilitation and strengthening of existing concrete structures and replacement of gate leaf. The cost of the gate leaf is estimated at 35,000 LVL and those for earth and structure works are 110,000 LVL. The total cost of rehabilitation of the Kalnagala sluice is about 145,000 LVL.

Table 10.1.1 Main Features of Hydraulic System

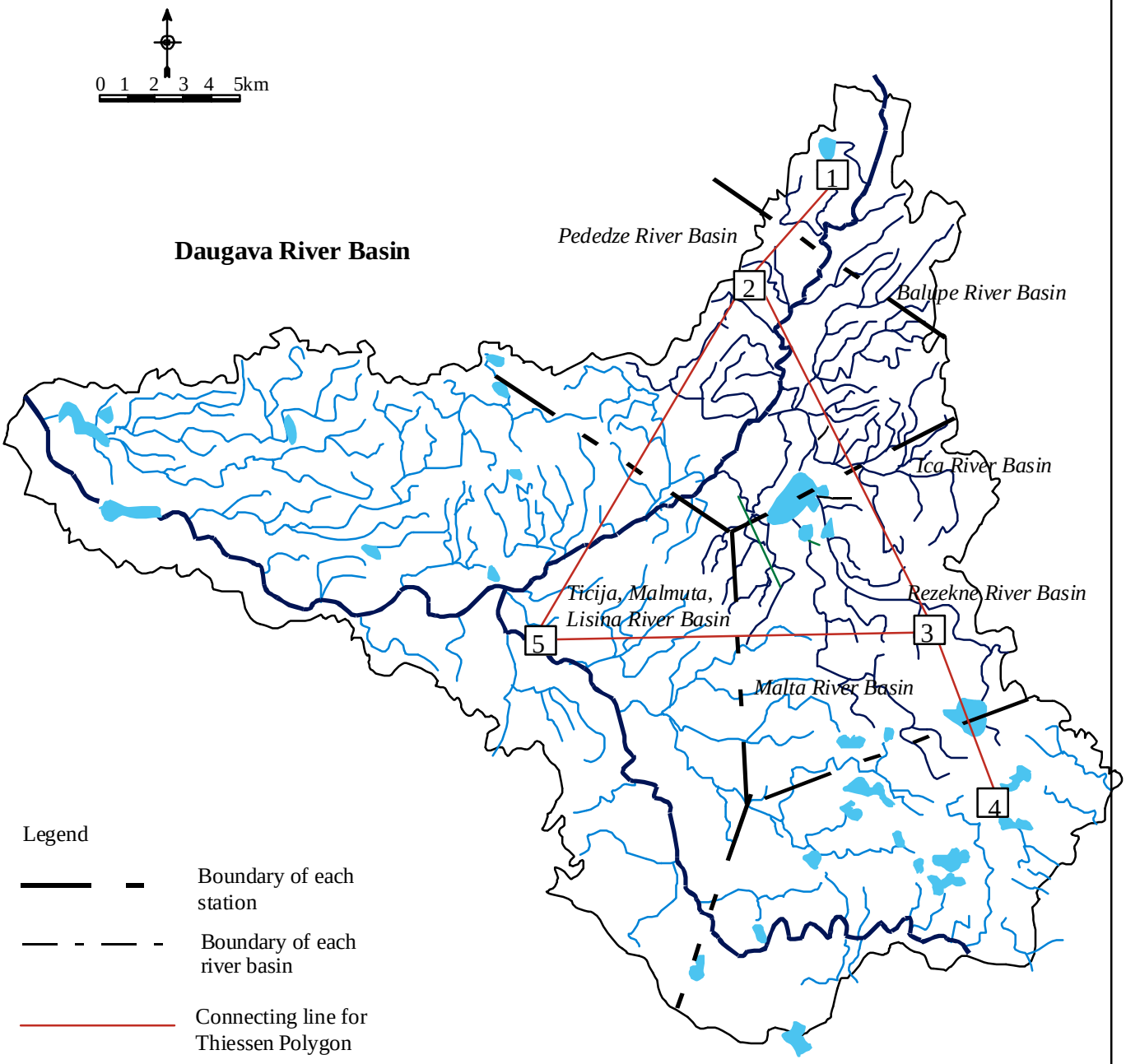
Lubana Lake	Storage			
	Gross capacity	million m^3	400.0	at water level of 95.30 m
	Average storage	- ditto -	135.8	at normal water level of 92.50 m
	Flood control storage	- ditto -	335.0	capacity from 91.20 m to 95.30 m
	Area of Water Body			
		ha	9,553	at surcharge water level of 95.30 m
		- ditto -	8,210	at normal water level of 92.50 m
		- ditto -	6,696	at minimum water level of 91.20 m
	Water Level			
	Normal water level	m	92.50	
	Flood water level	- ditto -	95.30	
	Surcharge water level	- ditto -	95.60	
	Minimum water level	- ditto -	91.20	
	Depth at Normal Water Level of 92.50 m			
	Max. depth	m	2.5	
	Average depth	m	1.6	
	Length and Width			
	Length	km	14.2	
	Width	km	7.9	maximum width
		km	5.8	average width
	Dyke System			
	Dyke	km	36.1	
	Natural embankment		6.3	
	Catchment Area			
	Aiviekste River Basin	km^2	2,160	
	Spring Flood Discharge from the Catchment Area			
	$Q_{1\%}$ probability	m^3/s	424	
	$Q_{10\%}$ probability	m^3/s	258	
	$Q_{25\%}$ probability	m^3/s	187	
	$Q_{50\%}$ probability	m^3/s	129	
	Summer Low Flow Discharge			
	$Q_{75\%}$ probability	m^3/s	1.60	
	$Q_{95\%}$ probability	m^3/s	0.78	
	Sluiceway			
	Aiviekste Sluice			
	Kalnagala Sluice			
Dyke System	Zvidzienes dyke	km	14.8	
	DA dyke	km	12.5	
	Ziemelu dyke	km	11.0	
	Naglu fish farm protection dyke	km	8.4	
	Rezekne River Bank Embankment	km	14.2	
	Malta River Bank Embankment	km	2 x 6	
	Pededze Diversion Canal Embankment	km	9.7	
	Kreslite Polder Dyke	km	8.7	
	Top Elevation of Dyke	m	96.00 - 96.50	
Canal System	Meiranu	km	25.0	
	Zvidziena	km	17.0	
	Idenu	km	20.5	
	Malta Diversion	km	6.2	
	Pededze Diversion	km	6.0	

Table 10.2.1 Inflow and Outflow Calculation for Lake Lubana

(Unit: m^3/s)

Location/ Station	Rezekne Rezekne - Griškani	Rezekne River mouth	Malta River mouth	Total Inflow to Lake Lubana	Allowable Max. Outflow	Proposed Max. Outflow	Proposed Min. Outflow
Catchment Area	(545 km^2)	(957 km^2)	(787 km^2)	per day	through Aiviekste	through Aiviekste	through Kalnagala
Jan.	2.82	4.95	4.07	9.0	16.3	9.0	0.0
Feb.	2.84	4.98	4.10	9.1	16.9	9.0	0.0
Mar.	4.95	8.70	7.15	15.8	17.1	15.0	0.0
Apr.	8.03	14.09	11.59	25.7	16.5	15.0	0.0
May	4.37	7.68	6.31	14.0	15.8	15.0	3.0
Jun.	2.76	4.85	3.99	8.8	15.1	9.0	3.0
Jul.	1.85	3.25	2.67	5.9	14.7	5.0	3.0
Aug.	1.66	2.91	2.40	5.3	14.7	5.0	3.0
Sep.	1.85	3.24	2.67	5.9	14.9	5.0	3.0
Oct.	2.27	3.99	3.28	7.3	15.4	7.0	0.0
Nov.	2.45	4.31	3.54	7.8	15.7	7.0	0.0
Dec.	2.51	4.40	3.62	8.0	16.1	7.0	0.0
Annual Total (x 10^6 m^3)	101	177	145	322	497	284	38

Note: Discharges at the Rezekne and Malta river mouths are estimated based on the discharge record of Rezekne - Griškani.
Total inflow is a total value of the Rezekne and the Malta river discharges.
Daily allowable maximum outflow is estimated taking account of evaporation loss, infiltration loss, and the allowable daily water level fluctuation.



1	Aluksne
2	Gulbene
3	Rezekne
4	Dagda
5	Zilani

Meteorological Station

Weight in proportion to the area

River Basin	Aluksne	Gulbene	Rezekne	Dagda	Zilani
Rezekne	–	–	0.94	0.06	–
Malta	–	–	0.69	0.31	–
Teicija,Malmuta, Lisina	–	0.06	0.57	–	0.37
Ica	–	0.14	0.86	–	–
Balupe	0.33	0.67	–	–	–
Pededze	0.65	0.35	–	–	–

Figure 10.1.1 Thiessen Polygon

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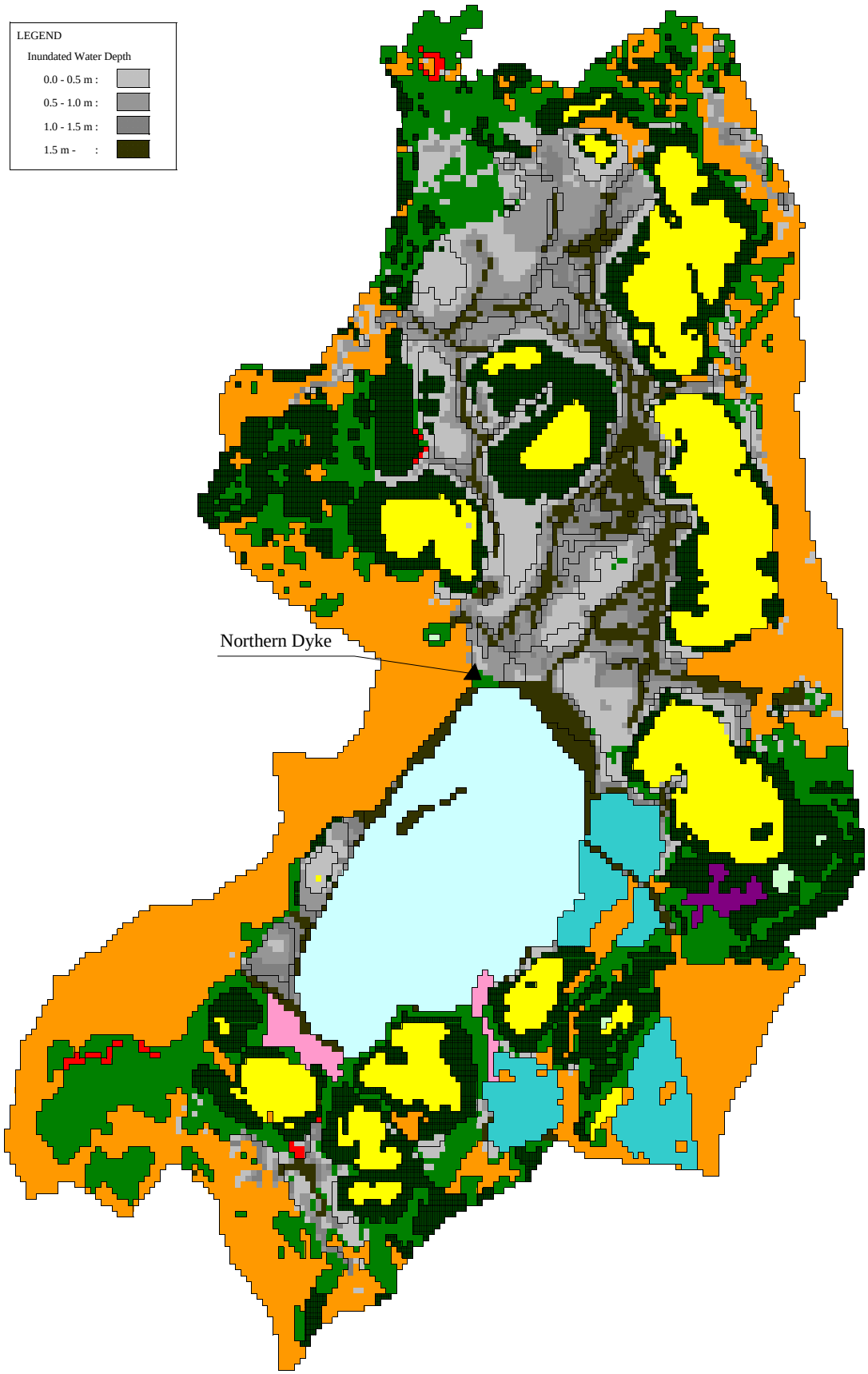

Figure 10.1.2 Flood Situation with Northern Dyke System

(Flood scale of once per 100-year)

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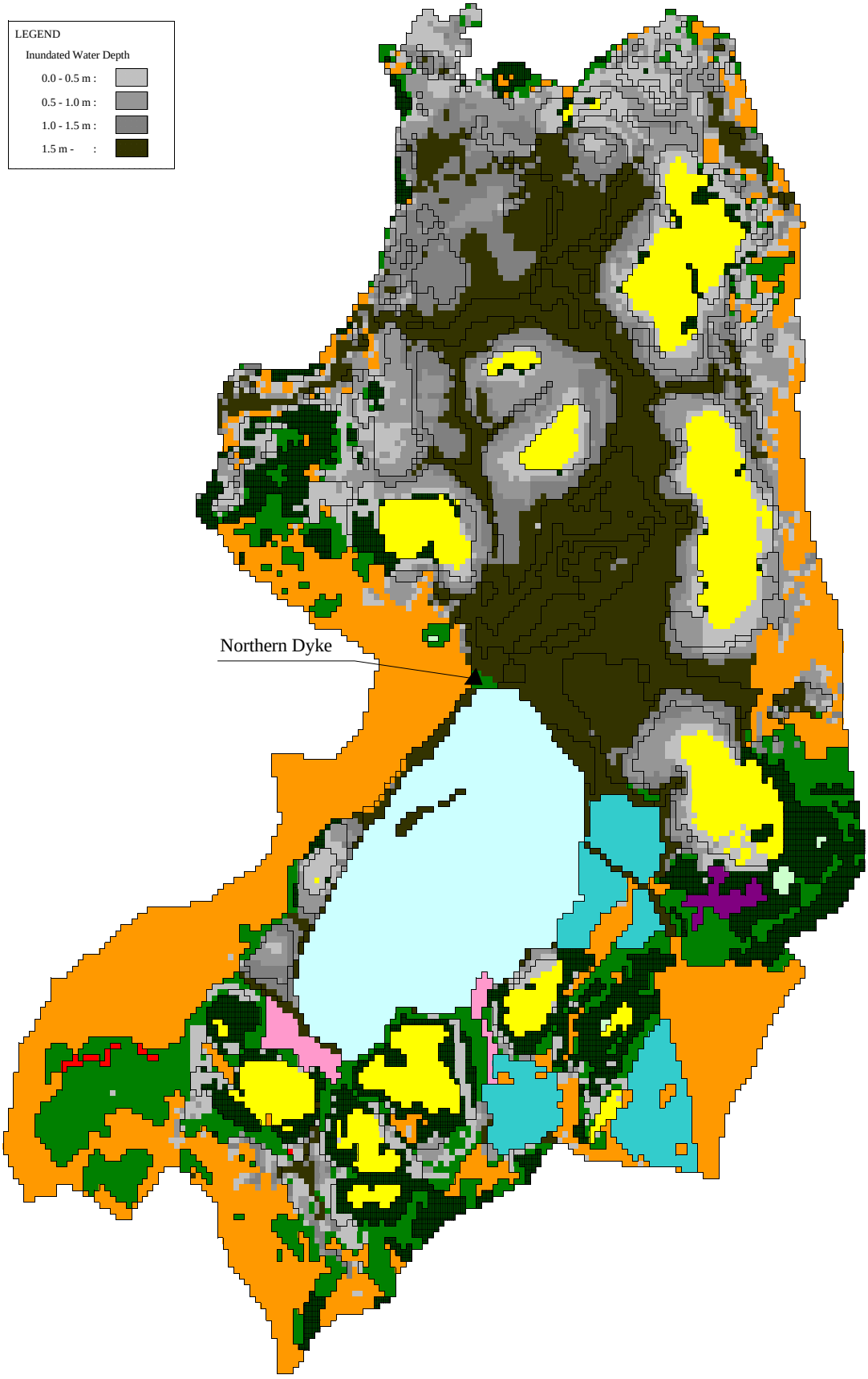

Figure 10.1.3 Flood Situation without Northern Dyke System

(Flood scale of once per 100-year)

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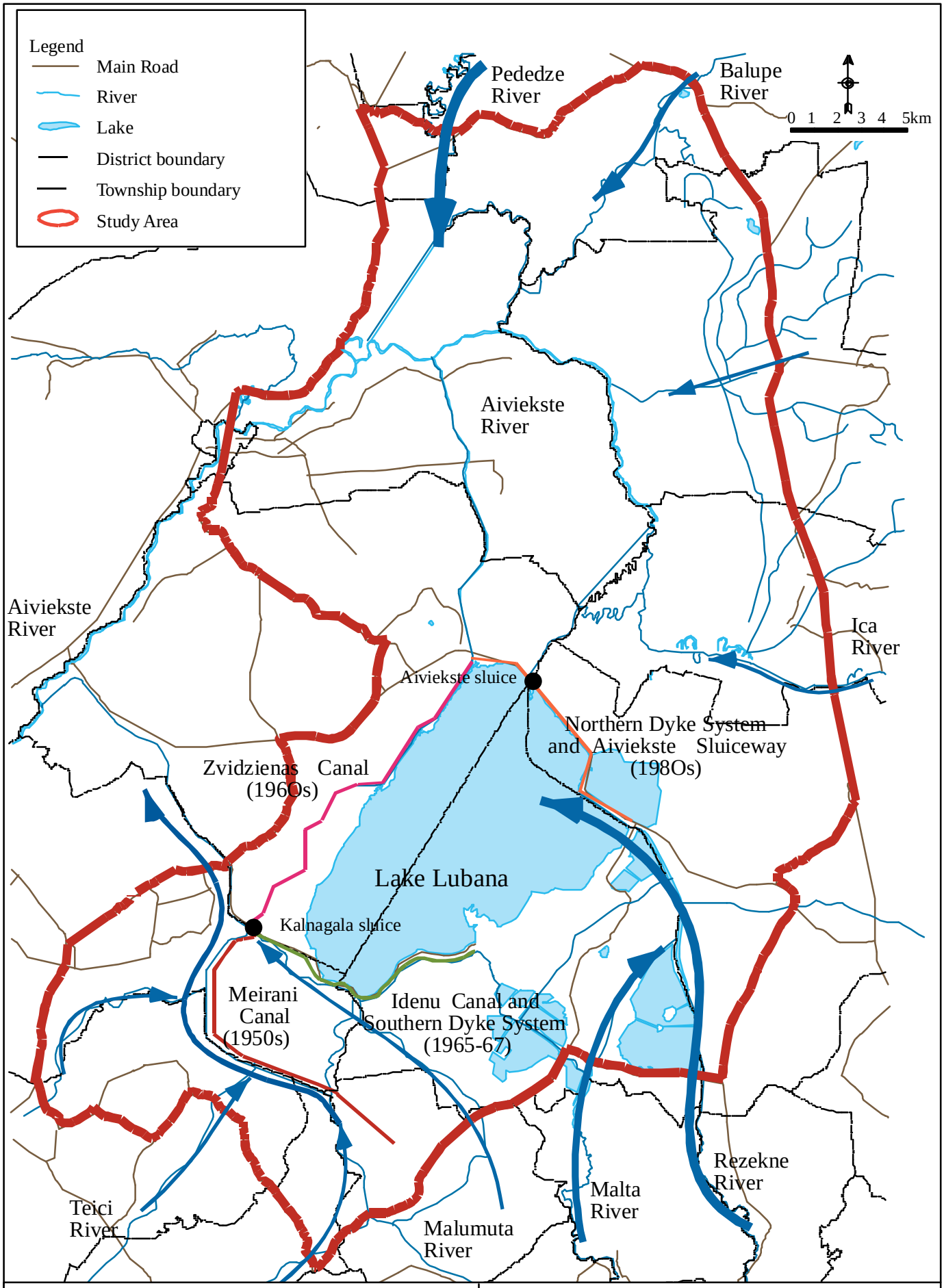

Figure 10.1.4 **Existing Flood Mitigation Facilities**

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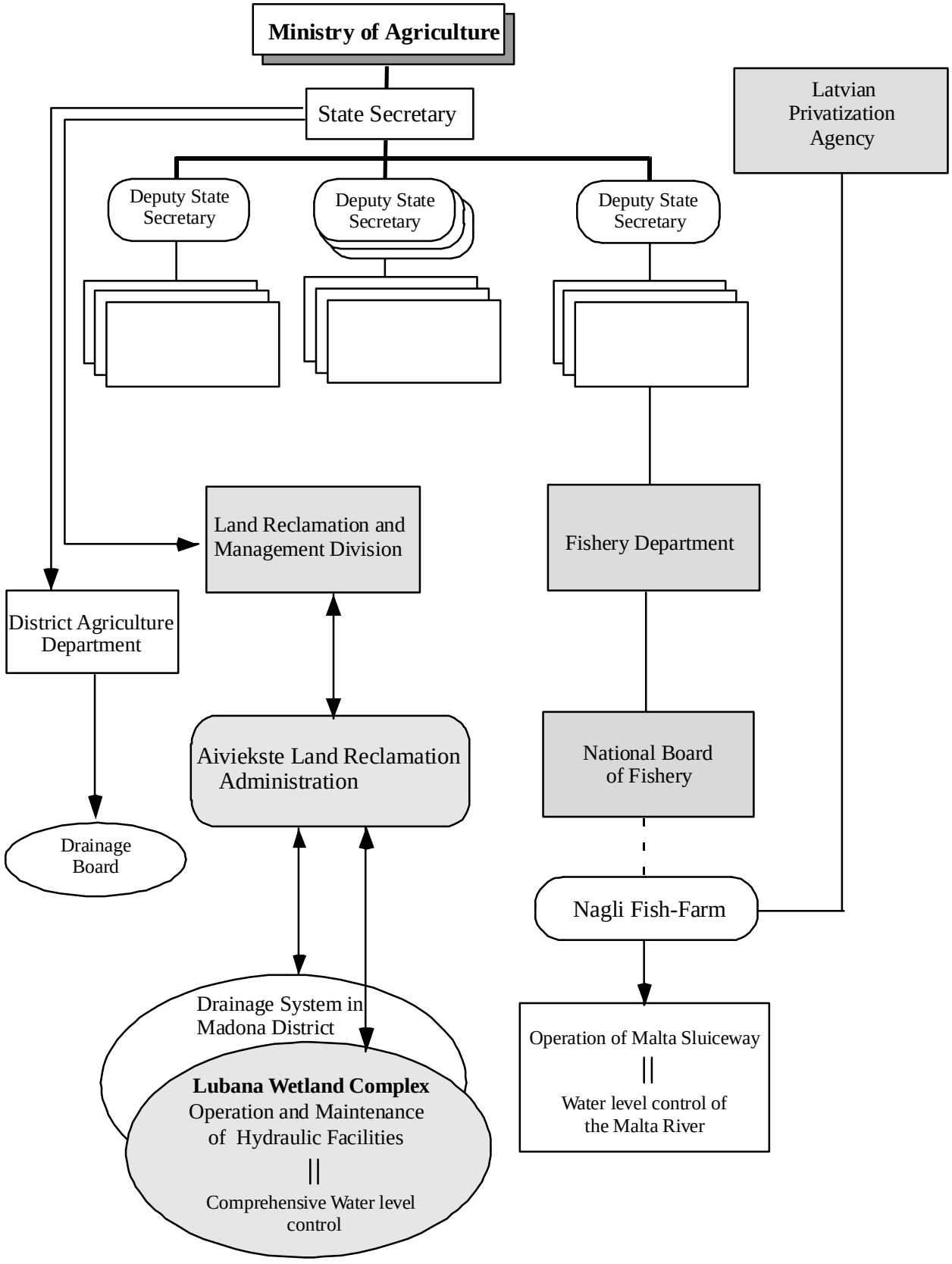

Figure 10.1.5 **Existing Organization for Water Level Control**

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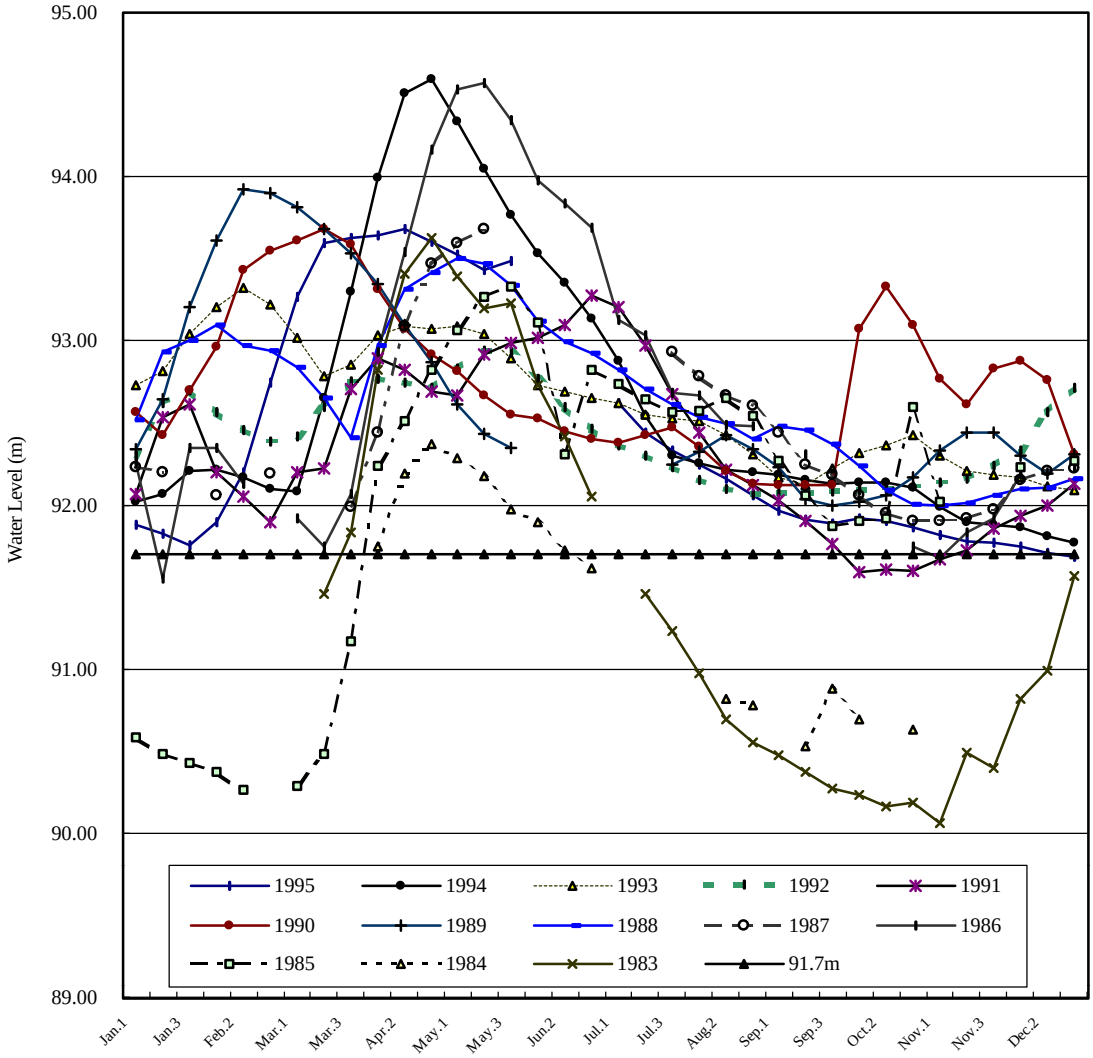

Station : Aiviekste Sluice

Figure 10.1.6 Water Level of Lake Lubana

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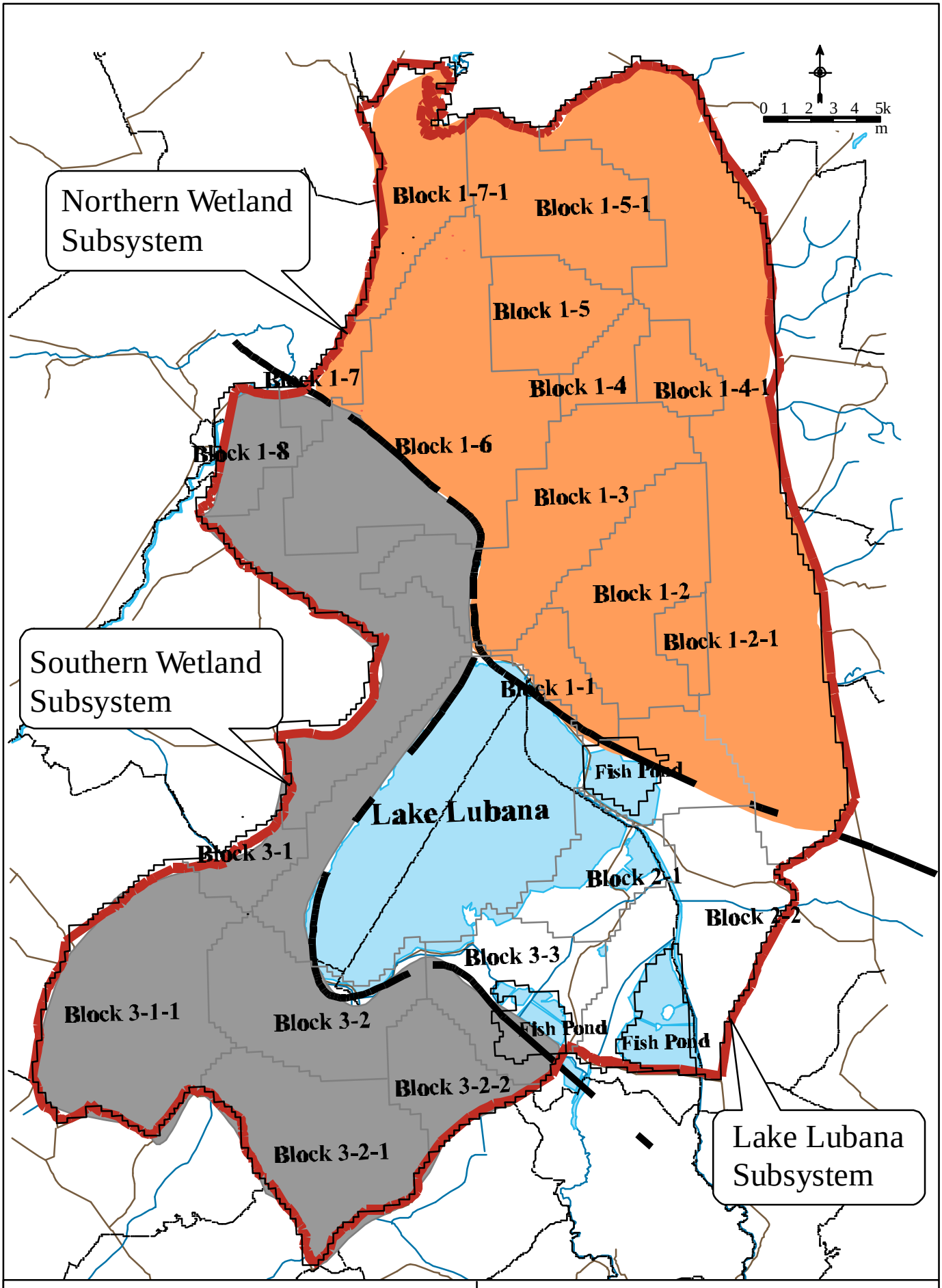

Figure 10.1.7 **Location Map of Subsystems and Blocks**

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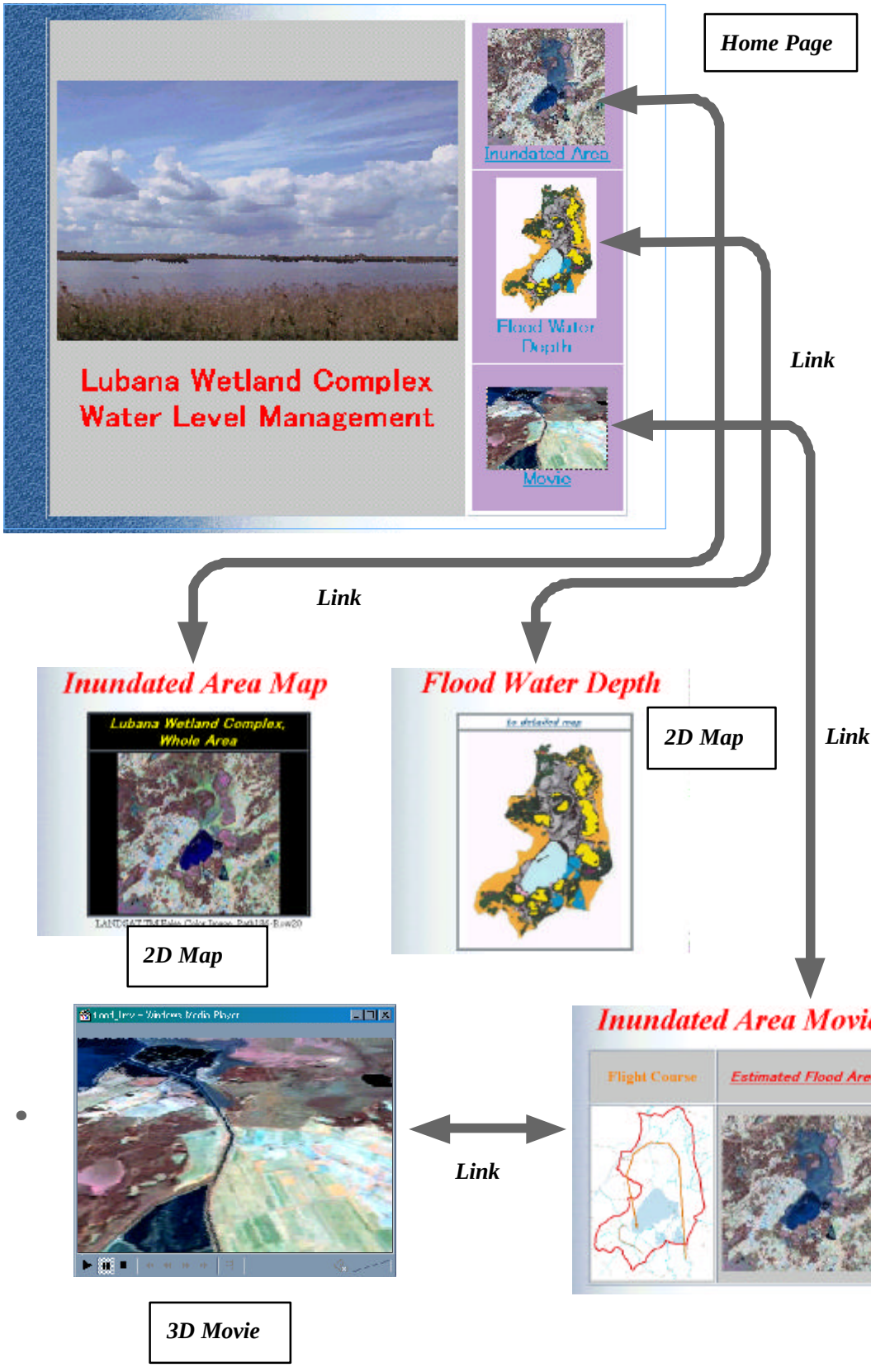

Figure 10.1.8 Proposed Display System

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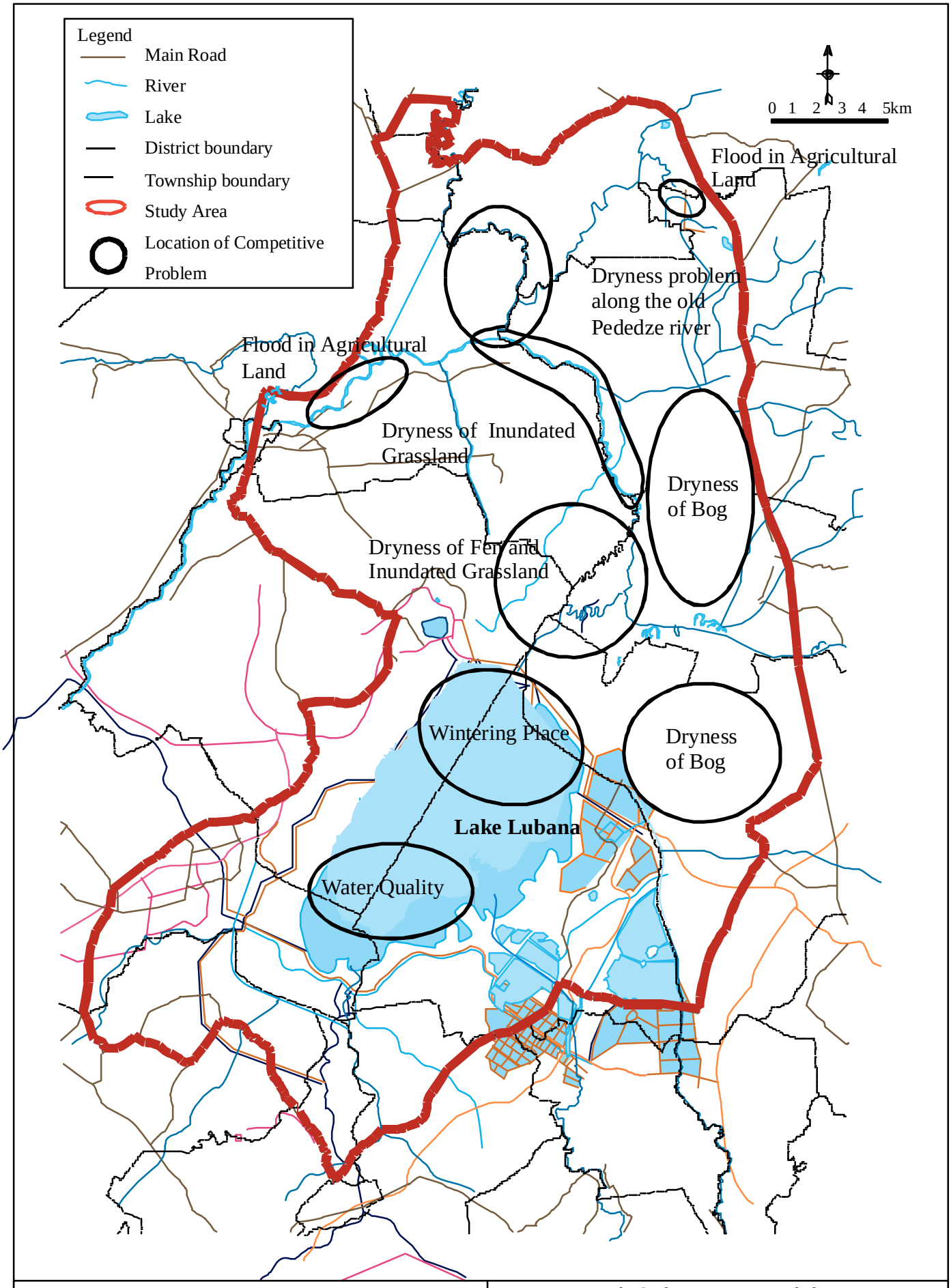

Figure 10.2.1 Location Map of Competitive problem in LWC

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

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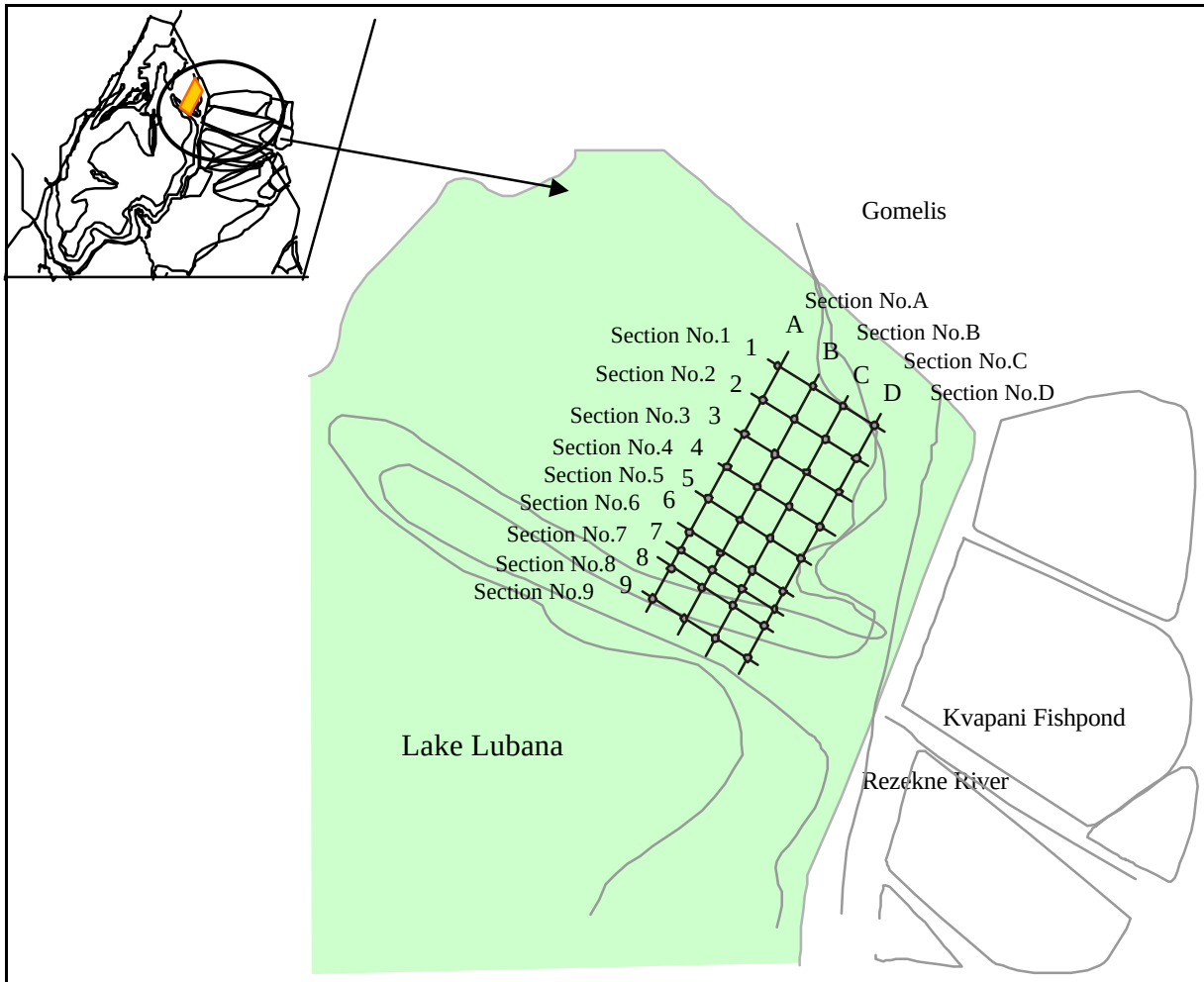

Location of Survey Point

		A	B	C	D
1	Latitude	56°47 ' 29.0"	56°47 ' 25.7"	56°47 ' 22.5"	56°47 ' 19.2"
	Longitude	26°56 ' 03.2"	26°56 ' 13.3"	26°56 ' 23.5"	26°56 ' 33.7"
2	Latitude	56°47 ' 23.3"	56°47 ' 20.1"	56°47 ' 16.9"	56°47 ' 13.6"
	Longitude	26°55 ' 57.3"	26°56 ' 07.5"	26°56 ' 17.6"	26°56 ' 27.8"
3	Latitude	56°47 ' 17.7"	56°47 ' 14.5"	56°47 ' 11.2"	56°47 ' 08.0"
	Longitude	26°55 ' 51.4"	26°56 ' 01.6"	26°56 ' 11.8"	26°56 ' 22.0"
4	Latitude	56°47 ' 12.1"	56°47 ' 08.9"	56°47 ' 05.6"	56°47 ' 02.4"
	Longitude	26°55 ' 45.5"	26°55 ' 55.7"	26°56 ' 05.9"	26°56 ' 16.1"
5	Latitude	56°47 ' 06.5"	56°47 ' 03.2"	56°47 ' 00.0"	56°46 ' 56.8"
	Longitude	26°55 ' 39.6"	26°55 ' 49.8"	26°56 ' 00.0"	26°56 ' 10.2"
6	Latitude	56°47 ' 00.9"	56°46 ' 57.6"	56°46 ' 54.4"	56°46 ' 51.1"
	Longitude	26°55 ' 33.7"	26°55 ' 43.9"	26°55 ' 54.1"	26°56 ' 04.3"
7	Latitude	56°46 ' 58.1"	56°46 ' 54.8"	56°46 ' 51.6"	56°46 ' 48.3"
	Longitude	26°55 ' 30.8"	26°55 ' 41.0"	26°55 ' 51.2"	26°56 ' 01.4"
8	Latitude	56°46 ' 55.3"	56°46 ' 52.0"	56°46 ' 48.8"	56°46 ' 45.5"
	Longitude	26°55 ' 27.9"	26°55 ' 38.0"	26°55 ' 48.2"	26°55 ' 58.4"
9	Latitude	56°46 ' 49.6"	56°46 ' 46.4"	56°46 ' 43.1"	56°46 ' 39.9"
	Longitude	26°55 ' 22.0"	26°55 ' 32.2"	26°55 ' 42.4"	26°55 ' 52.5"

Survey Result (Bottom Elevation :m)

	A	B	C	D
1	87.62	88.52	87.42	89.22
2	90.52	87.62	87.32	86.42
3	90.52	87.62	87.12	86.72
4	90.62	90.72	86.92	86.92
5	90.62	90.82	87.72	87.32
6	90.72	90.92	87.82	88.22
7	90.92	90.92	88.42	89.62
8	91.62	91.22	91.52	88.62
9	90.72	90.82	91.12	91.72

: Deep Area

Figure 10.2.2 Location Map and Survey Point in Lake Lubana

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

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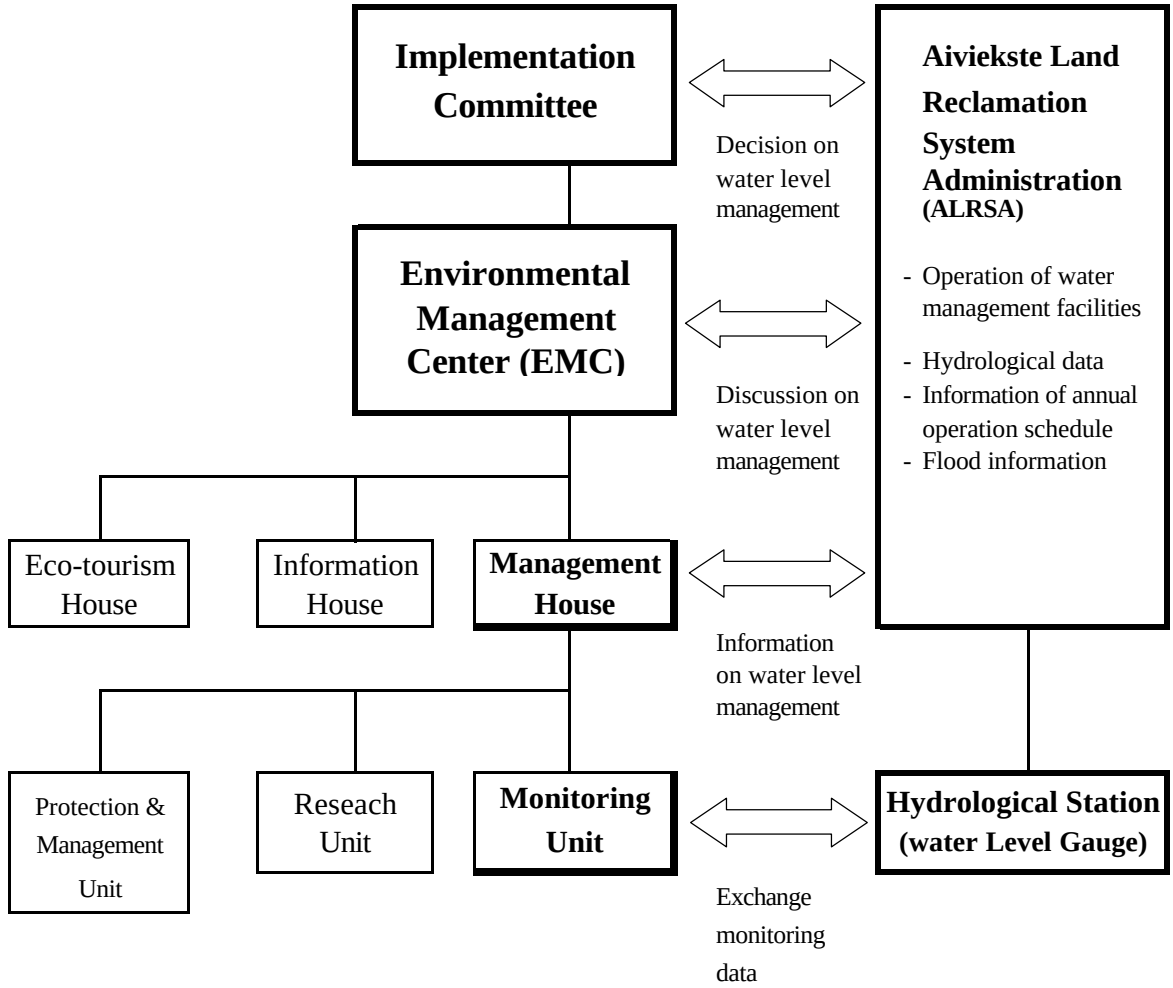

Figure 10.2.3 Proposed Organization for Water Level Management

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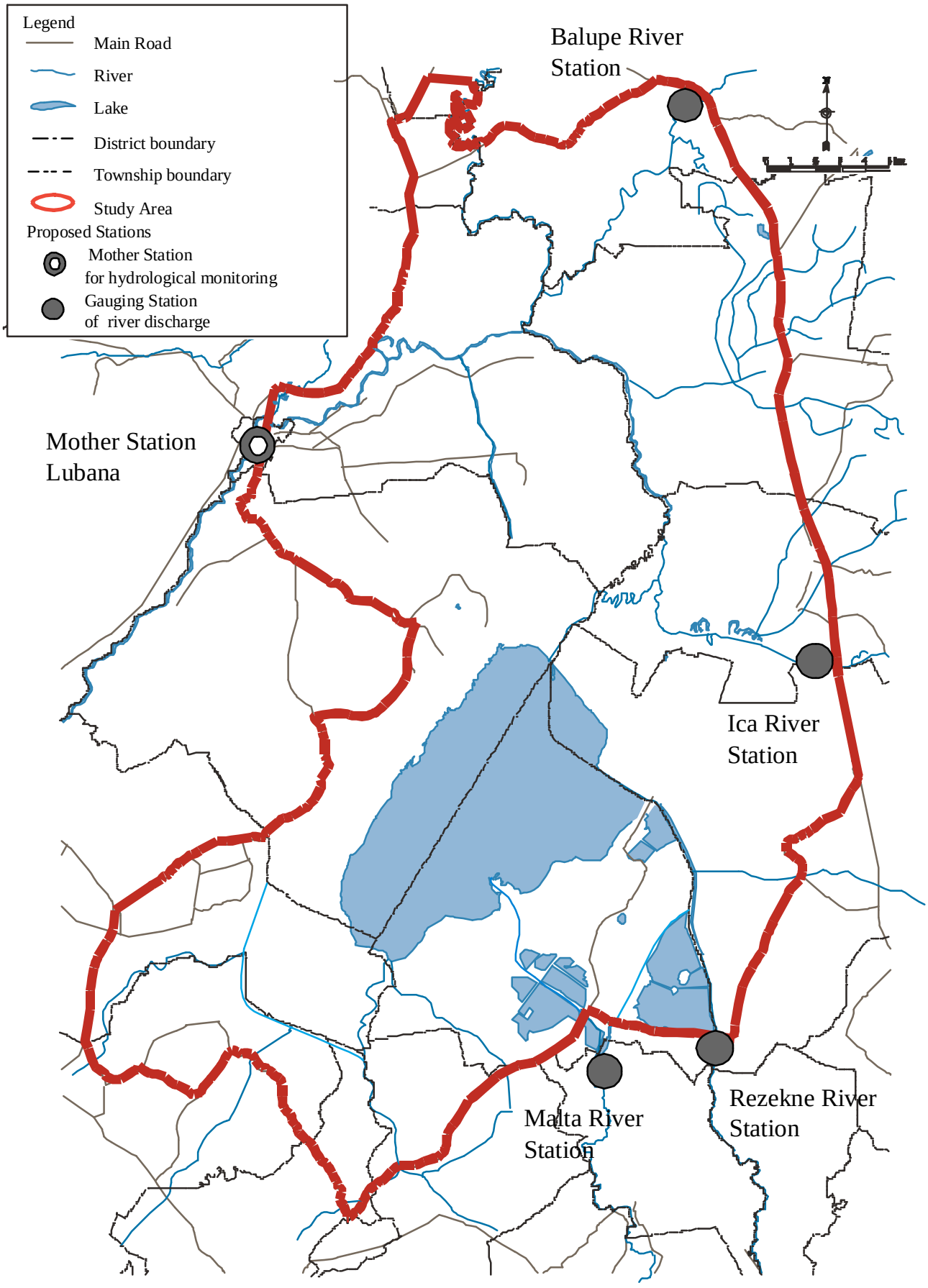

Figure 10.2.4 **Proposed Hydrological Monitoring Stations**

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

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CHAPTER 11

CHAPTER 11 ECONOMIC AND FINANCIAL ANALYSIS

11.1 Proposed Environmental Projects and Programs

11.1.1 Proposed Projects and Programs

Several concrete projects and programs have been proposed within EMP framework by each sector. Based on the sector wise evaluation related to effectiveness, necessity, and technical feasibility, the 11 projects and programs (EMP Projects) are selected for EMP as shown in the next table.

(1) Wetland conservation plan

Since the wetland conservation plan is to be a core of EMP, all actual projects proposed by the wetland conservation sector are put high priority in the EMP projects. Based on the concepts and objectives of the proposed projects, one project and three programs are formulated in the wetland conservation plan. The Environmental Management Center (EMC) Construction Project is a building work for installation of the facility and equipment, and for establishment of the organization responsible for the implementation of EMP. The Biotope Conservation Program consists of four subprograms focusing on conservation of the natural environment. The Environmental Research and Monitoring Program includes equipment installation and actual research and monitoring activities. The Environmental Education and Public Awareness Promotion Program consists of the EIMS subprogram and the Environmental Education subprogram. The indicative cost including operation and maintenance (O/M) cost up to 2010 is estimated at about 2.3 million LVL.

(2) Eco-tourism development plan

Although LWC embraces many attractive natural resources and high development potentials of eco-tourism, it has never experienced any eco-tourism and rural tourism projects so far. Therefore, the strategies of local community driven development and of focusing on the most potential areas are recommended for actual eco-tourism development of LWC. Thus, the Indrani and Lubana Eco-tourism Development Project and the Nagli and Gaigalava Eco-tourism Development Project are proposed as the concrete core projects for the eco-tourism development plan. These two projects are to be the pilot projects for full-scale investment in future. The indicative cost including O/M cost up to 2010 is about 0.9 million LVL.

(3) Fishery development plan

Due to the LWC's very small fishery production and gloomy demand prospect of carp fishery, the fishery development plan should focus on the exploitation of valuable fishes such as pike and pikeperch, and the recreational fishery. Therefore, the Fish Hatchery Development Project and the Angling Promotion Project are formulated in line with the

sustainable use of fish resources and promotion of eco-tourism activities. The indicative cost including O/M cost up to 2010 is about 0.6 million LVL.

(4) Water level management plan

Necessary measures related to water level management to keep the natural environment in good condition are included in the wetland conservation plan. It should be substantial to rehabilitate the existing Aiviekste and Kalnagala sluices in order to manage the water level of the lake properly. So, the Aiviekste Sluice Rehabilitation Project and the Kalnagala Sluice Rehabilitation Project are proposed for EMP. Moreover, the hydrological data and information is indispensable to prepare an appropriate operation manual and to operate the water level control facilities. Therefore, the Hydrological Station Construction Project is proposed within EMP to improve current insufficient conditions. The indicative cost including O/M cost up to 2010 is about 0.3 million LVL.

11.1.2 Costs for the Environmental Management Plan

Initial costs and O/M costs for each proposed project and program are shown in the following table. The total cost including the initial cost, O/M cost, and physical contingency (15% of the initial cost) up to 2010 is estimated at 4.6 million LVL, indicatively.

Proposed Projects and Programs for EMP

(Unit: 1,000 LVL)

Name of Projects and Programs	Initial Cost	O/M Cost	Total Cost
I. Wetland Conservation Plan	***1,444***	***879***	***2,323***
1. Environmental Management Center Construction Project	**375**	**105**	**480**
2. Biotope Conservation Program	**796**	**78**	**874**
2-a. Bird conservation subprogram	114	34	148
2-b. Mammal conservation subprogram	19	3	22
2-c. Bog and inundation grassland conservation subprogram	208	27	235
2-d. Fish conservation subprogram	390	14	404
3. Environmental Research and Monitoring Program	**166**	**248**	**414**
4. Environmental Education and Public Awareness Program	**107**	**448**	**555**
4-a. EIMS subprogram	74	171	245
4-b. Environmental education subprogram	33	277	310
II. Eco-tourism Development Plan	***521***	***393***	***914***
5. Indrani and Lubana Eco-tourism Development Project	**242**	**171**	**413**
6. Nagli and Gaigalava Eco-tourism Development Project	**279**	**222**	**501**
III. Fishery Development Plan	***414***	***227***	***641***
7. Fish Hatchery Development Project	**315**	**156**	**471**
8. Angling Promotion Project	**99**	**71**	**170**
IV. Water Level Management Plan	***293***	***9***	***302***
9. Aiviekste Sluice Rehabilitation Project	**138**	**6**	**144**
10. Kalnagala Sluice Rehabilitation Project	**145**	**1**	**146**
11. Hydrological Station Construction Project	**10**	**2**	**12**
Physical Contingency (15 %)	***401***	-	***401***
Grand Total	***3,073***	***1,508***	***4,581***

Note: O/M cost is the total cost up to 2010.

11.2 Economic Evaluation

11.2.1 Approach of Cost Benefit Analysis

(1) Conceptual framework of cost benefit analysis

The economic analysis is integrated into the evaluation of EMP considering the direct costs of equipment, operation and maintenance as well as the benefits and damage costs

avoided in the uses of environmental resources in LWC. This analysis builds on the environmental economic capabilities developed so far, aiming at evaluating feasibility of EMP's implementation from the socio-economic point of view.

For evaluation of socio-economic feasibility, "Cost Benefit Analysis" approach, which is internationally common and accepted, is applied with its general conceptual framework of evaluation equation as follows:

$$NB = Bd + Be - Cd - Cp - Ce$$

where NB : Net benefit generated by implementation of the projects
Bd : Productive benefit directly generated by the projects
Be : Environmental benefit by the projects
Cd : Direct cost necessary for the implementation of the projects
Cp : Cost for preventive measures for environmental conservation, if applied
Ce : Cost as environmental damage due to the project implementation

In many cases of productive or infrastructure sector projects, conventionally, "Be" and "Ce" have been ignored as items of the external economy and external diseconomy respectively, both of which are regarded as tangible in monetary terms. A major part of "Bd" in EMP is equivalent to "Be", and "Cd" equals "Cp". It is that its main targets are originally to conserve a good quality of environment or to further improve the environmental quality. On the other hand, "Ce" hardly accrues from EMP for the same reason. Therefore, the most proper cost-benefit equation for EMP is as below:

$$NB = Be - Cp$$

If "Be" of EMP is still left unmeasured as conventional, any cost-benefit analysis of calculating "NB" can not be carried out. In this context and nature of EMP's benefits, the study team considered "Be" calculation as most essential and is challenging its difficult evaluation, applying the existing evaluation methods for environmental values.

(2) Points of analytical approach

With increasing knowledge of both the economic and environmental values of LWC's ecosystems, cost benefit analysis can serve as a useful tool in analyzing conservation projects for these ecosystems. Considering the following four points, the evaluation is being carried out on various important aspects of LWC such as wetland vegetation, environmental education, and eco-tourism.

1) Use of social cost and benefit

Economic data, namely "social cost/benefit", reflecting real scarcity and consumption of local resources should be utilized, rather than focusing on individual enterprise's profits and expenditures in cash flow.

2) Application of Economic Internal Rate of Return (EIRR)

Among the three typical evaluation criteria, i.e. EIRR, net present value (NPV) and benefit-cost ratio (B/C), EIRR is applied to finally examine the economic viability, because EIRR has no trouble in selecting discount rates from the very beginning.

3) Appropriate time horizon for analysis

The economic analysis has to cover all the period when any cost or benefit accrues from EMP's implementation consisting of both construction and operation stages. EMP's benefits will last long beyond a period requiring the direct costs of management. However, 30- to 40-year is used as a time horizon subject to the economic analysis, since any costs and benefits accruing beyond such a period are discounted into present value of extremely small amount. One possibility to assess the economic soundness of EMP for further future is to discount the environmental benefits by setting basis years for discounting at the beginning of every generation (every 30 ~ 40 years). This approach will be also tried if really necessary and useful at the final stage of the study.

4) With-project/without-project framework

The analysis is carried out based on the net costs and benefits, identifying incremental costs/benefits generated purely due to EMP's implementation. Natural degradation of environment, measured in the without-project framework, has to be distinguished from that under the with-project situation.

11.2.2 Monetary Evaluation Methods for Environmental Benefits

The main purpose to apply the monetary evaluation methods is to quantitatively measure the benefits from implementation of EMP, not to measure LWC's value as a whole. Potential methods for estimating the monetary value of environmental resources and benefits, which may result from implementation of EMP, were examined. The next table presents a menu of valuation techniques, which have been developed so far in environmental economics field, as well as examples of the types of effects valued.

Menu of Valuation Methods for Environmental Effects

Valuation Method	Typical Effects Valued
A. Objective Valuation Approaches (OVA)	
1) Change in Productivity	Productivity
2) Cost of Illness	Health (morbidity)
3) Human Capital	Health (mortality)
4) Replacement (Restoration) Cost	Capital assets, and natural resource assets
B. Subjective Valuation Approaches (SVA)	
1) Preventive (mitigative) Expenditure	Health, productivity, capital assets, and natural resource assets
2) Hedonic Approaches - Property (Land) Value - Wage Differential	 Environmental quality, and productivity Health
3) Travel Cost (TCM)	Natural resource assets, and tourist attractions
4) Contingent Valuation (CVM)	Any effects including biological and aesthetic values

Source: Economic Analysis of Environmental Impacts, ADB/WB, 1994

(1) Objective valuation approaches (OVA)

The first set of methods in the table are OVA that are based on physical relationships that formally describe cause and effect relationships and provide objective measures of effects resulting from various causes. It uses "damage functions" which relate the level of offending activity to the degree of physical damage to a natural or man-made asset, or to

the degree of health impact. The OVA in general provide measures of the gross benefits, in the sense of losses avoided, of preventive or remedial actions. The important assumptions are:

- Net value of averting damage is at least equal to the cost which would be incurred if the damage actually occurred; and
- Rational individuals, in order to prevent some damage from occurring, would be willing to pay an amount less than or equal to the costs arising from the predicted level of environmental effects.

(2) Subjective valuation approaches (SVA)

In contrast to OVA, SVA is based on more subjective assessments of possible damage expressed in real or hypothetical market behavior. Using revealed behavior involves examination of real markets for goods or services which are affected by environmental impacts such as water pollution, in which people actually make trade-off between the environmental impact and other goods or income.

The travel cost method (TCM) is a means of determining value figures for things which are generally not bought and sold, and therefore fall outside of the market's pricing system. The non-market assets which are most often applied to are "recreational resources which necessitate significant expenditure for their enjoyment" as eco-tourism development in EMP. The basic premise of TCM is that, although the actual value of the recreational experience does not have a price tag even some activities collect fee such as proposed canoeing program in EMP, the costs incurred by individuals in travelling to the site can be used as surrogate prices (L. Karasin, 1999).

In other cases environmental impacts cannot be valued, even indirectly, through market behavior. The alternative is to construct hypothetical markets for various options to reduce environmental damages and to ask a sample of people directly to express how much they would be willing to pay for various reductions in environmental impacts. These are called the contingent valuation methods (CVM).

(3) Evaluation of Eco-tourism Development

So far, LWC has not been well used for tourism activity though LWC is considered to have potential with rich natural resources to fascinate tourists. Through implementation of EMP, the proposed eco-tourism development will bring out the potential value of the LWC in terms of the recreational use.

Some services and facilities provided by the proposed eco-tourism projects have market prices such as hotel charge and canoeing program fee. However, those revenues can not be counted as total value of the eco-tourism because many services and facilities, which are mainly common facilities and infrastructure, do not have market price such as use of boardwalk and road in LWC, and people can use them freely. In addition, it is assumed that people has motivation to come to LWC for recreational purpose under the proposed

eco-tourism development, only when people think that they can get benefit from the eco-tourism more than they spend for market and non-market cost.

Under the above circumstances, TCM will be attempted in the study to evaluate the recreational value of LWC brought out by the eco-tourism development. In TCM, transportation cost, travel time cost calculated as waged working, opportunity cost for length of stay in LWC is counted at various origin and occupation groups. Then, the estimated travel cost is multiplied by forecasted number of tourists to LWC for eco-tourism purpose to calculate total travel cost, on the premise that the forecasted number of tourists should be estimated based on the potential demand of the eco-tourism development in LWC.

11.2.3 Questionnaire Survey

(1) Objectives and methodology

For intentions of local residents to be reflected to the proposed EMP, a questionnaire survey was conducted to collect information on public opinion and awareness on environmental protection and development in the study area, evaluation of environmental conditions, willingness-to-pay (WTP) to environmental conservation. A sample of 513 households that are around 1 % of total households in townships related to LWC in Rezekne, Madona, Balvi, and Gulbene districts were selected randomly.

(2) Results of the survey

Although the survey was limited to only about 500 samples in the townships locating near LWC, the results of the survey shows some representative facts, ideas, and intentions of local people living in and around LWC. Answers on favorite points of landscape near local people's residences were dominated by "Lake and pond (20 %)", "Flower (13 %)", "Spacious view (13 %)", and "Trees and woods (12 %)" as shown in Table 11.2.1 (1) - (2). These points are typical component of landscape in LWC, which have potential to fascinate tourists to LWC.

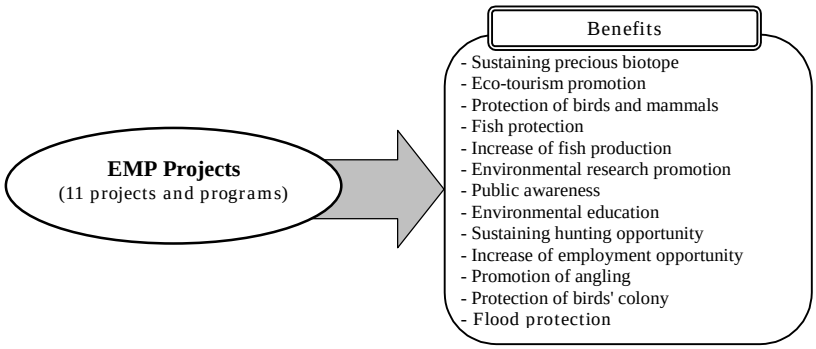
On the whole, people have intention on the environment in LWC with development issue directly connecting to local people's lives. To image environmental protection and tourism development of LWC in future might be ambiguous and rather difficult for interviewees in present circumstance, which there is no concrete plan and program in the area. More positive ideas and opinions from local people would be obtained by showing concrete image of the future environment and development to be proposed by EMP.

11.2.4 Benefits of Projects and Programs for EMP

The vision of EMP is the wise and sustainable use of nature resources in LWC, so that key components for the economic analysis are environmental goods or services that have been treated as external factors in the conventional analysis. It should be noted that the

environmental management hardly generates direct marketable products that can be important factors to assess the economical and financial validity.

The projects and programs for EMP (the EMP Projects) are proposed from different sectors as described in the previous chapters. The EMP Projects are expected to bring about many kinds of benefits as shown below. All the EMP Projects are planned to be interdependent and contribute to each other to gain overall benefit of EMP effectively. Therefore, economic benefits are estimated for each type of benefit, not for each project or program. After the identification of benefits and costs of the EMP Projects, economic evaluation is conducted for the overall EMP implementation.



Proposed Projects and Programs (EMP Projects) and their Benefits

In principle, economic evaluation of the development project is conducted by estimating the net benefit between "Without-project" and "With-project". The same manner is taken to the economic evaluation of the EMP Projects. The net benefit with implementation of the EMP Projects (with-project case) is estimated and then is compared to the net benefit of without the EMP Projects (without-project case).

11.2.5 Monetary Valuation Methods for Benefit Calculation

Implementation of the EMP Projects brings about various benefits in many aspects of EMP as shown in the previous table. Considering the correlation of the benefits, those benefits are synthesized to the conservation of biotope, eco-tourism promotion, and protection of birds and mammals. These types of benefits are valued as follows.

(1) Conservation of biotope

Existing precious biotope in LWC will be gradually degraded with certain period in the future unless some proper management methods and countermeasures are executed. It means that value of the biotope in LWC will be deteriorated without EMP implementation (without-project case). It is assumed that present biotope will be changed in the future as follows in case of the without-project, while the existing biotope, especially in NPZ and AMZ, will be maintained by implementation of the EMP Projects.

The following transitional periods of the biotopes are applied considering the low pressure to the nature environment by development activity in LWC under an assumption for the

without-project case that the present level of the development activity in LWC continue in the future. However, in the case where level of development activity in LWC increase in the future, the transitional period of the biotope will shorten. Consequently the net benefit of differences between with-project and without-project cases will increase.

Possible Change of Biotopes in Case of Without-Projects

Biotope Types	Specific Features	Transition Phenomena	Transitional Period
Inundated grassland	Breeding place of the Great snipes and other ecological functions	Changing into shrub such as willow by dryness and reduction to narrow area only along the river	50 years
Raised/Transitional bog area	Distinct biotope and other ecological functions	Vanishing by dryness due to existing drain ditches, and changing into shrub	over 200 years

Natural fire may cause serious damage and loss of the biotope in LWC. However, it is not included in the economic evaluation since it is difficult to predict its frequency.

Monetary values of unit area by type of ecosystem, which were estimated by a research (Robert Costanza et al., 1997), is applied to calculate indicative benefit of the biotope in LWC, though detailed ecological study is necessary for more appropriate valuation of the biotope in LWC. The research groups ecosystem functions into 17 major categories including both market and non-market components as shown in Table 11.2.2. By using the valuation results, economical value for unit area by each biotope type in LWC is estimated as shown in Table 11.2.3.

By applying the unit values by type of the biotope, total present economic value of biotope in LWC is estimated at about 28 million LVL/year at the year 2000 price level in Latvia as shown in Table 11.2.3. In the economic analysis, the loss of the economic value is considered as cost in without-project case, while the avoidable cost by implementation of the EMP Projects is considered as benefit in with-project case. Assume that the EMP Projects on wetland conservation start the operation at the beginning of year 2003, total annual benefits are 373 thousand LVL in 2003 and 1,244 thousand LVL in 2010 as shown in Table 11.2.4.

In the estimation, only value of unit area by biotope type is considered, but the ecosystem existing in a certain extent of area is not valued. Namely, precious ecosystem can be considered to be valued higher with wider extent of area in the view of preciousness. Also non-use value such as option, existence and bequest values were not estimated since detailed survey for the contingent valuation method (CVM) should be conducted for relative long study period. These values may also place an additional large amount of value in LWC.

(2) Eco-tourism promotion

In order to estimate incremental value of recreational use of LWC by implementing the eco-tourism projects, travel cost method known as an economic valuation technique is applied in the study.

A prerequisite of the travel cost method that recreational use value of designated area depends on consumption by tourists to the area is applied to estimation of economic benefit brought about by the eco-tourism projects in LWC. It is assumed that eco-tourists to LWC place higher value on eco-tourism service than their travel expenses consisting of transportation fee and travel time cost as wage (opportunity cost) as next simple equation. The travel cost method thus reveals minimum value of the recreational use value of the eco-tourism projects.

Travel cost = Transportation cost + Travel time cost

Potential number of eco-tourists to LWC for both foreign and domestic tourists is estimated around 430 tourists/year at present in total and will potentially increase up to around 850 in 2010 based on estimation by the JICA study team. It is assumed that the amount of potential eco-tourist in 2010 can be realized in the case of the with-project, and that the present situation does not have enough capacity for eco-tourism activity and facility in LWC.

Based on the tourism statistics in Latvia, a rate of foreign tourists in total number of tourists is estimated. And then number of foreign tourists is allocated by country of origin. Average prices of airfare and wage by country are applied for the estimation of the travel cost for each country. Supposing that the EMP Projects on eco-tourism start operation at the beginning of year 2003, 22,000 LVL in 2003 and 67,000 LVL in 2010 are estimated as economic benefit as shown in Table 11.2.5.

In the above estimation, the following assumptions are applied:

a) Flat rate of airfare is assumed during project period due to international competition of the market.

b) Annual increment rate of wage level as opportunity cost is 0.5 % per annum on average.

c) Number of potential annual tourists is realized at 6 % per annum of increase rate by implementing the EMP Projects, while almost the same number of present tourists visit LWC in case of without-project.

d) Origin countries of foreign tourists to LWC are considered based on present tendency of tourists. Therefore, potential tourists from other countries such as Japan are not included though there may be high possibility of increase.

e) Tourists tend to visit several other destinations, not only LWC. Therefore, suppose that 50 % of total estimated travel cost is applied to LWC's valuation.

(3) Protection of birds and mammals

Compared to the without-project case, implementation of the EMP Projects brings out positive results on protection of birds and mammals by maintaining and improving present nature conditions in LWC. Protection cost of animals of the proposed projects is rather lower than restoration cost of lost habitat, and it is impossible to restore in some cases. In a

sense, the cost avoided by implementation of the protection instead of the restoration in the future is considered as economic benefit of the EMP Projects.

The restoration cost method would normally be applied to evaluate economic benefit from protection of birds and mammals in the case of with-project. However, any related study and research on cost for restoring or mitigating similar habitat of LWC to be applied is not available at present, so that quantitative valuation can not be conducted except for the protection of habitat by maintaining present biotope which has already evaluated in the above.

Also, low number of bird and mammal species in Latvia compared to that in other countries can be protected in LWC by implementing the EMP Projects. Therefore, it should be evaluated on such significance and role of LWC in the viewpoint of protecting biological diversity in Latvia.

(4) Agriculture and forestry

The rural tourism in connection with eco-tourism projects proposed in EMP will create an additional income opportunity for farmers. Part of the benefit from rural tourism is included in the above estimation of economic valuation for eco-tourism projects. However, any expansion of agricultural land and introduction of new products will not be done by the EMP Projects. Therefore, economic benefit on agricultural production change is not brought about by the EMP Projects.

Forestry sector also does not have any influence by implementation of the EMP Projects. Proper forestry development is conducted with the existing practice operated by the State-shared Forestry Company. Therefore, forestry is also not considered in the estimation of the valuation.

Valuation Items

Type	Benefit to be Quantified	Valuation Method
Biotope	Maintained precious biotope functions	Application of estimated unit value of biotopes
Eco-tourism	Tourists satisfaction to LWC nature and eco-tourism facilities & activities	Travel cost method
Birds and mammals	Environmental services and goods from birds and mammals	Restoration cost method (Related data is not available for specific species seen in LWC.)

11.2.6 Preliminary Cost-Benefit Analysis

Only a Standard Conversion Factor (SCF) of 0.8 is preliminarily applied to convert financial cost to economic cost, considering the high value added tax rate in Latvia. The project period is set as 40 years, in terms of the period where the EMP Projects should be totally renewed and discounting effect for calculation of the present value.

Economic viability of the EMP Projects is evaluated by Economical Internal Rate of Return (EIRR) with a 40-year project period though the target year of EMP is 2010. As a result of the estimation, EIRR is about 30 % as shown in Table 11.2.6. Compared to interest rates ranging from 10 % to 15 % in the conventional economic analysis, the result means that the EMP Projects are viable economically even though some parts of benefits of them are only quantified in monetary value and all costs of the EMP Projects are estimated.

The economic analysis focuses on and evaluates the changes of national welfare by the EMP Projects. Fair distribution of benefits is not taken into account for both spatial and temporal viewpoints. Beneficiaries of the EMP Projects consist of various stakeholders such as eco-tourists, private entrepreneurs, municipality, and local residents.

Considering that sustainable environmental conservation and economic development in LWC are realized by local residents, a mechanism that most benefits should be distributed to local people in the long term would be necessary. In this sense, employment opportunity for local residents in and around LWC should be created such as nature guide for eco-tourism, business for eco-tourism activities, and rural tourism.

11.3 Financial Analysis

11.3.1 Cost Estimation

(1) Conditions of cost estimate

Major conditions applied for the indicative cost estimation in the above chapters are summarized below:

a) Initial cost for each project and program covers the expenses for labor, material, construction, equipment, and the contractor's indirect cost.

b) Prices are based on labor, materials and equipment prices as of September 2000. The exchange rate applied in the estimation is 1 LVL = 1.61 USD.

c) Land acquisition cost is excluded because almost every facilities will be constructed on public land.

d) Engineering service expense is included in the initial cost and operation & maintenance cost (O/M cost).

e) Taxes such as VAT are included in the cost estimated.

f) Renovation/renewal of the facilities and equipment: the renovation and renewal schedule and costs for the EMP Projects are included in the O/M cost based on their schedule as below.

g) Almost all materials and equipment can be procured in domestic market. Therefore, import of materials and equipment are not considered.

Renovation and Renewal Schedule

Item	Frequency	Cost
1. Facility*	Once 20 years Once 10 years Once 5 years except the above period	25 % of initial cost 10 % of initial cost 3 % of initial cost
2. Equipment and Vehicle (Bus)	Once 5 years (Once 10 years)	100 % of initial cost

Note: Renovation of the RC dam for bog conservation is every 10 years at 50 %.

(2) Cost of the EMP Projects

Indicative costs for the EMP Projects are estimated in relevant chapters and summarized below. Initial cost of the EMP Projects consisting of those for design, construction, equipment procurement, and physical contingency is estimated at about 3.1 million LVL. The O/M cost of them including training cost for staff from year 2001 to 2010 are estimated at about 1.5 million LVL. Total cost up to year 2010 is about 4.6 million LVL.

Cost of the EMP Projects

(Unit. 1,000 LVL)

EMP Projects	Initial Cost	O/M Costup to 2010	Total
I. Wetland Conservation Plan	1,444	879	2,323
II. Eco-tourism Development Plan	521	393	914
III. Fishery Development Plan	414	227	641
IV. Water Level Management Plan	293	9	302
Physical Contingency (about 15 % of the above)*	401	-	401
Total	3,073	1,508	4,581

Note: * The high physical contingency rate is applied because present estimation of the EMP Projects was conducted under preliminary specification of the EMP Projects.

11.3.2 Cost Recovery Schedule and Balance Sheet

The EMP Projects are interdependent and the benefits of EMP are brought about by overall implementation of the EMP Projects. Therefore, cost recovery mechanism should be considered within EMP framework, not by each project and program. The projects on eco-tourism and angling could collect a certain amount of fee for cost recovery, but the projects on wetland conservation and water level management plan do not recover the expenses by themselves. However, only the projects on eco-tourism and angling can not cover the required revenue of EMP as shown in Table 11.4.2.

The following financial sources should be additionally sought:

a) Governmental subsidy for Ramsar site: The governmental budget for the Ramsar sites may be subsidized to EMP of LWC in a regular basis after LWC is designated as the Ramsar site.

b) Special assistance for environmental program: The renovation/renewal of equipment may be applied to grant aid programs by national or international organizations such as LEPF, Fish Fund, LIFE Nature, and Global Environment Facility.

11.4 Implementation Schedule

11.4.1 Phased Plan

The EMP Projects were proposed as required measures to realize EMP. To implement the EMP Projects systematically and steadily, a stepwise implementation schedule, namely a phased plan, is required. Considering necessary time of capacity building for the implementation of the EMP Projects such as preparation of financial, technical, and human resources, and the consistency and linkage among the EMP Projects, a plan with three phases is proposed as follows:

- Phase I : Preparation period of the EMP Projects with design, procurement of equipment, construction, and civil works (year 2001 to 2003).
- Phase II : Commencement period of most of the EMP Projects with capacity building (year 2004 to 2007).
- Phase III : Full implementation period of the EMP Projects for sustainable operation after year 2010 (year 2008 to 2010).

These phases can be utilized not only for development of implementation schedules but also for checking the progress of the EMP Projects. Corresponding to the phases set above, the implementation schedules of the EMP Projects are prepared in Table 11.4.1. In these schedules, the stage classification such as design, equipment procurement, construction, training, and O/M were incorporated as shown in the patterned bar charts in the table.

11.4.2 Investment Program

The investment schedule during 2001 to 2010 based on the phased plan is shown below. It is important to note that O/M costs will be still needed after the target year 2010 to implement the EMP Projects continuously.

Investment Schedule (2001 - 2010)

(Unit: 1,000 LVL)

Items	Phase I (2001-2003)	Phase II (2004-2007)	Phase III (2008-2010)	Total (2001-2010)
Initial Cost	2,405	668	0	3,073
O/M Cost	124	848	536	1,508
Total Cost	2,529	1,516	536	4,581

Note: Initial cost includes the physical contingency in 15 %.

Objective of the financial analysis is to analyze viability of the financial plan for EMP as shown in Table 11.4.2, examining whether there will be enough money available to recover the estimated costs for the EMP implementation. Money necessary for implementation can be largely classified into initial cost and O/M cost. Since EMP consists of many components that can not recover their expenses by themselves unlike conventional development projects, it is difficult to expect high financial turnover from

the implementation. Therefore, conventional financial evaluation criteria such as Financial Internal Rate of Return (FIRR) are not to be applied for EMP.

11.4.3 Financial Arrangement for Initial Cost

The financial arrangement for initial cost of the EMP Projects may be made with combination of the loan and grant scheme from potential international donors. Assume that the grant scheme is applied to the Environmental Research & Monitoring Program and the EIMS subprogram which provide only equipment, and other projects and programs apply for a soft loan, which is a low interest rate and long repayment period loan scheme. Under three conditions, total amounts of the soft loan and grant applied are allocated below.

Financial Application for Initial Cost

(Unit: 1,000 LVL)

Soft Loan	Grant	Total
2,797	276	3,073

In case that the Latvian government borrows initial cost through bilateral soft-loan under the following conditions to implement the EMP Projects, repayment schedule is shown as Table 11.4.2.

- Interest Rate: 0.75 % per annum
- Repayment Period: 40 years including grace period 10 years

From 2001 to 2010, only interest will be repaid at about 21,000 LVL/year. Then, from 2011 to 2040, total repayment amount with the principal and interest will be about 104,000 LVL/year.

The O/M cost is basically born by domestic budget. Therefore, the total Latvian expenditure for the EMP Projects consists of the O/M cost and repayment of soft loan. Annual expenditure ranges from about 21,000 LVL/year to 445,000 LVL/year between 2001 and 2010, and 172,000 LVL/year on average. After the year 2011, annual expenditure ranges from about 220,000 LVL/year to 725,000 LVL/year and 361,000 LVL/year on average as shown in Table 16.4.2. Considering affordability of the expenditure for the EMP Projects, domestic annual revenue same as the annual expenditures should be at least required as shown in Table 11.4.2.

Figure 11.4.1 shows structure of financial arrangement for the proposed EMP projects. Although Latvian government guarantees the return of loan to a loan institution, it is essential to have main implementation bodies that are directly involved in the EMP projects, namely EMC, LETA, and ALRSA. Then, necessary budgets are allocated to the implementation agencies through the Ministry of Finance (MOF) and the district councils concerned, which are in positions to endorse and financially supervise the activities of the implementation agencies.

Table 11.2.1(1) Favorite Points of Landscape

Town and Township	Total		1) Daksare		2) Gaigalava		3) Nagli		4) Berzpils		5) Lazdukalna		6) Rugaji	
a) Mountain	22	(6)	3	(7)	1	(2)	1	(8)	1	(8)	9	(15)	0	(0)
b) Trees and woods	47	(12)	7	(16)	5	(11)	2	(17)	1	(8)	7	(11)	0	(0)
c) Grassy plain	15	(4)	1	(2)	4	(9)	0	(0)	0	(0)	2	(3)	0	(0)
d) Flower	49	(13)	10	(22)	11	(24)	1	(8)	2	(15)	7	(11)	0	(0)
e) Lake and pond	73	(19)	12	(27)	5	(11)	1	(8)	1	(8)	9	(15)	0	(0)
f) Farm	5	(1)	0	(0)	2	(4)	1	(8)	0	(0)	0	(0)	0	(0)
g) Orchard	19	(5)	6	(13)	4	(9)	0	(0)	1	(8)	1	(2)	0	(0)
h) Row of trees	4	(1)	0	(0)	0	(0)	0	(0)	0	(0)	1	(2)	0	(0)
i) Row of houses and streets	9	(2)	0	(0)	2	(4)	0	(0)	0	(0)	3	(5)	0	(0)
j) Night scene	32	(8)	2	(4)	1	(2)	0	(0)	0	(0)	4	(6)	0	(0)
k) Sky and clouds	33	(9)	0	(0)	6	(13)	4	(3)	2	(15)	5	(8)	0	(0)
l) Spacious view	50	(13)	1	(2)	4	(9)	2	(17)	4	(31)	9	(15)	0	(0)
m) Composition of view	17	(4)	3	(7)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
n) Others	8	(2)	0	(0)	0	(0)	0	(0)	1	(8)	5	(8)	0	(0)
Total	383	(100)	45	(100)	45	(100)	12	(100)	13	(100)	62	(100)	0	(100)

Note: Number in ( ) shows percentage of total.

Table 11.2.1(2) Favorite Points of Landscape

Town and Township	7) Lubana Town		8) Barkava		9) Murmastiene		10) Osupe		11) Varaklani		12) Dauksti	
a) Mountain	0	(0)	1	(4)	0	(0)	0	(0)	1	(4)	5	(8)
b) Trees and woods	0	(0)	5	(20)	10	(13)	0	(0)	2	(8)	8	(13)
c) Grassy plain	0	(0)	2	(8)	1	(1)	1	(9)	1	(4)	3	(5)
d) Flower	0	(0)	2	(8)	3	(4)	1	(9)	4	(16)	8	(13)
e) Lake and pond	0	(0)	10	(40)	25	(32)	1	(9)	4	(16)	5	(8)
f) Farm	0	(0)	0	(0)	0	(0)	0	(0)	1	(4)	1	(2)
g) Orchard	1	(25)	1	(4)	0	(0)	0	(0)	2	(8)	3	(5)
h) Row of trees	0	(0)	0	(0)	0	(0)	0	(0)	1	(4)	2	(3)
i) Row of houses and streets	1	(25)	0	(0)	1	(1)	0	(0)	1	(4)	1	(2)
j) Night scene	1	(25)	0	(0)	8	(10)	1	(9)	1	(4)	13	(21)
k) Sky and clouds	0	(0)	1	(4)	5	(6)	3	(27)	1	(4)	6	(10)
l) Spacious view	0	(0)	3	(12)	14	(18)	4	(36)	3	(12)	6	(10)
m) Composition of view	1	(25)	0	(0)	10	(13)	0	(0)	1	(4)	2	(3)
n) Others	0	(0)	0	(0)	0	(0)	0	(0)	2	(8)	0	(0)
Total	4	(100)	25	(100)	77	(100)	11	(100)	25	(100)	63	(100)

Note: Number in ( ) shows percentage of total.

Table 11.2.2 Ecosystem Functions

Type of Functions	Content of Functions	Examples
1. Gas regulation	Regulation of atmospheric chemical composition	CO_2/O_2 balance, O_3 for UVB protection, and SOx levels
2. Climate regulation	Regulation of global temperature, precipitation, and other biologically mediated climatic processes at global or local levels.	Green gas regulation, DMS production affecting cloud formation.
3.Disturbance regulation	Capacitance, damping and integrity of ecosystem response to environmental fluctuations	Storm protection, flood control, drought recovery and other aspects of habitat response to environmental variability mainly controlled by vegetation structure.
4. Water regulation	Regulation of hydrological flows	Provision of water for agricultural (such as irrigation) or industrial (such as milling) processes or transportation.
5. Water supply	Storage and retention of water.	Provision of water by watersheds, reservoirs and aquifers.
6. Erosion control	Retention of soil within an ecosystem	Prevention of loss of soil by wind, runoff, or other removal process, storage of stilt in lakes and wetlands.
7. Soil formation	Soil formation process	Weathering of rock and the accumulation of organic materials.
8. Nutrient cycling	Storage, internal cycling, processing and acquisition of nutrients	Nitrogen fixation, N, P and other elemental or nutrient cycles.
9. Waste treatment	Recovery of mobile nutrients and removal or breakdown of excess or xenic nutrients and components	Waste treatment, pollution control, detoxification
10. Pollination	Movement of floral gametes	Provision of pollinators for the reproduction of plant populations.
11. Biological control	Trophic-dynamc regulations of populations	Keystone predator control of prey species, reduction of herbivory by top predators.
12. Habitat refugia	Habitat for resident and transient populations	Nurseries, habitat for migratory species, regional habitats for locally harvested species, or overwintering grounds.
13. Food production	That portion of gross primary production extractable as food	Production of fish, game, crops, nuts, fruits by hunting, gathering, subsistence farming or fishing.
14. Raw materials	That portion of gross primary production extractable as raw materials	The production of lumber, fuel or fodder.
15. Genetic resources	Sources of unique biological materials and products	Medicine, products for materials science, genes for residence to plant pathogens and crop pests, ornamental species (pets and horticultural varieties of plants).
16. Recreation	Providing opportunities for recreational activities	Eco-tourism, angling, and other outdoor recreational activities.
17. Cultural	Providing opportunities for non-commercial uses	Aesthetic, artistic, educational, spiritual, and/or scientific values of ecosystems.

Source: The Value of the world's ecosystem services and natural capital, Robert Costanza et al., Nature vol.387 May 1997

Table 11.2.3 Pricing of Unit Area by Type of Biotope

(Unit: USD/ha/year)

Ecosystem Type / Ecosystem Function -LWC Biotope Type	1* Gas regulation	2* Climate regulation	3 Disturbance regulation	4 Water regulation	5 Water supply	6 Erosion control	7 Soil formation	8 Nutrient cycling	9 Waste treatment	10 Pollination	11 Biological control	12 Habitat refugia	13 Food production	14 Raw materials	15 Genetic resources	16** Recreation	17 Cultural	Total	Converted for Latvian Level of 2000*	Area in LWC (ha)	Total Present Value (USD/year)
Forest	**-**	**141**	**2**	**2**	**3**	**96**	**10**	**361**	**87**	**-**	**2**	**-**	**43**	**138**	**16**	**66**	**2**	**969**	**174**		
- Forest	-	141	2	2	3	96	10	361	87	-	2	-	43	138	× 0	○ 66	2	953	172	33,589	5,761,857
Wetlands	**133**	**-**	**4,539**	**15**	**3,800**	**-**	**-**	**-**	**4,177**	**-**	**-**	**304**	**256**	**106**	**-**	**574**	**881**	**14,785**	**2,661**		
-Inundated grassland	○3 44	-	△ 2,270	○ 15	○3 1,267	-	-	-	○1 4,177	-	-	○3 101	○ 256	× 0	-	× 0	○3 294	8,424	1,516	5,247	7,955,659
-Fen	○2 89	-	△ 2,270	○ 15	○2 2,533	-	-	-	○2 2,785	-	-	○2 203	△ 128	× 0	-	○2 287	○2 587	8,896	1,601	1,520	2,433,991
-Raised bogs/transitional bogs	○1 133	-	△ 2,270	× 0	○1 3,800	-	-	-	○3 1,392	-	-	○1 304	△ 128	○1 106	-	○1 574	○1 881	9,588	1,726	9,997	17,252,923
Lakes/rivers	**-**	**-**	**-**	**5,445**	**2,117**	**-**	**-**	**-**	**665**	**-**	**-**	**-**	**41**	**-**	**-**	**230**	**-**	**8,498**	**1,530**		
-Lake, river, canal	-	-	-	○ 5,445	○ 2,117	-	-	-	○ 665	-	-	-	○ 41	-	-	○ 230	-	8,498	1,530	8,256	12,628,708
-Fish pond	-	-	-	× 0	× 0	-	-	-	× 0	-	-	-	○ 41	-	-	○ 230	-	271	49	2,685	130,974
Cropland	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**14**	**24**	**0**	**54**	**-**	**-**	**-**	**-**	**92**	**17**		
-Agricultural land/dry grass land	-	-	-	-	-	-	-	-	-	14	24	0	54	-	-	-	-	92	17	19,853	328,766
Total																				81,147	**46,164,112**

Note: Bold figures are unit prices based on the reference.

LVL 28,673,361

"-" means lack of available information in the reference.

"○" shows the type of biotope has the function. The number with "○" shows rank of the function. Based on the rank, the pricing is weighted to original research data.

"×" shows the type of biotope does not have the function.

"△" shows the type of biotope does not have the function fully in LWC. Suppose that half of function is functioned.

The estimated prices of unit area by type of biotope are converted from prices in USA into that in Latvia at year 2000 price.

* Ecosystem function of the gas regulation and climate regulation is not counted in the economic analysis since those functions can not be considered only within the national economy.

** Ecosystem function of the recreation is counted in valuation of eco-tourism. Therefore, it is not counted in the valuation of

Source: The Value of the world's ecosystem services and natural capital, Robert Costanza et al., Nature vol.387 May 1997

Table 11.2.4 Economic Benefit by Maintaining Present Biotope

Year	Inundated Grassland								Raised/Transitional Bogs								Total Benefit (USD)
	Change of Area in Without-Project Case								Change of Area in Without-Project Case								
	NPZ&AMZ			DZ			Benefit NPZ+AMZ+DZ (USD)	Benefit of With-Without Project (USD)	NPZ&AMZ			DZ			Benefit NPZ+AMZ+DZ (USD)	Benefit of With-Without Project (USD)	
	Inundated grass land (ha)	Shrub (ha)	Benefit (USD)	Inundated grass land (ha)	Shrub (ha)	Benefit (50% of NPZ&AMZ) (USD)			Bogs (ha)	Shrub (ha)	Benefit (USD)	Bogs (ha)	Shrub (ha)	Benefit (50% of NPZ&AMZ) (USD)			
2000	4,098	0	6,180,809	1,150	0	867,244	7,048,052	0	9,671	0	15,459,577	326	0	260,564	15,720,141	0	0
2001	4,016	82	6,068,198	1,127	23	851,443	6,919,641	128,411	9,623	48	15,388,772	324	2	259,370	15,648,143	71,998	200,409
2002	3,934	164	5,955,587	1,104	46	835,642	6,791,230	256,822	9,574	97	15,317,967	323	3	258,177	15,576,144	143,996	400,819
2003	3,852	246	5,842,977	1,081	69	819,842	6,662,819	385,234	9,526	145	15,247,163	321	5	256,984	15,504,146	215,994	601,228
2004	3,770	328	5,730,366	1,058	92	804,041	6,534,407	513,645	9,478	193	15,176,358	319	7	255,790	15,432,148	287,993	801,638
2005	3,688	410	5,617,756	1,035	115	788,240	6,405,996	642,056	9,429	242	15,105,553	318	8	254,597	15,360,150	359,991	1,002,047
2006	3,606	492	5,505,145	1,012	138	772,440	6,277,585	770,467	9,381	290	15,034,748	316	10	253,403	15,288,152	431,989	1,202,456
2007	3,524	574	5,392,534	989	161	756,639	6,149,174	898,879	9,333	338	14,963,944	315	11	252,210	15,216,154	503,987	1,402,866
2008	3,442	656	5,279,924	966	184	740,839	6,020,762	1,027,290	9,284	387	14,893,139	313	13	251,017	15,144,155	575,985	1,603,275
2009	3,360	738	5,167,313	943	207	725,038	5,892,351	1,155,701	9,236	435	14,822,334	311	15	249,823	15,072,157	647,983	1,803,685
2010	3,278	820	5,054,703	920	230	709,237	5,763,940	1,284,112	9,187	484	14,751,529	310	16	248,630	15,000,159	719,982	2,004,094
2011	3,196	902	4,942,092	897	253	693,437	5,635,529	1,412,524	9,139	532	14,680,725	308	18	247,436	14,928,161	791,980	2,204,503
2012	3,114	984	4,829,482	874	276	677,636	5,507,117	1,540,935	9,091	580	14,609,920	306	20	246,243	14,856,163	863,978	2,404,913
2013	3,033	1,065	4,716,871	851	299	661,835	5,378,706	1,669,346	9,042	629	14,539,115	305	21	245,050	14,784,165	935,976	2,605,322
2014	2,951	1,147	4,604,260	828	322	646,035	5,250,295	1,797,757	8,994	677	14,468,310	303	23	243,856	14,712,167	1,007,974	2,805,731
2015	2,869	1,229	4,491,650	805	345	630,234	5,121,884	1,926,169	8,946	725	14,397,505	302	24	242,663	14,640,168	1,079,972	3,006,141
2016	2,787	1,311	4,379,039	782	368	614,433	4,993,472	2,054,580	8,897	774	14,326,701	300	26	241,470	14,568,170	1,151,970	3,206,550
2017	2,705	1,393	4,266,429	759	391	598,633	4,865,061	2,182,991	8,849	822	14,255,896	298	28	240,276	14,496,172	1,223,969	3,406,960
2018	2,623	1,475	4,153,818	736	414	582,832	4,736,650	2,311,402	8,801	870	14,185,091	297	29	239,083	14,424,174	1,295,967	3,607,369
2019	2,541	1,557	4,041,207	713	437	567,031	4,608,239	2,439,813	8,752	919	14,114,286	295	31	237,889	14,352,176	1,367,965	3,807,778
2020	2,459	1,639	3,928,597	690	460	551,231	4,479,828	2,568,225	8,704	967	14,043,482	293	33	236,696	14,280,178	1,439,963	4,008,188
2021	2,377	1,721	3,815,986	667	483	535,430	4,351,416	2,696,636	8,656	1,015	13,972,677	292	34	235,503	14,208,179	1,511,961	4,208,597
2022	2,295	1,803	3,703,376	644	506	519,629	4,223,005	2,825,047	8,607	1,064	13,901,872	290	36	234,309	14,136,181	1,583,959	4,409,007
2023	2,213	1,885	3,590,765	621	529	503,829	4,094,594	2,953,458	8,559	1,112	13,831,067	289	37	233,116	14,064,183	1,655,958	4,609,416
2024	2,131	1,967	3,478,155	598	552	488,028	3,966,183	3,081,870	8,510	1,161	13,760,262	287	39	231,923	13,992,185	1,727,956	4,809,825
2025	2,049	2,049	3,365,544	575	575	472,227	3,837,771	3,210,281	8,462	1,209	13,689,458	285	41	230,729	13,920,187	1,799,954	5,010,235
2026	1,967	2,131	3,252,933	552	598	456,427	3,709,360	3,338,692	8,414	1,257	13,618,653	284	42	229,536	13,848,189	1,871,952	5,210,644
2027	1,885	2,213	3,140,323	529	621	440,626	3,580,949	3,467,103	8,365	1,306	13,547,848	282	44	228,342	13,776,190	1,943,950	5,411,054
2028	1,803	2,295	3,027,712	506	644	424,825	3,452,538	3,595,515	8,317	1,354	13,477,043	280	46	227,149	13,704,192	2,015,948	5,611,463
2029	1,721	2,377	2,915,102	483	667	409,025	3,324,126	3,723,926	8,269	1,402	13,406,239	279	47	225,956	13,632,194	2,087,947	5,811,872
2030	1,639	2,459	2,802,491	460	690	393,224	3,195,715	3,852,337	8,220	1,451	13,335,434	277	49	224,762	13,560,196	2,159,945	6,012,282
2031	1,557	2,541	2,689,880	437	713	377,423	3,067,304	3,980,748	8,172	1,499	13,264,629	275	51	223,569	13,488,198	2,231,943	6,212,691
2032	1,475	2,623	2,577,270	414	736	361,623	2,938,893	4,109,160	8,124	1,547	13,193,824	274	52	222,375	13,416,200	2,303,941	6,413,101
2033	1,393	2,705	2,464,659	391	759	345,822	2,810,481	4,237,571	8,075	1,596	13,123,019	272	54	221,182	13,344,202	2,375,939	6,613,510
2034	1,311	2,787	2,352,049	368	782	330,021	2,682,070	4,365,982	8,027	1,644	13,052,215	271	55	219,989	13,272,203	2,447,937	6,813,919
2035	1,229	2,869	2,239,438	345	805	314,221	2,553,659	4,494,393	7,979	1,692	12,981,410	269	57	218,795	13,200,205	2,519,935	7,014,329
2036	1,147	2,951	2,126,828	322	828	298,420	2,425,248	4,622,805	7,930	1,741	12,910,605	267	59	217,602	13,128,207	2,591,934	7,214,738
2037	1,065	3,033	2,014,217	299	851	282,620	2,296,837	4,751,216	7,882	1,789	12,839,800	266	60	216,409	13,056,209	2,663,932	7,415,148
2038	984	3,114	1,901,606	276	874	266,819	2,168,425	4,879,627	7,834	1,837	12,768,996	264	62	215,215	12,984,211	2,735,930	7,615,557
2039	902	3,196	1,788,996	253	897	251,018	2,040,014	5,008,038	7,785	1,886	12,698,191	262	64	214,022	12,912,213	2,807,928	7,815,966
2040	820	3,278	1,676,385	230	920	235,218	1,911,603	5,136,449	7,737	1,934	12,627,386	261	65	212,828	12,840,214	2,879,926	8,016,376

Table 11.2.5 Potential Countries for Eco-tourist of LWC and Their Travel Costs

(Unit: USD)

	1 Germany	2 Finland	3 USA	4 India	5 Canada	6 France	7 Netherlands	8 Denmark	9 UK	10 Russia	11 S.Africa	12 Sweden	13 Belgium	14 Czech	15 France	16 Poland	17 Estonia	18 Lithuania	19 Belarus	20 Latvia	Total	50% Total for LWC*
2001	5,410	4,265	4,756	5,414	3,100	1,903	560	319	384	1,288	1,980	179	342	858	810	473	240	143	205	7,220	39,848	19,924
2002	7,460	5,884	6,551	7,456	4,273	2,624	770	438	528	1,777	2,724	246	471	1,183	1,117	650	331	196	282	9,967	54,929	27,464
2003	9,646	7,613	8,462	9,628	5,523	3,394	994	565	680	2,299	3,516	317	608	1,530	1,444	839	427	253	363	12,903	71,005	35,502
2004	11,977	9,458	10,496	11,938	6,855	4,215	1,232	700	842	2,857	4,357	393	753	1,901	1,794	1,040	529	314	449	16,041	88,140	44,070
2005	14,463	11,426	12,662	14,397	8,274	5,090	1,485	843	1,013	3,452	5,251	473	907	2,296	2,166	1,253	637	379	541	19,393	106,400	53,200
2006	17,114	13,527	14,966	17,012	9,786	6,024	1,753	994	1,195	4,087	6,202	558	1,070	2,717	2,564	1,479	752	447	638	22,973	125,858	62,929
2007	19,939	15,768	17,418	19,793	11,397	7,020	2,039	1,155	1,387	4,764	7,211	649	1,244	3,166	2,987	1,719	875	520	740	26,797	146,589	73,295
2008	22,950	18,158	20,028	22,751	13,112	8,081	2,342	1,326	1,592	5,487	8,284	745	1,428	3,645	3,439	1,975	1,005	598	849	30,879	168,674	84,337
2009	26,159	20,707	22,804	25,897	14,939	9,212	2,665	1,507	1,808	6,258	9,424	847	1,624	4,156	3,921	2,246	1,143	681	964	35,237	192,200	96,100
2010	**29,579**	**23,425**	**25,758**	**29,243**	**16,884**	**10,418**	**3,007**	**1,699**	**2,038**	**7,080**	**10,635**	**956**	**1,832**	**4,701**	**4,434**	**2,533**	**1,289**	**768**	**1,087**	**39,889**	**217,257**	**108,628**
2011	33,223	26,324	28,900	32,801	18,955	11,703	3,371	1,903	2,281	7,957	11,922	1,071	2,053	5,281	4,981	2,839	1,445	861	1,216	44,853	243,943	121,971
2012	37,105	29,414	32,243	36,584	21,161	13,073	3,758	2,119	2,540	8,892	13,289	1,194	2,287	5,900	5,564	3,164	1,610	960	1,354	50,151	272,361	136,180
2013	41,240	32,708	35,799	40,606	23,509	14,532	4,169	2,348	2,813	9,889	14,741	1,324	2,536	6,559	6,186	3,509	1,786	1,066	1,499	55,803	302,621	151,310
2014	45,645	36,219	39,582	44,883	26,008	16,087	4,605	2,591	3,104	10,951	16,284	1,462	2,800	7,261	6,847	3,875	1,973	1,178	1,654	61,833	334,840	167,420
2015	50,337	39,961	43,605	49,429	28,669	17,743	5,069	2,849	3,411	12,084	17,922	1,608	3,080	8,009	7,553	4,263	2,171	1,296	1,817	68,265	369,143	184,572
2016	55,334	43,949	47,883	54,263	31,501	19,507	5,561	3,123	3,738	13,291	19,663	1,764	3,378	8,807	8,304	4,676	2,381	1,423	1,991	75,125	405,662	202,831
2017	60,655	48,199	52,434	59,402	34,515	21,387	6,084	3,414	4,083	14,577	21,512	1,929	3,694	9,656	9,104	5,114	2,604	1,557	2,175	82,442	444,537	222,269
2018	66,322	52,727	57,273	64,864	37,724	23,388	6,640	3,722	4,450	15,948	23,476	2,104	4,029	10,561	9,956	5,580	2,842	1,700	2,369	90,244	485,919	242,959
2019	72,356	57,552	62,418	70,671	41,138	25,520	7,230	4,049	4,839	17,409	25,562	2,290	4,385	11,524	10,864	6,074	3,094	1,851	2,576	98,563	529,965	264,983
2020	78,781	62,692	67,890	76,843	44,771	27,790	7,857	4,395	5,251	18,966	27,778	2,488	4,763	12,551	11,831	6,598	3,361	2,012	2,795	107,432	576,846	288,423
2021	85,621	68,167	73,709	83,403	48,637	30,208	8,523	4,763	5,689	20,624	30,131	2,698	5,164	13,644	12,860	7,155	3,645	2,183	3,027	116,888	626,741	313,371
2022	92,904	74,000	79,896	90,377	52,751	32,782	9,231	5,153	6,152	22,391	32,631	2,920	5,590	14,808	13,956	7,746	3,947	2,365	3,273	126,969	679,842	339,921
2023	100,657	80,214	86,474	97,788	57,129	35,523	9,982	5,567	6,643	24,273	35,285	3,157	6,042	16,048	15,124	8,374	4,267	2,558	3,533	137,714	736,352	368,176
2024	108,910	86,832	93,468	105,665	61,786	38,442	10,780	6,006	7,164	26,277	38,104	3,408	6,522	17,368	16,366	9,041	4,607	2,763	3,810	149,167	796,487	398,244
2025	117,696	93,880	100,904	114,037	66,741	41,549	11,628	6,472	7,717	28,413	41,099	3,674	7,031	18,773	17,690	9,748	4,968	2,981	4,102	161,374	860,478	430,239
2026	127,048	101,387	108,810	122,935	72,014	44,857	12,528	6,966	8,302	30,688	44,278	3,957	7,571	20,270	19,099	10,499	5,352	3,213	4,413	174,384	928,570	464,285
2027	137,003	109,381	117,215	132,392	77,623	48,379	13,484	7,490	8,923	33,110	47,655	4,257	8,145	21,863	20,598	11,297	5,759	3,459	4,742	188,249	1,001,023	500,511
2028	147,598	117,895	126,151	142,441	83,590	52,128	14,499	8,045	9,581	35,690	51,242	4,576	8,754	23,559	22,195	12,143	6,191	3,720	5,090	203,023	1,078,113	539,056
2029	158,875	126,961	135,650	153,121	89,938	56,119	15,578	8,635	10,279	38,438	55,050	4,914	9,400	25,365	23,895	13,042	6,650	3,998	5,460	218,767	1,160,135	580,068
2030	170,877	136,615	145,749	164,471	96,691	60,367	16,723	9,260	11,018	41,364	59,095	5,274	10,085	27,288	25,704	13,996	7,137	4,293	5,851	235,542	1,247,403	623,702
2031	183,651	146,895	156,485	176,533	103,874	64,890	17,939	9,923	11,803	44,481	63,390	5,655	10,813	29,335	27,631	15,009	7,655	4,606	6,267	253,417	1,340,250	670,125
2032	197,245	157,840	167,897	189,351	111,516	69,703	19,230	10,627	12,634	47,799	67,951	6,059	11,586	31,514	29,681	16,084	8,204	4,939	6,707	272,461	1,439,029	719,514
2033	211,712	169,494	180,029	202,972	119,645	74,826	20,602	11,373	13,516	51,333	72,795	6,489	12,406	33,833	31,863	17,225	8,787	5,293	7,173	292,751	1,544,117	772,059
2034	227,108	181,903	192,925	217,446	128,291	80,279	22,059	12,165	14,450	55,095	77,938	6,945	13,276	36,302	34,186	18,437	9,406	5,669	7,667	314,367	1,655,916	827,958
2035	243,492	195,114	206,634	232,827	137,488	86,083	23,606	13,004	15,441	59,102	83,401	7,429	14,200	38,930	36,658	19,723	10,064	6,068	8,191	337,396	1,774,851	887,425
2036	260,927	209,179	221,207	249,172	147,271	92,261	25,248	13,895	16,492	63,367	89,201	7,943	15,180	41,727	39,289	21,089	10,762	6,491	8,746	361,929	1,901,375	950,687
2037	279,480	224,153	236,697	266,540	157,676	98,835	26,993	14,840	17,605	67,909	95,360	8,488	16,220	44,704	42,090	22,538	11,503	6,942	9,335	388,063	2,035,971	1,017,985
2038	299,223	240,095	253,162	284,996	168,744	105,832	28,845	15,842	18,786	72,745	101,901	9,067	17,324	47,873	45,071	24,077	12,289	7,420	9,959	415,902	2,179,151	1,089,575
2039	320,231	257,066	270,664	304,607	180,515	113,278	30,813	16,905	20,038	77,893	108,846	9,681	18,496	51,246	48,243	25,710	13,124	7,928	10,620	445,556	2,331,460	1,165,730
2040	342,585	275,133	289,268	325,446	193,036	121,203	32,902	18,032	21,365	83,374	116,222	10,333	19,740	54,836	51,619	27,444	14,011	8,468	11,321	477,144	2,493,479	1,246,740

Table 11.2.6 Economic Cash Flow and EIRR

(Unit: thousand LVL)

Year	Economic Benefit			Economic Cost of the Proposed Projects and Programs															Net Benefit
	Biotope	Eco-tourism	Total	1	2-a	2-b	2-c	2-d	3	4-a	4-b	5	6	7	8	9	10	11	Total	
2001	0.0	0.0	0.0	172.5	104.9	0.0	95.7	0.0	0.0	0.0	0.0	0.0	128.3	0.0	0.0	0.0	0.0	9.2	510.6	-510.6
2002	0.0	0.0	0.0	172.5	3.0	17.5	95.7	209.3	152.7	76.7	42.6	0.0	128.3	0.0	91.1	63.5	0.0	0.2	1,053.1	-1,053.1
2003	373.4	22.1	395.5	9.6	3.0	0.2	2.6	209.3	8.2	8.6	24.4	111.3	15.8	0.0	2.4	63.5	0.0	0.2	459.2	-63.7
2004	497.9	27.4	525.3	9.6	3.0	0.2	2.6	0.9	8.2	8.6	24.4	111.3	15.8	294.6	2.4	0.2	0.0	0.2	482.1	43.2
2005	622.4	33.0	655.4	9.6	3.0	0.2	2.6	0.9	8.2	8.6	24.4	11.6	15.8	4.8	2.4	0.2	66.7	0.2	159.2	496.2
2006	746.9	39.1	786.0	9.6	3.0	0.2	2.6	0.9	8.2	67.8	38.8	11.6	15.8	4.8	2.4	0.2	66.7	0.2	232.8	553.1
2007	871.3	45.5	916.9	16.8	3.0	1.0	3.4	0.9	141.0	8.6	24.4	78.8	15.8	4.8	40.0	0.2	0.2	0.2	339.1	577.8
2008	995.8	52.4	1,048.2	9.6	3.0	0.2	2.6	5.7	8.2	8.6	24.4	11.6	15.8	96.0	2.4	3.4	0.2	0.2	191.9	856.3
2009	1,120.3	59.7	1,180.0	9.6	3.0	0.2	2.6	0.9	8.2	8.6	24.4	11.6	67.0	4.8	2.4	0.2	0.2	0.2	143.9	1,036.1
2010	1,244.8	67.5	1,312.2	9.6	3.0	0.2	2.6	0.9	8.2	8.6	24.4	11.6	15.8	4.8	2.4	0.2	0.2	0.2	92.7	1,219.6
2011	1,369.3	75.8	1,445.0	9.6	3.0	0.2	2.6	0.9	8.2	67.8	39.6	11.6	15.8	4.8	2.4	0.2	3.4	1.0	171.1	1,273.9
2012	1,493.7	84.6	1,578.3	94.4	3.0	1.8	4.2	0.9	141.0	8.6	24.4	87.6	15.8	4.8	42.4	0.2	0.2	0.2	429.5	1,148.8
2013	1,618.2	94.0	1,712.2	9.6	3.0	0.2	2.6	5.7	8.2	8.6	24.4	11.6	15.8	104.8	2.4	11.4	0.2	0.2	208.7	1,503.5
2014	1,742.7	104.0	1,846.7	9.6	3.0	0.2	2.6	0.9	8.2	8.6	24.4	11.6	79.0	4.8	2.4	0.2	0.2	0.2	155.9	1,690.8
2015	1,867.2	114.6	1,981.8	9.6	3.0	0.2	2.6	0.9	8.2	8.6	24.4	11.6	15.8	4.8	2.4	0.2	0.2	0.2	92.7	1,889.1
2016	1,991.6	126.0	2,117.6	9.6	3.0	0.2	2.6	0.9	8.2	67.8	38.8	11.6	15.8	4.8	2.4	0.2	12.2	0.2	178.3	1,939.3
2017	2,116.1	138.1	2,254.2	16.8	3.0	1.0	3.4	0.9	141.0	8.6	24.4	78.8	15.8	4.8	40.0	0.2	0.2	0.2	339.1	1,915.1
2018	2,240.6	150.9	2,391.5	9.6	3.0	0.2	2.6	5.7	8.2	8.6	24.4	11.6	15.8	96.0	2.4	3.4	0.2	0.2	191.9	2,199.6
2019	2,365.1	164.6	2,529.7	9.6	3.0	0.2	2.6	0.9	8.2	8.6	24.4	11.6	67.0	4.8	2.4	0.2	0.2	0.2	143.9	2,385.8
2020	2,489.6	179.1	2,668.7	9.6	3.0	0.2	2.6	0.9	8.2	8.6	24.4	11.6	15.8	4.8	2.4	0.2	0.2	0.2	92.7	2,576.0
2021	2,614.0	194.6	2,808.7	9.6	3.0	0.2	2.6	0.9	8.2	67.8	41.2	11.6	15.8	4.8	2.4	0.2	3.4	2.6	174.3	2,634.4
2022	2,738.5	211.1	2,949.6	130.4	3.0	4.2	6.6	0.9	141.0	8.6	24.4	106.8	15.8	4.8	49.6	0.2	0.2	0.2	496.7	2,452.9
2023	2,863.0	228.7	3,091.7	9.6	3.0	0.2	2.6	5.7	8.2	8.6	24.4	11.6	15.8	124.0	2.4	28.2	0.2	0.2	244.7	2,847.0
2024	2,987.5	247.4	3,234.8	9.6	3.0	0.2	2.6	0.9	8.2	8.6	24.4	11.6	105.4	4.8	2.4	0.2	0.2	0.2	182.3	3,052.5
2025	3,111.9	267.2	3,379.2	9.6	3.0	0.2	2.6	0.9	8.2	8.6	24.4	11.6	15.8	4.8	2.4	0.2	0.2	0.2	92.7	3,286.5
2026	3,236.4	288.4	3,524.8	9.6	3.0	0.2	2.6	0.9	8.2	67.8	38.8	11.6	15.8	4.8	2.4	0.2	29.0	0.2	195.1	3,329.7
2027	3,360.9	310.9	3,671.8	16.8	3.0	1.0	3.4	0.9	141.0	8.6	24.4	78.8	15.8	4.8	40.0	0.2	0.2	0.2	339.1	3,332.7
2028	3,485.4	334.8	3,820.2	9.6	3.0	0.2	2.6	5.7	8.2	8.6	24.4	11.6	15.8	96.0	2.4	3.4	0.2	0.2	191.9	3,628.3
2029	3,609.9	360.3	3,970.1	9.6	3.0	0.2	2.6	0.9	8.2	8.6	24.4	11.6	67.0	4.8	2.4	0.2	0.2	0.2	143.9	3,826.3
2030	3,734.3	387.4	4,121.7	9.6	3.0	0.2	2.6	0.9	8.2	8.6	24.4	11.6	15.8	4.8	2.4	0.2	0.2	0.2	92.7	4,029.0
2031	3,858.8	416.2	4,275.0	9.6	3.0	0.2	2.6	0.9	8.2	67.8	39.6	11.6	15.8	4.8	2.4	0.2	3.4	1.0	171.1	4,103.9
2032	3,983.3	446.9	4,430.2	94.4	3.0	1.8	4.2	0.9	141.0	8.6	24.4	87.6	15.8	4.8	42.4	0.2	0.2	0.2	429.5	4,000.7
2033	4,107.8	479.5	4,587.3	9.6	3.0	0.2	2.6	5.7	8.2	8.6	24.4	11.6	15.8	104.8	2.4	11.4	0.2	0.2	208.7	4,378.6
2034	4,232.2	514.3	4,746.5	9.6	3.0	0.2	2.6	0.9	8.2	8.6	24.4	11.6	79.0	4.8	2.4	0.2	0.2	0.2	155.9	4,590.6
2035	4,356.7	551.2	4,907.9	9.6	3.0	0.2	2.6	0.9	8.2	8.6	24.4	11.6	15.8	4.8	2.4	0.2	0.2	0.2	92.7	4,815.2
2036	4,481.2	590.5	5,071.7	9.6	3.0	0.2	2.6	0.9	8.2	67.8	38.8	11.6	15.8	4.8	2.4	0.2	12.2	0.2	178.3	4,893.4
2037	4,605.7	632.3	5,238.0	16.8	3.0	1.0	3.4	0.9	141.0	8.6	24.4	78.8	15.8	4.8	40.0	0.2	0.2	0.2	339.1	4,898.9
2038	4,730.2	676.8	5,406.9	9.6	3.0	0.2	2.6	5.7	8.2	8.6	24.4	11.6	15.8	96.0	2.4	3.4	0.2	0.2	191.9	5,215.0
2039	4,854.6	724.1	5,578.7	9.6	3.0	0.2	2.6	0.9	8.2	8.6	24.4	11.6	67.0	4.8	2.4	0.2	0.2	0.2	143.9	5,434.8
2040	4,979.1	774.4	5,753.5	9.6	3.0	0.2	2.6	0.9	8.2	8.6	24.4	11.6	15.8	4.8	2.4	0.2	0.2	0.2	92.7	5,660.8

Note: 1.Environmental Management Center Construction Project,
2-a Bird conservation sub-program, 2-b Mammal conservation sub-program, 2-c Bog and inundation grassland conservation sub-program, 2-d Fish conservation sub-program,
3. Environmental Research and Monitoring Program, 4-a EIMS program, 4-b Environmental Education facility program,
5. Indrani and Lubana Eco-tourism Development Project, 6. Nagli and Gaigalava Eco-tourism Development Project,
7. Fish Hatchery Development Project, 8. Angling Promotion Project, 9. Aiviekste Sluice Rehabilitation Project, 10. Kalnagala Sluice Rehabilitation Project,
11. Hydrological Station Construction Project

EIRR=> 30.07%

Table 11.4.1 Implementation Schedule of the EMP Projects

Type	Name of Projects and Programs	Phase I			Phase II				Phase III		
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
I. Wetland Conservation Plan											
1	Environmental Management Center Construction Project	▨	▨	■	■	■	■	■	■	■	■
2	Biotope Conservation Program										
2-a	Bird conservation subprogram	▨	■	■	■	■	■	■	■	■	■
2-b	Mammal conservation subprogram		▨	■	■	■	■	■	■	■	■
2-c	Bog and inundated grassland conservation subprogram	▨	▨	■	■	■	■	■	■	■	■
2-d	Fish conservation subprogram		▨	▨	■	■	■	■	■	■	■
3	Environmental Research and Monitoring Program		▨	■	■	■	■	■	■	■	■
4	Environmental Education and Public Awareness Program										
4-a	EIMS subprogram		▨	■	■	■	■	■	■	■	■
4-b	Environmental Education subprogram		▨	■	■	■	■	■	■	■	■
II. Eco-tourism Development Plan											
5	Indrani and Lubana Eco-tourism Development Project			▨	▨	■	■	■	■	■	■
6	Nagli and Gaigalava Eco-tourism Development Project	▨	▨	■	■	■	■	■	■	■	■
III. Fishery Development Plan											
7	Fish Hatchery Development Project				▨	■	■	■	■	■	■
8	Angling Promotion Project		▨	■	■	■	■	■	■	■	■
IV. Water Level Management Plan											
9	Aiviekste Sluice Rehabilitation Project		▨	▨	■	■	■	■	■	■	■
10	Kalnagala Sluice Rehabilitation Project					▨	▨	■	■	■	■
11	Hydrological Station Construction Project	▨	■	■	■	■	■	■	■	■	■

Note: ▨ : Design, Equipment Procurement, Construction or Civil Works ■ : Operation and Maintenance (O&M) or Training

Table 11.4.2 Required Annual Revenue of the EMP Projects

(Unit: 1,000 LVL)

No.	Year	Expenditure				Minimum Required Revenue
		O/M Cost	Repayment of Loan		Total Cash Outflow	
			Principal	Interest Payment		
1	2001	0	0	21	21	21
2	2002	30	0	21	51	51
3	2003	94	0	21	115	115
4	2004	101	0	21	122	122
5	2005	116	0	21	137	137
6	2006	208	0	21	229	229
7	2007	424	0	21	445	445
8	2008	240	0	21	261	261
9	2009	180	0	21	201	201
10	**2010**	116	0	21	137	137
11	2011	214	83	21	318	318
12	2012	537	84	20	641	641
13	2013	261	85	20	366	366
14	2014	195	85	19	299	299
15	2015	116	86	18	220	220
16	2016	223	87	18	328	328
17	2017	424	87	17	528	528
18	2018	240	88	16	344	344
19	2019	180	89	16	285	285
20	2020	116	89	15	220	220
21	2021	218	90	15	323	323
22	2022	621	91	14	726	726
23	2023	306	91	13	410	410
24	2024	228	92	12	332	332
25	2025	116	93	12	221	221
26	2026	244	93	11	348	348
27	2027	424	94	10	528	528
28	2028	240	95	10	345	345
29	2029	180	96	9	285	285
30	2030	116	96	8	220	220
31	2031	214	97	8	319	319
32	2032	537	98	7	642	642
33	2033	261	98	6	365	365
34	2034	195	99	5	299	299
35	2035	116	100	5	221	221
36	2036	223	101	4	328	328
37	2037	424	101	3	528	528
38	2038	240	102	2	344	344
39	2039	180	103	2	285	285
40	2040	116	104	1	221	221
Total		9,209	2,798	547	12,553	12,553

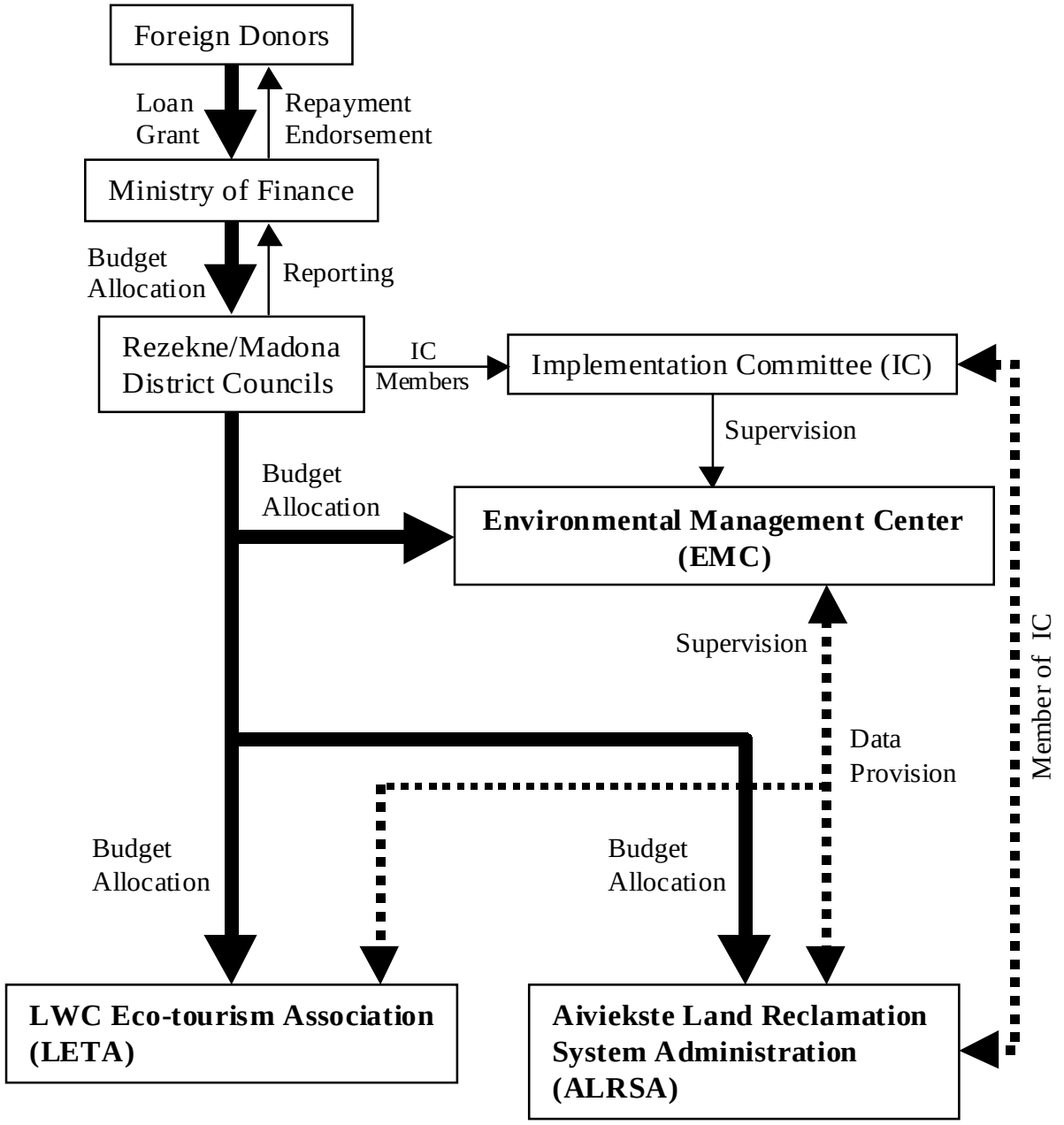


Figure 11.4.1 Financial Arrangement Structure for EMP Projects

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

JAPAN INTERNATIONAL COOPERATION AGENCY

CHAPTER 12

CHAPTER 12 RECOMMENDATIONS

12.1 Recommendation

12.1.1 Regional Development

(1) Three strategies are recommended for development in LWC, small scale rural development, multi sector development, and eco-tourism and rural tourism promotion. Under these strategies, it is essential to make use of any resources in LWC to improve the living standard of the local people. For example, idle arable land should be used for development such as afforestation for forestry activities, and eco-tourism and rural tourism should be actively introduced targeting the LWC naturalness and the existing primary industries. But this direction must be in accordance with sustainable development concept ignoring adverse impacts on environment.

(2) The primary industries with a long history such as agriculture, forestry and fishery should be continued simultaneously, neither terminating all these activities nor specializing a specific industry. It is not recommendable to introduce exotic industry such as heavy industry and mass tourism. LWC should aim at small-scale rural development based on the land and environment.

(3) Socioeconomic levels represented by employment rate, wage and education level in LWC should reach the national average. For this purpose, the development side requires local manpower, expertise, budget and institutional privileges in introducing non-traditional primary goods or processing methods, and in training local residents for eco-tourism and new productive technology. This requisite has a possibility to bring about financial or institutional conflicts with implementation of the proposed conservation projects. However, it is also a fact that financially rich communities can easily promote environmental conservation in contrast.

(4) In order to reach the economic growth with the nationally predicted rate in LWC, it is recommended to consider development projects at the regional or district level, regarding LWC as part of a larger project area. For example, further development in LWC can be carried out within the framework of the development plan for Latgale region prepared recently. Development directions in this plan such as rural tourism and information technology are to be expanded to LWC.

12.1.2 Land Use

(1) The recommended five land use strategies are 1) restriction on change of the existing land use pattern, 2) flexible and small scale conversion of the idle arable lands into forests, 3) harmonization of productive and recreational usage of water bodies, 4) building of small scale factories, facilities, and infrastructure, and 5) application of land use technologies friendly to local environment.

(2) The future land use planning of LWC is recommended to follow the proposed land use map, which is based on development potentials in the future as well as proposed land use appropriate for environmental conservation. The depicted land use categories are

classified into four areas, forest land, agricultural land, urban area, and retardation basin. Nature Preservation Zone (NPZ) is to be strictly preserved and the present land use pattern in Active Management Zone (AMZ) should not be changed in principle, while the land use pattern within Development Zone (DZ) is proposed to change.

(3) Since land in LWC is owned by different stakeholders such as private persons, private enterprises, the state and local municipalities, due agreement and compensation should be required where private land is planned to be converted to the protection area and even to different productive land, for instance from potentially arable land to forest. Therefore, the different stakeholders' interests on land use must be coordinated by providing local people with opportunities to participate in planning the concrete land use for LWC under the EMP framework.

(4) The already established land use situation should not be changed as much as possible, also ignoring additional construction of large-scale facilities and infrastructure. It is not only to prevent damages to the wetland ecosystem of LWC, but also to guarantee the productive land resource to the owners. A large part of LWC should continue to be utilized for agriculture, forestry and fishery in the future. Instead of expansion of the land for such primary industries, production should be improved by intensively inputting production resources, although application of land use technologies friendly to environment is recommended.

(5) Idle arable land is recommended to be flexibly converted between cultivated land and forest depending on economic profitability of the both industries. The agricultural and forest lands can be used not only purely for agricultural and forestry activities but also for rural tourism development based on the existing natural resources. In addition, water bodies such as Lake Lubana and fishponds should be managed so that they contribute to both commercial fishery and waterfowl preservation as eco-tourism object.

(6) An independent land use planning unit is recommended to be established for LWC. At the highest level, land use planning must be dealt with by a small committee of permanent members drawn from the local municipalities and agencies concerned with LWC. The land use committee should make recommendations on priorities, the creation and allocation of resources, and the establishment, approval and coordination of land development programs. Alternatively, these functions could be added to the proposed EMC and IC.

12.1.3 Fishery Development

(1) It is recommended to set a site specific concept on fishery in LWC as Lake of Pike. Pike and pikeperch must be the most important and symbolic fish species to be produced and conserved in LWC, because demand of ordinary freshwater fishes like carp species seems not to increase in near future considering people‘s general preference. This concept should be taken into consideration in relevant development and conservation activities, particularly for eco-tourism development. For the fishery

development in LWC, the fish hatchery development project and the angling promotion project are proposed. The total cost for these projects up to 2010 is estimated at about 641,000 LVL including necessary facilities and equipment.

(2) The construction of new hatchery complex is required in LWC for production of fish fry for restocking to natural waters and for release to fish angling ponds. Besides, a hatchery educational aquarium and some demonstration facilities about fish reproduction are necessary for eco-tourism development. A series of earthen ponds for brood-stock and juveniles are also included in this hatchery complex. A recommendable site of the fish hatchery complex is the wintering pond area of the Nagli fish farm.

(3) Angling should be considered as a substantial and important core of future regional development of LWC from viewpoint of wise use of natural resources. Considering current management situation of fishponds, several angling ponds should be opened by rehabilitation of a part of present aquaculture ponds of the Nagli fish farm. For promotion of angling activities in LWC, supporting facilities such as angler's huts available for car park, watching tower, fishing lots, and rental boats are proposed around the lake from fishing management viewpoint.

12.1.4 Wetland Conservation

(1) The recommended strategies taken for wetland conservation of LWC are to emphasize the biodiversity in rivers and lake, to preserve and conserve the wetland vegetation, to strengthen the function of forests, to manage game animals and birds through hunting, to promote eco-tourism for nature protection, and to focus on environmental education and public awareness. The conservation criteria should be determined not only preserving the present status but also retrieving old status as much as possible, in order to achieve the naturalness of LWC around 1930. At the same time, ecologically meritorious nature alterations like fishponds for waterfowl must be maintained.

(2) In addition to the regulations of protected areas, biodiversity of LWC should be protected by the proposed wetland conservation plan (WCP) which includes concrete projects and programs to be implemented in line with EMP. The total cost for WCP is indicatively estimated about 2.3 million LVL including O/M costs up to 2010.

(3) As a project, the construction of the Environmental Management Center (EMC) at Idena is recommended to establish a base for actual implementation of the proposed programs. The Biotope Conservation Program consists of 4 conservation subprograms for bird, mammal, bog & inundated grassland, and fish. Under the subprogram for bird, it is recommended to implement such concrete actions as improvement of natural breeding place for waterfowl, artifical breeding islands and nests for waterfowl, water level control of fishponds for waterfowl breeding, artificial nesting places and feeding for raptors, protection of natural nesting places, increase of prey animals for raptors, maintenance of grassland habitat for great snipe, and cormorant population control. The mammal conservation subprogram necessitates wildlife corridor construction,

enrichment of forest-meadow ecotone, and beaver population control. The bog and inundated grassland conservation subprogram is strongly recommended because raised bog, inundated grassland and fen are the characteristic biotopes of LWC, and because water level management is commonly crucial for their conservation. The subprogram for fish conservation proposes wintering place, patrolling, restocking of native fish species, spawning place, and river water level control as fish habitat.

(4) Environmental research and monitoring program is also recommended. Research in EMC is to be for management purpose, and pure scientific researches must be limited only when they are closely linked with management. 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, such items as fauna & flora, water-related items, socioeconomic statistics, and environmental & educational activities should be monitored in LWC and related areas. In addition, the EIMS sub-program and the Environmental Education sub-program are proposed. Dissemination of the research and monitoring results through EIMS in the form of annual report is strongly recommended.

(5) Since LWC fulfills the Ramsar convention criteria, it is recommended to register important biotopes of LWC collectively as a Ramsar site 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 is fragmented from the main area.

12.1.5 Environmental Information Management and Education

(1) The objectives of the Environmental Information Management System (EIMS) are recommended to be 1) decision-making, 2) monitoring, 3) environmental education, 4) public awareness, and 5) science promotion. The institutional framework for EIMS must be under the jurisdiction of EMC. 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 should be manned in accordance with the conservation needs. Hardware and software should be procured in Latvia, which must not require special knowledge for operation. The grand total for the hardware and software is about 74,000 LVL.

(2) The recommended Environmental Education and Training (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 through MEPRD. Following the national guideline, the regional education authorities and local schools can arrange their classes for environmental education.

12.1.6 Eco-tourism Development

(1) In order to attract the potential eco-tourists (around 400 persons/year at present, and 700 to 1,000 persons/year in 10 years), LWC should be well improved in terms of information, advertisement, access to the site, tourism facility, and tourism management. Reflecting the specific situations in and around LWC, strategies of eco-tourism development are recommended to be 1) sustainable natural resources management, 2) local community driven development process, 3) entrepreneurship promotion, 4) full support by local government and public institutions, 5) collaboration between public and private sectors, 6) small scale eco-tourism and long-term benefits, 7) supply-oriented management, 8) differentiation and diversification of eco-tourism, and 9) focusing on the most potential areas.

(2) Taking the locations and characteristics of eco-tourism resources into account, two eco-tourism development projects are recommended. The Indrani and Lubana Eco-tourism Development Project includes facility construction of tourism information center, accommodation lodge, canoe terminal & station, camping site as well as information board & signposts. On the other hand, the Nagli and Gaigalava Eco-tourism Development Project requires eco-tourism services through EMC facilities, tourist facilities at Kuvapani and the Orenisi island, observation tower/hut, camping site, board walk, canoe station, sanitation facility, and other necessary equipment. The total initial cost for the eco-tourism project in Gaigalava and Nagli is about 242,000 LVL, while that for Indrani and Lubana is 279,000 LVL.

(3) For the purpose of materializing the two eco-tourism development projects, it is proposed to form the LWC Eco-tourism Association (LETA) consisting of interested local governments, interested local people groups supported by academic institutes. Possible local governments which are active in promoting these projects are Gaigalava, Nagli, Lubana, Indrani and other interested townships. Possible academic institutes which will support the eco-tourism projects are DPU, the Teici State Nature Reserve Office and other interested institutions which are willing to support LWC eco-tourism from the academic capability. LETA is to be placed in EMC.

(4) The implementation of the tourism projects should be coordinated with other projects proposed under EMP. For instance, the tourist information building is a part of EMC. Therefore, it should be planned and constructed at the same time with good coordination. Bird watching towers, huts and a board-walk facility are to be used for wetland conservation program as well as eco-tourism. Based on the concept “carrying capacity”, visitor management must deal with regulations and zoning to protect the nature, licensing for hunters and anglers, warden patrols by EMC, and access controls of approachable locations, seasons, activity types and number of visitors.

(5) Eco-tourism activities and services should be regularly improved by the systematic evaluation and feedback system to attract more visitors and prevent inappropriate activities for nature protection. As an administrative organization, EMC needs to monitor eco-tourism activities if they meet the regulations. Governments should

facilitate economically viable entreprenourship providing financial, technical. regulatory, institutional, and physical supports for the private sector. The public sector investment is indispensable in the first phase, and then its operation and management should be gradually handed over to the private sector.

12.1.7 Water Level Management

(1) The principal purposes of the water level management plan should be to sustain the current ecosystem, to maintain suitable water level for the activities of agriculture, fishery, and forestry, and to protect towns and villages against floods. It is preferable not to change an existing water level for the existing ecosystem. Especially, the influence on the fish and birds should be avoided in and around Lake Lubana. At the same time, the water level management should be coordinated for existing industries such as agriculture, the fishery, and forestry as well as for prevention of any flood damage to Lubana town.

(2) For fish habitat conservation of the old Pededze river, the recommendable measure is to construct a gate structure in the embankment of the Pededze river left bank at the junction point of the old Pededze river. In addition to the gate structure, one small dam near Meirani village to keep water level high in the river section will be necessary. The amount to be diverted from the Pededze river should be estimated in consideration of water volume needed for the eco-tourism plan. The gate structure of slide type with 1m width and 1m height is proposed. The cost is estimated at 45,000 LVL indicatively. The small dam made of massive concrete with length of 25m will cost about 20,000 LVL.

(3) Water depth of 2.5m or more is required in the lake in order to ensure the wintering of fish. The possible countermeasures for the wintering place are: heightening of dyke bank, excavation of lakebed, excavation of fish channel, and excavation of canal system in the lake. The excavation of fish channel is the best solution for this problem from the viewpoint of the cost (384,000LVL) and the eco-system conservation.

(4) Continuous outflow from the Kalnagala sluice is recommendable as one of the effective solutions to improve water circulation for improvement of water quality in the southern part of the lake. About 6.5 to 16.5 m^3/sec of water can be discharged from the Kalnagala sluice even after ensuring 1.5 m^3/sec of river maintenance flow from the Aiviekste sluice. It is possible to manage by revising the existing operation rule of the lake.

(5) For improvement of the existing operation manual for Lake Lubana, important points to be considered are the influence of desiccation to the northern wetland by the volume change of outflow through the Aiviekste sluice and the influence to fish conservation. Therefore, the revised manual should include the following points:

1) - Utilize the Kalnagala sluice as much as possible to improve water quality.

2) - Basically, the proposed operation rule is based on the existing one.

3) - Discharge from the sluice should be the same amount as the inflow from two rivers as much as possible.

4) - Water level should keep at the level of 91.75 m or more for the fish conservation.

(6) At least four hydrological stations are recommended to estimate the flood water volume in the Balupe and Ica rivers for northern wetland and in the Malta and Rezekne rivers for the lake. The automatic data-collection system on an electronic basis is recommendable. In addition, one thermometer is necessary to estimate roughly the starting date of snow melting. The station should equip an automatic water level gauge, water-conveyance pipes, a storage box for a device with tower, and a data-transmission device using telephone line. One computer with a device for receiving data is necessary at the station to receive electric data. The indicative cost for establishment of the hydrological stations is about 10,000 LVL.

(7) As for the Aiviekste sluice, the whole structure should be replaced, including gate leaves, gate frames, culverts, inlet and outlet structures. One gate type structure is recommendable for smooth operation and simplified discharge control. The cost of rehabilitation of the Aiviekste sluice is about 138,000 LVL. The rehabilitation works of the Kalnagala sluice gate structure is also recommended, consisting of rehabilitation and strengthening of existing concrete structures and replacement of gate leaf. The cost of rehabilitation of the Kalnagala sluice is about 145,000 LVL.

12.1.8 Environmental Management Plan

(1) The fundamental vision of the EMP for LWC is recommended to be **Wise Use of the Lubana Wetland Complex**, with such goals to attain this vision as conservation of natural environment and sustainable use of natural resources. The target area of EMP should be the whole LWC (about 810 km^2) including Lake Lubana. These goals must give a way for designation to the Ramsar site in future. EMP comprehensively consists of such six components as 1) wetland conservation plan, 2) eco-tourism development plan, 3) guideline for environmental information management system, 4) water level management plan, 5) guideline for regional development, and 6) directions for land use planning.

(2) The EMP area is recommended to be divided into three zones, namely Nature Preservation Zone (NPZ), Active Management Zone (AMZ), and Development Zone (DZ). The environmental zone shows 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. 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.

(3) The conservation criteria under EMP should be achieved by the good combination of a facility plan and a regulatory plan. Since the regulatory plan for EMP needs to cover all types of proposed protection areas in LWC, it must be applicable for preparation of a site specific regulation of each protection area. The major activities to be restricted in LWC are largely categorized into 1) physical activities, 2) pollution activities, 3) ecological disturbance, and 4) other activities.

(4) Establishment of the Implementation Committee (IC) and the Environmental Management Center (EMC) is proposed for actual implementation of EMP for LWC. IC should be a management authority of EMP which deliberates, authorizes, and coordinates substantial matters related to EMP, and EMC is recommended as a site specific organization for actual implementation of EMP. These two organizations should be established before implementation of EMP because it will require a lot of preparatory works.

(5) In order to effectively and steadily implement the programs and projects proposed under EMP, five major institutional roles should be set up to realize wise and sustainable use of LWC and to manage the existing institutional difficulties. Those are 1) initiative role for local people's participation, 2) coordination role between environmental side and development sector, 3) enforcement and technical role on implementation, 4) environmental monitoring role for LWC, and 5) environmental education role for residents and visitors.

(6) Considering that sustainable environmental conservation and economic development in LWC are realized by local residents, a mechanism that most benefits should be distributed to local people in the long term would be necessary. In this sense, employment opportunity for local residents in and around LWC should be created such as nature guide for eco-tourism, business for eco-tourism activities, and rural tourism.

(7) Initial cost of the EMP Projects consisting of those for design, construction, equipment procurement, and physical contingency is estimated at about 3.1 million LVL. The O/M cost of them including training cost for staff from year 2001 to 2010 are estimated at about 1.5 million LVL. Total cost up to year 2010 is about 4.6 million LVL. The financial arrangement for initial cost of the EMP Projects is recommendable to be made with combination of the loan and grant scheme from potential international donors. It is recommended that the grant scheme is applied to the Environmental Research & Monitoring Program and the EIMS sub-program which provide only equipment, and other projects and programs apply for the soft loan, which is low interest rate and long repayment period loan scheme. The O/M cost should be basically born by domestic budget.

(8) The total Latvian expenditure for the EMP Projects must consist of the O/M cost and repayment of soft loan. Annual expenditure ranges from about 21,000 LVL/year to

445,000 LVL/year between 2001 and 2010, and 172,000 LVL/year on average. After the year 2011, annual expenditure ranges from about 220,000 LVL/year to 725,000 LVL/year and 361,000 LVL/year on average. Considering affordability of the expenditure for the EMP Projects, domestic annual revenue same as the annual expenditures should be at least required.

(9) The Wetland Conservation Plan, the Eco-tourism Development Plan, and the Hydrological Station Construction Project could be priority projects among the proposed 11 EMP Projects considering their quick effect and urgency. It is recommended that the Fishery Development Project should be implemented in line with the overall development of the Latgale region, and the Aiviekste and Kalnagala Sluice Rehabilitation Projects be designed taking the basin's flood control plan into account.

12.2 Conclusion

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 Reservation identified LWC as an important bird area in Europe and recommended its conservation in early 1990s. It is natural that a movement to apply LWC for a Ramsar site arose among the concerned people.

EMP indicates the implementation program, the relation with the local development plans, and the environmental benefit of the local society as much as possible. EMP leads the people concerned to contribute and participate in wise use of natural resources, and guides the direction of environmental conservation in harmony with regional development by giving common environmental goals and targets of LWC.

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

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 of the Ramsar convention 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 EMP, however, these problems will be solved and LWC will be able to accommodate more water birds, also improving habitat for fishes and mammals. There are following merits for the Ramsar-site 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.

Several concrete projects and programs have been proposed within EMP framework by each sector. Based on the sector wise evaluation related to effectiveness, necessity, and technical feasibility, the 11 projects and programs are selected for EMP. The EMP Projects are expected to bring about many kinds of environmental and economic benefits. All the EMP Projects are planned to be interdependent and contribute each other to gain overall benefit of EMP effectively. Implementation of the EMP Projects brings about various benefits in many aspects. Considering the correlation of the benefits, those benefits are synthesized to the conservation of biotope, eco-tourism promotion, and protection of birds and mammals.

Economic viability of the EMP Projects is evaluated by Economical Internal Rate of Return (EIRR) with 40-year project period though the target year of EMP is 2010. As a result of the estimation, EIRR shows about 30 %. Compared to interest rates ranging from 10 % to 15 % in the conventional economic analysis, the result means that implementation of EMP is viable economically even though some parts of its benefits are only quantified in monetary value and all costs of the EMP Projects are estimated.

As an overall conclusion, the proposed EMP could be justified in terms of social necessity and urgency, and the recommended projects and programs would be feasible and viable from technical and economic standpoints. So the projects and programs within the EMP framework are recommended to be implemented as quick as possible before the important wetland ecosystem in LWC is further degraded.