Lake Balaton Development Coordination Agency

Lake Balaton Recreational Area

LakeAdmin

Final Implementation Plan

IPICON Kft.

Lake Balaton Development Coordination Agency

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INTERREG IVC
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Contents

1. Introduction

Fresh waters make only 3% of the global water resources. Freshwater lakes, including reservoirs and ponds, are important elements for communities and their relevance is increasing. Lake ecosystems and their catchments have provided several societally valuable benefits and ecosystem services like shelter, drinking water, bathing water, food, a means of travel and wealth in a number of ways and allowed whole cultures to develop. Lakes have values associated with well-being and relaxation, their proximity has catalyzed rural development and been important in the regional socio-economic development. Lake districts are often very popular destinations for domestic and foreign tourism and visitors.

Eutrophication and its ecological consequences, pollution, over abstraction and invasive species are serious threats and increase the need for restoration and management to prevent the potential adverse economic and social impacts. There is increasing evidence that lakes are affected by climate change. Lake management is for these reasons an important part of sustainable regional development as set by Lisbon and Gothenburg agreements.

However, the most significant piece of legislation in response to the increasing threat of pollution and the increasing demand from the public for cleaner lakes, rivers and beaches and freshwater biodiversity, is the EU Water Framework Directive (WFD). This Directive is unique in that it sets out an established framework for the protection of all water bodies (including lakes) and for all EU member states to achieve good water ecological status by December 2015. This objective is likely to be achieved in slightly over half (53%) of EU waters and, therefore, more effort need to be scheduled for the following 6-year periods of WFD.

The economic values of attractive, clean lakes are well established. There is a rising appreciation of good quality lakes across Europe. More intensive lake protection through sharing good practices with European lake managers and the regional influencing bodies is critical if we want to improve the current quality of lakes in Europe and to build long term capacity for sustainable use of lakes.

2. Project description

The LakeAdmin Project (Interreg IVC) consists of ten partners from nine countries including Finland, the Czech Republic, Denmark, Estonia, Greece, Hungary, Ireland, Italy and Malta (**Fig.1**).

The Lake Admin project aims at an exchange of good water management practices to support the implementation of the Water Framework Directive in each of the partner regions and to produce case study collection on restoration and management experiences and water quality data from the relevant lakes in each partner region covering the last 30 years.

Fig. 1. Location of partner organisations in LakeAdmin

All participating regions have identified lakes as important elements in their regional development policies. LakeAdmin aims to improve the effectiveness of regional development policies related to water management and restoration of lakes, ponds and reservoirs by:

1. Sharing and transfer of good water management practices (**Table 1.**)
2. Mainstreaming of programs in participating regions, each participating region defining how the selected and adopted Good Practices will be implemented.
3. Compiling Good Practices and examples into guidance material ready to be disseminated to other regions in the EU, recognizing the European dimension and expanding values of the project beyond the partner regions.
4. Expanding the results of the LakeAdmin to a wider partner-network to have a long term impact.

Most partners have identified good practices including models for collaborative planning, lake restoration methods, experiences in public participation and lake management partnership and have evaluated the needs of knowledge (i.e. knowledge gaps) and effectiveness of the good practice actions.

By exchange of experience between partner regions, Good Practices will be transferred into regional Implementation Plans to be implemented within the operational programs of Water Framework Directive or/and Structural Funds in the participating regions. LakeAdmin will improve the knowledge of local and regional actors in lake management issues and give better tools to enhance the ecosystem services provided by lakes and reservoirs in line with the Lisbon and Gothenburg strategies.

The overall objective of the LakeAdmin Project is to improve goal setting through an integrated catchment management approach and quality of lake restoration outcomes and results in regions which

have acknowledged the importance of lakes in their economic development. In more detail the objectives are:

1. To capitalise the identified good lake management practices by transferring them to Implementation Plans.
2. To share good practices beyond partner regions by establishing open access guidance material available to lake managers, regional authorities and stakeholders in other regions.
3. To increase the use of collaborative planning methods and understanding in line with WFD principles.

Table 1: Summary of LakeAdmin Project Partners and Good Practices Identified

Country/ Partner	**Institution/ Region**	**Good Practice(s) Identified**
Partner 1 (Lead Partner) - Finland	Finnish Environment Institute	- Multi-criteria assessment in the comparison of options in lake restoration planning. - Mapping for presenting eutrophication pressures of lakes. - A practical tool for evaluating reduction of diffuse phosphorus loading. - Stakeholder participation and feedback. - Monitoring for investigation and surveillance of lake restoration cases.
Partner 2 - Finland	Savonia University of Applied Sciences	- A flexible education-model to help management planning for stakeholders. - Efficient and environmentally good use of manure for protection of watercourses
Partner 3 – Czech Republic	University of South Bohemia, Faculty of Fisheries and Protection of Waters	- Assessment of contamination with passive samplers and juvenile fish analyses. - Evaluation of the secondary losses caused by protected piscivorous birds - the great cormorant.
Partner 4 - Denmark	Alleroed Municipality	- Restoration of eutrophic temperate lakes by biomanipulation
Partner 5 - Estonia	University of Life Sciences	- Lake restoration guidance material in native language.
Partner 6 - Greece	Pelion Development Company	- Re-watering of a drained large lake in Greece - Planning the multi-purpose use of a reservoir
Partner 7 - Hungary	**Lake Balaton Development Coordination Agency**	**- Integrated shoreline management and spatial planning in the Balaton Region** **- Integrated regional on-line monitoring system.** **- Waste water treatment of small villages by on-site household units**.
Partner 8 - Ireland	West Regional Authority	- CAISIE “Control of Aquatic Invasive Species in Ireland**.**

The main outputs of LakeAdmin are:

1. European database of lake restoration case studies called LakeAdmin Archive.
2. Good Practice Guideline material to be disseminated also widely beyond the partnership.
3. Implementation Plans for each participating region (9 in total), in order to mainstream good practices in lake management.
4. A network of different stakeholders across regions involved in water management.
5. An increase in the capacity of individuals across the EU states in policy creation and implementation.

3. The importance of lakes

3.1. The current state of European waters

There are 14755 lakes classified for their ecological status in Water Framework Directive. Almost 6500 of them (44 %) are in less than good ecological status or potential (EEA 2012; **Fig. 2**). If lakes in Finland and Sweden are excluded, the picture is even worse and e.g. in parts of Central Europe more than 90 % of all water bodies (including rivers) are in less than good ecological status or potential. On the other hand, no significant pressures were reported for 48 % of the lake water bodies. Lakes are clearly in better status than transitional waters and rivers and also slightly better than coastal waters (**Fig. 2**).

From a lake restoration or management point of view it is noteworthy that in the EU scale the state of water bodies (**Fig. 3, left**) is not as good as it could possibly be based on the identified pressures (**Fig. 3, right**). This difference may be seen as a potential sign that the less than good status of some lakes, ponds or reservoirs, where they are not heavily affected by pressures of diffuse or point source loading, may call for management and/or restoration measures especially in the water body.

Diffuse loading from agriculture is a major pressure in one third of the water bodies in lakes and transitional waters, especially in north-western Europe in the regions where there is high fertiliser input and high river nitrate concentration (EEA 2012). Since all smaller water bodies have not been included in the classification, the real percentage of lakes influenced by diffuse loading from agriculture may be even higher. Moreover, discharges from wastewater treatment plants and industries and the overflow of wastewater from sewage systems is still a significant pressure for 22 % of water bodies in Europe (EEA 2012).

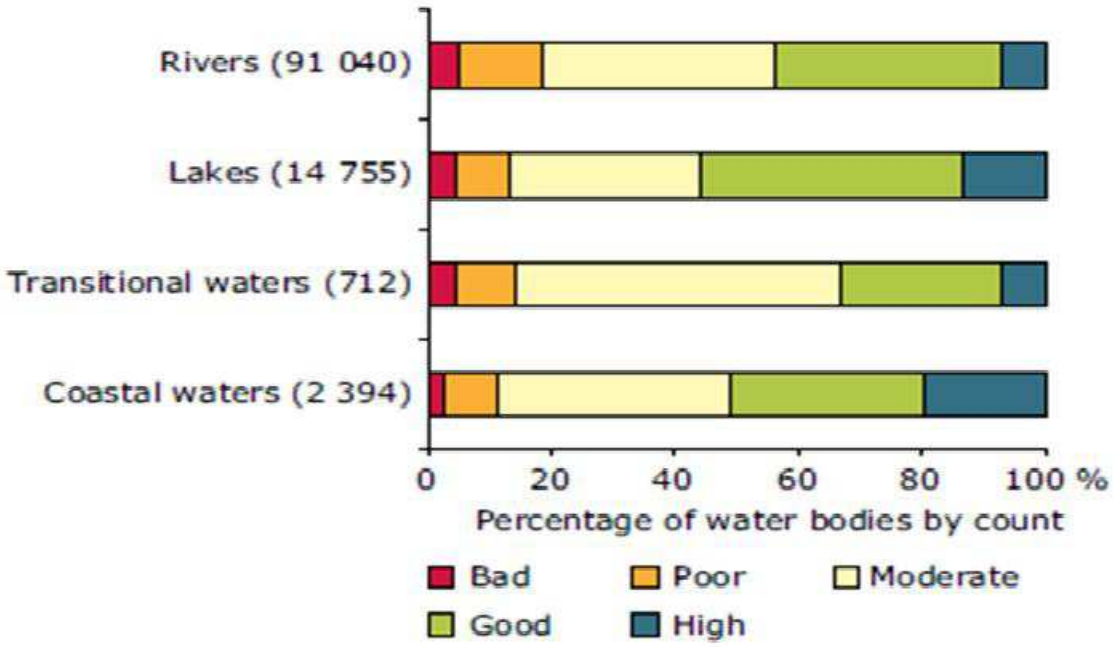

Fig. 2. Distribution of ecological status or potential of classified rivers, lakes, coastal and transitional waters (EEA 2012).

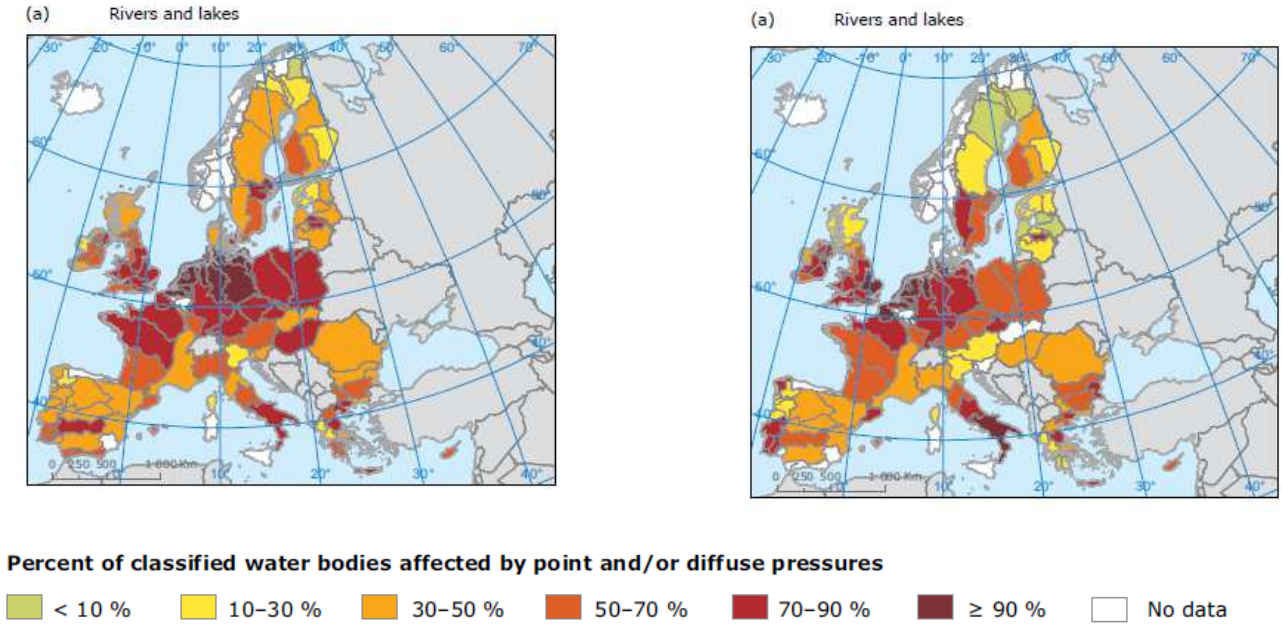

Fig. 3 : The percentage of water bodies with less than good ecological status in river basin districts in Europe (left) and the percentage of classified waters affected by point and/or diffuse pressures (right) (EEA Report 9/2012).

3.2. The current state of waters in the Lake Balaton Recreational Area

3.2.1 Assessment of the Lake Balaton water body in the Danube River Basin District Management Plan

Hungary is situated within the heart of the Danube Basin, the whole area of the country belongs to the Danube River Basin and there are a lot of transboundary relationships with the seven neighbouring countries.

The Danube and its tributaries, transitional waters, **lakes**, coastal waters and groundwaters form the Danube River Basin District (DRBD). For the purpose of the Danube River Basin District Management Plan (DRBM Plan), the DRBD has been defined as covering the Danube River Basin, the Black Sea coastal catchments in Romanian territories and the Black Sea coastal waters along the Romanian and partly Ukrainian coasts (ICPDR 2009a). All Danube countries with territories >2000 km2 in the DRB are Contracting Parties to the Danube River Protection Convention (DRPC): Austria – AT, Bosnia and Herzegovina – BA, Bulgaria – BG, Croatia – HR, the Czech Republic – CZ, Germany – DE, Hungary – HU, Moldova – MD, Montenegro – ME, Romania – RO, the Republic of Serbia – RS, the Slovak Republic – SK, Slovenia – SI and Ukraine – UA. In addition, the European Community – EC – is a Contracting Party.

Not all countries are EU Member States and therefore not obliged to fulfil the WFD, however all countries cooperating under the DRPC decided to make all efforts to implement the WFD throughout the whole basin. The Non EU Member States committed themselves to implement the WFD within the frame of the DRPC. In accordance with the WFD Article 13 (3), the Danube

countries have developed the DRBM Plan entailing measures of **basin-wide importance** as well as setting the framework for more detailed plans at the sub-basin and/or national level.

The Danube Basin is identified as the River Basin District, the main „unit" for water management in Hungary. With an area of 807827 km2, the DRBD is the second largest in Europe. The DRB is the „most international" river basin in the world covering territories of 19 countries. Those 14 countries with territories greater than 2000 km2 within the Danube Basin cooperate in the framework of the ICPDR. The Danube-basin-wide issues are coordinated by the International Commission for the Protection of the Danube River (ICPDR).

It has been agreed among the Danubian countries that the river basin management plan will be structured so that the plan can be studied on basin, national and sub-unit level. Therefore part A of the plan deals with issues of basin wide importance (so called roof level) and is coordinated by ICPDR, while part B type plans are the national plans of countries of the basin with the responsibility of the national competent authorities. More detailed plans (part C) are the integral parts of national plans.

The DRBM Plan is based on three levels of coordination:

Part A: the international, basin-wide level – the Roof level;
Part B: the national level and/or the internationally coordinated sub-basin level for selected sub-basins;
Part C: the sub-unit level, defined as management units in the national territory.

The information increases in detail from Part A to Parts B and C.

The investigations, analysis and findings of the DRBM Plan for the basin-wide scale (Roof level) focus on (ICPDR 2009a):

- rivers with catchment areas >4000 km2;
- **lakes >100 km2;**
- transitional and coastal waters;
- transboundary groundwater bodies of basin-wide importance.

Waters with smaller catchment and surface areas are part of the national RBM Plans.

Water bodies are the basic management units according to the WFD. All WFD assessments and activities are linked to the basic planning unit of water bodies.

In the DRBD, six lakes are identified as being basin-wide importance (ICPDR 2009a):

Neusiedlersee/Fertő-tó consisting of two water bodies (AT/HU),
Lake Balaton (HU),
Yalpug-Kugurlui Lake System (UA) consisting of the lake water bodies Yalpug and Kugurlui,
Rasim-Sinoe Lake System (RO) comprising Lake Razim and Lake Sinoe (also a transitional water body).

Assessment of the status of Lake Balaton water body in the Danube River Basin District Management Plan is presented in **Table 2** (ICPDR 2009b). **Table 3.** summarises whether significant hydromorphological alterations and chemical pressures are affecting the lakes in the Danube River Basin District (ICPDR, 2009a, Chapter 2.2). For further details see **Table 4**. (ICPDR, 2009b).

Table 2. Assessment of the status of Lake Balaton water body in the Danube River Basin District Management Plan

Source: ICPDR (2009 b): Danube River Basin District Management Plan, Final Version, Annex14

Name of Water Body: Lake Balaton
Water Body code with country code: HUAIH049

		Assessment in the Danube River Basin District Management Plan
Biological Quality Elements	Fish	
	Benthic invertebrates	
	Phytobenthos and Macrophytes	2 good
	Phytoplankton	2 good
	Overall Biological Status	2 good
HyMo	Hydromorphology – High Status (Y/N)	N
General Physical and Chemical conditions SUPPORTIVE to the Ecological Status		2 good
Specific Pollutants	Specific pollutants (good or failing for Ecological Status)	G good
Overall Ecological Status		2 good
Confidence class (high, medium, low for Overall Ecol.Status)		M medium
Artificial and HMWB	Artificial Water Body (Y/N)	N
	HMWB (Y/N)	N
	Ecological Potential Class	
	Confidence class (Ecological Potential)	
Chemical Status class	Chemical Status Class	G good
	Confidence class (Chemical Status)	M medium
Risk assessment for Non EU MS and also for EU MS in case of low confidence	Ecological Status	
	Chemical Status	
	Organic Pollution	
	Nutrient Pollution	
	Hazardous Substances	
	Hydromorphological Alterations	
Exemption Art. 4(4)	(Y/N)	N
Exemption Art. 4(5)	(Y/N)	N

1=high
2= good
3=moderate
4=poor
5=bad

G=good
F=failing
H=high
M=medium
L=low

Table 3. Presence of significant hydromorphological alterations and chemical pressures affecting DRBD lakes

Source: ICPDR (2009a)

	Country	Hidromorphological alleration	Chemical pressure
Neusiedler See / Fertő tó	AT/HU	No	No
Lake Balaton	HU	No	No
Lacul Razim	RO	No	Yes
Lacul Sinoe	RO	No	Yes
Lake Yalpung	UA	Yes	No information
Lake Kugrului	UA	Yes	No information

Table 4. Assessment of lake water bodies according to particular biological and chemical quality elements in the Danube River Basin District Management Plan
Source: ICPDR (2009b – Annex 14.)

Annex 14 of the DRBM Plan — Lakes

Water Body code with country code	Name of river	Biological Quality Elements					HyMo		Specific pollu-tants	OVERALL ECOLOGICAL STATUS		Artificial and HMWB				Chemical Status Class		Risk assessment for Non EU MS and also for EU MS in case of low confidence						Exemption Art. 4(4)	Exemption Art. 4(6)
		Fish	Benthic invertebrates	Phytobenthos and Macrophytes	Phytoplankton	Overall Biological Status	Hydromorphology - High Status (Y/N)	General Physical and Chemical conditions SUPPORTIVE to the Ecological Status	Specific pollutants (good or failing for Ecological Status)	OVERALL ECOLOGICAL STATUS	Confidence class (high, medium, low for Overall Ecol.Status)	Artificial Water Body (Y/N)	HMWB (Y/N)	Ecological Potential Class	Confidence class (Ecological Potential)	CHEMICAL STATUS CLASS	Confidence class (Chemical Status)	Ecological Status	Chemical Status	Organic Pollution	Nutrient Pollution	Hazardous Substances	Hydromorphological Alterations	(Y/N)	(Y/N)
AT10500200	Neusiedler See				2	2	N		G	2	H	N	N			G	H	N	N	N	N	N	N	N	N
HUAIH049	Balaton			2	2	2	N	2	G	2	M	N	N			G	M							N	N
HUAIH079	Fertő			2	2	2	N	2	G	2	M	N	N			G	M							N	N
[illegible] 0.0.0.0	Razim				2	2	N	2	G	2	L	N	N			F	M	N	Y	N	N	Y	N	N	N
UAKU	Kugurlui						N					N													
UAYL	Yalpug						N					N													

Explanations

	Labels in the table	Descripton	Possible values
	Water body code with country code	as in Article 5 Roof Report	
	Name of river	as in Article 5 Roof Report	
Biological Quality Elements	Fish	Status Class for the Water Body	1 = high, 2 = good, 3 = moderate, 4 = poor, 5 = bad
	Benthic invertebrates	Status Class for the Water Body	
	Phytobenthos and Macrophytes	Status Class for the Water Body	
	Phytoplankton	Status Class for the Water Body	
	Overall Biological Status	Status Class for the Water Body = worst case of the status classes of all biological quality elements (acc. to one-out-all-out principle)	
Hydromorphology	Hydromorphology - High Status	Only if biological quality elements are in high status hydromorphology must also be in high status	Y = Yes, N = No
General Physical and Chemical conditions	General Physical and Chemical conditions SUPPORTIVE to the Ecological Status	Status Class for the Water Body	1 = high, 2 = good, 3 = moderate, 4 = poor, 5 = bad
Specific pollutants	Specific pollutants (good or failing for Ecological Status)	Status Class for the Water Body for specific pollutants based on national quality standards; relevant for the assessment of Ecological Status. Specific pollutants are those pollutants that are regulated at the national level (and not included in the List	G = good, F = failing
OVERALL ECOLOGICAL STATUS	Overall Ecological Status	Worst case of the Biological Quality Class and Specific pollutants Status Class. For High Ecological Status additionally the General Physical and Chemical Parameters and the Hydromorphology have to be in high status.	1 = high, 2 = good, 3 = moderate, 4 = poor, 5 = bad
	Confidence class (high, medium, low for Overall Ecol.Status)	Confidence level of assessment (as discussed in the MA EG)	H = high, M = medium, L = low
Artificial and HMWB	Artificial Water Body (Y/N)	Is the water body artificial?	Y = Yes, N = No
	HMWB (Y/N)	Is the water body heavily modified?	Y = Yes, N = No, PN = provisionally no, PY = provisionally yes
	Ecological Potential Class	If the water body is artificial or heavily modified - please give the information of the Ecological Potential Class	2 = good and above, 3 = moderate, 4 = poor, 5 = bad
	Confidence class (Ecological Potential)	Confidence level of assessment (as discussed in the MA EG)	H = high, M = medium, L = low

Assessment criteria

Source: ICPDR (2009b): Danube River Basin District Management Plan, Final Version

	Labels in the table	Descripton	Possible values
CHEMICAL STATUS CLASS	CHEMICAL STATUS CLASS	Chemical Status Class for all pollutants that are regulated by the EU	G = good, F = failing
	Confidence (Chemical Status)	Confidence level of assessment (as discussed in the MA EG)	H = high, M = medium, L = low
Risk assessment for Non EU MS and also for EU MS in case of low confidence	Ecological Status	Risk Class for the Water Body	Y = at risk, P = possibly at risk, N = not at risk
	Chemical Status	Risk Class for the Water Body	
	Organic pollution	Risk Class for the Water Body	
	Nutrient pollution	Risk Class for the Water Body	
	Hazardous substances	Risk Class for the Water Body	
	Hydromorphological alterations	Risk Class for the Water Body	
Exemptions	Exemption Art. 4(4)		Y = Yes, N = No
	Exemption Art. 4(5)		Y = Yes, N = No

3.2.2 Implementing the Water Framework Directive in Hungary

Over 95 per cent of the surface water resources of Hungary originate abroad, large parts of the catchment areas of the main streams and their tributaries being situated beyond the borders. Hungary has been identified 20 transboundary groundwaters/aquifers. Transboundary groundwaters are shared with the seven neighbouring countries.

For practical reasons, the country is divided into river basin management „planning units". Four sub-catchments of the Hungarian part of the Danube Basin are designated as regional „sub-basins" and within them altogether 42 „planning sub-units" have been identified.

The four sub-basins are (VKKI 2010a):

1. Hungarian part of the Pannonian Central Danube sub-basin of the Danube River Basin District,
2. Hungarian part of the Tisza sub-basin of the Danube River Basin District,
3. Hungarian part of the Dráva sub-basin of the Danube River Basin District, and
4. **Lake Balaton Basin.**

The Balaton Basin is designated as stand-alone water management planning sub-unit because the high importance of the Basin (VKKI 2010b).

The river basin management plans of the different units differ in terms of detail, while their content is specified by the governmental decree 221/2004 (VII.21.).

The principal authorities responsible for water resources management and river basin management planning are the Hungarian National Water Authority and the 12 regional water authorities.

The Hungarian river basin management reports, plans and background materials are available in Hungarian at the website of the river basin management planning (www.vizeink.hu).

The catchment area of the Lake Balaton (together with the water surface) is 5,775 km2. The catchment area can be divided into three sub-catchments, the Northern, the Southern and the

Western (Zala river catchment area). The area of the western sub-catchment is about as large as the other two combined.

The Lake Balaton Basin "river basin management planning unit" is divided into two "planning sub-units". The two "planning sub-units" are:

4.1 Zala River Basin (the western part of the catchment) (VKKI 2010c) and
4.2 Lake Balaton Direct Basin (the Northern and Southern part of the catchment) (VKKI 2010d)

The Lake Balaton Priority Resort Area (LBPRA or Lake Balaton Region or Lake Balaton Recreational Area) consists of the lake itself and 179 municipalities around the lake and in the vicinity. LBPRA has been created by law (Lake Balaton Act, CXII/2000), and its area is roughly overlap with the 4.2 sub-catchment (Lake Balaton direct catchment, Lake Balaton planning sub-unit) of the River Basin Management Plan in accordance with the EU WFD.

3.3 Relationship between climate change and lake management

In 2013 the Fifth Assessment Report published by the Intergovernmental Panel on Climate Change (IPCC 2013) reaffirmed the on-going warming of the global climate system with increasing greenhouse gases, warming of the atmosphere and ocean, diminishing levels of snow and ice and sea level rise. From 1971 to 2010, 90% of the energy stored in the climate system (through positive radiative forcing) is attributable to ocean warming. The atmospheric water cycle is changing and global surface temperatures are increasing. A number of the scenarios in the report indicate that by the end of the 21st century temperatures will have increased by 1.5°C to 2°C (relative to 1850-1900) though there will be significant variability over time (inter-annual to inter-decadal) and will not occur on a regionally uniform basis**.** Air temperature increases of +2°C are expected to reduce half the total ice cover duration period and this will particularly affect larger deeper lakes (Nõges at.al., 2013a).

Climate impacts on lakes in Europe

The Climate and Lake Impacts (CLIME) project (2003-2005) sought to examine the impacts on lake systems. A report was prepared for the European Union Directorate General (Joint Research Centre) in 2005 which sought to identify the main climate impacts on European lakes and to establish the likely risk of failing to achieve good ecological status by 2015 due to climate change. The key outcomes were that:

- The response of lakes to climate forcing is most coherent for physical parameters (including rise of water temperature, especially of deep water and changes of ice regimes)
- The anticipated changes in the chemical regime of lakes are less coherent and depend strongly on lake type and local conditions (such as the changes in timing of Phosphorus (P) loadings, higher internal load due to higher temperature and lower Oxygen (O2), increase of total annual Nitrogen (N) loss from the catchments)
- The impact of climatic factors on dissolved organic carbon production and transport is complex and includes the combined effects of both temperature and precipitation on the decomposition, solubility and hydrological transport of these compounds5
- Due to complex interactions, biological changes induced by climate change are inherently unpredictable (such as cyanobacterial blooms)

Implications for Water Framework Directive implementation.

Ignoring clime change in the Water Framework Directive may have strong implications for the typology and quality assessment systems used for water bodies (Nőges et al. 2013a). Two of the most widespread pressures on ecological status of water bodies in the EU are:

1. Pressures that originate from hydromorphological modifications to water bodies; and
2. Pressures that stem from over-abstraction of water

According to the analysis of Adaptation Strategies of 18 RBMPs 2009-2015 (European Commission 2013), Estonia and Latvia fully excluded climate change issues, Germany discussed the issues very modestly, the Danube countries (ICPDR 2009c) concluded that climate change signals for the district are sufficient to act beyond existing scientific uncertainties, most countries described the observed climate change and its impacts to water resources management while UK and Ireland dedicated a separate report on climate change issues and conducted 'climate checking'/'climate proofing' of the River Basin Management Plan Programmes of Measures.

Short- and long-term objectives.

The EC Guidance document No. 24 (CIS WFD 2009) states that:

1. Apart from exceptional circumstances, it is not expected that, within the timeframe of WFD implementation (i.e., up to 2027), a climate change signal will become statistically distinguishable from the effects of other human pressures at a level requiring reclassification of sites. Studying reference sites does not give information on how impacted sites will respond to climate change.
2. It is likely that indirect pressures arising from human responses to climate change – both adaptation and mitigation - will have a greater impact on water bodies than the direct climate change pressures. These indirect pressures include damming and elevated water abstractions for irrigation, new flood defence infrastructure, intense production of energy crops.
3. The database of specific water related mitigation measures (Nőges et al. 2013a; 2013b) and guiding principles required for climate change adaptation include:
    a. Critical loading limits in lakes must be lowered in a future warmer climate as natural mechanisms that control phytoplankton development weaken.
    b. Being aware of the dominant cascading effects in lakes (rehabilitating zooplankton in lake monitoring schemes and following changes in fish feeding types and size structure)
    c. Considering geographic, and type-specific differences in sensitivity of lakes to pressures for selecting appropriate conservation, adaptation and restoration measures
    d. Avoiding trade-offs between measures (measures which endanger water resources, biodiversity and the ecological status of lakes, energy-intensive adaptation measures based on continuous use of fossil fuels and thus contradicting to climate change mitigation and energy-intensive restoration measures (e.g. sediment removal, fish removal) if natural processes sustaining the achieved results are not developed).

3.4 Climate change challenges for lake management in the Lake Balaton Region

In the last 30 years, annual average air temperatures changed between +1 and +1.3 ^{o}C in various regions of Hungary. In the Lake Balaton watershed the change is about +1.1 ^{o}C. Precipitation during the last 5 decades decreased by a few percent in the country overall, but the change is much larger in the Lake Balaton watershed where some 15-20 percent reduction has been experienced. These findings set the stage for the evaluation of climate change and climate impact in the Lake Balaton Region (Gallinaro et al. eds. 2012, 2013).

A large part of Hungary is affected by annual climatic water deficit, which will be deepened by the expected climate change.

According to the meteorological data of the past decades, Lake Balaton watershed is warming, precipitation is slightly decreasing, and the water balance is showing higher variability. Future climate predictions invariably show increases in temperature, and reduction of water excess in the natural water balance. Certain scenarios (Novaky, 2008) predict permanent negative natural water balance by as soon as 2050.

After the 30s of the 21st century the estimated drastic drop in the inflow and the increased evaporation will likely cause years without outflow to occur more frequently and also the decay of lake's water-substitution activity. For the most part of the second half of the century no outflow is to be expected and even the water-level and water supply of the lake can still decrease continuously.

The natural water balance of Lake Balaton may be improved by water transfer from other watersheds, but this action would result in other stresses and vulnerabilities, such as water shortage on the other watershed, introduction of foreign species, and conflicts of interests (Gallinaro et.al. eds.2012).

Relevant climate impacts

The specific impacts of climate change in the Lake Balaton Region are difficult to predict, but it is likely that they will add to water management challenges in the future (Ferincz 2014, Kováts – Ferincz 2012, Kováts ed. 2012).

Lake Balaton is large, extremely shallow lake with 594 km2 surface area and 3.3 m average depth. 51 water courses flow into the lake, of which only 20 have permanent discharge. Drought is the main concern for the Lake:

1) The unprecedented drought from 2000 to 2003 resulted in extreme low water level, loss of some 22 % of lake volume, and no outflow from the lake for more than 5 years. Such a situation happened for the first time in the recorded history of the lake.

2) The drop of groundwater level resulting in the sinking of ground and damage to the built environment as well as the reduction of agricultural production.

3) The increase of extreme weather events resulting in occasional flooding and erosion of the steep terrain along the northern shore.

4) As a result of the drought, the natural change of water balance (Precipitation + Inflow – Evaporation) became negative in year 2000 for the first time since reliable monitoring have been introduced in 1921, and remained negative for three more years.

Since water withdrawal from the lake is insignificant (corresponds to some 30 mm annually), regulation of water use is not a viable measure to prevent the dropping of the water level.

Consequences of low water level

1. Level drop for extended periods result in dried-up shoreline, formation of sand shelves, loss of spawning area.

2. Low levels inconvenience bathing tourists since they have to walk several hundred meters to find water deep enough for swimming.

3. Low levels result in extreme shallow water where filamentous benthic algae (such as cladophora) can grow in large masses. Wind action moves such algae mats to the shore or to the rip-rap, where they decompose resulting in smell and aesthetic problems.

4. Due to the lack of outflow some 10 to 20 tons of phosphorus (i.e. some 10 to 15 % of total P load) was not discharged from the lake – thereby worsening the nutrient situation.

5. The lack of outflow results in the impossibility to catch eel with eel-tarps placed at the outflow sluice. In an average year the Balaton Fishing Company could catch some 100 t of eel at very low cost (almost free). Since there was no outflow for 5 years, the fishing company suffered huge losses.

6. The lack of outflow results in the impossibility of the traffic of boats and ships through the Sió canal connecting Lake Balaton and the Danube River.

7. Due to the low level, a considerable part of spawning surfaces and aqueous habitats dried up.

8. At low water level, yachting and commercial shipping becomes difficult. Some larger ships and yachts are standing, load restrictions should be applied and harbours should be dredged frequently.

9. At low water level, wind induced resuspension of the sediment is more effective resulting in higher turbidity and potential problems of the feeding of zooplankton.

10. Dry weather also affects vineries and other agricultural production. During the experienced extreme dry year from 2000 to 2003, vineries considered building water retaining facilities and irrigation systems and applied soil cover by mulch-like materials to reduce evaporation.

Effects of high water level

Due to the increase of extreme weather, occasional increases of lake level due wind action as well as seasonal high levels due excessive precipitation are experienced.

1) As a consequence of wind action, level displacement of as much as 1 m was experienced causing damage to transportation infrastructure.
2) Winter high levels caused ice damage to the shoreline concrete structures (beaches) as well as flooding of low-lying areas in the south-western end. Flooding threatens houses close to the shoreline.

Effects of increased temperature

1) While the annual and seasonal means of physiologically equivalent temperature (PET) increasing, the number of comfortable days is on the decrease. If these trends will continue in the next years, we should expect both positive and negative results.
2) The increasing demand for the waterside (beaches) as well as the increasing length of the tourism season, are the possible positive results.
3) Negative impacts may be the overcrowded beaches, the ecological problems resulting from crowd, and the increasing frequency of certain extreme weather events (heat waves, storms, droughts, vegetation fires, etc.)

These possible impacts mean that the tourism industry needs to draw up adaptation plans on behalf of the sustainable tourism.

The possible adaptation measures to reduce the potential impacts caused by climate change

The first Hungarian National Climate Change Strategy (NCCS) was developed and adopted in 2008. The Second NCCS is under development. The NCCS developed recommendations on adaptation measures (keeping the rainwater in place, retaining river water, construction of small and medium reservoirs and building water transition structures). Water related recommendations and measures of the NCCS were included in the RBMP (European Commission 2012).

The RBMP (ICPDR 2009a, 2009c) describes specific climate change adaptation measures, such as:

- water retention measures,
- reduction of runoff,
- an increase in the utilization of treated waste water,
- an increase in the ratio of wetland and forest areas and
- an increase to the base flow of rivers.

The main measures related to water scarcity and drought are:

- the reduction of losses in urban distribution networks,
- measures to increase treated water re-use,
- improvement of the efficiency of agricultural water uses,
- reduction, management of groundwater abstraction,
- measures to enhance the resilience of the ecosystems to water scarcity and droughts,
- promotion of rainwater harvesting, and
- development or upgrading of reservoirs.

All the potential measures were assessed concerning their ecological, economical and social feasibility

3.5. Values of lake ecosystems and lake restoration

3.5.1 General background

Ecosystem services are benefits that people and society obtain from ecosystems. The term was introduced as a framework for social-ecological systems a decade ago in the Millenium Assesment which listed provisioning, regulating, cultural and supporting services. They can also be divided in two main categories, extractive and non-extractive (US EPA 2013, **Fig 4**.).

The concept can be a useful tool in local, regional and even global policy. In regional lake or water management, valuation of the ecosystem services can pave the way for implementing management programs and participation of local stakeholders. It can demonstrate that management of the aquatic habitats is not only a cost to be covered and only for a better environment, but also an investment safeguarding the benefits of natural capital to the local society.

The original approach has been largely focused on linking scientific research with ecological properties and biodiversity. But for a preliminary assessment of lakes and their management for regional policy, a simpler and more practical approach may be needed. For this purpose we have listed the frequency different uses of lakes or reservoirs which have direct economic significance or are related to these economically significant uses.

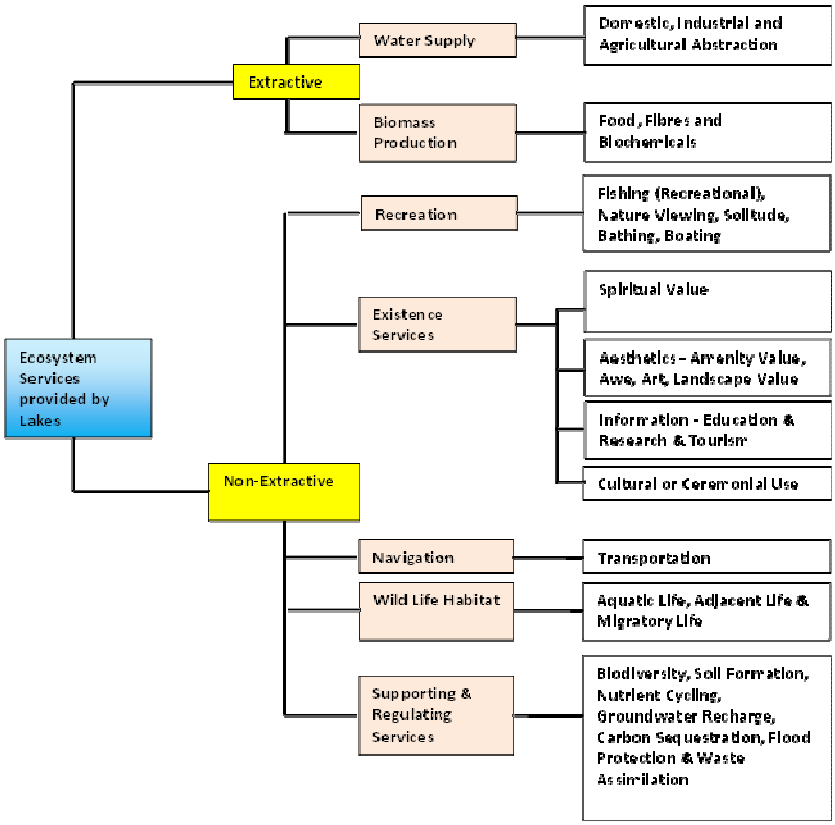

Fig. 4. Types of lake ecosystem services as defined in the US-EPA applied to Lough Corrib in the West Region of Ireland (Teresa O´Reilly)
see http://www.epa.gov/aed/lakesecoservices/ecosl.html

3.5.2 Ecosystem services provided by lakes and reservoirs in LakeAdmin regions

A preliminary survey of ecosystem services identified by partners in their regions resulted in a list of 16, mainly provisioning lacustrine ecosystem services related to some economically significant use of natural resources (**Table 5**.). These recognized ecosystem services are either directly (e.g. raw water, irrigation, aquaculture, commercial fisheries, hydropower) or indirectly (e.g. recreation, tourism, recreational and sport fishing) highly important in the local economy. Most of these ecosystem services are also dependent on a sufficiently high quality of water. Since their local economic value is high, extensive water protection or management measures have been or will be carried out to maintain them. The role of e.g. irrigation is of special importance in the southern, Mediterranean, partner regions while boating and fisheries are more specified as northern services. Recreation, biodiversity and landscape value were in high priority in all regions. We conclude that maintaining biodiversity and the economically significant ecosystem services share a common interest. Maintaining economically valuable activities like tourism may thus also require maintenance of biodiversity and at least in LakeAdmin regions the highest income from tourism is significantly related to high biodiversity.

Table 5. Benefits gained from ecosystems of lakes, reservoirs and ponds in LakeAdmin partner regions.

Abbreviations of ESS categories: P = Provisioning, R = Regulating, C = Cultural. Supporting services which are less directly policy related or measurable were not listed.

Ecosystem Services Lake use	ESS	Use of lakes in partner regions LakeAdmin countries (blue = yes, white = no)								
		Finland	Czech Rep.	Denmark	Estonia	Greece	Hungary	Ireland	Italy	Malta
Aquaculture	P									
Bathing	C									
Biodiversity	P									
Boating and sailing	C									
Env. education	C									
Fisheries commercial	P									
Fisheries recreational	P									
Fisheries sportfishing	C									
Flood protection	R									
Freetime residence	P/C									
Irrigation	P									
Landscape value	C									
Raw water	P									
Tourism	P/C									
Water sports	C									
Water transport	P									

Valuation of the ecosystem services could pave the way for implementing management programs and participation of local stakeholders since it demonstrates that management of the aquatic habitats is not only a cost to be covered but also an investment for the local society and environment.

3.5.3 Value of lakes in the Lake Balaton Recreational Area

Economic dimensions of the climate change effects

Low water level between 2000 and 2003 caused quantifiable and non-quantifiable (or difficult to quantify) economic damages. Kutics (2012) estimated the economic impacts of low water level and the lack of outflow from the lake:

Quantifiable damages:	
Commercial shipping:	1.0 to 2.0 million Euro/year
Commercial fishing:	0.5 to 0.7 million Euro/year
Dredging of harbours and bathing areas:	1.3 to 1.6 million Euro/year
Clean-up of cladophora biomass from shallow waters:	1.0 to 0.2 million Euro/year
Reduction of entrance fee revenues of beaches:	0.5 million Euro/year
The total quantifiable damages can be estimated to be:	3.4 to 5.0 million Euro/year
Overall decrease of tourism related incomes:	
total such income is estimated at	1300 million Euro/year

Value reduction of homes and second houses due to the loss of popularity of Lake Balaton region:

total value of the houses is estimated at 8.6 billion Euro

The potential damages that are difficult to quantify:

- Halt of shipping in Sió Canal
- Ecological damages
- Decrease of the number of tourists (guest nights)
- Yacht owners chose harbours at other lakes or the Adriatic due to the low level

Economically significant services of Lake Balaton Recreational Area

Lake Balaton Recreational Area provides economically important services. The Lake and its surrounding have multiple uses: recreation, hobby-fishing, source of raw water, navigation, residence area, etc. The permanent population of the area is 275,000 inhabitants, owning more than 120,000 houses and apartments. In addition to the permanent dwellings there are 72,000 holiday homes around the lake, which equals to 29% of the holiday homes of the country. Biodiversity and landscape play an important role as well. 198,100 ha of Natura 2000 sites is located around the lake and its monetary value is estimated to be 530 – 780 million €/year.

4. Lake restoration and WFD implementation in the partner regions

4.1. Description of Lake Restoration in the Lake Balaton Recreational Area

Feedback from the EU to the national implementation of WFD in the second RBMP period.

According to the Commission Staff Working Document COM(2012)670 final (European Commission 2012) the key strengths of the Hungarian National River Basin Management Plan are as follows:

- the RBMP has been developed in detail at national, sub-basin and sub-units level,
- it has a number of problem-specific annexes and background documents,
- stakeholders and public consultation were given a high importance,
- international co-ordination is good through multi- and bilateral agreements,
- the important pressures affecting surface water bodies are identified in the RBMP,
- the RBMP gives a comprehensive overview on objectives,
- the Programme of Measures is thoroughly developed providing water body level information about basic, supplementary and additional measures.

Several significant gaps exist though:

- the testing of typology of surface water bodies against biological data has not been completed in the first RBMP cycle because of the lack of sufficient data,
- there is a significant development in biological quality element but data gaps still exist,
- the assessment methods, reference values and class boundaries were not completed for all types,
- status assessment of surface water bodies are not reliable enough and there is also a high uncertainty in HMWB designation,
- exemptions are extensively used and the justifications for the exemptions are very general,
- financing of some of the measures does not seem to be ensured.

Need for integration

The River Basin Management Plan contains all the measures that are necessary to reach and maintain good chemical and ecological status of water. However, the plan does not include all the necessary measures to fulfil the demand of the economy and society. Therefore, in the implementation plan the WFD based River Basin Management Plan should be extended to the social and economical driven water resources management measures to reach true integration, of course not risking the targets of WFD. The River Basin Management Plans should be integrated with other plans and these can be considered as important interventions in regional and local policies such as land use and spatial plans, Operational Programmes and Rural Development Programmes and other important action plans and programmes which include:

- Southern Transdanubia Regional Operational Program
- Central Transdanubia Regional Operational Program
- Western Transdanubia Regional Operational Program
- Lake Balaton Development Plan
- Long Term Development Plan of Lake Balaton Recreational Area
- Local Rural Development Strategies of LEADER Action-Groups (Balaton-felvidék, Bakony-Balaton keleti kapuja, Dél-Balaton, Koppányvölgye)
- Lake Balaton Traffic Development Plan
- Lake Balaton Tourism Development Programme

- Baseline Review of Lake Balaton Recreational Area concerning the implementation plan
- National Climate Strategy and Action Plan

Significant issues of Lake Balaton water status

In case of Lake Balaton eutrophication and accompanying algae blooms constitute the challenge of water quality control. Eutrophication started in the 1960s as a result of reckless nutrient management in agriculture and the absence of appropriate sewage treatment. After the large scale algae blooms of 1982, serious nutrient control measures were introduced and after two decades water quality seemed to stabilize. However, during the extreme drought period between 2000 and 2003 higher temperatures and low water levels resulted in less favourable water quality in terms of chl-a. Since exchange of water between adjacent sub-basins is limited, eutrophication levels aggravate towards the west, and that of the Keszthely basin, which receives about one third of the lake's total nutrient loads, has reached hypertrophic level.

The key nutrient responsible for eutrophication is phosphorus. The external total phosphorus (TP) load was considerably reduced through sewer development and sewage treatment with P precipitation, diversion of treated effluents to other watershed and the radical (though partly unplanned) reduction of agricultural use of fertilizers.

The River Basin Management Plan for Lake Balaton Recreational Area includes a specific package of measures (Verbis et al. eds. 2014):

1. To reduce nutrient and organic loads
    - Collection and treatment of settlements' waste water
    - Other measures related to pollution from settlements (rainwater drainage system, waste management)
    - Direct pollution from industrial sources
    - Reduce of the pollutant and other organic loads from agricultural activities and increase the role of sustainability
    - The development and dissemination of good fishery and angling practices

2. Other pollution prevention and remediation of pollution (for example flood or prevention of hazardous and other pollutant inputs into water bodies)

3. Improvement of hydro-morphological status of water courses
    - Measures for the bed of water courses and water bodies/lakes
    - Measures for floodplains of water courses and for shoreline of water bodies/lakes

4. Modify the water uses which influence significantly the hydro morphological conditions Sustainable water use in order to protect the water quantity (mainstreaming ecological / environmental considerations)

5. Appropriate measures to ensure the quality of drinking water

6. Specific measures due to the natural values of wetlands and protected areas
    - Measures and adaption due to the natural values of wetlands and protected areas
    - Measures for designation to provide the living conditions of fishes in surface water
    - Special measures for natural spas

The most important types of lake water management measures planned for the next five years:
- further reduction of nutrient (dominantly external P) load

- Implementation of shore zone rehabilitation plans
- Improved lake water level regulation and corresponding infrastructure development
- Better water resources management at catchment level
- Improvement of urban run-off control

The most important measures of the relevant regional and local policies on lake water management:

- Reduction of nutrient loading from agriculture
- Waste water treatment systems
- Improvement of fish farming
- Water land use regulations
- Lake restoration
- Climate change damage control
- Rainwater management
- Elimination of accidental water pollution
- Flow management = in case it means water level regulation
- Water monitoring and quality management
- Sediment removal from standing water bodies
- Biodiversity management & species protection

4.2. Inclusion of the Lake Archive and rationale behind its preparation

The LakeAdmin Archive is a case study collection which is prepared to aid the transfer of Good Practices and preparation of the Regional Implementation Plans of LakeAdmin. Each partner region has participated in collecting and disseminating their previous experiences and knowledge on lake restoration themes and actual cases or measures from the past 10 - 30 years. This includes the problems addressed, methods and good practice approaches applied and the impacts and costs of the measures.

In Hungary 20 lakes were chosen for inclusion in the Lake Archive (**Fig 5**.). The list of the selected lakes by types (NEKI 2013):

Oxbow lakes:
- Lipóti Oxbow-Lake
- Tiszadobi Dead Tisza
- Alcsi Dead Tisza
- Szarvas-Békésszentandrási Dead-Branch
- Kisinci Lake
- Újszegedi Dead Maros

Large lakes of national significance:
- Balaton
- Velencei Lake
- Fertő Lake
- Tisza Lake

Wetland:
- Nyirkai-Hany Wetland

Spring lake:
- Hévízi Lake

Salin lakes:
- Kolon Lake
- Riha Lake

Danube-branch with regulated water level:

Ráckevei-Soroksári Duna

Reservoirs:

Tatai Öreg Lake
Zámolyi Reservoir
Lázbérci Reservoir
Gyöngyös-Nagyrédei Reservoir
K-XI Reservoir

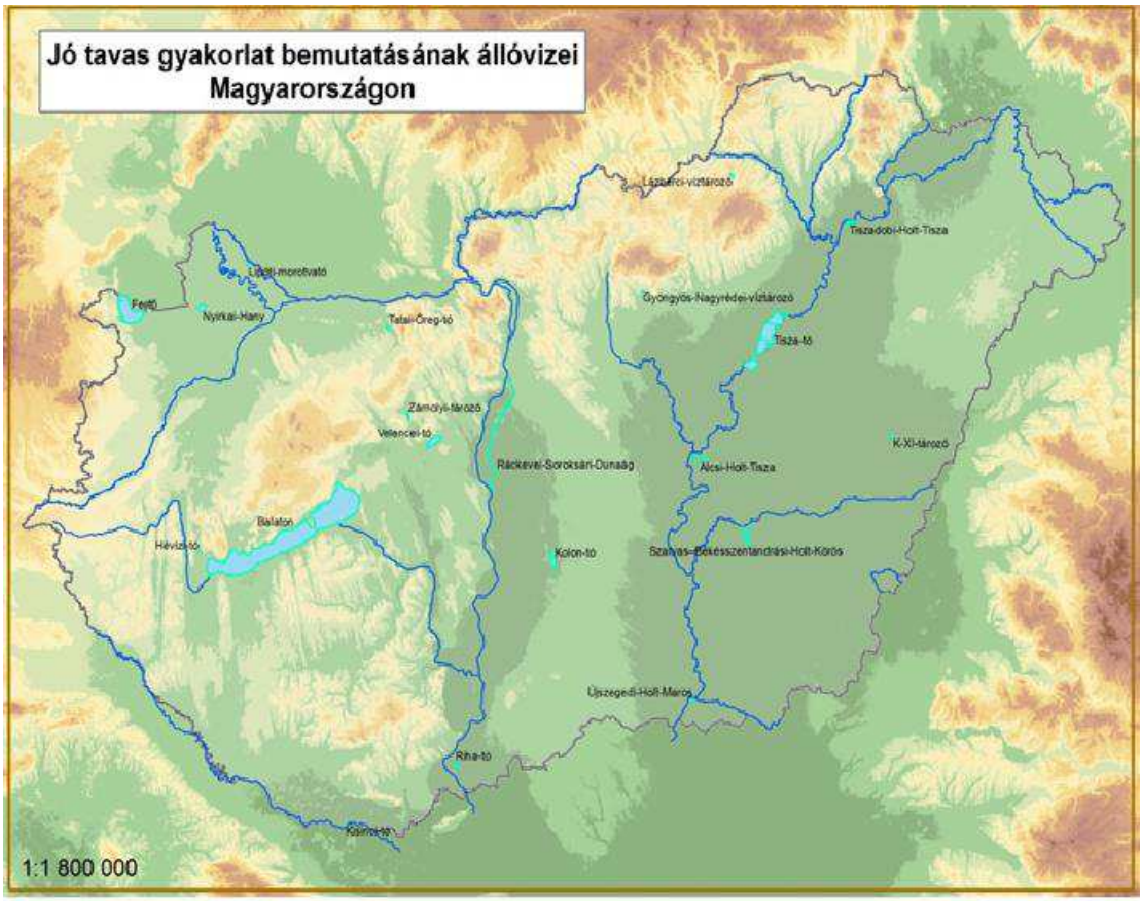

Fig. 5. Hungarian lakes chosen for inclusion in the Lake Archive

The significant issues that are managed by Good Practice(s) of lake restoration in the selected 20 Hungarian case-studies are presented in **Table 6**.

The short summaries on the Hungarian case studies (**Annex 1**) include the problems addressed, methods and good practice approaches applied and the impacts of the measures.

Oxbow-lakes along the Hungarian rivers on the plain areas are remarkable, specific lakes in Hungary because of their numbers, various features and functions. Several of them are dead river branches which formed naturally during the development of the rivers. However most of them evolved as the result of river regulation activities during the last 150 years. The most comprehensive survey on the oxbow-lakes exceeding 4 hectares was published by the Ministry of Environmental Control and Water Management (Palfai ed. 2003). Including oxbow –lakes that are smaller than four hectares, the total number of oxbow-lakes in Hungary comes to about 400. There are 50 (14 along the Danube and 36 in the water system of the Tisza) that are classified as "sanctuaries", that is they are strictly protected.

The main forms of utilisation of oxbow-lakes are the following: reservoir of excess water, excess water drainage, storage and transport of irrigation water, commercial fishing, angling, tourism, and water sports. Most of the oxbow-lakes - in addition to their importance from an environmental protection or ecological perspective – have a significant landscape-forming role.

The guidelines for the rehabilitation of oxbow-lakes have been continuously improved during conferences, workshops and the good experiences from rehabilitation works until they reached their current status.

4.3. Open Access Guidance Material

LakeAdmin is dedicated to identifying, exchanging, adopting and transferring Good Practices in lake management processes. Regional and local policy is also enhanced through closer co-operation between lake restoration managers and policy makers. The compilation of the LakeArchive, which includes data on previous restoration measures (including limnological, hydrological and ecological measures) spanning a time period of 30 years will no doubt increase the capacity of managing authorities to tackle environmental problems and issues associated with water body restoration. Access to the LakeAdmin Archive will be available to all relevant and appropriate stakeholders and authorities through the social networking site LakeWiki at http://www.jarviwiki.fi/wiki/Main_page?setlang=en. In the LakeWiki, each lake of over 1 ha, each drainage basin, region and river basin district has its own page. The development of the Lakewiki has followed a number of steps and can be reviewed at: www.jarviwiki.fi/wiki/LakeAdmin.

Table 6. Hungarian lakes selected for inclusion in the Lake Restoration Archive

x – the significant lake restoration issue that is managed by the Good Practice(s) implemented in the case-study of the selected lake

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	Name of the lake	Type of the lake	Restoration issues managed by the Good Practice(s)						
			P - load	Cyanobacteria-eutrophication algal booms	Oxygen-poor water	Sedimentation	Nature conservation objectives	Water supple-mentation	Improvement of drinking water
1.	Lipóti Morotva-tó	Oxbow lake						x	
2.	Tiszadobi-Holt-Tisza	Oxbow lake					x		
3.	Alcsi-Holt-Tisza	Oxbow lake				x		x	
4.	Szarvas-Békésszentandrási-holtág	Oxbow lake	x			x	x	x	
5.	Kisinci-tó	Oxbow lake						x	
6.	Újszegedi-Holt-Maros	Oxbow lake				x	x		
7.	Balaton	Large lake	x	x			x		
8.	Velencei-tó	Large lake				x	x	x	
9.	Fertő-tó	Large lake			x	x			
10.	Tisza-tó	Large lake	x			x	x		
11.	Tatai-Öreg-tó	Reservoir				x	x		
12.	Zámolyi-tározó	Reservoir					x		
13.	Lázbérci-tározó	Reservoir							x
14.	Gyöngyös-Nagyrédei tározó	Reservoir				x		x	
15.	K-XI-tározó	Reservoir					x	x	
16.	Nyirkai-Hany vizes élőhely	wetland					x	x	
17.	Kolon-tó	Saline lake					x		
18.	Riha-tó	Saline lake				x	x	x	
19.	Ráckevei-Soroksári-Duna	Danube-branch	x		x	x	x	x	
20.	Hévízi-tó	spring-lake					x		

4.4. Needs of knowledge

The Needs of Knowledge refers to the knowledge gaps found by the LakeAdmin partners and where regional policy makers could benefit from Good Practices adopted, implemented and monitored in LakeAdmin partner countries.

4.4.1. Needs of knowledge in LakeAdmin regions

The LakeAdmin partners identified the list of "Needs of Knowledge", which is presented in **Table 7**.

Table 7. Needs of knowledge in LakeAdmin regions
Partner 7 - Hungary

Partner	Name of the Need of knowledge	Link to an identified Good Practice (and GP owning partner)
P1	Costs of lake management as regional and local investments	Chapter on Ecosystem services
P5	Economic methods for utility assessment of lake sediments	- partially linked to Chapter on Ecosystem services
P5	Application of biomarker tests into the programs for assessing the ecological status of lakes	GP18. Biomonitoring by passive sampling and juvenile fish analysis (P3)
P6	Co-operation between stakeholders and authorities	GP15. Stakeholder participation and feedback (P1) GP16. Guidance of management planning for stakeholders (P2) and GP17. Lake restoration book in native language
P7	**Control of Aquatic Invasive Species**	**GP27 CAISIE "Control of Aquatic Invasive Species in Ireland" Ireland West Region (P8)**
P7	**IC tools for stakeholder participation**	**GP15. Stakeholder participation and feedback (P1)**
P7	**Approaches for Nutrient load control**	**GP8 Reduction of nutrient loading from diffuse settlement RENULDS (P1)**
P7	**Urban rainwater drainage**	**Multiple use of new urban rainwater lakes (P4)**
P7	**Approaches for integrated management**	**GP14 A practical tool for evaluation of reductions of diffuse phosphorus loading KUTOVA (P1)**
P8	The Negative Impacts resulting from the legacy of old Afforestation Practices on the Water Bodies of the West Region	partially linked to Chapter on Ecosystem services
P8	Potential Water Quality problems in relation to Agriculture	GP9. RAE (P2) and GP 14 Kutova (P1)
P8	Wastewater from Unsewered Properties (Commercial and Residential)	GP8 RENULDS (P1) and GP 13 On-site treatment of wastewater (P7)
P9	Elevating the level of environmental education	GP16 Guidance of management planning for stakeholders (P 2) and GP17 Lake restoration guidance material in native language (P5)
P9	Land use model for the integrated management	GP2 Pressure maps (P1) (partial link) GP14 Kutova (P1) (partial link)
P9	Assessment methodologies for evaluation of socio-economic values of nature	GP25, Small lakes ecosystem service value (P4) and Chapter on Ecosystem services
P9	Management of sustainable professional and game fishing	Chapter on Ecosystem services, Biomanipulation GP
P9	Management planning of artificial lakes	GP1 Multicriteria assessment (P1), GP3 Monitoring as a planning tool (P1), GP 22 Multi-purpose planning of the Plastiras Dam (P6), GP30 Planning to ensure the infrastructure of the Lake Stefaniada region (P6)

4.4.2. Local and regional needs

The Lake Balaton Development Coordination Agency (LBDCA) identified five local and regional needs and Good Practices to transfer to the Lake Balaton Recreational Area from the project partners:

1) Control of Invasive Aquatic Species

Invasive aquatic species are serious threats and increase the need for restoration and management to prevent the potential adverse economic and social impacts. There is increasing evidence that lakes are affected by climate change. The impacts of climate change has to be considered.

2) IC tools for stakeholder participation

To have clear definitions and IC tools to the participation of government authorities in funding of lake restoration is necessary.

3) Approaches for Nutrient load control

About one million Hungarian inhabitants are living in areas which are so scarcely populated that centralized sewage treatment is not cost effective. Small scale treatment plants and developments of dry toilets can facilitate a successful and cost-effective reduction of the nutrient loads.

4) Urban rainwater drainage

Due to climate change and Water Framework Directive there is an increasing need for urban rainwater drainage systems and rainwater lakes in or around urban areas to deal with overflow of rainwater.

5) Approaches for integrated management

For an effective RBM it is necessary to develop the management and planning practices and also the practices of integration, linking social and economic development with the protection of natural ecosystems. National and international guidelines should be developed to achieve the environmental, social and economic objectives.

EU Member States shall ensure in the River Basin Management Plans the establishment of the program of measures in order to achieve the environmental objectives established under Article 4 of WFD. An efficient inter-sector collaboration (the good practices of integration), particularly between agriculture, rural development, water industry, energy production, transportation, tourism, climate adaptation, and nature conservation should be developed, to support the identification the most cost-effective combinations of measures to achieve the environmental, social and economic objectives.

To complete the 1st river basin management cycle, and in preparing for the second cycle of the WFD therefore, integration of sector policies has high importance. The most important types of water management measures planned by the relevant regional and local policies, programs and plans contributing in the objectives of Lake Balaton Recreational Area water management are as follows (Verbis et al. 2014):

1) Better water resources management (outflow control, water transfer, control water level at marshlands) corresponding to high water level / low water level – flooding / precipitation deficit, peat fires at marshlands

2) Reduction of nutrient loads (reduction of external P load, management of Kis-Balaton area) corresponding to improve water quality, reduce the risk of increased lake water temperature and consequent risk of occasional algae blooms

3) Improved water level regulations (increase Sió channel capacity and sluices discharge capacity) corresponding to change of run-off characteristics – slightly higher frequency of extreme events

4) Strict control on commercial fishing both in lake and adjacent fish ponds corresponding to the reduction of the risk of the appearance of invasive species

5) Implementation of shore zone rehabilitation plans to improve littoral zone quality and functionality

Those are the major criteria for the selection of the Good Practices imported for restoration of Lake Balaton Recreational Area.

4.4.3. Relations to similar case studies

Integration of spatial planning concept and river basin management planning was the main objective of the international WAREMA (Water Resource Management in Protected Areas) project, supported by the EU (WAREMA 2008a, 2008b). The main aim of WAREMA was to develop participatory river basin planning procedures based on stakeholder networks in order to contribute to the implementation of EU WFD and the River Basin Management Planning. Context analysis reports, conflict management, action plans, spatial planning concepts, extensive discussion have been the major tools used in the project. The parties involved established a common vision on the priorities for nature, water and landscape protection, cultural heritage preservation, socioeconomic development and water resources management.

WAREMA has created stakeholder networks that will continue to operate as lake-basin partnerships, even after the project closure. New strategies have been developed for integrated land-water management with special reference to protected areas, as recorded in the Action Plan.

Four Pilot Project sites have been identified. The **Hungarian Pilot site, the Basin of Lake Velence** is a Ramsar site that is very important from a nature protection point of view, because it hosts important plant and animal species. The Velence Basin faces problems such as uncontrolled waste disposal, soil degradation, lake water level fluctuation, diffuse agricultural pollution, intensive tourism and recreational use of the lake.

The objectives of WAREMA in Lake Velence Pilot Project were to establish the basis for sustainable regional development of the lake basin that – beside more efficient use and protection of local resources – ensures the integrated regional and water management of the watershed in the course of a planning procedure based on public participation. WAREMA was intended to support the implementation of WFD and drafting the River Basin Management Plan.

The implementing partners were the following:

Region of Friuli Venezia Giulia – Italy
University of West Hungary – Hungary
Chamber of Agriculture of Fejer County – Hungary
Mediterranean SOS Network – Greece
Aitoliki Development Enterprise S.A. – Greece
Centre for Community Organizing Middle Moravia – Czech Republic

5. Good Practices

A Good Practice has been defined by Interreg as follows: "In the context of the INTERREG IVC programme, a good practice is defined as an initiative (e.g. methodologies, projects, processes and techniques) undertaken in one of the programme's thematic priorities which has already proved successful and which has the potential to be transferred to a different geographic area. Proved successful is where the good practice has already provided tangible and measurable results in achieving a specific objective." (Interreg IVC Manual May 2012)

5.1 Good Practices proposed by the Lake Balaton Development Coordination Agency

Three Good Practices are proposed by the Project Partner 7, the Lake Balaton Development Coordination Agency (LBDCA):

- GP31 Shoreline management to balance economic, social and natural interests in regional planning
- GP6 Waste water treatment of small villages solved by on-site household units
- GP13 Integrated regional on-line monitoring system

5.1.1 Shoreline management to balance economic, social and natural interests in regional planning (GP31)

The specific objectives of the GP include:

- restoration of environmental values, thus ensuring good environmental conditions in long term;
- providing free access to lake shore for citizens and visitors (for the public)
- supporting clear and consensus based shore zone development (spatial) plans serving both restoration and human use needs meanwhile setting strong limits for possible over developments

In the region of the Lake Balaton:

- special regulations were set to provide the legal framework to achieve the objectives,
- corresponding spatial plans were made to guide restoration and development activities,
- landscape management plan was prepared to ensure and facilitate implementation.

The application of this GP is recommended in shore zone areas where either environmental conditions or social usages are unsatisfactory.

5.1.2 Waste water treatment of small villages solved by on-site household units (GP6)

The major objective of the initiative was to provide cost efficient solution for small villages to solve waste water treatment. The waste water treatment of small villages was solved by the installation of individual small-scale wastewater treatment equipments to households. The equipments reduce the nitrogen and phosphorus load from the wastewater.

In small villages the construction of sewer and treatment plant is not cost efficient. On-site treatment units can solve the problem. Village level problem requires additional coordination efforts both in planning and installation, and operation phase.

The method was launched as a pilot program involving two settlements in 2010. Due to the success it was than extended into three further settlements in 2011. In 2013 more settlements were involved into the program

The application of this GP is recommended in small villages where centralised system is not cost efficient.

5.1.3 Integrated regional on-line monitoring system (GP13)

National level monitoring, including those specified by the WFD doesn't provide enough area specific information for daily operation and details of planning of improvement measures. In addition, environmental monitoring is rarely linked with monitoring of load factors.

Regional on-line monitoring system was launched in the Lake Balaton Region in 2006 including environmental, traffic and visitor counting sub-systems. The objective was

- to provide region specific information on the environment,
- to identify links with the load resulting from traffic, tourism and natural forces and
- to provide management alternatives where possible with the option of immediate response.

The application of this GP is recommended in areas where rapid change in environmental conditions can be expected, especially where it is interlinked with social-economic loads and/or benefits.

5.2 Good Practice guide for the practices proposed by the Lake Balaton Development Coordination Agency

Three Good Practices are proposed by the Lake Balaton Coordination Agency:

- Shoreline management to balance economic, social and natural interests in regional planning
- Waste water treatment of small villages solved by on-site household units
- Integrated regional on-line monitoring system

5.2.1 Shoreline management to balance economic, social and natural interests in regional planning

Origin of the good practice:
Project Partner 7, Lake Balaton Development Coordination Agency (LBDCA), Lake Balaton Recreational Area, Hungary

Summary:
Shoreline is the area of lakes where the growing societal demands of recreational and economic use of lakes and external loading from the catchment area meet the highest biological productivity, diversity and productivity. Littoral areas are of fundamental importance in lake ecosystems. More intensive use of shoreline by stakeholders (removal of vegetation and dredging) e.g. for recreation, boating or real estates causes needs to consider the proper functioning of the lake ecosystem and, in or close to protected areas, the habitats that are protected for biodiversity. These elements have been settled through a series of actions in the region of Lake Balaton.

Focusing on the shore zone area

1) special regulations were set to provide the legal framework to achieve the objectives,
2) corresponding spatial plans were made to guide restoration and development activities,
3) landscape management plan was prepared to ensure and facilitate implementations.

Objectives and goals of the Good Practice:

1. restoration of environmental values, thus ensuring good environmental conditions in long term;
2. providing free access to lake shore for citizens and visitors (for the public).

Target Groups:

Citizens, local and central governments, regional authorities (environmental and nature protection, national parks, water management)

Activities focusing on the shore zone area:

1) shore zone vegetation mapping (every 5 years);
2) determination of the shoreline considering natural and artificial interventions (every 10 years);
3) preparation of shore zone rehabilitation (spatial) plans (every 10 years);
4) formulation of landscape management plan to facilitate development programs according to funding opportunities. The planned activities are implemented through relevant organisations, such as reed management by the Water Management Directorate and National Park, shoreline protection works (rip-rops, walls, etc.) are maintained by the land owners either public or private, etc.

Bodies and organizations involved:

Citizens, local and central governments, regional authorities (environmental and nature protection, national park, water management)

The phase in which the practice is applied:

Planning and (partial) implementation

Implementation Process:

Planning phase takes 1-2 years including public consultation
Implementation phase is continuous (depending on funds available)
vegetation mapping - every 5 years
updating spatial plan - every 10 years

Results:

Clear and consensus based shore zone development (spatial) plans serving both restoration and human use needs meanwhile setting strong limits for possible over developments

Recommendation:

Recommended in shore zone areas where either environmental conditions or social usages are unsatisfactory

Practical example:

Lake Balaton is one of the most important natural assets of Hungary. Based on the lake environment provided ecological services, tourism gained national importance as well. Through tourism Lake Balaton region contributes to the national GDP by 2-3 % percent. This value is generated mostly in the mere 2 months of summer season.

However, shoreline became the most conflicting zone of several interests. Most common is the special care needed to balance human usages and environmental protection. In addition, human use by itself generates conflicts between individual and community interests. Furthermore, environmental and natural self-rehabilitation processes are altered at a level when human intervention is needed to restore environmental values. All of these resulted that by the end of 1990's the shore-zone of Lake Balaton

faced serious environmental degradation as well as conflicting human usages against public (community) interest. It was found necessary to regulate shore-zone usages and development and prepare plans for the rehabilitation of natural environment.

Years of launching:
Legal base for shoreline management of Lake Balaton established in 2000, planning started in 2002, implementation since 2004

Duration of the operation:

- Planning process by itself takes 1-2 years including public consultation.
- Since the implementation phase is continuous regular revision of plans is needed.
- For vegetation mapping 5 years revision periods is set
- The whole rehabilitation planning will be revised every 10 years.

Strengths:
Legal approval and enforcement of the spatial plans

Weaknesses:
Regulations alone are not enough, action plans as part of the development and restoration programs has to be the integral part of the planning process

Difficulties faced:
Lack of financial resources both in phase of implementation and revision of plans; unsatisfactory property rights (private rights) in several cases (i.e. private owners do not support the processes that have disadvantages for them)

Dissemination and exploitation of the results:
Dissemination is limited only to the distribution of the relevant information in the revision phases of the plans aiming at the involvement of wide variety stakeholders and the general public.

Use of the practice in other regions:
Not yet

The LakeAdmin Project Partner 3 (Czech Republic – University of South Bohemia, Faculty of Fisheries and Protection of Waters) has identified this Good Practice for transferring to the South Bohemian Region from the Lake Balaton Region (Hungary). The major phases of the transfer will be as follows:

- Definition of the area of the protection of aquatic organisms
- Determination of the specific options of operation in the selected shoreline zones
- Incorporation of the management options (restrictions) into the development plans

The LakeAdmin Project Partner 5 (Estonia – University of Life Sciences) also expressed its potential interest to transfer this Good Practice for improving the ecological status of Estonian Lakes.

References to the practice:
Landscape Management Plan (www.balatonregion.hu/ EUROSCAPES project);

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5.2.2 Waste water treatment of small villages solved by on-site household units

Origin of the good practice:
Project Partner 7, Lake Balaton Development Coordination Agency (LBDCA), Lake Balaton Recreational Area, Hungary

Summary:
According to the regional land use plan for the Lake Balaton Region, the building permission cannot be issued in areas where sewage treatment is not solved. Lack of solutions limits the development of small villages where the sewers and treatment plants may not be cost efficient and additional coordination efforts both in planning, installation and operation are required.

Waste water treatments of small villages are solved in the Lake Balaton Region by the installation of individual small-scale wastewater treatment equipments to households. The equipments reduce the nitrogen and phosphorus load from the wastewater. Depending on the sensitivity of the given area, the required effluent quality should not exceed 75 (100) mg/l COD; 15 (25) mg/l BOD, 10 mg/l NH_4-N; 25 mg/l TN_{unorg}. There is no regulatory requirement for TP concentration. The average reduction of annual external loading could be calculated based on the quality and quantity of generated waste water of households.

Objectives and goals of the good practice:
The objective is to provide cost efficient solution for small villages to solve waste water treatment.

Target Groups:
Planners and citizens, decision makers of small settlements

Activities:
- Selection of the settlements where according to the cost-benefit analyses of installation and operation, the traditional sewer networks are not realistic alternatives for waste water management.
- Pre-feasibility studies for the selected settlements.
- Recommendations for the most suitable solution.
- Approval by local councils of the Settlement Wastewater Management Programs (SWMPs) on the basis of the pre-feasibility studies. The approved SWMPs are the basic requirements for development funding, hence implementation.

Bodies and organizations involved:
Citizens, local governments, environmental authorities

The phase in which the practice is applied:
Planning, installation and operational phase

Implementation Process:
Application of this GP is recommended in small villages where centralised system is not cost efficient.

Results:
More settlements join the program and regardless of their small size they implement waste water treatment.

Practical example:
Lake water quality is sensitive to nutrient load from the catchment. Therefore, proper waste water treatment is necessary for settlements in the catchment. It is enhanced by the regional land use plan at Lake Balaton, stating that building permission can not be issued in areas where sewage treatment is not solved. The lack of solution limits the development of small villages. In addition, in small villages the

construction of sewer and treatment plant is not cost efficient. On-site treatment units can solve the problem. Village level problem requires additional coordination efforts both in planning and installation, and operation.

Year(s) of launching:
2010

Duration of the operation:
Planning and construction can take half to one year, the operation is continuous

Strengths:
Various products and providers were contracted and the installation and operation can be compared both in quality and costs.

Weaknesses:
Financial incentives varies from place to place. The total installation cost (planning, purchase of equipment, construction of drainage fields, start up the system) range from 3.500 – 4500 euro. The implementation of a system requires financial support to citizens from public organizations. The rate and amount of such support varies locally.

Difficulties faced:
Lack of experience on implementing a village level program. Lack of experience of running (operating) a village level system.

Dissemination and exploitation of the results:
The method was launched as a pilot program involving two settlements in 2010. Due to the success it was than extended into three further settlements in 2011. The program continued in 2013 (more settlements were involved into the program)

Use of the practice in other regions:
Not yet

The LakeAdmin Project Partner 6 (Greece – Pelion Development Company) has identified this Good Practice for transferring to the Region of Thessaly from the Lake Balaton Region. The major phases of the transfer will be as follows:

- Study on local needs of waste water treatment at the Lake Karla Area
- Comparative analysis of costs and benefits of central and on-site household treatment units
- Co-financing plan for on-site household waste water treatment
- Investigation of global market

References to the practice:
In-house documentations:
http://www.balatonregion.hu

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5.2.3 Integrated regional on-line monitoring system

Origin of the good practice:
Project Partner 7, Lake Balaton Development Coordination Agency (LBDCA), Lake Balaton Recreational Area, Hungary

Summary:
National level monitoring, including those specified by the WFD doesn't provide enough area specific information for daily operation and details of planning of improvement measures. In addition, environmental monitoring is rarely linked with monitoring of load factors. The Lake Balaton Integrated Monitoring System is the prototype of a monitoring system, which was established in the framework of a territorial cooperation of regional partners in 2006. The system has continuously been operating since then.

The prototype assists to derive long-term simulations in order to work out strategies, scenarios and management options. In addition, key information can be viewed on-line on traffic, visitor rates and water quality. The system can be used for everyday management to avoid unnecessary loads.

The prototype can easily gauge the state of the environment with real-time data and later with historical data. With this information, future forecasting can be carried out to understand what will occur in the area and to plan ahead for the future. The system also contributes to ameliorating the environmental condition of the region in that it gives stakeholders a good understanding of the situation at hand. The system is fully upgradeable through the addition of new monitoring equipment and latest technologies.

The data (measured by variety of sensors) are connected to a central database by wireless GPRS, for storage and processing. The central database is hosted on an "always-on" server. The server runs data collection, data structure management subsystem, data processing, data serving and controller applications. It also distributes data to other sources and organisations.

Key elements of the system:

- TUL: visitor counting module
- KOF: road traffic counting module
- VEB: water quality, quantity observing module
- MET: meteorological module
- KIN: external data importing module
- SAR: system management module
- CPC: central processing and data store unit
- DBM: database management module
- TIM: dissemination and information module
- DAT: data transfer module

System Components:

Environmental Monitoring Equipment

- Water Quality Stations (in-lake)
- Water-level and inlet monitoring stations
- Hydro-meteorological stations
- Meteorological stations
- Information stations at beaches
- Manual storm-signal units

Vehicular Traffic Measuring Units:

- In-road traffic detection units
- Speed monitoring units
- Traffic hazard signals

Tourist Counting Units

- Rotating gates and ticket booking system at beaches
- Infrared gates
- Ferryboat trafficregistry
- Video visitor estimating system

Additional Module (visualisation and information):

- Web (WAP, optimised for web)
- Interactive Web-terminals
- Road-side screens (LED signs that can display different messages)

Specific examples of the impacts on environmentally significant issues:

1) Direct utilization of meteorological data for public information and management
   The public is informed through 30 storm warning light towers around the lake, as well as at beaches and through the internet.

2) Water pollution
   Monitored parameters by the prototype that are suitable for the monitoring of pollution incidents are: pH, conductivity and dissolved oxygen concentration. These parameters can indicate chemical spills (such as chemical spills at road accidents); organic pollutants (sewage, septic tank sludge, wine processing sludge, etc.) and pollution during flash flood events.

3) Traffic control and GHG Emissions
   The traffic control module of the prototype contributes to the reduction of environmental load, such as GHG emissions in the following: In part, by offering alternative routes the traffic is more fluent and continuous, thus less energy is used, resulting in less emissions.

4) Algae and suspended sediment concentration
   The water quality is of concern primarily due to (potentially toxic) algal blooms in concentrated areas. Algal concentration (chl-a) is measured bi-weekly through the standard (manual) monitoring system. High suspended solids concentration in itself is not a problem, but it is important because it has a strong influence on chl-a concentration due to reducing transparency and increasing light limitation. The model has been developed using input data collected by the prototype: wind, air and water temperature, turbidity and solar radiation.

5) Water balance
   Flood warnings can be issued through the system, especially in cases of large seiche. Strong unidirectional wind may cause large water level displacement. This is more dangerous than a level rise due to inflow.

6) Water Quality Control
   Water quality control measures can be classified as short-term or emergency actions and long-term (planned) measures. The short term pollution incidents can be detected through the on-line system while it is highly improbable that such incidents are detected through standard bi-weekly (or monthly) sampling.

Objectives and goals of the Good Practice:
The objective was to provide region specific information on the environment and identify links with the load resulting from traffic, tourism and natural forces. Further it provides management alternatives where possible with the option of immediate response. The main goal of the monitoring system is to collect quantitative data useful for not only academics and professionals but also for the general public and tourists. The system manages information on environmental factors for better regional decision making.

Target Groups:
Experts, citizens, decision makers of local, regional and national level

Activities:
Additional developments and if needed re-structuring takes place occasionally. Operation is evaluated annually, data are processed on request or at least annually

Bodies and organizations involved
Water management bodies, local governments, meteorological service, civil protection groups, universities and research organisations

The phase in which the practice is applied
Planning, installation and operational phase

Implementation Process
Application of this GP is recommended where rapid change in environmental conditions can be expected, especially where it is interlinked with social-economic loads and/or benefits

Results:
More knowledge and information on lakes and surroundings; better understanding of environmental and socio-economic interactions; stronger support for decision making

Practical example:
Regional on-line monitoring system was launched in the Lake Balaton Recreational Area in 2006 including environmental, traffic and visitor counting sub-systems and internet-access to the continuous water quality monitoring of Lake Balaton.

Duration of the operation:
Operation and development is continuous

Strengths:
More up-to-date data and information, better management opportunities

Weaknesses:
High maintenance and coordination requirements

Difficulties faced:
Involvement of some relevant institutions, organisations

Dissemination and exploitation of the results:
Monitoring data is publicly available. The numbers of cooperating regional organisations, institutes are increasing.

Application of GP in other regions:
Not yet

References to the practice:
In-house documentations
http://www.balatonregion.hu;
http://bir.webeye.hu

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5.3 Transfer of the Good Practices into the Lake Balaton Recreational Area

The Lake Balaton Coordination Agency has identified five Good Practices from other Project Partners as most likely suitable measures for transferring to the Lake Balaton Recreational Area in order to try to obtain similar results and to improve and better the traditional and new lake management practices developed and used in Hungary.

The selected Good Practices are:

1. Reduction of nutrient loading from diffuse settlements - RENULDS (Project Partner 1, Finland)
2. Multiple use of new urban rainwater lakes (GP8, Project Partner 4, Denmark)
3. A practical tool for evaluation of reductions of diffuse phosphorus loading - KUTOVA (GP14, Project Partner 1, Finland)
4. Stakeholder participation and feedback (GP15, Project Partner 1, Finland)
5. CAISIE "Control of Aquatic Invasive Species in Ireland" (GP 27, Project Partner 8, Ireland)

The LBDCE recommends the study and use of the first four GPs for planners and lake managers, however the final decision on the implementation needs more information and studies by the potential users. The implementation of the GP27 (CAISIE) is under preparation.

5.3.1 Reduction of nutrient loading from diffuse settlement RENULDS

Origin of the Good Practice:
Project Partner 1, Finland, Finnish Environment Institute

The Lake Balaton Development Coordination Agency (LBDCE) has identified this Good Practice as one of the most likely suitable measures for transferring to the Lake Balaton Recreational Area in order to try to obtain similar results and to improve and better the traditional and new lake management practices developed and used in Hungary. The LBDCE recommends the use of this GP for the planners and lake managers. The final decision on the implementation needs more information and studies.

1) Introduction and background of the Good Practice

Wastewater treatment in urban areas, where about 80% of the Finnish population live, is of a high standard in international terms. About 95% of both organic matter and phosphorus, and about 50% of nitrogen are removed. However, about 20 % of the Finnish population live (1 million!) outside centralized municipal sewage treatment system. In summer, the use of holiday homes greatly increases the population of rural areas. In rural areas phosphorus discharges to water are 50% higher than in urban areas, where homes are connected to sewers and wastewater treatment plants.

RENULDS concerns about one million Finnish inhabitants in areas which are so scarcely populated that centralized sewage treatment is not cost effective. Implementation of RENULDS is based on the Act given in 2004 stipulating private houses to reduce nutrient loading of domestic sewage by some kind of treatment or procedure. Small scale treatment plants and developments of dry toilets facilitate a successful reduction of the nutrient loads.

A similar Good Practice "Waste water treatment of small villages solved by on-site household units" was proposed and implemented in the Lake Balaton Recreational Area by the Lake Balaton Coordination Agency. The Hungarian Partner would be interested to compare the two similar practices and transfer the more efficient elements of the approach applied by the Finnish Partner.

2.) Implementation of the GP in Hungary

The Good Practice RENULDS from the Project Partner 1 will be transferred by the Lake Balaton Development Coordination Agency (LBDCA) to the Lake Balaton Recreational Area.

2.1) Policies, strategies, plans that will be impacted, into which the GP will be integrated in Hungary

The Hungarian LakeAdmin Partner, the Lake Balaton Development Coordination Agency (LBDCA) recommends to integrate the Good Practice RENULDS into the programmes of measures of the updated, *Second RBMP of the Lake Balaton Region and* also into the Programme of Actions of the *updated National Water Strategy of Hungary* that is also under development. The good practice will assist with the implementation of the programme of measures of the Second RBMP and the actions identified in the updated National Water Strategy of Hungary. The Good Practice adopted in the Lake Balaton Recreational Area will also assist with the implementation of the EU Biodiversity Strategy to 2020 and the Hungarian National Biodiversity Strategy 2014-2020.

2.2) The management authority (MA), which will execute the GP

The Hungarian *National Water Authority* is responsible for the Second RBMP of the Hungarian Part of the Danube River Basin District and the National Water Strategy of Hungary. The *Regional Water Authority* is responsible for the Second River Basin Management Plan for the Lake Balaton Region.

The local municipal authorities will be responsible for the implementation of the action programmes and programmes of measures of River Basin Management Plans and Regional Development Plans.

2.3) The plan and strategy with which the programme expected to be addressed and the expected time of issue

Second River Basin Management Plan - expected in December 2015
Updated National Water Strategy – expected in May 2015
National and Regional Development Plans – expected in 2015
EU Biodiversity Strategy to 2020
Hungarian National Biodiversity Strategy 2014-2020.

5.3.2 Multiple use of small lakes near urban areas

Origin of the Good Practice:
Project Partner 4, Denmark, Alleroed Municipality

The Lake Balaton Development Coordination Agency (LBDCE) has identified this Good Practice as one of the most likely suitable measures for transferring to the Lake Balaton Recreational Area in order to try to obtain similar results and to improve and better the traditional and new lake management practices developed and used in Hungary. The LBDCE recommends the use of this GP

for the planners and lake managers, however the final decision on the implementation needs more information and studies.

1) Introduction and background of the Good Practice

The Good Practice (GP8) from Alleroed Municipality (Denmark) is considered by the Lake Balaton Coordination Agency as a potential Good Practice to improve and manage better the urban rainwater systems in the Lake Balaton Recreational Area and in Hungary. Alleroed Municipality agreed to study the possibilities to transfer the Good Practice "Multipurpose use of small lakes near urban areas" to Hungary.

1.1) Summary of the Good Practice that will be transferred

Objective: how to improve and manage better the urban rainwater systems in Hungary by transfer of GP8 from Denmark: The main objective using small lakes for multi-purpose is to face and solve the challenges of several problems and/or needs. Hence, these issues depend on the kind of challenges the area is influenced by.

1.2) Importance of better management of urban rainwater systems

Due to climate change and Water Framework Directive there is an increasing need for urban rainwater lakes in or around urban areas to deal with overflow of rainwater. In old days these were often dull concrete holes or hidden underground. Now they can join other aspects of city life and urban nature to create multipurpose areas that also benefit the local area by being an additive to nature and leisure time activities.

Large investments is due to take place the coming years to implement the Water Framework Directive and to combat effects on climate change with more urban flooding etc. to maximize society cost benefit the multipurpose use of these new "blue" town areas a multipurpose approach is needed.

1.3) Implementation of the GP in Denmark

In Alleroed Municipality multipurpose use of small lakes has been implemented in several places, primarily to handle rainwater but also to use the area so that it fit with the surroundings. The concept has for instance been implemented in Rørmosen (Alleroed) after flood problems in 2007. An agricultural field was transformed into a number of organic shaped lakes surrounded by a small forest with recreational pathways and additional shallow lakes serving as stepping stones.

To develop this concept even further, a case study area has been developed during the period of LakeAdmin in Lynge. The project is in its final stage and is a collaboration between University of Copenhagen and several public and private partners. The concept of multipurpose design of rainwater basins and lakes in urban areas has been further developed with the introduction of new technologies, such as the double porous filter.

The project is also a part of the WFD demands for protecting end recipients (river and Fjord) and the part that involves LakeAdmin has been implemented during 2013 and 2014.

The project has been presented and showed for the project partners at the Danish LakeAdmin seminar 2014. This project area is the first step in the LakeAdmin implementation plan for Lynge area which includes a network of small lakes.

Alleroed Municipality has identified the lake management issues as being flood problems, WFD demands, recreational potentials and the need of more biological diversity in urban areas.

The project is still being implemented and survey of the additional shallow lakes will be done in 2013-2014 as a part of the LakeAdmin Project.

2.) Implementation of the GP in Hungary

The Good Practice GP8 "Multipurpose use of small lakes near urban areas" from the Project Partner 4 will be transferred by the Lake Balaton Development Coordination Agency (LBDCA) to the Lake Balaton Recreational Area in order to improve and manage better the urban rainwater systems. The urban rainwater management is a priority of the National Water Strategy.

2.1) Policies, strategies, plans that will be impacted, into which the GP will be integrated in Hungary

The Hungarian LakeAdmin Partner, the Lake Balaton Development Coordination Agency (LBDCA) recommends to integrate the Good Practice GP8 into the programmes of measures of the updated, *Second RBMP of the Lake Balaton Region and* also into the Programme of Actions of the *updated National Water Strategy of Hungary* that is also under development. The good practice will assist with the implementation of the programme of measures of the Second RBMP and the actions identified in the updated National Water Strategy of Hungary. The Good Practice adopted in the Lake Balaton Recreational Area will also assist with the implementation of the Flood Risk Management Plans, the EU Biodiversity Strategy to 2020 and the Hungarian National Biodiversity Strategy 2014-2020.

2.2) The management authority (MA) body, which will execute the programme

The Hungarian *National Water Authority* is responsible for the Second RBMP of the Hungarian Part of the Danube River Basin District and the National Water Strategy of Hungary. The *Regional Water Authority* is responsible for the Second River Basin Management Plan for the Lake Balaton Region.

The local municipal authorities will be responsible for the implementation of the action programmes and programmes of measures of River Basin Management Plans, Flood Risk Management Plans and Regional Development Plans.

2.3) The plan and strategy with which the programme expected to be addressed and the expected time of issue

Second River Basin Management Plan - expected in December 2015
Updated National Water Strategy – expected in May 2015
Flood Risk Management Plan – expected in December 2015
National and Regional Development Plans – expected in 2015
EU Biodiversity Strategy to 2020
Hungarian National Biodiversity Strategy 2014-2020.

2.4) Expected challenges, difficulties in the procedure for GP transfer

According to the information and conclusions received from the Project Partner 4 (PP4), Alleroed Municipality, the expected challenges and difficulties are as follows:

- Complicated to make cross sector solutions
- Not necessarily easy to comply with WFD targets.
- Challenges of groundwater vulnerability may work against this type of solutions
- Financing and maintenance responsibility may be complicated
- It may take longer to implement multipurpose solutions
- Outlet approval more complicated than estimated

- Groundwater protection complications during the project
- Maintenance afterwards not entirely clear and needs coordination with responsible partners
- Different tender rules by the different stakeholders caused delays
- Not enough monitoring before project
- Several adjustments to water amount estimations during the planning phase
- Different financial periods and funding

There is a traditional sufficient cooperation between the LBDCA and the Water Authorities responsible for the Balaton Region, and the authorities of local municipalities, however the frequent changes in the institutional framework of water management are causing difficulties in the efficient cooperation. Currently the LBDCA is involved into the development of the Lake Basin Management Strategy elements of the updated National Water Strategy and into the drafting of the Regional Development Plans.

The delay in updating the RBMPs in Hungary is causing some difficulties in the import and implementation process of the the Good Practice.

2.5) Actions

The process of how to implement a multifunctional lake management system is complex as there are many factors to consider and professionals to involve. Some of the steps in the planning of multipurpose use of small urban lakes:

- Identification of the problems and needs (WFD, storm water management, recreation, biodiversity, stepping stone etc.)
- Identification of potential stakeholders.
- Considering the financial aspects. The project can include several different actors and therefore also potential financial interests. In the case of Rørmosen, Alleroed the local furniture company financed the planting of the forest and together with local gardener they obliged to maintain the area the first three years. The waste water and supply-company financed the making of the lakes.
- Selection of professionals included in the design and implementation process. It may be a challenge to do cross-disciplinary exchange but it is nevertheless important. Examples of professionals Alleroed Municipality has included in the design of multifunctional areas: landscape and city planners, biologists, nature- and water managers, professionals dealing with waste water, universities and entrepreneurs.
- Considering the legalisation: There can be much preparation associated with the legislative part of the planning. E.g. in Denmark the protection of groundwater is highly prioritised and groundwater vulnerability may therefore influence the selection of the project area.

2.6) Multipurpose use

Flooding
When choosing an area in the risk of flooding there are important issues that should be addressed

- Knowledge of the sewer system in the target area and catchment is crucial. Hence, separating rainwater from the main sewer system should be possible if not already separate. Background: flood problems often occur because the sewer system cannot lead the extra amount of water coming from high intense cloudburst. Hence, leading rainwater on the surface instead of leading to the sewers underground can reduce the risk of flooding significantly.
- Knowledge of groundwater vulnerability is essential in order to deal with urban water in the right manner. Salinity, heavy metals and oil compounds are among the most common challenges in this regard.

- Calculating the amount of rainwater coming from the catchment should involve a buffer capacity for future city development and also future adaptations to climate changes (flood risks).
- It is an advantage if the target area is a natural dip or lies somewhat in a lower level relatively to the surroundings so that water easy can be lead to the area e.g. the Lynge case study area is a naturally wet area. The area is low in level compared to the surroundings.
- One of the consequences of a flooding is that wastewater often is led to recipients causing deterioration of the water body. A new lake/water retention area can serve as buffer reducing the potential hydrological and biological damage of a flooding. Background: The Lynge case study area is an example of using the small lakes for the protection of recipients: Lynge stream has earlier been affected by overflow of wastewater and consequently the stream does not fulfil the WFD. With the new water retention basins water can be led to the recipient in a controlled matter. This will have a positive effect on the water balance in the stream. It is recommended to have an electronically dispenser measuring the water level in the stream.

Recreation

It is very important for citizens in or near urban areas to have recreational opportunities. However in cities and towns areas for recreation are often lacking and the small spots that are left are usually included in city developmental plans. Hence, plans multifunctional areas that are well thought out can have major impact on the decisions on future plans for unused areas.

- Existing local plans has to be well checked in order to know if there are future plans or restrictions for the target area.
- The recreational areas features need to be implemented in the plan from the beginning - The public security aspect has to be addressed; no steep slopes to basins, secured inlets and outlets from rain water pipes, no playing in the water etc.
- Important to involve local citizens and other potential users in the planning.
- Information of nature value, "why/how" rainwater management is essential in order to get
- A decision on the accessibility of the area (children, disabled, older people)

Biodiversity

Small lakes or ponds used for retention of waste water (rainwater coming from streets and roofs) have obviously not the best water quality, however they can still serve as stepping stones or even as habitats for e.g. amphibians. This is especially done by resembling natural conditions of small lakes and ponds such as:

- The lake should be shaped or designed so that they fit with the surroundings resembling a natural water body
- The slope of the brinks of the lake/pond/basin should at the highest be 1:5 and preferable 1:3
- Sun exposed brinks, hence there should be no tree planting near the shoreline
- Feeding birds should be minimized
- As it is with all ponds and small lakes the waters should be maintained to prevent overgrowth
- Different types of filtering mechanisms are good for water quality and biodiversity. E.g. a new innovative new technology has been developed for the Lynge case study area; water is led through a double porous filter before entering one of the basins. The advantage is better water quality in the pond and the following recipient.
- Newly restored ponds or dug ponds releases a lot of nutrient from the soil. By harvesting e.g. duckweed the first couple of years, relatively large amount of nutrients can be removed.

5.3.3 A practical tool for evaluation of reductions of diffuse phosphorus loading (GP6)

Second name: KUTOVA – a practical tool for estimating costs for reduction of diffuse phosphorus loading

Origin of the good practice:
Project Partner 1/SYKE/FI - Finnish Environment Institute, Finland
Karvianjoki river basin, Southwest Finland

1.) Introduction and background of the Good Practice

The Lake Balaton Development Coordination Agency (LBDCE) has identified this Good Practice as one of the most likely suitable measures for transferring to the Lake Balaton Recreational Area in order to try to obtain similar results and to improve and better the traditional and new lake management practices developed and used in Hungary. The LBDCE recommends the use of this GP for the planners and lake managers. The final decision on the implementation needs more information and studies.

1.1) Summary of the Good Practice that will be transferred

A practical spreadsheet tool was used in Finland to determine cost-effective measures for reduction of phosphorus loading and to build cost-effective combinations of measures at catchment scale. The tool consists of

- gathering the input data from the study area (P loading, potential of measures and reduction rates of measures for P)
- entering input data into the tool 3) comparing single measures for their cost-effectiveness and 4) building cost-effective combinations of measures.

The tool was developed in the joint, partially ERDF funded project of Finnish Environment Institute and Centre for Economic Development, Transport and the Environment in Southwest Finland ”Integrating scenario approach into the river basin management planning in the Karvianjoki river basin”. EU’s Water Framework Directive: good ecological status should be achieved in all water bodies using cost-effective programmes of measures

The tool can be used to assess costs and effects of water protection measures at catchment scale for instance when planning programmes of measures for the river basin management plans. The method gives a price tag for local or regional estimates of water management costs and facilitates estimates of an achievable phosphorus reduction rate. Furthermore, it supports better allocation of financial resources and improvement of communication between experts, authorities and local stakeholders. The method is transparent, easy to use, and its uncertainties are recognised.

The programmes of measures to reduce P-discharge from diffuse sources into surface waters in Hungary is a problem which needs Danube Basin level coordination, because the whole area of Hungary belongs to the Danube Basin. The overall objective of the implementation of the Good Practice is to support to reduce diffuse phosphorus loading in Hungary and in the whole Danube Basin as soon as technically possible and economically and environmentally justified. The study aimed at providing support for the preparation of integrated, coherent phosphorus control policy and strategy in the Danube Basin.

Phosphorus is the nutrient that most often limits growth in freshwater systems. Excess growth of plankton has several unwanted effects. It reduces visibility and makes the water less desirable for swimming and as a source for drinking water. At high plankton densities the occurrence of toxic algae is

more frequent. However, higher plankton productivity may increase the total fish yield and at the same time change species composition usually to less desirable species when P concentrations are high.

Different scenarios or sub-scenarios are possible to achieve the same targeted reduction in diffuse phosphorus load into the surface waters. This is the so-called "emission mix" within the scenarios. The results of scenarios and sub-scenarios show what strategy is the most cost-effective. In other words: *which "emission mix" guarantees the highest phosphorus reduction at lowest cost in long term*.

Differences among the various regions and countries or various groups of countries leading to different choices of phosphorus control measures and mix of the measures. Such differences regard basic principles of environmental policy, policy structures and policy environments.

The Good Practice is not directly applicable to other countries or regions, because the input data required has been designed with the Finish models and databases as well as the measures in national river basin planning guidance in mind. Even so, the GP could be modified for use in other regions.

1.2) Implementation of Good Practice in Finland

The GP was developed to help regional river basin managers to assess the costs and effects of the mitigation measures when planning programmes of measures for the river basin management. The GP allows better allocation of financial resources as well as it improves communication between experts, authorities and local stakeholders

The phase in which the practice is applied
General planning of the programme of measures in river basin management

Implementation Process
Gathering the input data from the study area (P loading from all identified sources, potential extent of the measures, and partially reduction rates of the measures). Entering the inputs into the tool. Comparing single measures by their cost-effectiveness. Building cost-effective combinations of measures.

*Target Groups***:**
Regional river basin management planners and coordinators

Year(s) of launching:
2008 (Kunnari), 2011-2012 (Marttunen *et al*.), 2013 (Hjerppe & Väisänen)

Duration of the operation:
1-2 weeks per river basin /catchment

Bodies and organizations involved:
Finnish Environment Institute,
Centre for Economic Development, Transport and the Environment in Southwest Finland

Results:
Identification of the cost of river basin management measures, estimate of the achievable phosphorus reduction rate at catchment scale, better allocation of financial resources, improvement of communication between experts, authorities and local stakeholders

Strengths:
Transparent, easy to use, uncertainties recognised, gives a concrete "price tag" of water protection for the programmes of measures and considers the differences in natural and human impacts between catchments and sub catchments.

Weaknesses:
The estimate includes many assumptions and uncertainties since many parameters must be estimated indirectly. Complete information is hardly ever available.

Difficulties faced
The amount of uncertainties and assumptions related to the data needed in calculations of the tool. Monte Carlo –simulation has been added in order to analyse the uncertainties

Dissemination and exploitation of the results
The results have been presented and widely discussed in Karvianjoki Panel, a joint group of stakeholders and authorities in May 2012, in the open seminar of the project ”Integrating scenario approach … “ in October 2012, in the national meeting of regional planners on implementation of the WFD in April 2012 and in separate meetings of the regional WFD planners. See for Marttunen *et al.* 2012 (in Finnish) and Hjerppe & Väisänen (2013, unpublished)

Application of GP in other regions
It has already been applied in seven other river basins/catchments in Finland.

References to the GP

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2.) Implementation of GP in Hungary

2.1) Policies, strategies, plans that will be impacted, into which the GP will be integrated

The Good Practice from the Ireland West Region’s CAISIE Programme will be transferred by the Lake Balaton Development Coordination Agency (LBDCA) to the Lake Balaton Recreational Area in order to control of invasive aquatic species (IAS). The implementation plan for *Control of Invasive Aquatic Species in Lake Balaton Recreational Area Programme (CIASBalaton Programme)* is under

development. This Programme is considered as a first step (a Pilot Programme) of the establishment of the *Control of Invasive Aquatic Species in Hungary Programme (CIASHU Programme)*.

The main objective of the CIASBalaton and CIASHU Programmes will be to contribute to the halting of biodiversity loss in Lake Balaton Recreational Area and in Hungary by preventing further impacts on native biodiversity from high impact invasive aquatic species.

LBDCA recommends to integrate the CIASBalaton Programme into the *Second RBMP of the Lake Balaton Region* and the CIASHU Programme into the *Second RBMP of the Hungarian Part of the Danube River Basin District*. LBDCA recommends also to integrate the CIASBalaton and CIASHU Programmes into the *updated National Water Strategy of Hungary* that is also under development.

The good practice will assist with the implementation of the programme of measures of the Second RBMP and the actions identified in the updated National Water Strategy of Hungary.

The Good Practice adopted in the Control of Invasive Aquatic Species (IAS) in Lake Balaton Recreational Area Project will also assist with the implementation of the EU Biodiversity Strategy to 2020 and the Hungarian National Biodiversity Strategy 2014-2020.

The Danube River Basin (DRB) is the "most international" river basin in the world, covering territories of 19 countries. Those 14 countries with territories greater than 2,000 km² in the DRB, cooperate in the framework of the International Commission for the Protection of the Danube River (ICPDR).

The Danube countries have developed the DRBM Plan entailing measures of basin-wide importance as well as setting the framework for more detailed plans at the sub-basin and/or national level.

The River Basin Management Planning and coordination needs a specific understanding in large river basins. It was not expected that guidance documents will be developed in the frame of WFD Common Implementation Strategy (WFD CIS) for international RBMP and especially not for the case of large international river basins. Therefore the good practices for Danube River Basin Management have been identified by the River Basin Management Expert Group of ICPDR. The objective of those GPs was to provide help for the realistic and reasonable preparation of the Danube level RBMP and coordination (to help the RBMP to focus on the critical tasks requiring Danube level planning and coordination activities considered absolutely necessary). The major task is the selection of the issues affecting the whole DRBD and requiring Danube level RBMP and coordination.

The DRBM Plan identified four significant transboundary issues that are a priority for the Danube Basin and the impact of the Danube River on the Black Sea (ICPDR, 2009). The Nutrient Pollution is one of those issues which potentially leading to over enrichment by nutrients and eutrophic conditions. The main sources were identified as point source emissions (municipal wastewater and industrial discharges) and diffuse sources from agriculture.

In the RBMP plan of the Danube, for 2015 (and for the period lasting until 2027), the future visions of river basin level, and the chances of the implementation thereof, were laid down. The Danube basin-wide vision for Nutrient Pollution (ICPDR, 2009) is the balanced management of nutrient emissions via point and diffuse sources in the entire DRB that neither the waters of the Danube nor the Black Sea are threatened or impacted by eutrophication The key conclusions of the DRBM Plan on the implementation of basin-wide environmental objectives and visions are as follows (ICPDR, 2009):

> The situation in the DRB and the Black Sea regarding N and P will be improved but not ensure the achievement of the environmental objectives. The reduction potential for the agricultural sector is difficult to quantify due to uncertainties in the future economic development of this sector, mainly in the middle and lower DRB. More stringent urban waste water treatment obligations with N and P removal, limitations on P in detergents (P

ban in laundry detergents and dishwasher detergents), coordinated measures on a wider scale to reduce the atmospheric deposition of N, the knowledge and understanding of the interlinks between Danube loads and the ecological response of the Black Sea are needed to achieve the environmental objectives

The draft of the Second RBMP for the Danube, the „DRAFT DRBM Plan – Update 2015" is based on data delivered by Danube countries as of 06 November 2014 and was elaborated for launching the public consultation process. An updated and further elaborated version of this document will be published in the beginning of June 2015 for an intensified public consultation phase. The DRBM Plan – Update 2015 will be finalized in December 2015, taking into account the results from the six months public consultation process.

A more detailed level of information will be presented in the national DRAFT RBM Plans. Hence, the DRAFT DRBM Plan – Update 2015 should be read and interpreted in conjunction with the national DRAFT RBM Plans.

The EU Strategy for the Danube Region (EUSDR) is a macro-regional strategy adopted by the European Commission in December 2010 and endorsed by the European Council in 2011. The Strategy was jointly developed by the European Commission, together with the Danube Region countries and stakeholders, in order to address common challenges together. On the website of the strategy (www.danube-region.eu) you can find out about the latest developments of the strategy, its 11 priority areas and main actions and projects, as well as information about existing funding opportunities.

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The Strategy is defined in a Communication (COM(2010)715, 2010), accompanied by a detailed Action Plan (European Commission, 2010), which presents the operational objectives and actions and demonstration projects of the EUSDR.

The strategy addresses four main objectives, or "Pillars":

1) Connecting the Region
2) Protecting the environment
3) Building prosperity in the Danube Region
4) Strengthening the Danube Region

These four pillars are translated into 11 priority areas (P1 – P11) coordinated by the participating countries, representing the main areas where the macro-regional strategy can contribute to improvements.

The second pillar has 3 priority areas:

- P4 Water Quality
- P5 Environmental risks
- P6 Biodiversity, landscapes, quality of air and soils

The objective of the P4 priority area is „to restore and maintain the quality of waters" (implementation of WFD and the measures of river basin management plans).

The key actions of P4 are as follows:

1) Implementation of the Danube River Basin Management Plan
2) Cooperation at sub-basin level
3) Development of information systems
4) Development of wastewater treatment facilities
5) Establishment of buffer strips along the rivers to retain nutrients
6) Cooperation between authorities responsible for agriculture and environment
7) Limitations of phosphates in detergents
8) Treatment of hazardous substances and contaminated sludge
9) Control of substances that are considered problematic
10) Reducing water continuity interruptions
11) To limit water abstraction
12) Exchange of good practice in integrated water management
13) Safeguarding of drinking water supply
14) Integrated Coastal Zone Management

2.2) The management authority (MA) body, which is expected to execute the implementation of the Good Practice

The Hungarian *National Water Authority* is responsible for the Second RBMP of the Hungarian Part of the Danube River Basin District and the National Water Strategy of Hungary. The *Regional Water Authority* is responsible for the Second River Basin Management Plan for the Lake Balaton Region.

2.3) The plan and strategy with which the programme expected to be addressed and the expected time of issue

Second River Basin Management Plan - expected in December 2015
Updated National Water Strategy – expected in May 2015
EU Biodiversity Strategy to 2020
Hungarian National Biodiversity Strategy 2014-2020.

The Good Practice from the Project Partner 1, Finnish Environment Institute is expected to be transferred by the Lake Balaton Development Coordination Agency (LBDCA) to the Lake Balaton Recreational Area in order to support the evaluation of diffuse phosphorus loading.

LBDCA recommends to integrate the Good Practice into the planning and implementation process of the *Second RBMP of the Lake Balaton Region, of* the *Second RBMP of the Hungarian Part of the Danube River Basin District and into the RBMP of the Danube River Basin District*.

The Good Practice will assist with the implementation of the hierarchical RBM planning process, with the selection of programmes of measures of the Second RBMPs.

2.4) Expected challenges, difficulties in the procedure for Good Practice transfer and lessons learnt from the Project Partner 1

The questions considering the challenges and difficulties in the procedure for the implementation of the Good Practice raised by Project Partner 7, the Lake Balaton Development Coordination Agency and answers by Project Partner 1, the Finnish Environment Institute are as follows:

1. **How to obtain the user manual of the KUTOVA spreadsheet tool and the user licenses**. There is no manual for using KUTOVA available in English. The manual version in Finnish can be found in
   http://www.syke.fi/fi-fi/Tutkimus__kehittaminen/Itameri_vesistot_ja_vesivarat/Mallit_ja_tyokalut/Vesienhoidon_mallit/Kustannustehokkaiden_toimenpiteiden_valintatyokalu__KUTOVA
   One possible alternative would be a joint venture, using KUTOVA in a smaller sub catchment and get acquainted with the procedure by the "learning by doing" method. The current version of Kutova demands no user licences.

2. **What are the input data, the costs and effects of mitigation measures?** *The input data includes the current phosphorus loading, the maximum extent of the measures (e.g. total field area), costs of the measures and reduction rates of different measures. The costs are based on estimates of the national WFD implementation sectorial teams. The effects are partly from Vihma model and literature (see appendix in Hjerppe & Väisänen 2014). Accuracy of the results is directly proportional to the quality and quantity of data on the input parameters. So far, the use of manure is not yet included in Kutova due to insufficient data on catchment scale.*

3. **How to determine cost-effective measures for reduction of phosphorus loading and to build cost-effective combinations of measures at catchment scale?** *The principle, equations and calculations are described in Hjerppe & Väisänen (2014).*

4. **How to gather the input data from the study area? How KUTOVA, WSFS-VEMALA, VEPS and VIHMA models are integrated?** *Kutova is designed to use all available databases (e.g. local land use, hydrology, building and apartment register), and loading models of the Finnish Enviromental Administration.*

5. **Which are the 19 different measures for reducing phosphorus loading contained by KUTOVA?** See Hjerppe & Väisänen (2014, **Table 8.**). In addition, the fields can divided in five slope categories and wetlands to nine categories according their size and percentage of field in the catchment.

6. **Are there specific conditions for KUTOVA to function?** *The calculation needs good input data.*

7. **Is KUTOVA an open system**? *Kutova is an Excel worksheet and in principle it is open.*

8. **How does a new measure get included in the KUTOVA?** *The current Kutova includes all measures included in the implementation of WFD in catchment areas for reduction of diffuse phosphorus loading in Finland. So, in principle, Kutova includes all measures identified and studied in Finnish agricultural research. However, any new information improving the accuracy of Kutova can be included if it is found valid (e.g. the use of manure).*

9. **Who can propose a new measure for inclusion?** *In theory, any person with valid new information. In practice, mainly the regional coordinators of River Basin Management.*

10. **What sort of screening will there be? Are there clear criteria for new measures**? *Addition of new measures would require data and information about costs, reduction rates and maximum extent of the measure.*

11. **How does KUTOVA link with the planning for other measures of RBMPs?** *Kutova is not directly linked with other measures, but its results are used by the regional coordinators in the POM´s of RBMP´s.*

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http://www.waterpraxis.net

Table 8 Measures included in the KUTOVA-tool by different sectors
Source: Hjerppe & Väisänen 2014.

Agriculture
Buffer zones
Constructed wetlands
Wintertime vegetation cover
Perennial grass
Controlled drainage
Optimal fertilization
Gypsum application on fields
Forestry
Buffer zones of logging area
Overland flow
Peak runoff control
Drowned weir for runoff control
Constructed wetlands
Scattered settlement
Sewer network for scattered settlement
New local wastewater treatment systems for scattered settlement
New local wastewater treatment systems for holiday housing
Peat mining
Overland flow with pump station
Overland flow without pump station
Peak runoff control
Chemical treatment of runoff waters

To reduce the load of phosphorus several abatement measures are available. Some of the measures are local, such as building sewage treatment plants, others, like imposing a ban or a limitation on the use of phosphorus from fertilisers, will also affect people living far from eutrophic waters.

In the literature cost estimates are given for various abatement measures. The cost ranges are large which may be acceptable due to different ways of realising technologies. The costs also vary from one

estimate to the other. For detailed studies, technological calculations cannot be avoided to make any decisions. There is also a wide variation among countries and regions. *The combined reduction in phosphorus by various abatement measures is not equal to the simple sum.* Several of the assumptions used in studies on costs of P-removal are subject to discussion.

The lack of relevant data is generally regarded as the biggest obstacle to performing and using benefit assessment. The case studies in the literature are used in most of the benefit studies, because the lack of their own data.

Several methods for valuing water quality improvements have been developed by economists. However, *there is no consensus on the question which methods are to be used in practice*. For a first-order-of-magnitude estimation of benefits it is possible to use existing benefit research.

More information

ICPDR (December 2014) The Danube River Basin District Management Plan – Update 2015, Draft, International Commission for the Protection of the Danube River (ICPDR)
www.icpdr.org

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Website of the Danube Region Strategy http://www.danube-region.eu

Website of the European Commission – DG Regional Policy
http://ec.europa.eu/regional_policy/cooperate/danube/index_en.cfm

Ijjas, Istvan (2011) European Union Strategy for Danube Region and the implementation of the Water Framework Directive, COST 869 Conference on "Mitigation options for Nutrient Reduction in Surface Water and Groundwaters", Final Meeting, Keszthely Hungary, 12-14 October 2011

5.3.4 Stakeholder participation in lake management (G7)

Origin of the GP:
Project Partner 1, SYKE/Finland, North Savo Regional Centre for Economic Development, Transport and the Environment (LPAB for the Finnish partners), Finnish Environment Institute

1.) Introduction and background of the GP

The Lake Balaton Development Coordination Agency (LBDCE) has identified this Good Practice as one of the most likely suitable measures for transferring to the Lake Balaton Recreational Area in order to try to obtain similar results and to improve and better the traditional and new lake management practices developed and used in Hungary. The LBDCE recommends the use of this GP or the applicable elements of it for the planners and lake managers. The final decision on the implementation needs more information and comparative studies.

1.1) Summary of the GP

The GP originates from the need to have clear definitions to the participation of government authorities in funding of lake restoration. It has been in routine use in lake management in many regions in Finland.

The major objective of the GP is to promote the commitment of local stakeholders and beneficiaries in lake management, to facilitate dialogue of stakeholders and authorities, to increase volunteer work and local funding for lake management

1.2) Implementation of the GP in Finland

Joint regional working groups consisting of regional and municipal authorities, different local stakeholders such as owners of water areas, angling clubs, voluntary lake associations, farmers' associations, nature protection associations have for a long time been a tradition in Finnish lake management. Representatives of the relevant stakeholders and beneficiaries are invited to a steering group: to promote the commitment of local stakeholders and beneficiaries in implementation of lake management measures, to facilitate dialogue of stakeholders and authorities. This will also increase volunteer work and local funding for lake management, in planning and realisation of a management is launched. Consent to measures concerning the lake is needed from local private owners of water areas or their associations. Local stakeholders may be responsible for part of measures and funding. They may for instance arrange collecting or use of biomass of vegetation removed or biomass of cyprinids removed in biomanipulation. Their volunteer work is often priced in budgets of projects. Established routines of participation favour also hearings of the Water Framework Directive.

The phase in which the practice is applied
Stakeholder participation is needed in all phases and tasks of management: identification of the problem, planning, funding, monitoring (mainly transparency), volunteer work in implementing the measures, especially participation in removal of macrophytes or fish removal

Duration of the operation
Stakeholder participation represents the continuous elements of lake management.

Bodies and organizations involved
The relevant stakeholder and beneficiaries include municipal authorities, municipal board members, local fishing associations (owners of water areas and fishing rights), local or regional farmer´s associations, angling clubs, nature conservation associations, associations of lake residents, regional environment and fisheries authorities,

The good outcomes resulting from the GP
When there is good discussion in which all can contribute and are listened, the decisions are better received by the citizens.

Difficulties faced
In rural areas ageing of the population has led to a loss of younger people to join in.

References
Memorandum 3/1990. The ministry of Environment.
Shapiro, J., Lundqvist, J.B. & Carlson, R.E. 1975. Involving the public in limnology – an approach to communication. Verh. Internat. Verein. Limnol. 19: 866-874.

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2.) Implementation of the GP in Hungary

The Good Practice will be transferred by the Lake Balaton Development Coordination Agency (LBDCA) to the Lake Balaton Recreational Area in order to improve and manage better the public participation processes.

2.1) Policies, strategies, plans that will be impacted, into which the GP will be integrated in Hungary

The Hungarian LakeAdmin Partner, the Lake Balaton Development Coordination Agency (LBDCA) recommends to integrate the Good Practice into the public participation processes of the updated, *Second RBMP of the Lake Balaton Region.* The Good Practice will assist with the planning and implementation of the programme of measures of the Second RBMP. The Good Practice adopted in the Lake Balaton River Basin will also assist with the implementation of the Flood Risk Management Plans, the EU Biodiversity Strategy to 2020 and the Hungarian National Biodiversity Strategy 2014-2020.

2.6) The management authority (MA) body, which will execute the programme

The Hungarian *National Water Authority* is responsible for the Second RBMP of the Hungarian Part of the Danube River Basin District. The *Regional Water Authority* is responsible for the Second River Basin Management Plan for the Lake Balaton Region.

The local municipal authorities will be responsible for the implementation of the action programmes and programmes of measures of River Basin Management Plans, Flood Risk Management Plans and Regional Development Plans.

2.7) The plan and strategy with which the programme expected to be addressed and the expected time of issue

Second River Basin Management Plan - expected in December 2015
Flood Risk Management Plan – expected in December 2015
National and Regional Development Plans – expected in 2015
EU Biodiversity Strategy to 2020
Hungarian National Biodiversity Strategy 2014-2020.

5.3.5 Control of Invasive Aquatic Species (IAS) in Lake Balaton Recreational Area

Origin of the Good Practice:
Project Partner 8, Ireland West Region, GP27 - CAISIE "Control of Aquatic Invasive Species in Ireland"

1) Introduction and background of the Good Practice

1.1) Summary of the Good Practice

The Good Practice (GP27) from the Ireland West Region's CAISIE Programme will be transferred by the Lake Balaton Coordination Agency to the Lake Balaton Recreational Area in order to control of invasive aquatic species (IAS). The implementation plan for Control of Invasive Aquatic Species in Lake Balaton Recreational Area Programme (CIAS in Lake Balaton Programme) is under development. This Programme is considered as a first step of the establishment of the Control of Invasive Aquatic Species in Hungary Programme (CIASHU Programme). The main objective of the

Programme is to contribute to the halting of biodiversity loss in Lake Balaton Recreational Area by preventing further impacts on native biodiversity from high impact invasive aquatic species.

1.2) Importance of the control of invasive alien species (IAS) in Lake Balaton Recreational Area

Lake Balaton with its catchment is one of the most important regions of Hungary. Not only in the view of its natural heritage and beautiful landscapes, but also in its economical role. As the economic consequences of the spread of non-native species (invasive alien species – IAS) have been growing, the most detailed understanding of their present status is of high priority. The chance of controlling such an invasion given the recent level of general knowledge is limited. Studies on the role of IAS in Hungarian waters and revealing the factors limiting or affecting their distribution patterns are needed. The need for such studies is growing in parallel with the drafting EU regulation on the prevention and management of the introduction and spread of invasive alien species (Kovats ed 2013, Ferincz 2014, European Commission 2013).

Invasive alien species are initially transported through human action outside of their natural range across ecological barriers, and that then survive, reproduce and spread, and that have negative impacts on the ecology of their new location as well as serious negative economic and social consequences.

The impact of IAS on biodiversity is significant. IAS are one of the major, and growing, causes of biodiversity loss and species extinction. They can damage infrastructure and recreational facilities and cause agricultural losses. IAS are estimated to cost the European Union at least € 12 billion per year and damage costs are continuing to rise (European Commission 2013).

1.3) EuLakes - European Lakes Under Environmental Stressors Project

There are a lot of important international and Hungarian studies on IAS in lakes. Those are collected and assessed in the EuLakes Project - European Lakes Under Environmental Stressors - Supporting lake governance to mitigate the impact of climate change (Ferincz 2014; Gallinaro-Cantani eds 2012; Gallinaro – Taverini – Cantani eds 2013; Kovats – Ferincz 2012; Kovats ed. 2012; http://www.eulakes.eu/).

The EuLakes was a European project funded by the Central Europe Program (ERDF funds) with the aim of investigating the best possible common actions to face the environmental risks related to climate change also involving the local communities in the new tasks.

The project aimed to support the sustainable management of four major Central European lakes (Lake Garda - Italy, Lake Neusiedl - Austria, **Lake Balaton - Hungary**, Lake Charzykowskie - Poland) with different characteristics, by fostering a combination of vulnerability and risk assessment programs, monitoring and participative planning to face climate change and other environmental stressors. Through a transnational partnership (nine European partners - coming from Italy, Austria, Poland and Hungary) linking research groups and local communities, the project integrated the conservation of sensitive lake ecosystems with diverse types of use (i.e. tourism, agriculture, etc.).

Lake Balaton is considered to be sensitive to biological invasions. There are non-indogenous species with well-known history of introduction and invasion. However in the EULAKES project only non-indigenous bivalve and fish species were addressed in details, and two species (a mussel: Sinanodonta woodiana, and a fish: Carassius gibellio) were selected for further investigations.

1.4) Implementation of the Good Practice CAISIE in Ireland

The CAISIE Project was an EU Life+ funded initiative co-financed by the National Parks and Wildlife Service and co-ordinated by Inland Fisheries Ireland. The project commenced in January 2009 and

concluded in January 2013. CAISIE contributes to the understanding and control of IAS in Ireland. Aquatic invasive species are a major threat to biodiversity in Irish freshwaters most particularly Lough Corrib in the West Region and their adverse effect will continue to increase unless effective eradication and control methods are developed. CAISIE focuses on researching and implementing control and eradication methods, a marketing campaign to increase awareness and stakeholder engagement.

Lough Corrib is a large lake in the west of Ireland. It has recently become home to Lagarosiphon major and zebra mussels. These invasive aquatic species have caused considerable changes to the ecology of the lake. Lough Corrib is Ireland's second largest lake, with a surface area of c. 17,800 hectares. The lake is of considerable ecological and conservation importance. It is designated as a Special Area of Conservation and Special Protection Area, and includes 14 habitats and six species listed in the European Union Habitats Directive. It is internationally renowned as a wild brown trout and Atlantic salmon recreational fishery (CAISIE 2013).

The broad objective of the CAISIE was to contribute to the halting of biodiversity loss in Ireland by preventing further impacts on native biodiversity from high impact IAS. The specific objectives of the project include:

- To protect the native biodiversity in Lough Corrib by eradicating, controlling or containing *Lagarosiphon major,* commonly known as the African Pond Weed.
- To conduct a detailed desk study and consult experts and authorities widely in order to collect data and to implement the widest range of containment, control and eradication procedures.
- To engage key stakeholders in an education and awareness programme.
- To exchange and disseminate information on control and management methods.
- To halt biodiversity loss by the end of the project and comply with European targets.

The list of aquatic or riparian invasive species which CAISIE focused on.

Key species at Lough Corrib:-

- Lagarosiphon major (Curly-Leaved Waterweed)
- Crassula helmsii (New Zealand Pigmyweed)

Key species on the Grand Canal, Barrow Line and Navigation:

- Lagarosiphon major (Curly-Leaved Waterweed)
- Leuciscus leuciscus (Dace)
- Hemimysis anomala (Bloody Red Shrimp)
- Crangonyx pseudogracilis(Northern River Crangonyctid)
- Elodea nuttallii (Nuttall's Pondweed)
- Crassula helmsii (New Zealand Pigmyweed)
- Azolla filiculoides (Red Water Fern)
- Dreissena polymorpha (Zebra Mussel)
- Fallopia japonica (Japanese Knotweed)
- Heracleum mantegazzianum (Giant Hogweed)
- Impatiens glandulifera (Himalayan Balsam)
- Gunnera tinctoria (Chilean Rhubarb)

Lagarosiphon major was first identified in Lough Corrib in 2005 and is capable of growing in inland waters up to 6 meters deep. It is native to southern countries of Africa and once established it strongly out-competes other native species. It grows in dense strands and can impede boat movement by becoming caught onto boat propellers and is considered dangerous for diving activities as equipment may become entangled in the weed and light visibility can be extremely poor. The presence of the weed has been confirmed at 35 sites on the lake.

The year of launching of the CAISIE Programme was 2009 and the life-time of the Programme was from 1st September 2009 to 31st December 2012. The bodies and organizations involved were as follows:

EU Life+ Programme, Inland Fisheries Ireland, National Parks and Wildlife Service, The Heritage Council, Office of Public Works, Environmental Protection Agency, Waterways Ireland, National Botanic Gardens, Galway County Council and
Inland Waterways Association of Ireland (IWAI)

The key activities of the CAISIE Programme:

- Project Initiation.
- Stakeholder consultations.
- Workshops on control / management options and remediation
- Programmes to eradicate/contain/control/manage invasive species
- The systematic removal of the weed from Lough Corrib using a wide range of tried and tested, as well as new and innovative, methods will be conducted over three field seasons.
- Evaluate the potential for biological control of aquatic invasive species in Ireland.
- Stakeholder engagement programme, education, awareness and dissemination.

The main good outcomes resulting from the CAISIE Programme:

Control Works on *Lagarosiphon major* in Lough Corrib have been undertaken with a combined programme of weed cutting, light exclusion using jute matting and chemical control methods. The successful weed control operations undertaken during the Life+ project have reopened previously overgrown areas of the lake for angling and boating. If no action was taken to control this highly invasive plant, 48% of Lough Corrib would become inaccessible. A series of presentations has been given to stakeholders by the project team and an exhaustive stakeholder network has been established. Awareness material to include research publications, informative articles, project bulletins, promotional leaflets and guides has been distributed. Implementation of the project has reduced the volume of *Lagarosiphon major* in Lough Corrib and limited the spread to other important water bodies. The public awareness campaign has been a success.

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Contact person of the CAISIE Programme:

Mary Molloy Email: mmolloy@galwaycoco.ie

More information:

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2.) Implementation of the GP in Hungary

2.1) Policies, strategies, plans that will be impacted, into which the GP will be integrated

The Good Practice from the Ireland West Region's CAISIE Programme will be transferred by the Lake Balaton Development Coordination Agency (LBDCA) to the Lake Balaton Recreational Area in order to control of invasive aquatic species (IAS). The implementation plan for *Control of Invasive Aquatic Species in Lake Balaton Recreational Area Programme (CIASBalaton Programme)* is under development. This Programme is considered as a first step (a Pilot Programme) of the establishment of the *Control of Invasive Aquatic Species in Hungary Programme (CIASHU Programme)*.

The main objective of the CIASBalaton and CIASHU Programmes will be to contribute to the halting of biodiversity loss in Lake Balaton Recreational Area and in Hungary by preventing further impacts on native biodiversity from high impact invasive aquatic species.

LBDCA recommends to integrate the CIASBalaton Programme into the *Second RBMP of the Lake Balaton Region* and the CIASHU Programme into the *Second RBMP of the Hungarian Part of the Danube River Basin District*. LBDCA recommends also to integrate the CIASBalaton and CIASHU Programmes into the *updated National Water Strategy of Hungary* that is also under development.

The good practice will assist with the implementation of the programme of measures of the Second RBMP and the actions identified in the updated National Water Strategy of Hungary.

The Good Practice adopted in the Control of Invasive Aquatic Species (IAS) in Lake Balaton Recreational Area Project will also assist with the implementation of the EU Biodiversity Strategy to 2020 and the Hungarian National Biodiversity Strategy 2014-2020.

Biodiversity Strategy to 2020

The Good Practice adopted in the Control of Invasive Aquatic Species (IAS) in Lake Balaton Recreational Area Project will be integrated into the EU Biodiversity Strategy to 2020 and the Hungarian National Biodiversity Strategy 2014-2020.

The EU Biodiversity Strategy to 2020 (European Commission 2011) is built around six mutually supportive and inter-dependent targets and twenty actions which address the main drivers of biodiversity loss. They aim to reduce key pressures on nature and ecosystem services in the EU by stepping up efforts to fully implement existing EU nature legislation, anchoring biodiversity objectives into key sector-policies, and closing important policy gaps. Global aspects are also addressed to ensure the EU contributes fully to implementing international biodiversity commitments.
The six targets covered by the EU strategy focus on:

1. The full implementation of the EU nature legislation;
2. Better protection and restoration of ecosystems and the services they provide, and greater use of green infrastructure;
3. More sustainable agriculture and forestry;
4. Better management of EU fish stocks and more sustainable fisheries;
5. Tighter controls on Invasive Alien Species; and
6. A greater EU contribution to averting global biodiversity loss.

The fifth target aims to ensure there is a comprehensive and coordinated EU-level response to prevent and control the introduction and spread of harmful Invasive Alien Species (IAS) across the EU. Invasive Alien Species are considered to be a major threat to biodiversity, second only to habitat loss.

The Target 5 means to combat Invasive Alien Species:

> „By 2020, Invasive Alien Species (IAS) and their pathways are identified and prioritised, priority species are controlled or eradicated, and pathways are managed to prevent the introduction and establishment of new IAS".

EU Biodiversity Strategy 2020 and the Aichi Biodiversity Targets

Davis et al. (June 2014a, June 2014b) provides a set of recommendations as commissioned by the Committee of the Regions (CoR) of the EU under the framework contract: "Multilevel-governance of our natural capital: the contribution of regional and local authorities to the EU Biodiversity Strategy 2020 and the Aichi Biodiversity Targets". The recommendations – addressed at Member States and local and regional authorities (LRA) - aim at improved achievement of the EU Biodiversity Strategy's targets for 2020 and the implementation of Convention on Biodiversity CBD Decision X/22.

By wording and focus the two documents are quite different. CBD Decision X/22 rather provides direction for the implementation of a multilevel governance framework, whereas the EU Biodiversity Strategy to 2020 focuses on targets for policy areas (**Table 9**.). Nevertheless, some of the actions addressed herein also contain aspects of multilevel governance.

Table 9. Overview of interrelations between CBD X/22 and EU Biodiversity Strategy

	Fields of implementation/policy areas				
	Biodiversity				
	Protected areas/species	Ecosystem services/Green Infrastructure	Agriculture and forestry	Fishery	Invasive Alien Species
	T1, A1, (f)	*T2, A6, (i)*	*T3, A 10*	*T4, A 13, A 14*	*T5, A 15, A 16*
Multilevel governance Mechanisms of implementation	Development and Implementation of national strategies/action plans (NBSAP) *(a)*				
	Establishment of local and regional strategies/action plans *(b)*				
	Rewarding the efforts of LRA *(d)*				
	Integrating of biodiversity in other relevant fields *(c: climate change/ sustainable development) (e: urban infrastructure) (A7: no net loss) (A 12; forest management plans) (A 17: indirect drivers globally) (A19: in development cooperation)*				
	Cooperation between local authorities (g)				
	Cooperation with LRA and consultation of LRA towards to CBD *(h) (j) (l) (A3: Natura 2000)*				
	Capacity building for LRA *(n)*				
	Cooperation of LRA with stakeholders *(p) (A3: Natura 2000)(A 11: forest holders)*				
	Research and technology *(o: urban biodiversity) (A5: ecosystem services)*				
	Mapping, monitoring and reporting *(k: cities' index)(A4: Natura 2000/species)*				
	Mobilising of additional resources *(A2: Natura 2000) (A8/A9: EU agriculture funding) (A18: globally)*				

The EU Biodiversity Strategy to 2020 states that the shared EU and international Aichi Targets for biodiversity "need to be pursued through a mix of sub-national, national, and EU-level action" and encourages “collaboration between stakeholders involved in spatial planning and land use management in implementing biodiversity strategies at all levels”. The National Biodiversity Strategies and Action Plans (NBSAPS) set national framework conditions and serve as important guidelines for the work at sub-national level. Thus, it is of crucial importance to create or adjust NBSAPS together with LRA.

Updating the river basin management plans

The first river basin management plans were published in 2009. Since this time there have been a number of developments and changes in the water environment and in the science behind assessing it. The competent authorities are now working to review and update the river basin management plans and will publish the revised plans in December 2015.

Since publishing the first river basin management plan, our understanding of impacts of IAS on the water environment has greatly improved. The European and Hungarian experts of IAS issues have made significant progress and partnership working has strengthened. However, there is still a lot of work to be done in order to meet the challenge of IAS in the Lake Balaton and in the Hungarian and EU waters in general. The consultation process of the second cycle of river basin management planning provides us with the opportunity to the development of new approaches to identify and address the significant water management challenges in the Lake Balaton Recreational Area. This Programme will produce an IAS guide, which will improve our understanding the control of IAS and support the planning of IAS control measures in the updated river basin management plan to be published in 2015. The input of this programme to the consultation and involvement in the second river basin management planning cycle will be essential.

Objectives of the GP

The broad objective of the project is to contribute to the halting of biodiversity loss in the Lake Balaton Recreational Area and in Hungary by preventing further impacts on native biodiversity from high impact IAS. This will be achieved through the development and demonstration of effective control methods, a programme of stakeholder engagement and awareness rising, and policy development and dissemination. The specific objectives of the project includes:-

1. To protect the native biodiversity in Lake Balaton Recreational Area by eradicating, controlling or containing IAS.
2. To prevent further spread of high impact IAS by implementing control measures.
3. To conduct a detailed desk study and consult experts and authorities widely in order to collect data on the ecology and invasive capacities of the more problematic alien species and on effective control methods. This information will permit the development of informed guidelines for effective IAS management.
4. To implement the widest range of containment, control and eradication procedures as is available in an effort to eliminate alien species from the targeted waters. The success of these methods will be scientifically monitored and the results will be used to inform ongoing control proposals. Specific research focus will be placed on developing new and innovative containment and control methods for use against the range of invasive species present in Hungarian waters.
5. To engage key stakeholders in an education and awareness programme aimed at preventing new invasions, further spread and reinvasion by existing high impact species.
6. To exchange and disseminate information on control and management methods with other European invasive species control teams and policy makers leading to more effective control of IAS in Hungary and across Europe.

7. To contribute to the protection of biodiversity in Hungary and the European target to halt biodiversity loss by 2020 by building capacity on IAS control.

2.2) The management authority (MA) body, which will execute the programme

The Hungarian *National Water Authority* is responsible for the Second RBMP of the Hungarian Part of the Danube River Basin District and the National Water Strategy of Hungary. The *Regional Water Authority* is responsible for the Second River Basin Management Plan for the Lake Balaton Region.

2.3) The plan and strategy with which the programme expected to be addressed and the expected time of issue

Second River Basin Management Plan - expected in December 2015
Updated National Water Strategy – expected in May 2015
EU Biodiversity Strategy to 2020
Hungarian National Biodiversity Strategy 2014-2020.

2.4) Expected challenges, difficulties in the procedure for GP transfer

Lake Balaton with its catchment is one of the most important regions of Hungary. Not only in the view of its natural heritage and beautiful landscapes, but also in its economical role. As the economic consequences of the spread of non-native species (invasive alien species – IAS) have been growing, the most detailed understanding of their present status is of high priority. The chance of controlling such an invasion given the recent level of general knowledge is limited. Studies on the role of IAS in Hungarian waters and revealing the factors limiting or affecting their distribution patterns are needed. The need for such studies is growing in parallel with the drafting EU regulation on the prevention and management of the introduction and spread of invasive alien species (Kovats ed 2013, Ferincz 2014, European Commission 2013).

There is a traditional sufficient cooperation between the LBDCA and the Water Authorities responsible for the Balaton Region, however the frequent changes in the institutional framework of water management are causing difficulties in the efficient cooperation. Currently the LBDCA is involved into the development of the Lake Basin Management Strategy elements of the updated National Water Strategy.

The delay in updating the RBMPs in Hungary is causing difficulties in the import and implementation process of the the Good Practice (GP27) from the Ireland West Region's CAISIE Programme to the Lake Balaton Recreational Area in order to control of invasive aquatic species (IAS).

Lessons learnt

Invasive alien species are initially transported through human action outside of their natural range across ecological barriers, and that then survive, reproduce and spread, and that have negative impacts on the ecology of their new location as well as serious negative economic and social consequences.

The impact of IAS on biodiversity is significant. IAS are one of the major, and growing, causes of biodiversity loss and species extinction. They can damage infrastructure and recreational facilities and cause agricultural losses. IAS are estimated to cost the European Union at least € 12 billion per year and damage costs are continuing to rise (European Commission 2013).

Since publishing the first river basin management plan, our understanding of impacts of IAS on the water environment has greatly improved. The European and Hungarian experts of IAS issues have made significant progress and partnership working has strengthened. However, there is still a lot of work to be done in order to meet the challenge of IAS in the Lake Balaton and in the Hungarian and

EU waters in general. The consultation process of the second cycle of river basin management planning provides us with the opportunity to the development of new approaches to identify and address the significant water management challenges in the Lake Balaton Recreational Area. This Programme will produce an IAS guide, which will improve our understanding the control of IAS and support the planning of IAS control measures in the updated river basin management plan to be published in 2015. The input of this programme to the consultation and involvement in the second river basin management planning cycle will be essential.

***2.5 Actions**:*

In order to manage the project, key actions are identified:

- Project Initiation. This entails the establishment of the project team, infrastructure, baseline data review (detailed desk study) and establishment of the Project Advisory Group. The Project Advisory Group and management structure will ensure efficient delivery of the project and fulfilment of the actions.
- Stakeholder consultations. Consultation with key stakeholders endeavours to secure further support for the implementation of the project and establishment of the stakeholder network.
- Workshop on control / management options and remediation. Workshops with stakeholders and international experts will be convened to inform the further development of the action plans for each project area.
- Programmes to eradicate/contain/control/manage IAS. These programmes collect and evaluate the results already obtained from research conducted in the area of aquatic plant and IAS management in Hungary and abroad. While traditional control and removal methods are used today, new methods will be studied and developed. A network of IAS management contacts will be established during the project, based on the EuLakes and LakeAdmin Project contacts to ensure that every available mechanism to tackle these aggressive aliens will be utilised.
- The impact on native communities in target water bodies of the removal of IAS will be closely monitored. This involved ecosystem-wide assessment and comparison of food webs and community structure in invaded and non-invaded areas.
- Evaluation of the potential for biological control of IAS in the Lake Balaton Recreational Area and in Hungary – carrying out the evaluation of biological control mechanisms for some of the high impact species and contribute to the guidelines on effective management of high impact IAS.
- Remediation of native biotic communities.
- Stakeholder engagement programme.
- Education and awareness programme.
- Dissemination programme.

Main groups of the actions:

Preparatory Actions
A Project Advisory Group (PAG) that includes representatives from key stakeholder groups will be established (*Action A1*). Extensive stakeholder consultations (*Action A2*) will take place and a workshop on control options and remediation will be convened (*Action A3*). Arising from the workshop, specific and targeted actions for Lake Balaton will be developed (*Action A4*).

Main Actions
The principal focus of the Project will be to undertake an extensive programme of measures to control the spread and proliferation of the highly invasive aquatic species and to elucidate their impacts on the native biodiversity. This will include:

(a) utilising and upgrading traditional control procedures and, where appropriate and necessary, developing new control methods and practices (*Action C1*);

(b) assessing the efficacy of these control measures on the target IAS and the impact on the native ecology of the Lake Balaton (*Action C2*);

(c) determining the impacts of the IAS on the resident fish, macroinvertebrate and plant communities in the Lake Balaton (*Action C2*); and
(d) trialling methods to remediate native communities following successful control of the IAS (*Action C5*).

Supplementary Actions:
Stakeholder engagement (*Action D1*), education and awareness (*Action D2*) and dissemination (*Action D3*) initiatives will form an integral part of the project throughout its duration.

2.6) Summary of work undertaken and results by actions

Extensive contacts will be developed with stakeholder groups including anglers, boaters, water sports enthusiasts, landowners, other public agencies, local community groups as well as the agricultural and horticultural sectors (*Action D1*).
A range of IAS education and awareness materials will be produced including biosecurity guidelines for various stakeholders, project bulletins, on‐site biosecurity signage for water users, invasive species alerts, invasive species identification cards, and other materials will be produced (*Action D2*). These materials will be widely disseminated to stakeholders and the general public. A permanent display will be developed by the project to increase general awareness of AIS among the public. The project website will form an important part of the dissemination programme (*Action D3*).

A comprehensive assessment will be carried out which identifies the principal vectors and pathways that facilitate the introduction and spread of AIS in the project areas and throughout Hungary (*Action C3*).

The extensive work undertaken during the project will continue to inform the management and control of AIS throughout Hungary. The various control methods developed and successfully used to treat the range of high impact AIS present in the project areas now provide a suite of practical tools for stakeholders. Using the resources and knowledge gained through the Project, the After-LIFE Conservation Programme (*Action E3*) will continue to tackle the remaining sites infested by IAS. Based on the experiences of the project, guidelines for effective stakeholder engagement will be produced which will provide a valuable resource for stakeholders involved in increasing the awareness of and implementing measures to tackle AIS in Hungary. An After-LIFE Communication Plan will be developed which outlines how the results of the project will continue to be disseminated and communicated (*Action D3*).

2.7 Time-table of implementation

Preparatory Actions

Action A.1: Project Initiation	July 2014 – June 2015
Action A.2 Preparatory Stakeholder consultations	July 2014 – June 2015
Action A.3 Workshop on control options and remediation	March 2015
Action A.4 Action Plans	June 2015 – July 2015

Concrete Conservation Actions

Action C.1 Eradication of IAS	3 years from launching
Action C.2 Quantify the Impact on Native Communities in target water bodies of the removal of invasive species	3 years from launching
Action C.3 Control of high impact invasive species in the Lake Balaton	3 years from launching
Action C.4 Evaluate biological control of IAS in Hungary	3 years from launching
Action C.5 Remediation of native biotic communities	3 years from launching

Stakeholder engagement, education and awareness, and dissemination

Action D.1 Stakeholder engagement programme	3 years from launching
Action D.2 Education and awareness programme	3 years from launching
Action D.3 Dissemination programme	3 years from launching

Project operation and monitoring

Action E.1 Project Management 3 years from launching
Action E.2 Monitoring of project performance 3 years from launching
Action E.3 After-LIFE Conservation Plan Last year of the project

After-LIFE Conservation Plan

The After-LIFE Conservation Plan will provide the following information:

1) an assessment on the status of the high impact IAS targeted during the project;
2) an account of how the conservation activities implemented during the project will continue and develop after it ends;
3) details of how the longer-term management of the project sites in regard to invasive species will be assured;
4) information on what further actions will be carried out and who the partners involved will be; and
5) it identifies secured sources of finance to enable this.

Expected long-term benefits

The Project will be the lead mechanism to manage the threat from AIS in Lake Balaton from its inception. The Project will facilitate the development of a wide range of control and stakeholder initiatives, which will provide enduring and long-term benefits within the project areas, and in Hungary. The Project will develop a range of skills that will continue to be used to target AIS.

2.8) More information

A significant amount of information on the adopted Good Practice is presented on the CAISIE's website. The most detailed information on the Project is presented in the Final Report Covering the project activities from 1st January 2009 to 31st January 2013 (CAISIE May 2013).

The Layman's Report of CAISIE Project is now online. This document provides a non-technical comprehensive report on all the activities of the project and its outcomes during its four year duration.

The After-LIFE Communication Plan sets out how the results of the CAISIE Project will continue to be disseminated and communicated after the end of the LIFE+ funding and indicates what external supports will be used to achieve this.

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Lake Fertő (Fertő-tó/Neusiedler See)

The Lake Fertő (Neusiedler See) is the fifth largest lake of Europe. As the westernmost lake of the continental salt lakes salanity may exceed the value of 2,500 mg/l in the summer months. Lake Fertő is shared by Austria and Hungary, the major part (76%) lies on the Austrian side. The lake and some of the surrounding areas belong to the National parks of the Hungarian Fertő-Hanság and the Austrian Neusiedler See – Seewinkel. In 2001 the landscape of Fertő and thus the Lake also were accepted as World Heritage Site. Lake Fertő is surrounded by the larges closed reed belts of Central Europe. Of the total area 57%, of the Hungarian part 87% is covered with reed.

As good lake management practice measures aimed at reducing external loads from last decades were taken into consideration. Reducing nutrient pollution of point sources is priority objective. External load comes from point and diffuse sources which increase in particular nutrient content in the lake. Formerly on the Austrian side sewage system and connected waste water treatment plants had been designed to reduce point source pollution, then a bypass channel was constructed for draining waste water out of the catchment area. In order to reduce diffuse pollution water of Wulka-Creek was diverted into the reed belt, then a colmation area was constructed near the city of Schützen am Gebierge.

On the Hungarian side filter beds of Rákos-Creek and wastewater treatment plant of Fertőrákos have been operating since 2004. By design principles removal of nutrients was the main target. Due to the enlargement and modernization of the UWWTP of Sopron, waste water from Fertőrákos and Sopronkőhida is disposed and treated outside of the catchment area. The above mentioned filter bed is therefore currently responsible for purification of diffuse pollution coming from catchment area of Rákos-Creek. Due to these measures, the lake's external load has significantly decreased for the second half of 2000's.

Other relevant measures for the maintenance of good ecological status of Lake Fertő:

- In the recent years in particular, the lake's internal load is responsible for the eutrophication phenomena.

The currently new project, KEOP 7.3.1.2 facing execution aims to slow eutrophication, to amend water supply of the south Hungarian reed belt and therefore to provide better ecological conditions. The project title is "Reconstruction of reed belts and system of water supplementation of Lake Fertő". By the project remedial dredging for improving water flow is planned in the reed belts and in the system of water supplementation. Furthermore the project aims at partial demolition of dumps to facilitate water exchange between the open water/channels' water and the water of reed belts. All the mentioned measures contribute to better water supply and improvement of ecological conditions in reed belts. Length of channels involved in reconstruction is approximately 76 km, the area of the concerned habitat is 4,327 ha. The project results qualitatively improved water supply and better reed-population health as well on the Hungarian side. The often stagnant and oxygen-poor water will be replaced by oxygen saturated flowing water, so flora and fauna of the reed belts get chance for survival. This is particularly important for the natural fish stocks of Fertő, because reed belts are also nursery grounds. However, positive measures are also beneficial for all unique communities formed by invertebrate and vertebrate fauna living in the open water and in the reed belts.

- Reed belts have significant role in the life of Lake Fertő.

Reed belts in good status improve water quality, however on the other hand accumulated organic matter of old reeds accelerates accretion processes in the lake. By the latter phenomena reed management can give effective help.

- Lake Fertő is supplied with water by groundwater and precipitation besides water of the Austrian Wulka-Creek and the Hungarian Rákos-Creek.

Water level regulation has been done since 1965. In 2011 the Austrian-Hungarian Water Commission accepted the regulation regard to sluice operation, which is still in force. This regulation ensures efficient water management, slows the overgrowth of reeds and supports better water supply in the reed belts as well.

Tatai Öreg-tó

The project „Rehabilitation of the Tatai Öreg-tó and the Által-ér river basin" was realised between February 2010 and 31. December 2011.

The sluices in the barrage that regular the water level in the lake were built in the 1970s. Since that time only minor repairs and maintenance were done. It indicated the reconstruction of the standing works and their movable parts, permitting a higher level of the flood and operational safety.

As part of the project, at the posterior side of the lake a water related habitat was built. After the drawdown of the water in the reservoir "Tatai Öreg-tó" in the wintertime it makes possible that water remains constantly on this posterior area (Tófarok). It ensures the habitat for the protected fauna and flora of the reservoir (water related Natura 2000 habitat). The reconstruction of the "Tatai Öreg –tó, Tófarok" makes possible the establishing of a nature trail on the floodplain.

The Tatai Öreg-tó is an important station during migration of Anseridae.

The project also diminish the flood along the Által-ér (water course) and Dunaalmási-csatorna (canal), which increases the agricultural territories, the river beds gets suitable for the intake of little water courses and rainwater harvesting systems.

With the bed regulation the shoreline was turfed. The agricultural areas reached the shoreline before, and the chemicals could flow any without filtering into the water. The turfed shoreline – beside its greenway task – operate as a natural colloid filter.

The main interventions on the floodplain and the lake were:
a./ Downstream of the Tatai Öreg-tó the canal system was reconstructed,
b./ Ground ecological aspects was the Által-ér (the main water course of the reservoir) before the Öreg-tó reconstructed, together with the Oroszlány-Kecskédi water course,
c./ The diversion canal of the final sedimentation pond was reconstructed into a water-saving structure,
d./ In the „Tófarok" a new water related habitat was built,
e./ The 5 sluices in the barrage of the Öreg-tó reservoir were restored,
f./ A pilot filter field was built in Oroszlány
g./ In 890 m length the shoreline of the Által-ér was rehabilitated in an ecological way on the eastern part.

Parallel, the WWTP of Tatabánya on the upper river basin was reconstructed (capacity building), making possible the reduction of nitrates by 80 kg/day.

Lipóti Holt-Duna (Lipóti Morotva-tó)

The oxbow lake „Lipóti Holt-Duna" is a cut off standing water of the Danube. Its area takes 68 ha. The groundwater level decreased drastically with the diversion of the Danube in October 1992 (due to the building of the the Gabcikovo power plant in Slovakia) and the earlier wetlands dried up totally in few weeks, the aquatic species died. The rehabilitation of the Oxbow Lake Lipót started in May 1994, until October 1994 water was pumped into the lake. Parallel the building of the submerged weir at the settlement Sorjás started. It first operated in May 1995, and made the water supply possible into the lake through the sluice in Dunaremete and the upper part of Zsejkei-canal.

Between May 1995 and March 2007 the ecological development of the water-supplementation system continued on the cut-off part of Szigetköz (Szigetköz is the area between the main Danube bend and the Mosoni-Duna river, which is a side arm of the main Danube). On the results of this activity became it possible to lead water through the Gombócos-Bár-Danube canal (after the dredging of the Nagy-Gyöpi canal) into the east part of lake. The water level of the oxbow lake is strongly regulated. After several years of water level monitoring were were the targeted water levels according to the complex demands fixed. Among diverse demands the nature-protection has the highest priority, taking into account especially the water demand of the rare tundra vole.

The lake is the pigeonhole of reed-song-birds, purple heron, and grebe.

With the harmonised operation of the Lipót area facilities (sluices, canals, weir) that takes into account the demands of stakeholders (protection of environment, tourism, fishing, line-fishing etc.) can be the water supply of the Szigetköz Water-supplementation system ensured.

In earlier periods (before 1992) this oxbow lake gave home the largest mud-minnow (Umbra krameri) assemblages of the Szigetköz but also the weather-fish stores were significant. This species (too) disappeared after the diversion of the main Danube canal (that indicated the dry up of the area), later mud-minnows disappeared for years from the whole region of the Szigetköz. Nowadays, after the water-supplementation the fish-fauna widened significantly with invasive species (chinese rasbora, bluegill, prussian carp, tubenose goby), the original native structure of fauna isn't restored, however native Tinca vulgaris can be found on here and weather fish is getting to reappear in the territory. From a nature conservational point of view the highest values are represented especially by protected herons (great egret, purple heron), that nest and brood here in colony, just like other, water-connected birds and the tundra vole assemblages here.

Ráckevei-Soroksári-Dunaág (RSD)

The region of RSD is a priority recreation area with significant natural values and national protected areas. The recreational value of the region is very much enhanced by the RSD's proximity to Budapest, additionally RSD has relatively stable and regulated water level with low flow rates, which gives the Danube-branch a lake character.

The RSD is popular fishing water also. Providing good water quality is key question in connection with the protection of natural values and areas used for leisure, recreational purposes. However, water quality of RSD is now burdened with numerous problems. Waste water from the UWWTP of South Pest, from the catchment area and the riparian strip is significant nutrient pressure. Alluviation, low water level and bad flow conditions results in areas of stagnant water. In the recent years as a result of these problems water quality became critical in many cases mostly due to the lack of oxygen. This has contributed to death of numerous fish, shellfish and snail species.

A) The project (KEOP-2.2.1/2F/09-2010-0002) -„Improvement of water management and water quality of Duna-branch and pollution removal from the riparian strip"- aims to achieve good ecological potential in the RSD.

The four planned stages of the comprehensive water protection project are the following:

1. Dredging and sludge disposal
Firtsly this stage aims to dredge and remove approximately 2 million m3 sludge (of 55% average total solids) which has deposited for several decades. Secondly temporary, final placement and utilization of the sludge have to be solved.

2. Hydraulic structures building and reconstruction
Safety operation is needed which provides adequate water quantity and quality in the Danube-branch. The Tassi drain structure has to be rebuilt because it was destroyed in flood in 1956. Furthermore reconstruction works have to be done by two existing big structures: Kvassay sluice and Tassi navigation lock.

3. Waste water transfer
Purified waste water from UWWTP of South Pest is transferred through underground (DN 1600 mm) canals into the main Danube arm.

4. Riparian strip project
The measures aims to abolish the direct pressures of the Danube branch coming from illegal sewage discharge of recreational areas and remove pollutants from the riparian strip.

In the period of 2007-2013 only the Riparian strip project was supported by the European Union. The other project elements will appear on agenda in the new program period which begins in 2013.
B) Improvements in UWWTP of South-Pest operated by FCSM Company

The new Organica® fixed-bed biofilm activated sludge technology system has been operating since 2012. The former chlorination technology of purified waste water was replaced by much safer and environmentally friendly UV disinfection. The project was carried out in-house, the total cost was 1.3 billion HUF.

C) Rehabilitation of Taksony-Island Branch
In the context of KMOP-3.2.1/09-2009-007 project dredging and disposal of 41,802 m^3 sludge were carried out in the 2,700 m long oxbow. These measures contribute to the survival of the oxbow lake.

As good lake management practice RSD shows positive trend with new improvements related to nature conservation and ecological status, however the realization of the planned activities has to be continued.

Kolon-tó

1988-89: 6.5 ha dredging, new project: The lake is Natura 2000 site, and Ramsari site. The project (since in 2010) has aimed to protect and ameliorate the natural values of the lake. The main targets were to safeguard the water stocks of the lake and that it can ensure its nature protectoral tasks. The rehabilitation of the open water surfaces, of the bogs and fens, and the maintenance of the bordering endangered Junipero-Populetum sandy grasslands were the main steps in the project.

Open water mosaics that ensure the variety in the habitats were created by dredging (ca. 40 ha) and red-cutting, invasive species were removed from the area (from 288 ha). An island for bird nesting was built.

Protected species gained better and bigger habitat, ecological processes got more stable.

Riha-tó

The National Park Directorate Danube-Drava (NPD-DD) collaboration with National Park Kopácsi-rét (Croatia) has elaborated a wetland-rehabilitation on Riha-lake in 2003-2004, which is part of the National Park. The Lake is the late oxbow of Danube, which hasn't nowadays direct connection with Danube, water-supply come only from Mohácsi-sziget inland-diversion- network. The Oxbow-lake was used earlier as fish-lake, in this reason were separated to 3 lake-units.

The rehabilitation was necessary on the one hand because of strong alluvium, on the other hand water-regulation works got in wrong status to trusteeship of state and NPD-DD. Canal-section of inland water filled up fully, consequently it was not possible to fill up lake with water. The culver between oxbow-sections were fill in as well and not allow water-flow among lake-units. In frame of rehabilitation were carried out: inlet-canal dredging, reconstruction of inland-water and retention works. Paving between 2 lake-units were tear down, therefore water-circulation is free. Section with strong alluvium were dredged on so-called Kis-Riha, so increased open water rate. Operation-program of inland-water diversion was agreed with operator of inland-canals to achieve goals: more water to get into the oxbow-lake. 20./2. In frame of the EU ETC South-East European Cooperation Program (SEE) 12 operators of protected area from 7 countries –amidst NPD-DD- compete successfully for formation of DANUBEPARKS project. Within the confines of DANUBEPARKS project NPD-DD had to do dredging of Kutas-canal- part of the Nyugati- főcsatorna to ensure water-supply of Riha-lake. This action will serve as speed and straight diversion of precipitation in winter-term and fill in to optimal water-level.

Balaton

The Lake Balaton is Hungary's largest standing water which represent high values in recreation, drinking water supply, nature protection and is a significant landscape element.

The first notable usage of the lake started in 1863 when at the source of the Sió river a sluice was built. It helped to regulate water levels in the lake.

After the stabilization of the water level several measures were taken around the lake: inflowing water courses got regulated, shore line of the lake was strengthened, the water shed got meliorated and agricultural use begun.

The nutrient-load from the catchment area of the lake increased as a consequence of developing civilization, urbanization, tourism, industrial developments and intensive agriculture. It was followed by the growth of internal loads and the accumulation of organic substrates. Eutrophication speeded up. Cyanobacteria- eutrophication was frequent, bacterial problems happened in the buffer zone, extent weed-problems and in more cases fish-destructions were observed.

Comprehensive Water-management Conception for Balaton was prepared in 1971, then it was followed by the Water-management Development Program for Balaton (BVFP): developing tasks got subordinated of water quality improvement.

„Kis-Balaton" water-protection system section I. got ready in the mid of the 80's. It is a lake and bog system at the mouth of the most significant inflowing river (Zala), which can be find at the western part of the lake. It made possible to remove the main part of the different loads from catchment area. The 1st part of the system was ready in 1985 (Hídvégi-lake). The second part's building started in 1984 and is still under construction.

Since the mid of the 1990's significant improvements of the water-quality were done:

- Fine layer-dreging of Keszthelyi- bay to promote water quality
- Expansion of waste-water canal-network and treatment-capacity (Implementation of Waste-water Program)
- Eduction of drawn waste-water from catchment area
- Development of the rate of the population-attach to sewage system
- Water-regulation according to environmental and nature-protectoral conditions
- Water quality protection works for inflowing water courses of the Balaton (filter zones by mouths, sediment ponds)
- Building reservoirs on water courses
- Melioration
- Forestation (erosion-protection)
- In the improvement of the water quality external conditions took also significant part:
- Ownership structure in the agriculture transformed after the change of regime, the use of chemicals got moderate, animal husbandry on the catchment nearly disappeared, so their significant polluting effectsdiminished, too
- Decrease in industrial production, part of industrial companies were liquidated, in this way industrial pollution decreased significantly as well

Since the March 17. 1989. the lake became a periodically protected Ramsar area, in summer it can be used free by the tourism.

2000. CXII. Decree: Balaton decree is the first regional legal-source on decree level, which includes landuse-rules as well. The law promote efficient protection of ecological status and nature values in the this significant part of recreation.

2006. Life Balaton project: implementation of the water-quality monitoring-system.

Velencei-tó

The Velencei Lake (Velencei-tó) is the second largest lake in Hungary. Until the end of the 1950s the lake wasn't modified. Only the overflowing waters of the surface outflow were driven into the canal „Dinnyés-Kajtori-csatorna" after 1892. The construction of the canal was decided in 1880, in 1903 a weir, in 1928 a sluice was built to regulate the outflow.

The recreational and sport needs appeared at the end of the 1950s; in 1971 the Development Programme for Lake Velencei was adopted. Its main goal was the revitalization of the bog-like lake (to stop and reverse the eutrophication), develop it into a place of recreation and sports.

Measures that took place:

- Reeds bed dredging: the 60-40% reeds-open water rate changed to 40-60% reeds-open water rate,
- Shore and bed regulation,
- Regulation of inflowing brooks,
- Sedimentation pond (on the Vereb-Pázmándi-vízfolyás (brook)),
- Capacity raising of waste water treatment and canalization (implementation of the Sewage programme),
- Purified sewage outtake from the river basin,
- Increase the rate of the connected inhabitants of the canalization,
- With the goal to ensure the balanced water management of the lake, the Zámolyi reservoir (Zámolyi-tározó) was built on the river Császárvíz in 1970. It was followed by an other reservoir building on the same river in 1975, under the name Pátkai reservoir (Pátkai-tározó).

Some of the measures didn't have the desired outcome; others became disputable under the present scientific knowledge and social needs. Due to the measures the water quality of the lake improved but also changed regarding the former status.

The government made a new legislation in 1995 (1031/1995) which contains the recreational goals of the lake but also handle the nature protection and the water quality improvement. It lasted until 2010.

Other goals:

- Crucial points are the stabilization of the water level in the lake, water supply to ensure the recreational needs taking - into account the ecological water demand.
- Under the task of the protection of the environment are the reeds and fish management that are influencing the biological balance of the lake. Recently – depending on the weather – reed harvesting is usual in winter.
- The lake has on its south-western area extended reeds, this part is under nature conservation
- Legislation: Regional development programme of the Lake Velencei – Vértes Special Recreational Area (1117/2005. (XII. 14.)

Zámolyi-tározó

The Zámolyi-reservoir is not designated as a separate water body according to the WFD, it is regarded as part of the Császár-víz water course (AEP380). The Zámolyi-reservoir's barrage was built at the border of the village Pátka, in the section 15+610 km of the Császár-víz. The catchment area is 248 km^2, upper part belongs to the mountain Vértes.

The reservoir started to operate in 1971, the main aim of its building was the water level regulation of the Velencei-tó, which is of recreational importance. The reservoir stores water of the high level periods, prevent the Velencei-lake from too high water levels but also mitigate here water deficits in summertime.

It is the upper element of the water-supplementation system and has direct connection with the Pátkai-reservoir. The volume of the Zámolyi-reservoir is 4,5 million m^3, which can temporarily be increased with the periodic retention of flood by 3.3 million m^3.

The reservoir in its current condition can't ensure the complete removal of the pollution from crossing waters (it should solve settling, filtration, and disposal). Additionally nature-protectoral aspects can't be ensured so that protected, specially protected, resp. Community Importance Species, their nests and nestlings are frequently damaged trough water-level fluctuation.

The investments of the project aim to mitigate the problems. Main objective of the project is to harmonise the previous investments (reservoir, forestation) on the water shed, which transformed the habitats and run mainly without any nature-protectoral aspects, with the objectives of the European Union, namely to achieve good ecological status.

The projects „Habitat-reconstruction-investments in Nature-park Vertes" I. and II. aim to build a pre-settling tank in Zámolyi-reservoir, to regulate the Császár-víz (the water course of the reservoir), to eliminate the melioration canals, and to rehabilitate forests and lawn.

Results of the projects are the follows:

- With the slow-down of the water release stabilise the assemblages of protected flora and fauna,
- Improve ecological status in the area
- Barrage building to ensure extra storage
- The slower water release from the reservoir passes more to the natural life-cycle of living organisms. These habitats of a better status ensure more the reproducing and alimentation conditions, increasing the biodiversity.
- The slow and periodic release from the upper part of the reservoir allows the removal of formed biomass with a nature protectoral handling (grazing, reaping, reed-cutting), consequently the natural organic matter accumulation and eutrophication slows down.

Lázbérci-tározó

The Lázbérc reservoir was constructed in 1969 primarily to meet municipal water demands from the region of Ózd, Kazincbarcika and the Sajó-valley. The reservoir has been operating since 1970.

The reservoir is located in Borsod-Abaúj-Zemplén County. The connecting waterworks was built below the dam of the reservoir, in the widening valley of Bán-Creek.

The waterworks provides healthy water supply for 130 thousand people of 24 settlements from the town triangle of Ózd-Putnok-Kazincbarcika.

The water production plant consists of the Lázbérc reservoir itself, the installed surface water intake structure and the purification technology.

Good lake management practice concerned mainly the new technological improvements from 1974 in connection with providing healthy drinking water.

In 1974 as first development, Cyclofloc patent implementation began with expansion of capacity from 16,000 m^3/h to 24,000 m^3/h. In 1988 a TIBEAN aerating device was installed. From 1990 the new polyaluminum-chloride flocculant BOPAC, developed and manufactured by Hungary was used, however problem of algal growth was not solved.

To reduce algal populations engineers former made efforts to improve sand filtration. Two sand filters were transformed to contain two layers (sand and hydroanthracite), but the development had not met with the expectations.

In 2002 the Management decided to test membrane filtration. Preliminary experiments demonstrated that application of active carbon filter is needed. Membrane filtration system has been operating since 2006 on the place of the former aeration device. Between 2010 and 2011 further capacity extension has done, now the plant works with 24,000 m^3/h filtering capacity.

Due to the new improvements healthy water supply is available in long term due to the ultrafiltration and technological developments; furthermore chemical load of consumers has significantly decreased.

Gyöngyös-Nagyrédei-tározó

The reservoir of Gyöngyös-Nagyréde is an artificial structure with the main aim of flood storage and run-off regulation. Also fishing is locally important on the lake. The water level, the volume of the stored water and the lake surface highly depends on the available water quantity, parallel to the run-off regulation rules.

Since 2010 water quality has been measured by the Nord-Hungarian Water Directorate, with the help of a non-accredited small laboratory. Yearly measuring frequencies vary that makes averages uncertain.

Data of the Gyöngyös-Nagyrédei-tározó (source is the non-accredited laboratory) in 2011 (2 samples average): pH:8,34, Ammonium (mg/l): 0,3, Nitrate (mg/l):<1, Nitrite (mg/l): 0,015.

The reservoir was built on the Tarján-patak (water course name) in 1975. The total river basin takes 70.3 km^2. Main discharge values are as follows: Q1 % = 42.0 m^3/s, KÖQ= 239 l/s. The area vary between 25-42 ha and the volume between 0.6-1.2 Mo m^3.

The rehabilitation of the reservoir was implemented in 2012. Works done were as follows:

- Dredging of the sludge deposits
- Rehabilitation of the engineering structures of the reservoir.
- Gaging station building for discharge measurement
- Revision of the operational rules of the reservoir, new regulations:
  - The highest operational water level was decreased by 1.5 m. It allows a better implementation of the main function of the reservoir that is the flattening of the flood waves.
  - The responsible authority also requires that the regulation rules of the reservoir contain concrete numeric data for the ecological water quantities, prescribe the gaging and documentation (also their technical parameters) of discharges of inflow and outflow.
  - The discharges of the Tarján water course downstream the reservoir can't be less than the sanitary flow. If the discharges upstream are less than the sanitary flow, all the discharge must be led to the downstream part.
  - The reservoir can only be uploaded by high-water level, taking into account that the ecological discharges are ensured downstream.
  - Recovery, if it requires water level reduction, can only be made between July-September. It is the period where protected fauna of the lake is not endangered.
  - Only native tree species can be planted along the shore.
  - Waste water and waste must be handled according to the updated regulations.

K-XI-tározó

K-XI reservoir is the part of Nagy-Sárrér region and it is located in Hajdú-Bihar County. The surrounding area is a characteristic landscape of the Berettyó-plain. The aims of the former reservoir construction (water supplementation and fish farming) have been completely changed for now. Originally it was built as isolated area because of fish farming. Currently the area is part of the Natura 2000 Network and Important Bird Area.

Before the measures ratio of open water area had gradually decreased. The reason of water level decrease was damaged structures which could not maintain the desired water level. Therefore ecological water demand also was not provided. Water level decline was followed by plant communities by which the amount of open water area had significantly decreased and shallow feeding grounds had disappeared of protected bird species. There had been no hydrological (water depth) and morphological barriers for spread of reed, bulrush, reed-grasses stock. Mitigation of species was transversely inhibited by integrated structures, food preference was limited.

In this case good lake management practice was providing needs of protected birds nesting in the area. Related to this target external environmental factors had to be changed so that required amount of water becomes available in the area. Ecological water demand was interpreted as the amount of water which provides living conditions in the area without restriction and is required for regular and continuous maintenance of their typical structural and functional features. For determination of ecological water demand water balance of the reservoir have to be considered.

As the results of measures structures responsible for uploading, regulating and draining have been renovated, green corridors were constructed to ensure free natural migration of species. To achieve good morphological conditions the river bed has been sunk. Forming of new vegetation was also regulated. Flora restoration involved creation of habitats with reed-grasses, marshes, sedge and thinning of bulrush. Ecological regulations as the finest methods were the last steps of the remedial works. In this stage regulation of species composition living in the above mentioned habitats has been done, furthermore green corridors have been set related to water flow and turbulence.

Tiszadobi Holt-Tisza

The oxbow is located in Hajdú-Bihar County. Tiszadobi Holt-Tisza was separated as a tributary of River Tisza during its water regulation works. Water supply comes from mainly groundwaters which are related to the surface water. When water supply was less because of low water level then surface water was transferred to the area by culverts in case of higher water levels. Originally alders swamp formed in the oxbow by which degradation started due to the surface water endowment.

Recognised this phenomenon surface water endowment finished in 2006, now water supply comes from groundwaters again. The area containing the alders swamp was delineated so the water level has stabilized. In this case good lake management practice was providing appropriate conditions for the maintenance of alders swamp.

Tisza-tó

Lake Tisza (Hungarian: Tisza-tó), also known as Kisköre Reservoir (Hungarian: Kiskörei-víztározó), is the largest artificial lake in Hungary. As part of the on-going Tisza River flood control project, it was built in 1973. Its filling was finished in the 1990s, resulting a 127 km² lake. The lake is 27 km in length, with an average depth of 1.3 m and a maximum depth of 17 m; it contains 43 km² of small islands. Following the reservoir's completion, Hungarians began to flock to the site for holidays. As a result, tourist infrastructure has been developed on the reservoir—renamed Lake Tisza—and the government has designated it an official tourism destination. The lake (or reservoir) has a new local ecology with a diversity of birds, plants, and animals. The lake is more and more regarded as an important area of nature conversation. There is regular WFD compliant monitoring on the lake. The Tisza River and its expanded space, the Lake Tisza are state property, therefore the Hungarian state is responsible for maintenance of the lake (e.g. drainage of harmful excess water, providing water for irrigation in dry periods, establishing and maintenance of adequate ecological conditions and values in use, improving social status).

The complex project of Lake Tisza

The state of Lake Tisza and the related water management system had been deteriorated in the recent decades which caused water quantity and water quality problems. The reservoir and its related facilities play important role in the lowland water management, therefore measures are necessary which maintain the proper water capacity, water quality, economic usefulness and preserve the precious ecological status. In order to maintain the long-term natural balance of the reservoir the following measures are essential: dredging of the buried sections of flushing flumes and reconstruction of regulation structures.

The biggest investment of the Lake has begun at the end of 2012. The total cost of the investment is approximately EUR 22 million and it is supported by the Hungarian Government and the European Union. The project aims to restore natural status by water bodies related to Lake Tisza and increase the capacity of the reservoir. Furthermore the development includes the following measures:

- structure reconstruction of Keleti-főcsatorna
- abolition of silting in the river mouth
- regulation structure reconstruction in order to provide water demands of agriculture, fishery and fishing
- structure reconstruction of Szarvas-Káka pump station, irrigation system of K1 main channel, the flood gate of Nagykunsági-főcsatorna
- development of a modern regulatory-control system

Building of a new fish ladder has begun by Kisköre barrage, between the main dam and the foreshore dam. Considering its size the fish ladder belongs to the most unique investments of Hungary. Due to the new structure mobility of aquatic fauna will be ensured, the ecological relationship between upstream and downstream habitats will be available. Construction has begun, and will have been finished by 2013. During a monitoring period after the works it will be examined how popular and used the new place by fishes is.

<u>In the individual basins of the lake:</u>

The Tisza-tó project indicates the layer dredging in the **Abádszalóki-basin** of the Tisza-tó. After the fulfilment, lake rehabilitation programme will be realized.

The Tisza-tó project indicates the layer dredging and the reconstruction of the water level controlling structure in the **Poroszlói basin** of the Tisza-tó. After the fulfilment, lake rehabilitation programme will be realized.

The Tisza-tó project indicates the layer dredging the shore strengthening in the **Sarudi basin** of the Tisza-tó. After the fulfilment, lake rehabilitation programme will be realized.

The Tisza-tó project indicates the removal of sludge by dredging in the Aponyhát-csatorna (canal) and Eger-patak, but also the reconstruction of the water level controlling structure in the **Valki basin** of the Tisza-tó. After the fulfilment, lake rehabilitation programme will be realized.

Alcsi holt-Tisza

In the main canal that supply the oxbow lake with water, the sludge will be removed by dredging. In the lake, shore strengthening and the reconstruction of the way of the water supply will be done. After the fulfilment of the project, further projects are needed to reach the GEP.

Szarvas-Békésszentandrási-holtágrendszer

1. Inland water regulation system developement in Szarvas – still on-going, in 2013 contracting
Oxbow lake bed rehabilitation, amelioration of flow conditions at works

The project site is the Szarvas-Békésszentandrási-holtágrendszer (holtágrendszer = oxbow lake system). The lake is mainly used for inland water treatment: receive, store and lead it away. The river basin of this oxbow of the Körös river takes 926.8 km^2, of it 350 km^2 is situated on deep floodplain.

The main aim of the project is the efficiency improvement on the inland water run off beside the amelioration of water quality, hydraulic conditions and ecological status. These targets are worked out in 3 project elements:

- Lake bed stabilization
- New work building in Anna-liget that (replacing the previous sluice) helps in water regulation
- Reconstruction of the sluice at oxbow mouth. This structure regulates the water level in the lake and helps the pumping to be more efficient. The improvements of the water regime will signiphicantly reduce the algal blooms (by 15%) and the overgrowth of water dependent flora (7%). It will also improve hydraulic conditions and water quality. Water storage capacity will be increased by dredging.

2. Habitat improvement on the Szarvas-Békésszentandrási-holtágrendszer aiming the protection of native fish fauna and other populations (September 2012 – April 2015)
The project aims to protect this Natura 2000 site by conservation and improvement of the positive natural conditions, and by protection of the important species and their habitats. The main steps of the projects:

- Reconstruction and capacity building of the siphons in Szarvas
- Dredging of 1.6 km length
- Construction of natural spawning site

Indicators: Project planning 25,825,287 Ft (86,000 EUR). 207 ha quality improvement of water related areas, 1,416 m dredging, removal of invasive woody elements on 9,630 m^2, 11,570 m^2 lake basin building with natural flora, setting on site of 6 zander (Sander lucioperca) nests, 7 siphon reconstruction, 1 new siphon building.

3. Reduction of contamination from waste water: The WWTP of Szarvas is under complex development (2011-2014) (4,840,000 EUR, capacity 3500 m^3/d, 21,525 inhabitants)

4. The WWTP of the settlement Kondoros is under capacity building, just like the settlement's sewage network (started in 2010) (4,250,000 EUR, capacity 550 m^3/d, 5,381 inhabitants).

Nyirkai-Hany

The Hanság -főcsatorna (Main canal), Rábca and Kis-Metszés-csatorna make possible the water supply on the Nyirkai-Hany. The reconstruction of the area was decided because no protected species were any more present, but on this Hany (old Hungarian name of water related areas) renaissance of an old wetland was ideal. Water level could be quickly increased. In 2001 the needed sluices and dams were built.

The main aim was to ensure nestling and feeding area for birds. In the first year native species of the Hanság area (fishes, Mollusca, plants) were settled. In the 4th year the vegetation stabilized and a succession was hoped on the fen. Contrary to it, succession slowed down and water related vegetation started to decay. Open water size grew which was due to the high water levels and herbivorous fishes. Three parts of the area can be handled by different hydraulic operation that makes possible to have different water levels on the reconstructed area. To maintain the diversity of the bird population fish regulation is necessary such as the water level regulation that takes into account the seasonal changes.

Kisinci-tó

The water supplementation of the Cún-Szaporcai oxbow lakes will be realised from the river Fekete-víz, building at the rkm 6+420 an impoundment. Through a channel can the water be directed to the lake, this channel is equipped with 3 sluices, 1 fish rack and 1 gauging structure. Also monitoring structures are built to measure water level, groundwater level, water intake. First aim of the monitoring is to ensure the good water management and regime in the lake.

Újszegedi Holt-Maros

The oxbow lake, Újszegedi Holt-Maros was generated in 1860 by the transection near the Maros river mouth in the area of Újszeged (in Szeged city). The area of the oxbow is 10 ha, it is 4 km long with an 25 m average width and 1.5 m average depth. It is the main receiver of the inland precipitation.

As the time passed more and more new houses were built, but sewage treatment plants were not built parallel with the public water supply constructions. Waste water was conducted to the Újszegedi Holt-Maros. The oxbow receives also leachate from thermal wells. As a result of these, the water and mud became highly polluted. There were vegetation overgrowth and unpleasant odour near the messy riverbank. The river bed was dilapidated, it was full of garbage and covered with reed. The oxbow silted up, anaerobic degradation began. The aims of the oxbow rehabilitation project were the following

- development of good basin conditions similar to the initial, natural state
- secure rainwater storage
- development of wetlands for ecological and recreational purposes
- landscape rehabilitation

The rehabilitation works were carried out in two stages. The first stage from 2000 to 2001 consisted of river bed rehabilitation works, constructing of rainwater treatment and discharge structures, building of a new pump station in the river mouth. In the second stage the formerly mentioned structures were built in, rehabilitation works of landscape and environment were implemented and works of water endowment system also finished. During the planning the experts sought to remove the large amount of contaminated sludge, to maintain the size of the reservoir and to provide the sufficient depth in order to ensure the self-cleaning process. During the works the river bed of the oxbow was cleaned and arranged, the unauthorized wastewater discharges and landfills were extinguished, leachate coming from thermal wells was excluded, the waterfront became well-groomed and a promenade was built.

After removal of the bottom sediment the river bed surface had to be conditioned with a bactericidal substance than it was covered with zeolite.

Referred to utilization the oxbow has the following functions:

- Holiday and recreational use,
- Fishing,
- Rainwater storage.

Hévízi-tó

KEOP-3.1.2/2F/09-2010-0002 „Habitat protection and reconstruction in the Lake Hévízi" project description:

The Lake Hévízi is a special natural phenomenon: it is turf bedded thermal source lake with a specific ecosystem which makes it unique in the world. The lake and the bog around is the habitat of many animal species protected in the country or in the EU. The reconstruction of this nature conservation area made the long term maintenance possible.

With the habitat reconstruction on the bog the main aim was to ameliorate the connection of the bog and the lake. The habitat gives place for 17 higher animals and 10 (only living in Hévízi Lake or known from very few spaces of the world) microscopic species. Direct interventions were done on the northern outlet and the lake: sheet pilling was removed and natural reed-sedge bank vegetation was created (on 320 m around the lake, 69 m on the whole length and both sides of the northern outlet, 515 m around the lake the old sheet piling reconstruction to prevent wash out. In all, the sheet piling was torn down on the half-length. Habitat reconstruction are made on 4.59 ha.

The water regime of the surrounded area ameliorates, natural habitats increase, species of the natural vegetation settle back. On the new habitats native but disappeared species can be settled, p.g. Comarum palustre. The turf bog is the protecting system of the thermal bath, with the mechanical and chemical filtering features it significantly reduces the pollution load of the lake, but it also contribute to the thermal regime regulation. The turf getting into the lake, as floating material reduces the irradiation, this way helping to regulate the toxic algae concentration and the structure of the species in the lake having curative power.

The project will also mean cost savings in the annual maintenance that contribute to the reconstructional needs per 15 years too.