Central Union of Municipalities in Greece

PROVIDING SUPPORT SERVICES IN THE DESIGN AND IMPLEMENTATION OF PROJECT ACTIVITIES

“Joint Water Resources management System for Long-term Efficiency - WRESTLE’’

In the framework of the implementation of the "INTERREG V-A Greece - Bulgaria 2014-2020" Cooperation Program

Deliverable 3.2.1: Good Practices identification & assessment

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1. Introduction

1.1. Water Resources Management

Water is a renewable but at the same time limited resource. It is one of the most valuable natural resources and its existence is directly connected to livelihood. Apart from that, water is significant due to the fact that it fulfills a number of important environmental functions. However, due to different reasons (e.g. pollution caused by urban, industrial and agricultural activities) the available water quantity is limited and its distribution is uneven. Therefore, prudent and rational use is required and it has to focus on an integrated approach that treats each use interdependently. For this reason, good practices implementation is imperative.

Water resource management is defined as the process that promotes the coordinated development and management of water and relevant resources in order to maximize the economic and social utility that is generated for the sustainability of vital ecosystems in a fair manner. Protection, preservation and rational exploitation of surface and ground water resources, control and constant monitoring of quantitative and qualitative parameters of water bodies as well as estimation to address environmental impacts constitute the primary goals for water resource management.

Water Framework Directive (2000/60/EU) was published on December 22nd 2000 and aims to establish a framework for Community action in the field of water policy. Achievement of the goals by all Member States is planned to be done on a pre-defined timeframe from 2002 to 2015. The main objective of the Directive is to upgrade and protect the quality of water resources to a large environmental extent.

1.2. WRESTLE Project

WRESTLE Project (Joint Water REsources management System for Long-term Efficiency) started being implemented in 2018 and it is going to be completed in 2020 and Lead Beneficiary is DEYAA (Greece). The overall objective of the project is to design and implement a Joint System in Greek - Bulgarian CB area for the sustainable management of the CB water resources available. The Joint System will facilitate protection of water quality/quantity and ensure efficient use in response to EU Directives and National legislative acts.

In the context of the project new methods related to water management will be jointly developed and adapted to the CB area conditions. Already developed and available information technologies will be exploited in order for project beneficiaries to implement a Joint system for monitoring water resources efficient use in order to minimize misuse/overuse of the resources or network leakages and prevent any other unpredictable failures of the current system that lead to a huge waste of resources on a

yearly basis. Moreover, providing a holistic approach, beneficiaries will work together in order to analyze the cross-border existing conditions and jointly develop a common cross-border approach for sustainable water management contributing to the adaptation of the Water Framework Directive requirements. The project will provide CB competent authorities and involved stakeholders with a detailed policy guide both for short-medium term and long term achievements.

Project activities will also include the integration of successful approaches and best practices in water management by both sides. Aiming at enhancing sustainable attitude towards water resources the project will also promote "green behavior" to targeted stakeholders and actors of the CB area through the implementation of an information and awareness raising campaign. The Campaign which aims at cultivating a responsible behaviour both in terms of efficient use of water resources as well as preventing pollution and quality/quantity deterioration will be addressed both to the general public as well as to specific target audience. The project's expected benefits include the conservation of water resources through the use of new technology, the reduction of operational and managerial costs of the drinking water and irrigation networks, the prevention of potential accidents and the increased citizens' sense of security and safety.

It is worth mentioning that the four organisations that participate in this project and manage a big part of the water in CB area are going to follow the instructions of the WFD, ensuring ecological patterns in this area. Finally, it is expected to reduce operating costs in drinking water and irrigation networks through the use of information technology, early prevention of possible accidents and leaks, and cultivation of rational and efficient use of water.

2. Good Practices

The term 'good practice' is used to indicate a tested process or action practically proven to be more effective than others when applied under specific conditions. Such good practices are meant for the Municipalities, their better organizing, to be directly applied after the necessary adjustments with the aim of better fulfilling a given local need. They are named good practices because they introduce innovation, yield results, are sustainable, can be 'copied', are transferable and easy to utilise. The term 'good practices' or 'best practices' or 'effective practices' is used to indicate a tested process or action practically proven to be more effective than others when applied under specific conditions.

According to the European Union, the main characteristics rendering a set of practices 'best' are the following:

- innovation, when a new creative solution is proposed which is also accompanied by a realistic implementation policy,
- effectiveness, as the proposal is actually feasible,

- sustainability, proven by how long the results last,
- easy reproduction, implementation under similar or identical conditions, and
- transferability, more specifically implementation in different environment by new users who want to adopt the practice.

3. Energy and Water Resources Management

In sustainable urban development, energy savings must keep up with water saving. Some examples of countries that have applied energy saving in conjunction with water saving are mentioned below.

- In **Germany** energy saving interventions have resulted in a reduction in energy expenditure in buildings as well as the electricity required for building air-conditioning. Water abatement facilities include innovative toilets that work with solar energy as well as modern wastewater treatment systems which are considered as a renewable source from which energy, resources and water can be recovered.
- In **Berlin** energy and water saving actions have been implemented and in particular it concerns: 40.000 m² green roofs, 2,550 m3 of water in 4 tanks for fire protection and toilet use, etc.
- In **Spain**, a greenhouse has been created to restore the evaporated water.
- In the **Netherlands**, 57% of all water supply systems is regulated by a flow control prediction model, while the remaining 43% from a conventional flow control system.

4. Ways of sustainable water resources management

4.1. Exploitation of unconventional water resources

Exploitation of unconventional water resources can be the key to resolve the issue of insufficiency and availability of water resources. Alternative water sources include rainwater recovery, flood water utilization, gray water recycling, artificial groundwater enrichment, re-use of treated urban waste water effluents and desalination using RES. As European and international experience shows, the great value of alternative resources, water recycling and reuse technologies are expected to grow at an increasing rate in the coming years.

1. **Rainwater**

Particular attention should be paid to the recovery of rainwater in urban areas, where it is essentially lost in the rainwater or dirty networks. Recovery and utilization of rainwater can be achieved by small and local scale interventions. In urban environment, rainwater collected from rooftops or pavements

and stored in tanks, is used for secondary uses. An important advantage is the flood protection of the urban area, while the urban networks are also protected by the peak supply.

Collection and exploitation of rainwater is a practice that has been adopted by many local authorities in areas with limited rainfall. The rain water collection system includes the following procedures: 1. Construction of a collection area made of waterproof material on ceilings of municipal buildings 2. Construction of storage where the collected water is stored in periods of drought 3. Construction of a transport system used to transport the water collected in the storage 4. Disinfection of collected water which is required when it is used for consumption.

2. Flood water

Urban areas produce significant amounts of flood water and those that come from roofs are considered to be the best. The drainage can be extremely variable, while for the containment and mitigation of its size, creation of rainwater containment / infiltration water bodies, construction of a porous pavement as well as creation of green areas and wetlands are recommended. The use of flood water is an alternative source of water resources for irrigation of parks, suburban green areas, urban cleaning, industrial uses, as well as wetland conservation, biodiversity protection and groundwater enrichment. Decentralized flood protection and rainwater collection in surface watercourses are good options for flood water utilization, mainly in the technical enrichment of underground aquifers.

3. Gray Water

Gray water constitutes an important alternative source, as after a small and appropriate processing can be re-used for selected household uses (mainly in the toilet), urban uses and irrigation (eg. garden and parks) replacing the use of drinking, clean water where its high quality is not necessary. Especially in public buildings gray water recycling systems application can lead to significant water savings.

The technologies applied for the management and treatment of gray water include physical, chemical and biological treatment systems. Most of these technologies are based on the principle of separating solids from liquids as a first step and disinfecting the liquid as a final step.

4. Artificial groundwater enrichment

The objective of artificial enrichment is, along with the construction of appropriate arrangements, to store water for future use, reduce losses through evaporation and drainage, increase / stabilize the level of aquifers in overexploitation conditions, normalize supply-demand fluctuations and improve the quality of available water. Moreover, a further goal is to limit wrecking and maintain the ecological provision of the rivers. Artificial enrichment is advisable in cases of uncontrolled land

reclamation and over-exploitation of groundwater and acts as a method of cleaning and storing water that has already been used for re-use by creating underground storage.

5. Wastewater management

There is a new perception regarding wastewater and it has to do with that it is considered to be a renewable source from which energy, resources and water can be recovered. Current trends refer to the re-use of effluent for irrigation, enrichment of underground aquifers and energy production. Crop irrigation is the best way to reuse sewage because it avoids degradation of the recipient water quality. Other positive aspects of the use of treated urban waste water for irrigation are the possibility of green areas creation, the desertification of fertile soils avoidance and irrigation and fertilization of recreational areas. The utilization of treated water needs to be recognized as a priority and obligation of wastewater treatment plants and should be integrated into the environmental conditions of the units.

Re-use of waste water effluent is not widespread at European Union level. The lack of the promotion of re-use of waste water effluent results in the lack of a single legislative framework for water recycling. Nowadays, treated wastewater recycling for irrigation is widely applied in some European Mediterranean countries, such as Italy, Spain and Portugal.

6. Desalination using Renewable Energy Sources (RES)

Desalination, although it is a proven way of producing freshwater from the sea or brackish aquifers, which seems to be able to resolve anhydrous island regions, must be the last choice for two main reasons: (a) due to the significant amounts of energy (40-75% of the operating cost of the plant) and (b) due to the environmental damage to ecosystems and consequently to marine organisms caused by the uncontrolled disposal of processing waste. The introduction of RES in desalination plants reduces pollutant emissions and energy consumption as well as the operating costs of the units. Solar thermal systems, photovoltaics, wind energy, wave energy and geothermal can provide thermal, electrical or mechanical energy. Desalination can also be used in remote islands and rural areas for small-scale applications. Hybrid water desalination systems are included in modern trends at international level.

4.2. Good Rainwater Practices

In the Cyclades, rainwater recovery actions were carried out with 19 new installations and the repair of 20 existing rainwater collection systems in selected public buildings. A pilot installation of a gray water recycling system has also been implemented. The program included water-saving actions by distributing water-saving equipment to island households with acute water scarcity problems. Local actions were taken to train artisans, students, teachers, and targeted awareness campaigns for the

general public were carried out. The estimated water benefit per year from the implementation of this program amounts to 8 million liters.

In Germany, rainwater is retrieved and used for household uses such as toilets and laundry. **In Canada** small streets of the city have been designed so that rainwater is led to artificial ponds made up of permeable materials to easily absorb water as well as in vegetation-filled urban parks. In this way the rainwater is cleaned before being absorbed by the soil.

4.3. Good Flood Water Practices

In Australia, flood water is stored in brackish aquifers through drilling to increase the availability of good quality irrigation water for environmental use. In public buildings **in India**, flood water is directly directed to replenishment of groundwater through infiltration, drilling and wells. This practice not only replenishes aquifers, which are often under overexploited conditions, but at the same time introduces good quality water to often polluted groundwater, improving their condition.

4.4. Good Gray Water Practices

In Morocco, Italy and Turkey large-scale purification of gray waters in artificial wetlands is being carried out to achieve specific quality objectives so that they can be used for irrigation. **In Cyprus**, the CYPROBELL water recycling system has been developed since 1985 and its installation has been achieved with a government grant of € 3,000 in 2009. After using this system, water is suitable for garden irrigation and / or use in toilets in order to save drinking water.

4.5. Good Artificial Enrichment Practices

In Kenya there is an underground water storage system, while **in Sierra Nevada (Spain),** the aquifer is recharged with irrigation channels, a system that does not require complicated infrastructure and can be easily applied to areas with hard rock. **In Hungary**, in areas with increased drought and water scarcity, the underground horizon is enriched by penetrating through the watercourse bed to produce drinking water. There are large-scale infiltration basins for enrichment of underground aquifers **in Florida**, while **in California**, infusion wells have been built to support groundwater.

4.6. Good Recycling Practices for Wastewater Outputs

Israel re-uses 75% of waste streams and **in Germany**, various types of toilets are installed, separating urine from the rest of the dirt without a cistern, empty toilets without the use of water, saving 30-50% of drinking water, etc. In addition, there are innovative toilets that use solar energy to produce hydrogen and electricity, and others that re-use nutrients and protect the water.

4.7. Good desalination practices using RES

In Morocco autonomous reverse osmosis desalination units with RES are used since 2008. **In Milos**, a desalination plant with a capacity of 3,360 m3 / day has been installed and operates since 2007. The unit is designed to meet all the needs of the island, both on an annual basis and at the daily peak.

5. Good Practices based on the Framework Directive

5.1. The Netherlands

The Netherlands have four river basins and the WFD was introduced on 27th November 2009.

5.1.1. Common Meuse Project

This project is collaboration between Flemish Region (Living Meuse) and Holland (Meuse Works) and it is about an innovative approach in order to increase safety levels against floods in these two areas. The overarching goal is to protect river basins from floods through dialog and consultation with the involved partners with the sake of environment protection as well as economic, social and agricultural development. The river basin districts also include Natura 2000 sites. It is worth noting that the Directive referring to floods has also been taken into account.

5.2. Germany

The WFD was adopted by the Government on 22 December 2009.

5.2.1. LIFE Project: "Water Resources Management in Co-operation with Agriculture"

The main reason for this project was the need of an effective and acceptable method of minimizing the impact of the agricultural industry, as it constitutes the main cause of groundwater failure to meet the rules of the Directive. The main goals of this project concerned:

- Development of innovative partnerships with local partners through project teams
- Demonstration of the use of water protection programs integrated with the agricultural production process and land use for the purpose of good water quality and protection

5.2.2. Cross-border co-operation of water bodies

The WFD states that a management plan should be adopted by national areas. This means that the competent authorities for the national regions should agree on the situation of water bodies on a transnational level, but also for their future after the implementation of the program. Following this, estimation of the impact on water bodies quality is paramount. Last, future condition of water bodies under consideration has to be predicted.

5.3. Cyprus

The river basin management of Cyprus, was adopted on 9 June 2011. The consultation process was extensive and transparent and involved the water and energy providers, NGOs and local authorities. In Cyprus there is a national approach to river basin design.

5.4. Malta

Malta has only one river basin that is not shared with any other countries. The WFD was adopted on March 2011. Malta has participated in“LIFE”project and its aim was the implementation of a second river basin through the establishment of an integrated policy in order to optimize water resources management in Maltese islands. Some indicative results are domestic water use reduction by 5%, increase in capacity of sewage treatment plants to produce clean water, flood risk decrease, improvement of groundwater status and awareness raising of the challenges water sector faces.

5.5. United Kingdom

The United Kingdom has three river basins shared with Ireland and there are five jurisdiction levels for the implementation of the WFD. This jurisdiction is among England, Wales, Scotland, Northern Ireland and Gibraltar.

5.5.1. Catchment Based Approach

A Catchment Based Approach is a holistic method of managing land and water. The aim is to develop a clear understanding of the pressures a catchment is facing by involving a range of interested parties from across the private and public sectors to share knowledge and information and jointly make decisions that develops a strategy for action that balances environmental, economic and social demands in an integrated and sustainable way.

5.5.2. River Welland

Welland is now one of 10 catchments across England where an integrated approach to catchment management is being piloted. During the 1970s the River Welland was significantly modified. The natural river morphology was altered to improve land drainage and flood water discharge. The river was deepened; many meanders, pools, riffles and glides were removed; and the river was constricted within high, straight banks. High winter flood flows and poor land management practices now cause significant bank erosion and sedimentation. Prior to modification, a high proportion of these nutrient-rich sediments would have been deposited on the floodplain, providing rich grazing pasture, but as a result of the flood defence works, a large proportion of these sediments now remain in the channel, degrading habitats including fish spawning gravels. As a result the River Welland is currently failing to meet the WFD objective of “good ecological status” because of high phosphate levels and poor fish populations.

5.6. Belgium

Belgium has a total area of 30528 km2 and a population of approximately 11 million. It consists of three regions: the capital city of Brussels, the Flemish region and the Walloon region and includes four river basins, shared with third countries. Only the Capital Region and Flemish have adopted the directive.

The Living Meuse project is a partnership with the Dutch project 'Meuse Works', with the main aim of increasing flood protection in the Flemish and Dutch sides. The project aims to increase the riverbed while maintaining its level, respecting coastal habitats affected by the Maa River.

5.7. Luxembourg

Luxembourg has a total area of 2,597 km2 and its population reaches 0.5 million. The largest part of Luxembourg (97.3%) belongs to the Rhine River International Basin. The remaining 2.7% is part of the Maaas International Watershed. There are 7 river basins, 6 of which belong to the Rhine International Basin. The National Basin Management Plan was implemented on 26 November 2010, focusing mainly on the Rhine, with some details on the Maas Basin.

Luxembourg participates in the following five river partnerships:

• Attert River Cooperation (Luxembourg-Belgium)

• Alzette River Partnership

• Our Rivers Cooperation (Luxembourg-Belgium-Germany)

• Collaboration of Syr Rivers

• Uewersauer River Cooperation

5.8. Czech Republic

The Czech Republic has a total area of 78866 km² and 10.5 million inhabitants. The International River Basin Management Plan was adopted in October 2009. The environmental objectives of the National Action Plan were harmonized with international river basin management methods. The advantages of the national management plan should include public consultation and quality and chemical controls on all surface water masses.

The Czech Republic has signed the Danube, Elbe and Oder River Protection Treaties, actively participating in the respective International Committees. What is more, the national plan for water resources monitoring concerns both surface and ground water and protected areas. All methods used are harmonized with the National Water Law.

5.9. Austria

Austria has a total area of 83870 km2 and a population of 8.3 million. It consists of three river basins of the Danube, the Elbe and the Rhine, all international. All the above basins are therefore governed by international cooperation and respect the decisions of the International Committees. Austria adopted the Watershed Management Plan in March 2010. Public consultation was also important in the adoption of the National Watershed Management Plan.

In 2012, the first international dialogue between Austria and Germany on the Salchach River, which forms the border between the two countries, began.

5.10. Latvia

Latvia has an area of 64,589 km2 and 2,067,887 million inhabitants. It consists of four river basins, all international. Specifically, the Daugava River Basin is cross-border and shared with Lithuania, Russia and Belarus. The basin management plan was approved by the Ministry of Environment in May 2010.

Since 2009, large-scale water collection, monitoring and control projects have been implemented to assess their pollution. Latvia's water resources are under less pressure than the European Union average. Low population density, large forests, low land use in agriculture combined with flood zones make it possible to moderate environmental damage.

6. European Projects as Good Practices Examples

6.1. Project AQUAKNIGHT

AQUAKNIGHT stands for AQUA KNowledge and Innovation transfer for water savinG in tHe mediTerranean basin. The implementation period was from 2007-2013 and the Lead Partner was the Institute of Communication and Computer Systems in Greece. AQUAKNIGHT project focused on optimizing consumption and minimizing the Non-Revenue Water (water not metered or billed to consumers) through the implementation of five pilot projects in the cities of Limassol (Cyprus), Genoa (Italy), Alexandria (Egypt), Tunis (Tunisia) and Aqaba (Jordan).

The expected results had to do with:

- Application of international best practices to evaluate and control water losses in the selected pilot areas
- Development of a manual of best practices for reducing commercial water losses in the water networks of the Mediterranean area
- Increase of staff knowledge of water utilities and capacity to reduce water losses with the consequent benefits in operational and financial terms

- Wide dissemination of best practices to control and manage water losses and make sure that tools reach a wide group of stakeholders in the participating countries and in other Mediterranean countries

Identification and Assessment of Good Practices	
Part A: General Information	
Project Title	*AQUA KNowledge and Innovation transfer for water savinG in tHe mediTerranean basin*
Acronym	*AQUAKNIGHT*
Project Objectives	*Project focused on optimizing consumption and minimizing the Non-Revenue Water*
Area of Good Practice Implementation	*Implementation of five pilot projects in the cities of Limassol (Cyprus), Genoa (Italy), Alexandria (Egypt), Tunis (Tunisia) and Aqaba (Jordan).*
Part B: Description	
Detailed description of good practice	*Project aimed at creating suitable expertise to improve system administration and reduction in non-revenue water*
Resources	*EUR 1.999.129,00*
Timeline	*2011.12.07 – 2014.12.06*

6.2. Project AQUANEX

Project AQUANEX (Conservation and quality assurance of the surface water bodies in Greece and Albania using earth observation techniques), started in 2014 and is going to be completed in 2020. Lead Partner is the Albanian Ministry of Tourism and Environment. AquaNEX addresses the challenges of WFD application and water resources management in the CB area. Albania needs to apply the WFD to enable water resources protection and sustainable management, and also support its accession to the EU.

The overall AquaNEX objective is to enable joint sustainable water resources management in the CB area and enhance its efficiency within the WFD with the application of advanced water monitoring tools. This is accomplished by ensuring technical compliance of CB Albania to the WFD, paving the

way for harmonizing national Albanian legislation to WFD and updating water quality monitoring systems in pilot areas with innovative technology while further applying WFD. The project's added value is enabling comprehensive water resources management in Albania resulting from legislative harmonization to the WFD and generating long-term improvements in pilot areas.

Identification and Assessment of Good Practices	
Part A: General Information	
Project Title	*Conservation and quality assurance of the surface water bodies in Greece and Albania using earth observation techniques*
Acronym	*AQUANEX*
Project Objectives	*Project focused on enabling joint sustainable water resources management in the CB area and enhancing its efficiency within the WFD with the application of advanced water monitoring tools.*
Area of Good Practice Implementation	*Greece and Albania*
Part B: Description	
Detailed description of good practice	*Project aimed at ensuring technical compliance of CB Albania to the WFD, paving the way for harmonizing national Albanian legislation to WFD and updating water quality monitoring systems in pilot areas with innovative technology while further applying WFD*
Resources	*EUR 1.712.420,00*
Timeline	*2018.03.01 – 2020.02.28*

6.3. Project CISWastewater

Project CISWastewater (Continuous improvement strategy for increasing the efficiency of wastewaters treatment facilities in the Black Sea coastal states) started in 2007 and it was completed in 2013. The Lead Partner was the National Research and Development Institute for Gas Turbines Comoti in Romania. The overall objective of the project was to achieve a stronger regional

partnership and cooperation to realize significant improvements of the wastewater treatment facilities management in the Black Sea coastal states.

The achievements concerned the development of expert knowledge on the situation of wastewater management and sustainable development increased in the Black Sea region. A new concept was developed to improve the management of wastewaters treatment facilities (WWTF) in 6 countries (Bulgaria, Romania, Russia, Turkey, Georgia and Ukraine), with direct access to the Black Sea or clearly integrated to the BS Basin. Moreover, increasing WWTF performance, by implementing the CIS concept in Romania, Region of South-East and in Greece, East Makedonia –Thraki Region was also achieved.

Identification and Assessment of Good Practices	
Part A: General Information	
Project Title	*Continuous improvement strategy for increasing the efficiency of wastewaters treatment facilities in the Black Sea coastal states*
Acronym	*CISWastewater*
Project Objectives	*Project focused on achieving a stronger regional partnership and cooperation to realize significant improvements of the wastewater treatment facilities management in the Black Sea coastal states.*
Area of Good Practice Implementation	*Black Sea Region (Bulgaria, Romania, Russia, Turkey, Georgia and Ukraine).*
Part B: Description	
Detailed description of good practice	*Project aimed at:* • *developing expert knowledge on the situation of wastewater management and sustainable development increased in the Black Sea region.* • *increasing WWTF performance, by implementing the CIS concept in Romania, Region of South-East and in Greece, East Makedonia –Thraki Region*

Identification and Assessment of Good Practices	
Resources	*EUR 455.380,00*
Timeline	*2014.01.01 – 2015.12.31*

6.4. Project FREE-MED

The implementation period for FREE-MED (Rivers Spaces of Balance for the Mediterranean) was from 2007 to 2013 and the Lead Partner was PATTO DELL'AGRO S.P.A, Italy. The overall aim was to preserve and restore environmental quality of natural water and human factor. The project was structured in 3 technical components:

- Experience sharing,

- Location of the good practices and

- Knowledge of the problems as regards management of river territories.

It also included workshops of analyses to look further into the common or complementary transnational problems which could be proposed with the experimentation. The workshops were organized on various topics: Governorship, Economy of water, Education to the environment, Promotion/Valorization of the inheritance, Eco-Tourism, Innovations.

Identification and Assessment of Good Practices	
Part A: General Information	
Project Title	*Rivers Spaces of Balance for the Mediterranean*
Acronym	*FREE-MED*
Project Objectives	*Project focused on preservation and restoration of environmental quality of natural water and human factor.*
Part B: Description	
Detailed description of good practice	*The project was structured in 3 technical components:* • *Experience sharing* • *Location of the good practices* • *Knowledge of the problems as regards*

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	management of river territories.
Resources	*EUR 1.254.360,00*
Timeline	*2009.03.01 – 2011.10.31*

6.5. Project HYDROCARE

Project HYDROCARE (Hydrological cycle of the CADSES regions) was implemented from 2000 to 2006, and the Lead Partner was the National Consortium of Universities for the Physics of Atmospheres and Hydrospheres, Italy. The project developed an integrated system capable of assessing the impact of hydrometeorological events on the water resources in the CADSES region (Central Adriatic, Danube and South-East Asia). Emphasis was put on the development of effective transnational tools for a rational exploitation of the water resources, with the purpose of preserving and enhancing economical and environmental welfare.

Such managing tools were illustrated also in practical terms by performing some case studies. Other main points of the project were reconstruction of the large and basin-scale hydrological cycle in the CADSES area, to be obtained by suitably merging observations (both local and remote) and models, and the development of a high level ICT network within a transnational frame for collecting and exchanging hydrometeorological data and providing relevant information to end-users such as professionals, farmers, entrepreneurs, public administrations and agencies.

Identification and Assessment of Good Practices	
Part A: General Information	
Project Title	*Hydrological cycle of the CADSES regions*
Acronym	*HYDROCARE*
Project Objectives	*The project developed an integrated system capable of assessing the impact of hydrometeorological events on the water resources*
Area of Good Practice Implementation	*CADSES region (Central Adriatic, Danube and South-East Asia)*

Identification and Assessment of Good Practices	
Part B: Description	
Detailed description of good practice	*Project aimed at:* • *developing effective transnational tools for a rational exploitation of the water resources, with the purpose of preserving and enhancing economical and environmental welfare..* • *reconstructing of the large and basin-scale hydrological cycle in the CADSES area,*
Resources	*EUR 2.466.200,00*
Timeline	*2006.01.01 – 2007.12.31*

6.6. Project IMAGE

Project IMAGE (Sustainable use of water resources and rural development in drought affected areas) took place in 2000 and finished in 2006. The Lead Partner was Basilicata Region – Department for Environment and Sustainable Policy, Italy. The main objective of this project was to develop a Water and Rural Development Support System (WARD¬SS). WARDSS is software that assists institutional organization in decision making processes on sustainable use of natural resources and rural development. The WARDSS architecture was based on an inter-institutional/participatory approach, whose design actively involve all parties associated to the water resource use/management.

Identification and Assessment of Good Practices	
Part A: General Information	
Project Title	*Sustainable use of water resources and rural development in drought affected areas*
Acronym	*IMAGE*
Project Objectives	*The main objective of this project was to develop a Water and Rural Development Support System (WARD¬SS).*
Part B: Description	
Detailed description of good	*WARDSS is software that assists institutional organization*

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practice	*in decision making processes on sustainable use of natural resources and rural development.*
Resources	*EUR 1.347.870,00*
Timeline	*2006.06.01 – 2008.03.31*

6.7. Project JointWaterS

Project JointWaterS (Promotion of a Joint Implementation of the Water Framework Directive (Directive 2000/60/EC) within the TranSbountary River Basin of Aoos/ Vjosa) lasted for six years (2007-2013). Lead Partner was the DECENTRALIZED ADMINISTRATION EPIRUS/WESTERN MACEDONIA-WATER DIRECTORATE EPIRUS, Greece. JointWaterS promoted joint action within the transbountary River Basin of Aoos/Vjosa, in cooperation with the overall national authorities on the matter in Greece and Albania. The objectives of the project were:

- promotion of cross-border communication and improvement of knowledge regarding the requirements of WFD,
- ensurance that common ground between the two countries is achieved through the implementation of WFD provisions on the Albanian part of Aoos/Vjosa River Basin,
- joint design of a water monitoring network/program, covering the needs and demands of both countries, with emphasis on the investigation of fishfauna populations' decline in the wider region,
- joint implementation of the monitoring program
- awareness raising of selected target groups on sustainable water management and
- ensurance of communication and cooperation among partners and stakeholders of both countries.

Identification and Assessment of Good Practices	
Part A: General Information	
Project Title	*Promotion of a Joint Implementation of the Water Framework Directive (Directive 2000/60/EC) within the TranSbountary River Basin of Aoos/ Vjosa*
Acronym	*JointWaterS*

Identification and Assessment of Good Practices	
Project Objectives	*The project promoted joint action within the transbountary River Basin of Aoos/Vjosa, in cooperation with the overall national authorities on the matter in Greece and Albania.*
Area of Good Practice Implementation	*Greece and Albania*
Part B: Description	
Detailed description of good practice	*Project aimed at:* • *promotion of cross-border communication and improvement of knowledge regarding the requirements of WFD* • *insurance that common ground between the two countries is achieved through the implementation of WFD provisions on the Albanian part of Aoos/Vjosa River Basin*
Resources	*EUR 346.763,39*
Timeline	*2012.07.01 – 2013.12.31*
Results	*Through the project transnational collaboration, communication and knowledge, control and sustainable water management were improved.*

6.8. Project LakeAdmin

This project stands for Regional administration of lake restoration initiatives, started in 2007 and was completed in 2013. The Lead Partner was the Finnish Environment Institute, Finland. Lake-Admin tried to improve the effectiveness of regional development policies related to water management, especially in the field of lake, pond and reservoir restoration and management. It was implemented in Finland, Denmark, Chez Republic, Hungary, Greece, Malta and Italy. These policies were about:

1. Sharing and transferring of good water management practices for better water quality and improved usability

2. Mainstream programmes in each participating regions by developing tangible implementation plans which help the adoption of good practices in preparing Operational Programmes.
3. Compiling good practices and European Lake Restoration Archive of reality-examples into open access guidance material.
4. Recognizing the European dimension and expand project mission beyond partner regions considering the new lake standards set by the WFD. For most EU states environmental standards for lakes within WFD are new and the obligations to protect or restore are a new and significant challenge.

Identification and Assessment of Good Practices	
Part A: General Information	
Project Title	*Regional administration of lake restoration initiatives*
Acronym	*LakeAdmin*
Project Objectives	*The project tried to improve the effectiveness of regional development policies related to water management, especially in the field of lake, pond and reservoir restoration and management.*
Area of Good Practice Implementation	*Finland, Denmark, Chez Republic, Hungary, Greece, Malta and Italy.*
Part B: Description	
Detailed description of good practice	*Project aimed at:* • *Sharing and transferring of good water management practices for better water quality and improved usability* • *Compiling good practices and European Lake Restoration Archive of reality-examples into open access guidance material.*
Resources	*EUR 1.862.333,00*
Timeline	*2012.01.01 – 2014.12.31*

6.9. Project NETWET 2

From 2000 to 2006 Networking Perspectives of Transnational Co-operation and Participatory Planning for Integrated Water Resources Management through the promotion of new forms of Spatial Governance or NETWET2 was executed. Lead Partner was the Center of Euro-Mediterranean Regions for the Environment (KEPEMEP-MedRegio), Greece. NetWet 2 focused on various important problems in the field of water such as:

- salinity of groundwater aquifers
- ecological balance of sensitive aquatic ecosystems
- drinking water
- environmental impact of organic agricultural practices on waters
- protection of flood risk areas
- protection of drought areas in relation to flood development
- protection of areas with high environmental hydraulic risk
- economic value of humid areas water

It aimed at the promotion of bottom-up participatory spatial planning and new forms of spatial governance at transnational level for the integrated management of water resources. The project's principal objective was the development of transnational co-operation for water management through:

1. promotion of water management integrated methods and

2. development of new conditions of bottom-up participatory spatial planning and new forms of spatial governance at transnational level.

Identification and Assessment of Good Practices	
Part A: General Information	
Project Title	*Networking Perspectives of Transnational Co-operation and Participatory Planning for Integrated Water Resources Management through the promotion of new forms of Spatial Governance*
Acronym	*NETWET 2*
Project Objectives	*The project aimed at the promotion of bottom-up participatory spatial planning and new forms of spatial governance at transnational level for the integrated*

Identification and Assessment of Good Practices	
	management of water resources.
Part B: Description	
Detailed description of good practice	*Project aimed at the development of transnational co-operation for water management through the promotion of water management integrated methods and development of new conditions of bottom-up participatory spatial planning and new forms of spatial governance at transnational level.*
Resources	*EUR 2.716.600,00*
Timeline	*2003.01.01 – 2006.06.30*
Results	*Through the project good practice development for water resources management in islands was achieved. Furthermore, innovative tools were created in order to identify and control water resources.*

6.10. Project RIVER 2 RIVER

This project started in 2014 and it is going to be implemented in 2020. The title intonates "Joint Actions and Networking for Sustainable Management, Environmental Monitoring and Protection of Surface Waters" and Lead Partner is Municipality of Metsovo, Greece. RIVER2RIVER project aimed to achieve wide-ranging benefits that result in healthy rivers and catchments. The motivation of the project was to maximize opportunities that have as goal to promote the necessity of CBC in water resources monitoring, management and protection, in line with the EU policy and, more specific, according to the provisions of the WFD, focusing mainly in the CB surface aquatic environments. The main goal of the project was to promote and ensure best practice restoration and management of rivers and their catchments under the EU WFD combining Green Infrastructure Approach and water governance initiatives.

Identification and Assessment of Good Practices	
Part A: General Information	
Project Title	*Joint Actions and Networking for Sustainable Management, Environmental Monitoring and Protection of*

Identification and Assessment of Good Practices	
	Surface Waters
Acronym	*RIVER 2 RIVER*
Project Objectives	*The project aimed to achieve wide-ranging benefits that result in healthy rivers and catchments.*
Part B: Description	
Detailed description of good practice	*The main goal of the project was to promote and ensure best practice restoration and management of rivers and their catchments under the EU WFD combining Green Infrastructure Approach and water governance initiatives.*
Resources	*EUR 423.891,72*
Timeline	*2018.03.01 – 2019.12.31*

6.11. Project SaveSafeWater

This project is about Networking for Reciprocal Safe Cross Border Water Supply towards a Worth Living Environment. The implementation period is from 2014 to 2020 and Water Association of Ioannina Basin, Greece is the Lead Partner. SaveSafeWater overall objective is to increase the capacity of CB infrastructure in water management through their rehabilitation as well as drinking water quality monitoring & reduction of NRW throughout the whole WS chain (from the water abstraction points back to the environment). SaveSafeWater not only safeguards water resources quality and quantity from natural and human pressures, but also assures water consumers health and safety as well as their quality of life, in compliance with EU and national legislation.

The expected change is the increase of water operators capacity in delivering safe drinking water and the management of waste water treatment. Smart Growth will be enhanced by:

- ✓ utilizing ICT,
- ✓ Sustainable Growth by supporting construction of water infrastructure and promoting environmental protection,
- ✓ adaptation to Climate Change (CC) and risk prevention,
- ✓ sustainable use of natural resources. Inclusive Growth will be enhanced by assuring public health and safety. Main outputs will be joint innovative methodologies and tools (water use

efficiency and quality monitoring) used to tackle drinking water management problems, considering human & natural pressures.

Identification and Assessment of Good Practices	
Part A: General Information	
Project Title	*Networking for Reciprocal Safe Cross Border Water Supply towards a Worth Living Environment*
Acronym	*SaveSafeWater*
Project Objectives	*The project objective is to increase the capacity of CB infrastructure in water management through their rehabilitation as well as drinking water quality monitoring & reduction of NRW throughout the whole WS chain.*
Area of Good Practice Implementation	*Greece and Albania*
Part B: Description	
Detailed description of good practice	*Project not only safeguards water resources quality and quantity from natural and human pressures, but also assures water consumers health and safety as well as their quality of life, in compliance with EU and national legislation. The expected change is the increase of water operators capacity in delivering safe drinking water and the management of waste water treatment.*
Resources	*EUR 901.583,26*
Timeline	*2018.04.02 – 2020.03.31*

6.12. Project WATenERgy CYCLE

Project's Lead Partner is Municipal Water and Sewerage Company of Larissa, Greece and it started in 2014. It is about the urban water full cycle: from its source to its end-users and back to the environment. The overall aim is to develop a common methodological approach towards efficient and effective transnational water and energy resources management. It was implemented in Bulgaria,

Greece, Cyprus and North Macedonia. A common challenge is to increase the current low level of innovative technologies use along the water supply chain, from the water's source to its end-users and back to the environment along with the increase in climate change resilience. WATenERgy CYCLE is a valuable and unique joint-tool for the design, preparation and implementation of an integrated multi-level approach in the urban (short term), rural and industrial (midterm) environment, promoting a Europe of worth living solidarity. A number of rational activities (networking, pilot actions, partner's exchanges and meetings, training workshops) in the fields of innovation and environment are the main outputs.

Identification and Assessment of Good Practices	
Part A: General Information	
Project Title	*Urban water full cycle: from its source to its end-users and back to the environment*
Acronym	*WATenERgy CYCLE*
Project Objectives	*The project objective is to develop a common methodological approach towards efficient and effective transnational water and energy resources management.*
Area of Good Practice Implementation	*Bulgaria, Greece, Cyprus, North Macedonia*
Part B: Description	
Detailed description of good practice	*WATenERgy CYCLE is a valuable and unique joint-tool for the design, preparation and implementation of an integrated multi-level approach in the urban (short term), rural and industrial (midterm) environment, promoting a Europe of worth living solidarity. A number of rational activities (networking, pilot actions, partner's exchanges and meetings, training workshops) in the fields of innovation and environment are the main outputs.*
Resources	*EUR 1.346.400,00*
Timeline	*2017.09.01 – 2019.08.30*

6.13. Project WMFP

The initials stand for Water Management and Flood Protection in Trakiets village, Haskovo municipality. It started in 2007 and it lasted for six years. Lead Partner was Municipality of Haskovo, Bulgaria. WMFP's aim was to bring Bulgarian and Greek partners together to solve the flood protection problem that plagued Trakiets village, Haskovo region in the cross-border region Bulgaria-Greece and at the same time to support establishment of partnerships between the stakeholders in the region in the area of water management. The overall objective of the project was to improve flood protection and water management and thus to contribute to protection of the environment and to the economic growth of the cross border region. The project activities comprised works for correction of Olu Dere river bed, construction of protective dike and forestation.

Identification and Assessment of Good Practices	
Part A: General Information	
Project Title	*Water management and flood protection in Trakiets village, Haskovo municipality*
Acronym	*WMFP*
Project Objectives	*The project objective was WMFP's aim was to bring Bulgarian and Greek partners together to solve the flood protection problem that plagued Trakiets village, Haskovo region in the cross-border region Bulgaria-Greece*
Area of Good Practice Implementation	*Greece and Bulgaria*
Part B: Description	
Detailed description of good practice	*The overall objective of the project was to improve flood protection and water management and thus to contribute to protection of the environment and to the economic growth of the cross border region. The project activities comprised works for correction of Olu Dere river bed, construction of protective dike and forestation.*
Resources	*EUR 581.531,75*
Timeline	*2011.03.14 - 2013.07.13*

6.14. Project WWM-QUAL

This project was carried out during the period of 2007-2013 and was about Transfer of know-how to Dojran Municipality and adaptation of DEYAK to the new status created by "Kallikratis" for the management of waste water in the area of intervention – Improvement of citizens' quality of life. Lead Partner was Municipal Enterprise for Water Supply & Sewerage of Kilkis (DEYAK), Greece.

The overall objective of WWM-QUAL was to support environmental resources in Kilkis and Dojran, by joint interventions in the quality of Lake Doirani's waters through the reconstruction of waste water treatment plant of Dojran and respective controls in the areas around the lake that integrated in Kilkis Municipality after "Kallikratis" enforcement. The core actions included the modernization - technological upgrading of water supply networks, namely:

- Preliminary studies for the integrated management of waste waters in the basin of Lake Doirani.
- Digital mapping and control measurements for selected points of waste waters disposal in both sewerage networks (Kilkis, Dojran)
- Reconstruction and modernization of Sewerage Processing Plant in Doiran
- Development of a Geographic Information System (GIS) for Digital Mapping of the Sewerage Networks.

Identification and Assessment of Good Practices	
Part A: General Information	
Project Title	*Transfer of know-how to Dojran Municipality and adaptation of DEYAK to the new status created by "Kallikratis" for the management of waste water in the area of intervention – Improvement of citizens' quality of life*
Acronym	*WWM-QUAL*
Project Objectives	*The overall objective of WWM-QUAL was to support environmental resources in Kilkis and Dojran,*
Area of Good Practice Implementation	*Dojran Lake, Kilkis*

Identification and Assessment of Good Practices	
Part B: Description	
Detailed description of good practice	*The core actions included the modernization - technological upgrading of water supply networks, namely:* • *Preliminary studies for the integrated management of waste waters in the basin of Lake Doirani.* • *Digital mapping and control measurements for selected points of waste waters disposal in both sewerage networks (Kilkis, Dojran)* • *Reconstruction and modernization of Sewerage Processing Plant in Doiran* • *Development of a Geographic Information System (GIS) for Digital Mapping of the Sewerage Networks.*
Resources	*EUR 501.799,00*
Timeline	*2007-2013*

7. Conclusion

Water resources management is a crucial matter that needs to be addressed as long as it concerns everyone on this planet. WRESTLE project focuses on the implementation of a Joint Water REsources management System for Long-term Efficiency which will facilitate protection of water quality/quantity and ensure efficient use in response to EU Directives and National legislative acts. A variety of projects regarding water resources management has been or is currently being implemented. In these projects there is collaboration between the participant countries, in order for optimal results to be generated. Therefore, WRESTLE takes into account relevant projects about water resources management based on the WFD that can be used as good practices in order to produce beneficial results and achieve the goals that have been set.

It is worth noting that good ecological state of river basins after the implementation of the European projects constitutes a good example, as long as the assessment that has been carried out afterwards manifests a significant increase in drinking water quality, effective flood management and non-

wasting of water resources. However, transnational cooperation is of paramount importance, as each country has to support the promotion of their natural resources, protect biodiversity, combat water pollution and finally, apply common adaptation measures to climate change.