



DESSIN

FINAL MAGAZINE

01 | DESSIN Project: final results



After four years of intense and exciting work, DESSIN has delivered the full portfolio of results it promised at project start. The whole package of DESSIN solutions aims to demonstrate that using the concept of ecosystem services can actually enable innovation in the water sector, in particular for new solutions, to tackle challenges of water quality and water scarcity.

Hence, the key result of DESSIN is an Ecosystem Services Valuation toolkit. This is a structured approach to measuring changes in ecosystem services (ESS), which may result from the implementation of a management or technology measure in a given water-related environment. It enables the user to assess a broad range of benefits and co-benefits resulting from the implementation of a specific measure or technology, linking biophysical, economic and sustainability assessments, sequentially. It follows an established adaptive management cycle (Drivers-Pressures-State-Impact-Response - DPSIR), which helps to disentangle the biophysical and social aspects of the system under study.

The practical application of this framework is expected to be by a policy- or decision-maker, who is confronted with a number of possible measures to choose from and to be applied in a freshwater-related environment (e.g. new technologies, management approaches, policy measures). It also can be used by organizations (e.g. technology developers, consultants), which are interested in whether consideration of ESS might provide support for uptake of new solutions.

DESSIN aims to demonstrate that using the concept of ecosystem services can actually enable innovation in the water sector, in particular for new solutions, to tackle challenges of water quality and water scarcity.



This key result of DESSIN comes in a paper version with comprehensive supplementary material, but has also been transformed into a user-friendly software module that is freely available to any interested user.

Apart from that, DESSIN has delivered a portfolio of validated technical solutions for water scarcity and water quality issues. Their technical performances have been demonstrated in five case studies across Europe, and their broader benefits and co-benefits have been evaluated by application of the DESSIN ESS valuation framework.

In short, the solutions proposed by DESSIN are:

- **Cross-flow lamella settler** for local treatment of combined sewer overflows.
- **High-rate filtration system** with specially designed filter media for combined sewer overflows.
- Fully automated **real-time control system for large sewer systems** to minimize combined sewer overflow.
- **Distributed re-use technologies** (modular and mobile) with focus on urban sewer-mining technologies for irrigation of urban green and mitigation of heat-island effects in water scarcity areas.
- **Hybrid aquifer storage and recovery (ASR combined with desalination)** in brackish aquifers for irrigation of greenhouse horticulture.
- System for **deep aquifer injection of pre-potable water** to improve freshwater availability and system flexibility for drinking water provision, while ensuring WFD compliance.



To further pave the way for new technology solutions on their route to market, DESSIN has also analyzed financing approaches conducive to innovation. There also is concrete guidance provided for practitioners, linking good practice and lessons-learned in governance regimes and financing options with the ecosystem services framework.

As part of the support package for SMEs to bring their solutions to the market, this has been complemented by market analysis and business environment reports for ESS solution packages, and a monitoring and evaluation system for innovation and continuous monitoring of framework conditions and outcomes.

02

Ecosystem Services Evaluation for decision making

DESSIN ESS Evaluation Framework

New solutions and advancements in technology are necessary to meet the water quality and scarcity challenges that Europe faces. However, innovations commonly meet a series of barriers to their implementation.

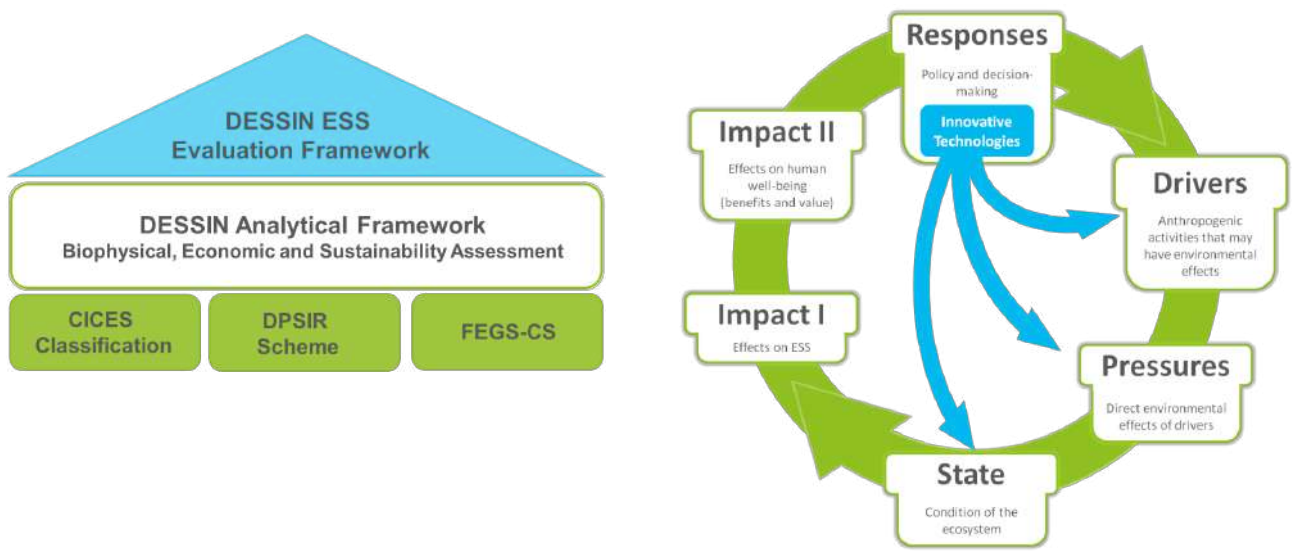
The DESSIN ESS Evaluation Framework is a methodology that assesses and analyses ecosystem services changes once a measure or solution is implemented and provides the necessary data for the decision-makers, such as administrations or companies, to choose the best option when investing in projects.

The DESSIN ESS Evaluation Framework supports evaluation planning, design and development of new solutions before being implemented in water management.

The methodology was developed on the basis of the Common International Classification of Ecosystem Services (CICES) and the Driving Forces, Pressures, States, Impacts and Responses (DPSIR) adaptive management cycle. In the DPSIR scheme as applied in DESSIN, the innovative technologies tested within the project are considered Responses that may have influence on Drivers (anthropogenic activities with environmental effects), Pressures (the direct effects of such activities) and States (the conditions of the ecosystem under study).

From the resulting changes in ecosystem state, the changes in ESS (Impact I) have been estimated. An economic assessment of the subsequent changes in the benefits as perceived by society in the value of the services derived from ecosystems (Impact II) have followed. Through the application of this methodology, the estimated change in the level of human well-being will inform policy and decision-making (further Responses).

The DESSIN ESS Evaluation Framework is a methodology that assesses and analyses ecosystem services changes once a measure or solution is implemented and provides the necessary data for the decision-makers.



DESSIN ESS Evaluation framework methodology



DESSIN ESS Tool

The Ecosystem Services (ESS) evaluation software tool by DESSIN, abbreviated ESS Tool, is based on the ESS Evaluation Framework. The tool provides a systematic approach to identifying, measuring, and valuing Ecosystem Services. It also is capable of measuring changes in ESS resulting from new policies or solutions, which makes the tool useful for cost-benefit analyses or other assessment exercises. Furthermore, the tool provides guidance for implementing the DESSIN sustainability assessment, which gives a broader perspective on proposed policies, projects and solutions.

The main target audience for the tool are scientists and planners who provide information and advice to decision makers. Technological service providers may also be interested in using the tool for marketing if their services are thought to have positive impacts on ESS. The ESS tool requires basic familiarity with Windows software. No specialized software skills are required.

However, the tool can be extended to estimate indicator values, including economic values, by scientists and engineers familiar with modelling and programming. The software tool is part of the MIKE Workbench software, which is used to work with simulation models, data, and maps. To use the DESSIN tool, the installation of this software is required. Some optional features of MIKE Workbench can be used to extend the tool to link to model results. These are not available for free though and require a license but the basic tool is free of charge.

Download links and instructions for the Ecosystem Services Evaluation software tool and the user guide are available in the DESSIN website.

DESSIN research is spread all across Europe

Located in five different countries, the demonstration sites at Emscher (Germany), Hoffselva (Norway), Westland (Netherlands), Athens (Greece) and Llobregat (Spain) have demonstrated and promoted innovative solutions to water related challenges, with a focus on water quality issues related to the implementation of the Water Framework Directive (WFD) and water scarcity issues.

Westland (NETHERLANDS)

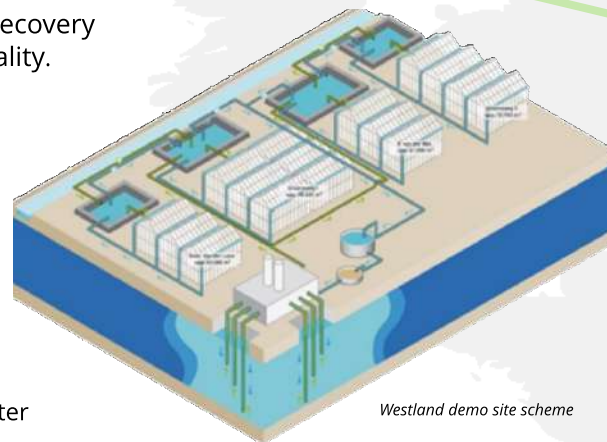
Freshkeeper and smart desalination. Aquifer Storage and Recovery (ASR) coupled with Reverse Osmosis (RO) to optimise water quality.

Evaluated ESS:

- ▶ Groundwater for irrigation
- ▶ Groundwater quality
- ▶ Stormwater retention

Results:

- ▶ More flexibility in storage of rainwater for irrigation
- ▶ Local salinity decrease in both aquifers
- ▶ Net abstraction reduced
- ▶ Increased stormwater retention volume
- ▶ Small concentrations of Zn and pesticides in infiltration water



Westland demo site scheme

Llobregat (SPAIN)

Flexible Aquifer Storage and Recovery (ASR) to improve groundwater resources. Injection and recovery schemes for the optimization of local water resources.

Evaluated ESS:

- ▶ Groundwater to be treated for human consumption
- ▶ Groundwater for non-human consumption (industrial processes)
- ▶ Groundwater storage as a reservoir
- ▶ Research opportunities
- ▶ Students formation
- ▶ Landscape and sounds that provide sensory experience; opportunity to view the environment and organisms

Results:

- ▶ Increase of groundwater resources
- ▶ Improvement of groundwater quality
- ▶ Improvement of associated ecosystem (surface water dependent)



Llobregat demo site



Demo WFD (quality)



Demo scarcity



Hoffselva (NORWAY)

High-rate filtration applied in Combined Sewer Overflows (CSOs) and assessment of communication technologies for CSOs.

Evaluated ESS:

- ▶ Surface water for non-potable use
- ▶ Maintenance of environment (physical, chemical, biological conditions)
- ▶ Experience from the use of landscape (transparency of the river water)
- ▶ Experience from the use of landscape (visual impression of water and riverbank)

Results:

- ▶ Increase of surface water for non-potable use
- ▶ Improvement in the maintenance of environment
- ▶ Improvement of the experience from the use of landscape
- ▶ Improvement of cultural ESS

Emscher (GERMANY)

Real Time Control (RTC) of sewer network and lamella settling as decentralised treatment for Combined Sewer Overflow (CSOs).

Evaluated ESS:

- ▶ Self-purification (N, P, C)
- ▶ Biodiversity (algae, macrophytes, invertebrates)
- ▶ Cultural ESS (aesthetic, experiential use, physical use, existence)
- ▶ Flood protection

Results:

- ▶ Improvement of self-purification
- ▶ Increase of biodiversity
- ▶ Improvement of cultural ESS
- ▶ Improvement of flood protection



Recreational activity in the Hoffselva lower catchment part



Lamella settler container solution at CSO facility

Athens (GREECE)

Sewer mining for urban reuse enabled by Advanced Monitoring Infrastructure (AMI) and Decision Support System (DSS) development.

Evaluated ESS:

- ▶ Microclimate regulation for reduced energy use and reduced energy bills from households
- ▶ Mitigation of groundwater scarcity and increase of future groundwater availability
- ▶ Qualitative evaluation of the range of new economic activities that could be created through water-enhanced ecosystem services

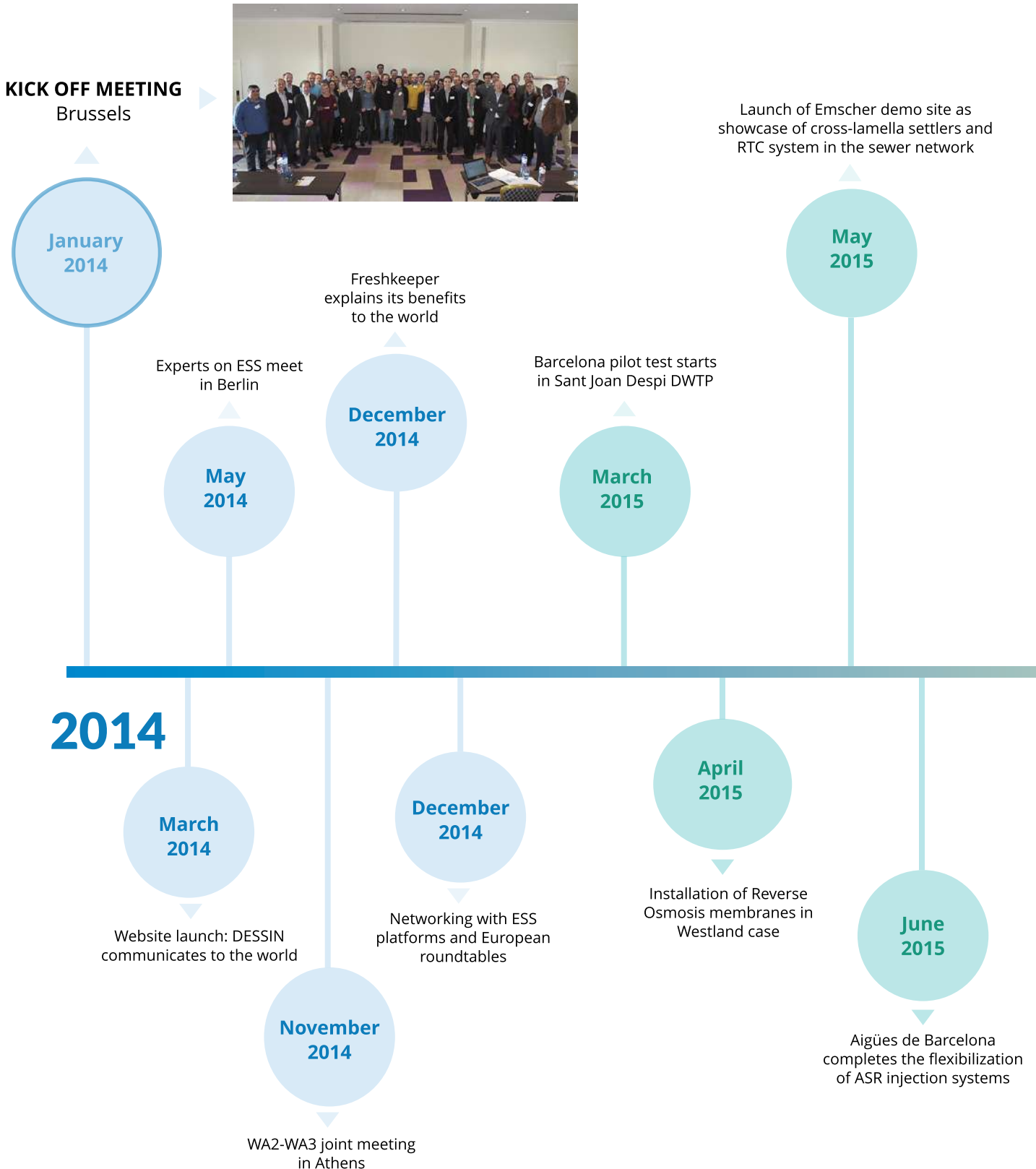
Results:

- ▶ Microclimate regulation benefits result in a reduced energy bill for a model household (4 people) by up to €180 per year
- ▶ Reduction of groundwater scarcity cost
- ▶ Increase of water availability
- ▶ Enrichment of economic activities in the area as well as enhancement of existing ones (mainly tourism)
- ▶ Two candidate business models (central operation and public-private partnership) are possible



Athens demonstration site

04 | The evolution of the project





Hoffselva partners install the container with cross-flow lamella settler



DESSIN Consortium meeting in Barcelona

DESSIN FINAL EVENT Brussels

January 2016

Emscher is ready to apply lessons learned in CSO at full scale

January 2017

December 2016

November 2017

Final report of the project summarizes main achievements

December 2017

2017

December 2015

Ecosystem Services methodologies ready to use

May 2016

Software development for ESS evaluation: user guides and system documentation

September 2017

ESS Tool applied to all DESSIN demo sites



05 | Partners

Coordination



IWW Water Centre (Germany) is offering research, consulting and development services for the water sector, covering the entire drinking water supply chain: active water resources management, water technology, water networks, water quality analysis, applied microbiology and water economics.

Denmark



DHI is an independent, international research and consulting organization. The main objectives are to advance in technological development and competence within the fields of water, environmental and health.

Germany



The University of Duisburg-Essen (UDE) has a focus on water-related topics, to which about 15 departments contribute. Two of these have contributed to DESSIN: The Department of Aquatic Ecology and the Department of Hydraulic Engineering and Water Resources Management.



Adelphi is a leading think tank for policy analysis and strategy consulting. They offer creative solutions and services on global environment and development, challenges for policy, business and civil society communities.



As a SME from Germany, UFT's main business activity is development, construction and installation of hydro-mechanical and electrical equipment for stormwater tanks and other treatment structures.



Ecologic Institute is a private non-profit think tank for applied environmental research, policy analysis and consultancy. Since 1995, the Institute has built a reputation for excellence in transdisciplinary and policy-relevant research.



Emschergenossenschaft (EG) is a self-governing, non-profit public corporation. Its main tasks are waste water treatment, ecological restoration and maintenance of rivers, flood protection, ground and rainwater management.



SEGNO is a profit-oriented research and development (R&D) performing SME, active in consulting and development services. SEGNO applies systems for use in visualization, databases, journaling and also implements logical solutions in PLCs.

The Netherlands



KWR is the research institute of the ten Dutch drinking water companies, their current stakeholders. This joint research collaboration program has resulted in a powerful knowledge base and an extensive collective memory for the drinking water sector.



BdB is a SME that is active as a manufacturer of reverse osmosis (RO) and other water treatment installations. The SME focuses on the horticultural industry and also manufactures installations for other industries, including chemical, car wash and food.



Norway



Oslo kommune
Vann- og avløpsetaten

Oslo Water and Sewerage Works (VAV) is a self-financing company within the municipality of Oslo. VAV supplies water and collects/treats sewage for the city's 624.000 inhabitants.



SINTEF is a multidisciplinary private research institute that performs contract research and development for industry and the public sector.



Inrigo Water AS is a Norwegian SME, developing and commercializing technology for treatment of drinking water, treatment of municipal and industrial wastewater, as well as developing new concepts for water recycling.



LKI is a small import and wholesale company, supplying the different parts of Norwegian on-and offshore industry with technical solutions and instrumentation for measuring and controlling different parameters.

Greece



National
Technical
University of
Athens

The NTUA is the leading technological and engineering school in Greece. NTUA is the main research partner for the Athens demonstration site, in collaboration with EYDAP. It provides input to innovation development, focusing on solutions for water scarcity and drought.



EYDAP supplies approximately 4,300,000 customers with water through an extensive network of 2,020,000 water meters and 9,500 km of water pipes. The sewerage sector serves 3,500,000 residents with sewers spreading over almost 6,000 km.



CHEMiTEC is active in Greece, Cyprus and Balkan Countries in the sectors of industrial process water, municipal potable water, waste water treatment and environmental technologies, supplying also innovative technologies.

Spain



Cetaqua is a non-profit foundation that integrates, manages and conducts research, technological development and innovation projects on the integral water cycle, in benefit of society and environment.



Aigües de Barcelona is the main water operator in the Barcelona Metropolitan Area, supplying more than three million inhabitants. AB is the owner of the Llobregat demonstration site, located in the biggest drinking water treatment plant of Barcelona.



Amphos 21 is a SME, providing scientific and technical consultancy services, addressing a range of environmental issues, mainly associated with the management and disposal of hazardous wastes, contaminated groundwater/soils, water management, environmental planning and specific software development.

United Kingdom



TELINT offers innovative information management systems, which combine remote monitoring and management of mobile, distributed platforms, remote monitoring of sensors and acquisition of sensor data.



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