



FERRO

Fostering European
Lake Restoration

Design and install the floating device with a solar-driven pump installed

Lead Beneficiary: University of Southern Denmark

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D8.1 *Design and install the floating device with a solar-driven pump installed*
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Subject to change

Summary

The deliverable 8.1 is part of work package 8, where a solar-driven pump is developed. The device will be used to pump phosphorus-rich lake water from the deep part of a lake (stratifying area, hypolimnion) onto land, where phosphate will be removed by filtration and recycled as fertilizer.

1. Pump design and development

A solar-driven pump has been designed and assembled. The specifications of the pump are listed in Table 1. The system can be moved easily due to its small size and weight and since the fold-out solar panels are mounted onto a trailer (Fig. 1b). This facilitates relocation and transportation to field sites even in rough terrain. The pump floats on the water surface and has a capacity of $23 \text{ m}^3 \text{ h}^{-1}$ under operation in the field (solar-powered). The solar panels have a surface area of 5.4 m^2 and produce sufficient energy to power the pump under sunny-weather conditions.

Table 1: Specifications of the pump

Specifications	Value
Length (cm)	80
Breath (cm)	35
Height (cm)	30
Weight (kg)	15
Pumping capacity - maximum ($\text{m}^3 \text{ h}^{-1}$)	31.0
Pumping capacity - powered by solar-panel ($\text{m}^3 \text{ h}^{-1}$)	23.3
Pipe inlet diameter (mm)	40
Pipe outlet diameter (mm)	80



Figure 1: Solar-driven pump installed in a Danish pond for testing (a). The fold-out solar panels mounted onto a trailer (b). Solar panels mounted onto a floating platform (c).

1.1. Pump application in Denmark

Prior to installation at demonstration site 3 Lake Fure (Denmark), the system has been tested under natural conditions in a Danish pond in summer 2024 (Fig. 1a). Here, the pump was optimized with respect to pumping capacity in combination with the removal of duckweed from the water surface through a sub-surface skimmer. Buoyancy of the pump was tested and adjusted to accommodate optimal floating under different pumping scenarios. Further, the diameter of the inlet and outlet pipes were optimized to ensure an optimal flow rate.

An enhanced design of the pump system is currently being developed in collaboration with the Dutch company Biophree, where the device will be installed on a boat to pump phosphorus-rich hypolimnion water from the deepest site in Lake Fure and subsequently filter phosphate out of the water.

1.2. Pump application in Czechia

The system (pump and solar panels) was sent to the project partner in Czechia, where it will be deployed to demonstration site 4 Vrchlice Reservoir. It is currently being adapted with the aim of filtering surface water through a phosphate-retaining filter. The solar panel was mounted onto a floating platform consisting of plastic pipes, and the set-up was tested under natural conditions in a small lake (Fig. 1c). Prior to the application in Vrchlice Reservoir, permissions need to be granted. The final permission is expected at the end of May, and on-site installation will be done in early June.

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