



Siphon wells for riverbank filtration

Background

- » Water is abstracted and piped to a central collector caisson without a permanent energy input using gravitational flow
- » Abstracted water is pumped from the collector caisson to the waterworks using high-flow pumps
- » Advantages:
 - » high operational safety in floodplains (no electricity supply),
 - » lower maintenance costs due to a reduced number of pumps,
 - » easier accessibility and maintenance of the dry mounted pumps,
 - » absence of harmful pressure surges (air vessel).

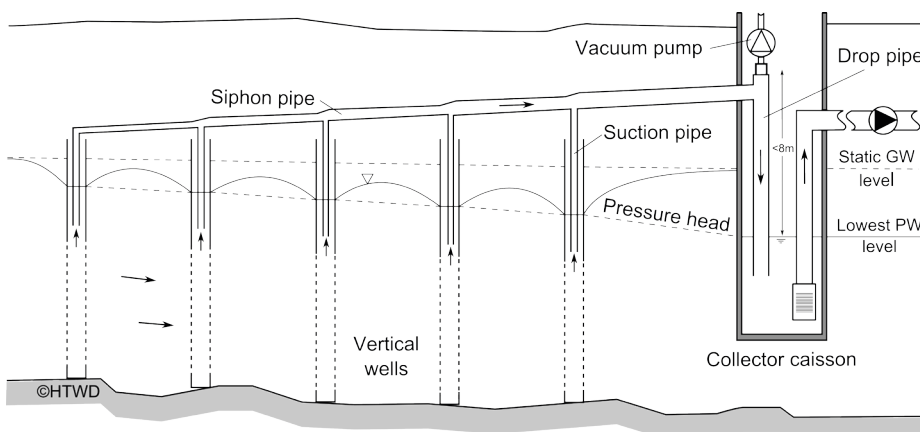


Design considerations for siphon wells

- » Typical siphon systems consist of multiple vertical wells and/or horizontal collector wells
- » Typical abstraction capacities range from 35,000 to 100,000 m³ per day
- » The siphon system only works if:
 - » the outlet of the drop pipe and the inlets of the suction pipes are permanently submerged,
 - » the siphon pipe is continuously air evacuated (degassing of dissolved gases or air entry through small leakages),
 - » the piping is permanently vacuum-tight.
- » Suction head is limited to 8 m (including safety margin)

Energy savings by siphon wells

- » Only two to three high-performance pumps are usually installed to abstract groundwater from the collector caisson (instead of pumping from every single well)
 - » dry-mounted centrifugal pumps are preferred (easier to maintain, higher energy efficiency factor compared to submersible pumps)
- » Real energy data from two investigated RBF sites indicate savings up to ≈70% (Bartak & Grischek, 2018)
- » 30–50% energy savings potential can be achieved by rehabilitating old siphon wells instead of an alternative equipment with submersible pumps



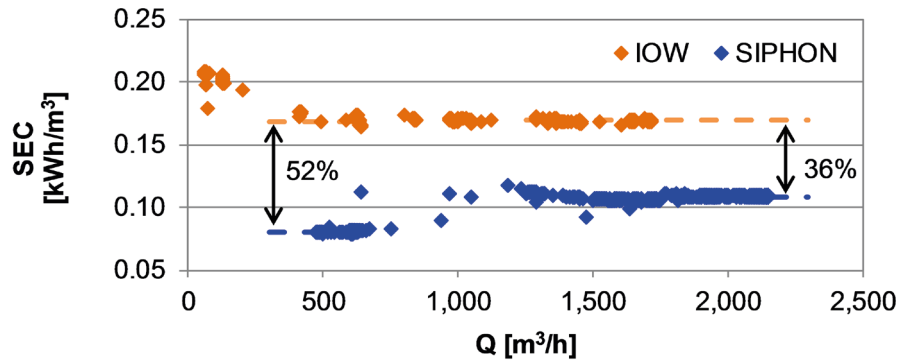


SIPHON - a free and Excel-based design tool for siphon wells

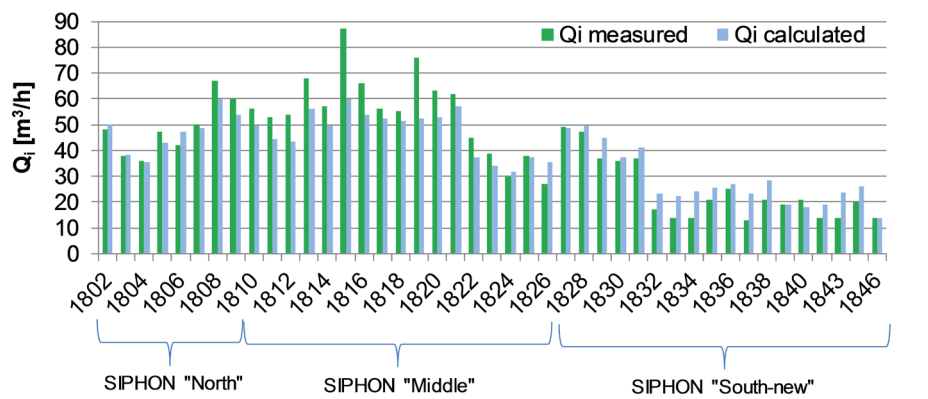
- » SIPHON can be used to plan the rehabilitation of an existing siphon system or to design a completely new one
- » Available online together with the documentation:
 - » www.htw-dresden.de/heber (in German and English)
 - » tools section of <http://dss.aquanes.eu/> (English only)

Further readings

- » Kroening, H. (2006) Renewal of the waterworks Curslack. *Wasserwirtschaft Wassertechnik* 5, 8–15. (In German)
- » Luckner, L., Eichhorn, D., Bornitz, U. (1971) Calculation of well groups with siphon pipes. *Wasserwirtschaft Wassertechnik* 21, 354–361. (In German)
- » Paavel, V. (1947) Calculation of Well Groups with Siphon Pipes. PhD thesis, TH Braunschweig, Braunschweig, Germany. (In German)



Measured specific energy consumption at AquaNES demo site no.2, Dresden-Hosterwitz (Bartak & Grischek, 2018)



Results from SIPHON for a siphon well gallery in Stuttgart (Germany)

References

Bartak, R., Grischek, T. (2018) Groundwater Abstraction through Siphon Wells - Hydraulic Design and Energy Savings. *Water* 10(5), 570. doi: 10.3390/w10050570.

Contact

Prof. Dr.-Ing. Thomas Grischek
 University of Applied Sciences Dresden
 Division of Water Sciences
 Friedrich-List-Platz 1
 01069 Dresden
 thomas.grischek@htw-dresden.de
 www.htw-dresden.de

