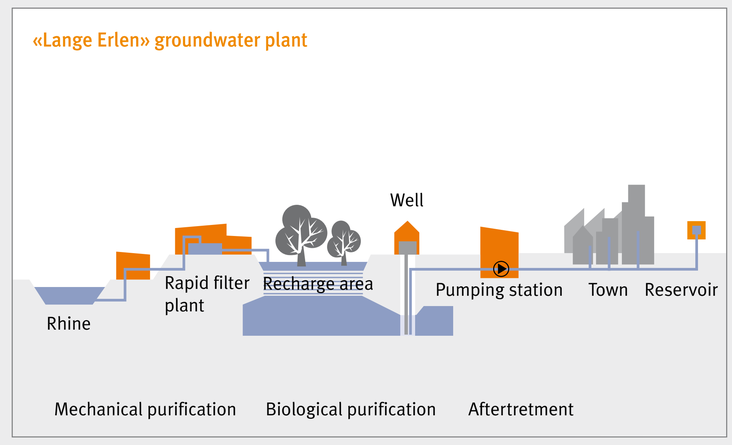
Artificial Recharge of Groundwater in the Waterworks «Lange Erlen» by Industrielle Werke Basel

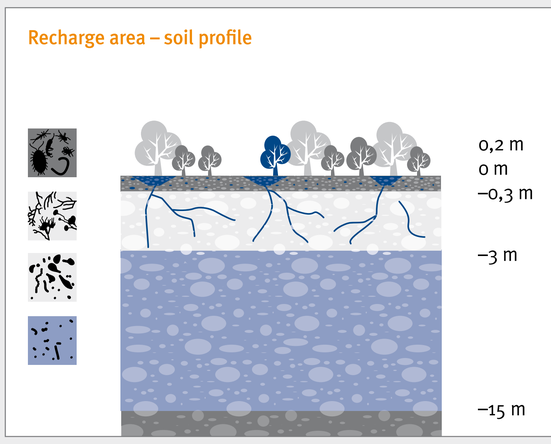
The city of Basel is situated in the North-Western part of Switzerland and borders Germany and France. It has about 200 000 inhabitants. Basel's water consumption amounts to about 26 million cubic metres per year. The water supply is guaranteed by two groundwater plants. The «Lange Erlen» plant is located in the East of the town, the «Hardwasser AG» plant is located in the South.

Groundwater works «Lange Erlen»
Rhinewater is prefiltered by rapid sand filtration to remove suspended solids and then pumped to forested recharge areas. There it seeps with 1-2 meter per day through a humus and fluvial silt.



Watering in the recharge areas with prefiltered Rhine water.

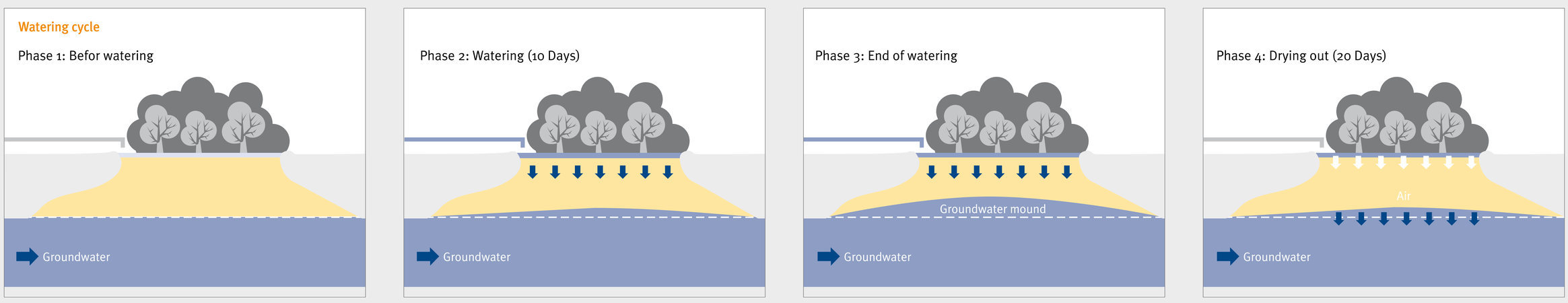
The raw water seeps through natural floodplain forrests: very efficient purification process.

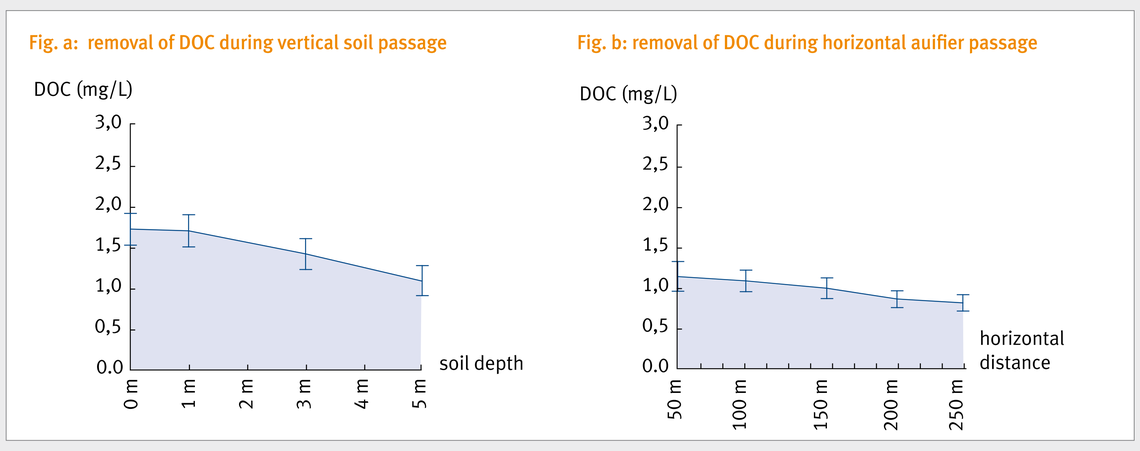


In the recharge areas the water percolates through the humus layer of the woodland soil and the layers below, thereby undergoing biological purification. Purification processes are varied and complex, as confirmed in a recently published dissertation. Woodland soil is a strange mixture: it consists of air, water, organisms, mineralogical and organic particles.

Within the humus and the top layer there are subterranean passages and channels everywhere, which are daily dug anew by creatures such as mice or worms. When percolating, the water has to squeeze through these tiny channels. In the process substances in the water are attached to the particles. Additionally, the microorganisms in the soil decompose a major part of the substances contained in the water. Thus, those substances which should not be in the drinking water, are filtered out or decomposed completely.

Thousands of microbes and millions of microorganisms are at work in the underground. They purify the water so thoroughly that later drinking water is obtained. In order to be able to live in the subsoil microorganisms need oxygen. Therefore, thorough aeration of the soil is crucial. Aeration is guaranteed by the watering cycle.





Characteristics of DOC (dissolved organic carbon) during the vertical soil passage in the recharge area (a) and during the horizontal aquifer passage from the recharge area to the extraction well (b). Purification mechanism occcurs in the different layers:

Top soil. Although soil microbial respiration and biomass were highest at and directly below the soil surface (Rüetschi et al., 1998), biodegradation processes had no observable effect on the DOC-concentration across the top soil.

Unsaturated sand and gravel horizon below the top soil. In the recharge area the air-saturated trickling filter environment of the sand and gravel horizon below the top soil provided ideal conditions for microbial degradation. Thus, the DOC-concentration declined strongly (Fig. a). The importance of biodegradation is supported by measurements of soil respiration and a rough estimate of carbon fluxes.

Groundwater level. Depending on the operating status of the recharge plant, the groundwater level in the recharge area oscillated between about 3-5 m below soil surface, thus creating a rich diversity of ecological niches in immediate vicinity of each other.

Aquifer. Based on a few chloride and radon measurements, dispersion was likely to be an important reduction mechanism along the aquifer passage. (Fig. b) Quality control measurements, routinely made by the waterworks since many decades, showed no evidence that the purification performance of the underground passage had been declining over time.
(Rüetschi, D. et al. 2005)