

In the main climatic zones of the Russian Federation, the 60-80 % of surface water flow is related to seasonal flooding, and flow then decreases during the remainder of the year ten- and hundred-fold. The lack of streamflow during dry seasons is especially significant for the small stream basins where the water demand is equal or higher than the low-water flow.

Traditionally, reservoirs are used or water is transferred from an adjacent stream basin to manage the annual stream flow distribution. However, in consideration of economic and ecological aspects, compensation seasonal groundwater pumping is a more beneficial method of mitigation of stream-flow deficiency during low-water periods.

A combined water system (CWS) is a complex technology comprising two separate sets of wells – major wells (MW) and compensation wells (CW) – located inside a single stream basin. MW is located on the stream bank or directly in the stream and is supplied by the capture of surface flow, thus depleting the stream flow. The deficiency of the streamflow in dry seasons can be compensated for by the short-term pumping of groundwater. The pumping rate of CW is determined by the difference between the water demand and the permissible water withdrawal of MW. The source for CW is the aquifer storage. Short-term groundwater pumping allows the use of aquifer storage instead of streamflow until drawdowns of the groundwater levels reach the edge of the stream.

The application of CWS for drinking-water demand for Arkhangelsk (Russian Federation) was investigated to illustrate the efficiency of this approach. The groundwater abstraction using traditional pumping water system causes impermissible stream depletion, therefore Permilovo ground water basin located in the area with perfect hydrogeological conditions is not being pumped. The compensation pumping allows to meet water demands during water-limited periods and to avoid environmental problems.