

**Title:** The Effects of a reduction in surface water discharge on the hyporheic environment and Chinook salmon embryos

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Significant spawning populations of spring chinook salmon occur downstream of several Bureau of Reclamation dams in the Yakima Basin. Water is still being released for irrigation demands during spawning, and discharge is often reduced after irrigation demands decline and spawning is complete. This reduction in discharge may result in a change in the magnitude and/or direction of hyporheic flow and, consequently, a change in the environment surrounding the incubating embryos that the adult female salmon chose during spawning. Vertical head gradient was sampled throughout the chinook salmon spawning reach below Cle Elum Dam before and after a change in discharge and throughout the incubation season to determine how a change in surface water discharge influences hyporheic flow. Fertilized spring chinook salmon embryos were incubated adjacent to these sampling points to determine how varying magnitudes and directions of hyporheic flow influence embryo survival. When surface water discharge was decreased experimentally for one day, hyporheic flow became more downwelling. However, as groundwater levels increase throughout the incubation season, hyporheic flow becomes more upwelling when discharge is steady. Embryo survival, length, and weight was similar throughout the range of hyporheic flows observed. The implication is that reducing the discharge from reservoirs after spawning may not be detrimental to incubating embryos. However, because of the many variables influencing hyporheic flow, further work to isolate the effects of reduction in discharge needs to be completed. The Bureau of Reclamation's Denver Technical Service Center has constructed a physical model of a spawning reach where vertical head gradient can be controlled. The use of this model will help isolate the effects of a change in hyporheic flow on embryo survival and condition.