

## Management of Estrogen Toxicity in Shallow Streams

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### ABSTRACT

Due to limited in-stream dilution, wastewater effluent discharges can have a significant impact on the resulting estrogen toxicity in small streams. This toxicity is more pronounced in mixing zones and can persist downstream depending on flow conditions, degradation and dispersion. This study investigates the attenuation of 17- $\beta$  estradiol, a natural estrogen, in the mixing zone of a shallow stream. Four parameters are investigated to identify the factors that contribute to spatial variations in estrogen toxicity: effluent toxicity, effluent discharge rate, background toxicity, and stream flow. The effect of surface diffusers on the spread of estradiol is also presented and discussed briefly. Results indicate that the impacts of dilution and dispersion on estrogen toxicity in the mixing zone are influenced mostly by the effluent discharge. Increased estradiol loads increase the severity of estrogen toxicity in the receiving water while higher effluent flows extend the spread of the mixing zone. Strategies for reducing estrogen toxicity in shallow waters can be based on whether it is more important to control estrogenic severity near the outfall or reduce the length over which estrogen toxicity persists. The release of treated wastewater can then be strategically staged around periods of high stream flow or low influent loads (for greater dilution) or low effluent flow (for shorter mixing length). Surface diffusers can also be installed to hasten the mixing process thereby reducing the length of the mixing zone.

**KEYWORDS:** estrogen toxicity; mixing zone; wastewater effluent