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# Small Drains, Big Problems: The Impact of Dry Weather Runoff on Shoreline Water Quality at Enclosed Beaches

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## ABSTRACT

Enclosed beaches along urban coastlines are frequent hot spots of fecal indicator bacteria (FIB) pollution. In this paper we present field measurements and modeling studies aimed at evaluating the impact of small storm drains on FIB pollution at enclosed beaches in Newport Bay, the second largest tidal embayment in Southern California. Our results suggest that small drains have a disproportionate impact on enclosed beach water quality for five reasons: (1) dry weather surface flows (primarily from over irrigation of lawns and ornamental plants) harbor FIB at concentrations exceeding recreational water quality criteria; (2) small drains can trap dry weather runoff during high tide, and then release it in a bolus during the falling tide when drainpipe outlets are exposed; (3) nearshore turbulence is low (turbulent diffusivities approximately 10−3 m2 s−1), limiting dilution of FIB and other runoff associated pollutants once they enter the bay; (4) once in the bay, runoff can form buoyant plumes that further limit vertical mixing and dilution; and (5) local winds can force buoyant runoff plumes back against the shoreline, where water depth is minimal and human contact likely. Outdoor water conservation and urban retrofits that minimize the volume of dry and wet weather runoff entering the local storm drain system may be the best option for improving beach water quality in Newport Bay and other urban-impacted enclosed beaches.