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Impact of Irrigation on Surface and Groundwater Quality in Southern Alberta

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Manure from Canadian livestock operations often ends up in the fields as fertilizer. In areas where there is a high density of intense livestock operation over-application of manure often occurs. Furthermore, the majority of farmsteads in rural areas use septic systems for treatment of wastewater. Pathogenic microorganisms may be present in both manure and human waste and thereby becoming a potential threat to water quality (surface water as well as groundwater), posing a risk to humans, aquatic life and wildlife. Better understanding of the transport of these microorganisms in soil is essential to ensure safe drinking water in rural and agricultural areas. This research looks at the temporal and spatial dynamics of microbial contaminants in relation to inorganic ions along two major transport flowpaths; an irrigation drain and general groundwater flow. Ten sampling sites were selected along the [U+F07E]20 km Battersea Drain, southern Alberta. All sites were sampled bi-weekly during flow (May till October). To assess the quality of the area's groundwater, a transect of eight groundwater wells, following the general flowpath of the area's groundwater, were sampled simultaneously. Sampling shifted to monthly following drain shut-off (November) and continuing throughout the winter. Samples were analyzed for major inorganic ions, nutrients, total coliforms, total E. coli, as well as pathogenic microbiological species such as E. coli O157:H7, Salmonella, Giardia, and Cryptosporidium. Results showed the greatest manure influence on surface water quality. Generally, the groundwater and drain water showed little variation in the inorganic chemical composition during flow, whereas total coliforms and total E. coli varied significantly both temporally and spatially. Following drain shut-off, significant increases (some >10 fold) were observed for inorganic ions where as microbial content decreased significantly (some to <1 MPN/100 ml). Groundwater contamination by microorganisms was localized in one area along the drain, likely from a nearby lifestock operation, but generally little temporal variation was observed in the water's inorganic composition.