Developing a Framework for Remote Water Quality Sensing of Nutrients from Urban Wastewater Effluent

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Urban wastewater treatment facilities collect water from populated areas and remove pollutants before discharging it into surrounding ecosystems. Many Louisiana wastewater treatment facilities utilize pond acreage for longer detention time to treat effluent instead of standard anaerobic and clarification processes. Due to the open nature of these facilities, weather events impact microbial processing causing facilities personnel to use more resources to meet discharge total maximum daily loads. Remote water quality sensing can provide real-time data for decision-making on energy optimization, chlorine dosing, and nutrient loads in discharged effluent. The study monitored inflow and outflow water to trace increased water quality metrics of nitrate, ammonium, temperature, conductivity, turbidity, pH, and dissolved oxygen to assess the pond's stability. Using deployable positions analytical sensors, hourly optical sampling provided data that was correlated to external weather factors (temperature, rainfall, etc.). The real-time data sets promote proactive responses for facility personnel to prevent reactive adjustments that can increase the cost of treatment. The preliminary data from this study shows fluctuation in microbial processing of nutrients and dissolved oxygen consumption when temperatures change rapidly, including cooling effects from large rain events. Nitrate and ammonium concentrations show variability in inflow while consistent trends of both nitrogen species in outflow indicate adequate pond processing regardless of initial concentration. The readily available data set is shared with the facility for operational changes and will be used to forecast best practices in microbial seeding and chlorine dosing to meet future industry goals. The remote system serves as a template for affordable, real-time monitoring solutions for wastewater effluent processing in urban watersheds.