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Summary the cumulative dissertation

Selection of Optimal Pollution Management Strategy for the Little Akaki River, Ethiopia, Based on Determination of Spatio-temporal Pollutant Dynamics and Water Quality Modeling

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1. This study was conducted on one of heavily polluted urban rivers in Ethiopia, the Little Akaki River (LAR) located in the capital city Addis Ababa, aiming at developing an optimum pollution management strategy in the river. Previous studies in the river often focus on cause-effect correlation based on snap monitoring campaigns.
2. The study was based on a bimonthly monitoring of the Little Akaki River main channel and tributaries water quality and the point sources located in the catchment based on grab sampling technique. Moreover, instantaneous flow measurement was conducted at the monitoring stations.
3. The study finding revealed that the dominant pollution sources in LAR were identified as domestic, industrial and small-scale urban agricultural waste. Accordingly, many of the physicochemical, heavy metal and nutrient pollutants have exceeded the permissible limit.
4. The Aba Samuel Lake located on the southern Addis Ababa and receiving significant quantity of pollution loads specifically from LAR is suffering from intensified eutrophication necessitating for immediate action plan.
5. Compared to the LAR main channel, the tributaries were found to carry higher pollution load owing to the management prioritization.
6. Compared to the point sources, pollution load contributed by nonpoint sources was significantly high. Moreover, the urban land use is the highest contributor to the organic and nutrients pollution of the LAR.
7. Nonpoint sources pollution loads are found to be significantly high in the middle segment of the LAR accounting for more than 50% of the total pollution load in the river.
8. The existing pollution management system in the surface water resources of the city in general and LAR in particular often ignore the role of nonpoint sources. This has resulted in an unsuccessful river restoration program.
9. Process-based modeling such as the integral application of chemical mass balance and watershed nonpoint sources model, PLOAD, was found effective in quantifying diffuse pollution sources load in data scarce catchments.
10. A water quality model, QUAL2Kw, was found to be effective and economical in simulating the pollutants transport in data scarce catchments such as the LAR. It was also found that integrating it

with a watershed nonpoint source models for development of better management alternatives was found efficient and promising.

11. The study revealed that none of the individual targeted mitigation scenarios (source reduction/control, diffuse source management and instream measures) were found efficient enough to restore the LAR natural ecology. Combined application of source-based point pollution control, diffuse pollution management and instream measures was thus found effective in managing the pollution in the LAR and restoration of its natural ecology.
12. Urban river pollution management studies are often complex and require an integrated approach. In this regard, development of working river pollution management system involves continuous monitoring, identification of possible pollution sources and implementing mitigation measures in response to these requirements are necessary. The study revealed that conjunctive application of watershed and water quality modeling was found effective in data scares developing countries.