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Sewage treatment technology selection using Life Cycle Assessment

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Sewage Treatment Technology Selection using Life Cycle Assessment

Research report

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Submitted to

School of Civil and Environmental Engineering, Faculty of Engineering and the Built Environment, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Science in Engineering

Supervisor: Prof Kevin Harding

January, 2021

DECLARATION

I declare that this research report is my own unaided work. It is being submitted to the Degree Master of Science to the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination or to any other University.



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(Signature of Candidate)

11 day of January 2021

Day *month* *year*

ABSTRACT

Global demand for freshwater continues to increase due to accelerated population growth, consequently several attempts has been made to increase its availability. Wastewater treatment remains an attractive alternative for freshwater replenishment. Traditionally, sewage wastewater treatment technology selection has been based on economic factors with little consideration to other sustainability criteria such as the environment and society. In this study, the Life Cycle Assement (LCA) method was utilised to determine and compare the environmental performance of a sequential batch reactor (SBR) and extended activated sludge (EASP) sewage wastewater treatment technologies located in South Africa. The LCA data was analysed using SimaPro® software, a registred trademark of Pre consultants, using ReCiPe midpoint method.

Electricity was responsible for the majority of process contribution towards the environmental burden of both treatment technologies, with contributions >90% on the freshwater ecotoxicity and human toxicity impact categories. The operational phase was a significant contributor towards the environmental burden on all impact categories compared to the construction phase (<10%). SBR facility performed better than EASP on freshwater ecotoxicity and human toxicity impact categories except for freshwater eutrophication. The use of renewable energy, plant optimization and conducting more Wastewater Treatments Plants (WWTP) LCA studies to improve inventory data specific to South Africa were recommended for this study to improve the environmental performance of the facilities.