

**UNIVERSITI TEKNOLOGI MARA**

**TECHNICAL REPORT**

**SOLVING WASTEWATER TREATMENT PROCESS NETWORK AS A  
SHORTEST ROUTE PROBLEM USING INTEGER LINEAR  
PROGRAMMING**

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IN THE NAME OF ALLAH, THE MOST GRACIOUS, THE MOST MERCIFUL

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## ABSTRACT

Wastewater treatment (WWT) is a process in which the solids in wastewater are partially removed and changed into relatively stable organic solids by breaking down complex organic solids. Wastewater treatment can be modelled as shortest route problem because it can improve the description, which is clearer and easier to observe in minimizing the costs of the wastewater treatment process. Shortest route problems are some of the most researched network flow optimization problems, with attractive applications in a variety of fields. One method for selecting the best approaches or restrictions that are actually required for every process is integer linear programming, which may also select the process of constraints that is the most affordable. Each step in the wastewater treatment process costs a lot of money. This is because there is no optimal sequences of treatment process selected that can minimize the cost for three different cases which are marine discharge, non-vegetable irrigation and boiler feed reuse. This can be proven when all the 15 sequence of nodes are selected to run the process of wastewater treatment. Hence the objective of this study is to treat the wastewater treatment at the lowest possible cost while considering the acceptable pollutant levels for three different cases which are marine discharge, non-vegetable irrigation and boiler feed reuse. The integer linear programming model was solved using Excel Solver. The best wastewater treatment process with the minimum cost for each cases were obtained. The overall cost if the wastewater treatment undergoes all the process is RM 3286. However, the findings indicate the total minimum cost incurred for are marine discharge, non-vegetable irrigation and boiler feed reuse are RM 343, RM 913 and RM 902, respectively. The results are described and discussed based on the sequence of nodes selected. The total sequence of nodes selected for marine discharge, non-vegetable irrigation and boiler feed reuse are 8, 11 and 9 respectively. Due to this , there are a huge different between total actual cost and the total cost after the optimal nodes selected.