

INVESTIGATION THE SOIL AQUIFER TREATMENT FOR DOMESTIC WASTEWATER TREATMENT, XAYSETHA DISTRICT VIENTIANE CAPITAL, LAO PDR

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Abstract - The study is being carried out to investigate the potential for applying SAT in Xaysetha district, Lao PDR and investigation the most suitable site for SAT in Xaysetha district. The methodology was used MCDA, GIS, RRA and semi-structured interview to rank SAT site and investigate the physical, social and economic factor at the most suitable site (Nonvay site). The results of SAT ranking indicated that Xaysetha district has a potential to construct up to 3 high suitable site, 8 moderate suitable sites, and 6 low suitable sites. On the other hand, the results of physical, social and economic assessment at Nonvay site represented that DO was exceeded the Lao National Environmental Standard, and the soil infiltration rate is about 24 mm/hour (0.58 m/day). The households around Nonvay site have their own land and they access to water use and have a relationship with 9 organizations. They product wastewater was estimate 150 liter/person/day. And the land available for SAT is worth to US\$ 39 million.

Keywords - Domestic Wastewater Treatment, Soil Aquifer Treatment, Xaysetha District, Vientiane Capital.

I. INTRODUCTION

Soil Aquifer Treatment (SAT) is a low-cost of wastewater treatment technology that relies on natural treatment processes in soil and aquifers. It improves the quality of sewage effluent and reduces the risk from water-borne diseases. It has been applied in many countries of the world including Israel, United States of America and Australia. The SAT has a potential for more widespread application but has never before been implemented in Lao PDR, where wastewater treatment in the country is still challenged, due to limited financial resources and use of wastewater treatment technologies.

The SAT method can be effective but requires several steps. First, it needs a pipe to connect the wastewater source so that it discharges to the SAT infiltration basin. Then, such wastewater will be treated by each layer of the soil in the unsaturated zone until it reaches aquifer and mixes with the ambient groundwater. Finally, it is returned to a river or the sea or else may be recovered using boreholes and reused for multiple purposes like agriculture, small industrial, park watering, street cleaning etc.

In the first phase of the research reported that SAT potential sites in Xaysetha District,

Vientiane Capital, where wastewater related problems are faced. The results indicated that Xaysetha district has a potential to construct up to 17 SAT sites (infiltration basins), each associated with the major villages or village clusters in the district. Moreover, this analysis shows that each site has its

own specific land area, wastewater pipe length, and capacity of household wastewater treatment. However, that research only relies on Geography Information System (GIS) and Remote Sensing (RS) methods without a field investigation. It follows that the success of a technological system such as SAT strongly relies on appropriate site investigation. The correct SAT site investigation, indeed, constitutes a fundamental first step in the process of SAT site implementation to make a decision whether to proceed the pilot scale testing and thus to make efficient use of human and financial resources.

The present study aims to: 1) rank the SAT sites for household wastewater treatment in Xaysetha district, Vientiane Capital, and 2) assess the potential of physical, social and economic factors at Nonvay site, Xaysetha district, Vientiane Capital.

This research is intended to benefit relevant government and line agencies responsible for solving wastewater issues in Lao PDR, particularly in Vientiane Capital. Meanwhile, it will provide a database for relevant sectors or organizations, who wish to consider or apply SAT technology in the Lao PDR or others low-income countries.

II. METHODOLOGY

2.1 SAT site ranking

In order to identify high, moderate and low suitable sites for SAT in Xaysetha district. Appropriate parameters such as soil type, slope, pipe length, and elevation were weighted with respect to their importance to SAT, using GIS overlay function and

The line graph below describes the soil infiltration rate at Nonvay site. It illustrated that between 5 to 60 minutes, the calculative infiltration rate was not steady but it was stable since 60 to 120 minutes which is average 8 mm/20 minutes. Consequently, the infiltration rate on Nonvay site is approximately 24 mm/hour (0.58 m/day). In overall, the soil infiltration rate which is 0.36 – 1.2 m/day is moderate suitable. Therefore, the soil infiltration rate at Nonvay site is 0.58 m/day, it means that the SAT site at Nonvay village is moderate suitable.

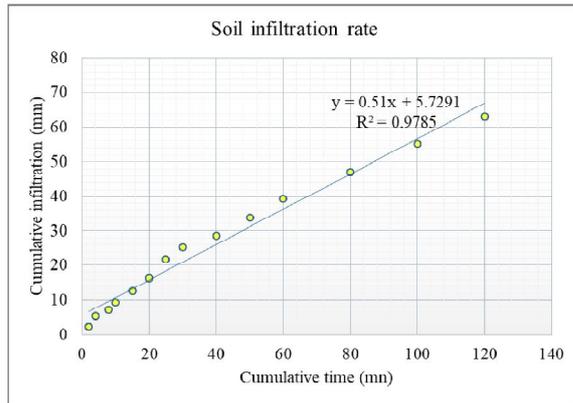


Fig. 3 Soil infiltration rate in the most suitable site

2) Social factors

• Social, cultural, and institutional resources

The results of holding a local community meeting with local people at Nonvay site shown that the local community has a relationship with 9 organizations such as water supply enterprise, school, office of natural resources and environmental, office of public works and transportation, temple, Xaysetha hospital, office of public health, department of water resources, and village office. These organizations take a different role for wastewater addressing to the local community. As shown on the [fig. 2].

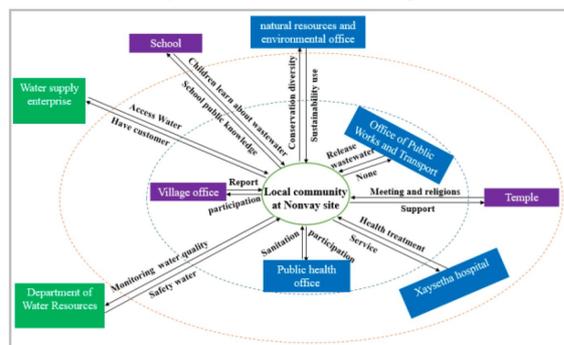


Fig.2 Analysis of the relationship between the organization and the community at Nonvay site.

As can be seen on the fig. 2, school, village office, and temple are located near to the local community, while natural resources and environmental office,

public works and transport office, public health office, and Xaysetha hospital are moderate located close to the local community. And the department of water resources, and water supply enterprise are far a way from the local community. However, the village office, office of public works and transport, and public health office have a relationship with local community at Nonvay site than others.

• Natural resources

In terms of natural resources assessment, most of households at around Nonvay site were located their home on their own land (95%), with the remainder residing on land owned by family relatives. They access to the water supply 90%, groundwater 88%, and bottle water 100%.

3) Economic factor

According to the land cost assessment at Nonvay site, the average of land cost is approximately US\$ 50 per square meter. Therefore, the Nonvay site covers 774,641 m², so the total land cost is US\$ 39 million.

CONCLUSION

The study is being carried out to investigate the potential for applying SAT in Xaysetha district, Lao PDR and investigation the most suitable site for SAT in Xaysetha district. The methodology was used MCDA, GIS, RRA and semi-structured interview to rank SAT site and investigate the physical, social and economic factor at the most suitable site (Nonvay site). The results of SAT ranking indicated that Xaysetha district has a potential to construct up to 3 high suitable site, 8 moderate suitable sites, and 6 low suitable sites. On the other hand, the results of physical, social and economic assessment at Nonvay site represented that DO was exceeded the Lao National Environmental Standard, and the soil infiltration rate is about 24 mm/hour (0.58 m/day). The households around Nonvay site have their own land and they access to water use and have a relationship with 9 organizations. They product wastewater was estimate 150 liter/person/day. And the land available for SAT is worth to US\$ 39 million.

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