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Master of Science in Environmental Science

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Wind-induced Resuspension of Total Suspended Solids in Laguna Lake During the Dry Season

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ABSTRACT

WIND-INDUCED RESUSPENSION OF TOTAL SUSPENDED SOLIDS IN LAGUNA LAKE DURING THE DRY SEASON

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Laguna Lake is the largest lake in the Philippines and provides several ecosystem services to both its inhabitants and surrounding cities and municipalities. The lake's water quality has been deteriorating over the years due to abuse in its usage. One of the parameters used to measure water quality is Total Suspended Solids (TSS) which are known to increase nutrient cycling and turbidity among other effects. However, few studies have been done on the dynamics of suspended solids in Laguna Lake. The lake's shallowness, averaging 2.5 m, allows wind-induced wave action to cause resuspension of solids settled on the lakebed. Due to the varying wind speeds experienced by Laguna Lake throughout the year, it is expected that different parts of the lake experience this phenomenon in varying magnitudes. This spatiotemporal variability may, in turn, affect the productivity in different parts of the lake throughout the year. This study aims to determine the critical conditions for wind-induced resuspension to occur and evaluate the spatiotemporal variability of wind-induced TSS in Laguna Lake during the dry season period. Analytical models were used to calculate bottom water motion as a proxy for TSS concentration and were compared to satellite-derived TSS measurements. The model used wind speed, fetch, and bathymetry as inputs and used orbital velocity to predict the resuspension phenomenon. Landsat-8

imagery was used to derive TSS concentrations for the entire lake.

The study showed that the TSS concentration and distribution across the lake varies throughout the dry season. The highest TSS concentration was recorded around the months of March, April, and the first weeks of May and then dropped down during the month of June. The lake-averaged satellite-derived TSS concentrations coincided with the monthly changes in wind speed. It is shown using in-situ based measurements that there is a critical orbital velocity value of 0.033976 m/s wherein the effects of wind-induced resuspension become the dominant driving factor in the increase of TSS in the water surface. Other combinations of data failed to produce a critical value for orbital velocity or wind speed due to a poor fit with satellite-derived TSS data. The observed spatiotemporal variation of TSS associated with wind can serve as a basis for regulatory bodies in recommending allowable water activities in different areas and times of the year to maintain a certain water quality standard. These results can further assist in determining the possible impact of changing wind patterns on the water quality parameters of Laguna Lake.