Notice of the Final Oral Examination
for the Degree of Master of Applied Science

of

TAO YU

BSc (Dalian Ocean University, 2010)

“Modelling Biofilm Activity in Bioretention Cells”

Department of Mechanical Engineering

Friday, December 18, 2015
10:00 A.M.
Engineering Office Wing
Room 502

Supervisory Committee:
Dr. Caterina Valeo, Department of Mechanical Engineering, University of Victoria (Supervisor)
Dr. Phalguni Mukhopadhyaya, Department of Mechanical Engineering, UVic (Member)

External Examiner:
Dr. Angus Chu, Department of Civil Engineering, University of Calgary

Chair of Oral Examination:
Dr. Dale Olesky, Department of Computer Science, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies
Abstract

Biofilms can be simply defined as communities of microbes attached to a surface. There are various types of biofilms, which include good biofilm or bad biofilm. Good biofilms offer valuable services to human society or the functioning of natural ecosystems such as those that contribute to controlled bioremediation of ground water and soils in Low Impact Development approach called bioretentions cell. This thesis researched ways to model biofilm activity at the field-scale and experimental data (BOD<sub>5</sub> and NO<sub>3</sub>-) to verify these models. Two mathematical models are presented in this work. The first model provides and tests the solution of substrate and biomass concentration while the second model modified the expression for the substrate flux into biofilm. They are analyzed using a sensitivity analysis and their performance is compared using field-scale data. The solution of concentration S(x) is computed with some selected values of dimensionless biofilm thickness δ (0.0375 and 3.75) and dimensionless substrate concentration outside of the biofilm S<sub>L</sub> (0.005 to 0.5) which shows these two parameters significantly effect on the results in the model. The simulation result illustrates that biofilm activity mostly occurs in the summer while the substrate flux is normally stable at similar level in the same season.