UNDERSTANDING THE IMPACT OF LAND USE ON MICROBIAL WATER QUALITY TO SUPPORT DECISIONS FOR A FUTURE LAND USE PLAN

Mohammed T. Aljassim

ABSTRACT

May River in the Town of Bluffton has been known for its high level of water quality. The May River is one of the major sources of shellfish harvesting in South Carolina. Due to the non-point source pollution of fecal coliform, the quality of the May River was degraded. As a result, shellfish harvesting classification in the May River was downgraded for the first time in its history. The rapid growth of the Town has led to a change in land use, which might be related to the increased levels of fecal coliform in the stream of the river. Furthermore, future land use developments are planned, and continues population growth is anticipated in the Town. Therefore, this research attempts to support the decision related to the implementation of a proposed land use plan by understanding the impact of the recent land use change on microbial water quality. Geographic Information System (GIS) was integrated with statistical analysis to assess the spatial relationships between different land use types and fecal coliform. We found that residential areas, forestlands and golf courses are significantly correlated with fecal coliform. Geographically Weighted Regression (GWR) was used to examine the spatially varying relationships between specific land use types and fecal coliform concentrations among the sampling locations. Predictive models were developed to predict fecal coliform concentrations by including data of land use types and meteorological and environmental factors. In order to determine the optimal spatial scale for the land use variables, several circular buffer sizes were developed and examined for their appropriateness in providing significant models for fecal coliform prediction. It was shown that

land use percentages within 1800 meters radius were most significantly correlated with fecal coliform. Rainfall measurements, water temperature, air temperature, salinity, and tide stage in addition to land use classes (residential areas, forestlands, and open spaces) within the 1800 meters radius were able to provide the most significant models for fecal coliform prediction. In order to predict the impact of the future land use developments plan, two rainfall scenarios (average and maximum precipitation) were used in the predictive models. The findings of this research indicated that the future land use plan will not lead to higher fecal coliform loadings than the current land use.