POINT AND NON-POINT SOURCE POLLUTION IN DELHI WATERSHED: QUANTIFICATION AND MANAGEMENT

by

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to the

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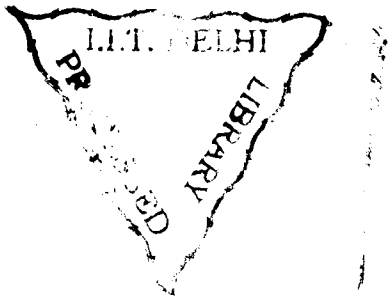

CERTIFICATE

It is certified that thesis entitled "**Point and Non-point source pollution in Delhi watershed: Quantification and Management**" submitted by Ms Priyanka Jamwal to the Indian Institute of Technology Delhi, for the award of the degree of Doctor of Philosophy, is a record of the original bonafide research work carried out by her under our supervision and guidance. The thesis has reached the standards of fulfilling the requirements of the regulations relating to the degree.

The results contained in this thesis have not been submitted in part or full to any other university or institute of the award of any degree or diploma.

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ABSTRACT

Point and non-point sources affect water quality in a watershed. In this study, both point and non-point sources have been considered and contribution of each of the source is determined for Delhi watershed. In Delhi city, the quality of urban runoff produced from sub-catchments is found to depend on the watershed variables i.e. land-use, population density and drainage area. The present quality of runoff produced from these sub-catchments does meet the effluent discharge standards for direct discharge to surface waters.

Multiple regression models were developed to predict pollutant concentration and load from the watershed. Load models explained greater variability as compared to the pollutant concentration models. Theoretical model was developed to determine public health risk from polluted runoff. It was found that increased exposure to poor microbial quality of urban runoff for shorter duration of time produced greater health risk to public as compared to health risk from surface water and groundwater.

Affect of climatic conditions and topography on survival of fecal coliforms (FC) in sewer systems of two different watersheds i.e. Marais (France) and Vasant Kunj (India) was evaluated. Average dry weather FC concentrations during summer and winter seasons were same within the sewer systems of both the watersheds. Greater variability in FC levels was observed within combined sewer system in Marais during summer as well as winter seasons as compared to the separate sewer system at Vasant Kunj. It was found that sediments support the growth of FC in the combined sewer systems thereby neutralizing dilution affect of excess flow during rain events.

Efficiency of all seventeen STPs employing different treatment technologies in Delhi city was evaluated. Oxidation pond and extended aeration treatment process turned out to be the most efficient STPs. The quality of effluent produced from all STPs except oxidation pond Timarpur and Mehrauli does not meet the effluent discharge standards of 1000MPN/100ml for direct discharge and for unrestricted irrigation set by National River Conservation Directorate (NRCD).

Data envelopment analysis was employed for determining the overall efficiency of sewage treatment plants in Delhi city. Depending on the availability of land, oxidation pond treatment technology comes out to be the most economical choice for treating sewage in developing counties. Extended aeration and BIOFORE technology turned out to be economically inefficient. For present quality of effluent produced by STPs in Delhi watershed, various cost, energy and manpower reductions are suggested, so as to transform these STPs to efficient entities.

By using multiple regression model and simple load estimation approach it was found that non-point source pollution contributes to higher FC load (MPN/yr) during monsoon period as compared to all year round the FC contribution from STPs. Therefore it can be concluded that there is urgent need of augmenting STPs and controlling quality of non-point source pollution for the sustainable development of watershed.

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