RAINWATER HARVESTING PRACTICES IN SRI LANKA AND AN INVESTIGATION ON COST EFFECTIVE DESIGN CONSIDERATIONS FOR WET AND DRY ZONES

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Degree of Master of Engineering in Water Resources Engineering and Management

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University of Moratuwa

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UNESCO Madanjeet Singh Centre for
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Department of Civil Engineering

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August 2014

DECLARATION

I declare that this is my own work. This thesis does not incorporate without acknowledgement of any material previously submitted for a Degree or Diploma in any other university or institute of higher learning to the best of my knowledge and belief and it does not contain any material previously published or written by another person expect where the acknowledgment is made in text.

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The above candidate has carried out this research for the Master's thesis under my supervision.

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Dr. R. L. H. L. Rajapakse Date

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AHP	-	Analytical Hierarchy Process
CWSSP	-	Community Water Supply and Sanitation Project
GBCSL	-	Green Building Council of Sri Lanka
GO	-	Government Organisation
IDF	-	Intensity Duration Frequency
LRWHF	-	Lanka Rainwater Harvesting Forum
NGO's	-	Non-Governmental Organisations
NWSDB	-	National Water Supply and Drainage Board
RDA	-	Road Development Authority
RRWH	-	Roof-top Rainwater Harvesting
RRWHS	-	Roof-top Rainwater Harvesting System
RWH	-	Rainwater Harvesting
WSSCC	-	Water Supply & Sanitation Collaboration Council
UDA	-	Urban Development Authority
VAO	-	Village Administrative Officer

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ABSTRACT

All over the world, masses of human beings consume water for both potable and non-potable uses. While access to safe drinking water is explicitly acknowledged as a basic human need, water has an economical value in today's world market. The water crisis and impending climate change impacts highlight the immediate need for adopting alternative solutions to relieve the pressure on conventional water sources and Rain Water Harvesting (RWH) is ascribed as one of the most sustainable, low cost solutions equally applicable to both the urban and rural water management systems. In consideration of ever growing need for water conservation and as a measure in addressing the future issues of sustainable water management, the Government of Sri Lanka (GOSL) has recently implemented policies, rules and regulations to promote rainwater harvesting and one of the technologies recommended by the government is the Roof-top Rainwater Harvesting Systems (RRWHS). However, the initial investment cost for the storage tank is relatively high for rural communities in need and lack of information on tank size selection, cost recovery time, etc., hinder the popularizing and adopting of RRWHS among both rural and urban communities. In this study, an evaluation and assessment of presently existing RRWH practices in Sri Lanka have been undertaken in an attempt to identify the probable reasons that hinder popularising of RRWH among both communities, while a special consideration is given to the design aspects lacking concerns of cost, making RRWHS unaffordable especially to rural communities in need. To investigate the design considerations under the constraints of economical and reliability aspects, the design of storage tank, conveyance system and quality system of RRWHS are considered. Based on the findings of the present study, the estimation of the storage tank size is recommended to be achieved by daily water balance equation method and the excel worksheet model developed in this study was found to be more effective than the mass balance, analytical, and sequent peak algorithm methods presently in practice. The conveyance system is recommended to be designed based on updated rainfall intensity values (from updated IDF curves) and the quality of water harvested can be improved by incorporating a fixed volume first flush diverter. The time for cost recovery estimated based on present tariff for pipe-borne water and average household water use has been recognized as a fact to justify use of RRWH in urban setups, further to other indirect benefits. The recommendations for the best methodologies and possible further improvements are proposed based on the benefits of cost reduction estimated according to the present water consumption rate using present water tariff and calculating the cost recovery period for the RRWH systems.