INTEGRATED WATER BALANCE STUDY FOR OPTIMUM UTILIZATION OF WATER RESOURCES OF WALAWE GANGA

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Declaration

The work included in the thesis in part or whole has not been submitted for any other academic qualification at any institution.

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Abstract

The Walawe Ganga originates from the southern slopes of the central hills at an elevation of 2300 m above mean sea level and has a catchment area of 2490 km^2. The Walawe basin receives rainfall from both monsoons ranging from 1000 mm to 2500 mm during an average year.

There is a concern now that the inflow to Uda Walawe may not support the on going left bank extension work due to the present high consumption of water in existing areas due to present practice of cultivating paddy in unsuitable soil and inefficient water management. Hence the main objective of the research study will be:

- To assess the water availability at the Uda Walawe reservoir with regulation at Samanalawewa.
- To estimate the extent of the new area that could be developed under the Walawe left bank extension project.

To assess the water availability in the basin, the river basin network model MIKE BASIN has been used. It mathematically represents the river basin encompassing the configuration of Main River and its tributaries, hydrology of the basin and the existing as well as potential major users and also their demands on water.

The basic input to the model consists of time series data of catchment runoff for each branch of the river network. Since there were no gauging stations upstream of Uda Walawe reservoir, runoffs in each of the sub basins were obtained from Rainfall-Runoff simulation. MIKE BASIN has a link to several rainfall-runoff models in MIKE 11 and NAM was chosen to simulate the runoff. The rainfall data during 1991-2000 were used for the analysis and as the time of resolution for rainfall was 24 hours the objective functions of NAM calibration were limited to overall water balance error and overall root mean square error. Initially, the Samanalawewa and Hulanda oya sub basins were simulated in obtaining NAM model parameters and by application of these parameters to similar basins, runoff data in other sub basins were produced.

MIKE BASIN was set up to carry out Simulations for three main scenarios consisting Present, Future and Present without Samanalawewa. The simulation period for Present

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scenario was 1992-2000. Simulation period for Future scenario was selected as 2005-2013 on following assumptions.

- The on going extension works will be completed by the year 2005
- The rainfall pattern for the period 1992-2000 will occur for the period 2005-2013
- Samanalawewa power plant will function as a base plant.

The results show that at present there are no irrigation deficits in the Uda Walawe irrigation project. But with increased irrigable area with intended left bank extension work, there will be deficits in Yala season during dry spells in the basin which occurred once in every four years. Further it was observed that even with the full development in the basin, the vast amount of water is spilled from Uda Walawe reservoir during the Maha season due to insufficient storage at Uda Walawe reservoir. Therefore the feasibility of increasing the storage at Uda Walawe reservoir may be investigated.

The net irrigable area in Uda Walawe Irrigation project under the right and left banks are 12,000 and 6110 ha and further 5151 ha of new lands will be developed under phase II of left bank irrigation extension project. In MIKE BASIN simulations new area was divided into two irrigation schemes having an area of extent 3600 and 1551 ha and simulations were carried out by curtailing the development area. The results show that by curtailing the development area, significant improvement in deficits could not be observed. Therefore, it is recommended to develop the full extent in extension area as the water resources are available during average years. However, it must be ensured that the cropping patterns assumed in obtaining design water requirements are practised in the extension area.

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List of abbreviations

ADB	-	Asian Development bank
CEB	-	Ceylon Electricity Board
Cumec	-	cubic meters per second
DHI	-	Danish Hydraulic Institute
FSL	-	Full supply level
ha	-	Hectare
HFL	-	High flood level
JICA	-	Japan International cooperation Agency
JBIC	-	Japan Bank for International Cooperation
km	-	Kilometer
km^2	-	Square kilometer
LB	-	Left bank
LBMC	-	Left bank main canal
m	-	Meter
mm	-	Millimeter
m^3/s	-	Cubic meter per second
MASL	-	Mahaweli Authority of Sri Lanka
MCM	-	Million cubic meters
m asl	-	meters above sea level
NORAD	-	Norwegian Agency for development Cooperation
OFC	-	Other field crops
RB	-	Right bank
RBMC	-	Right bank main canal
RVDB	-	River valleys Development Board
SAPI	-	Special Assistance for Project Implementation

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