

RECOMMENDATION LETTER

This is to certify that Mr. Binod Parajuli has prepared the Dissertation entitled **“APPLICATION OF HYDRO-METEOROLOGICAL AND GIS BASED HYDRAULIC MODEL IN RIVER TRAINING WORKS OF MARINE RIVER WITH PARTICULAR REFERENCE TO FOOD SECURITY”** to fulfill the Degree of Master of science in Meteorology of the Tribhuvan University is the record of the candidates own work carried by him under our supervision and guidance.

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LETTER OF APPROVAL

This Dissertation entitled “**APPLICATION OF HYDRO-METEOROLOGICAL AND GIS BASED HYDRAULIC MODEL IN RIVER TRAINING WORKS OF THE MARINE RIVER WITH PARTICULAR REFERENCE TO FOOD SECURITY**” submitted by Mr. Binod Parajuli has been approved as a partial fulfillment for the Master of Science in Meteorology.

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ABSTRACT

Marine River is one of the major Tributaries of Bagmati River originated from Mahabharat hills lying in south-western part of the Sindhuli District. Total river length is about 68 km and the total basin area is about 544 km². Annual rainfall in the basin area varies from 1,724 mm (driest year) to 3,320 mm (wettest year) with 2,580 mm as the annual average value. Statistical analysis showed that the 24 hour maximum rainfall for 15 years, 25 years and 100 years return periods are 369.9mm, 448.3mm and 583.8mm respectively. This showed the region is more susceptible to flood. A major flood disaster has occurred in Marine River on 19-21 July, 1993 which was caused by intensive rainfall in the central region of Nepal. At that time the rainfall of Hariharpur Garhi was 482.2 in record. Along with this the floods of 1899, 1985 and other minor floods had swept away a couple of villages, killed a number of people and livestock and damaged agricultural land and standing crops, and other infrastructures in the past. Flood of 15, 25 and 100 years return period estimated by Modified Dickens method were 1213.62m³/s, 1391.3m³/s and 1872.16m³/s respectively which were taken as the different design discharges for each to be compare to the river training works which was proposed for the protection of inundated land.

A one-dimensional hydraulic model in HEC-RAS was developed and executed which enabled the analysis of flooding under different scenarios. Suitable structural methods for flood control identified were levees along the banks. The proposed river training structures in the Marine River explicitly demonstrates the relationship among the three parameters, viz, rainfall intensity, reclaimed land and economic value with respect to food security. Hydraulic models coupled with Geographic Information System (GIS) are powerful tools for quantitative and qualitative monitoring of spatial and temporal variation of flows in the river. The dynamic capability of GIS interfaced models which provide impressive visual perception in the sense of spatial and temporal variation of the modeling results in different scenarios for planners, could be used as a decision making tool for river training and sustainable integrated water resource management. For the purpose three different scenarios for each of the return period floods were analyzed. The comparative study showed the value of reclaimed agricultural land are 218.52, 224.79 and 251.50 hector for 15, 25 and 100 year return period flood securing the food (rice) for 15.8%, 16.3% and 18.2% of the total population of the basin considering the per capita rice consumption to be 93.4kg/yr taking into account that the hybrid rice is cultivated.

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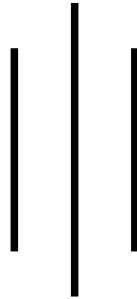
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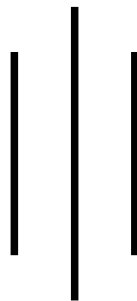
LISTS OF ACRONYMS

CDHM	Central Department of Hydrology and Meteorology
d/s	Downstream
DADO	District Agriculture Development Office
DDC	District Development Committee
DHM	Department of Hydrology and Meteorology
DoI	Department of Irrigation
DWIDP	Department of Water Induced Disaster Prevention
GCM	General Circulation Model
GIS	Geographical Information System
GoN	Government of Nepal
ha	Hectare
HEC-RAS	Hydraulic Engineering Centres' River Analysis System
HFL	Highest Flood Level
IoE	Institute of Engineering
LB	Left Bank
MBT	Main Boundary Thrust
MoEST	Ministry of Environment, Science and Technology
MS	Middle Siwaliks
MT	Metric Tons
NARC	Nepal Agricultural Research Center
PCJ	Prem Chandra Jha
PMP	Probable Maximum Precipitation
RB	Right Bank
RBL	River Bed Level
RECHAM	Research Centre for Hydrology and Meteorology
SOHAM	Society of Hydrologists and Meteorologists – Nepal
TIN	Triangulated Irregular Network
TU	Tribhuvan University
u/s	Upstream
US	United States
USACE	US Army Corps of Engineers
VDC	Village Development Committee
WECS	Water and Energy Commission Secretariat
WS	Water Surface

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**Dissertation submitted to the Central Department of Hydrology and
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