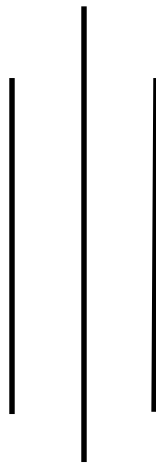


**ESTIMATION AND ANALYSIS OF LOW, HIGH
AND MEAN MONTHLY FLOW FOR UNGAUGED
ANDHI KHOLA RIVER**

A

Dissertation Submitted to the Institute of Science and Technology
Central Department of Hydrology and Meteorology
in Partial Fulfillment of the Requirements for the
Degree of Masters in Hydrology and Meteorology



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Letter of Recommendation

This is to certify that **Mr. Bhesh Raj Aryal** has prepared this dissertation on ‘Estimation and Analysis of Low, High and Mean Monthly flow of Andhi Khola River’ under my supervision. I certify that he had carried out all his work sincerely with keen interest. I hereby recommend this thesis for approval.

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Abstract

The Andhi Khola is one of the major tributaries of the Narayani River. The Andhi Khola basin is located in the Syangja district of Gandaki zone in the western development region of Nepal. The catchment area is 195 sq. km. with main stream length of 27.4 km and the basin is length 17km with maximum width of 18.3 km. The minimum elevation of main channel is 748 masl and maximum elevation of main channel is 2287masl. Physiographically 43.6% of catchment area of Andhi Khola basin lies below the 1000 masl and remaining 56.4% lies between 1000 and 3000 masl.

Human settlement is predominately in rural areas and agricultural activities are more intense in the lower elevation, particularly in river valley and flat areas. There is no major water uses project in the entire river course except for Andhi Khola Hydro power and small irrigation scheme. The growing settlement will require more water supply and more linked roads have to be constructed with many bridges and cannels for irrigation of flat areas. Since no discharge data for Andhi Khola at Borlangpul river were available, low flows and high flows have been estimated using transposition data with the help of data source (DHM) as referred by WECS/DHM method.

The discharge data of Andhi Khola River at station no. 415 have been transposed to the Andhi Khola River at Borlangpul for estimation of high flow and min monthly flow.

The low flow has been estimated with WECS/DHM method using the catchment area with associated parameters. The monthly minimum low flow for the return period of 2 years has been found to be $2.37\text{m}^3/\text{s}$. Similarly the monthly flows have been calculated as $1.69\text{ m}^3/\text{s}$ and $1.56\text{ m}^3/\text{s}$ for the return periods of 10 and 20 years respectively. The one day minimum low flow value for the return period of 2 years, 10 years and 20 years have been calculated as $1.8\text{ m}^3/\text{s}$, $1.22\text{ m}^3/\text{s}$ and $1.11\text{ m}^3/\text{s}$ respectively.

These values are very important for flood control scheme, irrigation and domestic water project that are likely to be implemented in the near future for this ungauged river. The flow duration curve has also been constructed for this river with the WECS/DHM method. The flow duration curve indicates that exceedence probability of 100% flow is only $0.67\text{m}^3/\text{s}$. Similarly exceedence probability of 20% and 60% are $19.98\text{ m}^3/\text{s}$ and 3.31

m^3/s respectively. These values are also very important for irrigation, hydropower, flood control scheme project and drinking project in near future. Regarding the high flood analysis for Andhi Khola river, discharge data at station no: 415 were transposed to Andhi Khola River at Borlangpul. Estimated flood for 5 years, 20 years, 50 years and 100 years have been calculated as about $213.4\text{m}^3/\text{s}$, $362.5\text{m}^3/\text{s}$, $478.1\text{m}^3/\text{s}$, $600.7\text{m}^3/\text{s}$, $777.1\text{m}^3/\text{s}$ and $922.1\text{m}^3/\text{s}$.

The discharge data of Andhi Khola River at Station No. 415 which have been transposed to Borlangpul site for Andhi Khola river gives reasonable estimated flood values as estimated by WECS/DHM method.

The estimated high floods by transposition method will be useful for designing the bridge near Waling Bazaar and Galyang Bazaar crossing the Andhi Khola to link different villages of Parbat district. The results from the discharge data transposition method for ungauged Borlangpul Andhi Khola River will be useful for water resources project in the near future and for different hydro power project. Such techniques will also be useful and can be applied for many ungauged catchment in various part of the country.

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Abbreviations

AWI	Average Wetness Index
DHM	Department of Hydrology and Meteorology
GIS	Geographic Information System
GLOF	Glacier Lake Outburst Flood
GBM	Ganga Brahmaputra Meghana
ICIMOD	International Centre for Mountain Development
KW	Kilowatt
MPF	Maximum Probable Flood
MW	Megawatt
MULTR	Multiple Regression Program
NOAA	National Oceanographic and Atmospheric Agency
SPS	Standard Project Storm
UK	United Kingdom
UNEP	United Nations Environmental Programme
US	United States
WECS	Water and Energy Commission Secretariat

Mathematical Abbreviations

A	Basin Area
A<3K	Basin area below 3000m
A<5K	Basin area below 5000m
$C_{d,T}$	Constant coefficient for a duration d and return period T
$F_{d,T}$	Coefficient of independent variable for duration d and return period T
g	Skewness coefficient
k_T	Frequency factor
L	Basin Length
Masl	Above mean sea level
r	Coefficient of corelation
R^2	Goodness of Fit
s	Standard normal variate
T	Return Period
y_T	Reduced variate
\bar{y}_n	Reduced extremes
Q_2	2 year return period flood discharge
Q_{100}	100 year return period flood discharge
$Q_{d,T}$	Discharge
x_T	Magnitude of flood
n	Standard deviation