Assessment of Changes in Hydrologic Regime of the Teesta River by Teesta –V Hydroelectric Power Project in Sikkim India

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INTRODUCTION

• Dams as monuments to progress and prosperity and hydropower as a contributor to the ever rising global energy demand has multiplied the number of hydropower constructions.

• According to the International Commission on Large Dams (ICOLD), more than 40,000 large dams are being built across the rivers of the world holding back 15% of total annual global river runoff (Baghel et.al 2010).

• The ailing manifestation of the river obstruction by hydropower construction can be categorized in the following four broad themes, Ecology, Social impact, Changes in Hydrological Regime (MC.P 2008).

• Dam constructions in India have seen serious condemnations and protests owing to its large scale environmental and social harm.
STATEMENT OF THE PROBLEM

• Hydroelectric generating projects in Sikkim have faced serious condemnations from the native society for their environmental and cultural repercussions.

• Change in catchment flow regime due to hydroelectric power projects construction, loss of productivity of land, increased rate of erosion and the impact on the social and cultural practices have been reported (ACT 2010).

• To analyse the changes in hydrological regime and catchment flows due to construction of Teesta V hydroelectric power project.
STUDY AREA

• A sub catchment of the river Teesta river basin in the Indian state of Sikkim.
• Teesta-Dikchu watershed The Teesta V hydroelectric power project.
• 510MW
• Operational since 2008
• Total area of 4657 Sqkm.
• located 88°13"E, 28°12N" to 88°51"E to 27°20"N.
• Elevation 310-7,734
METHODOLOGICAL FRAMEWORK

Sources of Data

1. Soil database-
   Soil Map of Sikkim
   Source: Geological Survey of India

2. Land use database
   Land use Land cover data.
   Source: USGS – Landsat 8.

3. DEM
   Aster DEM 30m
   (NIH Roorkee)

4. Weather database
   Rainfall and Temperature
   Source: India Meteorology Department Pune.,
   (Chungthang, Khanitar, Sankalam, Gangtok)

5. Reservoir Data
   NHPC Teesta V

Data Analysis

1. Soil and Water Assessment Tool (SWAT) (Data Generation)

2. Indicators of Hydraulic Alteration (IHA)

Hydrological studies in the 2,400 kilometres long eastern Himalayan stretches with a vast water reserve having a total ice cover of 3,735km (IR 2008)
## DATA BASE

### WEATHER

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RESULTS AND DISCUSSION

- SWAT Model Run Period: 2000-2015
- Calibration Period: 2006-2015
- Generation of daily time series flow data for a 15 year period.
- The generated data used in the IHA
IHA analysis reads the flow output in five groups:

1) Magnitude of monthly flow conditions
2) Magnitude and duration of extreme flow events (e.g. high and low flows)
3) The timing of extreme flow events.
4) Frequency and duration of high low flow pulses; and
5) The rate and frequency of changes in flows, before and after the construction of the Teesta V reservoir in the Teesta river channel.
CONCLUSION

• The 1-day maximum, 3-day maximum, 7-day maximum, 30-day maximum and 90-day maximum show a rising trend of the daily weekly, monthly and quarterly minimum flow cycle post period.
• The timing of extreme flow events are such that the dates of each annual 1-day minimum move forward from the 182\textsuperscript{nd} day in the pre-impact period to the 24\textsuperscript{th} day in the post-impact period.
• The dates of each annual 1-day maximum move forward from the 237\textsuperscript{th} day in the pre-impact period to the 211\textsuperscript{th} day in the post-impact period.
• Frequency and duration of low flow pulses count is higher in the post period than those in the pre-impact period and high pulse counts in the post-impact period is lower than those in the pre-impact period.
THANK YOU