Inter-Basin Water Sharing and Human Security: A Study of Manas-Sankosh-Teesta-Ganges Canal Project

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Degree of Master of Philosophy

By

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DECLARATION

I, Wangchu Lama, do hereby declare that the research work embodied in the dissertation titled "Inter-Basin Water Sharing and Human Security: A Study of Manas-Sankosh-Teesta-Ganges Canal Project" submitted to Sikkim University for the award degree of Masters of Philosophy, is my original work and it has not been submitted earlier to this or any other University for any degree.

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Date: 07/02/2020

CERTIFICATE

This is to certify that Dissertation titled **"Inter-Basin Water Sharing and Human Security: A Study of Manas-Sankosh-Teesta-Ganges Canal Project"** submitted to the Sikkim University for partial fulfillment of the degree of Master of Philosophy in the Department of Peace and Conflict Studies and Management embodies the result of bonafide research work carried out by Wangchu Lama under my guidance and supervision. No part of the Dissertation has been submitted earlier to this or any other University for any degree

All the assistance and help received during the course of investigation have been duly acknowledged by her.

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"Inter-Basin Water Sharing and Human Security: A Study of Manas-Sankosh-Teesta-Ganges Canal Project"

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Wangchu Lama

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List of Abbreviations

AIBP	Accelerated Irrigation for Benefit Project
CA, DWR	California, Department of Water Resource
CGWB	Central Ground Water Board
CHS	Commission for Human Security
CWC	Centre for Water Commission
DDT	Dichloro Diphenyl Trichloroethane
DPR	Detailed Project Report
FAO	Food and Agriculture
FR	Feasibility Report
GoB	Government of Bhutan
GoI	Government of India
GoWB	Government of West Bengal
GW	Global Water
GWP	Global Water Programme
HYV	High Yielding Variety
IBWT	Inter-basin water transfers
ICCPR	International Covenant on Civil and Political Rights
ICESCR	International Covenant on Economic, Social and Cultural Rights
IHP	International Hydrological Programme
ILR	Inter-linking of Rivers
IWP	Institute of Water Politics
IWRM	Integrated Water Resource Management
IWRS	Indian Water Resources Society
KW	Kilo Watt
LHWP	Lesotho Highland water project
MCM	Million Cubic Metres
MDG	Millennium Development Goal
Mha	Million Hectares

MOS&P	Ministry of Statistics and Programme
MoWR	Ministry of Water Resource
MoWR, RD&GR	Ministry of Water Resource, River Development and Ganga Rejuvenation
MSTG	Manas-Sankosh-Teesta-Ganges
MW	Mega Watt
NGO	Non-governmental organisations
NITI	National Institution for transforming India
NPP	National Perspective Plan
NWDA	National Water Development Agency
OHCHR	Office of the High Commissioner for Human Rights
PAI	Population Action International
PFR	Pre-feasibility Report
PSU	Public sector undertaking
R&R	Rehabilitation and Resettlement
SDG	Sustainable Development goal
SWP	State Water Project
TWP	The Water Project
UN	United Nations
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNHDR	United Nations Human Development Report
USGS	United States Geological Survey
WRG	Water Resource Group

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Chapter 1
Introduction

Water is the most vital part of human existence. Though 71 percent of the earth is covered with water, only 3 percent out of it is in the form of fresh water (The USGS, 2018). With each passing day, this finite resource is becoming scarce. Human activities, for development and their survival have become a threat to water security in the contemporary era. Recognizing the increasing problem of water scarcity, UN has observed access to clean water for drinking and sanitation as one of the basic human rights in the year 2010 (Hall, et al., 2013). Water scarcity impacts people from all walks of life. Consequently securitization of water has become a new way of thinking about water today. Water security is an affordable access to potable water, clean or safe water for sanitation, agriculture and other basic usages. Therefore, water security is the main agenda of human and national security (UN-Water, 2015). Inter-basin for water transfer can be taken as example and is considered feasible as an alternative to the scarcity of water by its proponents.

The literal meaning of inter-basin is joining of natural river channels (Prasad, 2004). Its aim is to reduce imbalance of water availability by linking river basins in a network of reservoirs or canals. The general objective of river-linking is to divert surplus water to the deficit areas for single or multipurpose use. Benefits such as prevention of droughts and floods, soil fertility, electricity generation, navigation can be achieved on implementation of inter-basin projects (Mirza, et al., 2008). The positive outcome of inter-basin comes in a huge bulk but its negative impacts are not less. It has profound impact on environment such as deforestation, damage of ecology, biodiversity. Adding to it, high expenditure is required on its implementation

and maintenance. Social displacement takes place in a huge scale leading to mass conflicts.

1.2 Statement of the Problem

Availability of safe water is imperative for the survival of every being. West Bengal is no exception in this matter. Despite the fact, that the state being land of many huge free flowing rivers that originate from the Himalayas there are water scarce regions too as rivers are not uniformly distributed with time and space. This results in uneven socio-economic growth across the state and its adjacent areas. Such situation demands for proper management of water resources for the well being of the society. Therefore, inter-basin water sharing is considered as one of the key techniques of proper water resource management. Advocates of inter-basin water sharing believe that problem of unequal distribution of water across the region would be solved on implementation of the inter-basin water sharing technique consequently, achieving water security to every section of the society.

1.3 Literature Review

1.3.1 Conceptual Framework

The word security is derived from the Latin word “Securitas” meaning lack of care. In layman’s term security is freedom from or resilience against potential harm. However, security is an “essentially contested concept” (Smith, 2002). It has various meanings and connotations and is dynamic in nature. Traditionally, referent object of security was confined to State and to shield itself from the external threats such as military attack (Anthony and Emmers, 2006). “Fetishisation of state” is said to be the major problem of traditional concept of security (Jones, et al., 1999). Focus was laid on the politico-diplomatic relationships among states (James, 2002). This notion of security has dominated the international relation for a very long period of time.

The concept of security was interpreted narrowly from realist perspective till the 1960s. The transition of security from a narrow realist perspective to a more liberal approach happened with the United Nations Development Programme Report 1994 that stated "human security is not a concern with weapons-it is a concern with human life and dignity." (UNDP, 1994). UNDPs focus was shifted to human development after the cold war and was supported by countries like Japan and Canada (Kerr, 2007).The concept of human security is said to have been derived from the traditional notion of security studies that focused on the protection of the states from military threats. It would eventually lead to the protection of citizens of the state (Morgan, 2007). The idea of human security under non-traditional security emerged as challenge to traditional security form, from the policy statement of UNDP (1994) human development report. It was more of human centric unlike the state centric traditional security. As there is no universal definition of human security, every individual has their own perspective. Human security is defined as "first safety from such chronic threats as hunger, disease and repression. And second, it means protection from sudden and harmful disruptions in the patterns of daily life whether in homes, jobs or in communities." (UNDP, 1994). The concept of human security became popular when Canada and Japan adopted it as an official policy (CHS, 2003).

The notion of security has shifted from condition of survival of state to the various accessibilities to better living standards of people and community. The cases of issues such as human trafficking, drug smuggling, sexual and drug abuse, environmental threats, natural resource conflicts are escalating rapidly and needs high security implications. There has been hybrid of concepts regarding the definition of human security (Tadjbakhsh and Chenoy, 2007). It varies from one scholar to another, one organisation to another and nature of threat.

A very simple way to define human security would be "absence of insecurity and threat" consisting of both freedom from fear as well as freedom from want. Freedom from fear includes fear of physical, psychological and sexual abuse, death, violence. Freedom from want means want of food, good health facilities, good living standards, employment and other requirements. Therefore, human security deals with the ability to identify threats, to prevent them from escalating and ways to mitigate their impacts after its occurrence. Non-traditional security issues are considered as threats to the national sovereignty and national integrity of the nation states according to many politicians and practitioners (Anthony and Emmers, 2006). The principles laid down by UNDP report on human security highlights 'freedom from fear' and 'freedom from want'.

The Commission on Human Security (CHS) was established in January 2001. The first report of it was published in 2003 that mentioned human security seeks to "protect the vital core of all human lives in ways that enhance human freedom and human fulfillment" (CHS, 2003). "Human security relates to the individual's personal freedom and safety from direct and indirect threats of violence. The promotion of human development and good governance, and, when necessary, the collective use of sanctions and force are central to managing human security. States, international organisations, nongovernmental organizations, and other civil society in combination are vital to the prospects of human security." (Vajpayee, 2012). Therefore, human security is concerned with protection of people from critical life-threatening dangers, regardless of whether the threats rooted in anthropogenic activities are natural events, whether they lie within or outside states, and whether they are direct or structural (Thakur, 2004). The UNHDR, 1994 specifically listed seven comprehensive dimension of human security (Acharya, 2007).

Table No. 1.1: Components of Human Security

Components	Criteria	Essentials
Economic Security	•Ensuring basic and stable income for every individual, household or community to fulfill their essential need sustainably and with dignity •Assured private and public sector employment, self-employment when necessary, government financed social safety nets.	•Human capital •Economic Capital •Public Finance •Financial reserves •Diversified agriculture and economy.
Food Security	•Ensuring that all people at all times have both physical and economic access to safe, nutritious food to maintain a healthy life. •It is a combination of three elements comprising of sufficient quantity of food availability on a regular basis; every individual should have Access to adequate amount of food and food utilization should be proper. People should have good nutritional impact when consumed	•Agriculture •Economy •Local and National distribution systems
Health Security	Guaranteeing a minimum protection from diseases and unhealthy lifestyles. It involves policies, strategies agendas and activities which minimizes susceptibility of public health such as pandemics, emerging infectious diseases, bioterrorism, disease outbreak, malnutrition and dual use research	•Universal basic education and knowledge on health related matters, indigenous/ traditional health practices. •Access to information and community-based knowledge creation.
Environmental Security	•Protecting people from long and short term ravages of nature, as well as deterioration of the natural environment. •Early warning and response mechanisms for natural and man-made disasters at all levels.	•Natural resource capital. •Natural barriers to storm action. •Natural environmental recovery processes. •Traditional practices that respect the environment.
Personal Security	protecting people from physical violence, whether from the state or external states, from violent individuals and sub-state factors, from domestic abuse and from predatory adults	•Coping mechanisms •Adaptive strategies •Memory of past disasters.
Political Security	Ensuring that people live in society that honours their basic human rights and ensuring the freedom of individuals and group from government attempts to exercise control over ideas and information.	•Good governance •Ethical Standards •Local leadership •Accountability and Mechanisms
Community Security	•Protecting ethnic groups and community identities. •Protection from oppressive traditional practices, harsh treatments towards women, or discrimination of ethnic, indigenous or Refugee groups.	•Social capital •Coping mechanisms •Adaptive strategies •Local NGOs

Source: United Nations, 2009; Acharya, 2007.

Within the ambit of human security, environmental security is included as one of the major areas that need to be addressed on a global scale through co-operation rather

than competition (Janouskova and Oulehlova, 2014). Here, environment plays role of referent object. Environmental changes can impinge on human life (Barnett, 2007). Environment security not only embraces national security but also entails global environmental security. Going by the community security approach of environment security the causes and impacts of environmental issues are not only confined to the borders of the nation but it goes further to global level. Problems such as ozone layer depletion, water scarcity, global warming is not restricted within the nation but has impact on other countries on equal level (Barnett, 2007). Pollutions do not respect the frontiers (Hough, 2008). Threat from ozone depletion, global warming, and acid rain is not confined within the borders of the particular country and is also not possible to be controlled through domestic legislation or by regional political co-operation (Hough, 2008).

Environmental security has become a major cause of concern since the past few decades. It falls under the new non-traditional security issues that have broadened the concept of security (Barnett, 2016). Environmental security ideas emerged with the end of cold war in the late 1980s. The debate over it is still going on. The idea of environmental security came from many sources. In security studies the concept of environmental security results from four inter related developments: publication of Rachel Carson's 'Silent Spring' (1962); Richard Falk's 'This Endangered Planet' (1971) and Harold and Margaret Sprout's 'Towards a Politics of planet' (1971); Richard Ullman's 'Redefining Security' (1983); growing recognition, that environmental change not only harm the ecosystem but is also a threat to human lives (Barnett, 2007). Environmental security is defined as "the local and planetary biosphere as the essential support system on which all other human enterprises depend." (Buzan, 1998). It is "the ability of individuals to avoid or adapt to

environmental change so that things are important to their well-being and are not substantially negatively affected" (Barnett, 2007).

The leading issue of environmental threat is interlinked with various human activities for socio-economic development. Therefore, unequal sharing of resource is counted as the major factor of all the problems in the world. Environmental security in the current era is included in both international as well as national developmental agenda. Various international bodies such as United Nations Environment Programme, United Nations Framework Convention on Climate Change have come up for the securitization of environment since 1970s. The goal of environmental security is to repair the damage caused to the environment for human life support and for moral value of the environment to prevent damage caused by any kind of human invasion (Linkov, 2006).

Water security became an important issue in the 1980s on a global level through seminal work of scholars like Shiklonanov, Falkenmark and Brown (Jagerskog and Swain, 2007). It is encompassed within the concept of environmental security and is associated with resource depletion. Water scarcity[1] due to booming population and change in hydrological processes in areas like Middle East and North Africa parts of Asia has brought importance of water security to the forefront. It has been rightly stated that "the world is fast running out of fresh water, our demand for this blue gold is increasing at a faster pace with passing time and thousand more people are compelled to survive in a water stressed-condition" (Rudra, 2009) Water security is defined as "the capacity of a population to safeguard access to adequate quantities of water of accessible quality for sustaining human and ecosystem health on a watershed basis, and to ensure adequate amount of protection of life and property against water

[1]According to Falkenmark a country is said to experience water scarcity if the available resource is below 1000 cubic meters per person per year.

related hazards- floods, landslides, land subsidence and droughts." (UNESCO-IHP, 2012). The definition was again redefined in 2013 by the UN-Water to a wider aspect (Young, et al., 2015).

Water security is the core component of national security of any nation as it is related to food and health security. There are various measures that are taken up by the countries for securitization of water. Impact of globalization along with technological advancement is visible in such measures. Constructions of dams, canal links, and inter-basin water transfer are some of the ways that are practiced to achieve water security in the resource scarce areas.

1.3.2 Inter-Basin Water Transfer

Inter-basin water transfers are defined by different authors in different ways, they are:-

> "A subset of water transfers, being defined as the transfer of water through a man-made conveyance across a basin boundary." (Dickson and Dzombak, 2017).
>
> "Is the deportation of water from one river basin to another" (Boddu, et al., 2011).
>
> "The purposeful arrangement of natural hydrologic patterns via engineering works (dams, reservoirs, tunnels and pumping stations) to mover water across drainage divides to satisfy human and other needs." (Micklin, 1985).
>
> "A large-scale artificial mass transfer of water from a water-surplus to a water deficient region in order to further the economic development of the latter, mainly through agriculture and industrial development." (Biswas, 1983).
>
> "The transfer of water from one geographically distinct river basin to another or from one river reach to another." (Davis, et al., 1992).

Water use extent differs from one country to another (Biswas, 1983). The world is facing huge challenges due to increasing demand of water resources by the booming population and the economies in every nation (PAI, 2011). Governments have come

up with an alternative to overcome the problem. Distribution of water is made even with the transfer of water from surplus areas to water deficit areas. Though, inter-basin linking is an expensive method, it is the need of an hour according to many politicians (Bandhopadhyay and Perveen, 2004). Inter-linking of basin is said to be geomorphologic process through which river systems and their flood plains are formed but it is argued that inter-linking of basins is done through manmade device in the contemporary era. Therefore, it requires well-established technology for every component required in the process (Prasad, 2004).

Inter-Basin from Global Perspective

The mismanagement of water can escalate serious water related problems in the near future. Control of water supplies could affect the geopolitical balance of power, predicting that upstream nations will exert influence over their downstream neighbours by controlling the flow of water (Yildiz, 2015). Conflicts over water are likely to become more contentious during the present century and atleast 48 countries will face severe water crisis by 2025 (Guidotti, 2002). The most affected region by water shortage will be the Middle East, with 14 countries. In the era of globalization ignorance by one nation can have serious implications on the entire population. Therefore the only ways to solve the issue is by war or by co-operation (Eminic, 2017).

Huge number of countries around the world relies on inter-basin water transfer (IBWT) system in order to deal with the problem of scarce resource. The idea of IBWT was historically generated in China. The Ligua Canal was completed in 214 B.C. and the Grand Canal was completed in 605A.D. for trade and economic purposes. With the successful implementation of the project, presently Biliuha-Dalian inter-basin transfer, trans-basin transfer of Luhan River to Tiajian and Tangshan,

inter-basin diversion in Feyian Province are some of the projects that are functioning in China (Mahabaleshwara and Nagabhushan, 2014). Rhine-Main-Danube Canal is considered to be a major canal project on a global level, active in transportation of goods; provide water for irrigation, industries and power generation plants (WWF, 2002).

In the United States both large and small scale projects have been carried out across basins. 50 percent of the identified IBWTs are concentrated in Texas, Florida, and North Carolina (Dickson, et al., 2017). California completed its first phase of State Water Project in 1973. Today it provides diversion of 4 cubic km of water flow from northern California to the water deficit areas of central and southern parts of the state (Baggett, 2002). The Texas water plan envisages redistribution of water in the Texas and New Mexico to meet the needs of the year 2020 (Baggett, 2002).

Major centres for social and economic development in Africa are situated in the areas with ample supply of water. Lesotho Highlands Water Project is a well-known IBWT project controlled by Lesotho and South Africa. Its purpose is to divert water from economically poor but water rich country of Lesotho to water deficit areas of South Africa (Ameer, et al., 2016). IBWT projects are developed to provide water supply to the water deficit areas but due to lack of proper water policy framework water is being used inefficiently. In order to get proper advantage of the IBWT the water policies need special attention (IBWT Africa). The Tagus-Segura IBT in Spain connects four Spanish Rivers Tagus-Jucar-Segura-Guadian with an objective to solve water deficit by 0.5 cubic Km/Year in Alicante, Murcia and Almeria Provinces (Pittock, 2009).

Inter-Basin at National Level

In the current era we witness number of intra as well as inter-state water conflicts. Water is becoming scarce and the quality of water is decreasing in many parts of the world (Chellaney, 2013). Theories such as Malthusian or Neo-Malthusian point out that population explosion, climate change and unequal distribution of water resource are some of the major driving forces of water related conflicts worldwide (Selby and Hoffmen, 2014). Geopolitical entity provides a base of Conflict in the South Asian sub-continent. It has both abundance as well as scarcity of water (Bala, 2018). Since the agriculture is the backbone of the region's economy water is the most the most imperative determinant of agriculture as well as other activities (Bala, 2018). Water therefore, has become a bone of contention between India and its neighbouring countries (Noshab and Mushtaq, 2001).

India is not a water scarce country. It's due to growing demand and overexploitation of water resource by the rapidly growing population that it is becoming scarce (GWP, 2014). There is augmenting pressure on freshwater resource worldwide (Brown, et al., 1998). Water related twin problem of flood and drought needs to be addressed appropriately. The estimated drought prone area in India is 51.12 MHa and flood prone area is 33.52 MHa (Mahabaleshwara and Nagabhushan, 2014).

Government is now attempting to safeguard natural resource which previously was not of great concern (Rajawat, 2016). Water demand is made by agricultural, industrial sectors and for domestic use in massive amount. Therefore revised National Water policy of 2012 focused on these three sectors for supply of water (GWP, 2014). The major project under the water policy was process of inter-basin water transfer to achieve water security in the country (NWDA, 2012).

The proposal for inter-linking of river basin project in India was made by Sir Arthur Cotton for navigation (Ameer, et al., 2016). The proposal gained momentum only in the early 80s with the formation of NWDA (Mahabaleshwara and Nagabhushan, 2014). Proposal was made for the inter-basin transfers that comprised of two components, Himalayan Rivers Development and Peninsular Rivers Development (Joshi, 2013). The Government of India made proposal to overcome the problem of drought and flood by inter-basin transfer of water from water surplus to water deficit areas (Khalequzzaman, et al., 2004).

16 link proposals for peninsular and 14 for himalayan components were identified by NWDA for preparation of feasibility of reports (Iyer, 2003). If the proposed plan is completed it will be the largest infrastructure project in the world (Prasad, 2014). The added objectives of the plan are to provide water for irrigation, generation of electricity, fishing in rural areas, transport infrastructure through navigation and additional production of food grains (Bharati, 2014). However, the plan faces a lot of opposing views in the Indian context on the basis environmental, ecological, social displacement impacts (Bharati, 2014). Many Himalayan Rivers are international rivers therefore, the plans will adversely affect the other water sharing countries as well. For example, implication of plan on Ganges and Brahmaputra will have impact on Bangladesh in every aspect (Mirza, 2008). Despite the criticisms faced by the idea proposal has been put forward for the implementation of the national plan through Ken-Betwa link project in Bundelkhand (NWDA, 2006).

The common objective of inter-basin project is to provide water to the water scarce areas from water surplus areas in every aspect (Prasad, 2014). Nitin Gadkari, former minister of WRGR & RD, India stated that “Indian Government plan to achieve universal and equitable access to safe and affordable drinking water by 2030.” (Arora,

2018). On a global level there are projects that have been successful in catering to the needs of the society. The project not only comes with positive outcomes but it is gravitated more towards negative impacts. Common problems associated with the project are disturbance in ecology, environmental threats, displacement of the people; earth tremors (Iyer, 2012). Conflicts related to water is becoming inevitable in the present era. The four types of conflicts witnessed due to inter-basin project in India are over compensations for resettlement and rehabilitation of the displaced; for environmental damages caused by the project; over benefit sharing of the project and over cooperative management of the project in international rivers (Bandhopadhyay and Perveen, 2008). Conflict can also arise due to the inequitable distribution of water in the water deficit areas (Sharma, 2003).

1.4 Rationale and Scope of the Study

Availability of safe water is a critical element in shaping the socio-economic condition of the region. Access to potable water or deficiency makes a mark difference in the livelihood of every being. Taking into consideration the state of West Bengal, there are huge free flowing rivers like Mahanadi, Teesta, Torsha, Ganges which originates from the Himalayas but these big rivers do not cover whole of the state uniformly. As a result of which uneven socio-economic growth can be witnessed across the state and the adjacent areas.

The proposal made for the IBWT in West Bengal is done with an objective to fix the above mentioned problems in and around the region. Inter-basin is considered as a boon as well as bane to the region in overall sectors. The proposal Manas-Sankosh-Teesta-Ganges (MSTG), a major project has not yet been successfully implemented. Various researches have been done on water related issues in the state but the major development project has been out of context till date. This study would help in

understanding the prospects of this project. It would discuss the merits as well as the demerits of the project and its implications on the environment including land, water, biological (flora and fauna), and climate due to development in the region. Therefore it will be easier for people on making informed decisions concerning such type of developmental projects.

1.5 Objectives

- To examine the history of inter-basin water transfer in the global context.
- To understand the evolution of inter-basin water transfer in India.
- To analyse and assess ideas, concepts and possible impacts of Manas-Sankosh-Teesta-Ganges canal project.
- To study the role of inter-river linking project in achieving human security with particular focus on water security in Manas-Sankosh-Teesta-Ganges canal project.

1.6 Research Questions

- What is the current status of inter-basin projects in India?
- What are the possible impacts of Manas-Sankosh-Teesta-Ganges canal project?
- What role does inter-river linking project play in achieving water security?

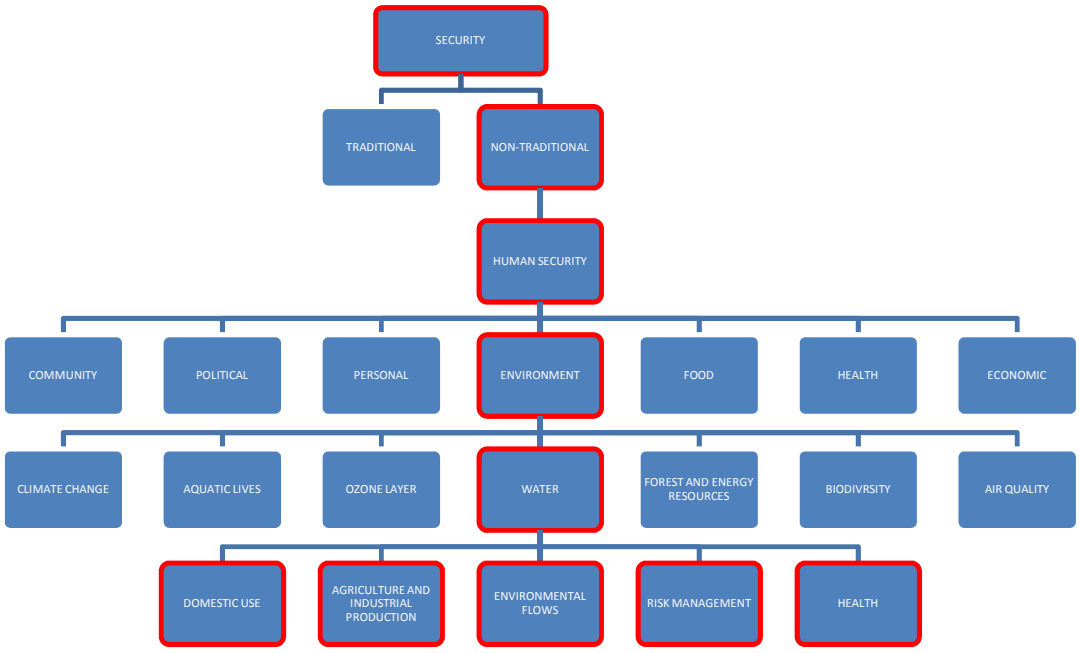
1.7 Methodology

1.7.1 Theoretical Framework

In the pre cold war era security as a concept was more of state-centric in approach. Securitization of state from direct violence was the national interest of every nation. End of cold war, redefined the concept of security. Focus of security got inclined towards individuals and people from state centric notion. Security in the contemporary era is categorized under two types:-

- Traditional security
- Non-traditional security

Figure No. 1.1: Components of Security



Source: - Self Compilation based on Literature Review.

Traditional security is the hard notion of security that was prevalent in the pre cold war era whereas non-traditional security is the soft notion of security that gained eminence in the post cold war era. Human security being people centric distinguishes it from the type of security that prevailed in the 19th and the 20th century. It has a new way of thinking in the present era. Human security is a comprehensive approach that addresses a broad range of challenges faced by the people. It encompasses seven essential components (UNDP, 1994) as shown in the figure above that are associated with human interest. Environment security one of the seven components of human security emerged as an important concept in security studies with the growth of environmental consciousness through literary work of authors like Rachael Carson and Richard Ullman. It not only covers the state security but also the security of

global environment (Barnett, 2016). Security of environment has become important today as humankind fails to maintain the life supporting ecosystems comprising of water, food, air at present as well as for the future. Water being the primordial resource is an essential part of every life. With the increase in population, demand of water also needs to be increased. The scarcity of safe water has become a worldwide concern apparently; water security becomes a major global agenda.

UN-Water defines water security as "the capacity of population to safeguard access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters and for preserving ecosystems in a climate of peace and political stability." (UN-Water, 2003). It involves the "availability of water in adequate quantity and quality in perpetuity to meet domestic, agricultural, industrial and ecosystem needs." (Swaminathan, 2001) Water security is where every person has access to enough safe water at affordable cost to lead a clear healthy and productive life, while ensuring the environment is protected and enhanced." (GWP, 2000). Water security is availability of an acceptable quality and quantity of water for healthy livelihoods, ecosystem and production coupled with an acceptable of water related risks to people, environments and economies." (Grey and Saddof, 2007).

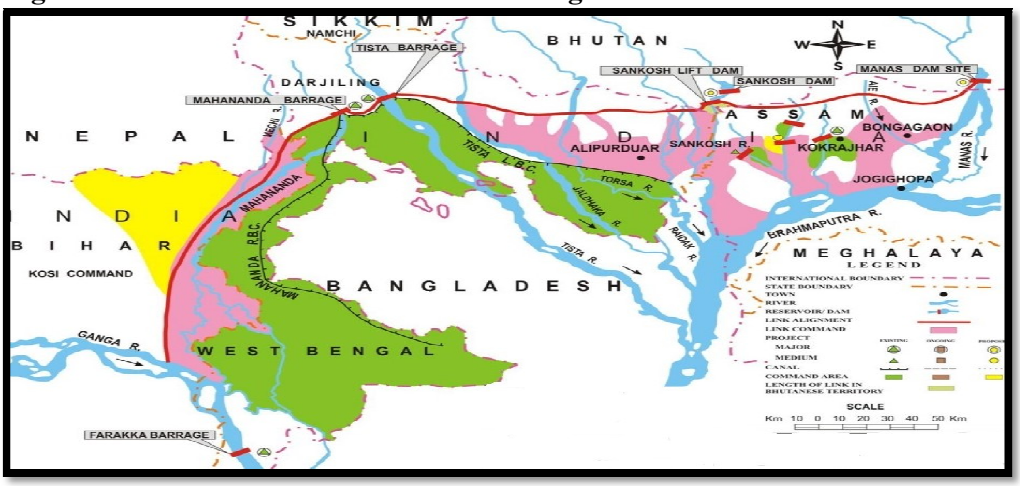
Analyzing the various definitions of water security, the goal of it is to provide access to adequate clean drinking water and other domestic purposes for the burgeoning population, water for healthy living, industrial and ecosystem needs and to prevent disasters. Therefore the underlying idea of water security is the need to address the insecurity of human and eco-political issues. Economic development, population growth, urbanization and climate change are some of the common factors that affect availability of safe water worldwide. In the year 2012, it was estimated that almost

one-fifth of world was living in areas of physical water scarcity and1.6 billion people were facing economic water shortage (UNDESA, 2005).

1.7.2 Study Area

Manas-Sankosh-Teesta-Ganges (MSTG) project is proposed to be implemented in and around West Bengal region. Amidst all the issues between Bangladesh and India the most contentious is the water sharing issue. Teesta water sharing dispute is always on peak between Bangladesh and West Bengal. Rivers cover an area of 88752 square kilometers of West Bengal and home to more than 90 million people and a wide variety of wildlife. It has drainage network of 29 basins Out of the 14 Himalayan components of inter-basin project, the most debated one has to be the MSTG link. MSTG link would supply surplus water from Manash-Sankosh-Teesta River to the Mahanadi basin and further to the south (WRRD & GR, 2018). Areas selected for the study is located in Jalpaiguri and Alipurduar districts of West Bengal. Teesta Barrage, Buxa Tiger Reserve and Mahananda Link Canal have been selected for the study to get detailed information on the projected MSTG Canal Link.

Figure No. 1.2: Manas-Sankosh-Teesta-Ganges Canal Link



Source: Water Resources Information System of India, 2012.[2]

[2] http://india-wris.nrsc.gov.in/wrpinfo/index.php? title=Manas-Sankosh-Tista-Ganga_Link (Accessed on 2/03/2019)

1.7.3 Research Design

A research design is a guiding plan for data collection and analysis of the research project. Research design is defined as "the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure" (Seltiz, 1962). There is multiple framework of research design out of which Descriptive methodology would be used within the Qualitative approach.

Qualitative research is a subjective approach following inductive reasoning. The researcher tries to understand and interpret the experiences by viewing the world from the lens of the individual that is being observed or studied. Observations, focused group discussions and interviews are some of the techniques that will be used in gathering field based information.

Descriptive research is aimed at casting light on current issues or problems through process of data collection that enables the researcher to describe the situation more precisely as compared to the application of other types of methodology (Fox and Bayat, 2007). It uses description, classification and comparisons to describe the situation. History, evolution, current issues of inter-basin water transfer at macro and micro level will be explained based on the information gathered from primary as well as secondary sources.

Table No. 1.2: Methods of Data Collection

Objectives	Methods of Data Collection	Sources of Secondary Data
1. To examine the history of inter-basin water transfer in the global context. 2. To understand the evolution of inter-basin water transfer in India.	Secondary sources- literatures on security studies and inter-basin water transfer were reviewed to understand its history, growth and development at macro- micro level. Government reports were also referred to, in collecting the information regarding the policies, framework and implications of inter- basin projects at different levels.	• USGS Reports. • UN Water- Annual Reports. • Human Development Reports. • MOWR Annual Reports. • National Water Policies. • GWP Reports. NITI Aayog Reports. Planning Commission Reports. • WRIS Reports. West Bengal Irrigation and Waterways Department Reports.
3. To analyse and assess ideas, concepts and possible impacts of Manas-Sankosh-Teesta-Ganges canal project. 4. To study the role of inter-river linking project in achieving human security with particular focus on water security in Manas-Sankosh-Teesta-Ganges canal project.	Primary sources- Focus group discussion was conducted with local communities. Semi-structured interviews were done with government officials and the local population to understand the perspectives of the participants. Method of data collection was based on sampling method. The local respondents and government officials were selected using snowball random sampling and purposive sampling. Secondary sources- information was gathered through review of topic related literature, government reports and newspaper articles.	

Table No. 1.3: Targeted participants for In-depth Interview and Focus Group Discussions

Government Officials	Local Communities
• Officials from Forest Department • Officials from Irrigation and Waterways Department • Officials from Teesta Barrage and Mahananda Barrage	• Local Farmers • Local Women • vendors

Table No. 1.4: Framework adopted to conduct Focus Group Discussions

Location for FGDs	No. of FGDs per area	No. of Participants	Composition of Participants
Fulbari	3- Farmers Local residents Vendors	3 to 10 members	• farmers • women • vendors
Oodlabari	3- Farmers Local residents Vendors		

Chapter 4 of this study discussing third and fourth objectives, as mentioned earlier is based on information collected from the field. Techniques used in compiling the information were interviews based on semi-structured questionnaires, recordings, call recordings and notes. Focus Group Discussions were done with different groups of people who are likely to get affected by canal construction. FGDs were done on the basis of semi-structured questionnaires. The only constraint faced during collection of information was that the participants were reluctant to involve themselves in the interaction.

Chapter 2
Inter-Basin Water Transfer and Human Security

2.1 Introduction

Freshwater is unevenly distributed in time as well as space globally. Human developmental activities have further deteriorated the condition therefore increasing pressure on water resources. Water security has become a global agenda and it is evident from the fact, that international conferences such as the World Water Week and the World Water Forum have prioritized water security as their major themes. Inter-basin water transfer projects, a large scale engineering projects are found to be the most suitable solution to the water related problems in many parts of the world according to the proponents of such techniques. IBWTs offer a panacea to the problem of uneven water distribution in many parts of the world. It also supports the socio-economic development of the regions as water is the most essential contributor to it. Alongwith its positive outcomes there are myriad drawbacks as witnessed by different IBWT projects at different levels.

2.2 Securitization of Water Resources

According to Sir David King, threat caused to human security due to environmental changes is said to be more harmful than the issue of terrorism (Foster, 2005). Environmental stress contributes to the escalation of conflict relating to socio-economic, political and other aspects (Lietzmann and Vest, 1999). It therefore, demands for implementation of policies to securitize environment at local, national as well as international level. There are a number of issues that needs to be taken care of to achieve human security. Water is the most important factor and the most debated topic from a micro to macro level. Water security can help in reducing conflicts, contributing to different aspects of the society. Pragmatic analysis of water security

generally varies from access to clean water, availability of water on local level. No single universal definition of water security is found till date though there are multiple general definitions available.

To understand water security it is important to understand the meaning of water scarcity[3] from where the whole concept of water security came into forefront. Water scarcity is the imbalance between demands and supply of water. Therefore, water scarcity escalates further if the management is lacking (FAO, 2019). In order to address the problem of water scarcity it is necessary to secure water resources to meet the demands of all, as stressed by the theme of International Water Day 2019 "leaving no one behind". In various fields, scholars define water security in terms of human rights, agriculture, health security, religious aspect etc. In the international level water security is attached to a broader aspect.

The world economic forum defines water security as "the gossamer that links together the web of food, energy, climate, economic growth and human security challenges that the world economy faces over the next decades." (World Economic Forum Water Initiative, 2012). Achieving water security entails allocation among users to be fair, well-organised and transparent. Food and agriculture are the major components of Sustainable Development Goal[4] to end poverty, hunger and malnutrition where water plays a significant role. Not only are these sectors that need water is facilitator of every sector. Whole world is dependent on water (FAO, 2019). The comprehensive meaning of water security can be understood from indicators listed in the following table:-

[3] According to Falkenmark a country is said to experience water scarcity if the available resource is below 1000 cubic meters per person per year.

[4] Sustainable Goals also known as global goals, were adopted by all United Nations Member States in 2015 as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030. For futher information access https://www.undp.org/content/undp/en/home/sustainable-development-goals.html

Table No. 2.1: Indicators and Definition of Water Security

Indicators	Definition
Basic Household Needs	The percentage of population with sustainable access to an improved water source
Agriculture production	The extent to which water is available and harnessed for agricultural production.
Environmental flows	Percentage of renewable water resources available in excess of environmental water requirement
Risk Management	The extent to which countries are buffered from the effects of rainfall variability through large dam storage
Independence	The extent to which countries water and food supplies are safe and secure from external changes or shocks.

Source: Global Water Forum, 2018

2.3 Importance of Water in Achieving Human Security

Water scarcity can mean "scarcity in availability due to physical shortage or scarcity in access due to failure of institutions to ensure a regular supply or due to lack of adequate infrastructure" (UN-Water, 2015). Demand for water has shown a rampant growth globally over the last century. Water scarcity has now become one of the leading challenges in the present world. With the increase in world population the challenge will become more pressing in the near future. The water that we consume directly in the form of food is much more than what we actually drink. Rapidly growing population as well as the urban areas will exacerbate water scarcity. It affects major part of the world and around 2.8 billion people every year (FAO, 2015).

More than 1.2 billion people lack access to clean drinking water. Access to safe water is fundamental for human health. Insufficient supply of water affect health adversely as it prevents proper sanitation and hygiene. It also is a key factor in water borne diseases such as diarrhea, typhoid. In the developing countries 80 percent of the illness is result of poor water and sanitation conditions (TWP, 2019). Water scarcity impacts food production on a larger scale. There is no alternative to water required for crop production. According to the International Water Management Institute, agriculture, which accounts for about 70 percent of global water withdrawals, is

continuously competing with domestic, industrial and environmental uses for a scarce water supply (TWP, 2019).

2.4 Global Water Policies

The recognition that access to water as a basic human right can be traced back to the initial human rights documents that is International Bill of Human Rights consisting of UDHR (1948), where Article 25 states that " Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control." Though ICCPR (1966) and ICESCR (1966) does not markedly mention water rights in the articles, it mentions right to standard of living, food and improvement of living conditions in Article 11 and 12 of ICESCR. Access to adequate water supply is imperative to achieve them (OHCHR, 2003).

The first specific orientation to the human right to water on the international context was addressed at United Nations Water Conference in Mar del Plata (Argentina) in the year 1977. The report of the conference states that "all peoples, whatever their stage of development and their social and economic conditions have the right to have access to drinking water in quantities and of a quality equal to their basic needs." (UN, 1977). The conference led to an action plan – International Drinking Water Supply and Sanitation Decade from 1981 to 1990. It was responsible in creating awareness worldwide regarding expansion of drinking water accessibility and proper sanitation in the developing countries.

International communities from the 1990s focused not only on the domestic use of water but also on the economic aspects of it. The principle 4 of the Dublin Statement,

1992 mentions that “the basic right of all human beings to have access to clean water and sanitation at an affordable price.” (UN, 1992). Considering the fact that water is being mismanaged and is the main reason of it becoming scarce, in the same year chapter 18, Agenda -21 of the Rio Declaration asks states to “promote community ownership and rights to water supply and sanitation facilities.” (UN, 1993). In 2000, a Millennium development goal was establishment with an objective to uplift the society in every aspect. It was to achieve 8 goals with 18 targets by 2015. Though it was successful in achieving its target in many parts of the world yet the progress has been uneven (Kumar, et al., 2016).

In the year 2002, ICESCR adopted a General Comment No. 15 with an aim to discard all the water related problems. It has put forward the legal bases of the right to water as guidelines for states. The General Comment distinctly affirms the legal base of the right stating that “the human right to water entitles everyone sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic uses.” It not only covers the domestic or personal use of water but also the other aspects of human security. The General Comment further states that “Parties should ensure that there is adequate access to water for subsistence farming and for securing the livelihoods of the indigenous people.” (CESCR, 2003).

Taking the escalating water crisis into account, a resolution on access to safe drinking water as a basic human right was introduced by Bolivia. It was adopted by the UN General Assembly in 2010 but is not legally enforceable. UN General Assembly recognized “the right to safe and clean drinking water and sanitation as a human right for the full enjoyment of life and all human rights.” (UN, 2010). To facilitate this resolution the UN Human Rights Council called upon states to “develop appropriate tools and mechanisms, which may encompass legislation, comprehensive plans and

strategies for the sector, including financial ones, to achieve progressively the full realization of human rights obligation related access to safe drinking water and sanitation, including in currently unserved and undeserved areas." (UN, 2010). Despite the declaration made by the UN, poor sections of the people are still deprived of their fundamental right to safe drinking water.

Though access to safe water is inextricably linked to human development yet MDG mentioned it in its targets distantly. Sustainable Development Goals was adopted by the world leaders under Agenda 2030 in the year 2015. Under it SDG 6 focuses on ensuring availability and sustainable management of water and sanitation for all. The UN bodies have put in rigorous efforts to show that water is the essential part of every living being. Extreme efforts put in by the International communities is not completely successful as 2.1 billion people are still living without adequate access to clean safe drinking water and proper sanitation (Reid, 2019).

2.5 Inter-Basin Water Transfer

As water is already unevenly distributed, human intervention in the water system has made situation worst. These interventions have been beneficial to overall sectors such as economic, domestic, agriculture therefore encouraging people to overexploit the finite resource. Water is dwindling at an alarming rate in greater parts of the world and is one of the biggest challenges faced by humanity (Brauman, et al., 2016). 40 percent of the world is said to experience water scarcity by 2030 (2030 WRG, 2009). The management sector of every country including national governments, international organisations, local communities are putting efforts to ensure supply of adequate amount of water to the growing population for their securitization (Bandhopadyay, 2009). Technological advancement came in as a boon as larger structures could be built to achieve their goals but that would further degrade the

environment. IBWT is considered to be the most feasible option to overcome water crisis worldwide since the ancient period (Biswas, 1977).

China was the first country to generate the idea of IBWT in the 214 B.C. Water was transferred with the help of Ligua Canal for trade and economic purpose. In Ancient Egypt IBWT was implemented to moderate the flow of Nile River. It also intended to supply water for irrigation and shipping sectors. Number of canals and bridges were constructed to transfer water to the lower lands (Zeid, 1983). Water transfer from Tigris to Euphrates in Mesopotamia, water transfer in Japan can be cited as some of the examples Ancient Water Transfer Projects. However the modern IBWT projects emerged only in the 19th century (Zhuang, 2016). In most of the cases, economic and engineering has been emphasized regarding the inter basin of water transfer. IBWT has prosperity to many parts of the world (Thatte, 2009). It is the outcome of major multi-purpose projects covering municipal, industrial hydro-power sectors (UNESCO, 1999). There are functioning as well as planned IBWT projects around the world intended to cater to the needs of the growing population. There were around 160 renowned projects by the year 2015 located in Australia, Africa, Japan, Canada, China, India (Zhuang, 2016). The following case studies are taken from different IBTS that are functional in different parts of the world. It will present evidence about the positive and negative implications of IBWTs across the world.

2.6 Experiences from Global Projects

2.6.1 South-North Water Transfer Project

Water availability in China is very low accounting to only a quarter of the world average in per capita water resources (World Bank, 2002). It is difficult to achieve food security without irrigation as 75 percent of China's grain production comes from

irrigated land (Jin and Young, 2001). Fluctuations in hydrological conditions leading to droughts may result in the crop production failure in the region.

Table No. 2.2: Profile of South-North Water Transfer Project

Location	China
Water surplus area	Yangtze river, Yellow river, Huaihe river and Haihe river.
Water Deficit area	Shangdong, Jiangsu, Hebei, Beijing, Tianjin, Bayankala, Gansu, Shaanxi, Inner Mongolia and Ningxia
Policy setting	State development and Planning Commission. Ministry of Water Resources.
Project cost	62billion US Dollars(expected)

Source: Circle of Blue Org., 2011; International Rivers, n.d[5].

Taking care of all these problems that are challenging human security in China, a number of inter basin water transfer projects have been put into action.

Map No. 2.1: Map of South-North Water Transfer Project

Source: Water Technology, n.d.[6]

There is huge disparity in distribution of water within the country where water availability per person in northern region is only a fraction of that in the southern region In the Northern part of China including Haihe, Huaihe, Huanghe basins or the Yellow River basin, the per capita renewable water resource is 700 cubic metres and

[5]Retrieved from https://www.internationalrivers.org/campaigns/south-north-water-transfer-project Accessed on 12/09/2019.
[6]Retrieved from https://www.water-technology.net/projects/south_north Accessed on 12/07/2019

is water stress region according to Falkenmark (Yang, n.d.[7]). The South-North Water Transfer Project influenced from the ideas of Mao Zedong, is considered to be the most ambitious of all the other projects of China, by many scholars (Freeman, 2011).

Table No. 2.3: Timeline of the South-North Transfer Project

Year	Progress of the Project
1952	Ideas of south to north water transfer was put forward by Mao Zedong
1990	Study was initiated
2002	Construction for Eastern Route started
2004	Construction for Central Route started
2013	Eastern Route started functioning
2014	Central Route started functioning

Source: International Rivers, n.d, Circle of Blue, 2011

The Project channels connect four major river basins benefitting three megacities, six provinces, and hundred millions of people. The project aims to deliver tens of billions cubic metre of fresh water per year from water surplus area of South China to the water deficit northern region. It comprises of three canals namely Eastern Route Project that will carry water from the Yangzi river to Jiangsu, Anhui, Shangdong, Heibei, Tianjin through 1800km long Hangzhou to Beijing canal; Western Route Project will carry water tapped from Tongtian, Yalong and Dadu to the West China; Central Route Project will carry water from the Han river to the Hubei, Henan, Hebei regions (Webber et al., 2017; Freeman, 2011). The Eastern Route that started functioning from 2013 has the capacity to supply 14.8 billion cubic meter/year from the lower Changjiang to the provinces of Jiangsu, Anhui, Shangdong and Heibei through pumps, reservoirs and canals (Webber et al., 2017).

[7]Retrieved from https://riob.fr/IMG/pdf/Water_in_China_Haihe.pdf Accessed on 14/09/2019.

Table No. 2.4: Summary of Inter-basin Water Transfer in China

Sl No.	Source	Destination	Volume diverted(cubic km/year	Length(km)	Irrigated land	Date of construction
1.	Yangtze	Huaihe	___*	400	2.80	1961
2.	Dongxiang	Hong Kong	0.62	83	0.03	1964
3.	Luanhe	Tianjin	2.0	286	___	1982
4.	Yellow	Tsingdo	0.64	262	0.09	1986
5.	Biliuhe	Dalian	0.13	150	___	1982
6.	Datonghe	Yongdeng	0.04	70	0.06	1990
7.	Qinglong	Qinhuangdao	0.17	63	___	1989
8.	Yellow	Baiyangdian	1.25	779	___	___
9.	Songhua	Liaohe	4.4	656	0.24	___
10.	Yellow	Taiyuan	1.4	453	___	___
11.	Yangtze	Huaihe	___	269	0.97	___
12.	Yangtze	Yellow	150	1150	2.26	___
		Huaihe, Haihe	130	1240	2.32	___
		Yellow	170	700	2.33	___

Source: Shao and Wang, 2003. *Data could not be found

2.6.2 Lesotho Highland Project

LHWP is a bi-national and one of the biggest IBWT projects in the world. It is under the joint management scheme of Lesotho and South Africa as per the LHWP treaty 1986 (Water Technology, 2019). It was proposed to divert about 70 cubic metres per second of economically weaker Lesotho Sengu River Water to the economically rich but water deficit Vaal River of South Africa (Water Technology, 2019).

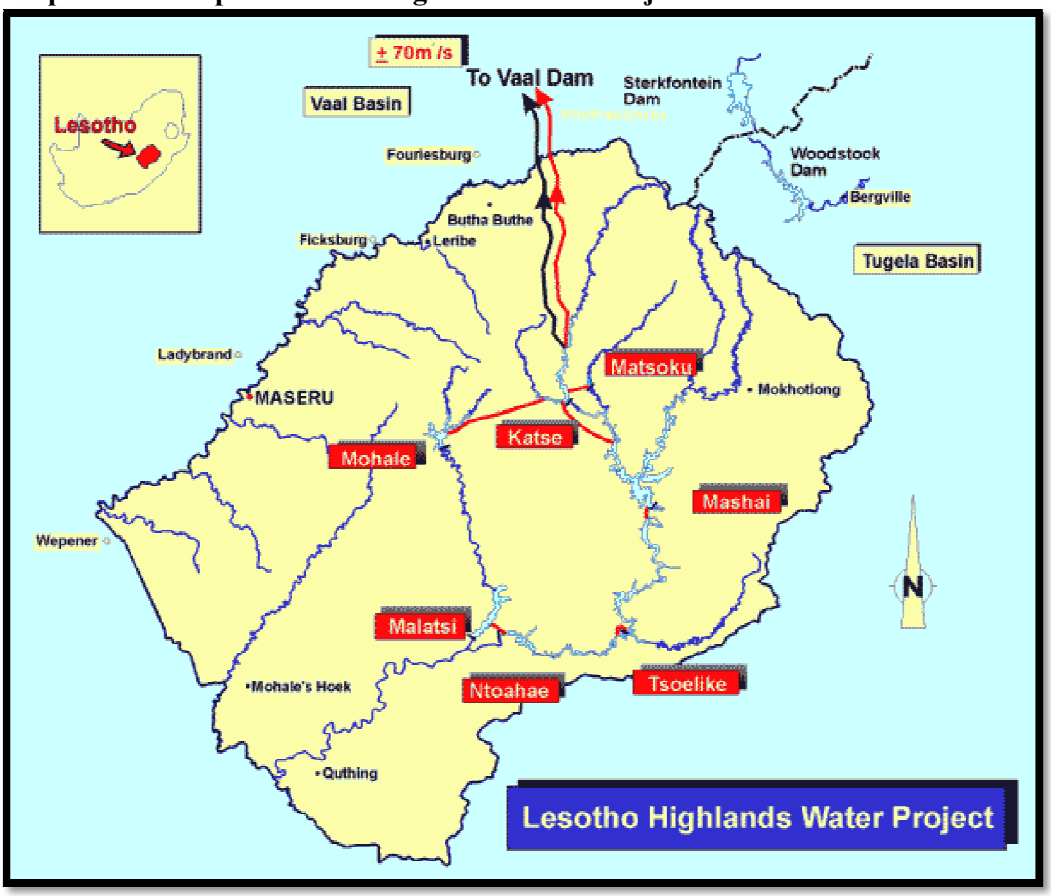
Table No. 2.5: Profile of Lesotho Highlands Project

Location	South Africa
Water surplus area	Malibamatso/Sengu River
Water Deficit area	Liebenbergsvlei/ Vaal River
Policy setting	Department of Water Affairs and Forestry
Project cost	36.8 billion dollars

Source: Lesotho Highland Development Authority, n.d.[8];

[8] Retrieved from http://www.lhda.org.ls/lhdaweb Accessed on 17/08/2019

Map No.2.2: Map of Lesotho Highland Water Project



Source: Centre for Investigative Journalism, 2018

Table No.2.6: Timeline of the Lesotho Highland Water Project

Year	Progress of the project
1954	Proposal for the project was made by Sir Evelyn Barring
1983-86	Feasibility study was conducted
1986	Treaty Signed that established the Lesotho Highlands Water Project and Phase I was started
1989	Construction began at Katse Dam
1990	First Environmental Action Plan implemented
1998	• Phase I-A completed • Water delivery from Katse Dam began • Power production from Mwela power plant
2002	Phase I-B completed
2005	Agreement signed for Phase-II between the Governments of South Africa and Lesotho
2006-08	Commencement and completion of feasibility study
2014	Construction of Phase II started

Source: African Development Bank Group, 2019

The LHWP projects made huge social and environmental impacts. The social impacts were on the resettlement of the communities affected by the project. A total number

of 372 households with around 2300 people were affected on implementation of phase-I of the project. During the implementation of phase-IB a resettlement programme was done where people could either move uphill to the Highland region or to the foothills or to the urban areas. The people to be resettled included those who were affected by the dam construction, those whose were likely to get affected in the future and those who resided in the danger zones. Aquatic systems of the Lesotho Highlands were affected by the construction (Hitchcock, 2015).

2.6.3 California State Water Project

The initiative for the SWP was taken post WWII. The growing population in the States demanded for more water resources for domestic as well as economic purposes. The State Water Project is the largest state-built, multipurpose project in the United States of America (CA, DoWR, 2019).

Table No. 2.7: Profile of California State Water Project

Location	United States of America
Water surplus area	Sacramento and Feather Rivers
Water Deficit area	South California and the San Francisco Bay
Policy setting	Department of Water Resource California
Project cost	17 billion dollars approximately.

Source: California, Department of Water Resources, 2019

Map No. 2.3: Map of State Water Project

Source: Maven, 2015.

Table No. 2.8: Timeline of the California State Water Project

Year	Progress of the Project
1951	Assessment of feasibility of IBWT in Western USA
1956	Creation for California Department for comprehensive statewide water management
1960	• California voters approve the Bruno-Porter ACT to finance construction of SWP • Stage I construction begins
1961	Construction began on Oroville dam which is the key storage on the Feather River
1962	First deliveries were made to the Bay area.
1963	Work began on the California aqueduct and San Luis reservoir
1968	Water was delivered to the San Joaquin Valley
1973	• Pumps and East West branches of the aqueduct were completed • Water delivered to South California
1997	Coastal Branch was completed

Source: Maven, 2015; CA, DWR, 2019.

Initially, it was built for single purpose that is for water supply but now it serves multiple sectors. It consists of canals, reservoirs, pumping plants, aqueducts, power plants to deliver water (SWP, 2018). It was designed to deliver water to 4.2 million acre-feet water per year (CA, DWR, 2019). Water from rainfall and snowmelt is stored in the storage tanks. Stored water is further released to the delta joining the Sacramento River. Delta plays a vital role in providing water to the water scarce area of California. Water from the Delta is to be dispersed to 29 water agencies the Upper Feather River, North Bay, South Bay, San Joaquin, Central Coastal and Southern California areas. Delta is habituated by over 750 species of plants and animals as well as 500000 people (CA, DWR, 2019).

Table No. 2.9: Details of California State Water Project

Facts	Figures
No. of storage facilities	33
Lakes/reservoirs	21
Reservoir storage capacity(total)	7.2 cubic km
Length of canals and pipelines	701 miles
Hydropower generation	8.6 billion KWh

Source: California, Department of Water Resources, 2019.

Table No. 2.10: Comparative Study of Global Level Projects

Impacts	State Water Project	Lesotho Highland Water Project	South to North Water transfer
Positive aspects of IBWTs	• The State Water Project supplies water for 23000 million people. The project supplies 70 percent of water to the urban customers of Southern California's Bay area and 30 percent for agricultural customers of San Joaquin valley. This project also irrigates 750,000 acres of farmland boosting up productivity. • Flood control- the State water project has been playing a significant role in the mitigation of flood since its	• Project provides the capital of Madeshu with water in times of paucity. • Electricity is generated to the Lesotho from Muela power station. • Investment was done on the Infrastructural development such as construction of roads. Though it was done to get access to the construction sites but it made communication easier for the people residing in the hilly regions.	• 1.4 billion Cubic meters of water supply per annum (1.256 billion cubic metres for residential and industrial purpose, 0.415 billion cubic metres for ecological purpose with an aim to reduce exploitation of groundwater resource. • Solve the unequal distribution of water spatially and regionally

	implementation. The Oroville dam controls flood in the Feather and Sacramento rivers. In the San Joaquin valley farmlands the Kern Intertie prevents occurrence of flood during high runoff years. • Nine hydroelectric power plants produce around 6 billion kilowatts of hydropower per year. As water is pumped from deltas for storage SWP plays role of a facilitator in energy generation for water pumping. • SWP construction such as reservoirs, forebays and lakes serve as a recreational point. It is suitable for camping, water sports while some sites along the California aqueducts are open for fishing. • Exhibition cum educational centres are also created for the visitors. Knowledge regarding importance of water as well as the centre is imparted to them.	• Around 4000 people got employed on the construction sites. Small stalls were started by villagers around the construction sites.	
Negative aspects of IBWTs	• Freshwater flow to the San Francisco Bay has reduced. • Decreased number of many species if fishes such as Chinook Salmon and Striped Bass. • The estimated economic impact of fisheries losses was 1.3 Billion USD post construction. • Transport of algal species from Silverwood Lake	• Displacement of villagers- Phase 1 A swiped away land, homes and resources of 20000 people while Phase 1B affected 7000 people of the rural mountain areas. It impacted the society as well as the neighbouring areas with influx of migrants. Though affected people were compensated but were not abiding to	• Poor quality of the transferred water, due to influx of untreated water along the route Pollution in the construction area is so high that its treatment needs huge expense. The environmentalists have shown their concern over the potential transmission of water borne diseases

	through California Aqueduct.	the agreements made previously. • The construction work of project damaged the local flora and fauna of the Lesotho Highlands. • Flow of water has disturbed the ecosystem. Many aquatic as well as terrestrial animals were affected by flooding as well as the control of water flow by dam construction.	and other health risks between the regions. • According to the Heibei conservation department, water resources in the province have declined by 50 percent over the past years. The reason behind it being the diversion of water. • The enterprises along the diversion routes have been forced to shut down so that there is no disturbance in the diversion scheme

Source: Snaddon, et al., 1999; Jin and Young, 2001; Yang and Zhender, 2005; SWP, 2013; CA, WDR, 2019; Austin, 2015.

By analyzing the above case studies it can be concluded that Inter- basin water transfer plays a major role in achieving human security in many countries, but problems associated with it are not less. IBWTs have benefited California, China, and Africa in many ways. Most of the cases are evident of providing water security to the people of water deficit areas by regulating water volumes of the recipient water bodies. IBWTs have increased water supply in the water deficit areas of urban South California's Bay Region as well as for agricultural customers of San Joaquin valley by the State Water Project. Lesotho Highland Project supplies water to the capital of Madeshu in times of crisis. It facilitates in the irrigation and yields increased productivity from the agricultural fields. The State Water Project irrigates 750,000 acres of farmland boosting up productivity, supplying water to the water stressed regions IBWTs controls overexploitation of groundwater. The major objectives of these projects have been control of drought and flood conditions in every country. Excess water in the water surplus regions are stored with the help of dams and reservoirs thus reducing flood situation in the region. Reserved water is further

transferred to the water deficit regions with the help of channels, consequently controlling drought situations. The Oroville dam, a part of State Water Project controls flood in the Feather and Sacramento rivers. In the San Joaquin valley farmlands the Kern Intertie prevents occurrence of flood during high runoff years. Another major contribution of IBWTs is in the field of energy security. In California, nine hydroelectric power plants produce around 6 billion kilowatts of hydropower per year. As water is pumped from deltas for storage SWP plays role of a facilitator in energy generation for water pumping.

Water transfer projects require huge construction such as reservoirs, forebays and lakes. They serve as a recreational point. It is suitable for camping, water sports while some sites along the California aqueducts are open for fishing. Investment was done on the Infrastructural development such as construction of roads. Though it was done to get access to the construction sites but it made communication easier for the people residing in the hilly regions. Around 4000 people got employed on the construction sites. Small stalls were started by villagers around the construction sites.

IBWTs, alongwith its numerous positive outcomes are followed by countless inevitable problems. A major drawback is a lack of comprehensive environmental assessments. Almost all the major IBWT projects have ignored its adverse effects on the environment. Economic prosperity has subordinated the environment to a huge extent. These projects dried up the streams and wetlands in its catchment areas. Thus, native vegetation in these areas is likely to perish. General geographical biasness towards recipient catchments at the expense of donor systems while transfer routes are effectively ignored.

Flow of water has disturbed the ecosystem in due to Lesotho Highland Project construction. Many aquatic as well as terrestrial animals were affected by flooding as

well as the control of water flow by dam construction. The environmentalists have shown their concern over the potential transmission of water borne diseases and other health risks between the north and southern regions in China. Therefore, there is a need of co-ordination between environmental assessments and other aspects of IBWT planning such as technical and economic studies.

2.7 Conclusion

Water scarcity in the contemporary era, in major parts of the world has brought awareness at every level. Water security has become a global agenda today. Water is the most abundant resource on earth and the most important element for survival of all. Scarcity of water threatens the existence almost every sector and the sustainability of the natural resource. There are many conventional as well as non-conventional projects practiced around the globe for water management. IBWT projects are one of many ways of water management. There are projects that have failed and some successfully implemented. The implemented projects have helped individuals, communities in many ways to overcome water-related issues while having adverse impacts on ecology resulting in tremendous environmental disasters as mentioned in the case studies above. Therefore, the problem of water scarcity calls for appropriate approaches to water resource management. It is necessary for the management body to ensure that social and economic needs are met in an equitable manner without threatening the ecosystems.

Chapter 3
Water Resource Management in India with Special Reference to River-Linking Project

3.1 Introduction

India being a diverse and worlds second most populous country it is difficult for the government to take care of demand of the booming population. Though government has been putting efforts in improving the living standards of the citizens, but overall development still need rigorous dedication of both the management as well as the citizens. With almost 600 million people grappling with water stress[9] and more than 200000 people dying every year. Due to inadequate access to potable water is likely to worsen the situation. India has taken significant steps to alleviate problem that are major hindrances to human security but a major chunk of people is still unable to come out of it. Flood situation has turned serious in places like Assam and Mumbai whereas western and southern states like Chennai, Bangalore are running out of water due to monsoon deficit. Proper and appropriate management of finite water resource is important to ensure food security and eliminate poverty in densely inhabited countries like India. Consequently, the only concrete long term plan to solve water woe according to state as well as the central government is inter-basin water transfer system.

3.2 Water Resources in India

Water supports all aspects of life and also plays a major role in planning residential areas as water is the key requirement for survival (Ameer and Ahmed, 2016). India being a vast country with a geographical area of 329 MHa and home to 16 percent of

[9] According to Falkenmark Indicator, If the amount of renewable water in a country is below 1,700m³ per person per year. The country is said to be experiencing water stress Retrieved from http://www.globalwaterforum.org/2012/05/07/understanding-water-scarcity-definitions-and-measurements/ Accessed on 16/09/2019.

the world's population with over 1.2 billion people (Census, 2011). Its water resource is distributed unevenly and is facing water stress. Annual precipitation received by India is about 1170mm annually. In places like Meghalaya it rains for 200 days annually whereas other areas such as deserts of Rajasthan receive rainfall only for 10 days a year. 4000 billion cubic metres of water is received in the form if precipitation out of which only 1900 billion cubic metres is in the form of renewable resource and only 1300 billion cubic metres is considered as potable water. The remaining amount is transferred to oceans or is polluted. Small amount of water gets stored in groundwater aquifers or in inland water bodies (AQUASTAT, 2019).

Table No. 3.1: Water Resources of India

Resource	Quantity (cubic km)	Precipitation (%)
Annual precipitation(including snowmelts)	4000	100
Evaporation and groundwater recharge	2131	53.3
Average annual potential flows in water	1869	46.7
Estimated utilizable water resources • Surface water • Groundwater	1122 690 432	28.1 17.3 10.8

Source: GoI, 1999; AQUASTAT, 2019

The water availability declined from 5177 cubic metres in 1951 to 1250 cubic metres in 1999 and is further estimated to decrease to 1140 cubic metres by 2050 (MoWR,2015)

Table No. 3.2: Past and Estimated Future Water Availability in India

Year	Population (million)	Per capita water availability (cubic meter/year)	Change from previous year (%)
1951	361	5177	0
1955	395	4731	-8.59
1991	846	2209	-53.31
2001	1027	1816	-17.92
2011	1210	1545	-14.92
2025	1394	1341	-26.37
2050	1640	1140	-14.98

Source: GoI, 2012.

The various sources of water in India are:-

Surface Water Resources- The major sources of surface water are rivers, lakes, ponds and tanks. There are around 10,360 rivers in India divided into four groups, the Himalayan Rivers, Rivers of the Deccan Plateau, the coastal rivers and the inland drainage basins in the Western Rajasthan. 1869 cubic Km is estimated mean annual rainfall in the river basin out of which only 690 cubic km of water is in the form of potable water. India's land area can be divided into 19 major river basins. Around 62 percent of annual water availability in the country is generated in the Ganges, Meghna, and Brahmaputra basin where the highest amount is from the Brahmaputra with 18400cubic million per year. 10 percent is from the west flowing rivers, while the remaining 28 percent is from other river systems that are distributed over the country (Kumar, et al., 2005).

Larger the population more is the demand for water. The country's population has increased by almost 250 percent since the attainment of independence from 359 million to around 1.37 billion in 2019 (MOS & P, 2019). The relation between water demand and population growth is direct. Water demand not only increases for domestic purpose but also for food production. To facilitate agricultural sector water resources are being over exploited to expand the dry season agriculture and the irrigated areas. Huge investments were made in the 1960s in surface water projects for the supply of water for agriculture (Briscoe and Malik, 2006). The per capita consumption of food grains in India has shown a significant increase over the past years (Kumar, 2000). In the regions where water availability is in abundance, water is being overused to serve various purposes such as recreational activities, industries and even domestic purpose.

The availability of water is declining with each passing day. Pollution is considered to be the major contribution in the scarcity of surface water resource. Over 70 percent of the available ground and surface water is reported as contaminated (Kumar and Bharat, 2014). According to the World Bank, 21 percent of the communicable diseases in India are due to unsafe water (Water Org, 2019). Injudicious exploration of water resource disturbs the physical, biological, chemical components of water therefore degrading its quality. This makes water unsuitable to fulfill basic requirements of people. Human activities such as disposal of untreated chemicals deteriorate the water quality directly or indirectly. India's smaller rivers have turned toxic and even the larger ones like Ganga have become impure. Some of the reasons behind it are population explosion, increased rate of industrialization and urbanization, poor sewage management. 33 percent stretches out of 45,019km comprising of major rivers such as Ganga, Brahmaputra, Krishna, Godavari and Narmada, are polluted (Briscoe and Malik, 2006).

India witnessed rampant industrialization and urbanization causing a lot of problems. The escalating number of industries has worsened the matter by putting pressure on the existing freshwater resources. Demand for water by Industries such as petrochemicals, fertilizers, chemicals has increased by 40 times from 100million liters/day in 1947-50 to 4000 million liters/day in the year 1997 (TERI, 1998). They are not only heavy water users but also are consumers of huge amount of hydroelectric power. If urbanization is taken into account, the housing societies and colonies in the cities own their personal groundwater pumping devices. Therefore over exploitation of fragile water resources is inevitable.

Groundwater Resources- It is the major component of total water resource in India. Its availability is not uniform in space and time. It is the major source of irrigation and

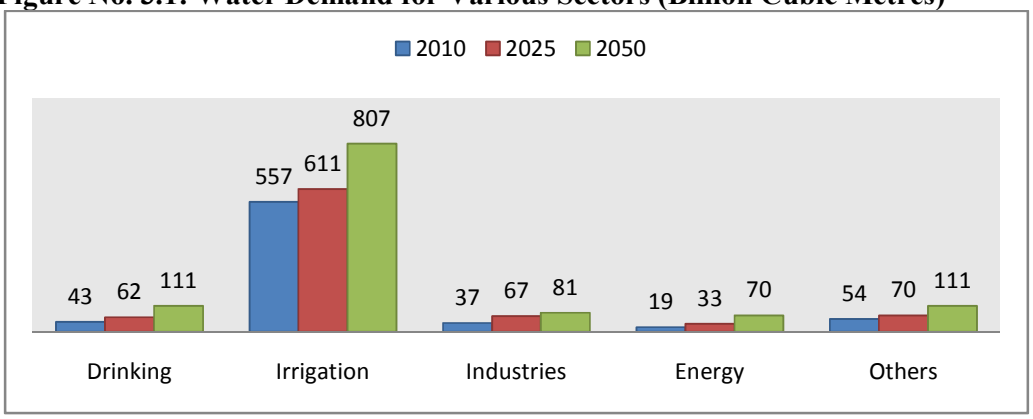
drinking water in rural as well as urban areas. India holds 432 billion cubic meters of groundwater refilled by rainwater and river drainage every year. 395 billion cubic metres is only in the form of fresh-water and is further distributed to different sectors (MOS & P, 2019). Ground water played an important role in the era of green revolution from mid 1960s onward. Ground water caters to the need of 60% of the country‘s irrigation, 85% of drinking water in the rural areas and 50% of urban water requirements (World Bank, 2012).

The period of green revolution in the 1960s was a turning point in the development of India’s agricultural sector. Water control became an important part of production. Groundwater pumping was done extensively. Drought and over pumping of groundwater is drying up aquifers which feed more than 30 million water wells across the country. One third of India’s groundwater resources are being pumped much faster than being recharged by rainwater (Circle of Blue, 2018). India being agriculture based country; water consumption is highest among all other countries (Maps of India, 2019). When monsoon rains are not sufficient groundwater is overused for farming (Busby, 2018). Farmers apprehended that it was way easier to extract groundwater than from the canals (Briscoe and Malik, 2005). With the increasing rate of contaminated water people depend on ground water.

Common perception regarding ground water is dig deeper for cleaner water depleting the water table and deteriorating the water quality. People with no alternative source of freshwater are the ones who suffer because of such practices (Upadhyay, 2012). With the technological advancement supporting tapping of ground water led to the overexploitation of resources especially in the arid and the semi-arid regions (Upadhyay, 2012). In Western, northwestern and southern regions of India, water is being over-exploited, therefore leading to crisis of basic water requirements. 12

percent Indians are already living in the 'Day Zero'[10] situation due to excessive groundwater exploitation (Matto, 2019). The unbalanced mining of groundwater is causing irreparable destruction to groundwater and need to be curbed through strong legislations and administrative regulations (Azariah, et al., 1998).

Figure No. 3.1: Water Demand for Various Sectors (Billion Cubic Metres)



Source: GOI, 2006.

Glaciers and Snowmelt- Glaciers and snowmelts are one of the major sources of water in the Himalayan region. Though these are not very good producers of freshwater, they serve their purpose at right time of the year that is in summer season. About 80% of river flows occur during the four to five months of southwest monsoon season (FAO, 2019). Climate change is significant in maintaining the relation between water demand and availability. Rising temperature results in increased demand of water by the crops.

Extreme rise in temperature affect the availability and the distribution of water in form of rainfall, groundwater, snowmelt, rivers deteriorating the quality of water. It intensifies the hydrological cycle increasing annual rainfall as well as drought conditions. Frequent drought and flood conditions impacts agricultural production negatively. India is a home to 17 percent of the world population but only has 3

[10]The idea is introduced by Cape Town. Day Zero is when most of the city's tap will be closed literally. For further information access to http://theconversation.com/day-zero-is-meant-to-cut-cape-towns-water-use-what-is-it-and-is-it-working-92055 Accessed on 16/09/2019.

percent of global water resources. Almost 40 percent of the land mass faces acute water stress (IWP, 2019). Though India is not a water deficit area as compared to the countries in the Middle East regions of the world there are various factors that make India a water-stressed region. Massive scarcity of water in states like Telangana and Maharashtra in the year 2016 revealed water shortage in the country.

It is thus understood that conservation and proper management of water resources is the need of an hour to protect us from health hazards, ensure food security, betterment of our livelihoods and protection of our environment.

3.3 Water Governance and Management

Good governance is imperative for any country to solve the problem of water scarcity or any other problem. In the context of India water crisis is often attributed to lack of government planning, increased corporate, privatization, industrial and human waste and corruption in the governance level (Snyder, 2019). Therefore, it is more important because of emerging and already existing water related crisis as well as the international disputes over water. Such disputes arise because of the negligence and mismanagement of available water resource (Reddy and Dev 2006). “Our country is facing a severe water problem, not because we don’t have adequate resources of water, but because of our inability to conserve and manage all the rainwater and available usable water resources in the environment.” (Vajpayee, 2012)

Taking factors such as pollution, population growth and high demand for food into consideration water management is of utmost important in the contemporary era. Though there are norms enforced by the Water Pollution Control Board in the country, it functions ineffectively. A large number of industries are small industries lacking financial resources in the better treatment of the industrial sewage which are comparatively expensive (Vani, et al., 1995). No one is against the water policies but

the major problem is that it is implemented by none though Article 51(A) makes it a fundamental duty of every citizen to protect and improve the natural environment including forests, lakes, rivers, wild life. It becomes a major hindrance in the water management policies (Reddy and Dev, 2006).

Though state is allocated with water related projects, government finds it necessary to set proper guidelines at a national level. National Water Policies laid their emphasis on developing data bank, estimating water availability along with its priority list (MoWR, 1987: 2002). The National Water Policy of India was first adopted in the year 1987 by National Water Resource Council (MoWR, 1987). The major provisions envisaged by the policy were based on the proper management of water resources for maintaining ecological balance, economic and developmental activities. In planning of the policy, clause 8 listed allocation of drinking water, water for irrigation, hydropower, navigation, industrial and other uses as priority concerns (MoWR, 1987). Since 1987, a number of issues and challenges were met by the government in the domain of water allocation and management.

Table No. 3.3: Key Objectives of National Water Policies

Sl. No.	National Water Policies (NWP)	Key Objectives
1.	NWP 1987	-Planning and development of water resources would be governed by national perspectives -Drainage basin recognised as basic unit of planning for water resource water development.
2.	NWP 2002	-To provide flexibility in the allocation of water resources. -To encourage non-conventional methods of water utilization such as inter-basin water transfer, artificial groundwater recharge.
3.	NWP 2012	-To encourage local community participation in water resource management. -To ensure equitable and sustainable use of water resources.

Source: MoWR, 1987; 2002; 2012.

Therefore, NWP was revised in the year 2002 (MoWR, 2002). Various water resources planning are listed in the NWP 2002. Non-conventional methods of water utilization such as inter-basin water transfer, artificial groundwater recharge were

encouraged to increase the utilizable water resources. Revised policy gave priority to ecology and environment and is added in the priority list of NWP 1987 (MoWR, 2002).

Rapidly growing population and rising demand of water posed serious challenges to eater security. Mismanagement of water resources is causing severe water crisis in many regions of the country. The NWP was again updated in the year 2012 envisioning proper water resource management so as to curb water related issues in the country (MoWR, 2012). It calls for the participation of local community to ensure equitable and sustainable use of water resources. NWP 2012 has scrapped off the priority list on water allocation stated in the NWP 1987 and 2002 (MoWR, 2012). Due to numerous challenges that has emerged in water sector, department of water resources finds it necessary to revise the National Water Policy. A drafting committee has been constituted on 5th November 2019 for the purpose (Mohan, 2019).

3.4 Institutional Mechanisms in Context of River-Linking Projects

In the global context, India is identified as one of those countries where water scarcity level is expected to grow exponentially over the coming years (IWRS, 1996). It impinges on the wellbeing of Human conditions in numerous ways. India is a home to nearly 17 percent of the world‘s population but only 4 percent of freshwater resource (Kumar, et al., 2016) and is categorized among top ten water rich countries though it is designated as water stressed region. India had 3000-400 cubic metre water per person per year in 1950 and currently has fallen down to1000 cubic metres that show a decrease of 400 per cent in the past 60 years (World Bank, 2019). Rainfall varies significantly from one place to another within the country that takes place in from June to September and without uniformity. India will face water deficit problems by 50 percent by the year 2030 (ADB, 2013). Water scarcity can result in dire

consequences impacting food security as most of the farming process relies on rain water.

Water has long been a source of conflict between or among the states across the world. Escalation of such conflicts is due to scarcity of water resources (Wolf, 1999). Number of scholars claim that water scarcity would lead to water war in the near future (Pradhan, 2017). Undoubtedly, Scarcity of fresh water resources has been one of the major impediments in India's progress. Several interstate intrastate conflicts over water have been prevalent in the country of which Cauvery water dispute, Teesta water dispute are well known. Such conflicts further escalate during the lean seasons when the water scarcity reaches an extreme point (Upadhyay, 2001). There are number of water infrastructure in India that has been there since the colonial rule yet they are not able to meet the demands of the people. Major developmental projects are coming up to expand irrigation and provide people with basic water requirements. Despite of all the efforts put in by the government to wave off the alarming growth of water crisis, it is still difficult to fulfill the objectives of water management bodies. There have been debates on past water development projects while there are some politicians and scholars who argue that inter-basin water transfer can be a solution to the problem of water crisis. The criticism faced by inter-basin system is not less either.

The National Water law of India is far more advanced as compared to the International law on water yet it lacks a proper framework for regulation of freshwater in overall aspects. Existing water law in India is a mixture of various laws, principles, irrigation acts that has been derived from the colonial period along with the recent water regulation measures. Therefore, lack of comprehensive water legislation Acts can result in contradiction between state and the central legislation with the country.

Constitutional Provisions- The constitution of India has vested the state government with the responsibility of water allocation under the Entry-17 of List-II falling under the state list. This inclusion came as part of the Government of India Act, 1935 that gave power to the state, to legislate in water related matters. States own authority for water supply regulation, fisheries, hydropower and others (Gadhre, 2018). However, Entry 56, List-II of the seventh schedule of the Indian Constitution entitles the central Government to regulate, develop and administer surface water sources on a national scale. Central government is also responsible in the settlement of inter-state as well as international water dispute under Article 262 of the Constitution (Mishra, et al., 2008). However, this mechanism is insufficient to deal with various aspects of water disputes. There have been cases where states have disobeyed the decisions of the tribunal. Centre has intervened directly over water sharing conflicts like in the case of Cauvery and has been unsuccessful. The demand for inclusion of subject in the concurrent list is raised by many environmentalists and organisations (Khanna, 2017). The inclusion of it in the concurrent list would set up comprehensive laws for proper allocation, conservation and usage of water resources. Complex issues over water cannot be solved by government bodies alone; it needs equal co-operation from the stakeholders, local population. If the water policies are regulated by the state government then it would turn out to be biased towards regional development rather than National development. The Constitution of India does not specifically recognize fundamental right to water nevertheless right to water has been derived from the fundamental right to life under Article 21. The political structure of water issues in India is inevitably linked with issues such as development, energy and food generation. India has undertaken extensive investment for water related infrastructural

development such as dams, storage structures and canal network to meet the demands of the growing population.

Five Year Plans- Based on Plans and Schemes, considerable progress has been made in respect of water resources development and management in India after independence through various Plans and such developments have helped to almost fivefold increase in total growth of the country. This is evident from the budgetary allocation that has taken a leap from Rs. 243,497crore in the 11th five year plan to Rs. 504,371crore in the 12th Five Year Plan in the drinking sector. The amount also increased in the sanitation from Rs. 120,774 in the 11th Five Year plan to crore to Rs. 254,952crore in 12th Five Year Plan.11th Five year plan also made an announcement to improve ground water table in 1180 over-exploited, critical and semi critical blocks in the most affected states, namely Andhra Pradesh, Karnataka, Maharashtra, Rajasthan, Gujarat, Madhya Pradesh and Tamil Nadu (MoWR, 2015). This scheme aimed to provide groundwater recharge facility and enhance its quality, improve condition of the affected areas and participation of community in water resource management (MoWR, 2015). This has made a huge contribution in achieving food, health and water security.

Administration of Water at the State Level- The water quality is regulated through the Water Act, 1974 under the supervision of the state government. Total 23196, Water quality monitoring stations has been established on a national level (CGWB, 2019). Monitoring is done on a quarterly basis for surface water and half yearly for groundwater (GOI, 2008). In the contemporary era the participatory approach to water resource management has gained momentum worldwide and India is not an exception in this case. The responsibility of water management is given to the local

village communities such as village panchayats in Maharashtra, Gujarat and Andhra Pradesh (Brewer, et al., 1999).

It is important to take into account that development in the field of water resources in the future can be more challenging. It is the responsibility of governments to look into such matters. In conditions water stress level of the freshwater at the macro level and actual scarcity and water stress in many areas of arid/semi-arid zones in India, there is an urgent need for conservation and better management. Effective strategies must consider not only managing the water supply better, but also in terms of managing the already available water resource.

The purpose of the water resource planning process is to ensure sustainable management of water supply, recognizing increasing pressures on water sources from factors such as increasing population, climate change and environmental requirements. Water security has become a key objective of both governmental as well as non-governmental agencies thus integrated water resource management is increasingly seen as the way of ensuring it (Pachova, et al., 2008). Water resource Management is "the ability to use sufficient quantity of water with good quality from the local to the global scale to meet the needs of humans and ecosystems in the present and in the future for better and sustainable life, and it make protection for humans from the damages brought about by natural and human-caused disasters that affect life sustainability." (Mays, et al., 2007).

3.5 Drivers and Issues of Water Management

The water resource management in India is done in an integrated manner. As the present world faces huge problems of water scarcity there is an urgent need for sustainable water resource management in India (Kumar, et al., 2005). The concept of integrated water resource management emerged in 1960s with a central goal of

achieving water security in overall aspects. IWRM is based on the principles of 3 Es; Economic Efficiency, Environmental Sustainability and Social Equity (Conradin, 2019). Some of the water resource management in India are:-

Rural Drinking Water Management- Before 1991 Government was in charge of providing drinking water to a population of 833 million people in 640,000 villages nationwide. Post 1991 local communities are vested with the responsibility of water supply systems. To support this World Bank has been working hand in hand with the Indian Government. Village panchayats are being educated and empowered to choose and construct their own water supply systems backed up by the state government (World Bank, 2019). Since, 2000 World Bank has helped around 36 million people across 40,000 villages in gaining better access to clean drinking water (World Bank, 2016). Due to village community participation the expenses has also been cut down (World Bank, 2019). However it must be noted that despite all these efforts put in by various bodies, "no source" villages (villages with no proper source of drinking water) still exist in India (IEP, n.d)[11]. More than 163 million people lack access to safe drinking water. Allotment of huge sum of Rs 86,956 crore for national rural drinking water project, has failed to achieve its targets of providing 35% of rural households till the year 2017 (Paliath, 2018). The failure to achieve above mentioned target is the result of poor execution and weak contract management according to the Comptroller and Auditor General (Paliath, 2018).

Flood and Drought Management- After the devastating floods in the year 1954; various national programmes were launched by the government for flood management (Kumar, et al., 2005). Some of them being high level committee on flood and flood relief, National Commission for integrated water resource development, national

[11]Retrieved from http://www.indiaenvironmentalportal.org.in/files/Water_Assessment.pdf Accessed on 29/11/2019.

water policy. They serve purpose of an advisor on water related issues in the country (Mohapatra and Singh, 2003). Many structural steps have been taken to control the damage in the flood plains by constructing levees, dams, embankments and spurs. A total length of 16,800 km long embankments, 32,500 km drainage canal and reservoirs has been constructed that controls flood risks in 1040 villages and 4760 towns (Kumar, et al., 2005). World Bank supported the Government in installations of these reservoirs by contributing an amount of Rs. 30 crore (World Bank, 2015). In addition to these structural measures there is a need for non structural measures too. In India, flood forecasting and warning started for Yamuna River in the year 1958 (Kumar, et al., 2005). The structural efforts put forward by various bodies have failed to completely mitigate drought and flood conditions in the country. Climate change has added to the severity of India. States like Andhra Pradesh, Gujarat has been experiencing rampant drought situation since 2015. About 42% of India's land area is still facing drought conditions in the year 2019. It is 6% drier to the year 2018. Failed monsoons are major reasons of such situation (Tripathi, 2019). While states such as Assam and Kerala, are devastated by floods caused by heavy rainfall. One of the major reasons behind flood situation, being mismanagement of dams and lack of co-ordination between states (Kapil, 2019).

Watershed Management- Watershed management aims at taking advantage of resources without disturbing the functioning of a river (Khalequzzaman, et al., 2005). Many projects and programmes are being carried out by the state, central government and the NGOs across India. It is executed to bring awareness among every section of the society on water related issues and to actively participate on implementation of

such measures. Some of the programmes are *Hariyali*[12]*, Neeru-Meeru*[13]*, and Tarun Bharat Sangh*[14] with their different aims and objectives relating to different water conservation practices.

Rain Water Harvesting- Rainwater harvesting is considered to be the most viable water resource management practice in India. It depends totally on the monsoon rainfall. In recent years, the Rainwater harvesting has been in news predominantly. Rainwater harvesting is actively practiced in India as the primary mode of societal adaptation to its environmental, natural conditions that revealed an in-depth understanding on the part of the people of the laws of nature that surrounded them and that they were a part (Pandey, et al., 2003). The optimal harvesting of rainwater is necessary for replenishing surface and groundwater reserves. Rainwater harvesting cannot be a onetime activity. Monsoon rainfall may vary over a period of time and space, and therefore Rainwater harvesting needs to be a continually evolving and adjusting phenomenon that takes into account the much localized factors and conditions relating to natural resources as they occur. Rainwater harvesting system is a highly decentralized approach. In contrast to water resource management in recent days has consistently followed a centralized approach.

Inter-Basin Water Transfer- Until now, colossal investments in engineering structures has made water extraction possible. To overcome the problem of unequal distribution of water, water transfer from water surplus area to water deficit area is taken as an ideal alternative. By looking at the positive aspects of the IBWT systems

[12]Project launched by former Prime Minister Mr.Vajpayee. it is an initiative under watershed management project that would enable the rural population to conserve water for drinking, irrigation, fisheries and Afforestation as well as to generate employment opportunities. https://www.thehindubusinessline.com /2003/01/28/stories/2003012800501701.htm. Accessed on 13/08/2019.

[13] Means water for you, is a water conservation and poverty alleviation initiative undertaken by government of Andhra Pradesh.

[14]Is a non-profitable environmental NGO focusing on self governance and political empowerment for villagers living around exploited rivers.

in the other countries India found it viable to overcome water security. ILR was proposed under the IBWT system in the country.

3.6 Historical Background of Inter-River Linking Project

Large areas of India come under arid zone, which make it difficult task for water management department of the country to manage water resources and distribution of water. Therefore, in country like ours inter-basin water transfer is one of the preferred solutions. There has been lots of mixed response made on this by scholars and activists. Inter-basin project in India is not a new concept. The simultaneous pattern of drought and flood escalates the hardship of the people (NWDA, 2016). To overcome such problems different people at different phases have opted for inter-basin water transfer as a solution (Thatte, 2016). The inter-basin water transfer, in India is collectively is also known as inter-river linking. It has been prevalent in the country since the ancient era. Some of the examples of inter-basin transfer that has been built decades ago are Yamuna canal and the Agra Canal that today transfer water from Himalayas to the parts of Punjab, Rajasthan and U.P. Sir Arthur cotton, British general and irrigation engineer , is the brainchild of river linking in India. He put forward the proposal of river linking in the 19th century for the purpose of inland navigation in Southern India. The concept was further revised in the 1960s by Dr. K.L. Rao, the then power and irrigation minister. His plan was to link Cauvery with Ganga through a canal under the National Water Grid[15]. The timeline of inter-basin water transfer is shown below on the basis of its evolution:-

[15]The National Water Grid is a large scale engineering proposal for the management of water resources in India by the inter-linking of Indian Rivers through networks of reservoirs and canals. For further information Access https: //www.jagranjosh.com/general-knowledge/national-water-grid-advantages-disadvantages-and-river-linking-project-plan-1554725785-1 Accessed on 19/10/2019.

Table No. 3.4: Evolution of Inter-River Linking Project

Year	Description
1955	IBWT plan was made by Sir Arthur Cotton
1972	Dr. K.L. Rao planned a National Water Grid that was not economically viable.
1977	Captain Dastur came up with the idea of Garland Canal that turned out to be technically impractical.
1980	Ministry of Water Resource under the National Perspective Plan proposed inter-linking of rivers scheme.
1982	National Water Development Agency announced 30 links suitable for further study.
1999	National Commission for integrated Water Resource Development plan supported IBWT plans.
2001-2002	Feasibility reports of 16 links were completed and declared classified.
2002	President of India declared ILR project Supreme court gave its verdict on the ILR project and to form task force and perform their job. Task Force for ILR was formed.
2005	Ministry of Water Resource invited state governments to propose intra-state ILR links.
2006	Feasibility studies were put up in public domain. State governments proposed intra-state links.
2012	Formation of another task force.
2015	Pre-feasibility studies completed for 16 ILR links at inter-state and 33 ILR links at intra-state levels. Detailed Progress Report for 3 ILR links at inter-state and 1 ILR link at intra-state levels.

Source: Self Compilation based on NWDA Reports, 2016

The concept of inter-basin water transfer is to be put into action for equal distribution of available water resource and to alleviate water related problems of floods and drought in the country. It may also play a major role in sustaining food-energy-water nexus as it is implemented with an objective to provide water for domestic needs, irrigation navigation, energy production (Sternberg, 2016). It also visualized:-

- Ganga-Brahmaputra Link
- Canal from Narmada to Gujarat and Western Rajasthan
- Links from Western Ghats
- Link from Chambal to Ajmer
- Canal from Mahanadi to Sharda.

This proposal was made to transfer 20 million acre feet of water during monsoon season by pumping water from River Ganga to irrigate 4 million hectares that would

require a huge economy. In the year 1977, Captain Dastur again initiated the concept of Garland canal to connect River Ravi to Brahmaputra and supply surplus water to the peninsular regions of India. All these propositions were declared to be irrelevant by the National Commission for Integrated Water Resource Development Plan (NCIWRDP, 1999). India is one of the fastest growing economies with an alarming growth rate of population therefore increasing demands for water supply is inevitable (Mall, et al., 2006).

National Water Development Agency

It was formed in the year 1982 as a society under Societies Registration Act 1860 to work on National Perspective Plan. It was established under the Ministry of Irrigation or the Ministry of Water Resources, River Development and Ganga Rejuvenation. The various functions carried out by the NWDA are:-

- To carry out detailed surveys and investigations of possible reservoir sites and interconnecting links in order to establish feasibility of the proposal of Peninsular Rivers Development Component (1981) and the Himalayan Rivers Development Component(1994). Forming part of the NPP for Water Resource Development by the then Ministry of Irrigation (now Ministry of Water Resource, RD & GR) and Central Water Commission (CWC).
- To carry out detailed surveys about the quantum of water in various Peninsular Rivers System(1981) and the Himalayas River systems(1994) which can be transferred to other basins/States after meeting the reasonable needs of the basins/States in the foreseeable future.
- To prepare FRs of the various components of the scheme relating to Peninsular Rivers Development (1981) and Himalayan Rivers Development (1994).

- To prepare DPRs (2006) of the link proposals under the NPP for Water Resource Development after obtaining concurrence of the concerned states.
- To prepare PFRs/FRs (2006)/DPRs (2011) of the Intra-State links as maybe proposed by the states. The concurrence of the concerned co-basin states for such proposals maybe obtained before taking up their FRs/DPRs.
- To undertake/construct/repair/renovate/rehabilitate/implement the projects either through an appointed agency/organization/PSU or company and projects forming parts of ILR, for completion of projects falling under Pradhan Mantri Krishi Sinchai Yojana (PMKSY)-2016 of which projects under Accelerated Irrigation Benefits Programme (AIBP) are also included and similar other projects (2016).
- NWDA to act as repository of borrowed funds or money received on deposits or loans given on interest or otherwise in such manner, as directed by the MoWR, RD&GR and to secure the repayment of any such borrowed funds/money deposits/loan etc. by way of mortgage, pledge, change or lien upon all or any other property, assets or revenue of the society both present and future (2016).
- To do all such other things the society may consider necessary, incidental, supplementary or conducive to the attainment of above objectives (1981).

Table No. 3.5: Particulars of Inter-River Linking Project

Sl. No.	Features	Himalayan component	Peninsular component	Total
1.	Linking canals	14	16	30
2.	Major reservoirs	9	27	36
3.	Linking rivers			37
4.	Power generation(MW)	30000	4000	34000
5.	Transferable water(cubic Km)	33	141	174
6.	Additional Irrigation area	13	22	35
7.	Cost of Project(Rupees)	185000 crore	106,000 crore	391,000 crore
8.	Length of Canals	6100 Km	4777 km	10877km
9.	Drought mitigation	1.7 m ha	0.85mha	2.55 m ha

Source: National Water Development Agency, 2015 and Sikdar, 2005.

Plan Formulation

In the year 1982, the idea of inter river linking gained momentum under the National Perspective for Water Development by the National Water Development Agency (NWDA). It was not until 2002 that the idea was contemplated. In 2002, the then Indian President, APJ Abdul Kalam referred to the idea of inter river linking as a solution to water problem, in one of his speech. In the year 2012, Supreme Court of India directed the Government to form a committee and work towards an implementation the Project by 2016 (Islam, 2006). Following this, the then Prime Minister, Atal Bihari Vajpayee made an announcement in the Parliament on the implementation of the ILR and to set up Task Force (Iyer, 2012). Special committee formed by NWDA on Interlinking of Rivers[16]. Task Force- the MoWR, RD&GR constituted a Task Force on Interlinking of Rivers according to the instructions of the Union Cabinet.

It was formed to:-

-Provide guidance on norms of appraisal, viability, impacts.

-Devise mechanisms for achieving consensus among states.

-Priorities project components for Detailed Project Report and implementation.

-Suggest modalities for funding

-Consider international dimensions.

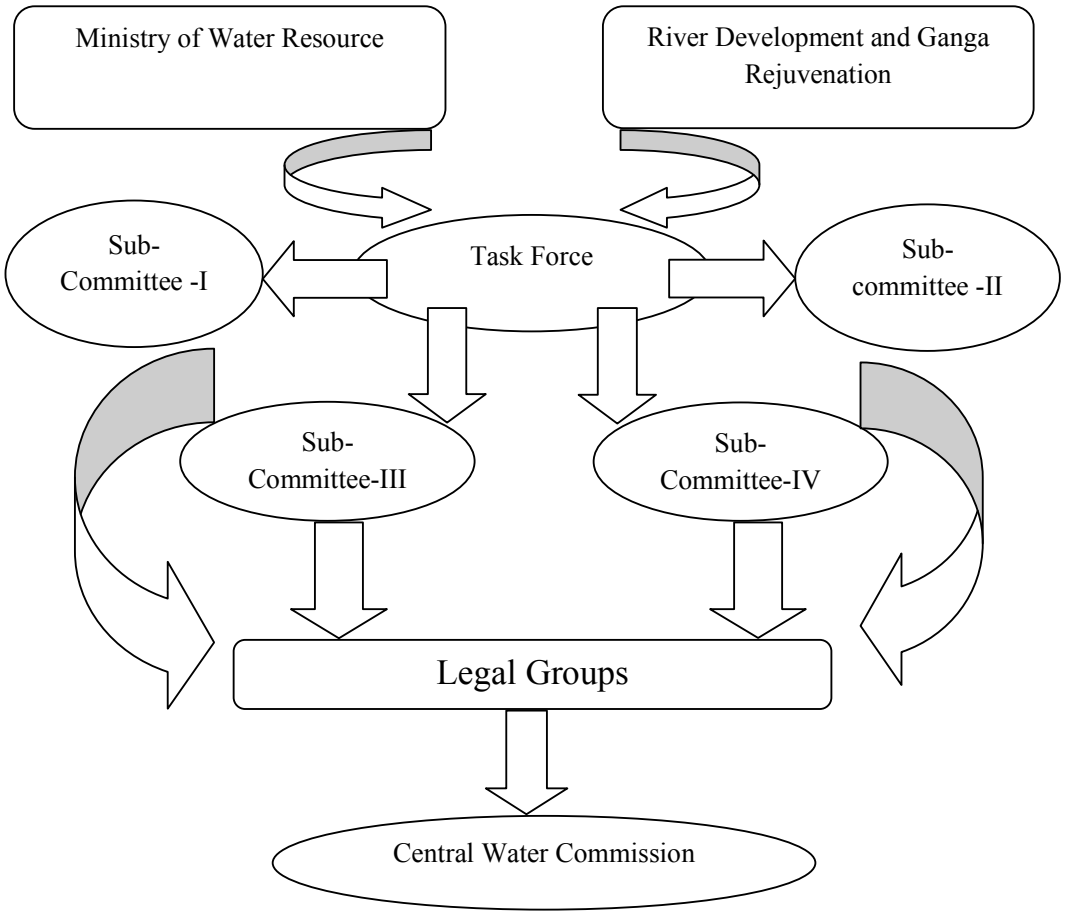
- Sub-committee- The special committee has formed four Sub-committees comprising of sub-committee-I for Comprehensive Evaluation of various studies and reports. Sub-committee-II for System Studies for identification of most Appropriate Alternate Plan. Sub-committee-III for Restructuring of

[16]Special Committee was formed by NWDA as per the instructions of the Supreme Court vide Gazette Notification dated 23/09/2015.

NWDA and Sub-committee IV for Consensus Building through negotiations and arriving at agreement between concerned states.

- Legal Groups- The Task Force of Interlinking if Rivers has formed a group on legal aspects to assist the force in their proceedings. Under it the Central Water Commission has been constituted for the legal proceedings and to enable provisions for the implementation of the river linking and projects.

Figure No. 3.3: Institutions involved in Inter-River Linking Project



Source: Self Compilation based on GoI, 2002

The process under NWDA undoubtedly is made from the rhetoric of former proposals and is based on the amalgamated principles of the previous proposals made by Dr. K.L. Rao and Captain Dastur.

Keeping those objectives intact NWDA adopted broader approaches and principles under the Ministry of Irrigation and the Central Water Commission:-

- Existing uses have to be kept undisturbed and honoured to the best extent.
- The ongoing water developmental activities, under the prevailing legal and constitutional framework.
- The perspectives development within the framework should keep in view all the existing agreements in between or amongst the states within the country as well as existing treaties with the neighbouring countries.
- As the storage sites are limited on account of topographical and other resources, the plan should be based on the principle of optimum level of development storage sites including development of new storages, big or small, wherever feasible. The plan should envisage appropriate multi-purpose and multi-objective development of water resource projects, for irrigation, flood control, hydropower generation (keeping peaking needs as one of the objective) and navigation, etc.
- While planning an inter-basin inter-state transfer of water resource, rational needs of the basins states for the foreseeable future shall be kept in view and provided for.
- Water development should have preservation and enhancement of the environment as one of the objectives, and provide for funds needed for Afforestation and improvement of forests in areas nearby. Recreation fisheries development etc. should also be taken into account.
- Domestic and industrial use of water as well as for irrigation should be given high priority. Pollution control should be one of the objectives.

- The people to be displaced by the project works should be given liberal rehabilitation and resettlement packages so that they are better off with improved living conditions.

Under the National Water Development Agency 30 Artificial Link would connect 37 major rivers of the country.16 Peninsular and 14 Himalayan components have been identified that would connect the major rivers in the Nation.

Figure No. 3.4: Map of Inter-River Linking Project in India

Source: My India (2019). [17]

Table No. 3.6: Physiographic Division of Inter-River Linking Project

Himalayan Component	Peninsular Component
1. Kosi-Mechi	1. Mahanadi-Godavari
2. Kosi-Ghagra	2. Ichampalli-Nagarjunasagar
3. Gandak-Ganga	3. Inchampalli-Pulichintala
4. Ghagra-Yamuna	4. Polamvaram – Vijayawada
5. Sarda-Yamuna	5. Almatti- Pennar
6. Yamuna-Rajasthan	6. Nagarjunsagar- Somasila
7. Farrakka-Sunderbans	7. Pennar-Cavery
8. Subernarekha-Mahanadi	8. Somasila- Grand Anicut
9. Jogighopa-Tista-Farrakka	9. Kattalai-Vaigai-Gundar

[17]Retrieved from https://www.mapsofindia.com/my-india/government/pm-modi-scheme-of-river-linking-projects-in-india Accessed on 18/10/2019.

10. Manas-Sankosh-Tista-Ganga	10. Ken-Betwa
11. Ganga-Damodar-Subernarekha	11. Parbati-Kalisindh- Chambhal
12. Chunar-Sone Barrage	12. Par-Tapi-Narmada
13. Sone Dam- Southern distributaries of Ganga	13. Damanganga- Pinjal
14. Rajasthan-Sabarmati	14. Bedti-Varda
	15. Netravati- Hemavati
	16. Pamba-Achankovil-Vaippar

Source: NWDA, 2002.

The main aim of bifurcating these links was because of the complexity that it would face in interlinking of the Himalayan and the peninsular components due its uneven terrain.

Himalayan Component- The Himalayan component envisage construction of storage facilities and river linking canals on the tributaries of Himalayan river tributaries such as Ganga and Brahmaputra with an aim to transfer its surplus water of the eastern tributaries of Ganga and to the Western regions. The Himalayan component is expected to increase irrigation by 22 million ha and 30 KW of hydropower generation. This would further help in controlling flood in Ganga-Brahmaputra basin.

Table No. 3.7: Himalayan Components

Sl.No.	River Links	Annual Irrigation (Lakh Ha)	Domestic and Industrial Supply(MCM)	Hydro Power (MW)
1.	Manas-Sankosh-Tista-Ganges	6.54	___*	5287
2.	Kosi-Ghagra	10.58	48	___
3.	Gandak-Ganga	40.40	700	___
4.	Ghagra-Yamuna	26.65	1391	10884
5.	Sarda-Yamuna	3.75	6250	3600
6.	Yamuna-Rajasthan	2.877	57	___
7.	Rajasthan-Sabarmati	7.39	282	___
8.	Chunar-Sone	0.67	___	___
9.	SoneDam- Southern Tributaries of Ganga	3.07	360	95
10.	Ganga(Farakka)-Damodar-Subarnarekha	8.47	484	___
11.	Subarnarekha-Mahanadi	0.545	___	9
12.	Kosi-Mechi	4.74	24	3180
13.	Farakka-Sunderbans	1.50	184	___
14.	Jogighopa-Tista-Farakka	___	216	1115

Source: MoWR, 2015. *Data could not be found

Peninsular Component- The peninsular component visualizes the interlinking of major rivers like Godavari and Mahanadi and their surplus water to be transferred through Krishna and Cauvery to the water deficit areas of southern region. This component also aims to transfer water to the metropolitan cities like Mumbai through Canals and to provide irrigation in the nearby coastal areas. It also provides for a water grid in areas such as Madhya Pradesh, Rajasthan and Uttar Pradesh with the help of storages.

Table No. 3.8: Peninsular Components

Sl.No.	River Links	Annual irrigation (Lakh ha)	Domestic and Industrial Supply (MCM)	Hydro Power (MW)
1.	Mahanadi-Godavari	4.43	802	445
2.	Godavari-Krishna(Pulichintala)	6.13	413	___*
3.	Godavari-Krishna(Nagarjunasagar)	2.87	237	975
4.	Godavari-Krishna(Vijayawada)	5.82	162	___
5.	Krishna(Almatti)-Pennar	2.58	56	___
6.	Krishna(Srisailam)- Pennar	___	___	17
7.	Krishna-Pennar(Somasila)	5.81	124	90
8.	Pennar- Cauvery(Grand Anicut)	4.91	1105	___
9.	Cauvery(Kattalai)-Vaigai-Gundar	3.38	185	___
10.	Ken-Betwa	7.34	55	78
11.	Parbati-Kalisindh-Chambal	4.50	13.2	___
12.	Par-Tapi-Narmada	2.32	76	22
13.	Damanganga-Pinjal	___	895	___
14.	Bedti-Varda	0.60	___	4
15.	Netravati-Hemavati	0.34	___	___
16.	Pamba-Achankovil	0.91	___	508

Source: GoI, 2002; Islam, 2006; Prasad, 2004. *Data could not be found

Out of the total 16 peninsular links the government has identified four priority links:-

- Ken –Betwa Link
- Damanganga-Pinjal Link
- Par-Narmada-Tapi Link
- Godavari-Cauvery Link

Status of these priority links shows that DPRs of the first three links are ready while feasibility reports of rest thirteen links are ready.

3.7 Salient features of Project

- Additional irrigation of 35MHa will be provided.
- Will generate 35000 MW of Hydropower.
- Cost of the project was US$200 Bn as per the NWDA Report of 2002.
- Will require 40 years for execution.
- Increase agricultural production by 250 to 450 Million tons.
- 10880km is the total length of the canal.
- Serve 260 million populations.
- 86 million populations will benefit from the Project.
- 37 rivers will be linked across the country

Table No. 3.9: Current Status of the Project

Specific tasks yet to be completed	Status
• Feasibility Reports of 14 links as envisaged as per NPP. • In the peninsular component 2 links are intra-state links. Government of Karnataka is making their own plans for the diversion of water.	• Alternatives are being studied for Mahanadi Godavari link and this will modify considerably the scope of Eastern link of peninsular component. • Survey and investigation in respect of two links in the peninsular component could not be taken up due to the requisite permission by the state Government of Karnataka. Necessary actions are being taken by NWDA as well as the SCILR with the Government of Karnataka to pursue with little progress.
• The Himalayan component requires extensive further survey and investigation, project finalization.	• The survey and investigation in respect the links under the Himalayan component linger on, since a portion of these links as well as the dam and diversion structure like barrage downstream for the reregulation have the identified locations in Nepal, Bhutan, as the case maybe.
• PFRs for 23 Intra-State links	• PFRs for 13 in progress
• DPR for select links for which PFRs are acceptable to the respective State Governments.	• Only about 50% of the 13 links could require DPR to be done by NWDA. PFRs are in progress as of now.

Source**:** MoWR, 2015; NWDA, 2012.

3.8 Viability of Inter-Basin Water Transfer Project in India

The idea of IBWT was conceived to meet the basic requirements of the country's population and for betterment of their living standards. Technically the idea of IBWT

is feasible to meet the demand for water made by the growing population yet the drawbacks of the same cannot be ignored.

Potential Advantages of Water Transfer to Achieve Human Security in India

Fair Distribution of Water across the Country- The foremost aim of the IRL project is equal distribution of water across the country. Therefore there will be fair chances of uniform distribution of water. As per an estimate, around 12% of land is prone to floods and 68 percent of land is prone to drought. Planning of inter-basin water transfer is done with an objective to mitigate the problems of drought in the regions with lesser rainfall and flood in the areas with higher rainfall. It will provide drought prone areas with water for drinking and sanitation to the least from the water surplus areas. Surface water utilization would be increased by 25 percent (Singh, 2003).

Increased Agricultural Productivity- Food self-sufficiency is a very essential and sensitive political factor in India, which makes an attractive justification for promoting public investments (Bandhopadhyay, 2009). India needs to produce 450 million tons of food grains per annum by 2050 for a population of around 1.5 billion (Nune, 2017). The major aim of inter-basin water transfer is to facilitate food production to ensure food security. The IBWT has considered both the internal consumption and exports that the country has to take care of. The agricultural sector is predominant in terms of generating employment and sustaining livelihood (SaciWATERs, 2013)

Increase in Irrigation- It will increase the potential of irrigation. It would be increased by 35mha, 25mha through surface irrigation and 10mha from through ground water irrigation in water scarce areas. Despite the use of huge amount of HYVs, DDTs, Pesticides total yield of crop is still very less to accommodate the

mounting population of the country (Mirza, 2008). In comparison to other countries the total output is substantially low. Inter-basin water transfer would boost up sectors like fisheries thus, creating more employment.

Enhancement in Power Generation- Hydro-electric power plants will be set up enhancing the power generation by 34GW. This would strengthen the nation grid. The addition of hydropower generation would help in curbing drinking water scarcity in the country.

Means of Communication- IRL Project would lift communication stress as it would facilitate inland navigation. This will also be advantageous to the defence system of the country as a means of security. 10000 km of navigation can be developed (Goyal, 2017). This would reduce transportation cost.

Risk Management- Implementation of the project will help reduce water related disasters. The will be reduction of floods and droughts. Water from overflowing rivers such as Ganga and Brahmaputra causing flood can be transferred to the regions that are prone to droughts. There would be reduction in the exploitation of groundwater decreasing the Drought level by 35 percent (Vidhyanathan, 2003). Water would be stored in the monsoon season and would be released in the dry season. It is a common scenario that river causes flooding in some of its basins whereas flood in its other parts (Prasad, 2004). The IBWT plans to store water in 36 of its storage tanks to control flood in the flood prone areas and transfer the surplus water to drought prone areas. Ponraj[18] stated that the main objective of the ILR Programme was to address the issues of flood and drought in the country (ORF, 2019).

[18]Associate of Late Former President A.P.J Abdul Kalam.

Challenges to Human Security by Inter- River Linking Project

Social Displacement- Large area would get submerged due to canals and Reservoir Construction leading to displacement of people as well as animals. Ecology will be left highly affected. Displacement of people would result in forced migration. Therefore rehabilitation and resettlement needs to done on a massive scale and is a very difficult task to achieve. Though this is one of the major tasks that need to be considered yet according to Dr. Janakarajan[19] Feasibility studies have not addressed the need to rehabilitate about 14 million people who would be left affected by the project (ORF, 2019).

Table No. 3.10: Estimated Social Displacement to be caused by ILR Project.

Construction for ILR	Estimated No. of people to be displaced
Himalayan Dams	245079
Himalayan Link Canals	311849
Peninsular Dams	611313
Peninsular Link Canals	311004
Total	1479245

Source: Mehta and Mehta, 2013.

High Cost- The cost of Project and recurring cost are quite high. Facilities such as Transportation, Better infrastructure, employment, medical would require huge budget but a necessity for the displaced people to get rehabilitated. This would add more cost to the Project. Compensation for environmental damage also needs to be fulfilled, again adding onto the budget of the project.

Intra-State and Inter-State Disputes- ILR Project is not confined to inter- basin rivalry only, but it also extends to the co-riparian countries. The rivers in the Himalayan components are mostly Transboundary River between India and Bangladesh, Bhutan and Nepal therefore water sharing among these neighbouring countries would not be uniform, impinging on their relationship (Waheed and Jha, 2017). In the initial period of the project's announcement these countries were

[19]President, SaciWATERS, Hyderabad.

apprehensive about its implications. The Indian Government assured them that only the peninsular river would be taken into account. The countries would be consulted in case of the involvement of the Himalayan Components. With the announcement made by the Supreme Court the neighbouring countries have been protesting against the project and has accentuated their anxiety (Iyer, 2012).

Environmental Concerns- This Project will be a major disturbance to the environment. It would consist of massive constructions such as dams, reservoirs, canals therefore submerging huge area of land and forest. It will further have negative consequences on ecology and biodiversity.

Table No. 3.11: Estimated total Land Submerged by River-Linking Project

Construction for ILR	Total Forest land to be used(in ha)	Total land to be used(in ha)
Himalayan Dams	4300	245079
Himalayan Link Canals	16758	311849
Peninsular Dams	73,646	611313
Peninsular Link Canals	9165	311004
Total	103869	1479245

Source: India Water Portal, 2014.

Diversions of river would impact the Hydrological regime of both the donor and the receiving ecosystem (Silk and Ciruna, 2004). It is a general concern arising out of such projects across the world. This would have negative impact on the hydrological process (Shiva, 2003). Soil erosion and sedimentation are common problems that will take place. Enormous resources will be required for the project therefore might result in resource scarcity as an alternative to water security.

Health Concerns- Dams and reservoirs take possession of large quantities of water that can cause outbreak of many water borne diseases. Construction sites release pollutants thus polluting the water sources. Consumption of water from such polluted sources jeopardizes public health.

Conflicts arising from Inter-River Linking- India has been witnessing conflict over resources. Intra as well as interstate conflict is prevalent since years. Water related conflict is visible in all corner of the state for example in the south region dispute between Karnataka and Tamil Nadu over Cauvery River, between Haryana and Punjab over Sutlej-Yamuna canal, between India and Pakistan over Indus River and between Bangladesh and India over Teesta and Ganges (Nune, 2017). The conflicts are becoming inevitable due to various factors such as lack of information from the government officials, the guidelines provided by the administration and many more. Likewise, conflict related to inter-river linking is not less. The most pertinent issues arising from it are compensation for resettlement and rehabilitation of the displaced and environmental damages from the project, conflicts over sharing the benefits and costs of the projects among the states of India and cooperative management of the project in an international river basin.

3.9 Conclusion

In India there are regions that are affected by droughts as well as regions affected by floods every year. Therefore, it would be unfair to say that India is a water scarce country or a water surplus country. Regions like Chennai were facing serious water shortages this year but at the same time places such as Mumbai and Assam were highly affected by flood. These issues arise due to lack of proper management of water resources, population explosion, pollution and the other such factors. Water resource management in India needs serious attention in this aspect. Though there are policies related to water yet the situation is chaotic. Management of resource needs equal participation and cooperation among all sections of the society. The water policies need to be strict and appropriate at all levels for overall development of the nation. Government has come up with the idea of inter-basin water transfer system to

reduce the resource related problems in the country. The proposed inter-linking river project is likely to trim down the seasonal pressure on water resources according to the government. The problem of unequal distribution of water would be addressed by the Project. Though the project may be feasible technically but it is obvious that it would be met by umpteen numbers of challenges such as political, economical, and environmental.

The project was initiated with an objective to eliminate water related problems aiming to achieve human security in every aspect. It is to transfer water from the surplus region to the deficit areas to cater to the needs of the people as well as every sector. Implementation of project would not only be advantageous to the people but it has its own cons attached to it. Proper management of the resource is crucial in achieving every component of human security in the nation. As people, communities as well as the government is becoming more conscious and responding to the water crisis, small initiatives need to be strengthened accordingly.

Chapter 4
A Study of Manas-Sankosh-Teesta-Ganges Canal Project

4.1 Introduction

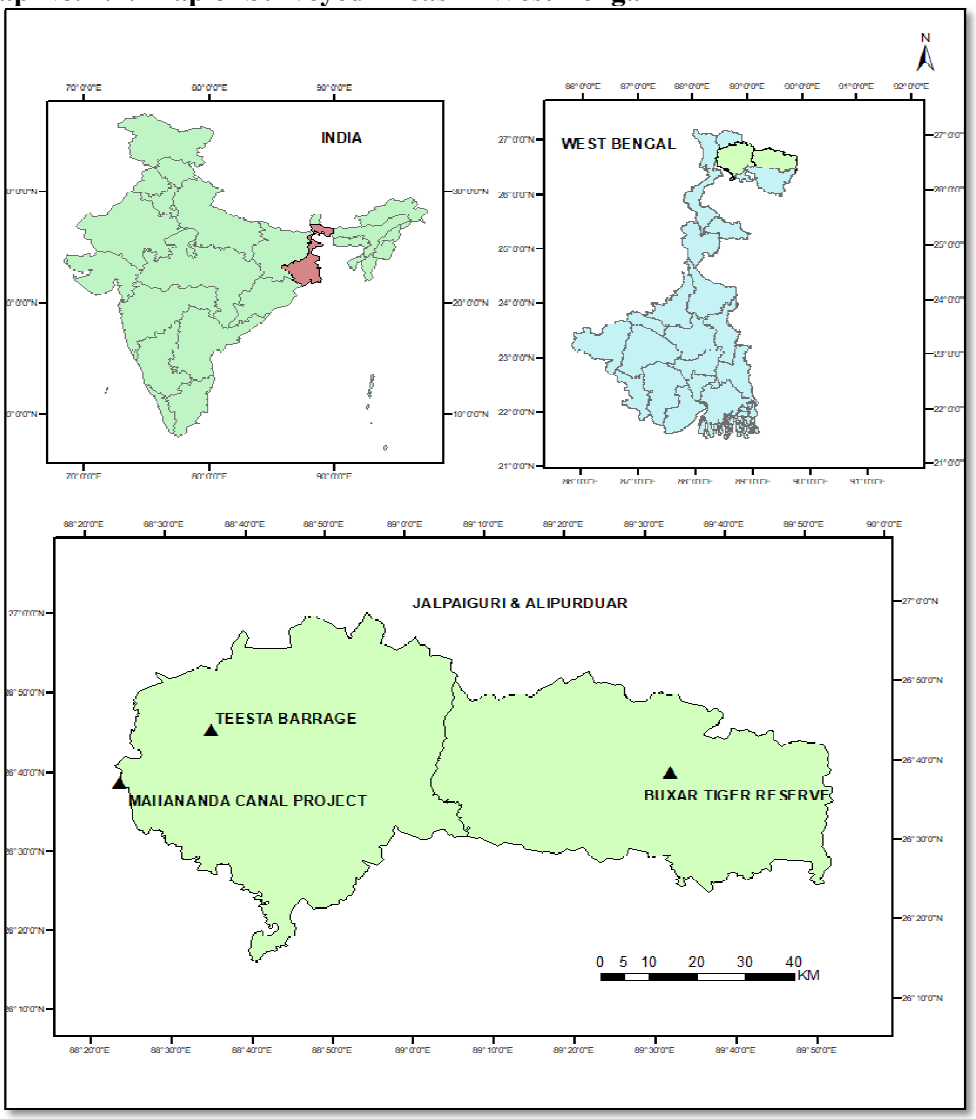
MSTG is a proposed project to link Rivers Manas, Sankosh, Teesta, and Ganges under the scheme of inter- basin water transfer in India. Rivers are envisaged to be linked by canals from Assam to Bihar so as to overcome water related problems in region and further transferring surplus water to the Southern parts of India. As water has become a major cause of concern for almost all the nations West Bengal (WB) is not an exception in this matter. State of West Bengal is located in the eastern part of India and India's fourth-most populous state with almost 9.4 crore of people according to Census of 2011. It stretches from Himalayas in the north to Bay of Bengal in the south with a total area of 88,752 square km (GoWB, 2011). West Bengal shares international borders with Bangladesh in the east, Nepal and Bhutan in the north. The neighbouring states of West Bengal are Sikkim, Assam, Bihar and Odisha (ibid). Numerous transboundary rivers between India and its neighbouring countries flow through the state of West Bengal.

Despite the fact that WB is a land of many rivers it is considered as one of the water stressed region in India. Improper management of its water resources can be counted as one of the many reasons behind it. Government of India has proposed inter-linking of rivers under the Himalayan component. MSTG link is intended to pass through Bihar, Assam and West Bengal regions of India with an objective to fix water related problems. The following chapter therefore will discuss the status of water management in the surveyed areas as well as the progress and various aspects of the project along with its advantages and Challenges with focus on MSTG Canal link.

4.2 Areas Surveyed

Jalpaiguri District of West Bengal is located at foothills of the Himalayas. It lies between latitude 27°00´N to 26°16´N and longitude 89°53´E to 88°25´E. Jalpaiguri District share its International borders with Bhutan in the north and Bangladesh in the south. It is surrounded by Darjeeling District in the west and northwest and Alipurduar District and Cooch Behar District on the east.

Map No. 4.1: Map of Surveyed Areas in West Bengal



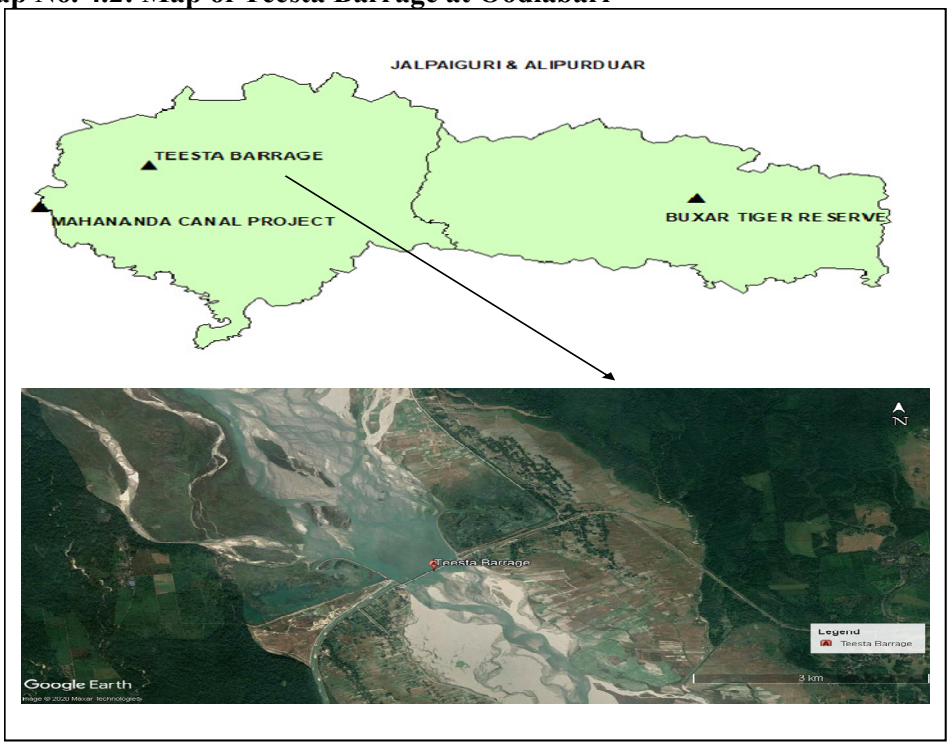
Source: Prepared by Researcher, January, 2020

The district is constituted of two sub-divisions; Jalpaiguri Sadar, Jalpaiguri Mal with a total population of 3,872,846.9 (GoI, 2011). Alipurduar, former subdivision of Jalpaiguri district (Times of India, 2014) was made the 20th district of West Bengal on 25th June, 2014. It lies between latitude 26.4° N to 26.83° N and 89°E to 89.9° E. it has a total area of 3,136km^3 with a total population of 1,501.983.

Teesta Barrage Project

Teesta Barrage Project is one of the largest irrigation projects in the eastern region of India. It is situated in a village named Gazaldoba in Odlabari. Project is planned to be completed under three phases.

Map No. 4.2: Map of Teesta Barrage at Oodlabari



Source: Prepared by Researcher, January, 2020.

Under the stage 1 of Phase I Barrage at Gazaldoba, pickup barrage across Mahananda and Dauk River has been completed. Under the same phase 78 percent of the main canal has also been completed. Phase II of the projects plans to produce 67.50 MW electricity. The already existing canal would be used in the MSTG Project. Phase III

of the Project envisage a link between Ganga and Brahmaputra for navigational Purpose. Teesta River would be utilized in the field of irrigation, hydropower generation, navigation and flood mitigation by linking with other rivers.

Table No. 4.1: Estimated Potential of the Entire Teesta Barrage Project

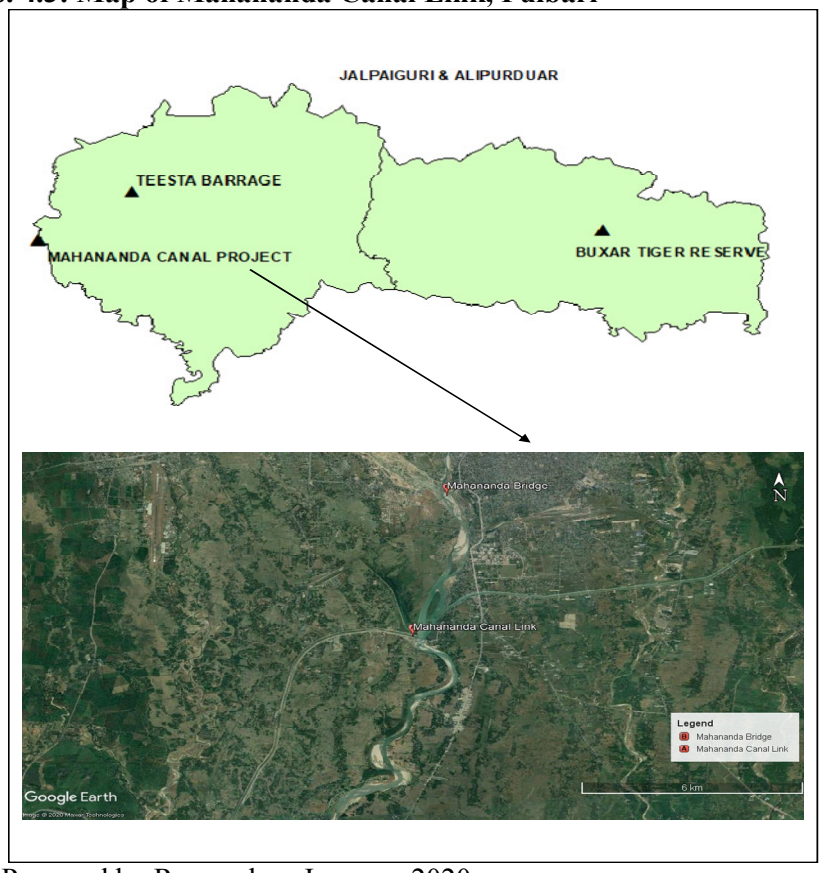
Irrigation	9.22 Lakh ha
Hydropower generation	67.50 MW

Source: GoWB, 2019

Mahananda Canal Link

Mahananda Barrage is located at the junction of Mahananda River and Teesta Canal in Fulbari area, Jalpaiguri. It was built in the year 1988 by the Irrigation and Waterways Department under the scheme of Teesta Irrigation Project.

Map No. 4.3: Map of Mahananda Canal Link, Fulbari



Source: Prepared by Researcher, January, 2020.

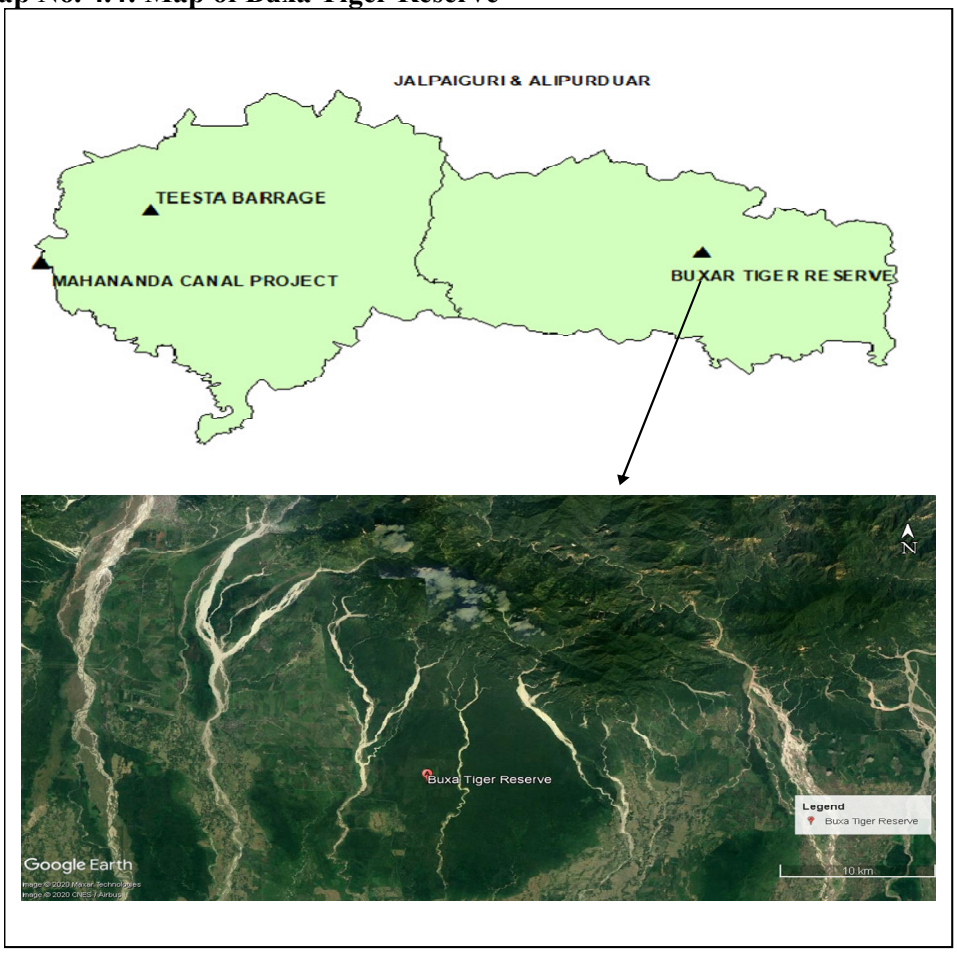
Since its construction Mahananda Canal has undergone multiple repairs as the collapse of embankment was frequent. Water that flows from right bank of the

Mahananda Barrage with the help of canal irrigates a command area of around 50000 ha.

Buxa Tiger Reserve

Biologically very rich Buxa Tiger Reserve (BTR) is located at Alipurduar District of West Bengal. BTR lies between latitude 26°30′ N and longitude 89°20′E. the total area of BTR is 385.02 Sq.km.

Map No. 4.4: Map of Buxa Tiger Reserve



Source: Prepared by Researcher, January, 2020.

It is a home to a major population of tigers. The forest villagers are totally dependent on BTR for their fuelwood, animal grazing. It generates employment to the local people in timber harvesting and plantation. It has diverse collection of flora and fauna and is biologically very rich. The present (2019) checklist mentions:

Table No. 4.2: List of Faunal Varieties in Buxa Tiger Reserve (in the Year 2019)

Sl.No.	Species	Number
1.	Amphibians	4
2.	Birds	246
3.	Fishes	33
4.	Mammals	68
5.	Insects	500
6.	Reptiles	41

Source: Buxa Tiger Reserve, Government of West Bengal, 2019.

Table No. 4.3: List of Floral Varieties in Buxa Tiger Reserve (in the year 2019)

Sl. No.	Species	Number
1.	Bamboo	4
2.	Cane	6
3.	Climbers	108
4.	Grasses and Reeds	46
5.	Herbs	189
6.	Orchids	144
7.	Shrubs	133
8.	Trees	352

Source: Buxa Tiger Reserve, Government of West Bengal, 2019.

Out of the faunal list mentioned in the figure above some of the species are endangered, threatened and rare. Some of them include Indian Tiger, Asian Elephant, Leopard Gaur, and Blacnecked Cranes. BTR has a catchment conservation of several major rivers like Sankosh, Jainti, Bala, Dima, Pana and Basra playing a major role in downstream habitation and irrigation is sustaining socio-economic wellbeing of the region. BTR also acts as a carbon sink zone for the region.

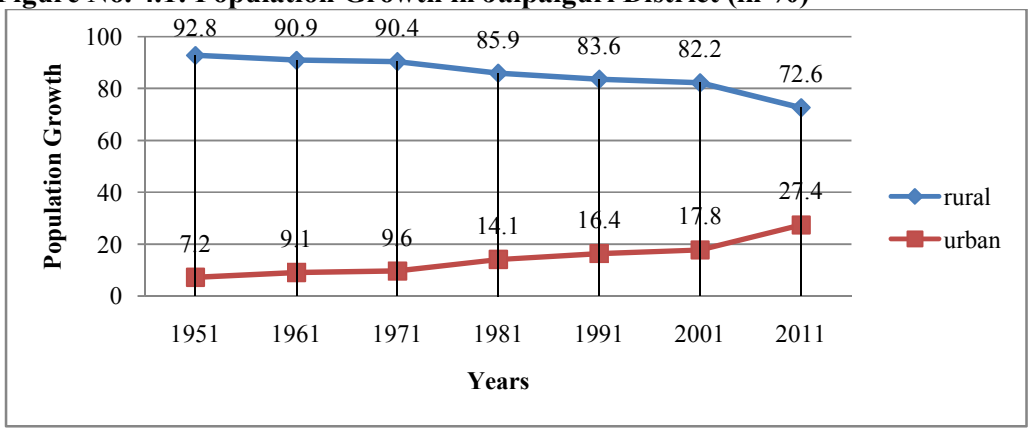
The eastern border of BTR meets the territories of Assam demarcated by Sankosh River. Western Border is surrounded by Tea Estates (T.E.): Jaigaon T.E., Torsa T.E., Dalsinghpara T.E., Barnabari T.E., Satali T.E., Nimtijhora T.E. On the south-west region lies Patkapara T.E., Dima T.E., Bhatpara T.E., Radhararani T.E., Chuapara T.E. and Mechapara T.E. BTR is demarcated by Bhutan on the north and the southern border is fringed by Irrigation lands and tea estates like Rohimabad T.E., Jainti T.E., Sankosh T.E. Kohinoor T.E. and Newsland T.E.

4.3 Water Scenario in the Study Area

Water as mentioned in earlier chapters is a crucial element for any being and its distribution varies with time and space therefore is unevenly distributed. This is one of the umpteen reasons that level of water scarcity is surmounting in every part of the world. The bourgeoning population and the development sectors and drying up of water sources in northern part of West Bengal are encouraging the level of water crisis to escalate further.

The figure below reveals that the total population has increased from 1951-2011. There is huge leap in the percentage of population growth in the urban area while rural population is decreasing gradually. Increasing rate of urban population is thus adding more pressure to the water resources as well as the management sector.

Figure No. 4.1: Population Growth in Jalpaiguri District (in %)

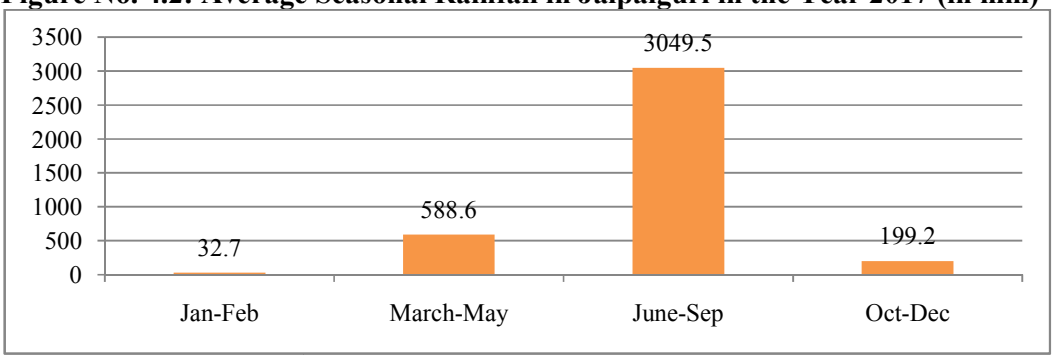


Source: District Statistical Handbook, Jalpaiguri, 2010-2011.

Whole of agricultural sector is dependent on rainfall in every part of India. Figure No. 4.2 shows that rainfall remains high in the monsoon season, from June to Sept. despite of high rainfall farmers still complain of dry monsoon Purulia, Bankura regions of West Bengal. This is due to uneven distribution of rainfall with time and space. Level of rainfall reaches to 32.7 mm. Average fall in the region is declining in the past decades gradually as shown by figure 4.3. Climate change has been cited as the main cause of variation in level of rainfall. Thus reservoirs and canal play a major role in

such situations. It supplies water to the fields during dry seasons for irrigation as well as domestic purpose

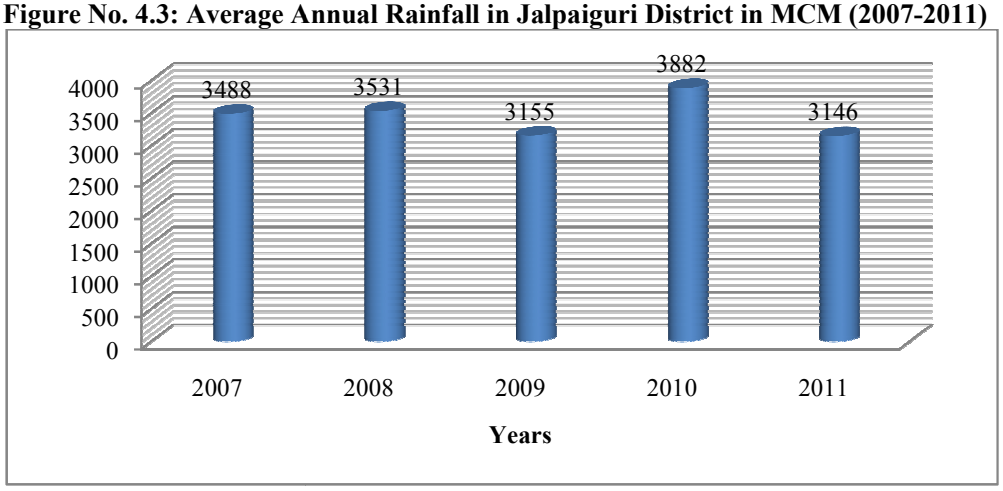
Figure No. 4.2: Average Seasonal Rainfall in Jalpaiguri in the Year 2017 (in mm)



Source: Nandargi and Barman, 2018.

Though extensive traditional use of surface water does not put much pressure on groundwater, but pumping of water and use of tube wells promote water scarcity. Considering all the water problems in the state, it is necessary for the management level as well as the citizens to take appropriate steps to overcome such issues.

Figure No. 4.3: Average Annual Rainfall in Jalpaiguri District in MCM (2007-2011)



Source: District Statistical Handbook, Jalpaiguri, 2010-2011

4.4 Major Rivers in the Region

Manas River

Manas River, a major tributary of Brahmaputra is a transboundary river between Bhutan and India. It is located in foothills of the Himalayas and is the largest river of Bhutan. The total length of the River is 376 km.

Table No. 4.4: Catchment area of Manas River in different countries

Sl.No.	Name of the Country	Catchment area (in km)
1.	India	272
2.	Bhutan	104
Total		376

Source: Goswami, 2018.

Manas River originates in southern Tibet and flows through Bhutan in south-west direction to the lower Himalayas towards state of Assam in India before draining into the Brahmaputra in Jogighopa. The river valley has two reserve forest areas, Royal Manas National Park in Bhutan covering 43,854ha and Manas Wildlife Sanctuary in Assam covering 391,000 ha (FAO, n.d.).

Sankosh River

It originates in Tibet passes through Bhutan and flows towards Assam and West Bengal in India, before draining into the Brahmaputra River. Sankosh River is known as Punakha in its upper reaches. The total length of the river is 321 km. it has an annual flow of 1900 ft^3 per second. Sankosh and its tributaries constitute the second largest river basin After Manas River in Bhutan (FAO, 1978).

Table No. 4.5: Catchment area of Sankosh River in different countries

Sl.No.	Name of the Country	Catchment area (in km)
1.	India	214
2.	Bhutan	107
Total		321

Source: Government of India, 2018

Teesta River

Teesta is a transboundary river between India and Bangladesh along with 53 other rivers. It originates from the Pahunri Glacier at an altitude of 8550m and flows southwards towards Sikkim, West Bengal where it is joined by Rangeet River, its main tributary (Meetei, et al., 2007). It makes its way to Siliguri and further towards Bangladesh before draining into the Mighty Brahmaputra (Chaudhuri and Chaudhuri, 2015). The total length of Teesta River is 629 km (ICIMOD, 2017). The river drains a

total geographical area of about 12159 km^2. It includes areas of both Bangladesh and India (Khawas, 2016). The Basin has been inhabited by a huge number of populations in Sikkim, West Bengal and Bangladesh since ages (Khawas, 2016).

Table No. 4.6: Catchment Area of Teesta River in Concerned Countries.

Sl.No.	Name of the Country	Catchment Area(in Km.)
1.	India	414
2.	Indo-Bangladesh Border	94
3.	Bangladesh	121
Total		629

Source: ICIMOD, 2017.

The major tributaries of Teesta River are Dik-Chhu, Rangpo, Lang Lang Chhu, Lachung, Rani Khola on the left and Ranghap Chhu, Rangeet, Ringyong Chhu on the Right. Teesta basin is home to almost 30 million people of Sikkim, West Bengal and Bangladesh (Waleskar, 2013).

Ganges River

River Ganges emerges from Gaumukh in the western Himalayas in Uttarakhand state of India flowing to Bangladesh. The length of River is 2525km long (Briney, 2019). Its Tributaries are Ramganga, Garra, Gomti, Ghaghara, Gandak, Koshi, Mahananda on the left and Yamuna, Tamsa, Son, Punpun, Kiul, Karamnasa, Chandan, Brahmaputra on the Right. Though Ganges is considered as lifeline to a hundreds of millions of people and is sacred rivers to Hindu yet is the most polluted River of India. Before emptying in the Bay of Bengal it flows through U.P., Bihar and West Bengal. Ganges Basin is home to 37 percent of total population of India (Shiva and Jalees, 2003).

4.5 Manas-Sankosh-Teesta-Ganges Canal Link

The proposed sub-project MSTG is approximately 457 Km long from Assam to Bihar planned under the Himalayan Component of ILR Project in India. Amongst the 14 links envisaged for the Himalayan region, the tributaries of Ganga and Brahmaputra

basin would be linked by the MSTG Project. The MSTG link is proposed under the Himalayan component of the NPP. MSTG link is considered to be the most important link under the Himalayan Component. It envisages the diversion of about 43,000 MCM of surplus water of Manas and Sankosh rivers to transfer to the existing Teesta and Mahananda Barrage. Water would get transferred to augment the flow of Ganga at Farakka and further supply it to the water deficit areas of southern regions:- Krishna, Pennar and Cauvery thus providing drinking, irrigation, sanitation and other facilities to the enroute command area. The diversion of the rivers would be supplemented by immediate rivers like Aie, Torsa, Raidak and Jaldhak.

The Pre-feasibility Report of the MSTG link is said to have been completed in 1996. Unfortunately Feasibility report could not be completed as the proposed link is supposed to pass through Manas and Buxa tiger reserves in Assam and West Bengal respectively in addition to some more forest areas. NWDA had announced in 2015 that it will be working on some other alternative to make the project forest free but there is no information thereafter. The project would consist of 2 dams to be constructed at Manas and Sankosh. Therefore, both the dams would be constructed inside Bhutan from where water would be transferred to already existing Teesta and Mahananda Barrages though a canal.

Table No. 4.7: Profile of Manas-Sankosh-Teesta-Ganges Canal Project

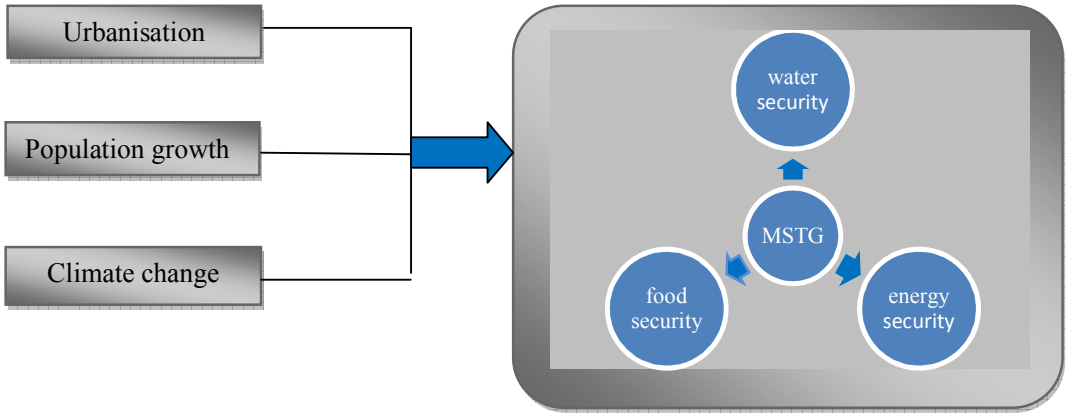
Length of the canal	457 km
Number of Dams	2
Amount of water to be transferred	43 Billion Cubic Metres
Number of barrages	2 along with the existing barrages
Hydropower generation	718 MW
Irrigated land	6.53 lakh ha
Rivers to be linked	Manas, Sankosh, Teesta, Ganges
States concerned	Assam, West Bengal and Bihar

Source: State Irrigation and Waterways Department, Government of West Bengal, 2019.

4.6 Objectives of Manas-Sankosh-Teesta-Ganges Canal Link

Growing population and rapid urbanization demands for more water. As climate change has become a major concern in every part of the world it is considered to be one of the most important factors of water crisis. Thus, MSTG take all these issues under consideration and aims to provide water, food and energy security for all, equally. Proper implementation of MSTG project with appropriate policies and acts would solve water issues in the enroute areas consequently, enhancing food and energy security.

Figure No. 4.4: Objectives of Manas-Sankosh-Teesta-Ganges Link Canal Project

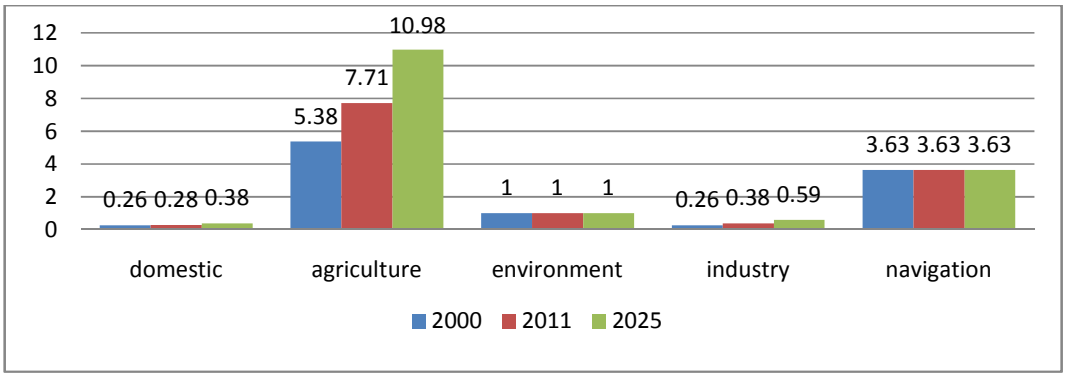


Source: Self compilation

The various objectives of the MSTG Project are as follows:-

Provide Water for Multipurpose- ILR as a whole aims in achieving water security throughout the country. Likewise major objective of MSTG is, even distribution of water in the concerned region as well as to the downsouth. This would be done by increasing the flow of Ganga for further distribution. Other purpose of MSTG is to provide water for agriculture, environment and navigation. This would thus, help in achieving energy and food security.

Figure No. 4.5: Past and Projected Future Water Requirement in West Bengal (in MhaM)



Source: GoWB, 2006.

As the demand for water is increasing every other day with increase in population and developmental sectors, water that gets drained into the Bay of Bengal will be put to use by MSTG. Future projections for water demand in West Bengal or any part of the world considers water diversion process as a need of an hour.

Augment Flow of Ganga- A minimum quantity of water is essential to sustain life of a river. Huge quantum of water is envisioned to get diverted to Ganges from Sankosh, Manas, Raidak, Torsa, Jaldhaka. Water from these rivers would be linked with Ganga River near Katakosh village 60 km upstream of Farakka Barrage. The average quantum of water present is the Ganga River is 1824 MCM, at the joining point. The flow of river is augmented by 24001 MCM from the mentioned river that is to get transferred to southern region of India. Thus, the water transferred will help in achieving water as well food security in the enroute command areas.

Risk Management- Mean high annual rainfall is the major contributor of flood in the Himalayan region. 42.3 percent of West Bengal is prone to flood (GoWB, 2015). MSTG concerned rivers like Teesta, Torsa, Jaldhaka, Raidak-I, Raidak-II, Sankosh are responsible in generating floods in different regions. Floods are caused in times of high rainfall in these basins with limited carrying capacity. Therefore, they discharge huge amount of water to the downstream regions. In view of its geographical location

at the end of Ganga Basin and other Himalayan Rivers flood management in the region is crucial. Assam, being land of many rivers it is a flood prone state and is considered to be an annual calamity. Further, erosion in rampant scale impinges on the overall development of the state. 39.58 percent of Assam is prone to flood that engages a huge landmass (GoA, 2019). Land erosion caused by the flow of Brahmaputra and its tributaries leave a major chunk of people devastated. The Rastriya Barh Ayog (RBA) estimated that 31.05 lakh hectares of the total 78.523 lakh hectares area of Asaam is prone to frequent flood situations(GoA, 2019). Satyapal Singh[20] stated that the proposed MSTG project will reduce the occurance of floods in Assam(Singh, 2018).

Table No. 4.8: Flood Affected Areas in Assam

Year	Area Eroded (in hectares)	No. of Affected villages
2001	5348	227
2005	1984.27	274
2015	92,820	1276
2017	86223	2500
2019	1,63,962	3024

Source: Staff, 2015; Sharma, 2017; Government of Assam, 2019

4.7 Progress of Manas-Sankosh-Teesta-Ganges Canal Project

Initially Pre-feasibility Report (PFR) of the Proposed MSTG link was planned through Gravity. The PFR was planned to be done under two phases. Phase I was to include 137 km area from Teesta to Ganges while Phase II was to include the remaining area of 114 km that covered areas between Manas and Sankosh. Thus the PFR is said to have been completed in the year1996. The PFR has not been studied meticulously. Apparently no social impact assessment has been done on the displaced as well for rehabilitation. The survey and investigation work of MSTG were planned in two parts. Firstly, CWC was entrusted with survey and investigation work of Teesta and Ganga reach while NWDA of Manas, Sankosh and Teesta reach. Survey

[20] Union Minister of state for water resources Assam.

and investigation was only partially fulfilled in the Sankosh-Teesta reach while in the remaining area it could not be fulfilled as it was Manas and Buxa Tiger Reserves, Gaburbasra Reserve and other adjoining forest areas. However Survey and Investigation of Teesta and Ganga reach was completed by the NWDA.

The Feasibility Report of the link is thus pending due to various constraints. Considering the various restrictions in mobilizing the Manas Dam in Bhutan and the Reserved forests the link was decided to be made under two phases thus making it a forest free project.

Table No. 4.9: Details of Manas and Sankosh Dams

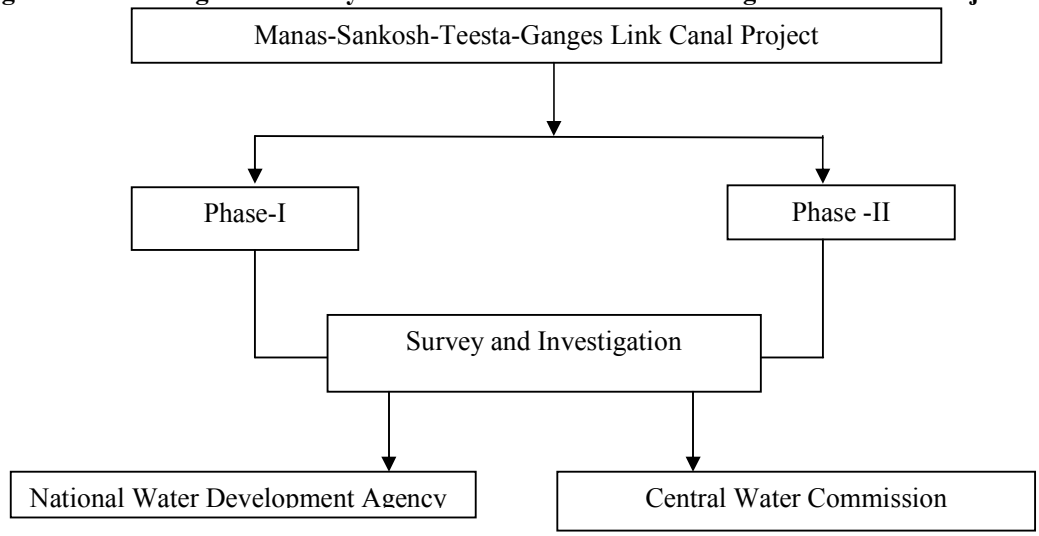
Sl. No.	Structure	River	Canal No.	Total Storage (10^6 $m^{3)}$	Submerged area (in Square Km)	Estimated displaced population (in thousands)
1.	Sankosh Lift Dam	Sankosh	1	144	8.21	131
2.	Sankosh Dam	Sankosh	1	3919	46.26	869
3.	Manas Dam	Manas	1	10938	80	1143

Source: Shiva and Jalees, 2003.

Ms. Uma Bharti[21] in the year 2015 made a statement "considering practical difficulties for surveys and investigation in Manas-Sankosh and Sankosh-Teesta reaches, National Water Development Agency (NWDA) has carried out alternate alignment studies for Manas-Sankosh-Teesta-Ganga link avoiding Manas Tiger Reserve and Buxa Tiger Reserves and other forests" (NDTV, 2015) yet, till date the process is on pending and no further progress has been made.

[21] Union Minister for water resources, River Development and Ganga Rejuvenation.

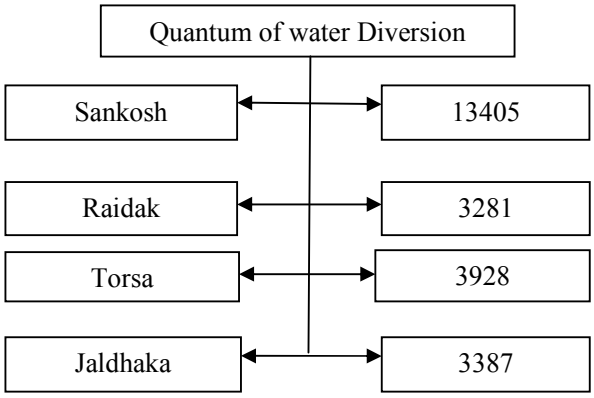
Figure No. 4.6: Alignment Study for Manas-Sankosh-Teesta-Ganges Canal Link Project



Source: Self compilation

Phase I- it would comprise of Sankosh-Teesta-Ganga link only excluding the Manas water. This would focus on avoiding the reserved forest covers in the aligned areas. It targets to transfer 24001 MCM.

Figure No. 4.7: Phase- I Quantum of water diversion in Million cubic metres.



Source: Self Compilation

The balance water post diversion from Sankosh, Raidak, Torsa and Jaldhaka is 22177 MCM whereas the requirement of the further enroute areas is 39737MCM. Therefore, there is shortfall of water to meet the demand of the links in the southern regions.

Phase II- It would comprise of Manas-Sankosh link while receiving water from the in between tributaries (Aie, Sankosh, Raidak, Torsa, Jaldhaka) used in the Phase I of the project. This would make MSTG link forest free to the maximum possible extent.

The NWDA in 2013 completed Survey and Investigation work of forest free arrangement while the overall work was completed in the year 2016. The only area left was Mahananda River. Taking phase I and Phase II into consideration, NWDA has prepared a Draft Feasibility Report of Forest free MSTG Project for the following that is likely to take place under three suitable scenarios:

Table No. 4.10: Scenarios of Draft Feasibility Reports of Manas-Sankosh-Teesta-Ganges Canal Link Project

First	Second	Third
With Sankosh-Teesta-Ganga link with Sankosh dam without contribution from Manas River. This is planned as an alternative to the phase-I of the MSTG link Project.	This would consider both Manas and Sankosh Dam. Contribution would be made by both the rivers. This is planned as an alternative-I to Phase-II of the Project.	Only Sankosh Dam would be considered. Water would be contributed from Manas and Sankosh Rivers. It is planned as Alternative –II to Phase-II of the Project.

Source: GoWB, 2019

According to the Officials, due to shortfall of water to meet the demand of the enroute areas MSTG is likely to fail to transfer assured amount of water to the adjoining links. The link would be able to function provided that the two heads constructed in Sankosh and Manas. Construction of two head-works for water storage is a difficult task as the project requires consent of Bhutan according to the Article 5-10 of the 1997 UN Convention on Non-Navigational Uses of International Watercourses. The transboundary water resources are common resources of the concerned states hence to be shared equally.

The major issues in MSTG are disagreement between the Co-riparian states. The rivers concerned in the project are transboundary Rivers considered to be the lifeline

of the masses as well as wildlife. Countries as well as states within the nation with surplus water disagree on presence of the same thus reluctant to divert water to other parts. Almost all the rivers concerned in MSTG Project are international rivers. It thus requires international co-operation for the project to start off. Currently there is absence of legislative framework on the basis of which Central Government can make intervention in this regard.

4.8 MSTG and Human Security with Particular Reference to Water Security

Drinking Water- Adequate drinking water facilities would be provided to the residential regions of enroute command areas by the MSTG canal link. Currently the already existing Mahananda Barrage is providing 50 million litres of water per day to the residents of 14 wards of Siliguri Municipal Corporation by the Public Health Engineering Directorate (P.H.E.D.). The demand for water increases every day. As the whole town is dependent on the Mahananda for their basic water requirements, failure to supply water even for a single day would make situation chaotic in the city as well as the management level. According to the officials the link that would be using the barrage would augment the water level. Therefore it would increase water quantity to be supplied to the ever-growing population of the metropolitan city of Siliguri. The people of Fulbari region experience severe water scarcity of drinking water throughout the year. This year, 2019 witnessed dry monsoon worsening the situation of the residents. The problem is likely to intensify in the winter season. Most of the wells are drying therefore have to rely on tap water nearby. Water distributions from the taps are also not continuous and are deprived of clean drinking water.

Drought and Flood Control- States like Assam as mentioned earlier are prone to flood during Monsoon season while states like Bangalore are grappling with water crisis because of dry monsoon. Large amount of overflowing water, according to the

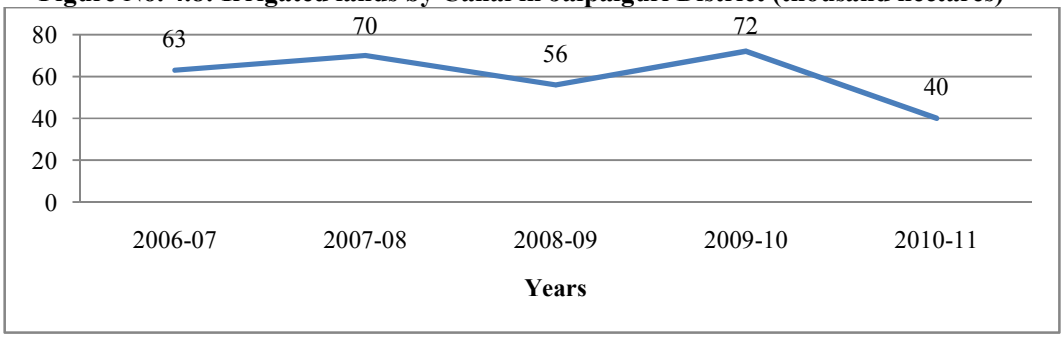
proposed project will be diverted from the Ganges and Brahmaputra. It is envisaged to be stored in reservoirs for further distribution to the down south where water is scarce is most parts. Therefore the MSTG Project will help in mitigating floods in the eastern regions while alleviating drought condition in the southern parts of the country.

Irrigation- During Monsoon the average rainfall in the district is heavier as compared to cities like Kolkata. Overflowing rivers cause huge devastation. To control such flood situation Teesta Barrage Project was initiated that would store water for dry seasons. Water would be supplied with the help of Canals to the villages and agricultural fields. According to the official reports of the government 58.4 ha of land is irrigated with the help of existing canal in the year 2018 (GoWB, 2019). These Canals that use water from the Mahananda Barrage to the nearby areas of Fulbari is used for irrigation

People have given up their lands to the Government for canal construction hoping that they would get enough water for agricultural production. Major parts of Jalpaiguri have faced dry monsoon this year in 2019 thus were unable to grow paddy. If there is abundant supply of water to the agricultural fields, farmers are looking forward to cultivate paddy instead of jute.

Some Farmers are hopeful of their better situation if implementation of MSTG is done while some believe that the same situation would prevail even on the execution of the same. The census of Jalpaiguri district show that canals make huge contribution in irrigation but drought situation in the year 2010-2011, made situation chaotic.

Figure No. 4.8: Irrigated lands by Canal in Jalpaiguri District (thousand hectares)



Source: District Statistical Handbook, Jalpaiguri, 2010-11

Farmers residing around the Mahananda Canal are fully dependent on the water supplied by the Canal. These Canals are functional but are irregular thus making situation of farmers difficult for irrigation. Fields do not receive water as per their requirement. Water has to be supplied from tube wells with the help of motor despite the existence of Canals.

According to the officials of the Mahananda Barrage, water cannot be supplied to the field though the existing canals are fully functional as the villagers residing in the route between the agricultural fields and Barrage use canals to dump their household waste. This in turn blocks the canal making it unable to supply water.

Communication Facilities- MSTG Project will be helpful in improving the communication and transportation facilities according to the Government Officials. It would construct bridges on main canals. Road connectivity would be improved by construction of State Highways and National Highways. This would also help in increasing the GDP. Though these are clauses mentioned in the NWDA policies yet no proper documentation has been done in this regard.

Hydropower Generation- The already existing Canals under the Teesta Barrage Project is capable of producing 7.50 MW of electricity from each Canal fall. The three canals in total are functional at present. This generates an income of 6.5 Crore rupees yet the target is 200 million rupees per year. On implementation of MSTG project

this target is expected to meet by enhanced hydropower generation by 35 MW. It would thus provide energy security to the residents, development sectors as well as the industries of Jalpaiguri district.

Groundwater Recharge- Due to dry monsoons farmers are forced to exploit groundwater. It exceeds the capacity of natural recharge. Water table has been declining at a faster pace. Canals play an important role in this matter. Water stored in reservoirs is supplied to the irrigation fields with the help of canals. Water seepage from canals and irrigation fields help in recharging groundwater. Water that is seeped underground can thus be used by the farmers during dry seasons.

Recreational Facilities- Already existing Barrages and Canals has encouraged tourist attraction spots. The MSTG Project would enhance the recreational facilities such as picnic parks, gardens, amusement parks thus drawing more tourists. This would lead to establishment of restaurants and shops by local people near them thus uplifting their economic conditions. Vendors have set up small shops and restaurants around Teesta and Mahananda Barrages. Though they make meager income but are happy that atleast they have source of earning. In addition to the already existing recreational facilities around these barrages MSTG plans to develop more of it thus creating more employment in the business sectors.

Potential Negative Impacts of the Manas-Sankosh-Teesta-Ganges Canal Link Project

The implementation of the proposed MSTG would no doubt curb the problem of water scarcity and enhance economic development in the region but one cannot deny the fact that it entails a number of negative implications too.

Impact on Hydrology and Water Balance- The major factors in maintaining the ecology and environment of a river basin are its hydrology and water balance. The proposed MSTG project envisages diverting a large amount of water from the

Himalayan Rivers to the water deficit areas of in the southern region. Transfer of water is likely to decrease the total water balance within the donor basins while increasing the water balance of the recipient basins.

Increase in Salinity- All the four rivers involved in the project originates in the Himalayan mountain ranges where precipitation is quite high. The concentration of total dissolve solid is low in the mountains. Heavy siltation is already an existing problem in the Himalayan region. MSTG flows through the arid and semiarid region of the Ganga Plain. Therefore there is concentration of salt due to high rise in level of evaporation downstream. The implementation of the project would increase the salinity level by evaporation further increasing the dryland salinity. Increased salinity is likely to affect the water quality as well as the biodiversity of the river basins.

Decrease in Water Level- Due to various constructions used in MSTG such as Dams, Reservoirs the flow of some rivers is likely to decrease. It is evident from the data collected from the already existing Teesta Barrage in Odlabari. Functioning of the Teesta Barrage and water diversion through Teesta-Mahananda irrigation has affected the flow of Teesta in a negative way (Mukherji and Shah, 2013).

Table No. 4.11: Declining Discharge Flow of Teesta after Operation of Teesta Barrage Project

Year	Discharge in Cumec	
	Maximum	Minimum
1978-79	721	361
1981-82	666	135
1984-85	795	182
1987-88	527	76
1991-92	653	135
1995-96	459	44
1988-89	364	36

Source: Mukherji and Shah, 2013.

Disturbance in Wildlife- River systems of the world are important not only for the survival of mankind but are equally important for the wildlife. The plans initiated by the NWDA for the Himalayan Component with reference to MSTG link raised

concerns regarding the ecological impacts. As per the reports for MSTG canal link, submergence of forest land and tea gardens is required. This would include Buxa Tiger Reserve in West Bengal, Manas National Park and vast areas of tea garden in West Bengal. Canal construction for MSTG link through Buxa Tiger Reserve and Manas National Park leads to various difficulties for the wildlife. Problems such as habitat fragmentation, loss of habitat quality arise for multiple species of animals, birds, mammals as mentioned in Table no.4.2 above.

Table No. 4.12: Estimated Land Submergence by Manas-Sankosh-Teesta-Ganges Canal Project

Land Types	Area required (in ha)
Forest Land	2133
Private, tea Garden and State Government Land	2194
Total	4327

Source: Sarkar, 2004; Thakkar, 2007.

Rehabilitation and Resettlement- MSTG envisages construction of Canals, Dams, and Barrages therefore leading to extensive land submergence as well as acquisition. Thus rehabilitation and resettlement (R&R) of the affected population is important and right of every individual. NWDA is assigned with the function of rehabilitation but not resettlement as mentioned in the NPP. In the state level no proper documentation of project has been done as per the officials involved in the project with regards to MSTG link. Diverse and suitable R&R policies for project affected individual needs to be included and revised in every Project Reports.

MSTG visualizes two dams at Manas and Sankosh Rivers each. At Manas River in Bhutan 20 m High Dam would be constructed. It would lie at 4km upstream from Indo-Bhutan Border with a storage capacity of 8750 MCM. At Sankosh River 253 km high Dam is planned to be constructed. It would be located in Bhutan, 12 km upstream from Indo-Bhutan Border with a storage capacity of 4930 MCM (GoB, 2003). The entire Manas-Sankosh Link is likely to be located in Bhutan. This would

submerge a vast land and forest area of Bhutan thus displacing a huge number of their human as well as animal population.

Conflicting Situations- Canal construction creates conflict between or among different stakeholders. In most of the situations conflict arises between the government and villagers regarding land acquisitions, R&R, compensation as well as the benefits from the Canals.

> *Case of Mr. Singh (name changed)-Canal needs to be constructed for MSTG that would pass through his land. Government has been demanding it with a huge compensation (not mentioned by the officials) but he is reluctant to give it. He is demanding for government job in return rather than monetary compensation. His firm decision would deprive many farmers of water supply for their production.*

In the study areas conflictual situations occur between the villagers too. Farmers in the Fulbari area are not able to receive water from the already existing Mahananda Canal Link, as the villagers have dumped their household waste in the Canals.

Farmers as well as the officials have approached the villagers multiple times in this regard, but it has been of no use. Development of MSTG Canal link is likely to face similar problems. People not involved in Farming are reluctant to understand the plight of the farmers. The proper utilization of canals is disturbed by such villagers. Conflicts also arise between the farmers. Even at times when canals are functional, lands that are near Canal make most use of water. While farmers at distant land, are deprived of their share of water.

4.9 Major concerns to the Neighbouring Countries

The major issue of contention between India and Bangladesh emerged with the construction of Farakka Barrage at the apex of Ganges delta (Shiva and Jalees, 2003). The MSTG project is likely not only to create unhealthy relation within the nation but it will also bitter the relation between India and Bangladesh. India and Bangladesh share 54 rivers. Any decision taken by one state would have impact on the other. For

Bangladesh water is a boon as well as a bane. Bangladesh already is already opposing against the construction of Teesta Barrage at Gazaldoba. It has diverted major share of water from the River Teesta (Khawas, 2016). While unannounced release of excess water from the barrage during monsoon has accentuated the situation. MSTG project if implemented would adversely affect various sectors of Bangladesh. Bangladesh being an agrarian country majority of the people is fully dependent on water resource for their overall development. On one hand the country is always running short of water for agricultural activities. Paradoxically, the country is affected by flooding and landslides every year, vast areas get submerged under water displacing a huge number of population as well as wildlife. The livelihood and economic development in the region directly depend on the availability of water management.

MSTG project would be met with stiff resistance by Bangladesh in sectors such as industries as well as irrigation system as well. MSTG along with the other Himalayan Links will affect 100 million Bangladeshi citizens living downstream of the Ganges and Brahmaputra. Sharing of Teesta River Water, Ganges River Water and construction of Farakka barrage is already contentious issues between the two countries thus implementation of project will further escalate the conflict as less water would be released by India. Bangladesh would thus suffer from problems such as poverty, environmental degradation, industrial breakdown and economic loss. Scholars and activists from Bangladesh have shown their disagreement to the ILR project as a whole after the decision given by Supreme Court in 2012 for the implementation of the same. Bangladesh initiated Teesta Barrage Irrigation Project in the 1970s. It was initiated with an aim to increase agricultural production in northern districts like Dinajpur, Rangpur, Jaipurhat, Niphamari, Gaibandha and Bogra of the country (Khawas, 2017).

Table No. 4.13: Features of Teesta Irrigation Barrage in Bangladesh

Parameters	Description
Project Initiation	1979
Barrage Capacity (Cusec)	10000
Nature of the Project	Multipurpose
Targets Districts	Niphamari, Rangpur, Dinajpur, Jaipurhat, Gaibandha, Bogra
Irrigable Area	540,000 ha
Project Phases	Two Phases
Branch Canal	80 km
Expected number of beneficiaries	21 Million

Source: Khawas, 2017.

Water diversion in India would reduce the flow of Teesta which is already a contentious issue between India and Bangladesh. Diversion of water through MSTG Canal link would deprive the above mentioned districts of Bangladesh, from estimated benefits of Teesta Irrigation Barrage. India has had a peaceful relationship with Bhutan. India's investments in the hydropower projects in Bhutan since 1960s has been strengthening bond between the two countries (Boruah, 2015). Prime Minister Lotay Tshering of Bhutan has showed his acceptance to the proposal of Sankosh Dam (Ahmad,n.d[22]). This dam is a major construction in the functioning of MSTG. On the other hand, environmental activists as well as the localites of Bhutan have showed their unwillingness by putting forward the issues that the project is likely to cause in the future. It would threaten the water security of the country as a major chunk of population is dependent on Manas and Sankosh rivers for their livelihoods (Khan, 2017).

[22] Retrieved from https://www.firstpost.com/long-reads/bhutans-plans-for-sankosh-dam-highlights-many-questions-about-countrys-pursuit-of-hydropower-6882701.html Accessed on 12/10/2019.

4.10 Conclusion

West Bengal cannot be considered as water scarce part of India. The distribution of rainfall in time and space makes the water scenario in the region chaotic. Government of India has planned water diversion for fairer distribution through canal links. Under the Himalayan Component MSTG Link is a crucial link proposed to divert link Himalayan Rivers to transfer water to southern parts of water deficit areas. The MSTG Project aims to fulfill the water demand of the growing population as well as other various sectors of the concerned states as well as the other parts of the country. It also intends to get rid of flood, drought and famine situations in the region.

As per the existing treaties and policies, decisions on Transboundary Rivers require consensus of the concerned states. However, it is lacking in the case of MSTG. The neighbouring states have denied to the implementation of the project. The benefits of the MSTG project should be taken by every state as well as the riparian states fairly. There is a need to develop accord among the states and countries involved. It is also pertinent that policies and Acts be made on account of the adverse impacts on environment and the society.

Chapter 5
Conclusion

International discourse on traditional security had long been dominated by the realist perspective in the past. The term security was more about protecting state from external threats, which needed military strength for its survival. It was only since 1970s that term security was understood from different perspective. Security meant securitization of human rather than the state. Post cold war era, priority of securitization was shifted from state to the people. Human security as a concept evolved since then. It is an amalgamation of seven components, which are economic, food, health, personal, environmental, political and community security which aims for the welfare of people increasing environmental depletion is making living condition of people complicated.

Deteriorating human condition due to environmental problems has urged the governing bodies to protect environment from various threats. Environmental security aimed at protecting people from long and short term devastation of nature, as well as deterioration of the natural environment. It can be done by alerting people and helping with mechanisms required for natural and man-made disasters at all levels. Visible environmental problems include issues such as global warming, water scarcity, ozone depletion.

It is needless to say that, water is the most essential resource required for the securitization of human being as well as the existence of ecosystem. Despite the fact that there is abundant supply of water yet increasing demand for fresh water globally, at an alarming rate and the scarcity of resource has become one of the biggest challenges in today's world. Even major chunk of regions of the most developed countries of the world such as USA are listed in the water stressed regions. Absence of strict laws with regard to water distribution, both at international as well as national

level is making situation more chaotic. Analyzing the current status of water demand and supply, it can be figured out that the issues of water scarcity will become more pressing in the future. This issue is becoming serious due to lack of proper management and the developmental activities taking place at various levels. Conflicts over water sharing are becoming visible at international, national as well as the local level.

Water Scarcity has become one of the major global concerns since past few decades. 3 percent of freshwater is to cater to the needs of 7 Billion people across the world. In this backdrop, inter-basin water transfer projects are considered as panacea to the issue of water scarcity according to its proponents. It is a feasible way of managing water resources and meeting demands of the ever increasing population, according to nations like China and India. Global inter-basin water transfer project in countries like China, Africa, and USA has to some extent been successful in solving the issue of water crisis. Consequently, there are reports of adverse effect of the projects in these countries. It has left hundreds of thousands people and animal displaced. Huge areas of land as well as forests are submerged by such projects.

Area wise, India is seventh largest and the second most populous country of the world. Population continues to increase at a rate of 1.7 percent every year since the past decade. It becomes hard task for the Government to evenly cater to the food and water demands of the booming population. Agriculture is considered as the backbone of Indian economy and has a major role in achieving food security of the country. Undeniably water is the most essential resource for better yield of any crop. Therefore, timely and adequate occurrence of rainfall is crucial in this case. Undoubtedly India has adequate sources of freshwater, yet water stress prevails due to skewed spatial and temporal distribution. Reliability on rainfall for any purpose is

declining every second. Floods during monsoon season leave thousands of families devastated, yet on the other hand there are many affected by droughts due to dry monsoon. The most affected are poor sections of the society though, international policies are set up for their upliftment. It thus calls for proper policy co-ordination so that there is better management of the water resources of the country.

Witnessing the growth in demand for water and food, Government of India, under NWDA agreed to the idea of ILR feasible, to overcome the problem. The proposal of ILR consisting of two components, Himalayan and the Peninsular is envisaged to overcome the problem of water related issues in the country. Transfer of water from water surplus area to water deficit area would mitigate floods as well as drought conditions. The combination of two components would make water distribution even, throughout the country. It will contribute not only in curbing water related problems but will also ensure food security of the country. However, ILR is ignorant of the fact that the construction process would submerge vast areas that are otherwise fertile for irrigation and better productivity. Conflict arising out of it is not only restricted to the nation but also among the neighbouring states. A management body, known as Task Force for ILR Project has been constituted by the Indian Government under the direction of Supreme Court. It has been composed with an aim to carry out detailed study of ILR in the overall aspects such as Science, Politics, and Economics and implement the Project and address the issues accordingly. NWDA initiated pre-feasibility studies in the year 1982, on its completion Detailed Project Reports were prepared for priority links.

In states like West Bengal, famines in the past have affected many lives. It thus is necessary for such places to properly manage its water resources to achieve food as well as water security. MSTG is capable of achieving such aspects of security in the

concerned areas. It would provide various benefits such as additional irrigation and hydropower benefits, mitigation of flood and drought conditions, increase in GDP, domestic water supply socio-economic development and improvement in transport and communication facilities. However, they have concealed the drawbacks of it. MSTG can be considered as an example of impractical planning of the Government. Though MSTG is considered as a boon to the growing population but from the past experiences it is evidently a bane to the environment.

The entire study reveals that water scarcity is a major global issue since the past few decades. Growing population and developmental activities has exacerbated water situation everywhere. Therefore its securitization and proper management has become need of an hour. Improper management of water bodies by the governing bodies as well as societies are common causes of water security in every part of the world. Adding to it is the climatic changes which were not foreseen in the past as a cause of water crisis. Hence, myriad water issues demand for non-conventional integrated water resource management techniques such as inter-basin water transfer and rainwater harvesting. On implementation of such techniques need meticulous arrangements in cases of inter-state as well as intra-state water sharing. Disagreements from neighbouring states or countries might result in conflicting situations. Consensus from the riparian states is necessary for techniques such as water diversion. MSTG has garnered attention as well as criticisms from Bhutan and Bangladesh. Planning of such programmes as figured out from the existing projects, reveal that adverse effects on ecology and environment has been ignored by almost all the countries. There are no proper laws regarding with regard to environmental damages or human displacement.

In this matter, India is not an exception. Policies and acts on water resources are not precise on a national as well as state level. Division of water related issues between the state and the centre has often created commotion in the country. Thus allocation of water related power where state or the center is to intervene, needs to be specified. India has planned a massive project for water diversion alongwith a list of guidelines. It however, has set up no strict policies at national or the state level, on account of the basic ecological impacts due to water diversion. The situation has become more chaotic at state level, due to lack of allotment of proper management and governing bodies for the project at the state level. Therefore, it is very important for the management body of the water governance with reference to the ILR Project to develop alternatives to mitigate the problems arising from it. Thus at times clashes between state and centre can be witnessed over water resource management. As inter-basin water transfer is considered as the most viable solution for water related problems in India, yet there is no proper documentation done in both national and state level. The responsibility of IBWT projects in India lies with Central Water Commission at the state level, according to the National Water Policies. However, in case of MSTG Canal Project, CWC Kolkata is unable to provide reports and documents of the same. Lack of co-ordination between the officials regarding MSTG Project is evident from such instances. Opinions on the project varies from one official to another thus, MSTG project does not have proper legislation and action plan. According to the limited information collected from the officials, it can be comprehended that the project lacks appropriate policies regarding protection of environment, rehabilitation and resettlement of socially displaced people and is economically not feasible for developing countries like India. On the other hand, implementation of MSTG project with proper legislation would cater to the increasing

demand for food, water, energy sources of growing population. The project would also be helpful in risk management by controlling Flood and drought situation in the concerned regions.

According to the study, lack of proper water resource management and population explosion are the key reasons behind water scarcity in every part of the world. Therefore to overcome this problem management needs amendments at all levels. It also calls for participation of people from every section of the society. The existing policies in relation to water need to be legally binding for proper utilization of water. Policies of IBWTs require revision taking into consideration its ecological and socio-economic implications. Delaying Project is a result of lack of particular body for IBWTs. Irrigation and water resources department are allocated with the task of managing IBWT Project. Separate bodies of officials need to be appointed to look into the matters of IBWT separately. More research can be conducted on the various methods of water resource management to overcome water scarcity. Studies can also be done to understand the technical aspects of IBWTs at national as well as local levels. Further study can also be done from the perspective of environmental justice with regard to IBWTs.

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ANNEXURE

Plate No.1: Canal Fall for Hydropower Generation

Source: Field Survey, 18th September, 2019

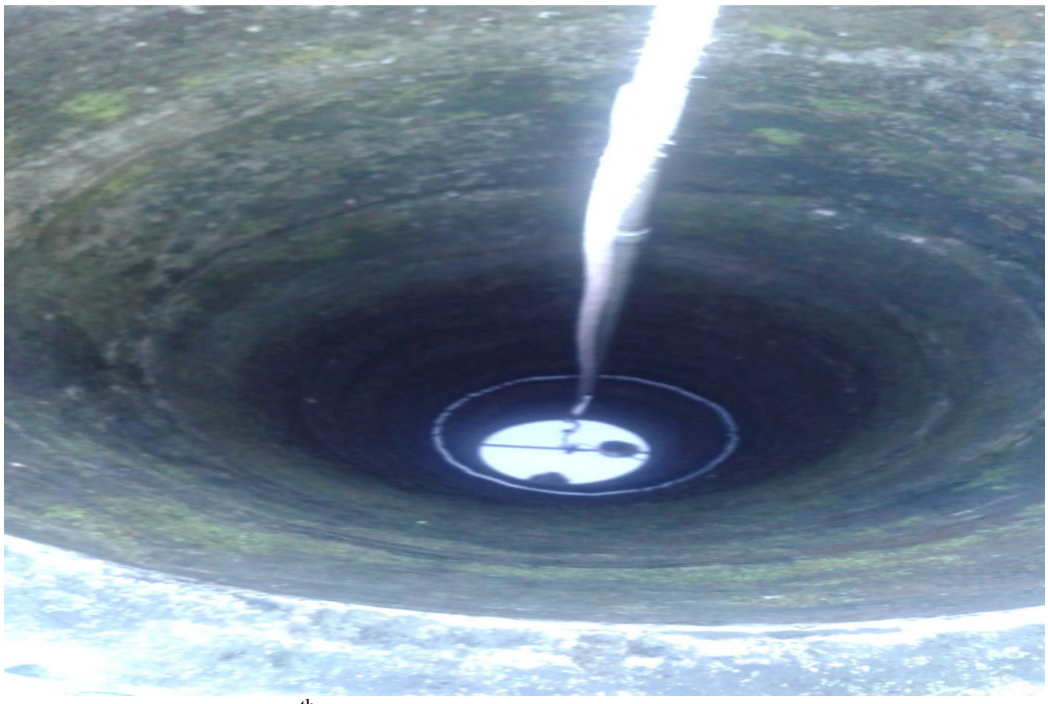
Plate No.2: Jute Plantation in Fulbari, Jalpaiguri

Source: Field Survey, 12 September, 2019.

Plate No. 3: Canals Used as Dumping Zones

Source: Field Survey, 13th September, 2019.

Plate No.4: Declining Water Level due to Dry Monsoon



Source: Field Survey, 13th September 2019.

Plate No. 5: Recreational Spot for Tourists

Source: Field Survey, 18th September, 2019

Plate No. 6: Mahananda Barrage

Source: Field Survey, 13th September, 2019