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Environmental Impact Assessment of Sone Canal Modernization Project

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ABSTRACT: The importance of environmental protection and its conservation measures has gained tremendous significance during the last two to three decades. In 1992, UN Conference on Environment and Development (UNCED) had discussed these in detail in its Agenda No. 21 and laid a lot of importance on environmental protection and conservation of its natural resources. The impacts caused by water resource developments include changes in micro climate, impact on land use, forests, agriculture, fisheries, tourism and recreation, soil erosion, variation in water table etc. The need to mitigate the adverse impacts and to ensure long terms benefits led to the concept of sustainability and environmental impact assessment analysis. In the present study, environmental impact assessment of Sone Canal Modernization Project in Bihar, India, has been done in detail and all pros and cons have been discussed for the sustainable development of command.

KEY WORDS: Development, Environmental Impact Assessment, Mitigation, Sustainable etc.

I. INTRODUCTION

Every development activity has an impact on environment. On one hand development is necessary to enhance the quality of life; on the other hand it is equally essential to ensure that the development is sustainable. Environmental Impact Assessment (EIA) is considered as crucial tool and mechanism for its sustainable development.

EIA may be defined as a formal process used to predict the environmental consequences of any development project and ensures that the potential problems are foreseen and addressed at an early stage in the projects planning and designing (FAO 1995). Therefore, it may be considered as a process of systematic identification and evaluation of the potential impact of the proposed projects to relative physical, chemical, biological, cultural and socio- economic component of the environment. The purpose of EIA is to identify, predict and evaluate impacts of the project on the environment and to formulate mitigation strategies to minimize adverse impacts that are likely to occur during project implementation and operation.

USA was the first country to formulate legislation in this respect and in 1969 enacted National Environment Protection Act. After that EIA related legislations started to begin in the developing world. In 1980, 75 countries adopted the EIA legislation and since 1990 the pace of legislative activity on environmental issues has increased significantly. At present, more than 100 countries have enacted EIA laws, decrees, guidelines and regulations according to United Nations Environment Programme.

In India, the Government has made various acts and legislations in order to ensure the sustainable development of projects. In 1978-79, a beginning was made with the impact assessment of river valley projects and since then impact assessment activities have been extended to other sectors also such as industries, thermal power projects, mining etc.

The purpose of this study is to identify the major environmental issues associated with the Sone Canal Modernization Project in Bihar as shown in Fig 1 and to formulate environmental mitigation measures. Since the activities have variable impacts on social, economic, geophysical as well as impacts on water quality, climate, flora and fauna, these impacts being closely related to each other have been analyzed from all aspects under the present study.

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II. DESCRIPTION OF THE PROJECT

The Sone Canal Command Area as shown in Fig 2 lies in the Bihar State of India and at present it is spread over 8 districts, namely Aurangabad, Patna, Jahanabad, Gaya, Bhojpur, Buxar, Rohtas and Bhabhua. The project was originally conceived in 1873-74 to cater the Rabi crop irrigation requirements. With the time demand for irrigation was increased and Kharif crop became principal crop in the command. In order to meet the increased demand of irrigation, a barrage was constructed in the year 1968 at Indrapuri in Rohtas district of Bihar. The project lies at latitude $24^{\circ} 48'N$ and longitude $84^{\circ} 07'E$. It has link canals on both side i.e. Eastern Sone link canal (ESLC) and Western Sone link canal (WSLC) to connect the old Sone Canal System, renamed as Eastern Low Level Canal (ELLC) and Western Low Level Canal (WLLC). The Sone Canal Modernization Project deals with ELCC and WLLC, collectively known as Sone Low Level Canal System (SLLC). The salient features of the project are as follows:

Catchment area at the Barrage site	- 68,916 sq.Km.
Mean Annual Rainfall	- 1398 mm
75% Dependable Annual Runoff	- 17577.38 Mm ³
Surface water available for the SLLC system	- 6167.5 Mm ³
Length of Barrage	- 1410 m
Design Flood Discharge	- 41,300 cumec
Max. Observed Flood Discharge	- 34,100 cumec
Pond Level	- 108.3 m
Weir Crest Level	- 104 m
River Bed Level	- 103.8 m
Under Sluice Crest Level	- 103.4 m
Design HFL	- 109.6 m
Afflux	- 1.22 m
Present Culturable Command Area (CCA) of SLLC	- 608754 ha
Gross command Area (GCA) of SLLC	- 796157 ha
Current Irrigation Intensity	- 120.5%

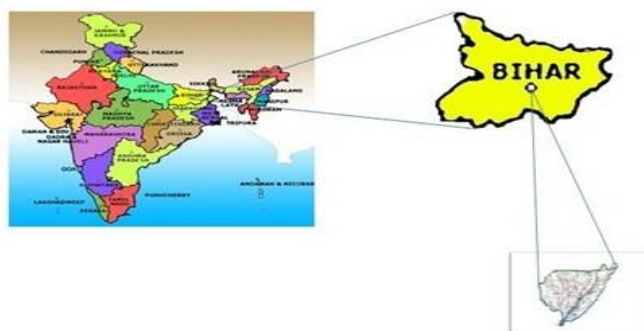


Fig:1 Location of Sone Command Area

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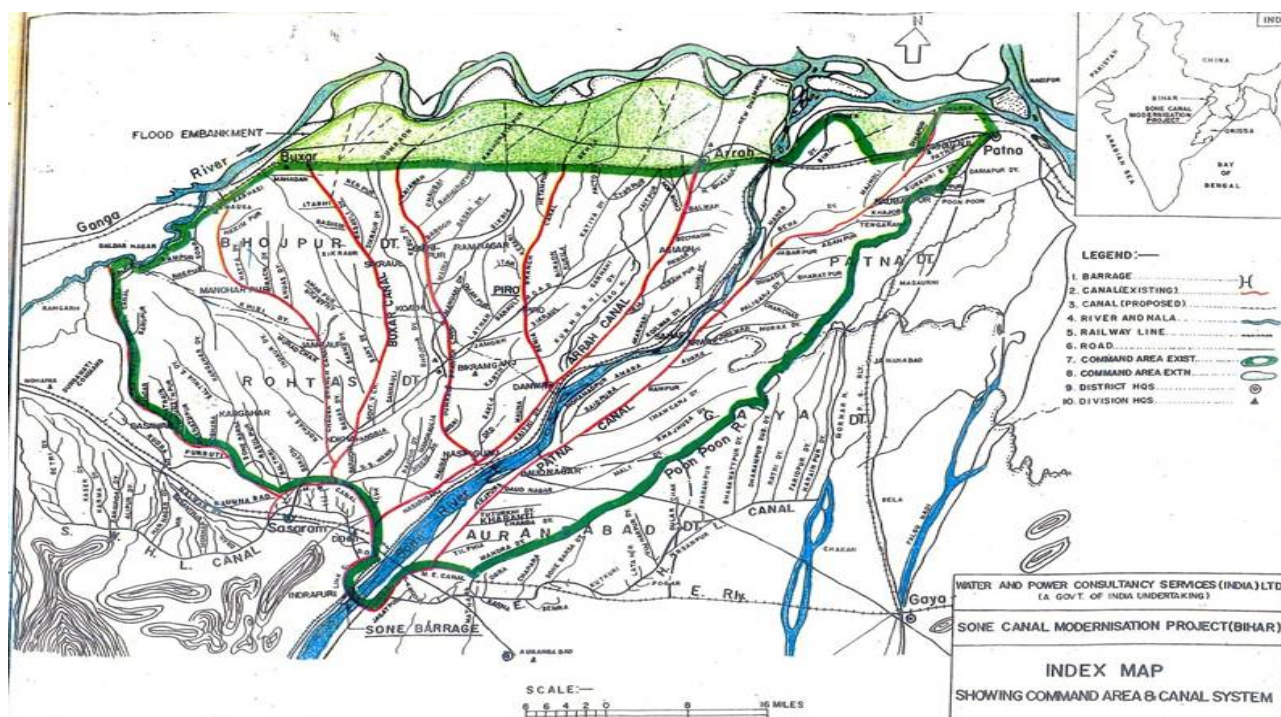


Fig: 2 Index Map of Sone Command Area

III.NEED FOR MODERNIZATION

The Sone Canal Project was originally conceived for Rabi wheat but it subsequently started catering for Kharif paddy which ultimately became a principal crop. Remodeling works executed in 1967-68 did not meet the requirements fully. The revised capacities of the various canals were not adequate to meet the ever increasing demand of modern agricultural practices over the years, where sufficient supply of water was needed at the right time, necessitating the Project Authorities to encroach into free boards. The canals had been put to more and more stress every year as more and more areas were brought under irrigation. This has resulted in severe damage to the canals in the absence of corresponding improvements and proper maintenance. Consequently, the system had developed many deficiencies, which can be categorized as:

- Engineering Deficiencies
- Agronomical Deficiencies
- Administrative and Legislative Deficiencies

The Engineering Deficiencies occurring in the existing canal system are:

- Low values of Critical Velocity Ratio
- Very flat canal bed slopes in certain reaches and steep slopes in other reaches
- Deterioration of design parameters resulting in generation of lesser velocities
- Deterioration of canal structures
- Inadequate number of cross regulators
- Inadequate number of escapes
- Unsatisfactory functioning of cross drainage structures
- Improper functioning of outlets
- Leakage of Gates

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- Seepage losses of canals
- Absence of field channels
- Wrong placement of sills of head sluices

The Agronomical Deficiencies in the command area are:

- Lack of scientific estimation of crop water requirements
- Defective crop calendar
- Arbitrary cropping pattern
- Absence of water management
- Deep submergence of paddy crops

The Administrative and Legislative Deficiencies are:

- Fragmentation of land holdings
- Unauthorized irrigation
- Lack of research studies
- Inadequate number of Agriculture Extension Centres
- Lack of Pilot Projects for demonstration
- Inadequate demonstration in farmer's fields
- Lack of efficient and quick communication facilities

In view of the deficiencies narrated above, the existing canal system is unable to supply adequate and timely water needed by the crops. The efficiency of the system is low and the crop yields per ha are poor. It is high time and extremely essential to remove these deficiencies. All these deficiencies could be removed by thoroughly modernizing the system. Herein lays the necessity and requirement for modernization. Apart from achieving significant improvement in overall irrigation efficiency, modernization will enable more intensive cropping and extension of irrigated area, leading to substantial increase in the yield of various crops per unit of land. Hence much improvement in the Environmental Quality (EQ) along with economic development can be made by modernization of the Sone Canal Project.

IV. ENVIRONMENT IMPACT ASSESSMENT ANALYSIS AND MITIGATION MEASURES

The Sone Canal Modernization Project envisages complete renovation of age old conveyance and distribution system so as to convert it into efficient and modern irrigation system. The irrigation intensity is proposed to be increased from the existing 120.5% to 162%. The system is proposed to be developed up to micro level with development of infrastructure for efficient water distribution. The area will be getting an efficient telecommunication system and metalled service roads along the canal system. It is hoped that with the increase in the irrigation facility, farmers will be confident of water supply, production from the agro-farms will be ensured and paying capacity of the farmers will also increase. This will enthruse the credit institutions to float agricultural loans. Together they will prevail on the farmers to treat agriculture as an industry and the production in the project area will increase considerably. The surplus production will create sufficient fund for improving the village industries.

In addition to the above advantages of modernization of project, the development will certainly cause some impact on environment and ecology. These have to be analyzed and mitigation measures have to be suggested for sustainable development.

1. IMPACT ON POPULATION

As per 2011 Census Data, the density of population in Bihar is 1102 persons per sq. km against all India average of 382 persons per sq. km. In the command area, the population, population density and literacy rate are as follows:

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District Name	Population	Population Density	Literacy Rate	Sex Ratio
Patna	5,838,465	1823	70.68 %	897
Gaya	4,391,418	883	63.67 %	937
Jahanabad	1,125,313	1209	66.8%	922
Aurangabad	2,540,073	769	70.32%	926
Buxar	1,706,352	1002	70.14%	922
Bhabhua	1,626,384	488	69.34 %	920
Rohtas	2,959,918	763	73.37%	918
Bhojpur	2,728,407	1139	70.47%	907

There is a tremendous scope for increase in advancement of education with improvement in the educational status of the village folk. Environmental uplift will be initiated with the advancement of education.

2. IMPACT ON FLORA AND FAUNA

The command area spreading over the foot of the Kaimur range to the bank of river Ganga abounds in flora and fauna. The support to the existing flora will be affected if there is submergence of land, cutting of forests, mismanagement of ground water level either by lowering or increasing the ground water level to such an extent that existing species cannot withstand with the changed situation. All these have been taken into account. Even after coming up of parallel canals to increase the discharging capacity, the banks of the existing canal will be kept undisturbed. Hence cutting of canal trees due to location of parallel canal is not expected. Rather, due care has been taken to make provision in the project estimate for plantation of additional trees on these canals. In case large number of laborers are engaged from outside, alternative fuel supply arrangements will have to be made at control prices to the temporary staff so that cutting of adjoining trees is avoided. Provision of ground water drafting has been made in locations where there is ground water at shallow depth to keep the land fit for the flora.

The command area is riparian in character and lies in juxtaposition with the north-eastern extremity of the Kaimur plateau. It becomes the meeting ground of the birds of the hills and plains. It also becomes the eastern frontier line of birds which come to India beyond the Hindu Kush and the Karakorum in winter and spread out over the plains of Northern India. The present scheme does not involve deforestation and damming of river. Hence, it will not have any adverse effects on the habitat of birds nor it will affect adversely the breeding area/ feeding area/ migration route of the visiting birds. Rather planting of trees along canal banks, larger green area, development of parks and gardens at the head works and other canal structures will provide ample habitat for the birds.

3. IMPACT ON NATIONAL PARKS AND SANCTUARIES BOTH EXISTING AND POTENTIAL

At present, there is no national park or sanctuary in the SLLC command area. So potential national park or sanctuary has not been considered at all, where the land is most suitable for agricultural purposes.

4. IMPACTS ON SITES AND MONUMENTS OF HISTORICAL CULTURAL AND RELIGIOUS SIGNIFICANCE

Ramrekha Ghat at Buxar is the only place in the project area to which very long standing religious importance has been attached. Tomb of Sher Shah and the birth place of Babu Kunwar Singh are other places of historical importance. None of these will be affected.

5. IMPACT ON AGRICULTURE, FISHERY AND RECREATION

There will be a positive impact on the agricultural field apart from increase in the facilities for fishery and recreation which are as follows:

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- Irrigation intensity will increase from 120.5% to 162% with break up as given below:

Period	Existing Intensity in %	Proposed Intensity in %
Kharif	67.5	74
Rabi	50	78
Hot Weather	3	8
Perennial	-	2
Total	120.5	162

- With the availability of assured water supply, high yielding varieties of crop will be cultivated.
- It is hoped with the modernization, the incentives will increase and the farmers will be able to get loans for providing adequate agriculture inputs.

From the supply of spills below Indrapuri barrage, it is found that spills are varying from 1161.9 Mm³ to 6619.7 Mm³ out of the share of SLLC system. A part of this water can be used to fill up the local ponds and Ahars at the time of lower crop water demand and greater availability of surface water. Danwar Lake, first reach of low level canal system attached to old Sone Anicut, can be developed for storing water. These water bodies can be used for fisheries and water sports and also for tourism development.

6. IMPACT ON PHYSICAL ASPECTS

Important physical changes envisaged after the modernization are as follows:

- Increase in canal capacity and its quality improvement.
- Lined canal will look even and beautiful.
- There will be more green patches and golden ripped crop fields after the cropping and irrigation intensity is increased.
- Aquatic weeds will not be seen in the lined canal.
- There will be limited loss of water in transportation.

7. IMPACTS ON THE RIVER REGIME

The existing average rate of annual withdrawal of water is 6086.3 Mm³. During the post development period, the annual average withdrawal with most favorable condition of reservoir operation will be of the order of 5584 Mm³. Thus on the annual basis, the river regime is not likely to be affected.

8. IMPACTS ON WATER-LOGGING AND SALINITY IN THE MODERNIZED SLLC COMMAND

In the post modernized condition, the existing gross command area of 0.68 Mha will increase to 0.796 Mha, whereas the average surface water diversion will decrease from 6086.3 Mm³ to 5584 Mm³ per annum. However, due to lining of the canal system and increase in irrigation intensity from 120.5% to 162%, the existing conveyance losses will substantially decrease. Construction of augmentation tube wells have been proposed in stages to take care of likely increase in the water table. Thus it is expected that the water table position will not change to cause water-logging condition in the post modernization period.

9. IMPACTS ON DRAINAGE CONDITIONS

So far, the command area was not in a position to get adequate water and the existing Ahars and land depressions could not accumulate any quantity of water for irrigation purposes. Only the natural drains were in operation and no artificial drainage system had been designed. Field to field drainage was being practiced. The drainage parameters have now been analyzed and a recommendation to increase the drainage capacity of various existing channels has been suggested by resectioning wherever required. High yielding variety of crops is generally associated with use of more fertilizers, pesticides etc. thus after modernization, upper layer of the aquifer is expected to be added which will have soluble salts to a greater extent. Due to the presence of extensive granular layer underneath, there is ample scope for the free ground water to flow into the adjoining river. Thus ground water pollution situation will be controlled by effluent.

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10. IMPACTS ON SOCIAL-CULTURAL ASPECTS

If the land is acquired to construct parallel canals, attempts will have to be made to compensate the marginal farmers with land available from other sources so that they do not become destitute.

11. IMPACTS ON PUBLIC HEALTH ASPECTS

As far as possible displacement from residential house units should be avoided. If some displacement becomes unavoidable, the occupants should first be compensated by giving them alternative accommodation. Minimum amenities of life should also be arranged for the temporary labor camps.

12. POSSIBILITIES OF NEW PROJECTS IN THE COMMAND AREA

- Minor Irrigation Schemes: Small irrigation projects and internal drainage lines are being taken up to supplement the isolated pockets within the command.
- Medium Schemes: Punpun and Karmanasa scheme may be taken up.
- Induced Recharge Projects: Central Ground Water Board may start on experimental basis some induced recharge projects.
- Kadwan Dam: It may be necessary to construct a balancing reservoir to serve the project area.

13. WATERSHED MANAGEMENT

Existing flood embankments are to be maintained annually. A watch on the problem of shifting of river channels has to be kept through observation and research work so that ecological balance of area is not affected.

V. CONCLUSION

The majority of anticipated environment impacts, identified during construction or implementation phases are temporal and limited in magnitude. The magnitude of impacts will depend upon the success and the manner in which the proposed environmental mitigation plans and programs are implemented. In the proposed studies, detail discussions were made in this respect. It will lead to create a confidence among the suppliers of water and farmers so that the cultivators will resort to most economic use of water which will obviate all ill effects. High yielding varieties of crop will be cultivated after modernization due to assured supply of water. Irrigation intensity will increase from 120.5% to 162%. Annual utilization of average surface water will decrease from 6086.3 Mm³ to 5584.6 Mm³ in the canal command. Therefore, there will be judicious use of water along with the increase of effective rainfall utilization.

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