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PERFORMANCE EVALUATION OF EARLY INPLEMENTATION PROJECT : A CASE STUDY

Submitted by.

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In partial fulfilment of the requirement for the degree of master of Engineering, Water Resources. Bangladesh University of Engineering and Technology, Dhaka.

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CERTIFICATE

This is to certify that this project work has been done by me and neither this project nor any part thereof has been submitted elsewhere for the award of any degree of diploma.

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WE HEREBY RECOMMENDED THAT THE PROJECT PREPARED BY SYED ISMAIL ALI ENTITLED "PERFORMANCE EVALUATION OF EARLY IMPLEMENTATION PROJECTS :A CASE STUDY" BE ACCEPTED AS FULFILLING THIS PART OF THE FULFILMENT FOR THE DEGREE OF MASTER OF ENGINEERING (WATER RESOURCES)

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A B S T R A C T

This study is concerned with the performance evaluatoin of a small scale irrigation and drainage project : Mashajan-lauhajang project which is typically known as an Early implementation project (EIP).

The assessment of the project is made with three aspects of evaluation: Engineering, Socio-economic and Environmental. In the chapter I, a simple introduction with the objectives of the project is given where the performance of EIP is shown. A project background information is provided in chapter-II and the detail of project with its objects are described in Chap-III. For better understanding, a literature review is attached as chap.IV to explain the process & terms needed for evaluating the impact of project. This chapter only includes the theoretical portion of the project works. From Chapter V to VIII, the study is elaborately described with the objectives of this project work.

In Chapter V, the method of data collection is explained. 10 Nos of villages out of 32 Nos of villages in the project area were chosen as sample villages with respect to land elevation. Different typs of questionnaire were prepared in accordance with the objectives of the study for the head of household and the group interview of the project area. Secondary data were also collected from file of the concerned office and the different reports on the project. During interview it is seen that some head of household have a tendency to hide information of their property. In that case cross checking is done to avoid wrong data analysis. To study the engineering impact assessment climatological data of the project area is collected. Topography, water level in the river and in the project area were collected

from secondary data. There are three main khals: Bhorra khal, Nardana khal and Nandapur khal, and two structure; Bhorra open fall board system regulator and Nardana regulator, are seen in the project area. The overall condition of these three khals are not good, at all. Due to land acqisition problem, the excavation of some section of these khals were not made as per design. Siltation is another big problem in this project. Due to mis-operation of the Bhorra open fall-board system regulators, heavy sediment water enters in the project for which the area under mitakhola beel has been badly silted and as per public openion the people of these area have been deprived from about 1000 mounds of crops in each year. Moreover the U/S of this sluice to the outfall of this khal was badly silted and reduced the width which hampers quick drainage. At Luhaganj the bed of the Nardana river is badly silted (about 0.06 to 0.09m) which hampers the drainage facility.

As par PP, a 4-vent regulator is proposed to be constructed in the Nardana but actually a single vent steel gate regulator has been constructed at the same place.

Operation and maintenance works of the project could be considered as nil. The project declared its completion in 1986 although all the project works could not be completed due to land aquisition problem. Only 45% of land aquisition is made. Moreover the allocated amount for O & M works of Tk.11.27 lac is utilized to mitigate previous liabilities.

No specific schedule for maintenance works are found. The visit of the concerned agency is not frequent. Some excavation works were done by the fund available from FDR and a fresh proposal in the name of reexcavation of Luhajang river was sent to FFW for approval.

In the socio-economic study it is seen that the financial and economical B/C ratio at this stage are 1.65 and 3.38 respectively which were 1.07 and 2.48 (PP, 1982). The internal rate of return is 37% (ECON) and 18.981 (FIN) which were 32% and 16.20% in the pre project condition. Still the project has got its viability due to high production of HYV. Therefore it is suggested to review the project elaborately and regular maintenance works with a specific schedule would be able to save the project.

Although the project achieved its goal in the context of production due to HYV, the environment in the project becomes poor day by day. Due to irregular opertion of the regulators, the people within the project suffers a lot. To avoid such circumstances, a guard/khalashi should be appointed from authority.

Fisheries in the project area would be better if available fund & modern technology are possible to be provided. Adequate medical facilities income generation for the target group and different type of credit facilities, are needed to lift the project to its goal and the socio-economic development thereby.

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(SYED ISMAIL ALI)

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LOCAL TERMS AND ABBREVIATIONS

BADC	: Bangladesh Agricultural Development Corporation
BBS	: Bangladesh Bureau of Statistics
BKB	: Bangladesh Krishi Bank
BRDB	: Bangladesh Rural Development Board
BS	: Block Supervisor
BSS	: Bittyaheen Samabaya Samitey
BWDB	: Bangladesh Water Development Board
Cms	: Cubic meter per second
CS	: Cheek Structure
DAE	: Department of Agricultural Extension
DTW	: Deep Tubewells
EE	: Executive Engineer
ESCAP	: Economic and Social Commission for Asia and the Pacific.
FDR	: Flood Damage Repair
FG	: Flushing Gate
FY	: Financial Year
Grihostail	: Household Work
Ha	: Hectare
HYV	: High Yielding Variety
IDA	: International Development Association
IFAD	: International Fund for Agricultural Development
KSS	: Krishak Samabaya Samitey
LGEB	: Local Government Engineering Bureau
LLP	: Low Lift Pump
LS	: Lum Sum

NCB	: Nationalized Commercial bank
NGO	: Non-Government Organization
O&M	: Operation and maintenance
PWD	: Public Works Development
R	: Regulator
RL	: Reduced Level
SDE	: Sub-Divisional Engineer
SDO	: Small Drainage Outlet
SE	: Superintending Engineer
SO	: Section Officer
SSFCDI	: Small Scale Flood Control Drainage & Irrigation
STW	: Shallow Tubewells
TCCA	: Thana Central Co-operative Association
Tk	: Taka
TOR	: Terms of Reference
UCCA	: Upazilla Central Co-operative Association
Upazilla	: Sub-District
WA	: Work Assistant
Aus	: Rice planted during March and April and havested during July and August (B. Aus =broadcasted aus; T. Aus = Transplanted aus).
Aman	: Rice planted before or during the monsoon and harvested in November of December (B. Aman= broadcasted aman; T.Aman =transplanted aman)
Boro	: Rice planted in winter and harvested during April to June.
Irri	: Short stem high yielding variety of Paddy (development at the IRRI)
Kharif	: Summer Season
Rabi	: Dry (winter) season (October through May)

Paddy	: Unhusked rice
Beel	: A small lake, swamp or body of year round standing water created by rains of flooding
Nadi	: River
Khal	: Natural Channel
Nala	: Excavated canal
Chhara	: Small hilly stream
District	: An administrative unit containing two or more sub-divisions.
Sub-Division	: An administrative unit containing several thanas
Thana	: Lowest level of civil administration in Bangladesh, also called police station.
Union	: A unit of local self-government consisting of rural representatives.
Mouza	: A small geographical unit without any administrative status but constituting a community of households.

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CHAPTER - I
INTRODUCTION:

I.I Background Information of EIP Project

Bangladesh is a disaster prone area and poverty stricken country with limited resources. It has over 1420 million hectares of territory of which 2.2 million hectarés are forest and about 9.06 million hectares are cultivable. Practically all suitable land is under cultivation, but about one third of the land is flooded every year by the three world biggest rivers: The Brahmaputra, Ganges and Meghna. The population of the country is estimated to be more than 100 million of which 30 percent of work force is under employed and 80 percent of the people are illiterate. For obvious reasons the economy of the country is mainly agro based and water is of vital importance of agriculture.

After two consecutive floods in 1954 and 1955, the most devastating flood occurred in Bangladesh in 1987 and 1988 which affected around 9.0 million ha land of which around 5.8 million ha. experienced severe drainage congestion during receding of flood. About 72 percent of all food grain were damaged during the time of monsoon (BWDB,Dec. 1938).

Bangladesh Water Development Board, an organization under Ministry of Irrigation Water Development & Flood control, is responsible for irrigation, flood control and drainage project. In 1964 , a master plan for the development of water resources was drawn up by IECO.The plan emphasized flood protection along the major rivers as well as in the coastal area. It included 51 major project. The cost of these schemes far exceeded available fund. Mainly because of financial constraint, the implementation of master plan which formed mejor guidelines for the operation of the

BWDB, has been rather slow. In view of the bottlenecks in implementing large scale project, low investment per unit which could be completed quickly. With this concept especially after the famine and flood employment opportuhe basic concept of Early Implementation Project is to produce return quickly with low investment, which proved successful and was adopted to other donor assisted projects, is known as Early Implementation Project (EIP).

Implementation of EIP projects commenced in 1974-75 following an agreement between the Bangladesh and the Netherlands Government to use bilateral aid funds for activities in water control. In the second phase (1982-86), it was agreed by three governments: Bangladesh, the Netherlands and Sweden that Swedish International Development Agency (SIDA) would also participate in the programme. Each of the governments cotributed an amount equivalent US$ 6 million in the second phase (BWDB, 1988).

EIP project have so far implemented many such EIP projects in the phases. The number of individual projects implemented and areas benefited are as follows:

Phase	Year	Nos. of projects	Area Benefited (ha)
I.	1975-81	44	37500
II.	1982-86	23	90000
III.	1987-91	19	80000

At present 63 out of 86 projects have been completed. The average benefited area per project is 6300 ha (BWDB, 1989). The performance of EIP cell is listed project wise in Fig. 1.1 and Appendix 1.1 . Although the EIP projects have generally been found as cost-effective and fast yielding but some of these could not accrue the desired benefits and in some cases produced adverse impacts.

The purpose of this study is to evaluate the impact of one EIP type project. The methodology of the assessment will be quite general and can be applied to similar projects.

The project selected for the present study is Mashajan Lauhajang project. It is a drainage and flood control project. The gross area of the project is about 4450 ha and the net benefited area is about 1620 ha.

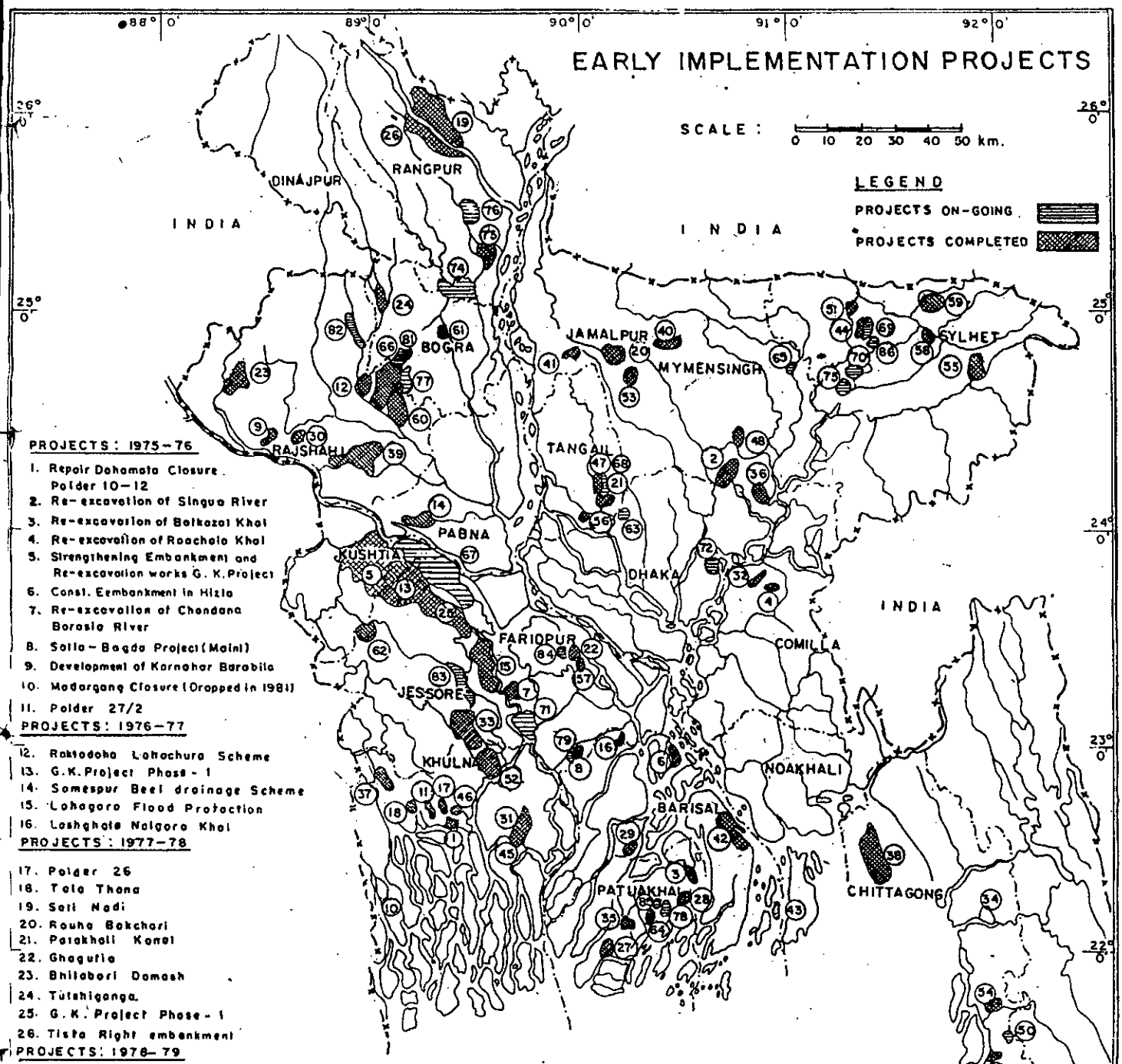
Post project evaluation of any projects is considered essential so as to find out whether the project completed is giving desired benefits or not. The findings and recommendation of the study could be very useful in the smooth operation of the project and experience gained could be fruitfully utilized in other projects. The specific objectives are as follows:

i) Engineering Study and evaluation.
This will include review of the design criterion used for the construction of various structures such as embankment, canal and drainage regulators, in the project area to ascertain whether the construction was done as per original plan or not.

ii) Socio-economic evaluation:
This consists of assessment of economic and socio-economic parameters for the post project condition and compare with the pre-project condition.

iii) Environmental Impact Assessment:

The indicators which affect the project environment are to be identified . The impact of associated indicators are then evaluated for the pre-project and post project conditions.



PROJECTS : 1975-76

1. Repair Dohamata Closure Polder 10-12
2. Re-excavation of Singua River
3. Re-excavation of Baikazol Khal
4. Re-excavation of Raachala Khal
5. Strengthening Embankment and Re-excavation works G. K. Project
6. Const. Embankment in Hizla
7. Re-excavation of Chandana Borasia River
8. Satla-Bagda Project (Main)
9. Development of Karnahar Barabila
10. Madargang Closure (Dropped in 1981)
11. Polder 27/2

PROJECTS : 1976-77

12. Raktadoha Lohachura Scheme
13. G.K. Project Phase - I
14. Somespur Beel drainage Scheme
15. Lohagora Flood Protection
16. Loshghata Nalgora Khal

PROJECTS : 1977-78

17. Polder 26
18. Tala Thana
19. Sati Nadi
20. Rauha Bakchari
21. Patakhali Kanal
22. Ghagutia
23. Bhitabari Damash
24. Tistahiganga.
25. G.K. Project Phase - I
26. Tista Right embankment

PROJECTS : 1978-79

27. Chakamaya-Panchakuralia Closure
28. Kalaiya-Nehalganj
29. Padrishibpur
30. Fallar Beel
31. Polder 34/3
32. Jamuna Khal

PROJECTS : 1979-80

33. Singia-Nabagati
34. Polder 63/1B (Dropped in 1985)
35. Amtali Closure
36. Bardoi Khal
37. Extension Polder 6/8
38. Sandwip Embankment (Special Project

PROJECTS : 1980-81

39. Bhadra Beel
40. Kanapara Embankment
41. Katakhali Khal
42. Bhola NE Embankment
43. Char Faizuddin
44. Shanghair Haor

PROJECTS : 1981-82

45. Polder 35/3
46. Gangrali Closure
47. Exin. Patakhali Kanal
48. Gazaria Beel
49. Polder 66/3
50. Polder 65/A-1
51. Angerali Haor

PROJECTS : 1982-83

52. Barakpur-Dighalia
53. Katakhal-Dublakuri Khal
54. Polder 65/A-3
55. Damrir Haor
56. Mashajan-Lauhajan
57. Chattar-Fukurhati

PROJECTS : 1983-84

58. Zilkar Haor
59. Patharchuri Haor
60. Nagar River
61. Sowra Beel
62. Hamadar Beel
63. Alior Beel
64. Polder 43/2C
65. Nawtana Khal

PROJECTS : 1984-85

66. Nagar Valley

PROJECTS : 1985-86

67. Faridpur Area-I
68. Patakhali-Kanal ROM
69. Shanghair Haor ROM

PROJECTS : 1986-87

70. Baram Haor
71. Bhuliar Beel
72. Baluchair Embankment
73. Sonali Embankment

PROJECTS : 1987-88

74. Nuruller Beel
75. Bhanda Beel
76. Saldanua Kotter
77. Upper Nagar
78. Surjamani Khal
79. Satla-Bagda P-3 (Rehab)
80. Flood Damage Repair

PROJECTS : 1988-89

81. Upper Nagar Valley
82. Badalgachi
83. Bamankhali-Baronali
84. Shakpatdia
85. Polder 43/2E
86. Tangua Haor

Fig:1.1:Performance of EIP Cell

I.2. Project Background Information

The project is located about 20 miles south west of Tangail District headquarters and 15 miles North west of Mirzapur Thana headquarter. The project area covering villages Moshajan, Fatehpur, Mamudpur, Pachchamari, Lakhinda, Panchadona, Banail, Bhabakanda, Kawalpur, Shail jana, Bangolla etc. The gross area is around 15,700 acres, The benefited area is estimated at 4500 acres.

The project consist of Moshajan beel, Kuraliakpara Haor, Sailjana and Bhyiuyakura beel. It had been suffering from drainage congestion for want of drainage outlet, as a result of which the fertile land lying around these beel could not be cultivated. In order to get rid of this problem the Chairman, Basail Union Parisad excavated the drainage channel of insufficient section for drainage of the beels in the year 1965 to 1968. As the result were good, the said channel was again re- excavated in the year 1979-80 by mass participation under channel digging programme. But as the channel could not be excavated or re-excavated to its required section, expected benefit could not be achieved. Hence there is a crying demand from the local people

for re-excavation of the channel with proper section to cope with the drainage need so as to reclaime an area of about 500 acres of land from the basine of the beels and also to change the cropping pattern of the areas.

In Auguest 1982, a project proforma of amounting Tk. 150.51 lac taka was prepared by BWDB with an expectation of good agricultural production and the following achievement as described below.

a) Good crops will ensured. This will be give incentive to the local farmers to bring more area under (HYV) paddy and introduction of more Rabi crops in more area with a little high production.

b) The cropping pattern of the medium low land could be changed and the cropping intensity thereoff will be increased.

c) Agricultural activities within the project area will be more intensified. This will lead to increase the demand for agricultural labour.

d) The net incremental benefit of the project at full development stage will be 64.04 lac from the national perspective. The economic IRR of the schemes stand to 32% which indicate viability of the schemes.

The project was appraised by the Appraisal Mission in 1982 as an early implementation project in order to improve the pre and post monsoon drainage of the area and limit the effect of flooding. The proposal in the appraisal mission report to cope the project objectives are as follows:

a) Excavation of the Nardana khal (7.4 miles) and its side channels , the Bangola khal (1.3 miles) and Nandapur khal (1.9 miles).

b) Excavation of Bhorra khal (2.3 miles) and its three branches channels (total length 0.8 miles) .

c) Construction of 4-vent sluice at the outfall of the Nardana khal and a 2-vent drainage sluiuce with possibilities for boat crossing at the outfall of the Bharra khal and

d) Construction of closure at Ufulki khal.

The appraisal Mission approved, the project in principal having B/c ratio 2.4. The project work started in 1984 under EIP programme of BWDB and declared completed on 1986.

1.3 Project Description and Objects.

1.3.1 Project Description.

a) Location and Extent. The project area (4450 ha gross and 1620 ha net) is located in Mirzapur Thana (Upazila) under Tangail district about 24KM South-East of Tangail Town. The Lauhajang river is in North-East and the Bansi river is in the South-West of the project area (Fig 1.2) An unmetalled road connecting Patulla and Aghaid Mahishmuro, traverse the project area. The description of the villages including area, household and population are appended in Appendix-1.3 and location of villages are shown in Fig 1.3

(Source: Small Area Atlas of Bangladesh'1986)

b) Physical components: The proposed project components for this project in to improve the pre-monsoon drainage of the

area and to limit the effects of flooding, the following physical components were proposed in the PP.

- to excavate the Nardana khal 11.90 km and its side channels the Bangolla khal 2.10 km and Nandapur khal 3.05 km.
- to excavate the Bhorra khal 3.70 km and its three branch channel of total length 1.29 km.
- to constract a 4-vent drainage sluice at the outfall of the Nardana khal and a 2-vent drainage sluice with possibilities for boat crossing at the outfall of the Bhorra khal.
- to close besides these khals, the Ufulki khals.

The physical infrastructure componants are shown in the Fig. 1.2.

1.3.2 Project Objectives.

Mashajan-Laohajang (EIP) project was constructed to achieve the following objectives.

i) Increased agricultural production

ii) Increased net farm income.

iii) Improve equality in income distribution and use of irrigation water.

iv) Increased employment oppertunities especially for landless, small and marginal farmers.

v) Maximum participation by small and landless farmers in construction, operation and maintenance of infrastructure and ownership and operation equipments.

vi) Establishment of self financed and selfmanaged farmers organization.

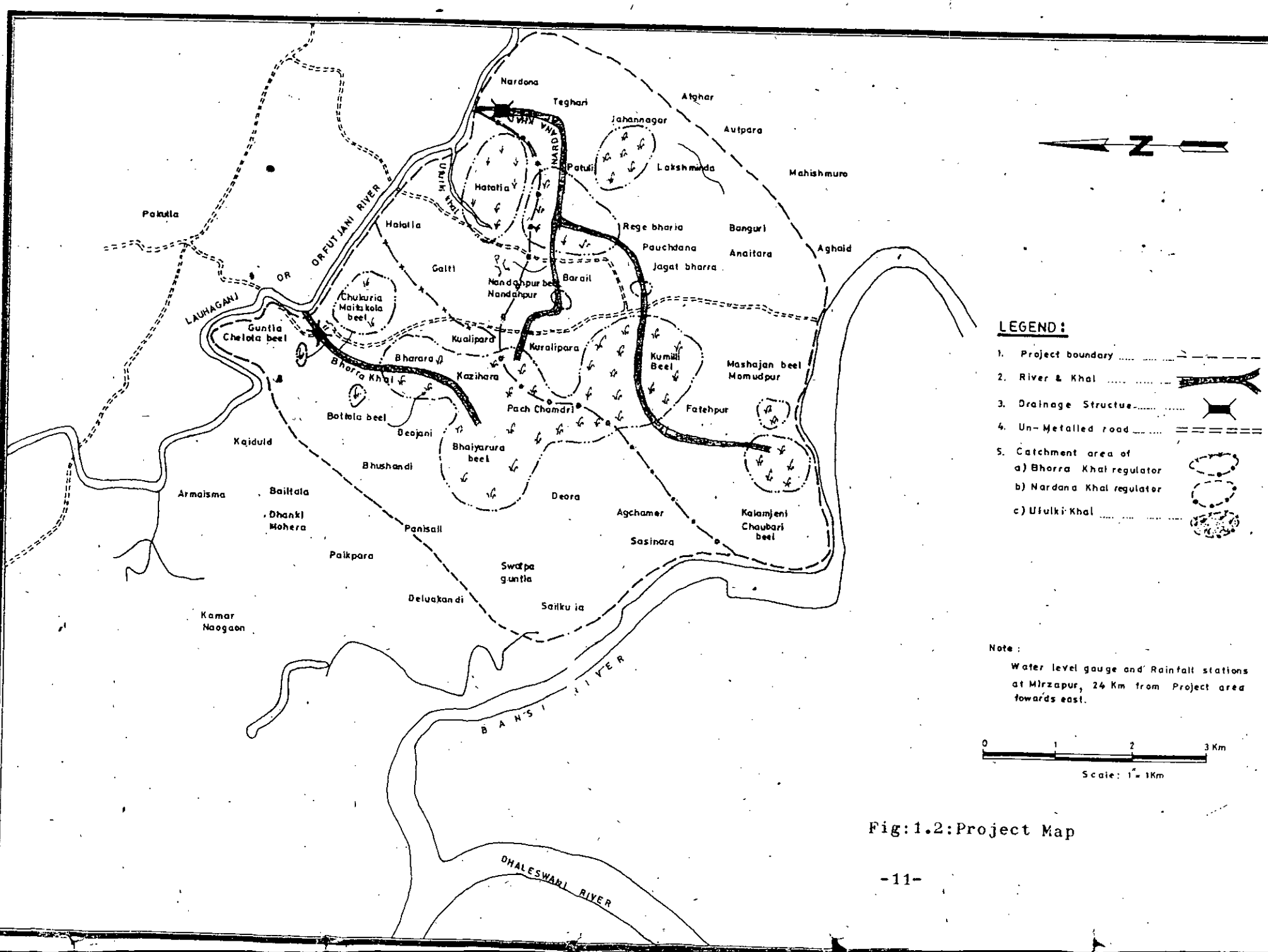


Fig:1.2:Project Map

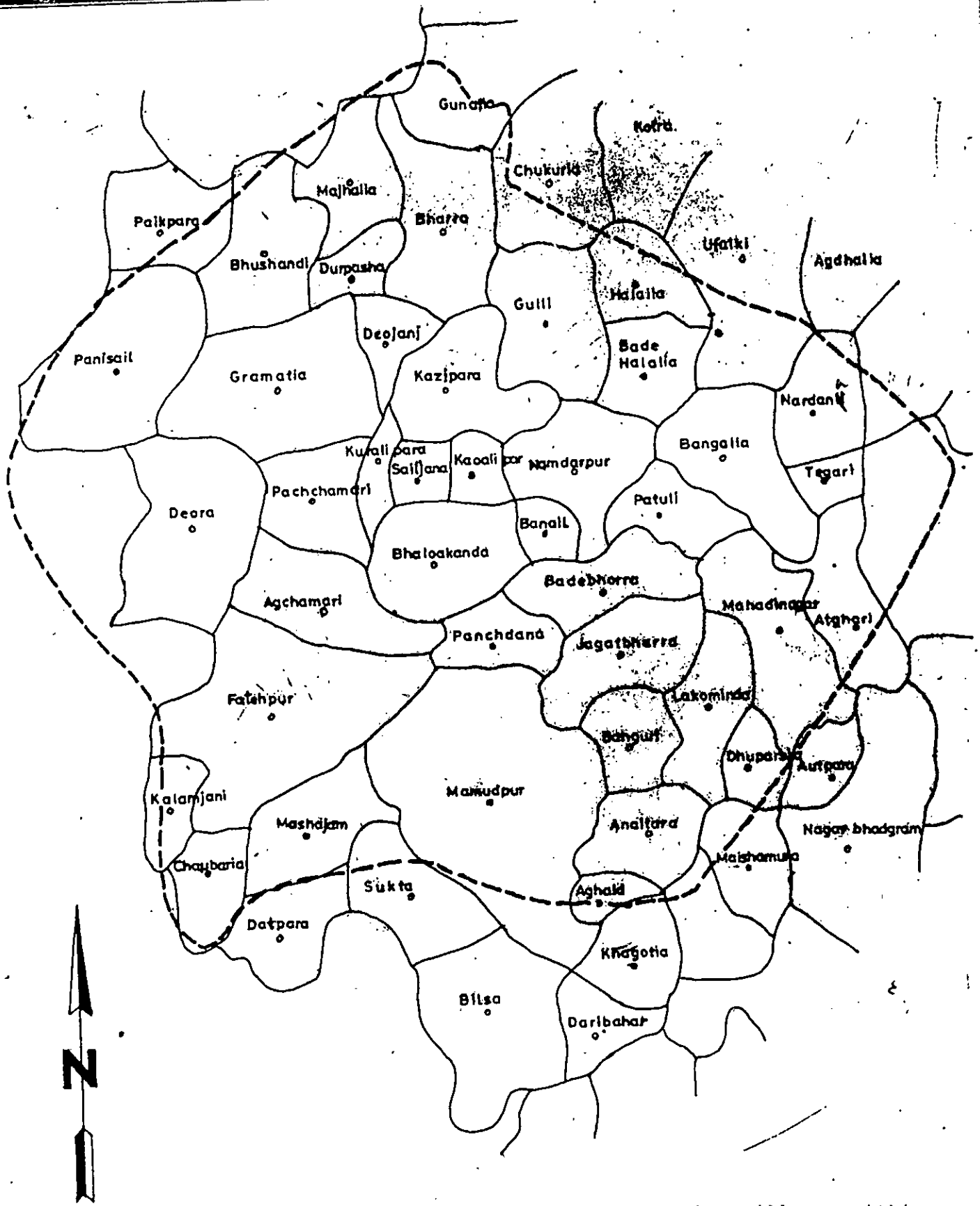


Fig:1.3: Map Showing Villages within Project Area

CHAPTER-II

LITERATURE REVIEW

2.1 Evaluation of Engineering Aspects of FCDI projects.

For Engineering evaluation the project is studied in detail on the basis of the aspects of design, cost, operation and maintenance. For this review of design criterion of the stuctures, the study of different reports related to the project and BWDB office correspondence were carried out. In addition to this, the field investigation of the project is done Engineering evaluation is done on the basis of following engineering aspects.

2.1.1 Design Selection:

Hydrological boundaries : The collection of hydrological data and analysis thereoff for the purpose of the schemes formulation constitutes the primary task. Major source of the hydrological data is Hydrology directorate of BWDB, where information are mostly preserved in compiled form. Once the basic Hydrological information is found out, subsequent analysis for the purpose of the projects are routine job.

a) River water level : In most of the EIP project, 1:20 yrs flood level is considered. BWDB has established many water level recording gauge station throughout the country in the main streams and rivers. All the data are then compiled by BWDB'S Hydrology Directorate. Short term data at the site are correlated to long term data of permanent stations.

In case of design of drainage structures, the maximum head difference at the structure occurs either in pre-monsoon or in the post-monsoon period. The size of structures is

general selected by comparing post monsoon and pre-monsoon flood routine. In Mashajan-lauhagany project, it is observed that the size of structure is mostly governed by post monsoon flood condition.

b) Rainfall: There are many stations throughout the country for recording daily rain fall. Different agencies in different time compiled the monthly, seasonal and annual rainfall of these stations. In absence of any rainfall recording station within the project area the weighted values are found from the records of nearby station. Calculation of weighted point rainfall and estimation of intensity and frequency, the design storm are generally made of to determine the design storm and the design flood. Short and medium duration rainfall and the frequency of Occurance are required for the design of drainage system. In this project, the critical drainage period lies in the months of pre- monsoon period when crops are still small or maturing stage and are susceptible to damage. The 5 days duration of selected frequency of 10 yrs for maximum rainfall values are analyzed and used for drainage systems in general. In case of the project rainfall and runoff index prepared by IECO (Presently named as Morrison knudson) in 1964 have mostly been used. Other climatological data for the project are given in appendix 4.1

c) Catchment leakage: Generally water enter the basin from outside by flooding . But rainfall is also one of the source of water in the Project area. The parameter generally used in the drainage projects are evapotranspiration, storage etc. IECO Study suggested evapotranspiration, storage and seepage looses to be

50% of the first 50 mm rainfall and 30% to 40% rainfall in excess of 50 mm for flat & hilly areas respectively (LDL 1968). In case of unpoldered projects, the leakage through small open crecks are considered in calculation of total run-off of the Profect.

Sructures

a) Planning of hydraulic structures in the project: Before the project, there were numerous khals within the project area. Most of this khals were natural drainage channels. Under the project drainage system, some of the natural channels were eliminated and some were linked with drainage systems of the project. The entire project area was divided into several basins and a drainage system was planned so that, from each of such basin area, water could drain out through drainage sluice. In order to draw run-off from each basin, the existing khals were , as for as possible, linked up to the structural outlets providing necessary bed slope.

In the project, the drainage structures are provide considering the topography of the land, natural slope of the land and availability of easy and short outlet channel connection with drainage ways.

b) Hydraulic design of type structures and its protection works: In designing the hydraulic structures, the factors to be considered are as below:

i) Energy disspation and stilling basin design: The energy dessipation in the jump depends upon the Froude number of the incoming flow. The different types of jumps have different Froude no. (F).

For F =1, the flow is critical and there is no jump.

F =1.7, no baffles or other dissipating device are needed.

F =1.7 to 2.5 baffles of sills are not required but basin should be sufficiently long.

F =2.5 to 4.5, the jump creates heavy oscillating waves on the surface. So stilling device must be provided to dissipate energy.

F =4.5 to 9.0. A true hydraulic jump occurs. So chute blocks, impacts baffle blocks and an end sill have to be provided to shorten the jump length and to dissipate the high velocity flow.

ii) Depth of scour and cut off wall: the depth of scour is usually determined by Lacey's regime scour depth equation.

$$R = 0.91 \left(\frac{q^2}{f}\right)^{1/3}$$

A value of 1.25 R on u/s and 1.50 R on d/s is widely used to determined the depth of cutoff wall which ofcourse later on to be checked from exit gradient consideration.

iii) Estimate of design head: In determining the design head for a regulator, the water levels of pre-monsoon and post monsoon period are required when max. Head difference occurs are taken into consideration.

iv) Exit gradient and floor length : The exit gradient is the determining factor for selection the floor length and vertical cut off depth. For the structure to be safe against piping, an exit gradient of 1/6 to 1/7 have been considered for the existing soil characteristics of the project.

v) Uplift pressure and floor thickness : In order to know as to how the seepage below the foundation takes place, flow profile curve is to be prepared. The percentage of pressure at various points is valid for complex profile if corrected for

- Mutual interference of plies.
- Thickness of floor
- Slope of the floor.

vi) Loose protective works :Followings consideration are to taken into account.

- Downstream invert filter: At the end of the concrete floor, an inverted filter, 1.5 to 2D long is generally provided.

Where D = Scour depth below river bed.

-Down stream Launching apron is provided for a length, generally equal to 1.5 times of scour depth.

-Upstream loose protection: Just before the concrete floor of the upstream, brick block protection is provided. The brick blocks are laid over packed stone for a length equal to D (D=XR-Y, where X = 1.0 to 1.5, generally taken 1.25, R is Lacey's normal scour depth and Y is the depth of water above bed.)

- The drainage sluices, which were not designed for flushing but as present being used for flushing, should be provided with new landward bottom and slope protective works sufficiently strong against scouring.

c) <u>Structural design of type structures</u>

Any structure shall be so designed that it remains stable against all external loads and pressure which it may encounter. The structure should be stable against overturning at any horizontal plane, sliding or shearing force on horizontal plane, water uplift pressure and over

stress of underlying foundation materials or soil. Generally the following safety factors are used for hydraulic structures of BWDB:

Over turning	:	Normal case	:	1.50
		Extreme	:	1.30
Sliding	:	Normal	:	1.50
		Extreme	:	1.30
Uplift				
Bearing	:	Normal	:	2.00
		Extreme	:	3.00

For design of hydraulic srtucture, generally the following steps are followed :

(i) Computation of design loads and pressure : The loads and pressures which may act on the structure are correctly listed and computed.

Dead loads: The wt. of all permanent and temporary components of structure, (such as concrete/ brick work, earthwork, water wt. etc.) should be calculated.

Live loads: The wt. of human occupancy over operating deck and regulator crest and trunk loads includes in live load calculation.

Pressure and forces: The various pressure and forces act on the structure, such as water pressure horizontally and vertically (uplift) and earth pressure horizontally and surcharge.

Impact: In the case of truck load 30% impact is considered additionally as live load.

(ii) Stability analysis and design of elements: The following main elements of the structure need to bedesigned:

- Conduit of barrel
- Abutment wall

- Base slab
- Head wall
- Wing wall
- Return wall
- Apron slab
- Operating platfrom

(iii) Stability analysis : The safety of the central part of the structure, wing wall and return wall are to be checked against overturning, uplift and bearing pressures. For the stability analysis the combined loads may produce critical loading at various stages of construction, operation or maintenance of the structures are to be found out and the stability of the component should be checked under the critical loading condition.

(e) **Siltation problems**: In the project the soil is mostly of alluvial type, with maximum percentage of fine sand and silt. As a result the design section of the channels do not exists for long time and requires regular maintenance. The sedimentation in the intake channels of the projects sometimes causing difficulties in the effeqtive operation of regulator/sluices gates. This is normal and natural phenomenions. During the high flood the surges occuring with immense volume of sediment is pushed inward from the river which are deposited in the almost calm and tranquil water of the intake channels.

The deposited silt normally deformed the shape of the channel/ khal and reduces its carrying capacity. It must therefore, be removed periodically by desilting operation.

2.1.2 Operation and water management

(i) Operation of the project components :

There is an operation and Maintenance wing in BWDB which supervises the activities of its field organizations. After the implementation, the projects goes for operation under the field organizational set up. The BWDB is divided into 14 zones (headed by CE), zones into several circles (headed by SE) again divisions are subdivided into several sub-divisions headed by sub-divisional Engineers.

The effective operation of hydraulic structure is one of the main pre-requisites to achieve the benefits. In general, because of the fund constraints in the operation and maintenance of the project, many problems have been created. Participation by beneficiaries in operation and maintenance may promote the efficiency and net benefit of the project.

(ii) **Water Management**

In the project concept it was expected that an ideal general approach should be the criterion of a water distribution system in such a way so that it served optimum utilization of agricultur development in the project area. The organization and management should take care so that a fair distribution of irrigation and drainage water are guaranteed for the improvement of agriculture in the area. Some problems related to water management are reported. This have mainly to do with drainage and with inadequate operation and lack of maintenance in completed structures.

With the implementation of EIP schemes, the cropping pattern have changed in many cases, the varieties have been replaced by HYV'S. As a result effective water management is needed.

2.1.3 **Maintenance**

In order to ensure the continuous flow of benefits from the investments, the proper maintenance system is of the utmost importance. For EIP projects, the first three years after completion, all physical works are maintained or monitored by the EIP cell. Afterward the responsibility lie with the BWDB.

In the past years, the found constraints in the maintenance of the EIP Schemes are proved to be the major bottleneck in the effective production which getting down the cropping intensity and hectarage yield in the many case as reported.

2.2 EVALUATION OF SOCIO-ECONOMIC ASPECTS

Evaluation is the process by which one could know the level of achievement of project objectives targeted before starting the project. After getting result form evaluation study, it is possible to made alternation, addition and modification of planning process for the smooth operation of the project during the project period to reach the goal and also have a better concepts of planning to start a new project. In this chapter, essential parameter or indicators which are needed for a project evaluation study, related to the impact assessment of a water resources project are briefly discussed.

2.2.1 Economic and Social Development :

In the water resources project planning, favorable economic analysis of investment shows adequate food production which increases the national income by certain amount. But it is to be admitted that more food production and larger national income are not end themselves. They are inturn means to other ends. If one keeps pursing this question, it will finally be observed that the ultimate objective of public works and the resources development programme is the "well-being" to the society, which is difficult to define. But it is possible to name a number of living conditions that collectively will provide the ingredients for what may be called the "well-being" of a society. These conditions would include the following:

i) Food, clothes and shelter.
ii) Individual and collective security.
iii) Luxury and convenience.
iv) Good health.
v) Good education.
vi) Harmonious family relations.

vii) Pleasant working conditions.
viii) A clean and stimulating environment.
ix) A certain level of culture.
x) A certain level of morality.

In Bangladesh there is no specific guidelines are followed for the evaluation of socio economic study. But in normal practice it is generally carried out with the concept that mostly the landless group of the project area are to be highly benefited. In the case of EIP type project, idea of providing maximum benefit to the landless people make sure the upliftment of socio-economic status of the project area. Some useful terms related to this study are discussed in this chapter for better understanding of the preseeding chapter.

2.2.2 Mathematics of Finance :

The purpose of this section is to make the reader familiar with the mathematical manupulations that are required for the economic analysis of water resources projects. For the sake of clarity, the use of mathematical formulas are kept minimum.

Discount rate or interest :It one person lends money to another person, he is entitled to some from of reward. This reward is called interest. Normally the rate of interest depends on three main factors : the state of economy, the risk involved in the loan, and the expected future rate of inflation.

When i represents the annual interest rate and P represents a present sum of money, while n represents a number of years, then the interest at the end of one year is up. When the investor chooses to withdraw his interest every year, he

will have collected after years a total amount of interest of nip.

However, when investor does not withdraw his interest rate and is able to invest his interest at the same interest rate as his original investment, then it may observe that the original p has increased to p+i alter one year and to $p(1+i)+p(1+i)i=p(1+i)^2$ after two years and to $p(1+1)^3$ after three years. Hence we find that amount f to which and original investment P has increased when subjected to compound interest rate is :

$f= p(i+1)^n$ 4.1

Present Value: It one investes p in the first year for n nos years at i amount interest rate, where f is the expected amount of n years the present value is calculated as

$$p=\frac{F}{(i+1)^n} \quad .....4.2$$

In the economic analysis of engineering projects the concept of present value is often used to compare estimated cost that will occur at different times.

Annuities: Let as assume that the annual sum A is invested at the end of every year on a compound interest basis. We would like to know to what sum these annual investment or annuity has grown, after n years. The last deposit of A, at the end of the nth year, has not accumulated any interest yet, and has therefore a value of A. The second last deposit is worth A(1+1). The third last is worth $A(1+i)^2$ and so on. We may therefore write :

$F=A+A(1+i)+A(1+i)^2 + ----------A(1+i)^{n-1}$

Multiplying both side by (1+i)

$F(1+i)=A(1+i) + A(1+i)^2 + \ldots + A(1+i)^n$

The result :

or $Fi= A(1+i)^n - A.$

$$F=\frac{A\,[(1+i)^n-1]}{i} \qquad \text{--------4.3}$$

Comparing with eg 4.2, we can write.

$$P=\frac{A[(1+i)^n-1]}{i\,(1+i)^n} \qquad \ldots\ldots\ldots\ldots\ldots\ldots 4.4$$

From eg. 4.3, we have

$$A=\frac{Fi}{(1+i)^n-1}$$

Comparing with eg 4.3

$$A=\frac{Pi(1+i)^n}{(1+i)^n-1}$$

Benefit: Water resource project benefits may be classified into two different criteria: Direct benefit and indirect benefits. Direct benefits are the immediate result of the project, such as the production of electricity, or the prevention of flood damages, or the increased firm production. Indirect benefits are those results of a project that are of a subsequent nature, such as stimulation of industry, or the increase in general taxation level, or the

increase in profits of all enterprises that supplies goods to, or that purchase products from, those people who realized the direct benefit from the first place.

The economic study requires to evaluate all consequences in commensurable monitory unit. Those benefits which could be measured by monetary unit are known as tangible benefits. But there are many values which defy such quantification. Unique or extremely rare values such as species of plant or animal life or sights of usual beauty have no acknowledged money value. Neither have direct effect on human beings physically loss of health or life, emotionally through loss of national prestige or personal integrity, or psychologically through environmental changes. We do monetary values serve to measure the achievement of such extra economic goals as income redistribution, increased economic stability, or improved environmental quality. Each value which can not be expressed as monetery terms is known as intangible benefit.

(a) Flood control benefits.

The elimination of flooding, or the reduction of the frequency of flooding, has a two fold beneficial effects. First, it prevents the occurance of flood damages. Second, if will stimulate increased food production in project area. In most cases, flood control benefits fall primarily in the first category, with the increased production benefits being of a secondary nature. Flood damages may consist of the following items:

i) Physical damage to buildings and their contents: bridges, highways, railways etc. The amount of damage is to be appraised in terms of the cost replacement, or repair of the property.

ii) Agricultural crop losses: These are to be appraised interms of market value , less any cost that had not yet been incurred at the time of loss.

iii) Loss of income due to interruption of business: The loss should be appraised interms of goods and services that would have been produced of the flood had not occurred.

iv) Cost of flood fighting, and the evacuation,care and rehabilitation of flood victims. It must be emphasized that the double counting between items 3 and 4 is to be avoided.

There is a relation between flood slags and flood damage. It could be obtained from a systematic survey of project area. The survey should not only be concerned with inquiries about damages that resulted from recorded flood, but also with potential damages that could result from floods of greater magnitude, perhaps upto the maximum possible flood. If different sections of total flood area are affected by different degrees by certain flood control measures, it may desirable to prepare separate flood damages curve for each of these sections. There are four principal engineering measures to control floods:

a) Reservoirs:
b) Dykes
c) Diversions.
d) Channel improvements.

b) Reclamation benefits: Reclamation of land means the restoration of raw and natural conditioned land to a desired state of cultivation. This can be accomplished in two ways depending on the natural state of land. It one land in subjected to periodic tlooding the

reclamation measures consists of building dykes to keep the flood water off the land, and excavation ditches and, canals to maintain a desired ground water level. If land suffers from a shortage of moisture, the reclamation measures consist of irrigating the land by means of storage reservoirs, canals and ditches. In bolh cases, however, the objective is the same, namely to provide the land with optimum moisture conditions.

Reclamation benefits may be defined as the increases in net firm income, resulting from the construction and operation of the principal reclamation works. The increase in net firm income must be calculated as the difference in net firm income for the project area with and without the principal reclamation works.

2.2.3 FINANCIAL AND ECONOMIC PARAMETERS FOR ANALYSIS

The financial and economic analyses have been made on the following assumptions and unit figures:

* Lifetime of the projects is generally fixed on 20 years. Excavation projects do have a shorter life span, for example in the 1990 appraisal 10 years has been taken for jamgaon Danra.

* Construction period has been estimated at 4 years, except for the Gur-nagor mini polder, where 3 years has been taken.

* The discount rate has been established at 15% (1990: 15%)

* Wage of unskilled labour has been estimated at 40 Tk/day for construction and earth work and 40 Tk/day agricultural labour.

* The following conversion factors have been used to transfer financial to economic prices:

- Unskilled labour	0.70
- Seeds for all rice varieties	0.96
- Urea	1.54
- Tsp	1.09
- Mp	1.43
- Pesticides	0.91
- Rice	0.96
- Standard conversion factor	0.81

These numbers have been taken from a recent update by the MPO (Master Plan organization).

The standard conversion factor has been applied to the costs of irrigation water and acquired land.

* The market price of rice has been taken at 5900 Tk/tons.

* The ratio of unskilled labour in the investment costs has been estimated at 95% for earth work (embankments and excavation) and 40% for structures. All other costs are taken as local costs (SCF applied).

* Only 75% of the costs for unskilled labour benefits this group.

* Agricultural benefits only consider changes in paddy production. Rabi crops contribute to benefits but changes are difficult to estimate, moreover benefits are expected to accrue more to the NTG than the benefits of increased Paddy production. Consequently economic indicators should be considered to be lower boundary estimates.

* Total investment and maintenance costs are increased with 5% for contingencies; 8% for engineering and supervising and 2.5% for overhead.

* The expected increase in agricultural production is not applied in the first year after finalizing the construction. It has been estimated that 50% of the increase is reached after 3 years.

* Investments related to "social issues", such as tubewells and cyclones, have not been taken into account for the benefit cost computations.

A spreadsheet computer model has been used to calculated the economic parameters and the distribution of benefits.

MAINTENANCE

Embankments are assumed to be completed in the third year of a four year construction period. Maintenance is considered: (i) during construction; and (ii) during a special three years O & M programme, to be implemented after completion of the construction.

Maintenance during construction is equally divided split over the last two years of a four years construction period.

Annual costs for routing maintenance, referring to this maintenance during construction and for the three years O & M, are estimated as follows:

* Full flood embankment: Tk 20,000 per km
* Submersible embankment: Tk 40,000 per km
* Sea dike embankment: Tk 50,000 per km

Structures are finished in the last years of the construction period and maintained for a period of three years under the three years O & M programme. Annual costs are taken at 2% of the investments related to all structures.

Re-excavation is not included in the maintenance programme. Emergency maintenance is included in the three years O & M and estimated at 1% of the total construction costs.
After the three years maintenance period, long term annual maintenance is estimated at 2% of the total investment costs (excluding contingencies, land acquisition, overhead and supervision).

S-INDEX

Since a number of years, the social index (S-index) has been calculated for each project. The S-index indicates the distribution of land over the different land holding categories. It has been argued that the higher the S-index, the more socially feasible is the project. Preferably, the S-index should be higher or at least equal to the national average of 0.9. Much weight has been given to the S-index addition to the technical and economic feasibility of a study.

Since the 1990 appraisal, this index has only been used in the pre-selection and feasibility phase, but not in the appraisal proper. The following explains first the methodology behind the S-index. Subsequently, it is explained why this S- index is not used any more in the appraisal.

For the calculation of the S-index, the percentage of the benefited area owned by each class of peasants is multiplied by a weight factor. Since the target group of EIP consists of landless, marginal and small peasants, the benefited areas belonging to these groups are given higher weight factors:

Table 2.1: **Categorization of farmers for S-index**

Peasant class	land holding (ha) (acres)		Multiplication factor
Landless peasants	0	0	(3)
Marginal farmers	0-0.99	0-0.39	2
Small farmers	1-2.99	0.4-1.9	1.5
Middle farmers-1	3-4.99	1.2-1.99	1
Middle farmers-2	5-6.99	2.0-2.79	1
Large farmers	7	2.8	0

The S-index is calculated for land owned, according to the formula:

$$\text{S-index} = \frac{2\,L1 + 1.5\,L2 + L3}{100}$$

Where:

L1 = Percentage of land owned by marginal peasants
L2 = Percentage of land owned by small farmers
L3 = Percentage of land owned by middle farmers.
The S-index for Bangladesh as a whole is 0.9

Over the last years the S-index consideration has been modified considerable. The way of reasoning has been that the prevailing pattern of land ownership is just one, yet very important social indicator. Attention has been paid in a more pronounced way to factors such as:

a. Geo-physical features of an area;
b. Modes of land employment;
c. Ways in which organizations of people find expression;
d. Residence and expenditure patterns of land owners; and
e. The distribution of benefits over target and non-target group.

New categories of farmers are given as below:

Table 2.2: New categorization of farmers (in acres)

Peasant class	Old EIP classes	GOB classes
Landless peasants	0 -	0 - 0.49
Marginal farmers	0 - 0.99	0.5 - 0.99
Small farmers	1 - 2.99	1 - 2.49
Middle farmers 1	3 - 4.99	2.5 - 4.99
Middle farmers 2	5 - 6.99	5 - 7.49
Large farmers	7 & Above	7.5 & Above

2.3 Evaluation of Agricultural Aspects :

In agronomic analysis, area under different flood depths are taken from the technical reports prepared by the field division of BWDB. Information on present cropping patterns and their extent of coverage on a percentage basis in different elevations, were collected through farmer interview during field visit to individual projects. Based on these, absolute area under different crops were estimate. Area actually suffering crop damages and weighted average damaged yield data were also collected and used for making a realistic and accurate assessment of present production. Cost of production were computed using data on the level of input use in each crop, collected from farmers during field visit to individual project. Future projections in respect of crop area and yield are based on cropping patterns presently practicised by farmers in problem free area within the project. This has been done for avoiding optimistic projections. Finally the net incremental benefit has been calculated using financial prices of inputs and government procurement prices of agricultural produces. In case of economic analysis, conversion factors and economic prices were used.

2.4 ENVIRONMENTAL ASPECTS

Since the 1950s growing environment awareness is increasingly focusing attention upon the interactions between development actions and their environmental consequences. In developed countries this has led to the public demanding that environmental factors be explicitly considered in the decision making process and a similar situation is now occurring in developing countries. Early attempts at project assessment were crude and often based upon Technical Feasibility studies and Cost Benefit Analysis (CBA). CBA was developed as a means of expressing all impacts in terms of resource costs valued in monetary terms. Flaws in CBA became more apparent and one consequence was the development of a new evaluation approach which came to be known as Environmental Impact Assessment (EIA). It has evolved as a comprehensive approach to evaluation, in which environmental considerations, as well as economic and technical considerations, are given their proper weight in the decision-making process.

Environmental impact assessment (EIA) has been initiated in response to a recognition that a broad range of concerns arise when human societies alter their environments. Environmental consideration have generally been ignored or neglected in development planning in most developing countries. Exploitation of nature without due care to its repercussions could lead to the disruption of social harmony due to the loss of human life, disease, destruction of forest and wildlife resources, degradation of fisheries -and all these negate the very objective of development as has been painfully realized in most developed countries. Developing countries, faced with the prospects of an overgrowing population and a standard of living which, for

the majority of their population, is subsistent, are now engaged in a determined effort to develop. Economic progress is the goal of all developing countries with an eye on improving the lot of its people, to alleviate the pressures on them and on the land, and to provide them with a better future. This development effort, in today's global context, has translated into rampant exploitation of the available resources and industrialization at the maximum possible pace by the use of technology . A side-effect of such an effort has been the adverse impact on the natural environment.

Consideration to the environmental aspects of development is not loss but a gain, as remedial action at a future date will cost considerably more and the damage done may be irreversible. Any development requires not only the monetary cost-benefit, but also and impact assessment to look into its environmental effects . So it must encompass environmental consideration at its planning stages. Correct choice of technology that would minimize the impact on the environment and enhance the quality of life is a necessity.

2.4.1 Initial Environmental Examination:

It is a question that how to determine whether the EIA process is needed for projects of smaller size and lesser complexity .

The first of preliminary step in applying the EIA process is to conduct an Initial Environmental Examination i.e., a "pre- EIA", which can be completed at low cost.

The EIA process may be likened to a project feasibility study (FS) and the IEE to the pre-fesibility study (PES) processes. For every project which is to be implemented,

preparation of the FS is routine, but the FS (which usually involves significant costs) is not undertaken unless the preliminary step of the (PFS) (preliminary Feasibility study) (relatively little cost)shows that the FS is merited.

Usually a professional input of one man week or less will suffice, if the work is done by an expert. If the initial environmental examination (IEE) shows that the project will likely not exercise and significant adverse effects, then this IEE or pre EIA becomes the total EIA and the EIA process is finished.

If the IEE shows that significant adverse effects are likely, then the IEE report must include the for the follow-up EIA study including (i) types and amounts of skills required, (ii) time required and (iii) estimated EIA costs .

With respect to the size of project which requires applications of the IEE/ EIA process, while it is true that for same type of projects a size may be delineated below which there is little likelihood of adverse effects, there are important exceptions, especially for industrial operations (Ludwigetal,1988) . For example, a small metal plating plant can seriously damage water resources because of the toxic substances used in the processing. Similarly many small scale mining operations can have very serious adverse effects. The best policy , whenever there is any doubt at all, is to apply the IEE process (which is always affordable), to determine whether any follow-up EIA studies will be needed , regardless of project size.

2.4.2 Environment impact assessment process

The EIA process seeks to infuse such actions with a sensitivity to their consequences, by providing an opportunity, within the decision making process to consider the effects of actions that may negatively affect the environment or certain groups of people even though they appear economically profitable. The EIA process thus has at least three roles to play: to identify the impacts of actions; to provide some decision making criteria for distinguishing the severity of impacts of alternative actions; and to communicate the assessment of consequences to the appropriate decision making.

EIA serves to provide organized information transfer on relevant aspect to decision makers. This process of assessment is forward looking seeking to predict the status of the environment with and without the development alternative. It includes identification, measurement analysis, interpretation of technical knowledge and application judgment and presentation. The interrelationship between policy, action and assessment is shown in figure 2.1

The results of the process are displayed in a report, document, or statement . On the basis of such a report, decision-making would easier and the objectives of the projects would more or less be acieved . For instance, it should be clear from reading the document why certain issues were considered and others were not; what alternatives were liminated and why; how comparisons were made; and what determined the ultimate choice.

The basic components and steps of and environmental impact assessment as shown in figure 2.2 for development scheme are

the following :

1. Defining objectives : Specify the objectives re levant to the development stage (e.g. , national economic development, flood control, drainage improvement , irrigation, etc.).

2. Existing environment : Evaluate the existing environment, resource capabilities and expected conditions without and scheme;

3. Alternatives : Formulate alternative schemes or projects to achieve varying levels of contribution to meeting the specified objectives. If one is already proposed, indicate this.

4. Identification/prediction of effects : Identify major and any significant secondary or tertiary effects and estimate future consequences for all or for selected alternatives;

5. Assess impacts : Analyze the difference among alternatives to show extent of impacts and trade off among specified objectives;

6. Formulation of usable recommendations : Use information generated by EIA to provide input into the design of the proposed project and alternatives, to minimize adverse effects;

7. Evaluate and choose : Select a recommended scheme from among the various objectives.

2.4.3 Methodologies for EIA

As a small project, no environmental impact study has yet been made by any organization or BWDB for EIP projects.

Although EIP projects are small, these like any other projects might have some effect on environment. A well thought out consideration of all attributes potentially impacted by an action , based on critical case studies of past experiences with similar actions is perhaps the most fundamental aspect of an EIA. The emphasis and purpose of the process, after all, is to bring potential impacts to the awareness of decision makers. The increasing sophistication and complexity of methods developed recently does not necessarily imply that these methods are either superior or more often used. There are approximately 100 methods for carrying out EIAs (Davis and Muller, 1984) but most of these can be divided into just a few classes . The following 8 methods are discussed here.

- Check lists
- Environmental evaluation system
- Matrices
- Networks
- Disaggregated methodology
- Overlay
- Cost benefit analysis
- Simulation modelling/ Adaptive environmental assessment

Checklist Methodology

Checklists are lists of environmental parameters or impacts indicators which the environmental analyst is encouraged to consider when identifying potential impacts. It represents one of the most basic of all methodologies used in impact assessment.

Checklist methodologies range from listings of environmental factors to highly structured approaches involving importance

weightings for factor and the application of scaling techniques for the impacts of each alternative on each factor. Simple checklists represent lists of environmental factors which should be addressed; however no information is provided on specific data needs, methods for measurement, or impact prediction and assessment. Simple checklists were extensively used in 1969.

Descriptive checklists refer to methodologies that include lists of environmental factors along with information on measurement and impact prediction and assessment. These checklists are widely used in environmental impact studies. Carstea, et al 1975 . . developed a descriptive checklist approach for projects in coastal areas. The methodology addressed the following actions/projects; riprap placement; bulkheads; groins and jetties; piers, dolphins, mooring piles, and ramp construction; dredging capital and maintenance ; out falls, submerged lines and pipes; and aerial crossing. For each of the actions/projects, environmental impact information was provided on potential changes in erosion, sedimentation, and deposition; flood heights and drift; quality; ecology; air quality; noise; safety/ navigation; recreation; aesthetics; and socio economics (PADC, EIA,1983)

Environmental evaluation system (EES)

The environmental evaluation system as developed by Battle Laboratories of Colombus, Ohio in the United States for the United States Bureau of Reclamation is Specifically oriented toward water resources projects (interim Mekong Committee, 1982) that are included in the checklist and instructions for their relative scaling with respect to other parameters and for the assignment of importance units. It is based

initially on a hierarchical checklist of 78 attributes or parameters, each to be represented by a numerical value.The EES is used to evaluate the expected future condition of the environmental quality "with " a "without " the project. A difference in Environmental Impact Units (EIU) between these two conditions either an adverse impact, which corresponds to a gain in EIU units. Mathematically, this process may be represented as follows (Calabrese,1976)

$$EI = \sum_{i=1}^{M} (V_{i1} * W_i) - \sum_{i=1}^{M} (V_{i2} * W_i)$$

Where

EI = envrionmental impact

V_{i1} =value in environmental quality of parameter i_1 with project

V_{i2} = value in environmental quality of parameter i_2 with project

wi = relative weight (importance) of parameter i

m = total number of parameters

To aid in transforming these parameter estimates into an environmental quality scale, value function graphs are used for each of the parameters in the system. Dee et al (1972) suggested the use of the following procedure to determine value functions for an environmental parameter.

1. Collect information on the relationship between the parameter and the quality of the environment .

2. Order the paramete scale, which is normally the abscissa, so that the lowest value is zero.

3. Divide the environmental quality scale into equal intervals ranging between 0 and 1, and determine the appropriate value of the parameter for each interval. This process is to be continued until a reasonable curve may be drawn.

4. Steps 1 or 3 should be repeated by various experts independently. The average values should produce the group curve. If parameters are based on value judgments alone, a representative cross section should be used.

5. If there are large variations among the different experts. a review may be performed.

6. Steps 1 to 5 to be repeated by various groups of experts to test reproducibility.

This procedure should be conducted for all the environmental parameters of interest of concern. It may be noted that this procedure is somewhat doubtful in nature.

There are a number of advantages to be obtained in using this system .It is very comprehensive in that it provides an extensive checklist of environmental characteristics and impacts that should be considered in water resource projects; both spatial and temporal aspects of identified impacts are accounted for in the weighing system. The system has also some important disadvantages. The aggregation of all values into an overall index tends to lose considerable information . It ignores economic impacts and only partially deals with social impacts.

Matrix methodology

An environment matrix is an extension to the use of a checklist It employs a list of project activities in

addition to list of environmental characteristics or impact indicators. The two are related in a matrix in order to identify cause-and - effect relationships . Column headings generally list the project activities while the row headings show the environmental characteristics of the affected system. Entries in the resulting matrix cells may simply show that an interaction takes place (the simple interaction matrix) or they may be qualitative or quantitative estimates of the interaction (qrantified and/or graded matrices.)

Leopold, et. al. (1971), designed one of the first matrices used to assist in the evaluation of the environmental impact of a resource project. Each cell in the Leopold matrix requires three operations:

- if an impact is possible, place a diagonal slash across the cell

- on the upper side of the slash, place a number from 1 to 10 indicating the magnitude of possible impact (1 is the least, 10 is the highest)

-on the lower side of the slash mark, place a number from 1 to 10 indicating the importance of possible impact (1 is the least, 10 is the highest).

Magnitude is defined as the degree of extensiveness of scale of the impact, while importance is a weighting of the degree of significance of the impact. The former can be based on fact, while the latter is based on judgment.

When all the relevant boxes have been marked a simplified matrix is then constructed which consists only of those

actions and environmental characteristics which are interacting (i.e the cells which have slash marks.) Leopold et al suggested that special note might be taken of boxes with exceptionally high individual numbers,by circling or otherwise marking the box.

Most practioners of EIA suggest that one of the main attributes of matrices is their highly visual nature. They can be equally useful in communicating ideas to the public or the decision-makers. A major deficiency of simple matrices is that, while first-order impacts are identified, second-order and higher interactive effects between impacts cannot be shown.

Networks

Networks are extensions of matrices and were proposed for use in environmental assessment work by Sorensen (1971). The approach involves the development of a "stepped matrix" of "cause-condition- effect network" to indicate the nature of environmental interrelationships. The networks is in the form of a tree called a relevance of impact tree. It is used to relate and record secondary, tertiary and higher order impact. To develop a network requires answering a series questions related to each of the project activities such as : what are the primary impact areas, what are primary impacts within these areas. What are secondary impact areas and so on. Networks were originally developed expressly for coastal zone planning and for addressing two issues especially pertinent to this zone: resolution of conflict among competing uses, and control of resource degradation (Sorensen 1970).

The procedure begins with a list of environmental attributes. These are linked by lines in a large diagram which are direction and magnitude of energy flows between all components. Activities associated with a particular project likely to cause impacts are included in the system diagram.

A network method may be suited for single-project assessments and is not recommended for large regional actions. In the latter case, the display may sometimes become so extensive that it will be of little practical value, particularly when several alternatives are being considered. Although not widely applied, Sorensen's approach has many advantages. Provision is made for identifying not only term effects, but also direct and indirect impacts. The relationship between cause and effect is the case with the network facilitates environmental design .

The approach cannot be described as a complete assessment system because there is no explicit consideration or alternative projects, beneficial impacts, nor is there an attempt made to evaluate the magnitude or significance of the impacts.

e) Disaggregated Methodology

Disaggregated methodology have evolved out of a dissatisfaction with quantitative assessment techniques which attempt to group diverse measurements and value judgments into one final number to express the total evnironmental, social and economic impact of a proposed action. An example of a disaggregated methodology is the Water Resources Assessment Methodology (WRAM) developed by the United States Army Corps of Engineers.(Interim Mekong Committee,1981).

WRAM begins with Checklist of "critical variables" selected by an interdisciplinary team consisting of professionals and local representatives familiar with the area under study. After pair wise comparisons of each variable with each other variables, variable weighting are expressed in "Relative Importance Co-efficients." The relative magnitudes of different impacts on the same variable is determined by a scaling system similar to that used in EES, with the result that impacts are scaled from o to 1, and not expressed in individual measurement units such as parts per million or kilocalories. For comparison among alternatives, "accounts" of impacts on each variable arising from different alternatives are listed. Account scores for each alternative are not aggregated , as it is intended that the separate scores for each impact will be used for the identification of trade-offs in decision-making.

As with other checklist based methodologies, WRAM does not incorporate a dynamic concept of time, and does not express interactions among impacts and cumulative and feedback effects.

Although accounts may be presented in an easily understood manner, the methods is rather weak in conveying meaningful information about direct, secondary and higher order impacts to decision makers and the public.

f) Overlay mapping

The overlay approach to impact assessment was first innovated by associated with Ian Mcharg. The essence of the method involves the use a set of transparent maps of a project area's environmental characteristics (physical, social, ecological, aesthetic, etc.). In general, the study area is subdivided into geographical units, topograhic

features, or differing land uses. Within each unit, information is collected on a variety of attributes subdivided among the categories of climate, geology, physiography, hydrology, soils, vegetation, wildlife habitats, and land use.

Within each category, those attributes most relevant to a particular problem are considered. In practice, attributes are often measured on an ordinal scale; for example the incidence of water pollution may be measured as high, medium or low.

For each attribute a transparent map is constructed using gradations of color to indicate areal extent and value rating within a geographical unit. All maps are then superimposed to produce a composite of all attributes. With this series of overlays, land use suitability, action compatibility and engineering feasibility are evaluated visually, in order that the figure 4.7 for agricultural suitability.

In recent years, overlay techniques using computer mapping to analyze data and search for areas of least impact have been developed.

The overlay approach is generally effective in selecting alternatives and identifying certain types of impacts, land use conflicts, or trade off in their spatial dimensions.

It also provides a very effeective, visual mode of synthesizing and conveying alternatives to an audience. However, the method does not lend itself to any measurement or expression of the magnitudes of impacts, nor the identification of secondary and tertiary interrelationships

among impacts. Clearly , the method is highly subjective , relying almost entirely on the assessor to identify, evaluate and judge compatible and incompatible land uses. The method can tend inherently toward too great a simplification ; there is no mechanism that requires comprehensive consideration of all impacts. In particular, many social and economic values are not considered.

Since there is a limit to the number of transparencies which can be viewed simultaneously, the approach is self limiting. In practice, overlay methodologies are rarely used as the sole basis of environmental impact assessment.

g) Cost benefit analysis

The ideal EIA methodology would be one which accurately incorporates the environmental costs and benefits of a project within conventional economic/ engineering cost benefit analysis.

This would be ideal because it would be much easier for decision makers to comprehend and evaluate. This methodolology is concerned not merely with effects on environmental quality, but rather, it seeks the conditions for sustainable use. It strives to evaluate effects in monetary terms and to express conclusions in an economic, cost benefit format.

The methodology developed by United Nations Environment Programme (UNEP) is an assessment system, utilizing the natural resources data base inherent in the convertional EIA as starting point , but refining it for the purposes of

development related decision making. The approach is therefore more oriented towards a resource use and management approach, more closely related to developmental planning and sought to be more directly linked to a decision making process. (ESCAP,1985)

The framework of the model is provided in the following six part format :

- Essential project description which set the physical and economic parameters for the analysis.
- Itemizing of the resources used in the project, indirectly affected, and residues created.
- Itemizing of the resources exhausted, depleted or deteriorated.
- Itemizing of the resource enhanced.
- Listing of the required additional project components.
- Summary of the conclusions and the formulation of the integrated cost benefit presentation.

The methodology developed by the East West center includes two specific approaches which are :

- defining and quantifying the significant natural system factor that can limit the success of development projects, and

- evaluating these factors in economic terms for cost benefit anlayis .

The significant criteria included are :

(a) dependence of development goal on natural system
(b) spatial extent of the effect
(c) degree of irreversibility
(d) urgency or the rate at which problems get worse.

Cost benefit analysis of the type assessment natural systems are not merely concerned with the effects on environmental quality, but rather, it seek the conditions for sustainable use of the natural resource in a region. This type of approach is not useful for scale development projects, but is better suited for the analysis and evaluation of a regional development plan.

The advantage of cost benefit analysis is that nature of expense and benefit accruable from a project are provided in monetary terms as is a common practice in traditional feasibility studies and hence enables understanding and aids decision making tremendously.

The difficulty encountered in the use of the technique is, of course that impacts have to be transformed and stated in explicit monetary and this is not always possible, especially for intangibles like the monetary value of the damages to health due to the advent of cholera,etc.

Simulation Modelling Workshops

Modelling methodologies for impact assessment, as they have been developed in recent years, have been designed to provide holistic approaches to the assessment process. Specifically, the Adaptive Environmental Assessment (AEA) procedure developed by Hollin and co-workers is intended to be used both for planning and for actual management of the area or resource modeled. In this way, the model serves less as and assessment of individual

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projects, and more as a tool to integrate impact analysis into large-scale plan and project formulation and execution. Central to the AEA process are workshops and extensive communication among a selective group of specialists and managers. The entire procedure is intended to be very flexible and adaptable to the varying needs of assessment. (Interim Mekong Committee, 1982)

Initially, a project manager sets up a study team consisting of bilolgists, econqmists, and other specialists, with a support staff having skills in ecology and modelling. A core group from the study team runs workshops, constructs conceptual or computer models and produces analytical output form alternative runs, while other specialists are called in as needed. Three or more workshops are held in the course of the process, including all specialists and ideally, representatives of environmental management agencies.

2.4.4 Choosing a method for MASHAJAN-LAUHAJANG project

The first workshops serves to define and bound the choosing a method in mashajan lauhganj project every project

development interacts with its human and natural environment in ways that are determined by its nature of the project, the specific characteristics of its surrounding and the interactions between these two sets of factors.

Since the overall study is involved with engineering study & socio economic study, the environmental impact assessment for this study is to be considered within very simple analysis . Because of adequate manpower, tends and time cosideration, CHECKLIST method is to be used in this context.

Following guidelines are used to adopt the checklist method which will be not very extensive but expected to be very informative.

Environmental parameters to be considered

Table 2.3 contains a list of environment parameters which should be reviewed in relation to proposed project development. The extent ot which any of these factors would be affected by the project should be described in the EIA.

where necessary, appropriate remedial measure should be incorporated into project evaluations. The following factors are to be considered in evaluating the potential environmental implications of irrigation projects.

TABLE 2.3: Environmental Indicators

Category	Sub category	Indicators
Geophysical		
	Soils	Soil type soil characteristics depth to water table
	Topography	watershe description,watershed map & drainage areasrelief
	Erosion/ sedimentation	local Erosion Problem Erodability of soils Local sedimentation problem stream bed loads.
Hydrology	Surface water	Inventory of water sources Inventory of water withdrawals

	water budget lake water surface elevations Surface area Lake stratification Depth offlow Flow velocity Discharge (average, low peak, seasonal variation) Flood and drought records (include flood frequency analysis)Flood control facilities Stream order Reservoirs (purposes, operating schedule)
Groundwater	Salt water intrusion Permeability of aquifers Depth to groundwater Yields Seasonal variations Long term trends Recharge areas Recharge rates Inventory of withdrawals Inventory of deep-well discharges
Meteorology	Temperature (daily and seasonal variation, high, low, mean) Wind (speed, direction,wind rose) Precipitation (seasonal

		variations,extremes,storm frequency analysis)Humidity (daily and seasonal variations)
Water quality	Surface water	Classification
		Stream standards
		Temperature
		pH
	Surface water	Conductivity
		Turbidity
		Total dissolved solids
		Total suspended solids
		Color BQD (5-DAY 20 C)
		BOD _ultimate
		COD 1/
		TOC 1/
		Dissolved oxygen
		Hardness Alkalanity
		Acidity Nitrate
		Amonia Total kjeldalh

		nitrogen Organic nitrogen
		Phosphate Ortho-phosphate
		Organic phosphorus
		Sulfates Cloride Flouride Iron Manganese
		Magnesium Potassium sodium calcium
		Silica Mercury Phenol Total coliforms
		Fecal colifoms sodium adsorption ratio
		(SAR) Pesticides Radioactivity
		Surfactants Heavy metals Trace Organics
		Carcinogens
	Groundwater	(Same indicators as for surface water)
Water	Water use	Flow (daily and seasonal variation)
		Residential water use Industrial water
		use Agricultural water use Commercial
		water use Municipal water use Metering
		systems Water Importation Water
		diversion
	Water treatment facilities	Intake water quality
		(Sea water quality
		indicators above) describe

		intake Describe plant Design capacity demand(time variation) Chemical additions Energy requirements Sludge type and quantity Sludge disposition Operational difficulties
	Distribution system	Size of lines Age and condition of lines Capacity flow (daily and seasonal variations) Pressure Storage requirements and capacity
Wast water system	Collection system	Sewer sizes Sewerage and condition Capacity Current flows (daily and seasonal variations) Problems (odor, sludge, etc.) Infiltration/ inflow analysis Stormwater Collection (separate and combined sewers)
	Treatment system	Describe system Locate facilities

Age and condition of plants Design capacity Raw waste characteristics (See water quality indicators above) Effluent characteristics (see water quality indicators above) flows and loads (average and loads (average and time variation) Describe sludge handling system Sludge type, quantity, moisture content, disposition outfalls Operational difficulties Outfalls Operational difficulties (door, insects,poor effluent, etc.)

1. Biochemical oxygen demand : Chemical oxygen demand: Total organic carbon.

1 A. General characteristics

An irrigation project generally serve to supply water to agricultural crops, supplementary natural rainfall. The crops are grown by farmers on small operating units. The increased crop production resulting from irrigation and other inputs provide additional resulting from irrigation and other inputs provide additional food and income to the farm water management aspects of irrigation projects aids in irrigation projects aids in irrigating as efficiently as feasible to reduce the waste of water and to increase production.

B. LOCATION SENSITIVE FACTORS

Soil, topography, water quantity and quality, access to markets, sources of agricultural inputs, the land and water uses, native flora and fauna, available rural population potential long term agricultural improvement factors in siting successful irrigation systems are normally located in the most favorable sites of a given region but these system often can benefit from project improvements.

Soil characteristics and land topography affect erosion, crop production potential, percolation below the crop root zone, and water run-off. The intended cropping pattern and irrigated area must be matched with an adequate water supply of acceptable quality. Preproject allocation of available water and land to other uses may limit project size.

C. Natural Environment

Serious soil erosion may occur when water is applied to steep slopes by various irrigation methods, unless the topography is modified by land granding and land shaping.

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The quality of the irrigation water may be determined if undesirable chemical products from industrial plants, other irrigated areas of saline/alkaline ground water are presents. Pesticides, herbicides and fertilizers in run-off water and most often harmful downstream users although some can be beneficial it similar crops are grown. Plant disease spread easily when water from an infected field in applied to another field with a susceptible crop. A large amount of irrigation or storm water run-off, through wasteful in some respects, may dilute chemicals to tolerable levels. Low quality water can be made usable by diluting it with high quality water.

D. Human Environment

An irrigation project leads to intensification of agriculture and tends to increase population density. Provision must be made to accommodate these people interims of housing, schools, shapes, road ways, cemeteries and cultural and religion centers. A common environmental concern associates with irrigation project is water related human health problem, some of which are mosquito-born (malaria, yellow fever, encephalitis), snail transmitted (schistosom, in which snail is an intermediate hoste) or water borne (dysentery, leptopirosis, lyphoid fever).

E. Restoration and Resultilization

If the quality is acceptable water in excess of crop needs which runs of an operating unit through surface and sub-surface drainage can be used for irrigation other units, for industrious, animal, fish productions and recreations. Borrow pits and constructed ponds may be stocked with fish, special lands adjacent to pipelines and access ramps in the irrigation and drainage channels can be constructed for watering channels.

F. Design Phase

Many negative environmental implications of an irrigation/ drainage project can be mitigated even avoid through good planning and design. The following items should be considered in the planning and design stages.

Soil type and depth.

Quantity and quality of Available water.

Crop water Requirement

Soil Erosion potential

Flooding potential

Allowable quality and quality of run-off water

Native flora and fauna

Surface and sub-surface Drainage requirements

Irrigation method

Health Requirement

Energy sources (if pumps are used)

Monitoring Programme

Accessory for farm inputs and outputs and for system operation and maintenance.

G. Implementation Phase

Soil is distributed during construction of an irrigation/ drainage project; other is potential for soil erosion by water and wind. Undesirable soil movement can accuse as result of

Land clearing

Land Granding

Worker Camps.

Channels construction.

H. Operating Stage

Negative environmental impacts can occur during the operation of a project due to lack of proper :

Maintenance of canals, Drains and Equipments Water management Monitoring of Flows and ground water.

A cheaklist is prepared with respect to the necessary information.

2.3.5 Limitation and Availability of EIA

The complexities of environmental management problems are vast and the design and implementation of solutions for these problems are difficult. The major limitations faced incorporating EIA into the planning phases of a project are the additional costs, incurred in its preperation, delays in the implementation of the project, and the lack of manpower and expertise in developing countries for assessing the impacts. Environmental impact assessment (EIA) is expensive in developing countries mainly for the limited technical and social data base upon impact projections can be made. As a result, large baseline data/information must be collected and this is perhaps the single most expensive and time-consuming endeavor in the preperation of an EIA report. The problem of manpower and expertise is acute in developing countries. It is imperative that developing countries produce local experts to reduce the reliance on expensive foreign expertise to the minimum. The availability of manpower and expertise within a developing country will increase when the opportunities for employment and career prospects in the increase as a result of increased emphasis and requirements for EIA and environmental programmes.

It is, essential that general guidelines for the preperation of EIA reports be developed in the context of developing countries, supplemented by guidelines specific for each development sector. Such guidelines should be practical from the viewpoint of application, comprehensive and through to cover all related aspects, having utility to actual development projects and relevant to the needs and reality of the developing countries. The guidelines provide for monitoring programmes to measure of plan implementation and the degree of effective of the environmental protection provisions.

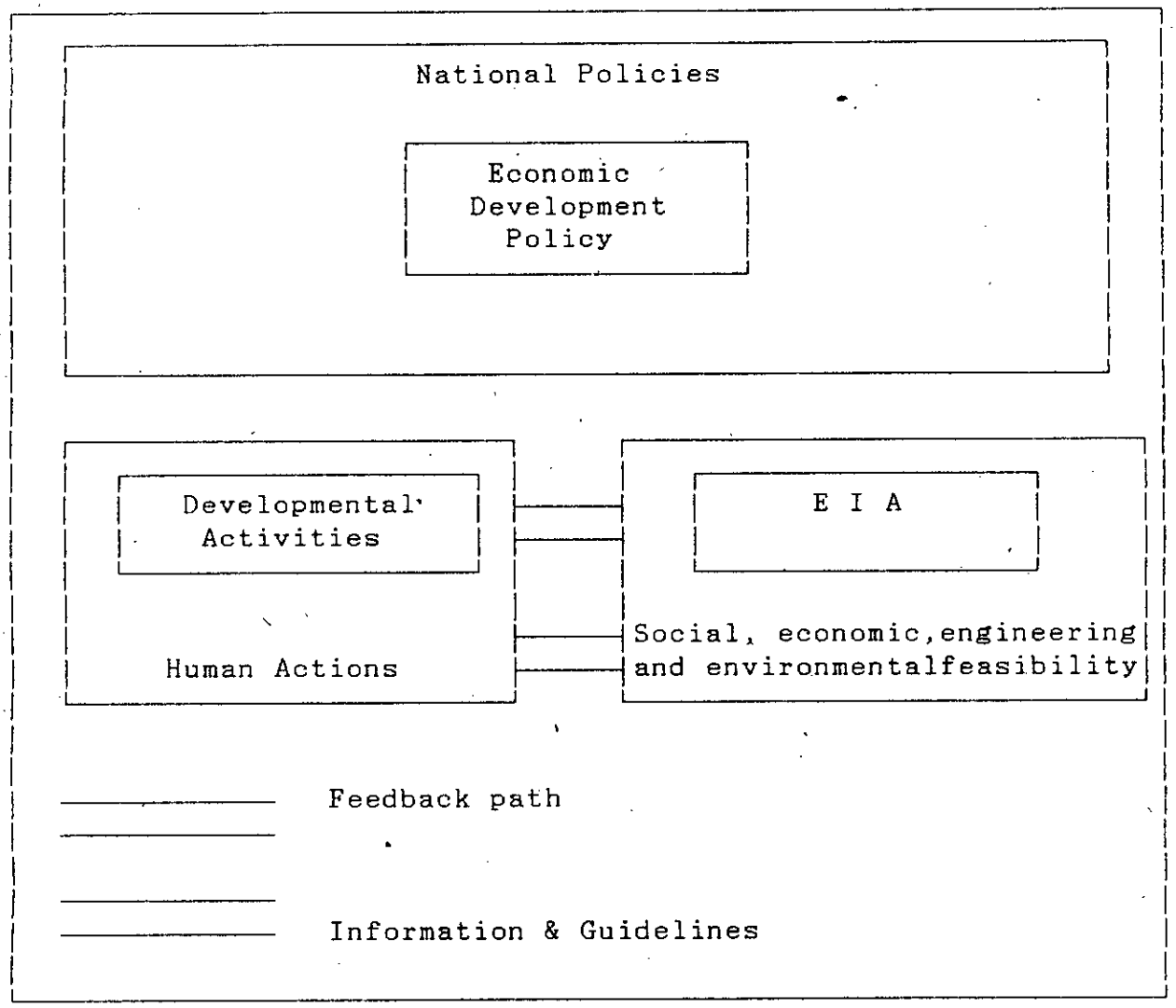


Fig 2.1 Inter-relationship between policy, action and assessment (ESCAP, 1985)

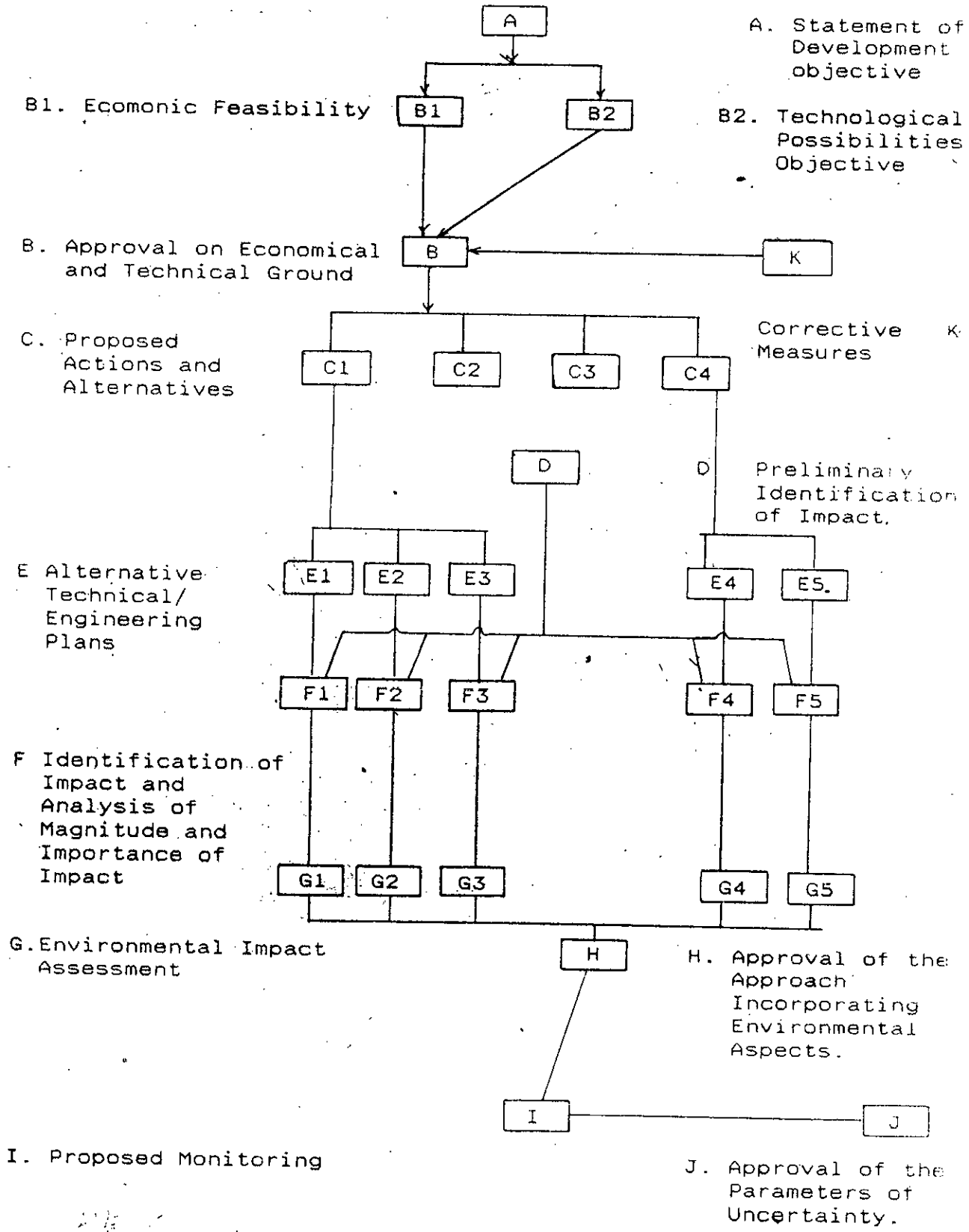


Fig. 2.2 Environmental impact assesment in development planning. (ESCAP, 1985)

CHAPTER-III

METHOLOGY OF DATA COLLECTION:

3.1 Selection of villages.

The project area covers 32 nos of villages. Out of these 10 nos villages are represented in Table 3.1.All the villages under the project are shown in Appendix-I.

TABLE 3.1: Allocation of sample villages for group interview according to land elevation and no. of house holds

Land Vaston	Upto 100 Households		101-200 Households		Above 200 Households		TOTAL	
	Total Villages	Sample Villages	Total Villages	Sample Villages	Total Villages	Sample Villages	Total Villages	Sample Villages
High Land	2	-	5	2	3	1	10	3
Medium Land	3	1	5	2	1	-	10	3
Low Land	8	3	2	-	3	1	12	4
Total	13	4	12	4	7	2	32	10

3.2 Sample Design

A multi stage random sample technique was adopted for sample design with villages as the primary unit design and the household as the ultimate unit of the study. The multistage technique involve drawing of villages by land elevation pattern and household by farm size. In sampling the household for field level interview the initial first step

was to list all the households of the sample villages with cultivable ownership. On the basis of the land ownership the households were divided into five categories as follows :

Landless (no cultivable land)

Marginal (0.004 - 0.405 ha of cultivate land)

Small (0.406 ha - 1.21 ha of cultivable land)

Medium (1.22 -1.62 ha of cultivable land)

Large (above 1.62 ha of cultivable land)

The samples were when randomly drawn basically following the proportion of the villages existing in different categories interim of either elevation or size. Minor adjustment in the proportional representation had been made to cover representative samples from all the strata, hereby introducing a bit of purposiveness in sample selection. Distribution of census sample households according to village land elevation category and firm size is shown in table 3.2 below. Thus for the data required for the agro-socio-economic condition. The project area, household survey had been carried out on firm household in representative villages grouped into three land elevation categories of village inside the project area.

Table 3.2 : Sample villages for group interview

SL.	Name of the villages	Union	Elevation	Nos. of households (As per ND. 1986, population census)
1.	Anaitara	Anaitara	High	163
2.	Agchamari	-Do-	Medium	151
3.	Fatehpur	-Do-	Low	599
4.	Jagat Bharra	-Do-	Low	94
5.	Mashajan	-Do-	Medium	131
6.	Panchdana	-Do-	Low	76
7.	Kaolipara	Banail	Low	84
8.	Kuralipara	-Do-	Medium	97
9.	Nardana	-Do-	High	143
10	Deora	-Do	High	263

3.3 Selection of the year survey.

The years 1981-82 and 1992-93 were taken as the reference years to represent the are project and post project situation. An error elements has been conditioned by small sample size and limited time for observation on impact.

Construction of Questionnaire : Pre-test Modification and operation.

Rapid Rural Appraisal technology (RRA) is now widely used for collecting data related to socio-economic study. This technique needs multi diciplinary group of people for taking interview of the people at site. Due to shortage of adequate manpower, the survey questionnaire was prepared in accordance with the objective of the study. The .

questionnaire contained very simple and direct open-ended as well as pre-coded questions. On the basis of the finding of the pre-test, the questionnaire was modified whenever thought necessary and then finally prepared in English. The questionnaire sought the following major items of information.

i) Identification.

ii) Demographic information of the households.

iii) Landholding and Tenurial Pattern in 1991 and 1992

iv) Topographical information (1991 and 1992)

v) Land Transfer (1991 and 1992)

vi) Terms of Share Cropping

vii) Irrigation

viii) Cropping pattern in 1991 and 1992

ix) Agricultural inputs used.

x) Prospect of HYV expansion.

xi) Cropping Intensity.

xii) Labour supply, employment and wages.

xiii) Crop damage during flood.

xiv) Agricultural credit.

xv) Agricultural Extension services.

xvi) KSS

xvii) Livestock and Poultry.

xviii)Income

xix) Asset owner

xx) Marketting.

xxi) Food consumption and

xxii) Involvement and participation in the use and maintenance of project facilities.

The fornate of the questionnarie to collect the data are attached as **Appendix-J**, Questionnaire for house hold survey and Appendix-K, Questionnaire for group **interview** of village Leaders & Farmers.

In order to collect input and output of the whole year, the researches relied to a great extent on the memory of the farmers. Many of the questions in the questionnaire were built in one another so that cross-checking of data was possible.

3.4 Secondary Data Collections :

Large volume of institutional and other secondary level data

had been collected from the upazilla officers in the project area and also from the published documents of the BBS and also from the field office, concerned directorate and the library of BWDB.

3.5 In depth investigation.

The primary data were supplemented by in-depth investigation and observations in the field. Such information were collected through informal interview and group discussions with various quartous including general farmers and the villagers. Also interview with the opinion leader like union Parishad and Member, school teacher and block supervision etc., the questionnaire has been updated.

3.6 Limitation of the study

a) Inadequacy of Base-line Data.

b) Reliability of Survey Data.

It is experienced that during field survey the farmers often do not furnish true information for reasons personal and or

otherwise. Large farmer most often try to conceal the actual amount of land owned by them and the act of leasing land for fear of losing it. In case of yield also, recall data are susceptible. By observation of the response pattern on the subjects, consultation of village records/documents, frequent visit to the villages, observation of the market behavior and consultation at random with inhabitants, data have been carefully cross-checked.

However limitation due to small sample size compared to population remains, even through the effort was given to made the sample as representative possible.

CHAPTER -IV

ENGINEERING IMPACT ASSESSMENT OF MASHAJAN-LAOHAJANG PROJECT.

4.1 Existing Engineering Infrastructure.

a) Bhorra khal.

i) Location : This khal organating from Bhaiyakura beel and falls at lauhaganj river at Chukuria. This is also connected by three small sides khals which carry water from Bottola beel, Maitakola beel and chelota beel.

ii) Length & Section: Average bed width is about 3.81m with side slope 2.3 where the bed level at outfall is +3.66m (PWD) and the long slope is 1:20000. The length of the khal is about 0.70km.

iii) Present condition : The side khals are in good condition and functioning well. Bhorra main khal also more or less in good condition except a small portion of Gramatia and Deogani where bed width and depth are less than the design. From the downstream of Bhorra sluice to the outfall of this khal was badly silted and

reduced the width and hampering quick drainage.

It is found at site, that the Bhorra main khal is connected by three sub-khal as described below.

Link of Bhorra khal	Length (mile)	Bed width (m)
1. Hossenbari khal	0.22	1.52
2. Mitakhola khal	0.31	1.52
3. Chillota khal	0.37	1.52

The area under the mitakhola beel has been badly silted up due to the entry of heavy loaded sediment water through the Bharra regulator throughout the year. As per public openion at site it is estimated that the farmars of this area has deprived from about 1000 maund crop in each year.

b) Nardana khal.

i) Location: This khal originates from Mashajan beel and runs through kumili and Bhabakanda Beel and falls at Lauhajang river at Nardana.

ii) Length & section: Average bed width is about 6.80m with side slopes 2:3, the bed level at the outfall is +3.68m

(PWD) and the long slope is 1:10000. The lenght of the khal is about 11.90km.

iii) Present Condition: Overall condition of this khal is very poor. The main khal has been coonnected by two sub-khal as below.

Link of Nardana Khal	Length (Km)	Bed width(m)
1) Nardana khal	3.05	1.52
2) Bangalla khal	2.45	1.52

Due to land aquisition problems and public opposition, necessary excavation works were not completed for which the khal becomes irriguler. At Chamari and Fatehpur, the bed was higher than the upstream and the bed width is also less than the design. At Chamari and Fatehpur, the bed was higher level than upstream and the bed width is also less than the design. At Nardana the bed of the khal was badly silted up (0.60 to 0.90m) which gratly affected the drainage facility. The outfall of Nardana khal at Lauhaganj river was badly silted up to the river bank level which is hampering the

drainage facility. In fact the remedial measurews is needed to brought the Nardana khal into its design section.

c) Nandapur khal.

i) Location: This khal is originated from Nandanpur Beel and falls into Nardana khal near Patuli.

ii) Length & section: The average bed width is +3.96m (PWD) where long slope is 1:10000 . The length of the khal is about 2 Km.

iii) Present Condition: The overall condition of this khal is not satisfactory. Width of this khal varies from 1.80 to 3.00m, depth of flow varies from 0.0 to 0.90m without slope and water hyacinth closed the khal.

Sections of Nardana khal, Bhorra khal and Nandapur khal are shown in figure 4.1

d) Bhorra khal Open Regulator.

i) Location: This regulator is located at Chukuria near the outfall of Bhorra khal.

ii) Type of the structure: Single vent regulator haveng opening 3.05 *11.90m² with stoplogs and hoisting device. It is an open fall board system regulator.

iii) Present Condition: It is an open fall board system regulator. The size of each fall board is 3.25m *200mm *152mm which is normally bigger than others. For this reason, it could not be possible to operate instantaneously when it is meeded. Moreover the old wooden fall board are not possible to fit with one another properly. For which flood water enter the project area with heavy sediment through the slit. In the rainy season, part of these boards are damaged by the movement of the boat of fisherman . Sometimes part of the boards are lost. No guard/khalashi are appointed to operate the gate. The present sluidce Committee could not be able to run the cost of av. 20 Nos. fall board operation. Plan and section of Bhorra ragulator are shown in fig. 4.2 and fig. 4.3 respectively.

Due to flood of 1990, the part of public road in downstream has completely eroded. Presently the rest of

the road on the left side of the regulator and about 40m of the apron at downstream are under the threatening of erosion.

e) Regulator cum bridge over Nardana khal.

i) Location: This regulator is located at Nardana near the outfall of Nardana khal.

ii) Type of structure: 2-Vent regulator of size 1.50 *1.80m²

iii) Present Condition: The gates are not operated properly. In 1986-87, the gates were closed during time when drainage needed.

The upstream and downstream loose apron in right side slopped portain are partically damaged. The downstream loose apron is badly silted. The gates and lifting device are not in good condition due to the lack of reguler maintenance works.

4.2 Hydrological boundaries :

(a) Location : The Mashaajan Lauhagang project is situated in Mirzapur Upazilla/Thana of Tangail destricat, is

bounded by Lauhanganj river in the north east and the Bansi river in the southwest of project area.

(b) Topography : The topography of the project land is a saucer type with variation of land from (+) 6.70m (PWD) to +8.23m (PWD). From the available maps, it is seen that overland flow predominant if the level is above 7.77m (PWD). When the level below this point, outflow takes place only through the three khals, directed, towards the lauhaganj river. The river banks has a level of about 8.23 (PWD).

The crops in the beel areas will be damaged when the lauhaganj river at the outflow of the Nardana khal raises above 5.34m (PWD).Some very low lying areas can not drain off optimal, as their lowest level are below the bed level of lauhaganj river (kumulli beel, chowbaria beel). Other climatological data are given in APPENDIX-B.

(c) Hydrological calculation of river water level : There are two water gauge stations. One is at Nardana in the river of Lauhaganj which is temporary one. The other permanent one is at Mirzapur in Bansi river. The

average water level difference of the two stations during post monsoon was found in the month August is 0.94m, September is 1.03m and October 1.472m for the year 1982 with average of 1.148m . The maximum level in the Bansi river at Mirzapur is given in APPENDIX-C and the level at nardana is given in APPENDIX-D.

(d) Climate : The coltected climatolcogical data from different soures are shown in APPENDIX - B.

(e) Catchment Leakage : In the Appraisal Mission Report '1992, it was proposed to contruct a clouser in the Ufulki khal to protect the inflow during monsoon. At the outfall of the Ufulki khal , no structure has yet been constructed. The entry of water through this khal is the catchment leakage of the project area. The khal was improved and serves for drainage for an area of about 4.53 sq.km at present.

4.3 Design parameters.

a) Drainage systems:

The main cocepts of the drainage system was to improve the pre-monsoon and pot-monsoon drainage of the project area and to limit the effect of flooding. The area was divided into three drainage basin for drainage of entire area through three khals namely Nardona Khal (11.90 km), Bhorra Khal (3.70 km), and ufulki khal. Two regulator: one 2-vent at the outfall of Nardona Khal and other 1-vent open regulator at the outfall of the bhorra Khal for an area of about 4.53 sq.km. at present are exist. The main khals and their connecting Khals were excavated to establish a drainage system . The entry water through Ufulki khal is the catchment leakage of the project area.

b) Design of Channels and their catchment area

In the appraisal report it was assumed that in the monsoon time the whole area entirely goes under water above a level of +7.77 m (PWD). Overland flow is predominant and that when the water level falls below this poiint, the outfall takes place through the khals directed the Lauhaganj river. The river bank was about +8.23 m (PWD) high.

In designing drainage system, it was assumed that the volume of water stored between elevation +7.77 to 5.4 m (PWD) are 15.30×10^6 cumec for Nardona khal catchment area and 4.534×10^6 cumec for Bhorra khal catchment. The drop of water level recorded in 1980-81 was 2.625 m in 14 days and 2.493 m in 13 days so it was assumed that the water level should fall from 7.77 m to 5.34 m (PWD) within 15 days.

Again the number of days that the water level remains below 5.34 m was recorded in the past as below :

2nd December 1974	-	8th June 1975	189 days
7th December 1975	-	4th June 1976	179 days
2nd December 1976	-	4th May 1977	154 days
17th November 1977	-	10th May 1978	174 days
13th November 1980	-	18th May 1981	186 days
24th October 1981	-	10th June 1982	234 days

So maximum is 234 days and minimum is 154 days.

For designing the drainage system following criterian were also taken consideration.

(i) Rainfall runoff : 25mm/day

(ii) Manning co-efficent, n : 0.30

Design parameters used for drainage khals are given in APPENDIX - E . Typical x-section of khals are given in fig. 4.1

c) Design of drainage structure.

There are 2 (two) regulators in the project area, one is 2-vent Nardana khal, another Bhorra khal open regulator.

i) Regulator-cum bridge over nardana khal. The regulator is located at the outfall of Nardana khal. This has been designed as a reinforced concrete structure with 2-vent of 1.52 x 1.8 m^2 vent (Fig 4.2 and 4.3) the design criteria in given APPENDIX - F.

ii) Bhorra khal open regulator : To save Aus crop from early flood, Bhorra khal regulator was constructed at Chukuria near the outfall of Bhorra khal. It was designed as a reinforced concrete structure with 1-vent of 3.00 x 8.38 m^2 size (Fig 6.4 and 4.5). The design criterion is proviede in APPENDIX - G.

Plan and section of Nardana ragulator are shown in fig. 6.4 and fig. 4.5

4.4 Siltation

Siltation is one of the major probelems of Mashajan Lauhaganj project. Specially the siltation in the nardana khal is in serious condition. It was informed that due to land acquisition dispute and public opposition, necessary excavation work could not be completed as per design during implementation of the project. As a result the khal section become irrigular.

At Chamari and Fotehpur, the bed is higher than u/s and the bed width is less than the design. Due to all these reasons the bed of Nardana khal badly sitled up (60 to 90 cm), which are greatky hamparing the drainage ability. The outfall of Nardana khal Lauhajong river is also badly silted up, reaching the drainage capacity of the structure.

In case of the Bhorra khal regulator, it is seen that the area under Mitakhola beel and Chetola beel is severaly affedted by siltation problem due to the lack of preper operation of the fall board in the regulator.

4.5 Construction cost

a) Comparative construction cost of components are given in APPENDIX - II.

b) Construction of different components are given in APPENDIX-I as Componentwise cost

4.6 Operation and water Management

Operation of drainage structure : The O&M of Bangladesh water development Board is solely responsible for the operation and maintenace works of the project. Bhorra khal regulator is an open type fall board system having an arrangement of fixing and lifting, the fallboards in the grooves. Although there is a sluice committe is incharge of the gate operation but they applied to the O&M division for their unwillingness to operate the gate, because it is very troublesome and laborious to fill the fall board in the grooves properly. They inform the authority that they are not capable to bear the cost of labour for this operation. The authority is requested to appoint a khalashi / guard in the sluice to operate the gate.

The gates of Nardana regulator are of lifting type. Inspite

of a need of a khalashi/operator, the present sluice committee operate the same. Due to the absence of proper maintenance, such as greasing the nut & bolt, the operation becames labouious. The gates are operated by the committee according to their wishes. Sometimes this type operation does not serve the requirement of all the beneficieries. So conflict among the users of u/s & d/s of this khal becomes a regular affair. This social conflict resulted the complete closing of gates in the year 1987, even at the period of drainage.

Sluice Committee : There are two committee for the two regulator, described as below.

Committee for 2 vent regulator at Nardanakhal

Name	Selected Village	Designation
Abdu kader Sarker	Nardana	President
Badshawa Dewan	Bangalla	Secretary
Abdul Khaleque	Nardana	Member
Mohiuddin	Bangalla	Do
Nazrul Islam	Patulli	Do

Committee for open type regulator at Bhorra khal

Name	Selected Village	Designation
A Barek Molla	Chukuria	President
Quader khan	Do	Secretary
Aviram Member	Do	Member
Mokaddes	Do	Member
Nayan Mia	Bharra	Member
Shamser Talukdur	Gulli	Do

Water Management

Since the sluice committee in the Bhorra regulator and in the Nardana khal regulator, are consist of influential people of different village, the project has been suffer due to the misoperation of gates by the influential people for which the availability of irrigation water or draining out of rain water becomes sometime unmanagable. There is no standard practice are followed. Even no records were seen to be kept at the structure. Project target is very much affected for this.

4.7 Maintenance

The project was declared empletion in 1985-86 . The allocated O&M fund of Tk.11.27 lac for the year 1986-87 was not utilized for maintenance purpose since the allocation was used to mitigate the previous liabilities. Practically no O&M works has been performed in this project. Since the project start its operation. In 1987-88 some excavation in BHorra khal of about 793m and in Nardana khal of about 305 m were done with the fund available from FDR. In fact there is no specific maintenance schedule was found in the sub-division/ division office of BWDB: A project in the name Re-excavation of Lauhaganj River was sent to FFW for approval.

Reasons for failure of Maintenance Works

(i) Manpower ; There is no regulator khalashi/ operator or water guard for the project. Only one sectional officer and work assistant who used to visit the project area and inform the higher authorities for any maintenance work or any local disputes regarding operation of the structure. Since there vist is not frequent or regular, the project has suffers lot of problems.

ii) Fund : For edequate maintenance fund, it is not possible to carry out the operation and maintenance works which create some severe drainage and siltation problem in Maitakhola beel area istead of achieving its target.

iii) Land Acquisition : It is one of the severe problem, that prevail since the project is inplemented. Due to public opposition, the adequate land acquisition in not possible as needed. For which some necessary excavation work could not be completed as per design which causes the khal section irriguler some where. At chamari, and Fotehpur, the bed in higher than u/s and the bed width in less than the design . Due to all these reasons, the bed of nardana khal in badldy silted up , reducing the drainage capacity of the structure.

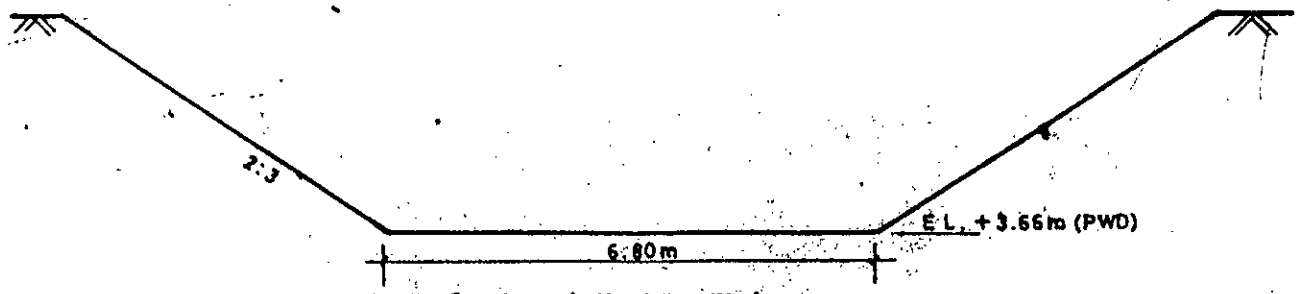
4.8 Variation in design & execution stage

1. In appraisal mission report, 4 vents regulator was proposed to be constructed at Nardana. But presently 2 vent regulator was built as per revised design of original plan.

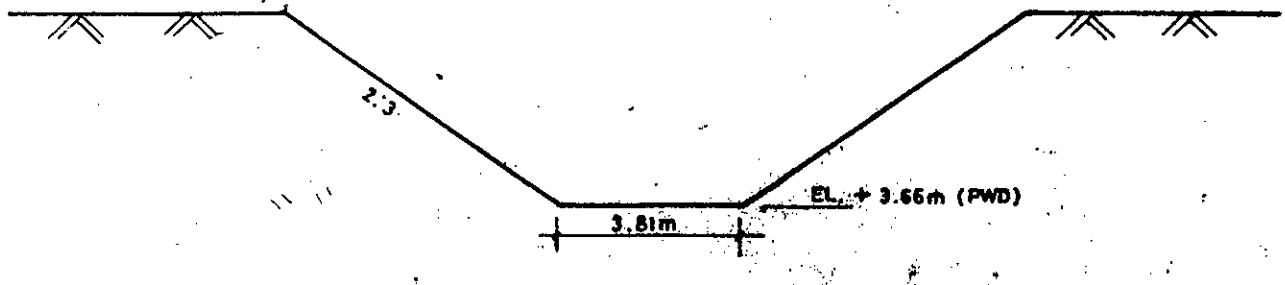
2. The Bhorra regulator was modified in May 1985 due to the demand of local people to have vehicle passing in addition to the boat crossing type structure.

3. Although there was proposal in the original plan, to construct a closure at the outfall of ufulki khal but this was not done in implementing phase which causes leakage of the project. The reason could not be traced form any sources.

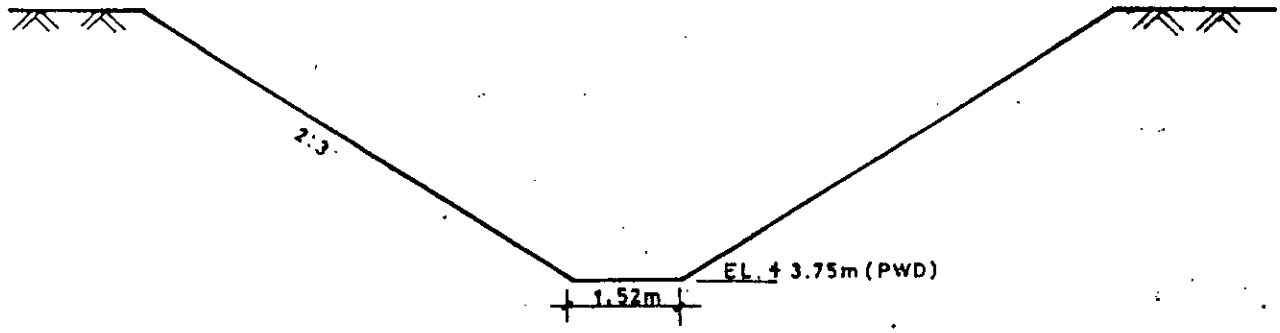
4. The project has declared its completion in 1985-86 . Although adequate land acquisition was not made as needed. Since the project component particularly khals could not be executed according to the plan and design due to land acquisition , the spoil earth was dumped on the bank of the excavated khals instead of spreading it over the agricultural field. As a result the gravity drainage toward connecting khal suffers, In some cases the section of the khals could not be excavated according to the design due the opposition of land owner.



Av. X- Section of Nordona Khal

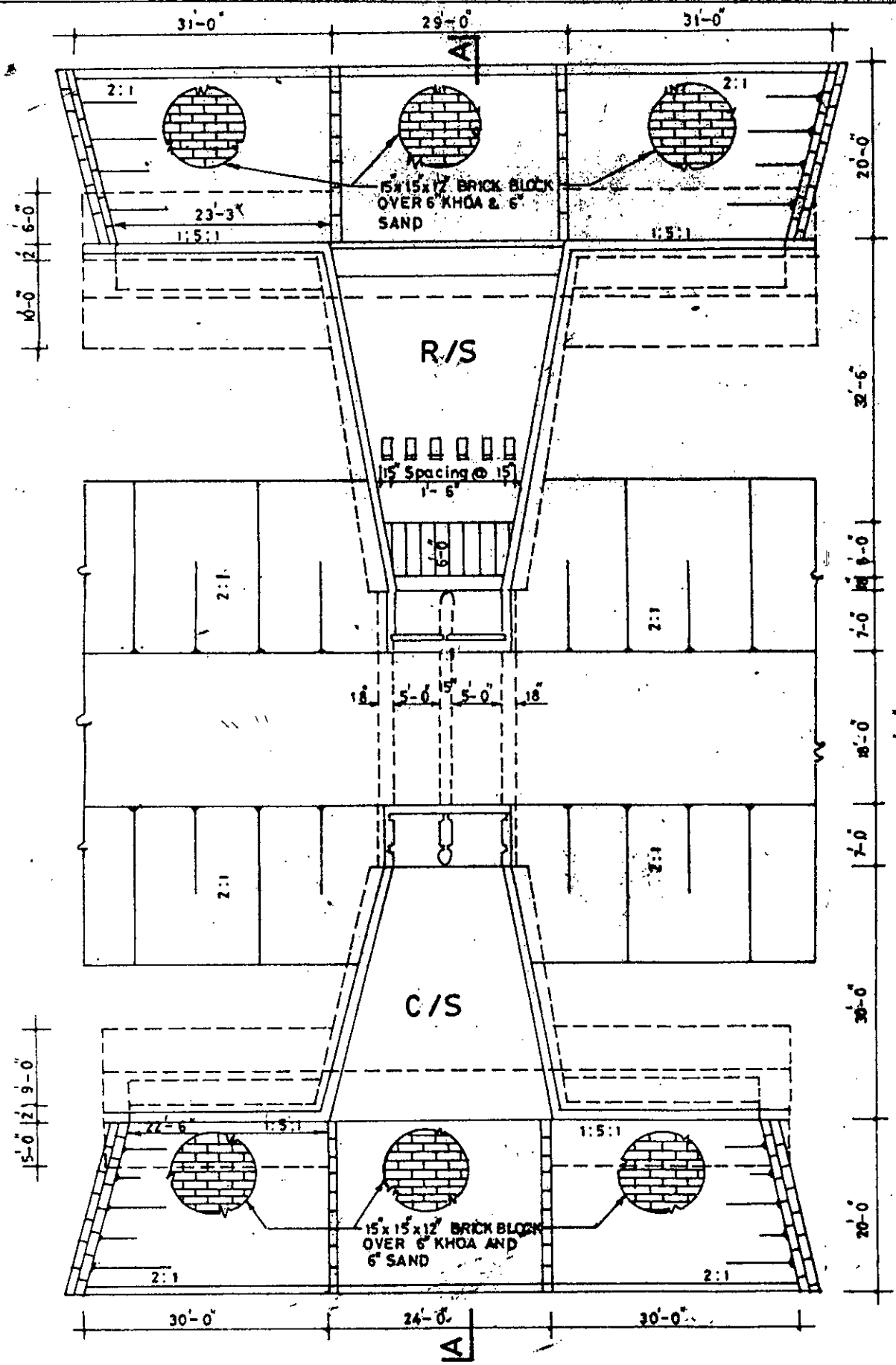


Av. X- Section of Bhorra Khal



Av X- Section of Ufluki Khal

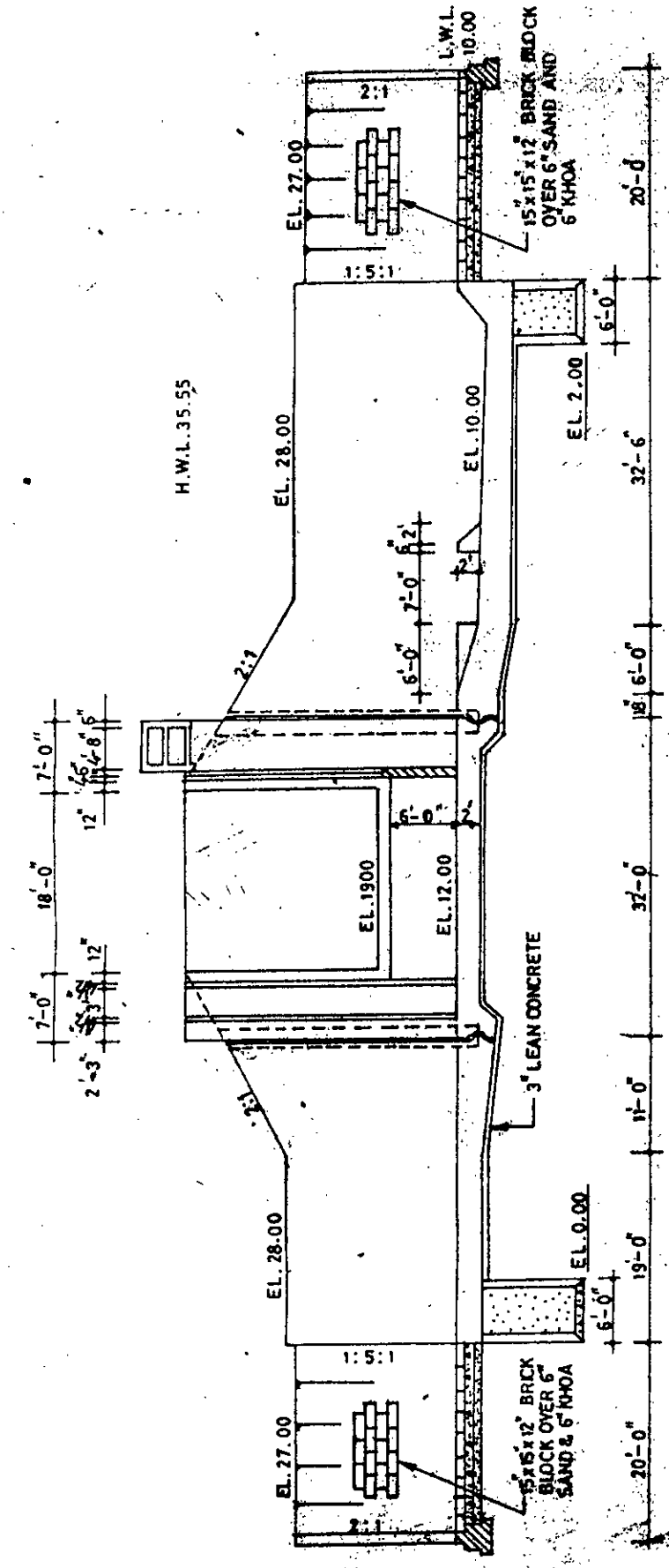
Fig: Section Of Khals



PLAN

Scale : 1" = 16'-0"

Fig:4.2:Plan Of Nardana Khal Regulato



SECTION A-A

Scale: 1" = 16'-0"

Fig.4.3:Section Of Nardana Khal Regulato

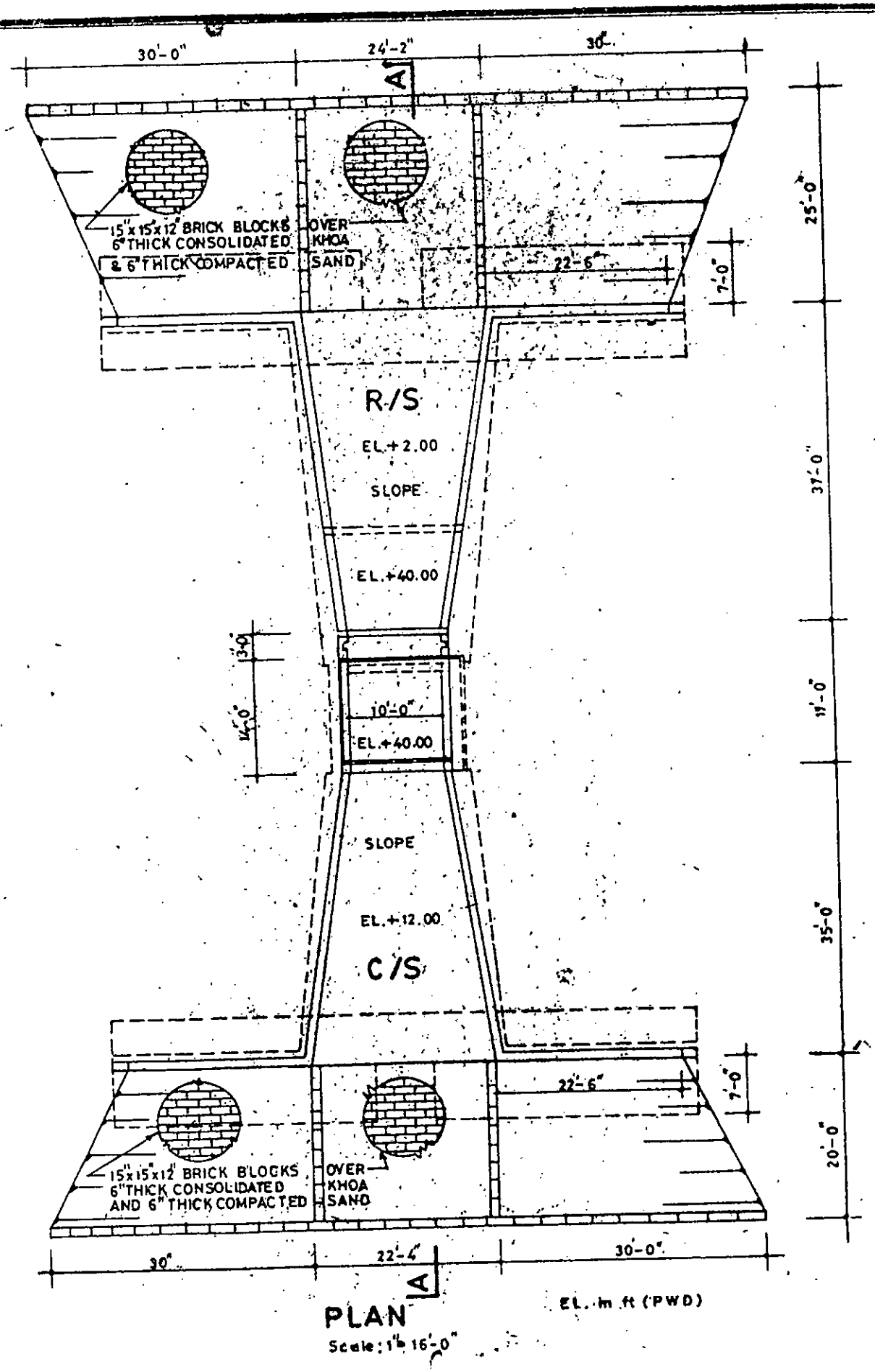


Fig:4.4: Plan Of Bharra Khal Regulator

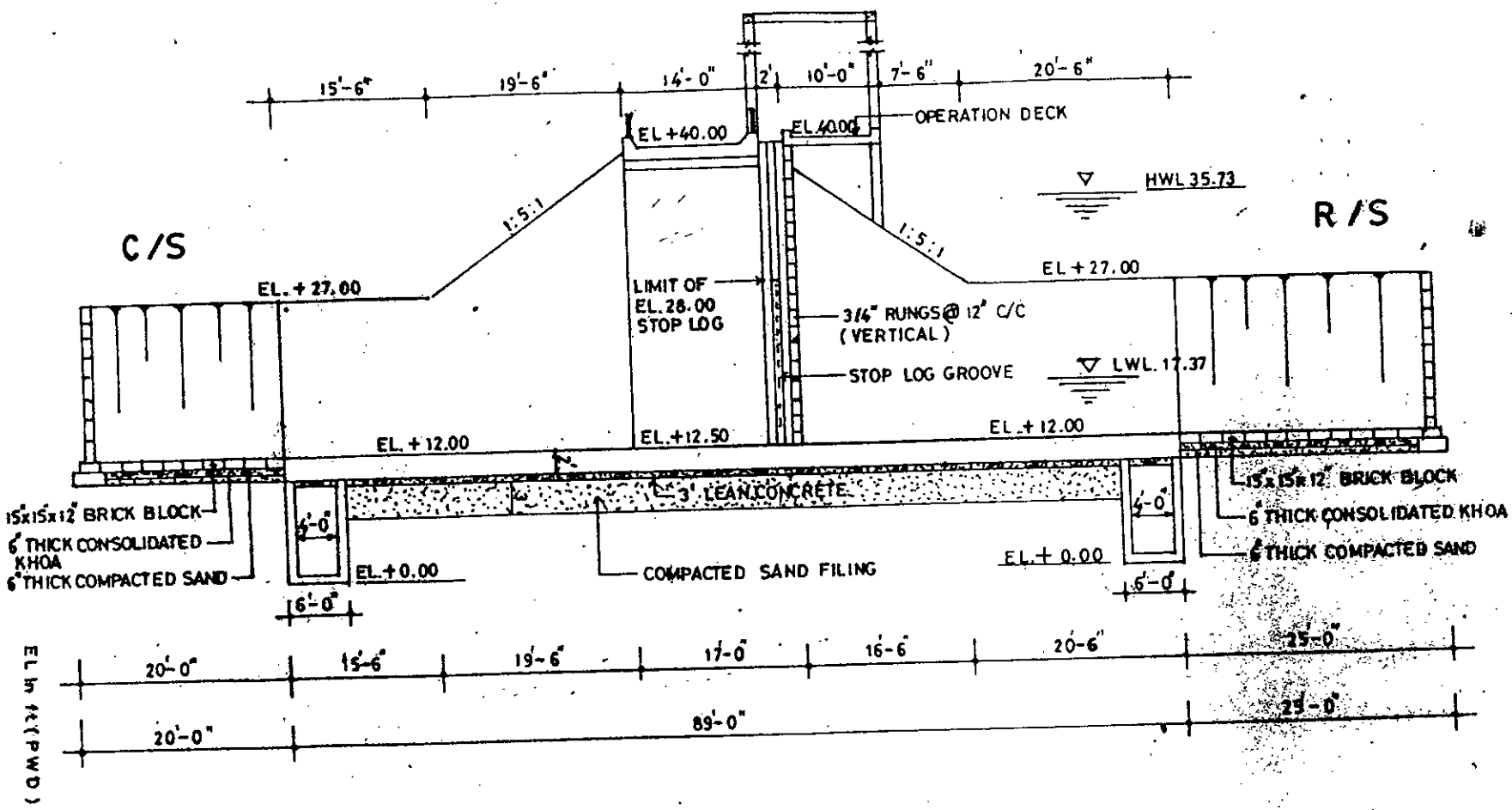


Fig:4.5; Section Of Bharra Khal Regulator

CHAPTER-V

SOCIO-ECONOMIC IMPACT OF THE MASHAJAN-LAUHAJANG PROJECT.

5.1 Introduction

In recent years, the introduction of the package of new inputs in the form of HYV seeds, irrigation, fertilizers pesticides and improved cultural practices has brought about remarkable changes in the agro-economy of most of the under developed countries. The technological package, though at an adoptive stage, is being made use of by farmers, belonging two different groups, irrespective of size and tenurial status in Bangladesh as well. The penetration of new inputs has widened new production possibilities giving an impetus to gradual change from subsistence farming to commercial agriculture. The aims of this study is to analyse the agro-socio-economic impact of the development activities in the project area.

5.2 Social-Background for Sample households.

The socio-economic characteristics of the sample households in the context of the survey refer to family size, sex, age, occupation, working member and dependent, education level, land ownership pattern, income etc . The information

available refer to post project period mostly. It would have been ideal if it was possible to compare those factors with the pre-project period. Due to absence of baseline data, this could not be done.

5.2.1 **Family Size.**

Average size of family in the project area has become 6.84 according to the sample survey. Average size of family is about 5.2 for landless farm (lowest) and 8.6 for large farm (highest) presented in Table 5.1.

Table 5.1: Size of Family of the Sample Households.

Farm Size	All sample villages	Nos of honaehold Sample
Landless	5.2	15
Marginal	6.5	24
Small	7.2	28
Medium	7.5	16
Large	8.6	7
Weighted Average	6.84	90

5.2.2 **Sex Distribution.**

Table 5.2 below gives the picture as to the sex distribution for the year 1992-93, where it is observed that 57% are male

and 43% are female. This also sharply contrasts with the national sex-ratio of 51% for male and 49% for female. Highest number of male member is observed in medium farms and lowest in small farms.

Table 5.2 : Sex Distribution of the Sample Households.

Farm Size	Sample villages	
	Male %	Female %
Landless	59	41
Marginal	56	44
Small	54	46
Medium	61	39
Large	60	40
All Sample Households	57	43

5.2.3 **Age Structure.**

The age structure of the family head and all members of the family of the sample households is shown in Table 5.3 for different categories of farm sizes. The mean age of the family head is 50.4 years and for all members in the family is 25.03 years. Among the farm sizes, the highest average age for head of the family is for the medium farm which is 56.8.

Average age of all members of the family is however found to be the highest in the size of farm households. The percentage distribution of head of household by age group is presented in Table 5.4 and the percentage distribution of population by age group is presented in Table 5.5.

Table 5.3 : Age Distribution of the Sample Households.

Farm size	Family Head	All members
Landless	46.7	27.76
Marginal	44.8	19.78
Small	52.3	27.22
Medium	56.8	30.76
Large	55.80	28.17
	50.4	26.03

Table-5.4 : Percentage Distribution of Heads of Households by Age Group

Age Group	Project Area					
	Landless	Marginal	Small	Medium	Large	All group
Up to 20	-	-	-	-	-	-
21 - 30	-	2	-	-	-	2
31 - 40	4	7	1	1	1	14
41 - 50	7	8	13	3	2	33
51 - 60	2	4	8	5	1	20
61 - 70	1	2	3	5	1	12
71 & above	1	1	3	2	2	9
Total No.of Households.	15	24	28	16	7	90

Table-5.5 : Percentage Distribution of population by Age Group Farm Size

Group	Landless	Marginal	Small	Medium	Large	All group
2.5 - 5	11	22	32	14	7	86
6 - 10	6	18	12	9	5	50
11 - 15	12	24	35	17	8	96
16 - 30	16	28	38	22	12	116
31 - 45	15	32	42	24	15	128
46 - 60	12	20	26	18	11	87
61 & above	6	12	17	16	2	53
Total Population	87	156	202	120	60	616

5.2.4 Occupation

Occupation Indicates sources of income from work,time-spent in work as well as social status.For the sample village under study,the most important primary occupation is agriculture (46.78%) which is to be expected.Due to the predominance of the landless and marginal and very small farmers,the sale of labour power as the principal occupation is also significant.

Table 5.6 shows that the principal occupation of 12 (80%) heads of landless households is sale of labour to the landholding groups. Agriculture is Principal occupation for 12 (50%) of the head of marginal household, 8 (33.33%) have to sell labour and another have other occupation like business,fishery, shop-keeping.

Table 5.6 : Percentage Distribution of Heads of the Households by Occupation and Farm Size.

Group	Landless	Marginal	Small	Medium	Large	All group
Cultivation	-	12	19	7	4	42
Agricultural Labour	12	8	-	-	-	20
Non-agricultural labour.	1	2	-	-	-	3
Service.	-	-	3	5	1	9
Business	-	1	4	2	2	9
Fishery	2	1	2	2	-	7
Small Industry.	-	-	-	-	-	-
Total Number	15	24	28	16	7	90

5.2.5 **Education**

Though the accessibility of the villagers to the schools and colleges has now become easy, the literacy rate of the heads of sample households is not satisfactory. The are as many as 70 (73%) who are illiterate, though of them 12 (29%) have achieved a reasonably satisfactory level of education. Table 5.7 shows that the literacy percentage is somewhat higher in the larger farm size categories than in the smaller size categories. This indicates that access to education is conditioned by asset.

Table- 5.7: Education level of Heads of Households by Farm-Size.

Farm Size	level of Education of Family Head				
	Illiterate	Primary	Secondary	Higher Secondary	Total and above
Landless	14	1		-	15
Marginal	20	3	1	-	24
Small	23	2	3	-	28
Medium	11	2	2	1	16
Large	2	3	2	-	7
All farms	70	11	8	1	90

5.2.6. WAGE OF THE AGRICULTURAL LABOUR:

Agricultural practice in the study area,like most other places in the country,is highly labour intensive. The poor peasent cannot afford to appoint day labour in their lands. Labour is generally from the farmer's own family,but this is rarely adequate,additional labour is hired particularly for cultivation of paddy,jute etc.The supply of labour is both local and migrants from outside the area.As observed female members of the family either of target or non target group do not work in the field. At least 22.12% percent of all households of the study area have some one in the household working as a daily wage labour.These people obviously come from the landless group and marginal farmars.The Agricultural labours generally get a daily wage TK.50 and two meal in peak season and daily wage of TK. 40 and one meal in off season.Some of the big farmer appoint a labours as seasonal basis or yearly.They pay them @ TK.300/- per month with food and clothes.

5.2.7 **INCOME**:

Table 5.8 shows that about (82.4%) of income of all sample households comes from agricultural sources.Average income of large farmers from the agricultural sources is about 6.5 times of the income of landless from the same sourcse. Average income from all sources of the sample households in the project area is TK. 17,419 annually.Per capita income is 3.5 times higher for the large farmers than the landless.The average per capita income of the sample households in TK.24.55 which is much lower than the national average,which is about TK. 6000.

Due to low per capita income,the farmers find no optimum accessibility to modern input and technology for agricultural development.

Table 5.8:Annual Income by Sample Households.

Firm Size	Average Income in taka per household per year			
	Agrilutural Sources	Non-agri-cultur	All Sources	per Capita Income(Total/)
Landless	6516 (77.70)	1870 (22.30)	8386 (100%)	1612
Marginal	7680 (71.11)	3120 (28.89)	10800 (100%)	1661
Small	13275 (81.82)	2950 (18.18)	16225 (100%)	2253
Medium	22183 (86.41)	3489 (13.60)	25672 (100%)	3423
Large	42632 (88.89)	5324	47956 (11.11)	5576 (100%)
All Firm	14523 (82.40%)	3096 (17.60%)	17619 (100%)	2455

5.2.8: **MARKET PLACES AND FACILITIES:**

The hats and bazars in rural Bangladesh perform a very important role as economic and socio cultural institutions.These are the places where goods and services are received and paid for,transactions are made,and social and cultural exchanges take places.Bazars have permanent shops and stalls .whereas,hats may not have such permanent shops and stalls.

In study area,there are 8 market places.From functional point of view,out of these 8 markets 6 are identified to be characterized as both hats and bazars.The rest 2 are identified as typically rural indigenous hats.On the basis of periodicity all of the hats are found to be bi-weekly.

5.2.9 **LIVE STOCK:**

Farm animals are mostly used as the source of draft power and their inadequacy hinders farm production and efficiency to a great extent.Bullock is virtually the only draft power

occasionally supplemented by buffalo's. In the area both small and medium farms have not a pair of bullocks draft animals.Milk cow does not exist even at the rate of one per family in the area.Only the large farms possess at least a milk cow which supplies milk for the family and a source of supplementary income for the households.Buffaloes are still fewer in numbers and not possessed by all.Calves,sheep and goats are also very few in number.One of the reasons for few animals may be attributed to the scarcity of fedder for the cattle, more particularly the absence of grazing ground.This situation not only hinders good agriculture but lowers farm income and reduces protein and calorie in-take which ultimately affect health and nutrition level of the farmers. Poultry birds are another source of farm rate.While all sizes of farms in the areas posses chicken,ducks are not much in number.

CHAPTER-VI

AGRICULTURAL IMPACT OF MASHAJAN LAUHAGANJ PROJECT

6.1 DISTRIBUTION OF LAND

Land is the foundation of village economic structure and the best index of wealth.There exists considerable inequality in the pattern of land distribution in the sample villages.Although there is no household with more than 16.00 acre of land,the predominance of the landless,marginal and small farmers in the villager under study tends to make the distribution pattern of land very unequal.Table 6.1 exhibits a highly skewed distribution pattern of land owned by the sample households.Landless and marginal farmers constitute 43.34% of the total sample households but own only 8.03% of land. The remarkable fact is that the top 7.77% of households own 66.12% of land.

TABLE 6.1 :Percentage Distribution of Household according to size and owned land of the sample Households.

Farm Size	No of Households	% of Households owned	% Of Land Owned
Landless	15	16.67	-
Marginal	24	26.67	6.61
Small	28	31.11	31.72
Medium	16	17.78	27.52
Large	7	7.77	34.15
All farms	90	100	100

6.2. CHANGE IN CROPPING PATTERN:

Cropping pattern reflects the decision of the farmers in respect of the distribution of his cultivable land under various crops, in different crop seasons of a particular

year. The objective conditions,such as,topography, soil condition and in which the farmers are involved,are significantly important to mould their production decisions.Changes in cropping pattern between two reference years of pre and post-project periods in given the Table. 6.2.

TABLE 6.2 : **CHANGE IN CROPPING PATTERN:**

Crops	Pre Project Acreage	Post Project acreage.
Aus	600	605
B.Amam	130	750
T.Amam	400	520
Jute	600	765
Boro-local	400	745
Boro-Hyv	1600	2240
Rabi	1300	2060
	6200	7765

6.3 : CHANGE IN CROPPING INTENSITY:

Land,the most scarce resource of the farmers,is not strictly a static quantity.If one of land,for instance,is made to yield three crops a year,it is as good as 1.21 hac of land.That is to say,it is the degree of utilization or cropping intensity,which determines the effective amount of land(Techno 1990) resources of the farmers,Cropping intensity is defined as total cropped area as percentage of net physical area.

The change in cropping intensity is present in Table 6.3. The finding support the earlier hypothesis that the project creates environments for technological change and thus intensifies land use.

TABLE -6.3 : **CHANGE IN CROPPING INTENTISITY:**

Crops	Pre-project	Post project
Net cropped	5000	4500
Gross cropped	6200	7765
Cropping intensity	124 %	172.56%

6.4.**USE OF AGRICULTURAL INPUTS:**

Agriculture in Bangladesh in almost totally depend on climatic conditions. Due to its vulnernbility to natural hazards, production as well as yields of crops fluctuate in time and space. It is found in the study area that the use of mechanized irrigation and chemical fertilizer were introduced first in the year 1966. High Yielding Varieties(HYV) of paddy and wheat began to be adopted in the area at the middle of the 1980's.It is observed that adoption of new technologies have diffused more slowly among the target group farmers than that of the non-target group farmers.Slow adoption among the target group farmers is obviously due to their inability to buy costly inputs of the package and lack of adequate knowledge.It also be found that all of the non-target group farmers have now adopted the new technologies whereas due to poverty and lack of access to cultivable land the percentage of adoption of new technologies among the target group farmers remain considerably low.

IRRIGATION:

Irrigation is carried in the area during the drier season with low or no rain.In general rainfall pattern in Bangladesh is of variable character and optimum distribution of rain is found to be rare even during the monsoon.Thus HYV crops like IRRI Boro, vegetable also need irrigation waters.Even some of the summer crops need irrigation water.Crop wise irrigation cost in the project area is given in Table-6.4.

TABLE 6.4-CROP WISE IRRIGATION COST:

Crops	Irrigation cost/acre(TK.)
Aus local	1200.00
Boro (L)	800.00
Boro(HYV)	1200.00
Oilseed	1200.00
Pulses	1200.00
Vegetable	1500.00

FERTILIZER:

In the study area cultivated lands are tilled year after year without being kept as fallow and crop rotation is also absent due to pressure on land.So crop lands are highly exhausted of necessary plant nutrients. More over,introduction of new HYV crops demand more nutrients than the normal fertility of land.Hence,use of chemical fertilizers has become unavoidable at the present situation.In general the farmers of the study area use manures of organic and inorganic type. Some who can afford also apply chemical fertilizers to produce certain crops. However use of fertilizer in the project area is given Table-6.5.

It is revealed from the farmers responses that if fertilizer could be made available easily on time a number of crops such as Irri.Boro,Aman,Potato,Sugarcane,Wheat etc.could be grown with considerable increased yield.Distribution of Household by pattern of fertilizer use to given in Table-6.6

TABLE-6.5 USE OF FERTILIZER PER ACRE

Crops	Ureas(Kg)	T S P(Kg)	M P (Kg)	Manures(md`s)
Aus local	30	20	8	15
T.Aman	25	15	8	15
B.Aman	28	25	10	15
Boro(L)	35	40	20	20
Boro(HYV)	40	55	30	25
Wheat	75	65	40	20
Jute	30	20	12	40
Oilseed	35	25	15	10
Pulses	45	30	12	15
Vegetables	45	35	25	30

TABLE - 6.6 : **DISTRIBUTION OF HOUSEHOLDS BY PATTERN FERTILIZER USE**

Dose	Landless	Marginal	Small	Medium	Large
Recommend Dose	-	2	7	9	6
Partial Dose	15	22	21	7	1
Nil/Negligible	-	-	-	-	-

SEED:

Better yield of crops considerably depend on the good quality of seeds.For indigneous crops,seeds in our county are generally procured and preserved by the farmers themselves. Healthy and mature seeds with special care is stored for about a year for the next crop season.However,in many cases it is reported that a considerably amount of seeds are destroyed every year due to lack of good storage facilities. Moreover,the Irony of fact is that the poor farmer families are forced to consume such seeds under compulsion at lean period of distress.In the study area it is reaveled that high yielding variation of Irri/Boro seed was first adopted by the non-target farmers in 1972 and the target group farmers in 1976.High yielding varieties of Aus and Aman seeds however,were introduced in the area in 1980 and 1981.HYV of was adopted by the non-target group farmers

in 1974,whereas target group farmers adopted 6 years later in 1980.The obvious reason for late adoption of HYV seeds by poor target group farmers is the initial high cost of the inputs(seeds,irrigation water high doses of fertilizer, pesticides, labours etc.) required for HYV crops.It is also revealed from the investigation that the cost and techniques involved in storage of HYV seeds restrict the farmers to have good quality seeds.However Distribution of house- hold by use of HYV seed to given in - Table - 6.7:

TABLE - 6.7 : **DISTRIBUTION OF HOUSEHOLDS BY USE OF HYV SEED**

Type od seed	Landless	Marginal	Small	Medium	Large
Using HYV seed	2	6	12	9	6
Using both HYV & LV	12	16	15	7	1
Not using Hyv seed	1	2	-	-	-

INSECTICIDES:

Pests and diseases have become an important factor affecting the yields of crops in the area.It is reported that in the study area a large quantity of rice is damaged due to pests and plant diseases every year. Insecticides and pesticides were very little used.The type of pesticides/insecticides found either liquid or granular.The actual quantity of use of perticides and insecticides in the project area weredifficult for calculations.So question were asked to the respondent to determine the level of use according to value of insecticies they incurred per acre and presented in Table-6.8.

TABLE 6.8 **COST FOR INSECTICIDES**

Crops	cost for perticides/area.
Aus Local	200.00
T,Aman(L)	200.00
B.Aman	200.00
Boro(L)	200.00
Wheat	200.00
Jute	200.00
Oil Seed	250.00
Pulses	300.00
Vegetable	400.00

Distribution of household by use of pesticiders is given in Table-6.9:

TABLE-6.9 :**Distribution of Households by use of insecticides:**

Insecticide	Landless	Marginal	Small	Medium	Large
As per Recommended Dose.	1	4	15	10	5
Partial Dose.	14	20	10	6	2
Nil/Negligible.	-	-	-	-	-

6.5 : **Services**

Services specially, institutional services are of vital importance in agricultural development of the country. Implementation of rural development programmes through increased agrticultural output and assuring material well-being of the rural people has been the professed policy of all the Government's in Bangladesh for long. In this regard the present Government has introduced thana system through administrative reorganization at the thana level (the lowest administrative unit) to reach services to the doors of the rural people. To this purpose a variety of institutions and agencies have been established at the thana level. But in the Project area people areunfortunate in this context. No institutional Credit facilities or NGO. like brac are seen to be existed in the project area to help in socio-economics development.

6.6 Agricultural extension

Agricultural extension service is vitally important for improvment of the project. But DAE and some NGO should be in the project area which is not found. The office BRAC was withdrawn few years ago.

CHAPTER - VII

Economic Impact Assessment.

The reigning price in Bangladesh is the price of rice; almost all other prices follow its flactuation. However wheat now becomes important as a price regulator considering rather impressive increase in the national wheat production recently. The official Government procurrment prices in rice and wheat have been used as the financial price in calculation of the project revenue. Sometimes, free market price are higher but seldom during or shortly after the period of harvesting, when most farmer sale their surplus. During calculation of benefit-cost ratio, the shadow prices of all the commodities or services are used. The economic and financial price of different commodities i.e. agriculture imputs and outputs are tabled in 7.1.

Table. 7.1: **Prices of agricultural Inputs and Outputs**

Sl. No.	Outputs	Financial Prices	Economic prices
	A. Outputs		
1	Paddy (Tk./mt.)	5,896.00	7,004.00
2	Wheat (Tk./mt.)	5,896.00	8,806.00
3	Jute (Tk./mt.)	6,700.00	7,956.00
4	Pulses(Tk./mt.)	8,040.00	8,040.00
5	Oilseed(Tk./mt.)	8,040.00	14,416.00
6	Vegetable (Tk./mt.)	2,144.00	2,144.00
	B. Inputs		
1	Rural Labour (Tk./Monday)	25.00	18.00
2	Animal Labour (Tk./pairday)	35.00	35.00
3	Fertilizer (Tk./mt,)		
	a) Urea (Tk./mt,)	4,800.00	7,242.00
	b) TSP (Tk./mt,)	4,550.00	10,472.00
	c) MP (Tk./mt,)	3,575.00	8,228.00
4	Insecticide (Tk./Kg,)	120.00	190.00

Source Economic Planning Directorate, BWDB, 1990

Some Standard Conversion Factors are used to evaluate economic capital cost listed in Table 7.2 . But for calculation the financial capital cost, actual capital cost of investment is considered. Total cost for financial capital cost consists of capital cost and operation maintenance cost. But the economical capital cost consists of capital cost, operation & maintenance cost and land cost.

Table 7.2 : **Conversion factor for calculation economic cost.**

Item	Conversion factor
1. Standard conversion factor	0.82
2. Specific conversion factor	
used in fertilizer	1.35
Power	1.43
Large industry	0.99 to

Small industry	1.26
Commerce	0.62
Residence	1.15
Tea estate	0.81
Seasonal uses, brick field	0.94
B. Electricity	
Used in industry	
Low and medium voltage	1.11
Commerce	0.76
Jute industry	1.34
Other than jute	1.14
Irrigation pump	1.62
Public water pump	1.11
C. Labour	
Unskilled labour	
Urban	0.73
Rural	0.71
Skilled labour	0.82
D. Other nontradeable	0.82
E. For foreign exchange	1.00

Source : Economic Planning Directorate, BWDB, 1990.

The economic & socio-economic parameters such as Benefit-cost ratio. Internal rate of return and S-index are calculate as below.

7.1 Benefit-Cost Ratio

The cost of production includes variable cost and fixed cost. Variable cost is the cost of production of different crops which includes the cost of manday, animal pair, fertilizer, seed, the seedlings,measures, pesticides and irrigation. The fixed cost for the up-keep of stockes, land tax, interest on credit and other cost.

Table: VII - COST OF PRODUCTION (Variable cost

CROPS	ACRAGE	MANDAY man day/ acre	MANDAY 1000no	ANIMAL PAIR pair/ acre	ANIMAL PAIR 1000no	UREA kg/ acre	T.S.P MT/ 1000 acre	T.S.P kg/ acre	M.P MT/ 1000 acre	M.P kg/ acre	SEED/ S.LINGS MT/	SEED/ S.LINGS kg/ acre	SEED/ S.LINGS kg	RATE/ KG	MANURES TOTAL	MANURES md/ acre	MANURES 1000'md	PESTICIDES tk/ acre	PESTICIDES total taka	IRRIGATION TK/ ACRE fin	IRRIGATION TK/ ACRE eco	100,000/ fin	100,000/ eco
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
AUS LOCAL	685	52	35.62	12	8.22	30	20.55	20	13.70	8	5.48	30.0	20550.0	12	2.466	15	10.28	200.0	1.37	1.12	1200	984.0	8.22	6.74
T.AMAN(L)	520	65	33.80	12	6.24	25	13.00	15	7.80	8	4.16	15.0	7800.0	10	0.780	15	7.80	200.0	1.04	0.85				
B.AMAN	750	55	41.25	10	7.50	28	21.00	25	18.75	10	7.50	15.0	11250.0	10	1.125	15	11.25	200.0	1.50	1.23				
BORO(L)	745	60	44.70	12	8.94	35	26.08	40	29.80	20	14.90	25.0	18625.0	12	2.235	20	14.90	200.0	1.49	1.22	800	656.0	5.96	4.89
BORO(HYV)	2240	65	145.60	15	33.60	40	89.60	55	123.20	30	67.20	25.0	56000.0	12	6.720	25	56.00	200.0	4.48	3.67	1200	984.0	26.88	22.04
WHEAT	540	55	29.70	15	8.10	75	40.50	65	35.10	40	21.60	60.0	32400.0	15	4.860	20	10.80	200.0	1.08	0.89				
JUTE	765	80	61.20	20	15.30	30	22.95	20	15.30	12	9.18	4.5	3442.5	25	0.861	40	30.60	250.0	1.91	1.57				
OIL SEED	270	40	10.80	15	4.05	35	9.45	25	6.75	15	4.05	4.5	1215.0	20	0.243	10	2.70	300.0	0.81	0.66	1200	984.0	3.24	2.66
PULSES	480	35	16.80	15	7.20	45	21.60	30	14.40	12	5.76	20.0	9600.0	30	2.880	15	7.20	300.0	1.44	1.18	1200	984.0	5.76	4.72
VEGETABLE	770	50	38.50	18	13.86	45	34.65	35	26.95	25	19.25			* 1500	11.550	30	23.10	400.0	3.08	2.53	1300	1230.0	11.55	9.47
TOTAL	7765		457.97		113.01		299.38		291.75		159.08				33.720		174.63		18.20	14.93			61.01	50.52

* Tk. 1500 is considered as the cost of seed per acre of land.

The amount of different compenents of variable cost comes from the approximate average value of questionnaire survey and presented in table 7.4 which based on 7.3 and 7.5.

Table 7.4 : **COST OF PRODUCTION** (VARIABLE COST)

ITEMS	QTY	UNIT	RATE (FIN)	RATE (ECO)	COST (FIN)	COST (ECO)
Manday	457.97	Thousand	25.00	18.00	114.49	82.43
Animal pair	113.01	Thousand	35.00	35.00	39.55	39.55
Urea	299.38	MT	4800.00	6923.00	14.370	20.726
T.S.P	291.75	MT	4550.00	10010.00	13.275	29.204
M.P.	159.08	MT	3575.00	7865.00	5.687	12.512
Seed					33.720	27.650
Manures	174.63	Th.md	10.00	10.00	17.463	17.463
Pesticides					18.203	14.926
Irrigation		LS			61.610	50.520
			TOTAL		318.372	294.988

Table 7.5: **COST OF PRODUCTION** (FIXED COST)

Net Cultivable Area = 4450 acar

ITEMS	RATE Fin	ECO	COST Fin	ECO

Upkeep of stock	180.00	147.60	8.100	6.642
land tax	70.25	57.61	3.161	2.592
Interest on credit	60.00	49.20	2.700	2.214
Other	62.00	50.84	2.790	2.288
		TOTAL=	16.751	13.736

(1) Av production / acre = 30 mound require 12 nos jute bags
Cost of 12 nos jute bags @ 10 Taka = 120
Misc cost for 12 nos jute bags @ 5 Taka = 60

180

(2) Av land tax for different catagories of agricultural land =70.25

(3) Av lone taken = Taka 1500 @ 8% interest for 6 Month
= Taka 60 / acre

(4) Other cost = 20% of item 1,2 & 3
= 0.20 (180 + 70.25 + 60)
= Tk. 62 per acre

For the estimating gross production value, acreage, yield/acre are needed to evaluate the data for acreage of different crops in the project area, collected from thana statistical officer. For yield/acre of different crop, the approximate average value from questionnaire survey has been taken.

The total estimate of the gross production value is presented in Table 7.23 (d). The net incremental benefit are then presented in table 7.7 .

Table 7.6 : **GROSS PRODUCTION VALUE**

ITEMS	ACRAGE	YIELD/ ACRE	PRODUCTION MT	RATE FIN	RATE ECO	COST FIN	COST ECO
							In100000/=
AUS(L)	685.00	20.00	511.19	5896.00	7004.00	30.14	35.80
B.AMAN	750.00	20.00	559.70	5896.00	7004.00	33.00	39.20
T.AMAN	520.00	25.00	485.07	5896.00	7004.00	28.60	33.97
BORO(L)	745.00	25.00	694.96	5896.00	7004.00	40.98	48.68
BORO (HYV)	2240.00	40.00	3343.28	5896.00	7004.00	197.12	734.16
JUTE	765.00	25.00	713.62	6700.00	7956.00	47.81	56.78
VEGETA-BLES	770.00	50.00	1436.57	2144.00	2144.00	30.80	30.80
WHEAT	540.00	30.00	604.48	5896.00	8806.00	35.64	53.23
OILSEED	270.00	18.00	181.34	8040.00	14416.00	14.58	26.14
PULSES	480.00	10.00	179.10	8040.00	8040.00	14.40	14.40
					TOTAL=	473.07	573.17

Table 7.7 : **SUMMARY SHEET**

A. PROJECT CONDITION

	ECO	FIN
1. GROSS PRODUCTION VALUE	334.00	230.85

2. COST OF CULTIVATION		
A) VARIABLE COST	136.10	136.42
B) FIXED COST	7.00	5.70
3. NET BENEFIT	180.90	88.73

B. PRESENT CONDITION

1. CROSS PRODUCTION VALUE	573.17	473.07
2. COST OF CULTIVATION		
A) VARIABLE COST	294.99	318.37
B) FIXED COST	13.74	16.75
3. NET BENEFIT	264.44	137.95
4. NET INCREMENTAL BENEFIT	70.53	52.23

For calculating investment cost year wise cost of project is shown in table 7.8 . The manpower required for the operation of the project tabled in 7.9 by following the PP. In the table 7.10 . O & M cost of the project within the project life period in shown. is 7.27. With all these tables, the financial B/C ratio (table 7.11) and the economic B/C ratio (table 7.12) are evalutauted.

Table 7.8 : **INVESTMENT COST**

YEAR	Description of Works	Financial Cost	Conversion Factor	Economic Cost
1982-83	Survey and boring	0.73	1.00	0.73

	Land acquisition	16.85	.00	-
	Earth work	22.48	0.71	15.96
	Project overhead	2.96	1.00	2.96
	H/Q overhead	6.65	1.00	6.65
	Sub Total:	9.67		26.3
1983-84	Land acquisition	12.41		0.00
	Regulator at Nardana	20.65	0.82	16.93
	Earth work	11.2	0.71	7.95
	Project overhead	3.27	1.00	3.27
	Head quarter overhead	7.35	1.00	7.35
	Sub Total:	54.88		35.5
1984-85	Regulator at Nardana	17.84	0.82	14.63
	Regulator at Bhorra	12.22	0.82	10.02
	Project overhead	2.22	1.00	2.22
	Head quarter overhead	4.98	1.00	4.98
	Sub Total	37.28		31.87
1985-86	Regulator at Bhorra	12.47	0.82	10.22
	Project overhead	0.92	1.00	0.92
	Head quarter overhead	2.07	1.00	2.07
	Sub Total:	15.46		13.21
Total:		556.22		106.88

Source: Project proforma of Mashajan lauhaganj schemes in Mirzapur
Table: 7.9 : Manpower Requirement for Operation

Type of Employees	Numbers	Salary per month (Tk.)	Total Wages (Tk.) Years 3-50
I.Technical Professonal :SDE	1NO.	1250	15000
II.Skilled Worker: Surveyor	1NO.	500	6000
III. Unskilled Workers: Work-Peon	2NO.	375	9000
Total			32000
T.A & Etc.			4200
Grand Total			34200

Ref: Project Proforma (PP.) of Moshajan-Lauhajong Scheme in Mirzapur.

Table-7.10: **O & M COST**

YEAR	OPERATION COST FIN	OPERATION COST ECO	MAINTENANCE COST FINAL	MAINTENANCE COST ECO	TOTAL COST FIN	TOTAL COST ECO
1982- 83	0.342	0.28			0.342	0.28
1983- 84	0.342	0.28			0.342	0.20
1984- 85	0.342	0.28			0.342	0.28
1985- 86	0.342	0.28			0.342	0.20
1986- 87	0.342	0.28			0.342	0.28
1987- 88	0.342	0.28			0.342	0.20
1988- 89	0.342	0.28			0.342	0.28
1989- 90	0.342	0.28			0.342	0.20
1990- 91	0.342	0.28			0.342	0.28
1991- 92	0.342	0.28			0.342	0.20
1992- 93	0.342	0.28			0.342	0.28
1993- 94	0.342	0.28	1.96	1.61	2.302	1.89
1994- 95	0.342	0.28	1.96	1.61	2.302	1.89
1995- 32	0.342	0.28	1.96	1.61	2.302	1.89

Ref : Project Proforma (PP) of Mashajan-Lauhaganj Scheme in Mirzapur

Table 7.11: **FINANCIAL B/C RATIO**

YEAR	INVESTMENT COST	O&M COST	TOTAL COST	DISCOUNT FACTOR	DISCOUNT TOT.COST	BENEFIT	DISCOUNT BENEFIT
1982- 83	49.67	0.342	50.012	4.046	202.35		
1983- 84	54.88	0.342	55.222	3.518	194.27		
1984- 85	37.28	0.342	37.622	3.059	115.09		
1985- 86	15.46	0.342	15.802	2.66	42.03		
1986- 87		0.342	0.342	2.313	0.79	52.23	120.81
1987- 88		0.342	0.342	2.011	0.96	52.23	105.03
1988- 89		0.342	0.342	1.749	0.60	52.23	91.35
1989- 90		0.342	0.342	1.521	0.52	52.23	79.44
1990- 91		0.342	0.342	1.322	0.45	52.23	69.05
1991- 92		0.342	0.342	1.15	0.39	52.23	60.06
1992- 93		0.342	0.342	1	0.34	52.23	52.23
1993- 94		2.302	2.302	0.8696	2.00	52.23	45.42
1994- 95		2.302	2.302	0.756	1.74	52.23	39.49
1995-2032		2.302	2.302	6.617	15.23	52.23	345.59
				TOTAL	576.50		950.16

B/C RATIO = 1.65 (at 15%)

Table 7.12: **ECONOMIC B/C RATIO**

DISCOUNT YEAR	INVEST. COST	O&M COST	LAND COST	TOTAL COST	DISCOUNT FACTOR	DISCOUNT TOT.COST	BENEFIT	DISCOUNT BENEFIT
1982-83	26.3	0.28	0.63	27.21	4.046	110.09		
1983-84	35.5	0.28	1.09	36.87	3.518	129.71		
1984-85	31.87	0.28	1.09	33.24	3.059	101.68		
1985-86	13.21	0.28	1.09	14.58	2.66	38.78		
1986-87		0.28	1.09	1.37	2.313	3.17	73.54	163.14
1987-88		0.28	1.09	1.37	2.011	2.76	73.54	141.84
1988-89		0.28	1.09	1.37	1.749	2.40	73.54	123.36
1989-90		0.28	1.09	1.37	1.521	2.08	73.54	107.28
1990-91		0.28	1.09	1.37	1.322	1.81	73.54	93.24
1991-92		0.28	1.09	1.37	1.15	1.58	73.54	81.24
1992-93		0.28	1.09	1.37	1.00	1.37	73.54	70.53
1993-94		1.89	1.09	2.98	0.8696	2.59	73.54	61.33
1994-95		1.89	1.09	2.98	0.756	2.25	73.54	53.31
1995-32		1.89	1.09	2.98	6.617	19.72	73.54	466.71
				TOTAL		419.99		1419.85

B/C RATIO = 3.38 (at 15%)

7.2 Internal Rate of Return (IRR)

IRR in the discount rate that makes present worth of net incremental benefit and present worth of cost equals to zero is computed from table 7.13 to 7.14. An interest rate table 7.15 is shown for the interest rate of 15% and 40%.

Table 7.13: Internal Rate of Return (ECO)

YEAR	TOTAL BENEFIT (PV)	TOTAL COST (PV)	NET BENEFIT (PV)	DISCOUNT FACTOR (HIGHER)	NPV AT HIGH DISCOUNT	DISCOUNT FACTOR (LOWER)	NPV AT LOWER DISCOUNT
1982-83		27.21	-27.21	28.925	-787.05	4.046	-110.09
1983-84		36.87	-36.87	20.661	-761.77	3.518	-129.71
1984-85		33.24	-33.24	14.758	-490.56	3.059	-101.68
1985-86		14.58	-14.58	10.541	-153.69	2.66	-38.78
1986-87	70.53	1.37	69.16	7.53	520.77	2.313	159.97
1987-88	70.53	1.37	69.16	5.378	371.94	2.011	139.08
1988-89	70.53	1.37	69.16	3.842	265.71	1.749	120.96
1989-90	70.53	1.37	69.16	2.744	189.78	1.521	105.19
1990-91	70.53	1.37	69.16	1.96	135.55	1.322	91.43
1991-92	70.53	1.37	69.16	1.4	96.82	1.15	79.53
1992-93	70.53	1.37	69.16	1.00	69.16	1.00	69.16
1993-94	70.53	2.98	67.55	0.713	48.16	0.8696	58.74
1994-95	70.53	2.98	67.55	0.5102	34.46	0.756	51.07
1995-2032	70.53	2.98	67.55	2.500	168.87	6.617	446.95
					TOTAL	-208.31	1531.15

IRR = 37%

Table 7.14: **Internal Rate of Return (FIN)**

YEAR	TOTAL BENEFIT	TOTAL COST (FV)	NET BENEFIT (FV)	FINANCIAL FACTOR (HIGHER)	NPV AT HIGHER DISCOUNT	DISCOUNT FACTOR (LOWER)	NPV AT LOWER DISCOUNT
1982-83	-	50.012	-50.012	28.925	-1446.60	4.046	-202.35
1983-84	-	55.222	-55.222	20.661	-1140.94	3.518	-194.27
1984-85	-	37.622	-37.622	14.758	-555.23	3.059	-115.09
1985-86	-	5.802	-15.802	10.541	-166.57	2.66	- 42.03
1986-87	52.13	0.342	51.888	7.53	390.72	2.313	120.02
1987-88	52.33	0.342	51.888	5.378	279.05	2.011	104.35
1988-89	52.33	0.342	51.888	3.842	199.35	1.749	90.75
1989-90	52.33	0.342	51.888	2.744	142.58	1.521	78.92
1990-91	52.33	0.342	51.888	1.96	101.70	1.322	68.60
1991-92	52.33	0.342	51.888	1.4	72.64	1.15	59.67
1992-93	52.33	0.342	51.888	1.00	51.89	1.00	51.89
1993-94	52.33	2.302	49.928	0.713	35.60	0.8696	43.42
1994-95	52.33	2.302	49.928	0.5102	25.47	0.756	37.75
1995-2032	52.23	2.302	49.928	2.500	124.82	6.617	330.35
				TOTAL	1968.99		373.66

IRR = 18.98%

* Single Payment Compound (F/P, i% N) amount factor
* Single Payment Project (P/F, i% N) worth factor

Table 7.32: **INTEREST TABLE (FIN)**

(F/P,i% N) P/F,i% N) AT 15% interest PERIOD	(1+i)^n	1/(1+i)^N	(F/P, i% N) (P/F, i% N) At 40% interest (1+i)^n	1/(1+i)^N
1	1.1500	0.8696	1.4000	0.7143
2	1.3225	0.7561	1.9600	0.5102
3	1.5209	0.6575	2.7440	0.3644
4	1.7490	0.5718	3.8416	0.2603
5	2.0114	0.4972	5.3782	0.1859
6	2.3131	0.4323	7.5295	0.1328
7	2.6600	0.3759	10.5414	0.0949
8	3.0590	0.3269	14.7579	0.0678
9	3.5179	0.2843	20.6610	0.0484
10	4.0456	0.2472	28.9255	0.0346
11	4.6524	0.2129	40.4957	0.0247
12	5.3303	0.1869	56.6939	0.0176
13	6.1528	0.1625	79.3715	0.0126
14	7.0757	0.1413	111.1201	0.0090
15	8.1371	0.1229	155.5681	0.0064
16	9.3576	0.1069	217.7953	0.0046
17	10.7613	0.0929	304.9135	0.0033
18	12.3755	0.8080	426.8789	0.0023
19	14.2318	0.0703	597.6304	0.0017
20	16.3665	0.0611	836.6826	0.0012
21	18.8215	0.0531	1171.3556	0.000854
22	21.6447	0.0462	1639.8978	0.000610
23	24.8915	0.0402	2295.8569	0.000436
24	28.6252	0.0349	3214.1997	0.000311
25	32.9190	0.0304	4499.8796	0.000222
26	37.8568	0.0264	6299.8314	0.000159
27	43.5353	0.0230	8819.7640	0.000113
28	50.0656	0.0200	12347.6696	0.000081
29	57.5755	0.0174	17286.7374	0.000058
30	66.2118	0.0151	24201.4324	0.000041
31	76.1435	0.0131	33882.0053	0.000030
32	87.5651	0.0114	47434.8074	0.000021
33	100.6998	0.0099	66408.7304	0.000015
34	115.8048	0.0086	92972.2225	0.000011
35	133.1755	0.0075	130161.1116	0.000008
36	153.1519	0.0065	182225.5562	0.000005
37	176.1246	0.0057	255155.7786	0.000004
38	202.5433	0.0049	357162.0901	0.000003
39	232.9248	0.0043	500026.9261	0.000002
40	267.8635	0.0037	700037.6966	0.000001
41	308.0431	0.0032	980052.7752	0.000001
42	354.2495	0.0028	1372073.8853	0.000001
43	407.3870	0.0025	1920903.4394	0.000001
44	468.4950	0.0021	2689264.8152	0.00000037
45	538.7693	0.0019	3764970.7413	0.00000027
46	619.5847	0.0016	5270959.0378	0.00000019
47	712.5224	0.0014	7379342.6530	0.00000014
48	819.4007	0.0012	10331079.7142	0.00000010
49	942.3108	0.0011	14463511.5998	0.00000007
50	1083.6574	0.0009	20248916.2398	0.00000005

7.3 : **Social-Index**

From the in-depth study of the sample villages, the S_Index in calculated from the following table 7.33.

Table 7.36: Land Ownership.

Social Class	Land owned (% of total land)
Land less	-
Marginal farmer (0.01 to 1.00 acre)	6.61
Small farmer (0.01 to 3.00 acre)	31.72
Medium Farmers (3.01 to 7.00 acre)	27.52
Large farmer (> 7 acre)	34.45
	100

$$\text{Therefore S\_Index} = \frac{2*6.61 + 1.5*31.72 + 27.52}{100}$$

$$= 0.88$$

Based on the S - index, the Social Benefit Cost ratio (SB/C) is found as below.

Economic SB/C ratio = 2.97
and Financial SB/C ratio = 1.45

CHAPTER - VIII

ENVIRONMENTAL IMPACT ASSESSMENT OF MASHAJAN-LAUHAJANG PROJECT.

8.1 Materiological Informations:

(a) Climate

The climate of the project area is essentially typical monsonic. The dominant season are experiences summer season from March to June, monsoon season from July to October and winter from November to February. Climatological data for mashajan- Lauhayjan project are started in Appendix 4.1 which describe the annual rainfall (mean), Mean monthly evaporation mean monthly relative humidity and also mean house of sunshine/day.

(b) Precipitation

The annual mean rainfall in the project area is estimated 1778mm. Rainfall various considerably from year to year which sometimes produce critical affect on agriculture.

(c) Humidity

Humidity is high almost throughout the year. Maximum humidity (about 89 percent) in the month of June and minimum humidity (about 64 percent) in the month of March.

8.2 Fisheries

The objectives of implimentating the Flood Control Drainage and irrigation (FCDI) project is to generate flood area and to use the same for agricultural purpose. But at this day, the environmental effects of FCDI project could not be ignored. The donor agencies like the World Bank and Asian Development Bank have made it momdatory for project appraisal. The general areas of environmental concern for FCDI project are : Fisheries, agriculture, Pollution from

pesticides and fertilizers use, soil degradation/ stability land use, health agricultural imputs, flora & Fauna , morpology, change in surface/ ground water, communication in both in land and water, flood control and drainage and socio-economics.

Although for this project, development of fisheries is of less importance but as per local people opinion of the project area huge low lying areas like beels & haors, namely Mashajan beel, Kumulli beel, Kuralipara haor, Sailjana beel and Bhyikura haor, are suitable for fisheries. With assistance from Government or NGO. These low lying areas are possible to made fishing area. still now some where the thin is tried in the private sector within the project area.

8.3 Land Acquisition

As per Project Proforma (PP) of the project, the net land required for acquisition is about 36.42 ha but actually amount of land acquistion during implementation in only 16.48 ha (BWDB, 1982). It was informed that due public opposition, this disputes remain which causes incompleteness of the project during implementation. As a result necessary excavation were not made for which some where the chanel sections become irregular. At chamari and Fotepur, the bed is higher than upstream and the bed which is less than the design. Due to all these reasons the bed of Nardana khal badly slited up (60 to 90 cm), which are greatly hampering the drainage ability.

8.4 Public Health

Since the project has been implemented, it is seen there is a little development was found in this sector. Due to socio economic development, the people of these area has better communication with the town. In Mirzapur a big hospital was established under a trust, where the people of the

surrounding villages may get free treatment. But unfortunately in the project area no such NGO or other organization has been established to encourage or to give ideas of medical health are found. Few people of the project area uses water of tubewell for drinking purpose. Most of the project people uses water from canal, ditch or haor for drinking & washing purpose. Sometimes water of these areas becomes heavily polluted due to jugging of Jute. From which malaria, disentry and other water borne disease evolves in epidemic form.

The people of the project area has got no modern medical facilities. Only some village medical doctors are now taking care of all these people.

8.5 Water Quality

Water quality for fishers : Development of Fisheries in Bangladesh is a crying demand and also is a scope of increase of national income. This project area has a vast space like pond, ditches beels & haors for fish. Somewhere fish cultivation is done on private sector. Water is fit for white fish like magur, telapia, rui, katla etc. as per public opinion. Water quality for drinking purpose : Water for drinking purpose is a tremendous problem of this project area. Most of the people uses water of pond, beels and haors for drinking purpose. A few has got shallow tubewell. At the begging of the monsoon they do not get water from these tubewells due to fall of water level. No such arrangement are made from Government level or from any non government organization (NGO) to supply fresh water or t advice how to get the same During jugging of jute at the end of harvesting, the water of the project area become severally polluted for which short of water for drinking as well as for washing purposes prevail.

Water quality for irrigation : The people of the project area has got no such problem except the people of the areas under mitakhola beel, and Chelota are severally affected after implementation of the project. Due to lack of proper maintenance & operating of fall board of Bhorra khal regulator, water with huge sediment enter the area and make the quality of irrigation water unfit. For the people of the project under this area become unfortunate.

8.6 Flood Control & Drainage.

Before the project was implemented, the major problem experienced in the area was early floods in March/April caused by heavy rainfall. The flood water did not recede quickly because the drainage capacity of the khal were insufficient . As a result poverty and crop damage were regular phenomenon. Another negative affect of this drainage congestion was post monsoon slow drainage. This used to hamper the harvest of Aman, delayed the land Preparation for Boro and made cultivation impossible in the low areas. Inflow into the area through the Nardana, Ufulki and Bhorra khals used to occur during the monsoon and also during high floods by over bank spills. Therefore, the project was initiated to improve the pre and post monsoon drainage of the area and to limit the ill effect of flooding.

The project was declared its completion in June, 1986. But due to land acquisition problem, the project work was seriously hampered and some of it works is still not yet complete as per design. As a result the khal section become irregular. At chamari and Fotepur, the bed is higher than upstream and the bed width is less than the design. Due to all this reason the bed of Nardana khal silted up and greatly hampered its drainage ability. The outfall of Nardana khal at Lauhajang khal river is also badly silted up.

The Bhorra khal open regulator is an open fall board regulator system. Due to its irregular operation and proper maintenance, huge sediment into the project area and affect mitakhola, chelota and bhorra.

As per Appraisal Mission 1982, there is proposal to construct Ufulki closer at the outfall of Ufulki khal protect the inflow during monsoon, but unfortunately no such structure has yet been constructed. The entry of water through this khal is the catchment leakage of the project area.

8.7. Impact Assessment of Mashajan Lauhajang Project by EIA techiniques.

After considering all the factors, which are responsible for the environment affect area listed and this affects are shown in table 8.1 by following the simple checklist technique.

Table.8.1
Environmental impact assessment of mashajan lauhaganj project (simple cheelelist method.)

Items	Nature of likely impact.									
	adverse						Benficial			
	ST	Lt	R	IR	L	W	ST	LT	SI	N
Fisheries							x			x
Public health		x		x	x		x			
Surface water hydrology		x		x	x		x			
Surface water quality		x		x		x				
Ground water	*	*	*	*	*	*	*	*	*	*
Soils		x		x	x			x	x	
Agriculture								x	x	
Socio economic							x			x
Live stock							x			x
Flood control& drainage								x	x	

Legend:
ST = Short term
IR = Irreversible
SI = Significant
* = Negligible

LT =Long term
L =Local
N =Normal

R= Reversible
W= Wide

CHAPTER - IX

DISCUSSION & RECOMMENDATION

9.1 Discussion : The project work on the impact assessment of early implementation project. A case study "has been prepared to reflect the present status of the project and the development in the post project condition with respect to pre-project condition of a EIP project Mashajang Lauthajang Project The project is evaluated by consodering the impact of engineering, agro-socio-economic and the environment to fulfill the objectives of the study.

The evaluation is based on same primary as well as secondary data. With the proper site visit and the collected data, the impacts of various aspects on the project has been elaborately discussed. 1992-93 is taken as the reference year. The survey questionnaire was prepared in accordance with the objectives . Each and every question were simple and open ended.

The primary data were supplemented by indepth investigation and observation in the field. Such information were collected through informal interview and group discussion

with vavions quartos including general farmers and the villagers. Also interview with the openion leaders like union parishad member, school teachers etc. Large volume of institutional of secondary level data had been collected from the thana officers in the project area, published documents of BSS and also form the concerned offices.

The selection of the sample silages are 10 which is sufficient but the numbers of interviews is about 110 which are not sufficient. This is only due to short of manpower, adequate fund and time constranits. However maximum efforts was given to the sample as representative as possible. The facts and figures from the study are discussed below.

Engineering study :

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1. The project "Mashajang Lauhajong" is situated is in Mirzapur thana (upazilla) under Tangail District about 24 Km. south east of Tangail town. The Lauhajong any river is in the north-east and the Bansi river is in south west of the project area. The gross area is around 4450 and the net benefited area is about

1620ha. There are about 32 nos villages are found within the project under the Anaitara and Banail union. Only two structures: 1 vent open fall board system resulator in bhorra and 2 vent regulator in Nardana and Three main khals: Bharra khal, Nardana khal and Nandapur khal are found in the project.

2. The topography of the project area is a saucer type with variation of land from (+) 6.70 m (pwd) to 8.23m (PWD) overland flow dominant above 7.7 m(PWD). When the level below this point, outflow takes place only through the three khals, directed towards the Luhaganj river. The river bank has a level of 8.23 PWD. The crops in the beel areas will be damaged. When the Luhaganj river at the outfall of the Nardana khal raise above 5.34m (PWD) some every low lying area can not below the off optimal as this level are below level (Kumilee beel, Chowbaria beel).There is a catchment leakage through Ufulki khal is found in the project. Where a couser was proposed in designing the project.

3. In the PPP, the land equation is about ha but actually ha land is made which is about % of total % less.

Due to land equation problem, same section of the threekhals were not excavated as per design for which water flows through the khals is irregular.

4. Siltation is one of the major problems of the project area. In case of Bhorra regulator, the tall board is normally begin md difficult to operate and needs huge repair for which heavy sediment water flows inspite of the closing through silt for which area under mitakhola beel and Chelota beel and seriously affected. Due to misoperating of the gate of regulator at Nardana, same thing is happening. At Fotehpur and Chamari the bed becomes higher than U/S and width becomes less than the design which hampers drainage facilities.

5. Two sluice committee area are exist. One for Bhorra Redfulator and another for the Nardana regulator. Generally member of these committee are influential people of the different area of the project for which due to misprision the gates, availability of irrigation water of draining of rain water becomes sometimes unmanageable. No standard practices are followed for the operation of the gates of these two regulators.

6. Practically no of O & M works has been performed since the project was started. Fund availability and absence of specific maintenance schedule are the key constants. Although there is a fund after the project started but exhausted to mitigate the previous liabilities. Generally For after complet in of and EIP projects it is handed over to the D & M of BWDB. Due to shortage of funds, it is not possible to maintained.

7. Variation in design and the evacuation stage are as follows:

- In appraisal mission report 4-vent regulator was proposed to be constructedat Nardana but in execution 2-vent regulator was built.
- The Bhorra regulator was modified due to demand of local people is May '1985 to have vehicle passing in addition to the boat crossing type structure.
- The is no clouser at Ufulki has yet been constructed although there was a proposal in the design.
- Land equation is % less although the project was delivered its completion in 1986.

Agro-Socio-Economic

1. Average size of family in the project area is 6.34 where it is 5.21 for lend-lease terms (convert) and 8.6 for large firm (highest).

2. The male and female ratio in the project are is 57:43 which is sharply constructed with national sex ratio 51:49 . Highest number of male number is observed in medium farms and lowest in small farms.

3. The main age of the family head is 50.4 years and for the members is 25.03 years.

4. In the project area, the most important occupation is agriculture (49.7%)

The principal occupation of 80% heads of lend-lease is sate of labour to the land holding groups. Agriculture is principal occupation for 50% of he head marginal household and 33% have sate this labour and the rest have this occupation like business, fisheries.

5. The literacy rate of the heads of the sample is not satisfactory. Only 29% have achieved reasonable satisfactory level of education where 73% are illiterate. The literacy percentage is somewhat higher in the large terms than the smaller. Which indicates the access to education is conditioned by areas

6. The agriculture allabour generally gets a daily wage of Tk.50/= and two meal in peak season and tk.40/= of one meal in off season. Some of the big farmer appoint a labour as seasonal basis or yearly. They pay --Tk300/= per month with food and clothes. At least 22.12% of all household have someone in the hansehold work as a daily wage labour. These people obviously comes from lend-lease and marginal group.

7. About 82.4% of income of all sample household comes from agricultural sources. Average income of Large farmers from the agricultural sources is about 6.5 times larger than the income of lend-lease.

Average income from all soruces of the sample household in the project area is 17,419 annually. Per capita income is

3.5 time higher for the large farmer than the lend-lease. The average per capita income is the 24.55 which is much lower than the national average. Due to tow per capita income, the farmers find no optimum accessibility to modern input and technology for agricultural development.

8. The copping pattern changes is seen to be predominate in Amon,Boro(hyv) and Robi due to post monsoon duainage facilities.

9. The cropping indensity in the pre-project condition was 124% but at the post project condition it is 172.56%.

10. It is observe that adoption of new technologies have diffused more slowly among the target group farmers than that the non target group farmers is obviously due to their inability to buy costly inputs of the package and lack of adequate knowledge. It also be found that all the non target group farmers have now adopted the new technologies whereas due to poverty and lack of access to cultivable land, the percentage of a option of new technologies among the target group farmers remain considerably low.

11. No NGO or any such organization are found in the project area from where the poor people of the area get financial as well as technical assistance.

12. The economic indicates as calculated are tabulated as below

Economic Indicates	Pre Project		Post Project	
	FIN	ECO	FIN	ECO
1.Benefit Cost ratio(at15%)	1.07	2.48	1.65	3.8
2.Internal rate of return	16.20%	32%	18.98%	37%
3.S_index (0.8)			0.88	0.88
4.SB/C ratio			1.45	2.97

From above it is seen that every indicators show positive effect of the project-although the project could not get any assistance from any organization. Only S-index is 0.88 which is 0.9 for all over Bangladesh.

Environment

1. Due to land acquisition problem, the section of many khals become irregular for which water could not able to drain

out at the end of post monsoon. So with farther study O & M measures are to be taken.

2. Public health development is not satisfactory. Due to digging of jute, water is polluted. At that period different type of water borne dieses evolves. No medical facilities within the project area from government level or private sector is seen for which poor people get no modern medical facilities.

3. Water quality for aeration purpose is good but scarcity of drinking water becomes tremendous during judging of jute. Very small numbers of tubewells are seen in the project area.

There is a huge scope of fisheries in the project area but due to lack of adequate knowledge this sector is deprived from any modern concept.

4. Livestock in the project area is not prospective because of small grazing field and lack of adequate knowledge.

5. Actually the project is a flood control and drainage scheme. Most of the land within the project is low-lying. The operation the gates of the two regulator are very much irregular for which the project has suffered since its implementation. Moreover catchment leakage from Ufulki khal affect the project very much . Photograph 1 to 6 show the poor maintenance of the project.

9.2 Recommendation.

- More study is needed to evaluate the projects properly.
- One guard /khalashi is to be appointed for each gate operation.
- Maintenace schedule is to be maintained to active the target. Maintenance budget is to by provided for smooth opeation of the project.
- Clouser at Ufulki is to be constructed to avoid the catchment leakage.
- All the khals are to excavated as per design.
- Adequate modern facilities are be provided from government and non government level to encorage the farmer for using modern technological package.

- NGO or like organization should come forward to help the people of the project to adopt family planning , to encourage the male / female in handicrapt, fishing and other soures of income generation.

- Illiteracy is one of the set back of development. The government should steps ahead to include the project people in education.

PHOTOGRAPH-1: Bhorra Regulator (Showing weeds are grown in the d/s which constrict water flow..

PHOTOGRAPH-2: Bhorra Regulator (showing damaged approach road and stop logs are kept into open air instead of store)

PHOTOGRAPH-5: Nardana Regulator(Showing poor maintenance works)

PHOTOGRAPH-6: Nardana Regulator(Shown loosen protective works at u/s,usual washing & bathing are to prohibited.

APPENDIX - A - Villages in the Sub-project Area

Name of Union	Name of Village	Area of Village	Estimated Household	Estimated Population
Anitara	agchamar	293	151	796
do	Aghaid	62	59	416
do	Anitara	223	163	981
do	Atghari	236	101	666
do	Badebharra	210	30	163
do	Banguri	213	107	699
do	Chaubaria	173	75	478
do	Datpara	235	114	804
do	Dhuparia	69	54	336
do	Fatehpur	457	599	3253
do	Jagat Bharra	272	94	673
do	Klamjani	111	61	363
do	Laksmandra	277	65	458
do	Mamudpur	914	502	2752
do	Mahadinagar	427	272	1568
do	Mashajan	244	131	776
do	Panchdana	150	76	430
do	Sukla	265	182	1036
Banail	Bade Halalia	196	74	475
do	Banail	189	136	995
do	Bangalla	328	211	1330
do	Bahabkanda	315	282	1540
do	Bharra	306	130	858
do	Bhushandi	333	143	867
do	Deojani	87	37	288
do	Deora	284	262	1645
do	Durpasha	124	53	335
do	Gulli	346	170	1117

do	Gramatia	543	158	1083
do	Halalia	186	66	414
do	Kaoalipara	85	84	551
do	Kazirhara	253	104	617
do	Kuralipara	92	97	630
do	Majhalia	231	184	1122
do	Nardana	198	143	1021
do	Namdarpur	205	108	763
do	Panchamari	62	91	560
do	Panisail	485	235	1441
do	Patuli	176	119	699
do	Sailjana	119	66	360
do	Teghari	74	42	231
Jumurki	Chuduria	432	273	1673
do	Gunatia	387	379	2295
do	Ufulki	607	424	2653

APPENDIX - B

Climatological Data for Mashajan-Lauhaganj Project

Sl.no.	Indicators	Reading
1.	Annual rainfall(mean) in mm.	1778
2.	Monthly temp. in o C	
a)	mean maximum	29.68(April)
b)	mean minimum	19.00(Jan)
c)	Highest	43.68(April)
d)	Lowest	5.00(Jan-Feb)
3.	Mean monthly Evaporation (mm)	
a)	Maximum	170
b)	Minimum	55.88
4.	Mean monthly relative humidity (in %)	
a)	maximum	8 (June)
b)	maximum	64 (Mar)
5.	Mean hours of sunshine/day	
a)	Maximum (Hours)	9.2 (Nov)
b)	Maximum (Houes)	5.7(June-Sept)

Ref : Master Plan, IECO & BETS '1988.

APPENDIX - C

Maximum Water Level in river Bansi at Mirzapur

Year	Max W/L (+)m PWD	Year	Min W/L + M PWD	Year	Max W/L + M PWD
1958	10.21	1969	9.03	1980	10.32
1959	9.08	1970	10.20	1981	8.47
1960	9.70	1971	9.02		
1961	8.87	1972	8.60		
1962	10.34	1973	9.22		
1963	9.28	1974	9.77		
1964	9.73	1975	8.00		
1965	9.19	1976	7.79		
1966	9.63	1977	8.97		
1967	8.55	1978	7.99		
1968	9.51	1979	8.09		

Ref: BETS,1988

APPENDIX - D

Maximum & Minimum Water Level at Nardana

Period	Maximum W/L + (m) PWD	Minimum W/L + m PWD
1972-73	9.80	3.89
1973-74	10.37	4.93
1974-75	10.84	4.53
1977-78	10.02	3.20
1978-79	9.01	3.06

Ref: BETS,1988

APPENDIX- E

Design parameter used for Drainage khal

Sl. No.	Drainage khal	Catchment area (sq.km)	Length (km)	Bed Level at outfall m (PWD)	Long slope	Av.bed width (m)	Side: slope	Max dis. (cumec)
1.	Nardana	27.20	11.90	+3.66	1:10000	6.80	2:3	8.50
2.	Namderpur (Branch of Sl.1)	5.12	-	+3.96	1:10000	1.52	2:3	1.53
3.	Ufulki	2.90	1.06	+3.75	1:10000	1.52	2:3	1.14
4.	Bhorra	15.53	3.70	+3.66	1:20000	3.81	2:3	5.36

APPENDIX - F

Design Criteria

(i)	Catchment area	: 3049 ha. (approx.)
(ii)	Lowest level of area to drain (11.70 km from structure)	: +4.85 m (PWD)
(iii)	Average ground level of the basin	: +7.30 m (PWD)
(iv)	Highest flood level in the basin	: +10.34 m (PWD)
(v)	Highest flood level of the outfall river	: +10.83 m (PWD)
(vi)	Road crest level	: +11.58 m (PWD)
(vii)	Design discharge	: +12.58 cumec
(viii)	Lower W.level of the outfall river	: +3.05 m (PWD)
(ix)	Invert level	: +3.66 m (PWD)
(x)	Floor length	: 9.76
(xi)	Depth of cut off wall	: 3.66 m
(xii)	Block protection length	: 6.09 m

APPENDIX - G

Design criteria

(i)	Catchment area	: 1931 ha (approx)
(ii)	Av. discharge (design)	: 8.089 cumec.
(iii)	Peak discharge	: 14 cumec.
(iv)	Average gorund level of the basin area.	: +8.23 m (PWD)
(v)	Lowest ground level of the basin excluding beel area	: +6.40 m (PWD)
(vi)	Highest water level at outfall river	: 10.89 m (PWD)
(vii)	Lowest Water level	: +5.29 m (PWD)
(viii)	Crest level of the structure	:+12.19 m (PWD)
(ix)	Invert level	: +3.81 m (PWD)
(x)	Length of the apron	: 11.28 m
(xi)	Block protection length	: 7.62 m
(xii)	Depth of cut off wall	: 3.05 m

CONSTRUCTION COST

APPENDIX- H

Comparative construction cost of components.

(Cost in '00000 Tk.)

Components	(appraisal)		P.P. (Final)		Actual cost	
	Quantity	Cost	Quantity	Cost	Quantity	Cost
Earth work in drainage channel	22.1 Km	62.1	15.29 Km	27.70	N/A	33.68
Regulator at Nardana	1 No. 4 vent	40.3	1 No. 4 vent	35.00	1 No. 2 vent	38.49
Regulator at Bhorra.	1 No. 2 vent	25.9	1 No. 2 vent	22.50	1 No. 1 vent open	24.69
		128.3		85.2		96.86
Contingency	5%	6.4				
		134.7		85.2		96.86
Project overhead	6.5%	8.8	8%	6.82	7.4%	7.17
Land acquisition	36.42ha	36.0	36.42 ha	36.00	16.48ha	29.26
		179.5		128.02		133.29
Survey & boring	-	-		L.S.		0.73
		179.5		128.02		134.02
HQ. overhead	2.2%	3.9	2.5%	3.20	16.60%	22.20
Cost escallation included in above Cost		L.S.		19.29		
Total:		183.4		150.51		156.22
					(3.8% above P.P.)	

1) Source - EIP- cell BWDB

2) Year of PP : 1982, year of construction : 1982 and year of completion : 1986-87.

CONSTRUCTION COST

Construction cost of different components are given in componentwise cost.

APPENDIX - I

		(00000 TK)
1.	Re excavation of khals (15.29 Km).	
i.	Nardona khal	24.55
ii.	Bhorra khal	6.59
iii.	Nandanpur khal	0.83
iv.	Hossain Bari khal	0.32
v.	Mitakhola khal	1.39
		33.68
2.	Construction of nardana 2-vent (1.52 x 1.83 m 2) regulator	38.49
3.	Construction of open regulator on Bhorra khal (1-vent 3x8.38 m^2)	24.69
4.	Survey and boring	0.73
5.	Project overhead (7.4%)	7.17
6.	Land acquisition (16.48 ha)	29.26
7.	HQ. Overhead (16.6%)	22.20
	Total cost of the project	156.22

Source- EIP-cell BWDB.

APPENDIX - J

Mashajan- Lauhaganj Project

Questionnaire for Household Survey

Sample No. _____ Stratum _____

Name of Respondent _____

Village _____

Union _____

Thana
(Upazila) _____

District _____

_____
Supervisor

_____
Enumerator

A. AGRO- SOCIO- ECONOMIC STUDY

1. Information on population, education and occupation of the members of household

Serial No.	Relationship with head	Age	Sex	Marital status	Education	Occupation

For Sex : M= Male, F = Female

For Marital Status: S= Single, M = Married, W = Widow, D= Divorced, SP=Separated.

For Occupation: C= Cultivation, LA = Agricultural Labour, LO=Other Labour, S = Services, B= Business, F= Fishery, SI = Small Industry

2. Land Ownership

(A) Cultivable: Acreage

(i) Single Crop _____

(ii) Double crop _____

(iii) Triple crop _____

(iv) Current fallow _____

(B) Non-cultivable:

(i) Homestead _____

(ii) Pond/Ditches _____

(iii) Orchard/Garden _____

(iv) Fallow land _____

(v) Others _____

(C) No.of plots ..... Total .....

(D) Area leased in _____ Single/Double/Triple

(E) Area rented in _____ Single/Double/Triple

(F) Area share cropped in _____ Single/Double/Triple

(G) Area rented out _____ Single/Double/Triple

(H) Share cropped out _____ Single/Double/Triple

3. System of Share Cropping

	Proportion of	
	Owner	Share cropper
(a) Input-sharing	_____	_____
(b) Crop-sharing	_____	_____

4. Irrigation

(i) Method of Irrigation	Ownership (i) Owned: individual/ by group (ii) Rented	Area (in acres)
(a) DTW	_____	_____
(b) STW	_____	_____
(c) Pump	_____	_____
(d) Hand Tubewell	_____	_____
(e) Indigeneous	_____	_____

5. Livestock

	Number	Value
(a) Working cattle	_____	_____
(b) Milk cows/buffaloes	_____	_____
(c) Other cattle	_____	_____
(d) Goats/Sheep	_____	_____
(e) Poultry (checken, duck, fowl etc.)	_____	_____

6. Cropping pattern, area and production in 1992

Crops	Rainfed			Irrigated			If there were crop damages, specify reasons*	
	Area (in acres)		Production (Mds)	Area (in acres)		Production (mds)		
	1985	1980	1985	1985	1980	1985	1992	1992
A. Rabi								
1. Boro-HYV								
2. Boro-LV								
3. Wheat-HYV								
4. Wheat-LV								
5. Pulses								
6. Oil-seeds								
7. Potato								
8. Vegetables								
9. Chilli								
10. Others (specify)								
B. Kharif-I								
11. B.Aus HYV								
12. B.Aus LIV								
13. B.Aus LV								
14. T.Aus HYV								
15. T.Aus LIV								
16. T.Aus LV								
17. Mixed Aus								
18. Jute								
19. Others								
C. Kharif-II								
20. T.Aman HYV								
21. T.Aman LIV								
22. T.Aman LV								
23. B. Aman								
24. Mixed Aman								
25. Others								
D. Perennial crops								
26. Sugarcane								
27. Others								

* Code : (1) Flood, (2) Draught, (3) Salinity, (4) Pest
(5) Others (specify) _____

7. Information on Marketing:

(a) Provide Information on the following:

Name of Crops	Quantity Sold (mds)	Price per maund (Tk)	Type of Trans-port(*)	Cost of Trans-port (Tk)	Place of Sale (**)	When Sold (month	Highest price of the year (Tk)	Lowest price of the year (Tk)
1	2	3	4	5	6	7	8	9
Aman paddy								
Aus								
Boro								
Wheat								
Jute								
Other								

(*) Type of transport used:

(1) Head load (2) Bullock cart (3) Boat (4) Truck

(5) Rickshaw (6) Others(specify)

(**) Product sold at :

(1) Farm gate (2) home (3) local market (4) distant market

(b) If you could not sell your produce at highest price, state reasons:

(1) Lack of storage facility
(2) Want of money for household expenses
(3) For repayment of debt
(4) Need for next farm expenses
(5) Other needs(specify)

(c) What is the distance of market from your house ?

(In miles) : _____

8. Household Income (Annual, 1992)

(a) Income from Crop : Tk. _____

(b) Income from produce other than crop:

Bamboo Tk. _____

Fruits Tk. _____

Wood/Cane Tk _____

Straw Tk. _____

Jute stick Tk. _____

Others Tk. _____

(c) Off-Farm Income, 1992:

Source of Income	Quantity	Price	Value
(a) Milk			
(b) Eggs			
(c) Meat			
(d) Duck/Chicken etc.			
(e) Fish			
(f) Others(specify)			

(d). Income from Services, Trade and Commerce, 1992

Sources of Income	Amount (in taka)
Labour	
Trade	
Service	
Other occupations (specify)	
	Total (Tk)

9. Household Expenditure in 1992:

Items	Value (in taka)
Food	
Clothing	
Fuel	
Education	
Medical	
Ornaments	
Furniture	
Transport	
Housing	
Festivals	
Others	
	Total Tk.

10. Labour use at different stages of farm production 1992

A. Crops		Area cultivated	Seedling		Land preparation and sowing		Weeding		Irrigation		Spraying/ Fertilizer		Harvesting and Threshing		Others (specify)	
			FL	HL	FL	HL	FL	HL	FL	HL	FL	HL	FL	HL	FL	HL
B. Aus	Local															
	HYV															
B.Aman	Local															
	HYV															
T.Aus	Local															
	HYV															
T.Aman	Local															
	HYV															
Boro	Local															
	HYV															
Sugarcane																
Potatoes																
'China'																
Pulses																
Chilli																
Onion																
Others(specify)																
B.Wage rate																

FL = Farm Labour; HL = Hired Labour

11. Farm Expenditure other than Labour Cost: 1992

Items	Cost (Tk.)
Seeds	
Urea	
TSP	
MP	
DAP	
Cow dung	
Pesticides	
Irrigation	
Hiring Bullocks	
Feed of Cattle	
Veterinary	
Transport	
Agricultural implements	
Land rent	
Taxes	
Insurance	
Others	
Total (TK.)	

12. Farm Assets

	Value (in taka)
(a) Land value	
(b) Farm implements	
(c) Houses	
(d) Industrial capital	
(e) Other business capital	
(f) Household assets	
(g) Financial assets (insurance, shares, bank deposit)	

13. Use of Modern Practices:

Items	Recommended Dose*	Partial dose	Nil/ Negligible
(a) Fertilizer			
(b) Insecticides			
(c) HYV seeds			
(d) Irrigation			
(e) Other practices			

* Information on Recommended Dose of fertilizer of different varieties Per Acre for different crops is supplied to the Enumerator.

14. Irrigation Cost Cropwise 1992

Crops		Cost (in taka)
Rice:	Aus	
	Aman	
	Boro	
Wheat		
Chilli		
Potatoes		
Sugarcane		
Vegetables		
Others(specify)		
	Total :	

15. Is the present extension service sufficient:

Yes No

If' No', what is your suggestion ? .....

16. Do you have any temporary fallow land ? Yes No

If 'Yes', what are the reasons ?

(1) Lack of moisture in soil

(2) Stagnant water

(3) Drought (lack of rainfull)

(4) Difficulties in field preparation

(5) Too much moisture

(6) Others (specify)

17. Use of fertilizer and pesticides

	1982		1992	
	Quantity	Price	Quantity	Price
Urea				
TSP				
MP				
Cow dung				
Pesticides				

18. Farmer's Indebtedness:

Sources of Credit	Amount of credit applied for 1982	Amount of money actually borrowed in 1992	Amount of out-standing loan'	Interest rate	Pur-pose	Amount repaid in 1991-92
Commercial Bank						
Cooperatives						
Other financial institutions						
Mohajans						
Relatives						
Others						

19. Do you face any problem due to construction of Project ?

Yes No

If 'Yes', what are these problems ?

(a) Jute retting problem

(b) Lack of drainage

(c) Decrease in soil fertility

(d) Non-availability of flood water

(e) Scarcity of fish

(f) Inland water transportation problem

(g) Others (specify)

20. Has the Project benefited you ?

Yes No

21. If 'Yes', how ?

a) Protecting flood b) Protecting erosion c) Protecting sand deposition d) Increasing agricultural yield e) Improving transportation f) Increasing irrigation facilities

g) Others

22. Do you intend to maintain the project components even if no further assistance is given by the government in this respect ?

Yes If yeas, why ? _____

No If no, why ? _____

23. What are the obstacles in maintaining/preserving the project component.?

_____

24. What is your suggestion for maintaining the project component ?

_____

25. Do you think that the project has been effective

Yes No

If 'Yes', how ? i) Intensity decrease

ii) Frequency decrease

26. If partially affective or not at all effective, how do you think it may be made more effective ?

i)

ii)

iii)

27. Did you get any assistance for agricultural purposes from the following institutions in 1992 ?

Name of Institutions	Types of Assistances				
	Financial	Advice on *			
		1	2	3	4
Directorate of Agriculture					
BADC					
BRDB					
Non-Govt.Organisation					
Other input supplying agencies(specify)					

* Advice on input use 1

" improved cultivation 2

" Marketing 3

" Miscellaneous activities 4

28. Do you face any drainage problem ?

Yes No

If 'Yes', what are the problems :

i) Water logging

ii) Rain water stagnation

iii) Others

29. What are your urgent needs ? (Tick the appropriate ones)

Credit Water Fertilizer Insecticides

HYV seeds Plant protection Improvement of roads

Improved marketing Draft animals Agricultural implements Others specify

30. Farm Implements Used

a) Plough

b) Harrow/ladder

c) Weeder

d) Sickle

e) Rake

f) Spade

g) Tubewell/Earthen well

h) Doon or other devices

Modern Implements Used

a) Tractor

b) Power tiller

c) Thresher

d) Mower

e) Truck

31. Information on Industries:

(a) Mention the name of Cottage Industry (if you have):

(1) Cane/Bamboo/Wood

(2) Handloom

(3) Pottery

(4) Rice husking

(5) Blacksmith

(6) Ghani (oil-crusher)

(7) Shoe-making

(8) Goldsmith

(9) Others (specify)

(b) Name of the Heavy Industry(if you have):

(1)

(2)

(3)

(4)

32. Information on Social Facilities:

Facilities	Number	Distance from respondent's house
Primary School		
Secondary School		
College		
Health Centre		
Youth Club		
Recreation facilities		
Market place		
Dispensary		
Co-operative society		
Welfare organisation		

33. Is there any rural organization in your village ?

Yes No

If 'Yes', name the relevant one:

(1) Farmer's Co-operative (KSS)

(2) Fisherman's Co-operative

(3) Weavers Co-operative

(4) Multi-purpose society

(5) Other (specify)

34. Are you a member of any of the above organizations ?

Yes No

If 'Yes', name the relevant organization.

Do you get any assistance from them ?

Ye No

If 'yes', what type of assistance do you get ?

(1) Financial

(2) Input supply

(Advice

35.(a) Are you and your wife interested in family planning programme:

(1) Yes, practise

(2) Yes, but do not practise

(3) No

(b) Did you have any contact with family planning worker ?

If Yes,

(1) How often : monthly/half-yearly

(2) Where : Home/Family Planning Office/Rural Health Centre

36. (a) What are the main sources of your drinking water ?

(1) hand tube-wll _____

(2) Ponds _____

(3) Well _____

(4) river _____

(5) others _____

(b) Distance of water sources from household.

_____yards

(c) Is there any scarcity of water in certain season ?

(1) Yes (2) No

If 'Yes', specify

(1) _____

(2) _____

37. Housing Indicators(Tick as appropriate)

(a) Type of ownership:

(1) OWN : _____ (2) Rented _____

(b) Type of roofing : Tin/Asbestos/brick/straw/other

(c) Type of wall : Tin/Wood/bamboo/June stick/mud/brick

(d) No. of rooms :

MASHAJAN- LAUHAGANJ PROJECT

B. Questionnaire for Engineering & Environmental Study.

1. Do you think that the project objectives are

- ☐ To increase the Boro/Transplanted/Rabi production by irrigation.
- ☐ Flood control ☐ Drainage of excess water.
- ☐ Flood control & drainage

2. Have you got any benefit from the project.

- ☐ Yes ☐ No.
- ☐ If partly, give the reason.

_____

_____

3(a). If it possible to achieve flood control with the project.

- ☐ Yes. ☐ No.
- ☐ If partly give the reasons.

_____

_____

(b) What you think if the project does not able to control flood.

- ☐ Inadequacy of drainage canal
- ☐ Proper operation & maintenance of the canal is needed.
- ☐ Canal needs redesign.
- ☐ Other, specify.

_____

_____

4(a) Is the project able to provide you adequate irrigation water when needed.

☐ Yes ☐ No.

☐ Adequate water is not available

(b) What are the measures/steps are to be taken for getting the necessary irrigation water

☐ To increase water supply in canal.

☐ To increase the number of pump & tubewell.

☐ To increase the working rate of existing pump & tubewell

☐ Need of proper maintenance of works of canal.

☐ To increase the number of canal

☐ To distribute water through suitable committee.

(c) The existing khals/canals are not sufficient.

☐ Yes ☐ No.

(d) If answer is no, what are the problems you have.

☐ No water drain khal when needed

☐ Inadequate supply due to smaller section.

5.(a) Is the irrigation water is of good quality.

☐ Yes ☐ No. ☐ No IDEA

(b) If irrigation water is not suitable, what are the problems you have.

☐ Salinity ☐ No Idea.

6(a) Whether the heavy rainfall or flood water receds smoothly.

☐ Yes ☐ No

(b) If no, the crops are affected by stagnant water

☐ Yes ☐ No

(c) Crop Areas affected by stagnant water

☐ ¼ ☐ 1/3 ☐ ½ ☐ Full

(d) In what season/time, drainage problems are seen.

☐ Boro ☐ Transplanted ☐ Rabi

7. Is there any delay in cropping after the recession of flood water in 1987 & 1988

☐ No such delay

☐ Boro / Aman

☐ Rabi crops

☐ Others specify:

8. Is the proper operation & maintenance work are goes in the project.

Irrigation canal ☐ Yes ☐ No

Sluice gate ☐ Yes ☐ No

If no, mention the reasons; _____

_____

9. Whether the sluice gate or Regulators are working as per need.

(a) Regulator ☐ Yes ☐ No.

If answer is no, the problems are

☐ Created water logging due to operation.

☐ Gates are not closed properly.

☐ Needs maintenance work

☐ Other, specify _____

_____

(b) Sluice gate ☐ Yes ☐ No.

If no, mention the reasons _____

_____

10(a) Wastage of irrigation water is seen.

☐ Yes ☐ No.

(b) If yes, the reasons are

☐ Irrigation water overflanked the khal/canal.

☐ Crack in khal, rat-hole or siltation in bed

☐ People uses water willingly.

☐ Section is large in compared to supply

☐ Water logging.

11. Following problems are seen for the construction of the project

☐ Navigation problem due to construction of gate.

☐ Road communication hampered for the construction of khal or canal.

☐ New road communications are developed.

☐ Other problem, _____

☐ Other facilities, _____

12. Do you think that both water from the river/khal and underground water by Deep tubewell are needed for irrigation purposes.

Yes, why _____

No, why _____

13(a) Is all the pumps are sufficient in project area

- ☐ Excess
- ☐ Short
- ☐ No idea

(b) If pumps are not sufficient, what you think

- ☐ To increase number of pump
- ☐ Smaller pumps are to be replaced
- ☐ Other, specify _____

_____

14(a) Have you noticed any difference in the followings

- ☐ Siltation in the river
- ☐ Rivers are not silted.

(b) Salinity affect in the river/khal

- ☐ Increases.
- ☐ Decreases
- ☐ No change

(c) Underground water level

- ☐ Increases
- ☐ Decreages
- ☐ Water logging created.

(d) Land fertility :

- ☐ Increases
- ☐ Decrease
- ☐ Same as before

(e) Unhyginic heath conditions are created

- ☐ Increase mosquitos,

(f) Drinking water & sewarage problems

- ☐ No water from tubewell
- ☐ No pure water from pond & khal.
- ☐ No proper sanitation facilities.

(g) Socio-economic conditions are developed.

☐ Yes ☐ No ☐ No change

(h) Diseases spreaded in the project area

Malaria	☐ Increases	☐ Decreases	☐ No change
Diesentry	☐ Increases	☐ Decrease	☐ No change

(i) Change in livestock.

- ☐ Increase
- ☐ Decrease
- ☐ No change

(j) Social development in the project

- ☐ Yes
- ☐ No
- ☐ Not understood

APPENDIX - K

Questionnaire
for
Group Interviews of Village Leaders and Farmers

I. Information related to agriculture

a) Cropping Pattern:

I. Major agricultural crops of the village*

	1992	1982
1.	LV/HYV	LV/ HYV
2.	LV/HYV	LV/HYV
3.	LV/HYV	LV/HYV
4.	LV/HYV	LV/HYV
5.		

* Tick as appropriate

II. Crop rotation(according to land elevation)

Elevation	Present	Before the construction of Project.
a) High land		
b) Medium land		
c) Low land		

b) Cropping Intensity

I. Has the acreage under multiple crops increased after construction of **Project**. ? Yes No

II. Do you prefer HYV to LV ? Yes No
If yes, why ? .....
.....
.....

c) Agricultural productivity

Do you think, agricultural yield per acre in your village has increased after construction of Project ?

Yes No

If yes what is the present yield (in maund) per acre ?

Crop		Present yield	Yield before the construction of project
i) T.Aman	LV		
	HYV		
ii) B.Aman	LV		
iii) Boro	LV		
	HYV		
iv) T.Aus	LV		
	HYV		
v) B.Aus	LV		
	HYV		
vi) Wheat	LV		
	HYV		
vii) Jute			
viii) Sugarcane			
ix) Chilli			

d) Production cost per acre

Major crops	Production cost now		Production cost before project.	
	Irrigated	Non-irrigated	Irrigated	Non-irrigated
Boro LV				
HYV				
T. Aman LV				
HYV				
B. Aman LV				
B. Aus LV				
HYV				
T. Aus LV				
HYV				
Jute				
Wheat LV				
HYV				
Potato LV				
HYV				
Chilli				
Sugarcane				
Pulses				
Others				

e) System of share-cropping — Proportion

Input-sharing .....

Crop-sharing .....

2. Information related to advantages and disadvantages of execution of khal.

a) Has the canal benefited your village ? Yes No

If yes, how ?

I. Protecting flood II. Protecting erosion

III. Protecting Sand deposition IV. Increasing agricultural yield V. Increasing Irrigation facilities

VI. Others

b) If the canal has benefited you and your village by increasing crop production and income, are you willing to pay for its its management and operation ? Yes No

I. If yes, how ? By: I. Paying higher taxes

II. Voluntarily contributing through village society/union parishad/upazila

III. Other means

II. If no, why ? .....

.....

.....

c) Do you intend to maintain the canal even if no further assistance is given by the government in this respect ?

Yes , If yes, how ? .....

No , If no, why ? .....

d) What are the obstacles to maintaining/preserving the canal ?

e) What are your suggestions for maintaining the canal ?

f) If the canal has been effective in controlling flood, how it has been effective ?

(i) By decreasing Flood Intensity

(ii) By decreasing frequency of flood

g) If the project has not been effective at all or partially effective, how do you think it may be made more effective ?

h) Do you think, your participation in the operation, management and maintenance of the canal will increase effectiveness of the canal ?

Yes No

If yes, how do you intend to participate ?

(i) Through Co-operative Societies

(ii) Through any other Organization

i) Do you face any problem due to excavation of canal ?

Yes No

If yes, what are these problems ?

i) Jute retting problem

ii) Lack of drainage

iii) Decrease in fertility

iv) Non-availability of flood water

v) Scarcity of fish

vi) Inland water transportation problem

vii) Others(specify)

j) What type of Drainage problem do you face in your village ?

I. Water-logging

II. Rain water stagnation

III. Others (specify)

k) Upon whom do you think the O&M of the canal should rest in future ? .....

3. Information on the existing state of the Canal.

a) Is the condition of the Embankment Good Bad ?

b) If bad, (i) What are the reasons ?

(ii) What do you think can be done in this respect ?

c) what steps are being taken by the relevant authority to improve the condition of the Canal ?

d) Is the measure taken by the authority in this respect adequate ?

Yes No

If no, what do you think can be done in this respect ?

4. Information on extension service and modern practices

I. Do you get any extension service in your village ?

Yes No

II. If yes, is the present extension service sufficient ?

Yes No

If no, what is your suggestion ?

III. Do you use the following in your village ?

a) Tractor

b) Power tiller

c) Thresher

d) Mower

e) Weeder

f) Truck

IV. Do you use the following ?

a) Chemical Fertilizer :- Recommended Dose Partial Dose

Negligible

b) Organic Manure* : Recommanded Dose Partial Dose

Negligible

c) Insecticide Yes No

d) HYV seeds Yes No

e) Irrigation water Yes No

* e.g., cowdung, compost, oilcakes etc.

5. Information on Industries

1. What type of cottage industries do you have in your village ?

Cane/Bamboo/Wood

Pottery

Blacksmith

Shoe-making

Hand loom

Rice Husking

Ghani (oil crusher)

2. Name of the Heavy Industries (if you have in your village).

6. Information on water sources:

I. What are the main sources of drinking water in your village ?

Hand-tube-well

Ponds

Well

River

Others

II. How do you irrigate lands in your village ?

By : DTW

STW

Power Pump

Hand Tubewell

Indigeneous Devices

7. Information on Social Facilities

Indicate the available facilities in your village.

Facilities	Number
Primary School	
Secondary School	
College	
Health Centre/Hospitals	
Dispensary	
Clubs(youth/mothers' etc., any other)	

7. Information on Social Facilities(continued)

Facilities	Number
Market place	
Co-operative Society	
Welfare Organization	
Play ground	
Park	

8. Information on Rural Organization

a) Is there any rural organisation in your village ?

Yes No

If yes, indicate the relevant one/ones :

Farmer's Co-operative

Fisherman's Co-operative

Weavers' Co-operative

Multi-purpose Society

Any other voluntary organization

b) What type of assistance do you get from them ?

Financial

Input supply

Advice

9. Information on Marketing:

a) Do you have any market place in the village ?

Yes No

If yes, what types of market is it ? Daily/Weekly/bi-weekly

b) Do you mostly depend on this market for sale and purchase of goods ? Yes No

10. Transportation Facilities

a) What are the main modes of transport in your village ?

Road Water Rail

b) Is the road network of your village satisfactory ?

Yes No

If no, how to improve it

11. Has landlessness increased / decrease in your village after the construction of the project ?

a. Increased

b. Decreased

c. Don't know

STATUS OF EIP PROJECTS

Early Implementation Projects No.	Name of the Project	Taken Up During Period	BWDB Circle	Completed During Period	Remarks
E-01	Repair of Doha. Clo. P.10-12	1975-76	Khunla	1975-76	Completed
E-02	Re-excavation of Singua Rive	1975-76	Mymenshing	1978-79	Completed O&M Redesign
E-03	Re-excavation of Batkazal Kh	1975-76	Barisal	1977-78	Completed
E-04	Re-excavation oj Koachala Kh	1975-76	Comilla	1978-79	Completed Part of Gumti Phase-II
E-05	Strenghtening of G.K. Projec	1975-76	Khustia	1975-79	Completed Ganges-Kobadak Project
E-06	Constr. Embankment Hizla	1975-76	Barisal	1978-79	Completed Taken over by SSSPCB
E-07	Chandona Barasia Project	1975-76	Faridpur	1976-77	Completed Not Suitable for O&M
E-08	Satla Bagda Project (Maint.	1975-76	Barisal	1978-79	Taken Up again as E-79
E-09	Karnahar Barabila	1975-76	Rajshahi	1978-79	Completed O&M Focus 90-91
E-10	Madarganj Closure	1975-76	Khulna	...	Dropped in 1981
E-11	Polder 27/2	1975-76	Khulna	1978-79	Completed Selected by DDP
E-12	Raktodoha Lohachura Scheme	1976-77	Rajshahi	1981-82	Completed O&M Redesign 90-91
E-13	G.K. Project Phase-I	1976-77	Khustia	1980-81	Completed Ganges-Kobadak Project
E-14	Somespur Beel Drainage Schem	1976-77	Rajshahi	1978-79	Completed Part of Pabna Irrigation & RDP
E-15	Lohagara Flood Protection	1976-77	Khulna	1978-79	Completed Part of FCD III Project
E-16	Lashgata Nalgora Khal	1976-77	Barisal	1979-80	Completed O&M Rehab. 90-91
E-17	Polder 26	1977-78	Khulna	1981-82	Completed Selected by DDP
E-18	Tala Thana	1977-78	Khulna	1981-82	Completed O&M Redesign 90-91
E-19	Sati Nadi	1977-78	Rangpur	1981-82	Completed FFW Involvment
E-20	Rouha Bakchari	1977-78	Mymensingh	1981-82	Completed Rejected for ROM in 1987
E-21	Patakhali Konai	1977-78	Mymensingh	1981-82	Taken up again as E-68
E-22	Ghagutia	1977-78	Faridpur	1981-82	Completed
E-23	Bhitabari Damosh	1977-78	Rahshahi	1981-82	Completed Taken up by SRP
E-24	Tulshiganga	1977-78	Rajshahi	1982-83	Completed O&M Redesign 90-91
E-25	G.K. Project Phase-I	1977-78	Khustia	1981-82	Completed Ganges Kobadak Project
E-26	Teesta Right Embankment	1977-78	Rangpur	1981-82	Completed Part of Teesta Project
E-27	Chakamaya-Panchakuria Closur	1978-79	Barisal	1981-82	Completed
E-28	Kalaiya Nehalganj	1978-79	Barisal	1980-81	Completed O&M Rehab. 90-91
E-29	Padri Shibpur	1978-79	Barisal	1981-82	Completed
E-30	Faliar Beel	1978-79	Rajshahi	1981-82	Completed Now part of FCD-IV
E-31	Polder 34/3	1978-79	Khulna	1981-82	Completed Not suitable for O&M
E-32	Jamuna Khal	1978-79	Comilla	1981-82	Completed Part of Gumti Phase-II
E-33	Singua Nebugati	1979-80	Khulna	1981-82	Completed Not Suitable for O&M
E-34	Polder 63/1B (Dropped in 198	1979-80	Chittagong	...	Dropped in 1985
E-35	Amtali Closure	1979-80	Barisal	1982-83	Completed
E-36	Bordai Khal	1979-80	Mymenshing	1983-84	Completed
E-37	Extension Polder 6/9	1979-80	Khulna	1983-84	Completed O&M Focus
E-38	Sandwip Embankment	1979-80	Chittagong	1986-87	Completed Not Suitable for O&M
E-39	Bhedra Beel	1980-81	Rajshahi	1982-83	Completed Part of PAbna Irrig. & RDP
E-40	Konapara Embankment	1980-81	Mymenshing	1982-83	Completed
E-41	Katakhali Khal	1980-81	Mymenshing	1982-83	Completed O&M Redesign
E-42	Bhola NE Embankment	1980-81	Bhola	1982-83	Completed Now Part of Bhola Irrig & RDP
E-43	Char Faizuddin	1980-81	Bhola	1983-84	Completed
E-44	Shanghair Haor	1980-81	Sylhet	1983-84	Taken up Again as E-69
E-45	Polder 35/3	1981-82	Khulna	1981-82	Completed Not suitable for O&M
E-46	Gangrail Closure	1981-82	Khulna	1982-83	Completed
E-47	Patakhali Konai Ext.	1981-82	Mymenshing	1982-83	Again taken up as E-65
E-48	Gazaria Beel	1981-82	Mymenshing	1984-85	Completed O&M Rehab.Irrigation
E-49	Polder 66/3	1981-82	Chittagong	1983-84	Completed Not suitable for O&M
E-50	Polder 65/A-1	1981-82	Chittagong	...	Completed Also Taken up for CDE IE-99
E-51	Angerolli Haor	1981-82	Sylhet	1984-85	Completed Taken over by FFW for O&M
E-52	Barakpur-Dighalia	1982-83	Khulna	1984-85	Completed

Early Implementation Projects No.	Name of the Project	Taken Up During Period	BWDB Circle	Completed During Period	Remarks
E-53	Katakhali-Dublakuri Khal	1982-83	Mymenshing	1983-84	Completed
E-54	Polder 65/A-3	1982-83	Chittagong	1983-84	Completed O&M Focus also CDR (E-99)
E-55	Damrir Haor	1982-83	Sylhet	1985-86	Completed O&M Rehab. But Taken over by FFW
E-56	Mashajan-Lauhajan	1982-83	Mymenshing	1985-86	Completed
E-57	Chatiar-Fukurhati	1982-83	Faridpur	1984-85	Completed O&M Rehab.
E-58	Zilker Haor	1983-84	Sylhet	1986-87	Completed O&M Focus
E-59	Patharchuri Haor	1983-84	Sylhet	1986-87	Completed O&M Focus
E-60	Nagor River	1983-84	Bogra	1985-86	Completed O&M Redesign 1990-91
E-61	Sowra Beel	1983-84	Bogra	1985-86	Completed O&M Rehab. 1990-91
E-62	Homodor Beel	1983-84	Khustia	1985-86	Completed Taken up by SSSFCDI under new name
E-63	Aliar beel	1983-84	Mymenshing	...	Dropped in 1986
E-64	Polder 43/2C	1983-84	Barisal	1985-86	Completed O&M Focus 1990-91
E-65	Nawtana Khal	1983-84	Mymenshing	1988-89	Completed O&M Focus
E-66	Nagor Valley	1984-85	Rajshahi	1986-87	Completed O&M Redesign 1990-91.
E-67	Faridpur Area-1	1985-86	Faridpue	1991-92	Ongoing Sheduled for Completion in 1991-92
E-68	Patakhali Konai ROM	1985-86	Mymenshing	1987-88	Completed O&M Focus
E-69	Shanghair Haor ROM	1985-86	Sylhet	1987-88	Completed O&M Focus 1990-91
E-70	Baram haor	1986-87	Sylhet	1991-92	Ongoing Sheduled for Completion in 1991-92
E-71	Bhutiar Beel	1986-87	Khulna	1991-92	Ongoing Sheduled for Completion in 1991-92
E-72	Balushair Embankment	1986-87	Dhaka	...	Dropped in 1986, Taken over by FFW
E-73	Sonail Embankment	1986-87	Bogra	1987-88	Completed O&M redesign 1990-91
E-74	Nuruller Beel	1987-88	Bogra	1991-92	Ongoing Sheduled for Completion in 1991-92
E-75	Bhanda Beel	1987-88	Sylhet		Ongoing
E-76	Satdamua Katler Beel	1987-88	Bogra	1991-92	Ongoing Sheduled for Completion in 1991-92
E-77	Upper Nagor River	1987-88	Bogra	1991-92	Ongoing Sheduled for Completion in 1991-92
E-78	Surjamoni Khal	1987-88	Barisal	1988-89	Completed O&M Rahab.
E-79	Satla Bagda Polder-3	1987-88	Barisal	1988-89	Completed O&M Focus 1990-91
E-80	Flood Demage Repair 1987	1987-88	.....		Completed 1990-91
E-81	Upper Nagor Valley	1988-89	Rajshahi	1990-91	Ongoing Sheduled for Completion in 1990-91
E-82	Badalgachi	1988-89	Rajshahi	1990-91	Ongoing Sheduled for Completion in 1990-91
E-83	Bamon Khali Baronali	1988-89	Khulna	1991-92	Ongoing Sheduled for Completion in 1991-92
E-84	Shakpaldia	1988-89	Faridpur	1991-92	Ongoing Sheduled for Completion in 1991-92
E-85	Polder 43/2E	1988-89	Barisal	1990-91	Ongoing Sheduled for Completion in 1990-91
E-86	Tangua haor	1988-89	Sylhet	1990-91	Ongoing Sheduled for Completion in 1990-91
E-87	Flood Demage Repair 1988	1988-89	.....		Completed 1990-91
E-88	Tulshiganga Left Embankment	1989-90	Rajshahi		Ongoing Sheduled for Completion in 1992-93
E-89	Satkhira Koloroa	1989-90	Khulna		Ongoing Sheduled for Completion in 1992-93
E-90	Polder 43/2D	1989-90	Barisal		Ongoing Sheduled for Completion in 1992-93
E-91	Polder 43/2F	1989-90	Barisal		Ongoing Sheduled for Completion in 1992-93
E-92	Bibichini	1989-90	Barisal		Ongoing Sheduled for Completion in 1992-93
E-93	Chitra Bhairab Afra	1990-91	Khulna		Ongoing Also O&m focus 1990-91
E-94	Jamgaon Danra	1990-91	Rajshahi		Ongoing
E-95	Joal Bhanga	1990-91	Sylhet		Ongoing
E-96	Khai Haor	1990-91	Sylhet		Ongoing
E-97	Korotoya F.C.	1990-91	Bogra		Ongoing
E-98	Udgol Beel	1990-91	Sylhet		Ongoing

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