社会開発調査部報告書

No. 122

Government of the Peoples Republic of Bangladesh
Flood Action Plan

North West Regional Study (FAP-2)

FINAL REPORT

ANNEXES

January 1993

Government of the Peoples Republic of Bangladesh
Flood Action Plan

North West Regional Study (FAP-2)

FINAL REPORT

ANNEXES

January 1993

CONTENTS

ANNEX 1 COMMENTS ON THE DRAFT FINAL REPORT AND RESPONSES BY THE CONSULTANTS

Comments are given in normal type, responses in italics.

1. General Comments by JICA 1-1

2. General Comments by ODA 2-1

3. General Comments by FPCO 3-1

4. Specific Comments by JICA 4-1

5. Specific Comments by ODA 5-1

6. Specific Comments by FPCO 6-1

Appendix 1 The Green River

Appendix 2 Agricultural Benefits

Appendix 3 The Karatoya-Bangali Basin

ANNEX 2 MEETING WITH NW REGION MPs, DECEMBER 1992

ANNEX 3 FAP2 WORKING PAPERS

1. GENERAL COMMENTS BY JICA

1.1 JICA highly appreciates the contents of the interdisciplinary and integrated report made through exhaustive work by consultants. Recommendation and conclusion of the report are sound in engineering, economic, social, environmental and ecological aspects.

Noted.

1.2 Recommendations urge the implementation of FAP 2.1 and FAP 2.2 projects, and JICA respects this recommendation. However, funding by Japanese Government for these projects needs further discussion among Japan, the United Kingdom and Bangladesh. JICA raises following points to be considered.

A. Allocation of the funds (grant aid, technical cooperation and loan) to Bangladesh is limited in Japan.

B. Japan, the United Kingdom and Bangladesh must review the urgency and priority of these projects in comparison with the other projects of FAP.

C. Priority of these proposed projects must be evaluated in comparison with projects of the other sectors (public health, education, etc.) within Bangladesh.

D. Japanese side needs the official request and after the receipt of the requests, Japanese government officially takes necessary consideration to decide funding or not.

E. Local cost must be prepared by Bangladesh government for the implementation of FAP 2.1. Bangladesh government must solve land acquisition problem of the project site.

Noted : these points are for discussion between GOB and the Donors.

1.3 Consultants follow the line of the Guideline of Project Assessment of FAP and benefits from flood control are estimated by analysis of the crop intensification, reduced damage to crop, property, and infrastructure, and (dis)benefits from the fishery. But, benefits of social stability and encouragement of economic development from flood control should be taken into consideration at this stage of project selection.

The GPA recommend that such secondary benefits could not be considered in project analysis. The consultants have followed the GPA in this respect.

1.4 Green river concept (partial protection) is reasonable, because full flood control is not achievable in respects of the topographical features (low-wetland) of Lower Atrai. However, Bangladesh Government should seek to obtain the support for this idea from residents in unprotected area through public participation and local assembly.

Extensive consultation with the public in the Lower Atrai was undertaken during the planning but this was on the basis of rapid rural appraisals. It is accepted that a systematic process of consultation on the Green River should now take place, of the type carried out for the Gaibandha project. The process

has stated with the recent meeting held with MPs. It should be borne in mind that those people living in the area recommended for only partial protection are not receiving effective protection at the moment, due to the extensive cuts.

1.5 Construction of the roads under Food For Work results in drainage problems due to no-provision of drainage facilities in road embankments as well as inappropriate alignment of roads without consideration of the existing drainage system. Thus, we recommend Bangladesh Government to establish the institutional framework in Food for Work Program to incorporate the advice from flood control and drainage aspects.

The consultants support this recommendation.

1.6 Economic analysis of the Gaibandha Improvement Project shows that IRR for base case is 10%, but Interim report show IRR of this project ranges between 16% and 23%. The reason of this discrepancy should be included in the Final Report in the form of footnote or others.

Noted - the reason is the greater detail of modelling and agricultural benefit assessment which resulted in reducing expected benefits.

1.7 Bangladesh Government supports reasonably the labour intensive work (manual construction method) to create employment. But, some reports show that improper manual compaction disrupts the durability of the embankment. Thus, compaction requires the work with mechanical equipment or strictly quality controlled manual work.

As stressed in Volume 6, Gaibandha Improvement Project - Engineering, the poor compaction works at the construction stage are responsible for deterioration of existing embankments in the GIP area. Employment of the mechanical construction method for the earth work will ensure the better quality and durability of the flood embankments planned for GIP, but will result in less benefit to local people despite higher construction cost as compared with the manual construction method as deeply discussed in Volume 6.

On the other hand, even the manual construction method can allow construction of flood embankments with the sufficient durability through the strict quality control of the construction works as seen in those constructed with the manual method in Japan in the past. The flood control works comprising construction of flood embankments have been implemented in Japan since 1500's to cope with the flooding problems caused mainly by passage of large scale of typhoons over Japan. Needless to say, the earth works including compaction were performed through the intensive use of man-power at the old time. As long as the information on existing embankments that we have got so far are concerned, they were embanked with insufficient compaction or just with placement of embankment materials without any compaction. It is considered that such a Contractor's idle performance resulted from the extremely low unit rate of embankment work specified in the BWDB's price schedules, say less than Tk. 30 per m3. In consideration of such a circumstance, FAP2 study has estimated the unit rate at Tk. 78 per m3 through the unit price analysis. Although it is expected that the sufficiently durable flood embankments can be constructed with this unit rate, it is recommended to confirm the adequacy of the manual construction method through the test embankment in the successive detailed design stage as proposed in Volume 6 or execution of small pilot projects as suggested below.

1.8 Consultants follow the guideline to estimate unit rates. However, execution of small pilot projects is preferable to verify the unit rates, before full-scale implementation of the projects.

We completely agree that the small pilot projects or test embankment should be executed to verify the unit rates as well as to determine the technical specifications of construction, especially those of embankment works, before full scale implementation of the projects. In this regard, we have proposed in Volume 6 to perform the test embankment in the course of the detailed design for GIP in order to establish the most suitable specifications for the embankment works, which can be fit to soil materials obtainable from the embankment sites. Based on the results of test embankment, adequate unit rates and technical specifications to be involved in the tender documents for construction of GIP are to be finalized in the detailed design stage.

2. GENERAL COMMENTS BY ODA

2.1 The consensus among ODA views is that the team has produced a comprehensive report that provides a clear overview of information regarding the situation in the North-West region. This information is derived from studies and surveys carried out by the team and from other sources. Note is taken that the documentation represents the carefully considered technical opinion of the study team on the basis of data gathered and analysed.

Noted:

2.2 There is, however, general concern that the discussion of the various scenarios and options (e.g Main Report Tables 8.1 and 8.2) do not fully take into account uncertainties in the supporting data. For example, the accuracy (and lack of standardised collation methodology) of existing official figures for fisheries and agricultural activities as a basis for development of models of future situations may be open to question, but discussion of this point is felt to be inadequate at present. Any uncertainties in these figures could have serious implications regarding the potential benefits of particular scheme options. The consequence is a general feeling that the attractiveness of the various schemes may appear to the non-specialist reader (especially of only Volume 1) to be overstated and that a less equivocal picture would require further gathering of evidence under well-defined conditions.

Problems of data collection and verification in Bangladesh are severe. However the consultants analysis of the various options is reasonable, and not over-stated. The consultants have spent considerable effort, including collaboration with FAP 17, to ensure that estimates of impacts on fisheries were not understated. This is reflected, for example, in the application of a scarcity premium to value fish output in the economic analysis.

2.3 The difficulties likely to be associated with Operation and Maintenance (O&M) requirements of any schemes are, ODA considers, rather glossed over, particularly considering that the second phase of FAP 13 (O&M) has not yet started. FAP 13-II is intended to develop O&M guidelines for FAP projects but definite recommendations are unlikely to be available for at least 2-3 years. That it may be rather early to make definitive recommendations such as those in Main Report Section 8.5 might be an honest (even if disappointing in some quarters) conclusion. The ODA view is that the case for recommending urgent adoption of the Gaibandha proposals is not strongly supported from the evidence presented. The potentially reasonable returns, together with the novel approach to be examined, appear to make the "Green River" approach in the Lower Atrai proposal worth further examination.

FAP 13-II will be of great value but it is unlikely that it will provide all the solutions to O&M problems (in the same way that FAP 16 will not provide all the answer to environmental questions). Moreover other programmes are actively working on O&M and developing new approaches at the present time.

The comments made on the Gaibandha project are noted. However it must be appreciated that piece-meal development of flood control waters in the project area will continue in any case (development of Kumarnai Bundh by SRP, erosion of Manos regulator etc.) Unless these are part of an overall development plan, the negative impacts on adjacent areas and consequent low investment benefits will also continue. We strongly recommend that FAP, with its improved approach to flood planning, should be involved in development in the Gaibandha area.

Our proposed rate of implementation is reasonable, both for the regional plan and the Gaibandha project (it is noted that elements of the Gaibandha compartmentalisation could be brought forward, as is indeed happening with the work currently being undertaken by SRP at Kumarnai Bundh). The proposed rate balances the need for further studies with the need to undertake urgent work in a dynamic human and physical environment, and where other organisations are actively working on similar or associated developments.

The comments on Lower Atrai developments are noted and welcomed.

3. GENERAL COMMENTS BY FPCO

VOLUME - 1 THE REGIONAL PLAN

3.1 **Karatoya-Bengali system** - a sub-regional plan from the Teesta to the Hurasagar is necessary. Gaibandha, although it can proceed to its next stage, is an integral part of the sub-basin and should be included. The study should include the finding of FAP1's master plan and cover all the activities being carried out by other organizations (SRP, EIP, FAP20 etc.)

The regional plan concentrates on the areas which suffer the deepest and most prolonged flooding, which are along the Brahmaputra and in the Lower Atrai. However our analysis, described in Volume 1, shows that sealing of the breaches in the BRE would effectively remove the risk of flooding in the middle reaches along the BRE. Since this is the major objective of FAP1, which is itself a major element of FAP, the need for a separate, sub-regional plan for the Karatoya-Bangali system is not apparent. The report does include the findings of FAP1 and all the activities being carried out by other organisations in this sub-region. The final report will also include additional analysis of our consideration of the second line of defence and make suggestions for flood proofing in the area.

3.2 **Flood Proofing and other complementary developments** - to be included in the plan. The responsibility for flood mitigation measures for Jamuna charland inhabitants is still being left to FAP1 instead of incorporating this under the NW regional plan. Little mention is made, also, of measures required for Teesta and Ganges charland. These deficiencies need to be corrected. Other developments involving water management such as agriculture, fisheries, navigation etc. should be considered as part of the regional plan.

Further work on flood proofing will be done for the final report. Section 8.3.4 discusses other developments involving water management, indicating that these are indeed part of the regional plan. A figure showing possible developments will be included.

3.3 **Implementation Plan** - too modest, one would have expected Taka 4 or 5 billions investment by year 15.

When taken with investments under other FAP components and other programmes such as EIP, the total plan for flood-related development in the NW region is about US$ 1000 million over 12 years.

3.4 **Compartmentalisation** - the broad FAP concepts are not fully addressed, particularly the public participation aspects.

These concepts are fully addressed in the Gaibandha project report including the public participation aspects. Until the results from FAP20 become clearer we have viewed compartmentalisation as primarily directed towards the management of drainage flows, and the elimination of cross-basin transfers. This has applied both in Gaibandha and for regional planning. We believe that these are practical and realistic steps which can be taken immediately and that the results from FAP20 can then build on them to achieve more active water management.

3.5 **Broad Water Management** - although not covered in the terms of reference, the report should have mentioned the need to broaden the planning base to include the dry season. (Teesta Irrigation Project is hardly mentioned).

In accordance with paragraph 1 of the Scope of Works for the study, the report is to "assess flood control and drainage options (and) to reduce and manage flooding, establish the preferred solution(s), prepare a Regional Water Development Plan, and to carry out feasibility studies of priority projects". It is accepted that it would have been desirable if the study had included broad water management aspects including dry season supplies but the fact that they were not can not be a valid criticism of this report. (Implications of dry season water management were included to the extent of an assessment of the impacts of flood control works on groundwater resources.)

3.6 **The Green River.** Although a well-conceived and welcome option for dealing with the extremely difficult problems of the Lower Atrai 'sump', further study is needed to overcome remaining difficulties. Therefore the proposal to undertake a sub-regional plan is supported. However no implementation of the Green River options in polder C&D should be undertaken until the planning work identifies, formulates and justifies the project. A general note on the Green River proposal is attached Appendix 1.

It is accepted that there is still considerable further work required on the green river concept, which is why a sub-regional study for this area has been recommended. The difficulties of the concept are clear, but so also are the practical difficulties of alternatives such as full flood protection (The Chalan Beel Study reported that there have been 100 cuts in the Chalan Beel polders since 1987). In developing the concept we have taken full account of comments made to us by FPCO and the Panel of Experts, we have held meetings with them to further elaborate our ideas, and explained our reasoning in working paper no. 8. Further comments from the consultants are given in Appendix 1.

The Green River presents the best opportunity for a stable and predictable flooding regime in the Lower Atrai, for the effective development of agriculture and fisheries, and for the improved quality of life that would result.

We recommend that the sub-regional study in the Lower Atrai should be associated with feasibility studies in Polders C and D: in our view the report has sufficiently identified, formulated and justified such a study.

3.7 **Institutions.** The consultants do not indicate what institutional arrangements need to be made for implementing and monitoring the regional plan. It is appreciated that this subject will be dealt with by FAP26 but, nevertheless, it would have been helpful for the consultants to have given their views taking into account the specific needs of their region (such as the problems of the Lower Atrai Basin and the (BRE). The institutional arrangements would need to consider how on-going projects/programmes (such as EIP, SRP, SSFCDI) can be included in the plan, as well as local government programmes (some of which can have impacts on drainage)

Noted. Further discussion of institutional issues will be included in the final report.

3.8 **Economic analysis.** This is thorough, but does not always follow the GPA. The analysis has been carried out in 1992 not 1991 prices and exchange rates, key economic prices have been reestimated, and the NPVs for project options are not presented. The GPA made it clear that consultants could make different assumption from those in the GPA but had to present an analysis using the GPA so as to ensure comparability between studies. This will have to be done by FAP2.

The price and cost estimates used should be the most recent available (allowing for trends, seasonal fluctuations) in order to make possible high-quality decision making, and to enable GOB and donors to develop accurately-budgeted programmes. As FAP proceeds it will make less and less sense to use 1991 price, nor is the value of doing this for "comparative purposes" apparent. It should be noted that two other Regional Studies will not report until 1993. It would be inappropriate for those studies to use 1991 prices, as they would have to do if the comparability agreement was too rigidly applied. In addition, within the NW region, there are many non-FAP water resources projects under preparation all of which will have used their own base year for prices. Unless all of these projects were to be also appraised by FAP, there are few strong grounds for conducting analysis in outdated prices.

NPV for the various options will be quoted. However NPV should not be used for ranking, which is why the consultants have continued to use the NPVR.

3.9 **Social analysis.** The main report should have described the process of participatory planning undertaken by the consultants (detailed in Annex 11) and the consultant should have identified key social impacts (e.g., land acquisition and resettlement rehabilitation of professional capture fishing households) for which mitigation measures will be needed. A clearer description of ways in which projects can be targeted to meet the needs of the poorest should have been included.

The consultants put considerable effort into this in relation to the Gaibandha project, and further discussion is included in the Final Report. We feel that this is a more useful approach then broad generalisations at the regional plan level.

VOLUME - 5, THE GAIBANDHA IMPROVEMENT PROJECT MAIN REPORT

The main report demonstrates that there is a good potential for Gaibandha to be the first FAP project in the NW region. However before proceeding to the detailed design stage the following have to be resolved:

- the report is not up to full feasibility report level: agriculture, environment, social and economic analyses, and some engineering (river training and compartmentalisation) do not contain the detail or are not adequately covered to justify proceeding with the project;
- the project package is incomplete: BRE improvements and flood proofing should be included and possibly other components should be added to make the project as comprehensive as possible; and

- the consultants should prepare a programme for bringing the GIP study up to full feasibility standard. Although there are some aspects that can be undertaken during the detailed design stage, the aim should be to produce a feasibility document now which establishes overall technical, social, environmental and economic viability. The alternative would be to introduce a further planning phase covering all the outstanding items and incorporating detailed design of the priority works. The output would be a full feasibility report to support financing which would have the advantage of further public participation; this time in detailed planning in the design of priority project components.

These points are further elaborated below and in the specific comments:

3.10 Brahmaputra Right Embankment

Unless FAP1's master plan includes the BRE sealing (as opposed to providing 'hard points') in its priority programme, BRE retirement and strengthening should be part of this project, together with any structures (G12-G15). In any case GIP should bear its share of the cost of all BRE work.

Costs related to BRE sealing were included in the project analysis.

3.11 Comprehensive Development

The Gaibandha Improvement Project has the potential for multi-purpose development; part of which could be under the main project and part under separate, but associated, programmes. The main project package could include:

- major CFD (including TRE & BRE) and river training
- minor CFD - compartmentalisation
- flood proofing external
- flood proofing internal
- beel improvements
- social projects - widened embankments, forestry, borrow pit or other culture fishery investments
- road improvements associated with compartment embankments.

Other developments which should in some way be tied to the main project, could include:

- navigation
- agricultural extension
- public health
- education

We entirely agree (except perhaps in relation to education). Although somewhat more limited in scope, the project proposals have been formed in this way in the Final Report.

3.12 Implementation Structure

Firm recommendations should be made for combining outstanding investigations, studies, and public participation activities with the traditional detailed design - construction - O&M activity sequence. FAP3.1 proposed such a system.

For FAP2.1 this could take the form of locally focused activities, such as planning for compartmentalisation, fisheries, navigation, flood proofing etc. being undertaken under PMU and in parallel with the engineering aspects of implementation.

Noted and agreed: this will be done in the final report.

3.13 Institutions

Further study is needed on the institutional arrangements for implementing GIP. Some aspects are clear, BWDB will be responsible for implementation and O&M of all major works (river training, river embankments, main structures and main drainage improvements). However it is anticipated that GIP will be a comprehensive project with the involvement of other sectors. FAP26's guidelines for such institutional arrangements will not be produced until a pattern of development for multi-sectoral FAP projects has emerged. In the meantime the Consultants should go further than the discussion in Chapter 6 and formulate provisional proposals for the institutional arrangements.

Noted: further institutional discussion will be included in the final report.

3.14 GIP Feasibility

The TOR state that a feasibility level analysis will be carried out. Nowhere in Chapter 1 is this made clear. In three important respects, the detail of analysis presented in the report is below that required for a full feasibility study: agriculture; social considerations; and environment (for which a full EIA is required to meet GOB and donor requirements). In addition, more realistic costing is required for:

- River Training. The proposed measures are likely to result in downstream morphological changes; the costs of mitigation measures should be included.
- Regulators and Sluiceways. These structures should have adequate provision for fish migration. Preliminary examination of the designs in Volume 6 indicate that costs should be increased to ensure adequate width/number of openings and provision of free surface flow during normal floods.
- Compartmentalisation. The costs of minor CFD works should be based on the design of a sample area.

It is clear that when the above plus allocation of some BRE costs are taken into account, the economic analysis will become less favourable. The Consultants should, however, consider the benefit of GIP (including TRE upstream Kaunia) to the downstream sub-region. An additional and significant benefit of GIP that has not been included is the flood protection of households and public infrastructure. As these benefits are difficult to quantify, the Consultant could consider adding the costs of flood proofing some of these facilities to the WO project case.

The report is not sufficiently detailed to be a 'stand alone' feasibility study. Much of the information presented in the social and economic annexes should be given in this report.

The Gaibandha Main Report (volume 5) must be read together with volumes 6 - 8 (which refer specifically to Gaibandha) and parts of volumes 9 - 15, which also have relevant data. Volume 8 is the EIA for the project. Volume 11 provides our social analysis of the project and volumes 12 and 13 the agricultural analysis, including results from detailed farm surveys in the area. Together these provide sufficient data on which to make decisions concerning the project, particularly in view of the likely need to reach some decisions within the next year. It is accepted that further data would improve the planning but such necessary data can be collected more effectively and appropriately during the long (11 yr) implementation period proposed.

We bear in mind that the proposed works might cause the downstream morphological change. However, the extent of the morphological change will have to be clarified in the detailed design stage based on the physical hydraulic modelling test. The best alignment of the river training works (including section of provision of groyne/revetment, width/length of groynes) is to be determined based on the physical modelling.

We attempted to collect the design standards of the fish migration facilities from FAP 17, which are to be provided for regulators and sluiceways, but any useful design was not available at the time of finalizing the Draft Final Report since FAP 17 was still under examination. On the other hand, it was informed that the cost for providing fish migration facility would be quite small as compared with the construction cost of regulator and sluiceway. In case that the fish passing way with a dimension of 1.5m in width and 7.4m in length which is controlled by up and downstream steel gates is to be installed in the regulator to be newly built, (in case of three steel gates) for instance, the construction costs is estimated to increase by 7% as compared with the without case. Besides, it is estimated that the total investment cost of GIP will increase by about 1%, even though the fish passing way is built on about each regulator. However, this should be examined in next D/D stage after more economical design thereof is to be finalized by FAP17.

The cost estimate for compartmentalization was made adequately and elaborately for each compartment based on the survey products and hydraulic modelling analysis.

Detailed comments concerning the method and level of benefits estimated are noted and responded to later in this document. While there can be different approaches to benefit estimation, our approach is methodologically sound and the results are correct within the levels of accuracy expected of a feasibility study. Benefits downstream have been included. Infrastructure protection benefits have also been included (through avoidance of non-crop damage). Multiplier effects on economic development have been excluded, following the recommendations of the GPA.

4. SPECIFIC COMMENTS BY JICA

4.1 Volume 5, page S-6, 7. GIP Implementation

It is advisable that the next stage of FAP 13 could base a pilot project at Gaibandha in order to develop new concepts and improved processes of O&M. In such a case, careful coordination between the both projects must be considered on implementation of GIP.

It would be very appropriate for FAP13-II to be based at Gaibandha if the Gaibandha project were implemented, since this would allow improved O&M to be supported by improved infrastructure. No practical proposals have been put forward, pending decision on FAP2.1 and FAP13-II.

4.2 Volume 5, Page 2-5, Table 2.5 Irrigation Equipment

Comparatively higher increasing rate of "other indigenous methods" like doons and swing baskets etc. may be results of rehabilitation activities after disastrous floods of 1987 and 1988.

Besides, quantitative estimate of the present water resource development by each means of irrigation equipment is desirable to be calculated, since GIP will have some impacts on the development trends of irrigation.

The factors behind the large increase in "other" methods of irrigation would certainly include rehabilitation after the major floods.

The impact of the proposed measures on net groundwater resource availability is negligible since total availability exceeds the net requirement for all the irrigable area. This will be further explained in the final report but it does not seem necessary to calculate the abstraction separately for each means of irrigation.

4.3 Volume 6, Page 5-6, (4) Revetment and Figure 5.27

Only two types of revetment works are conceived for river bank slope protection. It is needed to make coordination with FAP 21/22, Bank protection, River Training and APPM Pilot Project which is expected to create a proper design of river training including revetment works.

Two types of river structure are proposed to be provided for the purpose of protecting existing river banks; namely groyne and concrete revetment. In principle, groyne is planned to be provided at places where river banks are being or likely to be eroded by scouring due to shifting or meandering of the of the river channel, while concrete revetment at places where river bank is being collapsed by flood flow hitting directly the bank slope or natural slope failure due to the insufficient resistance force resulting from soil texture thereof. As far as spot imageries show, on the other hand, both banks of the Teesta in the Indian territory are successfully protected with groynes. This implies that provision of groynes is the effective measure against bank erosion due to scouring along the Teesta.

In accordance with this principle, the concrete revetment was planned to be provided near the Teesta outfall and at Sundarganj and Tarapur where it is confirmed through the site reconnaissance that the main cause of bank failure is direct attack of flood flow rather than scouring of bank foot. Actually, this type of revetment works are also provided at places on the Teesta Right Bank along the upstream reach and effectively functions as the bank protection work through the periodical maintenance

works. Moreover, the concrete revetment is designed to be covered with wirenet aiming at its stabilization. However, the design of the river protection work should be reexamined in the detailed design stage incorporating the study outcomes of FAP 21/22 as pointed out by the "Comment". Besides, the effectiveness of the river training works proposed for the TRE needs to be verified through the physical hydraulic model test in the detailed design stage for GIP as recommended in Volume 6.

4.4 Volume 5, Page 5-28 Negative Impact on Pure Tenants

Remedial measures to correct the negative change in net income for pure tenants ought to be suggested. If absolute impoverishment of tenants group should take place, the justification of the project might be heavily hurt.

The basic problem for tenants is their absolute lack of resources, with or without project. The measures most likely to support tenants would relate to tenure reform and provision of credit. These are desirable anyway within the broader context of a rural development strategy Further analysis of the survey results has shown that changes in tenants incomes probably do follow the same direction as changes in incomes of other groups (These results are discussed in the Gaibandha Final Report). In that sense the project has a relatively neutral impact on income distribution.

4.5 Volume 6, Page 5-16, Drainage Structure, Figure 5.21 to 5.23

The drainage structures including drainage regulator and sluiceway, whose typical plans, sections and profiles are illustrated in Fig. 5.21 and 5.22, need to be designed to properly function in the long term as originally planned. To ensure this, the following matters should fully be incorporated in designing these structures in next D/D stage:

(1) It appears that the seepage line along foundation of the structure is not long enough to constrain the seepage volume within a preferred range, although the required length is dependent on the subsurface condition of the structure site as well as the hydraulic conditions such as water levels at inlet and outlet thereof. To secure the sufficient length of seepage line, it is advisable to consider cut-offs both at inlet and outlet portions as well as cut-off wall in central part of culvert, according to the site conditions.

The depth of cut-off at inlet and outlet portions are determined based on the geotechnical condition of subsurface at the structure site assuming water level difference of 1 m. As commented, it will be needed to provide sufficient depth of cut-off as well as cut-off wall in the detailed design stage when the operation of these drainage structures are to be finalized in the detailed design stage. For instance, in case that a pond to be created by the regulator is planned to be used for water supply during the post monsoon season, more intensive treatment works for the structure foundation will be required to mitigate the seepage volume.

(2) Main concrete body of these drainage structures is designed to be founded on gravel foundation and lean concrete. The gravel materials should not be used as a foundation of this sort of structures since the gravel zone may form seepage routes. Therefore, only the lean concrete (low quality concrete) should be selected as the foundation type of the drainage structures.

The foundation for drainage structures, consisting of gravel/lean concrete, is planned to be adopted at place where the foundation soil layer is of loosed silty soil layer, in order to enable it to support the concrete body. Except for such worse cases on subsurface condition, it is estimated that lean concrete can support it sufficiently without gravel matressing. We agree that only the lean concrete is placed after sufficient compaction of the foundation soil even in such worse subsurface condition in order not create new seepage line.

(3) Weep holes on concrete walls of the drainage regulator, shown in Fig. 5.21 and 5.22 are not required to be provided, since there is a possibility that these weep holes lead to occurrence of seepage lines in earth fill portion behind the concrete wall.

The objective of the weep holes is to reduce residual water pressures in earth portion just behind the concrete wall from the structural point of view. However, we agree that weep holes are not required to be provided in the walls, at least below the designed high water level thereat (DHWL), in order to avoid occurrence of seepage routes behind the concrete walls as commented. The detailed examination on the stress analysis is to be made in the detailed design stage based on the designed water levels to be optimized according to integrated operation of the proposed drainage structures.

(4) Although the embankment slopes situated adjacent to the drainage structure are planned to be protected only with turfing, it is recommended that a range of the bank revetment works are provided to ensure the stability of the embankment body thereat, since these portions are susceptible to bank erosion and slope failure due to the flood flow during the monsoon season.

The reason why the bank revetment works adjacent to the drainage structures is that the flow velocity in the drainage structures is as quite small as less than 0.5 m/sec throughout the monsoon season according to the results of the drainage analysis, although we agree that the provision of the bank revetment works can ensure the stability of bank slopes close to the drainage structures which are often damaged due to flood flow. The detailed examination should be made in the detailed design stage.

5. SPECIFIC COMMENTS BY ODA

Economics Considerations

5.1 A summary of the economic findings is given in Tables 8.1. and 8.2 of Volume I and Tables 6.1 and 6.2 of Volume 13. Volume 13 should also include tables setting out the cost and benefit flows for each scenario and project. These could be in a form similar to Table 5.9 of Volume 5, with a breakdown of the different types of costs and benefits.

Noted.

5.2 Section 5.3. of Volume 1 presents two alternative scenarios for the "Green River Approach" in the Lower Atrai, one involving more protection than the other. The economic analysis in section 6.6. should cover both scenarios and should comment on the differences between them.

A full comparative analysis requires 25-yr model runs for all options under study. Time does not permit such further modelling, which should form part of FAP2.2.

5.3 Section 6.6.2 (b) of Volume 1 states that the Upper Karatoya development without the Bangali Floodway might approach economic viability. Whilst such a scheme would create problems downstream, the report should at least present an outline analysis of the costs and benefits from such a scheme, taking account of the disbenefits downstream.

This could be done. It is not clear, however, whether it would improve decision-making concerning the regional plan.

5.4 Since the FAP 1 study is not yet completed, it would appear to be inappropriate to provide detailed analysis of alternatives to the strengthening of the Brahmaputra Right Embankment. Even so, in section 4.2.4 of Volume 1, on the "Second Line of Defence", indicative costing should be given of the three alternatives mentioned.

Noted. Analysis of the "Second Line of Defence" will be expanded in the Final Report.

5.5 In sections 4.3.3 and 8.3.2 of Volume 1 it is mentioned that the Barnai and Naogaon schemes are likely to have an adverse impact on other areas in the Lower Atrai. Whilst the "bad case" should assume these schemes are completed as planned, there should be some indicative analysis of the negative economic impact of the systems and possible modifications to the schemes to lessen their adverse impact. More detailed analysis would be required in the feasibility study of the "Green River" scheme.

Noted. All such analysis should be part of FAP2.2.

5.6 More sensitivity analysis is required of the various options and scenarios. The information in Section 6.6.3 of Volume 1 should be presented in a table and the following additional analysis be carried out (including for Gaibandha)

a) assume no increase in crop yields (cf 6-6)
b) assume no scarcity premium for fish (cf page 6-11)
c) examine the impact on costs and benefits if the water level in the Brahmaputra rises 0.6m (cf page 5-11)

Noted. (a) and (b) are included in the Final Report but (c) can not be done without full model runs, for which additional time would be required.

5.7 Since the Hurasagar, Mohananda Right Bank and Upper Karatoya/Bangali Floodway Projects are clearly economically non-viable at present, in Figure 8.2. of Volume 1, outlining the Regional Plan, it would be preferable to put them under the "Long Term" section of the plan with no specific start date.

Noted.

Gaibandha Project

5.8 Section 4.1.3 of Volume 5 considers three design options, whereas four design options are presented in Figure 4.10 of Volume 6. The latter options more fully represent the range of alternatives, so that all four should be considered in Volume 5 and in the economic analysis; cost benefit tables should be produced for each (as at Table 5.9), along with tables showing the differences in costs and benefits compared to the base case.

Volume 6 correctly represents the number of "refined design option", though slightly different methods of analysis were used for each option. The Gaibandha Final Report will be corrected accordingly.

Full comparative economic analysis can not be carried out without 25-yr modelling runs of each option. Option O was selected in preference to Option N on the basis of economic analysis of the 10-yr runs. Option Q was rejected because it created a "breach" in the BRE.

5.9 In addition to Table 5.9 in Volume 5, it would be useful to have a further table setting out the distribution of each type of benefit and disbenefit between the Gaibandha area and other areas (along the lines of Table 5.7).

Noted.

5.10 Removal of the Manos Regulator would generate significant benefits through improved drainage, even if the project did not proceed (as shown on page 4-8 of Volume 6). The economic analysis should quantify these benefits (and any resultant disbenefits).

For comparative analysis the specific situation (Option A(?) see Figure 4.1, Volume 5) would have to be modelled for a 25-yr run. An analysis has been conducted excluding the costs of replacing the regulator: this is reported in Chapter 6 of the Final Report.

5.11 It could be argued that the "without project" case should be that without the Manos Regulator (which is likely to be washed away anyway). The analysis should show what difference this would make to the cost-benefit calculations for the base case.

Again, the "without project" case without the Manos Regulator would have to be modelled for a 25-yr run for a full comparative analysis.

5.12 In Table 4.3 of Volume 5 the comparisons between Options N and P indicate that major gains are obtained by removing the new regulator at the tail of the Manos. It is not clear why this should be so, since the regulator should be designed to minimize drainage congestion.

The gains shown are hardly major. The drainage regulators are designed to lower inland water levels to the outfall levels in 2 weeks (p 5.17, Volume 6): thus some "drainage congestion" is bound to occur.

5.13 All of the options in section 4.1.3 of Volume 5 allow the Brahmaputra to enter the Ghagot, so creating a breach in the BRE. The dropping of Option P on these grounds is not justified.

Opening the Brahmaputra to the Ghagot is not creating a breach in the BRE since backwater embankments are provided. Option P leaves agricultural land (the "countryside") unprotected, thus creating a breach in the BRE.

5.14 The benefits from reduced erosion by the Teesta make up a large percentage of the total benefits from the project. The estimated erosion losses (page 5-8 of Volume 5) are based on aerial photographs between 1983 and 1990 (page 2-3 of Volume 6). Is there evidence of such large losses occurring over a longer period of time?

As described in Section 12.3 of Volume 9, "Hydraulic Studies", analysis of historic survey data indicates that there has been a general trend of movement of the Teesta river to the South-West, and it is forecast through the morphological study that the time for morphological re-adjustment in the river Teesta is likely to be 20 to 50 years.

On the other hand, there is no firm evidence that certifies the occurrence of such losses over a longer period of time. However, it is considered natural that the river bank erosion will take place at the similar rate, unless the effective measure to maintain the river bank is to be provided since it is confirmed through interviews to local inhabitants during site reconnaissance that it has occurred every year to date, irrespective of extreme floods in 1987/1988.

To verify the adequacy of erosion rate estimated based on those aerial photographs, it is recommended to carry out the numerical and physical modelling analyses, or to re-estimate it using the latest aerial photography in the detailed design stage.

5.15 No value has been attributed to the accretion of land due to the movement of the Teesta. Whilst such land would be less productive than eroded land, it should be given some value.

This has been omitted since there are no data on accretion, although available evidence does not show a stable pattern.

5.16 The analysis on page 47 of Volume 13 would be improved if there was a table setting out (in economic terms) the capital and O&M costs and erosion losses over time for each embankment option.

The calculation is summarised in Table 4.4 of Volume 5.

5.17 Erosion due to the Brahmaputra (page 5-8 of Volume 5) will occur with and without the project, so should be ignored in the analysis, rather than counted as a disbenefit in the 'with project' case.

Accepted: this has been done in the Final Report

5.18 There appears to be a very large difference in the estimates of flood phasing for the MPO and model-based analysis (page 43 of Volume 13). Additional sensitivity analysis should be carried out for two cases, one assuming that flood phasing is closer to MPO estimates and one assuming that it is closer to the model estimates.

Despite the differences in flood phasing, the results in terms of cropping changes are rather similar, since the predicted changes in flood phasing are of a similar magnitude. Additional sensitivity analysis would therefore show little change in agricultural benefit.

5.19 In view of the major stresses on structures along the Teesta River, particularly the groynes and the revetment, it would appear prudent to use a higher figure for O&M costs than 3% of capital costs (page 5-11 of Volume 5).

To estimate the O&M cost, the groynes and revetment works are broken down in detail into earth works and concrete works, as presented in Volume 6 and then 5% and 3% are adopted as ratio of the O&M cost to the construction cost. It has to be noted that usually 1% of the total construction cost is adopted as the O&M cost in case of the flood control projects in Indonesia, which have been mostly implemented under the financial aid by Japan, although the river training works as well as other flood control works constructed in Bangladesh to date may require such a high O&M cost because of the inappropriate design and poor quality of construction as stressed in Volume 6. Thus, it is not conceivable to us that such an extremely high O&M cost equivalent to 10% of the construction cost will be needed, as long as they are to be properly designed based on the sufficient studies including physical modelling and to be constructed with the improved construction method and suitable construction materials.

Nonetheless, sensitivity analysis using a 10% rate for O&M has been conducted and is included in the Final Report.

5.20 Some of the fisheries activities listed in section 6.5.1 of volume 5, notably the development of borrow pits, look very non-viable from an economic point of view. The section should include some discussion of the economic case for each of the activities.

Noted. It is felt that more detailed examination of fisheries proposals should be carried out during the design stage. The borrowpit proposal should be considered on a pilot basis in the first instance.

5.21 If the team considers that FAP 2.1 and 2.2 are worthy of consideration, their knowledge of the requirements should allow them to propose draft Terms of Reference.

Noted.

Environmental Considerations

5.22 Given the long-term impact of any Flood Control measures it may be difficult to justify omitting environmental impact valuations in any cost benefit analyses basically because the data are not available at present (see Volume 4 final Para Page 1-2 and Page 4-20). The effect of the absence of such valuations on the economic analyses should be discussed.

The consultants have quantified, as far as possible, the likely impact on floodplain fish resources, which is one of the major long-term impacts. Where data do not exist, the consultants have taken the view that qualitative assessment and inclusion in the multi-criteria analysis is the best approach, rather than attempting to quantity impacts without adequate data.

5.23 There is some inconsistency in discussion of the environmental impacts in the summary in Volume 1, which is likely to be the only volume that many will read. Para 5 S-6 gives a list of impacts for CFD works and states the importance (i.e. significance) of inclusion of consideration of them in planning. Only one page later at the bottom of page S-7 social and environmental impacts are "generally signified as negative but are not of over-riding significance" for a not-completely clear group of project components. The discussion of this issue in Volume 4 (page 4-1) is not properly reflected in the summary volume.

The use of the concept of significant (twice) at the bottom of page 5.7 is regretted. The sentence should read "Social and environmental impacts are generally shown as negative but are not of such magnitude as to necessitate rejection of the proposals". The summary was circulated in draft form to all team members present at the time, which did not include the environmentalist. It therefore represents the consensus of the team but not necessarily the views of the environmentalist: there will be some difference in emphasis between Volume 1 and Volume 4.

5.24 Para 4 page 4-1 - formulation of the regional plan is based on the given condition that the Brahmaputra Right Embankment (BRE) is sealed and rehabilitated. Given the uncertainties regarding the outcome of FAP 1 a discussion of the consequences of an unsealed BRE merits discussion. The mention of the possible movement of the Teesta on page 4-13 indicates the dynamics of the river system, confounded by the possibility of public cuts.

This is done in Chapter 7 of Volume 9.

5.25 Para 3 page 7-6 raises the issue of the as yet unquantifiable future economic cost of loss of biological resources. However the preceeding paragraph notes that the projects in the regional plan are likely to contribute cumulatively to such losses. Given that the FAP 2 study is likely to be used to set planning and project goals for the future, some discussion of options is warranted, rather than the "escape clause" presented in the last sentence on the same page.

Such wide-ranging discussion is outside the Terms of Reference of FAP2.

5.26 The quite extensive list of recommendations expressed in Pages 5-22 to 5-24 is not reflected adequately in the summary volume.

Again there is an inevitable difference of emphasis between Volume 4, representing the views of the environmentalist, and Volume 1 representing the views of the team, as far as possible. Page 8.8 of Volume 1 itemises the recommendations thought to be most important and therefore requiring to be highlighted for possible funding.

5.27 The main report on the Gaibanda Improvement project raises the possibility of increased human disease (Volume 5 Page S-5) and public cutting (ibid. Page S-6 para 1), both of which would serve to undermine the compartmentalisation approach. In spite of this the report recommends the detailed planning and design stages of the Gaibanda Project be initiated immediately.

The time scale of the recommended implementation schedule for the Gaibandha project (Figure 6.1, Volume 5) must be appreciated. As currently shown this is an 11-yr project, with no physical work at all in the first two years, even though physical changes will take place (erosion of the Manos regulator, development of one of the downstream compartments under another project etc.). Further studies, consultation and detailed design work will be conducted during the long implementation period.

5.28 As the data for the Environmental Impact Study of the Gaibandha Improvement Project were collected over approximately four months rather than the complete year recommended in the FAP guidelines, the value of the data for planning purposes must be open to question. This situation is apparently confounded by the limited data on hydraulic parameters to calibrate the flood models used. Could this be considered as a "rush to judgement" for the scheme being considered?

As above; the proposed project is a measured response to a dynamic physical situation, with adequate time to do more detailed studies. The time and resources available to carry out EIAs on all FAP studies are felt to be inadequate. It was at FAP 2's specific request that resources for environmental work were enhanced following the Interim Report.

Engineering considerations

5.29 The detailed consideration of O&M issues in Volume 6 Section 8 is welcome but raises two issues; are there examples that can be discussed of the effective performance of Project Coordination Committees of the kind proposed and how is beneficiary participation, especially of the landless, to be arranged. Although the provision of a berm on the "country side" may help to reduce damage to embankments how will the requirements for the land involved be arranged, especially as the report suggests that this idea may in any case not be a permanent solution?

a) *Experience of Project Co-ordination Committees is not encouraging (eg. FAP13); however they seem an appropriate institutional framework and therefore efforts must be made to continue to improve them;*

b) *Models already exist for beneficiary participation (see Volume 6, Chapter 6) and can be further improved. This would be part of the function of the Project Management Unit (Volume 5, p 6.3).*

c) *The difficulty of land acquisition for the berm is noted.*

5.30 The argument that improved construction methods can reduce O&M requirements undoubtedly has some merits, but the trade off between high initial investment and lower O&M is by no means simple and requires some discussion. The emphasis on the report appears to be in raising construction standards rather than on the choice of technology. This is important as current experience in Bangladesh indicates that conventional flood control measures are rather vulnerable to premature failure.

It is not understood what is meant by this comment. The Gaibandha Report discusses some technology choices (Section 4.4, Volume 5). Are others being referred to?

5.31 It is stated that the Gaibandha BWDB O&M Division is showing encouraging methods of handling monitoring and maintenance works, but details of how this is being done and lessons which have been learnt which could be of wider application are apparently not discussed. The findings of FAP 13-II may provide some further guidance but little information will be available from that source for at least a couple of years.

Noted.

Fisheries Considerations

5.32 There are doubts about the validity of data from the Department of Fisheries. Initial findings from FAP17 indicate that such data are unsuitable for use in planning exercises. The Fisheries volume (Page F-14) acknowledges that historical official data may be questionable. This raises serious questions as to the basis for arriving at any quantification of future production parameters for different proposed schemes and consequent calculations of economic returns. A delay of decisions on recommendations until more reliable data are gathered should be discussed.

Historical data from the Department of Fisheries is not in itself essential to the calculation of economic returns and, as already noted, efforts have been made to ensure that estimation of the impacts on fisheries should not be undervalued. Delays in decision making may be appropriate but this must take into account on-going development in the region.

5.33 The report identifies the restocking of beels and development of pond aquaculture as being capable of making up for loss of traditional fishery opportunities as a result of flood control. ODA considers that the discussion of the economics of these changes, especially related to payment for the capital costs of the stocking of these water bodies, as well as the social issues relating to the changes in "ownership" of the water bodies, are not adequately discussed.

The report clearly recognises (Volume 1, p 5-5) that aquaculture can not compensate for capture fish losses. The economic and social impacts of restocking programmes are outside the ToR of FAP2; other studies and projects (notably 3rd Fisheries) are better equipped to address these issues.

Agricultural and Livestock Considerations

5.34 A discussion of the relevance of the existing DAE recommendation for fertiliser application etc. would be useful in Volume 12 Section 1.5. The recommendations are very general and there appears to be little capacity for adjustment to individual farmer circumstances which could greatly affect the economic analysis at the farm level.

This section is an assessment of data on input use, not a series of recommendations. It was used in the economic analysis. The comments concerning farm level analysis are noted.

5.35 The question of the quality of statistics discussed in Section 2.1 has been mentioned above. With several different sources of information, a discussion on the possible effects of different data collection, area aggregation and analysis methods on the accuracy of any baseline inputs into production models appears necessary, as this modelling forms an important element of the calculations of economic returns for project components.

Noted.

5.36 In section 2.2.1 the rather throwaway line "Economic and management reasons also play a part" appears. Economic and management parameters are unlikely to be without importance to individual farmers and should therefore not be replaced by external judgement without clear evidence that farmer motivations are understood.

Noted.

5.37 In 2.2.1 do the recorded reductions in livestock numbers reflect a deliberate policy of disposal by farmers or are they a result of unplanned losses? If the former the reasons should be discussed and if the latter then the reasons for the lack of the appropriate livestock support service requires discussion. Many small farmer studies have shown the importance of sales of animal products in maintaining a steady, even if small, cash flow between the periodic income from crop harvests - the reduction in livestock number mentioned might be discussed in this regard.

Reduction in livestock number appears to be mainly due to increasing pressure to utilise land for crop production, with consequent loss of grazing.

5.38 Are the changes in water regime described in 4.2 (b) - Page A-9 due to FCD measures or the result of availability of irrigation or if both can the two components be disaggregated for discussion?

The changes referred to are those due to FCD measures (FAP12 Main Report, Volume 1, p S-9).

5.39 The use of the word "optimum" in 4.2 (d) is unwise without qualification as it could refer to a variety of measures including overall yield, yield stability, some economic measure etc.

Noted.

5.40 In 4.2. (e) The second sentence is rather unclear referring to decrease in reduction - in comparison with what? The fourth sentence contains two separate ideas. Would it be more appropriate to consider the world-wide fertiliser use question in another forum - especially as the validity of this statement is greatly affected by government support policies?

Noted. Fertility has reduced because the nitrogen fixed by the blue-green algae has decreased following FCD projects. On the other hand the availability of other minerals increases due to better soil/water interactions.

5.41 It may be expedient (last sentence of 4.2) to omit crop residues from budget calculations but this could be justified by giving some idea of how small the percentages are of farms disposing of residues for manufacturing (e.g. strawboard) or for livestock feed use at present.

Noted.

5.42 In 4.3. (e) the switch to power tiller use is mentioned but it is stated that inappropriate cultivation methods are being used. The equipment is all being imported from countries where such machines are widely used, apparently very successfully. Why is it that the appropriate implements and operational guidance are not part of the package being imported into Bangladesh, given the potential importance of them in improving farmer performance and hence profitability? In (f) why is the assumption made if its basis is uncertain?

These comments are noted. Adaptive research is outside the ToR of FAP2.

It is reasonable to assume that, in the north-west region, migrant labour can be used to overcome labour shortages.

5.43 In section 5.1. the importance of forward marketing opportunities at reasonably certain prices in determining cropping patterns is not discussed. These considerations may be expected to be as important as flood level issues for the farmers as a basis for decisions.

Noted.

5.44 The accuracy of the production models is questioned in section 5.2.1. Does this suggest that further validation is required before useful results may be expected, especially as much of the economic returns analysis depends on the outputs of these models?

Improvements in modelling will undoubtedly improve the confidence of the results. In the meanwhile the modelling approach provides a sound basis for examining flood control options, as long as it is associated with other approaches such as MPO, FAP12 evaluations etc. The eonomic returns analysis was based on such other approaches as well as on model results.

5.45 Is the assumption implied in section 5.2.2 and 5.2.3 that cropping patterns are basically dependant on anticipated flood levels sound? To what extent might factors such as land tenure, individual farmer resource level and communications between the holding and market and input sources modify the picture?

It is noted (p A-18) that cropping pattern changes are not just a function of water levels. Therefore model output results have been modified as above.

5.46 In the figure presented for the Gaibandha Project, the predicted changes to crop production appear to be relatively minor, i.e. about 8% increase in total aman production and a drop in jute output. Do these rather small changes provide a real economic basis for supporting the project in comparison to the likely level of capital investment required?

Cropping changes are only part of the benefit of the project. Others include reduction in crop and non-crop damage, avoidance of loss due to erosion etc. As noted on p 5.14 of Volume 5, the project is sensitive to increases in agricultural returns but we believe that the changes in cropping patterns have not been optimistically assessed. The project as a whole has a return of 10%.

Social Development Considerations

5.47 There is a general comment that the linkage is rather poor between the excellent account of the complex sociological issues in the region presented in Volume 11 and the discussion of these issues in the Regional Plan. A particularly significant example is in the numerous references to public cutting of existing structures and the consequences that this has for existing (and future) FCD.

The prevalence of public cuts is the whole basis for the planning of FAP2 and underlies the concept of the Green River. The "numerous references" to public cuts surely provides the linkage called for.

5.48 The Regional Plan is basically presented as a set of engineering solutions to flood control. This is illustrated in Fig. 8.2 where the majority of components clearly involve infrastructural work of various kinds. Social development issues appear to be subsumed under the heading "flood proofing". The sociological issues which are of direct relevance to the implementation of the proposed regional plan, for example public participation in the implementation and in O&M, remain to be addressed, which may make premature the rather concrete (!) proposals for major FCD works in the Regional Plan.

These are specifically addressed for the Gaibandha project (Chapter 6, Volume 5). For the regional plan they are more generally addressed in Section 8.4 of Volume 1.

5.49 In the discussion of "associated developments" under the Gaibandha Scheme some sociological issues are addressed, e.g. fisheries, navigation, housing, sanitation and tubewells but substantive discussion of strategies to mitigate against adverse health aspects is absent. This is particularly important given the likely reduction in protein supply, especially for women, that may result from a reduction in capture fisheries. There appears to be no mention of the Ministry/Department of Health in the list of agencies which should be involved with the Project.

The comment is noted. The next stage of the Gaibandha project should include a component focusing on health.

5.50 Disadvantaged groups are specifically mentioned in the Project TOR as needing special attention. Among the large numbers of functionally landless communities in the Gaibandha area the Hindu fishing communities and the char dwellers require special discussion. In the former group the migration of male household heads to West Bengal has left many female-headed household who are particularly susceptible to nutrionally-related health problems. The growing number of char dwellers, considered as virtual outcasts by the mainland population is particular vulnerable to FCD measures.

Noted. The potential for targeting benefits to poor groups is discussed in Section 8.3 of the Gaibandha Final Report. These efforts should primarily focus on women.

5.51 The Project has been commended for its attempts to provide opportunities for consultation between the Project team and the potential beneficiaries. This is of course different from public participation in any finished FCD or other scheme. Given the somewhat limited horizons and range of experience of different environments of the local residents and the admitted uncertainties in the outcome of any schemes discussed by the Team, can any useful conclusions be drawn from the discussions held to date? Although there is little evidence of social cohesion for most of the time among communities in the Study area, except perhaps among the char dwellers, with strategies for flood response being basically made on an individual household basis, on occasions the community does operate as a unit e.g. in making public cuts in embankments. Can the team draw out any elements of this occasional community cohesiveness that could be incorporated into effective systems for management of common property resources and for provision of O&M requirements?

The limitations of the public consultations are noted. Nevertheless they do provide a sound basis for the feasibility plan, and for further development.

The second point will be addressed.

6. SPECIFIC COMMENTS BY FPCO

VOLUME 1, THE REGIONAL PLAN

Category 1

6.1 pS-3, Para 2, lst three lines

"Experience of previous .....in their management"
Small scale schemes should be part of large scale schemes planned on regional basis.

Comment agreed.

6.2 pS-4, section 3

Development scenarios are needed for the stretch between Bengali Floodway and North Hurasagar.

The major problem in the area is the breach flooding, BRE strengthening works under FAP -1 and Bangali Floodway solves problem of flooding and drainage in that area. The work of FAP20 will also contribute. We also considered a second line of defence from Kazipur to Serajganj against BRE which may also function as a development scenario in that area.

6.3 pS-6, Last but one para

"All these impacts ..... to be fully taken into account during planning"
Comment: It is practically impossible or may take decades to assess the impacts "fully" on the bio-physical environment. It is better to do that "appropriately" and not "fully".

Noted.

6.4 pS-7, section 1.6, first bullet, second sentence

Developments behind BRE should be covered by this regional plan. Project planning and implementation may well be delayed until results of FAP20 Pilot Project are available. In all probability FAP20 will be concerned mainly with water management, rather than with 'second line of defence' or sub-regional flood retention.

See response to comment 6.2

6.5 pS-11, top para and bullets

The problem with associated development is that it may not be given a high profile by other agencies and may not (or even never) be implemented. There should be some way of tying the programmes or projects to the FAP project. Flood proofing should be included in the FAP project.

Noted. Associated development has been more strongly emphasised in the Final Report and a preliminary budget allowed for it.

6.6 p3-12, sub-section 3.4.8. Planning Concepts

Clearly the sealing of BRE is the most important measure. However, internal drainage still has to be resolved. FAP2's efforts to examine and plan drainage at sub-regional level are still sketchy. The whole Karatoya Bangali system (including the Ghagot/Alai) from the Teesta to the Hurasagar should have been examined under present conditions and under possible future options. Regional planning must be comprehensive and, in this sub-region it should cover work being undertaken under SRP, EIP, FAP20, FAP1 etc., otherwise it will be difficult to assess the various options with their positive and negative impacts. Unless it is covered in volumes 9 or 10, there is probably a case for sub-regional planning as proposed for the Atrai Basin.

See response to. 3.1.

6.7 p4-1, sub-section Brahmaputra river

Sensitivity analysis should also be carried out to examine the effect of a full BLE from Bahadurabad to and along Dhaleswari L.B. on the Brahmaputra/Jamuna water levels (about 80% of BLE exists and it is probable that it will be sealed during the next decade or less). Why were the effects of Jamuna Bridge not considered? Is the effect on Bengali Floodway insignificant?

FAP25 model runs indicate that water levels at the outfall of the Ghagot are unlikely to be affected significantly by the construction of a left embankment along the Brahmaputra (BLE). The change in level at Bahdurabad is less than 10cm and this diminishes further upstream. At the outfall of the Hurasagar, hydraulic sensitivity analyses were undertaken for an increase in Brahmaputra levels of 0.5m, which is in the order of that indicated by the FAP 25 model runs. At the outfall of the Bangali floodway peak levels due to a BLE were predicted by FAP 25 to increase by about 10-20cm. Whilst these would have some implications on the backwater levees along the floodway, the change in level is effectively within the freeboard tolerance.

During the study the results of the FAP25 model results for other external influences, including the Jamuna Bridge, were not available. Sensitivity analysis for changes in water level due to the bridge should be incorporated in future study phases such as FAP 2.1 and 2.2, when the FAP 25 models runs will be available.

6.8 p4-11, section 4.3.2 general

Have there been public consultations in each of the Green River units? If so, a short para under each unit should be given to indicate public reaction - especially from those who are living in the proposed Green River tract.

Sub-poldering should follow the principles of compartmentalisation of which public participation is the key component. The term compartmentalisation should be used wherever a protected area (CFD) is subdivided into water management or drainage sub-units.

Public consultation was done along the Atrai where the Green River will flow particularly in Bogra polder -2 (Atrai RB and Khorsuti), Bogra polder- 3 (Khorsuti), Chalan Beel Polder - C (beel Halti and Singra), Polder - A (Gurudaspur), SIRDP (Taras, Nimaichari and Baghabari)

6.9 p4-15/16, references to Hurasagar

The southern part of the Hurasagar unit may not be effective as a Green River flow area. The 1987 flow areas show up very clearly on the satellite imagery on figure 4.4. The cyan and blue areas show the natural extent of moving water. The black areas (NE SIRDP and Hurasagar) were probably inundated but not moving appreciably.

Comment accepted. This is why the consultants also analysed a full flood protection option in this area.

6.10 p6-1, last para

Crop damage should be dealt with in the estimation of yields (see GPA, Annex 1, p2-3). If it is not possible easily for the consultant to do this, the report should make it clear (which it is not at present) what assumptions were made in estimating the 'without crop damage yields'.

See response to comment under Volume 12, Agriculture.

Yields have been estimated on the basis of the consultants' field surveys and secondary sources. These yields are "normal" yields, i.e. in the absence of significant crop damage. Crop damage estimates have been derived separately.

6.11 p6-2, para 1

The identification and costing of mitigation measures should have been completed, at least in indicative terms, in the regional plan. From the MCA, it is obvious that some projects will require more costly mitigation measures than others.

Would it be possible for these to be taken into account indicatively by including increment construction and O&M costs for such mitigation in the analysis?

The analysis attempted to quality benefits and disbenefits as accurately as possible. Mitigatory measures can then be planned and analysed separately, as "projects" in their own right.

The consultants remain of the opinion that detailed mitigation measures are best identified at feasibility stage. In the regional planning work the consultants have attempted to minimise adverse downstream impacts, but any adverse impacts at project level need to be dealt with in the more detailed planning of the project.

6.12 p6.8, para 5

See the general comment about following the prices in the GPA. For comparability with other studies, the 1991 fertilizer market prices should be used though the consultants may undertake supplementary analysis with the new prices. The last 10 years have too considerable fluctuation in fertilizer prices and this year's prices may prove no more 'permanent' than last year's.

It is highly unlikely that fertiliser subsidies, once reduced, will be reimposed, and therefore it is surely a more realistic basis for pricing to accept the convergence between financial and economic prices used in the analysis.

6.13 p6-11, last para

Similarly, fish prices. There may well be reasons for the consultants to undertake supplementary analyses using higher economic prices, but arbitrarily to base the entire analysis on an economic prices at 44% higher than recommended (125/88) is not in line with the GPA. The consultants should use the SCF and do sensitivity analyses with price 25%, 50%, 75% and 100% higher to compensate for likely shifts is market prices over time, 'scarcity premium' and possible underestimation of losses, if these seem reasonable.

The consultants conducted analyses of fish price trends and held detailed discussions with FAP16 and FAP17. As a result, the consultants made the considered (i.e. not arbitrary) judgement that it was appropriate to assume an increase in fish prices relative to other commodity prices. An increase of 25% was thought to be a reasonable approximation. The consultants omitted to apply the SCF to this price, an error which will be corrected. However, the consultants still consider that the basic assumption is appropriate (no price for fish is given in the GPA). It is intended to conduct sensitivity analysis assuming no scarcity premium as suggested by ODA.

6.14 p6-15

Prices should be in mid-1991 prices and exchange rates (USD=Tk38). Table 6.17 again, fine to use the NPVR, but the NPV should also be shown and any differences in project rankings due to using the different measures explained.

See response to comment 3.8

6.15 p6-20,(i)

In view of the sensitivity to forecast levels of agricultural benefits, further sensitivities on the values of key variables (e.g., rice prices, shadow wage rate) should be described.

Further sensitivity analyses on rice prices have been conducted. It is not clear what would be the value of sensitivity related to shadow wage rate: the impact would be very small.

6.16 p7-8, para 4

It would be useful to have a line in the MCA on 'Social Feasibility' of the various options. Why use a proxy? Much greater consideration should be given in this section to adverse social impacts (e.g., land acquisition, loss of livelihood by professional fishermen) and the manner in which these may be mitigated. Also to ways in which project benefits can be targeted to the rural poorest, especially women.
The section referred to is part of a discussion of the Impact Assessment matrix (Table 7.1), which is not intended to deal with mitigation measures. More detailed discussion is included in the relevant supporting volumes (particularly 4 and 11).

6.17 p8.4, para 5

Flood proofing of areas not considered in the analysis should be included. For example flood proofing of charlands.

Noted. A further discussion of flood proofing is included in the main reports.

6.18 p8-7, section 8.3.4

Complementary development should be identified as those projects or programmes which should be packaged with the FAP project and those which should be implemented separately (but somehow tied to the FAP project). Examples could be:

- packaged with FAP project
  - flood proofing within the project area where events exceed design
  - flood proofing in adjacent areas which may be impacted (even psychologically)
  - fishery project associated with water management
  - preservation/monitoring of an ecological beel

- implemented separately (but tied)
  - navigation
  - agricultural extension
  - infrastructural improvements (feeder roads)

In Gaibandha Improvement Project flood proofing was considered within the scope of physical works.

Navigation aspect was considered in the plan, the Ghagot floodway will facilate navigation facility through water transport round the year upto Gaibandha town. In the lower Atrai the cost estimates includes provision of navigation locks, which will allow boat traffic in polders in monsoon time. No structures are planned in the river, as such navigation facilities will be as of present condition in case of the Atrai, the L.Jamuna, the Nagor, the Barnai and the Sib etc. Since the river flows in the dry months completely dries up, integrating the navigation facilities with the national grid requires extensive dredging works which involves large scale costs and structural measures. LGEB is in particular looking after rural infrastructure (construction of roads, culverts and growth centers).

Hence NWRS recommends separate feasibility study for navigation and rural infrastructure development. However the study considered the associated development while the facilities like roads has been utilised as a work component/compartment, and CFD intervention on navigation routes.

6.19 p8-9, section 8.4, first para and figure 8.2

The plan is not particularly comprehensive. Associated/complementary development is not shown in figure 8.2

Noted. Such development is shown in the Final Report

6.20 Figure 8.2

Polders C&D should not be initiated until the sub-regional planning is well advance. Suggest detailed design starts after the first year of sub-regional planning. Also suggest the sub-regional planning for the Karatoya-Bengali basin be added to bring this area to the standard of the Lower Atrai basin. With a total of about US$ 87 million over 12 years the plan is modest, and could be expanded.

Noted, but not agreed (see responses to general comments).

Category 2

6.21 pS-5, para 2

How often would the Bangali Floodway be unable to drain water into the Jamuna? How far would water back up, could this be contained within embankments, and if not, what would be the impact? Was the possibility examined of using the former Karatoya channel which passes Bogra town as a spill channel?

Backwater levee will take care of the rising level of the Brahmaputra and backwater impact will be upto 23 km upstream from outfall shown in fig- 9.8 of Volume-9: Hydraulic studies and the backup water could be contained within the embankment. CFD embankment at the upstream will provide control flooding and drainage facilities. Fig- 9.12 (Volume - 9 : Hydraulic studies) explains that upstream development with floodway reduces Karatoya water level in the upstream reaches than the present condition.

Flood diversion through Karatoya old channel which passes Bogra town was not considered since the channel was closed to protect Bogra town from flooding: its use would cause flooding to the low laying areas around Ichamati-Gajaria scheme (an SRP on going project)

6.22 pS-5, 4th Para

"This means that ..... protection of boro".
Comment: This statement is not correct. At places where Boro grows in lower lands, those are very much succeptable to damage by early flood. This report also says that (page S-3, 4th para). So, the observation may be corrected.

Hydrological analysis confirms that rivers in the lower basin of the NW region tend to rise in July. In addition farmers harvest boro as early as possible, often in May. Therefore damage to boro is not extensive.

The comment on page 5.3 refers to a planning policy. Generally, physical protection is not necessary to fulfil this policy.

6.23 pS-5, Section 4, Benefits

Disbenefits to fisheries has been mentioned. Culture fishery, if given due importance, should contribute more than what is contributed by capture fishery.

Present indications are that, in the short to medium term, it is unlikely that gains in culture fisheries can compensate for losses in capture fisheries.

6.24 pS-7, Ist para

"The ground water.....recharge is high".
Comment: It is not correct that ground water is fairly abundant. Effects of present obstruction are already there. The sentence should reflect these.

Abstractions do have an effect. Nevertheless the FAP2 analysis (described in Volume 10) confirms that groundwater is indeed generally abundant.

6.25 pS-7, sec. 6, Last para, last 2 lines

"However, as noted above, the long term morphological impacts..... needs to be studied".
Already river embankments are there but less effective due to breaches. So, the river has already morphological impact over years. This fact need to be kept in mind while making the BRE effective.

Noted.

6.26 pS-7, Sec. 6, The Regional Plan

(a) Upper Karatoya and Bangali Flood way is one of the components of the Regional Plan but has not been mentioned here, which should be done.

The projects mentioned are possible long-term development, with low returns.

(b) Green River Strategy needs to be assessed also in respect of its social acceptability. It was experienced that the local people are not in favour of lowering height of existing embankments. Controlled flooding concept should possibly be applied.

The local people were consulted before the planning of the Green river strategy through a series of rapid rural appraisals. The sub-regional study will look into further social acceptability in the area, and should include a programme of systematic public sonsultantion. The Green river strategy does not recommend lowering of embankment crest. In the Green river strategy flows will be allowed after 2nd decad of July considering the monsoon crops (TDW Aman and B.Aman)

6.27 pS-7, The Regional Plan, 6th sub-para

"Other schemes show lower return .... little Jamuna".
Comments: Page S-9, Table 1 shows 16% IRR for Right bank of Little Jamuna, which is Contradictory.

Noted, The L.Jamuna right bank scheme can be included in the short term as in figure-3.

6.28 p1-3, table 1.3

Why has the reduction of flood plain fisheries been insignificant compared with the other capture fisheries?

See further discussion in Fisheries, Volume 12.

6.29 p2-9, 5th para

"Failure to plan the project within a regional context (Nagor Valley).
Comments: No regional study was available during planning stage of the project.

Comment Noted.

6.30 p2-10, Para 5: Other Aspects

"Lack of public consultation in planning"
Comments: Public consultation is always considered during planning of EIP Projects. The generalised statement may be corrected.

The statement is an accurate record of the FAP13 report. Of course it does not refer specifically to EIP.

6.31 p3-5, para 2

It would be useful to include the social dimension with the other three indicators (flood phase, crop intensity and crop damage). A coloured map showing the population densities could be added.

Noted.

6.32 p3-5, para on category 2 and section 3.3 generally

Low flood damage to crops is probably due to lack of confidence to intensify - CFD should help.

One would expect farmers to adopt cropping patterns according to flood vulnerability therefore damages would not be significant except in extreme cases, particularly breaches.

Flood damage is quoted in percentage terms, not absolute terms, therefore the categorisation is appropriate. The crop damage category is derived from high flood years, nonetheless analysis of high floods in 1987, 1988 and 1991 suggests that the same areas tend to suffer serious crop damage in all high flood years.

6.33 p3-10, section 3.4.6

Why is Teesta Irrigation Project not mentioned?

Teesta project lies within the planning unit-6. Since it is an irrigation project the Teesta project is not mentioned here but the flooding and drainage problem are discussed. The Teesta project is included within our consideration of existing schemes.

6.34 p3-10/11, section 3.4.6

The flooding problems are severe in the south-east corner of Upper Karatoya. This should be pointed out; Volume 3 shows that the Karatoya's carrying capacity is restricted in the area. Remedial measure suggested.

Noted: as such the study recommends Bangali floodway which will be designed to have sufficient section with outfall at Brahmaputra for flood mitigation purpose as stated in Volume-1 Section 5.5 and Volume -3 section 5.73. The improved section of floodway is furnished in table - 5.2. The above measure is sufficient.

6.35 p3-12, 3.4.9 Joypurhat (planning unit)

Comments: Flooding from Tulshiganga River may further be studied.

We understand that this is in hand through EIP. However available statistics do not indicate a particular problem here.

6.36 p3-13, Para 2

"Accordingly the extension ... the Naogaon Polder Project".
Comments: For more security of the Naogaon Polder prevention of flooding from Atrai through Patnitola should be ensured.

We understand that the Patnitola embankment is always breached due to poor construction and needs further strengthening.

6.37 p3-14, bottom para

Does the Pabna project not have upstream impacts along the Baral and Gumani rivers, or for the Polder A? What about impacts on adjoining Jamuna and Ganges char areas?

Pabna project have embankment upstream but it's topography does not comprises of flow area. There is large flow area on the left bank of Atrai river in polder - 4 as such there will not be significant impact of Pabna project along Baral, Gumani and polder - A. In the regional plan Pabna project is assumed to be completed.

The char lands adjoining Jamuna and Brahmaputra are subjected to flooding, in the Pabna project plan there is no provision of flood proofing works. However flood proofing works may be recommended.

6.38 p4-10, top para

Compartmentalisation in the CFD areas should be concerned more with internal water management than with flood retention/transfers.

Noted. However improved flood management is a useful and practicable first step towards more general improved water management through compartmentalisation

6.39 p4-10, para 2 and para 4

Setting a weir level at the 1:20 decad level in July or even June will not be suitable for the movement of fish fry into the area for average years.

Setting the weir at a 1:20 return period is certainly not 'gradual flooding' (para 4).

Noted : weir levels are fixed at 1:5 year in 2nd decade of July. It is expected that on average year fish fry will enter in the polder but it will be delayed. Embankment crest is fixed at 1 :20 year flood.

6.40 p4-10, 2nd para, 2nd and 3rd lines

"At the present.....as fixed weirs".
The purpose is to allow water entry as required. Fixed weir will fail to allow water to enter until the water level reaches the crest level of weir. So, in the beginning at least a few structure should be flexible regulating structure.

Comment not agreed. The desirability of flexible operating facilities is accepted but experience indicates that these can not generally be operated effectively under present condition in Bangladesh, due to conflicts over the mode of operation.

6.41 p4-10, 3rd para, lst three lines

"It should be noted that.....breaches and cuts."
Should the basis be only farmers satisfaction or what can be effectively gained? Why you term replacing b. Aman by t. aman as an ambitious plan?

Agricultural gains can only be achieved through farmers, therefore their satisfaction and motivation are important. Replacement of b. aman by t. aman is ambitious because it requires full flood protection. Experience shows that this is impractical in the Lower Atrai.

6.42 p4-9, Para-3, Line-3

It is not understood why this scenario has been called "Green River". One may think that Green River means no intervention and natural condition is maintained. Hence a clear definition is needed.

6.43 p4-13, sub sections Polder C and Polder D

Satellite imagery (figure 4.4) indicates that drainage from polder D might be more natural routed across the Fakirni into polder C. Enlargement of the Fakirni may be significant; perhaps a level-crossing would be a practical compromise.

There is hardly any great level difference, the question of flood equity between the people of two polders was considered in planning. Level crossing structure might create social conflict in the area which will lead to social conflict. Moreover this will lead to total damage to agriculture in polder - C as well as it will add more discharges to the Atrai system that will lead to rising of flood peak.

6.44 p4-14, para 2 (and elsewhere)

Can the adverse impacts of the Barnai project be avoided or mitigated at this stage? Has the NWRP nothing more constructive to propose than monitoring?

Noted. The impact of Barnai project has implication in the planning of Polder - D as the flood level increases on the Sib, NWRS adjusted the polder - D by flows through the center of the polder.

6.45 p4-17, para 5, last sentence

The consultants should indicate whose responsibility this should be, External impacts are the responsibility of the NWRP.

The point being made is that the external morphological impacts of TRE and BRE sealing by themselves are relatively minor. However, the cumulative effects of such measures, if repeated all over Bangladesh, could be significant. This should be addressed by a national or inter-regional study, not by the regional studies.

6.46 p4-18, Para-2

It has not been explained how the morphological and flood risk considerations led to the selection of a residual flow equal to 500 m^3/s.

Under the present condition the flows in the particular reach is 550-700 m3/s, reduction of flow is not substantial as in fig-5.7. It shows that due consideration was given for determining residual discharge. The overall policy was to try to avoid radically altering the dominant discharge.

6.47 p4-18, first bullet

Why should the Upper Karatoya be excavated for 100km? Vol. 3 indicates that only the downstream 40-50km has inadequate existing capacity for a 1:20 year flood.

The length of floodway is 100 km, resectioning requires for 100 km based on present survey available at pre-feasibility level: in the detailed design phase this can be verified.

6.48 p5-3, Para-5

The first assumption that the projects nearing completion in the region would be completed as planned is acceptable. But the other part of the assumption that they would function as designed may not hold. This is to be investigated by model study.

Alternative operational policies or failure for projects to operate as planned should be investigated during the model studies in FAP 2.2.

6.49 p5-7, para 3, first sentence

For Chalan Beel polder A, F0-F1 land is also slightly decreased in the With project situation (see table 5.2).

Noted.

6.50 p5-13, Morphological impact

How a decrease in dominant discharge will cause an increase in channel width and depth?
How has the time for morphological adjustment been ascertained?

'Increase' in channel width and depth should be replaced by 'decrease'. Included in Final Report.

6.51 p5-13, last para

"Closing breaches BRE.....effected by these breaches"
What type of morphological effects is anticipated?

Morphological implications and timescales are discussed in detail in Volume 9 'Hydraulic Studies'.

6.52 p6-2, section 6.2.1

First bullet: not higher value crops, but crops offering higher returns. First sentence of the para: delete high yielding which is irrelevant here and confuses the reader.

No response.

6.53 following p6-4, Table 6.1

This table will need amendment after taking into account comments made below (Volume 12, General) on crop flood tolerance limits?

Comment noted but not agreed - see our response to the comments on the Agriculture Volume. In any case Table 6.1 would not be affected by changes in crop flood tolerance limits - it is based on MPO's standard classification of flood depths.

6.54 p6-4

It is difficult to understand the text in this page and relate to Table 6.1. Proper explanation is needed.

The text describes a fundamental step in the analysis. It is not clear to the consultants what is meant by proper explanation.

6.55 p6-5, (a)

This is not necessarily so. Improved drainage is likely to increase the area on which HYV boro can be grown.

The point is noted. However, it is felt that any such increase in HYV boro would be small, since the areas with most potential - i.e. low-lying areas such as the Lower Atrai basin - will not be extensively drained under the proposals made in the regional plan.

6.56 Table 6.5

The assumptions made in estimating these costs (cropping patterns, planting dates, etc. should be included in a footnote.

Noted.

6.57 p6-7, last para

The consultant should have used the BBS Agricultural Crops deflator to express these costs of crops and inputs in 1991 constant price (GPA, Annex p2)

Noted, but also see response to comment 7.14.

6.58 p6-9, para-5, Table 6.10

The Table 6.10 shows that the crop damage in an Old district increases with the increase in the return period without an upper bound. Is this the return period of water level? yes, then the crop damage is likely to become constant after a certain return period. This is because when all the cropped area is submerged then the whole crop is damaged and the damage is constant for higher water levels. It is also not mentioned whether timing and duration of flood have been taken into account in the determination of expected annual crop damage.

Noted, but not agreed. The increase in crop damage for higher return periods is small, but such an increase could be expected when looking at an area the size of an Old District where some areas of high land are rarely flooded. The determination of executed damage is based on historical data which give areas of crops "fully" and "partially" damaged.

6.59 following p6-10, table 6.11, section D

If polder C has an inlet weir with a crest level at 1:20 June or July return flood, then fish production may not be the same as the present situation.

The inlet weir has a crest level at 1:5 in 2nd decad of July: this should not prevent fish movement in an average year although it may delay it. Production should not be adversely affected however.

6.60 p6-13, para-7

Derivation of a flood damage-frequency curve using the four year's data of the period 1985 to 1988 should be tried. The 1985 flood is approximately a 1 in 5 year flood (see page 5-5, last para). This is a considerable range in observed frequency available. The GPA should be followed in estimating the expected annual non-agricultural damage.

The flood damages - frequency curve was derived by fitting a Gumbel Extreme Value distribution to the available data series. It is not possible to get an accurate fit with 4 years data. The consultants have essentially followed the GPA in estimating non-agricultural damage.

6.61 p6-13, para-8

Assumption of a continuous relationship between crop damage and non-crop damage may not hold. This is because there usually exists an upper bound in the crop damage-frequency curve while similar bound may not exist in the non-crop damage-frequency curve.

Noted but not agreed, see response above to p6-9. Examination of actual data on non-crop damage shows that it is (in terms of value) principally to roads and embankments: it is reasonable to infer that considerable crop damage will follow in the wake of such structural failure. This is clearly borne out in the Middle and Lower Bangali, i.e. behind the BRE.

6.62 p6-14, para 4, last two sentences

These sentences seem to infer that embankment projects cannot be viable in low-lying areas. If this is not what the consultants believe, the sentence need recasting. There may be other reasons, e.g. ready availability of water communications - why the use of embankments, roads is less important in low-lying areas.

The text particularly refers to the Lower Atrai where the evidence of over 100 public cuts in recent years speaks for itself.

6.63 p6-18, (c) Gaibandha

The results should be given here so that the reader can compare them with other areas.

Noted.

6.64 p6-20, end of section 6.6.2

The explanation given in the last paragraph could be used to justify the recommended sequence of project development in the subregion, which should be stated.

Accepted.

6.65 p7-6, general comment

Doubtless good environmental-speak. But it is so general that it casts doubt on whether there is any foundation. It would help if some examples of endangered species were given.

Noted - refer to Volumes 4 and 14 for specifics.

6.66 p7-7, para 4

This para would belong better under Social Impacts.

Noted.

6.67 p8-5, subsection Brahmaputra Right Bank, para 4

FAP20 will probably be concentrating on internal water management associated with drainage improvement. Use of compartments as flood cells for containing Brahmaputra breaches will be largely the subject of public consultation and desk studies.

Noted.

6.68 p8-5, subsection Brahmaputra Right Bank

Gazaria Ichamati and other non FAP2 initiatives should be included in the Regional Plan.

Noted. They are

6.69 p8-8, bottom para

Flood proofing will also be important in green floodways in the Lower Atrai basin.

Comment agreed. This is incorporated in the Final Report.

6.70 p8-9, section 8.4.1

For financing, EIP, SRP, etc., programmes will need to be considered part of the regional water management plan, otherwise piecemeal development will continue.

The NWRS in its two years duration of study should have identified the possible small scale EIP type schemes in the region in view of overall regional plan perspective.

It did.

The schemes already implemented or under implementation by EIP, SSFCDI and other programmes should have been discussed in the light of overall regional plan proposed.

They were (except for SSFCDI, which are commonly too small in scale to be included in the regional plan).

Category 3

Category 3 comments are noted, unless otherwise shown.

6.71 pS-1, para 1

The NW region is no more variable than most other regions: c.f. NE and SW regions.

6.72 pS-1, section 1

The effects of flooding on the people and agriculture are mentioned. What about infrastructure, communications etc.?

6.73 pS-1, para 4 (and elsewhere)

What is referred to as the Lower Bangali is actually the lower Karatoya. (Check with top maps).

6.74 pS-2 (and several other maps)

a) Several district towns are wrongly located; e.g., Bogra
b) Show railway spur from Gaibandha to Fulchari Ghat.
c) Spell Chapai Nawabganj in full.
d) Correct the spelling of Purnabhaba river; (also at several places in text).

6.75 pS-7, para 2, end

A reference could usefully be made to the roles of FAPs1, 21+22 and 24 in such morphological studies.

6.76 pS-7, section 1.6, 2nd bullet

Clarify whether the redesign of Polder 2 is consistent with the green river strategy.

6.77 pS-7, section, 1.6, 5th bullet

Add flood proofing in unprotected areas (chars etc.)

6.78 pS-7, section 1.6, last bullet

No reference is made to the Upper Karatoya. Little Jamuna Right Bank is shown as short term in Figure 3.

6.79 pS-7, section 1.6, para 2

The 'main drains' should be amplified. Better to say 'Major interceptor and diversion drainage interventions and the Hurasagar.....'

6.80 pS-8, figure 2

A regional study of this magnitude deserves a better map to illustrate regional development Shading should be used to show:

- CFD areas (proposals)
- FCD areas (existing)
- FCD/I areas (e.g. Pabna)
- I areas (e.g. Teesta)

Symbols or hatching to show:

- Green River
- Flood proofing
- Local drainage and town protection
- etc.

Hopefully the final version can use colour.

6.81 pS-9, table 1, first column

The main drains should be shown (faintly) on Figure 2.

Comment not agreed. The main drains are not part of regional plan.

6.82 p1-2, Table 1.2

Give date of information, and add 'Area' before the % signs on the 2nd and 4th columns this GCA or NCA?

6.83 p1-5, para 1

The FAP15 report was generally available and should have been made use of.

The report was not available to the consultants.

6.84 p1-6, para 7

The aim of study cannot be to raise living standards. The aims of the projects resulting from the study, maybe.

Good comment.

6.85 p2-1, para 3, line 5

Clarify that 1m contour change in 5km applies only to the river thalwegs. Local relief with floodplains commonly is 2-3m within 1km.

6.86 p2-1, section 2.1.2

For all the parameters, year-to-year variability in temperatures and evapotranspiration level and in months of max/min occurrences deserve mention. This, together with rainfall variability, has significance for irrigation demand and crop performance.

6.87 p2-2, bottom para

Clarify the meaning of '1972/73'. It is usual to give rainfall data on a calendar year basis.

Hydrological year in Bangladesh is from April to March.

6.88 p2-3, para 5, line 1

Change Jamuna to Brahmaputra: the name Jamuna applies to the new course downstream of the Old Brahmaputra take-off.

6.89 p2-4, line 2

Change Bangali to Karatoya: see comment above on page S-1 para 4.

6.90 p2-4, para 2, line 6

Amend reference to Bangali in the light of page S-1, para 4, comment.

6.91 p2-5, para 3

Either before or after this para, describe local rainwater flooding as a separate category Rainwater flooding is very evident on Figure 2.5, especially on the Barind Tract, but also elsewhere on larger prints of this image.

6.92 p2-5, para 5

Clarify that the F classes are derived from MPO. In the MPO classification, F3 and F4 are both flooded deeper than 1.8m, but F4 land also stays wet for most or all of the dry season so that broadcast aman cannot be sown. (Even in the SRDI classification from which the MPO classes were derived, the limit between deeply and very deeply flooded land is 3m, not 3.6m).

Yes, F classes are derived from MPO. In the analysis of flood depths the consultants combined F3-F4 in one category of > 1.8m.

6.93 p2-8, para 6, line 2

Change 'irrigation' to 'migration'.

6.94 following p2-6, figure 2.6

The project areas should be shown; not just the embankment lines.

6.95 following p2-6, table 2.1

It would be helpful if the year of completion was added after the 'C'.

6.96 p2-8, para 6, line 2

Fish 'migration' routes - not 'irrigation'.

6.97 p2-9, para 1

Indicate that conflicts results in projects not achieving their objectives and sometimes failing.

6.98 p2-9, para 5

Should not FCD/1 (Protappur) be added as an economically successful project?

Its an FCD/I scheme presently under rehabilitation by SRP. FCD component of the area is considered in the Bogra polder -2.

6.99 p2-10, para-5, Other Aspects

"A large number of programmes ..... in a successful O&M strategy".
Comments: Land Reclamation Project and Delta Development Project are no more ongoing and as such may be deleted from the list.

6.100 p2-11, section 2.3

Should not Teesta and Pabna projects be mentioned?

6.101 p2-11, sub-section on SRP

Gazaria-Ichamati is shown on the maps, so should be described here.

6.102 p2-11, bottom line

Change 'complications' to 'implications'?

6.103 p2-12, para 4, line 2

Add BWDB before 'Project Implementation Unit'.

6.104 p2-14, end

Need to give more details on the results and lessons of Fisheries III.

6.105 p3-2, para 3, last sentence

Pumping could also be viable for urban areas.

6.106 p3-4, para 4

Clarify whether 1980 (etc.) crop year refers to 1979-80 or 1980-81. If the latter, it should noted that the 1987 aman crop was severely affected by floods in that year.

6.107 p3-4, section 3.3.2

It needs to be clarified that the data used for Figures 3.2-3.5 were (it is presumed) thana based.

Read Section 3.3.1

6.108 p3-5, para on category 4

F2-F4. > 50% = not <.

6.109 p3-7, para 3

On p2-3 it is stated that the Upper Atrai catchment in India is 'fairly small'.

6.110 p3-8, top line

Define or refer to a description of 'Atrai-Kakra project'

6.111 p4-1, general ... also p6-1, Chapter

Gaibandha should be included. The fact that it is covered in a separate volume is no reasonable for not presenting it in the same way as the other development scenarios.

6.112 following p4-2, figure 4.1

Show proposed sites for FAP21 bank protection trials.

6.113 p4-7, sub-section Lower Bengali Basin

This description is light for an area that has serious problems. Expand on the redesign

6.114 p4-8, sub-section Major Drains

Mention should be made of the shortened IC4 option which, at the time, the consultants were asked to examine, and which is now being considered as the Bengali Floodway.

6.115 p4-9, para 3, line 4

Presumably Figure 4.5 should be Fig. 4.3

6.116 p4-14, sub-section SIRD Project, para 1

Units 1,2 and 3 should be shown on figure 4.3

6.117 p5.9, table 5.4

Something is wrong in the percentages for Bogra Polder 4, With project F0 should possibly be 37 and not 47.

The percentage figure for the F3+F4 category is incorrect. It should read 30% instead of 40%. Included in Final Report.

6.118 p6-3, para 1

Amend table in the light of earlier comments.

6.119 p6-3, bottom two paras

The methodology should be summarized in the text for the convenience of readers. If considered to be too long for inclusion within the chapter, it could be given as an annex to this chapter or at the end of this volume.

6.120 following p6.5, Table 6.2

Add HYV boro.

6.121 table 6.7

Financial prices for crops need checking. Boro and especially wheat prices usually are not higher than those for aman, and both local aman and Pajam usually enjoy a premium value over HYV aman. Data for the flood years 1987 and '88 should have been discounted because of distorting effects.

6.122 p6-12, para 2, last sentence

The 'practical value of the wetland system' is not the reason why local residents regularly on the present polder embankments, so necessitating the moving of confining embankment back.

6.123 p6-12, para 3

Presumably the net income figure is annual.

6.124 p8.1, second st of bullets, 5th bullet

Suggest change to:
- establish appropriate institutional framework for implementation and O&M of scheme

6.125 p8-8, last para

Is flood proofing supposed to come under EMP (colon at end of top para).

6.126 General Comment

A contour map would be useful.

VOLUME 2: REGIONAL DATA AND PLANNING UNITS

Category 3

6.127 part-1, page R-5

The gross area of the region has been shown as 3456000 ha under caption.

4. Regional Data and Planning: but under summary Regional Data, the total of gross area of all Planning Units has been shown as 3456190.

6.128 Table-4, Cropping Pattern and Intensity by Planning Unit

Inconsistency has been observed in cropping intensity in different Planning Unit at random checking such as Belkuchi Thana of PU-0, Birampur thana in PD-2, Chilmari thana in PW-5, so cropping intensity of different thana of all Planning Units should be checked and corrected where necessary.

6.129 part-2, page 1-1 to 15-1

The gross area of all Planning Units under caption "General" are some what different with that of next-page-table. so, these should be corrected, as if each Planning Unit should have one gross area.

6.130 Cropping Pattern for all Planning Units

Here cropping patterns have been shown on the basis of total area of relevant crops in each planning unit. But single crop, double crop and triple crop areas have not been shown. It should have been shown at least on percentage basis.

VOLUME 3 ENGINEERING - REGIONAL PLAN

Category 1 Comments

6.131 Geographical location described in the text are in many case not found in the maps referred. This creates problems in understanding the texts.

Noted.

6.132 Costing: Unit rates of costing appears to be reasonable. O&M for earth work (5%) appears to be on higher side.

O&M cost based on the FAP guidelines, but we also consider that those O&M costs are rather high as compared with those adopted in the similar flood control projects in other developing countries.

6.133 A critical point for the assessment of the benefits of the proposed measures is the flood regime that will prevail after the introduction of flood protection. The approach described on p.3-3, Volume 3, may be wrong. The basis of the drainage design is apparently the coincidence of 1 5-year probable rainfall inside the protected area and a 20-year probable high flood level outside. If this indeed what the consultants propose, then this is not necessarily correct. Two extreme (and relatively easy) cases are: either internal rainfall and external floods are fully correlated, or they are entirely uncorrelated. In the first case, a 5-year internal flood will coincide with a 5-year external flood and never with the selected 20-year flood. In the latter case the combination selected by the consultant will have a 1 in 100 year's probability. In actual fact the correlation coefficient will be in between 1 and 0 and it will e very difficult to determine a more or less correct value. The consultants should therefore avoid the problem of joint probabilities. What they should do is to select for each protected area the historic year (out of the series of 3rd years) with the 5-year probable rainfall (if that is the accepted probability of occurrence) and simulate the flood events for the entire catchment for that year. Two situations could occur; the internal water level is higher than the external one, in which case the external level is determining for the internal flood condition; alternatively the internal water level could be lower than the external one, in which case the internal level is determining for the flood condition. The consultants should re-study this subject.

In fact FPCO should issue guidelines to the regional studies for this subject, so that the results of the studies, and notably so the calculated benefits, are consistent. I made this point when we were in Dhaka last time. For instance FAP3.1 made its own assessment, as does FAP20, and in all cases different approaches are being followed, making the assessed benefits entirely incomparable.

The procedure used by the Consultants for the drainage analysis is exactly as indicated in the comment. The model long time series runs were used to identify a year which was equivalent to a 5 year probable flood and the water levels and rainfall for this year were used for the drainage analysis.

Flood level for a 20 year probable flood were also calculated (using the some approach as above) and the results used for estimating embankment designs rest levels.

This comment should have been a question to ascertain precisely what the consultants did, before implying that errors have been made and revisions are necessary. The difference between design and analysis must also be noted. It was impossible to optimise the design of a large number of small regulators in the time available, therefore some design standard has to be used.

Detailed Comments:

Category 2

6.134 Page 2-6, last para

Katakhali river stated here is not visible in any map in this report; and so is the case with many other rivers and important places. This should be taken care of in the Final Report.

Noted.

6.135 Page 2-12, sl. (6)

It is stated that side drains along the embankments on the country side should generally be provided. Comments: This cannot be a general rule, because of the existing physical conditions in the project area. A system of drainage pattern is already developed in most of the areas. Those are to be utilized first to avoid land acquisition. Additional drains will only be considered if the existing drains are not adequate (Refer Naogaon Polder Planning). Normally villages are existing along the sides of the rivers. Therefore it may be difficult to excavate drains along the toe of embankment. The topography may also not permit this.

The text does not say that side drains should be constructed in any case. The text is described in general sense in consideration of the following:

Rainfall in a basin becomes runoff in the basin and some are collected in a drainage channel leading to a river and some other goes directly into a river. Accordingly whenever flood embankments are to be constructed, there may be a possibility to prohibit this drainage pattern of direct runoff to a river. In this case, there is a need to deal with this drainage. Of course even in this case there is a need to consider the natural topography thereby and the constraints of land acquisition and cost comparison between the case of construction of drainage sluices only and the case of combination of construction of side drain and reduced number of drainage sluices. In this sense the comment is right so long as the topography does not permit or some other situation does not permit the construction of side drains.

6.136 Page 2-12, sl (7)

It is said that drainage culverts with flap gates is implemented in this Naogaon Polder without having side drain net work.