RASHTRIYA BARH AYOG

(NATIONAL COMMISSION ON FLOODS)

REPORT

VOLUME-II

(APPENDICES)

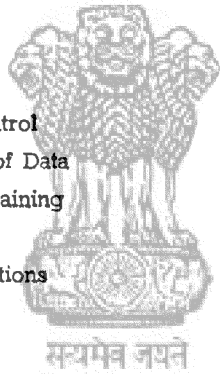
सत्यमेव जयते

GOVERNMENT OF INDIA
MINISTRY OF ENERGY AND IRRIGATION
(DEPARTMENT OF IRRIGATION)
NEW DELHI

MARCH 1980

VOLUME I

Chapter



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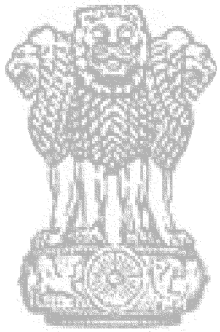

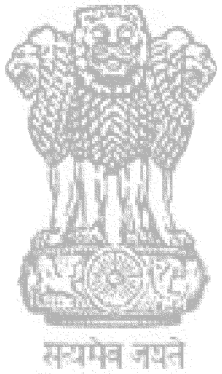
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PREAMBLE

Man has had to live with floods since the very beginning. Efforts have been made from early times to give protection to land and property. These early attempts catered to individual needs for protection to small areas.

Prior to 1954, about 5,300 km of embankments were constructed by Governmental agency, largely for the protection of irrigated areas in the north and deltaic tracts of the east flowing rivers in the south. These afforded protection to an area of about three million hectares.

2. The heavy floods of 1954 focussed the attention of the public and the Parliament on the inadequacy of the measures taken against floods. A programme of flood control was, therefore, launched at the national level in that year.

A large number of flood control/protection works of various types have been undertaken by the Central and State Governments since then. Also a number of Committees at the Central and State levels have been appointed to study and advise on general and specific measures. A resume of the background, terms of reference and recommendations of the important Committees is attached as Annexure II.

3. Since 1954, considerable progress has been made in the matter of flood protection covering the construction of about 8,400 km of new embankments and 16,000 km of drainage channels, 221 town protection works and raising of nearly 4,700 villages. This has provided protection to about 8 million hectares out of an estimated total of about 25 million hectares of flood-prone areas at a cost of nearly Rs. 430 crores.

Inspite of these measures, the figures of flood damage reported by the States have been on the increase in recent years. It was, therefore, felt that a study in depth may be made towards evolving an appropriate approach to the problem. The Government of India has accordingly constituted the Rashtriya Barh Ayog (National Flood Commission) to consider the matter in its various aspects and suggest suitable norms etc., vide their Resolution No. FC. 52(1)/76 dated 2nd July, 1976, copy attached as Annexure I.

4. A questionnaire has now been framed by the Commission for eliciting the requisite information under each term of reference, and is attached.

While framing replies to the questionnaire, the clarification and guidelines mentioned below may please be followed :

(i) River Basins/Sub-Basins

Wherever relevant, information for river systems may be supplied individually, and listed in the order : main river stem, tributary, sub-tributaries starting from the source downwards.

(ii) Units

Metric units may please be used.

(iii) Maps

(a) Scales of maps have been specified under the various questions. All map sheets should be of size 42 cms × 56 cms (size of the sheet adopted in the Irrigation Atlas forming part of the Report of the Irrigation Commission, 1972) and bound in a volume. Where the total area cannot be accommodated on a single sheet, it may be shown on more than one sheet with connecting lines indicated on each sheet. Sheets should not be folded.

(b) Where printed maps are not available, white prints may please be included. The prints should be legible and should show the reference of the question number on the top. Care should be taken that the towns, installations and chainages etc. as mentioned in the script are shown on the maps/plans.

(iv) Methodology

Details of methodology have been requested in a number of questions. These may please be given in sufficient lucidity.

(v) Documents

Wherever copies of Reports/Acts/Administrative Orders/Regulations have been requested, six numbers may please be supplied. If so many are not readily available, two copies should be the minimum.

Similarly, six copies of the reports of studies/investigations/assessment may also be supplied if available, in addition to the specific notes asked for in the questionnaire.

(vi) Sources of Information

It is probable that some of the data and statistics referred to in the replies are available in some published or documented papers. Reference to these may please be given at relevant places.

(vii) Format of Reply

The information may please be compiled separately for each term of reference. The question (giving the number as in the questionnaire) may be reproduced first and the material in reply (including notes where asked for) furnished underneath it utilising the full width of the page except for the margin, only one side of the paper may be used.

(viii) Copies of Replies and Maps

Three copies of the replies may please be supplied in bound volumes and ten copies in loose sheets. Twelve copies of maps may be supplied in bound volumes.

5. The questionnaire has been framed so as to elicit such information as may enable this Commission to review the problem in its various aspects. It is, however, possible, that there may be additional information which may be of assistance. The same may please be detailed at relevant places or included as a separate note for the benefit of the Commission.

6. Replies covering all items of the questionnaire in the very first instance will be appreciated. If, however, any item(s) are likely to take time, information on others may please be communicated, followed as soon as possible, by that on the remaining ones, making a suitable note at the relevant place in the initial compilation.

7. Illustrative photographs (aerial or other) wherever available of flooded area, structures, breaches, etc. may please be included in the text, where relevant.

ANNEXURE I

No. FC. 52(1)/76

GOVERNMENT OF INDIA
(BHARAT SARKAR)
MINISTRY OF AGRICULTURE & IRRIGATION
(KRISHI AUR SINCHAI MANTRALAYA)
Department of Irrigation
(Sinchai Vibhag)

New Delhi, the 2nd July, 1976.

RESOLUTION

Sizeable progress has been made in the flood protection measures since 1954, when the National Flood Control Programme was launched for the first time, in the country. Since then, nearly one third of the flood prone area has been afforded reasonable protection. During this period of two decades, considerable experience has been gained in planning, implementation and performance of the flood protection and control measures. Advancement in technology has taken place not only in India but also in foreign countries. Therefore, it has become necessary to conduct a study in depth of our approach and programmes of flood control measures. Formulation of a flood control policy would require detailed study of various problems concerned with flood control measures and also, aspects like soil conservation and afforestation. The Government of India have, therefore, decided to set up the Rashtriya Barh Ayog so as to evolve a coordinated, integrated and scientific approach to thd flood control problem and draw out a national plan, fixing priorities which could be implemented in the near future. The composition* of the Commission shall be as follows :

(1)	Shri Jaisukhlal Hathi	*Chairman (Part-time)*
(2)	Two experts in flood control (to be nominated later)	*Members*
(3)	One Economist (to be nominated)	*Member*
(4)	One Agronomist (to be nominated later)	*Member*
(5)	Representatives of the Central Water Commission, Ganga Flood Control Commission, and Brahmaputra Flood Control Commission	*Member*
(6)	One Member-Secretary (to be nominated later)	*Member-Secretary*

2. The terms of reference of the Commission will be as follows :

(1) To review the flood protection measures undertaken since 1954 and to make an evaluation of the benefits and effectiveness of the measures undertaken so far with special reference to embankments in reducing the damage.

(2) To identify the areas where a large number of Zamindari and/or unauthorised embankments, bunds, and spurs, etc, exist; to assess the effect of such constructions on the flood problem; and suggest remedial measures.

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*The composition of the Ayog, notified vide No. FC-52(1)/76 dated 10-3-77 is as under :

1.	Shri Jaisukhlal Hathi	*Chairman (Part-time)*
2.	Shri D. B. Anand	*Member, vice-Chairman*
3.	Shri R. C. Prasad	*Member*
4.	Dr. N. Patnaik	*Member*
5.	Dr. Kamta Prasad	*Member*
6.	Member (Floods), Central Water Commission	*Member-Ex-officio*
7.	Chairman, Ganga Flood Control Commission	*Member-Ex-officio*
8.	Chairman, Brahmaputra Flood Control Commission . . .	*Member-Ex-officio*
9.	Shri K. Ramesh Rao	*Member-Secretary*

(3) To identify the areas where construction of roads, highways, railways etc. and other encroachments into drains have aggravated flood problems and to suggest measures for improvements including legislative action, if any.

(4) To analyse the damage caused by floods in recent years and to identify areas requiring immediate flood protection measures.

(5) To evolve a comprehensive approach to the problem of floods in the country keeping in view the need for optimum and multi-purpose utilisation of water resources as also the role of soil conservation and afforestation in flood control.

(6) To make an analysis of the cost and benefits of flood protection measures.

(7) To suggest criteria for taking up flood protection measures and means of mobilising resources therefor.

(8) To recommend proper land-use in the flood plains with a view to minimise damage and to ensure overall increase in agriculture production.

(9) To examine the existing arrangements for maintenance of flood protection works and recommend measures for improving the same.

(10) To review the existing administrative and organisational set up for flood control at the Centre and in the States and suggest improvements where necessary; flood control to include flood forecasting and warning, flood fighting, formulation and implementation of flood protection measures.

(11) To examine the present procedure of assessing flood damage and suggest improvements.

(12) To examine any other matter related to floods and flood control and make suitable recommendations.

3. The Headquarters of the Commission will be in New Delhi.

4. The Commission will make its recommendations as soon as practicable but in any case within two years. It may, if it deems fit, submit interim report(s) on any specific problem(s). The Commission should submit the interim report basin-wise.

5. The Commission will devise its own procedure. It may call for such information and take such evidence as it may consider necessary. The ministries/ Departments of the Government of India will furnish such information and documents and render such assistance as may be required by the Commission.

6. The Government of India trust that the State Governments/Administrations of Union Territories will extend to the Commission their fullest cooperation and assistance.

Sd/-
(C. C. PATEL)
Additional Secretary to the Govt. of India

No. 52(1)/76-FC

Dated the 2nd July, 1976

ORDER

Ordered also that a copy of the Resolution be communicated to all Ministries/ Departments of the Government of India and all State Governments/Administrations of Union Territories.

Sd/-
(C. C. PATEL)
Additional Secretary to the Govt. of India

ANNEXURE II

IMPORTANT COMMITTEES ON FLOODS AND FLOOD PROTECTION MEASURES

Since 1954, the Central and State Governments have appointed a number of Committees to study and advise on the policy matters for the speedy implementation of the flood control/protection programme and also to examine the flood problem in general as well as in specific areas for evolving suitable remedial measures. The Committees appointed can be broadly classified into the following three categories :—

I. Appointed by the Government of India to deal with general flood problems in the country.

II. Appointed by the Government of India to deal with specific problems.

III. Appointed by the concerned State Governments to deal with particular problems in the State.

The following is a resume of the background, terms of reference and recommendations of the important Committees :—

I. Committees appointed by the Government of India to deal with general flood problems in the country

(i) High Level Committee on Floods

This Committee was set up in April, 1957 to make an assessment of the flood problem in the country and advise on the measures that should be taken to tackle it. The Committee consisted of senior engineers and a forest officer. The terms of reference of the Committee were :—

(a) To analyse the factors responsible for a succession of heavy floods in the Ganga and the Brahmaputra basins and to indicate, in a general way, after an examination of the hydrological and other relevant data available, the lines on which the flood problems in the various areas should be tackled.

(b) To review the measures undertaken to combat floods and to indicate the lines on which work should be proceeded in future both in regard to the construction of flood protection works and in regard to the collection of data for the formulation of long-term flood control measures.

(c) To lay down principles for the fixation of priorities in the construction of flood protection works.

(d) To examine specific flood problems of an acute character from States like Andhra, Orissa and the Punjab and to indicate the lines on which they should be tackled.

(e) To report on the circumstances in which embankments can be considered as a suitable method of flood protection.

(f) Any other recommendations bearing on the control of and mitigation of damage by floods.

The Committee submitted Volume I of their report dealing with the general assessment and principles and policies in December, 1957 and Volume II discussing flood control in various basins in November 1958. In their report, the Committee made a comprehensive assessment of the flood problems in the various river basins, reviewed the measures undertaken till 1957 and suggested lines for further measures and collection of data. They also reviewed the existing structure of the various flood control organisations and suggested modifications in their functions. The acute problems of floods in the different river basins were also dealt with.

(ii) *Minister's Committee on Flood Control*

This Committee was set up in February, 1964 and consisted of Ministers incharge of flood control in the various States and representatives of Central Water & Power Commission, Ministry of Irrigation and Power, Ministry of Finance and the Planning Commission. The terms of reference of the Committee were :

(a) To review and assess the action taken by the Central and State Governments in respect of the National Flood Control Policy outlined in 1954 with a view to indicating to which extent the various flood control measures have been effective and what further remains to be done in different States in the fourth, fifth and subsequent Plans.

(b) To suggest ways and means for financing flood control schemes.

(c) To examine the existing pattern of and suggest modifications and improvements to flood control organisations in the States and at the Centre and inter-State levels like the River Commissions.

(d) To examine and recommend policy in respect of flood warning and forecasting, flood plain zoning and flood insurance.

(e) To make recommendations on any other subjects relating to the above.

The Committee, submitted their report in December 1964. In their report, the Committee stressed the need for preparation of long range plans for flood control, coordination of flood control with other uses and improvement in the present system of collection of flood damage statistics. They did not favour the levy of flood cess as it would be an additional burden on the poor cultivators in the protected reach. They recommended change in the pattern of assistance to the State Governments for flood control works from 100% loans to 50% grant or subsidy. In the case of anti-sea erosion measures, it was recommended that these works should be financed from the Centre. The other recommendation included giving special assistance to the State of Assam which is subject to severe floods almost every year and setting up of Standing Committees for settling the disputes relating to the sharing of cost of road and railway bridges.

(iii) *Minister's Committee on Floods and Flood Relief*

During the floods of 1970 there was considerable loss of life in some parts of the country. The 5th Conference of the State Ministers of Irrigation and Power after reviewing the situation recommended the setting up of a Committee to go into the reasons for the heavy loss of lives and to draw suitable proposals for avoiding such loss of lives in future. The Committee was headed by the Union Deputy Minister of Irrigation and Power and consisted of Ministers incharge of flood control in some of the flood prone states and representatives of the Indian Meteorological Department and the Central Water & Power Commission. The terms of reference of the Committee were :

(a) To enquire into heavy loss of lives and property from floods and heavy rainfall.
(b) To examine and draw up suitable proposals for avoidance of such heavy loss of lives etc. in future.
(c) To study the question of co-ordinated action by various agencies in organising flood relief measures.

The Committee submitted its report in March, 1972. The more important of the recommendations made by the Committee were as follows :

(1) Flood forecasting centres should be established in all the flood prone river basins. Flood Meteorological offices should be established by the Indian Meteorological Department to work in close cooperation with the flood forecasting centres.
(2) Arrangements for dissemination of flood warnings should be made and the public educated about the significance of such warnings.
(3) Each State Government should prepare a manual for flood operations, including flood fighting, and should set up necessary organisations for the purpose.
(4) Long range and comprehensive plans of flood control should be prepared expeditiously by the State by engaging special staff, if necessary.
(5) Suitable legislation should be enacted by the States to prevent encroachment on the rivers and natural drainage channels.

II. Committee appointed by the Government of India to deal with specific problems

(i) *Expert Committee on Flood Problems of Coastal Districts of Andhra Pradesh*

This Committee was constituted in October, 1964 to suggest comprehensive measures for flood control on the coastal rivers and to examine and recommend proposals for lowering the flood level of Kolleru Lake and for improving the drainage in the Deltaic areas. The Committee had Shri A. C. Mitra, retired Engineer-in-Chief. Uttar Pradesh as Chairman and representatives of the Ministry of Irrigation and Power, Central Water & Power Commission and the Central Water and Power Research Station, Poona and Government of Andhra Pradesh as well as an expert from Netherlands as members. The terms of reference to the Committee were :

(a) To suggest a comprehensive Plan for control of floods in the coastal rivers like Budameru, Thammileru and Yerrakalva by construction of detention reservoirs or by diversion into adjoining valley or any other methods.
(b) To consider and recommend proposals for lowering the flood level of Kolleru lake either by improving the outfall channel Upputeru or by pumping or by both.
(c) To consider and recommend proposals for improving the drainage system in the area; and
(d) Any other recommendation that the Committee desires to make for prevention of floods and inundation.

In its report submitted in January, 1966 the Committee, inter-alia recommended the construction of three reservoirs across the Thammileru, Yarrakalva and Budameru rivers, widening and deepening of the Upputeru river from Kolleru lake to the sea and improvements to various drains in the Krishna and Godavari deltas.

(ii) *Committee on Flood Control in the Adhwara Group of Rivers of North Bihar*

This Committee was appointed in October, 1964 to make an assessment of the problems of floods in the Adhwara group of rivers (between the Bagmati and the Kamlabalan) in North Bihar and to evolve adequate plan for flood control on these rivers. The Committee had Shri Jafer Ali, Consultant in the Ministry of Irrigation and Power as Chairman and representatives of the Central Water and Power Commission and that Government of Bihar as members. The terms of reference of the Committee were :

(a) To make a complete study of the flood problems of the Adhwara group of rivers in North Bihar;

(b) To assess the flood control works so far executed and planned to be executed on these rivers, particularly in the context of very dense population in the area and the meandering nature of the rivers ;

(c) To recommend the nature of flood control measures that would be the best suited for flood control on these rivers, with special reference to the possibility of detention basins (or tanks), channel improvements by means of dredging, reservoirs, soil conservation in the upper reaches etc.; and

(d) To make any other suggestions relevant to the control of floods in this group of rivers.

The recommendations made by the Committee included the channelisation of the river Darbhanga-Bagmati, diversion of part of the discharge of river Bagmati into the old course of the river Kamla, provision of embankment in reaches where the rivers spill and provision of adequate number of sluices in the embankments.

(iii) *North Bihar Drainage Committee*

This Committee was set up in August, 1965 to make a detailed study of the drainage requirements in North Bihar which is traversed by the Bagmati, Kamla, Pahar, Kankai, Mahananda, Gandak and Kosi rivers. The Committee comprised Shri Jafar Ali, Consultant of the Ministry of Irrigation and Power as Chairman and representatives of the Central Water and Power Commission, Bihar Government and the North-Eastern Railways as members. The terms of reference of the Committee were :

(a) To study the existing data of drainage systems of North Bihar and suggest collection of further observations that may be useful in planning proper drainage of the region ;

(b) To study the effect of the railways, canals, roads and embankments on the drainage of North Bihar including the regimes of major river systems;

(c) To examine in particular the adequacy or otherwise of the waterways provided under railway and road bridges, and to suggest improvement in the existing waterways under railways and road bridges;

(d) To discuss and report on any other connected matters.

The Committee made the following recommendations :

(1) Augmentation of the existing network of rain gauges, gauge and discharge stations and collection of data on a systematic basis.

(2) Provision of adequate drainage systems in Irrigated areas and the criteria which are to be followed in their design.

(3) Provision of additional waterways for road and railway bridges and adequate drainage sluices in the embanked portions.

(iv) *Committee on Scientific Flood Forecasting in the Country*

This was set up in 1963 to review the system of flood warning existing in the country at that time and to recommend suitable organisation and procedure for undertaking effective system of flood forecasting. This Committee had on it representaetivs of the India Meteorological Department and the Central Water and Power

Commission. In its report submitted in 1965, the Committee recommended setting up of flood forecasting centres and sub-centres all over the country and setting up of a flood forecasting organisation to guide and co-ordinate flood forecasting programme.

(v) *Study of Scientific Assessment of Flood Damage*

Since the assessment of flood damage made by the States was not on a uniform basis and the need for laying down a uniform procedure for having accurate and reliable statistical data of flood damage from all the States was keenly felt, the work of evolving a standard scientific procedure for the assessment of flood damage was entrusted to the National Council of Applied Economic Research in 1964. In its report, in addition to outlining the procedure of computing damage, the setting up of Statistical Cells attached to Chief Engineers of Flood Control at State Hqrs., designation of the Distt. Collectors as the authority to co-ordinate all the reports of damage data sent by the officials in the Districts, training of village officers in the observation and preparation of reports of the damage caused by floods and the nomination of Flood Control Department in the States as the overall agency for the collection and dissemination of flood damage data.

(vi) *Study of Erosion Problem on the Brahmaputra*

A study group was set up in 1964 to make an assessment of the problem of erosion on the Brahmaputra. This Group consisted of representatives of the State Government of Assam, Central Water & Power Commission and the Central Water and Power Research Station, Poona. The report of the Study Group was intended for the use of an American Expert, who had been invited by the Government of India for giving advice on the measures against erosion on the Brahmaputra. In its report submitted in 1965, the Study Group dealt with the nature and extent of erosion problem, the causes for the erosion and the measures adopted in other countries.

The American Expert inspected the area in 1966 and taking into account the observations made by the Study Group, submitted his report in the same year. In his report, he observed that although it was desirable to have a comprehensive scheme for the control of erosion on the Brahmaputra by means of reservoirs, training works, embankments and spurs, etc., it might not be feasible to implement the scheme on account of technical and other considerations. He, therefore, recommended that the anti-erosion works should be carried out in specific reaches where the problem is acute.

(vii) *Subarnarekha Committee*

This Committee headed by the Member (Floods) of Central Water & Power Commission and consisting of Chief Engineers of Bihar, Orissa and West Bengal was constituted in August, 1972, for preparing a comprehensive co-ordinated scheme of flood control for the Subarnarekha Basin consisting of storage reservoirs in the upper reaches in the States of Bihar, Orissa and West Bengal, embankments in the lower reaches in Orissa and West Bengal and improvement of flow to the sea after examining the proposals formulated by the State Governments of Bihar, Orissa and West Bengal. In its report submitted in August, 1973, the Committee, inter alia, recommended provision of flood storage in the proposed reservoir at Chandil in Bihar and moderation of floods and construction of embankments in West Bengal and Orissa and their implementation in a co-ordinated manner. The improvement of drainage in the lower basin and measures for improving the flow conditions by providing straight cuts to the sea were also recommended.

(viii) *Gandak High Level Committee*

This Committee was set up in November, 1971 with Shri A. C. Mitra as its Chairman. It had also the Chief Engineers of Bihar and Uttar Pradesh and representatives of the Central Water & Power Commission and the Central Water and Power Research Station, Poona as members. The terms of reference to the Committee were :

(a) To study the behaviour of the river Gandak from Indo-Nepal border to its confluence with the Ganga before and after the construction of protective and river training works;

(b) To evaluate the performance of the works undertaken by Uttar Pradesh and Bihar State Governments from time to time;

(c) To examine different methods including construction of control structures and dredging which can be adopted to train the river flow in a more central channel.;

(d) To recommend economical and permanent additional measures that are to be taken and nature and extent of remodelling and strengthening of works already executed.

The Committee submitted its report in March, 1974. The recommendations made by the Committee included the strengthening of the embankments already constructed, implementation of additional works immediately downstream of the Balmiki Nagar Barrage for checking the possibility of the river entering its old course, and extension of the embankments beyond Chitauni Railway Station upto Pipraghat. As long-term measures, the Committee recommended investigation of multi-purpose reservoirs in the upper catchment of the river Gandak, channelisation of the river to enable it to carry the sediment without deposition and attain a stable course and controlled flooding by diversion of the part of the flood waters with its silt during the monsoon. The Committee stressed the importance of adequate maintenance of the works and continuous collection of hydrological data and watching the behaviour of the river for the planning of further works as necessary.

(ix) *Technical Experts Committee on Floods in North Bengal*

After the unprecedented floods of October, 1968 in North Bengal, an Expert Committee was constituted to go into the cause of high floods. The Committee had the Chairman, Central Water & Power Commission as the Chairman and representatives of the Ministry of Railways, Ministry of Transport, India Meteorological Department, Geological Survey of India, Central Water & Power Commission and the Chief Engineers of West Bengal as members. The terms of reference of the Committee were :

(a) To study the causes and prepare a detailed account of the course of the October flood in North Bengal ;

(b) To study and assess the nature and extent of damage caused to engineering structures during these floods;

(c) To lay down criteria for the design of engineering structures in North Bengal in the light of such studies and in particular for waterways for railway and road bridges;

(d) To make suggestions for remedial measures in critical areas ; and

(e) To study the existing flood warning system in the area and to suggest improvements therein.

In its report submitted in March, 1970; the Committee recommended measures which included soil conservation works in the upper catchment of North Bengal rivers, extension of waterways of road and railway bridges and construction of embankments and river training works. The Committee also recommended the extent and location of additional waterways for Jalpaiguri road and railway bridges on the Tista and raising and strengthening of embankments for the protection of the Jalpaiguri town. The Conmmittee reviewed the existing flood warning system and made recommendations for improving the same.

(x) *Committee on Flood Control and Drainage in Lower Damodar*

This Committee was set up in October, 1971 and had Chairman, Central Water & Power Commission as its Chairman, and Chief Engineers of West Bengal and Bihar, representatives of the Damodar Valley Corporation and the Chairman of the Water & Power Development Consultancy Services as Members.

The terms of reference of the Committee were :

(a) To make a study of the causes of flood and drainage congestion in the Lower Damodar region in recent years;

(b) To review the rules and regulations laid down in the Operation Manual of D. V. C. reservoirs drawn in consultation with and agreed to by CW& PC and the States of Bihar, and West Bengal in 1969 and to suggest modifications and improvements with a view to reduce flood and drainage congestion in the Lower Damodar Region;

(c) To examine the possibility of the moderation of flood peaks to the extent of limiting the discharges downstream of Durgapur barrage to 2.5 lakh cusecs for which the Lower Damodar Canalisation Scheme is being designed and executed by increasing the flood storage by:—

(i) Acquisition of land and properties to full reservoir level in Maithon and Panchet dams;

(ii) Providing flood storage in Tenughat dam ; and

(iii) Constructing more dams in upper Damodar Basin.

The Committee in its report submitted in May, 1972 recommended the acquisition of land at Maithon and Panchet reservoirs for providing full design flood storage capacity, construction of embankments along Damodar and Mundeshwari rivers, dredging of Rupnarayan river, adoption of modified operation schedule for reservoirs and improvement in the flood forecasting system.

III. Committee appointed by the State Governments to deal with particular problems in the States

(i) *Bhagavti Committee on Embankment and Drainage (Assam)*

This Committee was appointed in 1957 for reviewing the embankment and drainage projects in Assam. The recommendations made in the Report published in 1960 included carrying out regular sample surveys of the economic conditions of the people in different parts of the State annually to assess the impact of embankment and drainage projects, preparation of a comprehensive plan for flood control and provision of adequate number of sluices in the future embankments.

(ii) *Kosi Technical Committee (Bihar)*

This Committee was appointed in 1965 by the Bihar Government with Shri Kanwar Sain, retired Chairman of Central Water and Power Commission as Chairman and representatives of the Ministry of Irrigation and Power and Chief Engineers of Bihar Government as Members. The terms of reference of the Committee were :

(a) To review the achievements of the Kosi Project in Bihar/Nepal, with special reference to flood control benefits which have accrued in North Bihar; and

(b) To make a study of the residual flood problems of the Kosi river and suggest the future steps that are considered necessary to—

  (i) render flood control components of the present Kosi Project more secure and effective; and

  (ii) ensure optimum flood protection in the Kosi Basin.

The Committee submitted its report in 1966. The recommendations made included construction of a second barrage lower down at Dagmara for reducing the gradient and consequently the velocity and the erosive force of the river. The Committee suggested training works, dredging and bandalling as river conservancy measures to stabilise the channel and to increase the hydraulic efficiency and consequently the silt carrying capacity of the Kosi, precautionary measures including a flood warning system to prevent any large scale damage which can take place in case of a breach of any embankment due to an unforeseen cause, demarcation of flood hazard zones, in the areas subject to flooding and preparation of a comprehensive soil conservation scheme for the Tamur tributary of the Kosi which brings in one-fourth of the total coarse silt. The Committee also suggested quick annual reconnaissance survey and other river surveys immediately after the floods and periodical aerial surveys.

Subsequently the Bihar Government again set up a Committee with Shri Kanwar Sain as Chairman and representatives of the Central Water and Power Commission, Bihar Government, Central Water and Power Research Station and Shri M. R. Chopra, then Vice-Chancellor, Roorkee University, and Shri D. Mookerjea, retired Chief Engineer of Bihar as Members. The terms of reference of this Committee were:

(a) To review the functioning of the existing barrage and to suggest further measures that may be necessary to ensure optimum flood protection in the Kosi Basin ;

(b) To examine the feasibility and economics of the construction of a second barrage on Kosi near Dagmara;

(c) To study the siltation problems in the Eastern Canal and Rajpur Canal Systems and to suggest means for tackling the problems so that the silt entry into the canals may be minimised ;

(d) To study and suggest methods for tackling the drainage problems in the canal command area ; and

(e) To study the Chatra Canal Project and to suggest means for preventing silt entry into the canal and controlling Kholas crossing the main canal.

In its report submitted in April, 1971, the Committee recommended continuous and proper maintenance of the barrage and the embankments, collection and analysis of hydro-meteorological data on a continuous basis, studies in respect of exclusion of silt from the channel, measures for accelerated pace of development in the areas of the Kosi Canal, and the detailed investigations of the necessity of a second control structure at Dagmara.

(iii) *Orissa Flood Enquiry Committee*

This Committee was set up by the Government of Orissa in September, 1959. The Committee consisted of Shri S. N. Bhanja Deo, Minister of Orissa as Chairman, Chief Engineers of Hirakud Project, Central Water & Power Commission, and Orissa and the Technical Adviser to the Government of Orissa as Members. The terms of reference of the Committee were :—

(a) To enquire into and report the causes leading to the breach of the Simalda Ghai on the Kathjuri river on the morning of the 14 September, 1959 and to fix responsibility for the breach and to suggest measures to prevent similar breaches in future.

(b) To enquire into the causes of other similar breaches on Government embankments in the Mahanadi Delta area and to suggest measures to prevent recurrence of such breaches in future.

(c) To study the flood absorption capacity of the Hirakud Reservoir in its relation to the Mahanadi Delta area and to make recommendations for any additional measures necessary to be taken in the Mahanadi Delta area as a result of such study.

(d) To study the Mahanadi Delta Irrigation Proejct with reference to the flood problem and to report the steps to be taken.

Subsequently, the Committee was requested to study the flood problems and remedial measures on other rivers in the State.

The Committee submitted its report in 1962. The recommendations made by the Committee included the strengthening of the existing embankments, provision of permeable screens for preventing sand casting and river training works for protection of towns and valuable properties wherever economically justifiable. The other recommendations were model studies for evolving measures to counteract the effects of littoral drift at the outfall of rivers, sluices to drain out waterlogged area within saline embankments, provision of flood reserve in the Bhimkund and Salandi reservoirs, construction of embankments along the Subarnarekha down stream of the railway line and escapes at suitable points.

(iv) *Technical Expert Committee on Cyclone and Tidal Floods (Orissa)*

This Committee was appointed in November, 1971 and consisted of Shri M. C. Pani, retired Chief Engineer, Orissa as Chairman and representatives of the Central Water and Power Commission, Central Water and Power Research Station, Poona and the Chief Engineer Irrigation, Orissa as Members. The terms of reference of the Committee were :—

(a) To make analysis of the damage caused by cyclone and the tidal waves accompanying the cyclones in 1971 and earlier years.

(b) To examine alternative proposals for preventing the movement of tidal bore in land resulting in damage to crops and property.

(c) To examine various alternative measures for reducing loss of life and damage such as tidal embankments, restricted occupation of coast and communication provision and other appropriate measures.

(d) To recommend measures that can be adopted economically for protection against cyclones and tidal waves. The flood and drainage problems are interlinked with the problems of cyclones and tidal waves and have in many respects to be considered together, in evolving remedial measures.

(e) To examine the records of cyclones that occurred in the past years in Orissa.

In its Report submitted in February, 1976, the Committee recommended the provision of artificial dykes with afforestation in a belt of about 1 km on the sea side where sand dunes do not exist or are not wide enough plantation in a width of about 1 km along the coast where high and wide sand dunes exist and simplification of the system of rivers and creeks in the coastal belt by reducing number

of outlets to the sea, keeping open the river and other outlets required for efficient drainage of the area, provision of sluices for prevention of tidal bores from entering inland and new drainage cuts in the areas where there is drainage congestion.

(v) *West Bengal Flood Enquiry Committee*

This Committee was set up by the West Bengal Government in December, 1959. The Committee consisted of Shri Man Singh, retired Member of Central Water & Power Commission, as Chairman and Chief Engineers of Bihar and North Bihar, Central Water & Power Commission, Kosi Project, South Eastern and Eastern Railway, Irrigation, Flood Control, Roads & PWD, Calcutta Corp., DVC & Director River Research Instt.; West Bengal and representatives of the India Meteorological Department and Forest Department as Members. The terms of reference of the Comittee were :—

(a) to enquire into and determine the causes of the 1959 floods in the districts of (i) Midnapur, (ii) Howrah, (iii) Hooghly, (iv) Birbhum, (v) Burdwan, (vi) Bankura, (vii) Purulia, (viii) Nadia, (ix) Murshidabad and (x) 24-Parganas,

(b) to make an assessment of the effects of the floods ;

(c) to ascertain if the intensity of the flood in the river valley areas could have been reduced by proper regulation of releases from the dams ;

(d) to suggest remedial measures for the purpose of preventing recurrence of such floods in future ; and

(e) to indicate broadly in order of priority schemes for flood control and flood protection—river-wise, basin-wise, or area-wise as the case may be.

The Committee submitted its Report in 1962. The recommendation made included implementation of schemes which would eliminate or at any rate considerably reduce the chance of floods as experienced in 1959. It was suggested that the question of retention or otherwise of some of the Ex-Zamindari embankments should be examined by the Irrigation and Waterways Department of the State and as a matter of principle, embankments along the river channels in lower Bengal should be discouraged wherever possible and should be retained where indispensable. For improving the deteriorating rivers and channels for disposing of the run-off from the upper catchment and precipitation from the locality speedily and efficiently, resectioning of some of the channels, including remodelling structures on or along them and silt clearance by dredging and river training works were recommended. The other recommendations were : intense data collection programme including aerial surveys, investigation of the schemes necessary for flood prone areas and raising of villages.

(vi) *High Level Committee on Patna Floods*

This Committee was set up by the Bihar Government after the severe floods of 1975 in the Ganga and the Sone which submerged large areas of Patna City and caused considerable havoc. The Committee, consisted of Member (Floods) of the Central Water Commission as Chairman, two Members of Bihar Legislature. Chairman of the Ganga Flood Control Commission and the Chief Engineer of the Bihar Govt. as Members. The terms of reference of the Committee, inter alia, included investigation of the causes of floods and to suggest measures for future protection against similar catastrophies.

In its Report submitted in January, 1976, the Committee recommended implementation of certain works on priority basis before the floods of 1976. These included construction of embankments/masonry walls on the south bank of Ganga from Digha to Maner along with revetment at vulnerable places, construction of a new embankment from Maner to Saidabad along the right bank of Sone, construction of escape channel from Patna Canal upstream of Naubatpur through Khajuri distributary and Panchahua Nalla, raising and strengthening of Danapur distributary and improving and remodelling of the existing urban drainage in Patna. The Committee also recommended the remodelling of the drainage system in the rural area and raising and strengthening of the left embankment of Punpun along with construction of new embankments as works of second priority.

GENERAL

QUESTIONNAIRE

G.1 Please furnish in proforma G.1 data relating to the general land use statistics, population, per capita income etc. for each flood prone river basin/sub-basin of the State.

NOTES : (1) Main River Basins--These are basins of rivers which ultimately outfall directly into the sea

(2) Sub River Basins—These are basins of the tributaries/sub-tributaries of the main river

(3) Where information is not readily available for part of the districts covered in the basin/sub-basin, it may be computed approximately on proportionate area basis or as considered appropriate.

G.2 Please furnish in proforma G.2.1 details of cropping pattern, yield and prices for the State as a whole.

Please also furnish similar information in proforma G.2.2 for each flood prone river basin/sub-basin.

G.3 Please furnish in proforma G.3 a list of gauge, discharge and silt observation sites on the various rivers/tributaries covered in proforma G.1.

Please also supply a map to the scale of 1 to 1 million showing the river systems in the State, basin boundaries, railway lines, national highways and roads, important towns and installations and other features and the locations of the gauge, discharge and silt observation sites.

G.4 Please furnish in proforma G.4 a list of rain gauge Stations maintained by the India Meteorological Department, State Government and others indicating their location and the period of record of data available.

Please also supply a map to the scale of 1 to 1 million showing the location of these rain gauge stations.

G.5 Based on the data collected at the various observation sites indicated in G.3, please furnish information as in proforma G.5 for the gauging stations located nearest to the foothills, in the middle and lower reaches in each of the main rivers/ tributaries/sub-tributaries which are flood prone.

NOTE : In the case of rivers originating in/flowing into foreign countries, information from the data in repect of the nearest gauging point within the State may be furnished.

Please furnish notes on the manner of computation of the maximum flood discharge—whether it is by actual observations or by stage discharge curve or by any other method.

The method of computation of silt load carried by the river may also be detailed indicating whether it is according to the procedure recommended by the Central Water Commission (Central Soil Mechanics Research Station) or by any other method.

G.6 Based on the data of floods collected from 1954 onwards, please furnish the following information separately for each of the main rivers and the major tributaries and sub-tributaries :

(a) The areas in which the damage causing floods have occurred indicating the actual dates of occurrence, duration of the floods and the area affected by these floods. Please furnish hydrographs at the gauging site immediately upstream, of each flood.

(b) Has any estimate of the area liable to floods in each river basin and sub-basin been made for floods of 25 years, 50 years and 100 years frequency ? If so please furnish a statement of areas likely to be affected by the floods of these frequencies basinwise and sub-basinwise. Please also furnish a map to the scale of 1 to 1 million showing the various river basins and sub-basins and the areas liable to floods of different frequencies in different colours. Wherever flood protection works have been implemented, the areas protected may also be indicated in these maps. (Larger Scale maps of 1 to 250,000 may be adopted wherever necessary, to make the information clear).

G.7 Have the areas affected by maximum flood experienced so far, been assessed basin-wise and sub-basinwise ? Please supply the information in proforma G.7

Also please supply a map to the scale of 1 to 1 million showing the areas flooded during the maximum floods in each river basin and sub-basin. Wherever flood protection works have been undertaken, areas protected may also be shown (larger scale maps of 1 to 250,000 may be adopted wherever necessary to make the information clear).

G.8 Please furnish a map to the scale of 1 to 1 million (1 to 250,000 in case of severely flood affected basins) showing the various river basins/sub-basins and the areas flooded during the period 1954 onwards. The areas flooded may be shown by distinctive lines with the year marked thereon.

G.9 Based on the data collected from 1954 onwards, please furnish information relating to the areas which were affected by surface drainage congestion indicating duration with dates and the extent of the areas affected by such drainage congestion.

Please furnish a map to the scale of 1 to 1 million (1 to 250,000 wherever desirable) showing the drainage basins and the areas which experienced the above drainage congestion. The areas affected may be shown by distinctive lines with the year marked thereon.

G.10 From the flood damage statistics compiled since 1954, please supply in proforma G.10.1 district-wise details of the area and population affected by floods.

Please supply similar information basin-wise/sub-basin-wise in proforma G. 10.2 for the flood prone basins in the State (if basin-wise information is not readily available, if may be computed approximately on the basis of the figures in the districts and part of the districts covered in the basin/sub-basin on proportionate basis or as considered appropriate).

G.11 The various Flood Committees had recommended periodical surveys of the rivers for making an assessment of the changes in the river regime. Please furnish a note indicating the nature of the surveys that have been undertaken on the rivers in the State and their periodicity. Based on these surveys, please furnish 'L' sections and cross-sections (at each gauging site or where cross-sections have been taken) of the flood-prone rivers and their tributaries at intervals of every 5 years starting from the date of the first survey. The information for each survey may be shown in distinctive lines indicating the years of the surveys.

Please also furnish plan of the rivers to suitable scales, indicating the changes in their configuration during the period of surveys.

NOTE : The cross-section may be furnished at the same chainages.

G.12 Please furnish the following information relating to the provisions made in the Plans for the State as a whole and for the flood control sector and amount spent on flood relief/rehabilitation :

Plan	Plan outlay for the State as a whole	Plan outlay for the flood control sector	Amount spent on relief & rehabilitation in flood affected areas	Remarks
		(Rs. crores)		
1	2	3	4	5
First Plan 1951—56				
Second Plan 1956—61				
Third Plan 1961—66				
Annual Plan 1966—69				
Fourth Plan 1969—74				
Fifth Plan 1974—79				

G.13 Please furnish information of the Annual Plan provision recommended by the Planning Commission, budget provision made and the actual expenditure on flood control/protection for the State as a whole from the year 1951-52 onwards as below:

Year	Outlay recommended by the Planning Commission	Provision made in State budget (Rs. lakhs)	Actual expenditure	Remarks (Reasons for variation in any may be indicated in this column)
1	2	3	4	5
1951-52				
1952-53				
1953-54				
.....				
.....				
.....				
.....				
.....				
.....				
.....				
1976-77				

PROFORMA G.1

LAND USE STATISTICS FOR FLOOD-PRONE RIVER BASIN/SUB-BASINS

State
River basin/sub-Basin
Geographical area of the basin/sub-basin (Area in '000 ha)

Sl. No.	Item	1951	1956	1961	1966	1969	1974	Remarks
1	2	3	4	5	6	7	8	9
1.	Total reporting area							
2.	Net area sown							
3.	Total cropped area							
	(a) 'Kharif' cropped area							
	(b) 'Rabi' cropped area							
	(c) Summer cropped area							
4.	Gross irrigated area							
5.	Irrigated area during 'Kharif'							
6.	Irrigated area during 'Rabi'							
7.	Irrigated area during summer							
8.	Total area under forest							
	(a) hills							
	(b) plains							
9.	Area not available for cultivation							
10.	Other uncultivated land excluding fallow land.							
11.	Fallow land							
12.	Population ('000) (Only for 1951, 1961 and 1971 Census)							
13.	Density of population (No./Sq.Km.)							
14.	Per capita annual income (Rupees)							

Notes : 1. Please give the name of districts/part of the districts covered in each river basin/sub-basin.
2. The date of crop season viz. 'Kharif', 'Rabi' and Summer may be indicated.
3. Source(s) of data may be indicated.

PROFORMA G.2.1

CROPPING PATTERN, YIELD AND PRICES IN THE STATE AS A WHOLE

State

Sl. No.	Name of the crops grown	Area under each crop in thousand hectares						Per hectare grain		
		1951	1956	1961	1966	1969	1974	1951	1956	1961
1	2	3	4	5	6	7	8	9	10	11

yield of each crop in quintals			Average farm prices per quintal in rupees						Remarks
1966	1969	1974	1951	1956	1961	1966	1969	1974	
12	13	14	15	16	17	18	19	20	21

Note : Source of information may be given

PROFORMA G.2.2

CROPPING PATTERN, YIELD AND PRICES IN EACH FLOOD PRONE RIVER BASIN SUB-BASIN

State
River

Sl. No.	Name of the crops grown	Area under each crop in thousand hectares						Per hectare grain			
		1951	1956	1961	1966	1969	1974	1951	1956	1961	1961
1	2	3	4	5	6	7	8	9	10	11	12

yield of each crop in quintals		Average farm prices per quintal in rupees						Remarks
1969	1974	1951	1956	1961	1966	1969	1974	
13	14	15	16	17	18	19	20	21

Notes : (1) Please give information for river basin/sub-basin listed in proforma G.1
(2) Source of information may be given.

PROFORMA G.3

GAUGE AND DISCHARGE SITES

State

Sl. No.	Name of the River/tributary	Location of site	Catchment area in sq. Kms. (upto observation site)	Nature of observation			Year of start of observations			Remarks
				Gauge	Discharge	Silt	Gauge	Discharge	Silt	
1	2	3	4	5	6	7	8	9	10	11

Note : In the Remarks column, the following information may be incorporated :—

(i) Nature of bed and banks

(ii) The type of gauge, whether self-recording or ordinary. If zero level has been changed, please state date and how Correlated to the earlier one.

(iii) Method of discharge observation—by current meter/float etc.

(iv) Periodicity of guage, discharge and silt observation during monsoon and non-monsoon periods.

PROFORMA G.4

RAINGAUGE STATION

State

Sl. No.	Basin/Sub-basin	Area of Basin / Sub-basin in the State	Name of Station	Agency maintaining the station IMD/State/ Others	Whether Ordinary or Self recording	Date of commencement of observation	Remarks (Observation discontinued change of site etc.)
1	2	3	4	5	6	7	8

PROFORMA G.5

HYDROLOGICAL DATA FOR RIVERS

State
River

Location of site	Catchment area (Sq. Kms.)	Maximum flood discharge in cumecs with date	Flood discharge corresponding to danger level	Bank full capacity in cumecs
1	2	3	4	5

Total flow				Total silt load				Remarks
Annual		Monsoon		Annual		Monsoon		
Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	
(million cubic metres)				(cubic metres)				
6	7	8	9	10	11	12	13	14

Notes : (i) Separate compilation for each river system under sub-head : main, tributary, sub-tributary, tributaries & sub-tributaries from the head of the river/tributaries.

(ii) Under each sub-head, specify : foothill, middle reach, lower reach.

(iii) The date(s) of the monsoon(s) may please be specified. In case, there are two monsoon seasons, information may be supplied for each.

(iv) Source of data may be indicated.

PROFORMA G. 7

AREAS AFFECTED DURING THE MAXIMUM OBSERVED FLOODS

State

Sl. No.	Name of Basin/ Sub-basin	Maximum flood			Duration of floods (hours/ days)	Area affected (hectares)	Remarks
		Date	Discharge	Location where observed & gauge height	Date(s)		
1	2	3	4	5	6	7	8

Notes : (i) Source of data may be indicated.

(ii) Wherever possible average depth of inundation may be indicated in 'Remarks' column.

PROFORMA G.10.1

FLOOD DAMAGE DISTRICT-WISE

State,
Area '000 ha.
Population '000

District	Geographical area of the District	Area prone to floods *	Total area affected								Cultivated Area affected							
			1954—61		1961—1966		1966—74		1974—76		1954—61		1961—66		1966—74		1974—76	
			Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
For the State as a whole (Cols. 2 to 36)																		

*Please state how you define the areas as flood prone.

Note : Source of information may be indicated.

District	Geographical area of the District	Area prone to floods *	Irrigated area affected								Population affected								Remarks
			1954—61		1961—66		1966—74		1974—76		1954—61		1961—66		1966—74		1974—76		
			Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	
1	2	3	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
For the State as a whole (Cols. 2 to 36)																			

*Please state how you define the area as flood prone.

Note : Source of information may be indicated.

PROFORMA G.10.2

FLOOD DAMAGE BASIN-WISE

State

River

Area : '000 ha.

Popu- : '000
lation

Name of river basin/sub-basin	Geographical area of basin/ sub-basin	Name(s) of District(s) falling within basin/sub-basin	Area in* basin/sub-basin prone to floods	Total area affected								Cultivated area affected							
				1954—61		1961—66		1966—74		1974—76		1954—61		1961—66		1966—74		19	76
				Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
For the Basin as a whole (Cols. 5 to 37)																			

*Please state how you define the area as flood prone.

Note : (i) Information for each river basin (main tributary, sub-tributary) may be furnished in separate sheets.

(ii) Source of data may be indicated.

Name of river basin/sub-basin	Geographical area of basin/sub-basin	Name(s) of District(s) falling within basin/Sub-basin	Area in* basin/sub-basin prone to floods	Irrigated area affected								Population affected								Remarks
				1954—61		1961—66		1966—74		1974—76		1954—61		1961—66		1966—74		1974—76		
				Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	
1	2	3	4	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37

*Please state how you define the area as flood prone.

Note : (i) Information for each river basin (main tributary, sub-tributary) may be furnished in separate sheets.

(ii) Source of data may be indicated.

TERM OF REFERENCE NO. 1

To review the flood protection measures undertaken since 1954 and to make an evaluation of the benefits and effectiveness of the measures undertaken so far with special reference to embankments in reducing the damage.

Flood protection measures at governmental level prior to Independence were mainly by embankments and protected about 30 lakh ha. The national flood control policy was announced by Government of india in 1954 ; this comprised three stages viz. immediate, short-term and long-term. Since then a large number of flood protection measures have been implemented with an investment of over Rs. 400 crores, to benefit about 80 lakh ha.

Inspite of these measures, the damage figures reported in recent years have shown an increasing trend. It has therefore, been considered necessary to make an evaluation of the works undertaken so far. In this context information is now sought basin-wise/sub-basinwise with detailed information on schemes costing more than Rs. 25 lakhs each.

NOTE:—Where a scheme, as initially visnalised or by later addition, has formed a part of a bigger scheme e.g. an enbankment constructed in portions, information should be supplied for each porition even if the cost was Rs. 25 lakhs or less.

QUESTIONNAIRE

1.1 Please furnish a resume of flood control/protection measures implemented at Governmental level upto 1954, mentioning therein the nature of works implemented, the rivers on which such works have been carried out, their benefits and performance in general and the nature of development in the protected areas before and after the implementation of the works.

Please furnish details in proforma 1.1 basin-wise/sub basin-wise with details for each scheme costing more than Rs. 25 lakhs. Please furnish a map to the scale 1 to 1 million (or to a larger scale if required) showing the various river basins/sub-basins and the works implemented upto 1954.

1.2 Please give a resume of the flood control/protection measures since 1954, stating the nature of works implemented their location, performance and benefits in general and the nature of development in the protected area before and after the implementation of the works basin-wise/sub-basin-wise.

Please furnish details in proforma 1.2 basin-wise/sub basin-wise for the works completed separately for each of the following periods :—

(a) April 1954 to end of March, 1961
(b) April 1961 to end of March, 1966
(c) April 1966 to end of March, 1969
(d) April 1969 to end of March, 1974

Information may please be supplied for each scheme costing above Rs. 25 lakhs and the other schemes may be grouped together.

Please furnish maps to the scale of 1 to 1 million (or to a larger scale if desired) showing the completed works in each river system (as a whole or individually for large sub-basins) separately for the periods indicated above.

1.3 Some flood control/protection schemes have been suggested by the Committees/Experts constituted by the Centre/State concerned (some of the more important Committees have been mentioned in the Annexure II to the preamble). Please list the schemes chronologically from 1954 onwards in proforma 1.3 indicating the nature of the schemes and the benefits etc.

Please supply six copies each of the Reports of the Committee/Experts appointed by the State Government.

1.4 Have any flood control/protection plans in the various river basins been prepared on the lines suggested by the High Level Committee on Floods and the subsequent Committees on flood control ? Please give a note giving the broad

features of the plan for each river basin as a whole or by parts as convenient. Please also supply six copies of the plan.

1.5 Are the works implemented so far, in accordance with the overall plan and according to the priorities indicated therein ? If not, the reasons therefor.

Has any plan revised been prepared indicating new priorities ? If so, please supply six copies of the revised plan ?

1.6 Have any socio-economic surveys been carried out in the areas protected and reports prepared ? Please furnish six copies of each report. If no, reports have been brought out, a concise note may please be furnished for each survey.

1.7 For technical and economical reasons, it is not possible to provide flood protection under all conditions of flow and for all time to come. As such, is there any policy/practice by which developmental activities in the protected areas are regulated ? Please furnish a note, quoting examples.

1.8 Embankments

1.8.1 Please furnish a note indicating the method of fixation of the design flood for the embankments and the degree of protection provided (in terms of frequency of floods or any other criterion) for (i) predominantly agricultural area (ii) town protection works and (iii) protection of important industrial establishments, assets and lines of communication.

1.8.2 What are the general standards adopted in the design of embankments :

(a) Top width
(b) Type of top surfacing
(c) Free board
(d) Side slopes (indicating whether they are fixed on the basis of analysis of soils).
(e) Slope protection (indicating the governing factors).

Note : Where masonry walls have been provided, their standards may please be indicated.

1.8.3 Where embankments are provided on both banks, the method by which the distance between the embankment is fixed may please be indicated.

1.8.4 Is the embankment system planned for the entire river tributary system and the implementation taken up in a phased manner ?

Please furnish a note indicating the practice and the priorities for implementation.

1.8.5 Have the benefits of inundation and deposition of silt in the protected areas been taken into account while planning the embankments and while working out the benefits ?

Please supply a note on methodology.

1.8.6 Has any necessity been felt for providing water supply for the cultivation of crops in the area protected which used to be inundated previously ? If so, has the cost of such provision of water supply been included in the cost of the scheme ?

Please detail schemes where this has been done and in what manner.

1.8.7 Are any embankments being used as public highways ? If so, please state the length and locations.

Also please state the experience in this behalf-maintenance, patrolling during floods, breaches etc.

Is any portion of expenditure borne by the Highways Department ?

1.8.8 Please indicate whether any studies have been made of the effect on the soil properties of the embankments due to age and industrial effluents/waste discharged/dumped into the rivers. If so, please furnish a note.

1.8.9 Please give in proforma 1.8.9 detailed information in respect of all embankments schemes costing more than Rs. 25 lakhs each completed upto the end of March 1976 (both completed prior to 1954 and since 1954). Schemes costing

Rs. 25 lakhs or less but forming part of a continuous embankment, should also please be included.

1.8.10 Any other comments/suggestions of the State Government particularly on the assessment of the benefits/drawbacks of marginal embankments on river regime, effects on downstream works/areas, protected area etc. and about the desirability, location where suitable and other relevant matters, relating to embankments.

1.9 *Drainage (Storm water) Schemes*

1.9.1 Please give a note detailing the basis on which the design discharges for storm water drainage system are determined indicating whether it is on the basis of cost-benefit analysis, taking into account the frequency and intensity of rainfall, cropping pattern and the permissible depth of inundation or on the basis of any specified frequency of rainfall, cropping pattern and tolerance of crops or on ad-hoc basis.

What is the criteria adopted in the design of drainage for :

(a) predominantly agricultural areas ;

(b) urban areas ; and

(c) important industrial complexes etc ?

1.9.2 How is tidal lockage taken into account while designing the drainage system in the deltaic areas ? Please furnish a detailed note.

1.9.3 Is the planning of the drainage system done for the entire basin and implementation taken up in a systematic manner ? Please furnish a note indicating the practice and priorities for implementation.

Please supply six copies of the plan with maps for each basin where so prepared.

1.9.4 While investigating individual drainage schemes, is the possibility of using drainage water (in part or whole) to supplement canal flows or for storing in depressions etc. considered ?

Has such use been made anywhere in the State ? If yes, please furnish details with maps of relevant areas.

1.9.5 Has any study of drainage in various basins of the State been made by any Committee/Experts ? If so, please supply a note covering the problems and the recommendations, basin/sub-basinwise.

Please furnish six copies of the reports.

1.9.6 What is the effect of drainage system on water-logging and ground water table ? Please furnish a note with details.

1.9.7 Has any drainage system been planned and implemented covering more than one State ? What have been the problems that have been experienced in the planning, implementation and operation of such systems ? Please furnish a detailed note.

1.9.8 Please furnish detailed information in proforma 1.9.8 in respect of drainage schemes costing more than Rs. 25 lakhs each.

NOTE : (1) Schemes costing Rs. 25 lakhs or less forming a stage of a bigger one should be included in the proforma and covered by an explanatory note giving reference to the map vide term 1.9.3.

(2) In case there are no schemes costing more than Rs. 25 lakhs, information in respect of schemes costing more than Rs. 10 lakhs each may be given.

1.10 *Anti-erosion Works*

1.10.1 What is the general policy of the State Government for undertaking anti-erosion works ?

1.10.2 Are the various alternatives of protection considered before a decision on the nature of measures is taken ?

1.10.3 Please list the types of anti-erosion works undertaken in the State detailing the performance of two of each type.

1.10.4 Are any model experiments undertaken before carrying out anti-erosion works to investigate the possible effects of such works upstream and downstream and on the opposite side ?

Please furnish a note giving specific examples where such model experiments have been carried out ; also performance of the prototypes compared with the experimental results.

1.10.5 Has the experience of anti-erosion measures implemented so far led to any economical method of protection and design ? Please furnish a note.

1.10.6 Please give detailed information in proforma 1.10.6 in respect of anti-erosion measures costing more than Rs. 25 lakhs each. Please supply detailed plans of a few typical schemes.

1.11 *Raising of Villages*

Raising of villages above a pre-determined flood level and connecting them to the nearby roads or high ground as a measure of flood protection was adopted in the eastern districts of U. P. during ihe Second and the Third Plans. Similar measures have been adopted in some other States also. Please supply the following information wherever this method has been adopted :

1.11.1 What is the general performance of raising of villages as a method of flood protection ? Please furnish a note along with the criteria adopted in such cases.

1.11.2 Has this method by and large proved useful to the State Government in saving annual costs on evacuation and relief arrangements in the villages affected by the floods ?

1.11.3 Please state the cost of protection by such measures compared to the annual cost of evacuation and relief works for three specific cases.

1.11.4 What are the measures taken by the State Government to give adequate warning and assistance for evacuation etc. to the people in the raised villages in case the pre-determined flood discharge/level is exceeded ?

1.11.5 Has pre-determined flood discharge/level been exceeded in any case ? If yes, please quote up to 3 specific cases with a note giving details of warning, action taken, damage caused, relief measures and costs incurred etc.

1.12 *Reservoirs*

Reservoirs for providing flood control only have not been so far constructed in the country. However, multipurpose reservoirs providing specific flood control storage have been constructed, of which the important ones are Hirakud Dam in Orissa and the Damodar Valley Dams in Bihar.

1.12.1 Please furnish information in proforma 1.12.1 in respect of the multi-purpose dams where flood control storage has been specifically provided.

1.12.2 In respect of reservoirs with no flood control component, please state if any flood moderation is assumed. If so, please give a note with specific examples.

1.12.3 What was the basis for fixing the dead storage and the life of the reservoir in the project report ?

Have any studies been carried out either by computation of inflow and outflow of the silt charge or by reservoir capacity surveys on the extent of siltation and the consequent loss of storage capacity since the reservoir came into operation ? Please supply a detailed note indicating the resultes of such studies for each reservoir with six copies of relevant reports, if any.

1.13 *Channel Improvements*

Channel improvements were visualised in the short-term stage of the National Flood Control Policy.

1.13.1 Please furnish a note giving the following information as from 1954 :

(a) The rivers/tributaries where channel improvements have been accomplished, the locations and details like the date, method adopted, length, width, capital cost etc., of each. Also please supply details of maintenance expenditure, year by year from the date of completion.

Please supply a map or maps to a suitable scale showing these details.

(b) Whether these were undertaken after model experiments. If yes, Please supply six copies of each such report.

(c) Whether these improvements have achieved the results visualised or otherwise.

(d) Whether any modifications were required after completion. If yes, the the nature thereof, the cost and the results achieved.

(e) Comments on the suitability of such measures and locations and conditions where they could prove beneficial.

PROFORMA 1.1

River

State

FLOOD PROTECTION WORKS IMPLEMENTED BY THE GOVERNMENT UP TO 1954

Sl. No.	River/tributary/ sub-tributary	Name of the scheme	Nature of the scheme (e.g. embankment antierosion etc.)	Date of start	Date of completion	Capital Cost		Monetary value of average annual benefits	
						Estimated	Actual	Estimated	Actual
						(Rs. lakhs)		(Rs. lakhs)	
1	2	3	4	5	6	7	8	9	10

Length of embankment or drainage channel (Kms.)			Benefits from embankment or drainage channel ('000 ha.)			No. of towns or villages protected	No. of villages raised	Area benefitted from flood moderation in reservoirs ('000 ha.)	Districts benefitted	Remarks
Right Bank (of river)	Left Bank (of river)	Total	Right Bank	Left Bank	Total					
11	12	13	14	15	16	17	18	19	20	21

Notes : (i) Please furnish information separately for each river system (main, tributary, sub-tributary) listing the works in the order of embankments, drainage channels, river protection works, town protection works, raising of villages and flood control reservoirs or multi-purpose reservoirs with flood control benefits.

(ii) For each category, information may be furnished for individual schemes, costing over Rs. 25 lakhs each and all other schemes may be grouped together, giving information in columns. 7, 8, 9, 10, 13, 16, 17, 18 & 19.

(iii) The sub totals for each basin/sub-basin may be given at the end for each category of work with grand totals for each river system.

(iv) Benefits from the schemes to the Railways, National Highways, Industrial complex, State utilities and strategic places etc. may be indicated in Remarks column.

PROFORMA 1.2

State :
River :

FLOOD PROTECTION WORKS IMPLEMENTED BY THE GOVERNMENT AFTER 1954

Sl. No.	River/tributary/ sub-tributary	Name of the scheme	Nature of the scheme (e.g. embankment, anti-erosion etc)	Date of start	Date of completion	Capital Cost		Monetary value of average annual benefits	
						Estimated	Actual	Estimated	Actual
						(Rs. lakhs)		(Rs. lakhs)	
1	2	3	4	5	6	7	8	9	10

Length of embankment or drainage channel (Kms.)			Benefits from embankment or drainage channel ('000 ha.)			No. of towns or villages protected	No. of villages raised	Area benefitted from flood moderation in reservoirs ('000 ha.)	Districts benefitted	Remarks
Right bank	Left Bank (of river)	Total	Right Bank	Left Bank	Total					
11	12	13	14	15	16	17	18	19	20	21

Notes : (i) Please furnish information separately for each river system (main, tributary, sub-tributary), listing the works in the order of embankments, draingae channels, river protection works, town protection works, raising of villages and flood control reservoirs or multi-purpose reservoirs with flood control benefits.

(ii) For each category, information may be furnished for individual schemes, costing over Rs. 25 lakhs each and all other schemes may be grouped together giving information in columns 7, 8, 9, 10, 13, 16, 17, 18 & 19.

(iii) The sub-totals for each basin/sub-basin may be given at the end for each category of work with grand totals for each river system.

(iv) The information may be given separately for each of the following periods :—

(a) April 1954 to end of March, 1961

(b) April 1961 to end of March, 1966

(c) April 1966 to end of March, 1969

(d) April 1969 to end of March, 1974

(v) Benefits from the schemes to the Railways, Natioanl Highways, Industrial complex, State utilities and strategic places etc., may be indicated in Remarks column.

PROFORMA 1.3

SCHEMES SUGGESTED BY COMMITTEE / EXPERTS (CHRONOLOGICALLY FROM 1954

State

Sl. No.	Name of scheme	Sl. No. of the scheme in pro-forma-1.2	Name of the Expert/ Com-mittee recom-mending the scheme	Brief details of the scheme	Cost (Rs. lakhs)		State of im-plemen-tation of the scheme	Benefits (Ave. annual)		If not under-taken reasons thereof or whe-ther proposed to be dropped	Remarks
					Esti-mated	Actual		Esti-mated	Actual		
1	2	3	4	5	6	7	8	9	10	11	12

PROFORMA 1.8.9

EMBANKMENT SCHEMES COSTING MORE THAN RS. 25 LAKHS EACH

State

1. Name of the scheme
2. Location indicating the river, tributary etc.
3. Length of the embankment (km.) Right side
   Left side
4. Design features :
   (a) Design flood magnitude (cu.metres/sec.)
   (b) Frequency of design flood
   (c) Distance between the embankments (where on both sides) (metres)
      (i) Maximum
      (ii) Minimum
      (iii) Average
   (d) Basis for fixing design flood level
   (e) Free board above design flood level (metres)
   (f) Top width (metres)
   (g) Height of embankment (metres)
      (i) Maximum
      (ii) Average
   (h) Side slopes : Water side
      Land side
   (i) Nature of side protection, if any, with details.
5. Date of start
6. Date of completion : (a) Targetted
   (b) Actual
   (c) Reasons for early/delayed completion
7. Estimated cost (Rs. Lakhs) :
   (a) Projected
   (b) Revised with date indicating reasons for decrease/increase in cost and change and nature of scope, if any.
8. Has the estimate been closed? If so, what is the completed cost? If not, the reasons therefor and whether the routine maintenance is still being charged to the project estimate.
9. What is the booked capital cost of the scheme as on 31-3-76?
10. How many times since its completion has the embankment breached or been overtopped? Please give details indicating the number of breaches, year of occurrence of breaches/overtopping and the cost of repairs and further measures undertaken for raising and strengthening ofthe embankments and the damage caused during each of these events.

    Have the reasons for breaches/overtopping been investigated each time? Please state the results of such investigations in each case.
11. Has any necessity arisen for the retirement of the embankment on account of river attack? If so, how many retirements have been effected and at what cost? What is the reduction in the protected area on this account? Please furnish a large size index map showing the locations of the original embankment and retirements with dates.

    Have there been any problems in the provision of retirements? Please detail.
12. If retirements considered advisable have not been effected for any reason, river training/protection works may have been necessary. What is the cost of such protection works and the amount spent on their yearly maintenance?

    Please furnish details up-to-date. How does this cost compare with the assessed cost of the retirements?
13. What was the nature of development in the protected area before the construction of the embankment? Please give details alongwith the estimated assets e.g. buildings, roads, industries, railways etc. and the extent of area cultivated/irrigated crop-wise during the flood season and the Rabi season, before and after the completion of the scheme.
14. Have the benefits contingent upon inundation soakage and silt deposition in the flooded area before embanking been taken into account in working out the financial analysis of the scheme?
15. Has any problem of drainage congestion been felt after construction of the embankment? How many times has this occurred since completion of the scheme? If so, please state dates of occurrence, the average depth, duration and extent of protected area affected each time?
16. Please detail the annual benefits-physical (by crop acreageetc.) and monetary-visualised in the project and the benefits derived year by year up-to-date since the completion of the scheme and the average thereof.

17. Is the development following the security provided by the embankment being regulated? Has the protected area been properly demarcated for development of different categories such as cultivation/ irrigation, industrial development and urbanisation?

18. Has any evaluation been made in quantitative terms of the economic conditions in the protected area before and after construction of the embankment? Please furnish a note indicating the production, nature of assets, lines of communication etc. and also the overall prosperity or otherwise, in the area before and after.

19. What are the benefits that have accrued from the scheme in the shape of increase in revenue, saving of expenditure during floods and relief etc. to :—

(1) Local bodies,

(2) State Government, and

(3) Other agencies?

Please furnish a note.

20. Has the scheme resulted in creating additional flood problem either on the upstream or on the downstream or the opposite side of the area?

Has any evaluation of such effects been made? If so, please supply physical and monetary details.

21. Are the records of observations of river behaviour during the floods being kept for taking necessary action thereafter?

22. Are post-monsoon surveys including cross sectional areas carried out regularly for the study of river conditions in the embanked reach for undertaking remedial measures if necessary?

Are the longitudinal and cross-sections of the embankment taken after the floods every year for assessing the adequacy of the free board?

Please state the date of physical completion of the scheme and the years when raising/strengthening has been undertaken and the cost thereof each time.

If no raising/strengthening has been undertaken, Please state factors contributing to this situation.

23. Have the river surveys indicated any rise/fall in flood levels for the same discharge (please state the bench mark location) indicating aggradation/degradation? Has there been any formation of shoals or cutting across of meander bends? Please furnish a note.

24. Please furnish information of the amount spent during the years, compared with the estimated requirements, commencing from 1966 according to Embankment Manual or any other yard stick (which may) please be detailed) in respect of routine maintenance, replenishment of consumable items etc. as below (information may please be given separately for each year) :

(i) Year

(ii) Engineering works covering, raising and strengthening, widening, special repairs, protective works etc. :

(a) Estimated requirements

(b) Actual amount spent

(iii) Routine maintenance :

(a) Estimated requirements

(b) Actual amount spent

(iv) Patrolling :

(a) Estimated requirements

(b) Actual amount spent

(v) Replenishment of stock of consumable materials and T. & P. :

(a) Estimated requirements

(b) Actual amount spent

(vi) Temporary land acquisition :

(a) Estimated requirements

(b) Actual amount spent

(vii) Total :

(a) Estimated requirements

(b) Actual amount spent

(viii) Remarks

25. Please furnish a note detailing how the scheme was economically (benefit, cost ratio or other method) and/or otherwise considered justified, and comments on its actual performance since completion.

26. (a) Please state how the embankment was selected as the best measure in this reach. Where measures like raising of or ring bunds around villages, change of crop pattern, flood plain zoning etc. considered as alternatives or in conjunction?

(b) Have any sluices been provided in the embankment for use for controlled flooding/ reverse drainage/ inundation canals/ leading water to depressions on land side etc. ?

(c) Please furnish a detailed note covering the above and other relevant points which were (or not) considered at the time of planning the embankment.

PROFORMA 1.9.8

COMPLETED DRAINAGE SCHEMES COSTING MORE THAN RS. 25 LAKHS EACH

State

Notes :

(i) Please supply information for schemes costing more than Rs. 10 lakhs each in case there are no schemes costing more than Rs. 25 lakhs each.

(ii) Schemes costing Rs. 25 lakhs or less, forming a stage in a bigger scheme should please be included.

1. Name of the scheme.
2. Location indicating the basins/and the districts benefited.
3. Design features :
   (a) Catchment area (sq. km.)
   (b) Catchment characteristics (shape, vegetal cover, relief, slope etc.).
   (c) Design frequency and intensity of rainfall.
   (d) Run-off index (indicate the basis on which this has been fixed).
   (e) Crops grown— (i) Before the Scheme ;
   (ii) As visualised post-scheme ;
   (f) Depth and duration of inundation permitted.
   (g) Discharge per sq. km. and its basis.
   (h) Bed slope.
   (i) Extent of tidal lockage (in deltaic areas).
4. Date of start.
5. Date of completion
   (a) Targetted ;
   (b) Actual ;
   (c) Reasons for early/delayed completion.
6. Estimated cost in Rs. lakhs.
   (a) Original.
   (b) Revised with date.
   (c) Reasons for decrease/increase in cost with change and nature of scope, if any.
7. Benefits (as visualised in the scheme)
   (a) Physical
   (b) Monetary
8. Has the project estimate been closed? If so, what is the completed cost? If not, the reason therefor and whether routine maintenance is being charged to the project estimates?
9. What was the booked capital cost at Physical completion (state the date) of the scheme ? What is the booked cost as on 31-3-76 ?
10. How many times after completion of the scheme, has drainage congestion been experienced ? Please state years of such occurrences and the extent of benefit actually realised during these years. Have the reasons for drainage congestion been investigated? Please furnish a note or six copies of published reports, if any.
11. Have periodic surveys of the longitudinal and cross sectional area of the drainage channel been carried out ? If so, please furnish a note on the findings.
12. Is the deterioration, if any, of the drainage channels due to inadequate maintenance, remaining inoperative on account of adopting high design standard or encroachments, cross bunding, bed cultivation or any other cause ? Please furnish a note.
13. Has any necessity been felt after completion to remodel the drainage channel ? If so, what is the improvement done and at what cost ?
14. What was the nature of development in the area benefited before implementation of the scheme ? Please give details along with estimated assets and extent of area cultivated/irrigated crop-wise during the flood season and the Rabi season (in case of reclamation scheme) before and after completion of the scheme.
15. Has the implementation of the scheme affected the ground water table ? If so, please supply details.
16. What are the benefits actually derived during the operation of the scheme and what is the average annual benefit (physical and monetary) compared to that shown in the scheme report ?
17. Has any evaluation been made in quantitative terms of the economic conditions in the area benefited before and after completion of the scheme ? Please furnish a note indicating the production, value of assets, communications in the area before and after and also overall prosperity or otherwise.
18. What are the benefits that have accrued in the shape of additional revenue and other benefits to (1) local bodies (2) State Government (3) Other agencies ? Please furnish a note.
19. Has the scheme caused any special problem of drainoge in adjoining areas ? Has any evaluation of the areas thus affected been made ? Please furnish details.
20. What is the amount spent on annual maintenance of the Scheme starting from 1970-71 ? Please give details of expenditure seperately each year for special repairs and routine maintenance.

PROFORMA 1. 10. 6

ANTI-EROSION WORKS (COSTING OVER Rs. 25 LAKHS EACH)

State

1. Name of the Scheme with brief description
2. Location
3. Objective of the protection measure
4. Basis on which the type of work was decided
5. Date of start
6. *Date of completion*— (a) targetted
   (b) actual

   Reason for early/delayed completion.
7. *Estimated cost*— (a) Original
   (b) revised, with date.

   Reasons for revision of estimate, decrease/increase in cost indicating change in and nature of scope, if any.
8. Has the estimate been closed ? If so, what is the booked cost on completion ? If not, the reasons for not closing the estimate.
   Is the routine maintenance being still charged to the project estimate ?
9. Year-wise expenditure incurred after the completion of the scheme as revised.

Year	Expenditure in Rs. lakhs		Nature of special repairs
	Special repairs	Routine maintenance	
1	2	3	4

PROFORMA 1. 12.

MULTIPURPOSE RESERVOIRS WITH FLOOD CONTROL STORAGE

State

Name of the Scheme :

1. Gross Storage.

2. Dead Storage.

3. Live Storage.

4. (i) F'ood Storage (cushion)

   (ii) Area submerged between the flood storage levels.

5. What is the average and the maximum (designed and actual so far) inflow at the dam site—

   (a) during the monsoon period ; and

   (b) during the entire year.

6. What is the planned utilisation (irrigation/hydro power) during the monsoon period from the dam ?

7. Have any operation rules been drawn up for the regulation of the reservoir for the evacuation of floods ? Have they been revised ? If so, reasons therefor. Please supply six copies of the original and revised operation rules.

8. After the completion of the dam, has there been any revision in the flood storage to meet the increased demands of irrigation and power ? Please detail.

9. What has been effect of the construction of the dam on the river characteristic in the lower reach ?

10. Due to the reduction in the flows downstream by the moderation at the dam, has there been any encroachment into the flood plains leading to greater flood hazards in times of higher releases from the dam ? Have there been any instances after the completion of the dams of such releases causing significant damage ? Please furnish a note.

11 What were the flood moderation benefits envisaged in terms of area benefited and monetary value as given in the project and as actually obtained after completion ?

12. Have flood embankments been planned and implemented to contain the releases from the dam to provide protection to downstream areas ?

    What is the criteria for the design of the embankments in such cases i.e., what is the design-flood, whether it is the maximum release expected from the dam or releases corresponding to floods of the frequencies of 50/100 years ?

    Have the added flows from the uncontrolled catchment below the dam been taken into account ?

TERMS OF REFERENCE NO. 2

To indentify the areas where a large number of zamindari and/or unauthorised embankments, bunds and spurs etc., exist; to assess the effect of such constructions on the flood problem; and suggest remedial measures.

The earliest efforts of protection against floods were mostly those of the individuals/zamindars who constructed embankments for the protection of their private properties. These works were usually constructed in haphazard manner without due regard to the effect of such constructions on the upstream and downstream areas as also on opposite banks. Such lack of planning may equally apply to some embankments constructed under the test relief programme usually executed at short notice to provide immediate employment opportunities to flood affected people. Many such substandard works are likely to have been superseded by subsequent construction of regular embankments during the Plans while some others may still be in existence.

QUESTIONNAIRE

2.1 Please furnish details of zamindari/test relief embankments (separately) in Proforma 2.1 in respect of those which have not been superseded by embankments constructed under the flood control sector. Please also furnish a plan to the scale of 1 to 250,000 showing the locations of important embankments.

2.2 Please give a general assessment on the utility of the embankments referred to in 2.1. Has any separate assessment of the damage caused by breaches, overtopping etc. of these embankments been made ? If so, please furnish information in proforma 2.2.

2.3 Has the State Government taken over the responsibility for maintenance of the unsuperseded zamindari/test relief embankments ? Which is the Department in charge of such maintenance ? If different from the Flood Control Department, does that Department have necessary technical facility to maintain them ? Is there any proposal to transfer their control to Flood Control Department ?

2.4 Has any plan been formulated to replace these unsuperseded embankments or remodelling them as a part of the overall plan of flood control ?

Please furnish a note relevantly indicating alternatives considered, costs and benefits.

2.5 Please furnish information in proforma 2.5 for each of the zamindari/test relief embankments which provides protection to more than 1000 hectares. Please supply a map to the scale of 1 to 50000 showing the embankments for which detailed information has been furnished.

2.6 Are the zamindari/test relief embankments superseded by the regular embankments allowed to remain intact or demolished ? If not demolished, reasons therefor.

Please supply information in proforma 2.6, in respect of such embankments a have not been demolished.

2.7 Has any Committee/Expert examined the effect of the zamindari/test relief embankments and similar other works on the flood problem and given any report ? If so, please supply six copies of the report and a note indicating the action taken on the recommendations of the Committee/Expert.

2.8 Other comments and suggestions if any, of the State Government on the subject.

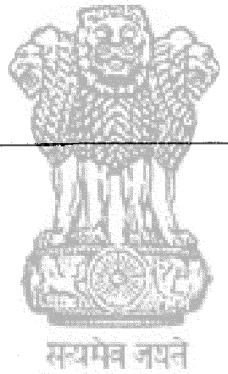
PROFORMA 2.1

Area in '000 Ha
Population in '000

Zamindari and Test relief embankments and other works (which have not been superseded by embankments constructed under the Flood Control Sector)

State

River basin/ Sub-basin	District	No. of embank-ments	Total length of embank-ments (Km.)	Area Pro-tected	Population pro-tected	No. of villages protected	Works other than embank-ments	Purpose & benefit of work in Col. 8.	Remarks
1	2	3	4	5	6	7	8	9	10



PROFORMA 2.2

DAMAGE CAUSED BY BREACHES, OVERTOPPING ETC. OF ZAMINDARI/TEST RELIEF EMBANKMENTS

State

River basin/sub-basin	District	Year	Area affected ('000 ha.)	Cropped area affected ('000 ha.)	Damage to crops (Rs. lakhs)	Popu-lation affected ('000)	No. of villages affected	Amt. spent on relief- (Rs. lakhs)	Amt. spent on repairs (Rs. lakhs)	Remarks
1	2	3	4	5	6	7	8	9	10	11

PROFORMA 2.5

ZAMINDARI/TEST RELIEF EMBANKMENTS WHICH PROVIDE PROTECTION TO MORE THAN 1000 HA. EACH

State

1. Name of the embankment
2. Location—River/Tributary/Sub-tributary
3. Details :
   - (a) Top width (metres)
   - (b) Side Slope : Water side
     Land side
   - (c) Height of embankment (metres)
   - (d) Length of Embankment (km)
   - (e) Nature of protection to embankment, if any
   - (f) Area protected in hectares, district-wise
   - (g) Cultivated area protected in hectares district-wise
   - (h) Population protected, district-wise
   - (i) No. of villages protected, district-wise.
4. Number of times, the embankment has been breached or overtopped since 1966, indicating the years when overtopped or breached.
5. What is the extent of damage caused during each of these events, (loss of crop and population affected etc.) ?
6. What is the amount spent on special repairs and relief in each of the years of breaches/over-topping mentioned in (4) above.
7. What is the amount spent yearwise on maintenance since 1971 ?

PROFORMA 2.6

ZAMINDARI AND TEST RELIEF EMBANKMENTS SUPERSEDED BUT NOT DEMOLISHED

State

River basin/Sub-basin	District	Number of embankments	Total length of embankments (km)	Remarks
1	2	3	4	5
Total for State				

TERM OF REFERENCE NO. 3

To identify the areas where construction of roads, highways, railways etc,. and other encroachments into the drains have aggravated flood problems and to suggest measures for imorovement including legislative action, if any.

Waterways at the crossings of railways, roads, canals over rivers, streams, drains etc., may not always be sufficient to allow unaffluxed flow under all conditions. The Railway Act provides for the increasing of waterways of the railway bridges at their cost on a justified request by the State Governments within a period of 10 years from the completion of the bridge.

Following the failure of some railway bridges, the Railways constituted the Khosla Committee of Engineers in 1957. This Committee recommended the provision of waterways for railway bridges to cater for the maximum recorded flood or flood discharge corresponding to a 50-year frequency whichever is greater without causing undue afflux. The Railways are adopting this norm in the design of new bridges as well as for reviewing the adequacy of the waterways of the existing bridges. It is understood that the National Highways are also adopting the same norms.

Due to canalisation, urbanisation and encroachment in the flood plains, the magnitudes of the flood discharges may increase and, therefore, review and extension of waterways may, at places, become necessary. Speedy action in this regard is often not possible on account of differences in views on the technical aspects and the sharing of costs amongst the various organisations. In order to expedite the agreement on the provision of waterways, State Committee of Engineers have been set up to examine *inter-alia* the adequacy of waterways and arrive at decisions on the extent of waterways needed Standing Committees under the Chairmanship of the Chairman, Central Water Commission have also been set up to settle disputes relating to the waterways and the sharing of costs between the Railways/ National Highways and the States.

QUESTIONNAIRE

3.1 Please furnish a note indicating the procedure adopted by the State Government in working out the waterway and checking the waterways proposed by Railways/National Highways.

3.2 Are the waterways at the Railway and National Highway crossing provided by the concerned authorities in consultation with the State Government ?

Is there similar consultation by the concerned State Departments with the State Flood Control Deptt. while providing waterways at the road and canal crossings.

3.3 Are there any specific areas which experience distress frequently at Railway and/or National Highway crossings ? Please furnish a note indicating the locations where such conditions have been experienced and the number of times these have occurred from 1966 onwards.

Please also furnish a map to the scale of 1 to 1 million showing the Railways and the National Highway crossings and the location of the distress area. Large scale maps for each of the specific areas showing the extent of flooding and the years in which the flooding has occurred may also please be supplied.

3.4 Information and maps similar to those in 3.3 may please be supplied in respect of distress areas at the crossings of State roads/canals/drains.

3.5 Has the State Government made any investigations into the causes for the distress conditions in the specific areas referred to in 3.3 and 3.4 ? If so, have the conclusions of these investigations been brought to the notice of the concerned authority and with what result ? Please furnish a note giving details of the specific cases.

3.6 Has any Committee/Expert(s) studied the drainge congestion and adequacy of waterways for the bridges and made any recommendations ? To what extent have the recommendations been implemented ? What are the reasons for non-implementation of the recommendations in specific cases, if any ? Please supply a detailed note. Please also furnish six copies of the report(s) of the Committee(s)/Expert(s).

3.7 Are matters relating to distress caused by inadequate wateways discussed at the meetings of the State Committee of Engineers ? How many times has this Committee met since April, 1971 ? Have these meetings helped in acheiving the desired results ? Please furnish a note.

3.8 Has any dispute relating to the difference in opinion regarding the waterway and sharing of costs of providing additional waterway for the Railways and the National Highways bridges been referred to the Standing Committee of the Chairman, Central Water Commission since April, 1971 ? Have any of these been settled ? Please furnish details.

3.9 Has the State Government met/shared the cost of widening any waterway of Railway and/or National Highway bridges ? Please give details of specific cases.

3.10 Is the present arrangement of the Standing Committee for the settlement of disputes regarding waterways with Railways and National Highways satisfactory or is any improvement necessary ? Please furnish a note giving the views of the State Government.

3.11 Has the State Government any view/suggestion on the bearing of cost & maintenance of additional waterways necessitated as a result of developments works, construction of embankments, canalisation etc., upstream of Railway/National Highway bridges ? Please furnish a note.

3.12 Has the State Government enacted any legislation prohibiting encroachment into drainages (natural and excavated) ? If so, please supply six copies of legislation. If not, please state whether and what administrative means are adopted and whether they are adequate to prevent such encroachments.

3.13 Does the State Government permit cultivation of river beds and berms and construction of temporary bunds for irrigation and/or fishing across drainages/ drains which may cause obstruction to flow ? If so, under what conditions ? Please furnish a note.

3.14 What is the practice adopted in the State in providing bridges over drains ? In cases where bridges are not provided at all, crossings, what are the measures taken by the State in preventing unauthorised crossings which may lead to obstruction or deterioration of the drains ?

3.15 Please give a general assessment of the problem caused by the construction of Railways, National Highways, roads etc., and the co-ordination amongst the various departments and suggestions if any in this regard.

TERM OF REFERENCE NO. 4

To analyse the damage caused by floods in recent years and to identify the areas requiring immediate flood protection measures.

QUESTIONNAIRE

4.1 Please list giving reasons the areas which, in the opinion of the State Government, require urgent flood protection.

Please furnish a map to the scale of 1 to 1 million (or larger scale, if required) showing these areas.

4.2 Please furnish in proforma 4.2 details of the damage caused each year in the areas referred to in para 4.1 from 1966, as well as in the State as a whole.

If the damage during the last 10 years has shown an increasing trend, please state reasons therefor.

4.3 Please furnish in proforma 4.3 the extent of damage in the protected areas due to breaches, overtopping or drainage congestion.

4.4 Was any Committee(s)/Expert(s) appointed by the State Government since 1966 to examine the damage caused by floods and suggest measures ?

If so, please give a note indicating the recommendations and the action taken thereon. Please supply six copies of the report(s).

4.5 Has the State Government drawn/taken up schemes for the protection of the areas identified in 4.1 ? Has provision been made in the State Plans for the implementation of these schemes ? Have any of these schemes been already taken up for implementation ?

Please furnish in proforma 4.5, information of the schemes proposed/taken up indicating their cost, benefits and expenditure incurred upto the end of Fourth Plan and actual expenditure/proposed expenditure during the Fifth Plan.

4.6 Other comments and suggestions, if any, regarding urgent protection works.

PROFORMA 4.2

DAMAGE CAUSED IN THE AREAS NEEDING URGENT FLOOD PROTECTION

State

Year

Sl. No.	Location of area (list district-whole/ part)	River/ Tributary/ Sub-tributary damage	Area affected (ha.)	No. of villages affected	Population affected	Cropped area under the villages (ha.)	*Cropped area affected (ha.)	Crop damage (Rs. lakhs)	No. of houses damaged	Value of houses damaged (Rs. lakhs)	No. of human lives lost	No. of cattle heads lost	Loss of public utilities (Rs. lakhs)	Total loss (Rs. lakhs)	Expenditure on relief & rehabilitation (Rs. lakhs)	Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Total damage in the areas requiring urgent flood protection (Total of Cols. 4—16).																
Total damage in the State during the year including other areas (Cols. 4—16)																

*If more than once in the same year, please state the area affected each time & strike total.

Notes : (i) Name of crops damaged may be indicated in the Remarks Col.

(ii) Source of data may be indicated.

PROFORMA 4.3

DAMAGE CAUSED IN THE PROTECTED AREAS

State

Year	Area affected	No. of villages affected	Population affected	Cropped Area under the villages (ha)	Cropped area affected (ha)*	Crop damages (Rs. lakh)	No. of houses damaged	Value of houses damaged (Rs. lakhs)	No. of human lives lost	No. of cattle heads lost	Loss of public utilities (Rs. lakhs)	Total loss (Rs. lakhs)	Expenditure on relief and rehabilitation (Rs. lakhs)	Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1966—67														
1967—68														
...														
...														
...														
1976—77														

* If more than once in the same year, please state the area affected each time & strike total.

Notes : (i) Name of crops damaged may be indicated in the Remarks Col.

(ii) Source of data may be indicated.

PROFORMA 4.5

URGENT FLOOD PROTECTION WORKS PROPOSED/TAKEN UP

State

Sl. No.	Name & location of Scheme	River basin/ Sub-basin	Districts to be benefi-ted	Estimated/ sanctioned project cost (Rs. lakhs)	Estimated Benefits			Annual Mone-tary value (Rs. lakhs)	Date of start	Targe-ted date of comp-letion	Expen-diture to end of 4th plan	Expenditure/provision in 5th Plan (Rs. lakhs)					Remarks
					Area (ha)	No. of villages	No. of Towns					1974—75	75—76	76—77	77—78	78—79	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

TERM OF REFERENCE NO. 5

To evolve a comprehensive approach to the problem of floods in the country keeping in view the need for optimum and multipurpose utilisation of water resources as also the role of soil conservation and afforestation in flood control.

The need for a comprehensive approach to the problem of flood control has been recognised in recent years. It is felt that in the overall context, flood control/protection should not be taken up in isolation but should form a part of water development schemes. This aspect has been stressed by the High Level Committee on Floods (1957) and has been indicated as one of the items to be taken into account while preparing the long range plan for flood control. Co-ordination of flood control with other water development projects had also been stressed by the Ministers' Committee on Flood Control (1964). In addition, this Committee had discussed the role of soil conservation in relation to flood control. The utility of soil conservation measures in the upper catchments of rivers and water management and land use had also been mentioned in the report of the Ministers' Committee on Floods and Flood Relief (1970).

QUESTIONNAIRE

5.1 Has the State evolved a comprehensive approach/plan to the problem of floods, keeping in view the need for optimum and multi-purpose utilisation of water resources of the State ? If so, please supply six copies thereof.

5.2 Has the feasibility of providing storage reservoirs for multi-purpose development/flood detention been investigated in the flood-prone river basins ? If so, please supply the information as in proforma 5.2.

Please supply a map to the scale of 1 to 1 million showing the location of the proposed storage sites and embankments in conjunction, if any.

5.3 Are any of the storages proposed located in foreign countries ? If so, have the problems that might arise in the planning, construction, maintenance and operation of the storages besides the time factor in achieving the benefits, specially, flood control, been taken into account ? Please furnish a short note.

5.4 Are there any natural depressions, jheels, bheels, chaurs, tals etc. in the various flood-prone river basins ? How are they being utilised at present ? Has the possibility of utilising the storage capacity of such depressions etc. in storing surface drainage water and waters diverted from the rivers during floods (for use, if possible, for irrigation pisciculture, acquatic crops etc.) been investigated ? Has any study been made of the capacities and the effect of such diversions on the flood moderation and the cost thereof ? Please supply the information basinwise/sub-basinwise in proforma 5.4.

Please supply a map (to a suitable scale) showing locations of large depressions, jheels etc.

5.5 Has the possibility of providing diversions in pre-determined areas with the object of reducing flood intensities/recharging of the ground water/utilisation for irrigation (inundation canals, controlled flooding etc.) been investigated ? Please furnish short notes basin-wise/sub-basinwise indicating the quantum, cost, purpose and benefits (physical and monetary) of diversion(s) envisaged. Please supply a map to the scale of 1 to 1 million showing the location of diversions.

5.6 The role of soil conservation measures in flood control has been mentioned from time to time. Have any studies been carried out at actual site locations regarding the effect of soil conservation measures on the normal floods and the high floods and also the sediment load carried by the rivers ? Please furnish notes including quantitative assessment. Please supply six copies of the reports, if any, of these studies.

5.7 Please list in proforma 5.7 the types of soil conservation measures (Contour bunding, gully plugging, check dams, terracing etc.) undertaken on catchment basis, their cost and area benefited/covered, during the Plan periods.

Please, give an assessment of their performance (reduction in run-off and silt load and increase in crop-yields) and suggestions, if any.

Please furnish six copies of evaluation report, if any.

Please also mention if the measures taken have been tampered with or otherwise became ineffective.

5.8 Are there any river valley project catchments in the State where soil conservation measures have been carried out under the Centrally sponsored programme ? If so, please furnish a note indicating the progress made on these measures and the evaluation of the implementation of these works on the sedimentation in the reservoirs. The method of computation of silt in reservoirs may also be indicated.

Please supply six copies of evaluation report, if any.

5.9 What is the agency carrying out the soil conservation measures ? Does it co-ordinate this work with the State Irrigation and Flood Control Departments and if so, how ?

5.10 Implementation of soil conservation and land use measures involves public relations, propaganda, co-operation of local land owners and others and, therefore, its success will depend upon local co-operation. Is such co-operation forthcoming or is there any law or regulation by which this can be ensured ? Please supply six copies of the law/regulations.

5.11 Taking into account the area to be covered, its cost and the experience of implementation of soil conservation works during the last two decades, what is the likely time required for effectively implementing the whole programme ? Please give a forecast of the planning stating the areas proposed to be covered and the anticipated cost for each stage. Please supply the information basin/sub-basinwise separately for the upper catchment (hilly areas) and the lower catchment.

5.12 Has there been any scientific study made to establish the effects of forest cover on rainfall-runoff, silt charge and flood flow ? Please furnish a note and six copies of report if any on the subject giving relevant data from field studies, along with views of the State Government on the subject.

5.13 Has any study been made on the extent of deforestation and its effiects on the flood flow and sediment load in each of the flood-prone river basins/sub-basins ? Please furnish a note and also census of forest acreages basi n/sub-basinwise as in proforma 5.12.

5.14 Is there a policy of afforestation and forest management for the hills and plains in the State ? If so, please furnish a note indicating details and status of its implementation.

5.15 Is there any legislation/regulation by which deforestation in private land is regulated ? If so, has it been successfully implemented ? Please supply six copies of the relevant legislation/regulation.

5.16 What is the extent of catchment of river basins/sub-basins in foreign countries ? Please give details basin-wise/sub-basinwise.

5.17 Comments and suggsstions, if any.

PROFORMA 5.2

PARTICULARS OF STORAGE RESERVOIRS FOR MULTI-PURPOSE DEVELOPMENT/ FLOOD DETENTION

State

Notes : Please supply information separately for each storage reservoir.

1. River basin/sub-basin
2. Location of storage site
3. Catchment area : in the State | In other States/ countries | Total

   (i) at storage site (sq.km.)
   (ii) total river basin (sq.km.)
   *(Please give the name of State(s)/country)
4. Live storage proposed (Million cu. metres)
5. Storage earmarked for flood detention (Million cu. metres)

6. Estimated effect of the storage on flood peaks (pre and post project figures) :
   (a) with the storage earmarked for flood control ;
   (b) Without specific flood storage.
7. Area of land submerged (hectares) :
   (a) between F. R. L. and M. W. L.
   (b) between flood storage levels
8. Are embankments proposed in conjunction with storage ?
9. Flood affected area likely to be benefited by the flood detention (hectares) :
   (i) Without embankments
   (ii) With embankments (if proposed)
10. Estimated cost of the storage (Rs. crores).
    Flood control component of the cost (Rs. crores).
11. Estimated cost of embankments, if proposed (Rs. crores).
12. Has any provision been made for soil conservation measures in the reservoir catchment ? If yes, the amount.
13. Annual benefits :
    (a) Irrigation (Hectares)
    (b) Hydropower (M.W.)
    (c) Others
    (d) Total monetary benefits (Rs. lakhs).

PROFORMA 5.4

PARTICULARS OF NATURAL DEPRESSIONS JHEELS, BHEELS, CHAURS, TALS ETC. IN FLOOD PRONE RIVER BASINS

State

Note : Please supply information individually for each river system basin/sub-basin-wise.

1. Total number of jheels, depressions etc.
   Please give the names of important ones.
2. Total capacity (cubic metres)
   (Please indicate individual capacity of large ones).
3. Total area of jheels etc. (hectares).
   Please give details of large ones.
4. How are the jheels etc. being utilised at present ?

PROFORMA 5.7

SOIL CONSERVATION MEASURES DURING THE PLAN PERIODS. (MEASURES INCLUDING CONTOUR BUNDING, GULLY PLUGGING, CHECK DAMS, TERRACING ETC.)

State
Area '000 ha
Cost Rs. lakh

Plan period	Critical area of the catchment needing soil conservation measures	Area treated in the catchment						Total		Remarks
		Type	Area	Cost	Type	Area	Cost	Area	Cost	
1	2	3	4	5	6	7	8	9	10	11
1st Plan 1951-1956										
2nd Plan 1956-1961										
3rd Plan 1961-1966										
Annual Plans 1966-1969										
4th Plan 1969-1974										

Note : (i) Type refers to soil conservation measures adopted.
(ii) Source of information may be given.

PROFORMA 5.12

CENSUS OF FOREST ACREAGES

State

River Basin/Sub-Basin (mention districts covered)

Year	Forest Area (ha)			Area deforested (ha)			Remarks
	Hills	Plains	Total	Hills	Plains	Total	
1	2	3	4	5	6	7	8
1951							
1956							
1961							
1966							
1969							
1974							

Notes: (i) Please furnish information separately for each basin/sub-basin.
(ii) Source of information may be given.

TERM OF REFERENCE NO. 6

To make an analysis of the cost and benefits of flood protection measures.

QUESTIONNAIRE

6.1 What is the procedure of benefit-cost analysis presently adopted by the State Government ? In this analysis, are the nature and magnitude of the flood problem to be solved precisely identified, all the viable alternatives (such as reservoirs, embankments, drainage, flood plain zoning etc.), and their benefits and costs worked out in detail and the administrative, legal technical and financial aspects considered in arriving at the best possible solution to the problem ? Please furnish a detailed note.

6.2 Are benefits and costs discounted ? If not, why not ? If yes, what is the discounting rate in use and basis thereof ?

6.3 What is the procedure adopted in the case of multi-purpose projects with flood control component ? Please furnish a detailed note on the data and procedure adopted for a few completed projects, showing how the benefits & cost are worked out for each component.

6.4 While calculating benefits, are the following taken into account ? If so, how are they estimated ?

(a) Value of the extra produce from agriculture that may be attributed to flood control.

(b) While estimating extra produce, are other supporting conditions, technological and institutional, taken into account ? What is the time interval after which full benefits are supposed to accrue ?

(c) What prices (i.e. wholesale, retail, farm, mandi, local, national etc.) of inputs and out-puts are used for valuing the benefits ?

(d) Increase in the value of land.

6.5 What are the direct benefits that are considered for flood control/protection scheme ? Are they estimated from the annual assessment of the flood damage in the area to be protected (agency carrying out and cross-checking the assessment may be indicated) or by carrying out detailed surveys and determining the areas liable to floods of different frequencies or any other method ? Are the remissions of land revenue, cost of flood relief operations etc., taken into accounts to the estimation or direct benefits ? Please furnish a note giving details of the actual method adopted for assessing the average annual benefits.

Are secondary benefits taken into account ? What are the nature of such benefits and how are they computed ? If not, are there any constraints in not including the secondary benefits ?

6.6 Are any socio-economic studies conducted for determining direct and indirect benefits ? If so, please indicate the agencies and methodology ? Please supply six copies of a typical report.

6.7 What are the various components going into the cost of the project ? Do they include secondary costs which are required to obtain secondary benefits ?

6.8 Are the risks, uncertainties, price changes etc., during the economic life of the project taken into account while working out the costs and benefits ? If so, how ?

6.9 Is allowance made for the benefits accruing without the protection due to inundation and deposition of silt during floods ?

6.10 Please furnish six copies each of the typical schemes implemented by the State Government in operation for about 8 to 10 years (or the longest period if of a shorter duration) for different categories of works such as reservoirs, embankment, drainage, anti-erosion, town protection etc., which explain fully the benefit-cost analysis that has been made.

The assessment of benefits both physical and monetary achieved from the schemes during the period of operation may be compared with the benefits envisaged at the time of formulation of the project.

The benefit-cost ratio at the time of formulation of the project may also be compared with the present benefit cost ratio, which may be worked out, at constant prices as included in the project taking into account any additional costs incurred subsequently for stabilisation of the benefits.

6.11 Taking into account the experience gained so far, have you any suggestions in regard to the methodology for cost-benefit analysis of flood control/protection and multipurpose projects with flood control component ?

TERM OF REFERENCE NO. 7

To suggest criteria for taking up flood protection measure and means of mobilising resources therefor

The High Level Committee on Floods (1957) had suggested consideration of economic and engineering aspects, commencement and rate of realisation of benefits, stage of preparation of Project reports and estimates, extent of public cooperation, strategic requirements and religious, historical and sentimental aspects while deciding *inter se* priorities of flood control/protection measures.

Recently, the Minister's Committee on Floods and Flood Relief (1970) had recommended that State Governments might consider ways and means of raising additional resources for capital costs and efficient maintenance of flood control works.

QUESTIONNAIRE

7.1 Please state whether flood control and storm water drainage scheme are undertaken under any Act(s). If so, please supply six copies of the relevant Act(s).

7.2 Are any criteria (whether different for different types and regions) adopted by the State Government for sanctioning flood control/protection schemes since 1954 ? If so, please furnish a not mentioning the rationale and difficulties, if any.

Would you suggest any modification to the criteria ?

7.3 How are priorities amongst the claimant schemes fixed in your State ?

7.4 Have any measures (betterment levy, flood cess, enhancement of land revenue/capital charge/crop charge etc.,) been adopted for a levy on the benefited area (including villages, public & private industries etc.) under the various types of schemes ? If so, please supply six copies of the legislation/administrative orders.

If legislation/administrative orders have not been enacted, issued or implemented, please furnish a note indicating the reasons therefor with suggestions if any.

7.5 Please furnish basis and details of the total area (including villages, public & private industries etc.) under levy and the amount collected during each of the financial years beginning from 1970-71 for the State as a whole. Similar information may be furnished in respect of individual schemes of the types mentioned in question 6.10 along with their capital costs and annual maintenance charges.

7.6 Other comments/suggestions, if any.

TERM OF REFERENCE NO. 8

To recommend proper land use in the flood plains with a view to minimise damage and to ensure overall incease in agricultural production.

The flood plain forms an integral part of the river system. Despite protective measures, it is neither technically nor economically possible to provide full immunity for all times to come. Judicious land use, however, can lead to beneficial development in the flood plain of a river system. This is achieved by a zoning of the plain and making selective use of the area for developmental purposes.

The question of flood plain zoning has been under consideration since the launching of the national flood control programme in 1954 but little progress appears to have been made. The Ministers' Committee on Floods and Flood Relief (1970) has recommended the preparation and publication of detailed contour maps showing the area likely to be affected by different magnitudes of floods. This had been supported by the Sixth Conference of the State Ministers of Irrigation & Power (1972) and they had also called upon the States to enact legislation for controlled use of flood plains. A draft model bill for flood plain zoning was prepared by the Department of of Irrigation and circulated to the States in May, 1975 for eliciting their views.

QUESTIONNAIRE

8.1 What is the progress made in the preparation of contour plans of the flood plain areas and demarcation of flood zones affected by flood for different frequencies ? Please furnish a note indicating the extent of areas requiring preparation of contour plans and the areas for which maps have been prepared. If not completed, please state the reasons, the present status and further programme for completing this work.

8.2 Has the State Government examined the draft Flood Plain Zoning Bill circulated by the Central Department of Irrigation ? What are its views thereon ?

8.3 Was any legislation enacted for regulation of the use (agricultural and others) of flood plains at any time in the State ? Has it been put into operation and how has it functioned ? Please furnish a note along with six copies of Legislation/ regulations.

8.4 Has land use regulation been attempted for complementing the engineering works in the areas provided with protection by controlling land use and encouraging more intensive use of the protected area ?

8.5 Describe (location-wise, if necessary) the present land use in the unprotected flood plains for each river basin/ sub-basins in the State.

Has any study been made on the pattern of floods, their duration and the nature of crops grown in these areas ? If so please supply six copies of the study.

In the light of these studies, has any attempt been made for devising suitable crops patterns for reducing the damage due to floods and to increase agricultural production ? Conclusions and recommendations of the State Government in this regard will be appreciated.

8.6 Has the State Government examined the possiblity of relocating flood vulnerable settlements ? If so, please supply details.

8.7 What are the views of the State Government on the administrative aspects of land use regulation ?

8.8. Has the State Government any suggestions on the land use pattern in flood plains (separately for protected and unprotected) for reducing the overall flood damage and to achieve optimum benefits ?

8.9 Will it be adequate if land use regulation is confined to the flood plains or should it be extended to the catchment area as well ? What is the pattern of land use required/suggested in the catchment ? Please furnish a note.

8.10 Please furnish a note on the general soil descriptions and properties of the flood prone areas basins/sub-basins-wise. A soil map(s) of the area(s) may be attached.

8.11 Has any study been made in the State on the beneficial aspects of flood deposition ? If so, the position may please be briefly stated with supporting data.

8.12 Please give a list of the normal cropping sequences, crops and varieties grown in different seasons in the flood prone areas giving the period of sowing/planting and harvesting along with a brief description of a agronomic practices including pests and diseases and plant protection measures in proforma 8.12.1 and 8.12.2.

8.13 Do you have any suggestions on the alternate cropping strategy for increasing agricultural production by suitable adjustments and adoption of new technology such as advancing sowing date, choice of substitute crops verieties, relay multiple cropping etc. ?

8.14 What are the post-flood agronomic measures taken on recession of the flood water for recovering the growth of standing crop ? Please furnish a note also covering agronomic practices such as land preparation, reseeding, transplanting or preparatory practices for the next season's corpping etc.

8.15 Please state the main constraints in implementing the post-flood agronomic measures in recovering the growth of submerged crop or raising alternate or substitute crops in making good the agricultural production.

8.16 Please state if any consideration has been given to providing some irrigation facilities during flood free periods in flood prone areas. If so, please furnish a list and map showing areas where this has been implemented.

8.17 In the case of the areas, mentioned in para 8.16, please detail crop sequences, crops/varieties that are currently followed ?

8.18 What are the flood emergency agricultural programmes in vogue in the State ? A comprehensive note on the subject may please be furnished giving all available data and expenditure for the last 5 flood years basinwise/Statewise as convenient. The State's recommendations for multiple or alternate land use in flood plains may also please be furnished.

8.19 Like the Famine Code, there may be approved codes for flood/Agricultural relief work. Six copies each may please be furnished. In case there is no such code, the State's views on developing flood manual/code for agricultural programme may please be given.

8.20 Fuel and fodder supply in flood prone areas are generally not adequate and the situation worsens with flood occurrences. In appreciation thereof, state the present position of fuel and fodder supply in the flood prone areas giving the human/livestock population and their demand for fuel and fodder. The planned projections of the State Government on the subject may please be furnished.

8.21 Please give a list of the grass and forest species which can stand annual floods and can be grown in flood plains on a commercial scale, especially along the stream banks.

8.22 Agricultural problems in flood prone areas are location specific. Developing suitable crops/varieties new agro-techniques and methods to meet the challenge of recurring floods, warrants systematic research on continued basis. In appreciation thereof, the present position of the organisational infrastructure for research and development (Universities/Agricultural Research Institutes or Centres) may be furnished along with planned projections for the future with respect to each flood prone area of the basins/sub-basins of the State. Six copies of the relevant research and development publications which give the achievements in these fields may please be furnished.

8.23 Please furnish a comprehensive note on research and development programmes for pisciculture/aquaculture in the inland ponds, jheels, and bheels in the flood plains.

8.24 Are there any existing local organisations in the flood prone areas for implementing suitable agricultural programmes or are there any proposals in this behalf ?

PROFORMA 8.12.1

IRRIGATED CROPPING SEQUENCE AND CROPS/VARIETIES POPULAR IN THE FLOOD PRONE AREAS

State

River System

Sl. No	River/ Tributary	District	Cropping sequence	Source of irrigation	Crop	Varieties	Seed rate	Period of sowing	Period of harvesting	Average yield (Quintals/ha)	Remarks
1	2	3	4	5	6	7	8	9	10	11	12

Notes : (i) Information may be furnished separately for each river system.
(ii) Source of information may be given.

PROFORMA 8.12.2

UNIRRIGATED CROPPING SEQUENCE AND CROPS/VARIETIES POPULAR IN THE FLOOD PRONE AREAS

State

River System

Sl. No	River/ Tributary	District	Crop	Varieties	Seed rate	Period of sowing	Period of harvesting	Average yield (Quintals /ha)	Remarks
1	2	3	4	5	6	7	8	9	10

Notes : (i) Information may be furnished separately for each river system.
(ii) Source of information may be given.

TERM OF REFERENCE NO. 9

To review the existing arrangements for maintenance of flood protection works and recommend measures for improving the same

The High Level Committee on Floods (1957) had emphasized the importance of adequate maintenance of the embankments and had recommended that the instructions contained in the Embankment Manual prepared by the then Central Water & Power Commission should be followed in this regard. This recommendation had been reiterated by the Ministers' Committee on Floods and Flood Relief (1970). The need for providing adequate funds for the maintenance of embankments and other flood protection works had also been stressed since the Committee had felt that the provisions made by the State Governments were inadequate.

QUESTIONNNIRE

9.1 Is the State Government following the instructions contained in the Embankment Manual issued by the Central Water & Power Commission ? Is a detailed drill laid down by the State Flood Control Deptt. for each of the embankment systems for maintenance and operation during floods, post-floods, season and immediately before the floods ? Please supply six copies of the drill laid down stating whether any difficulty is experienced in the implementation thereof.

9.2 Are gauges provided at stipulated intervals along the embankments for recording flood levels and arrangements made for their systematic observation during the floods ? Please supply details.

9.3 In the light of the experience gained during the last twenty years in the maintenance of embankments, are there any suggestions for modification of the instructions contained in the Embankment Manual ?

9.4 In the case of other flood protection works such as drainage channels and river training works, please furnish a note indicating the nature of maintenance done and the norms adopted for estimating the funds required for maintenance during the year.

9.5 Please furnish details of the estimated requirements for maintenance as worked out by the Deptt. amount provided in the budget for the annual maintenance and the actual expenditure on the maintenance of flood control works for each year from 1956-57 onwards upto 1976-77, for the state as a whole in the following proforma (separately for each type reservoirs, embankments, drains, etc.).

Financial Year	Estimated requirements for maintenance as worked out by the Deptt. (Rs. Lalkhs)	Amount sanctioned for maintenance in the budget (Rs. Lakhs)	Actual Expenditure (Rs. Lakhs)
1	2	3	4
1956-57			
1957-58			
.....			
.....			
.....			
1976-77			

9.6 Does the State Government obtain the co-operation and assistance of the public of the locality in the patrolling and maintenance of flood protection works and also in tackling emergent situation ? What is the response and the State Governments' comments on its utility ? Please furnish a note and six copies of regulations/ orders in this behalf, if any.

9.7 Are suitable approaches provided to the flood protection works for their inspection as well as for use during emergent situations ? Please detail.

9.8 Has the State Government other specific suggestion on the maintenance of flood protection, drainage & anti-erosion works etc. ?

TERM OF REFERENCE NO. 10

To review the existing administrative and organisational set-up for flood control at the Centre and in the States and to suggest improvements where necessary, flood control to include flood forecasting and warning, flood fighting, formulation and implementation of flood protection measures.

The setting up of flood control organisations in the States and the Centre was initiated when the National Programme of Flood Control was launched in 1954. The organisational set-up was first reviewed by the High Level Committee on Floods (1957) and certain modifications were suggested by it. Making a subsequent review, the Ministers' Committee on Flood Control (1964) recommended that atleast in the States with serious flood problems, Flood Control Departments distinct from Irrigation Departments should be organised under a Chief Engineer with adequate number of field circles and divisions to look after investigations, construction and maintenance of flood control works and also headquarter organisations should be set up to ensure coordination and control in matters of hydrological and hydrometeorological analysis, collection and publication of gauge and discharge data, flood warning and forecasting, flood economics including collection of damage data, regulation and operation of already completed works, soil conservation engineering and emergency flood fighting.

The Ministers' Committee on Floods and Flood Relief (1970) reviewed the arrangements for flood forecasting and warning and flood fighting. The Committee made recommendations which, interalia, included extension of flood forecasting network by the States on intra-State rivers, modernising flood forecasting techniques, improvement in the communication of warning to the people, setting up of quality control organisations for flood control works, need for proper flood fighting arrangements and training in flood fighting on the lines suggested in the model manual prepared by the Central Water Commission and circulated to the States.

QUESTIONNAIRE

10.1 Please furnish a note detailing the existing administrative and organisational set-up for flood control/protection (including flood forecasting and warning, flood fighting) in the State. Is the present arrangement adequate or are there any proposals for effecting improvements ?

10·2 Investigation and Planning of Flood Control/Protection Works

10.2.1 Please furnish a note indicating the procedure of collection of gauge and discharge data, supervision and checking the method of observation, intervals in which data collected is transmitted to the processing centre, examination and reconciliation of the data collected to ensure its accuracy and coordination, compilation and publication of the processed data.

Please also include in the note the type and qualifications of the personnel making the gauge and discharge observations, the number of stations supervised by each sub-division and number of stations under a Division and whether the sub-divisional and divisional officers are exclusively for the data collection or carry out this work in addition to other duties. (Please indicate the other duties).

In the processed data furnished to the Central Water Commission or any other Central agency ? Has the data been published by the State in the form of Water Year Books or any other form ? If so, please furnish six copies of the published data for the two latest years.

10.2.2 What is the set-up in the State for investigation, planning and designing of flood control/protection works ? Please furnish the information in the form of a chart of the organisation, including interdisciplinary personnel etc. Please furnish a note broadly detailing the duties and functions at each level also stating if the staff is exclusive or handles other duties also (Please detail).

Is the present set up in accordance with the suggestions made by the Ministers' Committee on Flood Control (1964) ?

Is the present set-up adequate to meet requirements ? If not, please state if you have any suggestions.

10.2.3 Is the present procedure of processing schemes for sanction through the Technical Advisory Committee, State Flood Control Board, Planning Commission, etc. satisfactory or are there any suggestions for modifications ?

10·3 Execution of Flood Control/Protection Works

10.3.1 What is the set-up in the State for execution of flood control/protection works both at the administrative and technical level ? Please furnish information in the form of an organisation chart. If the personnel at any level is not exclusive, please furnish a note regarding the other duties also handled.

10.3.2 Are the existing laws and regulations regarding land acquisition adequate ? Please furnish a note and six copies of relevant laws/regulations.

10.3.3 Are modern techniques like CPM (Critical Path Method) and PERT (Programme Evaluation and Review Techniques) applied to implementation of flood control/protection works ? Any comments ?

10.3.4 What is the present system of allocation of funds for flood control/protection works from year to year ? Does the system present any difficulty in the implementation of the works ? Are there any suggestions for improvement ? Any comments on the present accounts procedures ?

10.3.5 What is the policy and procedure for compensation and rehabilitation of persons displaced/affected by flood protection works ? Is the arrangement satisfactory or is any improvement required ? Please furnish a note.

10.3.6 Are there any delays in implementation of flood protection works on account of want of proper delegation of financial, administrative or other powers to the project authorities ? If yes, please furnish two or three examples with suggestions in this regard.

10.3.7 Is a periodic review of the performance of the flood control/protection works made to assess benefits achieved against these projected ? If yes, please furnish six copies of such evaluation reports for two works of each category.

10.3.8 What is the policy and procedure in the state for obtaining public participation in the execution and maintenance of flood protection and drainage schemes and what is the actual experience in this regard ? Please furnish a note.

10.4 Operation and Maintenance

10.4.1 What is the present organisational set up for the maintenance of flood control/protection works ? Please furnish a chart thereof and a note with your comments and suggestions regarding its adequacy and functioning.

10.5 Flood Forecasting and Warning

10.5.1 Are there any flood forecasting units set up by the State ? If so, what is the present set up ? Please furnish an organisation chart indicating the rivers on which the flood forecasts are issued.

10.5.2 Is there any proposal for extending flood forecasting arrangements ? Please state if you have any suggestions to improve its functioning.

10.5.3 Have arrangements been made for fixing warning levels and predetermining the areas likely to be affected at different levels ?

10.5.4 What is the arrangement made for communication of warnings to the people ? Which is the department responsible for disseminating the warning ? Is the present arrangement satisfactory ? Are there any proposals for improvement ? Is a liaison kept with the Flood Control Department/Flood Forecasting/Warning Organisation in this regard ? Please furnish a detailed note.

10.6 Flood Fighting

10.6.1 Has the State Government prepared a Manual for Flood Fighting or issued any orders in this behalf based on the model Manual of Flood Operations prepared by the Central Water and Power Commission ? If so, please supply six copies of the Manual/Orders.

10.6.2 What is the organisation available in the State for flood fighting ? Which are the State Government Departments concerned with flood fighting and how is co-ordination amongst these effected ?

10.6.3 What are the arrangements made for training/orientation of concerned personnel in the matter of flood fighting techniques ?

10.6.4 Is any arrangement made for public co-operation in flood fighting ?

Is there any legislation/regulation empowering the government to commandeer local residents for flood works in emergencies like repairs of breaches, raising embankments during floods etc ? If yes, please supply six copies.

10.7 In the fifth term of reference, comprehensive approach to the problem of floods keeping in view the multipurpose utilisation of water has been envisaged. What will be its implications in the administrative and organisational set-up for investigations/planning and implementation of flood control/protection works ? Will it be necessary to set up river basin authorities with involvement of variety of disciplines such as engineering, forestry, agriculture, soil conservation, economics etc. ? please furnish a detailed note.

10.8 Comments/Suggestions which the State Government may like to add.

TERM OF REFERENCE NO. 11

To examine the present procedure of assessing the flood damage and suggest improvements.

Flood damage is an important yardstick for assessing flood problems in different areas and in formulating economically viable schemes. The Ministers' Committee on Flood Control (1964) has recommended that the method suggested by the National Council of Applied Economic Research based on a pilot survey in North Bihar should be adopted by the States for the assessment of flood damage. They had also suggested that the Flood Control Department should send out field teams at the end of every flood season to contact revenue and other officials, visit flooded areas, ascertain from the local population and make their own assessment of the flood damage for the purpose of economic analysis of flood protection works.

In the report entitled 'Scientific Assessment on Flood Damages' the National Council of Applied Economic Research had recommended a procedure for assessing the damage caused by floods and also the nomination of the Flood Control Department in the States as the overall agency for the collection and dissemination of the flood damage data. The report of the National Council of Applied Economic Research had been forwarded to the States for appropriate action by the then Ministry of Irrigation & Power.

QUESTIONNAIRE

11.1 Is the procedure adopted in the State for assessing flood damages in accordance with that recommended by the National Council of Applied Economic Research ?

Is so, please supply six copies each of reports of two such surveys undertaken so far. Also State if norms for indirect damages as suggested in the report of the National Council of Applied Economic Research have been evolved.

11.2 If the procedure recommended by the National Council of Applied Economic Research has not been adopted, the reasons therefor may please be indicated. Please state if any other alternative method has been adopted and furnish six copies of the details thereof.

11.3 Which department of the State is in charge of the collection and publication of the flood damage data ? Does it associate the State Flood Control Department or any other Department (indicate the same) with this work ? If so, please state in what manner ?

11.4 Does the State Flood Control Department send out field teams to inspect the flooded areas, to contact the revenue and other officers and local population and make an independent assessment of the flood damage in the flood affected areas as recommended by the Ministers' Committee on Flood Control (1964) ? Please give a note detailing the manner in which this assessment is made.

11.5 Please furnish in proforma 11.5 individually, the details of the assessment of flood damage made in two flood affected basins/sub-basins for two worst flood seasons since 1954. Please also furnish a map to the scale of 1 : 50,000 showing the areas affected by these floods.

11.6 Comments/suggestions if any.

PROFORMA 11.5

DETAILS OF ASSESSMENT OF FLOOD DAMAGE MADE IN———————
BASIN/SUB-BASIN DURING THE FLOOD SEASONS———————
(DATES, MONTHS AND YEAR MAY PLEASE BE STATED)

State

		Crop				
	Extent of area in ha damaged and monetary value in Rs. lakhs.	1.	2.	3.	4.	5.
	(i) Totally damaged value					
	(ii) Between 50%and 100% damaged value					
	(iii) Between 25% and 50% damaged value					
	(iv) Less than 25% damaged Value					

*4. Extent of area give land revenue remission & the amounts thereof. (a) Full (b) Partial — Ha. Rs.

(State percentage)

5. (i) Number of houses damaged
(ii) Value of houses damaged (Rs. lakhs)
(iii) Damage to public utilities (Rs. lakhs)
(iv) Other damages
(v) Total

6. Basis of computations of monetary value of damages to crops and houses.

*If there are any other specific yardsticks adopted by the State, Please explain by a note.

TERM OF REFERENCE NO. 12

To examine any other matter related to floods and flood control and make suitable recommendations.

QUESTIONNAIRE

12·1 Research and Training

12.1.1 Is any research being carried out on problems like hydrology (specially watershed hydrology), river behaviour and protective works and similarly for relevant parameters in drainage schemes ? Please furnish a note.

12.1.2 Are there any agricultural institute/university/research stations carrying out scientific studies on watershed hydrology and alternative land use, cropping pattern etc., for upper catchments? Please furnish a note.

12.1.3 Please furnish a note indicating the arrangements if any for in-service training of personnel in the Flood Control Departments.

12.1.4 Is "Floods" included as a subject in departmental examination for serving engineers of State ?

12.2 *Inter-State & State-Centre Works*

What is the present mechanism of co-ordination for implementation at various stages and sharing of costs of Flood control/protection works affecting interests of more than one State and State-Central Departments ? Please state how this mechanism is functioning and suggestions, if any.

12.3 Please state your view in the matter of public co-operation for flood control/protection work with special reference to the experience in the State in this regard.

12.4 *Central Organisations and Boards*

12.4.1 A number of board and organisations like the Central Flood Control Board, Central Water Commission, Ganga Flood Control Commission etc., have been set up for planning and processing of flood control/protection schemes. Are there any comments/suggestions in this behalf?

12.4.2 Is there any co-ordination between the State & the Central Board of shifting Cultivation & Central Board of Forestry? Please furnish a note.

12.5 *Financing*

12.5.1 Please describe the existing pattern of financing of capital/maintenance/special repairs works relating to flood control/protection.

Please state if there are any comments/suggestions in this behalf.

12.5.2 In the light of a comprehensive approach to the problem of floods, is there any scope for attracting institutional finance?

Please furnish a note.

12.6 *Environment*

Are adverse effects (e.g. creation of stagnant pools in borrow areas, creation/augmentation of swamps, pollution by human and industrial waste etc.) of construction of flood control/protection works and drainage schemes etc. listed and remedial measures provided in the designs?

If yes, please furnish a detailed note stating specific projects and the nature of measures taken/proposed.

12.7 *River Conservancy*

Has the State enacted any legislation on river conservancy ? If yes, Please state how it has functioned and supply six copies of the legislation.

If not, please state what measures, if any are taken in this behalf, also, if you have any suggestions in the matter.

12.8 *Tidal Floods*

(for reply by the Coastal States only)

12.8.1 Please supply maps to the scale of 1 to-250,000 showing the coastal areas affected by tidal floods. (The years in which the areas were affected may also be marked on the map.)

12.8.2 Please furnish a note on the nature and extent (with dates etc.) of agricultural damage caused by tidal floods along with the measures taken to prevent such damage and increase overall agricultural production in the area.

12.8.3 Using the standard weeks of the India Meteorological Department, please give in a tabular form, the weeks when tidal flood occurred the duration of submergence, the standing/varieties and the stage of crop growth along with the specific crop damage caused and the suggested measures for protection.

12.8.4 In the coastal belt, ring bunds exist in some areas for preventing ingress of tidal water. Please give an assessment of the effectiveness of such ring bunds along with suggestions for their improvements or substitution.

12.8.5 What are the scientific and organisational steps taken for protection of coastal areas in preventing crop damage during tidal floods ? Please furnish a note indicating the warning systems in vogue and relevant measures taken and suggestions for improving the same.

12.8.6 Is there adequate agricultural research support to evolve suitable agro-techniques and crop husbandry for the coastal area prone to tidal floods ? If so, please furnish a note including suggestions.

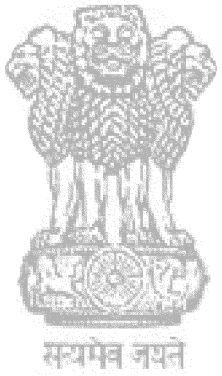
12.9 *Special Problems of Acute Nature*

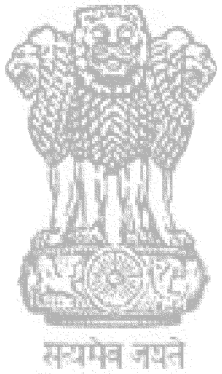
Please furnish a note detailing the methods adopted tried by the State in dealing with special problems in specific situations which may be of interest elsewhere.

12.10 Other suggestions, if any, relating to the terms of reference.

APPENDIX II

QUESTIONNAIRE TO THE STATE/UNION TERRITORIES OF ARUNACHAL PRADESH, MEGHALAYA, NAGALAND AND SIKKIM

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APPENDIX II

QUESTIONNAIRE TO THE STATE/UNION TERRITORIES OF ARUNACHAL PRADESH, MEGHALAYA, NAGALAND AND SIKKIM

Q.1 (a) A note on the problems of flood and drainage, if any, in the State may be given.

(b) Please list out the areas where serious floods have occurred in the past, their duration and the damage.

Please show the locations on the map as per Q.2 below.

Q.2 (a) Please supply a map to the scale of 1 to 1 million (or other convenient scale as available) showing the river system in the State, basin boundaries, roads, railways, important towns etc.

(b) Please indicate the extent of inundation and loss to crops, cattle, human lives, disruption to communication etc. in the proforma 2(b) attached.

Q.3 Please list out the areas giving location and acreages which in the opinion of the State Government are in need of urgent flood protection. A map showing these to a scale of 1 to 1 million, if available, may also be supplied.

Q.4 Has the State enacted any legislation prohibiting encroachment into drainages? Has the State Government noticed any areas which ex erience drainage congestion due to construction of road bridges/otherwise?

Q.5 The need for comprehensive approach to the problem of floods has been recognised in recent years. Under this approach, it may be necessary to prepare master plans for multipurpose utilisation of flood prone rivers, under which it may be necessary to construct detention dams for flood control, power, irrigation, etc., and carryout soil convervation, afforestation measures in upper catchments. What are the views of the State in this regard?

Please State your views, if any, regarding ihe administrative and organisational set-up for the above purpose.

Q.6 Has the State set up any landuse board? If so, a copy of the Government resolution/order setting up the board may please be furnished.

Q.7 Have you developed a landuse Plan? If so, please supply a copy thereof.

Q.8 Taking the State as a whole, what is the total area identified as critical areas for afforestation and soil conservation treatment?

As against this, please give the progress of achievement made under the different plans in the following proforma :

Plan	Outlay (Rs. lakhs)	Area afforested (ha.)	Area treated with soil conservation measures (ha.)
IVth			
Vth			
VIth			
Total			

Q.9 What are the tribal rights which support the practice of shifting cultivation ?

Please furnish a note detailing the measures taken or planned for the control of shifting cultivation.

Q.10 Is there any organised set-up in the State which is engaged in the systematic acquisition of hydrological data, watershed hydrology and water resources planning? If so, please furnish a note on the up to date achievements of that set-up.

PROFORMA 2(b)

DAMAGE CAUSED IN THE FLOOD AFFECTED AREAS

State
Year

Sl. No.	Location of area (List district-whole/part)	River/Tributary Sub-Tributary causing damage	Area affected (ha)	Extent of inundation	Population affected	*Cropped area affected (ha.)
1	2	3	4	5	6	7
Total damage in the State during the year (Cols. 4—15)						

Crop damage (Rs. lakhs)	No. of houses damaged	Value of houses damaged (Rs. lakhs)	No. of human lives lost	No. of cattle heads lost	Loss of public utilities including disruption to Communications (Rs. lakhs)
8	9	10	11	12	13

Total loss (Rs. lakhs)	Expenditure on relief and rehabilitation (Rs. lakhs)	Causes of flooding	Remarks
14	15	16	17

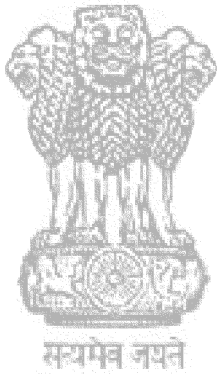
*If more than once in the same year, please state the area affected each time and strike total.

Notes : (i) Name of crops damaged may be indicated in the Remarks Col.
(ii) Source of data may be indicated.

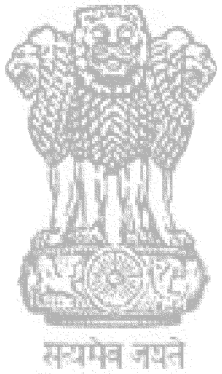
APPENDIX III

QUESTIONNAIRE TO VARIOUS DEPARTMENTS/ORGANISATIONS

(i) Central Water Commission
(ii) Central Water and Power Research Station
(iii) Department of Agriculture
(iv) Department of Agricultural Research and Education
(v) Department of Irrigation
(vi) Ganga Flood Control Commission
(vii) India Meteorological Department
(viii) Ministry of Shipping & Transport
(ix) Planning Commission
(x) Ministry of Railways (Railway Board)
(xi) Border Roads Organisation
(xii) Geological Survey of India
(xiii) Survey of India



5—23 DNFC/80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APPENDIX III

QUESTIONNAIRE TO VARIOUS DEPARTMENTS/ORGANISATIONS

QUESTIONNAIRE TO CENTRAL WATER COMMISSION

G E N E R A L

NOTE : Please follow the guidelines detailed in the Annexure

G.1 (a) The Central Water Commission and the Ganga Basin Water Resources Organisation have been entrusted with the task of observation of river flow data at key points on important rivers and tributaries on a permanent and scientific basis. Please furnish a note explaining the basis on which the locations of the key gauging stations have been planned, the number of stations that is ultimately required to be set up, the number set up so far and the time phasing for completing the project.

(b) Please furnish in proforma G.1 the list of key gauging stations established/ proposed on the various rivers/tributaries in the country.

(c) Please supply a map to the scale of 1 to 1 million (larger scale if required) showing the river systems, basin boundaries, railway lines, and other important features and the locations of the key gauging stations.

G.2 (a) Has any manual/memorandum been prepared for making observations and computations of discharges and silt loads for ensuring uniformity in collection and computation of data and circulated to the States ? If so, please furnish six copies.

(b) If not, please furnish notes on the methodology adopted at the key gauging stations for computation of discharge and silt loads indicating also the manner of computing the maximum flood discharge—whether by actual observation or from gauge discharge rating curve or any other method.

G.3 Please furnish in proforma G.3 information of river flow and sediment load based on the data collected at the key gauging stations for the flood prone rivers/ tributaries in the country.

G.4 (a) Is the gauge, discharge and silt data collected by the States at the sites maintained by them received in the CWC/Ganga Basin Water Resources Organisation ?

(b) Is it checked and compiled along with the data of key gauging stations and published in the form of Water Year Book ?

(c) Please furnish a note indicating the present status and six copies of the latest Water Year Books.

G.5 (a) Are Annual Flood Reports and maps showing the areas affected each year received in the CWC from the States ?

(b) Based on these, has any assessment of area prone to floods been made basinwise/sub-basinwise ?

(c) Please furnish a statement of the extent of areas prone to floods (indicating the definition of "area prone to floods") basinwise/sub-basinwise and a map to the scale of 1 to 1 million (larger scale if required) showing these areas. The flood protection measures implemented and the areas benefitted may also be shown in the map.

G.6 (a) Have the areas liable to drainage congestion (indicating the definition of "drainage congestion") been estimated ? If so, please state how estimated.

(b) Please furnish details of the areas subject to drainage congestion basinwise/sub-basinwise.

(c) Please also furnish a map to the scale of 1 to 1 million (larger scale if required) showing the areas, the drainage works implemented and the areas benefitted by them.

G.7 The CWC has estimated that an area of 25 million hectares is prone to floods and about 20 million hectares can be economically provided with protection. Please furnish a note indicating how these figures have been arrived at.

G.8 (a) It is understood that surface water resources studies are being carried out in the CWC, please supply a note indicating the present status of these studies.

(b) Have the results of these studies been published? If so, please supply six copies, if not, please supply a note giving the results of the studies carried out so far, especially for the flood prone river basins.

G.9 (a) Are flood damage statistics received regularly in the CWC from the States ? Are they furnished for the State as a whole or basinwise ?

(b) From the flood damage statistics received since 1954, please supply in proforma G.9.1 Statewise details of the area and population affected by floods.

(c) Please supply similar information basinwise/sub-basinwise in proforma G.9.2.

G.10 (a) The need for periodical river surveys for making an evaluation of the changes in the river regime has been stressed by the various Committees on Floods. Have any reports of such surveys carried out by the State Governments been received in the CWC ?

(b) If so, please furnish a note on the observations and conclusions arrived at by the CWC, particularly with regard to the effect of embankments, anti-erosion works, etc. mentioning specific locations, periods of observations, etc. leading to the conclusions.

G.11 (a) The Ministers' Committee on Floods and Flood Relief (1970) had recommended that each State Government should send details of relief expenditure to the CWC for compilation and publication. Is this information being received ?

(b) Please supply details in proforma G. 11 separately for each of the years 1966-67 to 1976-77.

PROFORMA G·1

KEY GAUGING STATIONS

Sl. No.	Name of the River/ Tributary	Location of site and State	Catchment area in sq. km. (upto Observation site)	Nature of observation			Year of start of observation		
				Gauge	Discharge	Silt	Gauge	Discharge	Silt
1	2	3	4	5	6	7	8	9	10

Nature of bed and banks	The type of gauge, whether self-recording or ordinary*	Method of discharge observation by current meter/float etc.	Periodicity of gauge discharge and silt observation during		Remarks
			Monsoon	Non-monsoon	
11	12	13	14	15	16

*If zero level has been changed, please state in 'Remarks' column date and how co-related to the earlier one.

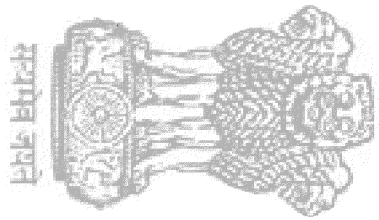
Note : (i) Please supply the information basin-wise in the order—main river and tributaries from the head down-wards.

(ii) The list may be continuous with one river system following the other.

PROFORMA G-3

HYDROLOGICAL DATA AT KEY GAUGING STATIONS

Sl. No.	River/ tributary sub-tributary	Station/ location of site & State	Catchment area upto site (sq. km)	Maximum flood discharge (cumecs with date)	Bank ful capacity (cumecs)	Period of record	Total flow				Silt load in p.p.m.				Total silt load				Remarks
							Annual Monsoon				Annual Monsoon				Annual Monsoon				
							Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	
							(Million cubic metres)				(million cubic metres)								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20



Note : (i) Information may be tabulated with one river system following the other.
(ii) The date(s) of the monsoon(s) may please be specified. In case, there are two mansoon seasons, information may be supplied for each.
(iii) Source of data may be indicated.

PROFORMA G.9.1

FLOOD DAMAGE STATEWISE

Area '000 ha
Population-million

State	Geographical area of the State	Area prone to floods	Total area affected								Cultivated area affected							
			1954—61		1961—66		1966—74		1974—76		1954—61		1961—66		1966—74		1974—76	
			Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
For the country as a whole (Columns 2 to 36)																		

State	Geographical area of the State	Area prone tc floods	Irrigated area affected								Population affected								Remarks
			1954—61		1961—66		1966—74		1974—76		1954—61		1961—66		1966—74		1974—76		
			Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	
1	2	3	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
For the country as a whole (Columns 2 to 36)																			

Note : Source of information may be indicated.

PROFORMA G-9.2

FLOOD DAMAGE BASINWISE

State
River
Area '000 ha
Population—Million

Name of river basin/sub-basin	Geographical area of basin/ sub-basin	Name(s) of district(s) falling within basin/ sub-basin	Area in basin/ sub-basin prone to floods	Total area affected								Cultivated area affected							
				1954—61		1961—66		1966—74		1974—76		1951—61		1961—66		1966—74		1974—76	
				Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
For the basin as a whole (Cols. 5 to 37)																			

Name of river basin/sub-basin	Geographical area of basin/ sub-basin	Name(s) of district(s) falling within basin/sub-basin	Area in basin/ sub-basin prone to floods	Irrigated area affected								Population affected								Remarks
				1951—61		1961—66		1966—74		1974—76		1954—61		1961—66		1966—74		1974—76		
				Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	
1	2	3	4	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
For the basin as a whole (Cols. 5 to 37)																				

Note : (i) Information may please be furnished in the order-main, tributary, sub-tributary from the head downwards.
(ii) Source of data may be indicated.

PROFORMA G. 11

EXPENDITURE ON FLOOD RELIEF

Year

(Rs. Lakh)

Sl. No.	State	Categories of relief and expenditure incurred														Grand Total
		Amount spent from State Funds						Amount spent from Central grants/loans						Total		
		Gratutious relief	House building loans	Taccavi loans	Agriculture/seed loans	Test relief	Miscellaneous relief	Gratuitous relief	House building loans	Taccavi loans	Agriculture seed loans	Test relief	Miscellaneous relief	State Funds	Central Grants loans	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Total for the country																

Note : States, where no expenditure has been incurred during the year, need not be listed.

TERM OF REFERENCE NO. 1

To review the flood protection measures undertaken since 1954 and to make an evaluation of the benefits and effectiveness of the measures undertaken so far with special reference to embankments in reducing the damage.

1.1 How many flood control/protection and surface drainage Master Plans for the various river basins/sub-basins have been received from the States for examination ? Have these been prepared keeping in view the guidelines and suggestions made by the High Level Committee on Floods (1957) in Vol.II of its Report and subsequent Committees on Floods ? Please furnish a note by each State giving your observations whether the plans conform to the above mentioned guidelines/ suggestions.

1.2 Apart from the Embankment Manual, has the CWC issued any manual/ guidelines for the investigation, planning and design of flood control/protection and drainage schemes ? If so, please furnish six copies of each.

1.3 The CWC examines individual schemes received from the State Governments and processes them wherever necessary for the approval of the Planning Commission. Based on the experience of the examination of schemes, please furnish the following information.

1.3.1 Whether the schemes are prepared keeping in view the guidelines in the Embankment Manual and other guidelines, if any, issued by the CWC ? What are the deficiencies generally observed in the investigation, planning and designs of the schemes ?

1.3.2 Is the method of protection decided after examining the various alternatives and taking into account the costs and benefits of each alternative or are the schemes prepared for a pre-conceived method of protection ?

1.3.3 (a) Since for technical and economical reasons, it is not possible to provide flood protection under all conditions of flow and for all times to come, have any guidelines been issued by the CWC, to the States for regulating developmental activities in the protected areas ?

(b) If so, please furnish six copies and state if the guidelines are being followed.

(c) If not, please state whether at the time of examination of schemes, the CWC makes suggestions regarding regulation of developmental activities in the protected areas. Please furnish copies of suggestions made/implemented for two schemes in each State.

1.4 *Embankments*

1.4.1 (a) Are the observations/suggestions made by the CWC communicated to the States and incorporated in the scheme reports before they are sanctioned and implemented ? Is there any arrangement in CWC for ensuring that the schemes are implemented accordingly ?

(b) If not, have any instances come to the notice of the CWC where schemes have been implemented without complying with its observations/suggestions ? Please furnish a list of such schemes State-wise indicating briefly, the points that have not been complied with.

(c) Have any instances come to the notice of the CWC where same important feature/scope of a scheme as approved has been modified by the State during its implementation ? If so, please furnish a list of such schemes Statewise indicating the modifications that have been made and your views on the advisability of the modifications carried out.

(d) Have the above been brought to the notice of the Ministry/Planning Commission ?

1.4.2 (a) Have any breaches/overtopping been reported in embankments listed in 1.4.1 which could be attributed to non-compliance with the observations/ suggestions made by the CWC and/or modifications carried out by the State Government in the approved scheme during implementation.

(b) If so, please furnish details with your observations.

1.4.3 (a) Are the likely adverse effects of embankment schemes on the upstream/downstream and the opposite side investigated by model experiments or otherwise and remedial measures proposed simultaneously ? If so, do they form an integral part of the embankment scheme ?

(b) In what situations are model experiments carried out or suggested ?

1.4.4 Are there any instances where soon after the implementation of the original scheme, further measures by way of raising/strengthening/improvements/ protection of embankments and/or improvement of drainage in the protected areas have been necessitated ?

If so, please furnish details of some specific cases (with details of the original scheme and the further measures) in different States, the reasons for further measures, the cost of the original scheme and that of further measures. Please in each case, state your views whether the further measures were such, the need of which could have been foreseen and taken care of at the design stage of the original scheme.

1.4.5 Have you come across cases where retiring embankments may have been technically/economically preferable to heavy protection/anti-erossion works ? If so, was the alternative studied/adopted ? Please quote specific instances.

1.4.6 Have any instances come to the notice of the CWC during the examination of revised estimates of schemes or in any other connection where maintenance of works has been or is being charged to capital account ?

Please furnish a note quoting specific instances and the action taken by the CWC thereon.

1.4.7 (a) Does the CWC get reports of the enquiries on breaches/overtopping of embankments conducted in the States ?

(b) What are the impressions gained from these reports and what are the views/suggestions of CWC in this regard ?

Please furnish a note.

1.4.8 Is there any available report/literature discussing the effect on the soil properties of embankments due to age and industrial effluent/waste, discharged/ dumped into the rivers ? If so, please give details of the conclusions quoting reference to the reports/literature.

1.4.9 Please furnish a note on the problems that have been experienced in the planning, implementation and operation of inter-State embankment schemes quoting specific cases.

Please offer your suggestions to improve such situations.

1.4.10 Please furnish a note with illustrative examples, if possible, giving your suggestions and the bases thereof on the degree of protection to be provided in terms of frequency of floods or any other criterion for :—

(i) predominantly agricultural areas ;

(ii) town protection works ;

(iii) important industrial complexes, assests and lines of communication.

1.4.11 (a) Please furnish a note giving your assessment and views on the benefits/drawbacks of embankments discussing the various factors involved.

(b) Also please describe situations/locations where you would consider them suitable/preferable/unavoidable.

1.4.12 (a) Please state whether the use of embankments should be restricted to inspection vehicles and transportation of men and materials during emergent situations or whether their use may be allowed as public highways.

(b) If the latter, please state your views in a detailed note regarding at what locations, under what conditions, construction standards, capital and maintenance expenditure, control, etc.

1.5 *Drainage schemes (surface)*

1.5.1 (a) Are the observations/suggestions made by the CWC incorporated in the schemes before they are sanctioned and implemented ? Is there any arrangement in the CWC for ensuring that the schemes are implemented accordingly ?

(b) If not, have any instances come to the notice of the CWC where schemes have been implemented without incorporating its observations/suggestions ? Please furnish a list of such schemes State-wise indicating briefly the points that have not been complied with.

(c) Have any instances come to notice of the CWC where some important feature/scope of a scheme as approved has been modified by the State during its implementation ? If so, please furnish a list of such schemes State-wise indicating the modifications that have been made and your views on the advisability of the modifications carried out.

(d) Have the above been brought to the notice of the Ministry/Planning Commission ?

1.5.2 (a) Have any instances of drainage congestion been reported in the schemes mentioned in 1.5.1 above, which could be attributed to non-compliance with the observations/suggestions made by the CWC and/or modifications carried out by the State Government in the approved scheme during implementation ?

(b) If so, please furnish details with your observations.

1.5.3 Are the likely adverse effects of the upstream drainage works on the lower areas of the scheme or other State(s) investigated and remedial mesures proposed simultaneously ? If so, are the remedial measures incorporated in the main schemes ?

Please furnish specific instances either way.

1.5.4 Are there any instances where soon after the implementation of the original scheme, further measures by way of remodelling/improvements etc. have been necessitated ?

If so, please furnish details of some specific cases (with details of the original schemes and the further measures) in different States, the reasons for further measures, the cost of the original schemes and that of further measures. Please, in each case state your views whether the further measures were such, the need of which could have been foreseen and taken care of at the design stage of the original scheme.

1.5.5 Have any instances come to the notice of the CWC during the examination of revised estimates of schemes or in any other connection where maintenance costs have been or are being charged to capital account ?

Please furnish a note quoting specific instances and the action taken by the CWC thereon.

1.5.6 Please furnish a note on the problems that have been experienced in the planning, implementation and operation of the inter-State drainage schemes quoting specific cases.

Please offer your suggestions to meet such situations.

1.5.7 (a) Do the guidelines, if any, issued by the CWC suggest the possibility of utilising drainage waters partly or fully to supplement canal flows or for storing in depressions ?

(b) If not, are suggestions made in this regard during the examination of drainage schemes ?

Please quote specific cases where such suggestions have been made/implemented.

1.5.8 Based on the experience gained so far, please furnish a note with illustrative examples, if possible, giving your suggestions on the bases on which the design discharges of storm water drainage systems may be determined and the criteria to be adopted in the design of drainage for :—

(i) premodinantly agricultural areas;

(ii) urban areas;

(iii) important industrial complexes etc.

1.5.9 Please furnish a note giving your assessment and views on the effect of drainage schemes on waterlogging and ground water table, changes in crop patterns, amelioration of the area etc.

1.5.10 Please furnish a note giving your assessment and views on the effectiveness of the drainage works in the deltaic tracts.

1.6 *Anti-erosion works*

1.6.1 (a) Are the observations/suggestions made by the CWC incorporated in the schemes before they are sanctioned and implemented? Is there any arrangement in the CWC for ensuring that the schemes are implemented accordingly?

(b) If not, have any instances come to the notice of the CWC where schemes have been implemented without incorporating its observation/suggestions? Please furnish a list of such schemes State-wise indicating briefly the points that have not been complied with.

(c) Have any instances come to the notice of the CWC where some important feature/scope of a scheme as approved has been modified by the State during its implementation? If so, please furnish a list of such schemes State-wise indicating the modifications that have been made and your views on the advisability of modifications carried out.

(d) Have the above been brought to the notice of the Ministry/Planning Commission?

1.6.2 Are anti-erosion schemes prepared on the basis of model experiments or based on the experience of past works? If the former, under what situations?

1.6.3 Have any instances of failure of anti-erosion works listed in 1.6.1 above, come to notice or been reported which could be attributed to the non-compliance of observations/suggestions made by the CWC or having been implemented without taking into account the recommendations made as a result of model experiments and/or modification carried out by the State Government in the approved scheme during implementation?

If so, please furnish details with your observations.

1.6.4 Are the likely adverse effects of anti-erosion works, upstream, downstream and on the opposite side, studied and remedial measures proposed simultaneously?

If yes, are they incorporated in the project? Please quote some specific cases.

1.6.5 Are there any instances where soon after the implementation of the original scheme, further measures by way of extensions/strengthening/improvements have been necessitated?

If so, please furnish details of some specific cases (with details of the original schemes and the further measures) in different States, the reasons for further measures, the cost of the original scheme and that of further measures. Please, in each case state your views whether the further measures were such the need of which could have been foreseen and taken care of at the design stage of the original scheme.

1.6.6 Please furnish a note on the problems that have been experienced in the planning, implementation and maintenance of Inter-State/Centre State anti-erosion works, quoting specific cases.

Please offer your suggestions to meet such situations.

1.6.7 Please furnish a note giving your assessment and views on the performance of anti-erosion works and their drawbacks, if any, and situations, locations where these works are suitable/preferable/unavoidable.

1.7 *Channel improvements*

1.7.1 Please list the channel improvement works that have been undertaken in different States indicating the methods used and situations in which a particular method has been adopted.

1.7.2 Were these works planned after carrying out model experiments?

1.7.3 Please furnish a note stating your views on the performance and utility of channel improvement works, types, situations/locations where suitable/preferable/unavoidable.

1.8 Please furnish a note giving your experience of operation of multi-purpose reservoirs with flood storage indicating *inter alia* whether there has been a tendency

for encroaching into the flood storage for maintaining/increasing irrigation and power benefits.

1.9 Please furnish a note indicating your experience of village raising works in Uttar Pradesh and why there has been less emphasis on the use of this method in recent years.

1.10 Is there any arrangement in the CWC for making periodical evaluations of the flood protection/drainage programme?

Please furnish a note quoting specific examples giving your assessment of the physical and monetary benefits to the benefitted areas after the implementation of the flood protection programmes.

1.11 Have you any views/suggestions regarding the present procedure for examining and processing of flood control/protection and drainage schemes for approval of the Planning Commission? Please furnish a note.

TERM OF REFERENCE NO. 2

To identify the areas where a large number of zamindari and/or unauthorised embankments, bunds and spurs etc., exist to assess the effect of such constructions on the flood problem; and suggest remedial measures.

2.1 Please furnish a note indicating the areas in different States where a large number of zamindari and/or other unauthorised embankments exist.

2.2 What is your general assessment of the utility of these embankments? Please furnish a note.

2.3 Have any instances come to your notice where these embankments have aggravated the flood problem? Please furnish a note giving your suggestions for remedial measures.

TERM OF REFERENCE NO. 3

To indentify the areas where construction of roads, highways, railways, etc., and other encroachments into the drains have aggravated flood problems and to suggest measures for improvement including legislative action, if any.

3.1 (a) Has the CWC identified areas where chronic drainage congestion has been caused as a result of the construction of roads, highways, railways etc. and intimated to the State(s) concerned?

(b) If so, please furnish a note indicating these areas basinwise/sub-basinwise, and the action taken thereon.

(c) Please also furnish a map to the scale of 1 to 1 million (larger scale if required) indicating the areas and the railway lines, national highways, roads, etc. which have caused the problem.

3.2 The Khosla Committee of Engineers, (1957) had recommended "the provision of waterways for railway bridges across natural streams and drains to cater for a maximum record flood or flood discharge corresponding to a 50-year frequency, whichever is greater". Based on the subsequent experience, has the CWC any suggestions or views regarding the adequacy or otherwise of waterways provided on the basis of this norm?

3.3 (a) The Khosla Committee of Engineers, (1957) had recommended the seting up of a cell in ths CWC for making flood estimation studies under the long-term plan in co-ordination with the India Meteorological Department. Has the cell been set up?

(b) If so, please furnish a note and comments, if any, indicating the organisational set up of this unit, its methodology of work, the progress made in the studies and the programme of further work.

(c) Have any of the studies been published? If so, please supply six copies of each.

3.4 (a) According to the Khosla Committee Report a unit in the Railways was to evolve one or more formulae for estimating flood discharges for the waterways of bridges based on the data already available. Have these formulae been developed in consultation with the CWC.

(b) If so, are these formulae being adoped in the design of flood protection measures?

(c) If some other formulae are adopted for any zone/region, please furnish a note giving details and reasons.

3.5 (a) Based on the recommendations of the Ministers' Committee on Flood Control (1964), Standing Committees headed by the Chairman, CWC have been constituted for settling disputes relating to provision of waterways and sharing of costs of Railways and National Highway bridges. How many disputes have been referred to the CWC since 1971? Please furnish information in proforma 3.6 (if no disputes have been referred after 1971, details may be given for the period from 1966 onwards).

(b) What is the procedure adopted in the settlement of disputes? Please furnish a note.

3.6 Have you any observations/views on the effectiveness of the Standing Committees referred to in 3.6 above? Please furnish a note.

3.7 The CWC is represented on the Committees of Engineers set up in the States. What are your views in regard to the functioning and effectiveness of these Committees, especially in regard to matters relating to the distress caused by inadequate waterways? Please furnish a note also indicating your suggestions, if any.

PROFORMA 3.6

DISPUTES RELATING TO WATERWAYS OF RAILWAY AND NATIONAL HIGHWAY BRIDGES

NOTE : Plese supply information for each dispute separately.

1. Name of the bridge under dispute.
2. Location of the bridge—River, Railway zone, National Highway No., State etc.
3. Name of the organisation referring the dispute.
4. Respondent organisation.
5. Points of dispute in brief.
6. Date of referring the dispute.
7. Date of settlement of the dispute.
8. Decision on the dispute and the broad basis for arriving at the decision.
9. Status of implementation of the decision.

TERM OF REFERENCE NO. 4

To analyse the damage caused by floods in recent years and to identify the areas requiring immediate flood protection measures.

4.1 (a) Has the CWC made any analysis of the flood damage from 1966 onwards and identified the areas requiring urgent attention?

(b) If so, please list such areas in each State/river basin, stating the basis of the categorisation.

(c) Please furnish a map to the scale of 1 to 1 million (larger scale, if required) showing these areas.

4.2 Please furnish in proforma 4.2 details of the damage caused each year in the areas referred to in para 4.1 from 1966 onwards.

4.3 Has the figure of damage from 1966 onwards shown in increasing trend? If so, please indicate the reasons therefor.

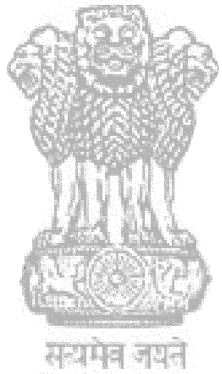
PROFORMA 4.2

DAMAGE CAUSED IN THE AREAS NEEDING URGENT ATTENTION

State
Year

Sl. No.	Location of area (list district whole/part)	River/tributary sub-tributary causing damage	Area* affected (ha.)	No. of villages affected	Population affected	Cropped area under the villages (ha)	Cropped* area affected (ha.)	Crop damage (Rs. lakhs)
1	2	3	4	5	6	7	8	9
Damage in the areas requiring urgent attention (Totals of Cols. 4—16)								
Total damage in the State during the year including other areas (Cols. 4—16)								

*If more than once in the same year, please state the area affected each time and strike total.



PROFORMA 4.2—(Contd.)

No. of houses damaged	Value of houses damaged (Rs. lakhs)	No. of human lives lost	No. of Cattle heads lost	Loss of Public Utilities (Rs. lakhs)	Total loss (Rs. lakhs)	Expenditure on relief and rehabilitation (Rs. lakhs)	Remarks
10	11	12	13	14	15	16	17

Note : (i) Name of crops damaged may be indicated in the Remarks Col.
(ii) Source of data may be indicated.

TERM OF REFERENCE NO. 5

To evolve a comprehensive approach to the problem of floods in the country keeping in view the need for optimum and multipurpose utilisation of water resources as also the role of soil conservation and afforestation.

5.1 Please furnish in proforma 5.1.1 information on the live storage capacities of reservoirs (irrigation, hydro, multipurpose etc.) of major and medium schemes.

Please also furnish in proforma 5.1.2 detailed information in respect of each reservoir (completed, in progress or planned) with a live storage of over 125 million cubic metres (about 1 lakh acre-feet).

5.2 (a) In their letter No. DWV.527 (22)/61 of 27-1-1962, the then Ministry of I & P had stated it is "essential that specific flood absorpotion capacity should be provided along with storage for other purposes viz. irrigation, power etc.".

Is the "flood" aspect specifically considered by the States in their irrigation and power projects submitted to the CWC?

Please furnish a list of projects (excluding D.V.C. and Hirakud) in which such specific provision has been made by the States.

(b) Please furnish a list of schemes in which flood storage, not provided in the projects received from the States, was included at the suggestion of the CWC.

5.3 (a) While preparing the project reports of reservoirs where specific flood storage is not provided, does the Project Authority carry out studies of suitable filling schedule for obtaining flood moderation benefits from the live storage provided for other purpose?

(b) If not, does CWC make a study and suggest suitable filling schedule?

Please furnish a note with examples.

5.4 From the experience of examination of flood control/protection plans and schemes prepared by the State Govts. and taking into account the topography, rainfall pattern, magnitude and duration of floods in the various flood-prone rivers, what are your views on the following, especially in the case of rivers with severe flood problems ;

NOTE : Plase quote examples in support of your views and specify river basins where each may be applicable.

(i) The scope of utilisation of natural depressions, tals, bheels, etc. for moderation of floods;

(ii) Scope for diversion of flood water to other basins or in the same basin for storage and utilisation;

(iii) Possibility of storing flood waters underground;

(iv) Allowing controlled flooding behind embankments through sluices. Should reverse drainage be effected through the same sluices or special drainage channels?

(v) Technical and economic possibility of construction of storage dams in the upper catchments and their likely effect on floods.

(vi) Scope of pumping as a measure for relieving drainage congestion.

(vii) Other feasible measures like check dams and soil/water conservation measures.

5.5 Has any study of the silt load carried by important rivers and tributaries been made over a period of years?

Please furnish information in proforma 5.5 for the imporant rivers/tributaries.

5.6 Please state if you have arrived at any broad figures of sediment rates to be used in designs.

If yes, please state figures zonewise/basinwise, and the bases thereof.

If not, do you consider such an exercise useful as guide to the States for use in their designs?

5.7 (a) Please supply information in proforma 5.7 in respect of soil conservation measures in river valley projects under the Centrally sponsored programme.

(b) Where silt observation posts have been established, please furnish details in the Remarks Column (or in a separate proforma) tabulating the posts, their locations, the reasult of yearly observations etc. and the conclusions drawn.

(c) Of the schemes listed, which are the ones specifically taken up from the flood control point of view?

(d) Where substantial/progress has been achieved in any catchment, please furnish notes mentioning the effects of the measures taken and the basis for conclusions reached in respect of sediment load, reduction in peak flows etc.

5.8 (a) Has the CWC evolved a comprehensive approach towards the problem of floods in the country keeping in view the need for optimum and multi-purpose utilisation of water resources as also the role of soil conservation and afforestation in flood control?

If so, please supply six copies thereof.

(b) If not, please furnish a note giving your views/suggestions in this regard.

PROFORMA 5.1.1

STORAGE CAPACITIES OF RESERVOIRS (FOR MAJOR AND MEDIUM SCHEMES) IN VARIOUS RIVER BASINS

Sl. No.	River basin	*Live storage capacity (million cu.m.)							
		Completed before 1954		Completed after 1954		In progress on 1-4-1977		Planned	
		Number	Total capacity	Number	Total capacity	Number	Total capacity	Number	Total capacity
1	2	3	4	5	6	7	8	9	10

*Including flood absorption component, if any.

PROFORMA 5.1.2

PARTICULARS OF STORAGE RESERVOIRS OF CAPACITY OVER, 125 M. CU. M. (1 LAKH AC. FT.)

Sl. No.	River/ Tributary	Name	Location	State	Catchment area at the dam site (sq. km.)	Total catchment area of river/tributary (sq. km.)	Total inflow into reservoir (million cu.m.)				Live storage (million cu. m.)	Withdrawal from storage during monsoon* (filling monsoon) (million cu.m.)	Flood storage, if any, (million cu.m.)	Present status (whether completed in progress or planned)
							Annual		Monsoon					
							Ave.	Max.	Ave.	Max.				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

*Please specify dates of monsoon.

Note : (i) The statement may be continuous with one basin following the other.

(ii) The basinwise list should be in the order : main followed by tributaries from the head downwards.

PROFORMA 5.7

SOIL CONSERVATION SCHEMES IN THE RIVER VALLEY CATCHMENTS UNDER THE CENTRALLY SPONSORED PROGRAMME

1. Name of the scheme
2. Total catchment area of the river valley project (sq. km.)
3. Critical area of the catchment requiring treatment ('000 ha.)
4. Area for which treatment has been proposed in the scheme ('000 ha.)
5. Cost of the scheme (Rs. lakhs)
6. Date of start of scheme
7. Progress made : (Area '000 ha.)
   (Cost Rs. lakhs)

Plan period	type	Area	Cost	Type	Area	cost	Total Area	Cost
Third Plan 1961—66								
Annual Plans 1966—69								
Fourth Plans 1969—74								
Fifth Plan 1974—79 (proposed)								

(Please add additional columns, if required)

8. Remarks

Notes : (1) Types of work in 7 include bunding, gully plugging, check dams, terracing, etc.

(2) Please give, in the Remarks column, a general assessment of the effects of the work based on discharge and silt observation.

TERM OF REFERENCE NO. 6

To make an analysis of the cost and benefits of flood protection measures.

6.1 (a) Has any procedure been laid down by the CWC for the analysis of benefits and costs of flood control/protection schemes ? If so, please furnish a detailed note with examples.

(b) To what extent is this procedure followed by the States ?

(c) If no procedure has been laid down by the CWC, please furnish a note indicating the procedures adopted by different States. Please furnish your views/ suggestions in this regard.

6.2 (a) Has any procedure been laid down by the CWC for working out cost and benefit analysis of multipurpose projects with flood control components ? If yes, please furnish a note with worked out examples of two or three latest projects.

(b) If no procedure has been laid down by the CWC, please furnish a note on the procedure followed by different States and views/suggestions of the CWC thereon.

6.3 Any other suggestions.

TERM OF REFERENCE NO. 7

To suggest criteria for taking up flood protection measures and means of mobilising resources therefor

7.1 What are the criteria adopted by the CWC for clearing flood control/ protection schemes ? Please furnish a note also giving the basis thereof.

7.2 The High Level Committee on Floods (1957) in para 8.4 of volume I of its report had recommended the pattern of priorities for taking up flood control/protection schemes. Please state if these are being followed, if not, please furnish a note on the alternative pattern adopted with reasons therefor and suggestions for improvement, if any.

7.3 Please furnish a note giving your views/suggestions on the matter of mobilising resources for financing flood control/protection schemes.

TERM OF REFERENCE NO. 8

To recommend proper land use in the flood plains with a view to minimise damage and to ensure overall increase in agricultural production

8.1 Does the CWC watch the progress in the preparation of contour plans of the flood plain areas and demarcation of flood zones affected by floods of different frequencies? Please furnish a note indicating the extent of areas requiring the preparation of contour plans and the areas for which maps have been prepared statewise/ basinwise up to 31-3-1977.

8.2 Please furnish a note giving your suggestions on the land use in flood plains (separately for protected and unprotected areas) for reducing the overall flood damage and to achieve the optimum benefits.

8.3 Will it be adequate if land use regulation is confined to the flood plain or should it be extended to the catchment area as well?

Please furnish a note with your suggestions on the pattern of land use in the catchments.

TERM OF REFERENCE NO. 9

To review the existing arrangements for maintenance of flood protection works and recommend measures for improving the same

9.1 (a) The Ministers' Committee on Floods and Flood Relief (1970) had made certain suggestions on the planning and design of embankments and their maintenance. Have any suggestions for modification or amplification of the instructions contained in the Embankment Manual been received from the States ?

(b) Has the Embankment Manual prepared by CWC been revised or is under revision? If revised, please supply six copies.

9.2 Based on the standard of maintenance laid down in the Embankment Manual, has any study been made of the cost of routine maintenance as percentage of the capital cost of the embankment in respect of major, medium and small embankments? Please furnish a note.

9.3 Based on the experience of the maintenance cost reported by the States, has any attempt been made to calculate it as a percentage of the capital cost for the various types of works other than embankments? If so, please furnish a note indicating the results.

9.4 (a) What is your impression regarding the standard of maintenance of flood protection and drainage works in various States?

(b) Please furnish a note of schemes where, in your opinion, the maintenance is not adequate along with assessment (personnel, techniques, annual grants, etc.) of the reasons and suggestions for improvement.

TERM OF REFERENCE NO. 10

To review the existing administrative and organisational set-up for flood control at the Centre and in the States and to suggest improvements where necessary, flood control to include flood forecasting and warning, flood fighting, formulation and implementation of flood protection measures

10.1 The Ministers' Committee on Flood Control (1964) had recommended that while project investigations should continue to be the responsibility of the State Governments, the CWC should be entrusted with investigations where work is to be done in neighbouring territories. Where inter-State problems are involved and where specifically requested by States for special reasons. Have any investigations been carried out by the CWC in pursuance of this recommendation? Please furnish details.

10.2 The above Committee had recommended the setting up of a suitable organisation in the CWC to help the States in investigation, planning and execution of soil conservation measures vis-a-vis flood control including the work to be done in neighbouring territories. Please furnish a note indicating the action taken on this recommendation, and the results achieved up to 31-3-1977.

10.3 The above Committee had also recommended that the organisation for flood control in the CWC should be reviewed and appropriate changes made in order to make it a really effective body in standardisation of technical procedures and coordination of national effort in flood control. Please furnish a note indicating the progress made in this behalf with special reference to the following items indicated by the Committee:—

(i) Standardisation of technical procedures in :
  (a) techniques of flood control planning ;
  (b) hydrological observations;
  (c) assessment of flood damage;
  (d) design of flood control works;
  (e) economic studies like benefit cost ratio determinations.

(ii) Review of flood control policies and evaluation of flood control programmes from time to time.

(iii) Coordination of flood control activities in the country with the activities of other Central Departments like Railways, Survey of India, India Meteorological Department etc.

(iv) Serving as a repository of information relating to floods and control works in the country for supply to the various Ministries.

(v) Studying continuously the latest developments in flood control techniques in other countries of the world for application to Indian conditions.

10.4 (a) The Ministers' Committee on Floods and Flood Relief (1970) had recommended the extension of flood forecasting facilities on more flood prone rivers and that in case of inter-State and international river basins involving two or more States, the flood forecasting system should be set up and operated by a Central agency.

Please furnish a note on the flood forecasting systems operated by the CWC before the setting up of this Committee and extensions made thereafter.

(b) Also please furnish a note on the performance of these flood forecasting units, and how their work is coordinated with the States and the India Meteorological Department.

(c) Specific examples where the flood forecasts issued by the CWC since 1970 have been useful in giving timely warnings to the people thereby reducing loss of life and property to a considerable extent may be indicated.

10.5 Which States have set up their own flood forecasting units, at what locations and covering which basin/area ?

Have they, in your opinion, functioned satisfactorily ?

Is there successful coordination between Central units and those set up by the States ?

Would you support the idea of such units by individual States or would you suggest that all units should be under the control of a Central agency ?

If you prefer all units to be under the control of a Central agency, do you think the States should share the costs ? If so, how ?

Please furnish a note covering the above and other relevant points.

10.6 The Ministers' Committee on Floods and Flood Relief (1970) had recommended that the existing system should be modernised for more reliable and accurate forecasts and for the purpose had suggested progressive adoption of improved techniques at all the centres by strengthening the existing set-up and augmenting the technical facilities. Please furnish a note indicating the progress made.

10.7 The CWC had prepared a manual for flood operations and had circulated the same to the States for preparing similar manuals taking into account the requirements to suit local conditions. Please state which States have prepared such manuals and sent copies to the CWC.

10.8 (a) The above Committee had recommended that the States should prepare technical notes dealing with problems of flood fighting each year and send the same to the CWC for compilation and circulation for the benefit of other States. Please furnish a note indicating the action taken in this regard.

(b) If any compilations have been made, please supply 6 copies each of the latest two compilations.

10.9 (a) The CWC acts as the secretariat for the Central Flood Control Board. Please indicate how many meetings of the Board have been held since inception up to 31-3-77 and the date of the last meeting.

(b) Please furnish six copies of each of the minutes of last two meetings of the Board.

(c) Please furnish a note listing the important policy decisions taken at each of the meetings and the present status of their implementation.

10.10 Is there any duplication of work between the CWC and GFCC?

Please furnish a note with your suggestions for improvement/rationalisation, if any, in this behalf.

10.11 Please furnish a note detailing the present organisational set-up for flood control (including flood forecasting) in the CWC and an organisational chart depicting the functions of the various offices thereunder.

Please also state if you have any and what improvements to suggest.

10.12 Please furnish a note detailing the role of the CWC in initiating, planning and processing of schemes for flood control/protection and drainage etc., coordination and consultation with States, and other departments etc.

Please also state if you have any views/suggestions in the matter.

TERM OF REFERENCE NO. 11

To examine the present procedure of assessing flood damage and suggest improvements

11.1 (a) Has the CWC laid down any procedure for assessing flood damage?

(b) The Ministry had circulated the procedures recommended by the National Council of Applied Economic Research in their report on ''Scientific Assessment of Flood Damages''. Is it being followed by the States?

(c) If not, is there any alternative procedure accepted by you? If yes, please supply six copies.

(d) Please furnish a note of your views/suggestions on this item.

TERM OF REFERENCE NO. 12

To examine any other matter related to floods and flood control and make suitable recommendations

12.1 (a) Land slides may lead to changes in the river courses and increase in the silt load. Does the CWC keep track of the occurrence of major land slides and obtain reports on their effects on the river conditions and the remedial action suggested/ undertaken by the concerned authorities.

(b) If so, please furnish a note indicating locations of the river basins/sub-basins where land slides are frequent, stating the nature of remedial measures that are generally adopted and the views/suggestions of the CWC.

12.2 Please furnish a note giving the views of the CWC on the effect of river bed cultivation in the non-monsoon months, on river conditions and flow during floods.

12.3 Would the CWC suggest promulgation of River Conservancy Acts?

If so, please outline, in brief, the important provisions which may be incorporated.

12.4 Apart from manuals etc., referred to in questions 1.2 and the pa hlet on Floods and Their Control in India (1977), has the CWC brought out any other publications in the field of flood control? If so, please supply six copies of each.

12.5.1 Are environmental aspects of flood control/protection and drainage works covered in the Project Reports and remedial measures as necessary provided therein ?

If not, does the CWC consider these aspects and suggest measures while clearing the projects ?

Please furnish a detailed note with specific examples.

12.5.2 Please furnish a note of the CWC's views/suggestions regarding environmental aspects relating to flood control/protection works and their ancilliaries.

ANNEXURE

GUIDELINES FOR FURNISHING INFORMATION IN REPLY TO THE QUESTIONNAIRE

1. *Units* : Metric units may please be used.

2. *Maps* : Scales for maps have been specified in the various questions. All map sheets should be of size 42 cm×56 cm. Where the total area cannot be accommodated in a single sheet, it may be shown on more than one sheet with connecting lines on each sheet. Sheets may not be folded.

Where printed maps are not available, white legible prints may be supplied. Reference to the question number may be shown on the top.

3. *Methodology* : Wherever methodology has been requested, it may please be given in sufficient lucidity.

4. *Documents* : Wherever copies of the reports, guidelines etc. have been requested, 6 numbers may please be supplied. If so, many are not readily available, 2 copies should be the minimum.

Six copies of reports of studies/investigations/assessments may please be supplied, if available, in addition to the specific notes asked for in the questionnaire.

5. *Format of Reply* : The information may please be compiled individually for each question and sub-question.

The questions have been framed so as to convey a general idea of the information needed. It is, however, requested that, in the interest of proper appreciation, the replies may, where helpful include additional information/suggestions.

The Ayog will also appreciate information/views/suggestions on related points, though not included in the questionnaire; these may please be added at the end of the replies to the *relevant term of reference*.

The question/sub-question, relevantly numbered, may be reproduced and the reply, including notes, where requested, furnished underneath the same.

Full width of the page, allowing a margin of about 5 cm. may be used both for the questions/sub-questions and the replies.

6. *Copies of the replies and maps* : Three copies of the replies may please be supplied in bound volumes and 10 copies in loose sheets. Twelve copies of the maps may please be supplied in bound volumes.

Replies covering all items of the questionnaire in the very first instance will be appreciated. If, however, any items are likely to take some time, information on others may please be communicated, followed as soon as possible by that on the remaining ones, making a suitable note in the relevant place in the initial compilation

QUESTIONNAIRE TO THE CENTRAL WATER AND POWER RESEARCH STATION, POONA

NOTE : Please follow the guidelines detailed in the Annexure.

1. (a) What is the role of CWPRS in the matter of hydraulic analysis pertaining to river behaviour and flood control ?

(b) Please furnish a note on the organisational set up for the above role and suggestions, if any.

2. Please furnish a note giving the details of the nature of research and model experiments that are being done in CWPRS on river behaviour and control problems, effect of flood protection and other works on river regime and other relevant matters relating to floods and flood control.

3. (a) Please furnish six copies each of the reports of the model experiments carried out by the CWPRS for two items in each category of flood control/protection works (embankments, anti-erosion, channel improvements, etc.) which have been in operation for at least five years.

(b) Please also furnish six copies each of the recent "Specific Notes" on the Kosi and the Brahmaputra.

4. In each of the cases referred to in 2(a) ante, please furnish the following information :—

(i) Where the works were not likely to be completed within one season, whether the model was retained, further experiments carried out and recommendations modified from season to season. Please specify such instances with your comments.

(ii) Whether the works have been inspected—annually or periodically—after completion of the above schemes to assess their performance. Please quote specific cases with notes.

(iii) Whether any additional works have been necessitated soon after the completion of the works. If so, please detail the same and the need therefor.

5. (a) Have you issued any guidelines broadly specifying the data required for specific types of flood protection works ? If so, please supply six copies of the same.

If not, do you think such a measure feasible and whether it would assist in timely completion of model experiments and implementation of works ?

(b) Please state whether complete requisite data is supplied by the Project authorities while requesting for model experiments. If not, please quote examples of some important works, the action taken, the time last and the resulting adverse effects.

(c) Where the works are to be spread over more than one season, are the reports about the performance of the works, and changes in the river conditions from season to season received in good time to enable further experiments and indicate modifications in the programme of works earlier recommended ?

If this has not always been the case, please quote examples of some important works.

6. In the CWPC publication "Flood Control Procedures and Practices in the United States (June 1962)", it has been mentioned that "the Ganga river and the Brahmaputra river are the two major river systems at present under active consideration for comprehensive basinwise multipurpose planning and the hydraulic model of these two systems would undoubtedly prove extremely handy and useful tools in the project designs".

Have hydraulic models of the above two river systems been laid and experiments carried out ? If so, please supply six copies of the reports of the experiments.

If not, is there any proposal for setting up such models in the near future ?

7. Referring to your work in general, please, in the case of flood protection/drainage works, state :—

(i) If there is a regular practice of assessing prototype behaviour vis-a-vis the results obtained in model experiments.

(ii) Have there been any instances of significant variations and/or adverse effects on either bank or in the river behaviour upstream/downstream ?

If so, please specify some important cases with details of the analysis made and further action suggested/taken.

8. Have any hydraulic design criteria for various types of flood control works been published by the CWPRS ?

If so, please supply six copies.

9. Based on the results of your basic research, model experiments, the experience of prototype behaviour and the experience in other countries, please furnish a note stating the suitability, effectiveness, location/situation where applicable of the following types of works :—

(i) Embankments,
(ii) Anti-erosion works,
(iii) Channel improvements,
(iv) River training works.

10. Please furnish a note on your views/suggestions on the construction of embankments and drainage works in the deltaic and tidal reaches of rivers.

11. Please furnish a note describing the studies made (in India or abroad) regarding the effect of embankments on river regime, giving specific examples.

12. Please furnish your views/suggestions on the manner in which deterioration in river regime conditions downstream of a reservoir can be kept to the minimum.

13. Has any study been made in the CWPRS on the effect of soil conservation measures on the runoff pattern and sediment load? If so, please furnish a note with the results and your observations.

14. (a) Has the CWPRS developed any telemetering type of water level recorders which could be used in flood forecasting/warning? If so, please furnish a note indicating the present status of manufacture and results of tests at actual site locations. What is the cost of such type of water level recorders in rupees and foreign exchange component, if any ?

(b) Has the CWPRS also developed other types of instruments for field/prototype observations of river behaviour? If so, please furnish a brief note.

15. Have any studies been made regarding the effect of river structures in close proximity to each other on the river regime? (Structures from Wazirabad barrage to Okhla barrage on the Yamuna at Delhi is an example.) If so, please furnish a note or six copies of the Report(s), if any.

If not, and as it is understood that the Yamuna model is still existing, could you please, from your self-sponsored research, urgently carry out an experiment (from some distance upstream of Wazirabad to some distance downstream of Okhla barrage) and furnish the Ayog with the results?

Based on this and experience elsewhere, please furnish a note of your views and suggestions relating to similar situations.

16. Have you any programme for exchange of ideas regarding techniques of research or model experiments amongst research workers in the country ?

Please furnish a note.

17. In the background of your experience, you may have information/views/suggestions which may be of assistance to the Ayog. Please supply a note covering the same under specific term(s) of reference or in general as convenient.

ANNEXURE

GUIDELINES FOR FURNISHING INFORMATION IN REPLY TO THE QUESTIONNAIRE

1. *Units* : Metric units may please be used.

2. *Methodology* : Wherever methodology has been requested, it may please be given in sufficient lucidity.

3. *Documents* : Wherever copies of the reports, guidelines etc. have been requested, 6 numbers may please be supplied. If so many are not readily available, 2 copies should be the minimum.

Six copies of reports of studies/investigations/assessments may please be supplied, if available, in addition to the specific notes asked for in the Questionnaire.

4. *Format of Reply* : The information may please be compiled individually for each question and sub-question.

The questions have been framed so as to convey a general idea of the information needed. It is, however, requested that, in the interest of proper appreciation, the replies may, where helpful, include additional information/suggestions.

The Ayog will also appreciate information/views/suggestions on related points, though not included in the questionnaire; these may please be added at the end of the replies to the composite questionnaire.

The question/sub-question, relevantly numbered, may be reproduced and the reply, including notes, where requested, furnished underneath the same.

Full width of the page, allowing a margin of about 5 cm. may be used both for the questions/sub-questions and the replies.

5. *Copies of the Replies* : Three copies of the replies may please be supplied in bound volumes and ten copies in loose sheets.

Replies covering all items of the questionnaire in the very first instance will be appreciated. If, however, any items are likely to take some time, information on others may please be communicated, followed as soon as possible by that on the remaining ones, making a suitable note in the relevant place in the initial compilation.

ITEMS ON WHICH INFORMATION IS REQUESTED FROM THE DEPARTMENT OF AGRICULTURE

1. (a) Please furnish a note indicating the role of the Department of Agriculture in the problem of floods in the country.

(b) Please detail the role specifically with regard to the soil conservation/afforestation in the river valley catchments.

What is the mechanism to ensure continued benefits from these works ?

What is the organisational set up for the above ?

2. What are the major agricultural problems limiting production in the flood prone areas of the country as a whole or by river-basins or States ?

Please furnish a note on the above problems and the possible remedial measures, taking into account the prevailing agro-climatic conditions of the regions and the available infrastructure for promoting suitable production programmes in the flood-prone areas.

3. (a) Have any cropping strategy and contingent crop plans been developed and recommended for adoption during the flood and the post-flood seasons in the frequently flooded areas of U.P., Bihar, West Bengal, the Assam Valley, and the coastal deltas of Orissa and Andhra Pradesh ?

Please furnish a note on the above recommendations giving the crops/varieties, agronomic practices etc., to be followed under the different agro-climatic conditions in the flood plains.

(b) Are there any standing code(s)/technical guide(s) prepared at the National level on contingent crop plans, to be followed in the event of flood occurrence ? If so, please supply six copies thereof.

4. Please furnish production analysis for Kharif and Rabi season crops for selected flood prone districts in the States of U. P., Bihar, West Bengal, Assam and Orissa year-wise from 1966 to 1976.

5. (a) Soil and water conservation/afforestation measures have been undertaken under the Centrally-sponsored schemes in 30 river valley projects. Please supply relevant information about the status of implementation of these schemes for each of the river valley projects in the attached proforma 5(a).

(b) If any quantitative evaluation has been made of the benefits (physical and monetary) accrued from these schemes in terms of increase in crop yields, moderation of flood flows and reduction in silt discharge, please supply six copies each of such evaluation reports. Otherwise, please furnish a note giving your observations on the above mentioned benefits obtained in the field from these schemes.

6. Soil and water conservation programmes have also been undertaken in the upper catchments of the flood-prone rivers other than the 30 river valley projects mentioned in para 5(a) above. Please furnish information regarding the same showing aggregate figures as follows :

(i) Total critical area
(ii) Total estimated cost of the treatments
(iii) Area treated up to 31-3-1977
(iv) Expenditure incurred up to 31-3-1977
(v) Targeted date for completion of treatment of the total critical area
(vi) Benefits (physical and monetary) accrued from these works.

7. (a) The National Forest Policy, 1952, has prescribed that in the country as a whole, one-third of its total land should be maintained under forest, As a safeguard against denudation, about 60% has been suggested for the Himalayas, the Deccan and other mountainous tracts liable to erosion.

Accordingly, afforestation programmes may have been undertaken during different Plan periods to achieve the National goals. Please furnish relevant information in the attached proforma No. 7(a), for the upper catchments of the 30 river valley projects mentioned in para 5(a) above.

(b) If any quantitative evaluation (physical and monetary, if possible) has been made of the benefits accrued from the above afforestation works on moderation of flood flow, reduction in silt discharge, timber yield, etc., please furnish six copies each of these reports.

If no evaluation report is available, please furnish a note with relevant supporting data on the benefits of the afforestation works.

8. (a) Please furnish a note on the policy for controlling deforestation and timber extraction in general and specifically as applicable to the river valley projects.

(b) Please also furnish your assessment of the effects of such deforestation on the increase in the silt discharge and the measures adopted for minimising the same.

9. Is there any action programme for controlling shifting cultivation, especially in the north-eastern hill States, Orissa etc. with a view to minimising flood and silt problems while increasing the agricultural production ?

Please furnish a note and details therefor by specific areas or in general, as the case may be.

10. Have there been any 'area development programmes' implemented in the flood-prone areas of U.P., Bihar, West Bengal, the Assam Valley, and, the coastal deltas of Orissa and Andhra Pradesh ?

If so, a copy each of such projects may be furnished along with copies of their latest progress reports.

11. Does the Department make any assessment of flood damages to agriculture in the country ? If so, please furnish a note indicating the methodology and suggestions for improvement, if any.

12. (a) Has the Department suggested any guidelines ensured ?

(b) Has a procedure been laid down for working out benefits-cost analysis of soil conservation/afforestation projects ?

Are there any manuals or guidelines issued by the Department in this connection ? If so, please furnish six copies of each.

Please furnish two illustrative examples of the analysis.

13. What criteria have been adopted in each Plan for determining (a) the total outlay on soil conservation/afforestation and (b) for sanctioning individual schemes ?

14. (a) How are the soil conservation/afforestation programmes in river valley catchments financed ? Would you suggest any modification in this procedure ?

(b) The draft Fifth Five-Year Plan recommends taking up of developmental programmes for reclamation of ravine lands with the assistance of institutional finance. Can this approach be adopted for programmes of soil conservation/afforestation in river valley catchments ?

15. The soil conservation/afforestation works continue till now as Government programmes executed mostly with Government funds.

Please furnish a note indicating the steps, if any, being taken to encourage the local people to take up these measures on their own.

16. Please furnish a note detailing suggestions, if any, for evolving a comprehensive approach to the problem of floods in the country and the appropriate organisational set-up therefor at the National and State level.

PROFORMA 5(a)

SOIL CONSERVATION SCHEMES IN THE RIVER VALLEY CATCHMENTS UNDER THE CENTRALLY-SPONSORED PROGRAMME

1. Name of Scheme
2. Total catchment area of the river valley project (sq. km.)
3. Critical area of the catchment requiring treatment (1000 ha.)
4. Area for which treatment has been proposed in the Scheme (1000 ha.)
5. Cost of the Scheme (Rs. lakhs)
6. Date of start of scheme
7. Actual/anticipated date of completion
8. Progress made : (Area 1000 ha.)
   (Cost Rs. lakhs)

Plan period	Type	Area	Cost	Type	Area	Cost	Total	
							Area	Cost
Third Plan 1961—66								
Annual Plans 1966—69								
Fourth Plan 1969—74								
Fifth Plan 1974—79 (proposed)								

(Please add additional columns, if required)

9. Remarks

Notes : (1) Types of work in 8 include contour bunding, gully plugging, check and detention dams, terracing etc.

(2) Please give, in the Remarks column, an assessment of the quantitative effects of the work relating to discharge, sediment, vegetative cover, agricultural yields (mentioning cover/grasses) etc., both in physical & monetary terms.

PROFORMA 7(a)

PROGRESS OF AFFORESTATION IN RIVER VALLEY CATCHMENTS

Area 1000 HA.
Cost Rs. Lakhs.

Sl. No.	Name of river valley project	Area in catchments			Anticipated completion date of column 5	Expenditure		Remarks
		Total	Under forest as on 31-3-77	Additional proposed for afforestation		As up to 31-3-77	Future anticipated	
1	2	3	4	5	6	7	8	9

ITEMS ON WHICH INFORMATION IS REQUESTED FROM THE DEPARTMENT OF AGRICULTURAL RESEARCH AND EDUCATION

1. (a) Please furnish a note on the research programmes carried out so far in the field of watershed hydrology, land use pattern, soil conservation etc. along with the major findings relating to rainfall-runoff relation, soil loss, crop yield etc.

(b) To what extent have these findings been applied in the field under the Centrally-sponsored soil conservation schemes in the 30 river valley projects and with what results? Please furnish a note.

2. Based on your research findings has there been any appropriate technology developed to improve agricultural production in the flood-prone areas specially in the States of U.P., Bihar, West Bengal, Orissa & Assam? If so, please furnish a note detailing the agronomic practices, crops/varieties, cropping patterns, agricultural implements/machinery, as well as alternate land use, if any, for livestock, pisciculture, aquaculture, horticulture etc.

3. (a) Based on your research findings and results from field verification studies, please furnish a note listing the flood tolerant crops and varieties along with their agronomic practices introduced since 1966 in the flood-prone areas, specially in U.P., Bihar, West Bengal, the Assam Valley, and, tidal coastal deltas of Orissa and Andhra Pradesh.

Please also furnish a note describing their performance as compared with traditional crop varieties.

(b) Similar information may please be furnished for areas suffering from drainage congestion.

Please also supply information regarding deep water paddy.

(c) Is any research study being done on the effect of deposition of silt during floods on soil fertility/productivity ?

If so, please furnish six copies of the report or furnish a note detailing the study and the conclusions arrived at.

4. A number of 'Jheels'/'Beels' (depressions) as also other inland water bodies occur in the flood plains of rivers. Please state if you have developed any appropriate technology to utilise these water bodies for profitable pisciculture/aquaculture.

Please furnish a note on your recommendations. Please also state whether such developments would be successful if these inland water bodies are subject to periodical flooding with silt-laden flood waters.

5. Please furnish a note detailing suggestions, if any, for evolving a comprehensive approach to the problem of floods in the country and the appropriate organisational set-up therefor at the National and State level.

ITEMS ON WHICH INFORMATION IS REQUESTED FROM THE DEPARTMENT OF IRRIGATION

1. The following Committees were constituted by the Government :—

(i) High Level Committee on Floods (1957)

(ii) Ministers' Committee on Flood Control (1964)

(iii) Ministers' Committee on Floods & Flood Relief (1970).

Please supply copies of Government orders/directives issued on each of the recommendations contained in the Reports of the above Committees.

Please also state how the implementation of the accepted recommendations is ensured and the present status of implementation.

2. Information may please be supplied on the status of implementation of the following specific recommendations :—

(a) Ministers' Committee on Flood Control (1964) :

(i) The idea of flood insurance (page 60-61).

(ii) Intensified training of officers in soil conservation with special reference to flood control (page 74).

(iii) Intensified training in aerial photo interpretation (page 74).

(iv) A suitable organisational set up in the CWPC to help the States in various aspects of soil conservation measures vis-a-vis flood control including the work to be done in neighbouring countries (page 74).

(v) Include examination of the problems of soil conservation in Assam and adjoining territories, particularly the 6th schedule areas by a Commission (page 74).

(b) Ministers' Committee on Floods and Flood Relief (1970) :

(i) The work of soil conservation in the catchments of inter-State flood-prone rivers should be taken up by the Government of India under the Centrally-sponsored programme (page 89).

(ii) The financing of flood control schemes should be 50% by grants and 50% by loans from the Centre (page 98) (Also recommended by the Ministers' Committee on Flood Control (1964) (page 38).

(iii) The expenditure on drainage schemes should be shared equally by the Centre, the States and the beneficiaries (page 98).

(iv) The State Governments may consider ways and means of raising additional resources by levying an annual cess on the beneficiaries both for capital works and their maintenance (page 99).

(v) The States should ensure adequate funds for maintenance of embankments (page 62).

3. Please furnish report(s) of specific studies, if any, carried out for evaluation of costs, benefits and effectiveness of flood protection/drainage measures initiated in the past.

4. Please supply copies of guidelines, if any, issued on the subject of costs and benefits of flood control/protection and drainage schemes.

5. (a) Please state the basis on which outlays for flood control schemes in the country and the States were recommended to the Planning Commission at the time of formulation of the Five-Year/Annual Plans.

(b) Please state whether while considering the outlays on flood protection & drainage works in the States, the adequacy of matching maintenance requirements is ensured.

6. What are the criteria and the priorities adopted while suggesting flood control/protection & drainage schemes for inclusion in the Plans ?

7. Please indicate suggestions, if any, that may have been considered for raising State resources which could be earmarked for flood protection/drainage schemes.

8. What is the experience of the present pattern of financing of State Plan schemes by way of block loans and grants as far as financing of schemes in the flood control sector is concerned ?

9. Please state the basis on which flood control/protection and drainage schemes are selected for financial assistance provided in the Departments' budget.

10. (a) What is the present status of the flood plain zoning bill circulated to the States in 1975 ?

(b) Please supply copies of rules/regulations/guidelines, if any, framed under the above mentioned Bill.

11. (a) Please supply copies of policy/directive issued in the matter of monitoring, construction and maintenance of flood control/protection and drainage schemes in the States.

(b) Are any specific arrangements made for monitoring the projects for which special assistance mentioned in 9 above is provided ?

12. Please state the present status of the following :—

(i) River Boards Act passed by the Parliament in 1956.

(ii) River Commissions and the National Water Resources Council recommended by the Irrigation Commission. (1969).

13. Please detail the role of the Department and its attached and subordinate offices in the field of flood control.

Please also furnish their organisational set-ups.

14. What is the progress in the adoption by the States of the procedure recommended by the NCAER in their Report on "Scientific Assessment of Flood Damages" ?

Is any other procedure accepted for the assessment of flood damage ?

15. Please state if and how co-ordination is effected in the implementation and sharing of costs of flood control/protection and drainage schemes involving inter-State/State-Central Departments.

Please also state how the release of committed funds is ensured from the Plan allocations of respective States/Central Departments.

QUESTIONNAIRE TO GANGA FLOOD CONTROL COMMISSION

GENERAL

NOTE : Please follow the guidelines detailed in the annexure

G.1 In connection with the preparation of the comprehensive plan of flood control in the Ganga basin, the GFCC would have collected from the States annual flood reports and maps showing the areas affected by floods and drainage congestion.

G.1.1 (a) Has any assessment of area prone to floods been made basinwise/sub-basinwise ?

(b) Please furnish a statement of the extent of areas prone to floods (indicating the definition of "area prone to floods") basinwise/sub-basinwise and a map to the scale of 1 to 1 million (larger scale if required) showing these areas. The flood protection measures implemented and the areas benefited may also be shown in the map.

G.1.2 (a) Have the areas liable to drainage congestion (indicating the definition of "area liable to drainage congestion") been estimated ?

(b) Please furnish details of the areas subject to drainage congestion basinwise/sub-basinwise.

(c) Please also furnish a map to the scale of 1 to 1 million (larger scale if required) showing the areas, the drainage works implemented and the areas benefited by them.

G.2 (a) In connection with the preparation of the overall plan of flood control in the Ganga Basin, the GFCC would have collected the available flood damage statistics from the concerned States from 1954 onwards.

(b) Please supply in proforma G.2.1 Statewise details of the area and population affected by floods.

(c) Please supply similar information basinwise/sub-basinwise in proforma G.2.2.

G.3 (a) The need for periodical river surveys for making an evaluation of the changes in the river regime has been stressed by various Committees on floods. Has the GFCC obtained reports of such surveys from the State Governments in connection with the preparation of the overall plan of flood control/protection in the Ganga Basin ?

(b) If so, please furnish a note on the observations and conclusions arrived at by the GFCC, particularly with regard to the effect of embankments, anti-erosion works, etc., mentioning specific locations, periods of observations, etc., leading to the conclusions.

PROFORMA G.2.1

FLOOD DAMAGE STATEWISE (GANGA BASIN)

Area '000 ha.
Population-million

State/ Part of State	Geographical area of the State/ Part of State	Area prone to Floods	Total area affected								Cultivated area affected							
			1954—61		1961—66		1966—74		1974—76		1954—61		1961—66		1966—74		1974—76	
			Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Total (Cols. 2 to 36)																		

State/ Part of State	Geographical area of the State/Part of State	Area prone to Floods	Irrigated area affected								Population affected								Remarks
			1954—61		1961—66		1966—74		1974—76		1954—61		1961—66		1966—74		1974—76		
			Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	
1	2	3	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36

Note : (i) Please also show sub-totals for each State/part of State.
(ii) Source of information may be indicated.

PROFORMA G.2.2

Area '000 ha.
Population-million

FLOOD DAMAGE IN THE GANGA BASIN

Name of Main tributary basin/sub-tributary basin	Geographical area of '1'	Name(s) of State(s)/ district(s) falling within '1'	Area prone to floods	Total area affected								Cultivated Area affected							
				1954—61		1961—66		1966—74		1974—76		1954—61		1961—66		1966—74		1974—76	
				Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Total for the basin (Cols. 2 and 4 to 37)																			

Name of main tributary basin/sub-tributary basin	Geographical area of '1'	Name (s) of State(s)/ district(s) falling within '1'	Area prone to floods	Irrigated area affected								Population affected								Remarks
				1954—61		1961—66		1966—74		1974—76		1954—61		1961—66		1966—74		1974—76		
				Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	Max.	Ave.	
1	2	3	4	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37

Note: (i) Information may please be furnished in the order—main tributary, sub-tributary from the head downwards.
(ii) Source of data may be indicated.

TERM OF REFERENCE NO. 1

To review the flood protection measures undertaken since 1954 and to make an evaluation of the benefits and effectiveness of the measures undertaken so far with special reference to embankments in reducing the damage

1.1 (a) How many flood control/protection and surface drainage Master Plans for the main river basin/sub-basins have been received from the States in the Ganga Basin for examination?

(b) Have these been prepared keeping in view the guidelines and suggestions made by the High Level Committee on Floods (1957) in Vol. II of its Report and subsequent Committees on Floods?

(c) Please furnish a note by each State giving your observations whether the Plans conform to the above mentioned guidelines/suggestions.

1.2 The GFCC examines individual schemes received from the State Governments and processes them wherever necessary for the approval of the Planning Commission. Based on the experience of the examination of schemes, please furnish the following information;

1.2.1 (a) Whether the schemes are prepared keeping in view the guidelines in the Embankment Manual and other guidelines, if any, issued by the CWC (if any guidelines have been issued by the GFCC, please supply six copies of the same)?

(b) What are the deficiencies if any, generally observed in the investigation, planning and designs of the schemes?

1.2.2 Is the method of protection decided after examining the various alternatives and taking into account the costs and benefits of each alternative or are the schemes prepared for a pre-conceived method of protection?

1.2.3 (a) Since for technical and economic reasons, it is not possible to provide flood protection under all conditions of flow and for all time to come, have any guidelines been issued by the GFCC to the States for regulating developmental activities in the protected areas?

(b) If so, please furnish six copies and state if the guidelines are being followed.

(c) If not, please state whether, at the time of examination of schemes, the GFCC makes suggestions regarding regulation of developmental activities in the protected areas. Please furnish copies of suggestions made/implemented for two schemes in each State.

1.3 *Embankments*

1.3.1 (a) Are the observations/suggestions made by the GFCC communicated to the States and incorporated in the scheme reports before they are sanctioned and implemented? Is there any arrangement in the GFCC for ensuring that the schemes are implemented accordingly?

(b) If not, have any instances come to notice of the GFCC where schemes have been implemented without complying with its observations/suggestions? Please furnish a list of such schemes State-wise indicating briefly the points that have not been complied with.

(c) Have any instances come to notice of the GFCC where some important feature/scope of a scheme as approved has been modified by the State during its implementation? If so, please furnish a list of such schemes Statewise indicating the modifications that have been made and your views on the advisability of the modifications carried out.

(d) Have the above been brought to the notice of the Ministry/Planning Commission?

1.3.2 (a) Have any breaches/overtopping been reported in embankments listed in 1.3.1 which could be attributed to non-compliance with the observations/suggestions made by the GFCC and/or modifications carried out by the State Government in the approved scheme during implementation?

(b) If so, please furnish details with your observations.

1.3.3 (a) Are the likely adverse effects of embankment schemes on the upstream/downstream and the opposite side investigated by model experiments or otherwise and remedial measures proposed simultaneously? If so, do they form an integral part of the embankment scheme?

(b) In what situations are model experiments carried out or suggested?

1.3.4 Are there any instances where soon after the implementation of the original scheme, further measures by way of raising/strengthening/improvements/protection of embankments and/or improvement of drainage in the protected area have been necessitated?

If so, please furnish details of some specific cases (with details of the original scheme and the further measures) in different States, the reasons for further measures the cost of the original scheme and that of further measures. Please, in each case, state your views whether the further measures were such, the need of which could have been foreseen and taken care of at the design stage of the original scheme.

1.3.5 Have you come across cases where retiring embankments may have been technically/economically preferable to heavy protection/anti-erosion works? If so, was the alternative studied/adopted? Please quote specific instances.

1.3.6 Have any instances come to notice of the GFCC during the examination of revised estimates of schemes or in any other connection where maintenance of works has been or is being charged to capital account.

Please furnish note quoting specific instances and the action taken by the GFCC thereon.

1.3.7 (a) Does the GFCC get reports of the enquiries on breaches/overtopping of embankments conducted in the States?

(b) What are the impressions gained from these reports and what are the views/suggestions of GFCC in this regard?

Please furnish a note.

1.3.8 Please furnish a note on the problems that have been experienced in the planning, implementation and operation of inter-state embankment schemes quoting specific cases, and, your suggestions to improve such situations.

1.3.9 Please furnish a note with illustrative examples, if possible giving your suggestions and the basis thereof on the degree of protection to be provided in terms of frequency of floods or any other criterion for :—

(i) predominantly agricultural areas;

(ii) town protection works;

(iii) important industrial complexes, assets and lines of communications.

1.3.10 (a) Please furnish a note giving your assessment and views on the benefits/drawbacks of embankments, discussing the various factors involved.

(b) Also please describe situations/locations where you could consider them suitable/preferable/unavoidable.

1.3.11 (a) Please state whether the use of embankments should be restricted to inspection vehicles and transportation of men and materials during emergent situations or whether their use may be allowed as public highways.

(b) If the latter, please state your views in a detailed note regarding at what locations, under what conditions, construction standards, capital and maintenance expenditure, control etc.

1.4 *Drainage Schemes (Surface)*

1.4.1 (a) Are the observations/suggestions made by the GFCC incorporated in the schemes before they are sanctioned and implemented? Is there any arrangement in the GFCC for ensuring that the schemes are implemented accordingly?

(b) If not, have any instances come to notice of the GFCC where schemes have been implemented without incorporating its observations/suggestions? Please furnish a list of such schemes State-wise indicating briefly the points that have not been complied with.

(c) Have any instances come to notice of the GFCC where some important feature/scope of a scheme as approved has been modified by the State during its implementation? If so, please furnish a list of such schemes State-wise indicating the modifications that have been made and your views on the advisability of the modifications carried out.

(d) Have the above been brought to the notice of the Ministry/Planning Commission.

1.4.2 (a) Have any instances of drainage congestion been reported in the schemes mentioned in 1.4.1 above, which could be attributed to non-compliance with the observations/suggestions made by the GFCC and/or modifications carried out by the State Government in the approved scheme during implementation?

(b) If so, please furnish details with your observations.

1.4.3 Are the likely adverse effects of the upstream drainage works on the lower areas of the scheme or other State(s) investigated and remedial measures proposed simultaneously? if so, are the remedial measures incorporated in the main scheme?

Please furnish specific instances either way.

1.4.4. Are there any instances where soon after implementation of the original scheme, further measures by way of remodelling/improvements etc. have been necessitated?

If so, please furnish details of some specific cases (with details of the original scheme and the further measures) in different States, the reasons for further measures, the cost of the original scheme and that of the further measures. Please, in each case, state your views whether the further measures were such, the need of which could have been foreseen and taken care of at the design stage of the original scheme.

1.4.5 Have any instances come to notice of the GFCC during the examination of the revised estimates of schemes or in any other connection where maintenance costs have been or are being charged to capital account?

Please furnish a note quoting specific instances and the action taken by the GFCC thereon.

1.4.6 Please furnish a note on the problems that have been experienced in the planning, implementation and operation of inter-State drainage schemes quoting specific cases.

Please offer your suggestions to meet such situations.

1.4.7 (a) Do the guidelines, if any, issued by the GFCC suggest the possibility of utilising drainage waters partly or fully to supplement canal flows or for storing in depressions?

(b) If not, are suggestions made in this regard during the examination of drainage schemes?

Please quote specific cases where such suggestions have been made/implemented.

1.4.8 Based on the experience gained so far, please furnish a note with illustrative examples, if possible, giving your suggestions on the bases on which the design discharges of storm water drainage systems may be determined and the criteria to be adopted in the design of drainage for :—

(i) predominantly agricultural areas;

(ii) urban areas;

(iii) important industrial complexes etc.

1.4.9 Please furnish a note giving your assessment and views on the effect of drainage schemes on water-logging and ground water table, changes in crop patterns, amelioration of the area etc.

1.4.10 Please furnish a note giving your assessment and views on the effectiveness of the drainage works in the deltaic tracts.

1.5 *Anti-Erosion Works*

1.5.1 (a) Are the observations/suggestions made by the GFCC incorporated in the schemes before they are sanctioned and implemented? Is there any arrangement in the GFCC for ensuring that the schemes are implemented accordingly?

If not, have any instances come to notice of the GFCC where schemes have been implemented without incorporating its observation /suggestions? Please furnish a list of such schemes State-wise indicating briefly the point that have been complied with.

(c) Have any instances come to notice of the GFCC where some important feature/scope of a scheme as approved has been modified by the State during its implementation? If so, please furnish a list of such schemes State-wise indicating the

modifications that have been made and your views on the advisability of the modifications carried out.

(d) Have the above been brought to the notice of the Ministry/Planning Commission?

1.5.2 Are anti-erosion schmes prepared on the basis of model experiments or based on the experience of past works? If the former, under what situations?

1.5.3 Have any instances of failure of anti-erosion works, listed in 1.5.1 above, come to notice or been reported which could be attributed to the non-compliance of observations/suggestions made by the GFCC or having been implemented without taking into account the recommendations made as a result of model experiments and/or modifications carried out by the State Govt. in the approved scheme during implementation?

If so, please furnish details with your observations.

1.5.4 Are the likely adverse effects of anti-erosion works, upstream, downstream and on the opposite side, studied and remedial measures proposed simultaneously?

If yes, are they incorporated in the Project? Please quote some specific cases.

1.5.5 Are there any instances where soon after the implementation of the original scheme, further measures by way of extensions/strengthening/improvements have been necessitated?

If so, please furnish details of some specific cases (with details of the original scheme and the further measures) in different States, the reasons for further measures, the cost of the original scheme and that of further measures. Please, in each case, state your views whether the further measures were such, the need of which could have been foreseen and taken care of at the design stage of the original scheme.

1.5.6 Please furnish a note on the problems that have been experienced in the planning, implementation and maintenance of inter-State/Centre-State anti-erosion works quoting specific cases.

Please offer your suggestions to meet such situations.

1.5.7 Please furnish a note giving your assessment and views on the performance of anti-erosion works and their drawbacks, if any, and situations/locations where these works are suitable/preferable/unavoidable.

1.6 *Channel Improvements*

1.6.1 Please list the channel improvement works that have been undertaken in different States indicating the methods used and situations in which a particular method has been adopted.

1.6.2 Were these works planned after carrying out model experiments?

1.6.3 Please furnish a note stating your views on the performance and utility of channel improvement works, types, situations/locations where suitable/preferable/unavoidable.

1.7 Please furnish a note indicating your experience of village raising works in Uttar Pradesh and why in recent years there has been less emphasis on the use of this method.

1.8 Is there any arrangement in the GFCC for making periodical evaluation of the flood protection/drainage schemes?

Please furnish a note quoting specific examples giving your assessment of the physical and monetary benefits to the benefited areas after the implementation of the flood protection programmes.

1.9 Have you any views/suggestions regarding the present procedure for examining and processing of flood control/protection and drainage schemes for approval of the Planning Commission? Please furnish a note.

TERM OF REFERENCE NO. 2

To identify the areas where a large number of zamindari and/or unauthorised embankments, bunds and spurs etc., exist; to assess the effect of such constructions on the flood problem; and suggest remedial measures

2.1 Please furnish a note indicating the areas in different States in the Ganga Basin where a large number of zamindari and/or other unauthorised embankments exist.

2.2 What is your general assessment of the utility of these embankments? Please furnish a note.

2.3 Have any instances come to your notice where these embankments have aggravated the flood problem? Please furnish a note giving your suggestions for remedial measures.

TERM OF REFERENCE NO. 3

To identity the areas where construction of roads, highways, railways, etc., and other encroachments into the drains have aggravated flood problems and to suggest measures for improvement including legislative action, if any

3.1 (a) Has the GFCC identified areas where chronic drainage congestion been caused as result of the construction of roads, highways, railways etc. ?

If so, please furnish a note indicating these areas basinwise/sub-basinwise and the action taken thereon.

(b) Please also furnish a map to the scale of 1 to 1 million (larger scale, if required) indicating the areas and the railway lines, National Highways, roads, etc., which have caused the problem.

3.2 The Khosla Committee of Engineers (1957) had recommended "the provision of waterways for railway bridges across natural streams and drains to cater for a maximum recorded flood or flood discharge corresponding to a 50-year frequency, whichever is greater".

The GFCC was "to make an assessment of the existig vent-ways under the road and rail bridges, and, to determine additional waterways to be provided for reducing the drainage congestion to reasonable limits".

In view of the above, please state :

(i) If, in your experience, the norm suggested by the Khosla Committee is adequate and has been adopted by you. If not, have you developed an alternative norm, which please detail with reasons.

If you have divided the Ganga Basin into zones/regions for working out design floods and developed formulae therefor or have these formulae been obtained from some other source ? If the latter, please indicate the source.

Please supply a map (to a suitable scale) of the Ganga basin, showing the zones/regions along with the formulae adopted in each.

(ii) The number of existing vent-ways (by categories : railways, National Highways, State highways, canal crossings etc.) for which the necessary assessment has been made by you, the action taken and the result achieved.

If a complete assessment has not yet been made, please state when you expect to achieve the same.

3.3 The GFCC is represented on the Committees of Engineers set up in the States. What are your views in regard to the functioning and effectiveness of these Committees, especially in regard to matters relating to the distress caused by inadequate waterways ? Please furnish a note also indicating your suggestions, if any.

TERM OF REFERENCE NO. 4

To analyse the damage caused by floods in recent years and to identify the areas requiring immediate flood protection measures

4.1 (a) Has the GFCC made any analysis of the flood damage from 1966 onwards and identified the areas requiring urgent attention ?

(b) If so, please supply list of such areas in each State by the main Ganga Basin/ sub-basins, stating the basis of the categorisation.

(c) Please furnish a map to the scale of 1 to 1 million (larger scale, if required) showing these areas.

4.2 Please furnish in proforma 4.2 details of the damage caused each year in the areas referred to in para 4.1 from 1966 onwards.

4.3 Has the figure of damage from 1966 onwards shown an increasing trend. If so, please indicate the reasons therefor ?

PROFORMA 4.2

DAMAGE CAUSED IN THE AREAS NEEDING URGENT ATTENTION IN THE GANGA BASIN

State
Year

Sl. No.	Location of area (list district whole/part)	Main river/ Tributary/ Sub-tributary causing damage	Area affected (h.)	No. of villages affected	Population affected	Cropped area under the villages (ha.)	*Cropped area affected (ha.)	Crop damage (Rs. lakhs)
1	2	3	4	5	6	7	8	9
Damage in the areas requiring urgent attention (totals of Col. 4-16)								
Total damage in the Ganga Basin of the State during the year including other areas (Col 4-16)								

* if more than once in the same year, please state the area affected each time & strike total.

No. of houses damaged	Value of houses damaged (Rs. lakhs)	No. of human lives lost	No. of cattle heads lost	Loss of public utilities (Rs. lakhs)	Total loss (Rs. lakhs)	Expenditure on relief & rehabilitation (Rs. lakhs)	Remarks
10	11	12	13	14	15	16	17

NOTES : (1) Names of crops damaged may be indicated in the Remarks Col.
(2) Source of data may be indicated.

TERM OF REFERENCE NO. 5

To evolve a comprehensive approach to the problem of floods in the country keeping in veiw the need for optimum and multipurpose utilisation of water resources as also the role of soil conservation and afforestation in flood control

5.1 From the experience of examination of flood control/protection plans and schemes prepared by the State Governments and taking into account the topography, rainfall pattern, magnitude and duration of floods in the Ganga and its tributaries, what are your views on the following :—

NOTES : Please quote examples in support of your yiews gnd specify locations where each may be applicabl)

(i) The scope of utilisation of natural depressions, tals, bheels etc., for moderation of floods ;

(ii) Scope for diversion of flood water to other basins or in the same basin for storage and utilisation;

(iii) Possibility of storing flood waters underground;

(iv) Allowing controlled flooding behind embankments through sluices. Should reverse drainage be effected through the same sluices or special drainge channels?

(v) Technical and economic possibility of construction of storage dams in the upper catchments and their likely effect on floods; and

(vi) Scope of pumping as a measure for relieving drainage congestion.

(vii) Other feasible measures like check dams and soil/water conservation measures.

5.2 (a) Has the GFCC evolved a comprehensive approach towards the problem of floods in the Ganga Basin keeping in view the need for optimum and multi-purpose utilisation of water resources as also the role of soil conservations and afforestation in Flood Control.

If so, please supply six copies thereof.

(b) If not, please furnish a note giving your views/suggestions in this regard.

5.3 Has the GFCC prepared a comprehensive plan for flood control in the Ganga Basin ?

If so, please supply six copies thereof.

TERM OF REFERENCE NO. 6

To make an analysis of the cost and benefits of flood protection measures.

6.1 (a) Has any procedure been laid down by the GFCC for the analysis of benefits and costs of flood control/protection schemes? If so, please furnish a detailed note with examples.

(b) To what extent is this procedure followed by the States?

(c) If no procedure has been laid down by the GFCC, please furnish a note indicating the procedures adopted by different States. Please furnish your views/suggestions in this regard.

TERM OF REFERENCE NO. 7

To suggest criteria for taking up flood protection measures and means of mobilising resources therefor.

7.1 What are the criteria adopted by the GFCC for clearing flood control/protection schemes? Please furnish a note also giving the basis thereof.

7.2 The High Level Committee on Floods (1957) in para 8.4 of volume I of its report, had recommended the pattern of priorities for taking up flood control/protection schemes. Please state if these are being followed. If not, please furnish a note on the alternative pattern adopted with reasons there and suggestions for improvement, if any.

7.3 Please furnish a note giving your views/suggestions on the matter of mobilising resources for financing flood control/protection schemes.

TERM OF REFERENCE NO. 8

To recommend proper land use in the flood plains with a view to minimise damage and to ensure overall increase in agricultural production

8.1 While collecting information for the preparation of comprehensive plans, has the GFCC obtained details of the progress made in the preparation of contour

plans of the flood plain areas and demarcation of flood zones affected by floods of different frequencies? Please furnish a note indicating the extent of areas requiring the preparation of contour plans and the areas for which maps have been prepared Statewise/basinwise.

8.2 Please furnish a note giving your suggestions on the land use in flood plains (separately for protected and unprotected areas) for reducing the overall flood damage and achieving the optimum benefits up to 31-3-1977.

8.3 Will it be adequate if land use regulation is confined to the flood plain or should it be extended to the catchment area as well?

Please furnish a note with your suggestions on the pattern of land use in the catchments.

TERM OF REFERENCE NO. 9

To review the existing arrangements for maintenance of flood protection works and recommend measures for improving the same.

9.1 The GFCC is to ensure proper maintenance of flood protection/drainage works in the Ganga basin. Please furnish a note detailing your organisational set up for this purpose, its functioning and coordination with State organisations.

9.2 (a) Please furnish a note on the basis adopted for annual requirements of funds for the various types of works.

(b) What is the source of maintenance funds?

(c) From your past experience, please state your views regarding efficient control, execution and funding of maintenance of flood protection/drainage works.

9.3.1 If the maintenance is being effected by the States, is the GFCC associated in any manner? If so, please detail, and, state if you have any and what improvements to suggest.

9.3.2 (a) What is your impression regarding the standard of maintenance of flood protection and drainage works in various States in the Ganga basin?

(b) Please furnish a note of schemes where, in your opinion, the maintenance is not adequate along with assessment (personnel, techniques, annual grants, etc.) of the reasons and suggestions for improvement.

TERM OF REFERENCE NO. 10

To review the existing administrative and organisational set-up for flood Control at the Centre and in the States and to suggest improvements where necessary, flood control to include flood forecasting and warning, flood fighting, formulation and implementation of flood protection measures.

10.1 (a) The GFCC acts as the Secretariat for the Ganga Flood Control Board.

Please indicate as to how many times the Board has met since the Commission was set up in 1972?

(b) Please furnish a note giving the important policy decisions taken by the Board at these Meetings and the present stage of their implementation.

(c) Please supply six copies each of the minutes of the last two meetings of the Board.

10.2 Is there any duplication of work between the CWC and the GFCC?

Please furnish a note with your suggestions, for improvement/rationalisation, if any, in this behalf.

10.3 (a) Please list the flood forecasting units under your control and a note regarding when started, general functioning and the benefits derived so far.

Please state if, in your opinion, the number should be increased and the locations where.

(b) Please state if there are any such units set up by the States and their locations, as also your views on their functioning and coordination etc. with the Central units.

(c) Do you think the present situation of units by both the Centre and the States is satisfactory or would you prefer all such units to be under the Central agency?

If the latter, do you think the States should share costs of these units? If so, how?

10.4 The GFCC is to operate flood warning systems.

Please furnish a note on the set-up and functioning of the system in each State, as controlled by you.

Please state if you have any modifications/suggestions in this behalf.

10.5 The functions of the GFCC are as laid down in Government Resolution No. FC-47(2)/72, dated 18-4-72.

Please furnish a note detailing your organisational set-up. In the light of the experience gained so far, please state if you have any views/sugestions in the matter.

TERM OF REFERENCE NO. 11

To examine the present procedure of assessing the flood damage and suggest improvements.

11.1 (a) Has the GFCC laid down any procedure for assessing flood damage?

(b) The Ministry had circulated the procedures recommended by the National Council of Applied Economic Research in their report on "Scientific Assessment of Flood Damages". Is it being followed by the States?

(c) If not, is there any alternative procedure accepted by you? If yes, please supply six copies.

(d) Please furnish a note of your views/suggestions on this item.

TERM OF REFERENCE NO. 12

To examine any other matter related to floods and flood control and make suitable recommendations.

12.1 (a) Land slides may lead to changes in the river courses and increase in the silt load. Does the GFCC keep track of the occurrence of major land slides and obtain reports on their effects on the river conditions and the remedial action suggested/undertaken by the concerned authorities?

(b) If so, please furnish a note indicating locations of the river basins/sub-basins where land slides are frequent, stating the nature of remedial measures that are generally adopted and the views/suggestions of the GFCC.

12.2 Please furnish a note giving the views of the GFCC on the effect of river bed cultivation in the non-monsoon months on river conditions and flow during floods?

12.3 Would the GFCC suggest promulgation of River Conservancy Acts? If so, please outline in brief the important provisions which may be incorporated.

12.4.1 Are environmental aspects of flood control/protection and drainage works covered in the project reports and remedial measures as necessary provided therein?

If not, does the GFCC consider these aspects and suggest measures while clearing the projects?

Please furnish a detailed note with specific examples.

12.4.2 Please furnish a note of the GFCC's views/suggestions regarding environmental aspects relating to flood control/protection works and their ancilliaries.

12.5 There are a number of abandoned river channels and depressions etc. in the Ganga Basin. Are they being put to any beneficial use at present?

Do you think, they could be developed for profitable pisciculture, acquaculture etc.?

QUESTIONNAIRE TO THE INDIA METEOROLOGICAL DEPARTMENT

NOTE : Please follow the guidelines detailed in the annexure

1. Please supply a map to a suitable scale showing the different meteorological regions, also, marking thereon boundaries of States and river basins as well as locational points like important cities, etc.

2. (a) What is the standard suggested by the IMD for the dispersion of rain gauge stations (ordinary and self-recording) in :—

(i) plain areas,

(ii) sub-mountainous areas.

(iii) Hill areas

(b) Please furnish information in proforma 2.1 of the existing number of rain gauge stations in each State, in proforma 2.2 for major river basins/sub-basins and in proforma 2.3 for the country as a whole.

(c) Please indicate the yardstick adopted for fixing the number of rain gauge stations (ordinary and self-recording) that should be maintained by the IMD in each State/river basin.

3. (a) Has the IMD, in consultation with the States, prepared a programme for the augmentation, where required of the rain gauge stations so as to achieve the dispersion standards as per 2(a) and (i) above.

(b) If so, please furnish in proforma 3.1 the schedule of augmentation of the rain gauge stations in each State, in proforma 3.2 for each major river basin/sub-basin and in proforma 3.3 for the country as a whole.

4. (a) Are the data of the reporting rain gauge stations maintained by the State Governments and other organisations received in the IMD regularly?

Are such data compiled along with the data of the IMD and published?

Please furnish a note indicating the period up to which the data has been compiled and published for the different States/basins.

(b) Please furnish six copies each of the published data for the latest two years.

5. Please furnish a note detailing the checks exercised by the IMD to ensure dependability of the data published by the IMD and other organisations.

6. The Khosla Committee of Engineers (1957) had recommended the setting up of a cell in the IMD for carrying out the following hydro-meteorological studies in coordination with the CWC :—

(i) Systematic analysis of past storms in different meteorological regions of the country to derive the maximum depth-duration-area data and to study the characteristics of the meteorological situations responsible for these storms.

(ii) To collect the data of all self-recording rain-gauges and scrutinise and process them,

(iii) To study the duration and intensity of rain fall for different return periods.

The Ministers' Committee on Flood Control (1964) had emphasised the need for the following studies in relation to flood control :—

(i) Field collection of storm data,

(ii) Basin rain-fall probability studies,

(iii) Rain fall intensity frequencies for local drainage design,

(iv) Standard project storm determination.

Please furnish a note indicating the progress made in carrying out each of the studies recommended above. Have any reports/technical memoranda been prepared for the various meteorological regions giving the results of these studies? If so, please supply six copies of each.

If not, please furnish a note giving the progress made in the studies and charts showing the results for different regions.

7. Please furnish a note and map(s) as required, describing the rainfall features in India and characteristics of cyclonic storms and depressions causing heavy rainfall and consequent floods in different parts of the country.

8. Has any estimate of flood potential of snowmelt been made?

If so, please furnish a note indicating the basins in which the snow melt can substantially contribute to the flood problems, also whether and not a quantitative assessment could be made.

9. The Ministers' Committee on Floods Relief (1970) had observed that a study of the Himalayan snow-fields with the aid of photographs and radiation data from the meteorological satellites can throw significant light on snow hydrology of the rivers. Has any study been carried out by the IMD in this regard?

Please furnish a note indicating the status and results of those studies and the use they are being put to in the matter of forecasting floods.

10. The above Committee had observed that for reliable forecasts of floods sufficiently in advance the following meteorological set-up would be necessary :—

(i) Adequate network of rain gauge stations of the measuring, recording and telemetering variety in order to provide a reliable estimate of the total rainfall over the catchment area during a specified period.

(ii) Network of telecommunications for quickly transmitting data from rain guage stations to flood forecasting centres.

(iii) Forecast facility for indicating quantitatively the expected rainfall over the catchment area during the forecast period.

(iv) Computational facility for quick conversion of actual and forecast rainfall over the catchment into the expected run-off.

(v) A research unit for constantly updating computational procedures and forecast formulae and reviewing the results of the techniques developed.

For this purpose, the IMD had prepared a detailed scheme envisaging a set-up of well-equipped flood meteorological offices. The details, of this proposal were to be finalised by the IMD in consultation with the CWC.

Please furnish a note indicating the progress made on each of the items mentioned above and the overall set-up of the Field Meteorological Organisation as up to 31-3-1977. Also, please detail the further yearwise time-schedule.

11. Please indicate the manner in which coordination is effected between the flood meteorological offices of the IMD and the forecasting units set up by the CWC and the States.

Are the present arrangements satisfactory?

Please state your suggestions/views for improvements, if any.

12. It is understood that the IMD has undertaken the manufacture of recording and telemetering type of rain gauges and some experiments have been carried out at site locations. Please indicate the present position regarding the capacity developed the IMD for the manufature of such rain gauges and their actual performance in the field.

13. Are the radar equipments proposed in the scheme manufactured indigeneously? If so, how is their performance?

Please furnish a note detailing the above information.

14. Please furnish a note giving details of the arrangements made by the IMD for the issue of forecasts of heavy rainfall, cyclonic storms and tidal waves (storm surges) to the State Governments and other organisations. Please also indicate in the note how the data received from the satellites, World Weather Watch (WWW) scheme

of the WMO and from the World Meteorological Centres (WMC) at Moscow, Melbourne and Washington DC are made use of.

15. Mention is being made of the possibility of modification of weather for reducing the flood damage. Please indicate the present status of such studies in the country and abroad.

Please supply six copies of the literature, if any on the progress made.

Also please furnish your views and comments on the applicability/utility of the method.

16. Please supply additional information/suggestions/literatures/reports, if any, which may be of assistance to the Ayog.

PROFORMA 2.1

DISPERSION OF RAIN GAUGE STATIONS (STATEWISE)

State :

Type	Area	Number of reporting stations							
		Ordinary				Self-recording			
	Extent (sq. km.)	Maintained by IMD	Maintained by State	Maintained by other organisations	Total	Maintained by IMD	Maintained by State	Maintained by other organisations	Total
1	2	3	4	5	6	7	8	9	10
				As on 1-4-64					
Plain									
Sub-mountainous									
Hill									
Total									
				As on 1-4-77					
Plain									
Sub-mountainous									
Hill									
Total									

Type	Number of non-reporting Stations			Grand total (Col 6+10+14)	Area of dispersion station (sq km)@	Remarks
	Telemetering* type	Ordinary	Self-recording	Total		
	11	12	13	14	15	16	17
			As on 1-4-64				
Plain							
Sub-mountainous							
Hill							
Total							
			As on 1-4-77				
Plain							
Sub-mountainous							
Hill							
Total							

*Please indicate the agency maintaining these stations.

@Please indicate how caculated.

PROFORMA 2.2

DISPERSION OF RAIN GAUGE STATIONS (BASINWISE)

River Basin

Area		Number of reporting stations							
		Ordinary				Self-recording			
Type	Extent (sq.km)	Maintained by IMD	Maintained by State	Maintained by other organisations	Total	Maintained by IMD	Maintained by State	Maintained by other organisations	Total
1	2	3	4	5	6	7	8	9	10
		As on 1-4-64							
Plain									
Sub-mountainous									
Hill									
Total									
		As on 1-4-77							
Plain									
Sub-mountainous									
Hill									
Total . . .									

Area		Telemetering type*	Number of non-reporting stations			Grand total (Col. 6 + 10 + 14).	Area of dispersion per station (sq.km.) @	Remarks
Type	Extent (sq. km)		Ordinary	Self-recording	Total			
1	2	11	12	13	14	15	16	17
		As on 1-4-64						
Plain								
Sub-mountainous								
Hill								
Total								
		As on 1-4-77						
Plain								
Suq-mountainous								
Hill								
Total								

*Please indicate the agency maintaining these stations.

@Please indicate how calculated.

ROFORMA 2.3

DISPERSION OF RAIN GAUGE STATIONS IN THE COUNTRY

Area		Number of reporting stations							
		Ordinary				Self-recording			
Type	Extent (sq.km.)	Maintained by IMD	Maintained by State	Maintained by other Organisations	Total	Maintained by IMD	Maintained by States	Maintained by other Organisations	Total
1	2	3	4	5	6	7	8	9	10
		As on 1-4-64							
Plain									
Sub-mountainous									
Hill									
Total . . .									
		As on 1-4-77							
Plain									
Sub-mountainous									
Hill									
Total . . .									

Area		Tolemetering type*	Number of non-reporting stations			Grand Total (Col. 6+10+14)	Area of dispertion station (sq.km.) @	Remarks
Type	Extent (sq.km)		Ordinary	Self-recording	Total			
1	2	11	12	13	14	15	16	17
			As on 1-4-64					
Plain								
Sub-mountainous								
Hill								
Total								
			As on 1-4-77					
Plain								
Sub-mountainous								
Hill								
Total								

* Please indicate the agency maintaining these stations.

@Please indicate how calculated.

PROFORMA 3.1

S CHEDULE OF AUGMENTATION OF RAIN GAUGE STATIONS (STATEWISE)
(From 1-4-77)

State

	Type of area and agency								Remarks
	Plain		Sub-mountainous		Hill		Total		
	IMD	State	IMD	State	IMD	State	IMD	State	
1	2	3	4	5	6	7	8	9	10
1. Additional number of stations required to bring the area of dispertion to standard.									
(a) Ordinary									
(b) Self-recording									
(c) Total									
2. Proposed augmentation during the balance period of Fifth Plan (1-4-77 to 31-3-79)									
(a) Ordinary									
(b) Self-recording									
(c) Total									
(d) Telemetering									
3. Proposed augmentation during the Sixth Plan (1-4-79 to 31-3-84)									
(a) Ordinary									
(b) Self-recording									
(c) Total									
(d) Telemetering									

PROFORMA 3.2

SCHEDULE OF AUGMENTATION OF RIVERGAUGE STATIONS (BASINWISE)
(From 1-4-77)

River Basin

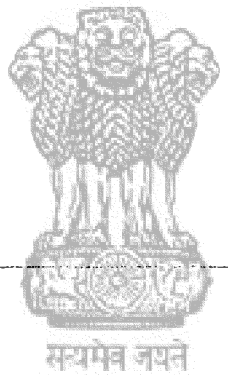
	Type of area and agency								Remarks
	Plain		Sub-mountainous		Hill		Total		
	IMD	State	IMD	State	IMD	State	IMD	State	
1	2	3	4	5	6	7	8	9	10
1. Additional number of stations required to bring the area of dispertion to standard									
(a) Ordinary									
(b) Self-recording									
(c) Total									
2. Proposed augmentation during the balance period of Fifth Plan (1-4-77 to 31-3-79)									
(a) Ordinary									
(b) Self-recording									
(c) Telemetering									
3. Proposed augmentation during the Sixth Plan (1-4-79 to 31-3-84)									
(a) Ordinary									
(b) Self-recording									
(c) Total									
(d) Telemetering									

PROFORMA 3.3

SCHEDULE OF AUGMENTATION OF RAINGAUGE STATIONS IN THE COUNTRY

(From 1-4-77)

	Type of area and agency								Remarks
	Plain		Sub-mountainous		Hill		Total		
	IMD	State	IMD	State	IMD	State	IDM	State	
1	2	3	4	5	6	7	8	9	10
1. Additional number of stations required to bring the area of dispertion to standards :									
(a) Ordinary									
(b) Self-recording									
(c) Total									
2. Proposed augmentation during the balance period of Fifth Plan (1-4-77 to 31-3-79) :									
(a) Ordinary									
(b) Self-recording									
(c) Telemetering									
(d) Total									
3. Proposed augmentation during the Sixth Plan (1-4-79 to 31-3-84)									
(a) Ordinary									
(b) Self-recording									
(c) Telemetering									
(d) Total									



QUESTIONNAIRE TO THE MINISTRY OF SHIPPING & TRANSPORT

Note : Please follow the guide lines detailed in the Annexure

1. Please furnish six copies of the extracts from the relevant National Highways Act which lays down the procedure for consultation with the State Governments in regard to the alignment of National Highways, provision of waterways for the crossings of rivers, streams, drains, etc., and stipulates the liability of the National Highways and the State Governments for bearing the cost of later augmentation of waterways for bridges.

2. Is there any manual or memorandum issued by the National Highways Department which lays down the methodology for determining the waterways for National Highway bridges across alluvial and other rivers? If so, please supply six copies of the same.

3. (a) The Ministry of Railways had appointed the Khosla Committee of Engineers (1957) to examine *inter alia* the method for determining the maximum discharge for the design of waterways under bridges in different regions of the country. This Committee had recommended the provision of waterways under bridges in different regions of the country. This Committee had recommended the provision of waterways to cater for the maximum dischage recorded for a period of not less than 30 years or a discharge corresponding to a 50-year frequency as determined from recorded floods. Studies for evolving formulae for the determination of design discharges were to be carried out under the short-term and long-term plans for use by the Railways and other concerned organisations including the National Highways.

Has the National Highways Organisation been associated with the development of these formulae? Are the formulae so developed being adopted by the National Highways in the design of their bridges?

(b) If not, please indicate the formulae that are being adopted by the National Highways for determining the design discharges for their bridges.

(c) Please supply a map to the scale of 1 to 1 million showing the zones/regions in which the country has been divided for the purpose and the formula adopted for each, also showing the State boundaries, National and State Highways, major railway lines and cities, etc.

(d) Please state the basis of each formula, as also what and why changes, if any, have been made in the basis and formula(e) since 1960.

4. (a) Taking into account the formulae adopted, have the National Highways made a review of the waterways of their bridges after 1960?

(b) Please furnish a note giving the results of such a review, indicating the number of bridges reviewed, number of bridges where waterways were found inadequate/excessive. Also please state the numbers in which it was considered necessary to augment/reduce the waterway provided. The information may please be supplied by giving totals of each type in the zone/region referred to in question 3.

5. (a) Arising out of 4 above, please supply information in proformae 5.1 and 5.2 regarding bridges (designed for discharges exceeding 3000 cumecs) where according to the review, waterways were found to be inadequate/excessive respectively.

(b) In the cases of bridges reviewed and listed in proforma 5.1 and 5.2, have there been any subsequent complaints from the State Governments/Railways regarding distress caused to the areas upstream of the bridge on account of the design flood or the design H.F.L. being exceeded? If so, please furnish information in proforma 5.3 and also a note for each of the bridges indicating the reasons for the distress conditions, if analysed and action taken/proposed to be taken.

6. (a) What are the measures taken to keep the waterways clear of silt and obstruction so that they are effective whenever the design flood occurs?

(b) Up to what distance upstream and downstream of the highway bridges do the National Highways carry out surveys and maintenance/conservancy operations? At what intervals of time are such surveys carried out?

7. (a) Are there any specific areas (other than those mentioned in 5 above) brought to the notice of the National Highways by the State Governments/Railways where distress conditions have been experienced by flooding/drainage congestion due to inadequacy of waterway at a National Highway bridge, obstruction of drainage by the National Highway embankments, silting of the link-drains, etc., and request made for providing additional waterways, new openings, clearance of link-drains, etc. Please furnish information by States/Railways from 1966 onwards and the action taken thereon.

(b) Please also furnish a map to the scale of 1 to 1 million (or other suitable scale) showing the areas where distress conditions have been pointed out by State Governments/Railways, also showing thereon the concerned National Highways and bridges in these areas.

8. (a) Where railway/State Highway/National Highway bridges/canal crossings are located in close vicinity on the same river, please state if mutual consultations are held between the concerned organisations while fixing the waterways for such bridges.

(b) Have there been any instances where such consultations have not been held and consequently adverse flow conditions have occurred at any National Highway bridge? If so, please supply necessary details in each case, the action taken in this behalf and the results thereof.

9. (a) Do the National Highways carry out observations of discharges at selected National Highway bridges? Please furnish information in proforma 10 of the gauge and discharge sites maintained by the National Highways.

(b) The location of these sites may be shown on a map of suitable scale.

(c) Please furnish a note on the method of computation of flood discharges at these sites.

10. At the sites where discharge observations are being carried out, have the reasons for exceeding the design flood level at discharges less than the design discharge, if such has ever been the case, been investigated? Please furnish a note giving the location of such cases and the reasons assessed.

11. (a) Please furnish in proforma 12.1 the damage where caused to any of the National Highways from 1971 onwards and in proforma 12.2, the details of damage caused by major disruptions due to floods/failure of upstream works.

(b) Where there have been major disruptions due to breaches and washing away of bridge(s), have the reasons been investigated? If so, please furnish notes for each of the major disruptions.

12. (a) Are the Technical Advisory Committees of the State Flood Control Boards and the Committees of Engineers in the States on which the National Highways are represented, adequate for effecting the necessary co-ordination and ensuring that the works undertaken by one agency do not affect those of any other?

(b) Have there been any instances where flood protection works like embankments, spurs, drainage channels, etc., and other works which might affect National Highways, have been constructed by any State Government/Railways without consulting the National Highways? If so, please list them Statewise/Railwaywise, mentioning the adverse effects, if any, the action taken by the National Highways and the results thereof.

13. Are matters relating to distress caused by inadequate waterways discussed at the meetings of the State Committees of Engineers/Technical Advisory Committees of the State Flood Control Boards? Does the National Highways participate in those meetings regularly? Have these Committees helped in achieving the desired results?

Please furnish a note detailing the position Statewise; also comments/suggestions, if any.

14. Based on the recommendations of the Ministers' Committee on Flood Control (1964), the then Ministry of Irrigation and Power had constituted Standing Committees with the Chairman, Central Water & Power Commission as Chairman and the representatives of the National Highways and State Governments concerned as Members to settle disputes regarding the extent of additional waterways to be provided and the sharing of costs. Have the National Highways referred any such disputes to the standing Committees since April, 1971? Have any of these been settled?

Please furnish a note giving details Statewise, mentioning, in each case, the number of the National Highway the details of the dispute and the decision.

15. Is the present arrangement of the Standing Committees for the settlement of disputes regarding the waterways with the State Governments satisfactory or do you consider any improvement necessary? If so, please state in what direction.

16. Are there any areas/ones in the country where National Highways have experienced severe conditions of silting/aggradation/blocking of their bridges?

If so, please furnish a note thereon, also stating your views/reasons/remedial measures etc.

PROFORMA 5.1

NATIONAL HIGHWAY BRIDGES WITH INADEQUATE WATERWAYS

Sl. No.	Zone/Region	National Highway number	River/Tributary	Location of Bridge	State/District	Date of review	Design discharge (cumecs)		Max. flood so far with date	Waterway (clear width)		Status of augmentation of waterway	Remarks
							Previous	As reviewed		Previous	Proposed after review	Actual/Anticipated date of completion	
1	2	3	4	5	6	7	8	9	10	11	12	13	14

Notes : (i) Information to be supplied for bridges with design discharge exceeding 3000 cumecs.
(ii) Waterway on the spill berms wherever provided may also be inclued in Cols. 11 & 12.

PROFORMA 5.2

NATIONAL HIGHWAY BRIDGES WITH EXCESSIVE WATERWAYS

Sl. No.	Zone/Region	National Highway number	River/Tributary	Location of bridge	State/District	Date of review	Design discharge (cumecs)		Max. flood so far with date	Waterway (clear width)		Status of effecting reduction in waterway	Remarks
							Previous	As reviewed		Previous	Proposed after review	Actual/Anticipated date of completion	
1	2	3	4	5	6	7	8	9	10	11	12	13	14

Notes : (i) Information to be supplied for bridges with design discharge exceeding 3000 cumecs.
(ii) Waterway on the spill berms wherever provided may also be included in Cols. 11 & 12.

PROFORMA 5.3

BRIDGES REVIEWED WHERE DISTRESS CONDITIONS HAVE BEEN POINTED OUT BY THE STATE GOVERNMENTS/SUBSEQUENTLY

Sl. No.	National Highway number	River/ tributary	Location of bridge	Reference to Sl. No. in		Design* flood discharge after review (cumecs)	Design H.F.L. after review (GTS)		Number of times, if any, when the flood discharge has exceeded the design discharge since augmentation/reduction (give discharge, gauge (GTS), date and year.	Number of times, if any, when flood level has exceeded the design H.F.L. since augmentation/reduction (give gauge (GTS), discharge, date and year)	Remarks
				Proforma 5.1	Proforma 5.2		Upstream	Down stream			
1	2	3	4	5	6	7	8	9	10	11	12

*Please state in the Remarks column if this is the 50-year or a higher observed flood.

PROFORMA 10

GAUGE AND DISCHARGE SITES MAINTAINED BY THE NATIONAL HIGHWAYS

Sl. No.	Name of the river/sub-basin	Location of bridge & National Highway number	State/ district	Catchment area in Sq Km upto observation site	Nature of observation		Year of start of observations		Design flood discharge of the bridge (cumecs) and design H.F.L. (GTS)	Max. flood discharge recorded after start of observations (cumecs) with date and corresponding gauge (GTS)	Max. flood level (GTS) attained (with date) and corresponding discharge in cumecs	No. of times, if any, when the flood discharge has exceeded the design discharge since (1960 give discharge, gauge (GTS) and date)	No. of times, if any, when HFL has exceeded the design HFL since 1960 (give gauge(GTS), discharge and date)	Remarks
					Gauge	Discharge	Gauge	Discharge						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

PROFORMA 12.1

National Highway No.

DAMAGE CAUSED TO NATIONAL HIGHWAYS DURING FLOODS/FAILURE OF UP-STREAM WORKS

Year	Total number of breaches	Total number of bridges washed away	Cost of restoration	Other losses, if any, estimated	Total loss	Remarks
				(..... Rs. lakhs .....)		
1	2	3	4	5	6	7
1971						
1972						
1973						
1974						
1975						
1976						

PROFORMA 12.2

National Highway No.
Year

DAMAGE AND MAJOR DISRUPTION TO NATIONAL HIGHWAYS DUE TO FLOODS/FAILURE OF UPSTREAM WORKS

Sl. No.	Location of disruption	River/tributary basin	Nature of disruption (whether due to breaches or damage/ washing away of the bridges)	Cause of damage (floods/ failure) of upstream works	Period of disruption date(s)	Cost of restoration	Other losses, if any, estimated	Total loss	Remarks
						(..... Rs. lakhs.....)			
1	2	3	4	5	6	7	8	9	10

ITEMS ON WHICH INFORMATION IS REQUIRED FROM THE PLANNING COMMISSION

1. Please furnish a note on the role of the Planning Commission in the field of flood control and the organisational set-up for the purpose.

2. Please indicate the priorities and the basis thereof allotted to flood control sector in the overall scheme of development in the various Five Year Plans.

3. Please furnish notes/reports of the studies effected by the Planning Commission to investigate the impact of floods on the developmental activities of flood-prone areas in comparison with flood-free areas.

4. Please supply Statewise targets and achievements—both physical and financial—in the flood control sector during each of the Five Year Plans indicating the reasons for short-falls, if any.

5. Please furnish a report of reviews/evaluations, if any, effected by the Planning Commission of the costs, benefits and effectiveness of flood protection measures, particularly of embankments.

6. Please supply copies of the reports or notes covering salient features of socio-economic surveys, if any, effected by the Planning Commission in the flood-prone areas-protected or otherwise.

7. (a) Please indicate whether since 1966, sanctions/additional funds/advance Plan assistance has been given to some flood protection works on priority basis and, if so, whether they were selected from a number of claimant schemes and the criteria governing their selection.

Please also state how timely implementation of such priority schemes is ensured.

(b) Please supply a list of the schemes that have received priority and these pending similar consideration.

8. (a) Please detail the policy implications/decisions that have emanated from the assessment and analysis of the flood damage in the country as a whole or by regions made by various Committees and by the Planning Commission on their own.

(b) Please furnish report(s) of the analysis and evaluation effected by the Planning Commission of the phenomenon of increasing trend in damage figures observed in recent years despite the implementation of a number of flood protection measures.

(c) Please indicate the machanism, if any, adopted by the Planning Commission for verifying the figures of damage—physical and monetary—which form important data in the formulation of schemes in the flood control sector.

9. (a) Please supply details of perspective plan of flood control along with matching plans for soil conservation and afforestation in the catchment areas formulated by the Planning Commission.

(b) Please indicate the present status of the preparation of integrated and comprehensive plans of flood control etc., to which attention has been drawn in the various Five Year Plans.

10. Please furnish details of the quantitative assessment, basinwise, if any made, of availabilities and projected demands of water resources for planning their optimum utilisation.

11. (a) Please furnish copies of criteria, if any, laid down for acceptance of the various categories of the schemes in the flood control sector as well as soil conservation/afforestation schemes in the upper catchments of flood-prone rivers.

(b) Please supply reports/guidelines, if any, issued for projects under the flood control sector similar to the report entitled "Criteria for Appraising the Feasibility of Irrigation Projects" issued by the Planning Commission.

(c) Please mention the rate of interest adopted presently for project appraisals.

12. Please supply appraisal reports of some typical schemes in the flood control sector prepared in the Planning Commission.

13. Please mention the procedure adopted for taking care of risks, uncertainties, price changes etc., during the economic life of projects while working out their costs and benefits.

14. Please state if consideration has been given to the social costs and benefits approach to schemes in the flood control sector and, if so, please supply a note on the methodology and and application with an illustrative example.

15. Please furnish reports of quantitative assessment made, if any, of the cost and benefits of soil conservation/afforestation in relation to floods and sediments control effected by the Planning Commission.

16. Please furnish a note detailing the patterns adopted in the various Plans for financing schemes for flood control/protection, drainage, and soil conservation and afforestation in the catchment areas.

17. The Third Plan had underlined the need for raising resources from the beneficiaries of flood control schemes in the form of betterment levy and flood cess. Please state the progress made therein and the actual resources raised upto-date from the beneficiaries in the various States.

QUESTIONNAIRE TO THE MINISTRY OF RAILWAYS (RAILWAY BOARD)

NOTE : (While furnishing the information in reply to the questions, the guidelines given in the Annexure may kindly be followed)

2. Please furnish six copies of the relevant Railway Act or extracts thereof which lays down the procedure for consultation with the State Governments in regard to the alignment of railway lines, provision of waterways at crossings of rivers, streams, drains etc., and stipulates the liability of the Railways and the State Governments for bearing of costs of later augmentation of waterways for bridges.

1. Is there any manual or memorandum issued by the Railways which lays down the methodology for determining the waterways for railway bridges across alluvial and other rivers ? If so, please supply six copies of the same.

2. (a) The Ministry of Railways had appointed the Khosla Committee of Engineers (1957) to examine *inter alia* the method of determining the maximum discharge for the design of waterways under bridges in different regions of the country. This Committee had recommended the provision of waterways to cater for the maximum discharge recorded for a period of not less than 50 years frequency determined from the recorded floods without causing undue afflux. Studies for evolving formulae for the determination of design discharges were to be carried out under short-term and long-term plans for use by the Railways and other concerned organisations.

Please furnish a note on the progress made so far in this regard.

(b) Please supply a map to the scale of 1 to 1 million (larger scale if required) showing the zones/regions and the formulae and the constants derived for each of the zones/regions under the short-term plan. What frequency flood do the constants evolved in the formulae correspond to ? Please also indicate whether these formulae have been evolved in co-ordination with the Central Water Commission and other organisations concerned.

(c) Please supply a similar map showing the formulae derived on the basis of the studies carried out so far under the long-term plan.

4. (a) Taking into account the recommendations of the Khosla Committee and the formulae developed for the different regions, have the Railways made review of the waterways of bridges ?

(b) Please furnish a note giving the results of such a review, indicating the number of bridges reviewed, number of bridges where waterways have been found inadequate and the number of bridges where the design discharge provided having been found excessive, it has been considered desirable to reduce the waterway provided. The information may please be supplied for each zone/region mentioned in question 3.

5. (a) Arising out of 4 above, please supply information in proforma 5.1 and 5.2 regarding bridges (designed for discharges exceeding 3000 cumecs) where according to review, waterways were found to be inadequate/excessive respectively.

(b) In the cases of bridges reviewed and listed in proforma 5.1 and 5.2, have there been any subsequent complaints from the State Governments regarding distress caused to the areas upstream of the bridges on account of the design flood or the design H.F.L. being exceeded ? If so, please furnish information in proforma 5.3 and also a note for each of the bridges indicating the reasons for the distress conditions, if analysed and action taken/proposed to be taken.

6. (a) What are the measures taken to keep the waterways clear of silt and obstruction so that they are effective whenever the design flood occurs ?

(b) Up to what distance upstream and downstream of the railway bridges do the Railways carry out surveys and maintenance conservancy operations ? At what intervals of time are such surveys carried out ?

7. (a) Are there any specific areas (other than those mentioned in 5 above) brought to the notice of the Railways by the State Governments where distress conditions have been experienced by flooding/drainage congestion due to inadequacy of waterway at a railway bridge, obstruction of drainage by the railway embankments, etc., and request made for providing additional waterways, new openings, etc. ?

(b) Please furnish information Statewise from 1966 onwards and the action taken thereon.

(c) Please also furnish a map to the scale of 1 to 1 million showing the areas where distress conditions have been pointed out by the State Governments as well as the railway lines and bridges in these areas.

8. Have any cases been brought to the notice of the Railways by the State Governments of adverse effects caused by railway bridges in their vicinity by way of erosion, change of course of the river, etc. ?

Please furnish information Statewise from 1966 onwards and the action taken by the Railways.

9. (a) Under the long-term plan, the Khosla Committee had recommended that the Railways should arrange observation of discharges and hourly gauge records at selected railway bridges during floods. Please furnish in proforma 9 information of observations at such bridges. The location of these bridges may be shown on a map of suitable scale.

(b) Please furnish a note on the method of computation of flood discharge at these sites.

10. (a) Are there any cases of discharge observation sites, where the design flood levels have been reached/exceeded at discharges lower than designed?

(b) If yes, please furnish, for each case, details like location, design and concerned, discharges and flood levels, the reasons assessed for the phenomenon, and, remedial measures proposed.

11. (a) Please furnish in proforma 11.1 the damage caused to the Railways in each zone from 1971 onwards and in proforma 11.2 the details of damage caused by major disruptions due to floods/failure of a railway affecting work.

(b) Where there have been major disruptions due to breaches and washing away of bridges, have the reasons been investigated? If so, please furnish notes for each of the major disruptions.

12. (a) Are the Technical Advisory Committees of the State Flood Control Boards and the Committees of Engineers in the States adequate for effecting the necessary co-ordination and ensuring that the works undertaken by one agency do not affect those of the others?

(b) Have there been any instances where flood protection works like embankments, spurs, drainage channels, etc., and other works which might affect the Railways have been taken up by the State Governments without consulting the Railways? If so, please list them Statewise mentioning the adverse effects, if any, the action taken by the Railways and the results thereof.

13. Are matters relating to distress caused by inadequate waterways discussed at the meetings of the State Committees of Engineers? How many times have these Committees met since April, 1971? Have these Committees helped in achieving the desired results?

Please furnish a note detailing the position Statewise; also comments/suggestions, if any, on the functioning of these Committees.

14. (a) Based on the recommendations of the Ministers' Committee on Flood Control (1964), the then Ministry of Irrigation and Power had constituted Standing Committees with the Chairman, Central Water & Power Commission as Chairman and the representative of railways and the State Governments concerned as Members to settle disputes regarding the extent of additional waterways to be provided and the sharing of costs. Have the Railways referred any such disputes to the Standing Committee since April, 1971? Have any of these been settled?

Please furnish a note giving details Statewise mentioning the Railway Zone, the details of the desputes and the decisions.

(b) Please also furnish details of outstanding disputes, if any.

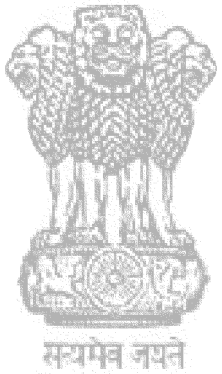
15. Is the present arrangement of the Standing Committee for the settlement of disputes regarding waterways with State Governments satisfactory or do you consider any improvement necessary? If so, please state in what direction?

16. (a) Are any rain gauges maintained by the Railways? Please supply details for each region/zone (referred to in question 3) indicating the total number of ra in gauges in categories of ordinary and self-recording.

(b) Have they been set up in consultation with the India Meteorological Department? Are they being inspected periodically by the India Meteorological Department, and is the data recorded supplied to the India Meteorological Department for publication?

17. Have the Railways got any system of their own for alerting the authorities incharge of Railway sections/bridges of the likely serious situations resulting from floods/ failure of works upstream and passing of such information to the State Governments and other authorities? Is there similar arrangement of obtaining information on the flood situation from the State Governments and the India Meteorological Department by the Railways? Please furnish a note.

18. Has a Co-ordinating and Planning Committee, as recommended by the Khosla Committee, been constituted for reviewing and publication of the studies carried out under the long-term plan? Have any of the studies, particulary those relating to the estimation of flood discharges in different river basins which will be of interest to the Flood Control Organisations also, been published? If so, please supply six copies of the same.



PROFORMA 5.1

RAILWAY BRIDGES WITH INADEQUATE WATERWAYS

Sl. No.	Climatic zone/region	Railway zone	River/Tributary	Location of bridge (No.....Section)	State/district	Date of review	Design discharge (cumecs)	Waterway (clear width		Status of augmentation of waterway	Remarks
								Previous	Proposed after review	Actual/Anticipated date of completion	
1	2	3	4	5	6	7	8	9	10	11	12

Note : Waterway on the spill berms wherever provided may also be included in Cols. 9 &10.

PROFORMA 5.2

RAILWAY BRIDGES WITH EXCESSIVE WATERWAYS

Sl. No.	Climatic zone/region	Railway zone	River/Tributary	Location of bridge (No.....Section)	State/district	Date of review	Design discharge (cumecs)	Water way (clear width)		Status of effecting reduction in waterway	Remarks
								Previous	Proposed after review	Actual/Anticipated date of completion	
1	2	3	4	5	6	7	8	9	10	11	12

Note : Waterway on the spill berms wherever provided may also be included in Cols. 9 & 10.

PROFORMA 5.3

BRIDGES REVIEWED WHERE DISTRESS CONDITIONS HAVE BEEN POINTED OUT BY THE STATE GOVERNMENTS

Sl. No.	Railway zone	River/tributary	Location of bridge (No..... Section)	Reference to Sl. No. in		Design* flood discharge after review (cumecs)	Design HFL after review (GTS)		Number of times, if any, when the flood discharge has exceeded the design discharge since augmentation/reduction (give discharge, gauge (GTS), date and year)	Number of times, if any, when flood level has exceeded the design HFL since augmentation/reduction (give gauge (GTS) discharge, date and year)	Remarks
				Proforma 5.1	Profomma 5.2		Upstream	Down stream			
1	2	3	4	5	6	7	8	9	10	11	12

*Please state in the Remarks column if this is the 50-year or a higher observed flood.

PROFORMA 9

Railway Zone :

GAUGE AND DISCHARGE SITES MAINTAINED BY THE RAILWAYS

Sl. No.	Name of the river tributary	Location of site (Brige No..... on Section .....etc.)	State/ district	Catchment area in sq.km. upto observation site	Nature of observation		Year of start of observations		Design flood discharge of the bridge (cumecs) and design HFL (GTS)	Maximum flood dis charge recorded after start of observations (cumecs with date) and corresponding gauge (GTS)	Maximum flood level (GTS) attained (with date) and corresponding discharge in cumecs	No. of times, if any, when the flood discharge has exceeded the design discharge since 1960 (give discharge, gauge (GTS) and date)	No. of times, if any when flood level has exceeded the design HFL since 1960 (give gauge (GTS) discharge and date)	Remark
					gauge	discharge	gauge	discharge						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

PROFORMA 11.1

Railway Zone

DAMAGE CAUSED TO RAILWAYS DURING FLOODS/FAILURE OF UPSTREAM WORKS

Year	Total number of breaches	Total number of bridges washed away	Cost of restoration	Loss in earnings due to disruption	Total loss	Remarks
			(..... Rs. lakhs.....)			
1	2	3	4	5	6	7
1971						
1972						
1973						
1974						
1975						
1976						

PROFORMA 11.2

Railway Zone :

YEAR :

DAMAGE AND MAJOR DISRUPTION DUE TO FLOODS ON THE RAILWAYS

Sl. No.	Location of disruption	River/Tributary basin	Nature of disruption (whether due to breaches or damage/ washing away of the bridges)	Cause of damage (floods/ failure of upstream works)	Period of disruption with dates	Cost of restoration	Loss of railway earnings	Total loss	Remarks
						(.....Rs. lakhs).....)			
1	2	3	4	5	6	7	8	9	10

LIST OF ITEMS ON WHICH INFORMATION IS REQUIRED FROM THE BORDER ROADS ORGANISATION

1. Please furnish a note indicating the frequency of designs flood, method of its computation and determination of the waterways' corresponding to this discharge in different regions of the country mentioning also whether the State Governments are consulted while fixing the alignment of roads and the waterways of bridges.

Please furnish two copies of the maps showing the different regions.

2. Please furnish a note detailing the precautionary measures that are adopted for reducing the occurrence of slips in roads and land slides in hilly terrain.

3. Have any symposia/seminars been organised by your Organisation on the design of waterways, measures for stabilising the roads in the hilly terrain and reducing the occurrence of land slides? If so, please furnish two copies of the proceedings.

LIST OF ITEMS OF WHICH INFORMATION IS REQUIRED FROM THE GEOLOGICAL SURVEY OF INDIA

1. Please furnish a map to a suitable scale showing the areas liable to frequent land slides in the catchments of flood prone rivers in the country causing changes in river courses and increasing silt load.

2. Has the Geological Survey of India maintained a record of the occurence of major land slides and the report on their effects on the river conditions ? If so, please furnish a note and two copies of each relevant report.

3. Has the Geological Suvey of India investigated or been associated with the investigations of the causes of major land slides referred to in (2) above ? If so, please furnish a note giving the results of such investigations and remedial action suggested/undertaken by the concerned authorities. Wherever available two copies of each of the relevant reports may please be furnished.

4. Have any symposia/seminars been organised under the auspicies of the Geological Survey of India on the occurence of land slides ? If so, please furnish two copies of the proceedings of such seminars/symposia.

LIST OF ITEMS ON WHICH INFORMATION IS REQUIRED FROM THE SURVEY OF INDIA

1. Please supply two copies of the Index map showing the areas where detailed surveys have been carried out and large scale maps prepared with contours particularly in the plains of the flood prone rivers in the country, indicating the scale of such maps and the contour intervals.

Please indicate whether such maps are available with the Survey of India. If not, the source from which such maps can be procurred may please be mentioned.

2. Have the Survey of India any programme of carrying out detailed surveys of the areas in the country with the object of preparing large size maps with contours at close intervals ? If so, please furnish a note indicating details of the proposal the scale of maps proposed, the contour intervals for flat and other areas, and the programme of Surveys and publication of maps.

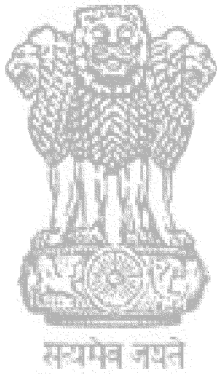
3. Demarcation of the flood zones in the flood plains of the various river basins is required for land use planning. It is considered desirable to have maps to the scale of 1 in 15000 with contours at 30 cm intervals for very flat areas and 60 cm for other plain area has been roughly estimated as about 200 lakhs ha.

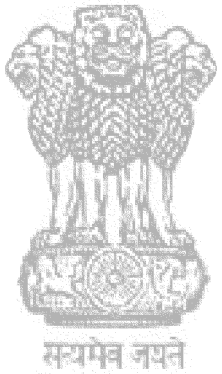
In case the Survey of India have no programmes of their own referred to in 2 above, please furnish a note indicating the time required for carrying out these surveys and preparing the maps with the existing Organisation and probable cost.

In case the maps are required to be ready by 1985, the nature of strengthening of the Organisation required may be indicated and if such expansion is effected whether the Organisation so created will be required to be continued for the normal survey programme of the Organisation after the conclusion of this specific work.

APPENDIX IV

PRESS NOTIFICATION INVITING
SUGGESTIONS FROM THE PUBLIC

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APPENDIX IV

PRESS NOTIFICATION INVITING SUGGESTIONS FROM THE PUBLIC

PRESS NOTIFICATION

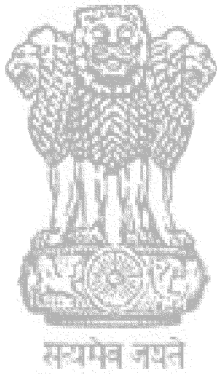
RASHTRIYA BARH AYOG

(NATIONAL FLOOD COMMISSION)

NOTICE

The Government of India have set up Rashtriya Barh Ayog (National Flood Commission) to, *inter alia*, make an evaluation of the benefits and effectiveness of flood control measures undertaken so far; evolve a comprehensive approach to the problem of floods keeping in view the need for optimum and multi-purpose utilisation of water resources and role of afforestation and Soil Conservation, suggest suitable land-use in the flood plains; make an analysis of costs and benefits and suggest criteria for taking up flood protection measures and means of mobilising resources therefor.

The Ayog will welcome views/suggestions on the subject. The terms of reference of the Ayog will be supplied on request. The views/suggestions may be forwarded by 31st January 1978 to the Member-Secretary, Rashtriya Barh Ayog, Vigyan Bhavan Annexe, New Delhi-110011.



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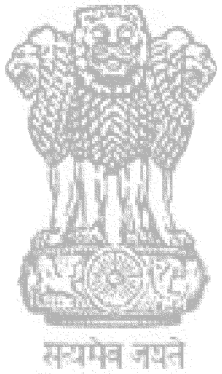
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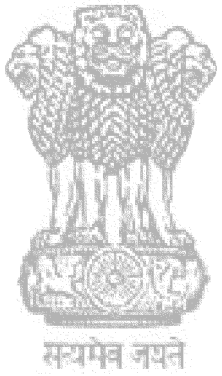
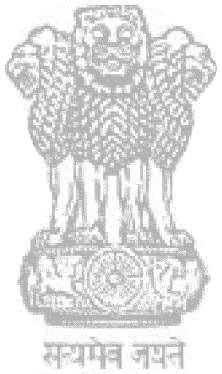
APPENDIX V

QUESTIONNAIRE TO MEMBERS OF PARLIAMENT

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APPENDIX V

QUESTIONNAIRE TO MEMBERS OF PARLIAMENT

सं० 8/21/77-रा०बा०आ०

भारत सरकार

राष्ट्रीय बाढ़ आयोग

विज्ञान भवन एनेक्सी, द्वितीय तल,

मौलाना आजाद मार्ग, नई दिल्ली-110011

दिनांक 28 जनवरी, 1978

8 माघ, 1899

विषयः— राष्ट्रीय बाढ़ आयोग—संसद सदस्यों के लिए प्रश्नावली ।

सेवा में

सभी संसद सदस्य गण

महोदय,

राष्ट्रीय बाढ़ आयोग की स्थापना 1976 में बाढ़ नियंत्रण उपायों के उपागम और कार्यक्रम का गहराई से अध्ययन करने और इस समस्या के बारे में एक समन्वित प्रस्ताव तैयार करने के लिए की गई थी । आयोग के "विचारार्थ विषयों" की एक प्रति संलग्न है ।

2. आयोग अपने कार्य की प्रक्रिया में विभिन्न स्रोतों से सूचना और सलाह मांग रहा है । आपकी सलाह हमारे काम के लिए बहुत मूल्यवान सिद्ध होगी । तदनुसार, मुझे आपकी सलाह जानने के लिए एक प्रश्नावली भेजने का निदेश हुआ है ।

3. आयोग आपका आभार मानेगा यदि आप 31 मार्च, 1978 तक इस प्रश्नावली का उत्तर भेज देने की कृपा करेंगे ।

भवदीय,

(के० रमेश राव)

सदस्य-सचिव

अनुलग्नक : यथा-उपरोक्त ।

NO. 8(21)/77—RBA

Government of India

Rashtriya Barh Ayog

NATIONAL FLOOD COMMISSION

II Floor, Vigyan Bhavan Annexe,
Maulana Azad Road, New Delhi-110011.

Dated January 28, 1978

8 Magh, 1899

Subject : *Rashtriya Barh Ayog—Questionnaire to the Members of Parliament.*

To

All Members of Parliament

The Rashtriya Barh Ayog was set up in 1976 to make an in-depth study of the approach and programme of flood control measures and for evolving a co-ordinated

approach to the problem. A copy of the Terms of Reference to the Ayog is enclosed.

2. In the course of its work, the Ayog is seeking information and advice from various sources. Advice from you would be of great value to our work. I am accordingly directed to enclose a Questionnaire for your advice.

3. The Commission will be grateful if you would kindly reply to the Questionnaire by the 31st March, 1978.

Encl : As above.

Yours faithfully,

(K. RAMESH RAO)
Member-Secretary

राष्ट्रीय बाढ़ आयोग

विचारार्थ विषय

1. 1954 से प्रारम्भ किए गए बाढ़ सुरक्षा उपायों की समीक्षा करना तथा क्षति को कम करने के लिए अब तक हाथ में लिए गए उपायों के लाभों एवं उनकी कार्यसाधकता का, विशेषकर तटबंधों के सन्दर्भ में मूल्यांकन करना।

2. ऐसे क्षेत्रों का पता लगाना जहां भारी संख्या में जमींदारी तथा/या अप्राधिकृत तटबंध, बंध तथा ठोकरें इत्यादि मौजूद हैं; बाढ़ समस्या पर उनके निर्माण से पड़ने वाले प्रभाव का निर्धारण करना; और उपचारी उपायों का सुझाव देना।

3. ऐसे क्षेत्रों का पता लगाना जहां सड़कों, राजमार्गों, रेलों इत्यादि के निर्माण तथा जल-निकासों पर अन्य अनधिकृत निर्माणों के फलस्वरूप बाढ़ समस्या में वृद्धि हुई है और उसमें सुधार लाने के लिए सुझाव देना, जिसमें विधायी कार्यवाही, यदि कोई हो, सम्मिलित है।

4. हाल के वर्षों में बाढ़ों से हुई क्षति का विश्लेषण करना और ऐसे क्षेत्रों का पता लगाना जहां बाढ़ सुरक्षा उपायों की तत्काल आवश्यकता है।

5. जल संसाधनों के अधिकतम और बहुद्देश्यीय समुपयोजन की आवश्यकता तथा बाढ़ नियंत्रण में भूमि संरक्षण एवं बनरोपण की भूमिका को भी ध्यान में रखते हुए देश में बाढ़ की समस्या के लिए एक व्यापक दृष्टिकोण अपनाना।

6. बाढ़ सुरक्षा उपायों की लागत और लाभों का विश्लेषण करना।

7. बाढ़ सुरक्षा उपायों को हाथ में लेने के लिए माप-दण्डों और उनके लिए संसाधनों को जुटाने के लिए सुझाव देना।

8. हानि को कम-से-कम करने और कृषि उत्पादन में समग्र रूप से वृद्धि करने की दृष्टि से बाढ़-प्रवण क्षेत्रों में भूमि के उचित उपयोग के लिए सिफारिश करना।

9. बाढ़ सुरक्षा कार्यों के रख-रखाव की वर्तमान व्यवस्था की जांच करना और उसमें सुधार करने के लिए उपायों की सिफारिश करना।

10. केन्द्र और राज्यों में बाढ़ नियंत्रण के लिए वर्तमान प्रशासनिक तथा संगठनात्मक व्यवस्था का पुनरावलोकन करना तथा जहां भी आवश्यक हो सुधारों का सुझाव देना। बाढ़ नियंत्रण में बाढ़ पुर्वानुमान तथा चेतावनी, बाढ़ से निपटने के लिए कार्य, और बाढ़ सुरक्षा उपायों को तैयार करना और उनका कार्यान्वयन सम्मिलित हैं।

11. बाढ़ क्षति का निर्धारण करने के वर्तमान तरीके की जांच करना और उसमें सुधार करने के लिए सुझाव देना।

12. बाढ़ों तथा बाढ़ नियंत्रण से संबंधित अन्य किसी मामले की जांच करना और उपयुक्त सिफारिशें देना।

NATIONAL FLOOD COMMISSION

Terms of reference

1. To review the flood protection measures undertaken since 1954 and to make an evaluation of the benefits and effectiveness of the measures undertaken so far with special reference to embankments in reducing the damage.

2. To identify the areas where a large number of zamindari and /or unauthorised embankments bunds and spurs etc. exist; to assess the effect of such constructions on the flood problem; and suggest remedial measures.

3. To identify the areas where construction of roads, highways, railways etc. and other encroachments into drains have aggravated flood problems and to suggest measures for improvements including legislative action, if any.

4. To analyse the damage caused by floods in recent years and to identify areas requiring immediate flood protection measures.

5. To evolve a comprehensive approach to the problem of floods in the country keeping in view the need for optimum and multi-purpose utilisation of water resources as also the role of soil conservation and afforestation in flood control.

6. To make an analysis of the cost and benefits of flood protection measures.

7. To suggest criteria for taking up flood protection measures and means of mobilising resources therefor.

8. To recommend proper land-use in the flood plains with a view to minimise damage and to ensue overall increase in agricultural production.

9. To examine the existing arrangements for maintenance of flood protection works and recommend measures for improving the same.

10. To review the existing administrative and organisational set up for flood control at the Centre and in the States and suggest improvements were necessary; flood control to include flood forecasting and warning, flood fighting, formulation and implementation of flood protection measures.

11. To examine the present procedure of assessing flood damage and suggest improvements.

12. To examine any other matter related to floods and flood control and make suitable recommendations.

राष्ट्रीय बाढ़ आयोग

संसद सदस्यों के लिए प्रश्नावली

1. आपके राज्य में बाढ़ समस्याओं तथा उनकी रोकथाम के लिए किये गये सुरक्षा उपायों के बारे में आपकी जानकारी और अनुभव के आधार पर :

(i) ऐसे बाढ़-प्रवण क्षेत्र कौनसे हैं जिन पर तुरन्त ध्यान देने की आवश्यकता है ?

(ii) इन क्षेत्रों में प्रायः कब-कब बाढ़ें आती हैं ?

(कृपया बताएं कि क्या वर्ष में एक बार अथवा दो वर्षों में एक बार, तीन वर्षों में एक बार, पांच वर्षों में एक बार अथवा कितने अंतराल पर बाढ़ें आई हैं ।)

(iii) आपके क्षेत्र में कौन से बाढ़ सुरक्षा उपाय अपनाये गये हैं ? किये गये निर्माण-कार्यों की निष्पत्ति के बारे में आप क्या मूल्यांकन करते हैं । कृपया उनके लाभ तथा प्रतिकूल प्रभाव, यदि कोई हों, उनका उल्लेख करें ।

2. कुछ लोगों का ऐसा विचार है कि गाद का जमाव तथा बाढ़ आप्लावन, बाढ़ों के बाद अच्छी फसलें पैदा करने के लिए लाभकारी होते हैं और बाढ़-ग्रस्त क्षेत्रों में बाढ़ सुरक्षा उपायों के अभाव में समस्त वार्षिक उत्पादन कर कोई महत्वपूर्ण प्रभाव नहीं पड़ता ।

कृपया इस बारे में, यदि संभव हो, मात्रात्मक आंकड़ों सहित, विशिष्ट उदाहरण देते हुए अपने विचार प्रकट करें ।

3. कृपया बताएं कि आपके क्षेत्र में कोई जमींदारी/परीक्षण-राहत तटबंध हैं ?

यदि हां, तो कृपया बाढ़ समस्या पर उनकी कार्यसाधकता के बारे में अपने विचार प्रकट करें ।

इन तटबंधों के भविष्य के बारे में आपके कोई सुझाव और विचार हों तो उन्हें बताने की कृपा करें ।

4. बाढ़ सुरक्षा/कटाव-रोधी उपाय करने के लिए आप कौनसे मानदण्डों और घटकों का सुझाव देना चाहेंगे ?

5. जिन नदी बेसिनों की आपको जानकारी है, उनमें बाढ़ों की समस्या पर काबू पाने के लिए आपके कोई सुझाव हों तो उन्हें बताने की कृपा करें ।

6. इस सिद्धांत के आधार पर कि जिन लाभों की व्यवस्था की गई है, उनकी लागतों को लाभग्राहियों को बर्दाश्त करना/आपस में बांट लेना चाहिये, कुछ राज्यों में संरक्षित क्षेत्रों में बाढ़ उपकर की वसूली के लिए अधिनियम पारित किये गये हैं। तथापि, ये अधिनियम अभी तक लागू नहीं किये गये हैं।

उपर्युक्त सिद्धांत तथा उसे लागू करने की विधि के बारे में आपके क्या विचार हैं ?

7. बाढ़ से प्रभावित होने वाले क्षेत्रों में विकासात्मक गतिविधियां शुरू की जाती हैं, यद्यपि यह भली प्रकार से पता होता है कि इन क्षेत्रों में प्रायः बाढ़ें आती हैं और उनके परिणामस्वरूप हानि होती है। इस तथ्य के बावजूद कि संरक्षित क्षेत्रों में भयंकर बाढ़ों से सुरक्षा की कोई व्यवस्था नहीं की जा सकती, उन क्षेत्रों में जोरदार विकासात्मक गतिविधियां होती हैं। इसे ध्यान में रखते हुए और क्षति को न्यूनतम करने की दृष्टि से क्या आप यह मानते हैं कि संरक्षित तथा अरक्षित बाढ़-प्रवण क्षेत्रों में बाढ़-क्षत्रों के निर्धारण द्वारा भूमि उपयोग को नियमित किया जाना चाहिये ?

8. क्या आपके विचार में बाढ़ सुरक्षा उपायों के आयोजन के काम में जनता का सहयोग लिया जाना चाहिये ? यदि हां, तो कृपया बताएं कि यह किस प्रकार किया जा सकता है।

9. क्या आपके विचार में बाढ़ सुरक्षा कार्यों के रख-रखाव के लिये जनता का सहयोग लिया जाना चाहिये ? यदि हां, तो कृपया बताएं कि यह किस प्रकार किया जा सकता है।

10. क्या आपके क्षेत्र में बाढ़-प्रवण नदी बेसिनों में कोई प्राकृतिक गर्त, झीलें, बील अथवा ताल आदि हैं ? यदि हां, तो कृपया बताएं कि इस समय उन्हें किस उपयोग में लाया जा रहा है ? क्या उन्हें बाढ़ जल के लिए अवरोध बेसिनों के रूप में उपयोग में लाने की गुंजाइश है तथा बाढ़ मौसम के बाद उन्हे कैसे उपयोग मे लाया जाये ?

11. यह सूचित किया गया है कि कई स्थानों पर जलनिकास प्रणालियों के अतिक्रमण हुए हैं, जिनसे जल के मुक्त प्रवाह में बाधा पड़ती है और परिणामस्वरूप बाढ़ समस्या गंभीर रूप धारण कर लेती है। ऐसे अतिक्रमणों की रोकथाम के लिए आप किन प्रशासनिक अथवा वैधानिक उपायों के सुझाव देना चाहेंगे ?

12. प्रायः यह कहा जाता है कि नदियों के आवाह-क्षेत्रों में वन-कटाई तथा खेती-स्थलों को बदलते रहने के कारण बाढ़ समस्या गंभीर रूप धारण कर रही है। क्या आप इस विचार से सहमत हैं ?

यदि हां, तो इस स्थिति में सुधार लाने के लिए आप किन व्यावहारिक उपायों का सुझाव देंगे ?

13. बाढ़ों के आने के समय तथा उनकी अवधि, क्षति की मात्रा और आपके क्षेत्रों में उगाई जाने वाली फसलों की जानकारी के आधार पर, क्या आप बाढ़-प्रवण क्षेत्रों में बाढ़ क्षति को न्यूनतम करने और कृषि उत्पादन में वृद्धि करने के लिये अपनाई जाने वाली फसलों को उगाने के प्रतिरूप और वैकल्पिक भूमि-उपयोग के बारे में भी कोई सुझाव देना चाहते हैं ?

14. क्या आप अपने क्षेत्र में बाढ़ सुरक्षा उपायों के रख-रखाव के बारे में कोई टिप्पणी और सुधार करने के लिए सुझाव देना चाहते हैं ?

15. कृपया अपने क्षेत्र में बाढ़ पूर्वानुमान, चेतावनी की क्रिया विधि तथा प्रसार की व्यवस्था के बारे में अपने विचार और सुझाव, यदि कोई हों, दीजिये।

16. "विचारार्थ विषयों" से सम्बन्धित अन्य सुझाव यदि कोई हों, देने की कृपा करें।

NATIONAL FLOOD COMMISSION

Questionnaire to the Members of Parliament

1. Based on your knowledge and experience of flood problems and protection measures undertaken in your State :

(i) What are the flood prone areas needing urgent attention?

(ii) How often have these areas been subjected to floods ? (Please say whether it is annual, or once in two years, once in three years, once in five years or at what intervals).

(iii) What are the flood protection measures adopted in your area? What is your assessment regarding the performance of the works undertaken? Please state, the benefits and adverse effects, if any.

2. There is some impression that deposition of silt and flood inundation are beneficial for raising good crops after floods and that the overall annual production in ccded areas is not significantly affected in the absence of flood protection measures.

Please state your views on the above, quoting specific examples with quantitative figures, if possible.

3. Please state if there are any zamindari/test-relief embankments in your area.

If so, please state your views on their effectiveness on the flood problem.

Please state if you have suggestions and views on the future of these embankments

4. What criteria and factors would you suggest for consideration for taking up flood protection/anti-erosion measures ?

5. Please state if you have any suggestions regarding the approach to the problem of floods in the river basins with which you are acquainted.

6. On the principle that beneficiaries should bear/share costs of benefits provided, Acts have been passed in certain States for recovery of flood cess in protected areas. These Acts have not, however, been implemented so far.

What are your views on the above mentioned principle and the method of implementation thereof ?

7. Developmental activities are undertaken in the flood plains even though it is well known that the areas are susceptible to frequent flooding and consequent damage. Increased developmental activities also take place in the protected areas inspite of the fact that no protection can be provided against all magnitudes of flood. In view of this and in order to minimise damage, do you think that regulation of land use in the protected as well as un-protected flood-prone areas should be adopted by flood-plain zoning ?

8. Do you think that the public should be associated with the planning of flood protection measures ? If yes, please state the manner in which this could be done.

9. Do you think the public should be associated with the maintenance of flood protection works ? If yes, please state the manner in which this could be done.

10. Are there any natural depressions, jheels, beels, tals etc., in the flood-prone river basins in your area ? If so, please state the use they are being put to at present and whether there is scope for utilising them as detention basins of flood waters and how to deal with them after the flood season ?

11. It is reported that encroachments into drainages have taken place at several locations which obstruct the free flow of water and aggravate flood problem. What administrative and/or legislative mesures would you suggest for preventing such encroachments ?

12. It is generally stated that flood problem is being aggravated due to deforestation and shifting cultivation in the catchment areas of rivers. Do you agree with this view ?

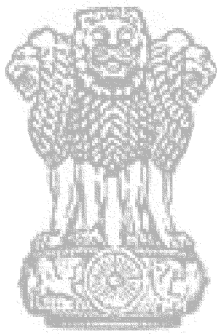
If yes, what practical measures would you suggest for amelioration of the situation ?

13. Based on the knowledge of the time of occurrance and duration of floods, extent of damage and the type of crops grown in your areas, have you any suggestions on the crops and the cropping pattern as also the alternate land use which could be adopted in minimising flood damage and increasing agricultural production in flood-prone areas ?

14. Have you any observations on the maintenance of flood protection measures in your area and suggestions for improvements ?

15. Please give your views and suggestions, if any, on the functioning of flood forecasting, warning and dissemination system, in your area.

16. Other suggestions, if any, relating to the Terms of Reference.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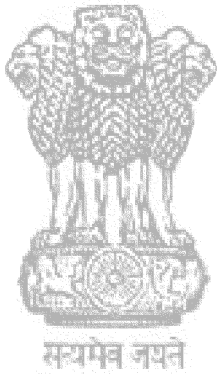
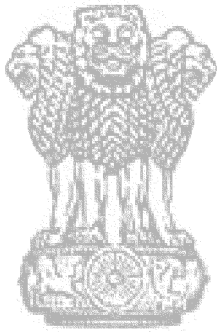
APPENDIX VI

NATIONAL POLICY STATEMENT
3RD SEPTEMBER, 1954
ON
"THE FLOODS IN THE COUNTRY"

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APPENDIX VI

STATEMENT REGARDING FLOODS IN THE COUNTRY, LAID ON THE TABLES OF BOTH HOUSES OF PARLIAMENT, BY SHRI GULZARILAL NANDA, MINISTER FOR PLANNING AND IRRIGATION AND POWER, ON SEPTEMPTER 3, 1954.

I. THE PROBLEM OF FLOODS

To study the situation created by the Floods in the North Eastern regions of the country, I flew over the affected areas and took the opportunity of discussing the various aspects of the problem with the Chief Ministers and Officials of the States concerned, namely, U.P., Bihar, West Bengal and Assam. I was accompanied by the Technical experts of the Central Government.

2. Vast stretches of land submerged under water, numerous habitations nearly buried under silt, roads, bridges and railway lines torn to pieces—this was the spectacle of devastation which the eyes encountered for hours together. It brought to the mind the human tragedy of large masses of people struggling to escape with their lives, uprooted from their hearths and homes and reduced to utter misery and destitution. This has been happening again and again over large parts of the country. This year's floods are stated to the worst over a long period.

3. After this overwhelming experience the feeling is natural that, however important our other pre-occupations may be, the most urgent task before us now is to save the people from these horrors. I have also come back with the sense of assurance that this can be done.

II. FLOOD SITUATION

(a) *1954 Floods*

4. An examination of gauges (Appendix I) and the rainfall records for above 30 years for stations for which information is available does not establish the fact that the 1954 flood is altogether exceptional, barring the case of Kosi and a few other rivers. What is exceptional about 1954, however, is that the floods in all the northern rivers of the country seem to have occurred more or less at the same time this year creating an unprecedented situation in point of duration, extent and intensity. On some of the rivers very heavy floods were experienced more than once. Various meteorological factors during the last 10 days of July and again at the end of August combined to cause heavy rainfall over and near the entire stretch of the eastern Himalayas, resulting in an excessive spilling of the tributaries of the Ganga and the Brahmputra.

5. According to the reports so far received, the total area encompassed by floods exceeds 25,650 sq. miles. Nearly 94 lakh people have been affected. 226 lives have been lost. More than 7,200 cattle have perished. It has been reckoned that crops have suffered damage over an area of about 132 lakh acres, valued approximately at Rs. 38 crores. Several towns situated on the banks of rivers are threatened with severe erosion. No comprehensive estimate has yet been made of the total number of houses that have collapsed on account of floods. The number of houses damaged or destroyed as so far reported by Assam, Bihar and U.P. is 50,000. In West Bengal, many thousand houses have been damaged or destroyed. Destruction of property in Assam has been roughly valued at Rs. 1.39 crores. Estimated value of property lost in Bihar, West Bengal and U.P., is not readily available. Loss on account of damage to roads, railways and bridges in Assam is estimated at Rs. 85 lakhs. In West Bengal, damage to communications runs into crores of rupees. Reports from Bihar and U.P.

are still awaited. The extent to which communications have been disrupted this time exceeds all past experience.

6. As known so far the position of the various States, chiefly involved in the floods this year may be seen from the following table :

Name of State	Area affected	Damage to crops	Damage to property	Damage to Communication	Loss of human life	Loss of cattle	Remarks
1	2	3	4	5	6	7	8
Assam .	12,000 sq. miles	Over Rs. 9 crores	Rs. 138.52 lakhs	Rs. 85 lakhs	17	3094	
Bihar .	10,000 sq. miles	*Over 32 lakh acres	†About 40,000 houses damaged or destroyed	Figures not available	42	*608	*Complete report not available. †Final figures are likely to be much higher.
West Bengal	Three floods : First flood 84 sq. miles 2nd flood 900 sq. miles 3rd flood 1000 sq. miles	Rs. 7.5 crores	Many thousand houses have been damaged or destroyed.	Damage runs into crores of rupees.	142	1500	
U.P. .	17 lakh acres (2660 sq. miles)	**Extensive damage to crops	Over 8000 houses damaged.	Figures not available.	25	2000	**Floods still continuing.

(b) Earlier floods

7. I asked the States of Assam, Bihar, West Bengal and U.P. to report the figures of the area affected as also the extent of damage to life and propety during the last 5 years. The information received from them is given in Appendix II. It will be seen that in Assam, during the last 5 years, there have been four heavy floods—two covering extensive areas and the other two somewhat restricted in extent while in 1953 the floods were of a mild nature. In Bihar during the last 5 years, there have been two severe floods and two mild ones while 1951 was a normal year. In U.P. there have been three heavy floods and one mild one during that last five years. 1951 was a normal year when there were no floods in U.P. In West Bengal there were three heavy floods out of which two were restricted in extent and one ie., of the current year was exceptional both in the severity and extent of flooding. In addition there were mild flood in 1951 and 1953.

8. Last year there were heavy floods in the Godavari in the South when a discharge of 2.8 million cusecs was recorded over Dhowlaiswaram weir. This flood over-topped and eroded flood banks and caused a good deal of havoc to the Rajhamundri town and the delta areas. The town was inundated and a number of houses collapsed. There was heavy loss of cattle and other moveable property amounting to several crores of rupees. Both telephone and telegraphic services were completely dislocated.

9. Floods were experienced in July 1948 and September 1950 in the Kashmir Valley. During both floods, a number of breaches occurred in the embankments on the left side causing heavy damage to the standing crops, roads, buildings and other property. The floods in 1953 were of medium intensity.

III. RELIEF MEASURES UNDERTAKEN

10. The following figures reflect the extent of action taken by various State Governments in connection with the floods this year :

State	Gratuitous Relief (Rs. in lakhs)	Agricultural loans (Rs. in lakhs)	Test Relief (Rs. in lakhs)	Rehabilitation & housebuilding grants & loans (Rs. in lakhs)	Total (Rs. in lakhs)
Assam	13.50	30.00	10.00	30.00	83.50
Bihar	*175.00	++240.00	—	—	415.00
+West Bengal	5.67	233.80	4.13	2.52	46.12
U. P.	2.20	**25.00	2.70	—	29.90
	196.37	328.80	16.82	32.52	574.51

*This amount includes schemes for providing employment and other similar measures.

++This includes agricultural and other types of loans.

+Figures given do not include rice doles, garments, cloth, blankets milk powder, medicines, etc., distributed to the affected persons.

** Takavi loans.

11. In the previous years (1950—1953) the total cost of relief measures in these States as follows :

State	Gratuitous relief and Governor's Relief fund (Rs. in lakhs)	Agricultural and Takavi Loans (Rs. in lakhs)	Test relief (Rs. in lakhs)	Rehabilitation and house-building loans and grants (Rs. in lakhs)	Total
Assam	21.9	45.3	—	—	67.2
Bihar	527.0	1141.0	—	—	1668.0
West Bengal	**4.54	—	—	—	4.54
U. P.	7.16	91.0	6.40	—	104.56
	560.60	1277.3	6.40	—	1844.30

**Figures for 1950, 1951 and 1953 have not been furnished by the State Government.

12. Central Assistance (in 1954): The following statement indicates the Central Assistance already sanctioned/under consideration in connection with the current year's floods (position as on September 1954).

State	Required			Assistance given
	For repairs to roads, embankments and buildings (Rs. lakhs)	Gratuitous Relief and Test relief (Rs. lakhs)	Takavi	
1	2	3	4	5
Assam . . .	85.06	Full expenditure incurred by State Government to stave off famine conditions caused by floods, and reimbursement of expenditure incurred on relief work last year.		Under consideration
Bihar	Reimbursement of 75% of expenditure on relief schemes.			50% of contribution for first two crores of expenditure and 75% contribution in excess of Rs. 2 crores.

1	2	3	4	5
West Bengal . . .	100.00	25.00		As grant, half the cost of (i) gratuitose relief and (ii) re-buliding of houses by poor people in affected areas subjet to a ceiling of Rs. 2.5 lakhs as Central share for each item. Af loan, half the cost of relief work subject to a ceiling of Rs. 7.5 lakhs.
U. P.		30.00*	21.30*	

*50% as subsidy and 50% as loan.

IV NATURE OF PROBLEM

13. The rivers of India are broadly divisible into three types :

(1) Peninsular;

(2) Central Indian; and

(3) Himalayan.

14. Floods in Peninsular rivers like the Cauvery and the Krishna are caused by heavy rainfall in the Western Ghats. Such occasions, however, are not frequent. The floods in the Cauvery are controlled to a great extent by the Krishnarajasagar and Mettur reservoirs. flood embankments in the Krishna Delta afford reasonable protection to that area.

15. Floods occur more frquently in the Central Indian rivers like Tapi, Narmada, Godavari (major portion), Chambal, Mahanadi and Demodar. These are caused by heavy precipitation of rainfall in the Western Ghats, Madhya Pradesh and Chota Nagpur.

16. The Himalayan rivers stand out as a separate class, the occurrence of floods in them is almost an annual phenomenon. The factors responsible for the destructive floods in these rivers are (a) heavy rainfall in the Himalayas (b) steep slopes of the rivers before they debouch into the plains, and (c) absence of easy out-fall facilities. Most of the Himalayan rivers drain themselves either into the Ganga or the Brahmaputra; and when these two mighty rivers are themselves in high floods the effective discharge of the waters of the swollen tributaries is not possible. Uncontrolled rivers tend to form numerous channels and extend their area of inundation. The flood problem, particularly in the North, has been aggravated by the fact that with the increasing pressure of population the areas liable to floods have been occupied for agricultural purposes.

17. The effect of earthquakes in increasing the volume of floods has not been fully established but there is evidence to show that the 1934 earthquake in Bihar has caused subsidence even up to 4 ft. in the middle portions of North Bihar. In Assam, it is stated that the earthquake of 1950, as a result of extensive hill slides in the catchments of the Brahmaputra and its north-eastern tributaries, the beds of these rivers have got silted up in varying degrees. It is also alleged that the road and railway embankments built across the drainage lines on both banks of the Brahmaputra hold up the flood waters in many areas, causing local flooding and aggravating the flood damage to crops in low areas. It is therefore, important that complete examination be made of the carrying capacity of the waterways in these embankments.

18. On some of the rivers the situation has been further aggravated by deforestation in the upper catchments causing soil erosion and increase in silt content of the rivers. Silt in the rivers does not generally cause trouble unless it is in very large quantities or is of coarse type. When the river carries an appreciable quantity of coarse silt, instability of its regime occurs, especially if the slope of the bed gets flatter. This results in a lateral movement of the river which can cause good deal of damage. Of the Himalayan rivers which cause floods, Kosi and Teesta are noted for this dangerous tendency. Except for the Kosi there are hardly any surveys showing the changes in the courses and the bed levels of the rivers.

19. Flood inundation this year has been extensive in the State of U.P., Bihar, West Bengal and Assam.

20. *Uttar Pradesh*:—The most severely affected districts of Uttar Pradesh are in the eastern part. The rivers which cause damage in this area are the Gogra and the Rapti. The former submerges an area of 3,000 sq. miles and the latter about 1,200 sg. miles normally every year. Inundation also occurs, as in the current year, near the confluence of the Ganga and the Ram Ganga and also in the upper rea ches of Bari Gandak (Narayani).

21. *Bihar* :—Practically the whole of North Bihar is liable to submersion during floods. The inundated areas can be broadly divided into three zones Western (6,000 sq. miles), Central (Kosi portion) 2,380 sq. miles and Eastern (1,690 sq. miles). The rivers causing spill in the Western zone are nearly 50 of which 10 are of medium size and three big size, these last being Burhi Gandak, Bagmati and Kamla. The numerous streams are spaced 2 to 4 miles apart. This area exhibits considerable similarity to the Huai basin in China.

Gandak :—Against the highest known discharge of 7,00,000 cusecs, this year's flood registered 6.5 lakhs cusecs. The main embankments remained in tact. Some areas within the loops were however flooded.

Bagmati :—The spill channels emanating from these rivers such as the Sugia, Sugia Pardesia, Hiraman etc. caused considerable flooding in the Bagmati Basin. The spill of the river Bagmati on both banks in Nepal Tarai caused considerable flooding north of Darbhanga-Narkatiaganj railway line. The spill on the left bank combined with the Lakhandei spill caused considerable havoc in and around Sitamarhi sub-division. Sitamarhi town ring bund was over topped.

Burhi Gandak :—The river was in high floods and there was considerable inundation in the valley.

Kamla :—This river was also in high floods and caused considerable damage in Madhubani and Benipatti areas. The level at Jayanagar is reported to have gone 2 ft. higher than last year's highest level.

Kosi :—The central portion of Bihar is traversed by the Kosi and is the most devastated portion of North Bihar. The present Kosi scheme (1953) will enable considerable control of the river. Recent July flood of 6.5 lakh cusecs has not shown any features which necessitate a change in the scheme. Since the inspection of the area in the third week of August 1954, further unprecedented floods of over 8 lakhs cusecs intensity have occurred. While this high level water would have spread across a larger area, it is not likely to warrant any material alterations to the 1953 scheme.

22. *West Bengal* :—Three successive high floods were experienced this year, first in mid June, second at the end of July and the third at the end of August. Of the many rivers causing destruction and havoc in North Bengal Teesta and the Torsa stand out prominently. of these the first is the more difficult to tackle as it has a tendency like the Kosi to change its course.

Jalpaiguri and Cooch Behar districts and parts of Darjeeling district were affected. The Assam Rail Link and the National Highway were breached. Cooch Behar was completely isolated for several days. Several towns have alrady suffered erosion and the threat continues.

23. *Assam* :—Assam has a large number of rivers running from the hills to Brahmaputra. Extensive areas on both banks of the Brahmaputra were flooded. Heavy erosion has occurred at Palasbari and Dibrugarh. A number of villages north of Kamrup, Goalpara and North Lakhimpur have been affected. Areas around Saidya and Saikhwaghat were under heavy inundation.

The damage caused by the floods in Brahmputra was aggravated by the fact that many of its major tributaries were in high spate at the same time.

24. *Jammu & Kashmir* :— For a fortnight, during May 1954, the Wular level rose considerably due to Pohru floods and submerged some cultivated lands. This would necessitate reconsideration of the proposal for diversion of the Pohru torrent into the Wular Lake.

V. ACTION TAKEN SO FAR

25. Although floods have been causing serious damage to property and inflicting terrible hardships on the inhabitants of certain States, no systematic attempt has been made so far to devise adeguate measures for flood protection in the areas so affected. Each time a heavy flood is experienced it has been the practice for the States to meet the situation by the adoption of such emergency measures as remissions of land revenue, grant of loans, gratuitious relief etc. designed to mitigate hardship. Flood committees have also been appointed from time to time by the various States, but their recommendations have, for the most part, remained a dead letter. In Assam committees were appointed in 1929, 1934, 1947 and 1950 and they suggested the collection of hy drological and other data. Bihar appointed two committees in 1926. But few, if any, of the recommendations were carried out. Very little was done in West Bengal to implement the recommendations of a flood committee which was appointed in 1922. It must be pointed out that all such committees were greatly handicapped in their investigations for want of basic information regarding the behaviour of rivers. Unfortunately the recommendations of successive committees for the collection of hydrological data were not followed up effectively.

26. After the attainment of Independence greater attention has been paid to flood control measures. The multi-purpose development of the Damodar, the Mahanadi and the Kosi, three of the most destructive rivers in the country will, after the completion of the projects now under way, provide substantial protection from floods in the areas they have been devastating hitherto. The Bhakra Dam on the Sutlej, the Matatila Dam on the Betwa, the Rihand Dam on the Rihand, a tributary of the Sone, the Gandhi Sagar Dam on the Chambal, are multi-purpose in conception and although flood control was not the dominant consideration, the areas through which the flow will be protected tc a large extent from floods.

27. A Scheme for the control of floods in the Kashmir Valley has recently been worked out with the assistance of the Central Water and Power Commission. The main features of the scheme are :

(1) Construction of a supplementary channel to divert 50 per cent of the peak floods from the Jhelum ;

(2) Improvement of the remaining out-fall channel taking off from the Wular Lake ; and

(3) Strengthening of the Jhelum bunds in the entire reach.

28. To obtain data as a preliminary step to drawing up of schemes, Investigation Circles have been opened in Assam and Bihar at the instance of the Central Government. U.P. Government has set up a Special Investigation Division. Investigations are also in progress in connection with multipurpose schemes with flood control as one of their objectives in the Tapi and Narmada Valleys.

VI. LINES OF REMEDIAL ACTION

29. It is possible to have recourse to the following measures of protection and flood control

1. Embankments were feasible to keep the flood out of areas which are otherwise subject to inundation.
2. Storage reservoirs, preferably on the tributaries.
3. Detention basins where the excess of flood water may be stored for a short time.
4. Diversion of the water of one river into the other.
5. Increasing the slope of the river by cutting down loops.
6. Dredging and channelling portions of the river where waterway has been reduced due to silting.

Besides these, some other measures like revetments and spurs will be necessary to safeguard any particular town exposed to the danger of being eroded. After collection of the requisite data, the choice of a appropriate method or combination of methods can be made. Hydraulic model tests will also be conducted for indications of proper solutions.

The preparation of a balanced scheme for a river basin is an extremely complex engineering, economic and social problem. All the known devices must be carefully considered and suitable combinations selected for each river basin.

SPECIFIC

30. As investigations proceed and data accumulate, the specific measures appropriate to each case will be formulated. What at the moment appears to be feasible for fealing with the flood problem in the different States is as stated below :

Uttar Pradesh

31. As the main problem is due to spilling and inundation, the State Engineers feel that a suitable remedy would be the construction of embankments on either side of the rivers so as to restrict the flooded area from an average of 10 miles width or so to about 1½ to 2 miles for normal flood discharges. Other suggestions are :

(1) to improve the slope of the river by cutting out loops and unnecessary bends so as to increase its silt carrying capacity,

(2) to divert a portion of high peak flood discharge of one river into another by means of diversion channels and regulators where possible,

(3) to provide silt catching basins at the points where a high silt-carrying tributary meets the main river,

(4) to dredge portions of the rivers where waterway has been considerably reduced due to silting.

To the above measures must be added the possibility of detention reservoirs.

Bihar

32. North Bihar is a big inland depression which, if left to itself, would built up in course of time by river action. Owing to the pressure of population, however, these areas have been exensively cultivated necessitating measures for flood protection. The Gandak plain has already been protected by embankments. A scheme for the Kosi area, consisting of embankments and diversion of part of flood waters is ready for construction immediately after the flood season.

33. For the areas between the Gandak and the Kosi a combination of embankments and storage reservoirs on the upper catchments may be necessary. Further consideration should also be given to the possiblity of diverting some water from Bagmati into Burhi Gandak. There are possibilities of using some natural depressions as emergency flood detention basins. The congestion of flood below Jhamta will be relieved to a certain extent by the construction of medium reservoirs in the upper reaches.

West Bengal

34. Basic information regarding the behaviour of the Teesta and the Torsa which cause most of the destruction in this area in North Bengal has not yet been collected Some of the data relating to these rivers will have to be collected in the upper catchment area, outside India, Short-term schemes for the protection of Jalpaiguri, Siliguri, Cooch-Behar, Alipurduar and Mathabhanga towns are an immediate necessity.

Assam

35. Immediate short-term measures are necessary to protect Dibrugarh and Palasbari which are in danger of being wiped out. Revetment work at Dibrugarh is in progress and the portion completed has withstood the recent heavy floods. Proposals are being worked out to ensure that the entire programme of revetment designed to give complete protection to the town will be completed in the shortest possible time. A similar revetment for the protection of Palasbari town will also be necessary. An estimate for this work has already been prepared. Certain areas in Brahmaputra valley can be protected against floods by the system of embankments. It would probably be necessary to construct storage reservoirs of small streams in their upper catchments.

Jammu & Kashimr

36. A scheme for 'Flood control and reclamation of the Kashmir Valley, has been worked out. At present a 10 ft. wide pilot channel along the centre line of the supplementary channel is being dug. It will soon be made 100 ft. wide. In addition to this, strengthening of the Jhelum bunds is also in progress. The target is to complete the entire scheme by the spring of 1957. Efforts are being made to complete the work earlier.

VII. INVESTIGATIONS AND DATA

37. Floods are causing damage not only in India but also in our neighbouring countries like Nepal, Sikkim and Bhutan. Large areas are being eroded and if proper

soil conservation measures are not taken in time, large tracts will become un-inhabitable. Collection of rainfall and other hydraulic data of rivers will greatly help all concerned to devise measures to avoid erosion of land and destruction due to floods.

38. An indication of the minimum data required for the preparation of an overall plan is given in Appendix III. The collection of data will naturally take some time. Every effort will, however, be made to expedite this work.

VIII. OUTLINE OF PROGRAMME

39. The programme of flood control and protection can be divided into three phases :

Immediate.—The first phase will extend over a period of two years. This period will be devoted to intensive investigation and collection of data. Comprehensive plans will also be drawn up and designs and estimates prepared for short-term measures of flood protection.

Some measures such as revetments, construction of spurs and even embankments may be applied immediately in selected sites.

Short-term.—During the second phase which may be taken to start with the second year and extend to the 6th or the 7th year, flood control measures such as embankments and channel improvements will be undertaken. This type of protection will be applicable to a major portion of the areas now subject to floods.

Long-term.—The third phase will relate to selecting long-term measures such as the construction of storage reservoirs on tributaries of certain rivers and additional embankments wherever necessary. This may take 3 to 5 years more.

40. A complete answer to the problem of flood may not be found in any single measure. Each case will have to be considered on its merits and a measure or a combination of measures adopted if a proper solution is to be found.

41. The question of constructing storages on major streams such as the Kosi, the Lohit, the Dihang and the Dibang, etc. can be considered only in combination with other water uses. While investigations may be carried out, when staff becomes available, it is not possible to include the construction of storage reservoirs at this stage amongst the short-term measures now visualised for flood control.

42. Although embankments do not provide absolute immunity from the floods they will ensure a very large measure of protection which, given good maintenance, should prove to be of a lasting character. Provided the enthusiasm of the people can be aroused, as it is stated to have been in China, and their cooperation secured for this work of national importance it should be possible to complete the embankments in about 7 years if a start is made immediately. This programme of flood protection work will incidentally provide on a tremendous scale opportunities for employment of a simple character, scattered over large areas.

43. The State Governments are primarily responsible for the execution of project for the control of floods in their area. As many of the major rivers of India pass through more than one State, the control of floods is an inter-State rather than a State problem. Denudation of forests by reckless exploitation in States where the head waters lie may expose a State in the lower reaches to devastating floods and yet the State affected would be helpless in taking remedial action. Furthermore, the financial resources of States may not always be adequate for underaking major flood control works. It is therefore obvious that unless the Centre takes the initiative in this matter and helps the State Governments to formulate and if necessary implement a systematic plan of flood control, no tangible progress is likely to be achieved in this direction. An Inter-State River Valleys Bill which aims at empowering the Central Government to take the initiative in matter pertaining to the regulation and development of inter-State rivers and river valleys will be introduced in the Parliament shortly.

IX. IMMEDIATE MEASURES

44. Collection of hydrological and other data should be given the highest priority and the efforts of the various departments of the Central and State Governments should be directed to this end. Data will have to be collected in Nepal, Sikkim and Bhutan for rivers rising in those countries and running through India. Besides the States concerned, Central agencies such as the Survey of India, Geological Survey, Meteorological and Forest Departments would have to participate in the effort.

45. The States as well as the Centre should make preliminary arrangements immediately for concentrated survey work and field investigation parties should commence work by the 1st October 1954. Flood Control Organisations should be set up immediately for the recruitment of staff.

46. Equipment required for field parties such as transport vehicles, survey instruments, etc. should, in the first instance be diverted, from the existing departments and replaced later on.

X. ORGANISATION

47. To ensure that the measures outlined above are carried out, it is proposed to create, with the consent of the States concerned, Flood Control Boards in the States which are liable to frequent floods. The Boards will be constituted in U.P., Bihar West Bengal and Assam in the first instance. Andhra and other States which are liable to floods will also be requested to adopt the same course. It will be the duty of these Boards to assess the flood problem in their areas and to (a) collect data, (b) prepare a comprehensive flood control scheme for the State, (c) indicate priorities, and (d) ensure the implementation of approved schemes. These Boards will be assisted, wherever necessary, by technical committees for the collection of data and the preparation of schemes.

48. A Central Flood Control Board will also be constituted on which the Union Ministry of Irrigation and Power and the State Boards will be represented. The Central Board will consider the schemes submitted by State Boards and draw up a national flood control programme, having regard to the availability of finance and technical personnel. The Central Board will also be assisted by a strong technical committee consisting of experts in flood engineering, soil conservation and agriculture. Experts from ECAFE and other foreign countries will also be invited to assist this committee wherever necessary. The Central Technical Committee will work in close cooperation with the Central Water and Power Commission.

49. Having regard to the magnitude of the work that will devolve on the Central Water and Power Commission it will be necessary to strengthen that organisation by appointing an additional Member with ancillary staff to be exclusively in charge of flood control.

XI. PERSONNEL

50. A large number of supervisors will be required for suvey work. It would be necessary to press into service all qualified men, whether retired or fresh from college. We may have to direct the final year students of overseer classes to undertake survey work treating, if necessary, the interruption of a year as a year of service if they enter Government service later on. It may also be necessary to get the engineering students of all denominations to work with the investigation parties during their summer vacation. These arrangements which are of an emergent character will not wholly meet the needs of the situation. The requirements of technical personnel should be carefully planned and arragements made in good time for training wherever necessary.

XII. COST

51. It is difficult to estimate with any degree of accuracy the cost of the measures that are being envisaged to ensure flood protection in all the States in India. Only a very rough estimate is possible at this stage. For U.P., North Bihar, West Bengal and Assam, an approximate estimate based on incomplete data comes to about Rs. 175 crores, Rs. 100 crores for 'immediate' and 'short-term' measures and Rs. 75 crores for 'long-term' measures involving storage on the tributaries of rivers in North Bihar and Assam. The short-term programme in these States can be completed over a period of about 6 to 7 years. The picture will become clearer and the estimates more firm as investigations progress and designs are drawn up. Similar measures required in relation to the problem of floods in other States will need a relatively small amount. The cost of the works can be reduced to a substantial extent by enlisting the co-operation of people in various ways. Contribution in the shape of voluntary labour is an important form in which people can help while graded potection levies would be perfectly legitimate where protection works are undertaken at the cost of the State.

52. The problem, however, does not cease with the building of flood protection works like embankments for an embankment that is not kept in shape is no embankment at all. These structures are liable to deteriorate unless the people protected by them are ever vigilant with regard to their maintenance. Not only is it therefore essential to kindle enthusiasm for the initial construction but to organise them for subsequent maintenance so that they may pass on these structures as a sacred trust to future generations.

APPENDIX I

COMPARISON OF 1954 FLOODS WITH MAXIMUM RECORDED FLOODS

Name of the river	1954 Flood		Max. flood between 1934—53		Previous maximum flood	
	Max. level	Date	Max. level	Date	Max. level	Date
1	2	3	4	5	6	7
BIHAR :						
1. Kosi at S.T. 13 (Barakshetra)	419.96 8,00,000c.s.	24-8-54	405.26	1948	414.86 (Computed 7,05,000 c.s.)	1927
	413.06 6,60,000c.s.	27-7-54			405.26 (observed 4,78,000 c.s.)	1948
2. Gandak at Triveni .	367.70	30-7-54	364.90	1950	367.75	18-8-1902
3. Lal Bakya at Gobari.	106.00		106.20	1935	107.60	2-9-1916
4. Teur at Ekadri .	242.30	26-7-54	244.00	1947	246.24	1893
5. Burhi Gandak at Secunderpur . .	174.64		175.85	1946	178.85	1916
6. Baya at Bhagwanpur	164.42	3-8-54	167.74	1953	167.74	1953
7. Bhagmati at Dhang	232.90		231.30	1946	234.80	1902
8. Kamla at Rajnagar .	195.75		197.75	1947	197.75	1947
9. Ganges at Digha .	165.01	17-8-54	172.41	1947	172.41	1923

APPENDIX I—(contd.)

COMPARISON OF 1954 FLOODS WITH MAXIMUM RECORDED FLOODS

Name of the river	1954 Flood		Previous Max. flood	
	Max. level	Date	Max. level	Date
1	2	3	4	5
U. P. :				
1. Gogra at Manjhi Inchcape Bridge	182.75	24-8-54	185.02	1936
WEST BENGAL :				
1. Torsa at Cooch Behar	191.50	28-7-54	189.85	1952
2. Kaljani at Alipur Duars	202.00	26-7-54	204.00	1952
3. Tista at Jalpaiguri	269.60	24-8-54	270.51	1950
4. Sutanga	212.00	29-7-54	214.43	1952
5. Jaladhaka		28-7-54		
6. Mahananda	382.00	28-7-54	380.00	1950
ASSAM :				
1. Brahamputra at Dibrugarh	343.00		343.86 343.30	1946 1931
2. Tejpur	219.90		221.40	1906
3. Gauhati	164.86		169.26	1906
4. Dhuri	97.62		97.29	1931
KASHMIR :				
1. Jhelum at Khannabal			5240.40	1950
2. Sangam			5229.70	1950
3. Awantipura			5219.40	1950
4. Badshahibagh			5212.20	1950
5. Munshibagh			5209.80	1950
6. Banyari			5180.80	1948
7. Sopore			5182.80	1948
8. Baramula			5178.80	1948

APPENDIX II

STATEMENT SHOWING DAMAGE TO CROPS AND HOUSES DUE TO FLOODS IN THE STATES OF UTTAR PRADESH, WEST BENGAL, BIHAR AND ASSAM FOR THE QUINQUENNIUM ENDING 1954

Year	Area under floods (lac of acres)	Damage to crops (crores) Rs.	House damaged (in thousands)	Damage to houses (in crores) Rs.	Cattle lost	Human lives lost	Total loss (in crores) Rs.
1	2	3	4	5	6	7	8
UTTAR PRADESH :							
1950 . .	26.00	12	25	1.25	2200	128	13.25
1951 . .	No floods						
1952 . .	No appreciable floods						
1953 . .	22.51	10	80	4.0*	341	23	14.00
1954 . .	17.00	7	8	0.4	2000	25	7.4
Total 5 years .	65.51	29	113	5.65	4541	176	34.65
Average . .	13.00	5.8	22.6	1.13	980	35	6.93

*Assessed at Rs. 500 as suggested by the Revenue Secretary, U. P. on Telephone.

APPENDIX II (contd.)

1	2	3	4	5	6	7	8
WEST BENGAL :							
1950 . .	.64	0.10	.55	.04	3000	80	0.14
1951 . .	.003	0.03	...	...	...	...	0.03
1952 . .	.64	0.10	.55	.04	severe	8	0.14
1953 . .	.064	0.05	...	.01	...	...	**0.06
1954 . .	6.40	7.50	N.A.	N.A.	1500	142	7.50
Total . .	7.747	7.78	1.23	.09	4500	230	7.87
Average . .	1.55	1.56	0.25	.02	900	46	1.58

**7 acres of Cooch Behar town washed away.

APPENDIX II (contd.)

1	2	3	4	5	6	7	8
BIHAR :							
1950 . .	3.35	1.0 } com-	...	...	...	...	1.0
1951 . .	0.07	... } put	...	...	...	...	...
1952* . .	0.99	.3 } ted	...	... }	...	...	0.3
1953 . .	over 73.00	29.0	84	6 } compu-	...	...	35.0
1954 . .	32.00	15.0 }	40	5 } ted	608	42	20.0†
Total . .	109.41	45.3	124	11	608	42	56.3
Average .	21.88	9.06	24.8	2.2	122	8	11.26

*Area under crops destroyed in 73 lac acres and this has been adopted against 64 lac acres total area flooded.

†Figures incomplete.

APPENDIX II (contd.)

1	2	3	4	5	6	7	8
ASSAM :							
1950 . .	5.76	2.5	N.A.	N.A.	5000	564	2.5
1951 . .	64.00	2.1	N.A.	2.2	7000	4	4.3
1952 . .	2.07	2.3	N.A.	1.9	5441	7	4.2
1953 . .	not given	0.2	N.A.	.3	837	4	0.5
1954 . .	76.80	9.0	N.A.	.34	3094	17	9.34
Total . .	148.63	16.10	N.A.	4.74	21372	596	20.84
Average . .	29.73	3.22	N.A.	0.95	4274	119	4.17

N.A. : Not Available.

APPENDIX II (contd.)

1	2	3	4	5	6	7	8
TOTAL OF STATES :							
1950 . .	35.75	15.60	N.A.	1.29	10200	772	16.89
1951 . .	64.01	2.13	N.A.	2.20	7000	4	4.33
1952 . .	3.70	2.70	N.A.	1.94	5441	15	4.64*
1953 . .	96.15	39.25	N.A.	10.31	1178	27	49.56
1954 . .	132.20	38.50	N.A.	11.74	7202	226	50.24†
Total . .	321.80	98.18	N.A.	27.48	31021	1045	135.66
Average . .	64.44	19.63	N.A.	5.50	6202	209	25.13

* Severe in West Bengal.

† Figures incomplete.

Note: This statement is based on the latest material supplied by the respective Governments, except that in some places costs have been computed where not supplied by the States. The figures for Bihar for 1954 may increase considerably.

APPENDIX III

A. SURVEYS

Ground and Aerial

(1) Correct course of the river from emergence from Himalayas to confluence with Ganga or any other river must be correctly known. The locations at which tributaries of the river join it and the angle must also be known.

(2) A longitudinal section showing the average bed level, maximum and low water levels must be obtained.

(3) Cross sections at intervals of one mile extending upto either five miles on either side or till the high ground, which is above MWL (a Maximum water level), whichever is less.

(4) Surveys of chaurs or low depressions adjacent to the river course.

(5) Mosaic aerial maps of the river system, scale 4 inches to 1 mile.

B. SILT DATA

(1) The sizes and percentage of silt particles at different periods of flow in the river at (i) exit from gorge, (ii) end of steep slope, and (iii) in the last reach of the river.

(2) Size and composition of bed material and banks on either side at intervals of a mile.

(3) Bed load determination–particles size and quantity.

C. RIVER FLOW

(1) Observation of rainfall data in the hill and plain catchment areas of river-study of the data collected previously

(2) Actual gauge and discharge observations of the river at 2 or 3 places.

(3) Determination of maximum flood levels by marks or enquiries.

(4) Incidence and intensity of storms.

D. STORAGE SITES

(1) Preliminary reconnaissance survey.

(2) Detailed survey of a few of the sites.

(3) Geological survey at the probable sites.

(4) Minimum Drilling.

(5) Materials of construction–soils, stone and sand.

(6) Transport facilities.

(7) Storage requirements and possible capacities.

(8) Capacity survey at a later date after the site is fixed.

E. HYDRAULIC MODEL TESTS

(1) Study of the flow in a single river.

(2) Inter-action of flows in different rivers.

F. EFFECT OF FLOODS IN THE MAIN RIVER ON THE DRAINAGE OF TRIBUTARIES

(1) Observation of flood levels in Ganga or Brahmaputra and its back water effect on the drainage of tributary rivers.

(2) Simultaneous observation of water levels in Ganga or Brahmaputra and tributary rivers.

G. SPECIAL CHARACTERISTICS OF THE RIVER DATA LEADING TO

(1) Heavy silting.

(2) Meandering.

(3) Violent movement.

(4) Heavy erosion.

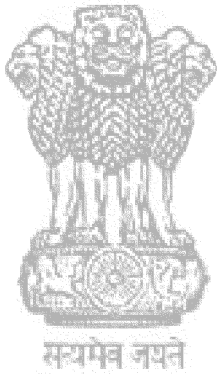
(5) Effect of shortening or dredging.

H. MISCELLANEOUS

(1) Survey of villages affected.

(2) Survey of existing waterways in road and rail embankments.

(3) Details of inundated areas and flood damages.

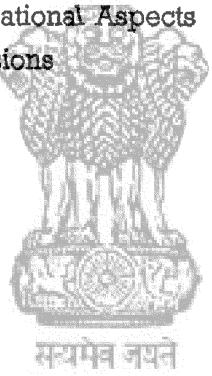


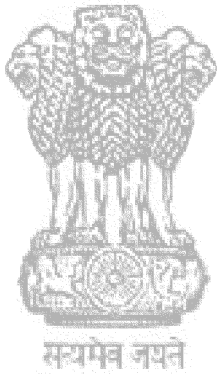
APPENDIX VII

DAMODAR VALLEY CORPORATION

A CASE STUDY

Chapter

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APPENDIX VII

CASE STUDY ON DAMODAR VALLEY CORPORATION

CHAPTER I

INTRODUCTION

Formation of the DVC

1.1 In 1943, the Damodar river was visited by a catastrophic flood. It caused widespread destruction, washing away villages, destroying fertile paddy lands and disrupting communication system. Calcutta was completely cut off for about 10 weeks. It was estimated that the loss in the valley was around Rs. 8 crores. In order to suggest remedial measures the Governor of Bengal appointed the "Damodar Flood Inquiry Committee" which suggested creation of an authority similar to that of the Tennessee Valley Authority (T.V.A.) in the United States. Thereafter, a conference of the representatives of the Central Government and the Government of Bihar and West Bengal was held which decided that all related data bearing on unified river development should be collected and a preliminary memorandum drawn up. This task was entrusted to Mr. W. L. Voorduin, Senior Engineer, TVA. Mr. Voorduin drafted a memorandum embodying the outline of a plan designed for achieving flood co ntrol, irrigation, power generation and navigation this is known as the "Voorduin's Preliminary Memorandum". This endorsed the creation of an "Authority" comparable to the TVA. After consideration of the Memorandum and the reports of a special high level United States Technical Mission and two Indian Associates, the three concerned Governments viz., the Governments of India, West Bengal and Bihar agreed to constitute the Authority. As an interim measure they appointed an administrator for the Damodar Valley Project to look after the preliminaries.

1.2 An agreed draft of the Bill was prepared and placed before the Legislative Assembly of India on 1st December, 1947. This emphasised that for "efficient administration, the Authority must be vested with a high degree of autonomy for conducting the undertaking". The State Governments agreed to surrender to the "Corporation" such of their powers as would enable it to discharge its functions effectively. The Bill was passed bythe Bihar and the West Bengal Legislatures and the Constitutent Assembly of India on 18th February, 1948. It was placed on the Statute Book on 27th March, 1948. On 7th July, 1948 the DVC became a corporate body with full authority for accomplishing the functions assigned to it. Thus, the DVC was a joint creation of the two states and of the Central Government. The participation of the Central Government was essential, firstly, for funds which the State Governments could not afford, and secondly on account of its interest in the successful managemnt of water resources of an inter-State river. Moreover, the Bihar Government could not be expected to invest in a project which would largely benefit the lower Valley, which was outside the State, and, West Bengal, in spite of being the main beneficiary, would not have liked to invest in the catchment areas falling in another State.

Objectives of the DVC

1.3 The statutory functions of the Corporation as given in Section 12 of the Act are :

(a) the promotion and operation of schemes for irrigation, water supply and drainage;

(b) the promotion and operation of schemes for the generation, transmission and distribution of electrical energy, both hydro-electric and thermal;

(c) the promotion and operation of schemes for flood control in the Damodar river and its tributaries and the channels, if any, excavated by the Corporation in connection with the scheme and for the improvement of flood conditions in the Hooghly river.

(d) the promotion and control of navigation in the Damodar river and its tributaries and channels, if any;

(e) the promotion of afforestation and control of soil erosion in the Damodar Valley; and

(f) the promotion of public health and the agricultural, industrial, economic and general well-being in the Damodar Valley and its area of operation.

The Case Study

1.4 The National Flood Commission was asked to review the flood protection measures undertaken since 1954 together with the existing administrative and organisational set-ups for flood control at the Centre and the States and to evolve a comprehensive approach to the problem of floods keeping in view the need for optimum and multi-purpose utilisation of water resources, as also, the role of soil conservation and afforestation in flood control. The Commission thought it useful to conduct a case study of the Damodar Valley Corporation because it provided the only example in the country having some bearing on the aspects involved.

It is a unique organisation in the country which was set up with jurisdiction over an entire river basin extending over more than one State and charged with the responsibility of flood control in the context of multiple use of water. Its other objectives included irrigation, power, navigation and overall development of the basin, Flood control was sought to be achieved by a series of multipurpose reservoirs located at different places, and improvement of the carrying capacity of the Lower Damodar. Besides soil conservation measures in the basin were also to be undertaken in the upper catchment.

Objectives of the Study

1.5 The objectives of the study are :

(a) to evaluate the performance of the DVC in moderating floods as part of the multi-purpose project for utilisation of water resources;

(b) to assess the effectiveness of soil conservation measures, undertaken in the upper catchment of the basin, in relation to the problem of floods; and

(c) to study the organisation set-up.

Methodology

1.6 The effects of the reservoirs on flood moderation and of soil conservation in reducing sediment deposition have been studied with respect to such aspects as :

(i) storage planned, created and utilised;

(ii) discharge from the dams and the barrage;

(iii) effect of flood moderation on river regime downstream; and

(iv) effectivenss of soil conservation measures.

Organisational aspects have been studied from the points of view of :

(i) the adequacy of the DVC Act;

(ii) effectiveness of the organisation as a decision making and executing body; and

(iii) the role of participating Governments.

Source of data

1.7 Data for the study have been collected mostly from secondary sources such as Annual Reports, Budget Estimates and other published and unpublished documents of the Corporation and reports of the various Committees set up by the Corporation and the participating Governments. Besides information generated through discussions with the officers of the Corporation, Flood Control Unit of the Government of West Bengal and the administrative Ministry incharge of the DVC at the Centre have also been utilised. In addition, field visits were made for assessing effectiveness of the soil conservation programme in the upper catchment.

CHAPTER II

ACTIVITIES—AN OVERVIEW

Construction of Dams

2.1 The multiple objectives of flood control, irrigation and power etc. have been sought to be achieved principally through a set of reservoirs constructed at different sites, on the river Damodar and its tributaries. The project had originally envisaged eight dams—Tilaiya, Maithon, Balpahari, Bokaro, Konar, Panchet, Aiyar and Berno. However, on account of financial and other reasons, the participating Governments decided to implement the unified scheme in two phases In the first phase only four dams, viz., Tilaiya, Konar, Maithon and Panchet, were constructed; The Tilaiya dam in February, 1953, the Konar in September, 1955, the Maithon in 1957 and the Panchet at the end of 1959.

Barrage & Irrigation Canals

2.2 Another important activity related to the construction of a barrage across the Damodar at Durgapur with the head regulators for canals on either bank for feeding, an extensive system of canals and distributaries. The barrage and irrigation works include the following ;

(i) the barrage at Durgapur (692 metre long);
(ii) the main canal, on the left bank (137 km) and the main canal on the right bank (89 km.);
(iii) the branch and minor canals, distributaries and drainge channels (2270km);
(iv) irrigation structures, like regulators syphons, sluices etc.

2.3 The barrage was started in 1952 and inaugurated in August, 1955. Its subsidiary structures were, more or less, completed by 1958. The left-bank canal and its distributaries serve the districts of Burdwan, Hooghly and Howrah, while the right bank canal system irrigates parts of the Burdwan, Hooghly and Bankura districts. Management of the barrage and irrigation system together with the work in connection with the development of the water courses/field channels were transferred to the Government of West Bengal in 1964-65.

2.4 The canals are designed to provide committed irrigation of 3.42 lakh hectares, and 0.22 lakh hectares, in Kharif and Rabi seasons respectively, besides providing water for industrial and domestic uses.

Navigation

2.5 Section 12 (d) of the DVC Act provides for the promotion and control of navigation in the Damodar river and its tributaries and channels. With this object in view, the left bank canal was designed as an irrigation-*cum*-navigation canal. It was opened for commercial traffic in July 1963.

2.6 In spite of the capital outlay of Rs. 5.35 crores on the navigational facilities incurred upto March, 1972, and also an average annual expenditure of Rs. 17 lakhs on maintenance of the canal, navigation continued to be unremunerative till 1971-72. A further capital outlay of Rs. 5.01 lakhs on the navigational facilities in the canal was incurred during the last six years from 1972-73 to 1977-78 and the average expenditure on maintenance of the canal during this period amounted to Rs. 19.25 lakhs per annum.

2.7 As against the anticipated annual flow of 2 million tonnes of cargo traffic, the quantity actually transported on trial basis through the canal per year was 1,667 tonnes in 1972-73, 125 tonnes in 1974-75 and nil in subsequent years.

Power

2.8 After completion of the first phase of the DVC project, the Corporation concentrated mainly on power generation, transmission and distribution to meet the rapidly growing industrial demand within and outside the valley. There are three hydel stations appended to Tilaiya, Maithon and Panchet dams and three large thermal power stations at Chandrapura, Bokaro and Durgapur. Commencing with an installed capacity of 100MW in 1952-53, the DVC built up a capacity of 1,241MW by 1974-75

to 1978-79; another 120MW unit at Chandrapura was added by 1978-79, while a 200 MW unit at Durgapur is in the final stage of construction and is expected to raise the total capacity in 1979-80 to 1,561 M.W. The Planning Commission has approved installation of a second unit of 40MW at Panchet and 200MW thermal unit at Bokaro "B" power station. The installed capacity of the DVC power system during 1978-79 was 1,301MW, out of which 1,197MW was thermal and 104MW was hydel.

Soil conservation measures

2.9—2.9.1 In order to deal with the problem of soil erosion in the upper catchment, a soil conservation Department was established in 1949. However, till 1955, the department was mainly engaged in land reclamation works for the purpose of rehabilitation. The Upper Damodar catchment, comprising a total area of 17,474 sq km has been divided into 39 sub-catchments. For the purpose of planning for soil conservation, 20 of these sub-catchments have been classified as priority I on the basis of their hydrological behaviour. Different measures of soil conservation are being carried out in 56 priority areas. These include afforestation, soil conservation, extension, and, soil conservation engineering.

2.9.2 Extension works include (a) investigation and planning, (b) terrace construcnon, (c) gully control measures, (d) wood land development, (e) grass water ways, (f) diversion channel, and (g) bench terracing etc. The engineering works include gully plugs, check dams, grade stabilisation structures, farm ponds, percolation tanks and sediment control dams. Sediment control structures have been constructed in actively eroded gullied areas for trapping the sediment and for improving the moisture regime of the areas for their effective rehabilitation.

2.9.3 The achievements under various schemes up to March, 1979, are listed in Table 2.1 .

TABLE 2.1

STATUS OF SOIL CONSERVATION SCHEMES

Nature of Measures	Total extent of works	Achievements upto March, 1979	Col. 3 as % of Col. 2	Priority work included in total		Col. 6 / Col. 5 %
				Target	Achievement	
1	2	3	4	5	6	7
1. Soil Survey						
(i) Reconnaissance .	18,00,000	12,45,822	69	8,58,617	10,48,030	22.06
(ii) Detail Survey . .	18,00,000	3,39,720	19	5,00,000	1,27,239	25.45
2. Afforestation . . .	1,88,581	1,24,777	66	86,969	90,385	103.9
3. Soil Conservation Extension	2,74,778	1,41,300	51	1,59,707	1,02,711	64.31
4. Soil Conservation Engineering	1,24,991	79,636	64	95,024	59,693	62.82

2.9.4 The total expenditure incurred on soil conservation programme till 1978-79 is given in the Table 2.5. The expenditure on these measures works out at Rs. 644 per hectare.

TABLE 2.2.

EXPENDITURE INCURRED ON SOIL CONSERVATION PROGRAMME

Period	Agricultural land	Non-agricultural land	Total
Ist Plan	0.43	7.02	7.45
2nd Plan	14.29	56.28	70.57
3rd Plan	90.03	148.52	238.55
1966-69	80.54	159.53	240.07
4th Plan	215.46	392.10	607.56
1974-79	298.25	563.04	861.29
	699.00	1326.49	2025.49

Rehabilitation

2.10 Consequent upon the construction of the dams, thermal plants etc., people have been displaced from their homes. For resettlement, they were given land, houses or cash compensation for their resettlement according to their choice. Four rehabilitation villages near Tilaiya had been set up, one each at Panch-Madho, Bachhai, Singrawan, and Gouri Karma. Moreover, the DVC has adopted two villages, viz., Bhureabe and Layakdih in Giridih and Purulia districts under its environmental development programme.

Expenditure incurred

2.11 The actual capital outlay on the different activities mentioned above upto 31st March, 1979 amounted to Rs. 425.45 crores. Of this Rs. 214.72 crores was provided by the participating Governments. The excess of Rs. 210.73 crores was met by the Corporation out of its internal resources (Rs. 158.76 crores) and loans and debentures (Rs. 51.97 crores). From 1969-70 onwards, the participating Governments did not make any contribution towards capital. Details regarding outlays and contributions made for different objects are given in Table 2.3.

TABLE 2.3

CAPITAL PROVIDED BY THE PARTICIPATING GOVERNMENTS

(Crores)

Participating Governments	Main Objects							
	Flood control		Irrigation		Power		Total	
	Outlay	Contribution	Outlay	Contribution	Outlay	Contribution	Outlay	Contribution
Union Government .	7.00	7.00	...	...	119.07	49.00	126.07	56.09
West Bengal Govt. .	11.50	6.93	49.46	30.02*	119.07	72.27	180.03	109.27
Bihar Government .	...	...	0.29	0.11	119.07	49.25	119.35	49.36
Total . . .	18.50	13.95	49.74	30.13	357.21	170.52	425.45	214.76

* Excludes capital expenditure of Rs. 3.59 crores incurred directly.

CHAPTER III

FLOOD MODERATION

Introduction

3.1 Flood moderation is an important objective of the DVC and is achieved through the operation of reservoirs. In order to examine the effectiveness of these reservoirs, it is necessary to have some idea of the river system and the basic design assumptions at the time of the formulation of the Project.

River system

3.2 The Damodar river rises in the Palamu Hills of Chotanagpur, at an elevation of about 609.57 m above M. S. L. The Barakar and the Konar in Bihar are its important tributaries. After flowing in south-easterly direction in the rocky areas of Bihar and West Bengal, the river enters the plains below Raniganj. Below Durgapur, it abruptly changes its course to southerly direction in the vicinity of Burdwan. Near Begua 'hana' it bifurcates into two channels, viz., the Damodar channel (also known as Amta Channel) and the Kanka-Mundeswari channel. The Damodar channel is silted up and now carries discharge during high floods only. The main flow passes through the Mundeswari channel which, in turn, further branches into two loops known as the Harinakhal and the Kabla nala which meet the main channel lower down. Ultimately the river discharges into the river Rupnaryan via the Hurhura, the Chaubisbigha, and the Aurora Khals. The river has a total length of about 540 km. Reachwise break-up of catchment area is as under.

1.	Catchment area upto the confluence of the Barakar	17,260 sq km
2.	Catchment area below the Barakar confluence upto Durgapur . . .	2,295 sq km
3.	Catchment area upto outfall in the sea	2,461 sq km
	Total . . .	22,016 sq km

3.3. The Upper Valley, has a drainage area of nearly 17,260 sq km. From its confluence with the Barakar, the Damodar flows through undulating plain for about 400 km before joining the Hooghly.

The Damodar basin in West Bengal covers a total area of 5,535 sq km including the area known as Trans-Damodar area measuring about 2,499 sq km.

Flood problem

3.4 The Damodar is a shallow, wide and flashy river. The entire left bank area which includes important industrial towns, is protected by an embankment since long. Vital means of communication like the G. T. Road and the railway lines connecting Calcutta with important places in the country pass through this area. The right bank was also embanked. But, as it became difficult to maintain both the embankments, the right bank was abandoned at places.

The river had a long history of floods. Data on stream flow at a place called Rhondia (Anderson weir) was available from 1901 on a continuous basis though the readings prior to 1932 were not considered reliable. For the period prior to 1901, the estimates of flow were available for a few years only. The discharges above 2,830 cumecs (1 lakh cusecs) are shown in Annexure 3.1.

3.5 It would be observed that a flood discharge of the order of 18,406 cumecs (6.5 lakh cusecs) had been recorded five times during the 50 years preceding 1959. However, the flood of 1943, which was 9,911 cumecs only (3.5 lakh cusecs) resulted in a deluge as the left embankment breached causing breaches at several places in the railway line and the G. T. Road. As already, indicated in Chapter I, this catastrophe led to the establishment of the DVC which constructed four reservoirs for the control of floods.

Design assumptions

3.6.1 The design assumptions for the planning of reservoirs contained in Voorduin's preliminary memorandum in so far as they relate to the flood control aspect are as under:

3.6.2 *Design storm.*—Detailed examination of flow data as available at Rhondia, revealed that maximum flow of 18,406 cumecs (6.5 lakh cusecs) had occurred twice in August 1913 and August 1935. Examination of the rainfall records revealed that the 1913 flood originated from a mean rainfall of 302 mm (11.9 inches) in five days. A storm rainfall of 234 mm (9.2 inches) in three days accounted for the flood in 1935. The study of rainfall records led him to believe that the August 1913 flood could have been much higher if the storm had been centered over the Damodar catchment. He further found that rainfall of 457 mm (18 inches) had been recorded in the neighbouring Sone Valley; this led him to fear that a storm of the same magnitude could as well centre over the Damodar catchment. Accordingly, a storm isohytel pattern, similar in shape and centred over the Damodar catchment was constructed giving an average depth of 508 mm (20 inches) which would result in 457 mm (18 inches) surface run-off assumping 90% run-off coefficient. The discharge hydrograph was then drawn similar in shape to the computed hydrograph of the 1913 flood.

3.6.3 *Design flood.*—The above procedure resulted in the figure of 28,320 cumecs (10 lakh cusecs) as the design flood. However, the design flood for the post-15th August period was assumed as 21,238 cumecs (7.5 lakh cusecs) because the rainfall during this period was normally of a smaller magnitude than that of the early monsoon period. It may be noted that the design flood was 50% more than the maximum observed flood of 18,406 cumecs (6.5 lakh cusecs), as it was felt that protection should be provided for a higher flood, in view of the fact that "the semi-protected area would be built up and if a flood larger than the flood for which protection was provided did occur, the damage and loss of life would be far greater than if no flood protection at all had been provided".

3.6.4 *Location of dam sites.*—Immediately above the confluence of the Barakar with the Damodar rivers, the drainage is of a somewhat triangular shape, conducive to higher rates of flow. It was, therefore, thought desirable to locate the control dams on both the rivers as near the confluence as the topography permitted; thus the sites selected were 8 km above the confluence, at Mainthon and Panchet.

3.6.5 *Assumed contribution from the uncontrolled catchment.*—The uncontrolled drainage area above Rhondia and below these two dams was about 1,720 sq km. which itself is capable of producing a flood of high magnitude. It was assumed that the maximum flow from this drainage area including regulated discharges through the sluice gates of the upstream dams would not exceed 7,079 cumecs (2.5 lakh cusecs). Voorduin, however, thought that "during large flood, the peak flow from the lower area would have passed down the river by the time the storage space in the control dams would be filled and water discharged over the spillways of these dams".

3.6.6 *Assumed drainage capacity of lower Damodar.*—It was assumed that the Damodar river below Durgapur could pass around 7,079 cumecs (2.5 lakh cusecs) which would result from 228 mm (9 inches) rainfall in the lower valley. It was recommended to "make provision in the lower river for flows upto 250,000 cusecs regardless of the amount of reduction in flood peaks due to upper storage reservoirs". In order to enable the river to pass this flood, it was felt that raising and proper maintenance of the left bank would be required, while little or no protection would be necessary on the right bank which would be flooded only when the flow reached about 5,663 cumecs (2 lakh cusecs).

3.6.7 *Storage planned.*—The studies on reservoir regulation and flow hydrograph showed that in order to moderate the design flood of 28,320 cumecs (10 lakh cusecs) to 7,079 cumecs (2.5 lakh cusecs) at Rhondia, a flood reserve capacity was needed so as to impound 228 mm (9 inches) run-off which was equivalent to $4.56 \times 10^9 m^3$ (3.7 million acre ft.). Accordingly, a system of seven reservoirs were proposed, which had about $3.58 \times 10^9 m^3$ (2.9 million acre ft) of controlled flood reserve and $0.61 \times 10^9 m^3$ (0.5 m acre ft.) of uncontrolled flood cushion above the top of the gates. A provision of $3.58 \times 10^9 m^3$ (2.9 million acre ft.) of flood storage closely approximates to the total volume of recorded flood of 1913 which had a maximum intensity of 18,406 cumecs (6.5 lakh cusecs).

Implementation of the project

3.7 The implementation of the unified plan of the DVC was decided to be undertaken in two phases. The first one which has been implemented, consists of the construction of 4 dams viz., Tilaiya, Konar, Maithon and Panchet and a barrage at Durgapur. The flood cushion therefore got reduced from the designed $3.58 \times 10^9 m^3$ (2.9 million acre ft) to $1.86 \times 10^9 m^3$ (1.51 million acre ft.). Even this could not be achieved in

practice as the lands upto the top of the gates were not acquired due to various reasons. The net available flood cushion is now $1.28 \times 10^9 m^3$ (1.047 million acre ft) only as detailed below :

TABLE 3.1

Sl. No.	Name of Dam	Name of the river	Flood cushion designed Elevation		Volume million ac. ft.	Flood cushion available Elevation		
			RL in feet	cub. mtrs.		RL in feet	cub. mtrs.	Volume million Ac. ft.
1.	Maithon . .	Damodar	480—500	0.543×10^9	0.440	480—495	0.38×10^9	0.311
2	Panchet . .	Barakar	410—445	1.09×10^9	0.881	410—435	0.67×10^9	0.540
3	Konar . .	Damodar	1397—1404	0.056×10^9	0.041	397—1404	0.59×10^9	0.048
4	Tilaiya . .	Barakar	1210—1222	0.178×10^9	0.148	1210—1222	0.18×10^9	0.148
				1.867×10^9	1.510		1.28×10^9	1.047

Flood moderation achieved

3.8—3.8.1 Examination of actual inflow and outflow data for the last two dams at Maithon and Panchet show that major floods nearing or exceeding the maximum observed inflow of 18,406 cumecs (6.5 lakh cusecs) occurred only in 1959 and 1978 as seen from the table 3.2.

TABLE 3.2

Year	Maximum combined				Max. water level at		Max. flood cushion		Durgapur Discharge	
	inflow lakh cumecs	lakh cusecs	outflow lakh cumecs	lakh cusecs	Maithen L.L. in feet	Panchet R.L. in feet	Maithen R.L. in feet	Panchet R.L. in feet	cumecs	lakh cusecs
1958 . .	15,715	5.55	4,955	1.75	N.A.	N.A.	N.A.	N.A.	5805	2.05
1959 . .	17,641	6.23	8,155	2.88	N.A.	N.A.	N.A.	N.A.	9911	3.50
1960 . .	9,854	3.48	2,944	1.04	N.A.	N.A.	N.A.	N.A.	2775	0.98
1961 .	14,611	5.16	4,559	1.61	495.10	432.33	495	435	5521	1.95
1962 . .	4,364	1.52	1,274	0.45	477.27	414.96	495	435	N.A.	N.A .
1963 . .	13,167	4.65	3,426	1.21	493.37	426.02	495	435	3454	1.22
1965 . .	10,562	3.73	2,209	0.78	473.58	418.75	495	435	2746	0.97
1967 . .	5,153	1.82	2,888	1.02	487.15	420.06	495	435	N.A.	N.A.
1968 . .	6,965	2.45	2,888	1.02	491.30	430.58	495	435	N.A.	N.A.
1969 . .	5,351	1.89	594	0.21	484.85	419.28	495	435	N.A.	N.A.
1970 . .	8,268	2.92	2,883	1.00	193.01	433.29	495	435	N.A.	N.A.
1971 . .	12,006	4.24	5,097	1.80	493.70	425.54	495	435	6286	2.22
1972 . .	3,511	1.24	877	0.31						
1973 . .	16,650	5.88	4,955	1.75	494.44	432.88	495	435	5748	2.03
1974 . .	6,513	2.30	1,415	0.50						
1975 . .	9,741	3.44	3,114	1.11	487.67	422.21	495	435	4474	1.58
1976 . .	8,410	2.97	4,615	1.63	487.88	428.85	495	435	5663	2.00
1977 . .	8,211	2.91	2,888	1.02	488.46	423.69	495	435	N.A.	N.A.
1978 . .	21,917	7.74	4,615	1.63	491.54	432.20	495	435	10,760	3.80

* Data collected from the D.V.C Office.

3.8.2 It is interesting to observe that the inflow into the two reservoirs has for most of the years been more than 7,079 cumecs (2.5 lakh cusecs) which was regarded as the safe carrying capacity of the river. The outflow from the dams has been restricted to less than 4,248 cumecs (1.5 lakh cusecs) in most of the years. Except for one year (1959), the outflow from the dams has been less than 5,663 cumecs (2 lakh cusecs). Similarly, the outflow from the Durgapur barrage has also been less than 7,079 cumecs (2.5 lakh cusecs) except in the years 1959 and 1978.

3.8.3 During 1959, the peak inflow into the reservoirs was 17,641 cumecs (6.23 lakh cusecs) which was moderated to 8,155 cumecs (2.88 lakh cusecs). However, the outflow from Durgapur barrage was 9,911 cumecs (3.50 lakh cusecs) due to the contribution from intermediate catchment. It has been estimated by the DVC authorities that had there been no dams, a flood of 22,937 cumecs (8.1 lakh cusecs) would have been experienced below Durgapur, which is much higher than the highest recorded i.e. 18,406 (6.5 lakh cusecs) till that date.

3.8.4 The 1978 flood was an all-time high. It is estimated by the DVC authorities that a flood of 33,414 cumecs (11.8 lakh cusecs) would have been experienced below Durgapur, had there been no dams, thus surpassing the design flood of 28,316 cumecs (10 lakh cusecs) as is shown in the table 3.3.

TABLE 3.3

REGULATION OF THE 1978 FLOOD

	(A) With 4 DVC Dams				Without Dams			
	3 hourly peak inflow		3 hourly peak outflow		3 hourly peak inflow		3 hourly peak outflow	
	cumecs	Lakh cusecs	cumecs	lakh cusecs	cumecs	lakh cusecs	cumecs	lakh cusecs
1. At Maithon and Panchet	21,917	7.74	4,615	1.63	26,958	9.529	26,958	9.529
2. At Durgapur .	10,732	3.79	10,732	3.79	33,414	11.767	33,414	11.767

3.8.5 It is useful to recall that it was the havoc caused by the 1943 flood which led to the establishment of the DVC. With the significant industrial development that has taken place below Durgapur, the potential of damage due to floods of the magnitudes of 1959, or 1978 and in the event of a breach in left embankment assumes frightening proportions. In the year 1978, but for the DVC dams, the whole of the industrial belt of Asansol, Durgapur, major portion of the districts of Burdwan, Bankura, Hooghly, Howrah, the G. T. Road and the E. Rly link would have been very seriously affected.

3.8.6 An examination of the available flow data of 1978 shows that the actual water levels in both Mainthon and Panchet dams at the time of arrival of floods were lower than the monsoon storage levels, by 0.304m and 1.07m respectively. This helped the regulation authorities to limit the outflow below the dams to 4,616 cumecs (1.63 lakh cusecs) instead of 5,663 cumecs (2 lakh cusecs) which could have occurred otherwise.

3.8.7 A study carried out by the DVC shows that if the pre-flood level in the reservoirs was at the monsoon storage, the 1978 flood would have been moderated to about 4,530 cumecs (1.60 lakh cusecs) only if lands had been acquired upto the top of the gates, which is not yet the case.

Contribution from the intermediate catchment

3.9 Mr. Voorduin had visualised that there would be substantial contribution of flow from the intermediate uncontrolled catchment. The Srinivas Rao Committee (1969) estimated that contribution of the uncontrolled intermediate catchment would be of the order of 3,964 cumecs (1.40 lakh cusecs). However, the maximum combined release from the dams in 1959 was 8,155 cumecs (2.88 lakh cusecs) while that at Durgapur was 9,911 cumecs (3.5 lakh cusecs), leading to the conclusion that synchronisable contribution was the order of 1,756 cumecs (62,000 cusecs) in 1959. The Committee suggested that the synchronoisable contribution from the intermediate catchment may be taken to be of the order of 2,549 cumecs (90,000 cusecs). Taking this into account, they suggested that the maximum outflow from the dams should be restricted to 4,531 cumecs (1.60 lakh cusecs). In 1978, the combined outflow from dams was restricted to 4,616 cumecs (1.63 lakh cusecs), whereas the maximum outflow from Durgapur was 10,760 cumecs (3.80 lakh cusecs). Thus, the synchronisable contribution was of the order of 6,144 cumecs (2.17 lakh cusecs) from the area below the dams upto Durgapur. The data on total contribution including that from area below Durgapur is not available.

It deserves special mention that the release of 8,155 cumecs (2.88 lakh cusecs) against an inflow of 17,641 cumecs (6.23 lakh cusecs) in 1959 achieved moderation to a much lower extent than that in 1978, when the release was eventually lower with a relatively higher inflow.

The meteorological phenomenon which caused the 1978 situation on account of the cyclone turning back towards the Bay causing extensive intense rainfall in the upper catchment followed by similar rainfall in the lower catchment of the Damodar basin is considered to be unprecedented as per the available data for more than 100 years. The synchronisation of the heavy reservoir release with the uncontrolled catchment contribution that occurred in 1978 could not have been envisaged by the original planners. To achieve flood moderation on such rare occasions, in a manner as to ensure non-sysnchronisation with the contribution from the intermediate catchment a much larger storage capacity would be needed. This would be highly expensive and not economically viable.

Drainage capacity of Lower Damodar

3.10—3.10.1 The moderation of the designed flood to 2.5 lakh cusecs, by itself, was not sufficient to tackle the problem of floods in the lower Damodar area, because of the inadequate drainage capacity. As mentioned in the preliminary memorandum, the carrying capacity of the lower reaches of the river below Begunia was about 1,416 cumecs (50,000 cusecs). In addition, there was the problem of the flooding of the land on the right bank from the waters of the neighbouring streams like Darakeswar, Silai and Kasai etc. Hence, Mr. Voorduin had rightly concluded that "the prevention of flooding on the right bank below Begunia is, therefore, dependent upon the solution of the flood control problem in the delatic plains of West Bengal".

The Committee appointed by West Bengal under the Chairmanship of Shri G. B. Mondal (1956) estimated that the bankful capacities of different channels into which the Lower Damodar split after bifurcation was only 4,305 cumecs (1,52,000 cusecs). Any flow above this figure would pass into the trans-Damodar area causing acute drainage congestion and spilage. The lockage of tidal channels at outfalls, would further add to the flood problem of the area. All the above factors lead to the situation that even if the entire flow from the upper catchment is prevented from passing below the dams, the contribution from the intermediate catchment itself may, under certain situations, cause flooding in the lower Damodar area. This underlines the need to undertake suitable measures in this area to supplement the flood moderation effect of the dams. Measures such as embankments along the Mundeswari to increase the carrying capacity of the river in lower reaches have been thought of from time to time. Elaborate schemes have been chalked out and cleared by the Planning Commission but for one reason or the other, it has not been possible to implement them. Over the years the drainage capacity is reported to have been reduced further on account of the continued silting of the river bed due to insufficient flushing and effect of the tidal prism. Moreover, the increased sense of security against floods has resulted in further encroachments into the flood plains and the river bed.

Effect of dams on regime of the river

3.11—3.11.1 Several problems arise in the lower reaches of a river after the construction of dams. In the case of the Damodar, the condition of the lower reaches of the river was far from satisfactory, even before construction of the dams. The various spill channels of the river were blocked with vegetation & silt, resulting in deterioration of the bankful capacity. The problem was further complicated due to the effect of tidal lockage. Considering all these facts the Lower Damodar Investigation Committee (1956) had called for a "proper unified development of the entire lower valley as a whole instead of solution of individual problems for local & short term benefits".

The Committee suggested some steps for checking the deterioration of the lower Damodar, such as the prevention of encroachments and the growth of vegetation in the channels so as to cause minimum obstructions to flow. It laid great stress on the conservancy of the river and observed that "in fixing the priority of water uses, the conservancy of the river channel itself must not be ignored and should be given due consideration along with other uses of water viz. irrigation and generation of power". It further recommended that "concentrated flushing doses should occasionally be released down the river in the interest of the conservancy of the river channels" and wanted "studies to be made while releasing the flushing doses" to assess the effect of such operation on the regime of the river as well as various interests on the banks".

An examination of the outflow data from the dams for the last 21 years from 1958 to 1978 reveals that for 7 years the maximum outflow was of the order of 4,248 cumecs (1.5 lakh cusecs) or more. It was around 2,832 cumecs (1 lakh cusecs) for another 7 yearcs. In the remaining 7 years, the flow has been quite small. No studies seem to have been carried out to assess the effectiveness of these releases on the downstream regime of the river. The fact remains that the obstructions to flow in the lower Damodar Valley are still of a very serious nature, causing severe distress conditions. The resulting reduction in the carrying capacity of the river, therefore, tends to aggravate the flood problem.

Conclusion

3.12 Had all the DVC dams been constructed or were taken up as per design assumptions, the design flood would have been moderated to 7,079 cumecs (2.5 lakh cusecs) only. The moderation achieved so far or likely to be achieved with the execution of the remaining dams has to be viewed in conjunction with the second basic assumption of the planners that the lower Damodar should have safe carrying capacity of 7,079 cumecs (2.5 lakh cusecs). While the four dams have served their purpose, the lower channel is not capable of carrying the moderated discharge. There are reaches below Amta, where the Damodar river is not even capable of carrying a discharge of 1,415 cumecs (50,000 cusecs, thus underlining the need for an immediate solution of the problem of drainage congestion of lower reaches in order to derive the maximum benefits of flood moderation.

ANNEXURE 3.1 (PARAGRAPH 3.4)

DISCHARGE ABOVE ONE LAKH CUSECS-RIVER DAMODAR AT RHONDIA

Year	Peack flow in Cumecs	Cusecs
1	2	3
1823	18,406	6,50,000
1840	18,129	6,40,000
1855	9,911	3,50,000
1860	9,911	3,50,000
1864	9,628	3,40,000
1865	12,742	4,50,000
1866	11,893	4,20,000
1877	14,158	5,00,000
1878	6,230	2,20,000
1907	6,796	2,40,000
1913	18,406	6,50,000
1915	4,530	1,60,000
1916	11,185	3,95,000
1917	11,185	3,95,000
1933	6,480	2,26,000
1934	4,814	1,70,000
1935	18,406	6,50,000
1936	7,079	2,50,000
1937	5,946	2,10,000
1938	3,115	3,10,000
1939	7,985	2,82,000
1940	8,778	3,10,000
1941	17,698	6,25,000
1942	10,618	3,75,000
1943	9,911	3,50,000

ANNEXURE 3.1 (PARAGRAPH 3.4)—(contd.)

1	2	3
1944	5,380	1,90,000
1945	3,426	1,21,000
1946	8,891	3,14,000
1947	7,362	2,60,000
1948	6,512	2,30,000
1949	7,702	2,72,000
1950	9,571	3,38,000
1951	11,015	3,89,000
1952	5,125	1,81,000
1953	8,297	2,93,000
1954	7,419	2,62,000
1955	2,831	1,00,000
1956	8,580	3,03,000
1957	5,692	2,01,000
1958	18,830 (without dams)	6,65,000
	5,805 (with dams)	2,05,000
1959	22,635 (without dams)	8,00,000
	9,911 (with dams)	3,50,000

CHAPTER IV

SOIL CONSERVATION MEASURES

Introduction

4.1 The soil conservation and watershed management programmes including check dams, small storage structures etc. are an integral part of the operations of the DVC. These measures are to help reducing the yield of silt from the catchment areas thereby prolonging the life of the reservoirs constructed *inter-alia* for moderating floods.

The Problem

4.2 The upper catchment of the Damodar valley suffers from the problem of soil erosion brought about by the ruthless exploitation of forests, over-grazing and improper management of agricultural land over many years. Table 4.1 provides some information on the extent of soil eroded and gravity of the problem. It will be seen that out of 1.7 million hectare of land, about 0.6 million hectares i.e. about 35 per cent were under active erosion.

TABLE 4.1

PROBLEM OF EROSION IN UPPER DAMODAR VALLEY[1]

(000' hectares)

Reservoirs & rivers	Total land area	Total area under active erosion	Sheet erosion	Gully erosion
1	2	3	4	5
Tenughat (Damodar)	422	168(40)	129(31)	39(9)
Konar (Konar)	96	35(36)	27(27)	8(9)
Panchet (Damodar)	560	170(31)	145(26)	25(5)
Tilaiya (Barakar)	73	28(38)	21(29)	7(9)
Maithon (Barakar)	529	190(36)	141(27)	49(9)
Durgapur (Barrage)	58	7(11)	6(10)	Neg.(1)
Total	1728	598(35)	469(27)	128(8)

[1].*Source* : Soil Conservation Department, DVC

Note :—Figures in brackets indicate percentages of total land area.

Small Catchments

4.3 The effect of various conservation measures is amenable to measurements only in small catchments. Keeping this in view, the DVC has studied the effect of these measures in such catchments in controlling soil erosion and moderating the run-off. In this connection Shri B. N. Murthy cites the following example of a watershed where such a control has been observed.

> "The Upper Sewani Sub-catchment covering an area of about 93.24 sq km (36 sq miles) in the Damodar Valley was subjected to integrated soil and water conservation measures during the years 1955-56 and the treatment was completed in 1961. The various measures adopted in this sub-catchment includes construction of terraces, scientific cropping practices, construction of drainage channels and waterways, the development of grass land, gully plugging, and afforestation, etc. The area taken up for treatment was about 40 per cent of the total catchment. The annual rate of sediment production from this catchment prior to the treatment was in order of about 904 cu.m./km. (1.9 acre ft/sq. mile of the catchment, while the post treatment conditions indicated an erosion rate of 381 cu m/sq km (0,8 acre-ft/sq mile) of the catchment. This clearly brings forth the effect of soil conservation measures in the watershed in controlling the soil erosion rate. By treating an area of 40 per cent over a period of 10 years the rate of soil erosion has been reduced by 55 per cent".*

Treated versus *Untreated Mini Catchments*

4.4. During the period 1961-65 a pair of comparable mini-catchments, one measuring 296 hectares and the other 309.5 hectares, in sub-catchment No. 29 were taken up for study. One mini-catchment (296 hect.) was treated fully while the other was left untreated. Stream gauging operations were carried out in both the mini-catchments. The results are given in Table 4.2.

TABLE 4.2

TREATED AND UNTREATED MINI-WATERSHED[2]

Year of observation	Treated mini-watershed		Untreated mini watershed	
	Peak discharge (cusecs)	Annual silt charges (acre inch/acre)	Peak discharge (cusecs)	Annual silt charge (acre inch/acre)
1	2	3	4	5
1962	160	0.62	452	0.27
1963	130	0.016	436	0.31
1964	148	0.014	103	0.33
1965	140	0.16	612	0.61
1966	110	0.015	412	0.50

*B. N. Muthy : Reservoir sedimentation, life and remedial measures : 1977 : CBIP Publication No. 126, pp. 128 (Symposium on Silting of Reservoirs with special reference to Estimating the life of Reservoirs and Measures to Arrest the Rate of Sedimentation).

[2]. Report on small Reservoir sedimentation studies Soil Conservation Department DVC (cyclostyled paper)

It is observed that there was some reduction in the silt charge as a result of soil conservation measures. On the other hand, conditions worsened in the untreated mini-watershed. Had the Hydrological data upto 1978 been available it would have thrown more light on the present status of those watersheds.

Silt deposition & estimated life of reservoirs

4.5 Mr. Voorduin as well as others had indicated that the soil erosion in the upper Damodar valley will continue to be a source of worry for the major multi-purpose reservoirs to be installed in the valley. Mr. Voorduin estimated that with the construction of eight reservoirs, the combined life of the system would be 100 years. In 1957, Iyengar and Murthy, in their paper entitled."Silt in Relation to storage Reservoir", estimated the probable life of the DVC reservoirs on the basis of the deposition of silt during the period 1949 to 1956 at Barhi (near Tilaiya), Konar (near Konar), Chirkunda (near Maithon) and Sudandhi (near Panchet). Again in 1959, the Committee for Augmentation of Water Resources of the DVC (A.W.R.C.) further analysed the above study and came to the conclusion that the actual annual silt deposition may be 30 per cent higher than that estimated by Iyengar and Murthy. The findings of the two studies mentioned above are given in Table 4.3.

TABLE 4.3

ESTIMATED ANNUAL SILT DEPOSIT AND LIFE OF RESERVOIR

Reservoir	Dead Storage (ac. ft)	Estimated annual silt deposit (ac. ft.)		Estimated life of reservoirs years	
		Iyengar & Murthy	A.W.R.C. 30% more & Murthey	Iyengar	A.W.R.C.
1	2	3	4	5	6
Tilaiya	60,000	404	525	149	115
Konar	49,000	224	291	219	168
Maithon	1,68,000	684	839	246	189
Penchet	1,42,000	1982	2577	75	57

Loss of storage capacity of the Reservoirs

4.6—4.6.1 Surveys on sedimentation were carried out in 1963, 1965 and 1971 in the case of Maithon reservoir, in 1962, 1964, 1966 and 1974 in the case of the Panchet and in 1967 in the Tilaiya. The main object of the surveys was to find out actual position of the reservoirs vis-a-vis sedimentation for taking measures to reduce the sediment inflow into them. Table 4.4 gives comparative data on sediment yield in the case of the Maithon and the Panchet reservoirs.

TABLE 4.4

SEDIMENTATION RATE IN MAITHON AND PANCHET[a] RESERVOIRS AND LOSS OF STORAGE CAPACITY.

	Loss of Storage capacity	
	Maithon sq km	Panchet sq km
1. Watershed area	5309 (2050 sq. mile)	9920 (3830 sq. mile)
2. Capacity inflow ratio	0.60	0.36
3. Annual observed sediment deposit (ac.ft.) per 100 sq. mile	325(1963) 300(1965) 275(1971)	282(1962) 260(1964) 210(1974)
4. Loss of storage capacity due to sedimentation in per cent of area :—		
(a) Dead storage space	22%	35%
(b) Live sotrage space	10%	18%
(c) Flood storage space	Negligible	Negligible

[a]. Source : Soil Conservation Department, DVC.

4.6.2 The above table shows that during the first 15 to 20 years of impoundment the Maithon and the Panchet reservoirs have lost part of the live storage which cannot be offset by the provision of dead storage space only.

4.6.3 Shri Murthy has quoted the example of Maithon watershed covering an area of 5309.5 km. (2050 sq miles), where 1165.5 sq km (450 sq miles) have been subjected to various soil conservation treatments. It has been estimated by repeated sedimentation surveys of the Maithon reservoir that the annual yield of sediment which was of the order of 9.09×10^6 cu.m. (6,560 acre-ft) during 1963 showed figure of 6.96×10^6 cu.m. (5,640 acre-ft) during 1973, thus showing a downward trend. Assuming that this reduction is consequent on the watershed management and other conservation practices alone, this has shown a 15 per cent reduction in the sediment load. Similarly, in the Panchet watershed with an area of 9,920 sq km (3,830 sq miles) soil conservation measures are being implemented in an area of about 1,554 sq km (600 sq miles) for the past 18 years. The sedimentation rate in Panchet reservoir which was in the order of 13.2×10^6 cu m. (10,700 acre-ft.) during the 1962 survey showed a downward trend to 9.87×10^6 cu m (8,000 acre-ft) during the 1974 survey. Assuming, once again that the downward trend is consequent on the treatment measures, it may be said that by treating 15 per cent of Panchet watershed over a period of 18 years, the sediment load has been reduced by 25 per cent. However, this study does not take into account the effects of other factors like removal of sand for stowing, consolidation and shrinkage of the silt as well as the effect of delta formation for which quantitative information is not available.

Maintenance

4.7 In the villages of upper valley where soil conservation measures like terracing, check dams and afforestation were carried out, it was found that most of the works had deteriorated over the period as the maintenance of these works was not being done. It is learnt that the DVC is not responsible for the maintenance of works as these are handed over to individual cultivator/gram panchayat. Afforested areas are also handed over to the State Forest Department after a period of 5 years. It was reported that land erosion was also due to over grazing, uncontrolled deforestation and forest fires. Field visits have revealed that there was no proper planning of the programme. Moreover, with the spread of the programme supervision was also not quite effective.

Conclusions

4.8 Soil conservation and afforestation measures are being implemented in the upper valley for sevearal years. Precise impact of such works on reservoir sedimentation is difficult to assess in the absence of long-term data. The available information indicates that while watershed conditions over the treated areas have shown some improve with respect to erosion, untreated areas have reported faster rate of deterioration. Rate of sediment deposition in the reservoirs has shown a decreasing trend. In some of the treated mini-catchments some reduction both in the peak discharge and the silt yield has been noticed. A final view on the trend can be taken only with the availability of long-term performance data.

CHAPTER V

ORGANISATIONAL ASPECTS

Introduction

5.1 The pattern of organisation for any undertaking has to be such as to enable it to fulfil its objectives as effectively as possible. The task assigned to the DVC was a difficult one more difficult than that of the TVA on which it was largely modelled. Apart from the objectives of flood control navigation, power, soil conservation, afforestation and area development which are like the TVA, the DVC has also been given the task of promotion and operation of irrigation schemes, and drainage. The incnlsion of several objectives, with conflicting interests, required an appropriate organisatihnal system which would have complete control over the management of the entire river.

Organisational set-up

5.2—5.2.1 Section 4 of the DVC Act provides that the Corporation shall consist of a Chairman and two other members appointed by the Central Government, in consultation with the State Governments of West Bengal and Bihar. This is in sharp contrast to the TVA where the Board of Directors consisting of a Chairman and two members is appointed directly by the President with the concurrence of the U.S. Senate without the States having any say in the matter.

5.2.2 Sub-section (1) of Section 5 of the original DVC Act provided that every member shall be a whole-time servant of the Corporation. This was reviewed in September, 1957. In view of considerable reduction in the volume of construction activity, it was felt that the structure existing then, of a whole-time Chairman and Members was top heavy and not justified by the quantum of work. Consequently, subsectioh(1) of section 5 referred to above was omitted with the result that it was open to the Central Government to appoint full-time or part-time members.

5.2.3 Early in 1959, when a further portion of the irrigation and power components of the DVC had been completed, it was felt that there was need only for a part-time Chairman. As policy decisions for which the Board was responsible were few and far between, it was considered sufficient to have only a part-time Board. Accordingly, the Board was constituted on a part-time basis and the Secretary of the Ministry of Irrigation and Power was appointed as the Chairman in addition to his duties in the Ministry.

5.2.4 This arrangement continued till 1963 when the affairs of the DVC started causing a great deal of concern on account of several administrative problems including non-implementation of decisions taken after consultation with the State Governments. It was felt that as this situation had arisen because of an honorary part-time Chairman with headquarters at Delhi, it would be desirable to revert to the original arrangement of having a whole-time Chairman with headquarters at Calcutta. Accordingly, a whole-time Chairman at Calcutta again appeared on the scene in 1963 and since then this arrangement of full-time Chairman and two part-time Members one each from Bihar and West Bengal has continued.

5.2.5 According to Shri S. N. Majumdar* the first Chairman of DVC, when all members were wholetime functionaries upto 1957 they "were all effective working members with certain field of activity of the Corporation allotted to each. They, however, did not keep themselves within rigid limits of their charge. The result was that each had a comprehensive view of the project even as he was more intimately familiar with the subject under his charge. Now only the Chairman is wholetime and the two members who are part-time attend the meetings as and when these are held".

5.2.6 The Act provides for a Financial Adviser who is appointed by the Central Government. In effect he is the representative of the Ministry of Finance in the Corporation. Though he is an officer of the Corporation, he enjoys an independent status under the Act. He tenders independent advice, which, however, is not binding on the Corporation.

*Integrated utilisation of water and Land Resources of Damodar River-DVC Library-unpunlished Document.

5.2.7 The Secretary is the Chief executive of the Corporation. He is appointed by the Central Government. During the period the Board functioned on a part-time basis, the Secretary was the *de-facto* head having all executive and administrative powers. In this arrangement of a part-time Chairman and a Secretary with full executive powers, it was felt that since the functions of the Secretary were analogous to that of a General Manager, his designation might be changed to convey his responsibilities correctly. Accordingly in June, 1959. he was redesignated as General Manager and Secretary of the Corporation. All other staff is appointed by the Corporation.

5.2.8 Efficient working of any organisation *inter-alia*, depends upon the nature of the internal organisation and professionalisation of management. In the case of the DVC, the first three positions *i.e.* Chairman, General Manager and Deputy General Manager have generally been filled by drawing officers from the Indian civil/ Administrative service. Power engineering is the other most dominant discipline. There is also a department of soil conservation under the charge of a Director. There are very few civil engineers specially in important positions, and, economists are conspicuous by their absence.

Powers

5.3—5.3.1 In order to carry out its functions, the Corporation has been vested with the following powers under the DVC Act :

(i) to acquire and hold such movable and immovable property as it may deem necessary and to lease, sell or otherwise transfer any such property;

(ii) to construct or cause to be constructed such dams, barrages, reservoirs, power houses, power structures, electrical transmission lines and substations, navigation works, irrigation, navigation and drainage canals and such other works and structures as may be required;

(iii) to prevent pollution of any water under its control and to take all measures to prevent discharges into such water effluents which are harmful to water supply, irrigation, public health or fish life;

(iv) to stock its reservoirs or water courses with fish and to regulate or prohibit taking out fish from the water under its control;

(v) to undertake resettlement of the population displaced by the dams, acquisition of land for reservoirs and protection of watersheds;

(vi) to aid in the establishment of co-operative societies and other organisations for the better use of facilities made available by the Corporation;

(vii) to undertake measures for the prevention of malaria;

(viii) to turn, divert or discontinue the public use of, or permanently close, any road or any part thereof, or

(ix) to discontinue the public use of, or permanently close any open space or any part thereof.

5.3.2 It is authorised to supply irrigation water in bulk to State Government for use by the cultivators and other consumers, including industrial and domestic, and to levy rates for services rendered. It is also authorised to generate and sell electric power to any consumer in the valley at a potential of not less than 30,000 volts.

Role of the Central Government

5.4 The powers of the Corporation were however not unlimited. Section 18 of the Act stipulates that "in discharge of its functions the Corporation shall be guided by such instructions on questions of policy as may be given to it by the Central Government". Moreover, in deciding whether a particular question is or is not a question of policy, the decision of Central Government is to be final. Any dispute between the Corporation and any participating Government regarding any matter covered by the Act or touching upon, or arising out of it, shall be referred to an arbitrator who shall be appointed by the Chief Justice of India and his decision shall be final and binding on the parties. The Central Government can remove any member of the Board of Directors who in its opinion (a) refuses to act (b) has become incapable of acting (c) abuses his position or (d) is unsuitable to continue as member.

Financing

5.5—5.5.1 The pattern of financing in the DVC is different from that in the TVA, whose expenditure on flood control and navigation is financed exclusively from the Federal budget without any financial involvement of the State Governments, while

that on power is met from borrowed funds. In the case of the DVC, however, the capital acquired for the completion of any project undertaken by it is to be provided by the three participating Governments according to their share in each of the three important objects. This, therefore, gives additional scope to the concerned Governments to influence the working and decisions of the Corporation.

5.5.2 The procedure for allocations of expenditure on different objects as laid down in Section 33 of the Act is given below :—

(1) expenditure solely attributable to any of these objects, including a proportionate share of overhead and general charges, shall be charged to that object, and

(2) expenditure common to two or more of the said objects, including a proportionate share of overhead and general charges, shall be allocated to each of such objects in proportion to the expenditure which, according to the estimate of the Corporation, would have been incurred in constructing a separate structure solely for that object, less any amount determined under clause (1) in respect of that object.

5.5.3 The total amount of capital allocated to different objects is as per sections 34, 35 & 36 of the DVC Act shared amongst the participating Governments in the following manner :—

(a) *Irrigation :*

(i) the Government concerned shall be responsible for the capital cost of the works constructed exclusively for irrigation in its State; and

(ii) the balance of capital cost under irrigation for both the States of Bihar and West Bengal shall be shared by the State Governments in the proportion to their guaranteed annual off-takes of water for agricultural purposes.

(b) *Power :*

The total amount of capital allocated to power shall be shared equally between the three Governments.

(c) *Flood control :*

The capital upto Rs. 14 crores shall be shared equally between the Central Government and the Government of West Bengal and any amount in excess thereof shall be the liability of West Bengal Government.

Functioning

5.6—5.6.1 After the completion of the first phase of its works consisting of four dams, the DVC took up the question of execution of the second phase. It set up a committee known as the Khungar Committee to go into the question of the need for additional dams. The views of the West Bengal Government as expressed before this Committee were against taking up the second phase due to various reasons mentioned by them such as the likely adverse effect on river regime, loss of fertilising silt in the inundated areas, increase in salinity and consequent deterioration of riparian land, difficulty about drinking water and loss of navigational facilities etc. However, the Committee did not agree with these views and it recommended that there should be additional flood absorption capacity in the dams of the DVC area.

5.6.2 The Committee's report was examined by the World Bank. Commending the report as the first comprehensive document dealing with all the connected problems of the Damodar Valley, the Bank recommended adoption of its recommendations.

5.6.3 Accepting the recommendations of the Committee, the DVC approached the three participating Governments for their sanction and funds. The Governments, however, decided that (i) no dam was to be constructed for flood control and (ii) for catering to industrial needs, a dam might be constructed at Tennughat by the Bihar Government to which the DVC might accord its formal approval.

5.6.4 The DVC again appointed a Committee of Experts (Sreenivasa Rao Committee) in 1971 to go into the various problems faced by it. The Committee's main findings with respect to flood control measures were as under :—

1. Acquisition of land and houses at Maithon and Panchet upto the top of the gates,

2. The Lower Damodar Valley be improved to take a flood discharge of 7,079 cumecs (2.5 lakh cusecs) to enable the flood moderation regulation being followed as recommended by the then Central Water and Power Commission.
3. Integration of operations of Tennughat reservoir with the DVC reservoirs.
4. Construction of an additional dam at Balpahari.

5.6.5 The DVC passed a resolution that investigations for the construction of Balpahari dam might be taken up, and approached the participating Governments for their administrative, technical and financial approval. In spite of repeated reminders the same has yet not been cleared.

5.6.6 It will thus be seen that important decisions of the DVC bearing upon its responsibilities with respect to flood control, which were backed by technical committees, could not be implemented on account of powers exercised by the participating Government in the affairs of the DVC.

Land Acquisition

5.7—5.7.1 River valley projects require considerable amount of land and, therefore, the speed with which land is acquired plays a crucial part in determining the progress. Normally land is to be acquired under the Land Acquisition Act, 1894. Since this involves very lengthy procedure and is time consuming, the Government of West Bengal, in the year 1948, assumed special powers under which land may be acquired on emergent basis. Similar provisions were made by the Government of Bihar though no special Act was passed. The entire land which has so far been acquired in the DVC area both in Bihar and in West Bengal has been acquired under special powers. As for compensation both the Governments decided to pay full and fair compensation to displaced persons, as far as possible in kind by giving land for land and house for house instead of cash compensation. However, people were interested in cash compensation only. Distance from the village of origin, relatively poor quality of land given in lieu of the one acquired and structures of newly constructed houses not being in harmony with one to which the people were used to, are some of the reasons for non-acceptance of compensation in kind. Moreover, many persons have settled on the fringes of the reservoirs and have started a vocation there. As a result there has been strong opposition from the affected population which has resulted in serious difficulties in the acquisition of any more land. So far the DVC has acquired about 48,360 hectares of land and paid compensation to the tune of Rs. 4.90 crores. Additional requirement works out to about 7,280 hectares in about 240 villages at an estimated cost of about Rs. 13 crores.

5.7.2 Several Committees appointed by the DVC/Government of India have strongly recommended immediate acquisition of land upto designed levels. Even the Chief Ministers of Bihar and West Bengal entered into an agreement to that effect. The problem, however, continues. This shows that land required for a project should be acquired while constructing the project and not deferred to a latter date.

Management of reservoirs

5.8—5.8.1 The organisation for an efficient management of multipurpose reservoirs should be such as to deal effectively with problems of conflict of interests amongst the different objectives which arise in such cases and become more acute when more than one State is involved as in the case of the DVC reservoirs. Under the Act the maintenance and operation of the reservoirs is the responsibility of the DVC. However, with the transfer in the year 1964 of the barrage and the canal system to West Bengal, the Central Government in exercise of the powers vested with them under part V Section 48(1) of DVC Act decided that functions relating to the releases of water from the reservoirs should be guided by such instructions as may, from time to time, be issued by the Central Government or the CW&PC or any other officer authorised by the CW&PC.

5.8.2 This direction was felt necessary because the releases had to be done in a coordinated manner so as to serve the interests of irrigation, power, navigation, industrial and domestic requirements etc. The control of releases could not be left with the DVC as they had emerged a beneficiary of water resources, having prime interest in generation of hydro-power (the other major objective. i.e. irrigation having been transferred to West Bengal).

5.8.3 In order to guide the operation of the DVC reservoirs, the CW&PC constituted a standing Reservoir Regulation Committee consisting of its Member (Floods), Chief Engineers of respective States and the DVC. The main function of the Committee is to discuss and lay down the principles for smooth and effective regulation of the reservoirs. A representative of the CWC is posted at Maithon for the purpose. It may, however, be noted that he only issues guidelines for the operations their executive control lies with the DVC.

5.8.4 The Tennughat dam which was constructed by the Bihar Government is maintained and regulated by that Government despite persistent damand from the DVC and recommendations by Committees that there should be close coordination between the DVC and the Bihar Government in the operation of this dam and that flood control aspect of all the reservoirs on the Damodar river system be better operated by one agency.

Relationship between the Corporation and the states

5.9—5.9.1 The success of any inter-State river basin authority of the type of the TVA and the DVC depends very much on the degree of cooperation received from the concerned State Governments. Generally the States which lose land for the construction of reservoirs without getting commensurate benefits tend to adopt an attitude of resistance. The TVA tried to lessen this resistance by giving other benefits to States adversely affected by its flood control projects. These included benefits in the field of agriculture and afforestation. Benefits from recreational and fishing facilities created by the TVA also go to the local Governmental agencies which maintain and supervise them. In addition, the TVA's programme of community development proved helpful in this context. This shows the desirability of empowering a river basin authority to take up some general developmental work also.

5.9.2 These developmental programmes have been so operated as to enlist the full cooperation and goodwill of the State Governments. The TVA works through the State, county and city Governments though it has its own officers at the local level also. It makes its services available to them and takes up a particular project only when requested by the local Governmental agency to do so. Apart from maintaining proven programmes, it works as a poineer in various fields of regional development by exploring fresh approaches to improving the quality of life in the region.

5.9.3 Such provisions have been made in the DVC Act also and, in the beginning, the Corporation undertook some programmes of a general developmental nature. However, later on the Corporation's activity in this respect became negligible and thus the leverage that it could have made use of, was not utilised.

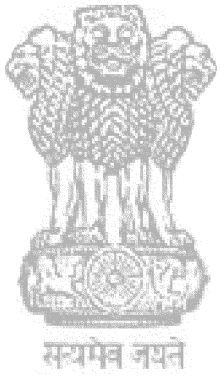
5.9.4 In the earlier stages of the functioning of the Corporation, a very healthy practice had developed where under the Chief Ministers of the two States met at Delhi under the Chairmanship of the Central Minister incharge of Power and Irrigation or the Prime Minister and sorted out the problems requiring high level attention in the working of the Corporation. Subsequently, however, the practice ceased, and, with that, areas of disagreements creating bottlenecks in the functioning of the Corporation increased. The present management of the DVC feels that had this practice continued, many problems currently faced by the Corporation would not have assumed serious proportions.

Autonomy—its extent

5.10—5.10.1 The DVC is a corporate agency. Its character is largely modelled on the TVA, which has a reasonable degree of autonomy and flexibility of a private corporation. The Central Government in drafting the Constitution of the DVC had emphasised that "for efficient administration, the authority must be vested with a high degree of autonomy for conducting the undertaking". However, this is not reflected in actual operation. As already mentioned, the powers of the DVC are subject to directions to be issued by the Central Government from time to time. The State Governments have also a hand in the management as they are providing their share of finances. In fact, the DVC is responsible to each of the three participating Governments and submit its report to them.

5.10.2 The Corporation, though vested with several powers could not use all of them. For various reasons, it could not function as a truly autonomous organisation. It came under criticism soon after its creation. An inquiry committee was set up by the Government of India which exonerated the Corporation of all charges, but as a result of findings of this committee, an Advisory Board of three participating

Governments was constituted to guide and direct the activities of the Corporation. The Financial Advisor assumed almost an independent status, and from the year 1952, onwards the participating Governments insisted on their prior technical and financial approval for execution of any scheme. The barrage and the irrigation system were transferred to the West Bengal Government on agency basis, and, with that transfer, the regulation of the DVC reservoirs was entrusted to a committee headed by the then CW&PC & now CWC. Though the jurisdiction of the Corporation was notified, the responsibility for improvement of the Lower Damodar was given to the Government of West Bengal. The Bihar Government was given the permission to construct and operate Tennughat Dam within the allotted jurisdiction of the Corporation. All these developments have tended to erode the authority of the DVC, and, reduce its effectiveness as an organisation for carrying out the functions assigned it.



CHAPTER VI

CONCLUSION

6.1 The Damodar Valley Corporation was established as an inter-State river basin authority for multi-purpose utilisation of water resources including flood control. Construction of a number of dams with earmarked flood cushion has been the principal method for achieving the objective of flood moderation.

6.2 Soil conservation and afforestation measures are being implemented in the upper valley for several years. In the absence of long term data, the precise impact of such works on reservoir sedimentation is difficult to assess. Some studies, however, over the treated areas have shown improvement with respect to erosion, while untreated areas have reported a faster rate of deterioration. Rate of sediment deposition in the reservoirs has shown a decreasing trend. In some of the treated mini-catchments, some reduction both in the peak discharge and the silt yield has been effected. With the availability of long term performance data, a final view of the trend could be taken.

6.3 The dams have been able to moderate floods to the extent designed and thus eliminate damage to the industrial belt in lower Asansol-Durgapur area and to help improve economic conditions.

6.4 The moderated flood discharge should match the downstream channel capacity which should be maintained accordingly. The Lower Damodar, however, is not capable of carrying the originally planned discharge of 7079 cumecs (2.5 lakh cusecs).

6.5 The drainage capacity in lower reaches is so low that even if the entire flow from the upper catchment were to be withheld behind the dams, the contribution from the intermediate catchment alone, under certain situations, can cause flooding in the lower Damodar area.

6.6 Over the years the drainage capacity is reported to have been reduced further on account of the continued silting of the river bed due to insufficient flushing and effect of tidal prism. Moreover, the increased sense of security against floods has resulted in further encroachments into the flood plains and the river bed.

6.7 The West Bengal Government did not agree to any more dams as they feel that any more control of the river will cause damage to river regime and worsen the already deteriorating conditions of the Rupnarain which is subject to tidal action and also have adverse effects on the Hooghly.

6.8 With the transfer of the irrigation system and management of the lower Damodar to West Bengal, and operations of the reservoirs being guided by the Committee headed by the CWC, the Corporation has been relegated to the position of a company with prime interest in power generation only.

6.9 There is a conflict not only between flood control and irrigation but also between flood control and power. This conflict becomes aggravated if the project is undertaken by more than one agency. In such cases, this can be resolved only by having a unified authority.

6.10 To increase the flood absorption capacity of the DVC dams, several Committees have recommended acquisition of land upto the designed levels. The DVC feels helpless as the land has to be acquired by the States concerned, which may not be inclined to displace their population. Since an agreement has now been reached between the State Governments, this difficulty, we hope, may be overcome.

6.11 In the initial stages, the DVC, in the exercise of its powers, undertook certain developmental activities in the valley, but later on these were discontinued due to introduction of the Community Development Programme. This prevented the Corporation from getting the cooperation from the States. Had the developmental activities continued to be undertaken by the DVC, there might have been better rapport with the State Governments and the people.

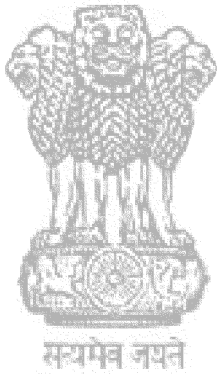
6.12 Efficient working of any organisation depends, *inter-alia*, upon the nature of its internal organisation and professionalisation of management. The organisational system for a big multi-purpose undertaking should recognise the role that can be played by multi-disciplinary teams of officers. The DVC is still far from realising this goal.

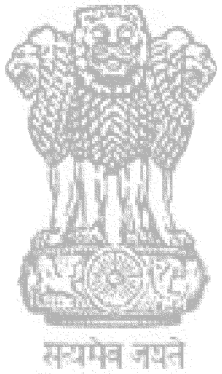
6.13 Over the years, the control of the DVC over the river has been diluted.

6.14 Though the DVC was intended to be an autonomous organisations, in practice, its autonomy is very much restricted.

6.15 The procedure for financing has further helped to keep the DVC subject to pressures and pulls of the participating Governments.

6.16 While the task assigned to the DVC was very difficult, involving as it did, three main objectives in conflict with each other, the authority delegated to it was inadequate.

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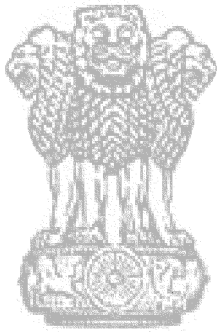
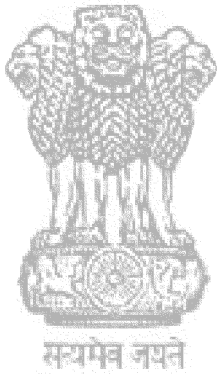
APPENDIX VIII

ITINERARY OF THE AYOG'S VISITS TO STATES ETC.

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APPENDIX VIII

ITINERARY OF THE AYOG'S VISITS TO VARIOUS STATES ETC.

S. No.	Dates	State/Organisation	Purpose
1.	6th August, 1977	Uttar Pradesh, (Mathura.)	Discussion on Ujjina-Kama-Pahri-Goverdhan drainage problem.
2.	2nd to 5th September, 1977	Orissa	Preliminary exchange of views and providing clarifications in respect of questionnaire issued to them.
3.	6th & 7th September, 1977	West Bengal	Do.
4.	8th to 10th September, 1977	Assam	Do.
5.	26th & 27th September, 1977	Uttar Pradesh	Do.
6.	28th to 30th September, 1977	Bihar	Do.
7.	8th February, 1978	Gujarat	Do.
8.	9th February, 1978	Maharashtra	Do.
9.	10th February, 1978	CWPRS Pune	Do.
10.	1st March, 1978	Haryana	Do.
11.	2nd March, 1978	Punjab	Do.
12.	13th & 14th December, 1978	Karnataka	Exchange of views and seeking clarifications on replies.
13.	15th & 16th December, 1978	Tamil Nadu	Do.
14.	17th to 19th December, 1978	Kerala	Preliminary exchange of views and expediting replies.
15.	14th February, 1979	Andhra Pradesh	Exchange of views and seeking clarications on replies.
16.	26th & 27th February, 1979	West Bengal	Exchange of views on important points and clarifications on replies.
17.	27th February, 1979	Damodar Valley Corporation Calcutta	Discussion on the Damodar Valley Corporation system for the Case Study.
18.	28th February to 1st March, 1979	Assam	Exchange of views on important points and clarifications on replies.
19.	2nd March, 1979	Manipur	Do.
20.	8th & 9th March, 1979.	Uttar Pradesh	Do.
21.	19th March, 1979	GFCC, Patna	Do.
22.	20th & 21st March, 1979	Bihar	Do.
23.	16th April, 1979	Punjab	Do.
24.	17th April, 1979	Haryana	Do.
25.	20th April, 1979	BBMB, Chandigarh	Exchange of views on the set-up for comprehensive approach/organisation problems.

14--23 DNFC (ND)/80

Visit to Mathura, Uttar Pradesh on 6th August, 1977 regarding Ujjina-Kama-Pahari-Goverdhan Drainage problem

Present

1. Thakur Balbir Singh, Minister (Irrigation), Uttar Pradesh.
2. Shri S. P. Rawat, Deputy Minister (Irrigation), Uttar Pradesh.
3. Shri Mani Ram Bagri, Local Member of Parliament.
4. Shri P. P. Caprihan, Financial Commissioner and Secretary, (I&P) Haryana.
5. Shri O. P. Chadha, Joint Secretary (I), Ministry of Agriculture and Irrigation.
6. Shri Hari Krishan, Chief Engineer (Irrigation), Uttar Pradesh.
7. Shri S. P. Malhotra, Chief Engineer (Irrigation), Haryana.
8. Shri J. P. Agarwal, Additional Chief Engineer (Irrigation), Uttar Pradesh.
9. Shri A. K. Choudhari, Additional Chief Engineer (Irrigation), Uttar Pradesh.
10. Shri B. D. Sharma, Director, Central Water Commission.

Visit to Orissa from 2nd to 5th September, 1977

Present

1. Shri Nilamani Routray, Chief Minister.
2. Shri Prahlad Mallick, Minister (Irrigation).
3. Shri Ved Prakash Agarwal, Member of Legislative Assembly.
4. Other local Members of Parliament and Members of Legislative Assembly.
5. Members of Legislative Assembly and local people of Bhargavi-Daya Doab at Puri.
6. Raja Saheb of Kanika.
7. Shri Rama Moorthy, Additional Chief Secretary.
8. Secretary (Finance).
9. Shri Raghupati, Member, Board of Revenue.
10. Shri S. C. Tripathi, Chief Engineer (Irrigation).
11. Shri C. Patro, Joint Director (Soil Conservation).

Visits to West Bengal on 6th & 7th September, 1977 and 26th & 27th Feb., 1979

Present (On different dates)

1. Shri Jyoti Basu, Chief Minister.
2. Shri Pravash Roy, Minister (Irrigation & Waterways).
3. Shri Ashok Mitra, Minister (Development and Planning).
4. Shri Jatin Chakravarty, Minister (Public Works Department).
5. Shri Kamal Guha, Minister (Agriculture).
6. Shri Radhika Mohan Banerjee, Minister (Relief).
7. Shri Jyotirmoy Basu, Member of Parliament.
8. Shri A. K. Ghosh, Commissioner (Agriculture Production).
9. Shri B. K. Banerjee, Secretary (Irrigation and Waterways Department).
10. Shri Banerjee, Secretary (Relief & Welfare Department).
11. Shri S. K. Ghosh, Secretary (Agriculture & CD Department).
12. Dr. Satyash Chakravarty, Chairman, Coordination Committee for National Flood Commission.
13. Shri C. D. Seshadri, Chairman, North Bengal Flood Commission.
14. Shri S. P. Sen, Chief Engineer (Irrigation & Waterways Department).
15. Shri J. K. Das Gupta, Chief Engineer (Irrigation & Waterways Department).

16. Shri B. N. Aich, Chief Engineer (Design & Research).
17. Shri P. B. Roy, Director, River Research Institute, West Bengal.
18. Shri S. M. Deb, Director, Central Designs Organisation (Waterways Department).
19. Shri P. R. Maiti, Director (Advance Planning).
20. Shri N. N. Ray, Superintending Engineer (I&P) Circle No. I.
21. Shri B. Dass, Superintending Engineer (I&P) Circle No. II.
22. Shri A. K. Sen Gupta, Additional Director (Agriculture).
23. Shri M. M. Pal, Deputy Secretary (Relief & Welfare Department).
24. Shri S. K. Bhattacharya, Deputy Secretary (LO & LLR Department).
25. Shri A. K. Mazumdar, Joint Director of Agriculture (Soil Conservation).
26. Shri S. K. Khasnobi, Joint Director (Agriculture).
27. Shri S. N. Sen Gupta, Deputy Director (Fisheries).
28. Shri S. S. Ganguly, Deputy Director (CDO).
29. Shri T. K. Biswas, Deputy Director (CDO).
30. Shri N. K. Bhattacharya, Executive Engineer (I&P Department).
31. Shri K. S. Bhattacharya, Executive Engineer (I&P Department).

Visits to Assam on 8th to 10th September, 1977 and 28th Feb. & 1st March, 1979

Present (On different dates)

1. Chief Minister.
2. Minister (Flood Control).
3. Minister (Agriculture).
4. Shri R. S. Paramasivan, Chief Secretary.
5. Shri Trivedi, Commissioner (Finance).
6. Shri M. C. Narsimhan, Commissioner (Agriculture & Rural Development).
7. Shri P. N. Rau, Developemnt Commissioner, Hill areas.
8. Shri S. D. Phene, Commissioner (Planning & Development).
9. Shri H. Gohain, Chairman, Brahmaputra Flood Control Commission.
10. Shri S. I. Haque, Secretary (Irrigation).
11. Shri Goshwami, Secretary (Revenue).
12. Secretary (Public Works Department).
13. Shri V. Ahmed, Director (Fisheries).
14. Director (Agriculture).
15. Director (Soil Conservation).
16. Shri P. C. Jain, Director (Planning), Brahmaputra Flood Control Commission.
17. Shri S. K. Nath, Superintending Engineer, Gauhati Circle.
18. Shri S. N. Sharma, Deputy Secretary, Public Works Department.
19. Shri I. Rasul.

Visits to Uttar Pradesh on 26th and 27th September, 1977 and 8th & 9th March, 1979

Present (*On different dates*)

1. Shri R. N. Yadav, Chief Minister.
2. Thakur Balbir Singh, Minister (Irrigation).
3. Shri Sharda Prasad Rawat, Deputy Minister (Irrigation).
4. Shri Kripa Narain Shrivastava, Chief Secretary.
5. Shri G. P. Tewari, Commissioner (Agriculture Production).
6. Shri Tandon, Commissioner & Secretary (Finance).
7. Shri Anand Swaroop, Commissioner & Secretary (Planning).
8. Shri S. D. Srivastava, Secretary (Irrigation).
9. Shri T. Prasad, Secretary (Finance).
10. Shri K. Agarwal, Secretary (Revenue).
11. Shri Surendra Singh, Secretary (Public Works Department).
12. Shri N. P. Tripathi, Secretary (Forest).
13. Shri J. M. Garg, Secretary (State Flood Control Board).
14. Shri S. Mehdi Hasan Rizvi, Spl. Secretary (Forest).
15. Shri B. P. Srivastava, Chief Conservator of Forests.
16. Shri Hari Krishna, Chief Engineer (I).
17. Shri B. N. Roy, Chief Engineer (Public Works Department).
18. Shri K. M. Srivastava, Chief Engineer (Rural Engg).
19. Shri Vijendra Singh, Additional Chief Engineer (Planning).
20. Shri P. L. Vijay, Additional Chief Engineer.
21. Shri J. P. Agarwal, Additional Chief Engineer.
22. Shri K. K. Singh, Additional Chief Engineer.
23. Shri Prakash Bahadur, Additional Chief Engineer.
24. Shri S. K. Kansal, Additional Chief Engineer.
25. Shri J. C. Jain, Additional Chief Engineer.
26. Shri K. N. Dwedi, M. D. Jal Nigam.
27. Shri Harihar Prasad Singh, Director (Agriculture).
28. Shri Mahender Nath Bhatnagar, Additional Director.

Visit to Bihar from 28th to 30th September, 1977

Present

1. Shri Karpoori Thakur, Chief Minister.
2. Shri Sachidanand Sinha, Minister (Irrigation).
3. Shri Kapil Deo Singh, Minister (Agriculture).
4. Shri Jageshwar Mandal, Minister (Cooperation).
5. Minister, Public Works Department.
6. Chief Secretary.
7. Irrigation Commissioner.
8. Adviser, Irrigation, State Planning Board.
9. Engineer-in-Chief, Irrigation.
10. Chief Engineer (Planning).
11. Other Chief Engineers and Heads of various other Departments of the State Government.

20th and 21st March, 1979

1. Shri N. Nagamani, Irrigation Commissioner.
2. Shri U. K. Verma, Engg-in-Chief cum Secretary (Irrigation) Irrigation Department.
3. Shri S. Prasad, Engg-in-Chief cum Special Secretary, Irrigation Department.
4. Shri A. K. Sinha, Engg-in-Chief cum Special Secretary, Irrigation Department.
5. Shri U. P. Sahi, Chief Engineer.
6. Shri R. P. Singh, Chief Engineer.
7. Shri M. A. Samad, Chief Engineer.
8. Dr. B. P. Sinha, Chairman, Bihar Construction Corporation.
9. Shri J. Bahadur, Director, Irrigation Research Institute.
10. Shri Gauri Shanker Singh, Joint Secretary Irrigation Department.
11. Shri S. N. P. Sinha, Director (Revenue) Cum Special Secretary.
12. Shri Mathura Prasad Sinha, Technical Adviser, Bihar Construction Corporation.
13. Shri P. N. Trivedi, General Manager, Bihar Construction Corporation.
14. Shri A. Kumar, Superintending Engineer, Drainage Circle.
15. Shri N. Rayee, Superintending Engineer, Patna Flood Control Circle.
16. Shri M. C. Chopra, Technical Secretary to Engg.-in-Chief and Special Secretary.

Visit to Gujarat on 8th February, 1979

Present

1. Shri Babu Bhai Patel, Chief Minister.
2. Minister (Revenue).
3. Chief Secretary.
4. Secretary (Revenue).
5. Secretary (Agriculture).
6. Shri J. F. Mistry, Chief Engineer (Irrigation Projects).
7. Director and other officers of ISRO.

Visit to Maharashtra on 9th February, 1978

1. Shri Vasant Rao Patil, Chief Minister.
2. Chief Secretary,
3. Shri V. R. Deuskar, Secretary (Irrigation).
4. Secretary (Finance).
5. Secretary (Revenue).
6. Chier Engineer (Irrigation).

Visit to CWPRS, Pune, on 10th February, 1978

1. Director
2. Research Officer, West Tripoli Thermal Power Station, Libya.
3. Research Officer, Tidal Power in India.
4. Research Officer, Ganga river at Ballia-baria.
5. Research Officer, Kosi.
6. Research Officer, Bombay Port.
7. Research Officer, Ganga river at Mansi.
8. Research Officer, Yamuna near Delhi.
9. Research Officer, Hooghly river.
10. Research Officer, Singapore, Port.

Visits to Haryana on 1st March, 1978 and 17th April, 1979

Present (On different dates)

1. Shri Virendra Singh, Minister (Agriculture).
2. Shri P. P. Caprihan, Financial Commissioner, Revenue and Commissioner I & P.
3. Shri Goswami, Secretary (I&P).
4. Shri A. N. Malhotra, Engg-in-Chief.
5. Shri K. K. Lakhanpal, M. D., Haryana, State MITC.
6. Mrs. Meenaxi Choudhari, Joint Secretary (I&P).
7. Shri V. P. Dhir, Joint Secretary (Revenue).
8. Shri Gurnam Singh, Chief Conservator of Forests.
9. Shri V. V. Yashrai, Chief Engineer (Drainage I).
10. Shri R. S. Mehra, Chief Engineer (Drainage II).
11. Shri B. Dass, Deputy Conservator of Forests.
12. Shri J. S. Chopra, D. S. O. Forests.
13. Shri Bhim Aggarwal, Superintending Engineer, Project Design Circle.
14. Shri M. G. Thukral, Executive Engineer (Projects).
15. Shri J. L. Gupta, Executive Engineer (Project Design).
16. Shri P. L. Kalra, Executive Engineer (G. W.)
17. Shri K. K. Rewari, Deputy Director (Agriculture).
18. Shri S. Sanlhim, Under Secretary (I&P).

Visits to Punjab on 2nd March, 1978 and 16th April, 1979

Present (On different dates)

1. Minister (Revenue).
2. Secretary (I&P).
3. Dr. H. L. Uppal-Irrigation Advisor.
4. Joint Secretary (Development).
5. Shri Darshan Singh, Chief Engineer (Drainage).
6. Shri Harbans Singh, Chief Engineer (Civil).
7. Shri S. N. Agnihotri, Chief Engineer (Thein Dam).
8. Ch. Rattan Singh, Chief Engineer (Projects).
9. Chief Conservator of Forest.
10. Chief Conservator of Soil.
11. Shri H. S. Rahdev, Deputy Conservator of Forests.
12. Shri Karnail Singh, Deputy Soil Conservator.
13. Shri D. V. Sahni, Superintending Engineer (B&R).
14. Shri A. K. Umrat, Superintending Engineer, Jullundur, Drainage Circle.
15. Shri Bachitter Singh, Superintending Engineer, Patiala Drainage Circle.
16. Shri K. K. Dhir, Deputy Secretary, (Revenue).
17. Romila Dubey, Deputy Secretary, (Agriculture).

Visit to Karnataka on 13th December, 1978 and 14th December, 1978

Present

1. Shri D. Deva Raj Urs, Chief Minister.
2. Shri Bangarappa, Minister (Public Works Department).
3. Shri K. H. Ranganath, Minister (Agriculture).
4. Shri N. Narasimha Rao, Chief Secretary.
5. Shri R. A. Naik, Commissioner (Revenue).
6. Shri K. S. N. Murthy, Commissioner & Secretary to Government, Agriculture and Animal Husbandary.
7. Dr. D. M. Nanjundappa, Secretary (Planning).
8. Shri D. R. Nayak, Secretary Public Works & Electricity Department.
9. Shri B. C. Angadi, Special Secretary (Irrigation).
10. Shri K. Ramachandraih, Chief Engineer Irrigation (South).
11. Shri P. R. Bellubi, Chief Engineer, WRDO.
12. Shri C. S. Shivanna, Director, Chief Engineer, KERS, K. R. Sagar.
13. Shri B. S. Patil, Deputy Commissioner, Dakshina Kannada.
14. Shri A. Krishnaswamy, Joint Secretary, Flood & Forest Department.
15. Shri G. N. Alasingnachar, Additional Director (Agriculture).
16. Shri R. M. Palanna, Deputy Conservator of Forests (Hq.) Rep. Chief Conservator of Forest (General).
17. Shri N. K. Sita Ramaih, Special Officer (Finance).
18. Shri H. N. Ramaswamy, Superintending Engineer, WRDO.
19. Shri S. C. Borogowda, Superintending Engineer, National Highways.
20. Shri B. C. Mallegowda, Superintending Engineer, (Designs) MI&PHE.
21. Shri B. H. Rajan, Joint Director KERS, K. R. Sagar.
22. Shri M. Maraiah, Executive Engineer, Planning and Investigation, WRDO.
23. Shri E. Viswanathan, Executive Engineer, Ministry of Transport (Roads Wing) Bangalore.

Visit to Tamil Nadu on 15th & 16th December, 1978

Present

1. Thiru M. G. Ramachandran, Chief Minister.
2. Thiru S. Ramachandran, Minister (Electricity).
3. Thiru C. Ponnayyan, Minister (Transport).
4. Thiru P. Kolandaivelu, Minister (Agriculture & Irrigation).
5. Thiru P. Saundarajan, Minister (Health).
6. Thiru B. Vijayaraghavan, Commissioner and Secretary (Public Works Department).
7. Thiru J. S. Bhango, Commissioner and Secretary (Transport Department).
8. Thiru T. Lakshminarayanan, Secretary to Chief Minister.
9. Thiru A. M. Swaminathan, Joint Secretary (Finance).
10. Thiru K. Inba Sagaran, Joint Secretary (Flood).
11. Thiru S. Manavalan, Chief Engineer (Irrigation).
12. Thiru B. A. Jeyapalan, Chief Engineer (Investigation).
13. Thiru E. C. Chandrasekharan, Chief Engineer (Highways & Rural Works).
14. Thiru K. S. Logavinayagam, Cnief Engineer (Floods—Highways).
15. Thiru P. Sivasankara Mannadiar, Chief Engineer (National Highways).
16. Thiru S. Muthuswamy, Additional Secretary, Board of Revenue.
17. Thiru A. Mohanakrishnan, Senior Deputy Chief Engineer (Irrigation), Public Works Department.
18. Thiru S. B. Tagore, Senior Deputy Chief Engineer (Building).
19. Thiru S. Rajagopalan, Deputy Secretary (Revenue).
20. Thiru N. Thirunavakkarasa, Executive Engineer, Public Works Department, Saidapet Pn.

Visit to Kerala on 18th December, 1978

Present

1. Shri K. Pankajakshan, Minister (Works & Sports).
2. Shri M. K. Raghavan, Minister (Labour & Housing).
3. Shri G. Gopalakrishna Pillai, Secretary (Water and Transport).
4. Shri K. Bharatan, Advisor, Irrigation Projects.
5. Shri K. George Mathew, Chief Engineer (Irrigation).
6. Km. P. K. Thressia, Chief Engineer, General Building and Roads.
7. Shri P. Aravindakshan Achan, Chairman and Managing Director, Kerala Land Development Corporation.
8. Shri N. Kunhikoya, Secretary (Revenue).
9. Shri Baby Abraham, Superintending Engineer (Irrigation).
10. Shri N. Copalan Nair, Deputy Director (Agriculture).
11. Shri R. Ananthanarayanan, Additional Director Incharge of Directorate of Agriculture.
12. Shri M. S. Nair, Deputy Director (Soil Conservation).

Visit to Damodar Valley Corporation on 27th February, 1979

Present

1. Shri A. C. Bandopadhya, Chairman.
2. Shri A. C. Roy, General Manager.
3. Shri S. K. Sen, Principal Chief Engineer (Electrical).
4. Shri K. R. Deb. Chief Engineer (Civil).
5. Shri B. L. Roy, Manager, Reservoir Operations.
6. Shri K. K. Saha, Deputy General Manager.
7. Shri N. K. De Sirkar, Additional Chief Engineer (Commercial).
8. Shri B. K. Mallick, Financial Advisor.

Visit to Manipur on 20th March, 1979

1. Shri L. B. Thanga, Chief Secretary.
2. Shri Wati Ao, Secretary, Irrigation and Flood Control and Commissioner.
3. Shri M. M. Gopalakrishna, Chief Engineer (Irrigation).

Visit to Ganga Flood Control Commission on 19th March, 1979

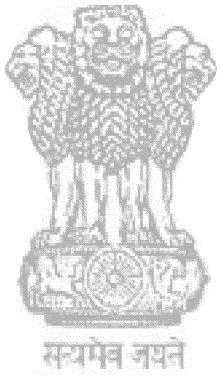
1. Shri R Ghosh, Chairman
2. Shri A. S. Chandrasekharan, Member.
3. Shri N. Sanyal, Member.
4. Shri N. Satchidanand, Director.
5. Shri G. S. Narayana, Director.

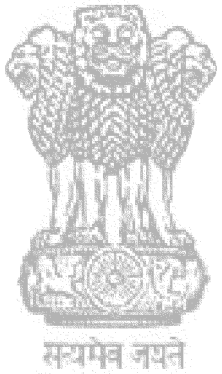
Visit to Bhakra Beas Management Board on 20th April, 1979

1. Shri B. C. Alva, Chairman.
2. Shri H. C. Dhawan, Member (Irrigation).
3. Shri Singhota, Secretary.
4. Technical P. A. to Chairman

APPENDIX IX

INDEX OF THE MATERIAL AVAILABLE WITH THE AYOG

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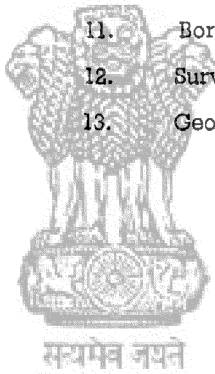
APPENDIX IX

INDEX OF THE MATERIAL AVAILABLE WITH THE AYOG

*REPLIES TO QUESTIONNAIRE RECEIVED FROM THE STATES/CENTRAL DEPARTMENTS/ORGANISATIONS

Sl. No.	States/Union Territories	Sl. No.	Central Departments/Organisations
1.	Andhra Pradesh	1.	Central Water Commission
2.	Assam	2.	Central Water & Power Research Station
3.	Bihar	3.	Department of Agriculture
4.	Delhi	4.	Department of Agriculture and Research Education
5.	Goa, Daman & Diu	5.	Department of Irrigation
6.	Gujarat	6.	Ganga Flood Control Commission
7.	Haryana	7.	India Meteorological Department
8.	Jammu & Kashmir	8.	Ministry of Shipping & Transport
9.	Karnataka]	9.	Planning Commission
10.	Kerala	10.	Railway Board
11.	Madhya Pradesh	11.	Border Roads Organisation
12.	Maharashtra	12.	Survey of India
13.	Manipur	13.	Geological Survey of India
14.	Orissa		
15.	Punjab		
16.	Rajasthan		
17.	Tamil Nadu		
18.	Tripura		
19.	Uttar Pradesh		
20.	West Bengal		



*1. Replies to Questionnaire issued to States/Central Departments/Organisations are available in two sets (Statewise and Termwise).

Further clarifications/information received from some of the States/Organisations is also available.

PROJECT REPORTS

Sl. No.	Particulars
1.	Construction of Main Tributary Dyke along R/B of Kellong from Hatigarh P.W.D. Road to Gurbardhan Hill in Nowgong Distt. (Assam) (Back Water Dyke) 1976-77.
2.	Protection of Dhubri Town from River Brahmaputra (Assam)
3.	Baghmati Flood Control Scheme (Bihar)
4	Buxur to Koelwar Ganga Embankment Scheme (Bihar)
5.	Mahananda Scheme in Distt. Malda (West Bengal)
6.	West Mograhat Basin Drainage Scheme (West Bengal)
7.	Lower Damodar Area Stage II, Vol. I (West Bengal)
8.	Lower Damodar Area Stage II, Vol. II (West Bengal)
9.	Mograhat Basin Drainage Scheme, Vol. II Drawing (W. Bengal)
10.	Lower Damodar Area (Supplementories) State II Report, Estimate & Drawing (W. Bengal)
11.	Lower Damodar Area Stage III, Report Estimate Vol. I (W. Bengal)
12.	Lower Damodar Area Stage III, Drawing Vol. II (W. Bengal)
13.	Lower Damodar Area State I, Vol. I, Report & Estimate (W. Bengal)
14.	Bagmati Flood Control in Middle reach (Bihar)
15.	,, ,,
16.	,, ,, Vol, II (Drawing)
17.	Buxur to Kalawar—(Report & Estimate)
18.	————————————Drawing Vol. II
19.	Flood Control Scheme Brahmani System, Project Report Volume I
20.	Delhi Administration Flood Control Wing, Project for storm water Drainage of Shahdra Area (Report & Appendix) Vol. I
21.	————————————Vol. II Estimate & Appendix
22.	————————————Vol. III Drainage
23.	Remodelling of Kama Phari Drain, Report with Design & Estimates (Rajasthan)
24.	Nowi Basin Drainage Scheme Modified Revised Estimate (West Bengal)
25.	Beel Balli Drainage Scheme Modified Reports & Cost Estimate (West Bengal)
26.	Mokameh Tal Drinage Scheme, Irri. Scheme Phase-II Drawing (Bihar)
27.	,, ,, Phase II Report

PUBLICATIONS

S.No.	Particulars
1.	Report of the National Commission on Agriculture, 1976; Part I Review & Progress.
2.	,, Part II Policy & Strategy
3.	,, Part III Demand & Supply
4.	,, Part IV Climate & Agriculture
5.	,, Part V Resource Development
6.	,, Part VI, Crop production Sericulture & Agriculture
7.	,, Part VII Animal Husbandry
8.	,, Part VIII Fisheries
9.	,, Part IX Forestry
10.	,, Part X Inputs
11.	,, Part XI Research, Education & Extension
12.	,, Part XII Supporting Services & Incentives
13.	,, Part XIII Rural Employment & Special Area Programmes
14.	,, Part XIV Planning Statistics & Administration
15.	,, Part XV Agrarian Reforms
16.	Report of the Irrigation Commission, 1972, Vol. I (2 copies)
17.	,, Vol. III, Part I (2 copies)
18.	,, Vol. III, Part 2 (2 copies)
19.	,, Vol. IV, Irrigation Atlas
20.	Ganga Flood Control Commission (An outline Plan of Flood Control in Ganga Basin) 2 copies
21.	A Manual of Flood Operations. (Flood Control & Drainage Dte, CWC) 2 copies
22.	A note on the Maintenance of Embankments (CWC) 2 copies
23.	The River Boards Act, 1956 (No. 49) (Arrangement of Sections) 2 copies
24.	Report of the Delta Committee (Final Report)
25.	Report of the Expert Committee on Floods for Deltaic Areas of Krishna, Godavari & Guntur Districts of Andhra Pradesh, Vol I
26.	,, Vol. II (Appendices)
27.	,, Vol. III (Maps)
28.	Ministers' Committee on Floods & Flood Relief, Vol. I (2 copies)
29.	Ministers' Committee on Floods & Flood Relief, Vol. II (2 copies)
30.	Report of High Level Committee on Floods (Flood Control in Various River Basins) Vol. II (2 copies)
31.	Report of Technical Expert Committee on Drainage and Waterways of Railways & Road Bridges in North Bihar, Vol. I (2 copies)
32.	Report of the Committee on Flood Control & Drainage in Lower Damodar (2 copies)
33.	Report of North Bengal Technical Experts Committee, Vol. III (Drawings)
34.	Report of High Level Committee on Floods, Vol. I, General Assessment, Principles & Policies
35.	Natural Resources/Water Series No. 5—Guidelines to Flood Losses, Prevention & Management in Developing countries United Nation Publication.
36.	Scientific Assessment of Flood Damages, National Council of Applied Economic Research
37.	Resolution Constituting the Ganga Flood Control Commission No. FC-47(2)/72 dated 18-4-1972
38.	Resolution constituting the Brahmaputra Flood Control Commission. (No. PCF.69/30 dated 26-6-70)
39.	Law relating to Flood Control in India, Indian Law Institute
40.	Floods & their Control in India, CWPC. 3 copies
41.	Resume on Floods & their Control in Assam, Brahmaputra Flood Control Commission
42.	Embankment Manual Investigation, Design & Construction Maintenance, CW&PC (2 copies)
43.	Flood Atlas of India, C.W. & P.C.
44.	Broad Guide lines for preparation of Project Estimates for Major Irrigation & Multipurpose Projects (2 copies) CWC
45.	Flood Plain Zoning Bill—Model Bill (2 copies)
46.	The Protection of the Coastal Area of Orissa Against Floods—General Recommendations *(by* H.A. Ferguson Netherland, 1972
47.	Final Report of the Cyclone Distress Mitigation Committee, Andhra Pradesh (May 1971)
48.	Natural Resources/Water Series No. 5 Guidelines for Flood Loss Prevention & Management in Developing Countries, (U.N. Publication) (As at Sl. No. 35, 2 copies)

Sl. No.	Particulars

49. Govt. of Canada Paper—
    (1) Federal Flood Control Reduction Publication (A Backbround Paper)
    (2) Flood & Flood Control — Do.
    (3) Guidelines for Federal Policy on Flood & Flood Threats — Do.
50. Integrated River Basin Development, Deptt. of Economics & Social Affairs (U.N. 1970)
51. River Basin Management Proceedings of Seminar Organised *by* U.N.E.C. for Europe (U. No. 1971)
52. National Systems of Water Administration, Deptt. of Economic & Social Affairs (U.N. 1974)
53. Report of the United Nations, Interregional Seminar on Flood Damage Prevention Measures and Management (U. No. 1969).
54. Organisation & Function of Ministry of Construction & Rivers in Japan, River Bureau, Min. of Construction, Japan. June, 1972
55. Rivers in Japan 1975, River Bureau, Min. of Construction, Japan, 1975.
56. U.P. Irrigation Department—Rs. 300 Crore Plan Flood Control & Drainage Schemes to provide protection to Area, Jan. 1976 (2 copies)
57. North Bengal Technical Experts Committee Report Vol. I (Reports) March 1970.
58. Manual on Measurement & Analysis of the Revised Edition, Sediment Loads in rivers, C.W. & P.C. 1970.
59. Manual on River Behaviour, Control and Training C.B. I. & P. Publication No. 60 (Revised), Sept. 1971.
60. Sediment Control in Rivers and Canals, C. B. I. & P. Publication No. 79, May 1966.
61. Symposium on Management of Irrigation Waters. C. B. I. & P. Publication No. 92, May 1969.
62. Symposium on optimum requirements and utilisation of Water for Irrigation crops. C. B. I &. P. Publication No. 94. March 1969.
63. Symposium on Efficiency of Water Distribution and use on the land, C.B. I. &. P. Publication No. 84, August, 1967.
64. Symposium on Economics and Financing of Irrigation, Drainage and Flood Control Works, C. B. I. & P. Pub. No. 63.
65. Symposium on Water logging—Causes and Measures for its prevention Vol. I, C. B. I. & P. Pub. No. 118, (December 1972) Vol II.
66. ,, C. B. I. & P. Pub. No. 118. (Dec. 1972)
67. Master Plan on Bihar for Flood Control, Government of Bihar (Report, Drainage, Summary of Proposals) 4 copies Revised—December 1976.
68. Floods and Their Control in India, Feb. 1977, CWC (2 copies)
69. Water; Resources and Hazard, Office of U. N. Disaster Relief Coordinator (UNDRC) U. N. Water Conference.
70. A Methodology for Flood Plain Development & Management Institute for Water Resources, Deptt. of the U.S. Army Corps of Engineers, December 1969.
71. National Programme for Accelerating Progress in Weather Modification, Interdepartmental Committee for Atmospheric Sciences, Report No. 159—June 1971.
    Federal Council for Science & Technology.
72. A Unified National Programme for Flood Plain Management, United States Water Resources Council, July 1976, Federal Register.
73. Water Resources Council, Water and Related Land Resources, Establishment of Principles & Standards for Planning, Vol. 38, Number 174, Sept. 1973.
74. National Atmospheric Sciences Programme, Fiscal Year, 1977.
    Interdepartmental Committee for Atmospheric Sciences, Federal Council for Science & Technology, Executive Office of the President, I CAS 20—Py. 77 May, 1976.
75. The National Weather Service & Water Management, U. S. Department of Commerce Publication, 1973,
76. Face to Face with A Flood, A citizen's Guide for Protection of Life and Property, U. S. Deptt. of Agriculture & Defence, Civil Preparedness Agency.
77. A Plan for Improving the National River & Flood Forecast and Warning Service, August, 1969, U.S. Department of Commerce.
78. Integrated Management of Land & Water Resouces, *by* Shri B. B. Vohra, Sept/76.
79. India in Space *by* Mohan Sundara Rajanf Jan. 76.
80. Third Five Year Plan (1961-66) Planning Commission, Govt. of India
81. Fourth Five Year Plan (1969-74) Planning Commission, Govt. of India.
82. Fifth Five Year Plan (1974-79) Planning Commission, Govt. of India.
83. Irrigation & Power Journal of C. B. I. & P. Golden Jubilee issue, Vol. 34. 1977.
84. National Water Grid of India, CWPC, Nov. 1973.
85. Bhagirath I. & P Quarterly, Jan. 1977.
86. International Commission on Irrigation & Drainage, Bulletin, Jan. 1967.

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87. Statement of Flood damages in the country (from 1953 to 1976)
88. Flood Control Procedures & Practices in the United States, CWPC (1958)
89. Proceedings of Seventh Regional Conference on Water Resources Development in Asia and the Far East, Water Resources Series No. 32, United Nations, 1967
90. The Use & Interpretation of Hydrological Data Water Resources Series No. 34. U.N.
91. Multipurpose River Basin Development, Part 2, Water Resources Development in Australia, Newzealand & Western Samoa Water Resources Series No. 36. U. N./1968
92. Crop Planning in Drought & Flood Prone Area, Indian Council of Agricultural Research, March, 77
93. From Far & Near in Irrigation & Power, CBI&P, April, 77
94. C. B. I. & P. 45th Annual Research Session Proceedings, General Reports & Discussions (Civil)—Vol. VI A
95. Draft 5th Five Year Plan (1974-79) Planning Commission.
96. 5th Five Year Plan, Irrigation Department, Govt. of Bihar.
97. Report 1975-76, Department of Science & Technology.
98. Preparation of Projects Reports—Irrigation, Multipurpose, Flood Control Drainage, Anti-Water Logging & Anti-sea erosion Projects Guidelines No. (Planning Commission's letter No. 11-16(12)/75-I and CAD dt. 22-11-1975).
99. Report 1975-76, Ministry of Irrigation (Deptt. of Rural Development).
100. A Short Note on Flood Problems and its Management in Bihar, April 1977, (2 copies)
101. Brahmaputra Flood Control Board—Constitution of Resolution (Amended)
    (i) No. DWY 502(37)/68 dt. 21-9-1978
    (ii) No. FC-2(23)/74 dt. 28-12-74.
102. Computation of Annual Cost in connection with Benefit Cost Ratio of Flood Control Projects.
    (Letter No. FC 11(1)/73 dt. 20-10-73.
    (From the then Ministry of I. & P.)
103. Ganga Flood Control Board—Constitution of Resolution No. FC 47(2)/72 dated 18-4-1972.
104. Draft Report—United Nations Water Conference, Argentina, 14-25 March 1977.
105. Conversion Factors & Conversion Table , I.S.I.
106. Note on Impact of Irrigation & Multipurpose Projects on Social, Economic & Environmental Conditions, (Sent by Member (WR) : CWC).
107. Note on Rural Engineering Surveys (sent by Member (WR) CWC)
108. Proceedings of the Fifth Regional Conference on Water Resources Development in Asia & Far East—U.N. Water Resources Series No. 23.
109. Proceedings of Fourth Regional Technical Conference on Water Resources Development in Asia & Far East. U. N. Flood Control Series No. 19.
110. Water Resources Project Planning, U. N. Water Resources Series No. 41.
111. Proceedings of the Tenth Session of Regional Conference on Water Resources Development in Asia & Far East U. N. Water Resources Series No. 44.
112. Annual Plan—1976-77 Planning Commission.
113. Water Management & Long Range. Planning in Hungary—1971 (in Hungarian language).
114. Crop Planning in Drought and Flood—Prone Areas, ICAR, March, 1977.
115. Summary Record of third & 4th Meetings of the Ganga Flood Control Board; held on 22-5-1975 and 24-7-1976.
116. Brahmaputra Flood Control Board—
    (i) Agenda Notes for 7th Meeting (5-4-75)
    (ii) Agenda Notes for 8th Meeting (27-5-76)
    (iii) Summary record of 7th Meeting (8-4-75)
    (iv) Draft Minutes of 8th Meeting (22-5-76)
117. The United States Experience in Flood Plain Management, (Presented at U. N. Water Conference held in Argentina) March, 1977.
118. Management of Upland Water Sheds. (Presented of U. N. Water Conference held in Argentina) March, 1977.
119. Ministry of Agriculture & Irrigation, (Deptt. of Irrigation) Report, 1976-77.
120. From Far & Near in Irrigation & Power, C.B.I.P. June, 1977.
121. Guidelines for Disaster Prevention and Preparedness in Tropical cyclone Areas —*Prepared by* ESCAP, & WMO & Red Cross Society, Bangkok, 1977.
122. The Columbia River Treaty and Protocol—Deptt. of External Affairs & Northern Affairs & National Resources, Canada—April, 1964.
123. The Columbia River Treaty—Protocol & Related Documents (Deptt. of External Affairs & Northern Affairs & National Resources, Canada—February, 1964.).

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124. Irrigation & Power Abstracts, CBI&P (No—370—May—June, 1976.)
125. Irrigation & Power Abstract, CBI&P (No. 371, July-Aug., 1975)
126. Preliminary Memorandum from States :
    (i) Maharashtra
    (ii) Assam
    (iii) Tamil Nadu
    (iv) Tripura
    (v) Goa Diu & Daman
127. Model Irrigation Bill, 1976, Min. of Agriculture & Irrigation (Deptt. of Irrigation)
128. Rational Methods of Flood Control Planning in River Basin Development, U. N., 1976
129. Yojna Journal, 1-14, July, 1977
130. Flood Problmes in West Bengal & their Control, Government of West Bengal. April, 1977.
131. Same as on Acc. No. 35 & 48
132. Irrigation & Power Research Digest, CBI&P, May, 1977
133. Man-made Lakes & its Effects on Eco System *by* Shri B. N. Murthy.
    CBI& P Research Scheme applied to river valley Project Mis. Report No. 6
134. Flood Control in the World (A Global Review) ICID, Vol. II, 1977, *by* S/Sh. Framji & Garg.
135. A Unified National Programme for Managing Flood Losses Communication from President of U. S., August, 1966
136. Water Resources Activities in United States, Flood & Flood Control Select Committee on National Water Resources, U.S. send U.S. 1960.
137. Yojna Journal—XXI, 13-14, Scientific Research in India, 15-8-1977
138. Flood Problems in Delta Region *by* Raja S. N. Bhanj Deo
139. Speech delivered in Orissa Assembly *by* Raja S. N. Bhanj Deo, 19th Feb. 1964
140. The Coast & Tidal Regions of Orissa, Their Problem, with an approach to Regional Planning *by* Raja Banj Deo.
141. Letters to Planning Commission & Additional Notes Regarding Tiberpara Dam Project *by* Raja Bhanj Deo.
142. Deep Drains in what Delhi Needs *by* Shri N. L. Sahdev, Rtd. CE, AIR
143. Irrigation and Power Journal of CBI&P Golden Jubilee Year 1927, 77, Vol. 34-No. 2. April, 1977.
144. Note on Flood Problems in Uttar Prdesh, Irrigtion Department, U. P. Sept. 1977.
145. Lucknow Flood Protection Scheme, Government of U.P., Irrigation Department.
146. Guidlines for Planning and Design of Surface Drains, I.S.I. (June 1977)
147. Report of United Nations Water Conference, Mor Dal Plata, 14-25 March,1977
148A. Report of the Expert Commitee on Integrated Development of Surface & Ground Waters, Min. of Irrigation (Department of Irrigtion) May, 1976.
148B. Atlas (accompanying the Report as at 148A)
149. Regulation of Flood Hazard Areas to reduce Flood Losses, Vol. I, Part i-IV (U.S. Water Resources Council)—1971
150. Flood Control Act of 1936, 74th Congress Session II, June, 1936. U.S.A.
151. National Flood Insurance Programme
    (i) Flood Disaster Protection Act of 1973
    (ii) Housing & Urban Development Act, 1969
    (iii) Housing & Urban Development Act 1968 U.S. Department of Housing & Urban Development, Jan, 1974
152. Disaster Relief Act, Amendment of 1974 (U.S.A. 1974)
153. Flood Problem in Bihar & their Control, (Irrigation & Electricity Deptt.) Govt. of Bihar, Sept., 1977
154. Patna Barh Sureksha Karya (in Hindi) Bihar Sinchai Vibhag, September, 1976
155. Water Policies in India and China *by* Jon Signreen
156. Bihar ki Sinchai Priyojna, in Hindi) Sinchai Vidyut Vibhag, June, 1976.
157. The Assam Relief Manual, Revenue Deptt., Assam, June, 1976
158. Recommendations & Conclusions of Administrative Reforms Commisson— A Compendium *by* Administrative Reforms Commission (Secretariat) July, 1970
159. The Himalayan Glaciers *by* Jagdish Bahadur
160. Measures to control floods in the Ganges and some of its major tributaries by K.H. Tiwari.
161. The National Prospective Programme for Development of Drainage Networks in Socialist Republic of Romania.
162. United Nations Water Conference—Economical Involvment of Regularisation of Teju River, Portugal February, 1976

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164. United Nations Water Conference, Mar Del Plata, Argentina, March, 1977
   (i) Economic Significance of Flood Control Development. *by* J. Vinese, Hungary, July, 1976
   (ii) Technical Approaches to and means of Developing understanding of Water resources and their use, Management and protection in Romania, Romania, July, 76
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