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IS 15845 (2009): Environment management plan for hydropower/irrigation/flood control/multipurpose river valley projects [WRD 24: Environmental Assessment and Management of Water Resources Projects]



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“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक

जल विद्युत/सिंचाई/बाढ़ नियंत्रण/बहुउद्देशीय जल संसाधन
परियोजनाओं की पर्यावरण प्रबंध योजना

Indian Standard

ENVIRONMENT MANAGEMENT PLAN FOR
HYDROPOWER/IRRIGATION/FLOOD CONTROL/
MULTIPURPOSE RIVER VALLEY PROJECTS

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BUREAU OF INDIAN STANDARDS
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FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Environmental Assessment and Management of Water Resources Projects Sectional Committee had been approved by the Water Resources Division Council.

A project's environmental management plan includes restoration, mitigation, amelioration and compensation. It consists of a set of measures to be taken during implementation and operations, to eliminate, offset, or reduce, adverse environmental impacts to acceptable levels. The plan should also include the actions needed to implement them.

This standard has been formulated based on the data received indigenously and also taking into consideration the practices prevalent in the field in India.

Indian Standard

ENVIRONMENT MANAGEMENT PLAN FOR HYDROPOWER/IRRIGATION/FLOOD CONTROL/ MULTIPURPOSE RIVER VALLEY PROJECTS

1 SCOPE

This standard provides guidance on environmental management plan of a project including restoration, mitigation, amelioration and compensation for the projects on hydropower, irrigation, drainage, flood control and multipurpose projects.

2 PRELIMINARIES

Environmental appraisal of the projects would be based on the following, in that order;

- a) *Source of Impact* — Detailed Project Report (DPR) containing detailed information on technical and financial aspects of the project.
- b) *Detailed Questionnaire* — Containing information on specific queries for determining the likely environmental impacts.
- c) *Environmental Impact Statement* — Containing self-assessment by the project proponents regarding the likely impacts of the project.
- d) *Environmental Management Plan* — The plan should include;
 - 1) safeguard and control measures proposed to prevent or mitigate the adverse environmental impacts;
 - 2) plan for rehabilitation of project oustees and affected persons/families;
 - 3) plan for dealing with accidents or disasters where applicable; and
 - 4) monitoring and feedback mechanism on implementation of necessary safeguards.

3 CRITICAL ENVIRONMENTAL REVIEW CRITERIA

Certain criteria used as an overall check for all major development projects relating to long-term national interests are as follows:

- a) Losses in precious/irreplaceable resources and undue use of such scarce resources;
- b) Accelerated use of resources in favour of short-term gains;
- c) Hazards to endangered species/ loss of biodiversity;

- d) Stimulus to population migration to urban centres;
- e) Increase in affluent-poor gap; and
- f) Long-term and short-term impacts on the vulnerable groups of the society such as women, weaker sections, tribals, etc.

4 KEY ELEMENTS OF MANAGEMENT PLAN

A mitigation or management plan should include the items as are described in the following sub-clauses;

4.1 It should include identification and summary of all the significant adverse environmental impacts that are anticipated including a detailed hydrological study. This is because the impoundment of the reservoir causes a drastic change in ground water condition within the catchment area and may change salinity of soil, cause water logging of the area, etc. Thus a detailed hydrological study is necessary for proper planning and formulation of a mitigation plan.

4.2 Description and technical details for each mitigatory measure, including the type of impact to which it relates and the conditions under which it is equipped (for example, continuously or in the event of contingencies), together with designs, equipment descriptions, and operating procedures, as appropriate.

4.3 Implementation schedule for measures that must be carried out as part of the project, showing phasing and coordination with overall project implementation plans.

4.4 Institutional arrangements for the assignment of the various responsibilities for carrying out the mitigatory measures (for example, responsibilities which involve operation, supervision, enforcement, monitoring of implementation, remedial action, functioning, reporting and staff training).

5 ENVIRONMENT SAFEGUARDS

In order to include rationale for the chosen approach and mitigation measures, those aspects of the project are considered which are geared specifically for reducing impacts or enhancing benefits. Key environmental

concerns should be addressed in the plan. Each of the identified issue should be presented in the following format:

- a) Description of each issue.
- b) *Source of Impacts* — Baseline supporting information.
- c) *Impacts and Management* — Studies and findings.
- d) Adequacy of the information/ further work.
- e) Proposed strategy for mitigation.
- f) Implementation schedule.
- g) Budget and source for funding.
- h) Responsibility for monitoring.

6 CONSTRUCTION IMPACTS

Mitigation in this regard is provided through design, strategy, construction specifications and general conditions of agreement for the contractors. Some construction related issues are similar to long-term issues (such as malaria propagation) and may be suitably dealt with. Documentation should be provided for the means of mitigating those construction impacts, which are found to be significant. Environmental Management Plan should also include the following plans:

- a) Management plan for proper dumping of muck and restoration of muck dumping sites; and
- b) Restoration of quarry sites/construction areas.

7 MITIGATION PLANNING FOR KEY MEASURES

7.1 Plantations (Including Green Belt/Compensatory, etc)

It should include the following details:

- a) Objectives of plantations and ultimate ownership.
- b) Methods for reclamation of spoil areas should also be described. This should involve afforestation for areas where the soil types and texture are suitable.
- c) Total area of project/township and details of area earmarked (in hectare).
- d) Suitability of the land for afforestation.
- e) Area (including width of green belt in m), already planted up/proposed to be planted in hectare. In case of afforestation/reforestation, areas should be in patches of not less than 20 hectare in size.
- f) List of species/choice of species to be planted with suitability for the land.
- g) Density of plantations with rotation period.
- h) Index maps and/or map showing the proposed area and adjoining forest boundaries.

- j) Year-wise phasing (physical and financial).
- k) Note on future management of the forest generated.
- m) Details regarding nursery development/ procurement of saplings and water availability.
- n) Plantation technique as per the soil type.
- p) Support watering (if any).
- q) Measures proposed for beautification of the project area (creation of parks, tourist spot, etc).
- r) Watch and ward details including fencing, etc.
- s) Maintenance of plantation including casualty replacement/weeding/hoeing/thinning, etc, (till it is established/transferred to territorial forest division).
- t) Responsibility and agency for implementation.
- u) Timetable and cost estimate.
- v) Monitoring mechanism.

7.2 Catchment Area Treatment Plans

It should include the following details:

- a) Area falling in various erosion intensity classes (hectare) as per silt yield index method.
- b) Macro watershed plan with maps showing areas already treated under other schemes after the survey work and presently proposed to be treated as well as the treatment measures for each watershed.
- c) Micro plan for catchment area treatment with justification for adapting a particular soil conservation measure on consideration of land use slope etc.
- d) Engineering measures (check dam, gully control, bench terracing, etc).
- e) Biological measures (plantations, closure, pasture development, etc).
- f) Phased programme (time table) including maintenance and costs.
- g) Agency for implementation.
- h) Public participation in implementation.
- j) Monitoring mechanism.

7.3 Resettlement and Rehabilitation Plan

The minimum Package under the Resettlement and Rehabilitation Plan should be in accordance to the National Policy on Relief and Rehabilitation and should include the following details:

- a) Details of land identified for resettlement.
- b) Homestead land/family.
- c) Agricultural land/family.

- d) Village and family-wise land getting affected.
- e) Village and family-wise land left after acquisition.
- f) Compensation package (details family-wise) in line with the provisions of national policy on resettlement and rehabilitation.
- g) Rehabilitation grants (tribal and others).
- h) Land for common facilities such as school, post-office, hospital, community centre, etc.
- j) Infrastructure facilities to be provided such as roads, electricity, drinking water, sanitation, public-health measures, schools, recreation facilities, places of worship, etc.
- k) Vocational training and generation of self-employment.
- m) Cost of rehabilitation and agency for implementation/monitoring mechanism.
- q) Training and sensitization.
- r) Long-term epidemiological surveillance of the diseases associated with the water resources development projects (Water-based/Water-washed/Water-born).
- s) Bio-waste management, including hospital wastes, bio-wastes, public latrines etc.
- t) Water quality monitoring (based on designated use water quality classification) for the identified parameters.
- u) Various on-going programmes of State/Central Government in the project area and format for coordination and reporting.
- v) Budget and source of funding.
- w) Responsibilities for monitoring.

7.4 Public Health Plan

7.4.1 Provision of incremental health care facilities in the cost of the project with maps for the following:

- a) People on the periphery of the reservoir (5 km aerial distance).
- b) Displaced and resettled people from the submergence zone.
- c) Workers at the project sites/dam site/canal sites/ command area/quarry areas.
- d) Prevention and control of malaria/filaria/schistosomiasis and other potential disease vectors through biological (including biogeographic surveys, Larvicidal fishes), chemical (including spraying) and engineering measures (like modifications in the designs of the water tanks, houses, etc).
- e) Number of existing health care facilities at dispensaries/hospitals etc as per norms of the State Governments/Central Government with maps.
- f) Number of proposed health centers (Allopathic, Aurvedic, Unani, etc) and status of facilities at each centre.
- g) Staff position (existing and proposed).
- h) Equipment including field testing equipments.
- j) Vehicles and ambulance.
- k) Medicines both preventive/curative including impregnated nets.
- m) Laboratory facilities including microscopes slide testing, etc.
- n) Mobile labs/field workers.
- p) Public awareness programmes/education etc.

7.5 Solid Waste Management Plan

A hydropower project involves sizeable congregation of labour and technical workforce, which results in the generation of substantial amount of solid waste. The solid waste management plan should include details regarding development of an integrated waste management strategy with due stress on Reduce-Reuse-Recycle principles. It should also provide insight on areas where waste may be converted into useful energy.

7.6 Seismicity and Rim Stability

It should include the following details:

- a) Implementation plan for the recommendations of dam safety panel/ review panel/study groups for modification of the dam infrastructure to withstand the maximum credible earthquake.
- b) Installation of monitoring instruments within the dam body.
- c) Establishment of a monitoring network around the reservoir.
- d) Stability of the rim of the reservoir.
- e) Appointment of staff.
- f) Collection, analysis and interpretation of the recorded data by the identified institutions.
- g) Provision for the budget and source of funding.
- h) Responsibility for the long-term monitoring.

7.7 Archaeology and Anthropology (Cultural Heritage)

It should include the following details:

- a) Source of impact on the monument and the approaches.
- b) Implementation plan to include design costing and time frame.
- c) Implementation of the recommendations of study

groups/Archaeological Survey of India/Anthropological Survey of India/State departments of archaeology and anthropology.

- d) Protection of identified monuments/mounds.
- e) Relocation of identified monuments/mounds.
- f) Excavation of identified mounds.
- g) Salvaging operations of the sculptures/statues/cultural heritage from the submergence zone.
- h) Identification of agency for implementation.
- j) Budget and source of funding.
- k) Responsibility for the monitoring.

7.8 Estuary and/or Downstream Environment

It includes the plan of action to prevent the short-term/long-term loss of flow during the period when the initial/final filling of the reservoir occurs. It should take into consideration the following:

- a) Tidal ingress.
- b) Water quality of the wells on the banks along the estuary.
- c) Drinking water supplies for the dependent population.
- d) Diseases proliferation.
- e) Channel morphology.
- f) Water quality.
- g) Plan of action to mitigate the negative impacts of the flow of surges from the generation of power when the turbines are switched on.
- h) Flood plain land use zonation under changed hydrological regime.
- j) Plan for minimum flows.
- k) Limitation and control of effluents from the expected industrial development along the estuary/river reach downstream.
- m) Plan for rehabilitation of endangered flora and fauna.
- n) Plan for protection of mangrove areas, if any.
- p) Plan for rehabilitation of the project affected farmers, fishermen, etc.
- q) Downstream flood risk.

7.9 Flora, Fauna, Carrying Capacity and Plan for Felling

It should include the following details:

- a) *Ex-situ/in-situ* conservation of the identified indigenous genetic resources (vulnerable, rare, endangered, threatened species or variants, etc).
- b) Creation of a new/enlargement of the existing conservation areas. Source of funding, agency for implementation and responsibility for monitoring are also to be included.

- c) Provision of migratory corridors/escape routes for identified species for re-location of impacted wildlife.
- d) Provision for improving the carrying capacity of the adjoining ecosystem to accommodate the extra wildlife moving out from the submergence area.
- e) Plan for felling of the trees from the submergence area in stages to ensure that wildlife is not trapped on hillocks during progressive filling of the reservoir.
- f) Plan for social forestry on available lands within the catchment for reducing stress on the existing forest on the fringes of the reservoir.
- g) Plan for providing minor forest produce like silk, lac, honey, or development of cottage industries in the villages for providing alternate means of sustenance.
- h) Coordination of various programmes/schemes of the State and Central Government, and institutes for rural developments. Identification of the agencies for co-ordination and source of funding and responsibility for monitoring.

7.10 Fisheries Conservation

Proper management of the new reservoir fishery for increasing yields and to ensure that fishing rights are allocated first to fishermen previously dependent on the disrupted riverine fishery. It should take into account the following details:

- a) Physico-chemical changes in the benthic environment or the water columns and consequent impact on food chain affecting fish species as applicable during and after the trophic burst stage.
 - 1) in upstream, downstream or in command.
 - 2) in reservoir, rivulets rivers, streams or in canals.
 - 3) at the confluence of the tributaries with the river.
 - 4) in the estuary or the deep sea.
- b) Measures for mitigating the loss of breeding/spawning grounds.
- c) Managing organic loading of the reservoir from the habitation, industries.
- d) Managing prey-predator relationship.
- e) Managing carbon-nitrogen ratio.
- f) Maintaining water quality.
- g) Propagation of indigenous species.
- h) Rehabilitation methodologies for the vulnerable, rare, endangered, threatened, etc, species.

- j) Norms for stocking of the reservoir, lakes or ponds.
- k) Location of the hatcheries.
- m) Seasons of ban, if any.
- n) Technological support for harvesting.
- p) Mesh type and size, net size and type, boats.
- q) Training.
- r) Cold storages, landing sites, transports.
- s) Marketing, warehousing, etc.
- t) Source of funding, responsibility for monitoring.

7.11 Command Area Plan

It aims for improvement in agricultural and water supply benefits, and minimize impacts from irrigation. The plan is to address the issues in terms of mitigating the effects of project activities on resources (physical, biological and socio-economic) and quality-of-life. These considerations are to be incorporated into the project concept from the earliest stages, particularly in areas where environmental factors overlap with engineering design.

7.11.1 Project Description

The irrigation component should be described under the following heads:

- a) Main canal from its head works,
- b) Branch canals, and
- c) Balancing ponds, if any.

The project description should include the following details:

- a) Infrastructure and operations at the local level to include provisions for the subheads. Construction of watercourses/field channels/land levelling and shaping/provision of field drainage.
- b) Assistance to farmers in the development of groundwater and conjunctive use schemes.
- c) Provision of roads.
- d) Development of marketing and warehousing facilities.
- e) Establishing agriculture demonstration farms.
- f) Strengthening cooperative structures.
- g) Arrangement of farm inputs.
- h) Consolidation of land holdings, where necessary.
- j) Scope for additional projects to include provisions for the subheads like municipal and industrial (M&I) water supply/village and rural water supply/development of fisheries/development of sanctuaries/national parks.

7.11.2 Source of Impacts

The project description should focus on design and operation components that result in environmental benefits or adverse impacts. It includes the design and construction aspects/alignment and design of canals/river crossings; locations/description of borrow pits and spoil piles/placement of bridges/slope protection and drainage, and other features. Operational measures like proposed operations and control system and the concept of rotational distribution of water/average seasonal applications should also be included.

7.11.3 Implementation Schedule

It should be provided in order to illustrate interactions with environmental assessment and project design and operations.

7.11.4 Drainage, Waterlogging and Soil Salinity

It includes the extent to which these problems (area, degree and frequency of waterlogging and soil salinity) will occur in future under alternative physical mitigation measures and operational scenarios and degree to which modifications in cropping patterns and land use can lessen the impact of high water tables and/or saline soil be provided.

7.11.5 Drainage Plans

Drainage plans give specific criteria that are readily translated into design features including design and installation of drainage facilities and sound irrigation water management. The drainage plan should be designed to fit the proposed cropping pattern and irrigation management strategy.

7.11.6 Conjunctive Use

A detailed plan for conjunctive use to include potential, future, worst case conditions like excess water in the early stage of the project/reluctance of private farmers to develop wells for conjunctive use/water quality of the pumped water, its mixing and disposal. Engineering design plans and mitigation measures relegated to the operations phase must be placed within an environmental perspective.

7.11.7 Land Acquisition and Resettlement

It includes land acquisition and relocation of people for construction of the main and secondary canals and to a lesser extent, distributory canals. Aspects of the resettlement plan that pertain to the command area need to be described. Adjustment to new modes of livelihood for existing population in the command area can be addressed through various types of extension services. A plan for increase in agricultural extension services throughout the command area should be included.

7.11.8 Socio-economic Factors

Factors related to the project activities need to be included

in this plan such as land aggregation, inadequate infrastructure, changes in modes of livelihood and impacts from resettled groups gauging the potential for negative conditions under the present situation and making recommendations for additional legal and physical measures as part of the plan.

7.11.9 *Social and Cultural Benefits*

Benefits should also be counted in order to provide proper weightage to the overall socio-economic front.

7.11.10 *Public Health*

The major considerations under this involve potential impacts on public health in particular the spread of malaria within the command area. Other public health issues include potential benefits from improved water supply and nutrition and impacts from other vector-related diseases. Diseases transmitted by mosquitoes like filaria and malaria and to a lesser extent, schistosomiasis.

- a) The plan should include the provision of a statistical unit to detect disease outbreaks in the local areas. It should stress on increased surveillance at the village level to detect the presence of malaria and increased use of anti-malarial drugs. It should also include a tiered approach involving the strengthening of village/district/state public health agencies in surveillance capability, including laboratory facilities capability and field personnel.
- b) Specific details concerning design and construction that mitigate against these conditions should be presented, including grading of borrow pits for positive drainage and lining of canals. The plan should stress on the following:
 - 1) Design of drainage systems to prevent standing water,
 - 2) Residual spraying during the monsoon season, and
 - 3) Regular flushing of canals to assure that water does not remain quiescent.
- c) The plan should include additional funding and budgets for the purpose of controlling malaria. The proposed level of funding and staffing to be presented in a manner that represents a strategic response to the problem. The current levels of funding and staffing for the state malaria control unit should be documented and shown to be responsive to historical trends in the incidence of the disease. The plan should include information on the job functions of staff and their normal routines in order to demonstrate how the malaria control programme works.

- d) Potential project benefits should also be presented in the plan like improvements in public drinking water supplies, which affects gastro enteric disease rates and infant mortality, along with other related indicators. Other benefits include improved nutrition and associated improvements in public health and better personal hygiene due to access to water for bathing.

7.11.11 *Management of Ground/Surface Water Quality*

A set up for improving the institutional basis for water management should be included for consideration of various aspects of water management, functional responsibilities, institutional strengthening, policy and legal reforms. It should stress on the following:

- a) Guaranteeing minimum flows in rivers.
- b) Abating existing pollutant sources and plans for treatment of discharges from Municipal and Industrial supplies.
- c) Mitigation of groundwater pollution necessarily involves corrective measures in regions of critical concern in the form of fertilizer and chemical use plans.
- d) Operational controls and education in the use of agricultural chemicals.
- e) Assigning responsibilities, or restructure existing responsibilities.
- f) Providing research inputs into the plans and long-term monitoring.

7.11.12 *Surface Water*

The characteristics of inflows from saline groundwater extractions, agricultural runoff and municipal and industrial discharges will largely determine river water quality in the absence of a significant base flow during the dry season. Management would involve restricted use of the water until proper provisions have been made for transport, treatment and disposal of downstream discharges. This would include,

- a) introduction of low-cost sanitation measures in rural villages receiving water.
- b) installation of street drains where they do not exist and where water providing house connections are being made for the first time.
- c) provision of wastewater treatment facilities and proper points of disposal for all municipalities and industries that receive water from the project.

7.11.13 *Groundwater*

Municipal, industrial and agricultural effluents can affect groundwater quality. Groundwater contamination from agricultural chemicals can occur in porous soil conditions,

under high infiltration rates when soluble and/or mobile chemicals are present, including ammonia, nitrate and pesticides. Management measures would require,

- a) managing the use of agricultural chemicals and water.
- b) cutting irrigation application rates to restrict percolation into the aquifer.
- c) intensive application of integrated planning and management.
- d) biological fertilizer use in critical areas.

7.11.14 *Agricultural Chemical Use*

It can lead to deterioration of organic soil properties, resistance of pests to control agents, acute and chronic worker exposure to chemicals and result in the presence of chemical residues in foodstuffs, requiring restrictions on pesticide use and training *via* an agricultural extension programme.

The chemical use plan should lay stress on introduction of proper use practices and monitoring in regards to growing instances of chemical residues in foodstuffs. The plan should also lay due emphasis on integrated pest management which is a multi-component proposal consisting of research, production, technology transfer and institutional response for introducing a combined approach for biological, chemical and crop management methods for control of agricultural pests.

7.11.15 *Natural Resources in Command Area*

It includes geological and biological resources. A general survey of wildlife throughout the command area is required. Information concerning biological resources is to be described more particularly for protected wildlife species. Since geological resources have no direct bearing on the project, the presentation of these data can be general.

7.11.16 *Forest Loss and Afforestation*

Forest loss includes places where trees have to be removed in order to make way for canals, branch and distribution canals. The documentation on the afforestation efforts should include land areas within specific locations and types of afforestation activity, types of trees which are planted (including exact numbers of individual species) and total areas under planting. In this regard effects on the local climate and rainfall resulting from irrigated agriculture and from afforestation need to be studied. The total atmospheric carbon held in biomass and its role in emission reduction should be calculated and presented as a project benefit towards carbon credit under Kyoto Protocol.

7.11.17 *Natural Fisheries and Aquaculture*

One of the project benefits is aquaculture development,

which is spurred on by supplies of fresh water, and which may provide a means for increasing income for small landholders. Excess nutrient loads (leading to eutrophication), pesticides, non-point pollutant sources affect estuarine fisheries. Considering these a formal action plan for aquaculture development should be presented as part of the environmental management plan.

7.11.18 *Flora, Fauna and Wildlife*

Establishment of reserves is an environmental management response that should result from an evaluation of impacts on wildlife habitats within and adjacent to the command area. The management plans (formulated for identified species/locations which strives for the minimum levels of interference) for the existing/proposed reserves should identify:

- a) Specific management goals and should present a means for obtaining identified goals.
- b) Provide sufficient scientific data and evaluation to substantiate the approach.
- c) Benefits and impacts on wildlife habitats outside of the reserves to the extent possible.
- d) Community participation in the wildlife management effort.

7.12 **Potential Environmental Ameliorative Measures**

The project should provide scope for the Potential Environmental ameliorative measures even at additional costs. They include the following:

- a) *Draw down agriculture* — This is a potential that may be of real value to the rural poor and needs to be dealt in the Environmental Management Plan.
- b) *Downstream community water supply* — The reservoir storage may be a good source of water for downstream community water supplies in the dry season.
- c) *Downstream aquaculture* — Downstream aquaculture potentials will usually be greatly enhanced by the availability of reliable source of fresh water throughout the year.
- d) *Forestry/wildlife reserves* — Because of the adverse effects of the project in facilitating and accelerating encroachment into the upper watershed, it may be desirable to include provision of conservation areas in the upper watershed while this is still feasible.
- e) *Recreation and eco-tourism* — The new reservoir may offer recreational potential that should be developed as part of the project, especially where this could be self-financing and beneficial to the rural poor.
- f) *Navigation* — Possibilities, if any may, be provided.

8 DISASTER MANAGEMENT

It may be defined as management of the sudden disruption of normal life of society causing damage to life and property to such an extent that normal social and economic mechanisms available are inadequate to restore normalcy. It may include but is not limited to the following;

- a) Water and climate like flood, cyclone, cloud burst, drought, sea erosion, etc.
- b) Geological like earthquake, dam failure, land slides, etc.
- c) Disasters related to canals and canal structures.
- d) Accidents like forest fires, building collapse, bomb blast, rail or road accidents, etc.
- e) Biological like epidemics, pest attack and similar disasters.

8.1 It includes the following steps:

- a) Dam break modelling.
- b) Preparation of inundation map showing inundation areas, settlement/villages falling under inundation zone, extent of inundation.
- c) Preparedness at Central/State/Community level and networking among them.
- d) Defining authority and appropriate budget for the operation and maintenance of the nodal agency.
- e) Role for media, education and NGO's for awareness and community mobilization. Providing Information and education for the masses.
- f) Plan to include diagnosis, resource evaluation and feedback.
- g) Checklist of the available resources.
- h) Provision for strengthening of database.
- j) Training and strengthening of the warning system.
- k) Early warning/Mobilization of the resources.
- m) *Communication and remote sensing* — Geographic information system for processing location based massive information, scientific investigation.
- n) Fire services for help in basic search and rescue and for coordination with police and health.
- p) *Health and medical care* — Medical first responders/Medical assistant teams/Mobile hospital/Hospital preparedness for mass casualties/Search and rescue units/Epidemic preventions/Trauma counselling.
- q) Police and paramilitary forces for additional assistance, like salvage, corpse disposal and

basic services, power, food and civil supplies etc.

- r) Rehabilitation and public insurance.
- s) Evacuation plan.
- t) Warehousing.

9 ENVIRONMENTAL MANAGEMENT PLAN IMPLEMENTATION

The Environmental Management Plan should make proposals for agency responsibilities, institutional strengthening and regional/river basin management planning. This agency should include the directorate level personnel from the State Ministries of Health, Forestry, Fisheries, Water Resources, the Department of Environment, the Pollution Control Board and the Water Supply and Sewerage Board, as well as the project liaison officer and the team leader for the project management group. The functions of this group include setting the project budget, environmental screening and determining the components and agency responsibilities for the Environmental Management Plan.

10 MONITORING AND REPORTING PROCEDURES

It consists of monitoring and evaluation procedures for physical and socio-economic factors related to environmental benefits and impacts. Sound monitoring programme is needed to provide assurance that problems will be identified early enough to allow remedial measures to be taken and for the following benefits:

- a) To ensure early detection of conditions that necessitates particular mitigation measures.
- b) To provide information on the progress and the results of mitigation.
- c) To integrate into the total project cost tables of the cost estimates and sources of funds for both the initial investment and the recurring expenses for implementing the mitigation plan.
- d) To strengthen environmental management capability in the agencies responsible for implementation/monitoring plans to cover one or more of the additionalities such as resource identification for technical assistance/faculty sensitization/development of equipment and supplies for monitoring needs/organizational setup.
- e) *Integration of the plan into the project's overall planning, design, budget, and implementation* — This ensures that the plan receives funding and supervision along with the other investment components and to establish the mitigation plan as a component of the project. Thus it helps in the following:

- 1) *Funding* — This is necessary to ensure that the proposed actions are adequately financed.
 - 2) To implement the mitigatory pressures the management, technical assistance, staffing and other institutional strengthening and training (strengthening local capabilities), is to be a part of the management plan.
 - 3) *Monitoring* — The plan should provide a critical path for implementation to enable the sponsors to evaluate the success of mitigation as a part of project supervision and as a means for improving future projects. It should also include the levels of monitoring and stress on availability of periodic progress reports.
- b) Local rural community power needs (in addition to transmitting power to urban centres).
 - c) Transmission lines/access roads routing (if alternative outing is available) should be planned to avoid precious forest/wildlife resources so as no undue restriction on the movement of wildlife and impairment of environmental aesthetics (scenic views) is caused. Also it should not cause undue soil erosion both during construction and later stage due to inadequate reestablishment of covering vegetation.

11 ADDITIONAL CONSIDERATIONS FOR HYDROPOWER PROJECTS

- a) *Multipurpose management needs* — Power

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