

## **ACTIVITY 1(c)- RIVER VALLEY & IRRIGATION PROJECTS**

### **STANDARD TERMS OF REFERENCE FOR CONDUCTING ENVIRONMENT IMPACT ASSESSMENT STUDY FOR RIVER VALLEY PROJECTS & IRRIGATION PROJECTS AND INFORMATION TO BE INCLUDED IN EIA/EMP REPORT**

#### **A. Scope of EIA Study**

The EIA Report should identify the relevant environmental concerns and focus on potential impacts that may change due to the construction of proposed project. Based on the baseline data collected for three (3) seasons (Pre-monsoon, Monsoon and Winter seasons), the status of the existing environment in the area and capacity to bear the impact on this should be analysed. Based on this analysis, the mitigation measures for minimizing the impact shall be suggested in the EIA/EMP study.

#### **B. Details of the Project and Site**

1. General introduction about the proposed project.
2. Details of Project and site giving L-Sections of all U/S and D/S Projects with all relevant maps and figures. Connect such information as to establish the total length of interference of Natural River and the committed unrestricted release from the site of Dam/Barrage into the main river.
3. A map of boundary of the project site giving details of protected areas in the vicinity of 25 km of project location.
4. Location details on a map of the project area with contours indicating main project features. The project layout shall be superimposed on a contour map of ground elevation showing main project features (viz. location of dam, Head works, main canal, branch canals, quarrying etc.) shall be depicted in a scaled map.
5. Layout details and map of the project along with contours with project components clearly marked with proper scale maps of at least 1:50,000 scale and printed at least on A3 scale for clarity.
6. Existence of National Park, Sanctuary, Biosphere Reserve etc. in the study area, if any, should be detailed and presented on a map with distinct distances from the project components.
7. Drainage pattern and map of the river catchment up to the proposed project site.
8. Delineation of critically degraded areas in the directly draining catchment on the basis of Silt Yield Index as per the methodology of Soil and Land use Survey of India.
9. Soil characteristics and map of the project area.
10. Geological and Seismo-tectonic details and maps of the area surrounding the proposed project site showing location of dam site and canal sites.
11. Remote Sensing studies, interpretation of satellite imagery, topographic sheets along with ground verification shall be used to develop the land use/land cover pattern of

the study using overlaying mapping techniques viz. Geographic Information System (GIS), False Color Composite (FCC) generated from satellite data of project area.

12. Land details including forests, private and other land.

13. Demarcation of snow fed and rain fed areas for a realistic estimate of the water availability

### **C. Description of Environment and Baseline Data**

1. To know the present status of environment in the area, baseline data with respect to environmental components air, water, noise, soil, land and biology & biodiversity (flora & fauna), wildlife, socioeconomic status etc. should be collected within 10 km radius of the main components of the project/site i.e. dam site and power house site. The air quality and noise are to be monitored at such locations which are environmentally & ecologically more sensitive in the study area. The baseline studies should be collected for 3 seasons (Pre-Monsoon, Monsoon and Post Monsoon seasons).
2. Flora-Fauna in the catchment and command area should be documented. The study area should comprise of the following:
  - a. Catchment area up to the dam/barrage site.
  - b. Submergence Area.
  - c. Project area or the direct impact area should comprise of area within 10 km radius of the main project components like dam, canals etc.

### **D. Details of the Methodology**

The methodology followed for collection of base line data along with details of number of samples and their locations in the map should be included. Study area should be demarcated properly on the appropriate scale map. Sampling sites should be depicted on map for each parameter with proper legends. For Forest Classification, Champion and Seth (1968) methodology should be followed.

### **E. Methodology for Collection of Biodiversity Data**

1. The number of sampling locations should be adequate to get a reasonable idea of the diversity and other attributes of flora and fauna. The guiding principles should be the size of the study area (larger area should have larger number of sampling locations) and inherent diversity at the location, as known from secondary sources (e.g. eastern Himalayan and low altitude sites should have a larger number of sampling locations owing to higher diversity).
2. The entire area should be divided in grids of 5kmX5km preferably on a GIS domain. There after 25% of the grids should be randomly selected for sampling of which half should be in the directly affected area (grids including project components such as reservoir, dam, powerhouse, tunnel, canal etc.) and the remaining in the rest of the area (areas of influence in 10 km radius from project components). At such chosen location, the size and number of sampling units (e.g. quadrates in case of

flora/transects in case of fauna) must be decided by species area curves and the details of the same (graphs and cumulative number of species in a tabulated form) should be provided in the EIA report. Some of the grids on the edges may not be completely overlapping with the study area boundaries. However, these should be counted and considered for selecting 25% of the grids. The number of grids to be surveyed may come out as a decimal number (i.e. it has an integral and a fractional part) which should be rounded to the next whole number.

3. The conventional sampling is likely to miss the presence of rare, endangered and threatened (r.e.t.) species since they often occur in low densities and in case of faunal species are usually secretive in behaviour. Reaching the conclusion about the absence of such species in the study area based on such methodology is misleading. It is very important to document the status of such species owing to their high conservation value. Hence likely presence of such species should be ascertained from secondary sources by a proper literature survey for the said area including referring to field guides which are now available for many taxonomic groups in India. Even literature from studies/surveys in the larger landscapes which include the study area for the concerned project must be referred to, since most species from adjoining catchments is likely to be present in the catchments in question. In fact such literature from the entire state can be referred to. Once a listing of possible r.e.t. species from the said area is developed, species specific methodologies should be adopted to ascertain their presence in the study area which would be far more conclusive as compared to the conventional sampling. If the need be, modern methods like camera trapping can be resorted to, particularly for areas in the eastern Himalayas and for secretive/nocturnal species. A detailed listing of the literature referred to, for developing lists of r.e.t. species should be provided in the EIA reports.
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referred to, for developing lists of r.e.t. species should be provided in the EIA reports.

4. The R.E.T. species referred to in this point should include species listed in Schedule I and II of Wildlife (Protection) Act, 1972 and those listed in the red data books (BSI, ZSI and IUCN).

## **F. Components of the EIA Study**

Various aspects to be studied and provided in the EIA/EMP report are as follows:

### **I. Physical and Chemical Environment**

#### **1. Geological & Geophysical Aspect sand Seismo- Tectonics:**

- a. Physical geography, Topography, Regional Geological aspects and structure of the Catchment.
- b. Tectonics, seismicity and history of past earthquakes in the area. A site specific study of the earthquake parameters will be done. The results of the site specific earthquake design shall be sent for approval of the NCSDP (National Committee of Seismic Design Parameters, Central water Commission, New Delhi for large dams.
- c. Landslide zone or area prone to landslide existing in the study area should be examined.
- d. Presence of important economic mineral deposit, if any.
- e. Justification for location & execution of the project in relation to structural components (dam /barrage height).
- f. Impact of project on geological environment.

#### **2. Meteorology, Air and Noise:**

- a. Meteorology (viz. Temperature, Relative humidity, wind speed/direction etc.) to be collected from nearest IMD station.
- b. Ambient Air Quality with parameters viz. Suspended Particulate Matter (SPM), Respirable Suspended Particulate Matter (RSPM) i.e. suspended particulate materials < 10 microns, Sulphur dioxide (SO<sub>2</sub>) and Oxides of Nitrogen (NO<sub>x</sub>) in the study area at 5-6 Locations.
- c. Existing Noise Levels and traffic density in the study area at 5-6 Locations.

#### **3. Soil Characteristics:**

Soil classification, physical parameters (viz., texture, Porosity, Bulk Density and water holding capacity) and chemical parameters (viz. pH, electrical conductivity, magnesium, calcium, total alkalinity, chlorides, sodium, potassium, organic carbon, available potassium, available phosphorus, SAR, nitrogen and salinity, etc.) at @ one sample/1000 ha of command area.

#### **4. Remote Sensing and GIS Studies:**

- a. Generation of thematic maps viz, slope map, drainage map, soil map, land use and land cover map, etc. Based on these, thematic maps, an erosion intensity map should be prepared.
- b. New configuration map to be given in the EIA Report

## **5. Water Quality**

- a. History of the ground water table fluctuation in the study area.
- b. Water Quality for both surface water and ground water for [i] Physical parameters (pH, Temperature, Electrical Conductivity, TSS); [ii] Chemical parameters (Alkalinity, Hardness, BOD, COD, NO<sub>3</sub>, PO<sub>4</sub>, Cl, So<sub>4</sub>, Na, K, Ca, Mg, Silica, Oil & grease, phenolic compounds, residual sodium carbonate);[iii] Bacteriological parameter (MPN, Total coliform); and [iv] Heavy Metals (Pb, As, Hg, Cd, Cr<sub>6</sub>, Total Cr, Cu, Zn, Fe) at minimum 10 Locations, however, the sampling numbers should be increased depending on the command area.
- c. Delineation of sub and micro watersheds, their locations and extent based on the Soil and Land Use Survey of India (SLUSOI), Department of Agriculture, Government of India. Erosion levels in each micro-watershed and prioritization of micro-watershed through Silt Yield Index (SYI) method of SLUSOI.

## **II. Water Environment & Hydrology**

- a. Hydro-Meteorology of the project viz. precipitation (snowfall, rainfall), temperature, relative humidity, etc. Hydro-meteorological studies in the catchment area should be established along-with real time telemetry and data acquisition system for inflows monitoring.
- b. Run off, discharge, water availability for the project, sedimentation rate, etc.
- c. Basin characteristics
- d. Catastrophic events like cloud bursts and flash floods, if any, should be documented.
- e. For estimation of Sedimentation Rate, direct sampling of river flow is to be done during the EIA study. The study should be conducted for minimum one year. Actual silt flow rate to be expressed in ha-m km<sup>2</sup> year<sup>-1</sup>.
- f. Set up a G&D monitoring station and a few rain gauge stations in the catchment area for collecting data during the investigation.
- g. Flow series, 10 daily with 90%, 75% and 50% dependable years discharges.
- h. Environmental flow release should be 20% of the average of the 4 lean months of 90% dependable year (MAF) during the lean season and 30% of Monsoon flow during monsoon season. For remaining months, the flow shall be decided by the Committee based on the hydrology and available discharge.
- i. A site specific study on minimum environment flow should be carried out.

## **III. Biological Environment**

### **1. Flora**

- a. Characterization of forest types (as per Champion and Seth method) in the study area and extent of each forest type as per the Forest Working Plan.

- b. General vegetation profile and floral diversity covering all groups of flora including Bryophytes, Pteridophytes, Lichens and Orchids. A species wise list may be provided.
- c. Assessment of plant species with respect to dominance, density, frequency, abundance, diversity index, similarity index, importance value index [IVI], Shannon Weiner Index etc. of the species to be provided. Methodology used for calculating various diversity indices along with details of locations of quadrats, size of quadrats etc. to be reported within the study area in different ecosystems.
- d. Existence of National Park, Sanctuary, Biosphere Reserve etc in the study area, if any, should be detailed.
- e. Economically important species like medicinal plants, timber, fuel wood etc.
- f. Details of endemic species found in the project area.
- g. Flora under RET categories should be documented using International Union for the Conservation of Nature and Natural Resources (IUCN) criteria and Botanical Survey of India's Red Data list along with economic significance. Species diversity curve for RET species should be given.

## **2. Fauna:**

- a. Fauna study and inventorisation should be carried out for all groups of animals including reptiles
- b. and nocturnal animals in the study area. Their present status along with Schedule of the species.
- c. Information (authenticated) on Avi-fauna and wild life in the study area.
- d. Status of avifauna their resident/migratory/ passage migrants etc.
- e. Documentation of butterflies, if any, found in the area.
- f. Details of endemic species found in the project area.
- g. RET species- voucher specimens should be collected along with GPS readings to facilitate rehabilitation. RET faunal species to be classified as per IUCN Red Data list and as per different schedule of Indian Wildlife (Protection) Act, 1972.
- h. Existence of barriers and corridors, if any, for wild animals.
- i. Compensatory afforestation to compensate the green belt area that will be removed, if any, as part of the proposed project development and loss of biodiversity.
- j. For categorization of sub-catchments into various erosion classes and for the consequent CAT plan, the entire catchment (Indian Portion) is to be considered and not only the directly the draining catchment.

## **IV. Aquatic Ecology**

- a. Documentation of aquatic fauna like macro-invertebrates, zooplankton, phytoplanktons, benthos, periphyton particularly on the rock substratum, so that this could reflect the food and feeding of grazing fish species
- b. Fish and fisheries, fish migration, migratory path elimination and seasonal migration pattern and breeding and spawning grounds.

- c. Fish diversity composition and maximum length & weight of the measured populations and migratory behaviour to be studied for estimation of environmental flow.
- d. Conservation status of aquatic fauna/fish and benthic communities.
- e. Sampling for aquatic ecology and fisheries and fisheries must be conducted during three seasons Pre-monsoon (summer), monsoon and winter. Sizes (length & weight) of important fish species need to be collected and breeding and feeding grounds should also be identified along the project site or in vicinity.

## **V. Irrigation and Cropping**

- a. Cropping pattern and Horticultural practices in the study area.
- b. Collection of primary data on agricultural activity, crop and their productivity and irrigation facilities component.
- c. Component of pressurized/drip irrigation and micro irrigation.
- d. Details of Conjunctive use of water for irrigation

## **VI. Socio-Economic**

- a. Collection of Baseline data on human settlements, health status of the community and existing infrastructure facilities for social welfare including sources of livelihood, job opportunities and safety and security of workers and surrounding population.
- b. Collection of information with respect to social awareness about the developmental activity in the area and social welfare measures existing and proposed by project proponent.
- c. Collection of information on sensitive habitat of historical, cultural and religious and ecological importance.
- d. The Socio-economic survey/profile within 10 Km of the study area for Demographic profile;
- e. Economic Structure; Development Profile; Agricultural Practices; Infrastructure, education facilities; health and sanitation facilities; available communication network etc.
- f. Documentation of Demographic, Ethnographic, Economic structure and development profile of the area
- g. Information on Agricultural practices, Cultural and aesthetic sites, Infrastructure facilities etc
- h. Information on the dependence of the local people on minor forest produce and their cattle grazing rights in the forest land.
- i. List of all the Project Affected Families with their names, education, land holdings, other properties, occupation, source of income, land and other properties to be acquired, etc.
- j. In addition to Socio-economic aspects of the study area, a separate chapter on socio-cultural aspects based upon study on Ethnography of the area should be provided.

## **G. Impact Prediction and Mitigation Measures**

The adverse impact due to the proposed project should be assessed and effective mitigation steps to abate these impacts should be described.

### **1. Air Environment**

- a. Changes in ambient and ground level concentrations due to total emissions from point, line and area sources
- b. Effect on soils, material, vegetation and human health
- c. Impact of emissions from DG sets used for power during the construction, if any, on air environment.
- d. Pollution due to fuel combustions in equipments & vehicles
- e. Fugitive emissions from various sources.
- f. Impact on micro climate

### **2. Water Environment**

- a. Changes in surface & ground water quality.
- b. Steps to develop pisci-culture and recreational facilities.
- c. Changes in hydraulic regime and down stream flow.
- d. Water pollution due to disposal of sewage.
- e. Water pollution from labour colony/camps and washing equipment.

### **3. Land Environment**

- a. Changes in land use/land cover and drainage pattern
- b. Immigration of labour population.
- c. Quarrying operation and muck disposal.
- d. Changes in land quality including effects of waste disposal
- e. River bank and their stability
- f. Impact due to submergence
- g. Adverse impact on land stability, catchment of soil erosion, reservoir sedimentation and spring flow (if any) [a] due to considerable road construction/widening activity [b] interference of reservoir with the inflowing streams [c] blasting for excavation of canals and some other structures

### **4. Biological Environment**

- a. Impact on forests, flora, fauna including wildlife, migratory avi-fauna, rare and endangered species, medicinal plants etc.
- b. Pressure on existing natural resources
- c. Deforestation and disturbance to wildlife, habitat fragmentation and wild animal's migratory corridors
- d. Compensatory afforestation -Identification of suitable native tree species for compensatory afforestation & green belt.
- e. Impact on fish migration and habitat degradation due to decreased flow of water
- f. Impact on breeding and nesting grounds of animal and fish.



## **5. Socio-economic aspects**

- a. Impact on local community including demographic profile.
- b. Impact on socio-economic status.
- c. Impact on economic status.
- d. Impact on human health due to water / vector borne disease.
- e. Impact on increases traffic.
- f. Impact on Holy Places and Tourism.
- g. Impacts of blasting activity during project construction which generally destabilize the land mass and lead to landslides, damage to properties and drying up of natural springs and cause noise pollution, will be studied. Proper record shall be maintained of the base line information in the post project period.
- h. Positive as well as negative impacts likely to be accrued due to the project are to be listed.
  - i. Positive and negative impacts likely to be accrued due to the project are listed.

## **H. Environment Impact Analysis**

Environmental Impact Analysis due to the project on the above mentioned components should be carried out for construction and operation phases using qualitative or quantitative methods.

## **I. Environmental Management Plan**

Environmental Management Plan aimed at minimizing the negative impacts of the project should be given in detail. The mitigation measures are to be presented for all the likely adverse impacts on the environment. The following suggestive mitigating plans should be included

### **1. Biodiversity Management Plan**

- a. Biodiversity and Wild Life Conservation & Management Plan for conservation and preservation of endemic, rare and endangered species of flora and fauna to be prepared in consultation with State Forest Department.
- b. Compensatory Afforestation in lieu of the forest land required for the project needs to be proposed. Choice of plants should be made in consultation with State Forest Department including native and RET species, if any.
- c. Fish suitable based passages (Fish passes/Natural bypass) must be included in the plan. This plan must be a scientific based study (seasonal migration) from the Fisheries Research Institute having experience in fish pass studies.

- d. Fisheries Conservation & Management Plan-Fish fauna inhabiting the affected stretch of river, a specific fisheries management plan should be prepared for river and reservoir.
- e. Plan for Green Belt Development along the periphery of reservoir, colonies, approach road, canals etc. to be prepared in consultation with the State Forest Department. Local plant species suitable for greenbelt development should be selected.
- f. Environmental Monitoring Programme with physical & financial details covering all the aspects of EMP. A summary of cost estimate for all the plans, cost for implementing all Environmental Management Plans including the cost for implementing environmental monitoring programme should be given. Provision for an Environmental Management Cell should be made.

## **2. Disaster Management Plan**

- a. Catchment Area Treatment (CAT) Plan should be prepared micro-watershed wise. Identification of area for treatment based upon Remote Sensing & GIS methodology and Silt Yield Index (SYI) method of SLUSOI coupled with ground survey. Areas/watersheds falling under 'very severe' and 'severe' erosion categories are required to be treated. Both biological and engineering measures should be proposed in consultation with State Forest Department. Year-wise schedule of work and monetary allocation should be provided. CAT plan is to be completed prior to reservoir impoundment. Mitigations measures to check shifting cultivation in the catchment area with provision for alternative and better agricultural practices should be include.
- b. Study of Design Earthquake Parameters: A site specific study of earthquake parameters should be done. The results of the site specific earth quake design parameters should be approval by National Committee of Seismic Design Parameters, Central Water Commission (NCSDP), New Delhi.
- c. Dam Break Analysis and Disaster Management Plan: The outputs of Dam Break Model should be illustrated with appropriate graphs and maps clearly bringing out the impact of Dam break scenario. Provision for early warning systems should be provided.
- d. Reservoir Rim Treatment Plan for stabilization of land slide/land slip zones if any, around the reservoir periphery to be prepared. Suitable engineering and biological measures for treatment of the identified slip zones to be provided with physical and financial schedule.
- e. Muck Disposal Plan- suitable sites for dumping of excavated material should be identified in consultation with the State Pollution Control Board and Forest Department. All Muck disposal sites should be minimum 30 m away from the HFL of river. Plan for rehabilitation of muck disposal sites should also be given. The L- section/ cross section of muck disposal sites and approach roads to be given. Financial out lay for this may be given separately. Detailed muck transportation plan delineating the path ways, number of trucks, quantity of muck

to be transported along with monitoring mechanism using latest technology, shall be prepared.

- f. Plan for Restoration of quarry sites and landscaping of colony areas, working areas, roads, etc.
- g. Command Area Development (CAD) Plan giving details of implementation schedule with a sample CAD plan.
- h. In the EMP, also include a sample CAD plan for a distributary outlet command. Such a plan is to show the alignment of irrigation and drainage channels. The components of the OFD works to be undertaken may be clearly mentioned along with a time schedule for their completion vis-à-vis the progress of irrigation development.
- i. Mitigating measures for impacts due to Blasting on the structures in the vicinity.

### **3. Socio - economic aspects**

- a. A detailed CER plan along with activities wise break up of financial commitment shall be prepared in terms of the provisions OM No. 22-65/2017-IA.III dated 30.09.2020. CER component shall be identified considering need based assessment study and Public Hearing issues. Sustainable income generating measures which can help in upliftment of affected section of society, which is consistent with the traditional skills of the people shall be identified.
- b. While formulating CER schemes it shall be ensured that an in-built monitoring mechanism for the schemes identified are in place and mechanism for conducting annual social audit from the nearest government institute of repute in the region shall be prepared. The project proponent shall also provide Action Plan for the status of implementation of the scheme from time to time and dovetail the same with any Govt. scheme(s). CER details done in the past should be clearly spelt out in case of expansion projects.
- c. Resettlement and Rehabilitation (R&R) Plan need to be prepared with due consultation with Project Affected Families (PAFs). The provision of the R&R plan should be according to the National Resettlement and Rehabilitation Policy (NRRP-2007) as well as State Resettlement and Rehabilitation Policy. Detailed budgetary estimates are to be provided. Resettlements sites should be identified.
- d. Public Health Delivery Plan including the provisions for drinking water facility for the local community.
- e. Local Area Development Plan to be formulated in consultation with the Revenue Officials and Village Panchayats. Local skill development schemes should be given. Details of various activities to be undertaken along with its financial outlay should be provided.
- f. Labour Management Plan for their Health and Safety.
- g. Sanitation and Solid Waste Management Plan for domestic waste from colonies and labour camps etc.
- h. Plan for Land Restoration and Landscaping of project sites.

#### **4. Miscellaneous**

- a. Energy Conservation Measures.
- b. Environmental safeguards during construction activities including Road Construction.
- c. Ground Water Management Plan.
- d. Water and Air Quality & Noise Management Plans to be implemented during construction and post-construction periods.

In the EMP, also include a sample CAD plan for a distributary outlet command. Such a plan is to show the alignment of irrigation and drainage channels. The components of the OFD works to be undertaken may be clearly mentioned along with a time schedule for their completion vis-à-vis the progress of irrigation development.

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