Chapter - 14

Environmental and Ecological Aspects

14.1 General

Survival of the mankind, with its alarming increase in population growth is linked in the long term, requires a stable eco-system and increase in food production, for which the development of water resources is unavoidable. The development of water resources project is linked with change in the environment of the area due to construction of reservoirs because of submergence of land, displacement of population including the flora and fauna and resettlement in the surrounding catchment, denudation of forest, water logging, salinity and alkality of soil, water quality and ground water table change, etc.

The environment and ecology is degraded by both inappropriate and lack of development. In respect of disturbance of environment, there are two schools of thoughts. One school holds that eco-system is fragile and highly unstable. It is implicit, therefore, that eco-system should be left as much as possible in its natural state and that its diversity should be preserved at any cost. Modification for the purpose of development should be minimal and confine to the range of tolerance limits of various elements of eco-system. The second school of thoughts assuring that the eco-system is globally stable and there is large element of built in resilience in eco-system. In any case, it is realized that the water resources projects should be planned to be aimed for the sustainable developments of the inter-connected elements that co-exist in the system.

Water resources development that meet the needs of the present generation without compromising the ability of future generation to meet their own needs will alone be considered as a sustainable development. It is, therefore, realized that the water resources projects should be planned, implemented and managed in such a way that the future demands of the growing population have to be met with minimum disturbance to the existing eco-system along with the incorporation of adequate control measures at appropriate stages to mitigate the adverse effects, if any; to maintain the sustainability of the system, in long run.

14.2 Present environmental & ecological status of the project area

The Andhra Pradesh State Govt. has planned Polavaram project as a multi purpose project to provide irrigation benefits to the up land areas, water supply to the industries in Visakhapatnam city including the steel plant, generation of hydro power, development of navigation and recreational facilities. The Polavaram-Vijayawada link canal as conceived by NWDA will make use of Polavaram dam as its headwork. The length of the link canal is about 174 Km. The Polavaram dam is located about 42 Km upstream of Godavari barrage at Dowlaiswaram. The power house with an installed capacity of 720 MW is also envisaged on the left flank of the Polavaram dam. The various features of the project area are:

a) No major industries or thermal power house is located in the project area.

b) The area likely to be inundated by the Polavaram project includes outcrops of Barakar rocks at Vinjaram and north of Tummalakunta, but their resource

potential of workable coal will be estimated at DPR stage. The only other mineral occurrences known in the inundated areas are of graphite at Kavilkunta and Bollapalle.

c) At present the ground water is being use for agriculture purposes. The ground water quality in the command area is generally within the permissible limits for irrigation. The depth of water table varies from near surface to 25 m below ground level.

d) There is no record of fish sanctuary in and around Polavaram reservoir area.

e) The forest area coming under submergence are generally dense with jungles, open scrubs of thorny bushes and other trees. The important timber species are teak, eppa, and bijasal or yegi. Common fuel species are tella tumma, maredu, udaga and Korier. Commercially important species found in the forest are teak, neem, kalan, sandalwood, sailaichar, cattle grass, gum etc. There is also good bamboo growth, which are being exploited by paper mills.

f) The downstream area of the project has a long history of floods. To protect the area from floods, flood banks have been formed considering the maximum flood level of year 1986.

Favourable aspects of the project

14.3.1 Irrigation : The Polavaram-Vijayawada link will irrigate an area of 5.82 lakh ha in A.P. and provide 2265 Mm^3 of water to Krishna Delta. Besides this, the project will provide 1236 Mcum of water for stabilization of existing command area under Krishna Delta.

14.3.2 Power generation: A power house on the left flank of Polavaram dam is proposed with an installed capacity of 720 MW.

14.3.3 Pisciculture: The reservoir can be utilized for development of fisheries. However, pre and post impoundment surveys have to be undertaken to work out the steps needed for development of fishery in the reservoir. Fish ladders will be provided to allow movement of important migratory fish population.

The Pisciculture development proposed to be created in the project area will also provide additional work to the local fishermen and revenue to the Government.

14.3.4 Water Supply: The project will also provide about 162 Mm^3 of water for meeting the domestic and industrial water requirement of areas.

14.3.5 Industrial development: Due to coming up of such a multipurpose project in the area may encourage setting up of some medium and small scale industrial units in and around the project area and will be helpful for the overall development of the area economically.

14.4 Need for impact assessments on environmental and ecological aspects of the project area

The major environmental and ecological aspects of a inter basin water transfer project mainly pertain to the areas of the reservoir site, downstream river course

below the dam, link canal enroute and command area of the project. Different types of environmental and ecological impacts may be observed in the areas due to the coming up of the project. It is, therefore, necessary to anticipate the possible adverse impacts along with the positive aspects from the relevant areas of the project. This will help to incorporate adequate control measures on the adverse effects from the project planning phase to various other stages of developments, such as implementation and management to accrue optimum benefits from the project. Relevant aspects on environment and ecology of Polavaram-Vijayawada link canal project and the possible impacts along with mitigative measures thereon have been discussed in the following paragraphs:

14.4.1 Reservoir site

The site of the dam on Godavari river near Polavaram village in West Godavari district of Andhra Pradesh has been proposed by the State of Andhra Pradesh on topographical, geological and economic considerations giving due relevance to submergence and rehabilitation aspects. The total area of submergence at FRL 45.72 m is 63691 ha, out of which 3705 ha is forest, 30650 ha are culturable land, 12688 ha are unculturable land and 16648 ha area is under river bed. 250 numbers of villages with about 16207 families having a population of about 1,44,812 are coming under submergence. Available information on population and properties affected are given in following Tables :

Table 14.1
State-wise number of villages and families coming under submergence*

Sl.No.	State	Number of villages	Number of families	Population (1991 census)
1	Andhra Pradesh	233	15235	135449
2	Madhya Pradesh	10	680	6620
3	Orissa	7	292	2743
	Total	**250**	**16207**	**144812**

** These are likely to change when actual estimation is made at the time of preparation of DPR*

Table 14.2

Properties affected due to submergence*

Sl. No.	State	Permanent houses	Semi permanent houses	Kutcha houses
1	Andhra Pradesh	1350	2300	18800
2	Madhya Pradesh	42	-	300
3	Orissa	13	-	290
	Total	**1405**	**2300**	**19390**

**These are likely to change when actual estimation is made at the time of preparation of DPR*

14.4.2 Environmental Impact

The National Council of Applied Economic Research (NCAER), New Delhi was entrusted with the studies of socio-economic and environmental implications of 6 inter-basin water transfer proposals of NWDA, and the present link is one among them. The present section on the Environmental Impact of the link project is mainly based on the conclusions drawn in their report.

14.4.2.1 Surface Water Regime

The link canal is designed as a contour canal and will interfere with natural surface drainage of the area. As such adequate cross-drainage works are provided in the project.

14.4.2.2 Impact on Groundwater

Provision of canal irrigation in the proposed command area causes additional recharge to the groundwater. As a result the groundwater levels will rise gradually year by year. Part of this augmented groundwater reserves find its way into the stream. To avoid likely rise in water table with consequent harm to crop pattern, the drainage system will have to dispose of the surplus recharge along with surface drainage.

14.4.2.3 Natural Resources

The area likely to be inundated by the Polavaram project includes outcrops of Barakar rocks at Vinjaram and north of Tummalakunta, but their resource potential of workable coal is not known. The only other mineral occurrences known in the inundated areas are of graphite at Kavilkunta, Velagapalle and Bollapalle. However, these are reported to be minor and not of economic importance. The main purpose of the Polavaram project is to provide water for irrigation to the ayacut upstream of the Godavari barrage, to supply drinking water to the Visakhapatnam steel plant and also to provide water to the chronic drought prone Cheepurupalle tract in which the manganese belt is situated. The mineral resources likely to be lost or their use precluded as a result of inundation will be very negligible. Even for these mineral commodities, plentiful and alternate sources are available in the vicinity of appropriate manufacturing centers.

14.4.3 Public Health Aspects

The formation and use of the water body is not likely to result in introduction or enhancement of water borne diseases provided no heavy industrialisation around the area takes place.

14.4.4 Aquatic Weeds

The chances of impounded reservoir leading to noxious aquatic weeds and intermittent host are remote in the given circumstances.

The nature of existing aquatic weeds in submergence area and their impact on fisheries development due to the formation of the reservoir will be studied in detail at the time of preparation of DPR.

14.4.5 Climatological changes

Some induced climatological changes may happen in the long run. But the type of changes cannot be outlined at this stage and will be studied at the time of preparation of DPR.

14.4.6 Impact on Seismicity

The Godavari river flows along a faulted graben, with the highest recorded earthquake in the region having occurred in 1968 near Bhadrachalam.

The Director (Seismology), India Meteorological Department, has opined that since the height of dam is less than 100 m, seismological observations are not necessary. However, keeping in view the past history of earth tremors in the region proposals are under consideration in consultation with the India Meteorological Department to monitor the pre and post project seismic activity.

The dam site falls in Zone – III as per the map of India showing the various seismic zones (IS code: 1893 – 1975 "IS criteria for earth quake resistant design of structures").

The horizontal and vertical inertia co-efficients worked out and adopted for various components are as given in Table 14.3:

Table 14.3
Seismic co-efficients adopted for various components

Component	Horizontal	Vertical
Spillway	0.12	0.06
Earth dam	0.08	0.04
NOF dam	0.12	0.06

14.4.7 Sedimentation

The Government of Andhra Pradesh has anticipated a sedimentation rate of 1.25 Ac. ft/sq.mile/year (0.0595 ha.m/km^2/year) for the free catchment against the IS code recommended rates of 0.048 to 0.096 ha.m/km^2/year. However, the actual rate of sedimentation, based on observed data of 22 years between 1969-70 and 1992-93 at Polavaram G&D site, maintained by CWC, is 0.0299 ha.m/km^2/year.

14.4.8 Frequency of Cyclones

Number of occurrences of severe cyclone storms that affected the area during past seventy years are given in Table 14.4.

Table 14.4
Number of occurrences of cyclonic storms

Month	Near Visakhapatnam	Near Kakinada

May	4	1
Jun	1	5
Jul	0	2
Sep	2	3
Oct	13	11
Nov	8	2
Dec	0	1

Source: Polavaram project report (vol-I), July 1982.

14.4.9 Archaeological Centers

No archaeological researches were attempted in the past on account of the presence of impregnable forest with wild animals, though it is well recognised and acknowledged that the two banks of the river Godavari and adjoining areas have been treasure houses of undiscovered cultural, archaeological and historical sites. Detailed survey of the adjoining areas covered has however been proposed by the state Archaeological Department. Before the reservoir is formed the detailed survey is proposed to be completed and any archaeological finds will be retrieved to safer places.

14.5 Adverse Impact of the Project

Though the implementation of any irrigation project helps in upliftment of general prosperity in the region, there are bound to be some adverse effects, which should be mitigated through suitable remedial measures. Some of the adverse impacts could be listed as below:

i. Resentment of the displaced people in the project area as well as submergence area, since most of the benefits of the project are for the people living in the command area: *A proper R&R package for resettlement of project affected peoples (PAPs) in the vicinity and similar climate with better civic amenities will be evolved. The PAPs will be resettled before the commencement of the project work.*

ii. Submergence of forest area may have environmental and ecological impact: *Proper Environmental Management Plan (EMP) will be evolved to reduce the impact on the environment due to the project. Also, to minimise the loss of forest additional afforestation programme will be taken up. Necessary provision has been made in the estimate for compensatory afforestation.*

iii. Waterlogging and salinity due to increased irrigation in the command area: *Proper drainage systems will be provided in the command area.*

14.6 Labour requirement

As per the norms of Central Water Commission, the employment generation per crore of rupees of the cost of the project is 155 persons in case of a major project. This 155 comprise 10 engineers, 11 other technical, 12 skilled, 93 unskilled and 29 clerical personnel. The expenditure towards the manpower in case of a major

irrigation project would be 23%, of the total expenditure of the project. This expenditure on manpower includes expenditure on pay and allowances, bonus, social security, office expenses and traveling expenses.

Total estimated cost of Polavaram - Vijayawada link project is Rs.148391 lakh (1994-95 price level). The manpower required for the construction of the project will be 230020 persons considering the cost of the project as Rs.1484 crore. This manpower of 230020 comprise 14840 engineers, 16324 other technical, 17808 skilled, 138012 unskilled and 43036 clerical personnel. The expenditure for the engagement of manpower will be Rs.34130 lakh.

14.7 Socio-Cultural Aspects

14.7.1 Population density

The catchment area of the Godavari basin at the Polavaram dam site is 306643 Km^2 . The unintercepted catchment area below the existing Sriramsagar dam upto Polavaram dam site is 215249 Km^2 . The population density in the catchment area of Polavaram dam site is 166 persons per Km^2, in the submergence area 227 persons per Km^2 and in the command area of the whole project is 497 persons per Km^2 .

14.7.2 Rehabilitation and resettlement of project affected people

The proposed Polavaram – Vijayawada link project involves the creation of storage reservoir at Polavaram, which submerges large areas including forests, cultivated land, villages etc. The prospects of submergence leading to loss of homes and means of sustenance will have a traumatic effect on the affected population. A proper and timely step for resettlement and rehabilitation of these persons is essential to minimise their suffering.

However, the problems relating to resettlement and rehabilitation (R & R) are quite complex. It is essential that the contents of R & R package should be very attractive. However, an efficient institutional arrangement for implementing the entire programme of R & R effectively is equally important. A humane approach during implementation is required, as it is a very sensitive issue. Active co-operation of the affected persons will be beneficial for successful implementation of the project. The attractive R & R packages along with effective implementation in reasonable time schedule has become an essential input for construction of major projects.

The primary objective of a good rehabilitation and resettlement strategy should be to reinforce the traditional ethos and aspiration of displaced people to develop a society living in perfect harmony with nature. Besides, the main thrust of the rehabilitation strategy also should aim at providing fair and equitable treatment of the persons displaced from their homes, professions, farms etc. due to construction of a project. This may require a detailed analysis of the cost involved in providing houses, land and civic amenities to the displaced people.

14.7.2.1 Housing

The total 16207 families are likely to be affected due to creation of Polavaram reservoir. These families would need to be resettled in different villages in the nearby areas. To expect a displaced person to embark upon the task of constructing a house by him is perhaps expecting too much from him. Therefore, a modestly

constructed house needs to be allotted to each of the affected family that would facilitate their prime need.

14.7.2.2 Land

There are considerable variations in the norms prescribed by different States and agencies in respect of land compensation to be provided to the affected persons. In some cases, the norms differ from project to project within the same State. The policy of providing land for land is commendable. However, complications may arise when the choice of land is also given to the affected families. To avoid dispute and problems, the selection of suitable agricultural land in the command area and its division into required sizes and its distribution by draw of lot with the control of a High Level Committee comprising senior officers of concerned departments should be performed. In the case of Polavaram-Vijayawada link project, 30650 ha of culturable area is coming under the submergence of the proposed reservoir at Polavaram. Therefore, at least an equivalent area of land has to be acquired, suitably in the command area of the project for encouraging to carry out the normal agricultural activities by the affected families.

14.7.2.3 Basic amenities

Facilities for health, education, water supply, market, sanitary, communication, community park, panchayat ghar etc. are to be provided to make the life in resettlements more adaptive and comfortable.

14.8 Tourism

The area can be developed as a tourist resort after the formation of reservoir. The Papikondalu Gorge about 5 km upstream of dam site in particular is a scenic spot and can be developed as a tourist resort.