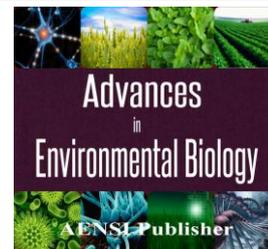




AENSI Journals

Advances in Environmental Biology

ISSN-1995-0756 EISSN-1998-1066

Journal home page: <http://www.aensiweb.com/AEB/>

Evaluation of Environmental impacts of Farrokhi Reservoir Dam in Qaen City and Its Related Plants

¹Ali Rezvani Mahmoudi and ²Mohsen Rezaee

¹Civil Engineering Department, Bozorgmehr University of Qaenat, Qaen, Iran

²University of Zabol, Zabol, Iran

ARTICLE INFO

Article history:

Received 15 April 2014

Received in revised form 22 May 2014

Accepted 25 May 2014

Available online 15 June 2014

Keywords:

The evaluation of environmental effects, Farrokhi Dam of Qaen.

ABSTRACT

The crisis of water shortage along with the problem of energy production led man to the idea of creating dam engineering science. In this context, Farrokhi dam of Qaen on the river Farrokhi, situated in Southern Khorasan was constructed to take advantage of the river flood occasions. The place where the dam was built is at a distance of 50 kilometers from Qaen city. The system of irrigation and drainage downside the dam is used to irrigate the farming lands of Farrokhi village. The dam was constructed in different phases, and it has strongly affected the environment around itself. This paper studied the environmental impacts of the dam and its related plants through analyzing the environmental resources. Data were collected through the available maps of Qaen basin, as the main basin of Farrokhi dam and field research. The method of ICOLD matrix was applied to evaluate the environmental impacts of the dam and its related plants. In this evaluation, the area under study was divided into three regions on the basis of how they were affected by the project: immediate, directly affected and indirectly affected. In each one of these regions, based on the proportional importance of the project, the directly and indirectly positive and negative effects of the project on the physical and biological resources as well as the social and economical situation of the region were studied, assessed, and finally evaluated and their consequences were reviewed. At the end, some practically simple techniques were suggested for the improvement and the decrease of the positive and negative effects of the project respectively.

© 2014 AENSI Publisher All rights reserved.

To Cite This Article: Ali Rezvani Mahmoudi and Mohsen Rezaee., Evaluation of Environmental impacts of Farrokhi Reservoir Dam in Qaen City and Its Related Plants. *Adv. Environ. Biol.*, 8(11), 1381-1386, 2014

INTRODUCTION

The construction of large dams, due to their widespread positive and negative impacts, has always been a controversial issue. Therefore, values such as flood control, water supply and etc. should be equally weighted against the changes in ecosystems and the likely drainage of agricultural lands. In recent years, the environmental impact assessment of projects, along with other issues have influenced the justification of the projects and have made them possible or impossible [5].

Environment impact assessment (EIA) involves the procedure of official study in order to predict the impact of activities and practices of a project on environment, man's sanity and human social welfare; in other words, the systematic identification and assessment of the impacts of the consequences of projects, programs and plans on the physical, chemical, biological, social and cultural components of the environment [3].

The Targets of Environmental Impact Assessment Studies:

The purpose of the environmental impacts assessment studies of water resources development projects is to ensuring compliance with established policies and objectives of the programs and activities of the project inline with environmental laws, regulations and standards. Therefore, through the performance of such studies, the implementation process of water resource development projects will be in line with the objectives of sustainable development, and finally, will lead in optimal utilization of water resources with the least environmental ill effects in order to achieve the objectives of water resources integrated management [6]. The major benefits of environmental impact assessment of the country's dams can be summarized as follows:

1. Developing a decision support system for project managers and decision makers.

Corresponding Author: Ali Rezvani Mahmoudi, Civil Engineering Department, Bozorgmehr University of Qaenat, Qaen, Iran.

2. Increasing environmental awareness and knowledge at different levels of society, authorities and decision-makers.
3. Setting possible effects and consequences of the project over the physical -biological resources, and the social - economic situation of the society in three areas: unrelated, direct effects and indirect effects.
4. Providing continuous monitoring guidelines and monitoring the effects during construction and operation [10].

MATERIALS AND METHODS

The environmental assessment method of Farrokhi reservoir dam:

According to the study area and existing facilities (Sampling, testing, and surveys) and also, the available guidelines from International Committee of Large Dams (ICOLD) for the environmental effect assessment of Farrokhi reservoir dam, the ICOLD matrix method was applied. This method is capable of good communication and flexibility, and has a good abstract form, a high option comparison power and economic aspect.

The environmental effect assessment of Farrokhi Dam was performed in two stages:

1. During construction
2. During operation of the dam

Electing activity components and environment:

To assess Farrokhi dam of Qaen, the matrix suggested by ICOLD, which gives acceptable results for large dams, was applied.

The Project Location:

The reservoir dam of Farrokhi was constructed over the Farrokhi River, 50 kilometers from Qaen, near Farrokhi village. It is a seasonal river that is supplied from seasonal floods.

The effect scope of Farrokhi reservoir dam of Qaen:

In general, based on existing guidelines, and according to important parameters such as regional topography, ecological conditions, ecological sensitivity (especially near the protected area of Shaskuh), hydrology system, social and economical structure as well as the scope and objectives of the project, three different areas were Identified, monitored and evaluated in order to evaluate the environmental effects of the project. Given the scope of the project environmental effects, they are as follow:

- The immediate area: Including the project site, dam reservoir and workshop
- Directly affected area: Including a radius of 5 km from the dam reservoir
- Indirectly affected area: Including the whole city of Qaenat, based on the national divisions.

RESULTS AND DISCUSSION

Predicting and assessing the environmental effects:

Predicting and assessing the environmental effects on physical resources:

- Operations such as preparing the site, excavation, filling and clearing the reservoir cause the destruction of vegetation and surface soil degradation.
- The construction of a dam, by lowering the partial or total solids and sediments that are deposited in the reservoir or dam lake disrupts the potential natural balance of sedimentation in down stream and causes the severe erosion of the river course in downstream [4,9].
- The exit of muddy water containing sediment leaves negative effects on the down stream areas and the environment of the region especially the protected area of Shaskuh.
- Because of the effect of water on the lake floor, there is the possibility of inducing earthquakes.
- The creation of heat stratification in the dam reservoir as follow:
 - The top layer (Elpilimnion)
 - The middle layer(Metalimnion)
 - The bottom layer (Hypolimnion) [1].
- Landslide: Because of the reaction between water surface and wet environment, landslide occurs that has two effects:
 - Reduction of the lake volume
 - Establishing long wave, overflowing of the dam or its destruction

Predicting and assessing the environmental effects on biological resources:

- In construction phase, different operations such as destroying vegetation, Utilization of borrowed resources, exploitation of mines and explosion, construction of access roads, making various work shops

and the settlement of workers, and in general, all practices in the construction phase, have various adverse effects on terrestrial and aquatic animals .

- Effects of water, stored in shallow reservoirs, on the development of Planktons.
- The impact of dam lake over the animal and vegetable species within the reservoir and its upstream such as animal migration, the development of new plant species and adoption of new animal species and the disappearance of some native species.
- Due to erosion, exploitation of borrowed resources_ will cause an increase in rivers sediments. All of these actions will increase water, soil, air and noise pollution and insecurity in the immediate area_ as well as the direct impact of the project on aquatic and terrestrial fauna.
- With the construction of the dam and the creation of a micro artificial lake, the climate within the directly-affected area of the project will be influenced and the vegetation will increase.

Predicting and assessing the environmental effects on economic, social and cultural resources:

- Items such as dust, wastewater and solid waste, from the health point of view, endanger the safety of the residents in the study area. Incidents, such as landslides, damaged buildings, electric shock, fire, vehicle accidents within the work place environment endanger the physical and mental health of workers, dam facility expert and visitors. Because of religious fanaticism and indigenous workers and residents of villages adjacent to the dam sites, events such as dam failure, landslides, landslides, drowning in the pool and tourists with different cultures can endanger social security of the study area.
- With the construction of Farrokhi dam, the lake of the dam will become a good place for tourist attraction and the economic prosperity of the region on the one hand, and the Likely tension between tourists and indigenous people on the other hand.
- Considering the fact that the water behind the dam will be used for agricultural purposes, the construction of the dam will lead to agricultural development in the directly-affected area , and the development of related industries and employment in the indirectly- affected area of the project.

Predicting and assessing the environmental effects through the pollutants of the project:

- With the construction of the dam, the traffic of Vehicles and visitors (Professionals, workers, tourists and native people) will increase, and because of population growth, the consumption of raw materials and the production of waste (domestic, agricultural and industrial) increases will also go up.
- Motor vehicles on the roads, the machinery of maintenance workshops and administration block, accident settlements will cause noise pollution.
- The entrance of wastewater and solid wastes of villages and towns bordering the river up stream and the reservoir into the reservoir depletes the water reservoir and the residence time of water behind the Farrokhi dam; provide more Eutrophic condition in water [11].
- The dam lake can be a source of many infectious diseases such as malaria and blood disease [2].
- Lake effect on plant growth and development: The plants grow in shallow lake water has caused damage to fish and provide a good environment for oviparous insects.

Overall summary results of the analysis of ICOLD method is as follows:

Table 1: Overall summary results of the analysis of environmental effects of Farrokhi Dam of Qaen by ICOLD method.

	Physical environment		Biological environment		Economical and social environment		Utility and pollution environment	
	Construction phase	Operation phase	Construction phase	Operation phase	Construction phase	Operation phase	Construction phase	Operation phase
Raw core	-52	+117	-202	+98	+117	+423	-135	+98
Coefficient	0.25	0.25	0.2	0.2	0.35	0.35	0.2	0.2
The final score of the coefficient	-27.04	+29.25	-40.4	+19.6	+40.95	+148.05	-27	+19.6

According to the above table, the overall effects of the project on 4 environment s of physical, biological, economical-social and utility and pollution in two phases of construction and operation is -53.49 and +216.5 respectively.

Environmental solutions (mitigation plan):

Table 2: Solutions to physical resources.

parts of environment	environmental factors	Project activity	description
Physical environment	geology	Excavation, embankment and aggregate supply	Natural materials must be taken out of the would-be reservoir as possible. Small coarse aggregates must be separated from fine conductors and changed into right dimensions by crushing
		Construction of dam and hydraulic structures	
		Accumulation of construction waste	Before the performance of the project the history of earthquakes must be investigated, and dam building is to be retrofitted against the most intensely occurred earthquake.
		Dam and Reservoir	
	Control and soil erosion	Removal of vegetation	The workshop buildings should be concentrated on one section, close together, so that they are not adjacent to any of the main and secondary channels, and have permeable soil as much as possible. The smallest possible area of land is to be devoted to collection of contaminated soils. And yet the accumulation of contaminated soils should be in the form of multiple masses in which the possibility of air infiltration is present. Concrete activities in seasons with the least rainfall, packed transportation of cement, and the placement of concrete construction station in the deepest point of the river are recommended. Restoring vegetation by controlling and soil conservation through the use of mechanical structures is recommended.
		Motor activity	
		Construction of dams and hydraulic structures	
	Sedimentation	Diversion of water	Sediment and erosion control and vegetation restoration are activities appropriate to eliminate or reduce the negative impact of water diversion.
		Dam and Reservoir	
	Suspended solids load	Diversion of water	The observance of Technical principles in Sand operation from the permanent rivers leading to the dam
		Dam and Reservoir	Erosion and sediment control operations in order to create balance on the suspended solids common in the upstream of the dam are recommended.
	The flow of downstream river	Construction of dams and hydraulic structures	The contractors' Schedule should be adjusted in such a way that activities needing a substantial volume of water should be done In autumn and after having agricultural lands sufficiently irrigated.
Regulation of river flows		The release of water stored behind the dam to downstream bed is recommended. It is better that most part of this stream be supplied from the depth of 10 to 20 meters of the reservoir.	
Dam and Reservoir			
Physical environment	Groundwater levels	Irrigation	The use of modern irrigation systems instead of traditional methods; In other words, the indiscriminate use of water from the dam is better to be avoided.
	Water Quality	Wastewater and solid waste disposal	The Use of absorbent wells as well as appropriate methods of sanitary waste disposal is recommended.
		Agricultural Development	The use of modern methods of irrigation (drip and sprinkler for tree crops) to avoid the indiscriminate use of water downstream in the exploitation phase.
		Regulation of river flows	

Table 3: Solutions to biological resources.

parts of environment	environmental factors	Project activity	description
Biological environment	sound and quality	Road building and technical buildings	Engine tuning of the machines used for construction projects causes the reduction of the pollutant emissions. The sprinkling to prevent dust and noise reduction by repairing car exhausts and ... Identifying and Locating blasting place should be done in the shortest time.
		Excavation, embankment and material supply	
		Drilling and blasting	
		Load and transport	
		Dam construction	
	forests and grasslands	Removal of vegetation	Removing the lowest vegetation cover, protecting the existing cover, its recovery, and changing land use
	Fishes	Water withdrawal	The observance of Technical principles in Sand operation from the permanent rivers leading to the dam, Rural wastewater pollution control, development and management of fish in the reservoir, with emphasis on native species and to determine the water flow downstream are recommended.
		Waste disposal and effluent	
		Accidents	
		Regulation of river flows	
	Birds	Removal of vegetation	Approaches to mitigate the effects of vegetation removal on trees and shrubs are recommended in this case. Reducing the use of chemical pesticides, biological or integrated campaigns instead of using pesticide is recommended. If you require the use of pesticides, a variety of unstable and changeable ones are to be used. Restoring vegetation and growing fish improve habitat conditions for birds.
		Agricultural Development	
	Other animals	Removal of vegetation	Removing the lowest possible level vegetation, restoring degraded vegetation, protecting vegetation against deterioration agents including uncontrolled use, land use changes and the control of erosion and sediment are recommended.
		Agricultural Development	
	Migration of land animals	transportation	Remedial actions, Vegetation restoration and controlling erosion and sediment are recommended.
irrigation			

Table 4: Solutions to economic, social and cultural resources.

parts of environment	environmental factors	Project activity	description
Economic social and cultural environment	Settlements and other buildings and facilities	Reservoir Inundation	The transfer of land in residential areas(rural and sparsely populated) downstream of the dam, and giving proper facilities such as material and financial assistance for the construction of new Heller settlements to the owners of lands located within the damages of reservoir are recommended.
	Agriculture& Livestock	Reservoir Inundation	Transferring part of agricultural land for development and improvement in coastal dam to owners of lands located within the dam reservoir damage,
	Safety &Health	accident visa	The activity of workshop equipment, due to using public roads, should be done on non-holidays. Experienced drivers with special driving licenses must be employed. Hot dirt roads are to be watered. The observance of other points about blasting and excavation are recommended.

Solutions to eliminate or reduce the negative effects of project pollutants:

- All health and safety facilities should be provided for tourists.
- For camps sewage collection septic tanks or wastewater collection system should be used.
- Promote the biological method of crop pests instead of pesticides.

Providing environmental education program:

In order to familiarize people with the importance of protecting the environment, particularly aquatic ecosystems, general environmental training for all levels of society according to their level of education should be provided.

Control and monitoring programs:

One of the most important operations to reduce the adverse environmental effects of the project, and enhancing positive impacts, is presenting and performing environmental control programs and monitoring during construction and operation of the project.

Conclusions:

The purpose of the Environmental Assessment Projects is the regulatory quantification of environmental effects on various environments by which we can assess the positive and negative aspects of a project.

As noted above, total effects of the project on four physical, biological, socio-economical and utility and pollution environments in two phases of construction and operation are -53.49 and +216.5 respectively.

Therefore, the total impact of Farrokhi dam in two phases of construction and operation was +163.01 which indicates the positive effects of the project alternatives with respect to options it is not executing.

As it can be seen, most of the negative effects are in construction phase and first, over the biological, and then, over the physical, utility and pollution environments. Using the proposed methods, we can reduce the intensity of their adverse effects.

Moreover, the most positive effects of the project are seen on the social and economic environment. The reason is the weak living conditions of people in the project neighboring regions and the effects of the Project on the employment and expansion of agricultural area.

Considering all the aspects, and the short-term and long-term impacts of the project, the construction of Farrokhi dam and its related plants, can be considered as a desirable option for South Khorasan province.

REFERENCES

- [1] Ayaz, A.H., 2001. Environmental impact assessment of Narmab dam and related plants. Proceedings of the First International Conference on Environmental Impact Assessment in Iran, pp: 114-106.
- [2] Butkin, D., K. Edwards, 1995. Understanding of environmental, translated by Vahabzadeh A. University Jihad of Mashhad.
- [3] Center, L.W., 1996. Environmental Impact Assessment. Mc Graw Hill Book co, Baltimore.
- [4] Erfanmanesh, M., M. Afuni, 1994. The pollution environmental, water, soil and air. second edition.
- [5] KarimiJashni, B., 2011. A Comparative study of Environmental Destructive Effects of Dams with the use of Tan and Raomatrix. Shiraz University.
- [6] Makhdum, M., 2008. Issues and problems arising from non-compliance with environmental and water projects. Series of lectures and papers presented at the seminar on: The assessment of environmental impact of water resources development projects.
- [7] MC Graw-Hill. 2002. Environmental Assessment. Second Edition.

- [8] Eacap, 1990. Environmental Impact Assessment, Guidelines for Water Resources Development.
- [9] Partany, S., A. Danande Mehr, 2004. Comparison of structural flood control. The 11th National Conference of Civil Engineering students. Hormozgan, Bandarabas, Iran.
- [10] Shariat, M., M. Monavari, 1996. Introduction to Environmental Impact Assessment. the first time, Tehran, Publications of Environment Department.
- [11] Yadolahi, A., 1998. The assessment of the environmental impact of the Rajae dam on the upper watershed of Tajan by using two methods overlapping maps and matrices. Master Thesis of Environment. Tehran University, pp: 159.