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## **Environmental Management Activities of An Infrastructure Development Project: The Case of Beris Dam, Malaysia**

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### *ABSTRACT*

*Development projects need to integrate environmental dimensions into project management functions to ensure successful implementation of environmental management and control practices throughout the development process. The management functions include the scope of work for environmental control, the quality of work or performance to be delivered, the scheduling for environmental works, and the most important one is the budget for environmental control. The aim of this paper is to examine and discuss about the environmental dimensions of Beris Dam during its construction and development process. The environmental dimension criteria and elements of the project were examined by means of reviewing environmental control documents used in the project's construction and development, and site visits. The review reveals that in general the Beris Dam EIA and EMP reports scored between 'unsatisfactory' to 'good' for the criteria and elements of good environmental practice. These findings indicate the need to increase both effort and implementation of environmental dimensions in project management to help improve the success of implementing environmental management activities in the construction and development of a project.*

### *ABSTRAK*

*Projek pembangunan perlu mengintegrasikan dimensi-dimensi alam sekitar ke dalam fungsi-fungsi pengurusan projek demi menjamin kejayaan amalan pengurusan dan pengawal alam sekitar sepanjang proses pembangunannya. Fungsi-fungsi pengurusan termasuklah skop kerja-kerja pengawalan alam sekitar, kualiti kerja yang akan dihasilkan, penjadualan kerja-kerja kawalan alam sekitar, dan yang paling penting ialah bajet untuk kerja-kerja kawalan alam sekitar. Tujuan kertas ini ialah untuk memeriksa dan membincangkan dimensi-dimensi alam sekitar Empangan Beris semasa pembinaan dan pembangunannya. Kriteria dan unsur dimensi alam sekitar projek ini telah diperiksa dengan cara mereview dokumen-dokumen kawalan alam sekitar yang relevan yang digunakan dalam proses pembinaan projek, dan melalui lawatan*

*tapak. Review ini menunjukkan bahawa pada amnya laporan EIA dan EMP Empangan Beris memberi skor antara 'tidak memuaskan' dan 'baik' bagi kriteria dan unsur amalan alam sekitar yang baik. Dapatan ini menunjukkan keperluan untuk meningkatkan usaha dan pelaksanaan dimensi-dimensi alam sekitar bagi membantu meningkatkan kejayaan pelaksanaan aktiviti-aktiviti pengurusan alam sekitar dalam proses pembinaan dan pembangunan sesuatu projek.*

## INTRODUCTION

Environmental management of development projects is a process for taking into account the environmental dimensions of the project activities from project inception to operational phase. The environmental management activities, which include environmental impact assessment (EIA), environmental management plans (EMP), mitigating measures, environmental monitoring and environmental auditing.

Many EIA literatures emphasized the importance of follow-up management and monitoring of development and should not stop at the decision stage. It should be more than an auxiliary to the procedures to obtain planning permission; rather it should be a means to obtain good environmental management *over the life* of the project (Hickie & Wade 1997; Chadwick & Glasson 1999; Saunders & Bailey 1999, Wood et al. 2000). However, less attention has been given on the environmental management aspects of projects and the actual implementation of the measures during construction and operational stages (Hickie & Wade 1998; Saunders & Bailey 1999).

In Malaysian practice, integrated project planning requires the project planner to assess and evaluate his planning decisions taking into account the technical, economic and environmental factors. It implies that EIA should be continuous process throughout the course of project planning. The full benefits of integrated project planning can be obtained only if project initiators willingly adopt this concept (DOE 2000). The process flow and relationship of environmental management and development process are summarized in Figure 1.

The environmental planning process can be divided into three stages based upon the timing of events in relation to the principle decision-making point for a particular project: the pre-decision, post-decision and transitional stages. The first stage occurs up to and including the approval decision itself. The second stage of EIA influence on environmental management occurs after the decision is made to proceed

with a project, i.e., the post-decision stage of EIA. Some new environmental management activities can be required during project implementation in response to unexpected events. Other management activities established during the pre-decision stage of EIA may require substantial modification or refinement as new problems or issues are encountered. These also represent the influence of the post-decision stages of EIA on environmental management (Saunders & Bailey 1999).

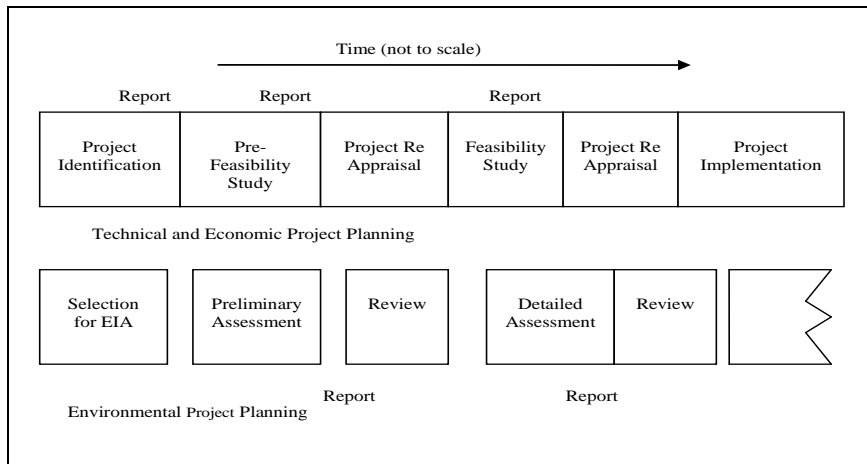


Figure 1. Integrated project planning  
Source: DOE 2000

The development process can be summarized into five stages: project inception stage, design stage, tender preparation and procurement stage, construction stage and operation stage. Usually, a project management team will be appointed to manage the project throughout the project stages. The project management must satisfy the scope and quality of work; time and cost/ budget of the project. In order to successfully implement environmental management activities in the development projects, we need to integrate environmental dimensions into project management functions that are the scope of work for environmental works, the quality of work to be delivered (performance); the scheduling for environmental works and lastly, the most important is the budget for environmental works. Therefore, this paper aims to discuss the environmental dimension of Beris Dam development process.

## METHODS

An initial environmental review was conducted to assess the environmental dimensions of the project development process. This review involves document reviews, site visits and interview with the site personnel. Most of the data and information for this review were gathered from document review. The site visits and interviews were conducted to verify and for further understanding of the situation at site.

### **Document Review**

A review package was used to assess the documents prepared and submitted during the development process. The term review has been used in various ways in the EIA literature. In this context it is used to describe the exercise of assessing the adequacy and quality of the environmental statements with reference to their conformity with the criteria and elements of good assessment practice. The review system was developed from earlier works (Hickie & Wade 1997, Harrington & Canter 1998, Mohamad-Said 1997, Shen & Tam 2002) and consisted of a checklist in 13 main sections with a total of 80 individual criteria, graded from “very poor” to “excellent” (Table 1). The main section headings were:

- ❖ The Project
- ❖ Site Description and Local Environment
- ❖ Environmental Management Setup
- ❖ Cost Estimates
- ❖ Legal Requirements
- ❖ Baseline Conditions
- ❖ Significant Environmental Impact
- ❖ Mitigating Measures
- ❖ Monitoring Program
- ❖ Emergency Response Plan
- ❖ Environmental Specifications
- ❖ Information Communication
- ❖ Overall Impression

Each section was prefaced by a question for the reviewer. For example: “Was sufficient information provided to enable a non-specialist to visualize the environmental management setup?” An example from part of the questionnaire is shown in Figure 2.

Table 1. Environmental statement review – subjective rating system and weakness index

Subjective Rating	Definition	Numerical Weakness Index
Very Poor	Important tasks poorly done or not attempted	6
Poor	Significant omissions and inadequacies	5
Unsatisfactory	Parts well attempted, but must as a whole be considered just unsatisfactory because of omissions and inadequacies	4
Satisfactory	Satisfactory despite omissions and inadequacies	3
Good	Only minor omissions and inadequacies	2
Excellent	No task left incomplete	1

<b>3.0 Environmental Management Setup:</b>							
Was sufficient information on the roles and responsibility provided for environmental management?							
		VP	P	US	SF	GD	EX
2.1	Company policy	6	5	4	3	2	1
2.2	Objective and Target	6	5	4	3	2	1
2.3	Commitment of top level management	6	5	4	3	2	1
2.4	Authorized personnel	6	5	4	3	2	1
2.5	Organizational structure, EMU, team on site	6	5	4	3	2	1
2.6	Environmental consultant or specialist	6	5	4	3	2	1
2.9	Project delivery method	6	5	4	3	2	1
2.7	Responsibility and scope of work	6	5	4	3	2	1
2.8	Linkages with other relevant parties	6	5	4	3	2	1
Comments:							
<b>4.0 Cost Estimate:</b> Was sufficient information provided on cost estimate for environmental works?							
		VP	P	US	SF	GD	EX
4.1	Cost for sampling	6	5	4	3	2	1
4.2	Laboratory/ testing	6	5	4	3	2	1
4.3	Equipments	6	5	4	3	2	1
4.4	Training	6	5	4	3	2	1
4.5	Documentation	6	5	4	3	2	1
4.6	Payment schedule	6	5	4	3	2	1
Comments:							

Figure 2. Example of part of the review questionnaire

The relevant documents were obtained from the project proponent and consultants involved in the project development process. The documents obtained were:

1. Preliminary Environmental Impact Assessment. April 1993.
2. The Preparation of Environmental Management Plan for the Proposed Beris Dam Project in the State of Kedah Darul Aman. Final Report. Vol 1. March 1999.

### **Site Visits and Interview**

Several site visits and interview with the site personnel were conducted to obtain information on the project management functions and also to verify the environmental aspects, environmental impact, mitigation measures and monitoring activities at the construction site.

### **CASE STUDY: BERIS DAM, MALAYSIA**

This paper will discuss the environmental management activities undertaken for the construction of a dam in a narrow valley of the Beris River, in the State of Kedah, Malaysia (refer Figure 3). The Beris Dam project is one of the dams recommended by the Japanese International Cooperation Agency (JICA) to be built in the coming years in order to alleviate water shortage problems to meet the demands for agricultural, domestic and industrial needs. The project was proposed by the Drainage and Irrigation Department (DID), Malaysia (DID 1993).

The Beris Dam is situated in the district of Sik, about 65 km southeast of Alor Setar, capital of the northern state of Kedah, Malaysia. The construction work of Beris Dam started in August 2000 and major milestone of reservoir filling completed in January 2004. The Beris Dam project is to fulfill the demand for potable water in the southern area of Kedah and also Penang Island. The dam will cover a total area of about 1600 hectares. The main components of the proposed Beris Dam are the division facilities, main dam, spillway, outlet works, saddle dam and relocated road. The reservoir for the Beris Dam inundates an area of 13.7 km<sup>2</sup> at normal water level of 84m.

Several characteristics of the Beris catchments make it imperative that a comprehensive Environmental Management Plan (EMP) be instituted to manage the impacts from the dam development. Key factors are the flooding of several stream systems, the downstream users in the Sungai Muda, the adjoining forest reserves of Terenas and Telui, and the steep hilly terrain surrounding the proposed inundation zone (DID 1999).

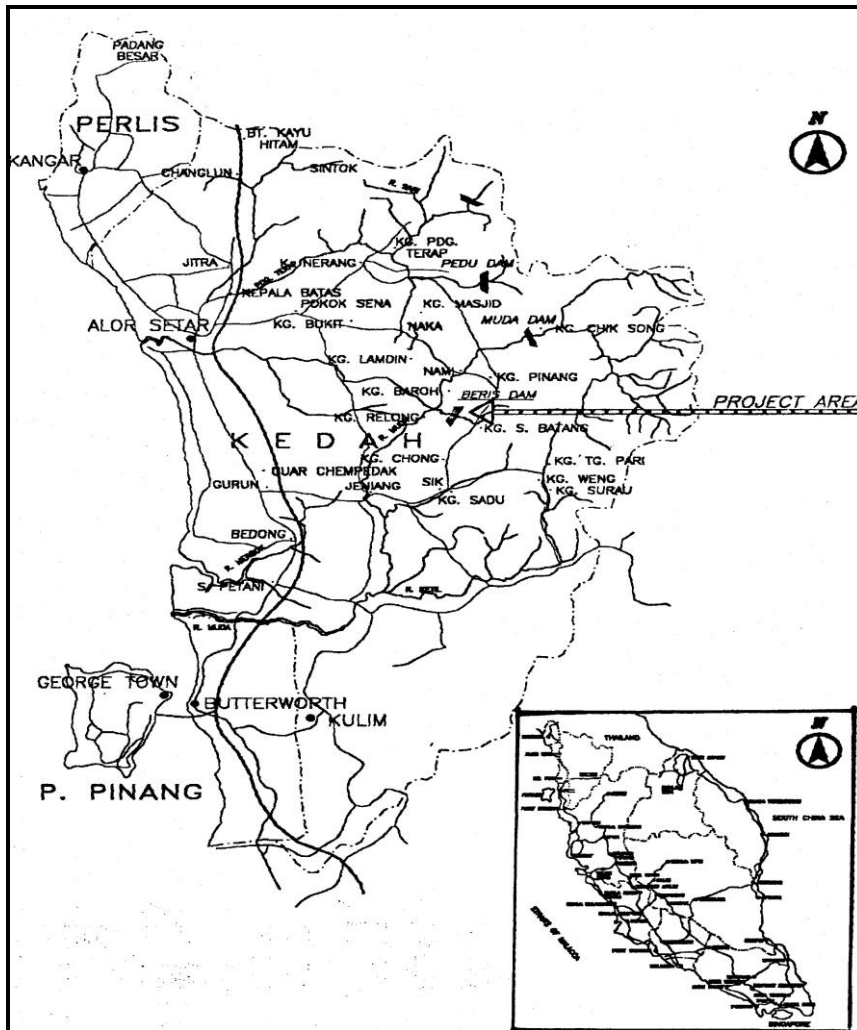


Figure 3. Location of Beris Dam, Kedah, Malaysia

## RESULTS AND DISCUSSION

The initial environmental review of Beris Dam project was summarized in 13 questions and findings will be discussed in three parts. Firstly, the findings related to environmental dimensions of project management functions. Secondly, the findings related to environmental action plan and thirdly the overall assessment of the documents.

## Environmental Dimensions In The Project Management

### The project

The Beris Dam project was initiated by the Malaysian Government based on the study done by JICA. Table 2 shows the list of activities (chronological events) related to project planning of Beris Dam from 1985 until the first impoundment of the main dam in 2004. The Preliminary EIA report for Beris Dam was prepared at the beginning of the detail design and related studies. Therefore, the EIA findings and recommendation could contribute in the design process. Rees (1999) also conclude that EIA can proactively contribute to improving the selection, design, siting, and implementation of programs and projects where it is initiated early, it involves the public, it evaluates development alternatives, and it is supported by effective monitoring and supervision.

Table 2. The technical and environmental activities of Beris dam project

Phase	Date	Events
Pre Decision	March 1985	Beris Dam Feasibility Study, JICA
	October 1992	Engagement of Consultant
	October 1992 – January 1993	Preliminary EIA Study
Post Decision	November 1992 – December 1993	Detail Design and Related Studies
	March 1999	Preparation of EMP
	August 2000	Mobilization of Construction Work
	September 2000	First Monthly Environmental Monitoring Report
	April 2002	DID contacted consultant for Independent Audit
	April 2003	Appointment of USAINS Holdings for Independent Environmental, Health and Safety Audit
February 2004	First impoundment of main dam	

EMP was prepared in March 1999 about a year before mobilization of the construction work and this gave the management ample time to organize and implement the management plan. Rees (1999) highlights that the effective implementation of EIA findings and recommendations hinges largely on the production of a focused EMP that includes clear



performance benchmarks and indicators to enable effective monitoring and supervision of mitigating measures.

Beris Dam EMP suggested for an audit every three months for the first year and every six months for the following years. However, the chronological events show that the audit team was only appointed in April 2003 when the construction was already about 87% completed. The aim of this audit is to ensure compliance to EMP and DOE approval conditions but because the audit was conducted late, most of the environmental impacts and monitoring activities during the first year were not audited. According to Rees (1999) the World Bank reviews noted that the Bank's environmental supervision of projects was inadequate and that serious environmental implementation problems could go untreated until reported by third parties.

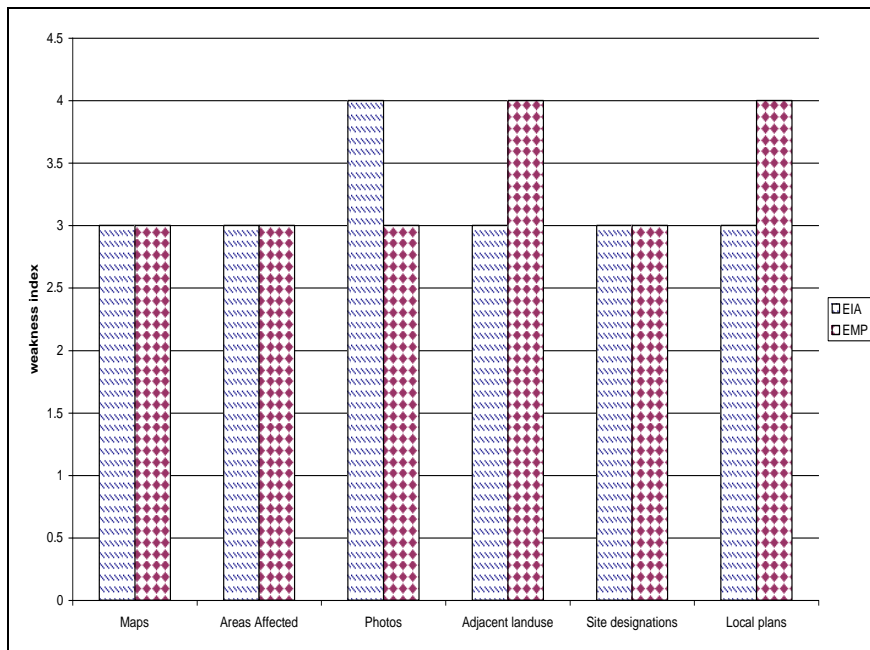


Figure 4. Graphical analysis weakness index for site description and local environment

### Site description and local environment

According to Hickie and Wade (1998) to provide the reader with a visual impression of the project, it is important to provide maps, diagrams and photographs within the document. The best place for most graphical

information is at the front of the reports after the contents page to provide a visual introduction to the project. The EIA and EMP of Beris Dam combine text with graphics but on separate pages. However the maps and photographs lack information such as legends for the readers to fully comprehend the surrounding areas. Figure 4 illustrates the graphical analysis of weakness index for site description and local environment. The EIA report provided more graphical information especially maps and photographs of the site and surrounding area compared to the EMP report.

### **Environmental management setup**

In any project management, the management team and organizational structure is very important to ensure smooth and successful implementation of the project. Organization design begins with an understanding of the working relationships necessary to complete the project. The next step involves the allocation of authority and responsibility. The result of the allocation of authority and responsibility is the establishment of an organizational chart (Gould & Joyce 2003).

The initial environmental review conducted reveals that the Beris Dam project management has outlined a clear and objective oriented institutional and organizational setup for environmental management. The institutional setup and organizational structure chart for EMP of Beris Dam is shown in Figure 5. Here each unit focuses on a specific technical area, grouping people by discipline, expertise, and technical training and thereby promoting technical teamwork. DID as the project initiator, has full authority in implementing environmental management of the Beris Dam project. Other agencies e.g. Wildlife Department and Forestry Department provide expertise and technical assistance to the environmental management team.

In order to assist DID in implementing the EMP; the management had setup the Environmental Management Committee (EMC) and the Environmental Monitoring Unit (EMU). The EMU comprises of one Environmental Officer at site assisted by a team of technicians to collect the necessary data. The Environmental Officer reports to the Project Engineer. EMU also has close liaison with the supervision team and construction contractors to ensure that environmental problems can be identified and addressed early (DID 1999).

According to Gould and Joyce (2003) the construction process must be correctly compartmentalized to allow people to specialize in their specific areas of expertise. Closely related to compartmentalization is providing the correct level of authority to the members of the project

team. Tam et al. (2004), suggest that effective environmental management in construction depends on team effort on site, which includes involvement and support from main contractors and their head offices.

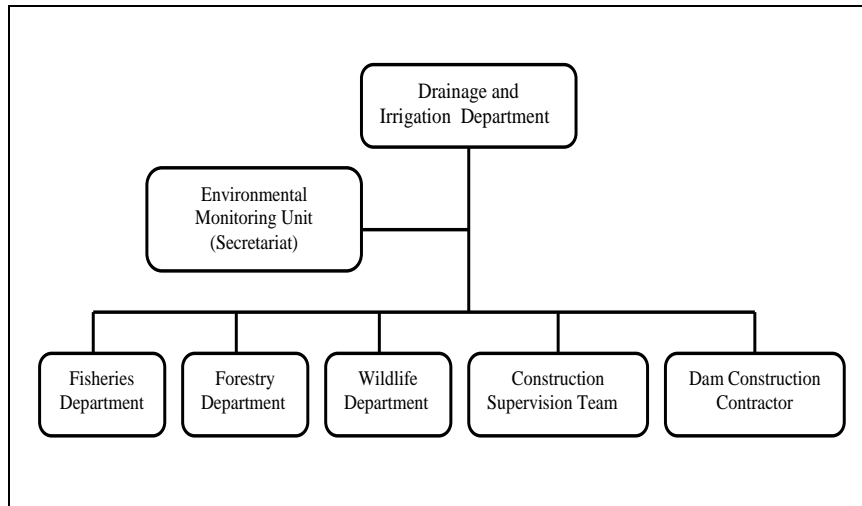


Figure 5. Organizational structure chart for Beris Dam  
Source: DID 1999

### Cost estimate

The EIA report prepared for the project did not include any cost estimates for any environmental management activities. Cost estimate for the other work packages such as the cost estimates for compensation to the legal owner, cost estimate for infrastructure works and cost estimate for public facilities/ buildings were listed as Appendices. Likewise, the Beris Dam EMP report also did not include any cost estimate for the monitoring and auditing programs suggested in the plan. Therefore, both reports could be categorized as having high weakness index.

### Legal requirements

Legal requirements criteria should provide information to which the project must subscribes and that are applicable to the environmental aspects of its activities. The review shows that both EIA and EMP reports provided 'satisfactory' information on legal requirements. The

relevant requirements were simply listed out in the documents and lack further elaboration on consequences of non-compliance incidents.

## **Environmental Action Plans**

### **Baseline conditions**

Several characteristics of the Beris catchments make it imperative that a comprehensive Environmental Management Plan (EMP) be instituted to manage the impacts from the dam development. Key factors are the flooding of several stream systems, the downstream users in the Sungai Muda, the adjoining forest reserves of Terenas and Telui, and the steep hilly terrain surrounding the proposed inundation zone (DID 1999).

The review conducted indicates that the documents generally provided a superficial description of the environment, covering most elements, but failed to provide explanation on the environmental links and interrelationship such as between ecology and geology. According to Hickie and Wade (1998), it is important to identify the key environmental features, in order to be able to analyze constructively the potential direct and indirect effects of the development. The interrelationship of environmental factors will be unique at each site.

In general, most of the baseline information in EIA is deemed 'satisfactory' and summarized the key issues represented by the data. The socioeconomic section was presented with comprehensive data and discussion. This might be due to the sensitive issue of resettlement and compensation to the existing community at site.

### **Environmental Impacts**

Construction is not by nature an environmentally friendly activity. Existing research suggest that construction activity is a major contributor to environmental pollution. Construction industry environmental impacts can be described under the categories of ecology, landscape, traffic, water, energy, timber consumption, noise, dust, sewage and health and safety hazards (Shen & Tam 2002).

In general, the impact criteria scored 'satisfactory'. The identification of key issues scored 'good' rating for documents, impact prediction and impact significance scored 'satisfactory'. However, the analysis of effects appeared to be mostly subjective in nature.

### Mitigating measures

The integration of mitigating measures in the project management practices is crucial for successful implementation of environmental management in development process. In general, the measures in the EIA report was 'unsatisfactory' and mostly subjective with very little or none graphical illustrations such as diagrams, maps and drawings. The EMP report however, provides more elaborate description of the measures. The measures, as in the EIA report, are mostly subjective. In general, this criterion was scored 'satisfactory'.

### Monitoring programme

The EIA report did not provide a detailed specification for a monitoring programme. The report only mentioned that there was a need for monitoring without detailing how or when this would be done. The only satisfactory programme drawn out was for endangered species. Therefore, the EIA report was graded as 'very poor' for monitoring programme. The EMP report satisfied most of the criteria for monitoring programme and detail management programme for pollution control soil erosion control was provided in the EMP report.

The effective implementation of EIA findings and recommendations hinges largely on the production of a focused EMP that includes clear performance benchmarks and indicators to enable effective monitoring and supervision of mitigating measures (Rees 1999). Table 3. summarized the parameters suggested and implemented for environmental monitoring. According to Hickie and Wade (1997), in trying to identify and control the environmental impacts caused by a project, it was noted that it was not essential to know which work method to be used, as long as it was possible to define the environmental parameters required to protect or conserve any given environmental features.

Table 3. List of parameters for environmental monitoring at different stages

Impact	Parameter
Air Quality	TSP
Water Quality	pH, Temperature, Conductivity, DO, Turbidity, TSS, BOD, COD, Nitrate, Phosphate, E. coli, Water level, Stream flow
Noise & Vibration	Noise
Soil Erosion	Sedimentation

**Emergency response plan**

The EIA report only provides a brief plan for emergency incidents and is not specific. A mathematical simulation for a dam break was provided in the EIA report. Volume 111 of the EMP report provides emergency plan for the dam, which covers different types of emergency that could occur. Therefore, the criteria scored between ‘unsatisfactory’ to ‘satisfactory’.

**Information and communication**

One of the facilitating functions to ensure successful implementation of a project is information and communication management. The environmental management information and communication management of Beris Dam project was handled by the EMU of the project management team. The EMU coordinate communication and information flow from the Project Proponent, the Technical Consultants, the Environmental Consultants and the Contractors. The information and communication criteria were graded as ‘good’ for EMP report but were graded as ‘very poor’ for EIA report. The contrasting result might be due to the fact that the EIA report did not have a comprehensive management plan in the report.

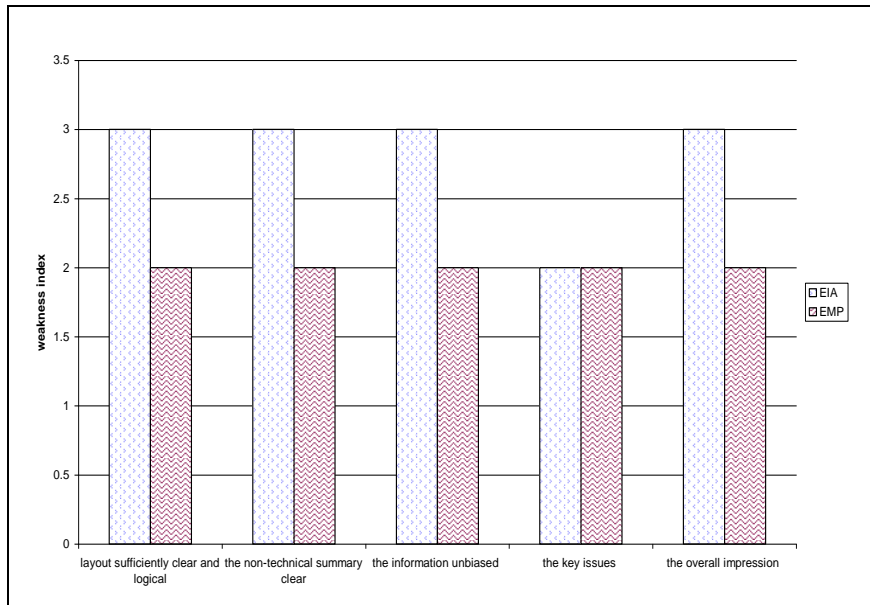


Figure 6. Graphical analysis of weakness index for overall impression

Ofori et al. (2002) in his study found that project (site) managers were responsible for environmental performance of the projects; and the project managers delegate part of their responsibility to their supervisors and also some contractors transfer part of the environmental responsibility to their sub-contractors.

### **Overall Assessment**

The overall assessment of the documents indicates that the EIA report was just 'satisfactory' and the EMP Report was 'good'. Figure 6 illustrates the graphical analysis for overall impression.

## **CONCLUSIONS AND RECOMMENDATIONS**

In any development projects with a large project team, it is often difficult to keep track of all the environmental issues throughout such a project. This study has revealed the need for a more prescriptive development process in the project management practice. EIA and EMP are seen as a project management tool and as such must effectively help manage the implementation of a project from initial stage, through to decision making point, and on to the successful completion of the project. In conclusion, the integration of environmental dimension in project management will ensure commitments in the EIA and EMP are turned into actions on the ground.

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