SOCIO-ECONOMIC IMPACT ASSESSMENT AUDITING: A CRITIQUE USING THE CASE STUDY OF THE HIBERNIA OFFSHORE OIL DEVELOPMENT PROJECT

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BY

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ABSTRACT

Environmental impact assessment (EIA) as a formal requirement began in the United States with the passage of the National Environmental Policy Act (NEPA) in 1969. Formal EIA procedures have since been adopted world-wide. However, until recently, little research had been undertaken with respect to "follow-up", i.e. evaluating the effectiveness of EIA in predicting the impacts or optimizing outcomes associated with human actions. In fact, it was not until the mid-1980s that questions regarding the utility and efficiency of EIA were given serious consideration. This has highlighted the need for formal EIA follow-up. The EIA audit process allows such follow-up through obtaining relevant information and examining and evaluating EIA procedures and the actual environmental consequences of a project or action.

The use of and experience with environmental audits is still limited, though the situation is changing as interest in the subject has increased over the past decade, with audit investigations conducted in Canada, the United Kingdom, the United States and Australia and elsewhere. However, the scope of these audits generally has been limited to bio-physical issues, with socio-economic issues either significantly under-represented or completely omitted.

The limited research in this area provides the underlying rationale for this thesis, which investigates socio-economic impact assessment (SEIA) auditing using Newfoundland's Hibernia oil development project as a specific case study. Based upon earlier audits, an SEIA auditing method is established and applied to this project. As in other audits, poor wording and inadequate monitoring data preclude an evaluation of the majority of Hibernia impact predictions. Of 193 impact predictions identified only eight could be audited. Of these, three are consistent, and the remaining five inconsistent, with the original predictions for the project.

These findings further confirm that, in general, neither the current format of Environmental Impact Statements (EIS) nor the quality of the monitoring data being collected is well-suited to the auditing approach typically used. This raises the question of whether the current approach to EIA is itself adequate or useful. In this thesis it is instead argued that an EIA approach emphasizing impact management rather than impact prediction, is better suited to the dynamic nature of both the development projects and the context in which they operate. Such an approach would also better integrate EIA into the broader environmental planning process.

DEDICATION

In memory of my grade 6 teacher who made schooling such a fascinating and exciting experience. She was a tremendous teacher and a beautiful person whose love for life and passion for learning are a continuing inspiration for me.

Laura Harris

(1946-1980)

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Agency -	Canadian Environmental Assessment Agency
BAACC -	Bull Arm Area Coordinating Committee
CEAA -	Canadian Environmental Assessment Act
CEARC -	Canadian Environmental Assessment Research Council
C-NOPB -	Canada-Newfoundland Offshore Petroleum Board
COGLA -	Canada Oil Gas and Lands Administration
EARP -	Environmental Assessment and Review Process
EIA -	Environmental Impact Assessment
EIS -	Environmental Impact Statement
EMR -	Department of Energy, Mines and Resources
EPP -	Environmental Protection Plan
FEARO -	Federal Environmental Assessment and Review Office
GBS -	Gravity Base Structure
HCSEMC -	Hibernia Construction Sites Environmental Management Committee
HMDC -	Hibernia Management and Development Company
NEPA -	National Environmental Policy Act
NOC -	Newfoundland Offshore Contractors
NODECO -	Newfoundland Offshore Development Constructors
OLS -	Offshore Loading System

Panel -	Hibernia Environmental Assessment Panel
PASSB -	PCL, Aker Stord, Steen and Becker consortium
SEIA -	Socio-economic Impact Assessment
SIA -	Social Impact Assessment

Chapter I INTRODUCTION

1.1 Environmental Impact Assessment: A Background

The early 1960s saw mounting public concern regarding the effects of human-induced changes to the natural environment. Since this time, there has been increasing public awareness of the need to identify, evaluate and effectively manage the impacts of human developments on both the physical as well as the human environments. The environmental movement in the United States during the 1960s resulted in a heightened environmental awareness and consequently increased public pressure for government to develop and implement measures to ensure that the environmental ramifications of development projects be considered. The American governmental response to this public persistence was the passage of the National Environmental Policy Act (NEPA) in 1969.

In response to similar public pressure in Canada, in 1973 the Canadian federal government developed a policy which created the Environmental Assessment and Review Process (EARP). From 1973 to 1987 this process was used to assess and manage the environmental effects of development projects falling within federal authority. Subsequently, from 1987 to 1991 efforts were made to reform Canada's assessment and review process which ultimately resulted in the passage of the Canadian Environmental Assessment Act (CEAA) in 1992 and which was proclaimed into law in 1994.

The CEAA and NEPA require that projects, within federal jurisdiction and deemed to have potentially significant environmental consequences, be subject to an environmental impact assessment (EIA), a process which attempts to identify, predict and assess the likely impacts of a project development. The proponent must prepare an environmental impact statement (EIS), a document which summarizes the results of the EIA, i.e. the anticipated impacts of the project, as well as proposed measures to mitigate any adverse impacts and\or enhance any beneficial outcomes. The EIS is reviewed by the regulatory body in order to assist in decision-making as to whether or not the proposed project should proceed.

Since the establishment of the federal EARP, the concept of project EIA has been embraced at the provincial level within Canada. Presently, each province has formalized assessment and review procedures in place. In some cases, these procedures are contained in legislation. Newfoundland, for example, enacted a formal environmental assessment process under its Environmental Impact Assessment Act, passed in 1980.

The notion of EIA has also diffused world-wide, with most developed countries having adopted formal EIA procedures. Since its inception, vast amounts of time and money have been expended on the implementing and conducting of EIA. However, until recently very little has been done by way of follow-up, that is, to determine whether EIA has been effective in the avoidance or minimization of adverse impacts and/or the maximization of benefits associated with human activities. In fact, it was not until the mid-1980s that questions regarding the utility and efficiency of EIA arose. Accompanying this was the recognition of the need for a formal feedback mechanism within the EIA process to identify and evaluate the actual environmental consequences of a project or action. The EIA audit is a process of obtaining relevant information and examining and evaluating EIA procedures and project or action outcomes.

Although the notion of post-project audits has existed in the literature since 1969, and while interest in the subject of environmental auditing has been increasing over the past decade, the use of and experience with environmental audits is still limited. Newfoundland is a case in point. Since the enactment of the province's environmental impact assessment legislation some fifteen years ago, there has been no formal audit performed to date for any project which has passed through the provincial EIA process.

The situation with respect to EIA auditing, however, has been changing in that over the last ten years the value and significance of follow-up has been realized world-wide, with a considerable increase in the level of thought and research being devoted to the subject. The provisions of the CEAA bear testimony to the increased emphasis given to follow-up. The Act requires the development of follow-up programs prior to the granting of project approval. A "follow-up program" under the Act is defined as one designed for the verification of the accuracy of the environmental assessment of a project; and the evaluation of the effectiveness of any mitigative measures developed to address the adverse environmental effects of the project (Canada, 1992:4), and as such parallels the notion of "EIA audit".

The regulations/guidelines governing the Act's follow-up provisions have yet to be finalized and will have to address a number of issues prior to the implementation of these audit/follow-up procedures. Such issues include the method of conducting an audit, the pre-requisites for auditing, the party or parties responsible for conducting as well as paying for the audit, and the authority responsible for administering the overall auditing process.

Those responsible for developing the CEAA regulations/guidelines can benefit from recent EIA audit research in that some of the above issues have received consideration through investigations which have been undertaken in several countries including Canada, the United Kingdom, the United States and Australia.

However, most of these studies, and much of the research which has been conducted with respect to developing a framework or methodology for auditing, have been limited in scope. Almost all have had a bio-physical bias, with socio-economic issues having been either significantly under-represented or completely omitted from the study. The reasons for this are not clear. It may be that socio-economic impacts are less tangible and not as easily quantified, thereby making them more difficult to audit. Or, as some researchers have suggested, the lack of socio-economic impact auditing research may testify to the fact that many EIA researchers view socio-economic issues as less significant than those of a bio-physical nature.

In any event, it can be argued that socio-economic issues, to date, have not received adequate attention in the research literature. It is both this lack of and need for EIA auditing research which emphasizes the socio-economic impacts of human actions that serve as the underlying rationale for this thesis.

1.2 Thesis Objectives

The purpose of this research is to investigate the concept of environmental auditing, and, more specifically, socio-economic impact assessment (SEIA) auditing, employing the development of offshore oil and gas from the Hibernia project in Newfoundland as a specific case study.

This thesis has three objectives. The first is to determine a method of performing a SEIA audit based upon a review of audit investigations performed to date. The second objective is to apply this method to the Hibernia experience -- that is to compare the actual socio-economic consequences of the project, to date, to the predicted socio-economic impacts -- in order to identify the pre-requisites for, as well as the benefits and constraints of, SEIA auditing. Finally, a more general objective is to examine the role of environmental impact assessment auditing in the broader context of environmental planning, using the results from the Hibernia audit case study.

1.3 The Hibernia Case Study

The Hibernia project had its beginnings in 1979 with the discovery of oil in the Hibernia P-15 well off the southeast coast of Newfoundland. In 1980, the proponent, Mobil Oil Canada, Ltd., applied to develop the resources of the field. Because the proposed project fell within Canadian federal jurisdiction, it was subject to the former EARP. Accordingly, an EIA was conducted and the results summarized in an Environmental Impact Statement (EIS). The Hibernia EIS contains predictions of the impacts likely to result from project activities.

Volume IV of the Hibernia EIS, in particular, addresses the socio-economic impacts of the project. A number of impact predictions are made with respect to issues such as housing, employment, demography, the fishery, and the impacts on Newfoundland's "social fabric". The auditing procedure developed for this research is used to evaluate the accuracy of these predictions.

1.4 The Auditing Procedure

The first step in the research was to identify predicted impacts of the project. The primary sources for this information are the report of the Hibernia Environmental Assessment Panel and the EIS. The Panel Report was reviewed first to determine those socio-economic issues raised during the public review of the EIS. This served to highlight issues of significant concern. This was followed by a review of the project EIS and the subsequent Environmental Protection Plan, designed for the Gravity Base Structure (GBS) construction site, to identify the impact predictions made by the proponent.

Once a list of impact predictions was compiled, an investigation of the actual socio-economic consequences of the project was conducted. This involved a review of monitoring data and other project reports. In addition, personnel from the provincial/federal government, Hibernia Management and Development Company (HMDC), Newfoundland Offshore Development Constructors (NODECO) and other industry representatives - those people responsible for impact management during the project - were contacted to supplement the monitoring data. The predicted impacts were then compared to actual project consequences.

The results of this analysis are then used to draw conclusions with regard to the Hibernia project, in particular, and EIA auditing procedures, in general. Some of the limitations of the contemporary approach to EIA also are discussed in light of the findings of the Hibernia audit.

1.5 Results of the Hibernia Audit

The results of the research have relevance to both the Hibernia project and other subsequent offshore oil and gas projects in Newfoundland and elsewhere. At the time of writing some two years remain in the construction phase of Hibernia before field development and production begin. Information resulting from this specific audit of Hibernia's site preparation and early development stages may be applied to subsequent stages of the project. As well, while Hibernia is Canada's first major Atlantic offshore petroleum field to be developed, other potential offshore oil and gas reserves have been discovered on Canada's east coast. Thus, the experience gained and lessons learned from this project should be employed to benefit future projects.

This research also provides insight into EIA as well as the broader environmental planning process. The CEAA prescribes the need for EIA follow-up programs. The definition within the Act suggests that "follow-up program" is synonymous with "EIA audit". The results of this research identify some of the requirements for and constraints to implementing such audit/follow-up programs.

The findings from this audit of Hibernia impacts are similar to those of most audits undertaken to date; poor wording of the predictive statements and the paucity of adequate monitoring data preclude an evaluation of the majority of predictions. The audit of the Hibernia project reveals that, of the 193 socio-economic impact predictions made, only eight are suitable for audit. Of these, outcomes from three are consistent with the original predictions while the remaining five either under- or over-estimate the impacts of the project.

These findings further confirm that in general neither the format of the EISs being produced nor the quality of the monitoring data being collected is well-suited to the auditing approach employed to date, with its emphasis on impact prediction accuracy. However, this raises the question of whether the current approach to EIA -- a "demand" approach, which emphasizes predictive precision -- is itself adequate or useful. In this thesis it is instead argued that a "capacity" approach to EIA, with a greater emphasis on impact management rather than impact prediction, is more appropriate to accommodate the dynamic nature of both the development projects and the context in which they operate. Such an approach would also serve to better integrate EIA into the broader environmental planning process.

1.6 Thesis Format

The thesis is divided into seven chapters. Following the introduction, Chapter II contains a discussion of the research literature relating to EIA auditing. The next chapter discusses the objectives of this research and also provides background information to the Hibernia project. Chapter IV contains a discussion of methods of EIA auditing, with particular attention given to the methods employed in two large-scale audits undertaken in Australia and the United States. This is followed by a description of the method used for the Hibernia socio-economic audit. The next chapter discusses the Hibernia auditing process and the results of that audit, while the implications of these findings, for Hibernia in particular and EIA in general, comprise the focus of Chapter VI. The final section of the thesis first summarizes the findings in order to draw conclusions regarding EIA auditing in general. The chapter concludes with a discussion of the implications for auditing, the current approach to EIA and the general environmental planning process.

In short the thesis takes issue with current EIA audit philosophy and recommends an alternative more in keeping with the dynamics of real-world impact management than traditional, static, accounting approaches.

Chapter II ENVIRONMENTAL IMPACT ASSESSMENT AUDITING: A REVIEW OF THE LITERATURE

2.1 Environmental Impact Assessment: Its Beginning

The contemporary environmental movement in the United States developed during the 1960s. This and the preceding decade were characterised by a thriving economy and rapid industrial development. However, during this time there developed a heightened public awareness and concern regarding the environmental costs and side-effects of these development activities and "a vague unease about problems that accompanied unbridled economic growth and prosperity" (Couch, 1989:5). As a consequence, public pressure mounted during the 1960s for government to develop and implement procedures which would ensure the consideration of the environmental ramifications of such development projects. The culmination of public persistence was the passage of the American National Environmental Policy Act (NEPA) in 1969. Incorporation of environmental issues into development planning and decision-making now became a legislated requirement. NEPA required that any proposed development considered to have potentially adverse impacts be subject to an environmental impact assessment (EIA).

EIA is a process designed to address the environmental implications of human activities. It involves the identification, prediction and evaluation of the likely impacts of human actions in order to assist in decision-making. Various definitions of EIA have been offered. For example, Lee (1983:5) defines EIA as:

> a process by which an action, that requires the approval of a public authority and which may give rise to significant environmental side effects, is submitted to a systematic environmental evaluation, the results of which are then taken into account by the public authority in deciding whether or not to approve it.

Munn (1985:159) goes somewhat further, suggesting that EIA is:

> an activity to identify, predict, interpret and communicate information about the impact of man's actions (legislative proposals, policies, programs, projects and operational procedures), on man's health and well-being (including the well-being of the ecosystems on which man's survival depends).

Others further expand the definition to include a mitigative or management component to address the potential impacts which have been identified. For example, Beanlands and Duinker (1983:18), describe EIA as:

> a process or set of activities designed to contribute pertinent environmental information to project or program decision-making. In doing so it attempts to predict or measure the environmental effects of specific human activities or do both, and to investigate or propose means of ameliorating those effects,

while CEARC (1988:1) defines EIA as a process:

> which attempts to identify and predict the impacts of legislative proposals, policies, programs, projects and operational procedures on the biogeophysical environment and on human health and well-being. It also interprets and communicates information about those impacts and investigates and proposes means for their management.

Since the passage of NEPA, the practice of EIA has been adopted in countries world-wide. For example, a similar environmental consciousness arose in Canada during the 1960s and 1970s. Canadians also became concerned about the increasing pressures being placed upon the environment by industrial and technological advances and called for "more concrete measures" to avoid future problems (Harrison and Rothschild, 1983:509). The federal government responded to these concerns with the establishment of the Canadian Environmental Assessment and Review Process (EARP) in 1973. From 1987 to 1991 steps were taken to reform Canada's assessment and review process which ultimately resulted in the passage of the Canadian Environmental Assessment Act (CEAA) in 1992. While the CEAA is now in effect. regulations governing certain components of the Act have yet to be finalized. Because the Hibernia project pre-dates the CEAA, it was subject to the former EARP. For comparative purposes, a general background and the components of this process as well as those of the new Act are outlined below.

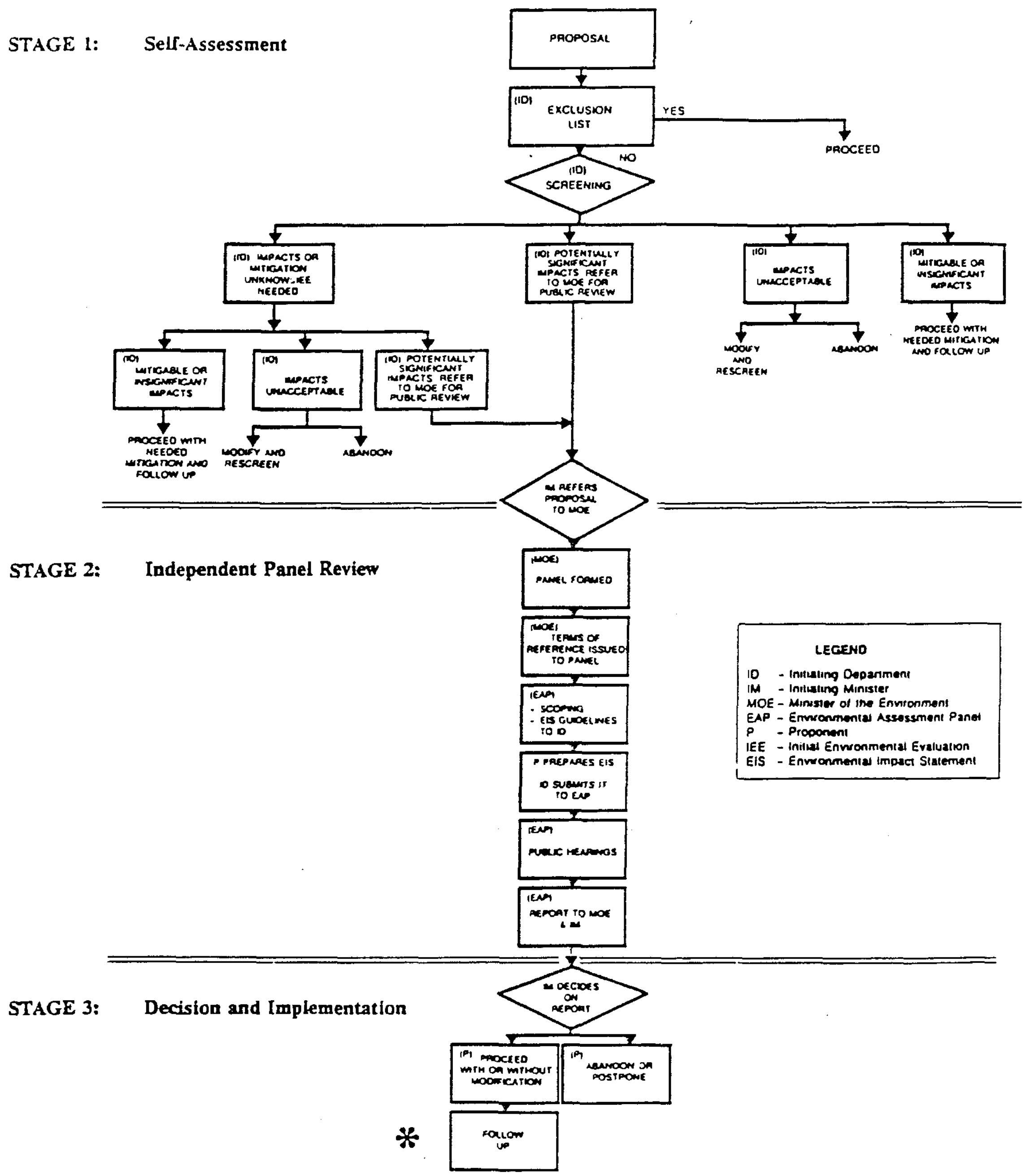
2.2 Canada's Environmental Assessment and Review Process (EARP)

Canada's EARP was established by a decision of Cabinet on December 20, 1973 and the Process was later modified by a subsequent Cabinet decision on February 15, 1977. Two years later, the Government Organization Act reconfirmed the federal environment minister's responsibility for the environmental management of federal activities. On June 22, 1984 the Environmental Assessment and Review Process Guidelines Order-in-Council (OIC) was proclaimed under the above Act. This OIC outlined and clarified the various roles, responsibilities and procedures of EARP (Couch, 1989:13).

The purpose of EARP was to ensure that all federal proposals are assessed early in the planning process in order to identify their potential effects on the natural and social environments. Couch (1988:13) defines a federal proposal as one in which a federal department is the direct proponent; makes a financial commitment; or is located within an area of federal jurisdiction.

The framework developed to help administer the Canadian Environmental Assessment and Review Process is illustrated in Figure 2.1. The process comprised three stages: i) self-assessment; ii) independent panel review; and iii) decision and implementation.

Figure 2.1: Framework of the Former Canadian Environmental Assessment and Review Process (EARP)



(Source: Based on Couch, 1989:12)

The self-assessment phase began with the submission of the proposed project to the initiating department, the federal department possessing the decision-making authority for the particular proposal, who screened the proposal to determine its potential impacts. If the potential impacts were deemed significantly adverse, the proposal was referred to the Minister of Environment for a formal public review.

The referral of the proposal to the Minister marked the beginning of the second stage of EARP -- the independent panel review. The Minister appointed the environmental assessment panel and issued its terms of reference for the review. The mandate of the panel was to assist the proponent in preparing an Environmental Impact Statement (EIS) document, distribute the EIS for public review and subsequently hold public hearings. Based upon its review, the panel submitted a report, containing its conclusions and recommendations, to the Minister of the initiating department and the Minister of Environment.

The third and final stage of EARP began with the initiating Minister reviewing the assessment panel's report and issuing a decision with respect to the proposal. Either permission was granted to proceed with or without modifications or the proposal was abandoned or postponed. For those proposals given ministerial approval to proceed, the initiating Minister was responsible for developing and administering appropriate follow-up procedures (Couch, 1989:13-14).

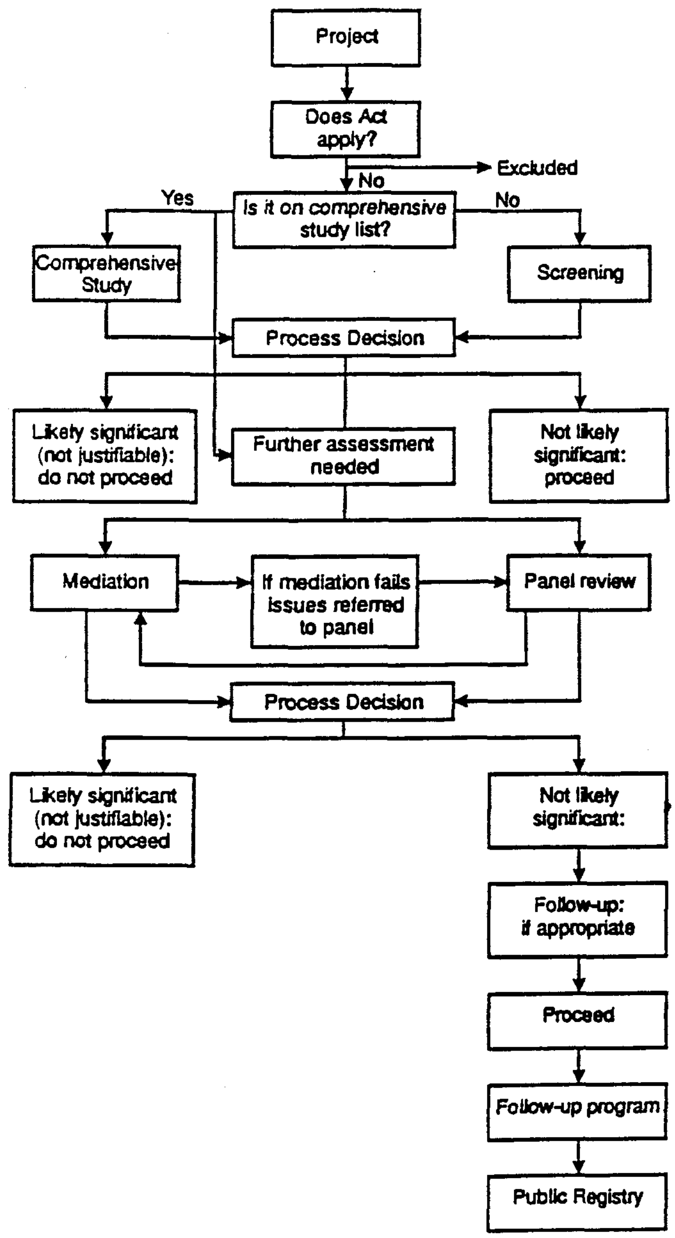
2.3 EIA as a Legislative Requirement: the Canadian Environmental Assessment Act (CEAA)

The Canadian Environmental Assessment Act (CEAA) was passed in January 1992 and proclaimed into law in 1994. The environmental assessment process pursuant to the CEAA is generalized in Figure 2.2.

An environmental assessment under the CEAA is generally required for projects of which a federal department or agency is the proponent; contributes funding or land: or serves a regulatory role through the issuing of permits or licences.

The CEAA outlines four types of assessment: screening; comprehensive studies; mediation; and panel review. These four types fall under the two broader categories of self-directed assessments and independent assessments. Screening activities and comprehensive studies make up the "self-directed" category in that the government authority responsible for the particular project is required to ensure that the provisions of the CEAA are complied with during assessment

Figure 2.2: The Environmental Assessment Process Under the Canadian Environmental Assessment Act



procedures. Mediation and panel review are classed as "independent assessments" because mediators and panel members appointed by the Minister of Environment are independent of the government (CEAA, 1994:12-13).

2.3.1 Self-Directed Assessment

If it is determined that the project is subject to the Act, the responsible authority decides whether to proceed with a screening or a comprehensive study. Screening -- defined as the systematic documentation of the environmental consequences of a proposed project as well as the significance of these consequences -- allows for the modification of the project plan and/or the development of strategies to either eliminate or mitigate any significantly adverse project-related environmental effects (CEAA, 1994:15).

Those projects needing comprehensive studies are outlined in the Comprehensive Study List Regulation, one of the four existing regulations of the CEAA. The scope of the comprehensive study includes that of the screening process and addresses other factors including the purpose of the project; viable alternatives to the project and their environmental implications; the existing capacity of renewable resources likely to be significantly impacted; public input; and the need for and requisites of any follow-up programs.

Upon completion of the screening process or a comprehensive study, a report summarizing their results must be completed under the authority of the responsible authority. Based upon the findings, a decision is made as to whether or not the project should proceed, should be cancelled, or warrants an independent assessment (CEAA, 1994:15-19).

2.3.2 Independent Assessments

There are generally four conditions under which a project would be referred for independent assessment:

- if uncertainty exists with respect to the potential for significantly adverse environmental impacts resulting from the project; or
- the likelihood for significant adverse environmental impacts is high but whether such effects are justifiable under the circumstances is uncertain; or
- public concerns regarding potentially negative project outcomes are such that an intensive assessment is warranted; or
- if the potential exists for project outcomes to result in transboundary effects, i.e. across international, provincial or federal/non-federal jurisdictional boundaries (CEAA, 1994:21).

Mediation is one type of independent assessment in which the Minister of Environment appoints an independent and impartial mediator to administer a process of negotiation between the stakeholders of the project. In the event that dispute resolution is not attained, the mediator will refer the project to the Minister for a panel review.

The panel review process under the CEAA is similar to that of the former EARP. The Minister, in consultation with the responsible authority, appoints the panel and establishes its terms of reference. The panel is responsible for directing the proponent in the preparation of the environmental impact statement (EIS), organizing public hearings and preparing a report summarizing its conclusions and recommendations.

In both types of independent assessment, the mediator or the panel is required to produce an environmental assessment report describing its rationale, any conclusions and recommendations as well as any input received from the public. This report is submitted to the Minister and the responsible authority and serves as the basis for any further decisions regarding the project. If it is determined that the project's impacts are not likely to be significant, before the project can proceed, the appropriateness of follow-up programs must be determined by the responsible authority (CEAA, 1994:21-29). The design or approval, and implementation of such programs is the responsibility of the Minister of Environment, as indicated in section 53 of the Act:

> Where the Minister has referred a project to a mediator or a review panel ...,the Minister shall, in accordance with any regulations made for that purpose, design or approve any follow-up program that the Minister considers appropriate for the project and arrange for the implementation of that program (Canada, 1992:37).

2.4 EIA: A Lack of Follow-up

Follow-up procedures are a formal requirement under the CEAA, and were also outlined under the former Canadian Environmental Assessment and Review Process. However, unlike the CEAA which appoints the Minister of Environment responsible for the design and implementation of follow-up programs, there was no specific body established under EARP to either oversee such activities or to ensure that they were performed. The Federal Environmental Assessment and Review Office was the agency responsible for administering the EARP. However, it was not within the mandate of the assessment and review office to conduct or coordinate follow-up procedures. Rather, as indicated in Stage 3 of Figure 2.1, it was the responsibility of the Initiating Minister to administer follow-up procedures for approved projects.

Research has shown, however, that the implementation of follow-up was not widespread under the former EARP. For example, a 1987 review of federal projects having been subject to the process concluded that:

> there is little evidence of consistent programs or procedures, scientific or administrative, for a comprehensive approach to follow-up. In addition,... follow-up is not done to the degree that it should be within the federal system (McCallum, 1987:733).

Instead, experience indicates that most emphasis has been placed on the initial stages of EIA, i.e. the pre-approval stage, while very little attention has been given to the post-approval and post-project components (Tomlinson and Atkinson, 1987a:188). This is evidenced by the fact that while data are readily available for pre-approval activities within the EARP, the same does not hold true for post-approval activities. For example, since the inception of the EARP in 1973, 56 of the projects subjected to the process proceeded to the panel review stage. Environmental assessment panel reports had been submitted to the Minister of Environment for 39 of these projects, thus marking the completion of the panel review stage. All of these reviewed projects were granted ministerial approval to proceed. However, whether follow-up investigations were conducted for the 39 projects is not easily ascertained as no composite data bank pertaining to such activities had been developed (Barnes, pers.comm., 1992).

The apparent lack of and uncoordinated approach to follow-up under EARP was related to the fact that there was no specific follow-up procedure outlined. In fact, there was no formal requirement to undertake monitoring -- one of the fundamentals for follow-up (see CEAA section 6.7). The CEAA has addressed this shortcoming of the former EARP as it contains formal provisions for follow-up programs (see CEAA section 6.8).

The inadequacy of follow-up procedures within EIA is not limited to Canada. Research indicates that the monitoring of project impacts is not a formal requirement under the EIA procedures of many countries. For example, the results of a comparative review of EIA systems of several countries (Wood, 1995) indicate that of the seven systems analysed, four did not contain specific requirements for monitoring, while the remaining three contained partial requirements. In many cases, discretionary provisions exist, but in practice, these are rarely employed. The United States is a case in point. Under the National Environmental Policy Act, monitoring is essentially discretionary and to date follow-up efforts have been generally "weak". In fact. according to Wood (1995), monitoring is widely recognized as the "weak link" in the American EIA system. The Canadian Environmental Assessment Act, on the other hand, fares well in the Wood (1995) comparison. The importance and value of EIA follow-up is acknowledged in the CEAA which formally defines 'follow-up program' and contains provisions for the development and implementation of such a program. The details of the follow-up program must be outlined and approved by the responsible government authority prior to project approval.

The lack of follow-up prevents the evaluation of EIA. For example, since its beginning, a considerable amount of time and money has been expended on the implementation of EIA. However, without effective follow-up procedures, it is not known whether this investment of resources has been worthwhile or whether the goals of the EIA process have been attained. Further, in the event that the project does not result in any significant adverse consequences, without such follow-up, determining whether this lack of any measurable negative impact is attributable to the assessment, proponent activities, the proposed mitigative measures, or just pure chance would be difficult, if not impossible (Rigby, 1985:215).

Because of this absence of follow-up and feedback, the effectiveness of EIA and its role in the planning process have come under question.

> There is, in fact, growing concern about the effectiveness and efficiency of EIAs at the technical and administrative levels and about the role of impact assessment in the broader process of planning... It is important, therefore, to examine the accuracy and utility of environmental impact forecasts and to evaluate the scientific, technical and administrative aspects of the EIA process in the context of overall development policy (Munro *et.al.*,1986:1).

It has been suggested that an environmental audit could provide the factual information necessary for such follow-up as well as the feedback mechanism to assist in the revision of future EIA procedures (Tomlinson and Atkinson, 1987a). Jakimchuk (1987) suggests that the environmental audit is "the missing link" which would help better integrate the assessment activities with the other components in the planning process.

2.5 The Environmental Audit

The term "audit", borrowed from accounting, conveys the idea of data certification and verification of practice. The notion of post-project audits, also referred to as post-project studies, evaluations or analyses, has existed in the literature since 1969 and, from the mid to late 1970s onward, interest in the subject of environmental auditing has been increasing (Rigby, 1985; Berkes, 1988).

2.5.1 The Value of Environmental Auditing

Perhaps the most commonly cited strength of environmental auditing is its feedback function. It is argued that information obtained from auditing should be incorporated into decision-making procedures of subsequent projects. According to Spaling *et. al.*(1993:70):

> Feedback would provide information on the effectiveness of institutional processes, and also on the accuracy and reliability of

> impact prediction... Ex-post evaluations would provide hindsight information contrasting the intended and actual EIA process, and comparing the predicted and observed impacts. This information would serve as a learning opportunity to improve project design and impact prediction for other proposed actions at different locations in the future.

Similarly, Buckley (1991:94) suggests that the principal advantage of systematic environmental auditing:

> is that it provides a feedback link in environmental planning and management... Environmental impact audit provides a measure of the accuracy of the initial prediction, and potentially, of the "environmental management effort" needed to bring actual impacts into line with expectations where initial estimates proved inaccurate. This also provides a "learning function" in EIA as a whole: future predictions can take into account the outcomes of past predictions.

Wood (1995:199) points out that in addition to assisting impact forecasting for future projects, the results of the audit also would serve a public relations function; they could demonstrate government and industry concern for the environment and also provide public reassurance of the effectiveness and success of their impact management strategies.

The absence of such knowledge of the successes and/or failures of the EIA process of past projects inhibits the advancement of such procedures. Without feedback, those techniques and procedures which prove to be effective and successful remain unknown to others. As a result, time and resources may be wasted as EIA practitioners and researchers independently "keep reinventing the wheel" (Munro *et. al.*, 1986:28).

Conversely, a lack of feedback may result in the propagation of ineffective or unreliable EIA techniques and procedures. Often, practitioners adopt information and methods from assessments of similar projects or similar environments. However, such an approach may be inappropriate as the validity of many of these techniques is seldom evaluated. As a consequence, it is quite possible that predictive techniques are being employed and, subsequently, decisions made and actions implemented based upon models and information whose validity and accuracy are unknown (Tomlinson and Atkinson, 1987a:188).

Some authors suggest that the feedback and learning opportunities associated with auditing could also serve to enhance the general approach to EIA. According to Tomlinson and Atkinson (1987a:188), a major weakness of EIA practice has been its use solely to obtain a development permit instead of as an environmental management tool. The focus has been primarily on the "front-end" or the pre-approval activities of EIA with little consideration being given to the outcomes of these approved projects (McCallum, 1987).

Sadler (1988:129) describes this lack of emphasis given to the *actual* socio-economic and environmental effects of the development project or to the effectiveness of the mitigative and management measures which are adopted as "the paradox" of EIA since the absence of follow-up precludes any opportunity to learn from other project experience and, therefore, inhibits the advancement of EIA. As Bisset and Tomlinson (1988:126) conclude:

> there is a need for a feedback mechanism in EIA which involves the transfer of knowledge from the actual environmental effects of a project or action to future EIA's...This can only be achieved through audits.

2.5.2 An Evolving Definition

While the idea of environmental auditing is some two and a half decades old, and a recurrent theme in the literature, the use of, and thus experience with, environmental audits is still limited. This may be attributed in the past to the fact that there was no standard definition for "environmental audit" (Rigby, 1985; Tomlinson, 1987; Bisset and Tomlinson, 1988; Buckley, 1991). Since first introduced, the concept has evolved and expanded. As a result, the term has come to be used to define and describe a much wider range of procedures and activities. This is illustrated by the various definitions of environmental audit which follow.

Munro *et.al.* (1986:2) distinguish between "environmental audit" and "comprehensive environmental audit". The focus here, however, is primarily on the variance between predicted and actual consequences:

> an environmental audit would do little more than catalogue and verify the effects of a project, or, to put it another way, collate the results of monitoring... A comprehensive environmental audit ... would relate the actual effects of a project to the predicted effects of the project and whatever mitigation measures were undertaken. On the basis of scientific evidence, it would define and analyze the causes of variance between the actual and the expected.

Tomlinson and Atkinson (1987a) apply the concept of auditing to other aspects of EIA. They propose seven different types of auditing and their roles within the EIA process. These are outlined below:

i) *Review or Draft EIS Audit.* This involves a review of the draft EIS vis-à-vis its terms of reference.

ii) *Decision Point Audit.* This type of audit examines the effectiveness of the EIS within the decision-making process.

iii) *Implementation Audit.* Its purpose is to determine whether the recommendations of the EIS or the Review Panel were implemented.

iv) *Performance Audit.* This is an examination of the company's internal environmental management of a project and its ability to respond to environmental incidents during project operations.

v) *Project Impact Audit.* Such an audit involves the examination of the environmental consequences of a project. Its purpose is to determine whether these consequences were originally forecast.

vi) *Predictive Technique Audit.* This involves a comparison between the actual and predicted effects of a project in order to verify and improve predictive techniques.

vii) *EIA Procedures Audit.* EIA procedures provide the framework within which EIAs for particular projects are carried out. An audit of these procedures would examine the performance of EIA procedures at the macro level and could include any or all of the above forms of audit.

Buckley (1991:121) further expands the definition and applies it not only to the EIA process but to the other aspects of the environmental management process, including: compliance, monitoring programmes, impact predictions, equipment performance, physical hazards, financial risks, products and markets, baselines and benchmarks, management programmes and structures, planning procedures and legislation.

Thus, over the past decade the label "environmental audit" has been adopted to represent a broader range of activities than was the case when it was first conceived. Initially, it was used to refer only to a follow-up of EIA predictions. However, "environmental audit" now refers to such things as testing a company's pollution controls and monitoring equipment to ensure that it meets operational specifications; assessing the "greenness" or the environmental friendliness of a company's retail products; or, with regard to corporation mergers and acquisitions, identifying any environmental liabilities associated with the takeover target that may be transferred to the new corporation (Buckley, 1991). As a result, EIA auditing, which was once synonymous with environmental auditing, is now only one of many types of procedures which fall under the umbrella of "environmental auditing".

The fact that the scope of the definition has broadened is indicative of the increased thought and research which has been devoted to environmental auditing. Some of this heightened attention has been directed toward the area of EIA auditing. As a result, EIA audit studies have been undertaken in such countries as Canada, Australia, the United States and the United Kingdom.

2.5.3 EIA Audit Case Studies

The majority of EIA audits that have been carried out thus far would fall under either Project Impact Audits or Impact Prediction Audits, as defined by Tomlinson and Atkinson (1987a). Some of these audit studies addressed single projects, such as the post-project evaluation of the CP Rail Rogers Pass Development (Ross and Tench, 1987), while others involved a multi-project focus, e.g. Buckley's (1991) national study of Australian impact predictions and Culhane's (1987a; 1987b) follow-up of American EISs.

To date, the most common form of EIA auditing being undertaken is the Predictive Techniques or Impact Prediction Audit. Such studies are concerned with assessing the accuracy of pre-project predictions and forecasts relative to actual project outcomes. A general recurring conclusion of such investigations has been that project impacts are rarely accurately forecast.

> ...there is an increasing amount of effort being directed towards evaluating the utility of EIA. This effort has led to a recognition that the predictive capabilities of the subject are, as yet, poorly developed and that accuracy of such predictions leaves much to be desired (Tomlinson and Atkinson, 1987b:259).

In most instances, the predictions have either fallen short of the observed impacts or have over-estimated the potential outcomes of a project or undertaking (Canter, 1985:264). Such conclusions are illustrated by the case studies which follow.

One of the initial efforts to conduct a comprehensive impact prediction audit was undertaken by the Bureau of Land Management, U.S. Department of the Interior in 1975 (see Bisset, 1980). The bureau carried out an audit of a politically controversial off-road motorcycle race which spanned approximately 155 miles of desert terrain from Barstow, California to Las Vegas, Nevada.

The results of this study revealed that many of the predictions in the EIS could not be tested due to insufficient and inappropriate monitoring data. Those predictions for which adequate monitoring data were available generally were determined inconsistent with initial forecasts (Bisset, 1980:384). For example, one of the key findings was that the extent of the ground surface area impacted by the race course was some 31 percent larger than was forecast in the EIS.

An audit of twelve U.S. power plant construction projects conducted by the Denver Research Institute also discovered a mismatch between actual and predicted impacts. For example, some of the findings indicated that the timing and magnitude of construction employment differed substantially from pre-project estimates. Construction workforce size estimates were usually wrong as they were often understated. In several instances, the actual number of workers exceeded the original forecasts by more than 200 percent (Gilmore *et.al.*, 1980:418).

Results also indicated that the geographical extent of the impact area for these construction projects was greater than expected due to an under-estimation of the extent of commuting to the construction site. It turned out that the commuting range was larger than anticipated. This resulted in an over-estimation of socio-economic impacts in the local area as the workforce was more dispersed (Gilmore *et.al.*, 1980:419).

An audit was also undertaken with respect to the socio-economic impacts of the Coal Creek power station in North Dakota (Leistritz and Maki, 1981). It was concluded that the impacts on fiscal characteristics, population and public services of local communities were "generally consistent with the predicted impacts" (Bisset and Tomlinson, 1988:123). However, the same did not hold true for the projections of construction worker housing requirements. These estimates exceeded the required number as many in-migrant workers preferred various forms of temporary accommodations to the mobile homes provided (Bisset and Tomlinson, 1988:123).

Murdock *et.al* (1982) reviewed a sample of American socio-economic impact statements to evaluate their accuracy. Due to a paucity of socio-economic information in many of the EISs, the final review was more limited than was initially intended in terms of both the number of EISs reviewed and the number of socio-economic variables audited. Thus, the final investigation involved a review of 44 EISs in order to assess the accuracy of 1980 population projections contained within these documents. The EISs contained projections for some 104 counties and 45 cities. These forecasts were compared with the population data in the 1980 U.S. Census.

The results revealed a wide discrepancy between actual and projected 1980 populations. Of the 104 county projections reviewed, 57 (or 55%) were in error by more than 10% and 14 (or 13%) were in error by more than 25%. As well, projections were equally likely to over-estimate as to under-estimate the actual population, as 48% of the forecasts were under-estimates while 52% exceeded the Census data.

The difference between the actual and predicted populations was even greater for the cities. Thirty-five of the 45 city projections reviewed (or 75%) were in error by more than 10%, 19 (or 42%) by more than 25% and 6 projections were incorrect by an error margin of more than 100%. As well, city projections tended to be over-estimates with only 9 (or 20%) of the forecasts falling below the actual number. The researchers concluded that the results of the accuracy assessment were "not encouraging" (Murdock *et.al.*,1982:339-346).

The inability of EISs to accurately forecast project impacts is further supported by the audit conducted to evaluate the accuracy of fish and wildlife predictions contained within the planning reports for 20 U.S Army Corps of Engineers reservoir projects. The unit "man-day use" was used to quantify the projections for angling and hunting use at these reservoirs and their surrounding areas (Tomlinson and Atkinson, 1987b:246-249).

Of the 20 projects reviewed, 16 contained sufficient data to evaluate angling projections and 18 projects provided adequate information to test the predicted hunting activity. With respect to angling, 11 of the 16 projects under-estimated man-day use with an average error of 63% while the remaining 5 over-estimated angling activity by an average of 179%. Total hunting was higher than predicted at 14 of the 18 projects (Tomlinson and Atkinson, 1987b:249).

Results of audit studies conducted in the United Kingdom have also revealed the limited predictive capability of environmental impact statements. Perhaps the most renowned U.K. audit study is that undertaken by the former Project Appraisal for Development Control (PADC), now the Centre for Environmental Management and Planning (CEMP), at the University of Aberdeen (see PADC, 1983).

The primary objective of this research was to determine the accuracy of impact predictions through the comparison of predicted and actual impacts of selected development projects and in doing so identify the optimum predictive techniques. The four projects included in the study were the Flotta and Sullum Voe oil terminals, the Redcar Steelworks and the Cow Green reservoir (Clark *et.al*, 1987).

A total of 94 predictions were audited of which 27 pertained to Sullum Voe, 17 to Flotta, 21 to Redcar and 29 to Cow Green. Firm conclusions were reached for 77 (or 82%) of these predictions. The results indicated that 44 (or 47%) were deemed accurate while 33 (or 35%) proved inaccurate. When analyzed on an individual basis it was found that 18 (or 67%) of the Sullum Voe predictions were accurate, 7 (or 41%) of Flotta's forecasts were judged correct, 5 (or 24%) were accurate in the Redcar case and 14 (or 48%) of the Cow Green reservoir outcomes were considered consistent with the projections (Clark *et.al*, 1987:530).

In another study, the Transport and Road Research Laboratory of the United Kingdom undertook research to evaluate the accuracy of predictions made in urban transport studies over a 20 year period (see Mackinder and Evans, 1981). Forty-four transport studies were selected for review from a series of urban studies, conurbation studies and land use transportation studies. Twelve forecast variables, including number of households, number of cars per head and numbers employed, were employed to measure the general forecasting process. It was concluded that the predictions generally over-estimated the level of change in the variables. For example, the projected number of households exceeded the actual number by 5%, car ownership was over-estimated by 27% and the numbers employed over-extended by 11% (Tomlinson and Atkinson, 1987b:257).

In addition to those case studies reviewed thus far, two audit studies have been carried out which were much more extensive in terms of the number of EISs included and the total number of forecasts audited. The first is that performed by Culhane (1987a; 1987b) with respect to the accuracy of EISs produced in the United States. This investigation included 29 EISs which contained a total of 1,105 forecasts. However, the number of forecasts for which auditing procedures were undertaken was considerably less in that a field sample of 239 forecast impacts was selected for the final analyses.

Unlike the CEMP audit in the U.K., firm conclusions regarding predictive accuracy were not formulated in this case in that the researchers concluded that, while the majority of the forecasts in the sample were not deemed accurate, few of them were "clearly inaccurate". For example, only 15 were considered blatantly wrong and were classified as "inconsistent". Another fifth of the forecasts were judged to be inaccurate, "but unclearly so".

> ..this evaluation found EIS forecasts to be not inaccurate. This double negative is used to highlight the conclusion that very few impacts in the sample are demonstrably inconsistent with EIS forecasts...On the other hand, only about a third of the forecasts in the study are tolerably accurate. The more numerous, middling forecasts are either pseudo-accurate solely by virtue of their forecasts vagueness or somewhat inaccurate in various complicated ways (Culhane, 1987a:375).

Buckley's (1991) evaluation of the environmental impact predictions of Australian EISs is an example of another extensive, large-scale audit. Unlike the approach employed by Culhane (1987a; 1987b), this study included only those predictions that were quantifiable and scientifically testable. As a result, the results are presented in a more precise and quantitative fashion.

Of the 181 predictions included in the investigation, 131 (or 72%) were found to be as or less severe than predicted while the remaining 50 (or 28%) proved more severe. The researcher reduced the total number of predictions to 68 by selecting only the most aggregated or the most critical of the fully quantified forecasts in each of the 9 major impact categories. Of these, 40 (or 59%) were as or less severe than expected and 28 (or 41%) were more severe. The overall mean accuracy of these 68 predictions was 44%, ±5% (1SE) while, individually, the predictions differed by more than three orders of magnitude, with the actual impacts ranging from 0.05x to 37x the predicted value (Buckley, 1991:115).

In summary, the above case studies illustrate the limited success with respect to accurately predicting the environmental effects of development projects. The majority of predictions made within the EISs of the projects reviewed either under- or over-estimate project impacts.

2.5.4 Procedural Difficulties in Conducting the EIA Audit

In addition to illustrating the inability of current techniques to accurately forecast the likely outcomes of development projects, the above studies also illustrate that impact prediction auditing is not as straightforward a task as it might seem, re-affirming the conclusions of Bisset (1980:389):

> Although the implementation of audits appears, superficially, to be a conceptually simple exercise, experience shows it is fraught with difficulties.

Three general procedural difficulties were common to several of the audit case studies. The first is that many of the predictions outlined in the environmental impact statements and other project documentation were unsuitable for audit. For example, Buckley (1991:96) discovered that many of these documents contained few testable predictions but rather simply outlined issues of concern. As well, those predictions which were testable generally addressed minor impacts while major impacts were discussed qualitatively.

Others have criticized the non-quantitative style as well as the nebulous wording of many of the EIS forecasts. For example, Culhane (1987a:374) describes forecasts as being "confoundingly vague" regarding impacts' significance and probability of occurrence, as lacking quantification and as being ambiguous with respect to the direction or beneficiality of impacts. Clark *et.al.* (1987:530) reported that in all the case studies they reviewed, many predictions were expressed in "vague, imprecise and woolly language". Similarly, McCallum (1987:737) found many predictions too vague to evaluate, while Canter (1985:264) made reference to the "non-specificity" of EIS predictions. As well, Munro *et.al.*(1986:12) concluded that most environmental predictions are imprecise and qualitative, and contain phraseology that was "tentative and uncertain".

A second general problem encountered during auditing procedures is a temporal one. First, few forecasts contain any reference as to *when* the impacts are likely to occur (Clark *et.al.*, 1987:532). Such a time frame is essential to ensure that appropriate monitoring measures are in place in order to identify project-related variations in a particular environmental component. Otherwise, project impacts would go undetected which could ultimately result in erroneous conclusions regarding either the environmental consequences of the project or the effectiveness of management systems established for the project.

Another time-related factor which complicates the auditing process is the time interval between formulation of EIS forecasts and the occurrence of the actual impacts. The specific details of development projects are almost always changed -- often substantially -- between the conceptual or design stage as employed for the EIA, and actual project operations (Buckley, 1991:96). As a result, project descriptions outlined in the EIS are frequently incomplete or tentative and the impact forecasts, which are based on these descriptions, no longer relevant and thus untestable (McCallum, 1987:737; Clark *et.al.*,1987:530). Researchers at the University of Aberdeen conclude that the project design factors exogenous to the project often change so much between assessment and audit that comparisons become very difficult (Munro *et.al.*,1987:15).

The third obstacle identified in the case studies involved monitoring data. The success of, and indeed, the ability to perform an audit, is contingent upon the availability and quality of pre-project and post-project operations monitoring data. In most studies, the monitoring data necessary to evaluate the reliability of impact predictions were either non-existent, insufficient or inadequate (Buckley, 1991:96; CEARC, 1988:2-3; Sonntag, 1987:451; Munro *et.al.*,1986:13; Canter, 1985:258; Murdock *et.al.*,1982:337; and Bisset, 1980:390).

Monitoring programs and data were seen to be deficient in several respects. Sometimes monitoring programs were not related to the forecasts outlined in the EIS and those programs that were related did not always generate data appropriate for audit. For example, predictions may have been made for a particular location or time period but the monitoring data were collected at a different location or expressed for a different period. As well, monitoring data often did not permit statistically valid testing of the predictions as the data either had too few samples, inadequate controls or too many missing data points (Buckley, 1991:96; and Clark *et.al.* 1987:533).

It was also found that baseline or pre-project information was often lacking (CEARC, 1988:2; and Canter, 1985:264). It is argued that in many cases such data do not cover a sufficient time period to allow the identification of natural or "without project" patterns in the environmental factors being considered. It is generally accepted that baseline data should span a period greater than one year to permit the identification of seasonal variations and natural longer-term fluctuations. However, achieving this is often not possible as time limitations prevent obtaining the requisite pre-operational data (Bisset, 1980:389). As a result, such insufficient data make it difficult to establish a cause and effect relationship between project activities and the resultant impacts (Clark *et.al.* 1987:533).

The availability and accessibility of monitoring data can be another obstacle in the auditing process. Data may be difficult to obtain either because they have not been published or because circulation of the information has been restricted (Buckley, 1991:118; and CEARC, 1988:3).

Both the nature of the impact predictions and the availability of adequate monitoring data have significantly limited the number of auditable predictions. In most case studies, a large proportion of predictions were deemed untestable due to the above limitations and thus excluded from the investigations. For example, Bisset (1980) reported that many of the predictions identified in the Bureau of Land Management study could not be tested due to poor monitoring data. Similarly, Buckley (1991) determined that of the thousands of forecasts contained in the 800-1000 EISs and equivalent documents produced in Australia between 1974 and 1982, monitoring data to test these predictions exists for only three percent of these EISs. In the study by Henderson (1987), of the 122 predictions identified for audit, 42 lacked sufficient monitoring data while 10 were either too vague or obsolete due to project modifications (Buckley, 1991:95). Murdock *et.al.* (1982) found that of the 225 EISs reviewed, only 44 were suitable for evaluation. As well, in the CEMP study, 791 predictions were extracted from the EISs and project documents of which 697 were untestable and 94 were audited (Clark *et.al.*, 1987).

The case studies demonstrate the complexities involved in performing an EIA audit. As indicated, precise forecasts and reliable monitoring data, the essential components for effective and constructive auditing have not been the norm. The concluding remarks of the authors of the CEMP study illustrate the general experience with EIA auditing:

> The main conclusion of the research, in terms of testing predictions, is that it has been very difficult to audit the impacts predicted for developments. Impact predictions are not phrased in a way which allows auditing, and they become obsolete very easily. In addition, existing monitoring programs are not very useful in providing data to allow predictions to be tested in a scientifically acceptable manner (Clark *et.al.*, 1987:537).

2.6 Socio-Economic Impact Audits

The above conclusions have been derived primarily from the auditing of bio-physical impact predictions. Indeed, such forecasts have been the focus of most audit studies while those pertaining to socio-economic issues are largely under-represented in much of the EIA audit research performed to date.

Few audits have focused specifically on socio-economic impact forecasts with the main exceptions being those studies conducted by Murdock *et.al.* (1982) and Gilmore *et.al.* (1980). Typically, socio-economic impact predictions either comprise only a small proportion of those being audited, as was the case in the follow-up study of Australian EIS predictions (Buckley, 1991) in which only nine of the 181 reviewed were socially related, or socio-economic issues are altogether excluded from the study, as in the CEMP study of the four development projects in the United Kingdom (Clark *et.al.*,1987).

One reason for the limited number of socio-economic impacts being audited may be related to the fact that forecasts involving socio-economic issues are severely lacking in many EISs. For example, in the study performed by Murdock *et.al.* (1982), more than 27 percent of the EISs reviewed were rejected from the analysis due to a lack of socio-economic projections and only one fifth of the 225 EISs investigated contained sufficient information for audit. These results led the researchers to conclude either that the U.S environmental review process is seriously flawed or that socio-economic issues are viewed as insignificant.

As most audits have addressed bio-physical impact predictions, much of the research which has been conducted with respect to developing a framework or methodology for auditing has had a bio-physical bias (see Rigby, 1987; Sadler, 1987; Davies and Sadler, 1990; and Buckley, 1991;). Whether the approaches adopted for bio-physical auditing research are appropriate for socio-economic impact projections is not known as there has been little research undertaken with respect to this. Davies and Sadler (1990) suggest that, because of the different nature of social impact assessment, it may be necessary to reassess existing auditing procedures in order to accommodate socio-economic impacts.

> The practice of social [i.e. socio-economic] impact assessment incorporates a number of assumptions and approaches which differ from those of EIA as it is conventionally defined. Therefore, it is useful to consider how the present guidelines must be reorganized to accommodate social practices. Although social impact monitoring has been the focus of recent research, little development has been achieved in the direction of monitoring and auditing social impacts and assessment methodology (Davies and Sadler, 1990:30).

This need for research in the area of socio-economic impact auditing thus serves as the basis for undertaking this particular research.

Chapter III THE HIBERNIA PROJECT CASE STUDY

3.1 Research Objectives

There are three objectives of the research. The first is to determine a method of conducting a socio-economic impact assessment (SEIA) audit. To achieve this, previous audit case studies, including studies emphasizing both socio-economic and bio-physical issues, were reviewed in order to identify the methods employed in these investigations to determine whether a standard EIA auditing procedure existed or if not, to devise such a method.

The second objective is to then operationalize the auditing method using the Hibernia offshore oil project as a specific case study. The scope of the audit was to compare the actual socio-economic consequences of the site preparation and early development phases of the Hibernia project, to date, with the predicted socio-economic impacts. The results from the audit could then be used to identify the benefits of, the constraints to and the pre-requisites for SEIA auditing.

The final objective is to examine the role of EIA auditing in the contemporary EIA process as well as the broader environmental planning process, on the basis of the results of the Hibernia audit.

3.2 The Hibernia Project

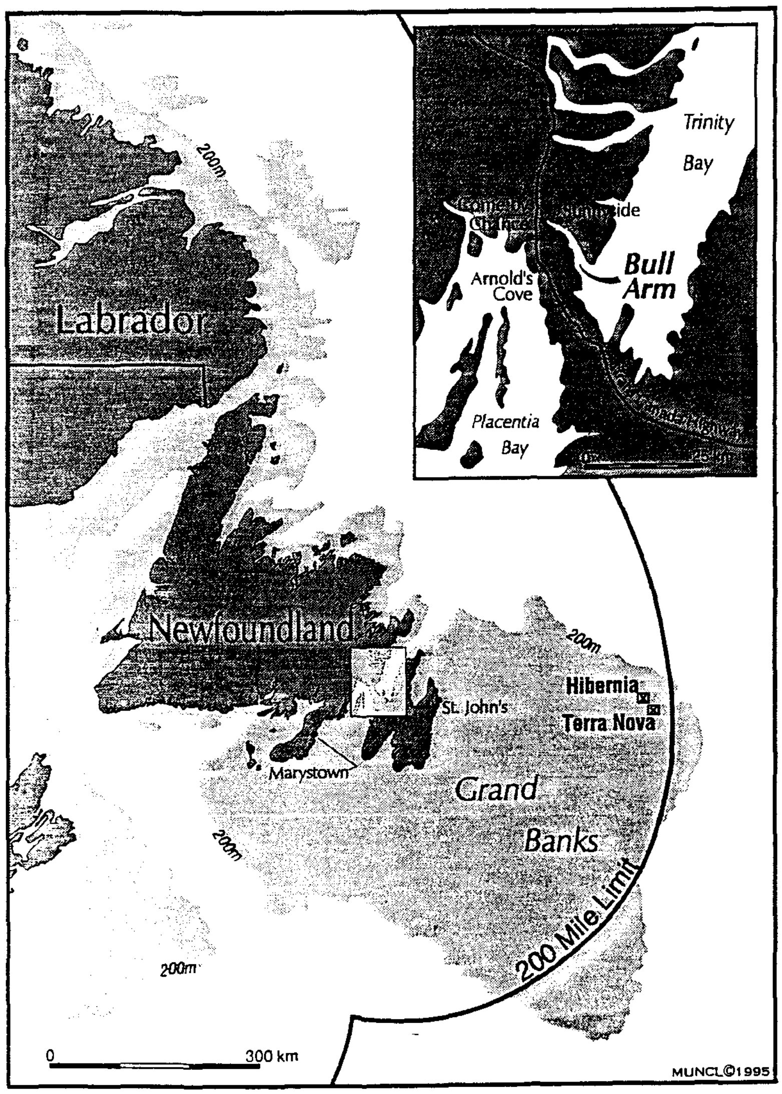
3.2.1 The Hibernia Oilfield

In May, 1979, Chevron Canada spudded the Chevron *et.al.* Hibernia P-15 discovery well under an exploration agreement, known as a farm-out agreement, with Mobil Oil Canada, Ltd. (C-NOPB, 1986:3). The Hibernia oil field is located 315 kilometres east-south-east of St. John's, Newfoundland. It is situated along the continental shelf, at the north-eastern point of the Grand Banks, in water with an average depth of 80 metres (see Map 3.1). The field covers an area of approximately 130 square kilometres and latest estimates place the Hibernia recoverable reserves at 666 million barrels of oil and 1,017 billion cubic feet of gas (C-NOPB, 1994:16).

3.2.2 Environmental Assessment and Approval for Hibernia

In 1980, Mobil Oil Canada, Ltd., the lead company of a group of five with interest in the field, applied on behalf of the group for permission to develop the field. Because of the nature of the proposed development project, Mobil's application

Map 3.1 Location of the Hibernia Oil Field and the Bull Arm Platform Construction Site



(Source: Storey, 1995:312)

was subject to Canada's former federal Environmental Assessment and Review Process (EARP) (see section 2.2).

The initiating department, Energy, Mines and Resources Canada (EMR), conducted an initial screening of Mobil's proposal and concluded that the magnitude of such a development project had the potential to adversely impact the surrounding environments. As a result, EMR referred the proposed Hibernia development project for a Panel Review (Hill *et.al.*, 1992:70).

As a consequence of EMR's referral, Mobil was required to undertake an environmental impact assessment (EIA) of the proposed project and to develop strategies to eliminate or mitigate any negative impacts and to optimize the benefits of the project. Accordingly, Mobil conducted the EIA between 1980 and 1985 and in May of 1985 submitted an environmental impact statement (EIS) which summarized the results of the EIA and outlined the proposed mitigative measures.

The Hibernia Environmental Assessment Panel (Panel) was formed to review the EIS. The Panel was established under the provisions of the Atlantic Accord -- an agreement signed between the Canadian and Newfoundland governments on February 15, 1985. Its mandate was to review the proposed project and to make recommendations with respect to the terms and conditions under which the project could proceed in a manner that was safe and environmentally acceptable. (HEAP, 1985:9).

During the course of its review, the Panel held hearings and accepted written submissions to ensure public input into the review process. In October 1985, public hearings were held which involved 29 meetings in ten different Newfoundland communities during which time interested parties were given the opportunity to comment on the EIS. The Panel heard 66 oral presentations and received some 90 written submissions during these meetings. In December 1985, the Panel submitted its report (HEAP, 1985) to the Canada-Newfoundland Offshore Petroleum Board (C-NOPB) recommending that the Hibernia project be permitted to proceed.

The C-NOPB was established under the Atlantic Accord as the body responsible for the administration of regulations regarding the development of hydrocarbon resources offshore Newfoundland. Prior to rendering its decision with respect to the Hibernia project, the C-NOPB reviewed and assessed Mobil's Hibernia Benefits Plan and Hibernia Development Plan (C-NOPB, 1986:4).

The Benefits Plan document outlines Mobil's objectives and strategies to optimize Hibernia-related benefits to Canada and Newfoundland. The Development Plan contains a detailed description of the various components of the Hibernia project including a description of project facilities; scheduling for construction and development drilling; and production forecasts (C-NOPB, 1986:4). Based upon its assessment of the Benefits and Development Plans and consideration of the Panel recommendations, the C-NOPB, in its **Decision 86.01**, granted conditional approval for the Hibernia project to proceed.

In its Decision, the Board outlined some 22 conditions to be met by the proponent. Five of these pertain to the Benefits Plan and are primarily concerned with the maximization of Canadian participation in project activities and, more specifically, employment and training for Newfoundland residents. The remaining 17 conditions, relating to the Development Plan, ensure that the design features of the production platform and its associated facilities are in accordance with environmental and human safety standards (C-NOPB, 1986:90-92).

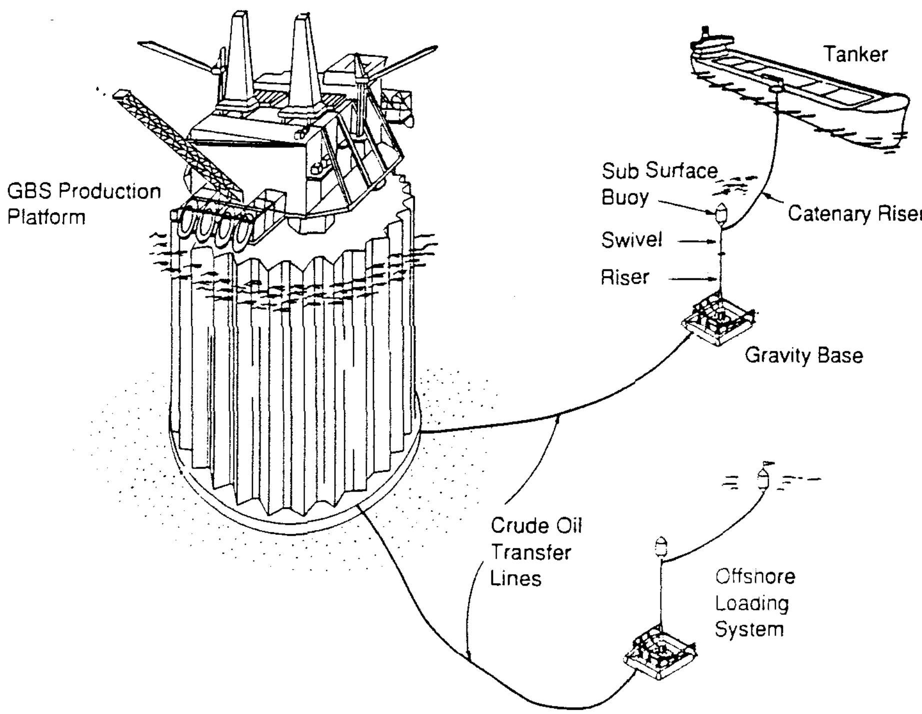
3.2.3 Hibernia's Fixed Production System

In the EIS, the proponent assessed the impacts of two main development alternatives for the Hibernia project: one involved the use of a floating production system while the other considered a fixed production system. In August 1985, Mobil submitted an EIS Update indicating its decision to select the fixed production system as the preferred mode of development. This system was subsequently approved by the Board in its 1986 Decision (C-NOPB, 1986:4).

The principal components of the fixed production system are the Gravity Base Structure (GBS) and Topsides, which comprise the production platform; the Offshore Loading System (OLS); and the crude oil tankers (see Figure 3.1). The GBS will be constructed of 450,000 tonnes of concrete and 70,000 tonnes of reinforcing steel. It will be 111.2 metres in height and have a diameter of 106.6 metres. The GBS will serve as a multi-compartment storage structure, with a storage capacity of 1.3 million barrels of oil, as well as a support for the production facilities with four shafts extending above the caisson to which the Topsides will be mounted (HMDC, 1992:1).

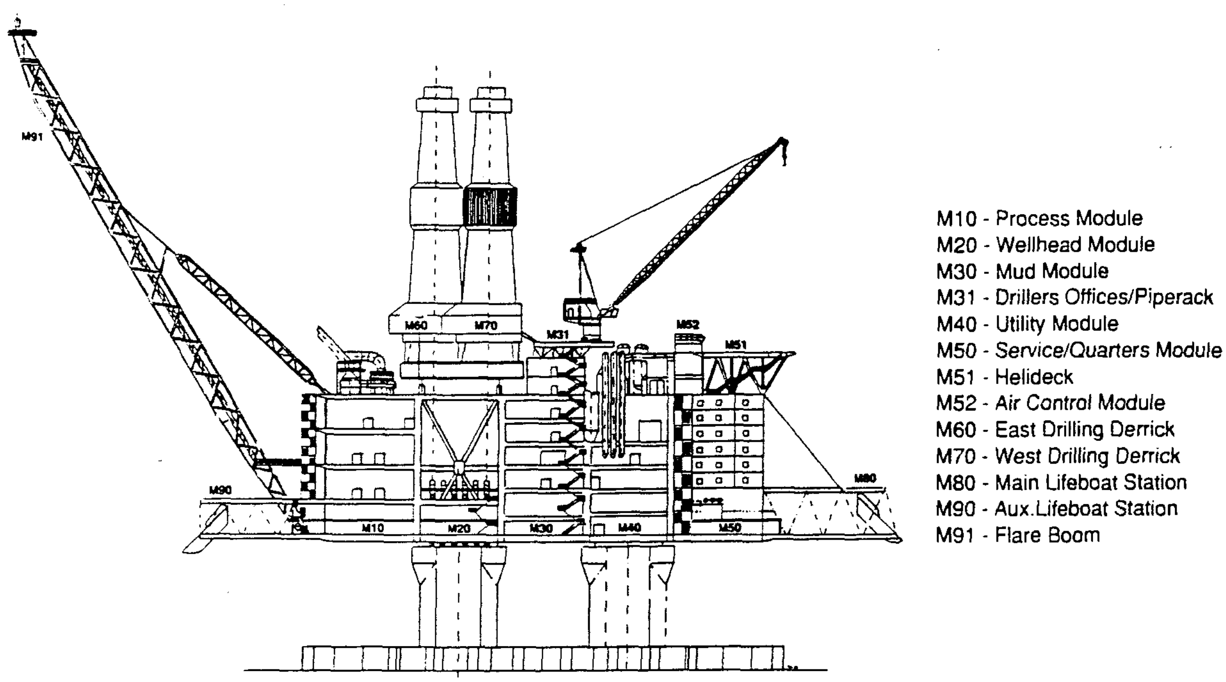
The Topsides will contain all drilling, crude oil processing and service and utility equipment for the platform, as well as the worker accommodations. The Topsides will consist of five super modules, weighing between 5,000 and 8,000 tonnes each, and seven topside mounted structures, each weighing between 250 and 1,300 tonnes (See Figure 3.2). The completed production platform, when

Figure 3.1: Components of the Hibernia Fixed Production System



(Source: HMDC, 1991:2)

Figure 3.2: Components of the Topsides Facilities for the Hibernia Production Platform



(Source:PASSB,1992:2.9)

installed and ballasted, will stand 221.3 metres tall and weigh more than 1.2 million tonnes (HMDC, 1992:1-2).

It was indicated in the EIS that the GBS would be constructed at Adam's Head in Placentia Bay, Newfoundland. In January, 1986, the construction of the GBS within this area was granted a site-specific exemption by the provincial cabinet from Newfoundland's environmental assessment procedures, subject to the completion and implementation of an Environmental Protection Plan (EPP) (Hill *et.al.*, 1992:70). Such a plan is a site planning document which outlines the procedures to be employed by the contractors and sub-contractors so as to reduce or eliminate any negative impacts and to enhance those which are beneficial (Shrimpton and Storey, 1992:102).

In March, 1986, the province established the Hibernia Construction Sites Environmental Management Committee (HCSEMC) with a mandate that included the formulation of guidelines and criteria for the EPP as well as the overseeing of the preparation of the proponent's EPP for the GBS construction site (see section 3.2.5.3)(Hill *et.al.*, 1992:70; Shrimpton and Storey, 1992:102).

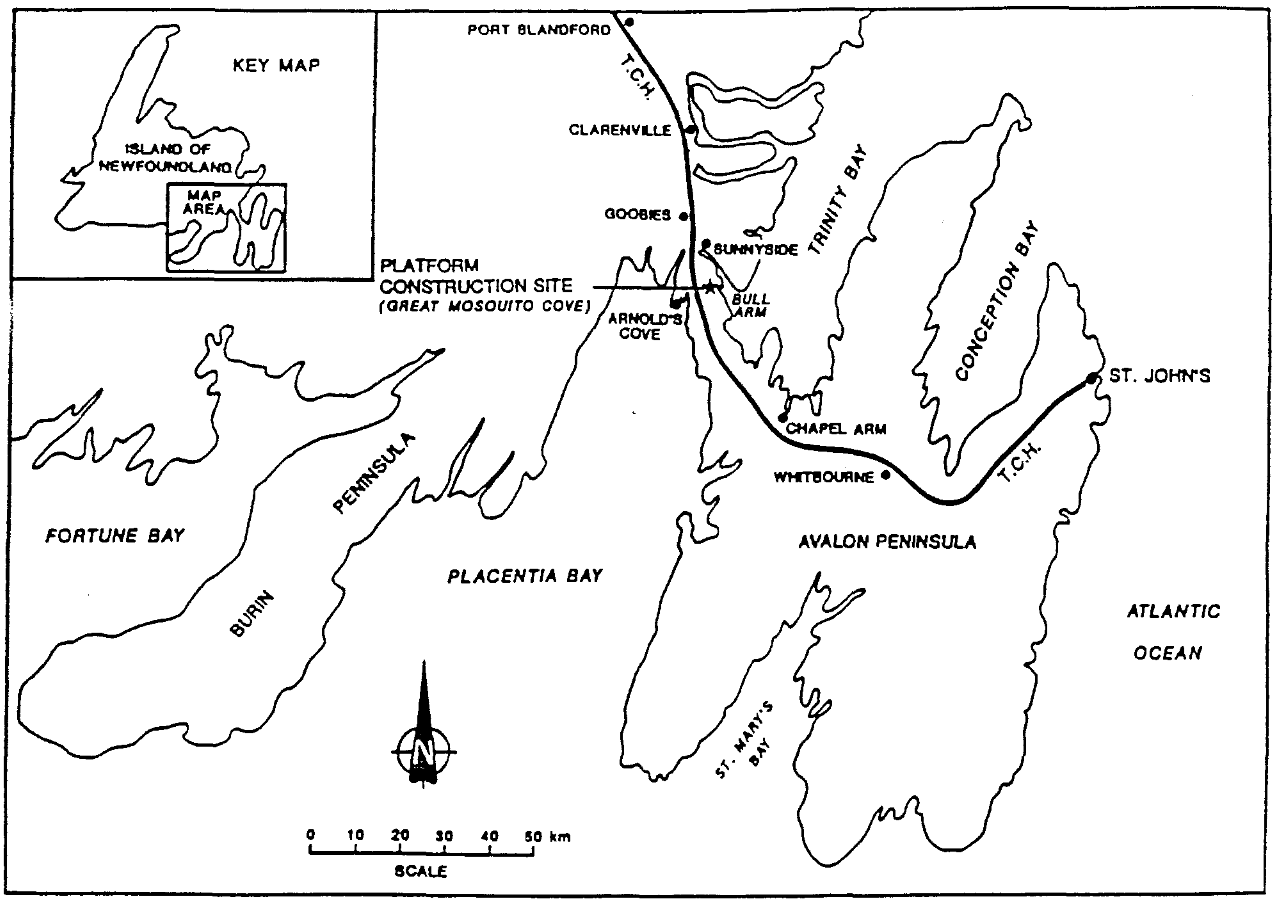
Some four years spanned the time between the Board's approval of the project and the initiation of development activities at the GBS construction site.

This delay was due primarily to problems experienced in finalizing the financial arrangements of the project between the governments and the proponent. During this four year period, project designs were reassessed and in September 1989 Mobil announced that it intended to change the site of the GBS construction from Adam's Head, Placentia Bay to Great Mosquito Cove in Bull Arm, Trinity Bay (see Map 3.2).

Mobil stated that the new site offered a number of advantages over Adam's Head including: a sheltered location for the GBS drydock; a near-shore deep water site permitting the mating of the GBS and Topsides closer to shore; less under-water excavation required; less marine transport and fishing activity in the Bull Arm area; the close proximity of the GBS construction and Topsides assembly sites; and a shorter route to tow the production platform to the oilfield (HMDC, 1991:5).

As a result of the GBS site change, the impacts on the area surrounding the new site had to be re-assessed. Thus, pursuant to the federal EARP, in 1990 Mobil submitted an Initial Environmental Evaluation (IEE) (see Figure 2.1)(MOCP, 1990). In June of the same year, the IEE was reviewed by the former Canada Oil Gas and Lands Administration who concluded that, because the construction of the GBS in Great Mosquito Cove would not present impacts

Map 3.2 Location of the Hibernia GBS Construction Site at Bull Arm, Trinity Bay



(Source:PASSB,1992:1.3)

any more significant than those identified for the initial GBS site, another full federal Panel review was not necessary. A similar conclusion was reached by the Newfoundland government and the new site was exempted from the provincial environmental assessment procedures, again, subject to the development of EPPs and their approval by the provincial environment minister (Hill *et.al.*,1992:70).

The development phase of the Hibernia project formally commenced on September 14, 1990 with the signing of the Project Cost-Sharing Agreement by the proponent and the federal and provincial governments. Construction of the Bull Arm site then began in October 1990. Since this time, activities at the site have been ongoing with respect to the construction of the GBS along with the fabrication of one of the five super modules (M-20 Wellhead Module) and four of the seven topside-mounted structures of the Topsides (M-81, M-82, M-83 and M-84).

3.2.4 Project Schedule

According to the latest project schedule, the lower portion of the GBS, which was towed from the drydock to the deepwater site in November, 1994, will be completed by the end of 1996. During the spring and summer of 1995, the various Topsides components were delivered to the site, with assembly expected to be completed by the end of the following year. The actual mating of the GBS and Topsides will take place sometime in the first quarter of 1997, followed by tow-out to the oilfield by mid-year and first oil production is scheduled for December 1997 (HMDC, 1993:2).

It should be noted that these dates for the above "milestones" in the development phase are later than those initially forecast at the commencement of development activities in 1990. On two occasions the project schedule required revision as a result of unforeseen events. For example, in February, 1992 Gulf Canada Resources Limited, one of the main project partners, pulled out of the Hibernia project. This resulted in an almost complete cessation of activities as the future of the project became unclear. As well, design problems with respect to the GBS were experienced in 1993 which again delayed the project by over a year. Thus, although the proponent maintains that the project is on schedule to meet the 1997 first oil production date, previous experience should not rule out the possibility that further unanticipated events might occur to further delay the production of first oil.

3.2.5 Main Participants in the Development and Environmental Management of the Hibernia Project

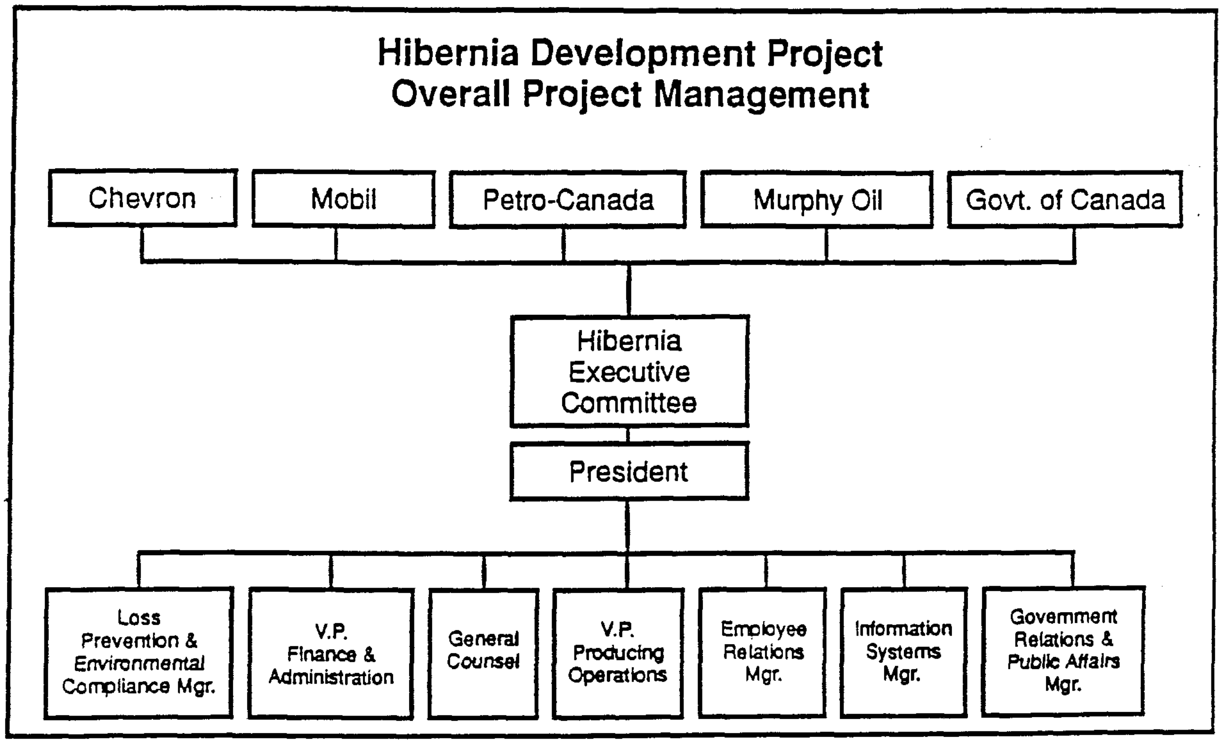
The main players involved in the project are the proponent and its contractors, government and the public. A brief summary of the participants and their respective roles in Hibernia follows.

3.2.5.1 Hibernia Management and Development Company (HMDC)

The proponent of the Hibernia project is now a consortium of five partners: Mobil Oil Canada, Ltd. (33.125%); Chevron Canada Resources (26.867%); Petro-Canada (25%); the Canadian government (8.5%); and Murphy Oil (6.5%). To oversee engineering and construction of the production system, field drilling and production operations, the partners formed a management company -- Hibernia Management and Development Company (HMDC) (Newfoundland, n.d.:5).

The structure of HMDC is such that seven senior managers are responsible for the overall management of the company. These managers report to the company president who, in turn, reports to the Hibernia executive committee. This committee comprises senior representatives from the partner companies (see Figure 3.3).

Figure 3.3: Structure of the Hibernia Management and Development Company



(Source: HMDC, 1991:4)

3.2.5.2 Major Project Contractors

Since the Hibernia Agreement was signed in September 1990, HMDC has awarded contracts for the development and construction of the production platform.

The first major contract involved the preparation of the GBS construction site in Bull Arm and for the actual construction of the GBS itself. This contract was awarded to Newfoundland Offshore Development Constructors (NODECO). This is a joint venture consisting of Atlas Construction INC. of Montreal, Quebec; Concrete Products of St. John's, Newfoundland; Doris Engineering of Paris, France; Janin General Contractors Ltd. of Montreal, Quebec; and McNamara Construction Company/George Wimpey Canada Ltd. of St. John's, Newfoundland and Toronto, Ontario (Newfoundland, n.d.:6).

Since the initial awarding of the GBS contract, project design has changed to include the process of slip-forming. Because Norwegian companies are experienced in this technology, HMDC has drawn on their expertise. As a result, NODECO is no longer the main contractor responsible for the GBS construction. Instead, the GBS Management Team (GMT) -- of which NODECO is a member -- has since been formed to oversee the GBS construction project. Other members of this new joint-venture contractor consists of Norwegian Contractors, Peter Kewitt and Sons (PKS) and HMDC, with Norwegian Contractors having assumed the lead role in engineering activities.

Newfoundland Offshore Contractors (NOC) was awarded the Topsides Engineering Procurement/Project Services Contract. As a result, NOC is responsible for detail design of the Topsides and procurement/purchasing of all equipment for the Topsides structure (NODECO, 1991 (vol.1):6-4). NOC is also a joint venture whose participants include Aker Engineering of Oslo, Norway; BFL Consultants Ltd. of St. John's, Newfoundland; Brown and Root International Inc. of Toronto, Ontario; Moneco of Calgary, Alberta; and SNC Group of Montreal, Quebec (HMDC, 1991:3).

The contract for the design, procurement and installation of the Topsides fabrication and assembly facilities at the Topsides site in Mosquito Cove, along with the actual fabrication and assembly of the Topsides Modules and topside-mounted components, was awarded to the consortium of PCL of Canada; Aker Stord of Norway; Steen Contractors Limited of Toronto, Ontario; and Becker Contractors Limited of St. John's, Newfoundland (PASSB) (Newfoundland, n.d.:6; PASSB, 1992:2.1-2.3). PASSB is responsible for the fabrication of the M-20

Wellhead Module; M-81 Main Lifeboat Station; M-82 Auxiliary Lifeboat Station; M-83 Flare Boom; and M-84 Helideck (see Figure 3.2)(PASSB, 1992:2.10).

Contracts for the remaining Modules and topside-mounted structures were also awarded. RDS of St. John's, Newfoundland won the contract for the three drilling Modules (M-71, M-72, M-73). The fabrication and construction contract for the M-10 and M-50 Modules was won by Hyundai Heavy Industries Co. Ltd. of South Korea while Belleli s.p.a. of Italy received the M-30 and M-40 construction contract (Newfoundland, n.d.:6) (see Figure 3.2).

3.2.5.3 Government Management Structures

The Atlantic Accord (1985) was an agreement of the joint federal-provincial management of the hydro-carbon resources offshore Newfoundland. Pursuant to the Atlantic Accord Implementation Acts (1987), the C-NOPB was established as the responsible authority for petroleum management as well as the administration of legislation and regulations governing the exploration and production of oil and gas resources in the Newfoundland area (C-NOPB, 1991).

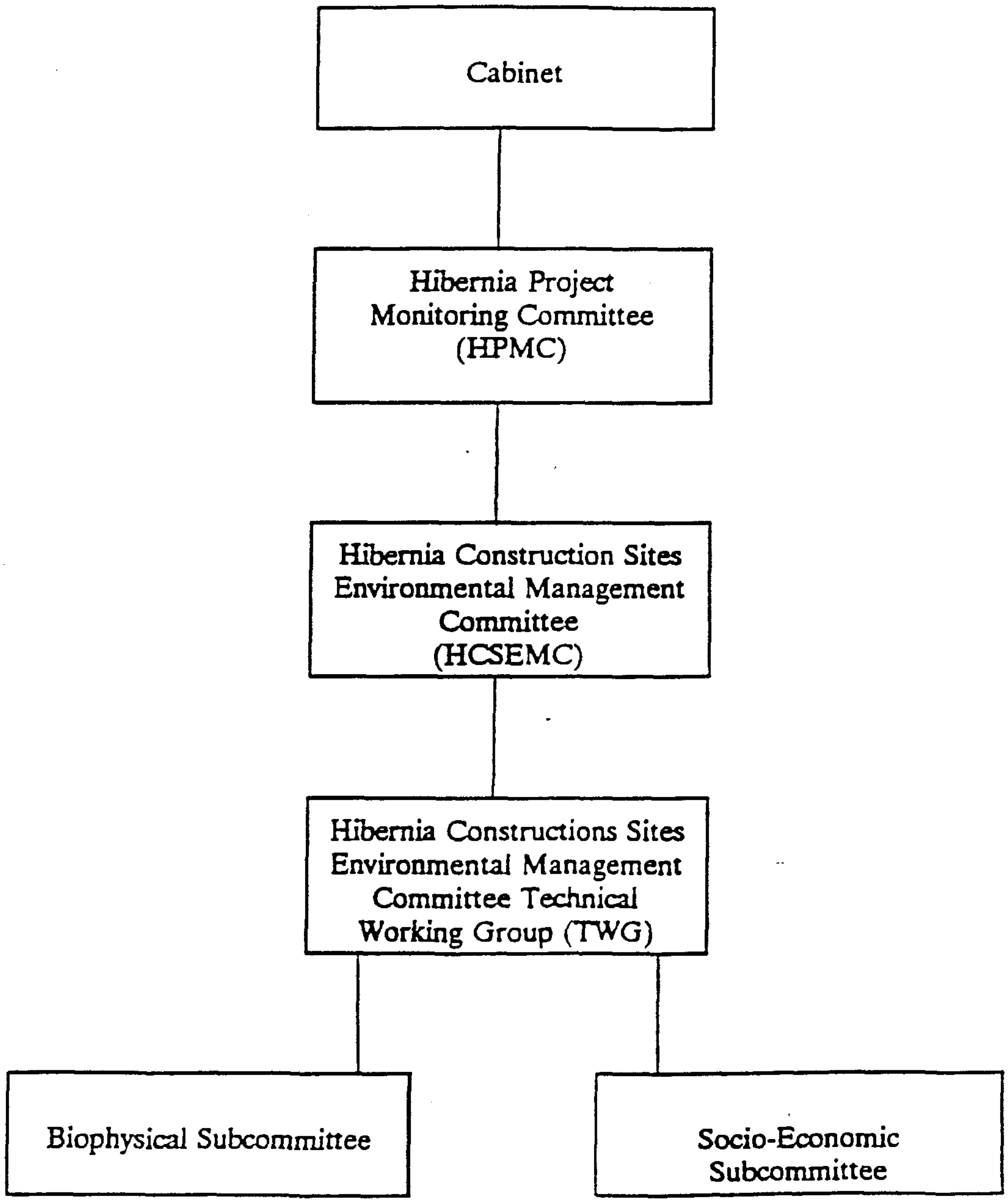
As a result, any petroleum development projects in this area require the approval of the C-NOPB. A proponent of offshore operations must submit a development application for the Board's review. This application is to contain three principle documents: a Development Plan, a Canada-Newfoundland Benefits Plan and a Development Application Summary. Approval of the Benefits Plan is a pre-condition to approval of the Development Plan (C-NOPB, 1988:1; C-NOPB, 1990:7).

While the C-NOPB is responsible for the offshore operations of the Hibernia project, the management of onshore activities is the responsibility of the Newfoundland government. A provincial government management structure has been developed to oversee Hibernia's onshore operations which are related primarily to the GBS construction project (see Figure 3.4).

A provincial government committee, the Hibernia Project Monitoring Committee (HPMC), was established to monitor Hibernia activities. The HPMC consists of Deputy Ministers and is responsible for such things as project-related economic benefits, legal agreements, environmental impacts, education and training, and safety. This committee reports to cabinet (Hill *et.al.*,1992:72).

The Hibernia Construction Sites Environmental Management Committee (HCSEMC) was formed to oversee onshore activities at the GBS construction site. HCSEMC's mandate includes the formulating of EPP guidelines, ensuring

Figure 3.4: Newfoundland Government Management Structure for Overseeing the Hibernia Project



public consultation and evaluating the effectiveness of the EPPs. HCSEMC reports to the HPMC. Various federal and provincial departments and agencies are represented on HCSEMC including Environment and Lands; C-NOPB; Education; Historic Resources; Development; Mines and Energy; Environment Canada; Fisheries; Fisheries and Oceans; Health; Employment and Labour Relations; Municipal and Provincial Affairs; Social Services; Canadian Coast Guard; Women's Policy Office; and COGLA (Hill *et.al.*,1992:72).

HCSEMC is a coordinating body. Any monitoring studies and investigations are intended to be the responsibility of the individual departments represented on the Committee. To assist in the process, the Hibernia Construction Sites Environmental Management Committee Technical Working Group (TWG) was established. The TWG is responsible for review and evaluation of EPPs; the development and implementation of socio-economic monitoring and public consultation programs; and the overseeing of the implementation of bio-physical effects and compliance monitoring programs. TWG members are directors and senior managers of various federal and provincial departments (Hill *et.al.*,1992:72).

The TWG is comprised of two sub-committees: one addresses bio-physical issues while the other is responsible for those of a socio-economic nature.

Recommendations pertaining to the implementation of the EPP and monitoring activities are channelled from the subcommittees through the TWG to HCSEMC (Hill *et.al.*, 1992:72).

3.2.5.4 The Public Component

From the outset, numerous interest groups and organizations have been formed to address the various issues that have arisen as the Hibernia project has evolved. These community groups have played an active role in some of the project decisions made to date. For example, since Bull Arm, Trinity Bay was announced as the site of the GBS construction project, a number of the region's community-based organizations have been involved in local and regional planning for the project. These included such groups as:

- the Rural Oil Impact Monitoring Agency
- the Trinity-Placentia, Isthmus Area and Southwest Arm Regional Development Associations
- the Concrete Platform Community Advisory Committee
- the Come By Chance Area Regional Fishermen's Committee
- the Come By Chance Area Business Association, and
- the Hibernia Impact Municipalities Association.

While, individually, each group has its own specific concerns and mandate, all have a common goal:

> While each community organization has its own mandate, geographic area of interest and concerns about the project, all groups share a common desire to maximize the social and economic benefits of GBS construction activity while minimizing any adverse social and environmental consequences of this project (Canning, 1990:1).

Since these groups share the same general mandate, it was decided that their collective interests would be better addressed by a single community organization rather than by each group acting independently. As a result, the Bull Arm Area Coordinating Committee (BAACC) was formed, circa October, 1990 (Canning, 1990). This group is comprised of representatives from fourteen organizations - local community groups, fishermen's committees, development associations as well as other interested parties - and serves as a liaison between local interest groups and the proponent, "a 'single window' access to HMDC, NODECO and HCSEMC" (NODECO, 1991:2.5). The committee is funded by the provincial and federal governments and office space and equipment is provided by HMDC (Hill *et.al.*, 1992:74).

It is these industry, government and community organizations which have responsibility for and/or interest in the management of the outcomes of the

Hibernia project. It is the industry and government groups which are primarily responsible for monitoring and auditing project activities and impacts.

Chapter IV METHODS

4.1 EIA Auditing Procedures

From a review of other audits completed to date, it is apparent that no one standard EIA auditing approach was employed. In the eight cases examined (section 2.3.3), the method outlined at the outset of each investigation required modification in response to a deficiency in the availability and suitability of monitoring data and/or the vague and imprecise nature of the wording of the impact predictions. Thus, each individual method was subsequently tailor-designed to accommodate the specifics of the particular study. Customized methods notwithstanding, there were some procedures common to several of the audit investigations.

4.1.1 Definition and Identification of Impact Predictions

One of the initial steps in any impact prediction audit involves compiling a list of those predictions to be included in the study. The primary sources for this information in those studies reviewed were the formal EIS and other documents produced for the environmental assessment in question (Gilmore *et.al.*, 1980; Murdock *et.al.*, 1982; Rigby, 1985; Clark *et.al.*, 1987; and Buckley, 1991). During the course of each investigation, these documents were content-analyzed to identify those predictions made for the particular project.

Prior to the content-analysis of the various project documents, a clear understanding of what constituted a prediction, as well as an impact, was necessary. Within the literature, reference is made to forecasts, predictions and projections contained within EIS documents. The three terms are somewhat related in so far as they all refer to a future time period. However, while a clear distinction is often not made between a forecast and a prediction -- frequently the two are used interchangeably -- the term projection conveys a meaning distinctive from that of the others.

According to their dictionary meanings, forecast and prediction are generally defined as being synonymous:

> forecast: a prophecy or prediction
>
> prediction: something predicted, a forecast, prophecy,etc. (Hanks, 1980:567, 1154).

Within the context of EIA audits, these terms are also used synonymously by many of the authors. For example, the aim of the audit of American EISs, was to determine the accuracy of EIS forecasts. In this case, *forecast* is defined "as any passage in the final EIS about future consequences of a proposed action " (Culhane, 1987b:219).

The definition of *prediction* offered by Clark *et.al.*(1987), in their United Kingdom case study, and Davies and Sadler (1990) conveys a meaning similar to that of Culhane's forecast definition:

> a probabilistic statement concerning a change or changes in environmental parameter or parameters arising from a project action (Also, "no change") Clark *et.al.*, 1987:527).
>
> a statement concerning anticipated changes in a particular environmental parameter or parameters arising from a specific action or course of action and can also include statements of no anticipated change (Davies and Sadler, 1990:6).

In these definitions of *forecast* and *prediction*, reference is made to changes or consequences resulting from a specific development activity.

Duinker (1987:404) also acknowledges the shared meaning of *prediction* and *forecast* but describes the latter as being a special type of the former. However, his definitions do not emphasize changes which are directly attributable to a specific cause.

> A prediction is defined as a statement specifying the present or future condition of a particular aspect of a system without measuring it, given certain characteristics of the system. A forecast is a special kind of prediction where we specify the future condition of a particular aspect of a system.

EISs also contain projections which, like forecasts and predictions, refer to future conditions. However, unlike these other terms, a projection involves an extrapolation or approximate calculation, based upon known or existing data, of conditions or trends beyond the range of the those data. Projections are usually derived from models with associated parameters and assumptions.

The EIS usually outlines two general types of projections, baseline projections and project-related projections. The former refer to the future status of a system (i.e. natural or human) or a component of that system. These are "without-project" projections. A project-related projection is one which outlines the future status of that same system or system component given the introduction of the particular development project into the system. These are "with-project" projections.

If, when comparing the "without-project" and the "with-project" projections, there is a difference between the two, this difference represents the amount of change which would result from the project. And this difference is termed the project impact (see Figure 4.1). Thus, the comparison of "with-project" and "without-project" projections serves as the basis for impact predictions or impact forecasts.

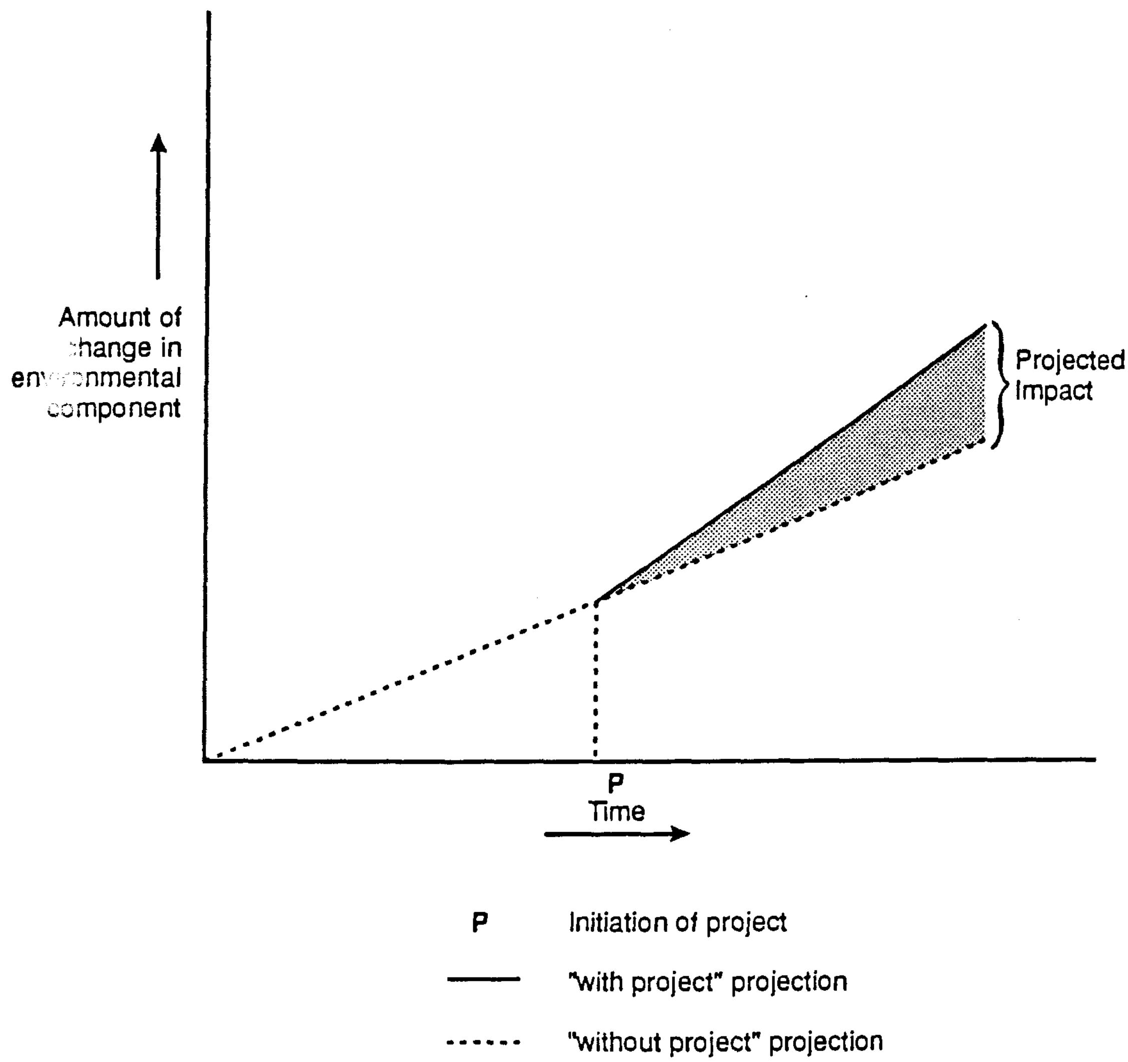
One of the primary objectives of existing environmental impact assessment procedures is to predict or forecast such impacts with sufficient accuracy in order to allow effective decision-making and management with respect to development projects.

4.1.2 Screening for Auditable Predictions

Once a definition of *prediction* or *forecast* has been established, the relevant documents reviewed and a list of predictions or forecasts compiled, the next general step in the auditing process involves a screening of those predictions or forecasts to determine those which are auditable and can be included in the investigation.

Criteria necessary to classify a prediction as auditable are outlined in EIA auditing literature. One such requirement involves the wording or the form of the presentation of the prediction. According to Clark *et.al.* (1987:528) and Tomlinson and Atkinson (1987b:260), the ideal prediction would be written as a

Figure 4.1: The Relationship Between Projections and Impacts



hypothesis and would be clearly defined in terms of the probability of occurrence, the geographical extent of the impact, a time scale within which the impact is likely to occur as well as the intensity or magnitude of the impact.

Culhane (1987a) also discusses the ideal prediction, as described within the environmental impact assessment literature, and includes many of the above characteristics but goes on to emphasize the importance of quantification within the prediction.

> Quantification is the essence of the ideal prediction ...the ideal EIS prediction is (1) quantified using (2) a technically appropriate unit of measurement, and clearly identifies (3) the affected populations or resources that are measured and (4) the time at which the effect is to occur; it should also (5) explicitly state the significance of the impact and (6) be qualified by an estimate of the probability of occurrence of the impact (Culhane, 1987a:362).

However, as most of the audit studies illustrate, the typical EIS prediction falls far short of this ideal, a recurrent finding is that many predictions are not quantitative and often are too vague or imprecise to audit (see section 2.3.4).

> Unfortunately, impact predictions are not expressed as hypotheses. Furthermore, many impacts are not readily quantifiable and are only described in qualitative terms (Clark *et.al.*,1987:528).

In addition to excluding non-quantitative predictions and those containing nebulous phraseology, other predictions -- "implied" and "conditional" predictions -

- are typically omitted from other audit investigations. EIS documents often contain statements which describe or outline the environmental impacts of similar projects developed at locations comparable to that of the particular project in question. However, if these statements do not explicitly predict that the proposed project will yield similar consequences, they are classified as "implied" predictions and are not included for audit (Davies and Sadler, 1990:22; Clark *et.al.*,1987:527).

In other cases, some predictions were found to be contingent upon assumptions concerning environmental conditions. If these requisite conditions did not result, the predicted outcome could not occur. Thus, even though such "conditional" predictions may be auditable on the grounds of adequate quantification and clear wording, the absence of the necessary conditions render them unauditable (Davies and Sadler, 1990:22; Clark *et.al.*,1987:532).

A third, and perhaps the most important, prediction screening criterion employed in the auditing investigations relates to the existence of relevant baseline and post-project monitoring information (Sonntag, 1987; Culhane, 1987; Clark *et.al.*,1987; and Buckley, 1991). Indeed, the success of the audit and the quality of its results are very much contingent upon the quality of the monitoring data. Both pre-project and post-project monitoring results are essential in order to establish a cause and effect relationship between the development project and the resulting impacts. In order to achieve this, the monitoring data must be compatible with the predictions outlined within the EIS in terms of unit of measurement, time frame and location. Results of impact audits performed to date indicate that inadequate monitoring data have significantly limited the number of predictions suited for audit (see section 2.3.4).

In addition to screening predictions for suitable wording and appropriate monitoring information, some studies evaluated the relevance of the prediction. Quite often there was a significant time interval between the date of EIS prediction formulation and the actual commencement of project activities and, thus, the occurrence of any associated project impacts. In many cases modifications were made to the initial project design and, as a result, some of the predictions were no longer relevant and therefore excluded from the audit investigation (Clark *et.al.*,1987:530; McCallum, 1987:737; and Buckley,1991:97).

The final result of this screening process is a list of relevant impact predictions regarding future project-related changes the wording of which clearly describes such changes and for which monitoring data are available to evaluate the accuracy of these predictions.

4.1.3 Project Impact Data Collection

Once a list of auditable predictions has been compiled, information about real project consequences must then be gathered and analyzed. The primary information sources concerning project impacts for many of the case studies were the documents, records and reports of the monitoring programs established by government and the proponent (Bisset, 1980; Murdock *et.al.*,1982; Rigby, 1985; Clark *et.al.*,1987; Culhane, 1987; and Buckley, 1991). Davies and Sadler (1990:23-25) outline other sources of relevant documentation including conceptual and feasibility studies; development plans; project technical specifications screening reports; results of scoping procedures; environmental impact assessment reports; operating and compliance records; and management plans and procedures.

In addition to this documented information, interviews or questionnaires may be employed either to supplement data obtained from the documentation or to evaluate those issues of a qualitative nature (Davies and Sadler, 1990:25). For example, in the United Kingdom audit (Clark *et.al.*,1987) local experts were questioned with respect either to the monitoring data or to their own interpretation of project-related events. Similarly, in the review of the Eastern Arctic South Davies Strait Drilling Project (Rigby, 1985), representatives from government and industry as well as community and public interest groups were interviewed to obtain information concerning the performance of the project.

4.1.4 Comparison and Analysis of Predicted and Actual Impacts

In light of the information obtained from the monitoring activities, project documentation, interviews and questionnaires, each of the auditable predictions can then be evaluated with respect to its accuracy.

Again, the approach employed in analysing and evaluating the predictions varied among the case studies according to the nature of the particular investigation. For example, in his national audit of Australian EISs, Buckley (1991) included only those predictions which were quantifiably testable. Culhane (1987), on the other hand, attempted to accommodate both quantifiable predictions and also those of a more qualitative nature. As a result, the approach taken and the conclusions reached in the two studies are quite different.

The remainder of this section discusses in some detail the approach employed by Buckley (1991) and Culhane (1987) in analysing and evaluating the predictions, in their respective studies. It should be noted that this discussion is limited to these two studies because in none of the other case studies is there a description of the method of analysis/evaluation used.

Buckley (1991) identifies two approaches for assessing the accuracy of predictions. The first emphasizes the logical correctness of the prediction, i.e. whether the conditions outlined within the prediction have been verified or refuted by the monitoring data. While such an approach will yield a proportion of accurate and inaccurate predictions, one might question the usefulness and validity of such results in that the level of precision of the prediction itself will largely dictate whether it is correct or incorrect. The higher the degree of precision, the greater the probability that the prediction will prove inaccurate or incorrect.

> Hence, the mere fact that a high proportion of predictions in an EIS have proved correct in a logical sense does not in itself demonstrate good environmental planning and management. It may simply show that the predictions were vague or unlikely to be falsified (Buckley, 1991:113).

Another drawback of this approach is that such a simplified binary labelling of predictions gives no indication of the degree of correctness or whether the prediction overstated or understated the actual project impact.

The second approach described by Buckley (1991) does provide information with respect to the direction of difference between the predicted and actual project outcomes. Such an approach focuses on the relative severity of the actual consequences as compared with those predicted. A distinction is made between predictions which are as or less severe than expected and those which prove more severe.

Buckley (1991) describes the results of the second approach as being more meaningful and useful than those of the first approach with respect to evaluating prediction accuracy. In order to demonstrate this point, both the logical correctness and the relative severity approaches were used in the Australian audit.

Upon comparing the predicted and actual impacts, each prediction was rated either correct or incorrect, depending upon whether or not the conditions of the prediction were substantiated. For those identified as incorrect, the direction of incorrectness was indicated through the use of such labels as *better* versus *worse* or *more* versus *less*. If the actual impact value exceeded that predicted, a label of *worse* or *more* was assigned, while a classification of *better* or *less* was used when the actual outcome fell below that predicted. In addition to this description of direction of inaccuracy, a measure of the extent of error was also calculated and expressed as a percentage generated from the predicted and actual impact values.

As an example, two predictions were made with respect to the wastewater discharge associated with a uranium mine. It was forecast that in years two and ten of operation the discharge would be 940,000 cubic metres and 1,230,000 cubic metres, respectively. However, the monitoring data indicated that in year two the discharge was 2,156 000 cubic metres and in year ten 577,000 cubic metres. As a result, in describing their accuracy, the following ratings were assigned:

prediction 1: Incorrect: 44%, worse

prediction 2: Incorrect: 47%, better (Buckley, 1991:103)

Each prediction within the study received a similar classification.

The results of the audit illustrate both the limitations of the logical correctness approach and the relative strengths of the proposed alternative approach. For example, of the 181 predictions audited, approximately 58% proved logically incorrect while roughly 42% were logically correct. While it may be argued that such results give some indication of our ability, or inability, to precisely predict project impacts, they are of no value with respect to addressing a more fundamental concern, that being the significance of the actual consequences of the project in question. For example, if in the previous example of wastewater discharge the predicted value was 940,000 cubic metres and the actual was 950,000 cubic metres, this prediction would be classified as logically incorrect. However, from an ecological perspective, this additional discharge may pose little threat. Furthermore, the fact that a prediction is incorrect does not always mean that the outcome is negative as may be connoted by the term, as when an anticipated adverse impact does not materialize or when the outcome is more beneficial than expected. For example, if it is predicted that a particular development project would result in a 20 percent increase in the crime rate in an area and such an increase does not result, while the prediction is incorrect, the outcome is positive. Similarly, if the unemployment rate in an area is predicted to drop by eight percent as a result of project-related employment opportunities and the actual drop is fifteen percent, although inconsistent with that expected, the actual outcome is beneficial.

The above limitations of the logical correctness approach to evaluating the accuracy of socio-economic impact predictions are related to the fact that audit studies have had a bio-physical emphasis. Generally speaking, the bio-physical impacts of a development project are of a negative nature whereby "more" impact typically means "worse". As indicated in the above examples, this does not apply to social and economic impacts where, in some cases, "more" or "less" impact can translate into "better" or "worse" depending on the particular socio-economic variable.

The second approach employed to evaluate the predictions avoids the above drawbacks. In addition to permitting the calculation of the number of accurate and inaccurate predictions, the results from this approach provide information concerning the nature of the impacts such as their magnitude and direction relative to the outcomes predicted. For example, upon analysing the findings, in terms of the relative severity of the actual impacts, 72% proved as or less severe while 28% were more severe than expected (Buckley, 1991:14). Such information would seem of a greater value from an environmental management perspective than a simple count of correct and incorrect predictions.

While the evaluation emphasizing the relative severity of project impacts is the better of the two alternatives proposed by Buckley (1991), this is not to suggest that this approach is without flaws. One drawback is the labels employed in classifying the predictions. The labels of *better* versus *worse* or *more* versus *less* are used in different instances. The problem is that the former pair are value-laden while the latter are of a more neutral nature. As a result, these pairs of labels are not comparable. For example, an actual impact value that is "more" than that predicted may be perceived as a "better" outcome in some instances and as a "worse" one in others. This, then, may pose difficulties when assessing the relative severity of the project consequences.

To use an example from the Australian audit, three predictions involved the project workforce. In two of these cases, the actual number of workers required exceeded the predictions while the other fell below the predicted value. The way in which these were categorized is unknown as the labels assigned to these particular predictions were not revealed in the study report. Are they more or less severe and from whose perspective -- the proponent or the community?

This, then, raises the question of evaluating the predictions solely on the basis of severity as such an approach is designed only to address potentially adverse impacts; it cannot accommodate predicted beneficial project consequences, again reflecting the audit's bias toward bio-physical issues. If, for example, a development project was predicted to increase sales for local business by 20% and the actual increase was 35%, the severity scale of the above scheme is inappropriate to evaluate this particular impact which would generally be considered as favourable.

Another drawback of Buckley's (1991) method is the manner in which the level of accuracy is presented. This measure of accuracy is expressed as a percentage which is calculated using the actual and predicted values. However, the author does not use a standard method of calculation in that in some cases the actual impact value is the divisor and the predicted value the dividend while in other cases the opposite is true. As a result, a specific percentage would carry a double interpretation. In order to clarify, these statistics were accompanied by the labels *better*, *worse*, *more* and *less* to indicate whether the actual impact was greater or lesser than anticipated. For example, an accuracy rating of 65%: better or 65%:less is translated to mean that the actual outcome was less than, and 65% of, the expected, while the ratings 65%:worse and 65%:more both mean that the predicted value was less than, and 65% of, the actual project impact.

While the above method may be legitimate and may achieve the objective of depicting the amount and direction of predictive error, it is complicated. These same objectives could be achieved in a less complex way. For example, expressing the relative accuracy of the impacts as a ratio of the actual to the predicted impact value in decimal form would eliminate the need for labels. Each impact would receive a numerical score and the closer the number to one, indicating an exact match between predicted and actual outcomes, the greater the accuracy of the prediction. Scores greater or less than one would indicate that the prediction either overstated or understated respectively the actual project consequences. As a result, the accuracies of the individual predictions would be more easily compared. Once again, however, the issue of significance is ignored.

Notwithstanding the drawbacks identified, the objectives of Buckley's (1991) evaluation scheme are of value. A basic, simplistic binary classification of correct versus incorrect predictions is of little value in that it provides nothing by way of constructive feedback with respect to impact prediction and assessment. An evaluation which incorporates a degree of accuracy and the direction of inaccuracy would seem much more useful in terms of gauging predictive capability.

The audit of American EISs undertaken by Culhane (1987), unlike the Australian audit, was not limited in scope to only those predictions that were quantifiably testable. The method of evaluation adopted in this investigation employed a rating scheme consisting of 39 codes and involved three comparisons of the actual impacts with those forecast. These comparisons emphasized:

- the match between the forecast and actual impact;
- the direction of the actual impact relative to that predicted; and
- the relative beneficiality of the actual impact.

Once again, the predictions could not be simply classified as right or wrong, there were numerous "grey" predictions. As a result, in summarizing the accuracy of the predictions, some seventeen categories were created ranging from "close", signifying the most accurate, to "inconsistent", representing the least accurate, with a series of, in my view, complicated classifications in between.

In Culhane's (1987) schema, the accuracy of the predictions may be described according to two broad categories - those which were consistent with the project consequences and those which were inconsistent. Within each of these categories were forecasts of varying degrees of accuracy (see Figure 4.2). With respect to consistent forecasts, those that were exactly correct or were very proximate to the actual impacts were classified as being "close". Others were also clearly accurate but were inherently apparent outcomes of the particular project. These were described as being "intuitively obvious". As well, predictions which forecast no impact and for which no impact was discernible were categorized as being consistent with project outcomes. Other predictions were predisposed to being accurate either because they contained a considerable range or were imprecisely worded. Such impacts were labelled as falling "within range of vague forecast". Finally, some predictions, while not straightforwardly obvious, were interpreted as being "arguably accurate" with respect to actual outcomes (Culhane, 1987a:372).

Similarly, a series of sub-classifications were designed for those impacts which did not match the conditions predicted. Forecasts which were clearly wrong

Figure 4.2: Culhane's (1987a) Forecast Accuracy Classification Scheme

Consistent (Accurate) Forecasts - close - complex, arguably accurate - within range of forecast - no clear impact, none forecast - accuracy was intuitively obvious
Inconsistent (Inaccurate) Forecasts - inconsistent - complex, deemed essentially inaccurate - impact exceeds forecast - impact less than forecast - some impact forecast, no clear impact - unanticipated - underanticipated
Others - impact disputed, spurious - impact has not yet occurred

were classified as "inconsistent". Such forecasts usually were found to be in the wrong direction. If, however, the forecasts correctly identified the direction of impact but either overstated or understated the magnitude of the actual project outcomes, these forecasts were not seen as "inconsistent" but instead were separately categorized as "impact exceeds forecast" and "impact less than forecast".

Another subgroup of inconsistent forecasts contained those which predicted some impact but for which no impact was found. Other predictions which were not consistent but not definitively inaccurate were labelled "complex, essentially inaccurate". Finally, monitoring activities discovered some impacts which either were not identified in the EIS or were significantly understated. These were classified as "unanticipated" and "underanticipated" impacts, respectively.

While most of the 239 forecasts audited fell into one of the two above broad categories, others did not. Some forecasts, for example, could not be so categorized because of the possibility that the impact had not yet occurred while in other cases the actual impact was disputed or was deemed "wholly spurious". These general categories and subgroups of forecast/impact types are summarized in Figure 4.2.

Because the seventeen accuracy classifications were nominal categories, they did not permit in-depth analysis. However, Culhane (1987a) suggested that the classifications could be arranged into a hierarchy of four ranks which formed something of a natural ordinal index. "Consistent" forecasts received the highest ranking while "inconsistent" received the lowest (see Figure 4.3). Each of the 239 forecasts was assigned one of these ranks and the mean ordinal was calculated and used as a measure of forecast accuracy. The forecasts were also sub-divided into four groups on the basis of impact type, e.g. physiographic, biological, economic and social. The mean ordinal was then calculated for each impact group (Culhane, 1987a:372-373).

In terms of evaluating Culhane's (1987a) assessment of forecast accuracy, the absence of complete details of the method used prevents a comprehensive review. For example, the two reports describing this audit investigation, (Culhane, 1987a and Culhane, 1987b), contain little information with respect to the coding scheme employed, other than the total number of codes involved. As a consequence, there still exist some unresolved problems with the information that is provided.

The first is of a technical nature. In both descriptions, (Culhane, 1987a and Culhane, 1987b), a summary table is provided which describes the match

Figure 4.3: Culhane's (1987a) Ordinal Ranking of the Accuracy Classifications

Rank 4:	- complex - complex, but arguably accurate
Rank 3:	- within range of vague forecast - no clear impact, none forecast - accuracy intuitively obvious - impact has not yet occurred
Rank 2:	- complex, essentially inaccurate - impact exceeds forecast - impact less than forecast - impact disputed - impact wholly spurious - unanticipated, but beneficial - underanticipated, but beneficial - no clear impact, some impact forecast
Rank 1:	- inconsistent - unanticipated, but adverse - underanticipated, but adverse

between the forecast and actual impact. For each of the four impact groups, i.e. physiographic, biological, economic, social and for the total number of forecasts audited, a breakdown of the number of forecasts falling within each of the seventeen categories and the four ranks is provided. In addition, the mean accuracy ordinal is calculated for each of the five groups of forecasts. However, the exact results of the investigation are uncertain in that there are inconsistencies in these two tables. For example, in one table the mean ordinal for the physiographic impacts is 2.88 and for the total number of forecasts is 2.81, while in the other report, the values given for these same impact groups are 2.83 and 2.80, respectively.

In addition to these differences, discrepancies exist within the individual tables in that some of the average ordinals outlined do not coincide with the indicated number of forecasts within each of the four ranks. For example, the mean accuracy ordinal for the 52 physiographic impacts is given as 2.88 (Culhane, 1987b:233) but my re-calculations based on the rankings of these forecasts within the table yield a value of 2.92. Similar calculation errors are also found with respect to the average ordinals for the economic, social and total number of forecasts in Culhane (1987b) and for the physiographic and economic impact groups in Culhane (1987a).

Other questions arise with respect to some of the classifications employed as well as the rankings assigned to these classifications. For example, it is unclear as to what is meant by the classifications "impact disputed" and "impact wholly spurious". Furthermore, the inclusion of these two categories along with the "impact has not yet occurred" group in an evaluation of accuracy is questionable. How can one reach any conclusion with respect to a prediction's success if the actual project outcome, upon which the success is gauged, is unknown?

Another problem associated with the categorizing and ranking scheme concerns those impacts identified as "unanticipated" and "underanticipated". A distinction is made between and separate categories created for beneficial unanticipated impacts, adverse unanticipated impacts, beneficial underanticipated impacts and adverse underanticipated impacts. When ranking the above four impact categories, those two representing outcomes of a beneficial nature were assigned a ranking of 2 while the pair of adverse impact groups received the lowest ranking of 1. Given that a higher rank value indicates a greater degree of accuracy, this particular assignment of rankings would seem to suggest that unanticipated and underanticipated impacts which are beneficial are more accurate than similarly categorized impacts of a negative nature. One could argue, however, that the attribute of "beneficiality" is unrelated to the measure of accuracy and thus should not be considered when evaluating forecast accuracy.

This, then, brings into question Culhane's (1987a) categorization and ranking on the basis of beneficiality as well as the meaning and relevance of the various mean accuracy ordinals.

In order to determine the influence of the above dubious categories and their associated rankings on the mean accuracy ordinals, Culhane's (1987a) summary table of forecast accuracy was modified. Under this revised approach, those categories containing forecasts for which the project outcomes were uncertain, i.e. "impact has not yet occurred"; "impact disputed"; and "impact wholly spurious", were eliminated from the evaluation. As well, both "unanticipated" categories were excluded because there were no corresponding forecasts for these impacts in the initial EIS documents. This is not to suggest, however, that the identification and acknowledgement of such unforeseen impacts is not of value but rather that the schema employed by Culhane is capable of measuring only the accuracy outcomes predicted and cannot be used to evaluate those outcomes not originally considered.

While the "unanticipated" categories were removed, the "underanticipated" categories were not. However, both "beneficial" and "adverse" groups were collapsed into one category which was then placed in the lowest rank. (see Table 4.1)

Table 4.1: Revised Version of Culhane's (1987a) Forecast Accuracy Summary

Rank/Classification	Physiographic	Biological	Economic	Social	Total
4 - Close	19	8	9	29	65
- Complex	1	0	1	2	4
3 - Within range of vague forecast	12	9	15	28	64
- No impact/none forecast	1	2	4	5	12
- Intuitively obvious	1	2	0	2	5
2 - Complex/inaccurate	1	1	0	0	2
- Exceeds forecast	2	0	5	3	10
- Less than forecast	5	3	9	8	25
- No impact/some forecast	1	3	11	3	18
1 - Inconsistent	5	1	3	6	5
- Underanticipated	2	1	2	0	5
Totals	50	30	59	86	225
Mean Accuracy Ordinals	2.94	2.90	2.58	3.06	2.88
Culhane's (1987a) Mean Accuracy Ordinals	2.89	2.82	2.51	3.00	2.80

The above exclusions and modifications reduced the total number of auditable forecasts to 225. The mean accuracy ordinal was then calculated for each of the four major types of impacts as well as the total number audited. The results indicate that in all cases the modified mean accuracy ordinal is higher than that outlined in Culhane (1987a). However, the relative accuracy of the five impact groups does not change. That is to say, social impact forecasts received the highest mean ordinal followed in turn by physiographic, biological, total number of and finally economic impact forecasts.

This, then, leads to the question of interpreting such statistics. For example, when referring to Culhane's (1987a) results, what does it mean that on a ranking scale from 1 - 4 the 89 social forecasts in the sample of 236 had a mean accuracy ordinal 0.48 higher than that of the 65 economic forecasts? And how does one interpret the finding that the mean accuracy ordinal for all forecasts is 2.88?

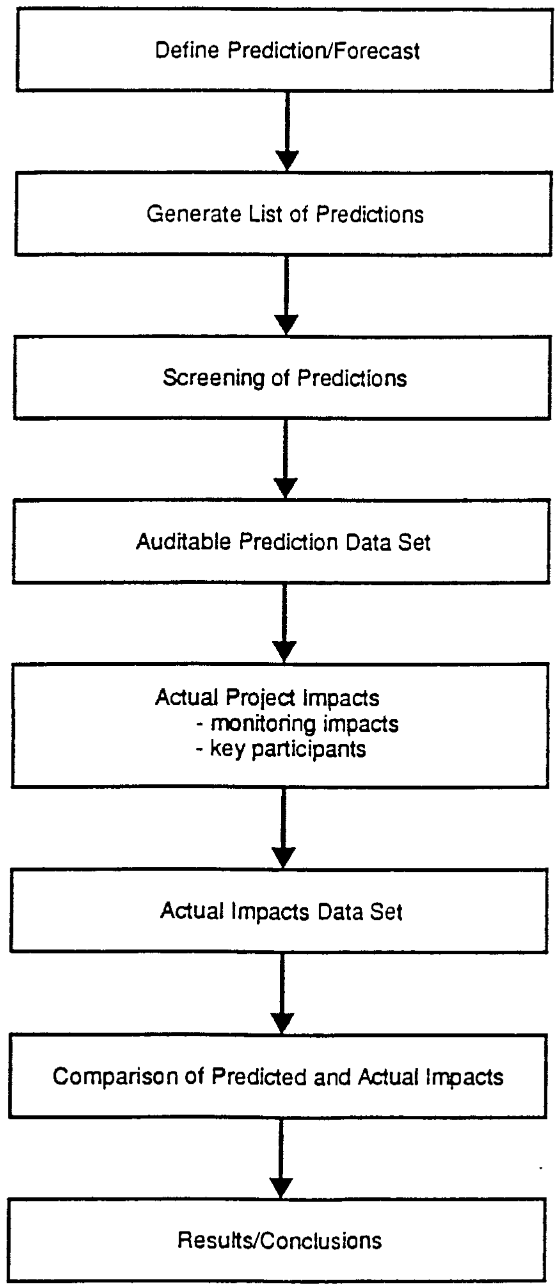
While it may be argued that the mean accuracy ordinals provide a means of comparing the forecasts for the various impact types, the relevance or utility of such findings, in terms of improving the environmental assessment process, is questionable. Aside from being an interesting academic exercise or in revealing our relative ability in precisely forecasting project development outcomes, such results would seem to have minor feedback value to the EIA practitioner, the EIS author or the decision-maker.

These criticisms notwithstanding, the audit investigation undertaken by Culhane (1987a) is among the first of such large-scale multi-project follow-up studies focusing upon the consequences of project developments relative to those outcomes predicted and raises a number of important issues. In particular, it served to highlight some of the obstacles to and pre-requisites for effective auditing, the drawbacks of many environmental impact statements prepared to date and the inadequacy of the subsequent monitoring programs that have been established.

4.1.5 Generalized Auditing Procedure

Turning to the procedures for auditing the socio-economic impacts of the Hibernia project, the general steps involved in conducting an impact prediction audit derived from the review of audits performed to date are outlined in Figure 4.4. These procedures were then applied to those socio-economic impact predictions generated for the Hibernia project. Details of the audit procedure and the results are presented in Chapter V.

Figure 4.4: General Steps Involved in an Environmental Impact Prediction Audit



Chapter V SOCIO-ECONOMIC IMPACT AUDIT OF THE HIBERNIA PROJECT

5.1 The Hibernia Socio-Economic Impact Audit: Procedure

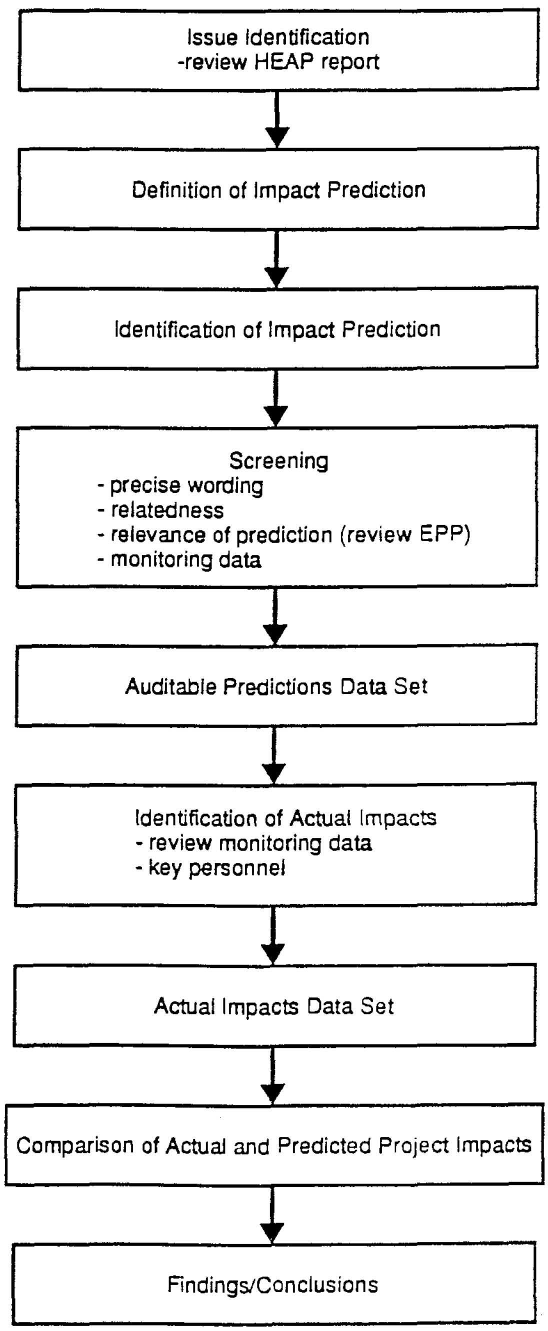
The procedure used for the Hibernia audit is outlined in Figure 5.1. This procedure is based upon, and closely resembles, the general auditing method outlined in Chapter IV. However, as was the case in most of the audits reviewed, the method for this audit was modified somewhat to accommodate the specifics of the Hibernia project.

This audit focuses upon those predictions, some of which were made initially in 1985 and others in 1991, which address the site preparation and early development phases of the Hibernia gravity base structure (GBS) construction project and the subsequent outcomes which have occurred between 1990 and 1995.

The definition of impact prediction adopted for this audit is based upon a review of the EIA audit literature and is taken as:

> any statement identifying change, and including direction of such change, to the social and economic environments in Newfoundland and which is directly attributable to the Hibernia project.

Figure 5.1: Components of the Auditing Method Employed for the Hibernia Project



The initial step of the audit involved an examination of the Report of the Hibernia Environmental Assessment Panel (HEAP, 1985) in order to identify the socio-economic issues of concern at the time that the EIS was subject to public review. Once a list of issues was compiled, Volume IV of the **Hibernia Environmental Impact Statement** (Mobil, 1985), which addresses socio-economic concerns, was content-analyzed to identify the predictions made with respect to these issues.

Once the compilation of a list of predictions was complete, each of the predictions was assessed using a series of screening criteria to determine those which were suitable for audit. The first screening was conducted to identify those predictions which contain precise wording, excluding those statements of a vague and general nature. Next, the remaining precisely worded predictions were screened to identify those specific to the Hibernia project, i.e. "implied" and "conditional" predictions as defined by Davies and Sadler (1990:22) and Clark *et.al.*(1987:527), were excluded.

The next stage in the screening process involved assessing the relevance of each remaining prediction to the newly chosen GBS construction site to address the fact that the location for the site was changed after EIS completion and project approval had been granted. To achieve this Volume IV -- the socio-economic component -- of the **Hibernia Development Project Platform Construction Sites Environmental Protection Plan** (EPP) (NODECO, 1991) was reviewed and those predictions which were no longer relevant excluded from further analysis.

When developing the EPP, NODECO reviewed the Hibernia Development Project EIS, the HEAP Report and other documents associated with the Panel's review, and liaised with local residents to identify project-related issues and concerns. The EPP, then, provides a 1991 update of the key project-related socio-economic issues. In particular, it discusses those issues associated with the newly selected GBS construction site at Bull Arm, Trinity Bay. However, unlike the EIS which contains predictions for both the St. John's and Come By Chance impact areas, the scope of the EPP is primarily the Local Impact Area surrounding the Bull Arm site (see Map 3.2). This is the same as the Come By Chance impact area discussed in the EIS. Thus, the issues within the EPP were compared to those of the EIS to determine those no longer relevant, any new issues which may have arisen after the writing of the EIS and any revisions to the still-relevant EIS predictions. EIS impact predictions related to issues no longer relevant or which had been amended within the EPP were excluded from the audit while any revised or newly formulated predictions within the EPP were added to the list.

The final stage in the screening process involved determining those predictions for which appropriate and adequate monitoring data were available. Only these were considered to be auditable predictions.

For the audit to be complete, it was necessary to identify the actual socio-economic outcomes of the Hibernia project. This information was obtained from monitoring programs which have been undertaken. Persons associated with project activities, such as personnel from HMDC, NODECO, BAACC and government, were contacted either to determine what monitoring data existed or, in some cases, to obtain explanation and/or clarification of the data.

The actual project consequences were then compared with those predicted in the EIS and the EPP. The results of this comparison served as the basis for assessing the accuracy of the auditable predictions.

5.2 The Impact Identification and Screening Components of the Hibernia Audit

5.2.1 An Overview of the Results of the Prediction Identification and Screening Activities

The documents reviewed to identify impact predictions were the EIS and the subsequent GBS EPP developed for the production platform construction phase of the Hibernia project. In total, 193 predictions were identified; 143 in the EIS and the remaining 50 in the EPPs. When the predictions were screened and coded, based on the criteria described below, many could not be audited. For example, only 78 EIS predictions and 29 EPP predictions -- 107 in total -- were identified as meeting the necessary criteria for audit. However, an additional 21 EIS predictions were excluded from the audit either because they were no longer relevant in light of subsequent changes to the project or they were updated by predictions in the EPP. Thus, 86 of the original 193 predictions were identified as "suitable" for audit.

The existing project monitoring data were then reviewed to determine which of the 86 predictions could be audited. Monitoring data were either non-existent or inadequate for 78 of these predictions. Thus, in the end, only eight of the 193 predictions identified could be followed up to assess their accuracy. A more detailed description of the prediction identification and screening components is provided in the sections which follow.

5.2.2 Identification of Impact Predictions

The initial step of the audit involved the identification of key issues using the report of the Hibernia Environmental Assessment Panel (HEAP, 1985). The categories of socio-economic issues addressed within the Hibernia EIS corresponded to the social and economic issues of concern raised during the public hearings and outlined in the HEAP Report (Mobil, 1985)(see Table 5.1).

Predictions within the EIS relating to these impact categories are outlined for three impact areas: St. John's, Come By Chance and Argentia. However, when the GBS construction site was changed from Adam's Head, Placentia Bay to the Bull Arm, Trinity Bay location, Argentia was no longer considered an impact area. As a result, during the review of the EIS for prediction identification, those sections involving Argentia were not considered and the content-analysis for predictions was limited to those sections relevant to the St. John's and Come By Chance impact areas.

Table 5.1: **The Number of Impact Predictions Under Each of the Ten Socio-Economic Impact Categories Within Volume IV of the Hibernia EIS**

Impact Category	**Number of Predictions**
1. Industry	3
2. Employment	4
3. Demography	6
4. The Fishery	13
5. Housing	12
6. Public Services/Commercial and Industrial Infrastructure	21
7. Community/Social Infrastructure	67
8. Land and Resource Use	9
9. Municipal Government and Finance	3
10. Newfoundland Social Fabric	5
Total	**143**

The EIS content-analysis yielded 143 socio-economic impact predictions. The ten impact categories contained within Volume IV of the EIS are outlined in Table 5.1 along with the number of predictions identified within each category.

The list of predictions included general, non-quantitative statements of change, as exemplified by the following prediction regarding project impacts on tourism in the province:

> Overall, the tourism industry could be positively affected by project activities, since construction of the Fixed Production System might be of interest to Newfoundlanders and visitors from outside the province (Mobil, 1985:323).

Other predictions consisted of tables containing quantitative data. Where such tables contained more than one item, i.e. predicted values for several years, all items in the table were treated as only one prediction. As an example, Table 4.5-5 within Volume IV of the Hibernia EIS provides demographic projections for the St. John's Impact Area. Of these, the values for the years 1986-1990 as well as the cumulative value for 1990 were included as part of the audit data, however these six values were counted as only one prediction.

It must also be pointed out that, due to the unforeseen delays in the project schedule, time-related modifications to some of the predictions were necessary. Project development activities initially were scheduled to commence in 1986. As a result, the EIS contains predictions starting with this year and spanning the period up to and including the year 2006. However, construction development activities were delayed some four years and work on the production platform did not begin until October 1990. As a consequence, when assessing the accuracy of the predictions, a straightforward comparison of the predicted and the actual values is not possible. As an example, the predicted housing demand value for 1991 in the EIS cannot be compared to the actual demand in 1991 as that year in the EIS represents year six in the original project schedule whereas in reality 1991 was only the second year. Since no updating of the predictions was undertaken by the project proponent, in order to address this mismatch in data, EIS predictions for the years 1986, 1987, 1988, 1989 and 1990 -- the initially-anticipated first five years of operations -- were compared to the results for the actual first five years of project activities, i.e. 1990, 1991, 1992, 1993 and 1994.

5.2.3 Screening and Coding of Impact Predictions

Prior to predicted-actual impact comparison, each of the 143 predictions was screened and coded according to its suitability for audit. The following codes were assigned:

G: wording of prediction too general for audit
C: prediction contingent upon other events which have not taken place
NR: prediction no longer relevant due to project changes
NYR: prediction not yet relevant because specified time period has not yet been reached
DS: prediction is a descriptive statement of quantitative data presented
R: a repetitive statement of impact already discussed
S: prediction suitable for audit

Based upon the above classification scheme, more than half of the predictions, 78 (54.5%), were determined as suitable for audit while 65 (45.5%) were considered unsuitable. Seventeen (11.9%) of the 143 predictions contained wording that was too general or vague for auditing purposes. Similarly, 17 (11.9%) were no longer relevant as a result of changes to project design and location. Eleven (7.7%) of the predictive statements were repetitious of a previously discussed prediction. Another seven predictions (4.9%) were conditional upon events which have not occurred and the same number were classified as descriptive statements of quantitative data presented. Finally, six (4.2%) of the predictions are not yet relevant as they involve

Table 5.2: Summary of Classification and Category for the 143 EIS Impact Predictions

*Category/ Classification	Industry	Employment	Demography	Fishery	Housing	Public Services	Commercial/ Social Infrastructure	Land/ Resource Use	Municipal Govt/ Finance	Nfld. Social Fabric	Total
General(G)	3	0	1	0	0	2	3	2	2	4	17
Conditional(C)	0	0	0	3	0	2	2	0	0	0	7
No Longer Relevant (NR)	0	0	1	9	0	4	0	2	0	1	17
Not Yet Relevant (NYR)	0	0	0	1	0	0	5	0	0	0	6
Descriptive Statement (DS)	0	0	0	0	5	0	2	0	0	0	7
Repetitive Statement (R)	0	0	0	0	3	1	6	0	1	0	11
Suitable for Audit (S)	0	4	4	0	4	12	49	5	0	0	78
Total	3	4	6	13	12	21	67	9	3	5	143

a future time frame. Table 5.2 summarizes the classification of predictions within each of the ten impact categories.

The majority of the total set of predictions identified in Table 5.2 relate to commercial and social infrastructure issues with a total of 67 (42.2%). The category involving public services is the next largest with 21 predictions (14.7%) followed by the categories involving fishery issues and housing issues with thirteen (9.2%) and twelve (8.5%), respectively. The land and resource use category contains nine predictions (6.3%) while the remaining five categories each contain six or less predictions.

In terms of those predictions suitable for audit, 78 (54.5%) of the 143 predictions in Table 5.2 fall into this category. In the case of four of the ten categories -- Industry, Fishery, Municipal Government/Finance and Newfoundland Social Fabric -- none of the predictions made in the EIS were included for audit.

The relevance of some of the above predictions is significantly affected by the five year delay between the time that the EIS was completed and commencement of project activities. Similarly, the post-EIS decision to move the GBS construction site to Bull Arm has significantly affected the relevance of many of the predictions. While the GBS construction project was exempted from the provincial EIA procedures, this exemption was granted subject to the development and implementation of an Environmental Protection Plan (EPP), which outlines procedures to be employed to eliminate or reduce the adverse project impacts and to enhance any beneficial outcomes (see section 3.2.5.1). As a consequence, the GBS contractor compiled an Environmental Protection Plan (EPP) (NODECO, 1991). Because the EPP provides an update of the socio-economic issues of concern associated with the project, it was content-analysed for predictions. The content-analysis of the EPP produced 50 predictions which were screened and coded. Twenty-nine of the predictions prove suitable for audit while of the remaining 21, five contain phraseology too vague or general, fifteen are not yet relevant and one was repetitive of a prediction identified earlier in the documents (Table 5.3).

To illustrate the different codes assigned to the predictions, specific predictions taken from the EPP are presented below. The following prediction specifically identifies the likely number of commuters travelling to and from the GBS site on a daily basis. As a result, this prediction was coded as suitable for audit.

> It is estimated that a peak of 650 workers may commute on a daily basis between the site and a variety of communities (NODECO, 1991:4-10).

Table 5.3: EPP Predictions: Classification and Category Summary

Impact Category	Number of Predictions	*Classification
1. Employment	1	S
2. Demography	1	S
3. Housing	4	S(3); G
4. Public Services/ Commercial/Industrial Infrastructure	7	S(7)
5. Community/Social Infrastructure	10	S(10)
6. Land & Resource Use	1	G
7. Social Fabric	2	G(2)
8. Commercial Fishery	24	NYR(15);S(8);R(1)
Total	**50**	**S(29);R(1);G(5);NYR(15)**

* S: prediction suitable for audit: G: wording of prediction too general for audit: R: repetitive statement of impact already discussed: NYR: prediction not yet relevant

This next prediction, on the other hand, is very general in describing the potential impacts of the project on local society and culture:

> new interest groups which gain legitimacy because of the project, may emerge within the community and become a permanent component of its social infrastructure (NODECO, 1991:4-19).

This specific prediction was excluded from the audit because of its vagueness.

Many of the predictions in the EPP involved impacts relating to activities in the project schedule which have not yet occurred. These were coded as "Not Yet Relevant" and obviously could not be audited. For example, the prediction which follows addresses the potential interference to fishery/marine traffic when construction of the Hibernia production platform is completed and is being towed out to the oilfield:

> The transport of the Platform from the top of Trinity Bay to the Hibernia Oilfield may interfere with fishing vessels or other marine traffic operating along the proposed route (NODECO, 1991:4-4).

The socio-economic issues addressed in the EPP were compared to those in the EIS. It was found that some of the issues discussed within the EIS were excluded from the scope of the EPP as they were deemed no longer relevant, while those still relevant were updated in the latter document. Predictions associated with the irrelevant issues were eliminated from the list and those outdated were replaced by those revised in the EPP. In the end, 21 of the 78 EIS predictions were struck from the list and 29 EPP predictions added to it for a total of 86 "suitable" predictions. It should be reiterated that because the EPP concerns only the Local Impact Area, none of the predictions added to or removed from the list relate to the St. John's Impact Area.

5.2.4 Monitoring of Impact Predictions

Those predictions identified as suitable for audit were then reviewed in light of the available project monitoring data. The results of this review indicate that of the 86 predictions, 67 (77.9%) could not be followed up due to a lack of project monitoring data. Of the 19 predictions (22.1%) for which monitoring has been conducted, the data available for eleven of these are insufficient or inadequate to evaluate their accuracy. As a result, only eight predictions (9.3%) were auditable.

The eight predictions included for audit fall into four impact categories: two are employment-related; three involve housing issues; one is of a demographic nature; and two are fishery-related (see Table 5.4).

Table 5.4: Final Set of Auditable Predictions

Impact Category	Number of Predictions
1. Employment	2
2. Demography	1
3. Housing	3
4. Fishery	2
Total	**8**

This absence of monitoring data is not due to the fact that the monitoring of impacts was not considered. In fact, the importance of monitoring was discussed during the public hearing process and was highlighted as one of the recommendations of the Hibernia Environmental Assessment Panel (HEAP, 1985), and commitments were subsequently made in the EPP to monitor both the project-related bio-physical and socio-economic impacts.

A provincial government management structure was developed to oversee the project in which the Hibernia Construction Sites Environmental Management Committee (HCSEMC) is the body responsible for coordinating monitoring associated with the GBS construction (see section 3.2.5.3.). Since the start of the project, HMDC and NODECO have been responsible for the bio-physical monitoring at the GBS site and a custom-designed monitoring program has been established. For example, a five year marine environmental effects monitoring program for the GBS construction site has been designed to measure sediment levels and numbers of blue mussels and winter flounder in the Bull Arm area (LGL Limited, 1994). In addition, NODECO, in its EPP, outlines a self-regulatory environmental compliance monitoring program wherein it was to monitor its own activities for compliance with laws, regulations, permits, authorizations and contractual or environmental impact assessment agreements (NODECO, 1991:9-1).

The monitoring of the socio-economic impacts of project activities has been the responsibility of the provincial government. HCSEMC has required the companies to provide certain data -- housing, employment, site delivery traffic -- and has relied on government departments for other information. However, unlike the bio-physical monitoring programs, there has been no attempt to link the socio-economic monitoring results to the impact predictions through a hypothesis-testing approach.

As a result of the above initiatives, monitoring has been and continues to be conducted. For example, HCSEMC since 1992 has been producing a quarterly review which summarizes the monitoring of such socio-economic variables as on-site employment, the proportion of project employment occurring in each of the four provincial economic regions, training, social assistance, daycare/pre-school enrolment and residential/commercial land sales. HMDC also produces quarterly housing reports which describe the distribution and quantity of project accommodations within St. John's and the Local Impact Areas. Socio-economic issues are also summarized in HMDC's Environmental Protection Plan Annual Reports.

Notwithstanding the commitments to and the assignment of responsibility for monitoring, to date, the monitoring of the socio-economic impacts associated with Hibernia has been deficient in several respects. The first involves the tardiness of implementing certain monitoring programs and studies. For example, the responsibility for monitoring the socio-economic impacts of the GBS construction project lies with HCSEMC. While project activities at the GBS site began in October 1990, a socio-economic monitoring program was not formally approved by HCSEMC until January 1993, some two years and four months later. Furthermore, the effective monitoring of many of the social and economic impacts is contingent upon knowledge of the demographic activity associated with the project. However, the initial study of the demographic impacts within the Local Impact Area was not completed until May 1994 (Newfoundland Statistics Agency, 1994). As another example, the potential increase in housing rental rates within the Local Impact Area and the negative consequences of such an increase for people on low and fixed incomes is an issue discussed within both the EIS and the EPP. However, it is not possible to determine whether such an increase has occurred as pre-Hibernia baseline studies were not conducted and that the first rental market survey for the Local Impact Area was not undertaken until 1994, with the final report being submitted to the Hibernia Project Monitoring Committee (see section 3.2.5.3) in November of that year.

Other weaknesses of the socio-economic monitoring being undertaken are associated with its process, purpose and function. The monitoring process includes the collection, storage, retrieval and analysis of data. The analysis component involves a comparison of the results at different time intervals in order to identify any changes that have occurred and to assess their significance and their relationship to the project (Storey *et.al.*, 1991:5-6).

The monitoring process for several of the Hibernia-related socio-economic components has been incomplete in that data are being collected but the analysis phase of the process is lacking. The traffic movement data set is a case in point. One of the issues of concern discussed in the EPP is the potential increase in traffic along the Trans-Canada Highway associated with the GBS construction site at Bull Arm. In particular, concerns were raised about the increased traffic congestion at certain times of the week and the potential hazard to children being bussed to school. To address the congestion concerns, traffic counters were placed at various locations along the Trans-Canada in proximity to the Bull Arm site. Over the past several years a data set has been compiled, however, up to the time of writing no comprehensive analysis of these data had been carried out.

With regard to the potential increased risk to school bussing, efforts have been made to track the number of project-related vehicles traversing the school bus routes during the peak morning and afternoon bussing periods. The volume of such project-related traffic is provided within some of the monitoring reports.

However, the significance of these statistics is not described. For example, such questions as to whether this volume of traffic is acceptable, whether it compromises the safety of the school children, how this traffic compares with non-project traffic and whether the cumulative effect of project and non-project traffic is problematic are not addressed within the monitoring reports. Consequently any predictions associated with this issue cannot be subject to audit as there are no or insufficient data to do so.

Table 5.5 summarizes the results of the prediction identification and the screening components of the Hibernia socio-economic impact audit. The prediction identification procedures yielded a total of 193 predictions, 143 in the EIS and 50 in the EPP. Of these, 185 were excluded from the audit for the following reasons: 22 were imprecisely phrased: seven were contingent upon other conditions which did not materialize; 38 were no longer relevant given the existing project context; 21 were couched in a future time frame; seven were descriptions of quantitative data; twelve were repetitive predictions; and 78 predictions could not be assessed due either to a lack of or insufficient project monitoring data.

Table 5.5: Summary of Results of the Screening Component

Prediction Classification	Number of Predictions
General (G)	22
Conditional (C)	7
No Longer Relevant (NR)	38
Not Yet Relevant (NYR)	21
Descriptive Statement (DS)	7
Repetitive Statement (R)	12
Insufficient Monitoring Data (IM)	11
No Project Monitoring Data Available (NM)	67
Auditable (A)	8
Total	**193**

5.3 Accuracy of the Eight Auditable Impact Predictions

The eight auditable predictions fell into two general categories, those of a non-quantitative nature and those containing quantitative data. There were three predictions in the first category while the remaining five predictions were couched in quantitative terms.

5.3.1 Non-Quantitative Predictions

The three non-quantitative predictive statements were found to be accurate descriptions of actual project outcomes. Two of these predictions address potential impacts on the fishery, and in particular predict that project-related traffic may result in damage to fishing gear in the Bull Arm area, while the other prediction involves house and land prices in the St. John's area.

Fishery Impacts

The Environmental Protection Plan (NODECO,1991) for the GBS construction project in the Bull Arm area outlines the potential effects on the various socio-economic and bio-physical environmental components. The two predictions involving the fishery which were included for audit were specific to the site development phase and GBS construction and Topsides fabrication activities in the drydock. The two predictive statements are presented below:

> Movement of project vessels within a designated traffic lane down Trinity Bay and into Bull Arm may interfere with normal fishing and vessel operations...damage fishing gear or fishing boats along the traffic route... (NODECO, 1991:4-2).
>
> Project vessels which do not confine themselves to the designated traffic lane may damage gear or fishing vessels operating along both sides of the traffic lane route (NODECO, 1991:4-6).

Project information indicates that some damage to gear has been reported. In 1992 two claims for fishing net damage were made and subsequently settled to the satisfaction of both the claimants and the project management (HMDC, 1994).

Housing Impacts

The other prediction within this category addresses potential increases in house and land prices in the St. John's area. It was predicted that project demands would not result in a significant increase in either land or house prices:

> neither land nor house prices are expected to increase significantly as a direct result of the demands of the [Hibernia] development (Mobil, 1985:263).

The monitoring data indicate that the housing demands associated with the project were easily absorbed by existing supply and did not result in a rise in the price of land or houses, which is consistent with that predicted. In fact, according to data collected by the Canada Mortgage and Housing Corporation (CMHC), Hibernia personnel have helped absorb some of the higher priced houses on the market in the St. John's area. In terms of increased house prices, according to CMHC average MLS sale prices in the St. John's area rose only marginally from $88,993 in 1990 to $92,011 in 1994, an increase of 3.4 percent (Woodman, pers. comm., 1995). However, whether this increase was a direct result of Hibernia could not be determined.

In any event, Hibernia activities did not result in significant increased demand for housing in St. John's. To date there has not been a need for specific action in terms of constructing additional housing units or developing additional building lots as a result of the project. As a consequence, the price of houses and land in the area was not significantly affected.

5.3.2 Quantitative Predictions

Of the five predictions within this category, two address employment issues within the Local Impact Area, one involves the incremental resident increases at the work camp and the remaining two consist of annual incremental housing forecasts for the St. John's and Local Impact Areas. Monitoring data indicate that project outcomes are not consistent with any of these five quantitative predictions.

Employment Predictions

The first of these predictions concerns the number of project-related jobs to be created in the Local Impact Area. Table 5.6 contains both the predicted and actual annual number of jobs (in persons) for 1990 to 1994. As indicated, some predictions over-estimate while others fall short of the jobs actually created. For example, it is predicted that by 1992 the number of project jobs would reach 1,155 while only 898, or 77.7 percent of the predicted value, were reported. However, in 1994 the job total was 4,019 -- 77.4 percent higher than the 2,265 predicted in the EIS.

The second employment-related prediction describes the peak number of workers at the Bull Arm site:

Table 5.6: Predicted and Actual Number of Hibernia Jobs Created in the Local Impact Area, 1990-1994

Year	1990	1991	1992	1993	1994
Predicted	250	850	1155	1465	2265
Actual	116	972	898	3060	4019

> It is estimated that the GBS construction project will employ, at peak, in the order of 3,600 workers at the Bull Arm site. The number of employed will rise from 1,600 in the 2nd quarter of 1992 to 3,600 in the 2nd quarter of 1993, and remain constant until the end of 1993. The labour force will decline rapidly to 2,600 in the first half of 1994 and decrease from 2,500 at the end of 1994 to close to zero by the end of 1995 (NODECO, 1992:4-5).

However, project information indicates that the actual number of workers at the Bull Arm site has surpassed that originally predicted. For example, as of July 1995, the total workforce on site was reported as 5,779 -- 61 percent higher than the 3,600 forecast.

Work Camp Predictions

A major concern expressed during the Hibernia public hearings was the project's potential adverse demographic impacts in the communities adjacent to the GBS construction site, particularly in terms of housing and community services. In order to avoid or lessen such impacts, a self-contained work camp was constructed at the Bull Arm site. The capacity and elements of this work camp are outlined in the Hibernia EIS (Mobil, 1985).

The EIS outlines the annual work camp increments for 1990-1994 as well as the cumulative value for 1994. Again, the individual increments predicted differ from those realized, sometimes above and other times below the reported levels (see Table 5.7). However, similar to the on-site workforce, the 1994 actual cumulative accommodation level is considerably above the predicted value. For example, it is forecast that at the end of 1994 work camp occupants would total 1,465. However, as of June of that year, the reported number was more than double this, as 2,969 persons were living on site. Since then, project design changes have resulted in an additional 480 individual rooms being added to the camp, bringing its total capacity up to 3,480.

Household Forecasts

The final two predictions consist of annual incremental household forecasts for the St. John's and the Local Impact Areas from 1990-1994 (see Table 5.8 and Table 5.9). In the case of St. John's, the project impact on housing demand is less than anticipated, with all the predicted increments exceeding those reported. While the difference between the predicted and actual is a high as 145 -- for 1992 the predicted demand (210) is more than triple that actually reported (65) -- the difference in the 1994 cumulative demands is 31, 262 versus 231. In contrast, analysis of the Local Impact Area data (Table 5.9) reveal that actual project demands generally surpass those predicted. however the differences were smaller than those for St. John's. For four of the five years, 1990-1993, 31 is the largest

Table 5.7: Cumulative Increments at the Bull Arm Work Camp: Predicted and Actual Values, 1990-1994

Year	1990	1991	1992	1993	1994
Predicted	143	546	751	958	1465
Actual	NA	673	642	2569	2969

Table 5.8: **Cumulative Household Increments St. John's Impact Area: Predicted and Actual Values, 1990-1994**

Year	1990	1991	1992	1993	1994
Predicted	41	67	210	234	262
Actual	NA	NA	65	98	231

Table 5.9: Cumulative Household Increments Local Impact Area: Predicted and Actual Values, 1990-1994

Year	1990	1991	1992	1993	1994
Predicted	7	35	49	63	96
Actual	NA	56	80	90	91

difference. In 1992, 80 houses were occupied by project employees compared to a forecast of 49. In 1994, however, the actual demand is exceeded by that initially predicted. The difference in this case is only five -- 96 versus 91.

5.4 Predictive Accuracy and General Project Outcomes

Because of the small number of predictions that were suitable for inclusion in the final audit, it is difficult to formulate any general conclusions regarding the accuracy of the Hibernia-related socio-economic impact predictions.

However, based on the findings of the audit and other project information, only general comments can be made with respect to the nature of the actual project consequences. To date, the negative socio-economic impacts of the Hibernia project have been minimal and most project impacts generally have been positive. The project-related demographic changes have been such that any impacts have been easily absorbed while local industry and residents have benefitted from the business and employment opportunities associated with the project. In fact, for many areas of Newfoundland, the spin-offs from Hibernia have been the only bright spot in a generally declining economy over the past five years.

With regard to the adverse impacts of the project, these have proved much less significant than had been originally anticipated before and during the Hibernia public review. The mitigative measures designed and implemented thus far have been successful in addressing the potential problems identified in the project's impact assessment and review process. For example, the construction of the work camp at the GBS construction site has been effective in reducing the level of interaction between project employees and surrounding communities. As a result, the initial concerns regarding higher house prices, increased crime rates, an over-extension of existing public services and infrastructure and a general "erosion" of Newfoundland's "social fabric" have not materialized.

The results of the Hibernia audit can be used to comment on certain aspects of EIA auditing, EIA itself and environmental planning. This audit investigation helps to identify the shortfalls and inadequacy of the approach to and current procedures employed in EIA auditing. The fact that only eight of the 193 socio-economic impact predictions made for the Hibernia project are suitable for final audit suggests the need for an alternative auditing procedure and/or revision to the way in which EIS predictions are presented. Also, the standard focus of the EIA audit illustrates some underlying limitations of the contemporary EIA approach itself as well as the general environmental planning process. These issues comprise the focus of discussion in Chapter VI.

Chapter VI THE IMPLICATIONS OF THE FINDINGS OF THE HIBERNIA AUDIT

6.1 The Socio-Economic Impact Audit Procedure

The procedure employed in the Hibernia audit is based primarily upon three case studies: the U.S. Audit (Culhane, 1987a); the United Kingdom Audit (Clark *et.al.*, 1987); and the Australian Audit (Buckley, 1991). The methods used in these studies were drawn upon to develop the method applied to the Hibernia project. It should be noted, however, that the Hibernia audit addresses socio-economic issues and has a single project focus, unlike the above three studies which were all multi-project investigations and dealt predominantly with bio-physical impact predictions.

The findings from this audit mirror those of the above three case studies. Three general conclusions emerge from this and other audits. The first is that the required components for conducting the audit are either insufficient or absent. Three types of procedural difficulties are found -- nebulous wording of predictions, temporal factors and inadequate monitoring -- which result in a large proportion of the predictions being unsuited for audit (see section 5.3.3). The second conclusion is that the auditing method itself is weak. Finally, the results of the Hibernia and other audits bring into question the fundamental approach to auditing. These issues are discussed further in the sections which follow.

6.2 Auditing Procedural Difficulties

When conducting the Hibernia audit, many of the problems encountered fall within the three general categories of procedural difficulties identified in other audit case studies: the nature of the predictive statements; the temporal component of the predictions and the project; and the monitoring of project impacts (see section 2.3.4).

Volume IV of the Hibernia EIS primarily outlines the issues of concern and contains relatively few predictions, similar to Buckley's Australian findings (1991:96). Furthermore, as is highlighted in several of the audit studies (Culhane, 1987a:374; Clark *et.al.*,1987:530; McCallum, 1987:737; Canter, 1985:264; and Munro *et.al.*,1986:12), the majority of the EIS predictions are non-quantitative and often are expressed in "vague and woolly language".

Time-related difficulties described within the EIA auditing literature (see Clark *et.al.*,1987:530; McCallum, 1987:737; and Buckley, 1991:96) are also a limiting factor in the Hibernia audit. Most of the predictions identified contain no time frame as to when the impacts are likely to occur. Also, the many delays to the Hibernia project schedule complicate the assessment of the predictions. A span of approximately five and a half years separated the completion date of the EIS and the commencement of project development activities at the Bull Arm GBS construction site. During this time interval, significant project changes occurred including the selection of the new site of GBS construction. As a result, many of the original predictions are irrelevant and many need to be modified in the light of new project information and changes in the "new-project" environment.

The third procedural obstacle is the paucity of adequate monitoring data (see Buckley, 1991:96; CEARC, 1988:2-3; Sonntag, 1987:451; Munro *et.al.*, 1986:13; Canter, 1985:258; Murdock *et.al.*, 1982:337; and Bisset, 1980:390). This is a major deficiency with respect to the socio-economic component of the Hibernia project as indicated by the fact that adequate project monitoring data are available for only eight of the 86 predictions identified as being suitable for audit (see section 5.2).

Three general reasons for undertaking socio-economic monitoring have been identified: compliance; project impact management; and policy evaluation. In the first instance, the data collected may be used to ensure that the project is operating in accordance with any agreements, regulations and legislation. In the second case, monitoring data may serve to identify undesirable unexpected consequences and allow for the development of responsive management measures. With respect to evaluation, the monitoring data may provide insight regarding the effectiveness of policies being implemented and developed (Storey *et.al.*,1991:5-6).

The inadequacy of the Hibernia socio-economic monitoring seems related to purpose for which the monitoring is being used. The main purpose of the monitoring undertaken for the project seems to be that of compliance, i.e. to ensure that monitoring commitments made within the EIS or the EPP are being fulfilled, and not specifically as a means for management. As a result, in some cases data have been collected or recorded but are of little value by way of managing project impacts. For example, one section within the HCSEMC quarterly monitoring reports addresses social services, an issue of concern identified within the EIS and EPP. It is reported that within the Local Impact Area the social services caseloads have increased during the course of the project. However, it is then stated that these changes cannot be directly attributed to project activities. Thus, while the social services requirements within the Local Impact Area are being monitored, the monitoring is not designed to highlight project-related change. Consequently, the resultant data cannot provide critical feedback concerning actual project outcomes. Such feedback is the primary function of monitoring and is essential for effective project impact management (see section 2.5.1).

6.3 A Revised EIS: Toward an Auditable Format

In order to overcome some of the problems associated with the auditing method employed in this Hibernia research, changes would have to be made at the EIS compilation stage. The general wording of such a large proportion of EIS predictions in the Hibernia case, as well as other case studies, indicates that the notion of auditing was not a consideration at the time of their writing. Several authors have described the "ideal" prediction for auditing purposes as one which is written in hypothesis format (Spaling *et.al.*, 1993; and Beanlands and Duinker, 1983) indicating the impact's magnitude, areal extent, time-scale, probability and significance (Clark *et.al.*, 1987:528; Tomlinson and Atkinson, 1987b:260; and Culhane, 1987a:362)(see section 4.1.2). Such a format would work toward the development of the necessary monitoring programs and increase the proportion of auditable predictions. However, while the writing of such "ideal" predictions would solve some of the procedural difficulties, there remain other issues which warrant consideration.

6.4 The EIA Process: A Shift in Emphasis

The primary objective of the EIA audits conducted to date has been to evaluate the accuracy of the predictions within the EIS by comparing these to the actual project outcomes. An implicit assumption of this approach is that the project and the future environment within which the project will occur will remain as originally projected. Only where the projected environment remains unaffected by exogenous changes and the project remains as originally conceived and implemented is it reasonable to expect that the predictions and outcomes will be similar and thus the comparison of predicted and actual project consequences would seem an acceptable approach. In reality, projects themselves and the context in which they exist are dynamic, such that changes in either may make the original predictions irrelevant. This is particularly so when there is a considerable time span between initial project definition and project completion.

Such has been the case with the Hibernia project, where 16 years have elapsed since field discovery in 1979. During this period there have been significant changes to the project context. For example, advances in the area of oil field technology since the early 1980s have resulted in changes to project design. HMDC now plans to employ directional drilling techniques which allow the drilling of most wells from the production platform. This reduces the original number of subsea components in the production area and thereby lowers the risk of damage to such components from icebergs. Also, the various fishing moratoria imposed in Newfoundland have dramatically changed the local economic and social circumstances. In such cases, the use of the original EIS predictions for audit is inappropriate, in that one would expect these predictions to be inaccurate given the changes which have occurred, and any predictions which did prove accurate would carry little credence.

The typical EIS is usually produced at a single point in time and is viewed as a definitive document of project outcomes. However, because the project can, and quite often does, change, the "static" EIS can rarely be meaningfully used as the basis for measuring expected change against actual change. In order to accommodate any project or environment changes, there needs to be a process which is dynamic and adaptive in nature. Given a set of goals and objectives for a project, the EIS must not be seen as the final product but rather as the "first cut" at impact identification and prediction. It has been suggested that the predictions within the EIS must be treated as perishable products with limited shelf-lives that require regular review and replacement (Storey, 1986:545). One way of achieving this is to revise the format of the EIS. Clark *et.al.* (1987:537), for example, propose that the EIS assume a loose-leaf form to allow for continual updating through additions and subtractions over the course of the project. Alternatively, there may need to be fundamental changes to the philosophy underlying EIA and the EIA process which arises from this.

Because the EIS document is a product of EIA, the limitations of the EIS reflect some of the underlying deficiencies in the EIA process itself. The current practice of EIA emphasizes the generation of project impact predictions. In most cases, Hibernia included, these predictions are made during the early stages of the planning process when there exists a high degree of uncertainty with respect to project parameters.

Despite this, great efforts are made to produce impact predictions. In many cases, because of the limited data available and the absence of predictive "tools" (i.e. models), the predictions made are very general, non-specific or "woolly". In other cases, where the "tools" and some data exist and assumptions can be made, attempts are made to generate *precise* predictions. For example, under the demographic impact section within the Hibernia EIS (Mobil, 1985:394), the project-related population increase into the Come By Chance Impact Area from 1985-2006 is broken down by gender across eleven age groups ranging from 0-4 years up to 50-55 years. These data indicate that in 1990, for example, of the newcomers to the area, there would be ten females between 0-4 years of age, 37 males in the 15-19 year range and three females 30-34 years old. While the monitoring data are not available to assess the accuracy of these numbers, is it reasonable to expect them to be accurate given the uncertainty involved and the various assumptions used to generate these figures? And if the predictions did prove accurate, given the project changes which have since occurred, such an outcome could only be attributed to chance and could not be taken as an indication of effective predictive techniques.

Notwithstanding the fact that the inability to accurately predict project development impacts is well-documented in the literature (see section 2.3.3), this does not imply that the practices of prediction and assessment should be abandoned. In fact, when properly used they can serve a critical function in the management of the project (see section 6.5). The problem seems to lie in the type of predictions being made and the approach to EIA in general.

There presently exists a strong preoccupation with predictive precision, whereby the primary focus is to quantify the demands of the project on the environmental variables in question. A widely held view among EIA practitioners and EIS writers is that the more quantitative and exact, the better the prediction, or as in the case of Duinker (1987), the only prediction worth having. Because of this preference and desire for quantitative precision, in many cases the prediction process becomes merely a "number crunching" exercise. As a result, quite often these impact values are "artificial" and are, therefore, not very meaningful nor very useful in terms of managing project demands. Also, the exactness of these predictions implies a spurious accuracy which can result in erroneous expectations regarding project impacts.

Because of the limitations of the existing process, it appears that a shift in emphasis is necessary in contemporary EIA. What is required when assessing socio-economic impacts, is a shift from what might be described as a "demand" perspective to that of a "capacity" perspective. That is, rather than focusing upon the demands that the project will place upon the various components of the environment, it might be more appropriate to assess the existing capacities of these environmental components.

Under the capacity approach, the need for predictive precision would be diminished. Prediction would still be essential but would require a different focus. Rather than attempting to calculate the impacts' exact quantitative values, the purpose of the prediction process would be to determine the magnitude of the impacts relative to the pre-determined supply thresholds of the various environmental components within the scope of the assessment. Thus, a more pragmatic approach to prediction, especially in the early stages of the project when the degree of uncertainty is typically highest, would involve generating predictions containing a range of impacts, with a maximum and minimum, rather than a single value. Over time, as the project parameters become more clearly defined, the predicted range of impact could be adjusted accordingly.

To use Hibernia as an example, there was concern that the project could place increased demands upon the existing housing stock within the Local Impact Area. In accordance with the demand approach, the project-related annual housing increments within this area were predicted for the life of the Project. Using the capacity approach, an assessment of the housing supply within the area would be carried out to establish the area's housing threshold, i.e. the maximum housing demand the area could accommodate without stressing the existing supply. This capacity or threshold projection could be determined by local authorities. The proponent then could assess the project's housing requirements using this threshold value. Rather than needing to predict demand exactly, a more appropriate measure would be the order of magnitude of demand relative to existing supply. Housing demands below the threshold value would be considered acceptable while any demands exceeding it would indicate the potential for negative consequences such as an increase in rental rates and/or land and house prices. Demands exceeding the threshold would, therefore, signify the need to develop mitigative strategies and monitoring programs involving input from the proponent and local and provincial authorities.

Such a capacity approach would also address one criticism of the socio-economic impact assessment (SIA) conducted in relation to the Hibernia project, that being the inefficiency of the process. The Hibernia SIA process, in striving to be fully comprehensive, devoted equal consideration to all socio-economic issues. As a result, considerable attention was given to potential impacts which were both inconsequential and easily predictable prior to the assessment process (Shrimpton and Storey, 1992:106). Knowledge of the threshold for the various socio-economic components would serve to identify those impacts which were not problematic and those requiring more in-depth examination. This would help focus the assessment on the more important issues and thereby result in a more efficient use of the assessment resources available.

This same capacity approach also could be used for the maximization of beneficial project impacts. For example, one of the primary issues associated with any development project is local employment opportunities. Knowledge of the local labour supply in the various occupations associated with the project could serve to highlight any shortages and, therefore, the type and scale of training programs required to enhance employment prospects for local residents.

The shift, then, from a demand to a capacity perspective would result in the emphasis of the EIA moving from impact prediction to impact management.

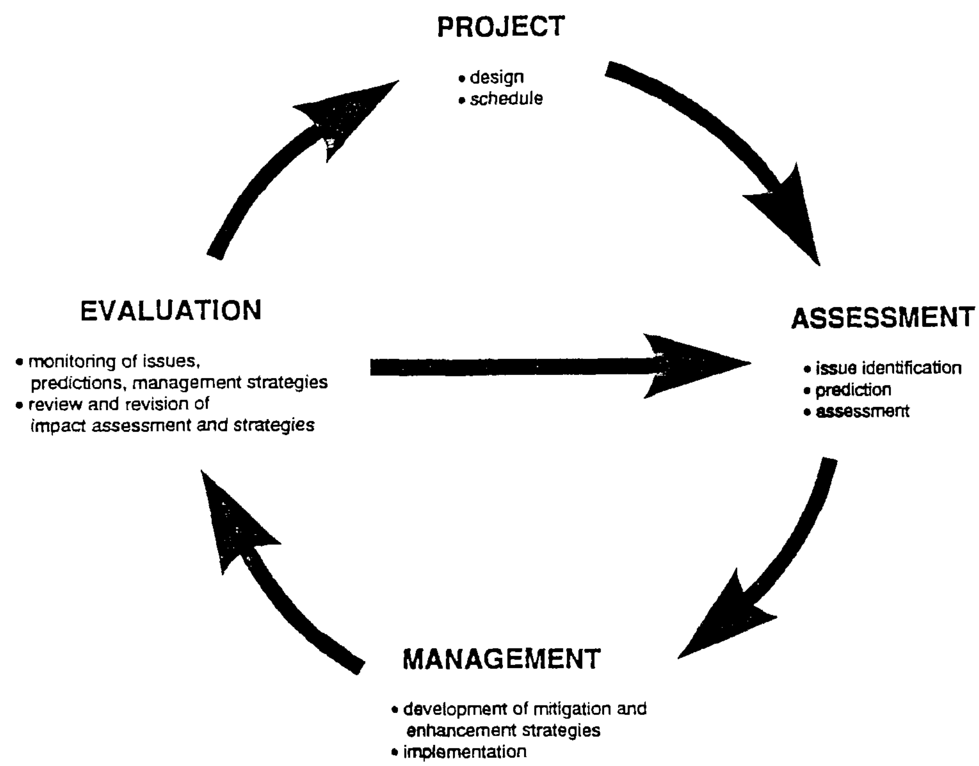
The objective is to minimize adverse impacts. Consequently, greater attention would be placed more upon the development of strategies to manage project outcomes rather than the development of techniques to precisely predict these outcomes. The problem with predicting impacts is the many factors exogenous to the project, changes to which may make the predictions wrong. As a result, there is a need to develop strategies which are flexible in order to accommodate such changes in the overall environment in which the project operates as well as the project itself to allow for quick reassessment and modification of predictions made.

Under this revised approach to EIA, the format and the role of the EIS would change. Instead of being viewed as a definitive document containing a list of precisely defined predictions, it would be treated as an initial inventory of possible project consequences at that particular point in time. It would outline the thresholds of the various environmental components under consideration, a predicted range of project impacts on these components, as well as an assessment of these predictions relative to the thresholds. The EIS, then, would not be seen as a final product of the EIA process, but rather as an ongoing working document to be referred to, reviewed and revised through the entire life of the project. As a result, the emphasis of EIA and the resultant EIS would change from impact prediction to impact management which would retain the decision-making assistance function of EIA but which is more attuned to the post-decision requirements of managing potential environmental impacts associated with human activities in an environment of uncertainty. More importantly, the adoption of a dynamic EIS would help establish an ongoing feedback link between assessment results and management decisions thereby integrating EIA into the broader environmental planning process.

6.5 The Environmental Planning Process

Over the past twenty-five years an enhanced public environmental awareness and demands for greater accountability for the environmental consequences resulting from development projects, have led to the formation of a more rigorous and formalized environmental planning process. From an initial requirement to simply determine and assess a project's potential impacts, the process has evolved and expanded to include management and evaluation components. Management involves the development and implementation of strategies designed to enhance, to avoid or to mitigate project outcomes. Evaluation is concerned with the monitoring of project outcomes and the review of them vis-à-vis the management strategies implemented. The environmental planning process is generalized and illustrated in Figure 6.1.

Figure 6.1: The Environmental Planning Process



(Source: Storey, 1995:311)

The assessment activities serve to identify, predict and assess the significance of the potential environmental project consequences. Ideally, following project approval, the results of the assessment, i.e. any information compiled, conclusions drawn and the recommended responses to address the specific project effects, should be integrated into the subsequent impact management stage. The main objectives of this stage are to avoid or reduce any adverse project impacts and to enhance any potential benefits.

The function of the evaluation component is to monitor and audit the identified issues of concern and the management schemes designed and implemented to address them. Evaluation is an essential element of the process in that it:

- ensures that the issues of concern are being addressed and the identification of any subsequent issues that may emerge;
- allows the evaluation and revision of impact predictions;
- provides information to allow an evaluation of the effectiveness of the management strategies; and
- serves a feedback function in that information generated allows modifications to the impact management process as the project proceeds and may also be used in the assessment and management of future projects.

6.6 EIA and Environmental Planning

The fundamental function of EIA is to serve as a planning tool. It is not intended to be an end in and of itself but rather a means to an end, which is to assist in decision-making associated with the project planning process. As Fromby (1990: 193) notes,

> the ultimate purpose of EIA is not just to assess impacts; it is to improve the quality of decisions.

As a result, assessment activities should be conducted as early as possible in the project planning process to allow the results to be used in the initial stages of project decision-making. However, because project decision-making and planning continue throughout the life of the project, assessment should also be an ongoing exercise. When the project commences, management plans and optimization strategies should be in place. Ongoing monitoring would then provide current information with which to evaluate the effectiveness of the mitigation and allow the identification and assessment of any unforeseen impacts. This information would then be used by managers to make any necessary modifications to the impact management strategies (Spaling *et.al.*,1993:70). Thus, EIA must be a continuous process in order to correspond to the dynamic nature of the project and the iterative nature of the environmental planning process, as depicted in Figure 6.1.

While the potential value of EIA to decision-making and the need for a continuous assessment process are widely acknowledged, current EIA and planning practices show little evidence that these have been either adopted or addressed. Some would argue that rather than being used to assist decision-making, EIA is becoming "decreasingly related to actual decisions" (Fromby, 1990:93). Quite often, EIA is employed as an *ex-post-facto* exercise. Typically, major decisions with respect to project alternatives and planning are made prior to conducting the EIA. The EIA is then used largely to generate mitigative measures for the pre-selected project (Ortolano and Shepherd, 1995:15) and the EIS is designed to support the decisions already made (Ensminger and McLean, 1993:48-49).

This post-decision employment of EIA is an indication of what Ortolano and Shepherd (1995:15) term "the integration problem", i.e. the failure to integrate EIA into the project planning process. Two primary causes of the integration problem are identified. The first involves the low priority or low degree of significance assigned to environmental considerations by project proponents. Quite often, environmental objectives "take a back seat" to other considerations, such as the internal economic rate of return (Ortolano and Shepherd, 1995:15). The second cause is the cost of undertaking an EIA. The EIA undertaken for military low-level flying exercises in Labrador, for example, took nine years to complete, from 1986-1995, at a cost of several million dollars. Thus, proponents would rather wait until the project is well-defined and has a high probability of being approved before investing in an EIA (Nelson, 1993 and Hirji, 1990 as interpreted and cited in Ortolano and Shepherd, 1995:15).

Thus, rather than being seen as a component of environmental planning, EIA has been generally viewed and treated as a separate process to be undertaken solely for the purpose of receiving development approval (Bisset and Tomlinson, 1988:126). In addition, the approach to EIA has not been of an active and continuous nature which recognizes the role of interaction and feedback within the process. Instead, a discrete approach to EIA has been assumed which has resulted in the process being carried out as a sequence of individual static tasks, beginning with the proponent's initial development application and ending with the decision regarding project approval (Spaling *et.al.*, 1993).

The reason for the discrete view and approach to EIA is related to the fact that much of the EIA research to date has focused upon the "front-end" of the process, i.e. scoping, screening and the identification, prediction and assessment of impacts (McCallum, 1987:743) rather than the "back-end" or post-approval stage of the process. In the past decade, the scope of the research has broadened with the notion of follow-up now being addressed with research being undertaken to determine the effectiveness of the "front-end" initiatives in managing the environmental consequences of the particular project. However, doing things in separate stages, where they are 'independent' of one another, fails to 'integrate' the pieces so that the 'back end'is considered when the 'front end' is being designed.

6.7 Monitoring and Auditing: Fundamentals for Follow-Up

The two fundamental components of effective follow-up are monitoring and auditing. While these two processes are discussed separately here, they are very much related. Monitoring involves a series of periodic and systematic data measurements over an extended period of time in order to detect change and to determine the nature of this change. The auditing process collates the monitoring data and evaluates the project-related changes relative to the predicted outcomes and the mitigative measures implemented. Thus, the success of the audit depends largely on the quality of the monitoring data and process which, in turn, can be evaluated and, if necessary, improved using the results of the audit.

The greatest value of monitoring and auditing, then, lies in their provision of critical feedback concerning both project consequences and the effectiveness of the implemented management schemes. The resultant information can benefit the management and planning of both the specific project ongoing at the time as well as subsequent projects.

The establishment of effective formalized monitoring and auditing procedures would also serve in transforming EIA from its current status as a discrete and static, "one-time-only", pre-approval process, into an adaptive, iterative process that continues for the life of the project. As well, the institution of formal follow-up procedures would help to overcome the fundamental flaw in the present environmental planning process, the "isolation" of the impact assessment phase. Ongoing monitoring activities from the pre-project to the post-project phase and the regular auditing of monitoring results throughout the project would result in the integration of assessment with the other components of the environmental planning process thereby fulfilling the intended role of EIA as a decision-making and planning tool.

The requirements for and benefits of EIA follow-up activities are not a recent discovery. For example, the importance of monitoring has been expressed since the 1970s (Ortolano and Shepherd, 1995:20) and the former Canadian federal Environmental Assessment and Review Process (EARP) ended with provisions for follow-up procedures (see Figure 2.1 and section 2.2). Despite this, such activities have not been commonplace. For example, based on a review of the EIA systems in place for the Netherlands, Canada, New Zealand, the United States, the Commonwealth of Australia and the United Kingdom, Wood (1995) concludes that few systems require auditing activities while the requirements for monitoring are either non-existent, discretionary, or lack a formal mechanism to ensure compliance. However, the recent increase in follow-up-related research has highlighted the demand for formal auditing procedures, as illustrated by the concluding remarks of McCallum in his review of environmental follow-up to Canadian federal projects:

> EIA programs and legislation have slowly brought real changes in the way projects are planned. It is suggested. however, that this process is unproductive unless follow-up also takes place...It is now time for governments to incorporate follow-up into the system (1987:743).

Such demands seem to have been heeded in that the Canadian Environmental Assessment Act (CEAA) provides for the development and implementation of formal follow-up programs (see section 2.3).

6.8 The CEAA: An Improved EIA

The Act in many respects has advanced the practice of EIA in that it directly addresses some of the deficiencies of the former environmental assessment and review process. For example, provisions for an environmental mediator and the "self-assessment" approach is aimed at improving the efficiency of the EIA process and reducing the significant time delays often associated with undertaking EIA. As well, the provisions for intervenor funding may help to enhance both the level of participation and the role of interested parties in the process. Further, the explicit requirement to consider the cumulative effects of several individual projects will serve to broaden the scope of EIA from the typical single-project, local-scale perspective to a multi-project regional, and perhaps national and international focus.

From an auditing standpoint, the Act has emphasized the value of and the need for undertaking audit investigations through its specification for follow-up. While the former EARP did contain provisions for follow-up activities, there was no formal requirement that they be carried out. However, the development of follow-up programs is a formal requirement of the Act which defines a "follow-up program" as one designed for:

> a) verifying the accuracy of the environmental assessment of a project, and
>
> b) determining the effectiveness of any measures taken to mitigate the adverse environmental effects of the project (Canada, 1992:4).

The details of such programs as well as arrangements for their implementation must be indicated before the project is allowed to proceed. This consideration of follow-up in the initial stages of the project could help overcome some of the procedural difficulties experienced to date in conducting audit studies.

The Act (section 55) also requires that the details of the assessment process, including the characteristics of the follow-up programs implemented and the results of such programs, be recorded in a public registry (Canada, 1992). Such documented feedback could benefit the assessment and management of future projects.

6.9 The Limitations of the CEAA

While it can be argued that the CEAA may contribute to improving EIA, limitations within the Act have been identified. The first pertains to the scope of the Act which is primarily project-focused with no specific considerations being outlined for the assessment of federal policies and programs. As well, the substantial discretionary authority of the responsible authority and the Minister of Environment in determining which projects warrant more intensive investigation and, therefore, are referred for mediation or a review panel, is seen as another drawback of the Act (Spaling, *et.al.*, 1993:72).

Another limitation involves the definition of follow-up program within the Act. The second part of the definition is limited to management strategies designed to *avoid* or *lessen* the negative impacts of the project while ignoring the effectiveness of strategies implemented to create or enhance the social and economic benefits of the project. These, it is argued, are equally important considerations in many projects:

> many mega-projects are undertaken with economic development objectives in mind, in which case measures designed to create or enhance economic and social benefits are as important as those designed to avoid or ameliorate adverse effects (Storey, 1995:331).

The nature of the follow-up and the resultant feedback is yet another potential shortfall. While provisions within the Act which allow for follow-up and the maintenance of a public registry will establish a formal feedback mechanism that should benefit subsequent projects, there is no explicit reference to a feedback process for a specific project. As a result, the Act does not seem to promote a dynamic, iterative assessment process, but rather seems to have adopted the discrete approach to EIA. It appears that the assessment process is still treated as a one-time exercise confined to the pre-approval stage of the project. The Act emphasizes that a project cannot proceed until an environmental assessment has been "completed". Notice of this "completion" is served by the issuing of an official certificate to this regard by the responsible authority. Provisions for this certificate are outlined in section 39 of the Act:

> A certificate that states that an environmental assessment of a project has been completed, and that is signed by a responsible authority that exercises a power of performs a duty or function...in relation to the project, is...proof of the matter stated (Canada, 1992:26).

With respect to the role of EIA, it is still described as an essential planning and decision-making tool that should be applied as early as possible in project planning (CEAA, 1994:6). EIA is considered an effective means of integrating environmental elements into the decision-making and planning processes so as to promote sustainable development (Canada, 1992:1). However, in order to achieve this integration of environmental factors, the results of the assessment component must be incorporated into the subsequent management component in the planning process (see Figure 6.1).

A criticism of EIA under the former EARP was that quite often the conclusions and recommendations of the review panel, i.e. the results of the assessment phase, were not adopted or implemented into management strategies. Such was the case, for example, with respect to the recommendations of the Hibernia Environmental Assessment Panel (see Locke, 1994). However, this has been addressed by the Act (section 38:2b) which requires that the government authority responsible for the project make public the extent to which panel, as well as mediator, recommendations have been adopted and further, requires justification for any recommendations not adopted (Canada, 1992:26).

The above provisions notwithstanding, the apparent discrete approach to EIA under the Act is unsuited to the dynamic nature of both the project and the planning process, thereby preventing the full integration of EIA into the decision-making and planning processes:

> the Act fails to fully integrate environmental assessment into the planning process. It reinforces procedures and establishes institutions for environmental assessment which are parallel to but distinct from those of planning...the role of EIA in decision-making needs to shift from one of peripheral, consultative involvement to one of integrated, decisive involvement (Spaling *et.al.*,1993:72).

Chapter VII SUMMARY AND CONCLUSIONS

The notion of environmental impact assessment as a formal process began with the U.S. National Environmental Policy Act (1969). It was a response to increasing public concern regarding the consequences of human development activities on the natural and human environments.

A similar environmental awareness occurred in Canada during the late 1960s and early 1970s. The public pressed government for formal procedures to ensure that consideration be given to the environmental impacts of human activities. The federal government responded in 1973 with the Environmental Assessment and Review Process. This process was applied to all developments for which the federal government had responsibility and was in effect until 1992, at which time it was replaced by the Canadian Environmental Assessment Act.

Since its inception, the practice of environmental impact assessment has spread world-wide, with formal procedures being adopted both at the national level of most developed countries and at lower jurisdictions within these countries. For example, all provinces within Canada have formal environmental impact assessment procedures in place. Thus, considerable resources have been expended on the implementation of such procedures over the past 25 years. However, until recently, very little had been done by way of follow-up to determine whether these assessment procedures have been effective in minimizing the adverse impacts and/or maximizing the benefits of development activities.

While the importance of follow-up to assessment activities had been discussed within the research literature two decades earlier, it was not until the mid-1980s that an increased research effort arose with regard to post-assessment audits. The primary objective of these audits was to determine the accuracy of the predictions made with respect to project impacts. While many of these audits had a single project focus, three were more extensive multi-project investigations, one involving the United Kingdom (Clark *et.al.*,1987); the United States (Culhane, 1987a); and Australia (Buckley, 1991).

A common characteristic of these three multi-project audits, and in fact of the majority of EIA audits performed to date, is the emphasis upon bio-physical issues; socio-economic issues are significantly under-represented in the EIA auditing research literature. As a result, the purpose of this thesis was to investigate socio-economic impact auditing. The objectives of this research were three-fold. Drawing upon the methods discussed in the literature, a method of conducting a socio-economic impact assessment (SEIA) audit was established. The second objective was to operationalize the auditing method using the Hibernia project as a specific case study. Finally, a more general objective was to examine the role of EIA auditing in the contemporary EIA process as well as the broader environmental planning process, on the basis of earlier findings and those from the Hibernia audit.

The results of the Hibernia socio-economic audit reveal that, of the 193 predictions identified in Volume IV of the Hibernia Environmental Impact Statement and the Environmental Protection Plan for the project platform construction site, 185 were unsuited for audit. Of the eight which were auditable, three were "accurate" and the remaining five cases were found to be significantly different from those predicted. These few results precluded any definitive conclusions with respect to predictive accuracy. The generally vague nature of the predictive statements; time- and project-related changes; and the inferior quality of the monitoring data resulted in the less-than-adequate comparison of predicted and actual project outcomes.

These conclusions are consistent with those of other audit investigations: a large proportion of impact predictions proved to be untestable and project impacts were seldom accurately forecast. Such findings are not surprising given that typically, and Hibernia included, the assessment is usually conducted and predictions made at a time when there is a high degree of uncertainty regarding project design details. As a result, and particularly when there is a delay between assessment activities and project implementation, project design modifications and changes to the exogenous socio-economic factors result in a significantly different project being undertaken from that originally and, consequently, significant differences between actual and predicted project outcomes.

The results of this research, then, as well as those of other audit studies, bring into question the current method of EIA auditing. The simple accounting framework, which calculates and examines the difference between predicted and actual outcomes, is an inadequate approach given the dynamic nature of projects and the socio-economic context in which they operate. Further, the results of the existing auditing approach are of limited value with respect to evaluating the success of the assessment process in the planning for and management of project outcomes. For example, a high percentage of "accurate" predictions may not necessarily indicate effective impact management but may simply show that the predictions were generally worded and thus unlikely to be found incorrect. Conversely, a low predictive accuracy may not indicate that significantly adverse consequences have resulted, as in cases in which actual outcomes were either less severe than anticipated or lessened by mitigative strategies. Thus, what is more important at the end of the day is not the proportion of EIS predictions which proved accurate, but rather whether the results of the assessment process promoted effective decision-making and contributed to the avoidance of unexpected, the minimization of adverse and the enhancement of beneficial project consequences. The EIA auditing approach employed to date, however, does not concern itself with such considerations.

This suggests the need for a shift in the emphasis of auditing from one which focuses on the "precision" of impact predictions to one which deals with the "effectiveness" of EIA as an impact management tool. With respect to feedback, a more pragmatic function for auditing would involve determining whether the key issues were identified, what enhancement or mitigation measures were developed to address them, whether these measures were implemented and the effectiveness of those that were. Compared to the current audit approach, the results of such an exercise would seem more useful by way of feedback for the management of both current and future projects.

The focus of the existing auditing approach is a reflection of the "demand perspective" of contemporary EIA with its heavy emphasis on predictive precision. Efforts are geared toward constructing the EIS as a definitive document containing a list of precise project outcomes. Using a "capacity" approach to EIA, the EIS, instead. would be used as a working document, an inventory of *potential* project impacts. The description of these impacts would include a range of impacts rather than a single value, thereby reducing the need for predictive precision. The EIS would also indicate the significance of these impact predictions relative to pre-determined threshold values of the various environmental components within the scope of the assessment. Predictions nearing or exceeding the thresholds would highlight the need for mitigative or enhancement management measures. As a result, the emphasis of EIA, and thus the focus of the EIS, would change from impact prediction to that of impact management. Accordingly, the focus of the audit would move from the accuracy of impact predictions made to the effectiveness of the impact management strategies employed.

This is not to down play the importance of EIA. The assessment process remains essential to the initial decision-making process when determining whether the project should or should not proceed. Once the decision is made to continue, the focus then shifts from the identification and assessment of the likely impacts of the project to the management of those impacts. Assessment is still an important component of the project management phase. However, its purpose changes from simply evaluating the project's environmental acceptability to also evaluating the project's environmental management strategies. Thus, similar to the term "environmental audit", the notion of EIA has evolved and now encompasses a much broader scope than was originally intended, including both pre- and post-approval activities. Hence, the term "environmental impact assessment" is too limited to adequately describe the post-decision role of EIA and should be expanded to "environmental impact assessment and management".

Over the past decade, this evolution of EIA has resulted in a shift in emphasis from front-end, pre-approval processes to back-end or post-approval activities. Much attention has been given to monitoring and auditing, with the importance and benefit of such follow-up procedures being widely recognized. However, research literature indicates that for most recent projects monitoring and auditing programs were either never put in place or the objectives of such programs not clearly defined. In cases where monitoring was undertaken, the quality of the data often prevented any thorough audit analysis of them. As a result, from an impact management perspective, the critical feedback function of monitoring and auditing could not be fully realized.

The inadequacy of the monitoring being undertaken is related to the fact that, despite the extensive research conducted in the past decade demonstrating the importance and value of monitoring, the monitoring of project impacts is not a formal requirement under the EIA procedures of many countries. For example, a comparative review of seven EIA systems of several countries indicates, four did not contain specific requirements for monitoring, while the remaining three contained only partial requirements. In many cases, discretionary provisions exist, but in practice, these are rarely employed.

Canada's EIA procedure under the Canadian Environmental Assessment Act is viewed positively relative to procedures of other countries. The formal definition of "follow-up program" under the Act and its requirement for the development and approval of the follow-up program prior to project approval were seen as strong points of the Canadian system.

This notwithstanding, there still exist some limitations of the CEAA with respect to the notion of follow-up. For example, the CEAA definition of follow-up program within the Act addresses only the effectiveness of any mitigative measures and does not specifically include the effectiveness of enhancement strategies implemented during the project.

Another potential shortfall of the follow-up section of the CEAA involves the function of the feedback to be generated. While the provisions of the Act seem to ensure feedback to benefit subsequent projects, there is no explicit feedback procedure for the project at hand. Such a feedback mechanism is necessary to establish EIA as a continuous, iterative process to span the life of the project and in so doing to help overcome the 'integration problem' and fully link EIA with the other components of the planning process.

The CEAA was officially passed in 1992. As of November 1995, only four of the regulations designed to administer its provisions had been finalized, with the regulations/guidelines governing follow-up issues among others still in the development stages. Hopefully, the final regulations applicable to follow-up will address the above deficiencies and ultimately establish monitoring and auditing procedures as a normal and effective part of project planning and management.

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