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Office of Environment and Social Development

Final Report

TA 2078-CAM - Strengthening Environmental Impact Assessment Procedures And Capabilities In Cambodia

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International Development Research Centre
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# TABLE OF CONTENTS

| SECTION 1 | OVERVIEW and EXECUTIVE SUMMARY |
| SECTION 2 | INSTITUTIONAL DEVELOPMENT AND PLANNING |
| SECTION 3 | HUMAN RESOURCES DEVELOPMENT STRATEGY |
| SECTION 4 | FOREWORD |

REGIONAL ENVIRONMENTAL DEVELOPMENT PLANNING (REDP)

CASE STUDY REPORTS:

1. Partial Environmental Inventory of Industrial Activity in Phnom Penh
2. Preliminary Review of Socio-Economic Conditions in the Boeng Salang Area of Phnom Penh
3. Preliminary Review of the Environmental Implications of the Prek Thnot Hydro Electricity Development Project
4. Guidelines for Preparing Initial Environmental Evaluations and Environmental Impact Assessments for Palm Oil Development Projects
SECTION 1

OVERVIEW

and

EXECUTIVE SUMMARY
1. OVERVIEW AND EXECUTIVE SUMMARY

1.1 Report Contents

This project report presents a description of principal activities and key findings from the ADB Technical Assistance project no. 2078-CAM: *Strengthening Environmental Impact Assessment Procedures and Capabilities in Cambodia*. The project has been delivered for the Royal Government of Cambodia over the past 18 months by the International Development Research Centre in cooperation with Global Environmental Consulting, Ltd. and Resource Futures International Ltd.

The report is presented as 4 sections in a single volume. Another important output of the project, an introductory manual on EIA and Environmental Planning, has been produced separately in Khmer and English language versions for limited distribution in Cambodia. Each of the sectional reports stands largely on its own, and is separately numbered. This first report summarizes the activities carried out during the TA and the principal findings of the two studies conducted. The findings of these studies are presented in their entirety in the following two sections of the report.

Section 2 addresses the Institutional Development and Planning task of the TA. The objective of this task was to provide support to the Ministry of Environment in developing internal organization and management procedures to introduce REDP and EIA, and to develop jointly with MOE a plausible institutional framework for environmental planning and assessment roles, procedures and relationships within the RGC.

Section 3 of this report analyses the Human Resource Development needs of the RGC in the field of environmental planning and assessment and suggests a five-year strategic plan for HRD investments. The current human resource situation of the government is described in relation to the skills and capacities needed to implement environmental planning and assessment. Goals and time-bound targets for HRD in this field are presented. Constraints to HRD are assessed, and given the needs and constraints, a set of recommended strategic training approaches are developed. The resource requirements to implement this strategy are estimated, and priority activities described.

A major component of this TA has been the development and delivery of an extended training course on EIA and REDP in the Cambodian context. The course was delivered from October 1995 to May 1996 to 38 participants, half from MOE and the remainder from provincial environment departments and other key line agencies. In almost all cases, this course represented the first formal exposure of participants to environmental management and planning concepts and tools. The course was delivered in English, although English fluency remains low among government officials. In spite of the novelty of the material
and the difficulty of the language and concepts, attendance at lectures and participation in class discussions and individual assignments was very high.

The culmination of the training course was the undertaking by course participants of a series of field-based case study projects. A regional environmental development plan was undertaken, along with four EIA case studies in different locations and sectors. These served both to solidify and demonstrate many of the concepts introduced in the classroom, and to provide supervised field experience for the course participants. The cases were selected and introduced by the consultant team, but all fieldwork planning, preparations, data collection, report writing and presentations were undertaken entirely by the course participants, working in mixed project teams. For many of them, these cases represented the first examples of this kind of work they had ever attempted, and certainly for almost all it was the first time they had attempted to prepare reports of this scope in the English language.

All five case study reports, as revised by the participant teams, are presented in this document as Section 4. They are included here for two reasons:

(i) to provide a complete set of project documentation, as these reports represent significant outputs from the project; and

(ii) to provide readers with an impression, based on their contents, of the capabilities of the course participants upon completion of the formal training component of the TA.

A review of the documents in Section 4 will provide a good sense of the capacity of RGC staff to undertake work in this field.

1.2 Chronological Outline of Activity

The activity for this project commenced with the inception study completed at end May 1995. The inception report was submitted to the Asian Development Bank and the Ministry of Environment on June 21, 1995. English language training for 22 of the pre-selected course participants began in July 1995. The official tripartite meeting was held on August 28, 1995 in Phnom Penh, and resulted in minor revisions to the inception report, along with several variances to the original contract (please see original documents: Revised Inception Report - August 1995 and Minutes of Tripartite Meeting, 28/8/95). The revised inception report was approved by ADB in late September.

Expert advisors were in the field by early October, equipment purchases were made and the EIA Training Course was officially opened by HE Dr Mok Mareth and Mr Henry Tucker,
representing ADB, on October 16, 1995. English language training for course participants continued from October through December. All major equipment items (including car) were purchased prior to the end of 1995.

Classroom training on concepts and tools of Regional Environment Development Planning took place as scheduled in November. A coastal development case study was selected for this portion of the training, with the full support of the Ministry of Environment and of provincial officials in Koh Kong province. Case study research and preparation work began in November and the field trip was held in January 1996.

Classroom lectures continued on elements of EIA practice and methods through February and March 1996. At the same time, preparation was underway for the four EIA case studies. The final English language training course finished in March.

Institutional development strategies included ongoing advice to the Ministry of Environment, and regular contacts with the Cambodia Development Council on project review and approval procedures. As part of the Institutional Development component of the project, the consultants worked with MOE to develop an organizational structure and workplan for the newly-formalized EIA Department (referred to elsewhere in this report, by preference, as the Project Review and Monitoring Department or PRMD). Donor coordination with UNDP and USAID has been an integral aspect of project delivery. Details of major project elements are discussed below.

1.3 Training Course

The core of this capacity-building TA was a 16-week training course which provided classroom instruction and formal introduction to essential EIA concepts and skills. A total of 38 trainees were selected for this course: 21 from the Ministry of Environment (national level); 5 from key provincial environment bureaux (i.e. reporting to MOE); and 11 from national-level line agencies (CDC, MAFF, MIME, MTour, MPWT, Min of Rural Development, Ministry of Public Health). In the case of the line agencies, it proved initially difficult to get them to respond to the official invitation from MOE but eventually the ministry received nominations from all the key target agencies. Of the total number of 38 participants who started the course in October 1995, 4 withdrew due to official re-assignment. Another participant, with a high level of English competence and technical knowledge of EIA, was forced to withdraw because of excessive workload in his own ministry. Four new participants subsequently joined the course to replace these departures (all from MOE).

Classroom instruction was scheduled 10 hrs / week, with additional assignments. While some participants who had onerous job responsibilities found this schedule demanding, attendance and participation were consistently high. Initially, limited English language
capability was a considerable barrier to classroom communication. However, with continued concurrent ESL training (4 hrs / wk) and opportunities for practice in classroom discussions, English use and comprehension improved substantially. Participants with a higher capacity in English are able to explain difficult concepts in Khmer to their colleagues, and to lead discussions in either English or Khmer. Written assignments were generally completed by all participants and most were submitted promptly. Participants worked together to help each other with writing skills, which remain generally weak. They also used project computer and photocopy equipment to prepare assignments and presentations in English and Khmer.

During the first half of the training course, construction and extension of the MOE office building caused substantial disruptions to lectures, but this was resolved with the completion of new classroom facilities as the building was finished.

The classroom instruction covered introductory concepts, regional environmental planning, data collection and management, report preparation, and several key technical skills for EIA, including the use of matrices and checklists, the development of inventories, mapping and map interpretation, and basic scoping studies. Participants devoted considerable effort to basic planning and management skills, learning how to establish practical ToRs for EIA studies and to plan and organize multi-disciplinary fieldwork.

Classroom instruction included lectures and short exercises, as well as presentations made by students. At the request of MOE, specialized training in Conflict Resolution and natural resource management was organized as part of the training. Guest lectures from visiting regional experts addressed comparative issues of EIA practice in South-East Asian countries, and alternative approaches to public participation in EIA.

The EIA training component included 18 weeks of classroom instruction combined with approximately 8 weeks working on case study projects. The in-class training sessions covered all elements of EIA preparation and review as summarized in the following table:
### Stages and Steps in EIA

<table>
<thead>
<tr>
<th>Stages</th>
<th>Steps</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Screening the project</strong></td>
<td>1. deciding whether and how to apply EIA requirements; that is, whether or not to proceed to IEE or EIA</td>
</tr>
<tr>
<td><strong>B. Scoping and Identifying Issues directly attributable to the proposed activity</strong></td>
<td>2. describing the project; identifying and evaluating alternatives 3. describing the environmental conditions 4. characterizing significant issues 5. setting boundaries on the assessment 6. validating the scoping</td>
</tr>
<tr>
<td><strong>C. Predicting Impacts on the biophysical Environment and the directly related social consequences and Evaluating Significance</strong></td>
<td>7. identifying interactions between the project and the environment 8. characterizing interactions 9. defining indicators of magnitude and importance 10. identifying and applying methods for analyzing interactions 11. ranking the impacts</td>
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<tr>
<td><strong>D. Planning to avoid, mitigate, or compensate for impacts; to monitor the success of these measures as well as the accuracy of the original impact predictions; to collect, compile and analyze monitoring results and to follow-up appropriately.</strong></td>
<td>12. identifying and designing mitigation measures 13. identifying and designing monitoring programs 14. designing and implementing environmental management plans</td>
</tr>
<tr>
<td><strong>E. Making Recommendations on whether to abandon the project; proceed with the project as is; or proceed with modifications and/or under certain conditions</strong></td>
<td>15. preparing and reviewing the EIA 16. consulting with the public 17. negotiating and awarding project approvals and conditions</td>
</tr>
<tr>
<td><strong>F. Following up on the assessment.</strong></td>
<td>18. evaluating the accuracy of impact prediction 19. ensuring commitments are met</td>
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1.4 English Language Training

English language training was essential for improving basic comprehension and communication skills of the course participants. This greatly assisted them in gaining access to and understanding international project documents, consultants and advisors in future. Participants highly valued the language training and generally attended the language sessions regularly in spite of their other commitments. Those few participants who consistently failed to attend language classes were warned and then dropped from subsequent training sponsorship.

1.5 REDP Case Study

The case study was on regional environmental planning for the provinces of Koh Kong and Kampong Som. The case study was conducted as if it were an actual project, with specific Terms of Reference and a management team composed of the best students in the course assigned to oversee the implementation of the case study.

Thus, while initial guidance, technical supervision, suggestions and support were available from the expert consultants, the details of case study organization and execution were mostly up to the participants themselves to manage. The groups collected secondary data from MOE and other ministries in Phnom Penh, making use of existing provincial reports. They prepared for fieldwork by dividing the sectoral and geographical data collection responsibilities among the three groups to make better use of limited field time. Primary data was collected on site by observation and measurement of environmental parameters, according to geographical sampling scheme verified by GPS. Field work was undertaken with the full cooperation and assistance of provincial and district authorities during late January 1996.

1.6 EIA Case Studies

Four case study projects covering various aspects of EIA were carried out though there was provision in the project for undertaking only three. The studies had two main objectives:

(i) to provide the students with practical experience in executing key steps in EIA; and

(ii) to demonstrate the feasibility and value of EIA, as well as the competence of the course participants in executing them.
Case studies were therefore selected to address real issues and current problems, and linked to other capacity-building initiatives or investment projects.

For a variety of reasons, two of the EIA case studies concentrated on environmental planning and management issues in Phnom Penh:

- Phnom Penh has the greatest concentration of industrial development and most rapid urbanization in the country.
- Both projects afforded opportunities for the participants to begin building working relationships with the Municipality of Phnom Penh, local authorities and others.
- Both projects facilitated efficient use of funds and time given the proximity of the field sites and relative ease of project execution.
- Security conditions were better than in alternative rural areas.
- Both projects promised good prospects for continuing work which would build upon the products of the case studies.

Of the two rural case studies, one addressed a major infrastructure development (dam), while the other focused on an agro-industry type project impinging on valued natural resources. Both projects typify the developments which government officials at the local and national level will have to deal with. Case studies are described in more detail in the Foreword to Section 4.

1.7 Institutional Development and Planning - Executive Summary of Section 2

Analysis of Institutional Development requirements shows that environmental planning and assessment procedures are still embryonic in Cambodia. While some international donors and IFIs are helping to put in place a national development planning and public investment framework, and others have supported regional environmental planning studies, the two kinds of planning are only weakly linked by the government.

A review of investment approved to date, and anticipated in coming years as political and economic stability grows, suggests the urgent need for project environmental review mechanisms in the RGC. These should especially be capable of responding quickly and transparently to project review needs generated by foreign private investors, and by international donors (especially IFI investments in infrastructure projects).

The current status of environmental planning and assessment in the RGC is that, largely as a result of this project, technical understanding and capacity is concentrated in the MOE, with a handful of well-informed individuals in other agencies. The draft LEP identifies the MOE as having responsibility for EIA review and regional environmental
planning, in close collaboration with line agencies. However, the mechanisms by which EIAs or REDPs would be prepared by project or sub-national planners have not been specified pending approval of the LEP. Informal relationships are beginning to be established, especially between CDC and MOE, and the MIME has created its own Environment Office to focus on sectoral issues within its jurisdiction.

The EIA Department within MOE is probably inappropriately named. It is not the normal function of a government agency to conduct EIAs. More appropriately, this agency should be reviewing EIAs conducted by project proponents (private or public). For this reason, the Institutional Development and Planning report recommends re-naming the department to the Project Review and Monitoring Department (PRMD). Within this department, more attention needs to be paid to matching skills and training to the requirements of different staff positions. In accordance with regulations for government organizations, the PRMD should be structured with 4 offices, the most important of which would be the Project Review Office and the Project Monitoring Office.

EIA review for investment projects should be kept simple and transparent, with requirements, guidelines, inclusion and exclusion lists to be developed by PRMD and provided to CDC and investors. A recommended process for EIA review and project monitoring would see the responsibility for provision of information and environmental analysis by the project proponent, with technical review and monitoring the responsibility of MOE, all mediated by recommendations to the responsible government agency (CDC or Ministry of Planning).

Environmental auditing of current industrial and other operating projects is recommended to be established through provisions of sub-decrees based on the forthcoming LEP. This process should see the burden of information provision rest with the owner or operator of the enterprise, in conjunction with the responsible line Ministry. MOE will review audit information and recommend action or continued monitoring as appropriate.

Regional environmental planning is already being undertaken as the result of various donor initiatives, but these have not yet led to the establishment of clear organizational responsibility and training for this function within MOE.

In the absence of formal EIA review procedures, the workplan for PRMD for the next year should focus on: development of sub-decrees for the LEP (which is expected to be approved shortly); informal piloting of project review procedures prior to their formal approval; preparation of EIA manuals for other ministries based on materials developed in this TA; continued training and information management. On the assumption that project proposals continue at approximately the same rate as the previous two years, but that only

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1 This acronym (PRMD) is used throughout the Institutional report, and for consistency is also used in this report. The reader should keep in mind that the use of this name implies a recommended change from the current official name of the department.
a small proportion of them require a full EIA, additional staff needs for the department have also been estimated.

The resource needs for PRMD include ongoing operating costs and capital depreciation, as well as salary supplements in order to retain competent staff whose skills are enhanced through donor investments in training and HRD. These resource needs are very unlikely to be provided by the RGC under current fiscal conditions, posing a serious question of sustainability of their operation. This issue merits further study and consideration: one alternative (although it has policy implications which require careful government consideration) is the institution of a review fee as part of investment project applications to the government. The study presents indicative financial statements which show the implications of such a fee on operating funds for PRMD.

1.8 Human Resource Development Strategy - Executive Summary of Section 3

The HRD context in Cambodia is severe: after systematic destruction of the educational system and loss of most educated people in the country, there are very few individuals or institutions in Cambodia with any capability to contribute to HRD in environmental assessment and planning. Additional contextual issues which affect the delivery of HRD are that it is often difficult in Cambodian organizations for skills, once learned, to be applied; and that policies for environmental planning and assessment remain to be formalized. These factors condition the prospects for using HRD to build capacity in this field.

The number of government staff who will need training in some aspect of environmental planning and assessment is estimated at approximately 140, nation-wide. However, their training requirements and operational responsibilities vary widely.

The most important skills to be developed by government staff in environmental planning and assessment are skills in managing the process. These include communications, consultation, report and correspondence writing, and organizational skills. Technical skills are also deficient, and new information management skills will be required for government staff engaged in this field.

MOE staff can be characterized as generally young, well-educated (by Cambodian standards), but with very limited academic training and language skills. Formal training in management skills is almost non-existent. In relation to the skills requirements for EIA and REDP, capabilities are very limited.

Goals for HRD can be expressed in terms of the kinds of performance which will be expected from the people and organizations involved. Performance characteristics of government agencies involved in environmental planning are listed, along with time-bound
targets for specific activity and behaviours. Performance goal descriptors are summarized in terms of the following features of the EIA / REDP system, which interact to support each other:

- regular
- systematic
- integrated
- effective
- efficient

Performance and behaviour targets are developed for each of these goals, over three different timeframes: 1 year, 2 years and 5 years. These are summarized in a matrix (Table 1).

Key constraints to HRD in this field include:

- lack of educational and training infrastructure (resource materials, reference books, learning institutions)
- lack of familiarity with how to use such infrastructure as it is restored.
- communications and translation issues
- logistics (meeting and training rooms, telephone service, making arrangements)
- low level of government staff salaries, leading to inattention and attrition
- strong patronage systems in public administration and decision-making
- difficulty of delegating authority in government
- lack of adequate support staff
- assignment of staff to job responsibilities which do not make use of new skills
- donor approaches to programming, which inadvertently weaken HRD and capacity-building.

The recommended approaches to HRD in environmental planning and assessment relies on an “in-situ case study method”, which focuses learning (in both management and substantive technical matters) on tasks directly relevant to job responsibilities. Instruction should be linked closely to supervision and coaching of work tasks to build confidence and experience of learners. At the root of this method is a long-term relationship between a resident advisor / trainer at MOE and the trainees who are the subject of HRD.

In addition to long-term, on-the-job coaching / supervision as a mechanism for training, there will also be specific needs for short-term, intensive specialized courses. These can be prepared in modular fashion, including classroom sessions, individual or group exercises and supervised fieldwork as appropriate. The selection of topics from among a long list of potentially useful areas should be made opportunistically on the basis of immediate needs and potential applications.
Foundation topics for training of government staff include basic tools of organization and administration such as English language training, report-writing, library and reference skills. Basic training should also include training in management of people and organizations, focusing on planning, project management, team-building, performance appraisal. Information management and record systems training are also needed as an element of foundation training. All these kinds of training are best provided in direct relation to the workplace responsibilities. They should be provided in-house, and in Cambodia. For many of these topics, external expertise will be required.

Specialized or advanced topics for EIA and REDP can, like the topics above, also be offered in Cambodia. The topics selected can respond to the needs of emerging development or industrial projects as required. Attachment of MOE staff to donor-funded EIA studies would be a productive alternative training mechanism for competent staff seeking more experience with application of techniques.

However, not all training can be provided within Cambodia. International training will be required in some cases where the subject matter best lends itself to direct exposure (e.g. comparison of policies and organizations, or harmonization of government policies among neighbouring countries). In addition, formal academic training, either in Cambodia (distance education) or overseas, will be needed for a small number of future trainers and technical specialists who should be selected carefully from among interested applicants to receive funding. In all cases of large investments in training programs, formal agreements between the trainee and supervisors or senior officials may be needed to gain commitments to complete the training and make appropriate use of the skills developed. This kind of training is particularly suited to university teachers who need to strengthen their theoretical and natural science framework.

Most of the training needs will be concentrated in MOE. However, other agencies will qualify for selected short-term technical trainings on topics where they could also usefully benefit. Provincial staff are likely to be involved mainly in regards to project definition and scoping, identification of issues and impacts, engagement of stakeholders in EIA and REDP consultations, and monitoring of project implementation and follow-up. These staff should therefore have a general awareness of the entire EIA / environmental planning process, but need not develop detailed technical skills in its execution. MOE should develop training capabilities in-house to be able to provide regular training of new staff and provincial agencies.

The HRD strategy should be delivered through an on-site, full-time HRD coordinator whose principal tasks are to provide guidance to professional work, identify training needs, and coordinate the delivery of specialized training elements. Coaching of staff in the application of new skills will be an important role. In addition to the HRD coordinator, inputs will be needed from three other training experts with specialized knowledge of
management and organizational development, advanced technical aspects of EIA, and information technologies.

The fundamental conclusion of this chapter of the report is that HRD is most effective when directly linked to supervised experience and application. For some basic organizational development needs (e.g. introductory computer training, records management, report writing, library and reference skills) local organizations can provide adequate instruction in training courses which they already offer. In other cases, particularly for management and communications skills, and for technical EIA and information management skills, external expertise will be required. Very little overseas training should be required, but careful selection of candidates and support of formal academic training is a good strategy to develop talent at PPU which can, over time, form the basis for a good deal of future technical training in this field.

The resource requirements for the delivery of the HRD strategy are estimated at about $1.45 million for the first two years, and a total of about $3.3 million over the five year planning horizon. These resource estimates do not include the one-time costs of equipping provincial environment offices, nor do they include all operating costs for the government. However, they do include allowance for maintenance and replacement of equipment. Resource estimates include allowance for four international experts, plus additional regional experts and sourcing of some training requirements locally.

HRD priorities reflect the need to move quickly to develop implementing sub-decrees for new national legislation, and to establish the credibility and effectiveness of the EIA review agency by dealing with several prominent cases. These priorities will require improved management, communications and internal organization skills as well. On-the-job coaching and support is likely to be the most effective way to deliver these urgent requirements.

1.9 Summary of Recommendations

Section 2. Institutional Development

a) MOE should change the name of the EIA Department to Project Review and Monitoring Department (PRMD).

b) The PRMD should be structured with 4 offices, of which the most important will be the Project Review Office and Project Monitoring Office.

c) EIA review for investment projects should be kept simple and transparent.
d) PRMD should develop environmental information requirements, assessment guidelines, project assessment categories (inclusion and exclusion lists) as part of the preparation of sub-decrees under the LEP, and provide these to CDC and investors.

e) Recommended process for EIA review: project proponent (donor, private investor, government agency) to submit project information including environmental assessment to approval agency, environmental assessment (in accordance with guidelines) to be forwarded to MOE for review, recommendations provided by MOE to approval agency for action on project. This process to be tested on ad hoc basis before formalization by sub-decree.

f) Environmental auditing of existing and operating projects should be established by sub-decree, with burden of information provision resting with the owner / operator as a condition of standard operational practice, and under supervision of the responsible line agency. Role of MOE / PRMD should be to establish guidelines and procedures and review monitoring reports.

g) PRMD workplan for next year should prioritize development of sub-decrees; informal piloting of review procedures; preparation and use of EIA manuals and guidelines; continued training and establishment of information management procedures and systems.

h) Resource requirements for ongoing operation of PRMD should be examined in the context of overall public administration reform by the Government, and in light of alternatives for sustainable financing of modest operational costs.

Section 3. Human Resource Development Strategy

a) Recommended approaches to HRD rely on an "in-situ case study method" to focus learning in both process management and substantive technical matters on tasks directly related to job responsibilities. Instruction should be linked closely to supervision and coaching of work tasks to build confidence and experience.

b) Specific needs for intensive training and skills development should be met through delivery of modular short-term local training sessions which could include small or large group classroom sessions and supervised fieldwork and exercises. Topics should be selected opportunistically based on current needs and emerging issues.
c) Foundation training topics for environmental assessment and planning include basic tools of administration and management such as report preparation, library and reference research skills, English language training.

d) Management training should focus on communications skills, planning, project management, team-building, performance appraisal, record systems and information management.

e) Formal academic training in Cambodia (by correspondence) or overseas will be required by a small number of officials and trainers (university instructors) to build technical skills, theoretical and systematic understanding over the longer term.

f) MOE staff should develop in-house training capabilities on EIA procedures to be able to build environmental planning capabilities in provinces and in line agencies.

g) Resource requirements for five-year HRD strategic plan will be approximately $3.3 million, including allowance for 83 person-months of effort by international experts, plus additional regional and local training resource inputs.
SECTION 2

INSTITUTIONAL DEVELOPMENT AND PLANNING

Principal author: Dr Peter McNamee
# Table of Contents

1. **INTRODUCTION** .................................................................................................................. 1

1.1 Objectives of the Institutional Component ............................................................................... 1

2. **THE CURRENT INSTITUTIONAL SITUATION IN CAMBODIA FOR ENVIRONMENTAL PLANNING AND IMPACT ASSESSMENT** ................................................................. 3

2.1 Planning and Investment in Cambodia ..................................................................................... 3
  2.1.1 Planning ............................................................................................................................ 3
    2.1.1.1 Environmental Planning and Incorporation of Environmental Considerations into Development Plans in Cambodia .................................................................................................. 3
  2.1.2 Investment and Projects ....................................................................................................... 4
    2.1.2.1 Comparative Analysis of Different Sources of Investment in Cambodia ...................... 4
  2.1.3 National Public Sector Investment ....................................................................................... 5
    2.1.3.1 Participation of MOE in Review of Domestic Public Sector Investments .................. 6
  2.1.4 Investment by IFIs .............................................................................................................. 6
    2.1.4.1 Participation of MOE in Review of IFI Investments ..................................................... 7
  2.1.5 Domestic Private Sector Investment ..................................................................................... 7
  2.1.6 Foreign Private Sector Investment ...................................................................................... 7
    2.1.6.1 Environmental Reviews of Private Sector Foreign Investments .................................. 9

2.2 Legal and Policy Framework for Environmental Planning and EIA .................................. 10
  2.2.1 Elements of the Law on Environmental Protection Relevant to ADB 2078-CAM ................ 11
  2.2.2 Interim Guidelines for the CDC .......................................................................................... 12

2.3 Private Sector Capacity .......................................................................................................... 12

2.4 Environmental Departments in Other Line Agencies ................................................................ 12

2.5 Related Initiatives ................................................................................................................. 13
  2.5.1 Cambodia Environmental Management Program (CEMP) ................................................. 13
  2.5.2 Environmental Technical Assistance Project (ETAP) .......................................................... 13
  2.5.3 National Environmental Action Plan (NEAP) ..................................................................... 14
  2.5.4 FAO Environmental Impact Assessment Training ............................................................... 14

2.6 Current Staff and Expertise Within the PRMD ....................................................................... 14

3. **RECOMMENDATIONS FOR MEETING INSTITUTIONAL OBJECTIVES FOR EIA IN CAMBODIA** ..................................................................................................................... 18

3.1 General .................................................................................................................................... 18

3.2 Environmental Impact Assessment of New Investment Projects .......................................... 18
  3.2.1 Recommended Institutional Arrangements to Implement EIA ............................................ 18
    3.2.1.1 Overall Process ........................................................................................................... 18
    3.2.1.2 Organization, Roles and Responsibilities of PRMD in MOE .................................. 20
  3.2.2 Roles and Responsibilities of Project Review Office ............................................................ 24
  3.2.3 Roles and Responsibilities of Project Monitoring Office ...................................................... 25
  3.2.4 Roles and Responsibilities of the Administration Office ...................................................... 26
8. APPENDIX D : PROPOSED PROJECT COMMENT AND REVIEW IN ABSENCE OF EIA

................................................................. 57
List of Tables

Table 1: Description of existing personnel in PRMD ..................................................... 16
Table 2: Calculation of staffing needs for PRMD .......................................................... 36
Table 3: Indicative budget for PRMD ......................................................................... 38
Table 4: Indicative one year financial statement for PRMD ........................................... 40
Table 5: Bases for ranking of environmental impacts of the project .............................. 54
Table 6: Specification of what is to be provided for each assessed impact .................. 55
Table 7: List of environmental resources to be considered in environmental assessments in Cambodia ..................................................................................... 56

List of Figures

FIGURE 1: PROPOSED ALLOCATION OF INVESTMENTS UNDER THE PIP ......................... 4
FIGURE 3: DISTRIBUTION OF FOREIGN PRIVATE SECTOR INVESTMENT APPROVED TO 31 MAY, 1996, ALLOCATED BY SECTOR ......................................................... 8
FIGURE 4: DISTRIBUTION OF FOREIGN PRIVATE SECTOR INVESTMENT APPROVED TO 31 MAY, 1996, ALLOCATED TO MINISTRY RESPONSIBLE ......................... 10
FIGURE 5: RECOMMENDED INSTITUTIONAL ARRANGEMENTS FOR IMPLEMENTATION OF EIA IN CAMBODIA ........................................................................................................ 20
FIGURE 6: GENERAL ORGANIZATION OF MOE AND RELATIONSHIP OF PRMD TO OTHER DEPARTMENTS AND OFFICES IN MOE (UNOFFICIAL) ................. 21
FIGURE 7: PROPOSED ORGANIZATION OF PRMD ............................................................ 23
FIGURE 8: PROPOSED ORGANIZATION OF PROJECT REVIEW OFFICE .......................... 25
FIGURE 9: PROPOSED ORGANIZATION OF PROJECT MONITORING OFFICE ...................... 26
FIGURE 10: PROPOSED ORGANIZATION OF ADMINISTRATION OFFICE ......................... 27
FIGURE 11: PROPOSED ORGANIZATION OF PLANNING OFFICE ................................... 28
FIGURE 12: RECOMMENDED INSTITUTIONAL ARRANGEMENTS FOR IMPLEMENTATION OF ENVIRONMENTAL ASSESSMENT OF EXISTING PROJECTS IN CAMBODIA................. 29
# Acronyms and Abbreviations

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADB</td>
<td>Asian Development Bank</td>
</tr>
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<td>AIT</td>
<td>Asian Institute of Technology, Bangkok</td>
</tr>
<tr>
<td>CDC</td>
<td>Council for the Development of Cambodia</td>
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<tr>
<td>CDRC</td>
<td>Cambodia Development Resource Centre</td>
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<tr>
<td>CG</td>
<td>Consultative Group</td>
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<tr>
<td>CIB</td>
<td>Cambodia Investment Board</td>
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<tr>
<td>CIDA</td>
<td>Canadian International Development Agency</td>
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<tr>
<td>CoM</td>
<td>Council of Ministers</td>
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<td>CRDB</td>
<td>Cambodia Reconstruction and Development Board</td>
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<td>EIA</td>
<td>Environmental Impact Assessment</td>
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<td>Environmental Technical Assistance Project</td>
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<td>European Union</td>
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<td>IEE</td>
<td>Initial Environmental Evaluation</td>
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<td>International Financial Institution</td>
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<td>LEP</td>
<td>Law on Environmental Protection and Natural Resource Management</td>
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<td>MAFF</td>
<td>Ministry of Agriculture, Forestry, and Fisheries</td>
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<td>MEF</td>
<td>Ministry of Economy and Finance</td>
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<td>Ministry of Industry, Mines, and Energy</td>
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<td>Ministry of Public Works and Transport</td>
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<td>Public Investment Plan</td>
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1. INTRODUCTION

This report is a summary of the work done and results accomplished during a five week field mission to Cambodia, 14 June to 19 July, 1996 by the Principal Consultant for ADB 2078-CAM. This field mission was conducted to complete the institutional component of the Technical Assistance. This report was submitted to MOE for comment and review and subsequently revised in September, 1996 and updated, with other elements of the final report, as a result of review comments from the Bank and MOE in January 1997.

1.1 Objectives of the Institutional Component

There are two sets of objectives of the Institutional Component: Institutional Development objectives and Institutional Planning objectives.

The Institutional Development objectives are to provide advisory assistance to MOE for:

(i) coordination of the technical assistance inputs to meet the overall needs of the Government including line agencies;

(ii) development of methodology to relate EIA studies to ongoing or planned regional environmental development planning projects;

(iii) review and assessment of the present environmental staff, organization, and financial and budgetary requirements;

(iv) design of the most appropriate institutional arrangements to implement the EIA program with particular attention to organizational efficiency;

(v) identification of the technical and managerial skills that will be required by the MOE to conduct an effective EIA program after assessing existing staff capabilities;

(vi) identification of training needs and formulation of a training plan including short-term overseas training and on-the-job training; and

(vii) development of an effective approach to strengthen the EIA capabilities of related agencies including implementing agencies, academic institutions, and private sector consulting firms.

The Institutional Planning objectives are to provide recommendations for the following aspects of institutional capacity building:

(i) assessing the needs for academic and practical training for environmental staff of MOE with particular focus on training in EIA methodology;
(ii) assisting in the planning to establish an environmental library for the MOE including suggestions on practical ways to obtain pertinent reference materials;

(iii) preparing detailed sectoral EIA manuals appropriate for use by Government line agencies;

(iv) assisting the MOE in appraising the EIA program implementation capabilities of the environment staff to make optimal use of personnel and for career development; and

(v) assisting in the development of an EIA information and networking system that takes into account how development strategies are affected by EIA decisions, what activities should be subject to EIA, which types of sectoral issues such as forestry management or coastal resource management are rightfully in the domain of EIA, or whether these issues should be considered as regional planning issues, and, if so, the relationship between the administrative structures.

The Principal Consultant provided advisory assistance to MOE and other ministries with respect to the above objectives through a series of meetings, seminars, workshops. This report documents the main areas of assistance provided and the main products and outputs of the field mission.

Note that Terms of Reference elements which refer specifically to Human Resources Development (skills identification, training needs, capacity-building) have been dealt with in detail in a separate section of the final report (Section 3 Human Resources Development Strategy). This applies specifically to Institutional Development objectives (v) and (vi) as well as Institutional Planning objectives (I) and (iv) above.
2. THE CURRENT INSTITUTIONAL SITUATION IN CAMBODIA FOR ENVIRONMENTAL PLANNING AND IMPACT ASSESSMENT

2.1 Planning and Investment in Cambodia

2.1.1 Planning

Formal planning in Cambodia is in its formative stages, and developing with considerable assistance from the international development community. The overall planning process to date is focused on four major donor initiatives:

(i) development objectives and setting of national goals were defined in the Cambodia National Plan for Reconstruction and Development (NPRD);

(ii) a medium term framework was prepared in the 5 Year Socio-economic Development Plan;

(iii) a set of short term operational programs were identified through the recently completed Public Investment Plan (PIP); and

(iv) the above three planning processes were integrated into the recently completed international Consultative Group (CG) process, culminating in a donor meeting in Tokyo in early July.

The PIP is most relevant public sector and IFI investment planning process with respect to environmental issues and EIA, because it provides a list of specific projects which Cambodia is targeting for formulation and implementation in the short term. The PIP consists of a rolling three year strategic plan and a one year tactical plan which is used for budget planning and allocation. The proposed allocation of investments under PIP to each ministry is presented in Figure 1. Of particular interest with respect to EIA is the large allocation of proposed investments in: infrastructure, including aviation (MPWT); industry, mines and energy (MIME), and agriculture (MAFF).

2.1.1.1 Environmental Planning and Incorporation of Environmental Considerations into Development Plans in Cambodia

This type of activity is still embryonic in Cambodia. To date, some environmental plans have been prepared:

(i) a coastal and marine environmental management program prepared under ADB RETA 5552: Coastal and Marine Environmental Management in the South China Sea;

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1 Some of this is an update of key components of the ADB 2078-CAM Inception Report.
(ii) a National Wetlands Action Plan prepared with the assistance of Wetlands International; and

(iii) an inter-ministerial working group has been brought together to address Tonle Sap issues.

![Figure 1: Proposed allocation of investments under the PIP.](image)

The 5 Year Socio-economic Development Plan and the PIP both qualitatively assessed the impacts of proposed projects, but national development and sectoral planning in Cambodia does not at all incorporate environmental considerations. The PIP notes the environmental acceptability of investment projects, but does not use environmental criteria in ranking or assigning priority to proposed investments.

2.1.2 Investment and Projects

2.1.2.1 Comparative Analysis of Different Sources of Investment in Cambodia

There are essentially four sources of investment into Cambodia; each varies in size (Figure 2):
(i) national, public sector investment;

(ii) investment from international lending institutions (primarily the World Bank and the ADB). This is coordinated by the CRDB within the CDC under the MEF;

(iii) private sector domestic investment; and

(iv) private sector foreign investment. This is coordinated by the CIB within the CDC under the MEF.

![Figure 2: Expected sources of investment in Cambodia (1996-1998).](image)

2.1.3 National Public Sector Investment

The PIP estimates that public sector investment in Cambodia will be about US $30 million per year for the foreseeable future (MOP 1996). About US $10 million will be for counterpart funding for investments by international lending institutions, leaving US $20 million to be invested by national line ministries, provinces, and government
enterprises. It is likely that this investment would consist of numerous very small scale projects to be implemented throughout the country.\(^2\)

Public investment decisions and trade-offs appear to be made within the MOP and the CoM. Sectoral and regional plans appear to essentially consist of lists of projects to be implemented, prepared without any type of master planning process. To prepare these plans, national line ministries and their counterpart provincial line departments, as well as provincial governments, prepare a set of project proposals for submission to the MOP, the MEF, and Council of Ministers. These institutions review, rationalize, and approve projects, and assign institutional responsibilities for project implementation.

It is not clear what the institutional aspect of the project cycle is for this investment, but it likely approximates the following:

(i) line ministries and provincial governments submit project proposals to the MOP;

(ii) the MOP, together with the MEF and the CoM, selects and approves projects for funding and implementation; and

(iii) the appropriate line ministry and provincial government implements the projects.

2.1.3.1 Participation of MOE in Review of Domestic Public Sector Investments

To date, it appears that MOE has neither participated in the assessment of environmental effects of domestic public sector investments nor reviewed EIA's or IEE's prepared as part of proposed domestic public sector investments.

2.1.4 Investment by IFIs

Total investments from the two major IFIs are estimated to be about US $150 million per year (MOP 1996).\(^3\) Much of this investment for the foreseeable future is likely to be used for infrastructure rehabilitation (transportation systems, irrigation systems, general public works, energy supply, water supply, etc.) and in sectors such as health and education. Some, but not all of these will require environmental analysis, either in the form of an IEE or a full EIA. The CRDB, as a part of the CDC, coordinates this investment.

\(^2\) For example, the RGC is financing the upgrading of a portion of Highway 6 immediately north of Phnom Penh.

\(^3\) IFI commitments at the recent CG meeting totaled about US $180 million.
2.1.4.1 Participation of MOE in Review of IFI Investments

To date, the MOE role in IFI investment projects in other sectors has been limited. There have been consultations on the nature of local environmental requirements and project characteristics, but MOE has neither participated in the assessment of environmental effects of specific IFI investment projects nor formally reviewed EIA's or IEEs prepared as part of proposed IFI investments. Of course, MOE has access, along with anybody else, to project documents which have been made publicly available in Cambodia.

2.1.5 Domestic Private Sector Investment

No figures were obtained for this source of investment; it is likely that it is extremely small in relation to other sources. It is not clear what is formal institutional mechanism for the review and approval of projects funded exclusively by the domestic private sector. Land use and construction permits are the jurisdiction of local administrative units for small projects.

2.1.6 Foreign Private Sector Investment

Foreign private investment completely dominates overall investment in Cambodia (Figure 2). Foreign private investment is managed by the Cambodian Investment Board (CIB), under the CDC. The CDC was set up by the RGC as a "one stop shopping" institution for prospective investors. The CDC is a part of the MEF. Decisions on applications are guaranteed within 45 days of submission. Line ministries may be consulted in the project approval process, but there are currently no formal or regular requirements for environmental appraisal in the project application or regular environmental stipulations attached to the project approval.

There appears to be no formal, proactive set of priorities for private sector foreign investment in Cambodia, and the CDC appears to be approving projects largely in response to the priorities of the foreign investment community. What can be surmised from government documents and interviews with officials from various government departments is that the priorities for investment appear to be: agro-industry; oil and gas; tourism; hydropower; and development of Sihanoukville as an economic growth pole for the country. Furthermore, it is likely that important features of the project approval process (e.g., length of project approval period) will not change substantially for some time.

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4 Investment from development assistance institutions (i.e., ADB, World Bank, and donors) runs second.

5 The CDC also contains the Cambodian Reconstruction and Development Board (CRDB) which is responsible for development assistance.
The pattern of foreign private sector investment approved in Cambodia since the promulgation of the Law on Foreign Investment on 1 August, 1994 (Figure 3) indicate the following:

(i) a total approved investment of US $1,249 million in 249 projects over a 22 month period; 
(ii) about 135 projects approved per year; 
(iii) an average per project investment of about US $5 million; and 
(iv) dominance of the tourism, agro-industry, building materials, textiles, and construction industries.

Aggregating the data of Figure 3 according to ministry responsible (Figure 4) indicates that MIME has had by far the largest total capital investment and number of projects to date, followed by MTour, and then MAFF and MPWT.

Figure 3: Distribution of foreign private sector investment approved to 31 May, 1996, allocated by sector.

6 This, plus Figure 3 do not include a US $1,300 million tourism investment project which has been slow to materialize; this would skew some of the legitimate trends evident in the investment data.

7 The aggregation is approximate but qualitatively accurate.
2.1.6.1 Environmental Reviews of Private Sector Foreign Investments

MOE has been requested on a number of occasions to review project proposals for their environmental implications; some of these occasions are described below. The information presented below reflects the absence of clear mandates and responsibilities and the need for improving inter-ministerial relationships with respect to environmental matters:

(i) on one occasion, the CDC sent eleven project files to MOE for comment and review. These projects were about to be or had been approved by the CDC. Each project was described on a single page; the information consisted of the project name, project size (area and/or output, plus investment), project location, national partner, and name and country of the investor. MOE prepared a response that the CDC apparently rejected. Apparently, the CDC prepared their own environmental terms and conditions;

(ii) MOE received a proposal for a hydroelectric power development project in Koh Kong Province, on the border of Thailand, from MIME for comment and review. The Minister requested one of the students in the class to prepare a desk study IEE which outlined the major environmental issues and impacts of the project. CDC has since approved the project;

(iii) MOE received an already approved project for a large sand mine in Kampong Som province. This project was signed by one of the Prime Ministers of Cambodia, and MOE was asked for comment and review. Some days later, a large contingent of MOE staff, consisting of Secretary-Generals, Directors of various Departments, and some Project Review and Monitoring Department (PRMD) staff paid a visit to the proposed project site. Upon completing the project, this group conducted a meeting at the CDC, presumably to discuss their findings and recommendations;

(iv) in mid-September, MOE was asked by a private company to comment and review the environmental implications of building a logging access road through an existing protected area. The company already has a forestry concession and is seeking approval to construct and use this access road.

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8 Although presently known as the EIA Department, Chapter 3 of this report proposes a renaming of the Department to more accurately reflect its true likely function under the LEP. For the sake of clarity, therefore, the name Project Review and Monitoring Department is used throughout this report.
2.2 Legal and Policy Framework for Environmental Planning and EIA

MOE has a legal mandate under the Cambodian Constitution, approved in late 1995. More recently, the Law on Environmental Protection and Natural Resource Management (LEP) was approved by the National Assembly November 18, 1996 and promulgated December 24, 1996. Under the Constitution, the Law enters into force within 20 days of promulgation. The LEP provides the authority for MOE to develop sub-decrees for approval by the Council of Ministers, addressing specific environmental assessment procedures and project eligibility for different levels of review. The Law also provides for MOE to develop sub-decrees on pollution, site inspection and public participation. Under the terms of the Law, MOE has the authority to review and provide recommendations on all EIA studies. An unofficial English translation of the LEP, as provided by MOE, is reproduced in Appendix A.9

The legal framework for EIA is therefore still under development. Details of an EIA review and approval procedure must be worked out within MOE and with other key

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9 It is important to recognize the overall framework for laws, decrees, and regulations in Cambodia. The Constitution is the overriding legal document. Laws (e.g. LEP) must be approved by the National Assembly then promulgated by the monarchy. Sub-decrees are implementing instruments of laws; these must be prepared by the government institution identified in the approved law, and they are approved by the CoM. Finally, regulations are subsets of sub-decrees and may be prepared by the particular government institution. The entire hierarchy must be internally consistent.
government agencies. A series of specific legal instruments, in the form of sub-decrees, specifying the details of the various pollution standards, assessment and monitoring procedures, must be drafted and endorsed by the CoM. In the meantime, and to speed this process of developing detailed legal instruments, institutional relationships among agencies should be guided to evolve informally in anticipation of what can be expected in an eventual legal framework.

2.2.1 Elements of the Law on Environmental Protection Relevant to ADB 2078-CAM

Notwithstanding the fact that an official translation of the new LEP is not yet available, the unofficial draft can serve as an indicator of the major issues. There are three major themes of the LEP that are relevant to ADB 2078-CAM.

First, the preparation of National and Regional Environmental Plans would require MOE to apply the regional environmental planning expertise it has gained through the REDP component of ADB 2078-CAM. Ideally, these environmental plans should proactively lay out a rolling program of environmental investments and technical assistance as a contribution to national development planning initiatives. MOE is gaining some experience with the preparation of environmental plans through participation in the World Bank NEAP, ADB RETA 5552, and the Tonle Sap Coordination Unit. A concern with respect to the preparation of Regional Environmental Plans is the absence of any formal government coordination mechanisms at scales larger than a province but smaller than the country as a whole. Without mechanisms for coordination and implementation of these plans, they may become meaningless exercises. The Planning Department of MOE will be the most likely department to undertake environmental planning activities within MOE. However, no members of this department participated in the training courses under ADB 2078-CAM.

As an important comment to this section of the LEP, it appears that there is at present no obligation for sectoral plans prepared by various line ministries to incorporate environmental considerations, issues, and concerns.

Second, Chapter 3 of the Law, consisting of Articles 6 and 7 in the attached draft, contains specific requirements for EIA in Cambodia. Chapter 3 stipulates that:

(i) all proposed and existing projects are to be assessed for their environmental impacts. The requirement for reviewing impacts of existing projects suggests an auditing function;

(ii) MOE must specify which types of projects are to be subjected to EIAs (i.e., inclusion/exclusion lists) and how EIAs are to be conducted (i.e., process, guidelines and manuals); and

10 The World Bank is currently providing assistance to MOE in the preparation of Cambodia's first National Environmental Action Plan (NEAP).
(iii) MOE will provide an EIA review function and make recommendations with respect to project approval.

Third, jointly with other line ministries, MOE has responsibility for monitoring and the authority to inspect projects as well as for taking or recommending action if required.

2.2.2 Interim Guidelines for the CDC

In late November, 1995, an international consultant working in the CDC prepared a set of interim guidelines that the CDC might be able to use with prospective investors as a part of their application process. The CDC has not yet responded to these interim guidelines, nor have they been implemented in any form.

2.3 Private Sector Capacity

While there are individuals who can perform the role of EIA project managers and/or technical coordinators, there is not a single institution in Cambodia with the capacity to prepare IEEs or EIAs to reasonable standards. The only exception to this is the PRMD in MOE. Other individuals with this capacity who have been trained in ADB 2078-CAM currently work in various government departments and ministries. Indeed, a number of the best students of the training course have been seconded to international development projects on a long term (i.e., up to two year) basis. There are no indigenous private sector firms which have experience and capability in preparing environmental assessments.

2.4 Environmental Departments in Other Line Agencies

MIME has recently formulated an Industrial Environment Office\(^\text{11}\), and prepared a draft sub-decree that would formally bring this Office into existence. It appears that this is the first environmental office in any ministry outside of MOE. This Office has 26 staff, but a budget that covers salary costs only; the Office has no equipment whatsoever. The Office has three sections:

(i) Survey and Statistics;

(ii) EIA; and

(iii) Administration.

Two of the staff in the Office completed the ADB 2078-CAM training courses. Because of budgetary limitations and the absence of a formal legal mandate, the Office has not yet actually conducted any environmental work but is preparing workplans for particular

\(^{11}\text{This office is part of the Technical Department of MIME. The Technical Department is a staff advisory group to the line departments in MIME: Power, Mines, Industry and Handicrafts; Planning; and Administration.}\)
activities. This Office has not yet considered the opportunity to inject environmental considerations into sectoral plans for industrial, mining, or energy development. Their immediate plans are to supplement existing inventories of operating industrial facilities, which currently focus on production parameters, with measures of gaseous and liquid effluents. This represents the beginning of an auditing and facilities monitoring function.

2.5 Related Initiatives

The following projects are relevant to the ongoing implementation of environmental planning and EIA in Cambodia.

2.5.1 Cambodia Environmental Management Program (CEMP)

CEMP is a two year project funded by USAID, implemented by CARE Cambodia. CEMP has six major components:

- preparation of strategic plans for MOE; one for MOE as a whole, and one for each Department within the Ministry;
- preparation of a Biodiversity Action Plan;
- provision of a Secretariat for the NEAP (see below);
- implementation of specific applied environmental management initiatives;
- development of a Natural Resources Information Management system for MOE; and
- environmental constituency building.

2.5.2 Environmental Technical Assistance Project (ETAP)

ETAP is a three year project funded by UNDP. The overall objectives of ETAP are:

- institutional and technical capacity building in: draft environmental laws, regulations, policies, and guidelines; procedures and guidelines for the organization and functioning of provincial offices
- setting up environmental offices in a number of key ministries
- environmental education and awareness: preparation of primary and secondary education materials; training of government officials
- information management
- demonstration projects for wetlands protection and parks improvement
2.5.3 National Environmental Action Plan (NEAP)

The World Bank is funding this activity. The NEAP will identify the major environmental issues facing the country and recommend strategic plans for addressing each of the issues. At the time of writing this document, the NEAP will be covering six environmental themes:

- forestry concessions;
- protected areas;
- offshore fisheries;
- urban and industrial pollution;
- the Tonle Sap ecosystem; and
- energy developments, particularly offshore oil and gas activities and hydropower development.

The NEAP currently has no provision to explicitly develop a strategic plan for institutional issues related to environment. The NEAP will be completed by the end of 1997.

2.5.4 FAO Environmental Impact Assessment Training

FAO is preparing a modest technical assistance to train a group of MAFF staff in EIA techniques for agriculture projects and activities. As currently configured, the project will use some of the best students of the EIA training course to serve as teachers in the project under the supervision of an international consultant.

2.6 Current Staff and Expertise Within the PRMD

There are currently 16 staff in the Department (Table 1). 11 of these staff participated in the training course; all have participated in a number of short courses and workshops on various environmental matters. Assignments and positions continue to be adjusted by the Ministry as the staff complement increases. As these adjustments take place, it will be important to consider the following features of the staff list:

(i) None of the staff members have had training in basic office management, planning, or administration;

(ii) A number of the best students in the EIA training course provided through this TA are members of the department;

(iii) Staff assignments may not reflect the expertise which course participants have now developed. For example, a number of the staff that are strong technically in environmental planning and EIA may have administrative positions or remain unassigned; and
(iv) Promotion and selection of staff for technical training continues to be a compromise between the technical strength of staff and the political realities of the country.

The broader issues relating to a mismatch between technical capacity and technical responsibility in staff allocation are addressed in more detail in the final report on Human Resource Development Strategy (Section 3 of this final report).
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<td>Koch Savath</td>
<td>Director</td>
<td>M.Eng.</td>
<td>Geodesics and Mapping</td>
<td>Enviornmental Technology Process and Procedures for EIA</td>
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<tr>
<td>Ly Naroun</td>
<td>Deputy Director, Project Review Office</td>
<td>B.Eng.</td>
<td>Mining Engineering</td>
<td>Environmental Technology Mining and EIA (Viet Nam)</td>
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<td>Mok Yan</td>
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<td>Civil Aeronautics</td>
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<td>Tea Chup</td>
<td>Deputy Director, Project Monitoring Office</td>
<td>B.Eng.</td>
<td>Fisheries Engineering</td>
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<td>Tung Kun</td>
<td>Vice-Chief, Project Review Office</td>
<td>B.Eng.</td>
<td>Physics</td>
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<td>Yim Chamian</td>
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12 All positions are acting positions until approved by the RGC.
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<td>Tin Sok Samedy</td>
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<td>Electrical Equipment</td>
<td>no</td>
<td></td>
</tr>
</tbody>
</table>
3. RECOMMENDATIONS FOR MEETING INSTITUTIONAL OBJECTIVES FOR EIA IN CAMBODIA

3.1 General

First, it is proposed that the name of the Environmental Impact Assessment Department of MOE be changed to the Project Review and Monitoring Department (PRMD) to more closely reflect its likely mandate as defined under the LEP. The PRMD would be responsible for all environmental matters related to investment projects in Cambodia.

With the recent passage of the LEP, but pending the approval and promulgation of enabling sub-decrees, the MOE should proceed on an interim basis to initiate the procedures needed to support a functioning EIA and environmental planning system. The specific actions required are presented below in the form of recommendations.

These recommendations here are presented in five sections. The first four relate to four qualitatively different functions necessary in EIA and environmental planning:

(i) EIA for new investment projects;
(ii) environmental assessment of existing projects;
(iii) environmental planning; and
(iv) incorporating environmental considerations into national economic development plans such as the PIP and sectoral plans.

The fifth provides a strategic plan for the short term activities of the PRMD.

3.2 Environmental Impact Assessment of New Investment Projects

3.2.1 Recommended Institutional Arrangements to Implement EIA

3.2.1.1 Overall Process

The recommended overall process for EIA is represented in Figure 5. This overall process is hinted at in the LEP. While specifics will need to be elaborated, the essential features of the process are as follows:

(i) The LEP and its associated sub-decrees set the overall legal and policy framework within which EIAs are to be conducted and reviewed. The MOE is responsible for preparing this framework, but continues to receive legal advisory support from the UNDP-ETAP program;
(ii) As a part of its investment application package, the Investment Review Body (CIB in the case of private sector foreign investment, CRDB in the case of IFI investment projects; and line ministries in the case of domestic public sector projects) provides EIA requirements and guidelines to prospective investors. These requirements and guidelines are specific to the type of project that the investor wishes to develop, and in accordance with the sub-decrees prepared by MOE. These sub-decrees will specify categories of projects and classify different types of applicants according to the type of assessment required;

(iii) If required, the investor prepares the EA (either IEE or EIA depending upon the requirements) and submits it as a part of its formal application to the Investment Review Body;

(iv) The Investment Review Body sends the EA report to the MOE for comment and review;

(v) The PRMD undertakes screening of projects based on assessment reports received and identifies those requiring additional information, analysis or assessment studies. In the case of further detailed EIA requirements, PRMD deals directly with the applicant to ensure mutual agreement on the scoping of the required assessment;

(vi) The PRMD provides a technical appraisal of the EA and provides its recommendations to an internal Project Review and Monitoring Committee;

(vii) The Project Review and Monitoring Committee submits the official MOE response to the Investment Review Body. This response includes terms and conditions which MOE recommends be included in the License Agreement between the RGC and the investor;

(viii) The Investment Review Body takes into account MOE's recommendations in making its decision regarding the proposed project. The Investment Review Body communicates the environmental terms and conditions to MOE so that it may monitor compliance; and

MOE would be able to conduct monitoring, inspection, and auditing of the project in accordance with terms and conditions specified in the License Agreement and the MOE subdecree on inspection procedures, and make recommendations to the Investment Review Body on matters of compliance.

One of the many details of the specific EIA requirements which will have to be resolved in the process of developing sub-decrees is the role of economic analysis of mitigation options. Cost estimates for environmental mitigation, measurement and monitoring as required by the LEP and sub-decrees ought in principle to be included in the environmental assessment documents prepared by proponents, and subject to critical review by PRMD. Cost factors should also form part of the considerations of MOE in determining required mitigation measures. The development of a better analytical
capacity and information base on these elements could be the legitimate object of further study and technical support to MOE.

Figure 5: Recommended institutional arrangements for implementation of EIA in Cambodia.

3.2.1.2 Organization, Roles and Responsibilities of PRMD in MOE\textsuperscript{13}

A generalized outline of the structure of the MOE is shown in Figure 6. This structure reflects certain statutory features which are common to all government organizations, such as the position of under-secretaries, and a single administrative "Cabinet" to serve the entire Ministry. It also illustrates the parallel structure of Departments within the Ministry. Each department is formally linked only vertically through the office of the Director-General or the Minister. Cooperation between Departments on project or planning issues is generally arranged on an ad hoc or informal basis.

\textsuperscript{13} The existing organization of MOE was formulated in the absence of any formal legal mandate for MOE to even exist. The approval of the LEP may require MOE to assess and if necessary revise its overall structure and organization.
Figure 6: General Organization of MOE and relationship of PRMD to other departments and offices in MOE (unofficial)
It is proposed that the PRMD be organized as shown in Figure 7. The PRMD would consist of four Offices:

(i) Project Review Office;
(ii) Project Monitoring Office;
(iii) Project Planning Office; and
(iv) Project Administration Office.

The Project Review and Project Monitoring Offices would be responsible for most of the technical activities of the PRMD related to review of EA's as well as project inspection and monitoring. It is in these Offices that the best technically-qualified environmental assessment staff in MOE should reside. Their work would be supported by Administration and Planning Offices. These Offices would sit between the two technical Offices and the PRMD Director, providing assistance with respect to staffing, logistics, information, and finances.

An important support function for the urgent immediate work of the PRMD (and particularly the drafting of sub-decrees) is legal advice. There is no internal office within the department to provide this service, nor is one needed. Legal advisory support will come from the Ministry's Legal Department (see Figure 6) and from the legal advisor assigned to the UNDP-ETAP program. It will be essential that in the drafting of sub-decrees the technical experts within PRMD and their legal advisors work closely together to clarify and develop new regulations.

The provisional roles and responsibilities of each of the four Offices are described below.

---

14 In fact, four Offices are not needed in the initial stages of the PRMD, but any government Department is required by sub-decree in Cambodia to have four Offices. In addition, each Office must have one Chief and a Vice-Chief. Therefore, while a project portfolio approach was contemplated, with particular staff in the PRMD being assigned a set of projects from EIA review to project monitoring, compliance, auditing, etc., this approach was rejected in order to conform to Cambodian law.
Figure 7: Proposed organization of PRMD.
3.2.2 Roles and Responsibilities of Project Review Office

The Project Review Office would be responsible for the implementation of the environmental review functions mandated by the LEP (Appendix A, Chapter III). The proposed roles and responsibilities of the Project Review Office (Figure 8) are:

(i) under the authority of the LEP and in the absence of detailed enabling Sub-decrees, undertake initial scoping, screening or determination of project category in response to requests from project proponents;

(ii) provide technical input and direction to the preparation of all sub-decrees and regulations related to Chapter 3 of the draft LEP. This includes, but is not restricted to:

- inclusion/exclusion lists
- guidelines for IEE/EIA preparation

(iii) review environmental assessment documentation (IEE or EIA reports, as required) for all project proposals and make recommendations with respect to:

- approval of the environmental assessment report OR rejection with stated reasons (e.g. insufficient or misleading information)
- action required by project proponent (e.g. further study, mitigation plan, etc)
- environmental terms and conditions for project approval, construction, operation, and abandonment agreements for follow-up monitoring and auditing;

(iv) in accordance with the LEP, prepare and maintain any other tools required for the preparation and review of environmental assessments in Cambodia. This includes, but is not restricted to:

- guidelines for IEE/EIA review
- mitigation guidelines; and

(v) as necessary, provide guidance to ministries, organizations, and project proponents with respect to EIA requirements in Cambodia.
3.10 Private Sector Development of Environmental Planning and Management Services

As of late 1996, there is no private sector organization in Cambodia offering environmental services because there is no demand for private sector environmental services. A formal evaluation procedure for private sector companies is therefore a low priority at this time. However, with passage of the LEP and continuing investor interest in Cambodia, there is likely to soon be sufficient demand, and sufficient local capability, to stimulate the emergence of private firms providing this type of service. It is also important to note that due to staff attrition from Government, capacity-building efforts, even if focused on Government staff, are likely to lead over the next five years to the emergence of private sector operations with skilled staff. The evaluation of local private sector environmental services could therefore be re-visited in 3-5 years.
4. LITERATURE CITED


5. APPENDIX A: DRAFT LAW ON ENVIRONMENTAL PROTECTION AND NATURAL RESOURCE MANAGEMENT

Note: the following document represents an unofficial draft of the legislation prepared for, and subsequently approved by, the National Assembly on November 22, 1996. Official translation of the final text as promulgated into law is not yet available.
Article 1 -
The purposes of this law are:

- to protect [and] promote environmental quality and public health through the prevention, reduction, and control of pollution.

- to assess the environmental impacts of all proposed projects prior to the issuance of a decision by the Royal Government.

- to ensure the rational and sustainable conservation, development, management, and use of the natural resources of the Kingdom of Cambodia.

- to encourage and enable the public to participate in environmental protection and natural resource management.

- to suppress any acts that cause harm to the environment.

Chapter II
National and Regional Environmental Plans

Article 2 -
The Ministry of Environment, in collaboration with other concerned ministries and institutions, shall:

- prepare a National Environmental plan.

- designate regions and prepare a Regional Environmental plan for each region.

The National and Regional Environmental Plans shall be decided by the Royal Government.
Article 3 -

The National Environmental plan is a plan of environmental protection and sustainable natural resource management throughout the Kingdom of Cambodia.

The National Environmental Plan shall:

- identify important environmental issues and important natural resource management issues that are related to socio-economic development.

- set forth measures to ensure environmental management.

Article 4 -

The Regional Environmental Plan shall be consistent with the National Environmental Plan.

The Regional Environmental Plan shall:

- identify important environmental issues and important natural resource management issues that are related to socio-economic development of the respective regions.

- set forth measures to ensure environmental management in the said region.

Article 5 -

The National and Regional Environmental Plans shall be reviewed and revised at least once every five years.

Chapter III

Environmental Impact Assessment

Article 6 -

An environmental impact assessment shall be done on every project and activity of the private or public, and shall be reviewed and evaluated by the Ministry of Environment before being submitted to the Royal Government for decision.

This assessment shall also be done for existing activities that have not yet been assessed for environmental impact.

The procedures of the process for environmental impact assessment shall be determined by sub-decree following a proposal of the Ministry of Environment.

The nature and size of the proposed projects and activities and existing activities, both private and public, that shall be subject to that environmental impact assessment, shall be determined by sub-decree following a proposal of the Ministry of Environment.
Article 7 -
All investment Project Applications and all proposed State projects shall be subject to an initial Environmental Impact Assessment or an Environmental Impact Assessment as specified in article 6 of this law. the Ministry of Environment shall review and provide recommendations on the initial Environmental Impact Assessment or the Environmental Impact Assessment to the competent bodies within the period determined in the Law on Investment of the Kingdom of Cambodia.

Chapter IV
Natural Resource Management

Article 8 -
The natural resources of the Kingdom of Cambodia, which include land, water, airspace, air, geology, ecological systems, mines, energy, petroleum and gas, rocks and sand, precious stones, forests and forest products, wildlife, fish, [and] aquatic resources, shall be conserved, used, developed, and managed in a rational and sustainable manner.

The natural protected areas including National Parks, wildlife sanctuaries, Protected Landscapes Areas Multiple use Management Areas shall be determined by Royal Decree.

Article 9 -
The Ministry of Environment, in collaboration with concerned ministries, shall conduct research, assess the environmental impacts on natural resources, and provide the concerned ministries with recommendations to ensure that the natural resources as specified in article 8 are conserved used developed, and managed in a rational and sustainable manner.

Article 10 -
Before making any decisions or undertaking activities related to the conservation, development, or management of natural resources, the concerned ministries shall consult with the Ministry of Environment about the sustainability of natural resources.

Article 11 -
The Ministry of Environment shall immediately inform concerned ministries whenever the Ministry of Environment finds that natural resources are not being conserved, developed, managed and used in a rational and sustainable manner.

Chapter V
Environmental Protection

Article 12 -
The Ministry of Environment shall collaborate with concerned ministries to develop an inventory indicating the following:

- the sources, types, and quantities of all pollutants and wastes being imported,
generated, transported, recycled, being treated, stored, disposed, or released into the airspace, water, land, or on land.
- the sources, types, and quantities of all toxic and hazardous substances being imported, manufactured, transported, stored, used, generated, being treated, recycled, disposed, or being released into the airspace, water, or into land or on land.
- the sources, types, and extent of noise and vibration disturbances.

Article 13 -
The prevention, reduction, and control of airspace, water and land pollution, noise and vibration disturbances and provisions on waste, toxic substances, and hazardous substances, shall be determined by sub-decree following a proposal of the Ministry of Environment.

Chapter VI
Monitoring, Recordkeeping, and Inspection

Article 14 -
The Ministry of Environment shall collaborate with concerned ministries to require the owner or responsible person of factories, pollution sources, industrial sites, or sites of natural resource development activity:

- to install or use monitoring equipment
- to provide samples
- to prepare or maintain and submit review records and reports.

Article 15 -
In order to carry out its responsibilities and its responsibilities on Natural Protected Areas, the Ministry of Environment, in collaboration with concerned ministries, may enter [and] conduct an inspection in a site, premises, building, on or in any transport facility or any place, etc., when the Ministry of Environment finds that these sources affect the environmental qualities.

The Ministry of Environment inspector and the official of the concerned ministry that is collaborating shall present their identification, and letter of authorization before conducting the inspection.

During the inspection, when the inspectors find any criminal offense, they shall immediately report the competent entity for taking legal action.

The inspection procedures shall be determined by sub-decree following a proposal of the Ministry of Environment.
Chapter VII
Public Participation and Access to Information

Article 16 -
The Ministry of Environment shall provide, following a request from the public, information on its activities, and shall encourage public participation in environmental protection and natural resource management.

Article 17 -
The procedure for public participation and access to information shall be determined by sub-decree following a proposal of the Ministry of Environment.

Article 18 -
Information related to environmental protection or natural resource management shall be mutually disseminated between the Ministry of Environment and different ministries.

Article 19 -
The special account of the treasury shall be created which is an Environment Endowment Fund for the Ministry of Environment to finance environmental protection and the conservation of natural resources in the Kingdom of Cambodia in accordance with the finance law.

The Environment Endowment Fund coming from contributions from the Royal Government, grants from international organizations, donations from kind people and from non-governmental organizations and other legal incomes shall be included in the National Budget for providing the above special account.

Chapter IX
Penalties

Article 20 -
For any person that commits a violation of the prescription of the Ministry of Environment as specified in article 14 of this law, the Ministry of Environment shall issue a written order requiring:

- Correction of the violating activities immediately or within a specified time period or
- Stoppage of its activities until that violation has been corrected or
- Clean-up the pollution immediately.
Article 21 -
Any person that refuses or obstructs the inspection officials for entering to conduct an inspection or to inspect in the sites as specified in the paragraph 1 article 15 of this law shall be subject of fine from five hundred thousand Riel (500,000 Riel) to one million Riel (1,000,000 Riel).

In case of repeated offense it shall be subject of fine from one million Riel (1,000,000 Riel) to five million Riel (5,000,000 Riel) or imprisonment from one month to one year, or both these punishments.

Article 22 -
If the violation causes danger to peoples' bodies or lives, to private property, to public property, to the environment, [or] to natural resources, it shall be subject to a fine from ten million Riel (10,000,000 Riel) to fifty million Riel (50,000,000 Riel) or imprisonment from one year to five years, or both these punishments.

Person that commit a violation shall be responsible for repairing damage and for compensating.

Article 23 -
In case when the violation causes serious disaster to society, the court will use circumstantial evidence connected with other offenses above in order to pronounce the sentence.

Article 24 -
Any environmental inspection officials who neglect by paying no attention, or do not comply with regulations of the Ministry, or conspire with the offender, or facilitate the commission of the offense, shall be subject to administrative sanctions or face prosecution before the court.

Article 25 -
The Ministry of Environment shall apply the provisions of above article 20 for any person that commits a violation of sub-decrees or other regulations related to the provisions of this law.
Chapter X
Interim provisions

Article 26 -
After entering into force of this law until December 31, 2001, for existing activities, the Royal Government may extend the period to comply with a sub-decree specified in article 13 of this law following a proposal of the Ministry of Environment.

In making a decision for this extension, it shall:

- Take into account the nature and extent of the harm to human health, to the environment and to natural resources that may result from this extension.

- Review the possibility, means, technicality, and finance of this existing activity.

Chapter XI
Final Provisions

Article 27 -
Any provisions that are contrary to this law shall be considered null.
6. APPENDIX B: PROVISIONAL LIST OF PROJECTS REQUIRING ENVIRONMENTAL ASSESSMENT IN CAMBODIA

<table>
<thead>
<tr>
<th>No.</th>
<th>Project</th>
<th>Minimum Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>agriculture development</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• land covered by forests</td>
<td>50 ha</td>
</tr>
<tr>
<td></td>
<td>• agriculture and degraded forest land</td>
<td>1,000 ha</td>
</tr>
<tr>
<td></td>
<td>• flooded and coastal forests</td>
<td>50 ha</td>
</tr>
<tr>
<td></td>
<td>• irrigation systems</td>
<td>5,000 ha irrigated land</td>
</tr>
<tr>
<td></td>
<td>• drainage systems</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>dams and reservoirs</td>
<td>400 ha to be flooded</td>
</tr>
<tr>
<td>3</td>
<td>aquaculture</td>
<td>300</td>
</tr>
<tr>
<td>4</td>
<td>roads</td>
<td>30 km</td>
</tr>
<tr>
<td>5</td>
<td>railways</td>
<td>30 km</td>
</tr>
<tr>
<td>6</td>
<td>airport</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>ports</td>
<td>ships more than 200 t</td>
</tr>
<tr>
<td>8</td>
<td>buildings</td>
<td>12 m height</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8,000 m² floor area</td>
</tr>
<tr>
<td>9</td>
<td>hotels</td>
<td>30 rooms</td>
</tr>
<tr>
<td>10</td>
<td>hospitals</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>tourism area</td>
<td>50 ha</td>
</tr>
<tr>
<td>21</td>
<td>restaurant</td>
<td>500 seating capacity</td>
</tr>
<tr>
<td>13</td>
<td>housing development</td>
<td>20 ha</td>
</tr>
<tr>
<td>14</td>
<td>resettlement area</td>
<td>300 households</td>
</tr>
<tr>
<td>15</td>
<td>dredging</td>
<td>50,000 m³</td>
</tr>
<tr>
<td>16</td>
<td>sewage treatment plant</td>
<td>10,000 persons to be serviced</td>
</tr>
<tr>
<td>17</td>
<td>mining</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>mine exploration</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>hazardous chemical storage</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>oil storage depots</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>shipyards for building, repair, and disassembly</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>mechanical industries</td>
<td>20,000 t/yr</td>
</tr>
<tr>
<td>23</td>
<td>textile and dyeing factory</td>
<td>5 million m²/yr</td>
</tr>
<tr>
<td>24</td>
<td>leather tanning factory</td>
<td>800 t/yr</td>
</tr>
<tr>
<td>25</td>
<td>pulp and paper mill</td>
<td>8,000 t/yr</td>
</tr>
</tbody>
</table>

22 In the case that a minimum criteria is not specified, projects of all sizes require an environmental assessment.
<table>
<thead>
<tr>
<th>No.</th>
<th>Project</th>
<th>Minimum Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>plastics factory</td>
<td>300 t/yr</td>
</tr>
<tr>
<td>27</td>
<td>tire factory</td>
<td>500 t/yr</td>
</tr>
<tr>
<td>28</td>
<td>rubber factory</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>plywood and artificial wood factory</td>
<td>100,000 m³/yr</td>
</tr>
<tr>
<td>30</td>
<td>sawmill</td>
<td>20,000 m³/yr</td>
</tr>
<tr>
<td>31</td>
<td>battery manufacturing facility</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>power plants</td>
<td>10 Mw</td>
</tr>
<tr>
<td>33</td>
<td>oil refinery</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>iron and steel mill</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>other smelting enterprise</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>cement industries</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>agro-processing factory</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>chemical fertilizer plant</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>pesticide industries</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>landfill</td>
<td>100,000 m³</td>
</tr>
</tbody>
</table>
7. APPENDIX C: PROPOSED EIA GUIDELINES FOR INVESTORS

7.1 General Guidelines

7.1.1 Content of Environmental Assessment Reports

All environmental assessment reports prepared under the LEP, whether they be IEE's or full EIA's, must have the following outline:

- Executive Summary
  1. Introduction and Background
  2. Project Objectives
  3. Project Description
  4. Description of Existing Environment
  5. Impact Analysis
  6. Mitigation Plan
  7. Monitoring Plan
  8. Conclusions and Recommendations
  9. Technical Appendices

7.1.2 Methodology for Impact Analysis

A cross impact matrix will be provided as a part of every environmental assessment report. The impact analysis presented in the cross impact matrix will be conducted using the following procedure.

The impact analysis will consider the possible effects of the project activities on the environmental resources of concern in the study area. The results of the impact analysis will then be used to identify mitigation and monitoring requirements.

Two items will be initially necessary to conduct the impact analysis:

(i) a detailed project description, outlining the major activities that will take place as a result of the project. This will be provided in Chapter 2 of the environmental assessment report; and

(ii) an environmental setting; that is, a list of environmental resources that may be affected by the project activities. This will be provided in Chapter 3 of the environmental assessment report.

Each possible impact of the project (i.e. combination of project activity and environmental resource) will be assessed using field data collected from the project area, results of similar projects elsewhere in southeast Asia, and professional judgment on the part of the environmental assessment team. Each possible impact will be
assessed as being None, Insignificant, Significant and Ability to Mitigate Unknown, Mitigate, or Impact Unknown. For each impact, the environmental assessment team will provide a written rationale for the ranking. The bases for assessment are defined in terms of the time scale of effect, the spatial scale over which the effect may occur, and the magnitude of the effect (Table 5). It is important to note that the assessment of impacts will be conservative in that the occurrence of any one item in Table 5 will be sufficient to assign the corresponding ranking. In addition, what is provided in the environmental assessment report after the conclusion has been reached depends upon the specific conclusion itself (Table 6).

<table>
<thead>
<tr>
<th>Basis for Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
</tr>
<tr>
<td>• project activity is physically removed from the resource of concern</td>
</tr>
<tr>
<td>Insignificant</td>
</tr>
<tr>
<td>• the time scale of the impact is shorter than the life span or time scale of the resource of concern</td>
</tr>
<tr>
<td>• the area which the impact may occur is smaller than the area over which the resource of concern occurs</td>
</tr>
<tr>
<td>• the magnitude of the impact is small relative to the abundance or quality of the resource of concern</td>
</tr>
<tr>
<td>Significant and Ability to Mitigate is Unknown</td>
</tr>
<tr>
<td>• the time scale of the impact is equal to or longer than the life span or time scale of the resource of concern</td>
</tr>
<tr>
<td>• the area over which the impact may occur is equal to or larger than the area over which the resource of concern occurs</td>
</tr>
<tr>
<td>• the magnitude of the impact is equal to or larger than to the abundance or quality of the resource of concern</td>
</tr>
<tr>
<td>• the resource of concern has international or global significance, (e.g. an endangered species or international waterway) and</td>
</tr>
<tr>
<td>• it is uncertain whether the significant impact can be effectively mitigated</td>
</tr>
<tr>
<td>Mitigate</td>
</tr>
<tr>
<td>• the significant impact can be effectively mitigated</td>
</tr>
<tr>
<td>Unknown Impact</td>
</tr>
<tr>
<td>• the presence of the project activity is uncertain</td>
</tr>
<tr>
<td>• the occurrence of the resource within the study area is uncertain</td>
</tr>
<tr>
<td>• the time scale of the impact is unknown</td>
</tr>
<tr>
<td>• the spatial scale over which the impact may occur is unknown</td>
</tr>
<tr>
<td>• the magnitude of the impact can not be predicted</td>
</tr>
</tbody>
</table>
Table 6: Specification of what is to be provided for each assessed impact.

<table>
<thead>
<tr>
<th>Conclusion in Impact Analysis</th>
<th>Mandatory</th>
<th>Optional</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>• document rationale</td>
<td></td>
</tr>
<tr>
<td>Insignificant</td>
<td>• document rationale</td>
<td>• specify monitoring</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• specify mitigation</td>
</tr>
<tr>
<td>Significant, Ability to Mitigate Unknown</td>
<td>• document rationale</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• specify monitoring</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• specify data needs</td>
<td></td>
</tr>
<tr>
<td>Mitigable</td>
<td>• document rationale</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• specify monitoring</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• specify mitigation</td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>• document rationale</td>
<td>• specify mitigation required if monitoring detects adverse effects</td>
</tr>
<tr>
<td></td>
<td>• specify data needs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• specify monitoring</td>
<td></td>
</tr>
</tbody>
</table>

7.1.3 Environmental Resources to Be Considered in the Environmental Assessment

The resources to be considered by the proponent in the preparation of the environmental assessment are listed in Table 7.

7.2 Specific Guidelines

There would be a set of guidelines specific to each type of project (i.e., agro-processing, hydropower projects, etc.). These specific guidelines would contain two items:

(i) a list of the minimum set of project activities whose potential environmental impacts must be considered in environmental assessment; and

(ii) a list of the major environmental impacts for which detailed mitigation plans must be prepared.

The PRMD is currently preparing provisional specific guidelines for priority project types.
<table>
<thead>
<tr>
<th>Physical Resources</th>
<th>Ecological Resources</th>
<th>Social and Economic Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soils</td>
<td>Terrestrial Biota</td>
<td>Income</td>
</tr>
<tr>
<td>Surface Freshwater Resources</td>
<td>Forests</td>
<td>Food Production</td>
</tr>
<tr>
<td>hydrology</td>
<td>Wetlands</td>
<td>Drinking Water Supply</td>
</tr>
<tr>
<td>water quality</td>
<td>Aquatic Biota</td>
<td>Nutrition and Health</td>
</tr>
<tr>
<td>Groundwater Resources</td>
<td>Freshwater Fisheries</td>
<td>Education</td>
</tr>
<tr>
<td>quantity</td>
<td>Marine Fisheries</td>
<td>Employment</td>
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<td>quality</td>
<td>nearshore</td>
<td>Gender Issues</td>
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<td>Marine Water Quality</td>
<td>offshore</td>
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<tr>
<td>Geology and Minerals</td>
<td>Biodiversity</td>
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<tr>
<td>Air Quality</td>
<td>Parks and Reserves</td>
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Table 7: List of environmental resources to be considered in environmental assessments in Cambodia.
8. APPENDIX D: PROPOSED PROJECT COMMENT AND REVIEW IN ABSENCE OF EIA
Kingdom of Cambodia
Nation-Religion-King

Ministry of Environment
No. 48 Samdech Preah Sihanouk Boulevard
Phnom Penh, Cambodia.

[enter date here]

[enter name of CDC person here]
Council for the Development of Cambodia
[enter CDC address here]

Dear [enter name here]:

Re: Review of: [enter details of proposed project here]

The Ministry of Environment has reviewed the documents provided to the Ministry on [enter date here] regarding the above-captioned project.

The Ministry was unable to make a complete and detailed assessment of this project because insufficient information was provided.

Projects of this type are known to have a number of major environmental and social impacts. These are listed and described on Page 2 of this review. Also, suitable mitigation measures for these environmental effects are listed and described on Page 2 of this review. Under the Law on Environmental Protection, it is the responsibility of the investor to implement these mitigation measures.

It is the recommendation of the Ministry that this project be approved, on the condition that the agreement with the investor include the terms and conditions presented on Page 4 of this review.

or

It is the recommendation of the Ministry that this project application not be approved, until such time as the investor has completed a detailed environmental assessment of the proposed project. We estimate that a proper environmental assessment of the project would require [enter amount of time or cost required.] The Ministry would be pleased to review the environmental assessment once it is completed.

Sincerely,
Type of Project: [enter type of project here]

Major Environmental Impacts:

[List and describe major environmental impacts here]

Suitable Mitigation Measures:

[List and describe suitable mitigation measure here]
Proposed Environmental Terms and Conditions for enter details of proposed project here

[enter proposed terms and conditions here]
SECTION 3

HUMAN RESOURCES DEVELOPMENT STRATEGY

Principal author: Dr Stephen Tyler
Table of Contents

1. INTRODUCTION AND TERMS OF REFERENCE............................................... 1

2. THE HRD CONTEXT IN CAMBODIA............................................................... 3
   2.1 Human Resources Legacy........................................................................ 3
   2.2 Training Institutions ............................................................................. 4
   2.3 Training is not Capacity-Building............................................................ 6
   2.4 Capacity-Building and Policy Change....................................................... 7

3. HRD NEEDS - ENVIRONMENTAL PLANNING AND ASSESSMENT .......... 9
   3.1 Overview of Institutional Development Requirements (summary of Section 2: Institutional Development and Planning).................................................. 9
   3.2 Demand for Environmental Planning and Assessment Skills.................. 11

4. SKILL REQUIREMENTS FOR EIA AND ENVIRONMENTAL PLANNING.... 14
   4.1 Process management skills .................................................................... 14
   4.2 Technical / scientific knowledge and analytical skills ............................... 15
   4.3 Information Management Skills .............................................................. 16
   4.4 Characterization of MOE Staff Capabilities .............................................. 16

5. GOALS AND OBJECTIVES OF HRD STRATEGY ....................................... 20
   5.1 Goals for HRD....................................................................................... 20

6. TARGETS FOR STRATEGY IMPLEMENTATION......................................... 23
   6.1 Time-Bound Targets ............................................................................. 23
      6.1.1 Targets to Regularize Environmental Planning and Assessment Procedures 23
      6.1.2 Targets to make EIA / REDP More Systematic .................................. 24
      6.1.3 Targets for Integration of EIA and REDP .......................................... 25
      6.1.4 Targets for Effectiveness ................................................................ 26
      6.1.5 Targets for Efficiency ................................................................... 27
   6.2 Goal and Target Matrix ......................................................................... 28
List of Tables

Table 1: HRD Goals and Time-Bound Performance Targets for RGC .................29
Table 2: Estimated Resource Requirements for 5-year HRD Strategy (US$) ..........61
Table 3: Ministry of Environment Staff Profile .................................................66

List of Figures

Figure 1: Educational Level of MOE Staff ..............................................................17
Figure 2: MOE Staff - Years Since Completing Studies (1994 baseline) .................18
Figure 3: Language Ability of MOE Staff (1994 baseline) ........................................18
Acronyms and Abbreviations

ADB  Asian Development Bank
AIT  Asian Institute of Technology, Bangkok
CDC  Council for the Development of Cambodia
CDRC Cambodia Development Resource Centre
CG  Consultative Group
CIB  Cambodia Investment Board
CIDA Canadian International Development Agency
CoM  Council of Ministers
CRDB Cambodia Reconstruction and Development Board
EA  Environmental Assessment
EIA  Environmental Impact Assessment
ETAP Environmental Technical Assistance Project
EU  European Union
IEE  Initial Environmental Evaluation
IFI  International Financial Institution
LEP  Law on Environmental Protection and Natural Resource Management
MAFF Ministry of Agriculture, Forestry, and Fisheries
MEF  Ministry of Economy and Finance
MIME Ministry of Industry, Mines, and Energy
MOE  Ministry of Environment
MOEd Ministry of Education
MOP  Ministry of Planning
MPWT Ministry of Public Works and Transport
MRC  Mekong River Commission
MTour Ministry of Tourism
NEAP National Environmental Action Plan
NGO  Non Governmental Organization
NPRD National Plan for Reconstruction and Development
PED  Provincial Environment Department
PIP  Public Investment Plan
PPU  Phnom Penh University
PRMD Project Review and Monitoring Department
REDP Regional Environmental Development Planning
RGC  Royal Government of Cambodia
TVET Technical and Vocational Education and Training project
UNDP United Nations Development Programme
UNEP United Nations Environment Programme
1. INTRODUCTION AND TERMS OF REFERENCE

This report contains the conclusions of the consultants’ review of Human Resource Development (HRD) requirements for the Royal Government of Cambodia in the field of environmental assessment and planning, and a strategic plan for meeting these requirements. These conclusions are the outcome of several elements of project effort by all team members, including *inter alia*:

- collection of available information on MOE staff, organization and function
- interviews with managers and professional staff and observation of functions of different MOE groups
- interviews with management and staff of other international TA projects actively engaging MOE
- assessment of participant capabilities through student exercises assigned in the EIA training courses
- assessment of management and organizational skills through observation and evaluation of conduct of case studies and field exercises
- interviews with environment/planning groups in other key line agencies
- appraisal of training programs offered at local institutions
- comparison with other HRD strategies and plans being prepared by various donors and development experts in Cambodia
- interviews with experienced Khmer and expatriate trainers in Cambodia
- experience acquired working with MOE staff in the course of completing other project elements, particularly Institutional Planning and on-the-job training components.

This HRD Strategy addresses training and human resources for institutional development, and so meets the requirements of selected elements of TA 2078-CAM Terms of Reference under the categories of Institutional Development, Institutional Planning and Human Resources Development Planning. Specifically, this report addresses the following elements of the project Terms of Reference, as clarified by agreement during the first tripartite meeting after the Inception Report:

**C. Institutional Development**

8. The consultant will provide advisory assistance to the Secretary of State for Environment (ed. - now MOE) and other key counterparts on the following:

... (v) identification of the technical and managerial skills that will be required by the Environment Secretariat to conduct an effective EIA program after assessing the existing staff capabilities;

(vi) identification of the training needs and formulation of a training plan including short-term overseas training and on-the-job training;...
D. Institutional Planning

9. The consultant will work closely with the Secretary of Environment to develop recommendations for institutional capacity-building. These tasks will include:

(i) assessing the needs for academic and practical training for environmental staff of the Environment Secretariat with particular focus on training in EIA technology;

... (iv) assisting the Environment Secretariat in appraisal of the EIA program implementation capabilities of the environment staff to make optimal use of the personnel and for the career development;

E. Environment Sector Human Resources Development Planning

10. The consultants will prepare a human resources development (HRD) plan, in consultation with the Secretary of Environment which will include a feasibility-level strategy to develop environmental planning and management capability within the Government. The human resources development plan will:

(i) include a clear statement of objectives and goals for the next five years to address manpower needs within the field of environmental assessment and planning among sectoral and multisectoral agencies of government;

(ii) assess the constraints to HRD for the environment sector, taking account of the current state of environmental affairs in the Government including major sectoral problem areas, areas of critical geographical concern, administrative institutions and interrelationships among agencies, and the Government budgetary resources available for environmental protection issues;

(iii) include specific time bound targets for the next five years, to determine the degree to which objectives are met;

(iv) identify the immediate needs and inputs to implement Environment HRD Plan working budgets keeping in mind the programming priorities and responsibilities of SSE and other government agencies;

(v) identify critical manpower requirements to be filled in the short-term and medium-term and material resources required for manpower training.

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2 "Environment Sector" is understood by clarification of Tripartite Meeting #1, to mean "environmental assessment and planning" (Tripartite Meeting #1 - Minutes).
2. THE HRD CONTEXT IN CAMBODIA

The premise underlying this HRD strategy is that human resource development is a crucial constraint to the achievement of the broader strategic goals of implementing a functional environmental planning and review system within the Royal Government of Cambodia. The situation of Cambodia (described in more detail below) eminently justifies such a premise. However, the notion that HRD alone will lead to the successful implementation of environmental planning and assessment must be tempered by the exigencies of the Cambodian context.

2.1 Human Resources Legacy

It is vital at the outset that the reader understand the unique human resource context of Cambodia. The people of Cambodia have been subject to immeasurable suffering as a result of more than 20 years of violence and the systematic destruction of most of the country's intellectual and administrative capacity. This is not only a matter of an entire generation of intellectual leaders, teachers and public officials being lost, but of the organizational framework, the institutions of training, knowledge, and administration being completely dismantled. The country not only faces the task of training its people, but of simultaneously rebuilding its organizational structure for training, education, knowledge, professionalism and public administration. In terms of academic training and infrastructure, including teachers, libraries, and the discipline of academic work (examinations, papers, reading literature), Cambodia is starting from a local base which is very close to zero. Persistent social and psychological trauma in the face of a conflict which still drags on in some parts of the country, further complicate an already difficult situation.

Educational levels in Cambodia are on average very low. Adult literacy, at 38%, is the lowest in S.E. Asia (much lower, for example, than Lao PDR at 54%). As recently as 1992-93, 80% of school leavers had only primary education, and half of these only 3 years of low quality primary education in rural areas (ADB, 1995).

The positive aspects of Cambodia's HRD situation, such as they are, have to do with the many admirable qualities of her people. There are many bright, highly motivated, hard-working, hopeful and well-intentioned young people who are more interested in building their future than in dwelling on the past. A substantial number of professional staff have been trained overseas (mostly in Eastern Europe and the former Soviet Union). An increasing number are gaining access now to donor-supported educational and training programs in the region. They have a high degree of enthusiasm and energy. It is these widespread traits which HRD programs seek to harness and support.
2.2 Training Institutions

Various donor initiatives, particularly supported by the European Union (EU), are underway to support the rebuilding of Cambodia's post-secondary institutions. But the current situation at most of these institutions means that the rebuilding process will last a great many years. The institutions which are most relevant to this study are:

(i) Phnom Penh University: includes faculties of Science, Social Science and Humanities, and Foreign Languages. There are only a handful of senior staff with Ph.D.s from overseas institutions. Most teaching staff have limited qualifications. There are virtually no laboratory or library facilities. Textbooks are very limited in any language, but most students lack foreign languages to gain access to international literature. Tests administered in Khmer by foreign institutions seeking to determine quality of graduates in natural sciences have found low levels of basic theoretical comprehension or analytical ability.

(ii) Chamcar Dong Agricultural Institute: provides technical training in applied sciences relating to agriculture, forestry, fisheries. The institution serves to train staff for government service in agricultural extension. The focus is on very practical field technical skills. There has been some previous technical assistance from Vietnam, including educational exchanges and scholarships to Vietnamese institutions.

(iii) Technology Institute of Phnom Penh: training in engineering technologies, including hydrology, civil engineering, chemical engineering, mining.

(iv) Technical College, Preak Leap: vocational training in forestry, veterinary science, irrigation. Program overlaps to some extent with Chamcar Dong.

All the institutions are weak in their ability to provide training in the specialized management and technical skills required for environmental planning and assessment (see section 4 below). Even basic scientific and technical skills taught at these institutions are weak because of the lack of resources for field and laboratory training. Without exposure to field conditions or to practical problem-solving and application of lecture material, graduates of all these programs have abilities which are, in general, lower than their paper qualifications might indicate to an external observer.

This situation is further complicated by a lack of coordination and planning between institutions. For example, as different teaching units within Phnom Penh University have found donor support for their work, there has been a tendency to create their own institutions. This trend was underway even during the period of Vietnamese occupation, as remnant organizations re-formed frequently with new institutional names, and independent mandates. After the elections in 1993 these trends were further exacerbated, with the result that units which were previously part of the University have now become largely independent (e.g. Law, Economics, Business). Proposals to re-integrate the national University system have been put forward, but for
now institutional rivalries mitigate in favour of preserving each organization's independence.

The administrative responsibility for the technical institutes is also shifting. They have been traditionally under the direct jurisdiction of their parent ministry (MAFF, MIME, etc). While they continue to report to the relevant line ministry, the Ministry of Education is now exercising a much stronger supervisory role over academic affairs such as curricula and examinations.

A major ADB capacity-building project (Loan 1368-CAM) addresses Technical and Vocational Education and Training (TVET). The focus of project investments is on basic employment skills in Central and Southern Cambodia (with a special emphasis on health workers), as well as capacity-building in the MOEd for policy and planning in TVET. The project aims to have 15,000 trained in basic skills, to address the shortage of basic employment skills to meet labour needs for infrastructure and industrial investments which are now underway. There is relatively little attention in the project to specialized post-secondary or professional training, which is perceived (with some justification) as a lower priority.

In addition to these formal institutions of post-secondary training, there are many private training organizations emerging in Cambodia in response to the desperate HRD situation. Most of these are commercial in nature and oriented to practical skills such as English language training, accountancy, computer skills and applications. They operate mostly in Khmer, but also in English (and occasionally French). These kinds of organizations may be increasingly suited to providing low-level, locally-appropriate training in basic office operating skills of this type.

Most NGOs also focus on training and HRD as a key element of their operations. Local staff almost inevitably require training in skills required for their organizational responsibilities. However, relatively few NGOs actually offer training services to a broader public. Of those which do, one of the most professional is the Cambodian Development Resource Institute (CDRI), established and managed by expatriates with long experience and excellent contacts in Cambodia. One of CDRI's main programming objectives is to strengthen middle management and professionals in the RGC, and to that end they continue to develop a variety of course offerings. Courses of potential interest to the objectives of this study include offerings in library and information management skills, English language report writing and official communications, project management and conflict resolution.

3 Other NGOs with expertise relevant to this study, who already offer public training programs in Phnom Penh include: PACT (management and organizational development), World Education (non-formal education, training trainers), ACE (Australian Centre for English), Institute of Khmer Habitat (participatory planning), LIDEE Khmer (computer networking, internet). The capabilities and program offerings of these organizations vary frequently as their small staff and resource situation changes.
2.3 Training is not Capacity-Building

This HRD Strategy includes assessment of the kinds of skills required for EIA and environmental planning in the Royal Government of Cambodia, an appraisal of the likely demand for those skills and the manpower requirements in comparison with available personnel, and develops a goals-based strategy for training and human development. In order to be clear on what is intended in this report, we distinguish at the outset the difference between "training" and "capacity-building" and highlight some crucial considerations which are beyond the scope of this work.

Training consists of imparting knowledge and skills. These are typically best acquired through both study and practice, with learning generally much more effective through practice. Training is an operation whose subjects are individuals: it is the individual who acquires skills, knowledge and understanding. Greater skills, knowledge and understanding mean that the individual has higher potential to contribute to the activities of his or her organization. However, in order for this potential to be realized, organizational capacity-building is required.

Capacity-building increases the ability of individuals and organizations to act. It is more comprehensive than training because while successful training requires only the demonstration of new skills, capacity-building requires the demonstration of action. In order to act on knowledge and skills acquired through training, individuals must find management support from their own organization. Support could include such elements as:

- assignment to tasks directly relevant to the skills and knowledge acquired
- delegation of responsibility and authority to take action consistent with ability and accountability
- clear understanding by members of the organization of their roles, tasks and relationships to organizational objectives
- internal communication and agreement on performance expectations, measures of achievement, reporting and feedback on performance
- recognition and incentives for individual and group performance

Without the support of an enabling organizational environment, there is no assurance that any amount of training will ever be applied. For example, it is not unusual in many countries that staff nominated to training programs are subsequently re-assigned on returning to their organizations to completely different functions (where newly-learned skills may be inappropriate).

In Cambodia, where government organizations are struggling with redefined mandates and major new administrative challenges, roles are often unclear, staff are given little responsibility or authority to utilize the skills they may have been trained in, and there are few opportunities for internal strategic communications about organizational objectives, strategies, and linkages. Individuals are given orders and only receive
feedback if their performance is judged deficient. Salaries are insufficient to meet basic survival needs (when they are paid) and there are no prospects in the near future for significant salary increases. In this kind of organizational environment, training alone will not build the capacity of individuals and the organization to act in a professional and competent manner.

It is important that the Ministry and donors both recognize the need to match training and skills development with job responsibilities as an essential part of capacity-building. Staff with highly-developed skills may be unproductive if assigned to inappropriate positions. Similarly, advanced technical training may be largely wasted on staff whose principal role is administration or management. It may be much more important that they receive training in management skills.

2.4 Capacity-Building and Policy Change

There is a kind of chicken-and-egg question here: there is little incentive to invest in creating a particular kind of administrative capacity (e.g. environmental planning) unless there is a clear demand for this kind of capability. On the other hand, government decision-makers are sometimes reluctant to create the policy framework required to mandate action in a new field of activity if they believe that their staff lack the capacity to actually implement the policies under consideration. Both of these views are understandable.

There is little doubt in Cambodia of the need for improved environmental assessment and planning to cope with the large number of investment projects which are planned for the country's development, and reduce environmental damages incurred in the development process. This view seems to be shared by many government agencies. However, at the moment, the policy framework within which this planning could be implemented is very weak (see further discussion in Section 2: Institutional Development and Planning).

Development and investment in Cambodia are proceeding rapidly. It may well be preferable to embark on capacity-building before the preparation of final policy documents, sub-decrees and regulations governing the processes to be used in Cambodia. Indeed, if RGC officials are better informed and experienced with environmental assessment and planning, they will be better able to make informed judgments about the appropriate applications and procedures to be adopted in their own operations.

However, it is important that the reader of this report recognize that the most carefully-prepared HRD strategy will be ineffective without an enabling policy framework. There will be no significant improvement in organizational capacity unless the RGC implements policy changes which legitimize and institutionalize EIA as part of project planning and review in both the public and private sectors, and makes formal
provisions for integrating REDP into sectoral and regional development plans. Steps in this direction are well underway, but are not yet assured of success.

The preceding contextual factors should be taken into consideration when evaluating the merits and likely impacts of alternative approaches to HRD in this sector. The report which follows emphasizes the training and HRD needs of the RGC in relation to environmental planning and assessment. As argued above, there are important contextual issues and collateral interventions needed to help ensure that this training and human resource development is effective in strengthening organizational capacity.
3. HRD NEEDS - ENVIRONMENTAL PLANNING AND ASSESSMENT

The need for HRD in the field of Environmental Planning and Assessment in Cambodia will depend on the nature of institutional responsibilities as they are eventually assigned in this field, and, in accordance with these responsibilities, the number and type of professional staff required to meet them. The national Law on Environmental Protection (LEP), which took legal force in early 1997, provides for the introduction of environmental planning and assessment in Cambodia under authority of MOE. However, the formal structure for environmental planning is still taking shape (see Section 2: Institutional Development and Planning).

In the absence of a firm institutional structure, the need for HRD is assumed to be linked to anticipated investment patterns and to be based on the model of institutional development suggested in the companion part of this final report (Section 2: Institutional Development and Planning).

The anticipated patterns of investment generate expectations about the key sectors requiring substantial environmental professional effort, and the overall part of planning, assessment and review effort required. The general institutional design recommended in Section 2 suggests in which organizations this professional effort will be concentrated and implies a set of professional roles for different agencies in the process of environmental planning, assessment and review.

3.1 Overview of Institutional Development Requirements (summary of Section 2: Institutional Development and Planning)

Analysis of Institutional Development requirements shows that environmental planning and assessment procedures are still embryonic in Cambodia. While some international donors and IFIs are helping to put in place a national development planning and public investment framework, and others have supported regional environmental planning studies, the two kinds of planning are only weakly linked by the government.

A review of investment approved to date, and anticipated in coming years as political and economic stability grows, suggests the urgent need for project environmental review mechanisms in the RGC. These should especially be capable of responding quickly and transparently to project review needs generated by foreign private investors, and by international donors (especially IFI investments in infrastructure projects).

The current status of environmental planning and assessment in the RGC is that, largely as a result of this project, technical understanding and capacity is concentrated in the MOE, with a handful of well-informed individuals in other agencies. The new LEP identifies the MOE as having responsibility for EIA review and regional environmental planning, in close collaboration with line agencies. However, the
mechanisms by which EIAs or REDPs would be prepared by project or sub-national planners have not been specified. Informal relationships are beginning to be established, especially between CDC and MOE, and the MIME has created its own Environment Office to focus on sectoral issues within its jurisdiction.

The EIA Department within MOE is probably inappropriately named. It is not the normal function of a government agency to conduct EIAs. More appropriately, this agency should be reviewing EIAs conducted by project proponents (private or public). For this reason, the Institutional Development and Planning report recommends renaming the department to the Project Review and Monitoring Department (PRMD). Within this department, more attention needs to be paid to matching skills and training to the requirements of different staff positions. In accordance with regulations for government organizations, the PRMD should be structured with 4 offices, the most important of which would be the Project Review Office and the Project Monitoring Office.

EIA review for investment projects should be kept simple and transparent, with requirements, guidelines, inclusion and exclusion lists to be developed by PRMD and provided to CDC and investors. A recommended process for EIA review and project monitoring would see the responsibility for provision of information and environmental analysis by the project proponent, with technical review and monitoring the responsibility of MOE, all mediated by recommendations to the responsible government agency (CDC or Ministry of Planning).

Environmental auditing of current industrial and other operating projects is recommended to be established under the authority of the LEP, through provisions of sub-decrees to be developed by MOE. This process should see the burden of information provision rest with the owner or operator of the enterprise, in conjunction with the responsible line Ministry. MOE will review audit information and recommend action or continued monitoring as appropriate.

Regional environmental planning is already being undertaken as the result of various donor initiatives, but these have not yet led to the establishment of clear organizational responsibility and training for this function within MOE.

In the absence of formal EIA review procedures, the workplan for PRMD for the next year should focus on: development of sub-decrees for the LEP; informal piloting of project review procedures prior to their formal approval; preparation of EIA manuals for other ministries based on materials developed in this TA; continued training and information management. On the assumption that project proposals continue at approximately the same rate as the previous two years, but that only a small proportion

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4 This acronym (PRMD) is used throughout the Institutional report, and for consistency is also used in this report. The reader should keep in mind that the use of this name implies a recommended change from the current official name of the department.
of them require a full EIA, additional staff needs for the department have also been estimated.

The resource needs for PRMD include ongoing operating costs and capital depreciation, as well as salary supplements in order to retain competent staff whose skills are enhanced through donor investments in training and HRD. These resource needs are very unlikely to be provided by the RGC under current fiscal conditions, posing a serious question of sustainability of their operation. This issue merits further study and consideration: one alternative (although it has sweeping policy implications which require careful government consideration) is the institution of a review fee as part of investment project applications to the government. The study presents indicative financial statements which show the implications of such a fee on operating funds for PRMD.

In terms of implications for HRD, the Institutional Development and Planning recommendations suggest the following schema for environmental planning:

(i) MOE has key responsibility for EIA review, monitoring, and Regional Environment Development Planning (REDP). This responsibility rests mainly in the PRMD and in the Planning Department.

(ii) MOE provincial bureaux play a supportive role, providing information and local coordination of environmental planning, assessment and monitoring as requested and led by MOE.

(iii) MOE recommendations and plans are submitted to key central agencies or project approval agencies, who interact with public or private project proponents (mainly CDC or MOP). These agencies must understand the environmental review process, information and monitoring requirements and be prepared to attach environmental conditionality to project approvals as recommended by the MOE review.

(iv) Regional environmental plans as required by law are likely to be prepared by multi-agency task forces composed of sector and provincial staff, led by MOE (e.g. Ton Le Sap Coordinating Unit). Priorities for these include: Ton Le Sap (already underway with EU and FAO funding); Coastal Zone (ADB project); Sihanoukville urban / industrial development; Greater Phnom Penh urban / industrial development.

3.2 Demand for Environmental Planning and Assessment Skills

With this emerging institutional setup, and bearing in mind the estimates of activity prepared already in the Institutional Development and Planning report, the total number of government staff likely to require environmental planning and assessment skills can be estimated as follows:
• MOE/PRMD: 21 (cf. section 2 report)

• MOE / Planning Dept: Assume 2 or 3 REDP exercises each year, with ongoing follow-up in project definition, planning and multi-agency task forces lasting two years each. With each REDP requiring at least 25 person-months, and follow-up activities for each requiring 6-8 person-months / year, annual work requirements for this task alone are about 100 person-months. Allowing for management, administration and other functions (such as MOE strategic planning) puts the minimum professional staff for the department at around 12-15 persons.

• MOE / other departments: Technical experts in other MOE departments will be called on from time to time to serve on project review or planning teams on a short-term secondment basis. It is expected that they will understand the basics of the environmental planning and assessment processes, but will chiefly contribute their specific technical skills and knowledge to the process. Approximately 10 professional staff could be involved in this kind of situation.

• MOE / provincial environment departments: A small number of staff in each provincial office will need basic environmental planning training so that they can more effectively participate in project review and regional planning activities led by central staff with stronger technical skills. Total number of staff involved is unlikely to exceed 40 nationwide.

• Central agencies: Key central agencies which approve projects and plans require basic expertise in environmental assessment and planning in order to be able to understand the information requirements and procedures which environmental planners require, and to integrate these with their national, regional, sectoral, PIP and project planning / approval responsibilities. Probably will involve no more than 6 professional staff and a small number of management.

• Line agencies: will supply sectoral experts to contribute to regional environmental planning exercises, and will be responsible for undertaking EIA for public investment projects which they are responsible for implementing. Given priority investment and planning areas, and existing precedents in MIME (discussed in Section 2 above), the number of staff involved here could reach 30 or 40.

The total number of government staff to be reached by specialized EIA / REDP skills development and training programs could therefore be expected to be in the range of 120-130 persons throughout the country.

In addition to this group, which will represent the core of the professional activity in the field, there will be many other government officials who will need to know about environmental planning and impact assessment, but will have no active professional role in its execution. These are particularly management and decision-making officials who will need to understand how best to use the information generated by environmental planning, and to recognize the value of the skills and analysis which is involved. This group is best reached by awareness-level information and exposure to practical cases. These kinds of information and exposure should be carefully and
deliberately set up to maximize its impact on this important group. As the individual activities involved will incur relatively little cost; be very short-term in duration, and will not result in learning or application of new skills or human resources, these kinds of awareness and promotional activities are not considered further in this report. However, the importance of these activities should be emphasized: they will be crucial to acceptance and implementation of the new legal mandate of MOE, for example. The Administration Office of PRMD and the Department of Education and Communication within MOE should be involved in these awareness / promotion activities (see further organizational details in Section 2).

The above groups will be actively involved professionally in the implementation of new procedures for environmental planning and assessment. But HRD is needed for another set of Cambodian professionals: trainers. Attrition and economic growth will lead to continued demand for learning these skills and the basic technical, natural scientific and social scientific understandings on which they are based. In addition, the introduction of formal EIA requirements for investment projects will create a demand for skilled practitioners in the private sector to help investors to better design their projects. This growing demand is likely to drain the most competent and qualified staff from government, so the implication is not so much that specific private sector staff need to be trained, but that attrition in the government ranks will be high.\(^5\)

Initially, due to the lack of local trainers and the urgency involved in meeting current needs, most training is likely to be in-service: directed to professionals who are already involved in the field but need to learn new skills (this was the approach adopted in the current TA, for example). However, over time, it will be essential to develop teaching and training capability in Cambodia at the post-secondary and pre-professional level. This is particularly true for natural sciences, and social sciences, with an emphasis on understanding basic theory, field processes, data collection, and the integrative disciplines (such as ecology, geography or urban planning). Thus an important long-term human resource development need is for qualified trainers and instructors in the basic disciplinary fields at Cambodia’s post-secondary educational institutions.

Although more people will be needed in the longer term, over the five-year planning horizon of this study, the numbers involved at post-secondary institutions will be relatively small (perhaps 5 or 6 individuals). In addition, however, a small number of MOE staff should be expected to assume the role of trainers, especially in relation to other government staff in the provinces or in other line agencies. They will need a certain amount of pedagogical training in addition to enhancing their technical skills to assume this role.

\(^5\) This has particular implications for government staff salaries: because the most competent government staff will increasingly have other options for employment in this field as demand for these skills grows in the private sector, in order to retain competent professional staff, the government will be obliged to reform salary structures or seek opportunities to supplement staff salaries.
4. SKILL REQUIREMENTS FOR EIA AND ENVIRONMENTAL PLANNING

The promise and challenge of EIA is to improve the quality of public and private-sector development decision-making. The objective of the exercise is not to approve or reject one project or another (although extreme cases of impact may not be tolerated), but to make all projects more beneficial to the country by reducing the costs they impose on the environment, and on those people most exposed to environmental degradation - the poor. Therefore the effectiveness of any EIA procedure should not be measured by the technical sophistication of the ecological models used, but rather by the learning which goes on through the interactions between interested stakeholders in the stages of project planning and review. Three kinds of skills are crucial to the success of EIA:

- process management skills
- technical / scientific knowledge and analytical skills
- information management skills

4.1 Process management skills

Environmental planning and impact assessment are not policies, not outcomes, not products or technologies, they are processes for reaching better decisions. The processes require complex interactions between stakeholders whose interests are often perceived to be competing: different government agencies, private investors, NGOs, affected publics. It is through the management of this process that the greatest gains in learning can be made. The management of any decision process involving multiple organizations with conflicting interests is a tricky business, doubly so when the process is a new one. It is the development of process management skills and capabilities which is the highest priority for HRD in this field in Cambodia.

Some examples of the kinds of skills referred to include:⁶

(i) **consultation**: knowing when and how to solicit information and advice from others

(ii) **communications**: knowing how to communicate well. This includes being able to give clear directions, but also knowing how to listen to others. An essential element is being able to clarify disagreements rather than argue about them.

(iii) **conflict resolution**: environmental assessment can involve judgments and opinions which conflict sharply. It requires special skills to get past the

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⁶ Language is vital for communications, but these skills do not refer to language limitations: even if all work is undertaken in the Khmer language, the same concern would apply.
conflict, learn more about what is happening, and help protagonists to identify solutions.

(iv) **report writing**: being able to write clear and concise reports, which identify outcomes, explain causes and recommend actions.

(v) **correspondence**: ability to prepare clear and concise official letters, memos and written advice.

(vi) **organizational and management skills**: to run an effective EIA process requires a well-managed organization. Lines of communication must be clear, managers must be able to plan work, delegate, evaluate, coach and supervise, including providing appropriate feedback to staff. Planning and running effective meetings is also an important management skill.

4.2 **Technical / scientific knowledge and analytical skills**

Good EIA requires strong technical skills, particularly in natural sciences, social sciences and health, in order to be able to predict likely impacts, identify crucial ecological, social and health effects, and assess risks associated with development alternatives. Of course, the need for such skills depends to some extent on the nature and scale of the project and the characteristics of the site and context. In sensitive cases, where complex systems and potentially-hazardous substances are involved, it may indeed be the case that sophisticated technical analysis is called for. These skills come only with rigorous academic training and years of professional experience. For this reason, it is common practice for the assessment, prediction and analysis of impacts to be undertaken by specialists. For the same reason, it will be a long time before such specialists are found in Cambodia. The requisite scientific training and experience is simply not available in the country. So EIA technical specialists will need to be recruited internationally whenever they are needed (at least for a timeframe which exceeds the five-year horizon of this study). This constraint need not limit the introduction of EIA - indeed it is not uncommon in many other jurisdictions.

In the immediate term, bringing in such skills from outside Cambodia will require RGC staff to improve their foreign language skills in order to communicate effectively with the foreign experts. In the medium term, a small number of well-qualified government staff can acquire basic scientific and technical / analytical skills through undergraduate or post-graduate training programs. In the longer term, the instructional and training capacity in the field of natural sciences within Cambodia must be improved, so that eventually basic technical skills in field and analytical biology, ecology, chemistry, physics, sociology and economics can be taught within Cambodia.
4.3 Information Management Skills

EIA, like other planning procedures, requires the collection, analysis, communication and evaluation of information. The process is highly sensitive to the quality and quantity of relevant information, and the learning which is essential to the effectiveness of the exercise requires careful management, manipulation, storage, and communication of this information. Skills in information management are very important to good EIA. This includes not only understanding the parameters affecting the need for, and quality of, raw data, but also ways of sorting, storing, retrieving and presenting the data and analytical conclusions derived therefrom. Electronic data processing technologies have become indispensable in such procedures, but the procedures are (or ought to be) driven by need, not by the technologies themselves. Therefore, on the basis of a clear understanding of the need for and uses of information, computer skills can be very helpful in terms of:

- research and information retrieval
- recording and storing data
- data base management
- modelling
- report-writing
- data presentation (graphical, digital / thematic mapping, etc)
- communicating, transmitting and exchanging data

The acquisition of these skills could greatly enhance EIA effectiveness, if the skills are appropriately applied.

4.4 Characterization of MOE Staff Capabilities

A summary of MOE staff data is available from a survey undertaken in late 1994. Selected elements of the survey data are summarized in Appendix A. The data is now 2 years out-of-date, but is the most recent available. While a number of staff have been reassigned between departments in that period (and department names have changed), the aggregate picture remains fairly accurate. There has been a small turnover of staff within the Ministry overall.

The principal features of note in MOE staff backgrounds include the following:

- by Cambodian standards, MOE staff are well-educated. However, their formal qualifications are very weak by international standards (see Fig. 1)
- most of the staff are recent graduates of Cambodian technical institutes. The MOE was created by the secondment of technical staff from several other agencies (mainly within MAFF and dealing with irrigation, hydrology, agricultural extension, forestry, rural development). It appears that the officials responsible for selecting staff chose mainly younger, less experienced government officials to transfer. This is also in part a function
of Cambodia's demographic peculiarities: a whole generation of young professionals disappeared in the late 1970's, so there are now few middle-aged, experienced professional staff (see Fig. 2)

- very few MOE staff were trained overseas, and those were trained in Vietnam, Russia or Eastern Europe
- language skills are relatively weak (Fig. 3). While about half of the professional staff claimed some ability to read basic English, very few were able to work in that language (this situation has changed in the past two years with intensive English language training, in part through this TA, and further contact with a variety of donor projects within the Ministry)
- while many staff have a limited background in natural or applied science, none have specialized or post-graduate educational qualifications in any environmental science (biology, ecology, geography, resource economics, etc)
- none of the staff have formal training in management, although some have been trained in accounting or finance
- a substantial proportion of the staff, even two years ago, had some exposure to short-term training programs in Cambodia

While the relative youth of MOE staff means that they have little practical field experience, it also means that they are enthusiastic and amenable to re-training in a new subject. Some evidence of that can be seen in the relatively high proportion of staff who, even two years ago, had some exposure to in-country short-term training sessions. Given the very limited language skills of participants, it is hard to judge how effective these trainings were. However, since this survey, there have been many more opportunities for short-term training within the country. Some of the results, in the case of the PRMD staff in particular, are summarized in Table 1 of the Institutional Development and Planning report (Section 2).
Fig. 2 MOE Staff - Years Since Completing Studies (1994 baseline)

- > 10 years: 16%
- 5 - 10 years: 14%
- 2 - 5 years: 23%
- less than 2 years: 47%

Fig. 3 Language Ability of MOE Staff

1994 baseline

- Basic Reading
- Working Ability
- English
- Russian
- French
- Vietnamese

Based on survey of HQ staff.
The lack of experience of MOE staff is a significant drawback though, in terms of developing the judgment which is an important element of professional work in this field. While the staff have weaknesses in both academic and practical background, their limited work experience (on average) suggests that attention to practical job-oriented learning opportunities will be most beneficial in strengthening their professional judgment and self-confidence.

In relation to the skill requirements for undertaking EIA and REDP, as outlined above (section 4.1 - 4.3), the capabilities of MOE staff are very limited. Many of the skills cannot be adequately represented in the results of the survey. The formal training received by MOE staff has not adequately prepared most of them, for example, to prepare good technical reports or official correspondence, even in the Khmer language. Project management, communications and office management skills are also weak. These capabilities will be tested now that the LEP is approved and formal EIA requirements lead to a sharp increase in workload in MOE.

The staff profile built up from this survey data thus provides useful information on capabilities and HRD needs. This data has been supplemented through the accumulated exposure of the consultant team to collaborative work with the participants in the EIA / REDP Training Course over a period of more than 8 months of classroom instruction and case studies.

Through the Training Course component of this TA, and the related ESL training, participant skills and capabilities in a number of important dimensions have been greatly strengthened. However, it is clear that, given the base from which this project started, there is a large HRD and capacity-building task ahead. The products generated by course participants as part of the training undertaken in this TA provide some illustration of the current capabilities of MOE staff who have undergone several months of intensive training in EIA / REDP methods and English language. The case study reports produced by course participants are assembled in the following section of this report (Section 4: case study reports), in much the form that they were submitted. These reports therefore provide some evidence of both how far the participants have come in understanding and being able to apply the basic concepts, and also how far they have still to go in improving professional skills.

Consultants have reviewed the reports and provided feedback on structure and presentation, and edited contents for comprehensibility. However, the writing and analytical work has been done by the case study groups themselves.
5. GOALS AND OBJECTIVES OF HRD STRATEGY

The strategic goals which are important to the Ministry of Environment and the Royal Government of Cambodia have to do with the overall performance and administration of EIA review, not only with human resource development.

The overall goal is to achieve and communicate greater understanding of environmental consequences in order to provide better guidance to development planning and decision-making on a project-specific, sectoral and regional basis. The results which the government is trying to achieve are more effective and environmentally sustainable development, lower environmental costs, and improved living conditions for the (environmentally-vulnerable) poor.

5.1 Goals for HRD

Human resource development needs must reflect different requirements over different timeframes. In the immediate term, these needs are to reinforce the capacity already developed at MOE through this TA, by building staff confidence and administrative consistency through more regularized procedures, better screening of projects, and improved communications with stakeholders.

In the medium term, effort needs to be devoted to developing core competencies in environmental planning and assessment in other line agencies who must interact with MOE, and in provincial environmental bureaux who are better equipped to collect local, project-specific field information and undertake IEE analysis consistent with national policies and procedures.

In the longer term, the focus must be on developing capacity at Cambodian training institutions and at MOE to equip a new generation of professionals for multidisciplinary environmental management jobs. Post-secondary and post-graduate educational programs need to be developed in formal educational institutions, and within MOE training and leadership skills need to be fostered so that professional staff can train new recruits and provincial environmental staff.

HRD goals can also be expressed in terms of the kinds of performance which will be expected from the people and organizations involved. These goals can be summarized by the following performance descriptors:

(i) **Regular**: Ad hoc procedures need to be refined and standardized. Staff should have a clear conception of their job (even if that job is flexible) and a regular system of reporting, and internal administration. EIA review should be undertaken on a consistent and timely basis, according to review priorities assigned on the basis of project screening procedures which increasingly involve PEDs and line agencies.
(ii) **Systematic:** Planning procedures should be thorough and information-intensive, beginning with screening to determine priorities for effort. A prerequisite here will be the formalization of EIA and review procedures after approval of the LEP and related guidelines, sub-decrees and administrative orders. Eventually, MOE planners and EIA reviewers should have access to a wide range of information sources both inside and outside Cambodia and be able to apply these in conjunction with evaluation of local ecological knowledge through context-appropriate processes for public communication and involvement. A high level of interaction with other MOE departments and line agencies will be required. Information technologies may support such behaviours, but the key objectives are the behaviours themselves, not merely the adoption of certain technologies. IT support could include GIS/remote sensing applications, expert systems for project screening, Internet use for reference and consultation purposes, data bases on projects, impacts and technical expertise within the government, management support and communications systems (e.g. online info reports and newsletters) as well as administrative tracking systems to ensure thorough and accurate procedures.

(iii) **Integrated:** Environmental planners must integrate their activities with the RGC project planning and review process. This will require a much better awareness and appreciation of EIA/REDP outside MOE, especially among senior decision-makers. It will also require confidence and communication/presentation skills from MOE staff, and transparency in the process in order to build external trust. Key central and line agencies must be reassured of MOE intentions, mandate and capabilities. MOE must be responsive to policy priorities set by the government, and be able to add value, through specialized skills and expertise, to development planning and review. It will be essential to keep partner agencies well-informed of changing priorities, procedures and experiences.

(iv) **Effective:** EIA review and environmental planning should become more consistent and technically competent. This will require acquisition of more technical skills and supervised experience. Professionals, project teams and their managers must become more responsible for their performance (both individually and collectively) and must be held accountable for quality control in their respective assigned tasks. In-service and on-the-job training should be seen as normal organizational behaviour and incentives provided for staff to continue to upgrade technical and managerial skills.

(v) **Efficient:** Cost-effectiveness will be an important long-term consideration in order to demonstrate the development benefits of EIA and environmental planning. This consideration applies also to interaction with external players, especially project proponents and investors. Requirements should be clear and concise. Procedures should be transparent to reduce confusion and wasted effort (i.e. all parties know
what will happen next and who is responsible, and will have access to official documents which result). Effective screening of projects and plans will ensure the best application of limited resources. Sharing scarce technical expertise (through secondment from other MOE departments and line agencies), use of library and reference materials to benefit from case studies and other countries' experience, access to low-cost Internet resources, and team-building for trust and collaboration all contribute to higher operational efficiency. Formalization of mandates, role clarity, improved communications skills, judgment and experience, and growing confidence will build staff capacity to interact with external players in a positive and efficient fashion.

Typically, all of these goals interact to reinforce each other. Thus similar operational time-bound targets and objectives can support more than one goal.
6. TARGETS FOR STRATEGY IMPLEMENTATION

Progress in the achievement of the strategic goals identified above can be measured through specific skill-linked targets. These targets represent behaviours or applications whose accomplishment are tangible or can be easily verified or measured. While they may not demonstrate complete achievement of the strategic goals, these targets can be used in the course of implementation of technical assistance and training programs to evaluate progress.

6.1 Time-Bound Targets

The timeframes required for human resource development goals are long. Learning complex new management and technical skills such as environmental planning and assessment requires years of effort and guidance. However, the initial steps in the learning process may manifest results even after one year of concerted effort. Targets are identified for each of the goals outlined above in relation to three different time horizons: 1 year, 2 years and 5 years.

6.1.1 Targets to Regularize Environmental Planning and Assessment Procedures

In the short term, the main requirements for regularizing procedures within MOE are the development of improved organizational and management systems. In order to move from the current ad hoc system of handling planning and project requests, the emerging structure and staff assignment should be reviewed and, if possible, simplified and then approved by the Ministry. It will be essential in order to build on investments made already that existing trained staff be retained in PRMD and assigned to tasks which best make use of their new skills. Basic administrative systems for communications, task assignment, project management and filing must be developed and implemented. Once the sub-decrees accompanying the new LEP are approved, it should be easier to develop simple internal operating guidelines to smooth procedures.

In the medium term, project screening should become routine and standard assessment procedures and guidelines should be in operation. In addition, as new staff are recruited to fill growing demand or to deal with attrition, the MOE should be able to specify the skills and qualifications needed for these positions. Trainers from MOE should be trained to deliver modular administrative and technical skills development training packages to provincial environment departments and to other line agencies.

By the end of the five-year strategy horizon, training systems within MOE should be in place and used routinely to indoctrinate new staff in EIA policies and procedures, as well as to train the relevant provincial and line agency staff. The planning and review procedures will be widely understood throughout the government, and surprises and misunderstandings about these will be few.
6.1.2 Targets to make EIA / REDP More Systematic

The first, and most important task for PRMD will be to develop the sub-decrees and regulations to support the new LEP. These will contribute greatly to systematizing the collection of information and the review of EIAs by making requirements transparent. To be able to address the many information and analytical requirements of the new EIA procedures, it will be important that a wide range of sources of information and expertise be available to PRMD. They will need to identify government staff with relevant technical expertise, and provincial staff who can collaborate in terms of local knowledge. As MOE library resources expand, it will be more important for technical staff to be able to use this resource for reference purposes. Library and research skills are presently almost unknown in Cambodia due to the absence of libraries.

Another potential source of parallel information could be the international data sets available through Internet. Internet service will be available shortly in Cambodia, and one measure of how systematic EIA review and environmental planning have become would be the demonstration of Internet search skills based on specific assessment-related questions. It would be feasible to provide training and equipment for this task, and to evaluate initial implementation, within a short timeframe.

In the intermediate term, these new skills and resources could be used to develop standard references, including (for example) routine consultation of key websites, library materials linked to screening procedures for specific sectors or project types. In order to address specialized or sensitive issues, PRMD will also have to develop procedures for referral or external consultation. An important part of these external consultation systems could be the development of protocols and basic procedures for public consultation appropriate to project scale and impacts.

It will be vital that technical and administrative competence not only be developed internally, but that it be clearly visible to other agencies. This links to the effectiveness of communications and of task performance, dealt with below.

For its own purposes in demonstrating and tracking systematic performance in EIA review and environmental planning, it would be helpful for MOE to develop a project data base with both external information on the project itself, and internal information on how it was handled, who was responsible, the nature of recommendations, follow-up monitoring program, etc.

In the longer term, a variety of information-based technical support systems (GIS, data bases, expert systems) could be used to support systematic EIA review and planning.

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8 Much of the internet data could be expected to be relevant only to industrialized country audiences (e.g. US government specifications and requirements). However, sources such as ADB and the World Bank also provide substantial information including recent reports and publications on project experience and review methodologies which would be directly applicable. An increasing number of development NGOs also maintain websites and, increasingly, data sets.
For maximum impact, these systems should be structured simply, but linked so that they can make EIA information accessible to users who will be most affected by projects (e.g. other agencies, local governments, investors). These support systems could also be used as platforms to support interactions with line agencies and with provincial environmental departments on a full range of planning and assessment issues.

6.1.3 Targets for Integration of EIA and REDP

In order to better integrate EIA and REDP into the regular administrative processes of MOE and other government agencies, short term targets could be the establishment of transparent procedures (that is, processes where everybody knows which agency is responsible for what, and decision criteria are explicit) for handling EIA reviews. These could be incorporated directly into the MOE strategic planning work which is underway.

MOE will have to be able to engage in regular consultations, and negotiate with other agencies on a range of issues relating to project review and assessment. As a start, PRMD could develop the procedures and skills required through improved communications with other departments within MOE. PRMD must be able to communicate its mandate for EIA and the procedures it uses to other agencies or else it is unlikely to ever have these integrated into government procedures.

In the medium term, these consultations should clearly extend beyond MOE, and good relations should be developed with CDC, as the most important project referral and decision agency. However, while a special relationship with CDC should emerge quickly, in the medium term, an acceptable target indicating progress on this front could be that key actors at least are aware of EIA procedures and understand the basic requirements.

One group which should be expected to respond more quickly, and to be more sensitive to the need to establish good precedents is the international donor community. These organizations are already familiar with international practice in environmental assessment, and should be able to adapt their usual requirements to the emerging Cambodian EIA requirements and review processes. Donors can set a very useful and confidence-building precedent at an early stage by being fully cooperative and involving PRMD in EIA plans and reviews.

A government and donor agency email system would simplify communications in this regard. As Internet and email spreads in Cambodia over the next few years, PRMD should actively seek opportunities for investing in email software, training and coaching.

In the longer term, of course, it is reasonable to adopt targets such as the expectation of EIA’s becoming standard procedures for both public and private investment projects. PRMD communications skills should be well-developed and applied regularly with a
wide range of government agencies. Finally, over the 5-year horizon it should be expected that the first formal concepts of environmental assessment and planning will appear on academic curricula as Phnom Penh University and the technical colleges strengthen their curricula.

6.1.4 Targets for Effectiveness

In the short-term, effectiveness of environmental planning and assessment is unlikely to change much without determined intervention. One of the most important considerations is that on-site supervision and coaching by a sympathetic but knowledgeable international expert could, by itself, provide a huge boost to the productivity and effectiveness of the organization. Until the youthful staff of MOE gain experience and confidence, it will help them enormously to have a "coach" easily accessible who can review their work and advise on how to proceed.

While an advisor on-site will help to overcome shortfalls of experience, specific action will also be needed to address technical expertise deficiencies among MOE staff. For reasons which are discussed further below, it will be very difficult, and relatively ineffective from an operational standpoint, to have government administrative staff sent to lengthy overseas training. However, promising academic personnel from PPU could be sent on long-term training to boost their academic qualifications and skills in key related fields such as biology, ecology, physical geography, social sciences, economics, and planning. The selection criteria for such trainee candidates should be discussed carefully in light of anticipated teaching and leadership responsibilities. Clarification of these selection criteria would in itself be a measure of short-term progress. It could take well over a year to agree on the kinds of training, selection criteria and candidates for such training.

In the meantime, short technical upgrading courses will be needed within PRMD, and conceivably also for provincial environment department and PPU staff, to enable them to meet the demands which will be increasingly imposed on them as a result of the passage of the LEP.

PRMD staff should, within a relatively short period of time, be able to identify information deficiencies in IEE or EIA materials sent to them (an increase in effectiveness over current performance). It will take longer for them to be able to identify most analytical or logical shortcomings in materials submitted. The achievement of such capability will mark a significant milestone in capacity.

Protocols and procedures for monitoring the implementation of EIA recommendations will be very important to achieving an effective operation. The protocols and procedures themselves may be developed relatively early on, but it will take more time to actually implement the range of compliance monitoring and sanctions required.
In order to improve effectiveness, PRMD must become more concerned itself with performance of individual staff and of the entire unit. Performance criteria, simple evaluation and reporting systems, once in place, would demonstrate significant target accomplishments. These could be combined with staff performance appraisals and management feedback, undertaken perhaps under the guidance of an external advisor at the outset. Over the long term, it should be evident that effectiveness is being improved through both attention to training needs and performance incentives for individual staff, as well as the modification of EIA review procedures as a result of experience and evaluation.

Over the five-year planning horizon, the first candidates selected for overseas training should have completed their studies towards a Masters degree and have returned to Cambodia. These should form the core teaching group for senior undergraduate courses in natural and social sciences at local institutions, where these kinds of courses should appear in greatly strengthened form by the end of the planning period.

6.1.5 Targets for Efficiency

Achievement of some of the other targets already mentioned would contribute to efficient outcomes. In particular, early clarification of the procedures to be followed in EIA and REDP would help to formalize the role and mandate of PRMD with respect to other agencies and avoid potential duplication. When PRMD is clear on its role, and can explain this to other agencies, this is a significant milestone.

The efficiency of PRMD procedures can only be determined through establishing systems for internal monitoring and review of the effort going into EIA and environmental planning. Without this kind of management information, efficiency gains will be harder to spot. However, an easy first step in improving efficiency will be the development of standardized response forms for typical information requests, reports, communicating outcomes of reviews, and developing standard formats for internal administrative reporting. A start has already been made on this in Section 2 of this report on Institutional Development and Planning, Appendix D (standardized response form). With experience, other kinds of standard correspondence may be developed to speed staff responsiveness.

By the end of the two-year period, these standardized forms should be in use by MOE for information requests, correspondence, reports. This measure should help PRMD to meet the review deadlines requested by central agencies (principally CDC). Internal monitoring should show that review effort per project declines as staff gain skills and experience. One of the procedures that could help in the more efficient utilization of staff resources is the secondment of specialized technical skills, particularly from elsewhere in MOE.

Inter-agency efficiency will increase as other agencies outside MOE gain clarity on the EIA process and their roles in it. Because of its crucial role, a key agency to work on
will be CDC. Once they accept the process and understand their role in it, efficiency will be aided greatly. It is likely to take most of the 5-year planning horizon to gain acceptance and clarity from all the major government and provincial agencies who should be involved in environmental planning and assessment. Eventually, these agencies should all be contributing in an appropriate manner to the process under the guidance of MOE. Technical skills required for EIA and REDP will increasingly be found within the government as short-term and formal training programs accumulate graduates.

6.2 Goal and Target Matrix

The time-frame and goal elements discussed above can be combined in a matrix, whose cells contain individual HRD objectives and time-bound targets.
### Table 1. HRD Goals and Time-Bound Performance Targets for RGC

<table>
<thead>
<tr>
<th>Goals</th>
<th>Performance Targets</th>
<th>Medium (2 yr)</th>
<th>Long (5 yr)</th>
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<tbody>
<tr>
<td><strong>1. Regular</strong></td>
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<td></td>
<td>a) basic management skills (communications, planning, assignment, feedback) demonstrated within PRMD</td>
<td>a) project screening routine and review process being used</td>
<td>a) train all new PRMD staff in EIA policies and procedures</td>
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<td>b) engage existing trained staff in EIA review process and continuing HRD</td>
<td>b) standard assessment guidelines and review process as appropriate to project scale and impact</td>
<td>b) train all relevant provincial and line agency staff</td>
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<td></td>
<td>c) develop and use basic admin. systems for internal communications and filing</td>
<td>c) specify skills and qualifications needed for recruitment of new staff</td>
<td>c) planning and review procedures will be widely understood and anticipated by line agencies and provincial officials.</td>
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<td></td>
<td>d) simplify PRMD structure and clarify job descriptions</td>
<td>d) train MOE trainers to deliver modular administrative and technical training to provinces and line agencies</td>
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<td></td>
<td>e) develop internal operating guidelines and simple procedures, with responsibilities identified</td>
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<td><strong>2. Systematic</strong></td>
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<td></td>
<td>a) develop sub-decrees and implementing regulations for LEP</td>
<td>a) develop basic technical and info support systems (e.g. screening, library references, Internet resources)</td>
<td>a) implement variety of technical support systems for EIA, including GIS linked to data base, expert systems for provincial IEE's</td>
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<td></td>
<td>b) identify sources of expertise for planning and assessment in MOE departments and other line agencies</td>
<td>b) develop basic local public consultation / review procedures as appropriate to project scale and impact</td>
<td>b) develop and implement procedures and systems to make EIA information accessible to those affected (e.g. other agencies, private sector, local people)</td>
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<td></td>
<td>c) involve provincial staff in REDP and EIA pilots as sources of local knowledge</td>
<td>c) demonstrate technical and admin. competence to other agencies</td>
<td>c) consultations with line agencies and provinces cover full range of planning and assessment issues</td>
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<td></td>
<td>d) library training to improve access to information</td>
<td>d) develop project data base</td>
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<td></td>
<td>e) Internet training to evaluate utility of external information sources</td>
<td>e) establish technical referral system involving other MOE departments and line agencies</td>
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<td><strong>3. Integrated</strong></td>
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<td></td>
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<td></td>
<td>a) transparent processes for handling REDP and EIA incorporated into MOE strategic plan</td>
<td>a) awareness of EIA procedures and requirements in most government agencies</td>
<td>a) EIA (led by line agencies) standard procedure for large public investment projects</td>
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<td></td>
<td>b) regular and frequent consultations between PRMD and other departments of MOE</td>
<td>b) regular and frequent consultations between PRMD and CDC</td>
<td>b) private investors prepare and submit EIA's as a routine element of project planning</td>
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<td>c) PRMD can communicate EIA mandate, processes clearly to other agencies</td>
<td>c) private investors understand EIA requirements</td>
<td>c) regular and frequent consultations between PRMD and line agencies</td>
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<td>d) donor agencies understand EIA requirements</td>
<td>d) donors meet all EIA requirements and submit EIAs to PRMD for review</td>
<td>d) EIA and REDP concepts appear on advanced curriculum of courses at PPU and technical colleges</td>
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<td>e) email conference system with other agencies</td>
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<td>Goals</td>
<td>Performance Targets</td>
<td>Medium (2 yr)</td>
<td>Long (5 yr)</td>
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<td><strong>4. Effective</strong></td>
<td><strong>Short term (1yr)</strong></td>
<td><strong>Medium (2 yr)</strong></td>
<td><strong>Long (5 yr)</strong></td>
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<td>a) supervision, coaching and on-the-job training in EIA review skills b) identify skill requirements, selection criteria for up to 5 candidates for overseas training c) organize short technical upgrading courses for PRMD, provincial MOE and PPU staff d) PRMD able to identify information deficiencies in IEE or EIA e) monitoring protocols and procedures developed</td>
<td>a) develop performance criteria for PRMD b) develop appraisal process for staff performance c) undertake self-evaluation of procedures identifying problems and recommending improvements d) PRMD able to identify information and analytical deficiencies in IEE / EIA e) select staff for overseas training f) start upgrading local training institutions’ curriculum and teaching skills g) compliance monitoring and enforcement sanctions in place</td>
<td>a) senior undergrad level courses in biology, geography, ecology, planning, systems analysis, social science, available through PPU b) complete training overseas to Masters level c) PRMD able to routinely specify measures required to rectify information or analytical deficiencies in IEE / EIA d) standard EIA review procedures modified to improve performance, based on analysis of project monitoring experience</td>
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<td><strong>5. Efficient</strong></td>
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<td>a) formalize PRMD mandate and role wrt other agencies to avoid duplication b) role clarity for PRMD c) establish system for monitoring internal review effort d) develop standard formats for common information requests, official correspondence, reports, reviews, and internal administrative reports</td>
<td>a) process in place to second short-term technical inputs as required from MOE depts and line agencies b) role clarity for CDC c) review effort per project declining d) PRMD meets review timelines set by CDC e) PRMD uses standard format letters, reports.</td>
<td>a) role clarity for all government agencies and PEDs b) IEE and field data collection undertaken by PEDs under guidance of MOE c) technical expertise for EIA review found mostly within RGC (advisor roles declining) d) standard format letters and reports modified to improve efficiency</td>
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7. CONSTRAINTS TO HRD

There are several obvious constraints to delivering HRD programs in Cambodia, even given sufficient resources to do the job. One of the most fundamental constraints, affecting all the others, is the lack of training infrastructure. This was referred to in Chapter 2, HRD Context (p. 3 above) of this report. There are very few skilled trainers and teachers, and very limited understanding of pedagogy, training methods, and educational administration. With very weak educational systems, and poor post-secondary training, there is relatively little understanding of the academic requirements of disciplined study, reading, critical discussion, writing and practice. There is also almost none of the infrastructure (libraries, videos, reference materials, audio-visual equipment, facilitators and trainers), in either Khmer or foreign languages, which would be expected to be available by most instructors in an advanced training program.

Similarly, there is little experience with the use and application of such materials. Thus, if an instructor tried to tell students in Cambodia to “look this up in the library and prepare a report for next week”, the students would probably not know how to do this, even if they had access to a library with the relevant materials in it. Not only would they not know how to find information in a library or reference book, but they would probably not know how to prepare a simple report. As another example, meetings and training sessions are often conceived and delivered as lectures, where the leader or expert stands in front of the participants and talks at them for several hours, in spite of the most basic rules of pedagogy which suggest that retention of unsupported lecture information is almost nil. A basic understanding of what it means to study, to learn, to teach: these are all hard to find in Cambodia.

This situation is changing rapidly because of investments by almost all of the aid organizations operating in Cambodia, who need to develop the skills of their local staff and to train implementing staff to execute their projects. Therefore, over the five-year planning horizon, the improvement of local skills in training and delivery of training programs should help ease some of these constraints.

Another major set of problems are in the effectiveness of the HRD and its application to organizational capacity-building. Several constraints in this regard should be considered in the planning and structuring of future assistance programs. None of these need be insurmountable, but effort and attention should be devoted to ensure that pitfalls are avoided.

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There is an important exception to this statement. Hundreds of thousands of Cambodians spent 15 years or more in huge refugee camps, mostly along the Thai border. Within these camps, relief organizations provided high-quality practical training including medical, surgical and nursing training, teacher training, basic literacy and even some foreign language skills. Repatriation programs generally moved these people to rural areas of Cambodia.
7.1 Communications

The basic precondition for effective training is communication. But communication across quite different cultures, and between different languages, can be very difficult. In the case of Cambodia, the issue is not merely a question of translation. Many technical and scientific English terms do not have widely-recognized Khmer equivalents. Thus, new Khmer terms must be created, or old ones used in new ways, or elaborate explanations must be given, just to explain what is meant by a single English word. In the case of many technical terms, this is not easy because there is a whole body of theory and related concepts embedded in the English terminology which cannot be translated.10

A related issue is that there are very few competent translators in Cambodia, and these few are extremely busy with high-level or commercial demands on their skills. Without a knowledge of some of the technical terminology and its context in English, translators cannot adequately convey the meaning to their audience. This is a problem, not only for presentations by trainers, but for the translation of technical publications, guidelines and reports. In the absence of good translators, there is a risk that the translation effort generates more confusion than it resolves.

For these reasons, improved language skills are essential. The need is for Khmer staff to learn more English, and apply what they already know more frequently, and for long-term expatriate advisors to also learn Khmer, and to include project time and resources as required to enable them to do so.

7.2 Logistics

In addition to the lack of educational infrastructure (institutions, trainers, administrators, study practices), as described above, HRD programming must allow for the logistical problems of meeting simple requirements related to training programs.

At times, for example, it can be difficult to find a suitable meeting room in which to hold a training session. Rooms at MOE are booked for a variety of donor-funded trainings and internal meetings, involving different groups within the Ministry, organized and funded by different donors. They often do not know of each others’ existence. Booking of accommodation for such events is handled relatively efficiently within MOE, but there are still occasional conflicts. There are relatively few venues outside the Ministry with the facilities to cater to private meetings.

Another important constraint is power supply. The reliability of power has improved substantially in the past couple of years, but grid outages, backup failures, and local disruptions due to construction are frequent. Such disruptions affect air-conditioning,

10 This problem is widely recognized within the MOE, so IDRC is supporting the development of a Khmer-language glossary of selected environmental and technical terminology. This will be a first, partial step towards helping resolve this problem.
making unventilated interior spaces impossible to work in; computers, which can be shut down safely only if they have functioning UPS systems; photocopiers, which are typically so large that UPS becomes prohibitively expensive; overhead projectors and audio-visual aids. Voltage fluctuations, frequency variations, spikes and other electricity quality problems are also common, causing damage and reduced operating life for most electronic equipment.

Purchase of supplies and equipment can be problematic. Many consumer goods which are also used in training programs are now widely available at reasonable prices locally (e.g. computers, VCR, video camera). However, specialized peripheral equipment (e.g. high-speed modems, oversize monitors, colour plotters) or replacement parts (e.g. projector bulbs, rechargeable batteries for portable equipment) may be impossible to find. A related issue is service: while it may be possible to purchase new equipment, user support may be either non-existent or exorbitantly expensive. HRD planners should keep this in mind, and allow for depreciation, maintenance, and import of equipment and spares in project planning.

Telephone service is also problematic. Handphones are costly, but much more reliable for basic communications than the land-based lines. The latter are subject to frequent disruption due to construction, deliberate tampering, poor quality line connections and flooding of underground lines. Handphones also offer the advantage that they enable the bearer to be traced regardless of where his or her meeting is. Many government offices and public buildings have no telephones at all, and there is no reliable directory of telephone listings through which numbers can be found. People are frequently out of the office, and because most offices lack either trained secretaries or receptionist, nobody knows where they are, when they will return, or even how you can leave a message. If you do not have a handphone number for the party you are trying to reach, you can spend a lot of time trying to find them.

Even such simple matters as office (or training room) cleaning and provision of furniture can be a problem, unless resources are budgeted for them. While it is not difficult to purchase such services, it should not be assumed that a commercial landlord or an institutional host will automatically provide them.

7.3 Attrition

One of the issues particularly relevant to HRD strategy is that as government staff gain skills through training programs such as the one provided in this TA, or the programs envisioned as part of this strategy for future HRD, they leave government for more lucrative positions in the private sector. From the overall standpoint of Cambodian development, this is not a net loss. The skills and knowledge acquired through donor investments remain within the economy and are put to productive use. However, from the standpoint of government effectiveness it will be a problem.
The very limited skills available in Cambodia, combined with rapid growth in the private sector, particularly in various commercial services to support emerging trade and investment operations, means that many of the skills acquired by trainees in these programs will continue to be in high demand for the foreseeable future. Such skills as English language, basic organizational and management skills, report-writing and computer operation will all be essential for the operation of an effective government office. But they will also be needed for private commercial operations too.

The problem is that government salaries cannot compete with the private sector. While there are clearly perceived advantages to the security of government positions, these cannot compensate for salary levels which are insufficient for survival. At present, all government staff with dependents are obliged to have other jobs to provide their primary income.

The problem is widely recognized, but there are no easy solutions. Current practice is that, in general, officials try to accommodate the best staff and keep them in government service by 'seconding' them to paid counterpart positions on certain donor-funded projects. This provides a salary sufficient to live on, training opportunities, and some professional experience (ranges depending on the nature of the project and the behaviour of the expatriate project staff - sometimes few opportunities for meaningful work are provided).

The down side of this situation is that such people are effectively removed from service within the department. In other words, they are no longer available to do the government work (e.g. EIA review) for which they were originally trained and to which they were officially assigned.

Another alternative is that competent people leave the government. Formal resignations are rare, because in many government offices there is relatively little work and many staff, so frequent absenteeism seems not to be a concern (at least in the short term). In such cases, of course, staff are unable to do much work (should it arise) for their government job. The only way that trained government staff are likely to stay focused full-time on their assignments is if they receive some form of supplemental salary.11

While retaining technical staff is therefore a problem, the situation may be even worse for administrative and support staff. A modern commercial or public sector office, working in an international environment, requires administrative support staff with typing and computer skills; administrative and clerical skills to maintain, store and retrieve information; and verbal / written communications skills in more than one language. Anybody with this set of skills in Cambodia is in high demand as the commercial sector grows.

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11 This issue has been studied by UNDP in relation to current donor practices and the implications for future development project counterpart agreements in Cambodia (report not available at time of writing).
As an example of the difficulties to be faced in maintaining skilled staff under current conditions in the MOE, the EIA Department (PRMD) lost 3 of its most capable staff in the short period between the end of the EIA training course (June 1996) and the conclusion of the project (October 1996). During this period the department was formalizing its organization and its workplan, and was beginning to respond to informal project referrals in a professional way. However, competent staff on regular salaries were offered much more highly-paid positions on donor project counterpart teams, or more lucrative external commercial opportunities. In the absence of continued external project support for staff salaries, this level of attrition for the best staff seems likely to continue (i.e. in the range of 60% per year).

7.4 Management and Organizational Development

One of the constraints to the effectiveness of HRD in Cambodia is the nature of public administration and decision-making. The general assumption of technical HRD for public officials is that it will foster a more professional, competence-driven government service. However, there are many aspects of decision-making and organizational behaviour which mitigate against this. Some of these features are embedded in popular and traditional images of how organizations work, and can be found even at the village level.

For example, a technocratic view of the role of decision-making authority or power is that it enables its holder to influence (or, in the extreme, to choose) the best course of action for the organization or the broader society which it represents. Holders of such authority ought therefore to be knowledgeable and experienced in their field, so they can make the best decisions. On the other hand, if tradition and culture hold that the role of authority and power is mainly to reward its supporters, then the quality of decisions is less important than the quantity of resources which can be gained through those decisions. Another way of putting the issue is whether decision-makers ought to act in the broader “best interests” of an anonymous collectivity (“society”), or in the narrower “best interests” of those people who are their loyal supporters. Depending on one’s background and values, one of these positions will make more sense than the other.

One can find evidence in almost every government organization anywhere in the world that both of these tendencies are active. However, there are clearly social and cultural values which lead to different expectations of “proper” behaviour. In Cambodia, there is evidence from village-level organizations on up to the State that it is expected by most participants that the main role of those in authority is to ensure that their supporters are rewarded.¹² This kind of organizational behaviour is often described as a “patron-client” system. Such systems are common in many developing countries. The argument is not that patron-client relations always determine organizational

¹² See for example Vijphen and Saroeun (1996), who analyze how real authority shifts at the village level in response to control of external resource flows, rather than in relation to formal title or position.
behaviour in Cambodia, but only that in the absence of other evidence, this is the common assumption which participants themselves make.

Patron-client structures also influence the expectations of staff about their role and behaviour too, as the flip side of this relationship. In a strong patron-client system, the main purpose of staff is not to undertake their professional duties to the best of their ability. Rather it is to support their patron. There may not be a conflict between these positions. But if there is, junior members of patron-client structures understand that their future career, access to resources, promotion, and opportunities depend not on how well they do their assigned task, but on how successful their patron is. This has a clear impact on motivation and organizational behaviour.

The nature of decision-making is another issue about which cultural assumptions play an important role. Village meetings to discuss important local issues are common in Cambodia. However, group discussion of a contentious topic does not mean that all members of a group have a say in the outcome. Deference to authority, particularly in public, makes it very difficult for disputants to make their case. An observer may misinterpret the absence of explicit disagreement as consensus. This conclusion may be unjustified, however: participants report their disagreements in private but cannot express them in public against those who hold authority (Vijghen and Sareoun, 1996).

Strong social conditioning in this matter poses a potential problem for the behaviour of any government office charged with reviewing projects which are already endorsed by senior government officials. It is very difficult (and possibly self-destructive) to be critical when open criticism of the views of high officials is socially unacceptable. This situation poses some difficulties for HRD in the environmental planning field, because professional training is intended to provide tools through which government officials can be highly critical of projects with severe environmental implications. It will require substantial creativity and tact to figure out how to apply such tools to improve high-impact projects without causing offense.

The same views about power and decision-making also make it more difficult for organizations to be managed according to Western, technocratic precepts. The question of delegation of authority is central to this problem. If the main purpose of authority is to reward supporters, and if the views of officials who hold authority are the most important factors in making decisions at any level, then delegation of authority is clearly self-defeating. This would hand off power and hence resources to other people, thereby rendering the delegator less effective. However, it is a common assumption of HRD strategies, particularly management training strategies, that the organization involved will delegate authority down to an appropriate level of competence.

It must be stated clearly that it is not the purpose of this report to argue whether organizational power and decision-making ought to change in Cambodia. The traditional expectations of a rural population can break down quickly with education and urbanization, and there are already signs of increasing professionalization in the
public service. There are also examples of economically successful patron-client societies. However, it is important to point out the contradictions between an HRD strategy which assumes a certain set of values about decision-making and the role of the public service, and a set of assumptions which are widespread in Cambodia and quite different.

Another set of organizational issues which constrain effective HRD relates to the way in which administrative support staff are provided. The structure of government offices is standardized by regulation. Administrative functions of every Ministry are handled by a separate “Cabinet”, rather than by line departments. This makes sense in the case of services such as accounting and funds management, inventory, and personnel. It makes less sense in the case of secretarial and clerical support, where an argument could be made for closer functional and supervisory links to operating units. In many ministries (certainly in MOE) there are virtually no support staff of any type working in a line department within the ministry. It can also be difficult to find administrative support staff with even basic clerical skills (see section 7.3 above).

As a result of the lack of skilled support staff, professional staff are obliged to devote time to clerical and administrative support duties (e.g. photocopying, typing, deliveries, routine correspondence, purchasing, etc). Filing of documents is ad hoc. Management of records and reference material is haphazard. It would be more effective if these tasks were carried out by persons who were trained to do them, not by people trained for other jobs.

A related issue is the assignment of staff to different job responsibilities. This matter is linked to the question of incentives for HRD. From the standpoint of the organization, the incentives for HRD are clear: better trained staff can perform their tasks better and the organization will become more effective and powerful. However, from the standpoint of the individual, learning new skills (or new languages) is hard work. There is no direct financial incentive (unless the trainee leaves his or her government job for another which demands more skills but pays better). If competent trainees are not assigned to tasks where they can use their new skills, they will have even less incentive to participate fully in the training. To improve the motivation of trainees, job responsibilities should be assigned in relation to the skills they acquire.

### 7.5 Donor Programming

Because of the situation in Cambodia, capacity-building is a frequent theme of donor support. However, in spite of this there are very few aid projects which are specifically designed to build capacity. Normally, the capacity-building objectives are added on to an existing project of investment or technical assistance.

The way in which donor projects are frequently structured also makes it difficult to ensure effective capacity-building. To start with, most donor projects are defined and implemented at a level much too sophisticated for the Cambodian counterparts to have
meaningful input (language capability is an important constraint here, as are basic technical concepts). Second, the technical advisors to these projects are normally selected on the basis of their technical expertise, and not specifically on the basis of inter-personal, pedagogical, or cross-cultural communications skills. Expatriate advisors are also very costly, so resource efficiency demands that they work to tight time deadlines. Frequently, the result is that the advisors soon discover that their local counterparts cannot keep up with the pace of the work, and the process of learning required for them to do so is much longer and more tedious than can be accommodated in the product-oriented terms of the particular project. In frustration, the advisor takes on the responsibility of doing all or most of the work herself, in order to complete the assigned task. Very little learning, skills development, or capacity-building takes place, but a report is produced.

Another problem is that the small number of mid-level government officials who have good foreign language capabilities are always sought to attend international workshops. It is very common for international organizations to find small amounts of funding to invite “representatives” from Cambodia to attend such workshops. However, when the number of linguistically-qualified candidates is so low, the key mid-level people in a department or Ministry find themselves spending much of their time flying around the region attending workshops. Far from building capacity, this result can be “capacity-draining”.

Both of these kinds of donor programming undermine the role of HRD in building competence and organizational capacity. Particularly in the case of Cambodia, it is important that donors have realistic expectations for the role and capabilities of counterparts, and that projects be structured so that there are opportunities for counterpart officials to be engaged at their own level, whatever that is, and incentives for them to increase their level of skills through participation in the project.
8. TRAINING APPROACHES AND TOPICS

Given the needs and constraints outlined above, what are the approaches to HRD in this field which are most likely to be effective in Cambodia? There are many training approaches which have been used in development capacity-building, from short local workshops to 6-year overseas graduate programs. Training could take place in the local, or in foreign languages, and be delivered by different kinds of trainers or learning facilitators. A range of training methods is suggested below, with explanations based on the analysis presented in previous chapters of this report.

8.1 Some Basic Principles

The training approaches suggested below rely on the following principles for their design:

- training should be in the local language whenever possible. In Cambodia, because of the lack of skilled trainers or instructors in almost every field (see chapter 7 above), this is only practical for very basic kinds of training, e.g. correspondence, business administration, introductory computer use.
- training should be undertaken whenever possible in Cambodia. There are so few candidates even qualified to be trained in a foreign language abroad, that the capacity of any organization will be significantly impaired even by their temporary absence. In addition, international travel will be disruptive and distract from learning opportunities, especially for short term training.
- international training should be carefully focused to take maximum advantage of the setting or the specialized institutional skills available.
- instructors should set clear expectations and "learning goals" for trainees at the start of any training program, and review with them whether or not they have been accomplished. Roles and tasks required of instructors and trainees should be made clear.
- trainees should have opportunities to apply new skills as they are learned.
- learning should follow a "spiral" approach, where linked subjects are introduced in a basic way, and then applied to solidify understanding and experience. Instructors return to the same topics again, but in more depth, with more technical detail, higher analytical content, more information requirements. Learners apply this greater detail and sophistication, and come around once again to the same topics to address special cases, advanced topics, specialized issues. Thus learning progresses in a spiral fashion by going around to the same set of topics, but at higher and higher levels of sophistication. At each level of the spiral, opportunities for practice are provided before the subjects are revisited.
- organizational and management skills should be introduced together with substantive technical skills, so that substantive activities can be matched with management and organizational strengthening.
8.2 Foundation Training Approaches

EIA and REDP are planning procedures which require some basic degree of technical understanding as well as an appreciation of decision-making contexts and organizational theory. Much of this can be learned under supervision through practical experience, guided observation and analysis of cases. In fact, for most kinds of other professional training, one of the most effective methods employed by leading graduate and professional schools worldwide is the case study method, which basically involves the approach described above. One advantage of this method is that it helps to develop professional judgement and a culture of learning by doing, through the documentation, review and analysis of real situations. Another advantage is that reinforces the notion that learning and skills upgrading ought to be an essential part of normal professional practice.

The foundation of the training model proposed for HRD in Cambodia can be thought of as an "in-situ case study method". Learning will be focused on the jobs which staff are already assigned to undertake, so their motivation should be high. New skills can be applied immediately in projects on which staff are already working. Instruction and supervision will be closely linked. In a context where the background and prior training of staff widely, but is generally quite poor, it is impossible to make assumptions about what educational backgrounds trainees bring with them. This approach will have the benefit of allowing the training coordinator / tutor to learn more about the trainees by working with them, in order to better design specific instructional packages.

Learners are always reluctant to try something new in a context in which the results count (i.e. if they make a mistake, it could reflect badly on their professional stature or on their position, or on their organization). To help reduce these risks, especially on sensitive applications of new skills, the government staff / learners in this case will be able to call on the support, supervision and advice of a permanent, full-time resident "tutor / coach" whose principal job will be exactly to structure pedagogical exercises around the regular workload of the EIA and planning units, and to provide follow-up advice to learners on the applications of new skills.

To strengthen skills of the entire group in some key technical or management areas, short-term intensive training sessions can be scheduled, using trainers drawn from local, regional or international expert pools depending on the nature of the topic and the availability of the instructional expertise. These short-term, specialized training courses would be planned to link with predictable workflow and project needs within MOE. Short-term training will be "modular", developed in fairly standard, predictable length units which will include classroom sessions, individual or group exercises (simulations, role-playing, preparatory assignments, analytical exercises) and, if possible, supervised field work. Such modules will require approximately one person-month each to develop and deliver.
An advantage of the combined approach of instruction / supervision and specialized technical intensive courses is that it offers the continuity of a long-term advisor with the stimulation of new faces and ideas from short-term trainers. One drawback is that the unique context of Cambodia means that regional or international trainers will take some time to gain familiarity with the constraints on training and HRD here, and tailor their training packages appropriately. A reasonable solution to the need for varied technical training expertise, but the simultaneous need for familiarity with the Cambodian situation, would be to select short-term intensive training programs from among a cadre of regional or international trainers with experience in Cambodia already, or to limit the number of different individuals involved, but engage them for more than one topic or course.

8.3 Foundation Topics

The basic topics for foundation training should build on the material covered already in this TA. Some of this material will need to be revisited (using the spiral approach described above). In the absence of regular application of EIA, learned skills may be lost quickly and need to be regained.

8.3.1 Tools

The following topics should be seen as providing a basic set of tools for the practice of environmental planning and assessment within the context of a professional public service organization. They are, of course, applicable in other contexts too, but for reasons outlined in previous chapters of this report, are particularly important for this field.

- English Language Training: English skills remain weak, but due to the lack of technical materials and specialists in Cambodia, and the dominant role to be played by international investors and aid agencies in the country's development over the coming years, English skills will be needed by professionals hoping to learn or work on environmental planning and assessment
- basic writing skills in Khmer and English: technical report preparation, correspondence, information requests, using official Cambodian government style as well as standard Western business styles of writing
- computer skills: keyboard skills, especially using Khmer characters, touch typing, data entry, word processing, spreadsheet, graphics and presentation software
- basic library and reference skills: information search, retrieval and management. How to use citations in reports. Copyright, plagiarism issues
- communications skills: training in more effective interpersonal relations and communications skills. This must be sensitive to the Khmer culture, but should introduce modern professional communications concepts to improve
typical practices. Emphasis should be placed on the role of effective communications in management

For some of these tools, basic training can be found in Cambodia, and sometimes even in Khmer. Computer training courses and writing courses are offered in Khmer, mostly by private and organizations. A library skills course is also available locally.

8.3.2 Management and Organizational Development

In addition to these basic tools, foundations training should include management and organizational skills, including:

- planning tasks, setting priorities and translating to job assignments
- project management and evaluation
- team-building
- personnel management and supervision
- performance appraisal
- information management and record systems

The management of information is a key element of effective EIA administration. Skill levels in this area within MOE are very basic (even document filing systems are lacking). As skills and experience increase here, more advanced topics can be introduced. In addition to the library and reference skills suggested above, specialized instruction and technical support can be sought for improving database management, and in the use of technologies facilitated by improved electronic communications networks in Cambodia, such as e-mail, and use of internet resources for systematic information search, exchange and retrieval functions.

Personnel management and appraisal is among the more challenging topics because of the difficulty many Cambodian officials have in separating personal and professional issues. While there is increasing recognition that personal issues ought not to dominate relationships in the workplace, there is no familiarity with techniques for reducing conflicts and isolating these two aspects of interpersonal relations.

These kinds of training can be offered in-house, and provide scope for immediate implementation. However, trainers for most of these instructional units must come from outside Cambodia. Local expertise and training skills in these areas are too weak. There are many opportunities for training courses in these areas to be designed around specific tasks which MOE / PRMD will be undertaking anyway, such as the introduction of guidelines or process requirements, or the strategic planning exercise being led by CEMP.

A special need which would have very high returns would be training in how to manage foreign consultants in environmental assessment and planning. In spite of a growing number of foreign experts on long-term assignment to the MOE, the staff would benefit from clearer expectations of the roles of foreign experts, and of how best to define and
manage their tasks. This is a topic which can be taught and readily put into practice. Subjects which could be covered in such instruction include:

- task definition and ToRs
- counterpart vs. donor roles in TA
- contracting procedures
- supervision, reporting
- integrating projects and reports into other work

Again, some of these topics have been introduced already in the current TA, but should be revisited and practiced in greater depth in “spiral” fashion.

8.3.3 Technical EIA Skills

As the opportunities arise through projects or preparation of sub-decrees, environmental planning and PRMD staff should be provided with intensive short courses in technical aspects of EIA. These will need to be delivered by foreign experts but modified according to local peculiarities based on a good knowledge of the country. Among the likely topics in which staff training would be beneficial:

- REDP: tools for analysing and presenting trend information
- scenario development as a planning, forecasting, and assessment tool
- ranking techniques for project comparison and prioritization of alternatives
- EIA: tools for rapid screening of projects
- Uses of expert systems and data bases in project screening
- Environmental economics
- Effective strategies for public participation in EIA in Cambodia, including approaches to evaluation and application of indigenous knowledge in environmental assessment
- Conflict resolution in natural resource and environmental management
- Monitoring programs for typical sectoral projects

Practical Attachment to Donor EIA Studies as a Learning Mechanism

There are a large number of donor-funded investment projects planned for implementation in the near-term future in Cambodia. Most of these require EIA studies under the requirements of the donors. An appropriate mechanism for developing professional skills in EIA for PRMD staff would be to arrange with cooperative donors and executing agencies to have one or two MOE staff assigned full-time to assist EIA teams as a practical learning assignment. Part of the agreement would have to be that all parties concerned recognized the learning objectives, as well as the substantive EIA objectives, involved in such an arrangement. This kind of arrangement would not be purely philanthropic on the part of the professionals or consultants charged with the responsibility of preparing the EIA. In fact, based on the level of knowledge they already have, many of the staff of PRMD could make a very positive contribution to any EIA conducted by foreigners unfamiliar with the Cambodian situation.
One of the topics in which systematic support is needed for professional staff in this field in particular is how to increase general awareness levels of the need for, and benefits of, environmental planning and assessment. Care must be taken in the delivery of early EIA efforts that these are not perceived to be obstructionist in the face of high-profile investment projects. This will require improved sensitivity and skills in such matters as: communications to key audiences, presentation and appearance of interventions, marketing skills.

Additional topics will likely arise opportunistically in relation to specific sectoral development issues in Cambodia (e.g. rapid development of offshore petroleum resources, if it emerges in the next few years, will mean a need for intensive technical training in marine pollution and environmental management issues). The strategic plan for HRD should remain flexible enough to accommodate specific topical priorities as they emerge over the next five years. However, it should be clear that they can be delivered in a consistent fashion, and coordinated with the general tool-building and management capacity development.

In all cases suggested above, the skills and capacity needed can best be developed through a combination of short-term, intensive hands-on type training modules, and immediate supervised application of skills through practical assignments related to ongoing activity. This will require both specialized and general on-site supervisory support, depending on the specific topic.

8.4 Specialized Training and HRD Approaches

Much of the skills development needed in environmental planning and impact assessment can come from the approaches outlined above. However, for certain advanced or specialized topics, alternative approaches may require international travel and training. These could be needed for a variety of reasons:

- the topics are only of interest to a small number of candidates in Cambodia and can be more efficiently addressed through participation in a regular training program outside Cambodia
- topics are best covered through field-based training which requires travel outside the country
- topics are inherently linked to international cooperation and comparison, requiring travel and exchange (e.g. standardization of environmental planning procedures and requirements in Mekong Sub-region)
- topics require a depth of theoretical or specialized technical understanding that is only available from a small number of international institutions (e.g. many issues like ecological thresholds, irreversibility, resilience are poorly understood even by some scientists and practitioners. Specialized approaches like cumulative impact or policy impact assessment may only be understood well by a small group of practitioners)
• formal academic training (for a limited number of staff likely to become trainers, specialists, or lecturers)

These kinds of training needs will best be met by exploring selected opportunities outside Cambodia. The costs of such training are high, both in terms of the direct resource costs, as well as the opportunity costs of removing highly competent people from their positions within government service. For this reason, candidates should be selected carefully to ensure they fit the future requirements of the organization. In addition, formal agreements should be reached with each of the trainees, involving the agreement of the trainee, the senior officials of his or her department and Ministry, and the HRD program advisor. These agreements should specify:

• the learning objectives of the training
• duration of the training
• specific commitments to employ the skills learned in job assignments for the staff on return
• commitments from the trainees to formally share lessons learned in some way with colleagues (e.g. report / paper / workshop / training session)

For overseas academic study, an alternative study option should be explored. A number of highly reputable international universities offer degree programs by distance learning or correspondence. These programs can be much more sophisticated in their methods than simply reading lessons and responding to assignments by correspondence. Often, correspondence lessons are involved, but the most comprehensive programs offer a package which would include a personal visit to Cambodia by a qualified university tutor to introduce the course to a small group of students, then periodic opportunities for interaction with instructors by video or telephone linkages (depending on the capacity of the telecommunications system). Papers and assignments are graded by university faculty and full academic credits awarded according to the program.13

One of the prerequisites to these kinds of courses is that they require English language competence, and for graduate level courses there is an assumed mastery of basic undergraduate topics. In Cambodia, neither of these prerequisites is easily met.

International study tours to compare or analyze EIA practices elsewhere in the region can be an appropriate learning tool under carefully prepared conditions, but they will be of limited benefit to MOE staff until they have more domestic experience. Until EIA procedures are tested in Cambodia, and staff gain experience with these, they will have little basis on which to determine the suitability of procedures elsewhere.

13 It is difficult to complete a natural science program by distance learning because of the laboratory and fieldwork requirements.
Options for Graduate Study in Environmental Management in Cambodia

There are already two potential options for pursuing graduate studies in environmental management in Cambodia, in spite of the fact that no such courses are offered at Phnom Penh University (PPU).

The Asian Institute of Technology (AIT) is exploring the possibility of offering a postgraduate diploma in environmental management which consists of a 12-month, two-part program comprising:

1. 4-month “bridging” program for eligible Science Faculty graduates only. Program includes ESL training, basic environmental sciences and inter-disciplinary training.
2. 8-month diploma program offered jointly by PPU / AIT. Lecturers are accredited by AIT, if not AIT faculty members. Successful graduates would achieve eligibility for admission to AIT regular Master’s degree programs.

Another option is available to more advanced candidates who already possess an internationally-recognized undergraduate degree and good English language capability. That option is to register in a Master’s degree program with an overseas university (several reputable candidates exist including University of London). Relevant degrees such as Economics or Environmental Management are offered through distance learning. With a group of students registered in the course together, special arrangements could probably be made to have instructors visit a couple of times a year to introduce programs and establish relationships to be maintained by correspondence and email. In addition, a qualified local tutor might be hired (at additional expense) to help maintain more disciplined progress than might take place through individual study alone. With a group of registrants, they could meet several times a week (or even daily for up to half a day) to tackle course work together, stage tutorials, and discussions under the guidance of the tutor. This is a model which has already been effectively applied in Cambodia with organizational assistance of CDRI.

Another potential mechanism for learning more about administration and review of EIA and environmental planning would be for MOE to negotiate with a neighbouring country in SE Asia to have one or two staff members seconded to the environmental planning and review agency in that country, and to work on projects and administration there with experienced professional staff. Such arrangements might last between 6 months to a year. Less than 6 months is probably not worthwhile, due to the challenges of initial adaptation.

8.5 Specialized Topics

The kinds of topics which lend themselves to specialized study outside Cambodia, using approaches such as those discussed above, include the following:
• basic undergraduate sciences: needed to strengthen theoretical, laboratory and teaching skills for Cambodian experts who will be teaching natural sciences or environmental subjects, particularly at PPU and technical colleges

• postgraduate degrees: very limited need for these in the planning horizon of this study. May be appropriate for a couple of the best officials and PPU lecturers

• advanced topics in EIA, such as: Environmental effects assessment: using and evaluating advanced methods; Integrating economic issues into EIA

• regional harmonization of review standards and procedures in the Mekong Subregion; or in relation to impending ASEAN membership

• comparative policies on EIA within SE Asia, and operational difficulties with current arrangements

• ASEAN standards and membership implications for environmental planning

• regional workshops or information exchanges on EIA

These topics have two main HRD objectives for EIA and environmental planning in Cambodia:

(i) develop curriculum and teaching capacity, particularly at PPU, to do better scientific training; and

(ii) gain practical experience in administration and advanced technical procedures through participation in international exchanges, comparisons and workshops. To ensure full benefit from such training opportunities, regional host countries must be prepared to undertake significant preparations and organization, and participants must be prepared to share insights and make suggestions for local improvements on their return.

8.6 Training for Line Agencies and Provincial Environment Departments

The environmental planning and assessment HRD requirements of line agencies and provincial departments will be related to their particular roles in the EIA process (see Institutional Planning and Development Section 2 of this final report document). In the same way that EIA and REDP skills within MOE can best be developed through a combination of practical, supervised work assignments and intensive training modules building on the baseline provided in this TA, the skills needed in other agencies can be developed through selective participation in the same training opportunities.

A starting point for all agencies, including other departments of MOE, will be general awareness training and information about the nature of EIA and the specific requirements adopted for Cambodia (once these are approved). This awareness level training should be led by MOE/PRMD, but will itself require external advisory support.
and coaching to build confidence and clarity in the presentation. While the detailed technical inputs required for this awareness training will not be large, they will be very important. The success of all the other training and capacity-building suggestions contained in this report is largely dependent on the ability of MOE / PRMD to prepare and present a positive, constructive and competent image to other key government agencies. Without widespread and substantial recognition of their role, development contribution, and capability, PRMD will be unable to effectively implement their mandate and the remainder of the training will become somewhat moot.

The prerequisite to defining specific training requirements and participation for other agencies will be an agreement between these agencies and MOE on the initial structuring of institutional roles, responsibilities and interactions in the emerging environmental planning and assessment system. Suggested mechanisms are described in Section 2 of this final report. Their implementation will take the form of specific sub-decrees to the LEP. Subsequent to the approval of these sub-decrees, the line agencies can be integrated into training programs developed for MOE which best fit their needs and roles.

For their own staff, basic organizational development and management training are likely to be left to the individual Ministries, or to other donors as part of a larger scale public administration reform project. However, some of the information management, library and reference training, and consultant supervision training, which are likely to be oriented or adapted to specifically environmental contexts, could be offered to a joint audience of MOE and line agency staff. Participation in short-term training courses and practical training assignments (such as the case studies in this TA) provide an opportunity to develop working relationships between professionals in different agencies. Application of new skills can then become a joint, or collective exercise.

Provincial staff are likely to be involved mainly in regards to the following areas: project definition and scoping, identification of issues and impacts, engagement of stakeholders in EIA and REDP consultations, and monitoring of project implementation and follow-up. These staff should therefore have a general awareness of the entire EIA / environmental planning process, but need not develop detailed technical skills in its execution.

As MOE staff gain confidence and experience with EIA review, and as their skills improve through further training, some staff should be selected to develop specialized roles as trainers and communicators. This will require specialized "training of trainers" within MOE, equipping them with fundamental understandings of communications and learning tools for adults, and with modular instructional tools of various kinds for use with Khmer language audiences.

The products of this TA (presentation files and graphics, Khmer language EIA manual, basic training and practice for leading provincial officials) provide a good foundation for future training led by MOE. There will be a need to adapt some of these materials for use in Khmer only, to simplify and concretize the presentation, and to develop new
training materials for the provincial level. Most of this work can be undertaken by MOE itself, with the kind of coaching and guidance envisioned as part of this overall HRD strategy. By adopting the role of trainers themselves, MOE can improve communications and teaching skills to better prepare themselves for continuing training within Cambodia in this field.

8.7 Linking HRD to Organizational Capacity

A key aspect of a successful HRD program is that it should be linked closely to the emerging skills needs of participants. In the case of MOE/PRMD, the development of applications for professional skills can be anticipated as new procedures and requirements are developed. This provides the opportunity to plan training programs to ensure that skills are available when needed.

As an example of how this would work, consider the development, over the next two years, of scoping requirements for provincial offices and checklists/inclusion/exclusion lists for provincial staff. The development of the scoping procedures, inclusion lists and guidelines could take place first, with training of provincial staff to follow, so that they could be prepared to implement the requirements when they take effect. Finally, expert systems and computer support could be installed in provincial offices through donor support programs to assist in executing this task. Thus the programming functions of the staff, and the development of new national procedures and tools, are closely linked to planned training activities. The exact timing of different activities is less important than that expectations and costs be clear to participants.

As with the on-the-job training elements, where reinforcement of recently-learned skills is rendered more effective with full-time professional support to MOE staff, so the linkages between program planning and training schedules and priorities would be easier if the training coordinator were also working simultaneously with MOE staff on elements of program development.

8.8 Implementing Training Program

The training program described above has a number of components requiring coordination with each other and with government program and policy development. It also consists of a set of mutually-reinforcing elements which must be implemented both sequentially and conjointly to be most effective. The combination of management and technical training together with applications through delivery of a regular workplan implies that the only feasible implementation model is through on-the-job coaching and supervision, linked closely to coordination of specialized training inputs.

This model requires a full-time HRD coordinator within MOE, who is also capable of providing guidance on implementation of new skills through day-to-day assignments, in order to give government staff greater confidence in applying these skills. The qualifications of this key HRD support position are crucial to the success of the HRD
strategy. The nature of the support needed demands that the person have knowledge and experience with EIA and environmental planning. However, more importantly, the person in this position must be a good coach and teacher: able to listen and provide confidence through drawing out the knowledge and motivation of staff trainees. Adult education experience and cross-cultural communications skills would be definite assets in this position. The HRD coordinator / coach should probably also be responsible for coordinating the training contributions of other specialized experts from outside Cambodia, in accordance with the topics and approaches suggested above. By being involved in reviewing the environmental planning and EIA work of the Ministry, the HRD coordinator can better integrate training requirements with emerging concerns. This person must therefore be easily accessible to MOE staff, and work closely with PRMD in particular.

With responsibilities for coaching and supervising the applications of new skills in day-to-day work with MOE, the HRD coordinator should not have to be responsible for delivering reports, training programs or other outputs, but should focus mostly on these HRD support tasks. In addition to the general coaching and professional guidance provided by an on-site HRD coordinator, specific regular inputs will be needed over the course of the planning horizon of this strategy in the following areas:

- management and organizational development
- technical aspects of EIA, including both analytical and procedural issues
- information technologies, data bases and computer applications

In each of these cases, there would be benefits to having training and related on-the-job implementation support undertaken mainly by a single, well-qualified trainer who could return at intervals consistent with the training needs and coordinated schedule. By maintaining the same personnel, greater familiarity with the specific problems of this context would be obtained, and better working relationships developed.

The fundamental conclusion of this chapter of the report is that HRD is most effective when directly linked to supervised experience and application. For some basic organizational development needs (e.g. introductory computer training, records management, report writing, library and reference skills) local organizations can provide adequate instruction in training courses which they already offer. In other cases, particularly for management and communications skills, and for technical EIA and information management skills, external expertise will be required. Very little overseas training should be required, but careful selection of candidates and support of formal academic training is a good strategy to develop talent at PPU which can, over time, form the basis for a good deal of future technical training in this field.

Some flexibility in the implementation of the HRD plan will be needed to respond to rapidly changing conditions in Cambodia over the next five years. Institutional responsibilities, external assistance projects, project investment, political structures, public administration reform: all are likely to have an effect on the delivery of environmental planning and EIA. As skills within PRMD and MOE increase, and these
external conditions change, the implementation of training support will need to be tailored to new conditions. The structure of training delivery suggested here provides both continuity, support and flexibility, through a combination of long-term expert support and short-term intensive training and learning situations. This provides a robust solution to HRD needs in this field.
9. RESOURCE REQUIREMENTS

The resources required to implement this HRD strategy are summarized in this chapter. The focus here is on external consultants, travel and out-of-pocket expenses which are directly related to the HRD activity. Two explanatory points should be noted:

(i) Government resources available: Even for local costs, direct government financial contributions will be minimal. The MOE has confirmed that in the current budget year, they have received only one-third of even the basic operating budget requested from the Ministry of Finance. The government is able to meet their basic payroll requirements (at least in Phnom Penh), but salary levels are minimal. Beyond salaries, government resources are sufficient only to cover ongoing electricity, telecommunications and fuel costs, with minimal (insufficient) basic supplies of office stationery and no maintenance of equipment. There are no funds available for equipment purchase, depreciation, preventive maintenance, local travel, international communications and regular operational supplies. For all intents and purposes, therefore, the government resources available to contribute to the HRD strategy implementation consist of baseline staff salaries, and in-kind provision of office space (completely unequipped). These resources are not quantitatively estimated below.

(ii) The resource requirements presented below focus on HRD strategy implementation only. Additional resources for office and field equipment purchase and depreciation, local travel, materials and supplies will be needed to ensure that all the responsible government offices (MOE, line agencies, provincial environmental departments) are able to fully execute the mandates which they are expected to develop through institutional strengthening and HRD investments in the next several years. For example, the additional resources required to provide essential equipment (telephone, motorcycle, basic furnishings) for all provincial environment offices country-wide probably amounts to a one-time total cost of $200,000, while on-going incremental operating expenses for the entire government environmental management structure (excluding potential future lab facilities) could be estimated in the range of $100,000 / year. The fiscal capacity of the RGC to provide these resources, even though they are modest, at any time in the foreseeable future is very low.

In this chapter of the report, preliminary estimates are derived for input costs to the 5-year HRD strategy which has been developed above. These estimates will need to be revisited in the course of specific project development according to the particular requirements of different donor organizations, particularly if the entire program is not supportable by a single donor.
9.1 Staging

Over the five-year horizon of this strategy report, the external resources needed for training should diminish for two reasons:

- most of the limited number of government staff who require this training will already have received it
- the capacity of local experts (in MOE and in PPU) to provide training in the subject will increase substantially

As a result, the intensity of external resource use should decline gradually over the duration of the program. However, even at the end of the period, ongoing costs for training stipends, operating costs and depreciation of equipment will be substantial, and MOE may still not be able to function fully independently (particularly in terms of ongoing operational costs). A crucial issue for the sustainability of the organization and the capacity built through this HRD strategy is the longer-term viability of the organization in a highly-constrained fiscal environment. This issue is beyond the scope of this report, but must be addressed to resolve long-term questions.

For the first two years, resource requirements will be high and intense, with no decline. Therefore the estimates of resource needs have been disaggregated into two time periods over the five-year planning horizon: Years 1 - 2 and Years 3 - 5. Resource needs will be concentrated in the first, shorter period. A quantitative summary of resource estimates is presented in Table 2 at the end of this chapter.

9.2 Key Consultant Inputs

The external resources needed to deliver this HRD strategy comprise chiefly the expert assistance needed for long-term core training and program coordination, plus the trainers brought in for short-term specialized instruction from time to time. Other resource requirements (tuition for local and overseas courses, local travel, expenses and material supplies) are discussed in the following section.

9.2.1 Senior environmental planner

9.2.1.1 Tasks

The Senior Environmental Planner will provide professional and intellectual guidance to the entire HRD program, supervising all consultants and acting as project manager in terms of coordinating other inputs. Close collaboration with MOE staff counterparts will be a key element of this task. Other tasks include:

- project management and coordination
- formal reporting requirements
• liaison with Royal Government of Cambodia and donor(s)
• preparation and delivery of specialized training modules on technical topics in EIA / REDP, including: tools for analysing and presenting trend information; scenario development, ranking techniques, rapid screening tools, use of data bases and expert systems in project screening; monitoring programs for typical sectoral projects.
• prepare and provide, in close cooperation with Organizational Development Specialist, training to staff of MOE (and other relevant organizations) on how to train other government staff in basic environmental planning and assessment techniques

9.2.1.2 Qualifications

The key requirement for this position is knowledge of and experience with practical approaches to environmental planning in the field. Of almost equal importance is a familiarity with Cambodia and its unique HRD context. Minimum qualifications should include:

• at least 10 years of professional experience in EIA practice
• experience in development of guidelines and review procedures for EIA
• experience in teaching EIA methods
• experience in project management and coordination of technical inputs
• strong academic qualifications and theoretical understanding of natural sciences or social sciences, and their applications to environmental planning and assessment.

Most of the experience above should be in an international context, particularly in Asia. In addition, adult education experience and Khmer language capability would be important assets.

9.2.1.3 Level of Effort

Years 1-2: 9 person-months (more emphasis on project management, administration)
Years 3 - 5: 10 person-months (more emphasis on technical training)

9.2.2 EIA specialist / trainer / coach

9.2.2.1 Tasks

This position will involve field coordination, logistics and detailed scheduling of training inputs, under the guidance of the Senior Environmental Planner. The incumbent will also be responsible for direct supervision and coaching of MOE / PRMD staff as they undertake structured learning through skills application, or as they do regular work
assignments employing new skills. The coaching task will require thoroughness, rigour and sensitivity to maintain a detached and supportive position while carefully monitoring and providing feedback on work. These tasks will require close working relationships with Cambodian staff of MOE / PRMD. Other tasks will include:

- coordinate and schedule specialized training inputs
- provide management support to PRMD in development and execution of their workplan
- help to review EIAs, supervise fieldwork and review internal administration of MOE / PRMD
- provide or facilitate follow-up training / review / implementation to training courses delivered by others
- provide advice on workflow and office management
- facilitate inter-agency contacts and formal working relations
- on-the-job training as required in technical and procedural issues related to EIA
- assist MOE to negotiate practical attachments to donor project EIAs
- help to select and supervise academic trainees
- study tour organization and oversight

9.2.2.2 Qualifications

This is the most crucial position on the entire team. Most on-the-job training and coaching will be delivered by this person. The candidate for this position should be selected very carefully. Key skill requirements focus on communications and HRD skills, rather than on technical qualifications. The successful candidate must be confident and supportive, rather than authoritative. He or she must be comfortable giving authority to Khmer counterparts rather than trying to exercise it directly.

- Excellent cross-cultural communications skills, modesty, patience, flexibility and self-confidence
- Solid theoretical and empirical background in either natural or social sciences
- Good knowledge and professional experience with EIA (minimum 5 years)
- Experience and appreciation for organizational dynamics and management in a bureaucratic environment

Good organizational skills, management skills, and adaptability in the face of unexpected change are all essential. Khmer language familiarity would be a major asset. Adult education experience would be an asset. Extensive computer experience (PC Windows environment) would be an asset.
9.2.2.3 Level of Effort

Years 1 - 2: 20 person-months
Years 3 - 5: 18 person-months

9.2.3 Organizational Development specialist

9.2.3.1 Tasks

This position provides the HRD program with its main technical support in the field of management and organizational development. Skills and training ability in this field are weak in Cambodia, so this position will need to be recruited internationally. Over the course of this HRD strategy implementation, the consultant will be required to coordinate efforts with other technical inputs under the guidance of the Senior environmental planner, in close collaboration with MOE staff, and in accordance with schedules developed and coordinated by the EIA expert in the field. Main tasks will be:

- develop and deliver on-going, progressively more sophisticated training modules in management skills for PRMD and other environmental planning units within MOE
- provide follow-up coaching and on-the-job support to the training
- assist the EIA expert / resident “coach” in identifying and following up key new skills and responsibilities in ongoing work of the MOE
- provide advisory assistance to PRMD / MOE in establishing and strengthening internal organization and procedures
- provide advisory assistance to PRMD / MOE in establishing and strengthening external institutional linkages and procedures.
- provide training and advisory support for the development of PRMD planning, reporting, recruitment, supervision, appraisal, communications and team-building.
- prepare and provide training to MOE staff in how to manage foreign consultants.
- prepare and provide, in close cooperation with Senior Environmental Planner, training to staff of MOE (and other relevant organizations) on how to train other government staff in basic environmental planning and assessment techniques.

9.2.3.2 Qualifications

The incumbent should be a specialist in HRD, organizational development, management training, adult / informal education, and training of trainers. Minimum requirements should include:
• more than 10 years experience with management training and organizational development in a public sector environment in SE Asia
• excellent communications and interpersonal skills
• experience with applications in environment and natural resource management

Knowledge of Khmer language would be an asset. Familiarity with the development context and public administration in Cambodia would be a very useful asset.

9.2.3.3 Level of Effort

Years 1 - 2: 6 person-months
Years 3 - 5: 6 person-months

9.2.4 Environmental Information Technology Applications specialist

9.2.4.1 Tasks

This position will provide technical support in the implementation of new information technology systems for MOE and the RGC which will support the HRD strategy. Technical support will include needs assessment and system specification, in close coordination with other expert team members. It will also include, like the other positions, explicit training and on-the-job follow-up responsibilities.

• conduct detailed needs assessment for IT support to REDP and EIA review tasks of MOE. Specific applications to be covered, in close consultation with Senior Environmental Planner and MOE staff, include: data base development, DBMS applications, email and internet applications, GIS support, and internal management information systems
• assist with acquisition, installation, and application of new IT systems.
• develop and deliver specific training modules for staff of MOE and other relevant agencies on the use of new IT applications
• provide followup consultation and assistance to ensure that systems are working and staff are using them appropriately

9.2.4.2 Qualifications

The incumbent for this position should hold qualifications in environmental management / environmental science and computer systems. These qualifications could consist of a combination of academic credentials and experience. As with other technical inputs to this strategy, training and communications skills are very important.

• academic training in environmental science / natural resources preferred
extensive experience in the application of information technologies to environmental planning / EIA
extensive experience in IT system configuration, specifications, setup, and debugging for environmental applications
extensive experience training users in new applications, especially in SE Asia

9.2.4.3 Level of Effort

Years 1 - 2: 8 person-months
Years 3 - 5: 6 person-months

9.3 Short-term Training Specialists

In addition to these long-term technical resource persons, whose inputs will be required repeatedly over the duration of the HRD strategy in order to maintain progress and continuity, there will be a need for specialized short-term technical specialists for training purposes. Such specialists can be sought from within the region, for topics which include:

- Conflict resolution and negotiation techniques in environment and natural resource management
- Specialized technical writing skills
- Drafting / revision of legislation or regulations
- Public participation strategies in Cambodia
- Cross-cultural communications skills
- Management and professional communications skills
- Management of the EIA process

Other needs may be determined in response to specific situations or emerging requirements.

These trainers will probably be engaged for up to 1 person-month each for the preparation, delivery and on-the-job follow-up for a short-term training module lasting several days. Their qualifications will include extensive experience with training in the selected subject matter, mostly within the region. As always, sensitivity to the unique development context of Cambodia would be an asset.

The total level of effort required for these short-term specialized training modules has been estimated at 8 person-months for Years 1 - 2 (4 pers-mo/ yr), and 3 person-months / yr for each of the succeeding 3 years.
9.4 Local Training Support Inputs

A number of HRD support activities should be able to be sourced locally. Some of these will involve participation in regularly-scheduled ongoing courses, while others involve the placement of specialized support which can probably be found locally.

One of these positions might be an academic tutor, for example, who would work with a small group of students over a two-year period during which they took a complete Master's degree program by distance learning (see description in Chapter 8 above). The tutor's role would be to help interpret difficult technical English concepts, provide discipline and leadership to academic discussions, and coach students on writing skills. Weekly, or twice weekly mini-lectures might be used to review the study materials, and supplementary learning tools, such as simulations or role-playing, may be designed. This type of position could be expected to require roughly half of the tutor's time over the 2-year duration of post-graduate studies, and might appeal to foreign graduate students on long-term research postings in Cambodia.

Other local consultants could be envisioned to provide specialized support for computer systems maintenance and/or basic training; report-writing in Khmer language; office management, filing and record-keeping; etc.

Total resource requirements during the first two years are estimated as 12 person-months / yr, declining to 8 person-months / yr subsequently.

9.5 Other Resource Requirements

Other resources needed in order to implement this strategy include the usual international travel and per diem requirements for internationally-recruited experts, plus local travel and per diems for field training, case studies and project site visits in association with various training exercises. Preparation of training materials and translation costs will be significant due to the high local costs of this kind of support.

Due to low government salaries (see chapter 7 above), during training periods it will be essential that trainees devote their full attention to the course and follow-up materials. In order to compensate them for lost income from their second jobs, training stipends will be needed. For long-term training outside Cambodia (e.g. formal academic training), stipends will also be needed.

Equipment costs over the duration of the project provide for purchase of additional computer equipment and associated power management equipment, plus replacement of existing equipment as it becomes dilapidated.

Course tuition and fees for local courses and overseas academic training will be needed, with demands increasing as local candidates master basic academic skills to become eligible for more advanced training.
9.6 Total Resource Requirements

Total resource requirements for the HRD Strategy are estimated at $US 1.45 million for years 1 and 2 only, and a total of $3.289 million over five years. Details of these estimates are shown on the following page in Table 2. Further details of the assumptions underlying these cost estimates are presented in Appendix B.
Table 2: Estimated Resource Requirements for 5-year HRD Strategy (US$)

<table>
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<th>Years 1-2</th>
<th>Years 3-5</th>
<th>TOTAL</th>
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10. IMMEDIATE HRD NEEDS AND PRIORITIES

The immediate HRD needs for environmental planning and assessment in Cambodia are to follow up on the progress made through this TA. If there is a significant gap in delivery of subsequent support, there is risk of significant backsliding in the application of skills already acquired. To continue the progress already made in introducing these techniques to MOE and other government agencies, the following steps should be pursued urgently:

- emphasize the continuing future involvement of key trained staff who participated in the current TA. Of course, new staff may also be involved, but progressive gains in skills and management capacity are only possible if the core group remains continuously involved in the HRD program
- now that the national Law on Environmental Protection is approved, there is an urgent need for implementing sub-decrees. PRMD is already working on draft requirements such as inclusion / exclusion lists and EIA sectoral guidelines. Urgent technical support and training in these areas would help them to feel more confident about their proposals
- institutional development measures as recommended in Section 2 of this Final Report will be needed to clarify roles and responsibilities of different actors within the RGC. Until these roles and responsibilities are clarified, it will be difficult to proceed with a major HRD program

The most urgent issue requiring HRD support to MOE is responding to the passage of the new environmental legislation (LEP). This legislation provides explicitly for EIA and REDP, and gives authority to MOE to develop the detailed regulatory framework and review procedures for these activities. In the wake of the legislation's passage, it can be expected that critics will watch MOE closely to see how well they can respond.

The first priority for PRMD, and its advisors, during this period will be the development of implementing sub-decrees governing the EIA and REDP processes. These will involve negotiations with a number of prominent government agencies.

Next, and probably concurrently, will be engagement in a number of prominent EIA reviews and continuing regional planning activities. With the passage of the legislation, MOE will be in a much better position to take a leading role in these exercises, but its legitimacy will derive as much from the confidence and effectiveness with which it handles sensitive issues, as from its new legislative mandate.

Both the negotiations and drafting of the sub-decrees and the involvement in sensitive EIA reviews will require careful attention to internal management issues. Miscommunications, conflicting assignments, contradictory efforts and ineffectve use of limited staff resources are all likely to further complicate the delicate tasks lying just ahead for PRMD / MOE. As a result, early management and organizational
development interventions, particularly if simple and tailored to support a period of intensive professional activity, will be very useful.

It will be important to MOE’s credibility that during this crucial period it has access to administrative and management advice as well as technical support, through low-key, competent advisors with whom it has already developed a working relationship. Such advisors must be willing to take a back seat to the MOE staff, in order to allow these staff to gain credit and recognition outside the organization. Good communications and working relationships will be essential so that each group knows what to expect from the others during this intensive and stressful period.

PRMD staff understand, in general terms, what is needed, largely as a result of the training and institutional development delivered through this TA. The HRD inputs which would be required during this sensitive period involve mainly on-the-job training and coaching. Without experience in applying the EIA and REDP skills that they have learned, staff are understandably hesitant to make recommendations. What is needed is an experienced coach, familiar with the knowledge and skills they have already developed, who can help compensate for their lack of judgement without doing their work for them.
11. REFERENCES


12. APPENDIX A: STATUS OF MOE STAFF - 1994 BASELINE SURVEY RESULTS

A survey of all staff in the newly-created Secretariat of State for Environment was undertaken by interview and survey form in late 1994. Full information was obtained on number of staff and basic personal information from both headquarters (Phnom Penh) and provincial SSE bureaux. Some data were incomplete for provincial personnel, as many of the offices were inaccessible. The reliability of the data, which was assembled by an English / French-speaking consultant, must be qualified as almost all of the questions had to be translated, and at the time, staff felt very insecure having been transferred from other agencies, so their responses to some questions could have been slightly exaggerated.

A summary table of key data for each of the departments of the then SSE (department names have changed and it is now MOE) are presented in the following table.
### Ministry of Environment Staff Profile
#### 1994

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#### Years since graduation

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| 2 - 5           | 1       | 1.2  | 32.5     | 41.5   | 25.2 | 29.4  | 18.8  | 34.6  |
| 5 - 10          | 4.9     | 5.6  | 5.3      | 8.9    | 9.2  | 3.6   | 5.0   | 5.0   |
| > 10            | 2.5     | 2.6  | 2.6      | 2.4    | 1.9  | 3.15  | 3.0   | 20.0  |

#### In-service training

| UNDP / CEAT     | 0.0     | 48   | 6.3      | 1.2    | 1.2  | 14.2  | 26.2  | 3.15  |
| other in Cambodia | 2.5  | 46   | 5.9     | 9.8    | 10.1 | 5.6   | 9.6   | 8.40  |
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#### Working ability

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13. APPENDIX B: RESOURCE REQUIREMENTS DETAILED ASSUMPTIONS
Assumptions underlying HRD resource requirements estimation:

General note:

Local costs for office supplies and communications are very high. Equipment costs are comparable to international market and items are locally available.

Equipment depreciation rates high, due to climatic features, high level of airborne dust, power supply fluctuation, and no preventative maintenance. This means most electronic and sensitive mechanical equipment will need to be replaced at least every 2 - 3 years.

Consultant remuneration:
- international consultants @ $18k (net of all social benefits and allowances)
- regional consultants @ $6k
- local consultants @ $1k

Travel requirements (for 2 years):
- 4 trips N. America-PNH return - Sr Consultant
- 2 trips + spouse - EIA expert
- 3 trips - HRD expert
- 3 trips - IT expert all @ $3500
- 8 trips @ $1k - regional experts

Per diems:
- (for 2 years) 22 person-months field time - excluding EIA Trainer @ $150 / day

Local per diems:
- 500 person-days / yr for first 2 years @ $25/day

Size of target group:
- 15 core staff (mostly PRMD / MOE)
- additional 5-15 staff from other agencies for short-term trainings, local trainings, field work

Training stipends (for first 2 years):
- 15 persons @ 24 months
- 15 persons @ 4 months
- $200 / month
Equipment requirements:
- computers for PRMD and other key line agencies as competence / computer training and use justifies (unlikely to exceed total requirement of 12 machines plus peripherals, but most will need replacement over 5-year planning horizon)
- basic equipment for provincial offices is NOT included: estimated as $10k for each
- communications equipment will also need replacement

Course registrations:
- local courses - for years 1-2, 120 registrations / year in short courses including computer training, English language, communications, report-writing, etc. @ $200 / ea. Increasing rates thereafter.
- academic courses - 2 candidates enrolled in correspondence post-graduate training course (diploma or M.Sc.) @ $11,000 each - based on available information for high-quality international courses, with local tutor part-time. In years 3-5, increasing to 5 candidates, of whom 2 enrolled overseas in full-time study.

Contingency @ 10%
SECTION 4

FOREWORD

REGIONAL ENVIRONMENTAL DEVELOPMENT PLANNING (REDP)

CASE STUDY REPORTS:

i) Partial Environmental Inventory of Industrial Activity in Phnom Penh

ii) Preliminary Review of Socio-Economic Conditions in the Boeng Salang Area of Phnom Penh

iii) Preliminary Review of the Environmental Implications of the Prek Thnot Hydro Electricity Development Project

iv) Guidelines for Preparing Initial Environmental Evaluations and Environmental Impact Assessments for Palm Oil Development Projects

Prepared by Training Course Participants
FOREWORD - CASE STUDIES

There was provision in the project for undertaking three EIA case studies and one REDP case study, as an integral part of the training program. The case studies had two main objectives:

- to provide the students with practical experience in executing key steps in EIAs and REDPs; and
- to demonstrate the feasibility and value of EIA and REDP, as well as the competence of the course participants in executing both, to senior officials.

This was interpreted to mean that the case studies should address real issues and problems of high priority, and that they should be linked to other training and capacity building initiatives underway or planned for the near future.

In fact, in addition to the REDP case study, four other case studies focusing on different aspects of EIA were conducted. For a variety of reasons, two of the EIA case studies concentrated on environmental planning and management issues in Phnom Penh. These reasons included the following:

- Phnom Penh has the greatest concentration of industrial development and most rapid urbanisation in the country
- Both projects afforded opportunities for the participants to begin building working relationships with the Municipality of Phnom Penh, local authorities and others
- Both projects facilitated efficient use of funds and time given the proximity of the field sites and relative ease of project execution
- The security conditions within the city were relatively good during the period in which the projects were undertaken
- Both projects promised good prospects for continuing work which would build upon the products of the case studies

One of the projects undertaken outside of the city addressed a major infrastructure development. The other focused on an agro-industry project impinging on valued natural resources. Both projects typify the types of development with which government officials responsible for environmental assessment will have to deal.

All course participants were involved in the REDP case study. Each student participated in one EIA case study located in Phnom Penh and one located outside of the city. The students were assigned according to their background and interests.

The process of undertaking the case work was deemed to be as valuable, if not more so, than the products. Each study team had to develop its own terms of reference, make contact with local authorities and experts, and execute the terms of reference within budget. The actual field work was undertaken with a minimal amount of supervision. The written reports were prepared in English - not in Khmer - by the trainees. These reports are presented in this volume to demonstrate the work undertaken and the level of performance of RGC staff in English at the conclusion of the training course. A minimal amount of editing has been done by the advisors; no changes have been made to the meaning of any of the reports.

The following table describes the case studies for the project.
### Description of Case Studies

<table>
<thead>
<tr>
<th>Title</th>
<th>Subject</th>
<th>Project Objectives</th>
<th>Products</th>
<th>Links</th>
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</table>
| Regional Environmental Development Planning Case Study: Coastal Zone of Cambodia | • regional environmental plan for Koh Kong and Kampong Som provinces | • planning and preparation of an REDP  
• field logistics  
• team management and integration | • survey of baseline conditions, problem identification, development of strategies | • ADB coastal zone management  
• provincial forestry service  
• MOE ongoing studies on mangrove protection |
| Partial Inventory of Industrial Activity in Phnom Penh | • a preliminary inventory of industrial developments within Phnom Penh, their operations and waste management practices | • preparation of terms of reference  
• identification of environmental issues and screening  
• collection of baseline information for future EIAs  
• recommendations on further work including monitoring | • basic inventory report with recommendations for follow-up monitoring work | • possible precursor for practical projects within Department of Pollution Control |
| Preliminary Review of Socio-Economic Conditions in the Boeng Salang Area of Phnom Penh | • investigation of living conditions and public attitudes concerning proposed rehabilitation of the sewage canal and relocation of residents | • preparation of terms of reference  
• development and delivery of a survey on conditions and attitudes of residents living near the project area  
• basic exposure to public consultation practice  
• scoping and analysis of alternatives | • advisory report to be presented to the Municipality of Phnom Penh | • complements University water quality monitoring study and ongoing work by the Department of Urban Affairs |
| Report on Case study project for Developing Guidelines for Environmental Impact Assessment of Oil Palm Development Projects | review of a proposed oil palm project through literature reviews, field observations and consultation with stakeholders | preparation of terms of reference | report on issues and potential impacts | ongoing environmental and socio-economic studies of the Ratanakiri region |
| Preliminary Review of the Environmental Implications of the Preak Thnot Hydro Electricity Development Project | evaluation of a pre-feasibility report prepared by the project proponent | collection of specified baseline environmental information | report on findings of field work | preparation of staff for review of numerous possible future hydro-electricity projects |
| | | preparation of terms of reference | presentation of recommendations for follow up in an EIA | | |
| | | review of a pre-feasibility study | | | |
| | | identification of issues and deficiencies | | | |
| | | review of and recommendations on mitigation measures and monitoring | | | |
| | | development of recommendations for analysis in project EIAs | | | |
REGIONAL ENVIRONMENTAL DEVELOPMENT PLANNING (REDP)
Table of Contents

INTRODUCTION ...................................................................................................................... 1

SUMMARY OF CURRENT CONDITIONS AND TRENDS IN THE CoASTAL ZONE OF CAMBODIA .................................................................................................................. 2

General Description of Coastal Zone ................................................................................ 2

Regional Environmental Development Plan for Cambodian Coastal Zone .................. 5

Overall REDP Goal .............................................................................................................. 5

REDP Objectives ................................................................................................................. 5

Component A: Natural Resources ....................................................................................... 5

Component B: New Economic Developments ..................................................................... 7

Component C: Capacity Building and Public Awareness .................................................... 7

Description and Analysis of Representative Priority Projects ...................................... 9

Project Profile #1: Sihanoukville Master Plan: Review Update and Zoning ............... 9

Project Profile #2: Sustainable Marine Fisheries Development .................................. 10

Project Profile #3: Sustainable Use of Coastal Mangrove Ecosystem ....................... 11

Project Profile #4: Seagrass and Coral Reef Conservation .......................................... 12

Project Profile #5: Evergreen Forest Conservation for Watershed Protection and Wildlife Conservation ................................................................. 13

Project Profile #6: Environmental Monitoring System Establishment .................... 14

Project Profile #7: Development of Strategic Plan for Coastal Ecotourism .............. 15

Appendix A: Terms of Reference for Regional Environmental Development Planning Case Study ...... 16

Objectives ............................................................................................................................ 16

Terms of Reference Provided by Asian Development Bank ...................................... 16

Scope of Work ....................................................................................................................... 17

General................................................................................................................................ 17

Types of Issues and Projects to be Examined ................................................................ 17

Workplan ............................................................................................................................... 18

Step 1 - Scoping .................................................................................................................. 18

Step 2 - Assessment of Current Conditions and Trends .............................................. 18

Step 3 - Strategic Plan ........................................................................................................ 19

Step 4 - Project Preparation ................................................................................................. 19

Step 5 - Pre-feasibility Study for Selected High Priority Investment Project ................ 19

Step 6 - REDP Report ........................................................................................................... 20

Organization of the REDP Study Team ......................................................................... 20

Terms of Reference for Management Team .................................................................. 21

Terms of Reference for Physical Resources Working Group ..................................... 22

Terms of Reference for Ecological Resources Working Group .................................. 22

Terms of Reference for Social and Economic Resources Working Group ............... 22
APPENDIX B: CURRENT CONDITIONS OF STUDY AREA ..........23

PHYSICAL RESOURCES ........................................................................................................... 23
    Surface Fresh Water Resources ......................................................................................... 23
    Groundwater Resources ........................................................................................................ 28
    Marine Water Quality ............................................................................................................ 41
    Air Quality Resources ......................................................................................................... 43
    Priorities of Physical Environmental Resources .............................................................. 44

ECOLOGICAL RESOURCES ................................................................................................... 44
    Terrestrial Biota ..................................................................................................................... 44
    Wetlands ................................................................................................................................ 46
    Aquatic Biota .......................................................................................................................... 52
    Forest Resources ................................................................................................................... 56
    Fisheries .................................................................................................................................. 58
    Park and Reserves .................................................................................................................. 64

SOCIO-ECONOMIC RESOURCES ......................................................................................... 70
    Drinking Water Supply ......................................................................................................... 70
    Nutrition and Health ............................................................................................................. 71
    Gender Issues ....................................................................................................................... 73
List of Tables

Table 1: Overview of Natural Resources Component .................................................. 6
Table 2: Overview of New Economic Developments Component ................................ 8
Table 3: Overview of Capacity Building and Public Awareness Component .................. 8
Table 4: Summary of Surface Freshwater Resources in Koh Kong ................................ 24
Table 5: Summary of Freshwater Resources in Kampong Som ..................................... 26
Table 6: Description of Surface Water Quality Sampling Points in Koh Kong, January 1996, conducted as part of REDP case study ............................................ 29
Table 7: Results of Surface Water Quality Monitoring in Koh Kong, January, 1996, conducted as part of the REDP case study ....................................................... 31
Table 8: Description of Surface Water Quality Sampling Points in Kampong Som, January 1996, conducted as part of REDP case study ..................................... 32
Table 9: Results of Surface Water Quality Monitoring in Kampong Som, January, 1996, conducted as part of the REDP case study ............................................. 33
Table 10: Description of Well Water Quality Sampling Points in Koh Kong, January 1996, conducted as part of REDP case study. Note that two additional samples were taken, one in a stream and another as tap water ........................................ 35
Table 11: Results of Well Water Quality Monitoring in Koh Kong, January, 1996, conducted as part of the REDP case study ....................................................... 36
Table 12: Description of Well Water Quality Sampling Points in Kampong Som, January 1996, conducted as part of REDP case study ............................................. 39
Table 13: Results of Well Water Quality Monitoring in Kampong Som, January, 1996, conducted as part of the REDP case study ................................................. 40
Table 14: List of Indigenous Tree Species Found in Kampong Som ............................ 45
Table 15: List of Plant Species Found in Mangrove forests of Koh Kong Province .... 49
Table 16: Additional Plant Species Found in Cambodian Coastal Zone ..................... 50
Table 17: Distribution of Forests in Koh Kong in 1970 .............................................. 57
Table 18: Summary of Existing Information on Mangrove Forest in Koh Kong and Kampong Som Provinces ........................................................... 57
Table 19: Freshwater Fish Aquaculture Production in the Coastal Provinces .......... 63
Table 20: List of Tree Species Found in Ream National Park ................................. 66
Table 21: List of Fish Species in the Ream Region .................................................. 67
Table 22: Description of Health Resources and Health Statistics in the Study Area ......... 72

List of Figures

Figure 1: Summary of Current Conditions in Cambodia's Coastal Zone ..................... 3
Figure 2: Expected Future Conditions in Cambodia's Coastal Zone ......................... 4
Figure 3: Trends in Shrimp Farm Area in Koh Kong Province .............................. 51
Figure 4: Trends in Timber Harvest in the Study Area ......................................... 59
Figure 5: Trends in Timber Harvest in the Study Area ....................................... 60
Figure 6: Reported Commercial Marine Fisheries Capture in the Study Area ............ 61
Figure 7: Brackish Shrimp Aquaculture Production in the Coastal Provinces .......... 63
<table>
<thead>
<tr>
<th>Acronyms</th>
<th>Abbreviations</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADB</td>
<td>Asian Development Bank</td>
</tr>
<tr>
<td>EEZ</td>
<td>Exclusive Economic Zone</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agriculture Organization</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>IDRC</td>
<td>International Development Research Centre</td>
</tr>
<tr>
<td>IUCN</td>
<td>International Union for the Conservation of Nature</td>
</tr>
<tr>
<td>MOE</td>
<td>Ministry of Environment</td>
</tr>
<tr>
<td>NGO</td>
<td>Non Governmental Organization</td>
</tr>
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</table>
Introduction

This report summarizes the results of the Regional Environmental Development Planning (REDP) case study conducted by the students of the ADB 2078-CAM EIA training course. The overall objective of the REDP case study was to reinforce concepts taught during a three week training module on Regional Environmental Development Planning. Terms of Reference for the case study are provided in Appendix A.

The entire case study, including this report, was implemented by the students of the course. The role of the international consultant team was to:

(i) define specific Terms of Reference;
(ii) provide guidance and direction on the case study field missions; and
(iii) nominal editing of the written report prepared by the students for language, format, and general ease of reading.

The REDP prepared under this case study is intended for all three coastal provinces: Koh Kong; Kampong Som, and Kampot. Time and security constraints limited the detailed analysis of current conditions and environmental trends in the coastal zone, including field missions, to the two westernmost provinces of Koh Kong and Kampong Som, plus the marine area out to the EEZ corresponding to these two provinces. It is assumed that conditions in these two provinces are indicative and representative of all of Cambodia's coastal zone.

Including this Introduction, this report contains three sections:

(i) Chapter 2 contains an overview of current physical, environmental, and social conditions in the study area; and
(ii) Chapter 3 contains the details of the proposed REDP for the coastal zone of Cambodia developed by the students of ADB 2078-CAM.

The main report is supplemented by two Appendices: Terms of Reference for the REDP as given to the students; and a detailed description of the existing situation in the two representative provinces of Koh Kong and Kampong Som.
Summary of Current Conditions and Trends in the Coastal Zone of Cambodia

GENERAL DESCRIPTION OF COASTAL ZONE

Cambodia is a country of 181,035 km² situated in southeast Asia in the Southwestern part of the Indochinese Peninsula. The country maximum extent is about 580 km from east to west and 450 km from North to South. It is 2,438 km bordered by Viet Nam, Laos and Thailand.

Cambodia has a 435 km coastline on the Gulf of Thailand. Three provinces occupy this coast line: Koh Kong with land area of 11,160 km², Kampong Som with land area of 868 km², and Kampot with land area of 5,209 km². Much of the Cambodia coastline is sparsely populated and features natural ecosystems which have suffered relatively little exploitation in comparison to many other tropical areas.

A summary of current and expected future conditions (in the absence of investments and associated technical assistance) for Cambodia's coastal zone are presented in Figure 1 and Figure 2.

---

1This chapter is a synthesis of Appendix B.
Figure 1: Summary of current conditions in Cambodia’s coastal zone. Freshwater and offshore fisheries and food production were not assessed.
### FUTURE CONDITIONS

<table>
<thead>
<tr>
<th>Human Activity, Natural Processes</th>
<th>Physical</th>
<th>Ecological</th>
<th>Social</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population and Demography</td>
<td>3 2 1 2 2 2 3 2 2</td>
<td>3 2 2</td>
<td>3</td>
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<tr>
<td>Infrastructure and Inputs</td>
<td>1 2</td>
<td>2</td>
<td>2</td>
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<tr>
<td>Lowland Agriculture</td>
<td>2 2 3 3</td>
<td>3 3 3</td>
<td>2</td>
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<tr>
<td>Upland Agriculture</td>
<td>3 2 3 2 3 2 3 2 3</td>
<td>3 2 2</td>
<td>3</td>
</tr>
<tr>
<td>Forest Activities</td>
<td>2 2 1</td>
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<tr>
<td>Harvesting of Biological Resources</td>
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<tr>
<td>Urbanization</td>
<td>2 2 2</td>
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<tr>
<td>Industrial Development</td>
<td>2 1 2 1 2 1 2 2 1</td>
<td>3 2 2</td>
<td>2</td>
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<tr>
<td>Energy Generation</td>
<td>2 1 2 1</td>
<td>2 2 2</td>
<td>2 2</td>
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<tr>
<td>Port Development</td>
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<tr>
<td>Transportation</td>
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<tr>
<td>Tourism</td>
<td>2 3 2 3 2 3</td>
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<td>3</td>
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<tr>
<td>Natural Hazards (Typhoons and Floods)</td>
<td>1</td>
<td>2 3</td>
<td>1</td>
</tr>
</tbody>
</table>

### Magnitude

| Population and Demography        | M | H | M | H | L | M | M | L | M | M | H | H |
| Infrastructure and Inputs         | L | L | L | L | L | L | M | M | M | M |
| Lowland Agriculture               | M | M | M | M | M | M | M | M | M | M | M | M |
| Upland Agriculture                | H | H | H | H | L | M | L | M | L | H | H |
| Forest Activities                 | H | M | M | H | H | L | M | L | H | M | L | H |
| Harvesting of Biological Resources| M | M | M | M | M | M | M | L | M | M | M | M |
| Urbanization                      | M | M | M | M | M | M | M | M | M | M | M | M |
| Industrial Development            | M | M | M | M | M | M | M | M | M | M | M | M |
| Energy Generation                 | M | M | M | M | M | M | M | M | M | M | M | M |
| Port Development                  | L | L | L | L | L | L | L | L | L | L | L | L |
| Transportation                    | M | L | M | L | M | L | M | M | M | M | M | M |
| Tourism                           | L | H | M | M | M | M | M | M | M | M | M | M |
| Natural Hazards (Typhoons and Floods) | L | L | L | L |

### Overall Assessment

| Population and Demography        | U | U | I | S | S | S | S | S | U | U | S | U |
| Infrastructure and Inputs         | S | I | I | S | S | S | S | S | S | S | S | S |
| Lowland Agriculture               | S | I | I | S | S | S | S | S | S | S | S | S |
| Upland Agriculture                | I | U | I | U | U | U | S | S | S | S | S | S |
| Forest Activities                 | U | S | U | U | U | I | S | I | U | S | S | S |
| Harvesting of Biological Resources| S | S | S | S | S | S | S | S | S | S | S | S |
| Urbanization                      | M | I | I | S | I | S | S | S | S | S | S | S |
| Industrial Development            | S | S | S | S | S | S | S | S | S | S | S | S |
| Energy Generation                 | S | S | S | S | S | S | S | S | S | S | S | S |
| Port Development                  | I | I | I | I | I | I | I | I | I | I | I | I |
| Transportation                    | I | I | I | I | I | I | I | I | I | I | I | I |
| Tourism                           | U | S | I | S | S | S | S | S | S | S | S | S |
| Natural Hazards (Typhoons and Floods) | U | U | U | U |

**Figure 2:** Expected future conditions in Cambodia's coastal zone. Freshwater and offshore fisheries, drinking water quality, and food production were not assessed.
Regional Environmental Development Plan for Cambodian Coastal Zone

OVERALL REDP GOAL

The goal of the REDP for the study area is to:

*Manage, conserve, and protect coastal and marine environment and its resources with respect to sustainable development concept to improve socio-economic conditions of the people in Cambodia's coastal zone*

REDP OBJECTIVES

Within this overall goal, three components are proposed for the REDP, centering on:

(i) Component A: Natural Resources;
(ii) Component B: New Economic Developments; and
(iii) Component C: Capacity Building and Public Awareness.

Each of these is described in greater detail in the following sections below.

Component A: Natural Resources

The objective of the Natural Resources Component is to:

*Provide increased economic opportunities to the coastal people relying on productive natural resources while simultaneously rehabilitating, protecting, and managing these resources.*

Six environmental programs are proposed to meet this objective; the activities that would be carried out in each of the proposed programs are outlined in Table 1:

(i) Program A.1: Sustainable Land Use in Coastal Zone
(ii) Program A.2: Rational Use of Mineral Deposits in Coastal and Marine Zone
(iii) Program A.3: Sustainable Use of Coastal Mangrove Ecosystem
(iv) Program A.4: Evergreen Forest Conservation for Watershed Protection and Wildlife Conservation
(v) Program A.5: Seagrass and Coral Reef Protection; and
(vi) Program A.6: Sustainable Marine Fishery Development.
<table>
<thead>
<tr>
<th>No.</th>
<th>Program</th>
<th>Program Activities</th>
</tr>
</thead>
</table>
| A.1  | Sustainable Land Use in Coastal Zone             | • Identify current status of land use  
• Conduct land use classification using appropriate criteria (urban, human settlement, agriculture, forest, protected area, etc.)  
• Establish detailed land use map for coastal area  
• Prepare and implement a land use management plan with the participation of Government, non-government and community groups |
| A.2  | Rational Use of Mineral Deposits in Coastal and Marine Zone | • Conduct an inventory for coastal and marine mineral deposits  
• Identify the current status of the mining industry in the area  
• Identify the values of the mineral deposits for industry, recreation, local community livelihood, and environmental services  
• Design and implement environmental management plan for mineral deposits |
| A.3  | Sustainable Use of Coastal Mangrove Ecosystem   | • Conduct an inventory and evaluation of mangrove ecosystem (species, productivity, environmental function, importance for environment and economics, etc.)  
• Conduct a socio-economic study within mangrove ecosystem area  
• Design and implement a mangrove restoration and preservation program  
• Design and implement a mangrove sustainable use management plan  
• Improve environmental planning and management capacity for the MOE provincial offices  
• Provide alternative sources of income and environmental awareness to local communities |
| A.4  | Evergreen Forest Conservation for Watershed Protection and Wildlife Conservation | • Select area of high biodiversity and watershed value  
• Conduct an inventory of the protected area  
• Establish and develop buffer zones surrounding the area  
• Provide alternative economic opportunities for local people currently depending on natural resources of the protected area  
• Design and implement comprehensive management programs for protected area including reforestation, conservation, and ecotourism development |
| A.5  | Seagrass and Coral Reef Protection               | • Conduct an inventory for seagrass and coral reef  
• Choose appropriate areas for protection  
• Investigate appropriate protection measures  
• Design and implement a protection and management plan  
• Prepare adequate regulations for seagrass and coral reef protection  
• Establish an efficient and effective law enforcement mechanism  
• Encourage ecotourism development in the selected area |
| A.6  | Sustainable Marine Fishery Development          | • Determine the current status of the fishery  
• Establish an efficient and effective law enforcement mechanism  
• Design and implement a protection and management plan |
Component B: New Economic Developments

The objective of the New Economic Developments Component is to:

\textit{ensure that environmental considerations are integrated into decision-making on new investment projects and current activities}

Five environmental programs are proposed to meet this objective; the activities that would be carried out in each of the proposed programs are outlined in Table 2:

(i) Program B.1: Regional Master Plan Review and Preparation, and Zoning;

(ii) Program B.2: EIA Implementation for Investment Projects;

(iii) Program B.3: Economic Migration Control;

(iv) Program B.4: Environmental Monitoring System Establishment; and

(v) Program B.5: Development of a Strategic Plan for Coastal Ecotourism.

Component C: Capacity Building and Public Awareness

The objective of the Capacity Building and Public Awareness Component is to:

\textit{increase environmental knowledge and experiences for relevant agencies and communities to manage, rehabilitate, and protect coastal and marine environment}

Two environmental programs are proposed to meet this objective; the activities that would be carried out in each of the proposed programs are outlined in Table 3:

(i) Program C.1: Prepare and Integrate Environmental Education Program into the Existing Education System and Local Communities; and

(ii) Program C.2: Institutional Capacity Building.
### Table 2: Overview of New Economic Developments Component.

<table>
<thead>
<tr>
<th>No.</th>
<th>Program</th>
<th>Program Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.1</td>
<td>Regional Master Plan Review and Preparation, and Zoning</td>
<td>• Collect information on existing sectoral activities (industrial, urban, tourism, etc.)&lt;br&gt;• Identify areas in need of immediate and long term development&lt;br&gt;• Ensure that zoning corresponds to the identified needs in specified areas&lt;br&gt;• Conduct socio-economic study in selected areas&lt;br&gt;• Design an implementation strategic plan for meeting the needs</td>
</tr>
<tr>
<td>B.2</td>
<td>EIA Implementation for all Investment Projects</td>
<td>• Identify the priority project for doing EIA&lt;br&gt;• Strengthen capacities of MOE provincial offices and relevant agencies to undertake or review EIA study&lt;br&gt;• Integrate EIA into economic planing and decision-making of all levels of Government&lt;br&gt;• Provide opportunity for all groups affected by development projects to review EIA and comment before official approval</td>
</tr>
<tr>
<td>B.3</td>
<td>Economic Migration Control</td>
<td>• Conduct demographic and socio-economic studies in the region&lt;br&gt;• Prepare and implement environmental education and vocational programs for migrated people&lt;br&gt;• Prepare and implement infrastructure and water supply development project&lt;br&gt;• Create and promote environmental-friendly occupations for migrated people</td>
</tr>
<tr>
<td>B.4</td>
<td>Environmental Monitoring System Establishment</td>
<td>• Prepare environmental standards for all relevant sectors and areas of activity&lt;br&gt;• Create and implement monitoring channels and systems&lt;br&gt;• Create and implement training programs for all levels of monitoring system (village to national)&lt;br&gt;• Establish a laboratory and monitoring facilities</td>
</tr>
<tr>
<td>B.5</td>
<td>Development of a Strategic Plan for Coastal Ecotourism</td>
<td>• Conduct an initial study on prospective area for ecotourism development&lt;br&gt;• Select high potential areas for ecotourism development&lt;br&gt;• Prepare and implement an ecotourism management plan</td>
</tr>
</tbody>
</table>

### Table 3: Overview of Capacity Building and Public Awareness Component.

<table>
<thead>
<tr>
<th>No.</th>
<th>Program</th>
<th>Program Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.1</td>
<td>Prepare, Integrate Environmental Education Program into Existing Education System and Local Communities</td>
<td>• Design an educational program for primary, secondary schools, and university level&lt;br&gt;• Conduct environmental training courses for teachers&lt;br&gt;• Promote public awareness on environmental issues</td>
</tr>
<tr>
<td>C.2</td>
<td>Institutional Capacity Building</td>
<td>• Design environmental training programs for MOE provincial staff and affiliated agencies&lt;br&gt;• Promote national understanding on environmental issues among governmental officers&lt;br&gt;• Conduct training courses and seminars on environmental planning and management</td>
</tr>
</tbody>
</table>
Description and Analysis of Representative Priority Projects

PROJECT PROFILE #1: SIHANOUKVILLE MASTER PLAN: REVIEW UPDATE AND ZONING

Location: Sihanoukville, Kampong Som Province

REDP Component: Component B: New Economic Developments

REDP Program: Program B.1: Regional Master Plan Review and Preparation, and Zoning

Project Objectives:

(i) Review and update existing Sihanoukville Master Plan
(ii) Zoning industrial, housing, business, commercial, and recreational areas

Project Description:

The project should respond to the needs of designing sustainable development policy for socio-economic development of Sihanoukville. The project activities will include a study of the existing master plan, information collection on sectoral activities (industrial, urban, tourism, land use, etc.); and identification and assessment of current socio-economic development in Sihanoukville. Emphasis will be made on zoning that will take into consideration all socio-economic, environmental, historical, cultural, and aesthetic aspects of the studied areas.

Rationale and Benefits:

Sihanoukville has the fastest growing economy and urbanization outside of Phnom Penh. It attracts many national and overseas investments covering different sectors of the economy. All this will have significant impacts on the environment if no adequate measures are taken. Uncontrolled urbanization, industrialization, aquaculture and tourism development will create potential air, water and noise pollution; soil degradation; loss of biodiversity and human health impacts. These problems will be also increased by lack of environmental management law, facilities, capabilities and appropriate monitoring system; and poor management. The implementation of this project will be able to reduce the environment impacts significantly.

Estimated Cost: US $200,000
PROJECT PROFILE #2: SUSTAINABLE MARINE FISHERIES DEVELOPMENT

Location: All Coastal Provinces

REDP Component: Component A: Natural Resources

REDP Program: Program A.6: Sustainable Marine Fishery Development
Program A.3: Sustainable Use of Coastal Mangrove Ecosystem

Project Objectives:

(i) protect the quantity of existing fish and to avoid over exploitation of fish.
(ii) establish and efficient and effective law enforcement mechanism.
(iii) protect the mangrove forest and flood forest along the coastal zones for the sanctuary and nutrients for aquatic biota especially for the species of fish.
(iv) design and implement a protection and management plan

Project Description:

Appropriate project design for fisheries that factors sound management and development of the resource require a range of skills in biology, ecology, economics, law and engineering. Knowledge of existing law and socioeconomic norms which regulate individual and community property and use rights to fishing grounds within a project area are fundamental to project design.

National fisheries laws and joint venture agreements for fisheries should contain provisions that would help achieve resource management objectives and protect the environment.

Rationale and Benefits:

(i) Provide alternative sources of income and sustainable economic growth
(ii) Public education programs for fishermen on effects of damage and way to avoid it.
(iii) Fisheries management for optimum sustained yield.

Estimated Cost: US $5 million
PROJECT PROFILE #3: SUSTAINABLE USE OF COASTAL MANGROVE ECOSYSTEM

Project Location: Peam Krasop District, Koh Kong Province

REDP Component: Component A: Natural Resources

REDP Program: Program A.3: Sustainable Use of Coastal Mangrove Ecosystem
Program C.3: Prepare, Integrate Environmental Education Program into Existing Education System and Local Communities
Program C.4: Institutional Capacity Building

Project Objectives:

(i) conduct an inventory and evaluation of mangrove ecosystem.
(ii) sustainable use of mangrove ecosystem and protect natural resource such as habitat for fish nutrition's of fish, Protect wetland of coastal zone.
(iii) conduct a socio-economic study within mangrove ecosystem area.
(iv) improve environmental planning and management capacity for the Ministry of Environment provincial offices.
(v) development policy of environment, restoration of shoreline mangrove ecosystem.

Project Description:

Mangrove ecosystems are very valuable in ecological importance and economic benefits to this coastal community. Mangrove provide important habitats and shelter for various species of aquatic life as well as shoreline stabilization and protection from storm. Mangrove ecosystem are significant to both the economic and to the protection of coastal environment.

Rationale and Benefits:

(i) Improved capacity for management protect area.
(ii) Design and implement a mangrove sustainable use management plan
(iii) Provide alternative sources of income and environmental awareness to local communities.
(iv) Management plan, staff office environment awareness about benefits of mangrove, provide knowledge local people living around protected area. Provincial environmental conditions, creating awareness to people.
(v) Design and implement a mangrove restoration and preservation program.

Estimated Cost: US $2 million
PROJECT PROFILE #4: SEAGRASS AND CORAL REEF CONSERVATION

Project Location: Coastal zone in all coastal provinces

REDP Component: Component A: Natural Resources

REDP Program: Program A.4: Seagrass and Coral Reef Protection

Project Objectives:

(i) Conduct an inventory for seagrass and coral reef
(ii) Select appropriate area for protection
(iii) Establish checkpoint to control and monitor human activities on the resources
(iv) Develop regulations for seagrass and coral reef protection

Project Description:

- There are many species of coral Reef and seagrass along the coastal areas of Cambodia
- It is very important to know base line information for conservation. Seagrass and coral reef create a new living environment which give shelter, protection and food to a variety of living organisms.
- Marine resource research must be conducted urgently to ensure sustainable development.

Rationale and Benefits:

(i) keep ecosystems healthy for other species habitation.
(ii) provide coastal stabilizers.
(iii) provide a center to research Marine resources as well as a center for tourists.

Estimated Cost: US $2.0 Million (est.)
PROJECT PROFILE #5: EVERGREEN FOREST CONSERVATION FOR WATERSHED PROTECTION AND WILDLIFE CONSERVATION

Project Location: Koh Kong and Kampong Som

REDP Component: Component A: Natural Resources

REDP Program: Program A.5: Evergreen Forest Conservation for Watershed Protection and Wildlife Conservation

Project Objectives:

(i) Natural and modified ecosystems that essential for maintaining life support systems conserving wild species and areas of particularly high species diversity

(ii) Sustainable use of wild resources use of wild resources in modified ecosystems

(iii) Recreational and educational uses of natural, modified, and cultivated ecosystems

(iv) Conserve water and soil in zones that are highly erodible

(v) Maintain wild genetic resources

(vi) Regulate and purify water flow, notably by protecting wetlands and forests

(vii) Protect coastal habitations from natural disasters, such as floods and storm surges

Project Description:

This project will be carried out some areas in Koh Kong and Kampong Som such as Ream - 21,000 ha of lands, Botum Sakor - 171,250 ha, Peam Krosorm - 23,750 ha - and Phnom Somkos - 333,750 ha (Koh Kong). The management of the green forest and wildlife conservation are very difficult for the reason it result in forest and wildlife are decreased.

Rationale and Benefits:

(i) Establish and develop buffer zones surrounding the area

(ii) Fees collected from tourism

(iii) Improvement in national and regional budgets

(iv) Sustainable harvest of natural products

Estimated Cost: US $5 million
PROJECT PROFILE #6: ENVIRONMENTAL MONITORING SYSTEM ESTABLISHMENT

Project Location: entire coastal area of Cambodia

REDP Component: Component B: New Developments

REDP Program: Program A.3: Environmental Monitoring System

Project Objectives:

(i) Select areas for environmental standard
(ii) Select, implement protection and management for actual impact
(iii) Compliance with environmental operating conditions
(iv) Effectiveness of environmental mitigation measures
(v) Develop an environmental monitoring system
(vi) Establish evaluation results
(vii) Establish the resources to design and to implement monitoring
(viii) Establish and improve monitoring and enforcement programs

Project Description:

- Design principle for developing a monitoring programs
- Design the collection of base line of information with the long term (data should be sufficient quality) interview with local people, group people, expert, politic concern
- Create and implement assistance to administrative and monitoring agencies, including scientific research and training
- Collect and establish location, number and type of monitoring stations
- Ongoing monitoring programs

Rationale and Benefits:

- Real-world economic, budgetary, management tools
- Cost effective
- Feedback of a and action to be taken on the results

Estimated Cost: US $250,000
PROJECT PROFILE #7: DEVELOPMENT OF STRATEGIC PLAN FOR COASTAL ECOTOURISM

Project Location: entire coastal area of Cambodia

REDP Component: Component B: New Developments

REDP Program: Program A.5: Coastal Ecotourism

Project Objectives:

(i) ensure the sustainable development and conservation of the local natural resources which can be best improve the environment.

(ii) Review the local characteristics

(iii) Select the high potential ecotourism areas

(iv) To obligate ecotourism to control the discharge of solid and liquid waste into water ways by building proper settlement.

Project Description:

The work of this project would focus on primary kind of ecotourism. It is widely recognized that coastal zones require more comprehensive planing if their utilization is to be sustainable. To develop and carry out such a plan, it is necessary to have input from all levels.

Rationale and Benefits:

The technical and financial support of the government and international organizations with the benefit of economic development of Cambodia in the increased exploitation of natural resources is inevitable, but these scarce natural resources must be allocated carefully, so as to avoid permanent degradation of environment.

Estimated Cost: US $100,000
Appendix A: Terms of Reference for Regional Environmental Development Planning Case Study

OBJECTIVES

The objectives of the Regional Environmental Development Planning (REDP) case study are to:

(i) reinforce REDP concepts learned in the classroom through the preparation of an actual REDP for a selected study area; and

(ii) provide useful and practical advice to provincial governments in the selected study area on environmental strategies, priorities and proposed potential projects.

TERMS OF REFERENCE PROVIDED BY ASIAN DEVELOPMENT BANK

The Asian Development Bank has provided the following general Terms of Reference for the REDP case study:

(i) prepare an inventory of environmental resources using an appropriate classification system that indicates the importance of each environmental resource, including its past and current condition, trends in degradation, and probable future condition without remedial environmental protection measures;

(ii) document the existing conditions and trends and present the projections based on the preferred or planned economic development scenario; alternative strategies to achieve acceptable environmental quality should be developed and the preferred strategy determined; the preferred strategies should lead to a series of realistic and affordable policies to achieve desirable targets (including quality standards) and ultimately outlining a range of measures necessary to implement those policies; the strategy should also address, as required, water quality management, solid waste management, air quality management, watershed management, forest/wildlife management, coastal management, legal and institutional development and coordination, environmental monitoring and economic linkages;

(iii) analysis of economic and social factors such as population growth, income disparities, spatial variations in development, resource demands, etc. projected for the plan period;

(iv) assigning priorities to proposed environmental improvement projects and, for a sample project, analyze to the prefeasibility level and subject to an initial environmental examination; and

(v) planning a follow-up environmental monitoring program for the sample environmental improvement project to provide decision makers with feedback on the achievement of objectives (the monitoring program must be cost-effective).
SCOPE OF WORK

General

The overall study area is the coastal provinces of Koh Kong and Kampong Som. The exact planning area will be determined as a part of the REDP case study.

The following studies will be used as the basis for preparing an initial draft REDP:

(i) Koh Kong studies conducted by IDRC;
(ii) materials prepared under ADB RETA 5552: Coastal and Marine Environmental Management in the South China Sea;
(iii) Koh Kong master planning study conducted by Khmer Research Institute;
(iv) results of various coastal studies conducted by IUCN and the Asian Wetland Bureau; and
(v) draft Cambodia State of the Environment Report.

These materials will be available in the project library.

Additional information that is required will be obtained in a field visit to be undertaken by the entire class. The involvement of provincial institutions in the preparation of the case study is strongly encouraged.

The study team will prepare one paper copy and one computer copy (MS Word for Windows, and MS Excel spreadsheet software) of all reports. At the end of the study, each student will receive one paper copy of the report.

Types of Issues and Projects to be Examined

Issues to be examined in this study will meet one or more of the following criteria:

(i) the condition of non-living and living resources found in the coastal and marine environment of the study area, and changes in that condition caused by human activities or natural processes; or
(ii) the health and economic condition of people using these non-living and living resources for their existence, livelihood, and well-being.

Investment and technical assistance projects to be considered in this study must meet one or more of the following criteria:

(i) protection, maintenance, or rehabilitation of the non-living and living resources found in the coastal and marine environment of the study area;
(ii) improvement in the health and socio-economic condition of people using these resources for their livelihood and well-being, as well as improvement in their ability to use these resources in a sustainable way;
(iii) improvement in the ability of institutions to deliver the services required for the protection, maintenance, and rehabilitation of these resources. This includes the provision of necessary services to the people utilizing these resources.

WORKPLAN

The REDP case study will be conducted in eight steps; each step is described in detail below.

Step 1 - Scoping

The scope of the REDP will be clearly defined with the following activities:

- **Issues** - the environmental issues of the study area will be clearly defined and listed
- **Environmental Resources and Indicators** - the valued environmental resources of the study area will be defined and listed. Three groups of environmental resources will be considered: Physical Resources; Ecological Resources; and Social and Economic Resources. From one to three indicators will be defined for each environmental resource.
- **Human Activities And External Factors** - the important human actions and natural processes that are influencing the valued environmental resources in the study area will be defined and listed;
- **Space** - the extent of the study area and the planning units within the study area will be clearly described.
- **Planning Horizon** - the planning horizon for consideration of environmental effects will be outlined

Step 2 - Assessment of Current Conditions and Trends

The environmental conditions of the study area will be clearly assessed. This will be done by preparing a short report (approximately five pages) for each environmental resource. Each report will examine all of the issues identified for the environmental resource. These short reports will have the following outline:

- description of resource;
- trends in the indicator(s);
- explanation of factors causing trends;
- environmental implications of these trends;
- prediction of changes in resource without intervention;
- comment on quality of data and information;
- laws, policy, regulations; and
- a description of the institutions responsible for the management of the resource.

Differences among planning units will be described, and, where possible, these reports will be supported by 1 to 3 graphs or tables.

After the short reports for each environmental resource have been prepared, summary matrices will be prepared, one for current conditions and one for future conditions.

The final activity in this step will be to rank the environmental resources in order of priority and sort the issues according to this priority listing.
Step 3 - Strategic Plan

A strategic plan for regional environmental management, rehabilitation, and protection will be prepared. This strategic plan will consist of:

- the overall goal of environmental management, rehabilitation, and protection in the study area;
- the objectives of environmental management, rehabilitation, and protection in the study area;
- the environmental programs required for implementation of the strategic plan; and
- the objectives of each of the environmental programs.

Step 4 - Project Preparation

A list of investment and technical assistance projects will be prepared. Taken together, these projects will meet the objectives of the environmental programs identified in Step 3, above.

A short report (one to two pages) describing each project will be prepared. These reports will have the following outline:

- Name of Projects
- Project Objectives
- Brief Description
- Rationale and Benefits
- Estimated Cost

The projects for each program will be ranked in order of priority.

Step 5 - Pre-feasibility Study for Selected High Priority Investment Project

A 10 to 20 page pre-feasibility study of a selected high priority investment project will be prepared. This study will have the following outline:

- Background and Rationale
  - current trends in project area
  - related projects in the area
- Objectives and Scope
- Implementation
  - implementation schedule
  - executing agency
  - required inputs
  - initial environmental evaluation
  - effect on households
- Cost Estimate
  - estimate for each component
  - cost recovery
- Justification
  - quantified benefits
- non-quantified benefits
- financial and economic rate of return
- Project Risks
- Recommended Monitoring Plan

Step 6 - REDP Report

A detailed report of the REDP case study will be prepared. This report will have the following outline:

1. Introduction and Objectives (3 pages)
2. Summary of Current Conditions and Trends (7 pages)
3. Strategic Plan (5 pages)
4. Description and Analysis of Projects (15 pages)
5. Recommended Project Ranking and Justification (5 pages)
6. Implementation Plan for REDP (3 pages)
7. Supporting References
8. Appendices
   - Terms of Reference of REDP
   - Maps
   - Current Conditions and Development Trends (100 pages)
   - Project Descriptions (30 pages)
   - Pre-feasibility Study for Selected High Priority Project (10 to 20 pages)

Organization of the REDP Study Team

All students will participate in the case study. The study team will be organized as follows:
TERMS OF REFERENCE FOR MANAGEMENT TEAM

1. Manage all activities in the study and liaise with the International Consultant Team.
2. Assist the working groups in elaborating details of the work plan including the overall sequence of activities and the identification of detailed milestone schedules for each group.
3. Provide advice and assistance to the working groups concerning the organization, structure, format, technical terminology, technical content, documentation and English usage of all project reports.
4. With the assistance of the International Consultant Team, prepare the pre-feasibility study report for the selected high priority project.
5. Form three working groups: a data processing working group; an English translation working group; and a word processing working group. Guide the activities of these three working groups.
6. Using the ideas and contributions of all members of all technical working groups, take primary responsibility for the scoping of the REDP case study, preparation of the overall strategic plan, project identification; and ranking of projects.
7. Assist and guide each of the six technical working groups in the preparation of their information and reports.
8. Responsibility for the assembly and integration of the case study report.
9. Plan and coordinate required case study meetings and field missions.
TERMS OF REFERENCE FOR PHYSICAL RESOURCES WORKING GROUP

1. Contribute to the scoping of the REDP case study, preparation of the overall strategic plan, project identification; and ranking of projects.
2. Under the direction of the management team, prepare reports documenting the current conditions and trends of the physical environmental resources and issues identified during scoping activities.
3. Prepare short project descriptions as directed by the management team.
4. Assist in the preparation of the pre-feasibility study for the selected high priority project if required.
5. As required, participate in a data processing working group; an English translation working group; and a word processing working group.
6. Participate in all scheduled team meetings and field missions.

TERMS OF REFERENCE FOR ECOLOGICAL RESOURCES WORKING GROUP

1. Contribute to the scoping of the REDP case study, preparation of the overall strategic plan, project identification; and ranking of projects.
2. Under the direction of the management team, prepare reports documenting the current conditions and trends of the ecological environmental resources and issues identified during scoping activities.
3. Prepare short project descriptions as directed by the management team.
4. Assist in the preparation of the pre-feasibility study for the selected high priority project if required.
5. As required, participate in a data processing working group; an English translation working group; and a word processing working group.
6. Participate in all scheduled team meetings and field missions.

TERMS OF REFERENCE FOR SOCIAL AND ECONOMIC RESOURCES WORKING GROUP

1. Contribute to the scoping of the REDP case study, preparation of the overall strategic plan, project identification; and ranking of projects.
2. Under the direction of the management team, prepare reports documenting the current conditions and trends of the social and economic environmental resources and issues identified during scoping activities.
3. Prepare short project descriptions as directed by the management team.
4. Assist in the preparation of the pre-feasibility study for the selected high priority project if required.
5. As required, participate in the data processing working group; an English translation working group; and a word processing working group.
6. Participate in all scheduled team meetings and field missions.
Appendix B: Current Conditions of Study Area

PHYSICAL RESOURCES

Surface Fresh Water Resources

Hydrology

Surface fresh water is the main source of water in Cambodia. Cambodia has a unique and beneficial hydrological system dominated by the Mekong river. The catchment hydrology of the country consists of two major drainage basin, Mekong and the coastal basin. Highly coordinated drainage systems characterize the southerly fall of the coastal ranges except on the lowland around the bay of Kampong Som which generally features smaller, simple drainage systems.

The rivers which flow into the Gulf of Thailand are relatively small with water levels increasing and decreasing with the volume of rainfall. The river and streams in the coastal areas are general short and have their sources from hill of about 500 m to 600 m attitudes. They meander between hills and fall before reaching the plain located 15 to 20 km from the sea.

Current Conditions The important rivers in Koh Kong are described below and in Table 4.

- **Stung Metock** Take its source from Phnom Thom (1258 m. It meanders Parallel to the Cambodia- Thai boarder and flow into the sea at thnal krabey. The Stung Metock has a catchment area of about 1135 km² up to the point where it enters the Prek Koh- Pao estuary, the Stung Metock basin is mountainous and unpopulated. The rainfall over the SMT basin is about 3500 mm / year and other document was written that 3305 mm / year. The average daily flow of this river is approximately 86 m³/s. To date there exist no data on the transport of sediments bedloads and suspended loads in the above described river, located in Cambodia’s coastal areas. Depending on local people said that the sedimentation rate was approximately 1-10 cm per year. And the maximum flood flow 1079 m³/s.

- **Stung Russei Chrum** Take it source from highlands in Pursat province. The river has a catchment area of about 2726 km². The rainfall over the SRC basin to about, on average, 3500 mm/year and some document was written that 2665 mm/year. The average daily flow of the river is 152 m³/s and the maximum flood flow of river is 1825 m³/s.

- **Stung Sala Minthun** collects its head water in the Cardamom mountains is thmar-Baing District. The SSM river has a catchment area of about 1568 km² up to the point where it enters the Prek Klang Yai estuary. The rainfall over these river may be about 3500 mm/year and (2783 mm/year) on average. The average daily flow of the SSM river is about 93 m³/s and the maximum flood flow is 1310 m³/s.
Table 4: Summary of surface freshwater resources in Koh Kong.

<table>
<thead>
<tr>
<th>Name of river</th>
<th>Source and position</th>
<th>Latitudes</th>
<th>Longitudes</th>
<th>Catchment Area (km²)</th>
<th>AAR (mm)</th>
<th>MAR (mm)</th>
<th>ADF (m³/s)</th>
<th>MFF (m³/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stung Metock</td>
<td>Phnom Thom (1258 m), flow into the sea at Tinal krabey</td>
<td>-</td>
<td>-</td>
<td>1135</td>
<td>3305</td>
<td>2382</td>
<td>86</td>
<td>1097</td>
</tr>
<tr>
<td>Stung Russei Highland (Pursat province)</td>
<td>-</td>
<td>-</td>
<td>2726</td>
<td>3500 (2665)</td>
<td>1754</td>
<td>152</td>
<td>1825</td>
<td></td>
</tr>
<tr>
<td>Stung sale Muthun</td>
<td>Headwaters (cardavion mountains) Thmar Bang district.</td>
<td>-</td>
<td>-</td>
<td>1556</td>
<td>3500</td>
<td>1870</td>
<td>93</td>
<td>1310</td>
</tr>
<tr>
<td>Stung Chai Areng</td>
<td>Flows into the Gulf of Thailand at Prek Klang yai</td>
<td>-</td>
<td>-</td>
<td>2107</td>
<td>4000 (2873)</td>
<td>1959</td>
<td>131</td>
<td>1564</td>
</tr>
<tr>
<td>Toul Koky Basin</td>
<td>Peam Krosop (village) (Commune) Mouthun Seyma (district) source of water is the mountai- nous surrounding the Basin areas</td>
<td>11°34' North</td>
<td>103°03' East</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
• **Stung Chey Areng** Flow via the Prek Klang -yai estuary into the Gulf of Thailand opposite Koh Kong island. The SCA river has a catchment area of 2107 km². The upper and middle SCA basins are generally mountainous. The rainfall over this river may be about 4000 mm/year (2873 mm/year) on average. The average daily flow of SCA is approximately 131 m³/s and the maximum flood flow is 1564 m³/s.

• **Toul Koki Basin** is situated in Peam Krosop village, Toul Koki Commune, Monthun-seyma district between latitudes 11° 30' North and longitudes 103° 03' East. The Toul-koki basin take its source from mountains surrounding this area and the volume of water stocking on the basin could be irrigated on about 150 ha.

The important fresh water resources in Kampong Som are described below and in Table 5:

• **Prek Piphot River** flows into Kampong Som bay near the village of Phum Khsach Sa. The river has a catchment area of about 1164 km². The upper of Prek is mountainous and the middle is flat on low hills. The rain-fall over the Prek may be about 4000/year (3032 mm/year) on average. The average daily flow is about 78 m³/s and the maximum flood flow is 1095 m³/s.

• **Prek Kampong Som River** flows into Kampong Som bay near the village of sré-Ambel. The river has a catchment area of about 2645 km². The north-eastern part of the catchment area consists of a high plateau, the kirirom Plateau, with altitudes of 500-600 m about sea level. The rainfall over Prek may be about 3500 mm/year on average 2214 mm/year. The maximum flood flow may be about 1792 m³/s.

• **Prek Toek Sap River** has situated in Riem village, Riem commune Prey Nop district between latitudes 10° 35' north and longitudes 103° 41' east. The PTS take its source from Ta-las Chrang Krohom mountains, with altitudes of 800-1000 m about sea level. The PTS water regime was divided two major parts. The first is freshwater in rainy season and the second is marine water in dry season, they meander between source to the sea located 30 km long from the sea. This river are not only influenced by the rainfall but influenced by the seawater also. The range of depth water in the river may be about 1-6 m Max.

• **Prek o Tress** take its source from otress highland and mountain. The Prek has situated in o-tress quarter and Stung-Hao district between latitudes 10° 43' north ad longitudes 103°37'30" east. The Prek (x-tress has 10 km long from source to the sea, and the average of depth is 2 m, an sea water in dry season and fresh water on rainy season.

• **Chana Lake** takes its source from Bek-chan and Ta-Baing mountainous. The basin has situated in Bot Koki village, Ocnha Henh commune, Prey Nop district between latitudes 10° 35' north and longitude 103° 44.35" east.

• **Prek Touph station Reservoir** takes its source from highland of Kampong Som city. the station has situated in quarter N°5, Metapheap district between latitudes 10° 37' 30" north and longitudes 103° 30' East. The station has 87 ha of basin area and Maximum capacity stocking of water about 1 million m³ and depth of basin is about 1.5 m on average. The capacity of water supply 2000 m³/day for used in whole city.
Table 5: Summary of freshwater resources in Kampong Som.

<table>
<thead>
<tr>
<th>Name of river</th>
<th>Source and position</th>
<th>Latitudes</th>
<th>Longitudes</th>
<th>Catchment Area (km²)</th>
<th>AAR (mm)</th>
<th>MAR (mm)</th>
<th>ADF (m³/s)</th>
<th>MFF (m²/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prek Piphot</td>
<td>Source from mountainous and low hills river flow into Kampong Som bay</td>
<td>-</td>
<td>-</td>
<td>1164</td>
<td>4000</td>
<td>2114</td>
<td>78</td>
<td>1095</td>
</tr>
<tr>
<td>Prey Kampong Som</td>
<td>The Kirirom Plateau, with altitudes of 500-600 m about sea level and flow into Kampong Som bay near Sre Ambel village</td>
<td>-</td>
<td>-</td>
<td>2645</td>
<td>3500</td>
<td>1311</td>
<td>110</td>
<td>1792</td>
</tr>
<tr>
<td>Prey Tock Sap</td>
<td>Source from Ta-las Chrang Krahom mountains Riem commune Prey Nop district</td>
<td>10°35' North</td>
<td>103°41' East</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Prey 8-Tress (Rolous Thom)</td>
<td>Source from high land (8tress) and hills villages N°2 Stung Hao district</td>
<td>10°43' North</td>
<td>103°37'30&quot; East</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8-Chana Basin</td>
<td>Source from Bek-Chan mountains and Ta-Baing mountains Bot-Koki villages Ocnha-Heing Prey Nop district</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Prey Toup station</td>
<td>Source from highland surrounding the city at quarter N°5 Mithapeap district</td>
<td>10°37'30&quot; North</td>
<td>103°30' East</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
In Koh Kong and Kampong Som areas among the rivers that flow into the sea, Russei Chrum is the greatest and Stung Chay Areng and Prek Kampong Som having a little less. Most streams usually dry up in the dry season and are full of water in the rainy season.

**Trends and Factors Causing Trends** Among the eleven of rivers and basin, Stung Metock, Toul Koki basin and prey Toup station are most important in this case study and its has the project for each one. The factors causing trends including:

(i) Human influences are very important factors causing trends of fresh water. The human activities caused changes of surface freshwater and water quality. The Toul Koki project is in order to construct the dam may be cause flood for this area and in the same reason for diversion project at Stung Metock.

(ii) economical and social factors: Some of all economic and social activities caused freshwater hydrology and water quality changes. Over used of water by rapidly growth rate of population, over exploitation forest lowland agriculture, transportation etc., All activity above may be caused surface freshwater and water quality to be changes from day by day and very heavy threatened.

**Environmental Implication Of These Trends** The environmental implication of diversion project at Stung Metock are as follows:

(i) Diversion project at Stung Metock impact on water regimes is that mean, the daily flow to change from 86 m³/s to 38 m³/s and causes drying up in some places.

(ii) Diversion project impact on hydrogeology and especially is level of groundwater and quality of ground water and soil.

(iii) Diversion project impact on water quality caused by decomposition of biomass, Erosion, sedimentation and eutrophication.

(iv) Diversion project impact on biodiversity due to loss of more than 4000 ha forest included flora and fauna on other way, the present of the Dam and decreasing of water daily flow are obstacle for fish migratory.

(v) Diversion project impact on socio-economic condition. However, Stung Metock but the present of the Dam could be indirectly effected on socio-economic condition in this area such as: fisheries, agriculture, forestry, social work and clearing water supply, etc.

The second project at Toul Koky commune has a little impact less than diversion project was done by hydrology office at Koh Kong Province. Depending on actual survey at the field, the environmental impacts of the project are:

(i) forest inundation in the area due to cut down forest for agriculture crop.

(ii) impact on biodiversity

(iii) freshwater quality causing by chemical fertilizer and pesticide used.

(iv) Impact on water regime due to flood at rainy season.
In Kampong Som, the environmental implication of dredge a basin project at Prek Toup station for water supply has some problems such as:

(i) The project should be change in water stocking, is that mean, the basin area is larger and deeper than before.
(ii) Impacts on fisheries living and aquatic flora and fauna.
(iii) The project could be impact on water quality
(iv) The project could affect human health
(v) When implementing of the project will be meet the lack of water for drinking and using in whole city.

*Prediction Of Changes In Resources* With population growth, surface fresh water resources change in both quantity and quality.

In the lowland and upland agriculture areas, predominately in the surface agronomic land, anthropogenic problems are contributing factors include domestic waste, fertilizers uses and crop processing by individual farmers. These have reduced the suitability of surface freshwater for drinking and the situation is more crises by a scarcity of good quality groundwater.

While surface water quality in Koh-Kong and Kampong Som provinces is a regional issue dependent on the water management policies of jurisdictions upstream of the river.

So the diversion project at Stung Metock or irrigation project at Toul Koky commune in Koh Kong province and dredging project at Prek Toup station in Kampong Som are together caused surface freshwater quality is threatened by anthropogenic activities including solid waste, agricultural run off carrying crop residue fertilizers, sedimentation in the river and flood and other development activities increase in the fresh water areas.

*Policy Framework* Cambodia does not have a national water management policy addressing the multi-sectoral interest of water use. A comprehensive water management policy is needed which will rationalize water use in the area of agriculture, fisheries domestic use, hydro-power industry, transportation and tourism. The scarcity and misuse of fresh water pose a serious threat to sustainable development and protections the environment and the ecosystems on which they depend are all a risk unless water resources are managed efficiently.

*Freshwater Quality*

The results of surface water sampling done during the REDP case study are presented in Table 6, Table 9, Table 10, and Table 11. All water quality samples meet WHO standards for the parameters that were measured.

*Groundwater Resources*

*Current Conditions*

Ground water is a very important natural resource for development in Cambodia. The consumption of ground water should be considered and well understood for sustainable
Table 6: Description of surface water quality sampling points in Koh Kong, January 1996, conducted as part of REDP case study.

<table>
<thead>
<tr>
<th>Province</th>
<th>District</th>
<th>Commune</th>
<th>Town/Village</th>
<th>Location of Source</th>
<th>Source</th>
<th>Sample Number</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Koh Kong</td>
<td>Mondul Seima</td>
<td>Bak Khlong</td>
<td>Bak Khlong</td>
<td>Sea</td>
<td>A1-1</td>
<td>22/01/1996</td>
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<td></td>
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<td></td>
<td></td>
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<td>A2-2</td>
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<td></td>
<td></td>
<td>A2-3</td>
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<td>D2-10</td>
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<td></td>
<td>Beng Krachar</td>
<td>D1-11</td>
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<td></td>
<td></td>
<td></td>
<td>Peam Koh Yor</td>
<td>Peam Koh Yor</td>
<td>E1-12</td>
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<td></td>
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<td></td>
<td>Khong Khnong</td>
<td>Khong Khnong</td>
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<td></td>
<td></td>
<td>E3-15</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Smarch Gnam</td>
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Table 6 (cont’d): Description of surface water quality sampling points in Koh Kong, January 1996, conducted as part of REDP case study.

<table>
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<tr>
<th>Province</th>
<th>District</th>
<th>Commune</th>
<th>Town/Village</th>
<th>Location of Source</th>
<th>Source</th>
<th>Sample Number</th>
<th>Date</th>
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<td>I1-27</td>
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<td>I3-28</td>
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Table 7: Results of surface water quality monitoring in Koh Kong, January, 1996, conducted as part of the REDP case study.

<table>
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<tr>
<th>Date</th>
<th>Sample No</th>
<th>Flecal Colif per 100 ml</th>
<th>Alk mg/l CaCO₃</th>
<th>NH₄-N mg/l N</th>
<th>F mg/l Fe</th>
<th>Fe mg/l Fe</th>
<th>Mn mg/l Mn</th>
<th>(NO₃+ NO₂)-N mg/l N</th>
<th>NO₂-N mg/l N</th>
<th>Cond mS/m 25 C</th>
<th>Temp C</th>
<th>PH</th>
<th>NH₄ mg/l NH₄</th>
<th>NH₃ mg/l NH₃</th>
<th>NO₃ mg/l NO₂</th>
<th>NO₂ mg/l NO₂</th>
<th>Salinit ppt</th>
<th>D.O mg/l</th>
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<td>73.00</td>
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<td>0.05</td>
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<td>0.00</td>
<td>0.62</td>
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<tr>
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<td>2.00</td>
<td>&gt;100</td>
<td>158.00</td>
<td>0.03</td>
<td>1.10</td>
<td>0.85</td>
<td>0.08</td>
<td>0.18</td>
<td>0.06</td>
<td>0.12</td>
<td>209.00</td>
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<tr>
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<td>3.00</td>
<td>&gt;100</td>
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<td>0.03</td>
<td>0.00</td>
<td>6.00</td>
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Table 8: Description of surface water quality sampling points in Kampong Som, January 1996, conducted as part of REDP case study.

<table>
<thead>
<tr>
<th>Province</th>
<th>District</th>
<th>Commune</th>
<th>Town/Village</th>
<th>Location of source</th>
<th>Source</th>
<th>Sample Number</th>
<th>Date</th>
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<td>Kampong Som Port</td>
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<td>V1-63</td>
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</tbody>
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32
Table 9: Results of surface water quality monitoring in Kampong Som, January, 1996, conducted as part of the REDP case study.

| Date | Sample No. | Fecal Colif. per 100 ml | Alk. mg/1 CaCO₃ | NH₄-N mg/l N | F mg/l F | Fe mg/l Fe | Mn mg/l Mn | (NO₃+NO₂)-N mg/l N | NO₂-N mg/l N | NO₃-N mg/l N | Cond. mS/m 25°C | Temp. °C | pH | NH₄ mg/l NH₄ | NH₃ mg/l NH₃ | NO₂ mg/l NO₂ | NO₃ mg/l NO₃ | Salinity ppt | D.O mg/l |
|------|-------------|-------------------------|------------------|--------------|-----------|------------|------------|-------------------|--------------|--------------|----------------|----------|-----|---------------|-------------|-------------|-------------|-------------|-----------|---------|
| 25 Jan | 8 | 71 | 95 | 0.15 | 0.75 | 0.50 | 0.021 | 0.22 | 0.019 | 0.201 | 50.4 | 25.5 | 6.12 | 0.195 | 0.180 | 0.884 | 0.063 | 0.00 | 0.266 |
| 9 | >100 | 121 | 0.60 | 1.70 | 0.25 | 0.016 | 0.35 | 0.004 | 0.346 | 349 | 28.8 | 7.28 | 0.780 | 0.720 | 1.522 | 0.013 | 22.20 | 4.549 |
| 10 | >100 | 177 | 0.20 | 0.80 | 0.60 | 0.006 | 0.369 | 0.340 | 0.029 | 120.3 | 26.8 | 6.63 | 0.260 | 0.240 | 0.128 | 1.122 | 0.70 | 1.033 |
| 11 | 50 | 121 | 0.10 | 2.00 | 0.015 | 0.180 | 0.069 | 0.111 | 36.3 | 29.5 | 6.39 | 0.130 | 0.120 | 0.488 | 0.228 | 0.10 | 5.500 |
| 12 | >100 | 38 | 0.00 | 0.20 | 0.25 | 0.002 | 0.580 | 0.014 | 0.566 | 3.08 | 29.5 | 6.61 | 0.000 | 0.000 | 2.490 | 0.046 | 0.30 | 8.770 |
| 13 | 22 | 30 | 0.00 | 0.25 | 0.40 | 0.026 | 1.040 | 0.023 | 1.017 | 41.2 | 27.1 | 5.37 | 0.000 | 0.000 | 4.475 | 0.076 | 0.10 | 4.540 |
| 14 | 55 | 108 | 1.08 | 1.60 | 0.05 | 0.006 | 0.440 | 0.007 | 0.433 | 327 | 29.0 | 7.45 | 1.404 | 1.296 | 1.905 | 0.023 | 20.80 | 4.489 |
| 26 Jan | 15 | 26 | 0.00 | 0.40 | 0.16 | 0.018 | 0.007 | 0.173 | 22.6 | 29.8 | 6.18 | 0.000 | 0.000 | 0.761 | 0.023 | 0.20 | 3.900 |
| 16 | >100 | 56 | 0.00 | 0.50 | 0.40 | 0.002 | 0.560 | 0.014 | 0.546 | 22.6 | 29.8 | 6.18 | 0.000 | 0.000 | 2.402 | 0.046 | 0.20 | 11.29 |
development and prevent the natural resources, because Cambodian less understanding in groundwater resources.

At the present, groundwater resources are not well understood. Wells construction were built in the areas where there are lack of fresh water bodies especially in the coastal zone which few streams, and other freshwater sources, for family’s using and crops.

According to case study in those areas, Koh Kong and Kampong Som most of the people use the groundwater for cooking and watering the crops (vegetables), but the water were taken from the wells had been build and using are open wells which diameter of 1 meters and deep 3 to 6 meters and were built from concrete.

Referring to information of the Women’s Affairs Department in Koh Kong, 20 UNICEF wells are planned for two villages, Khun Chhang and Smach Mean Chey, Smach Mean Chey District. Only 12 wells have been dug in these villages to date.

We have no information about the statistic of wells in the entire province of Kampong Som, because all the wells have been built by the family.

According to the short time of case study, we chose some of the wells to analyze the quality where shown in Table, Table, Table, and Table. The characteristics of each of the sampled wells are as follows.

**Koh Kong Province** Five wells were sampled in Koh Kong Province, all in Smach Meanchay Village:

- Well #1 in Khung chang village, Smach Meanchey commune. Each well was built with concrete in deep of 3 m to 4 m. The one we were analyzed is locate 5 m from the house. It is an open well which 4 m deep. In rainy season water deep of 2 m and in dry season water remaining only 0.3 m. The capacity of this well can supply for 5 families in the rainy season, but in dry season just only one family including supply for the crops. This well was built in May 1995.

- Well #2 is located in Smach Meanchy village, Smach meanchey commune, Smach Meanchey district. This well was build in May 1994 on the sandy soil which deep of 4 m that constructed from the concrete with 1 m diameter. In rainy season this well content of 2.5 m water deep and in dry season remaining only 1 meters.

- Well #3 is in Smach Mean chey Commune, Smach Meanchey district. This well was build in 1990 which 3.5 m deep and 1 meters diameter with the concrete, that located 8 meters from the street. In rainy season this well content 3 meters water and in dry season remaining only 0.5 meters deep.

- Well #4 was located in Prey Svay village, Smach Meanchey commune, Smach Meanchey district. This well was build in 1992 without concrete which deep of 2 meters, content of 1 meters water in rainy season and 0.5 meters in dry season.

- Well # 5 is located in village II, Smach Meanchey commune, Smach Meanchey district, was build in 1987 with the deep of 3.5 meters. In rainy season the water deep of 2 meters and in dry season remaining only 0,7 m.
Table 10: Description of well water quality sampling points in Koh Kong, January 1996, conducted as part of REDP case study. Note that two additional samples were taken, one in a stream and another as tap water.

<table>
<thead>
<tr>
<th>Province</th>
<th>District</th>
<th>Commune</th>
<th>Town/Village</th>
<th>Location of source</th>
<th>Source</th>
<th>Sample Number</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Koh Kong</td>
<td>Smarch Mean Chey</td>
<td>Smarch Mean Chey</td>
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<tr>
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<td>Smarch Mean Chey</td>
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<td>Smarch Mean Chey</td>
<td>Open well</td>
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<td>Smarch Mean Chey</td>
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<td>23/01/96</td>
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<td>Prey Svay</td>
<td>Prey Svay</td>
<td>Open well</td>
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<td>Koh Kong Hotel</td>
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Table 11: Results of well water quality monitoring in Koh Kong, January, 1996, conducted as part of the REDP case study.

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<th>Temperature °C</th>
<th>Conductivity mS/m 25°C</th>
<th>Salinity ppt</th>
<th>pH</th>
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Table 11 (cont’d): Results of well water quality monitoring in Koh Kong, January 1996, conducted as part of the REDP case study.

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### Table 13: Results of well water quality monitoring in Kampong Som, January, 1996, conducted as part of the REDP case study.

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Kampong Som

Four wells were sampled in Kampong Som:

- Well #1, located in Riem national Park Khan Prey Nub about 20 meters from the sea. The deep of the well is about 2.5 meters and water deep 1 metres. This well was dug in 1994;

- Well #2, in Bort Koki Village, O Okngaheng commune, khan Pry Nub. The characteristics of the well are: 3 meters depth; 2.4 meter water depth; open well without concrete; and located 10 meters from Road No. 4

- Well #3, O Muy Village, Commune 4, Khan Mitapeat. This well is 6.6 meters deep and has a water depth of 1.6 m in the rainy season, and 0.8 m in the dry season

- Well #4 is located in village No. II, O Tress Commune, Steung Hao district. This well was constructed in 1986. It is 3.5 m deep and water exists at a depth of 1.5 m. This well supplies water for more than five families, especially in the rainy season.

According to the interview to the people and visiting in those areas (Koh Kong and Kampong Som), there appears to be a problem of groundwater supply and demand. Freshwater demand is increasing, but the supply of freshwater is limited in the study area, because the coastal zone has few freshwater sources and some of them have disappeared because of human activities and natural processes, so that the remaining groundwater sources are becoming shallower. In addition, wells are generally unavailable to most rural areas in the study area.

Groundwater quality depends on the depth of the wells. The shallow wells have poor water quality, because there not enough filtering capacity in the soil layer. Water depth in groundwater wells is decreasing; in the future, rural people will meet the problems of water supply.

The factors are causing the problems above are: deforestation; soil erosion; increasing uncontrolled handicraft and industrial with the disposal of liquid that contain chemical substances; lack of technical and financial capacity for digging wells; and population growth. Referring to the demands of water supply in the present and in the future we can predict that in the future the water supply in the rural area without appropriate measures for rural development and other activities to protect the natural resources as ground water quality in the study area.

Marine Water Quality

Introduction The Cambodian coastline measures 435 km, extending from the Thai border to the Vietnamese border, and consists of large estuary in the northern part of Koh Kong Province and a greatness bay of Kampong Som province. The total Cambodia marine surface is estimated to have 42,000 sq. kilometers: about 23 percent of Cambodia's land area. Separately, Koh Kong coastal zone is 141 km with total population of 70,000 inhabitants along this coast line but Kampong Som coastal zone have 121,079 inhabitants. Using seawater of both provinces for navigation, transport services and for shrimp farm and other exploration is on steady increase of the current activities resulting inevitably in heavy environmental damage to marine quality, especially to other kinds of marine life.

Current Conditions A summary of current marine water quality conditions in the study area are as follows:
Salinity changes seasonally with level of freshwater flow. Nevertheless, salinity has varied about 10 percent from the dry season to the rainy season.

- **pH** varies between 6.7 and 8.5
- Temperature varies 2.2°C throughout the year
- Dissolved oxygen varies from 4.2 to 4.8 ml/l in Koh Kong and from 4.5 to 4.6 ml/l in Kampong Som

**Trends** With good opportunities for investment, urban and industrial development, and improvements in the standard of living, persons are moving to the study area from different and other regions of Cambodia or from outside the country. The coastal zone ecosystems are likely to be subjected to heavy pressures from these above-mentioned activities, with consequent effects on human welfare. Thus, marine water quality may be expected to deteriorate due to the following set of activities:

- **Population Growth**: With this study area being favorable for living, foreign and local people converge here to take existing benefits of natural resources from this region such as mangrove cutting down for manufacturing charcoal, developing shrimp and other exploration. Population emigration to the region is higher than in the past. In each estuary of Koh Kong mangrove sub-region is disordered floating- houses directly on seawater- that attribute marine quality impairment by way of dumping used something into it. What's more, most residents earning their living with fishing and mangrove cut for charcoal productive is poor at awareness of sanitary conditions and of environmental conservation methods. Finally, the failure to recognize local authority’s immediate, legislative steps to govern floating houses certainly become another further burden on the marine water quality.

- **Shrimp Farming**: Shrimp farming leases most recently increased to 1000 ha in Koh Kong in 1996; each pond is uses fertilizer and food for rearing shrimp. A report of one Koh Kong fishery official voiced the concern that of 280 ha of shrimp farm now operating in Koh Kong, 70 percent were heavily damaged by acids caused by using chemical substance in pond. Today shrimp yields decline as ecological damage rises. Therefore, the most serious water quality problem facing Koh Kong Province constitute effect of the acids on nearby marine life.

- **Urbanization and Industrialization**: Today, Kampong Som province is in the process of urbanizing. Many factories which will dispose waste water is into seawater are planned to be built. In Koh Kong, urbanization has so far progressed relatively little. There is one Sokimex storage station in Koh Kong, closely located along its coast, where is the target of environmental revision and managing stocked oil, in fear of it spilling and spraying into seawaters. There by previously preventing marine quality from oil related widespread pollution both in those place and in all another region. For Kampong Som coastal zone, there are many industries and big petrol exploitation that require environmental officials of this province to be drafted then to take the serious action against environment marine quality impact provoked by petrol exploration of inventor and desperately to need to have this project assessed before operating in their province.

- **Charcoal Production**: Koh Kong's many charcoal kilns, amounting from 130 to 400 kiln 1995, was built in the mangrove sub-region where this forest is cut down to make also charcoal. Enormous amounts of ash, making seawater increasingly salty when they are...
dumped into estuary, is major problem effective on fragile ecosystem and at the expense of marine life.

- **Port Development and Transportation**: The two provinces' current transportation activities, currently under way, have some reduction and impact on marine water quality.

### Air Quality Resources

**Description of Resources**

Air is very important for human life around the world but if the air has pollutants, these pollutants may affect our health. If we talk about the quality of air in coastal zone in Cambodia especially at Koh Kong and Kampong Som, the air quality is generally good, but there are many indicators which affect air quality such as industrialization, transportation and charcoal manufacturing locally.

**Industrialization** The number of factories and handiwork in Kampong Som and Koh Kong Province are not so much as Phnom Penh. Kampong Som has only 3 factories and 150 handiwork operations, while Koh Kong has only 172 handiwork enterprises. This number can not affect air quality very much at the coastal zone, because most of the handicrafts are produced by hand. Air quality may be affected by the small number of generators in handicraft enterprises, factories, and electricity power plants. In spite of this these facilities can not pollute the air at the coastal zone to the same extent as the Phnom Penh.

**Transportation** Transportation in Koh Kong Province and Kampong Som is not a problem for air quality, because in these two cities the number of vehicles and motor cycles has not so much, didn't have the traffic James as in Phnom Penh. Koh Kong has only 144 vehicles 510 motorcycles, 14 trucks and 172 boats and Kampong Som has only 629 vehicles 1050 motorcycles, 139 trucks and 700 boats with an International port. Inspire of the case like that the number of pollutants into the air also very small can not polluted the air at the coastal zone.

**Deforestation for Charcoal Manufacture**

The mangrove forest is the place for cleansing the pollutants from the air. At Koh Kong Province, mangrove has destroyed by many people who cut the mangrove to produce the charcoal. In charcoal processing, they produced pollutants in to the air, especially suspended particular matter into the air, but the charcoal oven located far from each other about two or 3 kilometers, so that the pollutants can not affect air quality very much and any air quality problems can be cleaned up by the mangrove forest nearby.

**Prediction of Future Conditions**

Koh Kong is a small province located along the seaside and bordered by Thailand. Traffic is not so busy, most of the transportation in Koh Kong Province is conducted by boat, and the province is surrounded by mountain. The Royal Government has few projects for development in this area, and air quality will likely not decrease in the future. Kampong Som has an International port and the National road No. 4 connects this city with Phnom Penh. Kampong Som is also the city which Royal Government has planned projects for industrial development, tourism, and international port expansion. We can therefore predict that the population in the city will increase very fast. The number of vehicles, motorcycles, boats, factories, the number of ships
into Cambodia, and the number of tourist will also increase. All of this will make a problem for air quality in the future in this province.

In order to prevent the air pollution in this area the government must have a law or strict regulation for investors to make an EIA for all projects before conducted and to stop importing the second hand vehicles and motorcyccles. The Ministry of Environment must cooperate with the Ministry of Public Work and Transportation, the Ministry of Industry, and the Ministry of Commerce in order to prevent decreases in air quality in the coastal zone.

**Priorities of Physical Environmental Resources**

Based on the analysis of current conditions in the study area, the physical resources have been grouped into two categories based on urgency for action:

(i) Lower Priority for Action:

- Geology and mineral
- Soil
- Surface freshwater
- Ground water

(ii) Higher Priority for Action:

- Marine water quality
- Air quality

**ECOLOGICAL RESOURCES**

**Terrestrial Biota**

**Introduction**

It is believed that Cambodia features approximately 120 mammal species, 600 birds and an unknown number of reptiles, amphibians and other animal groups. Over 2300 species of vascular plants have been described for Cambodia of with at least 25 percent are regularly used by rural communities for medicinal or other purposes. However many more remain to be described. A more detailed account of the diversity of plant and animal species in Cambodia is currently the subject with the Ministry for Environment.

**Assessment of Current Conditions and Trends**

Cambodia possess a diverse flora with some areas featuring numerous endemic species. Five main vegetation types are recognized: humid forest, sub-humid forest, open savanna forest and allied grasslands, and hydrophilic communities.

The Kampong Som area has *Shorea hypocha* and *Dipterocarpus costatus*. The indigenous tree species in this area are listed in Table 7.
Table 14: List of indigenous tree species found in Kampong Som.

<table>
<thead>
<tr>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mangifera macrocarpa</td>
</tr>
<tr>
<td>Miliusa velutia</td>
</tr>
<tr>
<td>Terminalia corticosa</td>
</tr>
<tr>
<td>Lithocarpus farinulanta</td>
</tr>
<tr>
<td>Calophyllum thorelli</td>
</tr>
<tr>
<td>Cinamomum iners</td>
</tr>
<tr>
<td>Amora gigantea</td>
</tr>
<tr>
<td>Ficus maclellandii</td>
</tr>
<tr>
<td>Knema globularia</td>
</tr>
<tr>
<td>Nephelium hyleucum</td>
</tr>
<tr>
<td>Guiosa squamosa</td>
</tr>
<tr>
<td>Irvingia malayana</td>
</tr>
<tr>
<td>Heritiera javanica</td>
</tr>
<tr>
<td>Sterculia lychnophora</td>
</tr>
</tbody>
</table>

The plant resources more this have been to provided to communities areas for built, medicinal or other purposes. An additional it is supporting balance climates no change more and support animal wild and maintain natural environment.

Koh Kong and Kampong Som has abundant fauna. The relatively large extent and diversity of forest cover maintains a diversity and abundance of wildlife. This fauna features a wide array of mammals including carnivores, primates, bears, elephants, rodents, bats, deer and native cattle. The vast wetlands feature large number of waterbirds. There are: wild buffalo (*Bulabos bulabos*), Tiger (*panthera tigers*), Leopard(*Pathera leo*), Pileated Gibbon (*Hylobates Pileatus*), Otter civet (*Cynogale bennetti*), Chestnut, Headed Partridge(*Arborophila cambodiana*), Rabbit, hare, musk deer (*Tragulus pigmaeus or Tragulus kanchil*), wild boar, Tiger cat, Kind of monitor lizard (*Varanus nebulosus*), pangolins (*Manis javanica*). The abundant fauna in the study area provide human communities their livelihood with hunting or other activities.

**Trends in the Resources and Factors Causing Trends**

Data and information to support the description of the resources above are not perfect, and precise data for estimation are not supported by graphs or tables. But, we can determine trends from reviewing existing documents and by professional judgment. The remaining floral species are currently threatened by illegal activities such as logging, even though these activities are regulated by the government. Fauna are currently threatened by accelerated habitat pressure, poaching, illegal hunting trade, and landmines.

The details of the factors creating risk to terrestrial biota are listed below:

(i) **Population Growth** impacts the environmental resources heavily because of poverty and lack of awareness about resource values. In order to conform to the political and economic situation in the present many people are shifting to exploitation of the natural resources notably terrestrial biota by harvesting the resource;

(ii) **Infrastructure and Inputs** impacts the habitat of fauna but it's a small influence because the provinces still have undeveloped infrastructure;

(iii) **Harvesting of Biological Resources** is a wide spread action;
(iv) **Upland Agriculture** such as agriculture encroachment impacts plants, floral species and degrades habitat of fauna;

(v) **Forestry Activities** such as the forest exploitation, poor logging methods and deforestation by illegal logging and lack of reforestation. This causes decrease of the vegetation and habitat of the wild animals;

(vi) Industrial development consists of small industrial facilities, such as: tile kiln, brick kiln, charcoal oven, and saw mill. Those destroy a lot of forest resource and habitat of the wild animals;

(vii) Shrimp farming is impacting the terrestrial biota severely because the shrimp farming is spreading and degrading wildlife and mangrove forest, and

(viii) **Mangrove Charcoal Production**: the action of the mangrove charcoal production at the moment is an active sector and without control. This decreases the mangrove forest and flora species found in mangrove forests.

### Wetlands

#### Introduction

Wetlands may be defined as "Area of marsh, fen, peat-land or whether natural or artificial, permanent or temporary, with water that is static, flowing, fresh, brackish or salty, including areas of marine water, the depth of which at low tide does not exceed six meters".

Cambodia is rich in wetland environments. Over 30% of the country is wetlands. Following internationally accepted criteria for wetland identification. Over 20% (36,500 km²) of the kingdom may be classified as wetlands. This presents over 5% of the Asia's total area of wetlands. Cambodia's significant wetlands can be divided into four main are: The Mekong River (468 km in length) and its flood plain, the Great lack is lake Tonle Sap (between 13,00 km² and 2,500 km²) and its flood plain, the Stung (river) Sen (3,000 km²) and the coastal estuaries of Stung Kaoh Pao and Stung Kep, In addition, Cambodia has numerous other wetlands, notably streams, ponds, fresh water swamps and marshes, mud flats and seagrass beds.

The Kingdom of Cambodia is culturally and economically linked to wetlands. Most the population, live in wetland areas and the central part of Cambodia, being essentially a large wetland comprising flood forests, has been exploited by Cambodians for centuries. Wetland products harvested by local communities include food (fish, water birds, edible plants, animals) medicine, water and fuelwood. Wetland areas support rice and fish productive sectors economically, fish and fish products are the single most important source of protein for Cambodian population. Wetland provide nutrient-rich and sheltered habitats for fish (spawning and nursery area or habitats for adults) and therefore play a central role in the supply of animal protein in Cambodia. Agriculture is supported by water from wetlands.

Wetlands serve a wide variety of ecological functions which support economy activities or are of economy value. In addition to supporting agriculture and fisheries they maintain water cycles and protect inland areas from flooding. Coastal wetland act as barriers against storm surges and protect coastline from erosion. Many wetlands are important as filtering systems, cleaning polluted water removing silt, encouraging plant growth and further improving water quality.
Cambodia's wetlands are important sanctuaries for birds and other species of wildlife not commonly found in other countries in the world.

Separately, the wetland areas in Koh Kong and Kampong Som provinces is the same characteristic as the other wetland in Cambodia because it has a special complex ecosystem and gives many benefits for men and animals as well.

Description of Resource

The wetland resources play a significant role in economy, and have enormous potential for people and animals. Most of people in Koh Kong and Kampong Som live in wetland areas and many rural areas depend on wetland for their livelihood.

In addition to the central roles played by wetland in agriculture and fisheries productions are commonly harvested from wetlands by local people. wetland products include food (fish, birds, mammals and plants) medicine, water, peat, timber, fuelwood, cane, reeds for thatch and matting, and resins. Wetlands frequently also supply products which constitute an income supplement during difficult times when other sources of income are available. Such products can make the difference between survival or failure for rural population. Further more, certain wetland areas have cultural and religious significance.

Food Source: Apart from fish primary sources of protein provided by wetlands and of importance to local people include waterbirds (commonly hunted for their meat and eggs), frogs, mollusk, insects and turtles (including tortoise and terrapins).

Wetland Plants: Over 100 species of plants have been identified from Cambodian wetlands (personal communication IUCN), some of which may be rare and/or endangered. Plants from wetland areas provide important benefits such as food and medicine (e.g. the lotus plant is used for food and medicine purposes). In addition plants are used by local people for a variety of purposes such as thatching for roofs walls and for cooking utensils.

Wetland Fauna: Many endangered animal species are found in Cambodia. Endangered species inhabiting Cambodia's wetlands include:

- Irrawaddy Dolphin - *Oreaella breirostris*
- Chines white Dolphin - *Sotalia chinensis*
- Black Finless porpoise - *Neophacena phocanoides*
- Eastern Sarus Crane - *Grus antigone sharpii*
- Giant Ibis - gigantea
- White Shoulder Ibis - *Pseudoibis davisi*
- Gerater Adjutant stork - *Leptopilos dubius*
- Lessre Adjutant stork - *Leptopilos Javanicum*
- Siemese crocodile - *Crocodylus saimensis*
- Giant trasak - *Probarbus jullieni*

Mangrove Flora: Mangrove forests occur on sheltered coastal sites where sufficient muddy sediment can accumulate. Situated in the intertidal zone these forest are inundated twice daily by the tides. Mangrove forests are well know for their high biological productivity and their consequent importance to the nutrient budget of adjacent coastal waters. They are important breeding areas for fish and also protect the shoreline from erosion.
in Koh Kong Province has an area of mangroves about 31,100 ha and Kampong Som province has an area of mangrove about 2,300 ha (Source: Ministry of Agriculture). But in the present, the mangroves in the both province are threatened by firewood collection, the cutting of mangroves for charcoal production, aquaculture and wood chipping operations.

Initial research and field study has found 42 species of trees and shrubs belonging to 20 plant families in the mangrove forests of Koh Kong Province as presented in Table and Table.

Trends In The Resource, Factors Causing Trends, And Environmental Implications

There are many factors affecting on the wetland resources in Koh Kong and Kampong Som provinces.

Population and Demography The wetland resources are threatened by the growing population in the areas with destroying the wetland resources for their livelihood and exported the resources to the other countries.

Forestry Activities The long term sustainability of this valuable wetland and coastal resources are threatened by uncontrolled management and overuse, most notably by large-scale charcoal production, logging for fire wood and construction materials, as well as conversion to salt fields and intensive shrimp farming.

In Koh Kong Province, by the Director of the department of fisheries (1994) has estimated that more than 300 charcoal kilns produced over 24,00 t of charcoal in 1992 which was mostly exported to Thailand (approximately 94%). It would take about 100,000 tones of mangrove wood to produce this amount of charcoal.

Charcoal production for export is illegal without licensed concessions. Taiwan had a contract with the Cambodia Government for 10,000 tones to be exported in 1992 (Chea Peng chheang 1994).

Charcoal kilns are now growing in number while mangrove forest are increasingly cut. According to local provincial officials, the number of charcoal kilns totaled 224 in 1993. At that time, 200 of the kilns with diameters between 8-10 m were destroyed by an Anti-charcoal kilns commission set up by the local authorities in Koh Kong province. Consequently, there was an actual increase in the number of kilns, but with smaller diameters (from 3-5 m), and often re-located deeper into the forest. According to one of the commune chief, the number of kilns had reached almost 1,000 by November, 1994.
Table 15: List of plant species found in mangrove forests of Koh Kong Province (Source: Department of Nature Conservation and Protection, Ministry of Environment).

<table>
<thead>
<tr>
<th>Family</th>
<th>Scientific Name</th>
<th>Local name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acanthaceae</td>
<td>Acanthus ebracteatus</td>
<td>Psaot tock</td>
</tr>
<tr>
<td>Pteridaceae</td>
<td>Acrostichum aureum</td>
<td>Prong</td>
</tr>
<tr>
<td>Pteridaceae</td>
<td>Acrostichum speciosum</td>
<td>Prongkandpr</td>
</tr>
<tr>
<td>Myrsinaceae</td>
<td>Aegiceras corniculatum</td>
<td>Krachaukdaineang</td>
</tr>
<tr>
<td>Meliaceae</td>
<td>Amoora cucullata</td>
<td>Chher toek kraham</td>
</tr>
<tr>
<td>Rutaceae</td>
<td>Atalantia monophylla</td>
<td>Krochmarkhaoch</td>
</tr>
<tr>
<td>Avicenniaceae</td>
<td>Avicenia officinalis</td>
<td>Smekhmao</td>
</tr>
<tr>
<td>Avicenniaceae</td>
<td>Avicennia marina</td>
<td>Doem Srem Talae</td>
</tr>
<tr>
<td>Barringtoniaceae</td>
<td>Barringtonia racemosa</td>
<td></td>
</tr>
<tr>
<td>(Lecythidaceae)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tiliaceae</td>
<td>Brownlowia tera</td>
<td>Nannang</td>
</tr>
<tr>
<td>Rhizophoraceae</td>
<td>Bruguiera cylindrica</td>
<td>Kong Kong sendek bay</td>
</tr>
<tr>
<td>Rhizophoraceae</td>
<td>Bruguiera gymnorhiza</td>
<td>Basac phkar kra ham</td>
</tr>
<tr>
<td>Rhizophoraceae</td>
<td>Bruguiera parviflora</td>
<td>Kong Kong Sendek khmao</td>
</tr>
<tr>
<td>Rhizophoraceae</td>
<td>Bruguiera sexangula</td>
<td>Basac phkar sor</td>
</tr>
<tr>
<td>Aprocynaceae</td>
<td>Cerbera odollam</td>
<td>Choeung tea</td>
</tr>
<tr>
<td>Rhizophoraceae</td>
<td>Ceriops decandra</td>
<td>Phlong deng phkar sor</td>
</tr>
<tr>
<td>Rhizophoraceae</td>
<td>Ceriops tagal</td>
<td>Phlong deng phkar kroh ham</td>
</tr>
<tr>
<td>Verbenaceae</td>
<td>Cheroendrum inerme</td>
<td></td>
</tr>
<tr>
<td>Leguminosae</td>
<td>Derris trifoliate</td>
<td></td>
</tr>
<tr>
<td>Euphorbiaceae</td>
<td>Excicaria agallocha</td>
<td>Katoum</td>
</tr>
<tr>
<td>Asclepiadaceae</td>
<td>Finlaysonia martima</td>
<td>Doem Krapeastrei</td>
</tr>
<tr>
<td>Sterculiaceae</td>
<td>Heritiera littoralis</td>
<td>Kaitale</td>
</tr>
<tr>
<td>Malvaceae</td>
<td>Hibiscus tilaceus</td>
<td>Kabas prey</td>
</tr>
<tr>
<td>Leguminosae</td>
<td>Intsia bijuga</td>
<td></td>
</tr>
<tr>
<td>Rhizophoraceae</td>
<td>Kandelia candal</td>
<td>Lam ka chae</td>
</tr>
<tr>
<td>Combretaceae</td>
<td>Lumnitzeria littorea</td>
<td>Kra nhep phkar krohham</td>
</tr>
<tr>
<td>Combretaceae</td>
<td>Lumnitzeria racemosa</td>
<td>Kra nhep phhkarkroh sor</td>
</tr>
<tr>
<td>Palmae</td>
<td>Nypa fruticans</td>
<td>Doem chak</td>
</tr>
<tr>
<td>Palmae</td>
<td>Phoenix paludosa</td>
<td>Msaao peung</td>
</tr>
<tr>
<td>Verbenaceae</td>
<td>Premna obtusifolia</td>
<td>Char leut</td>
</tr>
<tr>
<td>Rhizophoraceae</td>
<td>Rhizophora apiculata</td>
<td>Kong kang senleuk toch</td>
</tr>
<tr>
<td>Rhizophoraceae</td>
<td>Rhizophora mucronata</td>
<td>Kong kang senleuk thom</td>
</tr>
<tr>
<td>Euphorbiaceae</td>
<td>Spium indicum</td>
<td>Sram tek pray</td>
</tr>
<tr>
<td>Sonneratiaceae</td>
<td>Sonneratia Alba</td>
<td>Phle ampu</td>
</tr>
<tr>
<td>Sonneratiaceae</td>
<td>Sonneratia caseolaris</td>
<td>Lamphu</td>
</tr>
<tr>
<td>Sonneratiaceae</td>
<td>Sonneratia griffithii</td>
<td>Phle ampea</td>
</tr>
<tr>
<td>Sonneratiaceae</td>
<td>Sonneratia Ovata</td>
<td></td>
</tr>
<tr>
<td>Malvaceae</td>
<td>Thespesia populnea</td>
<td>Potek sarmuth</td>
</tr>
<tr>
<td>Malvaceae</td>
<td>Xylocarpus granatum</td>
<td>Kam boh sor</td>
</tr>
<tr>
<td>Malvaceae</td>
<td>Xylocarpus moluccensis</td>
<td>Tobon khmao</td>
</tr>
<tr>
<td>Malvaceae</td>
<td>Xylocarpus rumphii</td>
<td>Tapan</td>
</tr>
</tbody>
</table>
Table 16: Additional plant species found in Cambodian coastal zone
(Source: Department of Fisheries).

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Name in Khmer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hibiscus tiliaceus</td>
<td>Boas</td>
</tr>
<tr>
<td>Excoecaria agallocha</td>
<td>Cheur chor</td>
</tr>
<tr>
<td>Terminalis catappa</td>
<td>Chombok rang</td>
</tr>
<tr>
<td>Hernandia</td>
<td>Por phler</td>
</tr>
<tr>
<td>Heritiera littoralis</td>
<td>Ksai</td>
</tr>
<tr>
<td>Sindora maritima</td>
<td>Kro kos</td>
</tr>
<tr>
<td>Barringtonia Spp</td>
<td>Rang tuk</td>
</tr>
<tr>
<td>Morinda</td>
<td>Nhor</td>
</tr>
<tr>
<td>Malaleuca leucadendron</td>
<td>Smach</td>
</tr>
<tr>
<td>Soaevita</td>
<td>Rokkhocheat Ibat</td>
</tr>
<tr>
<td>Canavalis</td>
<td>Smauve</td>
</tr>
<tr>
<td>Ipomaca pes caprae</td>
<td>Smauve</td>
</tr>
<tr>
<td>Tribulus terrestris</td>
<td>Smauve</td>
</tr>
</tbody>
</table>

In an interview with a charcoal kilns owner, it was learned that an average size kilns of 6 m in diameter can covert 45 tones of mangrove wood in to 15 tones of charcoal during a 1 month production cycle. As coastal people build charcoal kilns with a different diameters, depend on location, situation and market requirements, while the productivity has changed too.

Charcoal kilns with a diameter of 5 m actually can produce 50 hab (1Hab = 60 Kg) of charcoal 10 times a year. From estimations made in October, 1994, a kiln owner can earn 105,000 Bath ($4,200 US) per year with charcoal selling price of 3.5 Baht per kilogram.

About 30% of charcoal production is for local domestic use and 70% for illegal export to the other countries.

**Intensive Shrimp Farming** According to the Chief of Fisheries Office in Koh Kong Province the total area of shrimp with licenses is 897.96 ha, but in the present, the shrimp farms are operating only 415.29 ha because some of the shrimp farm owners hesitate to operate theirs because of disease from shrimp larvae imported from Thailand (Figure 3).

So the owners wait for a time to see the result of the existing operations. But, some of the shrimp farms have not operated yet, the data of shrimp farms in each year are increasing (Figure 3) that lead to the destruction of mangrove forest in the wetland area.

Shrimp culture is now on the rise in large scale and with sophisticated technology, so that it should be called "intensive shrimp culture". However, there are still no settlement for solid and liquid waste treatments. Along with large-scale mangrove clearing, the impact on the surrounding environment is one of the main threats to the destruction of coastal ecosystems. According to local officials, there are 105 entrepreneurs exploiting a total territory of 840 ha as of November, 1994. Of this total area, there is a division into three classes:

(i) 238 ha - under intensive use
(ii) 177 ha - under construction
(iii) 425 ha - given licenses but not yet reached construction stage.

There are now an additional 63 entrepreneurs who are applying to expand the intensive shrimp farm territory by an added to the Agricultural direction in Koh Kong Province but, as of yet, they have been refused.

So these activities are very seriously effect and are the most impact on the wildlife sanctuaries in the areas.

**Prediction of Changes In Resources Without Intervention**

In Koh Kong and Kampong Som provinces have been meeting the serious problems of uncontrolled and unregulated investment in intensive shrimp culture and charcoal production. So it has led to destruction and pollution of the environment in the areas. Over-exploitation on wetland would cause degrading of wetland resources, and loosing of large species in the areas as well.

**Quality of Data and Information**

According to the information on the wetland resources, have showed the declining of resources in wetland areas caused by local people in Koh Kong and Kampong Som province, including the intensive shrimp culture, the cutting mangrove for charcoal production and the other activities with and without licensed concession.
These activities are still continuing environmental destruction every day by the over-exploitation on the wetland resources in the provinces.

Aquatic Biota

Invertebrate Resources

Prawns are a significant resources for our country. Mangrove forests are a vital habitat for them. Prawn lay their eggs in deep water but the larvae migrate passively in the plankton, moving with Ocean currents to the nutrient-rich water around the mangroves to feed and grow. They hide in the decaying leaves and feed on organic detritus to the sub-adult stage, when they migrate back in to deeper water. Loss of mangroves affects prawn productivity.

Coral Reefs

The corals and coral reef in Cambodia sea may be divided into three major types:

(i) Fringing reefs project seawards directly from the shore. They are living surrounding islands and border continental land masses and are the most common type of reef;

(ii) Barrier reefs, though similar to fringing reefs, are separated from the land mass by a shallow lagoon; and

(iii) Atolls reefs, rest on the summits of submerged volcanoes. These are usually oval or circular with a central lagoon. Atolls are most common in the Indo-pacific region. Darwin postulated that developed on the shores of slowly subsiding volcanic island. As these islands sank, the vigorous upward growth of coral at the reef periphery produced first a barrier reef and then, as the island finally disappeared beneath the sea atolls formed. This subsidence theory was subsequently confirmed.

There are many species of the corals and coral reefs in Cambodia sea. Some of them have been identified by the research team of the Ministry of Environment such as follows:

- Sarcophyton
- Diploria
- Pocillopora
- Fungi
- Hydrophora Rigida
- Montipora Acquituberculata
- Favita
- Platygyra

Some species have been found around Koh Ses, Koh Thmei, Koh Mano, Koh Tateam, Koh Smach, Koh Ample Thom, Koh Samit, Koh Rong Samloem, Koh Kong, and Koh Pus.

The living coral organism or polyp is a tiny tube-shaped animal that extracts calcium compounds from sea water which it uses to build a protective skeleton. After one polyp establishes itself on a bare rock, it may divides by budding and establish a colony, which, given the correct conditions, may continua to grow at the rate of a few millimeters or centimeters a year. To grow well, corals need the warm temperatures of tropical or subtropical water, a food supply in the
form of organic particles which they catch with their mobile tentacles, and light, as many corals live closely with algae which need light for photosynthesis.

A reef forms gradually over a long period as a result of the activities of both corals and algae. Corals growing close together will trap sand and rubble which is held fast by calcareous algae. The growth of the coral reef creates a new living environment which will give shelter, protection, food and anchorage to a variety of living organisms.

The reef itself is a barrier against the force of the sea and the lagoon it provides tranquil water and a stable environment for marine organisms. There are many coral species and their different shapes, structures and colors, seen with the myriad of colorful creatures that live around the reef-fish, shellfish, anemones, can be an important food source, a major tourist attraction and a valuable source of scientific information.

Seagrasses

Seagrasses are the only group of submerged flowering plant in the marine environment. They thrive in shallow-water coastal habitats. Like the terrestrial grass from which they originated they possess erect leafy shoots and creeping stem or rhizomes which are effective for propagation. In contrast to other submerged marine plant (e.g. Seaweeds or algae), Seagrasses flower, develop fruit and produce seeds. They also have true roots and an internal system for the transport of gases and nutrients.

**General Status of Seagrasses in Cambodia:** The coastal waters of Cambodia have some of the world’s richest ecosystems characterized by extensive coral reef and dense mangrove forest. Blessed with warm a tropical climate and high rainfall, these water are further enriched with nutrients from the land which enable them to support a wide diversity of marine life.

There are some 50 varieties of seagrasses worldwide, 12 of which are found in tropical waters. In Cambodia there are a few species of seagrasses identified so far:

- Tropical eelgrass (*Enhalus aeroides*)
- Fiber, stand grass (*Halodule pinifolia*)
- Syringe grass (*Syringodium isoetifolium*)
- Dugong grass (*Thelazia hemprichii*)

Seagrass have been known to serve as food for turtles. Eelgrass makes a contribution to coastal fisheries providing nurseries, shelter and food for fish, invertebrates and dugong. Eelgrass also reefs and mangrove in reducing wave energy, regulating water flow and therefore coastal erosion. Seagrass beds have been sighted in Kampong Som bay and around some islands in Kampot and Koh Kong.

**The Importance of Seagrasses** There are two types of uses of seagrass in Cambodia:

(i) Traditional uses:

- Woven into baskets
- burned for salt, soda and warmth
- stuffing for mattresses
- roof thatch
- upholstery and packing material
- compost for fertilizer
- insulation for sound and temperature
- fiber substitute in dikes
- piles to build dikes

(ii) Contemporary uses:

- sewage filters
- paper manufacture
- source of useful chemicals
- fertilizer and fodder
- food and medicine

Seaweeds

Algae, often know by their common name seaweeds, are much more diverse than seagrass and a host of species colonize rocks, rock pools, and sandy areas as well as the reef top. They play a significant part in the transfer of energy in the lagoon and are a vital part of many food web some herbivorous fish and host of invertebrate life forms like grazing mollusks, feed on the algae, the smallest of which are unicellular forms that colonize the leaves of seagrasses and the surface of rock.

The importance of algae as reef-builders is not fully appreciated by most people. Specialized in secreting algae and other branching forms, form a matrix in which sand and rubble are held fast. As the particles are bound together, they form a substratum on which, or in which other organisms can grow. Some red and green algae which grow in the sea bed are collected for food. Algae could also be used as a source of raw materials for the pharmaceutical industry.

Explanation of Factors Causing Trends

In general, it is believed that the distribution and abundance of aquatic biota in the study area is decreasing. The following are thought to be the most likely causes:

(i) Population growth: people need food and they catch more fish;

(ii) Mangrove depletion: destroys habitats; loss of nutrients and food for fish; loss of aquatic ecosystems;

(iii) Fish harvesting by local people and businessman: Harmful fishing practices such as push nets and drag nets are especially destructive since they serape the ground and destroy the seagrass beds. These small mesh nets also capture many of Juvenile fish that support offshore fishery. In coral reef environments the most dangerous fishing equipment destroys the coral and kill many juvenile species. The second most destructive method is poison;

(iv) Increasing of tourists effect on coral reefs;

(v) Discharge of domestic waste and pollution into sea water from uncontrolled settlements, shrimp farming, and industries.
(vi) Oil and natural gas exploitation lead to explosions, spills and leaks into water. They pollute aquatic biota.

According to the reasons above, the aquatic biota will change rapidly from base line to the higher level. If the Government or involving Ministries don't care and don’t solve this urgent problems, they will more seriously effect on aquatic biota, especially fish. Then people will lose the protein intake from fish.

If destructive fishing is stopped in the coastal fishing zone, seagrass beds and coral reefs, the coastal ecosystem will start to recover. Number of aquatic species will begin to increase (allowing for two years recovery) and more fish, squid, crabs and shrimp will be caught by fishing communities. Living standard will get better and fisherman will not have their village and families in search of work to supplement their income. Traditional ways of village life will remain intact.

**Institutional and Policy Issues**

First, the Government needs to clarify the mandate, role and responsibilities for the line Ministries with respect to coastal zone management. This again is a rejection of the need to coordinate Government agencies on multi-sectoral planning and management issues. Clarification is also required on the respective authority of the central and provincial Governments. Second, the Government must address the adequacy or inadequacy of existing or proposed legislation. Tana (1994) notes that the focus of current fisheries legislation is to regulate the exploitation of inland fisheries, the legislation lacks any consideration of environmental management. The draft Environmental law proposed by the Ministry of Environment is umbrella legislation and hence general in nature. While coastal and marine resources are mentioned in the draft legislation and are the purview of the Ministry of Environment, decrees regarding the management of these resources have yet to be drafted.

Related to the legal issue is the question of enforcement. The Government currently has little control over unauthorized illegal activities including illegal timber harvesting (including mangrove), fishing mining and others. Therefore, the capacity of agencies responsible for monitoring, surveillance, and enforcement need to be developed.

**Responsible Agencies**

In order to solve the complex problems, the involvement of all the following organizations are required:

- Ministry of Environment
- Department of Fisheries.
- local authorities
- Ministry of Interior
- Ministry of Tourism
- Ministry of Industry Energy and Mine

They must work together to protect and to prevent human activities that lead to polluted aquatic biota and decreasing quality of the environment.
Forest Resources

Description of Resources

The forest is a valuable resource for the National economy. Forests provide oxygen and are important for human and animal. Also the forests provide rainfall for Agriculture and protection from soil erosion. The most used forests were habitats for biodiversity, based on the forest inventories of the 1960's. FAO concludes that there has been an average annual deforestation rate of 500 to 100,000 ha from early 1960 to the late 1980's. Since 1990 the rate of deforestation has accelerated rapidly but no reliable figures are available. There are numerous reliable observations of the quantity of logs transported across specific border points i.e. 2,500 cm³/day. These in themselves are of concern but taken cumulatively across all illegal border points. It suggests that the rate of deforestation is well beyond the level of sustainable logging.

The following forest types are found in the study area:

(i) Natural forest (old growth): consisting of virgin and lightly modified forest. Virgin forests are essentially unmodified by human activities. This type of forest may contain gaps caused by the normal death and regeneration of trees and may include areas of phases which have been affected by natural events such as: land tides, typhoons, or volcanic activity lightly modified forest. Similar to the above the composition and structure of which have been affected by the hunting and gathering activities of indigenous people;

(ii) Modified (secondary) forests: The first type of modified forests are those which have been abandoned, so that a full tree cover of indigenous species has been able to develop another form of modified forests which have been subjected to various intensities and frequencies of logging but which still remain covered with a tree or shrub cover of indigenous species. There may be two kinds of natural regeneration and others where this has been supplemented by environmental planning.

(iii) Planted forests: contain forest crops raised artificially either sowing or planting which are in general area in which the naturally occurring tree species have been totally or mostly replaced by planted trees.

(iv) Degraded forests: land areas which have been so intensely modified by cultivation or other disturbances that they remain covered with grass or no forest. These lands are unlikely to recover to the original level without species rehabilitation.

Forests in Koh Kong Province Before 1970

In 1970 in Koh Kong, forest land was 1,195,700 ha, equaling 92.64% of the total area of the province. The types of forests at that time are described in Table.
Table 17: Distribution of forests in Koh Kong in 1970.

<table>
<thead>
<tr>
<th>Forest Type</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prey labs</td>
<td>24,000</td>
</tr>
<tr>
<td>Prey srong</td>
<td>901,400</td>
</tr>
<tr>
<td>Prey sakandal srong</td>
<td>12800</td>
</tr>
<tr>
<td>Prey srool</td>
<td>10,900</td>
</tr>
<tr>
<td>Prey baytuncheonanix</td>
<td>149,100</td>
</tr>
<tr>
<td>Prey Mangrove</td>
<td>32,100</td>
</tr>
<tr>
<td>Prey smex</td>
<td>42,300</td>
</tr>
<tr>
<td>Prey rossey</td>
<td>23,100</td>
</tr>
</tbody>
</table>

Description of Mangrove in Koh Kong

It was estimated by FAO that total area of Mangrove forest along Cambodia's coastline was 37,000 ha before 1970 (Table 17). Although this seems rather low considering other future estimates, it should also be recognized the development and exploitation of mangrove forests at that time probably was not extensive. Mekong Secretariat and LUMO (1992) through satellite imagery and remote sensing estimate that total mangrove cover is 83,700 ha whereas Chea Peng Chheang (1993) of the Department of Forestry claims that only 37,000 ha are left in the country. Koh Kong Province has the vast majority of mangrove forests in Cambodia (63,200 ha). Estimated by Lumo in 1992 and 31,100 ha by Chea Peng Chheang. Mangrove are spread along Dong Tung, Mondul Sema, Koh Kong, Kiri Sakor, Botum Sakor, and Sre Ambul Districts.

Table 18: Summary of existing information on mangrove forest in Koh Kong and Kampong Som Provinces.

<table>
<thead>
<tr>
<th>Koh Kong</th>
<th>Kampong Som</th>
<th>Total (Ha)</th>
<th>Source Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>31,100</td>
<td>2,300</td>
<td>33,400</td>
<td>Chea Peng Chheang</td>
</tr>
<tr>
<td>16,000</td>
<td>17,400</td>
<td>33,400</td>
<td>FAO (before 1970)</td>
</tr>
<tr>
<td>63,200</td>
<td>13,200</td>
<td>76,400</td>
<td>Mekong remote sensing Lansat 1992</td>
</tr>
<tr>
<td>63,200</td>
<td>13,200</td>
<td>76,400</td>
<td>Lansat 1992-89</td>
</tr>
<tr>
<td>63,200</td>
<td>13,200</td>
<td>76,400</td>
<td>LUMO 1992</td>
</tr>
<tr>
<td>63,200</td>
<td>13,200</td>
<td>76,400</td>
<td>Catherine Vallee, Man Kosal wetland of current Cambodia</td>
</tr>
<tr>
<td>31,000</td>
<td>3,700</td>
<td>34,700</td>
<td>Thart Sovannarith, Student of Fishery Faculty,1989-93</td>
</tr>
</tbody>
</table>

Explanation of Factors Causing Trends and Environment Implications of These Trends

Koh Kong and Kampong Som provinces have been relatively undisturbed up until the current decade. However, due to political changes, population increases, as well as economic growth and business influence from neighboring countries, the impact to the environment has become more acute. A number of economic activities are booming such as logging, intensive shrimp farms, charcoal production, klim chan production.

Klim chan is a smelling perfume that is collected from cutting a certain type of tree that grows in the mountains of Koh Kong and Kampong Som. Small amounts of this perfume are extracted by cutting the entire tree. The perfume is then illegally exported and sold at very high prices. Naturally klim chan extraction is conducted by using mangrove wood which is burned in klim chan kilns. Mangrove wood is used because of its high caloric content. The current number of kiln factories used for klim chan extraction is 37 (from Koh Kong and Kampong Som Environment Departments).
There are many factors affecting forests in Koh Kong and Kampong Som provinces:

(i) **Population and Demography**: The forest products are needed by the growing population;

(ii) **Forestry Activities**: The long term sustainability of this valuable forest resource is threatened notably by large scale charcoal production logging and firewood and construction materials (Figure 4); and

(iii) **Shrimp farming and Charcoal Production**: Shrimp farming in Koh Kong Province the cutting of mangrove for charcoal production and the conversion to shrimp farms are growing concerns, it is estimated in Koh Kong. Approximately 30% charcoal production for local domestic to use and 70% for export to Singapore so this activity has very serious effects on mangrove resources (Figure 5).

The most immediate and serious effect on forest resources is the accelerated pace of investment in forestry and the associated destruction of the mangrove forest for charcoal production. Erosion of coastal areas is occurring where mangroves have been degraded. Uncontrolled and unregulated investment in forestry has led to severe destruction of the environment in Kampong Som and Koh Kong Provinces, with the initial symptoms of over exploitation, usually include a decline in average forests zones and the disappearance of many species, is already occurring.

**Legal and Policy Requirements**

The following are recommended legal and policy actions required to properly manage the forest resources of the study area:

(i) develop environmental regulations to control forest development. Increase the control of foreign Forestry through various means; and

(ii) establish clear definitions of roles, responsibilities and relationships among institutions responsible for the management of forestry.

**Fisheries**

**Introduction**

The Gulf of Thailand's fisheries suffered dramatic over-fishing following the mechanization of Thailand's fishing fleet in the 1960's. This resulted in a loss of biological diversity and the Gulf became dominated by invertebrates (Dennis and Woodsworth, 1992). In comparison, the coastal area of Cambodia including its marine waters have been lightly exploited until recently. Therein lies the importance of its potential role for the rehabilitation of the depleted fish stocks of the entire Gulf. Fish catch-per unit effort is reportedly ten times greater in the fish-depleted water adjacent to Cambodia. The Naga expedition from 1959 to 1961 identified coastal water off Cambodia as zones of high biological productivity and important nurseries for fish breeding in the Gult. These zones are associated with the seasonal reversal of monsoon wind which assist the movement of the nutrients to the surface, tidal mixing, land drainage and mangrove forests 435 fish species from 97 families have been identifies in Cambodian waters (Tana 1994).
Figure 4: Trends in timber harvest in the study area. Source: Forestry Department.
While 80 per cent of the protein consumed in the Cambodian diet comes from fish, over 60% of the total fish catch is from the inland fisheries from 1990 to 1993, the total marine catch averaged 35,775 tons per year. The total number of people engaged in the marine fisheries is estimated at less than 10,000 people in addition, the capture capacity of the fishing fleet is low being comprised mainly of unmotorized or low power boats that remain inshore. In 1993 there were 2,705 fishing boats with engines less than 50 horsepower compared to 186 boats with largest (Tana 1994). Regular access to these area is sought by fishing fleet from neighboring countries and constant risk of over-fishing exists due to Cambodia's minimal ability to supervise the activities of these fleet- Cambodia's own catch harvests have remained in the 50-65,000 tones per annum range.

The Cambodian EEZ and the whole Gulf of Thailand is a productive area due to its shallowness (average depth of 20 meters and maximum depth of 87 meters) and the predominance of a muddy and muddy-sandy bottom. Fishery resources in the Gulf of Thailand can be divided into tow groups: pelagic and demersal. Pelagic fisheries are important for the commercial market and include: mackerels; anchovies; sardines; small tunas and comforts. Important demersal fish in the study area are: threadfin breams; coraker; big-eyes; lizard fishes; hairtails; flatfishes; snappers; barracudas; groupers; shark; and conger eels.

The fisheries sector plays a significant role in the economy representing up to 5% of GDP. The sector has enormous potential with a largely untapped marine capture fisheries reserve and favorable conditions for the development of a fish export industry (World Bank, 1994). With respect to the coastal area, fisheries production primary comes from 2 sources: marine capture and aquaculture. Marine fisheries involves the exploitation of resources by Cambodian based coastal fishermen in inshore area and by foreigners (legally and illegally) in offshore areas. Aquaculture is practiced principally in inland areas of the country however, the techniques and
methods are expanding to the coastal area (FAO, 1993). As mentioned in the previous section, shrimp aquaculture is practiced in coastal bays and mangrove swamps.

**Marine Capture Fisheries**

There is a lack of available information regarding marine fisheries. As suggested by FAO (1993), this may be because past administrations have not put a high priority on such information considering inland fisheries to be more important.

**Figure 6** shows the reported commercial marine capture in the two coastal provinces. It is apparent from the graph that an overall increase in marine production has occurred since 1980. Commercial fish capture in Koh Kong Province has been substantially greater than marine capture in Kampong Som province, while marine capture in Koh Kong showed a dramatic increase in 1990 only to be followed by a downward trend. The substantially higher levels reported in Koh Kong may due to the size of the provincial waters, better provincial reporting, and the relatively closer location to Thailand yielding possibilities for trade and higher levels of foreign. **(Figure 6)** also suggests that harvest of marine fisheries resources in the areas where fishing effort is concentrated may have reached or exceeded the sustainable limits of the fish populations.

![Graph](image)

**Figure 6: Reported commercial marine fisheries capture in the study area.**  
*Source: Department of Fisheries.*

**Aquaculture** There are 2 types of aquaculture in the coastal zone watershed: freshwater aquaculture and brackish or saltwater aquaculture. Based on a limited preliminary field survey, freshwater aquaculture is of limited extent, while brackish or saltwater aquaculture can be found primarily in Koh Kong.
Before the war, freshwater aquaculture reached its high in 1970 with an approximate production of 5,200 t (FAO, 1993). High valued species were mainly grown and sold in Phnom Penh. Since the war, a successful effort has been made to re-introduce freshwater aquaculture for fish breeding now yielding greater quantities than those recorded in 1970. Historically, it is believed that cage and pen culture originated in Cambodia in the 10th century (FAO, 1993). Similar to the 1970's, aquaculture production has been on cage culture and geared to meet urban demand.

Table shows the reported commercial freshwater fish aquaculture production in the two coastal province. Of the total of 110 t of freshwater aquaculture fish grown in 1989 has declined to the present time.

Shrimp aquaculture was introduced to the coastal provinces in the latter half of the 1980's primarily in Koh Kong near and inside mangrove forest areas. Figure 7 shows the reported commercial brackish shrimp aquaculture production in the coastal provinces. From 1991 to 1994 shrimp production has increased which average of production 2,732 t/yr.
Table 19: Freshwater fish aquaculture production in the coastal provinces. Production figures are in t.

<table>
<thead>
<tr>
<th>Year</th>
<th>Kampong Som</th>
<th>Koh Kong</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>15</td>
<td>60</td>
<td>75</td>
</tr>
<tr>
<td>1989</td>
<td>50</td>
<td>60</td>
<td>110</td>
</tr>
<tr>
<td>1990</td>
<td>57</td>
<td>10</td>
<td>67</td>
</tr>
<tr>
<td>1991</td>
<td>30</td>
<td>70</td>
<td>83</td>
</tr>
<tr>
<td>1992</td>
<td>13</td>
<td>70</td>
<td>83</td>
</tr>
<tr>
<td>1993</td>
<td>15</td>
<td>-</td>
<td>15</td>
</tr>
<tr>
<td>1994</td>
<td>35</td>
<td>-</td>
<td>35</td>
</tr>
<tr>
<td>Total</td>
<td>215</td>
<td>200</td>
<td>415</td>
</tr>
</tbody>
</table>

Figure 7: Brackish shrimp aquaculture production in the coastal provinces.

Explanation of Factors Causing Trends and Environmental Implications of These Trends

There are many factors affecting fisheries in Kampong Som and Koh Kong Provinces:

(i) *Population and Demography:* Fisheries production is unable to meet the demand of the rapidly growing population. This has caused a substantial drop in consumption and deteriorating nutrition, especially in the rural parts of the study area;

(ii) *Forestry Effects on Fisheries Habitat:* The most immediate unregulated threat to the coastal zone is the accelerated pace of investment in shrimp farming and the associated destruction of the mangrove forests for threat to the marine environment,
particularly where mangrove areas have been degraded. The regional impact of damaging the remaining area of high marine productivity is likely to be high;

(iii) **Fishing Capacity**: Most of the fishing fleet is comprised of unmotorized or low-power boats that remain inshore. This means that most of the fishing effort is concentrated on the inshore fisheries stocks, and the absolute capture capacity of the fishing fleet is low. In 1993 there were 2,709 fishing boats with engines less than 50 horsepower compared with 186 boats with larger engines (Tana 1994). Regular access to Cambodia's waters is sought by fishing fleets from neighboring countries, and a constant risk of overfishing exists due to Cambodia's minimal ability to supervise the activities of these fleets.

(iv) **Oil and Gas Exploitation**: Recent results offshore exploratory drilling suggest that Cambodia has a high potential for natural gas and a modest potential for oil. One test well has yielded 4.7 million cubic feet of gas and 180 barrels per day of light condensate crude. The effect of Gas and oil exploitation on the water quality and on the fish habitats is an increasing concern.

Total commercial fisheries output between 1990 and 1994 averaged 26,666 tons per year of which 17,974 tons (67%) were marine capture fish in Koh Kong, 8,692 tons (33%) were marine capture fish in Kampong Som. Total commercial freshwater fish aquaculture averaged 59.28 tons per year, and the total brackish shrimp aquaculture production averaged 2,732 tons per year, of which 2,060 tons (75%) were shrimp aquaculture production in Koh Kong and 672 tons (25%) were shrimp aquaculture production in Kampong Som. High levels of exploitation, poor management and continuing environmental degradation are claimed to have irreparably damaged these fisheries such that they are now incapable of regaining their 1960 level of production.

**Legal and Policy Requirements**

The following are recommended legal and policy actions required to properly manage the fisheries resources of the study area:

(i) environmental regulations to control coastal development;

(ii) increase the control of foreign fishing through various means; and

(iii) establish clear definition of roles, responsibilities, and relationships among institution responsible for management of coastal and marine resources.

**Park and Reserves**

**General Importance of National Parks**

Park and reserves are very important, because the main goal is to keep some ecosystems pristine from direct human influence. With National Parks, we have a system of protected areas, to maintain the diversity of ecosystems, species and wild genetic resources, and to protect the world's great natural areas for their intrinsic, inspirational and recreational values. A protected.
area provides safeguards to:

(i) natural and modified ecosystems that are essential for maintaining life-support systems, conserving wild species and areas of particularly high species diversity, and supporting scientific research;

(ii) culturally important landscapes (including places that demonstrate harmonious relationships between people and nature) historic monuments, and heritage sites in built-up areas;

(iii) sustainable use of wild resources in modified ecosystems;

(iv) traditional, sustainable use of ecosystems in sacred places or traditional site of harvesting by indigenous people;

(v) recreational and educational uses of natural resources;

(vi) conserve water and soil in zones that are highly erodible if the original vegetation is removed, notable by protecting wetlands and forests;

(vii) regulate and purify water flow, notably by protecting wetlands and forests;

(viii) shield people from natural disasters, such as floods and storm surges by protecting watershed forests riverine wetlands, coral reefs, mangroves and coastal wetlands; and

(ix) maintain wild genetic resources or species important in medicine.

Because of limitations of time and resources, Ream National Park in Kampong Som was used as the representative park and reserve for the case study.

Introduction to Ream National Park and Description of Park Resources

Ream National Park, which covers about 21,000 ha, is located in the District of Prey Noup in Kampong Som. It was officially inaugurated as a National Park on 21 March, 1995. The National Park has a high diversity of flora and fauna including several endemic species of plants such as Rafflesia zollingeriana and rattan species Plectocomia elongata. For a long time, park resources such as bamboo, firewood and medicinal plants have been utilized by the people living adjacent to the park. Such utilization is now against the law, because the area has been declared a National Park. Some floral and faunal surveys have been conducted in Ream National Park (Table , Table ).

Explanation of Factors Causing Trends and Environmental Implications of These Trends

Park resources are still harvested because of the disadvantaged socio-economic conditions of the communities surrounding the park. Most of them depend on the natural resources in the park to fulfill their daily needs.
Table 20: List of tree species found in Ream National Park.

<table>
<thead>
<tr>
<th>No.</th>
<th>Cambodia name</th>
<th>Scientific name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ta trav</td>
<td>Fagraea fragrans (loganiacees)</td>
</tr>
<tr>
<td>2</td>
<td>Cheur Kmav</td>
<td>Diospyros Sp (Ebenacees)</td>
</tr>
<tr>
<td>3</td>
<td>Grire</td>
<td>Melanorea hera laicera (Anacardiaceae)</td>
</tr>
<tr>
<td>4</td>
<td>Don Chaim</td>
<td>Tarrietia Javanica (Sterculiaceae)</td>
</tr>
<tr>
<td>5</td>
<td>Rang Phnom</td>
<td>Pentacme Siamensis (Dipterocarpaees)</td>
</tr>
<tr>
<td>6</td>
<td>Pcheak</td>
<td>Shorea obtusa (Dipterocarpaees)</td>
</tr>
<tr>
<td>7</td>
<td>Neng Deng</td>
<td>Dipterocarpus costatus</td>
</tr>
<tr>
<td>8</td>
<td>Pideak</td>
<td>Anisoptera glabra (Dipterocarpaees)</td>
</tr>
<tr>
<td>9</td>
<td>Cheur tarl teuk</td>
<td>(Dipterocarpus alatus (Dipterocarpaees)</td>
</tr>
<tr>
<td>10</td>
<td>Koki casach</td>
<td>Hopea pirei (Dipterocarpaees)</td>
</tr>
<tr>
<td>11</td>
<td>Chor Mas</td>
<td>Vatica astroticha (Dipterocarpaees)</td>
</tr>
<tr>
<td>12</td>
<td>Koki phnong or comnangn</td>
<td>Shorea hypochra (Dipterocarpaees)</td>
</tr>
<tr>
<td>13</td>
<td>Cham cha</td>
<td>Toona febrifuga (Meliaceae)</td>
</tr>
<tr>
<td>14</td>
<td>Sro Gom</td>
<td>Payena ellipica (Sapotaceae)</td>
</tr>
<tr>
<td>15</td>
<td>Sro Sor</td>
<td>Podocarpus cupressina (Podocarpaece)</td>
</tr>
<tr>
<td>16</td>
<td>Sro Cror Horm</td>
<td>Dacrydium Olatum (Podocarpaece)</td>
</tr>
<tr>
<td>17</td>
<td>Chan Grisna</td>
<td>Aguilaria crasna (Thymeliaceae)</td>
</tr>
<tr>
<td>18</td>
<td>Svay Chomreng</td>
<td>Swintonia pirei (Anacardiaceae)</td>
</tr>
<tr>
<td>19</td>
<td>Tlork</td>
<td>Parinarium annamensis (Rosaceae)</td>
</tr>
<tr>
<td>20</td>
<td>Tror Meng</td>
<td>Caralia lucida (Rhizophoraceae)</td>
</tr>
<tr>
<td>21</td>
<td>Paong</td>
<td>Callophyllum Sp (Guttiferes)</td>
</tr>
</tbody>
</table>
Table 21: List of fish species in the Ream region.

<table>
<thead>
<tr>
<th>No.</th>
<th>Local Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Burrujasa smirori</td>
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<td>9</td>
<td>Boble Phnek lean</td>
<td>Dasuatis akaji</td>
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<td>Acrobatus marini</td>
</tr>
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<td>11</td>
<td>Boble Ork</td>
<td>Mobula eregoodoo tenkee</td>
</tr>
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<td>12</td>
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<td>Pastinac dus sephn</td>
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<td>Boble Sloeuk</td>
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<td>21</td>
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<td>22</td>
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<td>Parastamteus niger</td>
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<td>23</td>
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<td>24</td>
<td>Trey Toukke Svit</td>
<td>Epinephelus awoara</td>
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<td>Pvistolei fasaiatius</td>
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<td>27</td>
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<td>Lujusan fulviilama</td>
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<td>28</td>
<td>Trey Kro Hom Thmor</td>
<td>Priacantus hamrus</td>
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<tr>
<td>29</td>
<td>Trey Chan Chas</td>
<td>Alectis indica</td>
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<td>Chloroseombrus chrysumus</td>
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<td>32</td>
<td>Trey Rom</td>
<td>Seombe roidas lysam</td>
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<td>33</td>
<td>Trey Sloeuk Base</td>
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<td>34</td>
<td>Trey Tro Cheak Dom Rey</td>
<td>Ephippus orbis</td>
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<td>35</td>
<td>Trey Meca</td>
<td>Seomberomonruss guttatus</td>
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<tr>
<td>36</td>
<td>Trey Bla Thou</td>
<td>Rastraliges Kanagurta</td>
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<td>37</td>
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<td>Leithinus Hacentapherus</td>
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<td>Trey Tro Sok Clon Cley</td>
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<td>Trey Bek Chnang</td>
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<td>Trey Do Ang Kor</td>
<td>Gerrus abbrevialis</td>
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<td>43</td>
<td>Trey Sek</td>
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<tr>
<td>44</td>
<td>Trey Chang Kom Bey</td>
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<tr>
<td>45</td>
<td>Trey Som Bao Meas</td>
<td>Gazzaminuta</td>
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<tr>
<td>46</td>
<td>Trey Som Bao Chan</td>
<td>Leicgnathis equilus</td>
</tr>
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Table 21, continued

<table>
<thead>
<tr>
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<th>Scientific Name</th>
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</thead>
<tbody>
<tr>
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<td>Lates calcarifer</td>
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<td>48</td>
<td>Trey Ses</td>
<td>Trichurus haumela</td>
</tr>
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<td>49</td>
<td>Trey Dave</td>
<td>Isthophius gladius</td>
</tr>
<tr>
<td>50</td>
<td>Trey Canh Chak Sia</td>
<td>Toxotes chatares</td>
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<td>51</td>
<td>Trey Mrech</td>
<td>T. melanopleura</td>
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<td>52</td>
<td>Trey Kbok Sor</td>
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<td>53</td>
<td>Trey Kbok Kong Kang</td>
<td>V. fenebi</td>
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<td>54</td>
<td>Trey Ang Rel</td>
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<td>55</td>
<td>Trey Kbok Lmeat</td>
<td>G. falis</td>
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<tr>
<td>56</td>
<td>Trey Kbok Sok</td>
<td>T. feticps</td>
</tr>
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<td>57</td>
<td>Trey Kbok Kmao</td>
<td>A. (ictarus) Melias</td>
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<td>58</td>
<td>Trey An Deng Bouy</td>
<td>P. angulbaris</td>
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<td>59</td>
<td>Trey Kdo Chan</td>
<td>S. microptetorolys</td>
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<tr>
<td>60</td>
<td>Trey Sraom Dave</td>
<td>C. dorcab</td>
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<td>61</td>
<td>Trey Sioucre Say</td>
<td>H. Zunasi</td>
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<tr>
<td>62</td>
<td>Trey Kon</td>
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<td>Trey Chek</td>
<td>Seriolina nigrofasciato</td>
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<td>65</td>
<td>Trey Phnong Koas</td>
<td>T. Anastomila</td>
</tr>
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<td>66</td>
<td>Trey Phnong Prat</td>
<td>T. nidicus</td>
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<td>67</td>
<td>Trey Kro Hom Thmo</td>
<td>P. nasus</td>
</tr>
<tr>
<td>68</td>
<td>Trey Con Touy Bey</td>
<td>P. cephalus nidicus</td>
</tr>
<tr>
<td>69</td>
<td>Trey AndatCher</td>
<td>Pandachirus Pavoninus</td>
</tr>
<tr>
<td>70</td>
<td>Trey Khok</td>
<td>T. lepturus</td>
</tr>
<tr>
<td>71</td>
<td>Trey Andat Chercla</td>
<td>P. Pavoninus</td>
</tr>
</tbody>
</table>

To overcome these problems the measures taken were mainly restricted to guarding and management authority has increased the security and extension activities. These activities are now considered to have been inadequate and they tended to create continuous tension between the park administration and the surrounding communities.

As a compromise, the administration tried to implement a new approach, in which people who need park resources can be accommodated without degrading the park's integrity. Park genetic resources, which have an economic value, were selected, propagated and then distributed to the needy communities for further cultivation and use. Such measures are also intended to improve the welfare of the surrounding communities.

**Population and Demography** The area is crowded. 4,631 families and 20,840 persons are living in the Ream area. The population is extremely young; under 16 year (51.36% of the population). The ethnic composition of these persons are as follows:

(i) Khmer Race amount: 83.5%
(ii) Chines Race amount: 0.7%
(iii) Islam Race amount: 15.7%
(iv) Vietnamese Race amount: 0.06%; and
(v) Saoch Race amount: 0.04%
**Forestry Activities** There are approximately 3% of families logging in the National Park. These logging activities have been occurring since 1991 but not large scale activities, and after Paris Peace Agreement the Government allowed increased forest exploitation in the area.

**Agriculture** About 65 percent of population living in National Park are farmers. Because of a lack of irrigation systems and changing climate, most families suffer a lack of food each year. Only about one third of the families collect enough production to ensure a constant food supply all the year. The other families suffer lack of food from four to five months in the year.

**Harvesting of Biological Resources** This fishing is very important for food supply for about 50% of the families living in the National Park. Excess production is sold at the market and to Thai businessman. Generally, they catch fishes, crabs, and shrimp by using nets. Harvests average 2 to 3 kg/d and can be sold for 1500 riels/kg. Before 1970 the Ream area had high fisheries production. Since then, with insecurity and uncontrolled fishing fisheries production in the region have been constantly reduced.

Depending on the forest resources were effected almost of destruction and uncontrolled wildlife hunting used by gun as well lead to number of wildlife's in ream area migration to other areas which are undisturbed thereby general observation of wildlife hunting in the ream area now have small activity but the problems which we are concerned are water bird catch by used put net and cassette record, because the tools are high level for water birds catch to be enable from 300-400 birds per night especially are water hance and egret.

**Recommended Actions**

The following items are recommended for appropriate management of parks and reserves in the study area:

(i) Environmental Protection Laws must be formed for forestry; fish which existed in the region; biodiversity; and wetlands;

(ii) Specific legislation needs to be developed so that each national park may have: location and precise boundary; specific management zones and regulation; central management authority; and mechanisms for local participation in management. The legislation should be designated in conformity with the country's existing laws as well as accordance with the general development policy. Particular attention should be given to international, national, regional, traditional, and customary regulations; and

(iii) Environmental policies should be developed for persuading local people living around the parks and reserves to understand about national park management and their value in national resources preservation. This education campaign should be carried out through media and also reach local communities.

**Description of the Institutions Responsible for the Management of the Resource**

For management of the National Park the Ministry of Environment can not be responsible alone and other institutions must be involved, such as:

- Ministry of Agriculture
- Ministry of Interior
• Ministry of Tourism
• Ministry of Rural Development
• local governments because they understand about the local conditions.

SOCIO-ECONOMIC RESOURCES

Drinking Water Supply

Description Of Resource

The rivers which flow into the Gulch of Thailand are relatively small with water level increasing commensurably the coastal areas are generally short and have their sources from hills of about 500 to 600 m altitude. These innumerable streams, which usually dry up in the Streams and rivers are flooded during the rainy season. In the dry season the low-lying rivers are filled with sea water, Then the people in this region use the wells and tanks.

Prediction of Changes in Resource

Rapid urban population growth and industrialization are putting severe strains on the water resources and environmental protection capabilities of many cities, town and province. Early in the meet century, more than half of the province’s population will be living in urban areas. Special attention needs to be living in to the growing effects of urbanization on water demands and usage and to the critical role played by local and municipal authorities in managing of drinking water supply.

In the future the population in Koh Kong is growing up to 100 to 150 thousand (from 1995 to 2000). So the drinking water supply must supply the need of growing population throughout the coastal areas. The province must create many station pumps, improve potable water supply areas of Koh Kong and Kampong Som, through the provision of a number of small wells and water tanks.

Strategies for Ensuring Good Drinking Water Supply in the Coastal Zone

• Supply and assistance to communities in managing their own systems on sustainable basis.
• Encouragement of the local population, especially women, youth, indigenous of the local communities, in water management
• Linkages between national water plans and community management of local waters
• Integration of community management of water within the context of overall planning
• Promotion of in appropriate water management techniques and primary health care, primary health and environmental care at the local level, inducing training for local communities
• Rehabilitation of defective systems, reduction of wastage and safe reuse of water and water use and ensured operation and maintenance.
• Substantial increase in urban treatment capacity commensurate with increasing loads.
• To effectively plan and manage water supply and sanitation at the province, district and community level, and to utilize funds most effectively, trained professional and technical staff must be developed within each country in sufficient numbers.
• Establishment of protected areas for sources of drinking water supply.
Sanitary disposal of excreta and sewage, using appropriate systems to treat water. Waters in urban and rural areas.

Expansion of urban and rural water supply and development and expansion of rainwater catchment systems particularly in small is Lands.

Building and expansion, where appropriate of sewage treatment facilities and drainage systems.

Treatment and safe reuse of domestic and industrial waste waters in Koh Kong town and rural area.

Control of water associated diseases.

Strengthening of functioning of Movement in water resources management and, at the same time, ginning of full recognition to local authorities.

Environment of water development and management base on a participatory approach, involving uses, planers and policy makers at all levels.

Application of the principle the decisions to be taken at the lowest appropriate level, with public consultation and involvement of users in the planning and implementation of water projects.

Human resource development at all levels, including special programming for women.

Nutrition and Health

Description of the Resource

Table contains an indicative description of the health situation in the study area.

The rate of malaria is higher than other illness every year because of many causes:

(i) Many persons are immigration, so they face with a new weather;

(ii) They don't know method to protect from illness;

(iii) lack of food protein;

(iv) lack of money, mosquito net hygiene; and

(v) hard work.

Also, the quantity of medicine and instrument that the Health Departments of Koh Kong and Kampong Som receive are not enough for the patients.
Table 22: Description of health resources and health statistics in the study area.

<table>
<thead>
<tr>
<th>No</th>
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<th>Density</th>
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<th>Commune Clinic</th>
<th>Bed</th>
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<th>Dentist</th>
<th>Assistant doctor</th>
<th>Assistant chemist</th>
<th>Assistant dentist</th>
<th>Nurse</th>
<th>Midwife</th>
<th>lower midwife</th>
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<td>2</td>
<td>34</td>
<td>21</td>
<td>14</td>
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<td>2</td>
<td>Kampong Som</td>
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<td>7</td>
<td>1</td>
<td>24</td>
<td>9</td>
<td>2</td>
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<td>ill</td>
<td>ill</td>
<td>ill</td>
</tr>
<tr>
<td></td>
<td>malaria</td>
<td>dead</td>
<td>dead</td>
<td>dead</td>
<td>dead</td>
</tr>
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<td></td>
<td>Som</td>
<td>174</td>
<td>01</td>
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<td>2</td>
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<td></td>
<td>Kong</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
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</tbody>
</table>
Gender Issues

General Conditions

The distribution of female employment in the study area is as follow:

- Participation in agriculture production - 30%
- Fishery - 30%
- Trade - 20%
- Government staff 1%
- Female students 10%
- Female work at home 10%

Women in the study area face many social problems, many of them must to take care their sons, some need extra-supports and some has become a night club girls, prostitution that, in this form, can earn more money.

Conditions in Koh Kong are very serious because widow rate up to 4500 persons in 1990. Their husbands died by malaria or have become handicapped by mines so that most families managed by women are in difficult financial situation. A majority of women have been living on poverty, their income are less than $100 per year.

Traditionally, rural women rarely finish primary school, even with the national policy that women have equal rights to men in education.

Family planning is rare in the study area. In general one women has five children, but some of them have from five to twelve children. This higher rate of birth could affect women's health and their economic condition. The maternal death rate in giving birth is 9/1000.

Major Issues

The major issues with respect to gender are:

(i) increase number of jobless women;
(ii) increase in prostitution and number of women with HIV;
(iii) lack of family planning;
(iv) increasing income from agriculture production for women; and
(v) decreasing participation of women in government.

Recommended Strategies

- National development principal to reduce poverty
- Create measure and increase the number of women in government
- education on gender issues
- Increase quality of home work professional
- Increase government institutional cooperation with NGOs which work for women and children
- Create health center for women and children in a whole country
- To improve women and children rescue program according to National Development
Partial Environmental Inventory of Industrial Activity in Phnom Penh

A case study prepared for the REDP and EIA Training Course of the Asian Development Bank
ADB 2078-CAM
October 1995 to June 1996

Prepared by:
- YEM DARARATH
- TIN SOKSAMEDY
- PAK SOKHARAVUTH

November, 96
1. Purpose and Objectives

The purpose of the case study is to begin developing baseline information on current industrial activity in Phnom Penh to assist the assessment of the environmental impacts of future industrial development in the city.

The major objectives of the project are:

a) to develop a format for collecting and reporting information on the environmental implications of industrial activity.

b) to collect information on a sample of operating industries.

c) to identify the key environmental issues associated with these industries, including waste disposal, air pollution and water pollution problems.

d) to report the information collected to the Pollution Control Department of the Ministry of the Environment and to the Municipality of Phnom Penh.

e) to make recommendations for future work.

2. Background

Phnom Penh, the capital of Cambodia, is located in the intersection of the Mekong and Tonle Sap Rivers. Phnom Penh has a total area of about 2906 km², with a population of about 823,103 persons. The city is the political and cultural center of Cambodia.

Much of the industrial development in Phnom Penh is spread out along the river bank. At the time these industries were constructed and put into operation, little if any attention was given to environmental protection concerns and measures.

To avoid environmental impacts of new industrial development, the potential impacts of certain new projects should be assessed before these projects are approved and begin operating. EIA should help plan the monitoring of potential impacts on air and water quality from new industry and help design and implement mitigation measures to reduce the pollution of the air and the water. To do so, it is necessary to collect baseline information on existing industrial activity and to understand what kinds of effects this activity may be having on environmental resources.

Prior to beginning the study, it was assumed that factories operating in Phnom Penh are discharging pollutants, including hazardous and toxic wastes, into river and/or sewer systems without treatment. These pollutants have the potential for threatening human health through the impairment of the quality of drinking water. This is a particularly serious problem in developing countries such as Cambodia where water is rarely treated especially in regions that are far from province and city before consumption, and thus exposes many people to the risk of waterborne infection and causing scandalously high rates of infant mortality.(1)

In addition to the discharge of untreated wastewater which can contain organic matter and other pollutants, these factories are also disposing solid wastes into the river. The solid wastes also contain pollutants such as chemical substances and organic matter. These pollutants can impair river water quality, which, in turn can lead to problems for aquatic life.
and for human health because drinking water and the water used by people in Phnom Penh is pumped from the river. In some cases the factories are also discharging solid wastes onto the nearby land. Some factories also emit atmospheric pollutants such as SO$_2$, NO$_x$, CO$_2$, and suspended particulate matter into the atmosphere which can pose more problems for human health, such as lung problems which may develop into chronic ailments.

Metal contamination usually occurs on a local or regional scale as a result of industry in a particular area. Industrial wastes in landfills are also sources of metal contamination, such as from aluminum, especially when combined with acidic water.

Conducting the research is very important for EIA. As is well known, lack of baseline data on environmental quality is often a weakness of EIA reports. If we want EIA reports to be accurate we would have to have all information on the environmental implications of industrial activities. The research will also help us assess further development projects related to industrial areas. This means that we will get more experience in environmental pollution and we will also learn more about doing EIAs on other projects.

3. Scope
The scope of this project is limited to examining industrial operations located in a small portion of the most industrialized area of Phnom Penh. This case study was designed as a first step in collecting baseline information for such operations. The study area is bounded by Monivong bridge to Chak Anre Krom near Takhmav (Road N°2 river Meanchey District) and concentrate on the larger industrial operations. A variety of types of industries was selected. It was considered that if the results of this initial project prove useful, the survey could be easily expanded with additional resources.

The factories which were visited during this case study are as follows:

1. ANCO factory 708, St.2, Mean Chey district, Phnom Penh.
2. Plastic-tie factory St.2, Mean Chey district, Phnom Penh.
3. Leather factory 552-556, St.2, Mean Chey district, Phnom Penh.
4. Tire factory 644, St.2, Mean Chey district, Phnom Penh.
5. Glass factory St.2, Mean Chey district, Phnom Penh.
6. Tobacco company 508, St.2, Mean Chey district, Phnom Penh.
7. Garment factory St.2, Mean Chey district, Phnom Penh.
8. Garment factory-MV 754, St.2, Mean Chey district, Phnom Penh.
9. Textile factory 756, St.2, Mean Chey district, Phnom Penh.
10. Saw Mill 824, St.2, Mean Chey district, Phnom Penh.
11. Chicken Husbandry 624, St.2, Mean Chey district, Phnom Penh.
12. Plastic M.P.P 526, St.2, Mean Chey district, Phnom Penh.

These factories are located in Meanchey District, from Monivong bridge to Chak Anre Krom near Takhmav, along the Bassac river side (one side only of Road 2). (see map in appendix).
4. Methods and Tasks
The study involved two principal activities: a review of the literature on the environmental problems caused by industrial development, and a field survey of selected industrial sites.

The study terms of reference defined the following major tasks:

- selecting a study area and developing a list of the kinds of factories located there,
- identifying and contacting concerned institutions in advance of undertaking the field work,
- developing a survey form designed to capture all information pertaining to environmental management and protection measures at industrial sites,
- undertaking the field survey of the selected factories, and
- preparing a report.

The literature review enabled the team to collect other information regarding environmental impacts and conditions for the types of industries included in the field survey prior to undertaking the site visits.

The field survey itself involved the following tasks:

- preparing the survey form and ensuring that all team members and site supervisors received a copy in advance.
- scheduling the site visits with the staff at the factories to be visited during periods when the factories are operating.
- interviewing workers and supervisors to determine what raw materials and chemical substances are used, and to determine how and what wastes are generated by their operations.
- following the process in each factory from the point where input materials enter the worksite to the point where products and wastes exit. Waste sources to be inspected include the production processes, piping maintenance operations, storage areas for raw materials, and finished products.

Analysis and reporting of the literature review and the field survey was also conducted through several steps:

- compile and analyze information collected,
- draft conclusions and formulate recommendations for future inventory work,
- review findings and recommendations with experts,
- inform the Municipality of Phnom Penh, the Ministry of Industry and CDC of findings, and
- prepare a final report.

5. Study Findings

5.1 Industrial development in Phnom Penh.
There are few industries in Cambodia. Most of them are food and textile industries. To date, even though the rate of economic growth in Cambodia has been strong and is accelerating,
growth in the industrial sector has been relatively small. However, Cambodia aspires to rapid
development of industries and mining based on investment inflows in the near future\(^2\).

Thus industrial pollution is a pressing problem in the near future. For one things, industrial
development has forced in large new projects, while there has been little investment in
replacing and maintaining equipment. This, in turn, would imply the existence of leaky
systems and the absence of pollution control devices\(^3\).

5.2 Potential environmental impact of Industrial Development

Environmental pollution affects the air we breathe, the water we drink and the food we
consume. It also affects the production of food and the general quality of our surroundings. It
may pose risks to our health and well being as well. While the environmental impacts of
industry are relatively limited in Cambodia at present, there is potential for such impacts to
escalate as industrial development increases. EIA of new industrial development in
Cambodia is particularly important as no environmental regulations yet exist. The principal
concerns, described in more detail below, are water pollution and air and noise pollution.

5.2.1 Water Pollution

A few industries are producing toxic and hazardous wastewater. Some usually discharge
their effluents into the Bassac river directly without treatment, thus polluting water quality and
damaging biota and aquatic culture. Production of ANCO company is fresh water. It uses
chlorination with sodium hypochlorite to safeguard the bacteriological quality of the water
during its stay in the distribution network or in their processing. Thus, their wastewater might
contain sodium hypochlorite.

Some factories flow their wastewater into the sewer. This wastewater has never been
treated, as the companies have no treatment devices. The wastewater consists of many
different chemical substances and has high temperature and pH.

As we know, the rates at which various chemical processes occur in water depend upon
water temperature, with warmer water generally causing reactions to go faster.

Some chemical substances cause corrosion and damage to the sewage system. These
above problems emanate from a textile factory. It discharges its wastewater consisting of
toxic chemical substances, and high temperature and high pH as well into the sewer without

treatment. This wastewater flow to Cheug Ek lake by pumping and then to the Bassac river.

PCBs are polychlorinated biphenyl, organochlorine compounds that previously were used in
insulators, plastics and fluorescent lights. PCBs are very stable compounds, and concentrate
in fatty tissues, and thus build up along the wood chain where they can adversely affect
reproductive systems. When heated, PCBs can form furans, which are many times more
toxic than the PCBs themselves.\(^4\)

The wastewater from plastic-tie, tire, and plastic M.P.P factories are discharged into the
Bassac river directly without using treatment methods. If we do not take into account we will
not know more about the damage or any other problems caused by them.
5.2.2 Air and Noise Pollution

Every day we use energy, transforming it from a high to a low energy form. The source of our energy, and the way we use it, can have profound environmental consequences. This means energy is a critical part of environmental crisis, and needs to be addressed. About 80% in consumed by the industrial market economics.

Owing to the lack of power, all factories in Cambodia as in other countries in the world always utilize generators for their processes. Most generators use oil for their operations. Therefore, gases exit from the smoke stacks of generators without special treatment causing air pollution. These gases comprise particulate mater, sulfur oxide, nitrogen oxides, hydrocarbons and other organic compounds, can lead to be very harmful for the environment and for the human health.

Nitric oxide accounts for most of the nitrogen oxides emitted by artificial sources. Nitric oxide is oxidized in the atmosphere to form nitrogen dioxide. High levels of nitrogen dioxide increase the risk of respiratory infection and impair lung functions in asthmatics. So all factories should use other methods for reducing these effects.

The toxic gases of industry can spread in the air. Dumping of industrial waste can be dangerous for public health and pollute the air in the absence of protection and mitigation measures.

In addition, these factories also create noise problems for people living nearby because each factory uses its own generator. Moreover many people living in those sites have lodged complaints about these nuisances to the MOE.

5.3 Environmental Management Practices

The case study survey of the factories examined in area bounded by the Monivong Bridge to Takmav Mean Chechey district collected information on the following:

- waste disposal practices
- hazardous materials storage and handling

5.3.1 Waste disposal

There is much refuse, sludge and other discarded material resulting from industrial operations.

A few factories produces hazardous waste in their processing causing death (especially to fish) or irreversible disease. Additionally, chemical waste of factories sometimes pose a serious threat to human health and the environment. Plastic tie, tire, textile and plastic MPP factories transport their solid waste to dispose in landfill in the suburb of Steung Mean Chey (see the below table). These wastes comprise plastic and some chemical waste (from textile factories).
Furthermore, waste water from one third of surveyed industries has been discharged directly into the Bassac river and two thirds into the Choeung Ek lake. This waste water has not been treated, so it causes big problems for water quality. As we mention above, there are many areas in Cambodia, far from the city, where water is rarely treated before consumption.

<table>
<thead>
<tr>
<th>Type of Factory</th>
<th>Method of Waste Disposal</th>
<th>Air &amp; Noise Pollution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Solid</td>
<td>Liquid</td>
</tr>
<tr>
<td>1- Anco</td>
<td>Recycling</td>
<td>Cheug Ek Lake</td>
</tr>
<tr>
<td>2- Plastic-tie</td>
<td>Steung Mean</td>
<td>Bassac River</td>
</tr>
<tr>
<td>3- leather</td>
<td>Steung Mean</td>
<td>Cheug Ek Lake</td>
</tr>
<tr>
<td>4- Tire</td>
<td>Steung Mean</td>
<td>Bassac River</td>
</tr>
<tr>
<td>5- Glass</td>
<td>Steung Mean</td>
<td>Cheug Ek Lake</td>
</tr>
<tr>
<td>6- Garment</td>
<td>Steung Mean</td>
<td>Cheug Ek Lake</td>
</tr>
<tr>
<td>7- M.V Garment</td>
<td>Steung Mean</td>
<td>Cheug Ek Lake</td>
</tr>
<tr>
<td>8- Tobacco</td>
<td>Steung Mean</td>
<td>Cheug Ek Lake</td>
</tr>
<tr>
<td>9- Textile</td>
<td>Steung Mean</td>
<td>Cheug Ek Lake</td>
</tr>
<tr>
<td>10- Sawmill</td>
<td>Recycling</td>
<td>No</td>
</tr>
<tr>
<td>11- Chicken Husbandry</td>
<td>Recycling</td>
<td>Bassac River</td>
</tr>
<tr>
<td>12- Plastic M.P.P</td>
<td>Steung Mean</td>
<td>Bassac River</td>
</tr>
</tbody>
</table>

### 5.3.2 Storage of Dangerous Materials

Storage of dangerous materials is not well to organized yet (Garment MV, Textile, Leather factories). There is a lack of measures to protect and prevent dangerous materials from entering the environment because Cambodia in the past has never had competent handling and storage services. Even so, some factories are well organized and well managed (Tobacco factory). Although we have to prevent significant impacts we advised the companies to undertake technical mitigation to separate materials and store them to prevent environmental impacts and damage from happening.
6. Conclusions
Based on the results of the case study, the following conclusions have been drawn by the study team:

- The study provides some of the baseline information required to improve current conditions and to prevent deterioration of the environment in the future. The baseline information collected in this study is a first step in collecting information for a greater number of operating industries and provides a model approach for reporting such information.

- All factories have never treated their wastewater as they have no environmental experts to explain them about serious problems occurring everyday.

- None of the factories have measures for storing their hazardous and harmful materials.

- Most of the factories use out of date of equipment. This means that they do not replace and maintain their equipment.

- Most of factories are also producing nuisances such as air and noise pollution which are disturbing people living nearby.

- Owners and operators of industrial factories are not aware of the potential dangerous posed to public health or to workers by their operations. They have never trained their workers on environmental concepts.

- There are no environmental norms and standards for any of the companies surveyed to implement.

7. Recommendations
The following recommendations are suggested to respond to these issues:

- The Department of Pollution Control of the Ministry of the Environment should monitor all industrial activities, that is, the Department should continue to collect information from factories in the near future.

- The Department of Pollution of Control should provide any knowledge or skills regarding mitigation measures to these factories in order to reduce their pollution.

- The Department of Pollution Control should test water quality and air quality in the vicinity of the industrial sites.

- Wastewater from these factories should be treated before being discharged into the river or lake and solid wastes should be disposed of in a safe manner.

- All factories should replace their old machinery in order to reduce air and noise pollution.
• Department of Pollution Control should produce pollution norms and standards for investors to limit the concentration of pollutants being discharged into the environment.

• All new factories should be subjected to environmental assessment prior to receiving approval.
References


(2), (3) Strengthening capacities in trade, investment and the environment for the comprehensive development of Indo-China, United nation, New York, 1995.

Appendices

1 - Team structure

2 - Map
Preliminary Review of Socio-Economic Conditions in the Boeng Salang Area of Phnom Penh

a case study prepared for the REDP and EIA Training Course of the Asian Development Bank ADB 2078-CAM

May 30 1996
ACKNOWLEDGMENTS

This report was prepared by a group of 18 EIA students led by a team leader Dr. Ma Bunnel. The 18 students are: Mr. Chhiv Kosun, Mr. Lou Veasna, Mr. Kan Vibol, Mr. Yim Sambo, Mr. Leang Mengleap, Mr. So Sry, Mr. Duong Sam Keat, Mr. Yim Chamnan, Mr. Leng Pothika, Mr. Bun Racy, Mr. Ban Aun, Mr. Seng Teak, Mr. Tung Kun, Mr. Tan Bunna, Mr. Heang Dara, Miss Hou Kalyan, Miss Kriel Tina, and Miss Phoeun Kanha.

We would like to express our appreciation to the following people who assisted us in preparing this report:

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- Boeng Salang sub-district officers:
  - Mr. Ung San: Boeng Salang sub-district chief,
  - Mr. Phong Srun: Boeng Salang sub-district deputy,
  - Mr. Bun Long: village chief number 9,
  - Mr. Thov Muth: village chief number 7,
  - Mr. Mao Touch: village chief number 10,
  - Mr. Mom Sarim: village chief number 5,
  - Mr. Ke Thong: village chief number 14,
  - Mr. Sok Sovannara: village chief number 17,
  - Ms. Ouch Oeun: village chief number 16,
- the 157 families who permitted our group to interview them,
- Mr. Chhorng Vantha and Mr. Moeung Sophan: sewage canal officers working for the sewage canal department in Phnom Penh.

Finally, on behalf of the team leader, we wish to acknowledge the special contribution made by Dr. Keith Williams, who assisted in preparing the terms of reference for this project, in writing this report, and in making numerous suggestions for improvements, additions and corrections.

Dr. Ma Bunnel
Team leader
H.E. Ly Thuch's Assistant
# TABLE OF CONTENTS

INTRODUCTION .................................................................................................................. 1

I. BACKGROUND .................................................................................................................. 1

II. PURPOSE AND OBJECTIVES ........................................................................................ 1

III. SCOPE .......................................................................................................................... 2

IV. PROJECT AREA AND ITS FEATURES .......................................................................... 2

V. METHODS AND TASKS ................................................................................................ 3

VI. CONCLUSIONS .............................................................................................................. 8
   1. Education .................................................................................................................. 8
   2. Health and Nutrition ............................................................................................... 8
   3. Water Supply .......................................................................................................... 8
   4. Community satisfaction ......................................................................................... 8
   5. Recreation ............................................................................................................... 8
   6. Income .................................................................................................................... 8
   7. Aspirations ............................................................................................................. 9

VII. RECOMMENDATIONS .................................................................................................. 9

BIBLIOGRAPHY .................................................................................................................. 10

APPENDICES ..................................................................................................................... 11
   1. Guideline for interview ......................................................................................... 12
   2. Survey form ........................................................................................................... 17
   3. Maps ....................................................................................................................... 21
   4. Terms of Reference .............................................................................................. 29
INTRODUCTION

Cambodia consists of the total land area of 181,035 square kilometers. The biggest city of the country is Phnom Penh, which covers around 35,670 ha. including seven districts and 820,000 people were living in the city in 1995. Most of the Phnom Penh water surface areas are Boeng “lakes” e.g. Boeng Kak, Boeng Salang, Boeng Choeung Ek, Boeng Trabek, Boeng Tumpun, Boeng Chhouk, Boeng Snor, Boeng Broyab, Boeng Kbarl Domrey etc. Some have become resorts such as Boeng Kak, Boeng Snor while others become basins to dispose of all kinds of waste water such as Boeng Salang, Boeng Trabek, Boeng Tumpun. One of these waste water disposal basins addressed here is the Boeng Salang.

I BACKGROUND

Boeng Salang sub-district belongs to Tuol Kok administrative district where the population size has a total around 123,000. The Boeng itself is one of the principal receptacles of the water retention in Phnom Penh. It gathers water from a surface area approximately 560 ha. with the perimeter 11.6 km and its length is 1.6 km with a holding capacity of 142,000 m3.

Many squatters live around the Boeng and solid and liquid wastes flowing into it have been impacting it, particularly during the wet season. Not only squatters around the Boeng affect the lake but also the sewage canals with their inlets and some roads of the Tuol Kok district. As well, retention of solid wastes make its volume become smaller and smaller.

For the reasons mentioned above, the Urban Affairs Bureau has cooperated with French Company and have spent much time studying the water catchment of the Boeng Salang, the physical characteristic of the Boeng Salang and the lower area connecting with such as Stung Manatee and Boeng Tampun. The project studied is to rehabilitate the Boeng, the sewage canals of the water catchment and some roads of the Tuol Kok district and be funded by the World Bank and the Asian Development Bank. This would improve the welfare of the population living around the Boeng and ensure the safeguard of the Boeng Salang against retention.

A map showing the project area is attached to this document as Appendix 4.

II PURPOSE AND OBJECTIVES

The Boeng Salang project of the Urban Affairs Bureau was assessed by a team of the EIA students of the Environment Ministry. There were many purposes for the assessment. One of the most important purposes which could be raised at this moment is how to identify opportunities for enhancing the positive socio-economic impacts of the Boeng Salang sewage canal rehabilitation project.

To achieve the above purpose, the EIA team selected a number of objectives as following:

1- To identify the socio-economic impacts and assess their significance.
2- To solicit the views of the local squatter community to determine their concerns.
3- To make recommendations about the socio-economic impacts to improve the project.
III SCOPE

Once the Boeng Salang rehabilitation project is put into action, squatters living around the Boeng would be relocated to the reservations of the Phnom Penh municipality. One of the most important environmental components to be characterized is the socio-economic conditions, including the views and concerns of squatters to relocate and whether the squatters are satisfied with the relocation or not. This required that some of those squatters be interviewed. A copy of the interview survey form is attached as Appendix__.

After analyzing the result of the interviews with the squatters, recommendations were made to improve the socio-economic conditions.

IV PROJECT AREA AND ITS FEATURES

The Boeng Salang sub-district belongs to the Tuol Kok administrative district, which covers the western side of the Phnom Penh city. The sub-district is divided into three areas:

- the southern part of the Phnom Penh university,
- the south-western part of the Tuol Kok district, and
- the southern area around the Boeng Salang itself.

The intervention perimeter of the project consists of the total land area of 199 ha., on which 4800 families are living, and is delimited by:

- to the north: street number 182 or Oknha Phan,
- to the west: Yothapol Khemarek Phoumin Boulevard,
- to the south-east: Samdach Monireth Boulevard, and
- to the east: Mao Tse Tung Boulevard.

Before the project is put into action, the most important priority is that a number of squatters should be removed from the area around the Boeng to the municipality reservations. That is why the first census of squatters to be relocated was undertaken by the inquiries of the Urban Affair Bureau. The result indicated that there were 875 families, of which 563 were living around the Boeng.

Objectives of the Boeng Salang Rehabilitation project.

They can summarized as:

- the rehabilitation of streets in Phnom Penh, at least 55 km, and the inlets and the sewage canals connected with them,
- the restoration of the Boeng on a regular contour, a sufficient holding capacity and a sufficient discharge rate with or without pump suitable to the intensity of precipitation for the Boeng Salang water Catchment,
- the rehabilitation of the watercourse below the Boeng “Stung Meanchey and Boeng Tumpun water way”.
V METHODS AND TASKS

Methods

First of all, the EIA team leader and advisors met officers and French experts working for the Phnom Penh municipality to obtain information about the Boeng Salang rehabilitation project. They provided us with much information, including a survey form and family questionnaire. The team have traveled along Yothapol Khemarak Phoumin Boulevard to look at the pump stations and the Boeng Salang general situation.

The French expert “Ms Corrine Petite” was invited to the Environment Ministry later to present a seminar on how to interview people. And then, the Boeng Salang local authorities were contacted, in particular the Boeng Salang sub-district chief, to seek their cooperation with us to conduct the survey of squatters and clarify the current socio-economic issues. Finally, the officers of the sewage canal office contributed and provided some information on the water catchment sewage canals, including a map.

Tasks

To conduct the survey, the EIA team was broken into seven sub-groups. Each had two students led by the Boeng Salang village chief to talk with the local squatter community. The Table 1 shows the names of the seven student sub-groups and the village chiefs, and the numbers of the villages. Among the 563 families living around the Boeng, 157 were interviewed during three days from 10 to 12 of April 1996. Each sub-group analyzed and recorded the result of the survey, including the feeling of those squatters whether they were satisfied with the project or not. All in all, a common table (Table 2) was done to integrate the result of the seven sub-groups.

After speaking with the local squatters, the team was broken one more again into 6 sub-groups (Table 3) to contact the Boeng Salang sub-district officials to seek data on the current socio-economic components. The result of the current socio-economic components coupled with further information provided by the officials and the highlights of the project, led the EIA team to construct an initial impact matrix, using a standard matrix form, as follows:
Table 1:

EIA Case Study
Boeng Salang Rehabilitation Project
Interview from 10 to 12 of April 1996.

<table>
<thead>
<tr>
<th>No</th>
<th>Interviewer</th>
<th>Village Chief</th>
<th>Village Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Miss. Hou Kalyan</td>
<td>Mr. Bun Long</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Miss. Kriel Tina</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Mr. Lou Veasna</td>
<td>Mr. Thov Mut</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Mr. Ban Aun</td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Mr. Kan Vibol</td>
<td>Mr. Mao Touch</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Mr. Bun Racy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Mr. So Sry</td>
<td>Mr. Mom Sarim</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Mr. Leang Meng Leap</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>Mr. Duong Sam Keat</td>
<td>Mr. Ke Thong</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Mr. Yim Chamnan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VI</td>
<td>Mr. Yim Sambo</td>
<td>Mr. Sok Sovannara</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Mr. Seng Teak</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VII</td>
<td>Mr. Tan Bunna</td>
<td>Mr. Ouch Oeurn</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Mr. Leng Pothika</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VIII</td>
<td>Total Survey</td>
<td>157 Families</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>Survey</td>
<td>Result</td>
<td>NØ</td>
</tr>
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<td>-----</td>
<td>-------------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>----</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>II</td>
</tr>
<tr>
<td>1</td>
<td>Education</td>
<td>A few families had sent their children to school</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>26</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>III</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>IV</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>2</td>
<td>Nutrition and Health</td>
<td>A lot of families go to public hospital. All families buy drinking water</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IV</td>
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<td></td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>VI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Health problems: always disease suffered such as diarrhea, fever, dengue (children)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Health problem is medium, always some diseases suffered such as, fever and diarrhea.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sick all families</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Drinking water supply</td>
<td>All families buy drinking water</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>26</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>V</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>VI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Water used was bought</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No water for drinking almost all families bought water from water trucks.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Community Satisfaction</td>
<td>A lot of families dislike living in the area but have no choice</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>26</td>
</tr>
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<td>IV</td>
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<td></td>
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<td>V</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>VI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Almost of families were not satisfied with their community because of in the area was filled with all kinds of residuals and especially foul smell fills the air, affected their health</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Seven families liked while another thirteen families disliked living in the area.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thirteen families dislike while another six families like living in the area.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dislike living in the area all families</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Recreation</td>
<td>A lot of families have plan to visit recreation centres, but due to a</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>26</td>
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<td>IV</td>
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<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>VI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Most have TV and radio to entertain in their free time</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Most of families like holiday in city for recreation and watching T.V at their</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Most of families like holiday in city recreation centre and watching T.V at their home, because unable to visit any</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>No free time for holidays.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td><strong>Employment and Income</strong></td>
<td>A lot of families are financially short for supporting their family.</td>
<td>Some of families are working with government business, income for subsistence.</td>
</tr>
<tr>
<td>---</td>
<td>--------------------------</td>
<td>------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------</td>
</tr>
<tr>
<td>7</td>
<td><strong>Aspiration for the future</strong></td>
<td>Most of families agree to relocation move but not unless the Govt. compensates them. A few families disagree because it is place that they had lived for many years.</td>
<td>All families agree to resettlement move if the Govt. or organization compensates them.</td>
</tr>
</tbody>
</table>
Table 3: EIA student schedule to
Contact with Boeng Salang Officials
On Socio-economic Environmental Components (22/04/1996)

<table>
<thead>
<tr>
<th>No.</th>
<th>EIA students</th>
<th>Boeng Salang Officials</th>
<th>Environmental Components</th>
<th>Date</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mr. Leng Pothika</td>
<td>Mr. Ung San</td>
<td>- Drinking Water Supply - Nutrition and Health</td>
<td>Monday</td>
<td>8.00 - 9.30</td>
</tr>
<tr>
<td></td>
<td>Mr. So Sry</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mr. Yim Chamnan</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mr. Chhiv Kosun</td>
<td>Mr. Ung San</td>
<td>- Land Use - Food Production</td>
<td>Monday</td>
<td>9.30 - 11.00</td>
</tr>
<tr>
<td></td>
<td>Mr. Duong Sam Keat</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mr. Tung Kun</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Mr. Yim Sambo</td>
<td>Mr. Ung San</td>
<td>- Social Services - Employment</td>
<td>Monday</td>
<td>14.00 - 15.30</td>
</tr>
<tr>
<td></td>
<td>Mr. Seng Teak</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mr. Leang Mengleap</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>3</td>
<td>Mr. Kan Vibol</td>
<td>Mr. Ung San</td>
<td>- Income - Cost of living</td>
<td>Monday</td>
<td>15.30 - 17.30</td>
</tr>
<tr>
<td></td>
<td>Mr. Heang Dara</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Mr. Lou Veasna</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Mr. Tan Bunna</td>
<td>Mr. Phong Srun</td>
<td>- Education - Community Satisfaction</td>
<td>Monday</td>
<td>8.00 - 9.30</td>
</tr>
<tr>
<td></td>
<td>Mr. Bun Racy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mr. Ban Aun</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Miss. Hou Kalyan</td>
<td>Mr. Phong Srun</td>
<td>- Amenity - Neighborhood Character</td>
<td>Monday</td>
<td>9.30 - 11.00</td>
</tr>
<tr>
<td></td>
<td>Miss. Kriel Tina</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Miss. Phoeun Kanha</td>
<td></td>
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</tr>
</tbody>
</table>
VI CONCLUSIONS

The following comments about the sewage canal study in the Boeng Salang district are based on the points of view and concerns expressed by the people living in the area. These concerns are the fundamental basis to decision-making to develop projects.

These conclusions are the following:

1. **Education**

Almost all children were sent to school, although their parents finances are in short supply in the family very young children and children living in the poorest families do not go to school. Parents are thinking about their children's future.

2. **Health and nutrition**

Most families have access to a government hospital because of poverty or other reasons. A few richer families have access to private hospital care. Mortality from any diseases during the last few years has been low.

3. **Water Supply**

90 percent of families lack a water supply system. Water used is brought by water trucks or bought from dealers in water living in the area who have reservoirs. Drinking water supply was not of good quality unless it was boiled. If it is not boiled, it will cause diarrhea or other diseases.

4. **Community Satisfaction**

Almost all families disliked living in the area but it was impossible to relocate because of a financial shortage. Four reasons which made them dislike the area were:
- densely populated area
- lack of water supply
- lack of electricity
- bad odors caused by the sewage canal.

5. **Recreation**

Almost all families have not had a holiday due to financial shortage and lack of time.

6. **Income**

Almost all people who live in the area are labour workers, other workers and civil servants. Their income at subsistence level results in poor health due to lack of vitamins. They can earn from 1000-6000 Riel per day. As well, there are inadequate supplies for their children at school.
7. Aspirations

The development project has strong support from the people living in the area. Almost all families agree to a resettlement if government, investment company or development community compensate them. Other families have suggested to the government that they consider this problem according to reason. They can not use the power of political government.

VII RECOMMENDATIONS

1. It is requested to seek agreement between the project owner and people affected.

2. It is requested that the government provide financial support to them to enable them to find new residences.

3. It is requested that the project owner conduct an Environmental Impact Assessment (EIA) and make a clear report to submit to the EIA Department.

4. The project owner, government and local people must consult or negotiate with each other, if in any case there is a disagreement.

5. It is requested that all problems have to have a reasonable resolution between project owner or government and people.

6. It is requested that the project owner or government carefully monitor this project.

7. It is requested that the local and municipal authorities take strict measures before allowing people to build new houses, in the development area.

8. It is requested that the project owner or government or local authority coordinate and educate the local people about essential parts of the project to the community.
BIBLIOGRAPHY

Boeng Salang rehabilitation project (December 1995)

Women and children in Cambodia (1995)
APPENDICES

APPENDIX 1: Guideline for Interview

APPENDIX 2: Survey Form

APPENDIX 3: Maps

APPENDIX 4: Terms of Reference
GUIDELINES FOR INTERVIEWING

I'll present some general instructions for tree points:

1. for interviewing,
2. "probing" to expand on superficial responses,
3. dealing with "I don't know" responses,
4. recording responses.

1. for interviewing

- When you interview someone you can be asked in a conversational manner, establish a harmonious & friendly relationship with the respondent before beginning the interview. If the respondent is not relaxed & comfortable, the interview may not be productive.
- Find time & place to conduct the interview so that instructions & disturbances are minimised. If there are intrusions try to protect the privacy of your interview and by diplomatically suggesting that a conversation with the intruder might be postponed until after the interview has been completed.
- Listen critically to the responses to make sure they are adequate and relevant to the questions asked. If the respondent engages in discussion not related to the topic, politely direct the conversation back to the topic.
- Use "probing" techniques discussed below to obtain complete answers to all questions, but never suggest an answer to a question or give opinions even if asked to do so.
- Review the interview guide at the end of the interview to ensure that all questions have been covered.

2. Probing

- The quality of an interview depends a great deal on the interviewer's ability to probe, so that complete answers are obtained. Probes may motivate a respondent to enlarge on a previous response, to clarify or to explain the reasons for the responses. Probes also focus the discussions on the specific content of the interview so that irrelevant & unnecessary information can be eliminated.
There are several techniques for probing:

- A brief assertion of understanding & interest (By example: by nodding your head & saying such things as "oh", "yes", and other simple words.)
- Repeat the question if the respondent did not hear the question or appears to have misunderstood it.
- Repeat the respondent's reply using neutral probe questions to stimulate further thought by the respondent (By example: Why do you think so? What do you have in mind? Anything else?)

3. The "I don't know" responses

"I don't know" responses are common, particularly among respondents with little or no formal education. The "I don't know" answer can have several meanings:

- Perhaps the respondent didn't understand the question so he answers "I don't know" to avoid embarrassments if he admits that he doesn't understand. Here, the interviewer should ask the question again, but more slowly & with more emphasis on important aspects of the question.

- The respondent may answer "I don't know" because he is thinking the question over & wants to say something to fill the silence. The interviewer must be sensitive to the respondent's capabilities & shift techniques to suit the situation, & be patient & allow enough time for the respondent to formulate an answer.

- Perhaps the respondent may be trying to evade the question because he is uninformed, is afraid of giving a "wrong" answer or because the question strikes him as being too personal. In such case restore or support the respondent's trust by assuring the respondent that all information will be kept in the strictest confidence.

4. Rules for recording the responses

- Write the answers directly during the interview, because later the interviewer will miss different things.

- Write exactly the key words or phrases using the respondent's own words. Don't summarise & paraphrase the respondent's answers.

- A good technique to hold the respondent's interest & take verbatim notes is to start repeating what the respondent has said, as you are writing the reply.

- Write out in detail the results of an interview soon after it has been completed. Interviews completed in the morning should be "decoded" by noontime or early in the afternoon, those done in the afternoon, should be written up by late afternoon or early the next morning.

5. Interpretation & reporting

- The report must focus on the purpose of the survey & not an interesting anecdotes.
<table>
<thead>
<tr>
<th>ប្រភេទ</th>
<th>ក្រុម</th>
<th>ប្រភេទ</th>
<th>សណ្ឋាគារ</th>
<th>សម្រាប់</th>
<th>សម្រាប់</th>
<th>សម្រាប់</th>
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</thead>
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</tr>
</tbody>
</table>

### ប្រវត្តិសាស្ត្រ

1. កំពុងសិក្ខារ និងអភិវឌ្ឍន៍
2. កំពុងមានប្រយោជន៍ និងអភិវឌ្ឍន៍
3. កំពុងសិក្ខារ និងអភិវឌ្ឍន៍
4. កំពុងមានប្រយោជន៍ និងអភិវឌ្ឍន៍
5. កំពុងសិក្ខារ និងអភិវឌ្ឍន៍
6. កំពុងមានប្រយោជន៍ និងអភិវឌ្ឍន៍
7. កំពុងសិក្ខារ និងអភិវឌ្ឍន៍
8. កំពុងមានប្រយោជន៍ និងអភិវឌ្ឍន៍

### រឿងសម្រាប់ពិភពសព្ទ

1. រឿងេ ត្រីលោក និងអគ្គិសនីសម្រាប់
2. រឿងេ ត្រីលោក និងអគ្គិសនីសម្រាប់
3. រឿងេ ត្រីលោក និងអគ្គិសនីសម្រាប់
4. រឿងេ ត្រីលោក និងអគ្គិសនីសម្រាប់
5. រឿងេ ត្រីលោក និងអគ្គិសនីសម្រាប់
6. រឿងេ ត្រីលោក និងអគ្គិសនីសម្រាប់
7. រឿងេ ត្រីលោក និងអគ្គិសនីសម្រាប់
8. រឿងេ ត្រីលោក និងអគ្គិសនីសម្រាប់
1 Group number ........................................ Property title ..............................................................
2 House number ........................................ Our house number ..................................................
3 Family name ..........................................

4 Occupation ship
   1 Owner □ Cost (house) .. Cost (land) .................................................................
   2 Rental □ Cost (monthly) ................................... Owner residence ......................................
   3 Temporary rental □ Cost (monthly) ............... Owner residence ......................................
   4 Hosted □ 5 Unoccupied □

5 How many families ................................ How many persons ............................................

6 House size
   Width (meter) ........................................
   Length (meter) ........................................
   Number of the floor ................................
   Total size ............................................

7 House material
   Floor .....................................................
   Wall .....................................................
   Roof .....................................................

8 Kind of house
   On the ground □ Over the ground □

9 House condition
   Dilapidated □ Medium □ Good □

10 Profession of Head of family .................................................................

11 Type of activity .................................................................

Surveyor
Introduction

Our names are  ........................................................................................................................................

We are conducting a survey for the Ministry of the Environment and we would like to ask you a few questions about what it is like to live in this area.

First, could you tell me the following things:

<table>
<thead>
<tr>
<th>Village Number</th>
<th>Group Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>House Number</th>
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<tbody>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Family Name</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Family Size</th>
</tr>
</thead>
<tbody>
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<td></td>
</tr>
</tbody>
</table>

I. Education

A. How many children in your family go to school?  

B. Where do they go to school?  

C. Is this far from, or near to, your home?  

D. If your children do not go to school, why not?  

E. What academic level have your children reached?
   1. primary school  
   2. secondary school  
   3. high school  
   4. university  
   Diploma: yes? no?  

F. If any of your children have completed school, what do they do now?
   1. job with government  
   2. job with the private sector  
   3. other (specify)  

II. Nutrition and Health

A. What health problems does your family suffer from the most? (e.g., diarrhea, dengue fever, etc.)  

B. Have any members of your family died from any diseases?
   yes no  

C. When members of your family get sick, where do you go for help?
   1. private hospital  
   2. government facility  
   3. other (specify)  

III. Drinking Water Supply

A. Where does your family get drinking water?  

B. What is the quality of your drinking water?
   1. good  
   2. fair  
   3. poor  
   other (specify)  

IV. Community Satisfaction

A. Do you and your family like living here?
   1. Yes, why? .................................................................
   2. No, why not? ............................................................

B. What do you think are the most important problems in this area?
   1. garbage ......
   2. sewage ......
   3. other (specify) ......

V. Recreation

A. How does your family spend its free time? e.g., sports, TV, other
   .............................................................................

B. How often do you do each of these activities every week?
   .............................................................................

C. If no activity, why not?
   .............................................................................

D. Is there any type of recreation your family would like to do but cannot?
   Specify .................................................................

E. Why can't you do these activities?
   1. not enough time ......
   2. not available ......
   3. other (specify) ......

VI. Employment and Income

A. How many members of your family work to make money?
   .............................................................................

B. What kind of job does each person do?
   1. official ........................................................................
   2. non-official ..............................................................

C. How much does each person get paid per week or month?
   .............................................................................

D. How do you think you could earn more money?
   .............................................................................

VII. Aspirations for the future

A. Are you and your family comfortable living here? Please explain.
   .............................................................................

B. What is the most important thing that you think needs to be done to improve your current living conditions?
   .............................................................................

C. Do you and your family intend to keep living here?
   .............................................................................

D. What, if anything, do you think the government, NGOs or other people should do to help you?
   .............................................................................

VIII. Is there anything else you would like to tell us about living here?

.................................................................................... 
Thank you very much for taking the time to speak with us today. We appreciate your help.
APPENDIX 3

Map 1: Le Réseau Primaire D'Assainissement

Map 2: Les Six Bassins Versants Indépendants de la Ville: "Etat Projété"

Map 3: Bassin Versant Du Boeng Salang: "Etat Actuel"

Map 4: Bassin Versant du Boeng Salang: "Amenagement Projete"

Map 5: Plan de Situation des Villages et des Groupes

Map 6: Maisons à Demolir et Deplacer

Map 7: Parcelles Vides et Occupées
Réseau primaire:

- Ø 150 cm
- Ø 100 cm
- Ø 50 cm
- Ø 30 cm
- Canal

Station de pompage

Réseau secondaire:

- Ø 60 cm
- Ø 50 cm
- Ø 40 cm
- Ø 30 cm

Sens d'écoulement
Ville de PHNOM PENH - Département du Drainage et de l'Assainissement
DIAGNOSTIC DU RESEAU D'ASSAINISSEMENT
LES PRINCIPES DE DRAINAGE ET D'ASSAINISSEMENT DE LA VILLE DE PHNOM PENH
LES SIX BASSINS VERSANTS INDEPENDANTS DE LA VILLE: "ETAT PROJETE"

Fond de plan: APUR
Juin 1995
Ville de PHNOM PENH - Département du Drainage et de l'Assainissement

DIAGNOSTIC DU RESEAU D'ASSAINISSEMENT

BASSIN VERSANT DU BENG SALANG

"Aménagement projeté"

Fond de plan: APUR

Agence DESAIX
Juin 1995
I. BACKGROUND

Boeng Salang sub-district belongs to Tuol Kork district of Phnom Penh city where the number of population has totally around 123,000. The Boeng is one of the principal receptacles of the retention in Phnom Penh. It gathers water from a surface area approximately 560 h.a with the perimeter 11.6 km and its length is 1.6 km containing of the stocking capacity 142,000 m³.

Many Squatters living around the real Boeng and solid and liquid waste remaining into the Boeng have been impacting, particularly at wet season, not only areas and squatters around the Boeng but also inlets of sewage canals at the Boeng Salang sub-district. Besides, retention due to solid waste makes its volume become smaller and smaller.

As the reasons mentioned above, the Urban Affair Group of Phnom Penh municipality has spent much time to study the sub-district. The project is to rehabilitate the sewage canal located in the Boeng Salang sub-district and be funded by the World Bank and Asian Development Bank. This will improve welfare of population living in the area and ensure safeguard of the real Boeng against retention, but require relocating squatters living around the Boeng to reserves of Phnom Penh municipality.

II. PURPOSE

To identify opportunities for enhancing the positive socio-economic impacts of the Boeng Salang sewage canal rehabilitation project.

III. OBJECTIVE

- To identify potential environment impacts.
- To solicit the views and concerns of the people who will be affected on identified socio-economic impacts.
- To make recommendations to the Phnom Penh Municipality.

IV. SCOPE

Once the Boeng Salang rehabilitation project is put into action, squatters living around the real Boeng will be relocated to the reserves of the municipality. One of the most important environmental components to be characterized is the condition of socio-economic component, including views and concerns of people to relocate and whether they are satisfied or not. This requires to select a sample of people to be interviewed about their feelings and needs.

After analysing the result of the interviews with the sample of people, recommendations will be made and sent to the Phnom Penh Municipality to facilitate a compromise arrangement for the relocation of the local population.
V- METHODS AND TASKS

Methods

- Select the specific site of the sub-district, necessary project activities and environmental components as the target to study,
- Contact institutions and NGOs concerning the selected site and the project, using simple approaches to get data available and developing these approaches to justify data.
- Selecting a sample of people at the selected site to interview.
- Compile the results of the interviews and analyze them.

Tasks: are going to be addressed on

1- Outlining the project: the project will be outlined by using a map and the important information such as general layout, location, population size and exodus, objectives of urban drainage improvement;

2- Finding socio-economic data in the selected site and identifying potential impacts through an interaction matrix. According to the matrix, socio-economic data that could be ranked are:
   - Drinking Water Supply,
   - Nutrition and Health,
   - Land Use,
   - Food Production,
   - Social Services,
   - Employment,
   - Income,
   - Cost of Living,
   - Education,
   - Community Satisfaction,
   - Amenity,
   - Neighborhood Character;

3- Designing, developing and conducting questionnaire to interview a sample of the public:
   - Prepare draft questionnaire,
   - Review with Bureau of Urban Affairs,
   - Revise the questionnaire,
   - Select a sample of people to interview,
   - Conduct survey;

4- Compiling the result of the interviews and analysing:
   - Quantify,
   - Describe graphs, tables...
   - Describe results,
   - Conclusions,
   - Recommendations,

5- Report on the case study:
   - Prepare draft and report,
   - Discuss with the experts
   - Revise the report.
VI- PROJECT TEAM

The nineteen students in the EIA case study of the Boeng Salang rehabilitation project could be divided into six sub-groups, and each has to be responsible two environmental components. This shows in table below:

PROJECT TEAM OF BOENG SALANG REHABILITATION
Manager Advisor: Mr Douglas Wright, Dr Keith Williams
Manager: Mr Ma Bunnel
Assistant: Mr Chhiv Kosun, Mr Lou Veasna

<table>
<thead>
<tr>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>DRINKING</em></td>
<td><em>LAND USE</em></td>
<td><em>SOCIAL SERVICES</em></td>
<td><em>INCOME</em></td>
<td><em>EDUCATION</em></td>
<td><em>AMENITY</em></td>
</tr>
<tr>
<td>WATER SUPPLY</td>
<td><em>FOOD PRODUCTION</em></td>
<td><em>EMPLOYMENT</em></td>
<td><em>COST OF LIVING</em></td>
<td><em>COMMUNITY SATISFACTION</em></td>
<td><em>NEIGHBORHOOD CHARACTER</em></td>
</tr>
<tr>
<td>1- Mr Leng Pothika</td>
<td>1- Mr Chhiv Kosun</td>
<td>1- Mr Yim Sambo</td>
<td>1- Mr Kan Vibol</td>
<td>1- Mr Tan Bunna</td>
<td>1- Miss Hou Kalyan</td>
</tr>
<tr>
<td>2- Mr So Sry</td>
<td>2- Mr Doung Samkeat</td>
<td>2- Mr Yim Chamnan</td>
<td>2- Mr Heang Dara</td>
<td>2- Miss Kriel Tina</td>
<td>2- Miss Phoeun Kanha</td>
</tr>
<tr>
<td>3- Mr Yim Chamnan</td>
<td>3- Mr Tung Kun</td>
<td>3- Mr Leang Mengleap</td>
<td>3- Mr Lou Visna</td>
<td>3- Mr Ban Aun</td>
<td>3- Miss Phoeun Kanha</td>
</tr>
</tbody>
</table>

Each sub-group needs a guide to help in the interview

II PROCEDURE TO ANALYZE THE CURRENT CONDITIONS AND TRENDS FOR EACH ENVIRONMENTAL COMPONENT:
- description of component
- trends in the indicator
- explanation of factors causing trends
- environmental implications
- supported by 1 to 3 graphs or tables
- prediction of changes in resource without intervention "Planning horizon"
- comment on qualities of data and information
- laws, policy, regulations
- institutions - highlight differences among planning units
Preliminary Review of the Environmental Implications of the Prek Thnot Hydro Electricity Development Project

a case study prepared for the REDP and EIA Training Course of the Asian Development Bank
ADB 2078-CAM

October, 1996


**Note to the Reader**

This case study was originally planned to evaluate the Kamchay hydroelectric project. Because of security reasons, it was necessary to change the location of the case study to a similar project called the Prek Thnot. Consequently, many references are made to Kamchay as the background work, including the terms of reference, were all centred on Kamchay. The actual fieldwork was carried out at Prek Thnot and so the findings of the case study relate to that project instead. Even so, it is considered that similar issues would have arisen for both projects and it was concluded that the case study remained a valuable exercise. Because of the change in location, the proponents of the Kamchay project was not involved in this case study and no report was made to them.
## Contents

1. Introduction and Background ........................................................................... 1

2. Purpose and Objectives of this Study ................................................................. 2

3. Scope ................................................................................................................ 2

4. Methods, Tasks and Schedule .......................................................................... 2

5. Findings ............................................................................................................ 3

5.1 Ecological Resources ..................................................................................... 3
  5.1.1 Background ............................................................................................... 3
  5.1.2 Freshwater Fishery ................................................................................... 4
  5.1.3 Forestry and watershed management ....................................................... 5
  5.1.4 Wildlife Resources ................................................................................... 7

5.2 Physical group .................................................................................................. 8
  5.2.1 Potentially significant impacts of the project .......................................... 8
  5.2.2 Conclusions and Recommendations ....................................................... 10

5.3 Socio-Economic Group ................................................................................... 10
  5.3.1 Employment, Income and Food production .......................................... 10
  5.3.2 Nutrition and Health ................................................................................. 13
  5.3.3 Socio-economic evaluation ................................................................. 13
  5.3.4 Conclusions and Recommendations ..................................................... 14
1. Introduction and Background

As part of a training course on Environmental Impact Assessment and Regional Environmental Development Planning, several course participants undertook a preliminary review of the potential environmental impacts of a hydro-electric power development project called the "Kamchay" project. Actual field work was carried out another site due to security problems. The second site is called "Prek Thnot".

The Kamchay hydro-electric project is located in Kampot province, 160 kilometers South-West of the Phnom Penh Capital, in the Southern tip of the Elephant Mountains range this project has been under consideration discussed since the 1950's. The project, however really came to life with the Russians in 1965 who conducted an exhaustive and detailed study of the project which was then stored away. After the events in Cambodia in the 1970's, the Mekong Commission accompanied by the same Russian team, revised the parameters of the project to increase its capacity and make it even more tempting to develop; but these efforts were vain. In 1973, the Mekong Secretariat revised the Kamchay project and made the recommendation that the water from this project be directed to the Sanker river (Kampot) to achieve 20 meters additional elevation which would increase efficiency and could irrigate a 35,000ha area located in South and East of Kampot City, near the Cambodia-Vietnam border.

In 1988, the Russians "Technical Hydro Project" reviewed the 1965 study, supported by the Mekong Secretariat plan which included the irrigation component (35,000ha) and could produce 120MW. In 1992, Japanese experts highlighted the real potential of Kamchay River and tried to conduct a study of the economic and technical aspects of this project; however once again the study was never completed. In January 1994 during a Canadian commercial mission to Cambodia, the Kamchay project was proposed once again by a consortium led by of Hydro Quebec and the Pomerleu company, to Cambodia's Minister of Industry, Mines and Energy, his Excellency Pou Sothyvakra. The Canadian consortium produced a pre-feasibility report which contains, among other things, a preliminary analysis of the environmental implications of the project. The report concludes that an EIA should be undertaken for the project.

The Prek Thnot project is located in Kompong Speu province 70 Kilometers west of Phnom Penh capital. This project is a multipurpose development for power generation irrigation and flood control in the lower Prek Thnot river basin. The project began in 1969 but was suspended in 1973 because of unstable security condition. In the late 1980s, however, the Government of Cambodia was determined to attain a self-sufficient food supply by increasing its production of the level, and looked for the possibility to resume the construction of the project.

The estimated discharge with a return flow ratio of 20% in the case of double cropping is summarised hereunder. Under the "without dam" conditions (Alternative 1), the discharge of the Prek Thnot river would decrease almost to one third in the dry season and two thirds in the rainy season after the implementation of the project. In the case of alternative 2D, the discharge of the Prek Thnot river would decrease from almost half to one third. The discharge in the dry season would fairly increase in the alternative 3D mainly due to the use of water for power generation. (See the table below.1)

1 Information obtained from the report on the Prek Thnot Multi-Purpose Project.
<table>
<thead>
<tr>
<th>Prediction Point</th>
<th>Existing MCM (%)</th>
<th>Alternative 1 MCM (%)</th>
<th>Alternative 2D MCM (%)</th>
<th>Alternative 3D MCM (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>a) Tuk Thla</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- dry season</td>
<td>176.1 (100)</td>
<td>62.8 (36)</td>
<td>98.8 (56)</td>
<td>262.5 (149)</td>
</tr>
<tr>
<td>- rainy season</td>
<td>1,465.4 (00)</td>
<td>1,125.1 (77)</td>
<td>452.8 (31)</td>
<td>620.4 (42)</td>
</tr>
<tr>
<td><strong>b) P. Thnot Bridge</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- dry season</td>
<td>180.8 (100)</td>
<td>69.3 (36)</td>
<td>111.9 (56)</td>
<td>273.5 (151)</td>
</tr>
<tr>
<td>- rainy season</td>
<td>1,501.5 (100)</td>
<td>482.7 (77)</td>
<td>495.7 (31)</td>
<td>661.9 (44)</td>
</tr>
<tr>
<td><strong>c) Lower Tonle Bati River</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- dry season</td>
<td>0.6 (100)</td>
<td>19.1 (318)</td>
<td>81.4 (13567)</td>
<td>53.2 (8867)</td>
</tr>
<tr>
<td>- rainy season</td>
<td>58.7 (100)</td>
<td>78.7 (134)</td>
<td>97.5 (166)</td>
<td>77.2 (132)</td>
</tr>
</tbody>
</table>

The active storage volume is 980 MCM and its high water level is 28.3 m above the mean sea level. The dam could produce 18,000 kw and could irrigate 75,000 ha for alternative 2 (irrigation priority) and 20,000ha for alternative 3 (power priority).

The environment is one of the important aspects to be studied at present, especially environmental impacts caused by the project and resettlement issues.

2. Purpose and Objectives of this Study

The purpose of this case study is to ensure that the proposed project receives the appropriate level of environmental impact analysis. The objectives of the case study are to:

- identify potential issues and environmental impacts associated with the project;
- review the findings and conclusions of the pre-feasibility study and to validate these findings and conclusions through literature reviews, a field visit and other means; and,
- provide comments back to the proponent on the needs for and scope of an environmental impact assessment for the project.

3. Scope

It was decided by the case study team that their review would cover the entire pre-feasibility study with focus on the environmental analysis section. It was also decided that the team would take into consideration all aspects of the environment which potentially will be affected by the project activities. A list of environmental resources and project activities initially considered important for the study is provided in Appendix A.

4. Methods, Tasks and Schedule

The case study was carried out by two principal means:

- By reviewing the pre-feasibility study itself as well as other documentation, information and data on similar projects.
- Through conducting a site visit and carrying out interviews with local people.

The specific tasks of the project were as follows:

A. Advise the Proponent of the Case Study
B. Write the Terms of Reference
Prepare Draft TOR  
Prepare First Progress TOR and Detail  
Review TOR With Experts  
Prepare Final TOR and Inform Concerned Institutions  

C. **Review the Pre-feasibility study.**  
Read the Pre-Feasibility Study.  
Collect and Review other Background Information.  
Identify the Key Issues.  
Interview Experts.  

D. **Case Study Analysis**  
Research the Key Issues.  
Prepare Schedule, Interviews and Site Visit.  
Arrange a Trip with the Local Authority before the Site Visit  
Conduce Interviews and Site Visit  
Report and Identify Possible Mitigation Measures  
Prepare Draft Recommendations  
Review Recommendations with Experts  
Finalize Recommendations  
Present Recommendations to the Proponent

All of the work was carried during the months of March, April and May 1996.

5. **Findings**

The following findings refer to the location of the Prek Thnot project and not to the Kamchay project which was the original focus of this study. Potential issues are described under the headings of Ecological Resources, Physical Resources and Socio-Economic Resources. Recommendations relative to each set of resources are also presented.

5.1 **Ecological Resources**

5.1.1 **Background**

The most striking feature in the study area is the absence of natural system such as undisturbed forests, grasslands or wetlands. Consequently, biological diversity is poor and large wildlife is not found. With the elimination of habitat the many ecological benefits usually derived from natural systems have gradually disappeared.

As for forests, commercial forestry would have been largely responsible for their depletion, along with proximity to the large urban centre of Phnom Penh where a big demand for firewood exists.

The aquatic habitat is also much disturbed. Although waterbodies abound, most dry up in the dry season and water for domestic purposes is in short supply then. River and stream banks are eroding and the riverine vegetation that provides natural stability to river banks has disappeared in many places. The new network of canals that have been constructed in the 1970s is reported to have interfered with natural inundation.

Sediment generated by eroding river and canal banks has contributed to reducing channel capacity, affecting water flow, and increasing water temperature, among other environmental effects. Finer particles of silt are suspended and are affecting turbidity. These ill-effects will interfere with the physiological functions and population dynamics of aquatic life. It has been reported that species of fish have declined in abundance and perhaps in diversity too. Poor maintenance is a major reason for the present state of the canals.
5.1.2 Freshwater Fishery

The Prek Thnot River and its tributaries upstream of the dam site are characterized by clear water in the dry season but turbid waters (even with small inflows) due to local rain storms in the rainy season. However, substantial changes in the regime of downstream sectors of the river combined with the presence of several weirs and flow diversion structures, have altered the aquatic ecology and fishery resources. Specific biological investigations to prove the nature and extent of such effects have not been undertaken to date.

The majority of fish species in the Prek Thnot river system are “black fish” consisting mainly of omnivorous detritus feeders and carnivores including claridae. Anabantidae and ophicepalidae populations fluctuate according to the reservoir conditions, based on data from other projects already implemented in the river basin. Fish are harvested mainly on a subsistence basis using traditional methods, particularly throw (cast) nets (sam nagn) and baited traps (Pourng). It is also reported that the use of explosives and poisons and shooting are also practiced in remote parts occupied by military units in the catchment area. Harvesting of fish trapped due to receding floods and to rice fields is also common. All sizes of fish are taken at any time and this results in general in over-exploitation of the fishery on a local and regional basis.²

Fisheries programs designed to address these problems in the future after the project is built are mainly funded or proposed to be sponsored by the Mekong Secretariat and include the following:

- Management of freshwater fisheries in Cambodia with an objective of optimizing the use and sustainability of live and lake fisheries.
- Management of reservoir fisheries Phase 1 with an overall objective of increasing reservoir fishery production through commonly based fisheries planning and management.
- Management of regional fishery resources, designed to identify vulnerable fish stocks and overcome poor fisheries management practices.

No baseline data on aquatic ecology, fish population and distribution in the upper Prek Thnot river are available. Surveys of actual fisheries and sampling of benthic organisms and algae or other indicators of primary productivity were not carried out. It is suggested that an aquatic ecology and fishery study be conducted once access to the upper reservoir areas is possible. This should be carried out jointly with downstream irrigation projects.

Based on the references available and discussion with relevant authorities, the status of fish and fishery in the upper reaches of the Prek Thnot river is considered to be as follows:

- the river and tributary fish population seem to consist predominantly of species such as clarias batrachus (cat fish), channa micropelt (snakehead), Anabas testudines (climbing perch) and the smaller trichogasster spp. (Gouramy).
- there is high possibility that less common smaller species characteristic of clear water, such as Rasbora spp. exist in the uppermost reaches in undisturbed forest areas.
- some stocked cyprinidae (carp fish) in local ponds have been tracked in the Phnom Surouch District, but no subsequent checking of the survival rate, use, and effectiveness of stocking has been conducted.
- effects of downstream weirs and diversions need to be considered in the context of overfishing at critical locations and upstream survival of “white fish ”species through the Prek Thnot river system during both the wet and dry seasons.
- aquaculture in the reservoir area is limited due to the poor socio-economic status of the farmers and a complete lack of any supported local fishery extension programs.

²Prek Thnot Multi-Purpose Project.
5.1.2.1 Aquatic Biota

Additional investigation on the aquatic ecology and fisheries are desirable. These should be undertaken under the supervision of a fishery biologist fully knowledgeable about the Mekong tributaries and reservoir fishery. The main focus would be in the vicinity of the dam site, downstream and in an accessible major tributary.

A baseline survey will be a priority as more detailed information is required on exactly which species are involved above and below the Roleng chrey weir. The baseline conditions should be firmly established for comparison with the fishery conditions prevailing in other Mekong tributary streams, and reservoirs located on tributaries.

This study is required so that a more valid and detailed determination of species which would be adversely affected by the project can be made. The extent to which they may be affected and their present use in the system can be made in any further environmental impact analysis and for projection of reservoir fishery composition yield and development planning.

5.1.2.2 Conclusion

It is important to make further study about fish species which would be lost, or new ones created, in the reservoir after the dam is constructed.

5.1.3 Forestry and watershed management

5.1.3.1 Current Administrative Situation

Acts and regulations relating to forest management and protection in Cambodia including references to any provisions associated with catchment management have not been finalized by the Department of Agriculture, Fisheries and Forestry for presentation to and approval by the government of Cambodia. There is no definite target date for completion of the proposed national forest acts and related regulations. Currently, day-to-day management of forests in the Prek Thnot catchment area is undertaken by the Kompong Speu Provincial forestry Department.

A specific ministerial decree forbidding the logging of tropical pines (Pinus merkurrii) was put in to effect in late 1991, and this is important to the project area because stands of tropical pines exist in the Southwest sector of the catchment area. These were previously being logged and sold in the export market, both legally by provincial military authorities and illegally. It is considered that illegal logging. According to information of the Provincial forestry Department, current forestry activities in the catchment area are limited to the following:

- removal of dead trees and selected species by individual farmers for sale as firewood and making charcoal, this occurs throughout the accessible lower sectors of the catchment area including the reservoir area.
- removal of selected tree species for hand sawing into timber or dressing as construction poles, but there was no evidence of trucking of round logs from the project area using the national Road No 4.
- cutting of selected minor forest products, particularly bamboo and small poles for sale to local and regional markets to be mused for small house construction and fencing.

5.1.3.2 Area of forest in the past and present

According to maps of Kompong Speu province in 1970, 525,500 ha was land forests, (including some land forests of Koh Kong province because the land forest boundary is different from the current administrate boundary in Kompong Speu province. Land forests were photographed by satellite from 1994 to 1995 in the province and there were 473,319 ha of land forests standing. Therefore, 52,181 ha have been lost. This has been caused by:
• shifting cultivation of people in Pol Pot regime
• some of land forest had been entrusted to Koh Kong province which carried out administrate map of the province.

The species composition of forests in Kompong Speu province shows widespread growth in many areas. Species representation is as follows:

- dense forest : 96,777 ha
- mini-dense forest : 112,870 ha
- jungle forest : 130,826 ha
- scrub forest : 132,837 ha
- Pine forest : 2 ha
- flooded forest : 7 ha

There are 14 areas of reserved forest in Kompong Speu province having a total area of 100,720 ha in 1975.

5.1.3.3 Forest status in the Project area
Virtually all the original forest cover in the reservoir area has been removed from the reservoir area and secondary regrowth (generally less than 10 m in height) prevails. Some original forests remain in the western part of the reservoir flooding zone such as in the north of the Phnom Kraing Devey area. Secondary regrowth of bamboo is observed in most riparian zones of the reservoir area.

There is a total of 11,000 ha of forest in the catchment area. There are two types of forest: jungle forest and mini-dense forest with valued tree species such as:

Cheur Teal : (Dipterocarpus costatus)
Pa Deke : (Anisoptera glabra)
Ta Peng : (Dipterocarpus Obtusifolius)
Trach : (Dipterocarpus intricatus)
Schro Mas : (Vatica astroticha)
Pcheak : (Shorea obtusa)
Socrom : ......
Po Pel : (Hopea recoepl)

Indications are that substantial stands of undisturbed forest remain and residual forest cover in those areas are subject to illegal logging in the past 15-20 years. Substantial road systems constructed for both legal and illegal logging operations exist in the main Prek Thnot valley and in the southwest part of the catchment area.

5.1.3.4 Conclusions and Recommendations
Considerable uncertainly exists as to the present status of forests in the catchment area of the Prek Thnot river, and access to most of the area has not been possible in recent years. Even though it is known that the actual forestry activities and their extent are unknown at present, although there are some logging activities such as removal of trees for fire wood, timber, and poles by individual farmers and illegal logging on a larger scale in remote parts of catchment area.

No formal legislation relating to the protection of forest resources or their management exists in Cambodia at present such legislation is planed and being formulated but no definite date for the establishment of laws and regulations has been set.
The area to be inundated by the reservoir has already been logged. So direct environmental impacts would be minimal. Implementing the project without having completely secured access to the catchment area would be risky because this might result in further uncontrolled encroachment into remaining forest areas. There would be potential risks of increased erosion and changes in the patterns of runoff to and sedimentation in the reservoir, if effective forest and catchment area management practices are not implemented in conjunction with the reservoir operation after the project’s completion.

It is recommended that a comprehensive forest and catchment area management program be carefully planned and implemented focusing basically on the following:

- prioritization of land use 1 forest classification mapping of the catchment area of the Prek Thnot Dam,
- execution of a baseline forest inventory in the catchment area under the supervision of an experienced forester to provide basis for preparation of a sustainable forest management plan,
- formulation and implementation of a forest and catchment area management program including supporting activities during the initial operation period of the project.

5.1.4 Wildlife Resources

5.1.4.1 Current situation

The general and specific distribution of wildlife in the Kompong Speu province is currently unknown, and no wildlife surveys have been undertaken in the catchment area by provincial or national forestry authorities since the early 1970s. Consequently, only secondary information was obtained from discussions with farmers. It was learned that the wildlife population has gradually diminished due to hunting and trapping by local farmers and military units, both from the Government and Khmer Rouge.

Additional losses have also occurred since the mid 1970s due to extensive mine fields and logging activities in the remote parts of the catchment area. Although there is no definitive proof, some illegal trade in wildlife and wildlife products might be occurring in conjunction with illegal and uncontrolled logging activities using the road from the upper catchment area to Thailand Via the Prek Kompong Saom valley in Khet Koh Kong province. The traded wildlife is likely to consist of smaller mammals such as primates and cats and of exotic bird species such as pheasant and dove.

According to information obtained from national and provincial forestry departments there exist wildlife such as primates, small cats and deer, including some rarer species such as: elephant, gacer, benteng, and bigger cats (leopard and Tiger) in the catchment area. It was also reported that the wildlife population in the Prek Thnot reservoir area is severely degraded and limited mainly to deer, small cats and reptiles.

5.1.4.2 Wildlife management and protection

Currently the Wildlife Protection Office (WPO) of the forestry Department, has the direct responsibilities for wildlife management and protection. WPO is headquartered in Phnom Penh, has limited staff, equipment, and budget and is unable to actively police in the field. Also wildlife protection legislation (laws and regulations) has not yet been finalized for gazetting and approval by the government of Cambodia. Practically, the capability of the Kompong Speu province forest Department to protect wildlife is restricted due to the absence of wildlife laws and regulations, extreme constraints on access to remote areas due to a lack of trained
manpower and necessary facilities. Consequently wildlife protection activities in the Prek Thnot catchment area are extremely limited at present.

Most recently, the national WPO has undertaken (with ministerial approval) a campaign promoting wildlife conservation. This has focused on all species in general and brochures have specifically listed the following species of concern, which are relevant to the Prek Thnot catchment area:

1. **Mammals**
   - Guer - Bos gaurus (Bos frontalis, locally kting)
   - Sambar - Rusa unicolour (Cerrus unicolour, locally, Breas)
   - Bibos gaurus - Bos Sondiacus (locally Tonsaon)
   - Elephant - Elephas indecus (locally Domrei)

2. **Birds**
   - Sauraes Crane - Grus antogone (locally Kriel)
   - Plumed Egret - Egretta intermedia (locally Kok)
   - White Vented Myna - Aerodotheres Javanicus (locally Sarekab)
   - Spotted Dove - Streptopelia chinensis (locally Lolok)

**5.1.4.3 Wildlife Impact Assessment**

The basic project impacts on wildlife resources will occur while the reservoir is being constructed and filled. Water surface in the area will cover 135 km² of land, including 11,000 hectares of forest land which could cause damage to any wildlife habitat. The main species likely to be affected by the reservoir include small populations of barking deer and common birds.

**5.1.4.4 Conclusions and Recommendations**

There is sufficient evidence that more remote sections of the Prek Thnot catchment area support a diversity of wildlife which includes several species of conservation interest. It is practically impossible to conduct a comprehensive wildlife survey in the catchment area under the present conditions of access restriction by all parties including Cambodia government personnel. A baseline wildlife survey should be undertaken in the catchment area once the land use forest classification maps have been prepared and access to the area has been secured.

Almost the entire reservoir area was cleared of forest cover, mostly over 20 years ago. There are no indication that the filing of the reservoir would adversely affect the wildlife resources in the catchment area. However, the construction of the reservoir and population resettlement in its vicinity would create an additional pressure on the wildlife resources in the larger catchment area. Therefore, additional study on the number and species of wildlife is needed in the Prek Thnot catchment area.

**5.2 Physical group**

**5.2.1 Potentially significant impacts of the project**

**5.2.1.1 Impact on soil quality**

The Prek Thnot area as a whole has on average poor soil and appears not to be really suitable for large scale irrigation development. However sizable areas of good land do occur and it is recommended that these better soils be used for limited irrigation development. The present study can only roughly indicate where these better soils occur.
What are the good soils and that the poor ones is relatively much better known than location of the various soils (report from department of irrigation). The preliminary finding on land capability are summarized in figure 1. The codes represent land capability classes for irrigated rice and have the following meaning:

1. highly suitable
2. moderately suitable
2R moderately suitable, only for rice due to flooding
3. poorly suitable
3R poorly suitable only for rice due to flooding
4. very poorly suitable
5. not suitable

Indications are that South of the Prek Thnot river soil conditions are better in an alluvial strip mainly south of the river. Field checks indicated that in the south-west soils are as poor or even poorer than on the left bank. The preliminary classification is class 3 and class 4 land; i.e., poorly to very poorly suitable for irrigation.

It is recommended that the areas which have been pointed to as appearing the most suitable for irrigation be surveyed in detail before irrigation works are planned or implemented. About 25 soil samples have been delivered to the soil laboratory of the Ministry of Agriculture. Since already several hundreds of soil samples from Prek Thnot area have been analyses, the result of the present analyses are not expected to contribute very much to the study. In this context it is noted that analytical soil studies are less important than actual field surveys.

Impacts on soils given present soil conditions are not expected to be significant.

5.2.1.2 Impacts on Air pollution, noise and vibration

Impacts on air quality and noise and vibration levels could be considered around the dam site and construction roads. However, the areas which could be affected are limited from the sources of pollution. Special facilities such as hospitals, schools and pagodas, which could seriously be affected by negative impacts, are far enough away from the pollution sources that they are not of concern.

5.2.1.3 Change in micro-climate

In general, a change of micro-climate usually occurs when a reservoir has a huge surface area, particularly in the arid or semi-arid regions. The reservoir area of the project is less than 200 Km². Therefore, it is too small to cause substantial impacts related to micro-climate change around the environment.

5.2.1.4 Water quality and quantity changes

Impacts on the water quality to be caused by the project are:

- eutrophication of the reservoir and its water quality also will be changed during operation of the project;
- change of the river flow regime; and,
- water quality in downstream river would be caused by the change of river flow regime and the application of fertilizers and agrochemical in the proposed irrigation area.

The results of the assessment of the water quality change are shown in the EIA report which concludes that the proposed reservoir has low eutrophication potential and no serious impacts are expected in the reservoir area.
5.2.2 Conclusions and Recommendations

The preliminary assessment of the impacts of the project on the physical environment lead to some the following conclusions:

- the impacts on air pollution, noise and vibration are low level, during the operation of the project.
- the impacts on water quality have been described and explained very clearly in the EIA report which concludes that the alternatives 1 and 3D would not cause serious impacts on the water quality mainly due to the relatively small amount of additional pollution load from the irrigation area and additional water supply for power generation. However, the alternative 2D is expected to affect downstream water quality though its magnitude would not be so serious.\(^3\)

We suggest that the proponent needs to consider the following points to minimize the impacts of the project:

- explain clearly about design of mitigation measure on water pollution
- analyze and identify samples of groundwater and its quality
- the investors should provide new vehicles and machines for operating the project. All of the machines and vehicles must have environmental protection equipment for controlling smoke and noise.

5.3 Socio-Economic Group

5.3.1 Employment, Income and Food production

5.3.1.1 Baseline Conditions

After collecting all information at Kompong Speu province about employment and workers, it was determined that:

- there are 973 sawmill small factories with 1,108 people (1056M) salary: 50.000 → 100.000 R
- There are, in the staff of the state, 3,623 people (F:827 P) average salaries: 40-50.000 R

There were things happening in the villages near or on the dam site:

- Many of the traditional villages showed an extraordinary degree of trust even where people were not close friends.
- They had money from the rice fields, livestock and other jobs.
- Many small earnings added together made enough for the daily food, there was no idea of just one job, this is the way that village people live.

To obtain the present socio-economic data on the displaced people, a survey was conducted in three selected villages of the two sub-districts and two districts in and around the reservoir area. The survey was carried out by the local people and officers by using a prepared questionnaire which aimed to determine:

- Who are the poor?
- What resources do they have?
- What are their real needs?

\(^3\) Prek Thnot Multi-Purpose Project.
The poor are happy if they can earn money in many small ways and so be self reliant. A certain age group has no education at all. There were a few books and no papers. When we Cambodians talk of poverty we are not talking about not having shelter or clothes or cooking pots. We are talking about lack of food, because this is the most basic thing. When hunger is extreme it can stop a person from thinking about almost anything else; dignity, relationships, and respecting the law all become unimportant. Many families have land less in this situation, and they rarely die directly of hunger but die of diseases (cholera, diarrhea, etc.) when they are still children. The poorest people from villages still go to cut wood in the mountains although now this is extremely dangerous and illegal. They sell it to buy food to support their life. Some village families only have the ability to live hand to mouth from day to day, and some even just from morning to night. In recent years the people have been faced not only with the chronic shortage of land for the poor, but also with floods and droughts, especially Tang Sya sub district.

Villagers were asked: "If we wanted to get water for drinking and water for agriculture, what would we do?" The best hope of the village people was the repair of the reservoir and perhaps the digging of a channel through the village. In the dry season rice could be grown when there was enough water. Income earners:

Income
In developing countries, all members of low income families are drawn into the struggles for survival, since no one source of income is adequate. They need to have additional non-farm sources of income to protect themselves against such factors as bad crops and emergencies which might force them to sell land, livestock, or farming equipment.

Soils
According to villager perceptions, the soils were once fertile and villagers didn’t need to use chemical fertilizers for their crops. Soils started degrading since 1982/1983, at the same time the forest was destroyed. Soil fertility has become increasingly degraded year by year. The need for chemical fertilizer has been increasing every year in order to maintain the same size of yields.

All households in two villages (Tang Sya sub-district) cultivate rice for consumption.

Livestock
The important animals in the study villages are cattle, pigs, and chickens. The objective of raising cattle is to produce calves (2 calves in 3 years, drafting, and sale). For pigs, 95% are involved in pig raising for sale. Villagers in 3 villages of 2 sub-districts use traditional methods to raise animals.

Economic status
According to the interviews, the economic status of villagers in the study villages were classified in to 3 types: poor, medium and a few rich people. For the three types of villagers, we describe the households as follows:

- The rich household generally has 7 to 8 cattle, one motorcycle, rice sufficiency, a small business, a house constructed with a tile roof, wooden walls and a wooden floor.
- The medium status household has 2 to 3 cattle, rice insufficiency for up to 3 months, a small business, a house constructed with a tile roof, sugar palm leaf walls, and a bamboo floor.
The poor household has no cattle to one cattle, rice insufficiency for about four to five months, labor selling for rice supplements, a house constructed with a sugar palm leaf roof sugar palm leaf walls and a bamboo floor.

Occupation and labor allocation
Interviewees have been predominantly engaged in agriculture, in both crop cultivation and animal raising. Rice is grown mainly for home consumption, and other crops are produced for cash income. There are about 70% in 2 village in Tang Sya sub-district with a rice insufficiency but in Tom Por Meas sub-district, there are 20% with a rice insufficiency. Therefore they mainly have to depend on the sale of rice cash crops and cake, and forest vegetable and the rice bank project to supplement rice. Livestock is for working in the field and for cash.

Market and credit
Phnom Penh district has a market for villages in this area. It's distance from the villages is about 10-20 Km to buy rice, food, clothes, chemical fertilizer, pesticide seeds, and as well they can sell their agricultural products in the market. However, the price is controlled by middle men when the supply of agricultural products is high, the middlemen suddenly offer lower prices. To transport products to the market, they use ox carts, bicycles, and motorbikes, or carry goods on their shoulders or heads. Sometimes, the middlemen come to buy products especially cattle, pigs and chickens, directly in the village.

Credit
There was no formal credit in these villages. Villagers used to borrow from neighbors in cash or in kind, for short periods from 3 days to 3 months without interest, but the amount of loans were very small.

5.3.1.2 Conclusions and Recommendations
So the result of the survey on socio-economic characteristics and responses to the resettlement are: almost all villagers of the villages around the reservoir areas are farmers, they have lived in their birth place, the level of education is generally low the displaced people would be vulnerable to drastic change in their socio-economic conditions. It is necessary to support them socially and economically for facilitating their resettlement in new sites, but next to or nearby the reservoir.

It is recommended that the proponent should be careful in implementation of the resettlement and compensation plan. It is necessary to support displaced people socially and economically for facilitating their resettlement in new sites. The proponent should explain clearly about mitigation and prevention measures in the resettlement site.

NB* Agricultural land (Dey SRea): The average size of this land is one to 4 ha per household. This land use only for rice, because rice is the major crop in and around the reservoir area, It's yield is about 1T/ha/year.

Employment: Wage employment is rarely available in either village. Exchange labor and hired labor are practiced. Hired labor is mostly practiced in agricultural activities. The wage scale is 2000 to 2500 R per man day in the peak period (transplanting and harvesting rice)
5.3.2 Nutrition and Health

5.3.2.1 Introduction

These are the health services currently available. This table indicates that service is low throughout the province:

Kompong Speu health infrastructure list

<table>
<thead>
<tr>
<th>No</th>
<th>People</th>
<th>District</th>
<th>Sub-dist</th>
<th>Village</th>
<th>Provincial hospital</th>
<th>District hospital</th>
<th>Clinic</th>
<th>Bed</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>498158</td>
<td>8</td>
<td>87</td>
<td>1289</td>
<td>1</td>
<td>8</td>
<td>25</td>
<td>279</td>
</tr>
</tbody>
</table>

Kompong Speu health government staff list

<table>
<thead>
<tr>
<th>No</th>
<th>Doctor</th>
<th>Pharmaceutical</th>
<th>Dentist</th>
<th>Nurse</th>
<th>Paramedic</th>
<th>Mid-wife</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>42</td>
<td>8</td>
<td>1</td>
<td>42</td>
<td>1</td>
<td>77</td>
</tr>
</tbody>
</table>

5.3.2.2 Hygiene and Education of Kompong Speu Province

The health department of Kompong Speu has cooperated closely with other departments fighting against illness in all parts of the province, especially in four districts which have relation to the proposed hydro-electric dam.

After our discussion with the health department of this province and our interviews directly with the people in Prek Thnot dam area, we have not obtained clear information about dangers from illness and death rates, but we know that many people have malaria, the reason is because they are logging, making charcoal, and hunting, etc..

According to the report of the provincial health department, it shows that it is capable of stopping illness, depending on medical supplies and equipment. Now, however, some organizations have helped, but this amount of help can not reach the needs of the people.

After interviewing the local people in the Prek Thnot dam area, we suggest that the proponent build clinics or hospitals with sufficient equipment in the new resettlement sites. These should be staffed by medical doctors having good experience. Efforts should also be made to create new jobs which local people can work in so that they can stop logging the mountainsides.

5.3.3 Socio-economic evaluation

According to data and information about the socio-economic conditions of the people living in the four districts (in the reservoir) they face several difficulties:

- they can work only in the rice fields and in logging
- though they know that logging is destroyed environment and that it is dangerous for nature, they can not find another job besides this.
- the government or provincial authorities have to reduce these activities and create new jobs for the people so that the environment could be improved along with socio-economic conditions
5.3.4 Conclusions and Recommendations

It has been long regarded that economic development and environmental conservation are incompatible and many believe that the degradation of environmental quality is justified to achieve certain economic objectives. Generally, irrigation and agriculture development are associated with dams and reservoirs and potentially drastic ecological changes in the command areas.

So in order for this project to be operated in a sustainable manner, development, both Government and investors have to check and study very clearly the problems that exist now and the problems that could happen in the future.

Recommendations for rational environmental management and an environment action plan are presented below. The recommendations range from land use to environment education and include a variety of fields in which a little extra knowledge and attention can lead to long-term sustainable resources.

5.3.4.1 Prediction of Impacts

In the future, Prek Thnot hydro-electric construction would be:

- Ensured good environment by including people which logging and made charcoal etc. to find new job.
- Reduced number of malaria person, because they can not make any exploration at the top of mountain.
- People's life condition would be raised by created new infrastructure.

5.3.4.2 Responsible institutions

Department of public health, department of environment and local authority and another departments concerning have to plan and measure to mitigate by:

- Opening work shop to promote the people about the difficulty which will be happen from deforestation.
- Used all measure to promote people to take care, and protect their health and to fatten up that is a vital of all persons.

5.3.4.3 Requirement of the people

To build a hospital in the sub-district, as soon as possible, for improving their health. If the government needs to resettle these people, they want the government to compensate for land with money. They want to resettle near to the dam and together with their village.
Appendix A: Environmental Aspects and Project Activities

It was decided by the case study team that their review would cover the entire pre-feasibility study with focus on the environmental analysis section. It was also decided that the team would take into consideration all aspects of the environment which potentially will be affected by the project activities. These resources and activities included the following, although not all were reviewed given the time constraints of the project:

**Resources**

*Air*
Quality

*Land*
Soil quality
Erosion
Rice field production

*Parks and Reserves*
Forest Resources
Rare and endangered species

*Surface Water Quality and Quantity*
Water irrigation (dry and rainy seasons)
Aquaculture

*Ground Water Quality and Quantity*
Effects on groundwater recharge and regime

*Fish*
Species
Quality and quantity

*Socio-Economic Resources*
Food production
Gender issues
Employment
Income
Drinking water supply
Education
Nutrition and health

*Project Activities*

*Reservoir*
*Direct loss of land/productivity from inundation.*

General Land Use
- specific land uses: agriculture or grazing land, forest or timberland, wetlands and marshes
- commercial productivity: mineral resources, fisheries.
Loss or land and/or relocation of structures, buildings and people
- infrastructure sites
- homes and villages
- road and railways
- businesses
- recreation facilities.
- cemeteries, archeological and historic sites.
- Loss and/or fragmentation of habitat.
- habitat type.
- loss of hunting opportunities.

Environmental impacts due to the reservoir itself.
- reduction of the fishery (new kinds of fish)
- creation of shoreline habitat
- insect breeding, other health related problems

Impacts resulting from the dam as a barrier.
- sediment deposition in reservoir.
- loss of fish runs.

Alterations in water quality due to impoundment.
- impoundment of nutrients and wastes
- decrease in water quality
- increase in rate of eutrophication
- growth of algae
- thermal stratification

Effects of periodic inundation or fluctuating shoreline.
- adverse effects on wildlife habitat and vegetation
- loss of recreation use
- decreased aesthetics at low stage.

Water intake, power tunnel and flood spillway

Potential adverse effects.
- downstream effects
- change and natural fluctuation in flow conditions
- effect on fisheries, water use
- decreased aesthetics at low flow
- increase mosquito problem at low flow
- decrease sediment in downstream channel
- increased erosion
- increased water quality
- improvement in downstream fisheries

Potential positive effects of low regulation or low flow augmentation.
- Improvement of water quality
- Improvement of downstream aesthetics
- Improvement of downstream fisheries
- Reduction of mosquito problem
- Improved recreation potential

The construction and operation of the power station itself, access roads and of the transmission lines, were deemed to be outside of the scope of this review.

Access Road
Appendix B: Project Team

The project team for this case study was organized as follows:

**Director:** Koch Savath
**Team Leader:** Uy Khema

**Physical Resources:** Heng Nareth - leader group
- Heng Nareth: Air
- Phoeun Kanha: Air
- Hean Virak: Water
- Tin Soksamedy: Water
- Ngin Sambat: Land
- Yim Channan: Land

**Ecological Resources:** Bun Racy - leader group
- Bun Racy: Freshwater fishery, wetlands, aquatic biota.
- Leang Mengleap: Forest resources, habitat, terrestrial biota.
- Hou Kalyan: Forest resources, habitat, terrestrial biota.
- Chea Vuthy: Biodiversity, park and reservation
- Lou Veasna
- Bann Aun

**Socio-economic Resources:** Khim Sovatha - leader group
- Khim Sovatha: Employment, income, food production
- Ros Thoun: Drinking water supply, nutrition and health.
- Ma Bunnell: Social services
- Chhiv Kosun: Biodiversity, park and reservation
- Prak Vong: Land use, education, gender issue, historic structures
- Sau Thavarak
- Huy Phalvudy
<table>
<thead>
<tr>
<th>PROJECT ACTIONS</th>
<th>AIR</th>
<th>LAND</th>
<th>WATER</th>
<th>ECOLOGICAL</th>
<th>SOCIAL, ECONOMIC</th>
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<tr>
<td>Temporary worker Housing</td>
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<td>Land Clearing</td>
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<td>Site preparation</td>
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<td>Population and demography</td>
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<td>Material Storage</td>
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<td>Facility Construction</td>
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<td>Road and Infrastructure</td>
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<td>Lowland Agriculture</td>
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<td>Forestry Activities</td>
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<td>Urbanization</td>
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<td>Industrial development</td>
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<td>Upland agriculture</td>
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<td>Staffing</td>
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<td>Material Handling</td>
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<td>Waste Generation</td>
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<td>Product Transport</td>
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Environmental Interaction Matrix
Guidelines for Preparing
Initial Environmental Evaluations and
Environmental Impact Assessments for
Palm Oil Development Projects

a case study prepared for the
REDP and EIA Training Course
of the Asian Development Bank
ADB 2078-CAM

Ministry of the Environment
Royal Government of Cambodia

Draft
14 October 1996
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Many sources were consulted in the developing these guidelines. These include draft requirements for preliminary environmental impact assessments prepared by Dr. Keith Williams for the Cambodian Investment Board, draft guidelines for public and private sector investments prepared by DHV Consultants for Pakistan, and a background document on the environmental implications of oil palm development in Rattanakiri province prepared by Sarah Colm for the International Development Research Centre. The contribution of these sources is greatly appreciated.
Contents

1. INTRODUCTION ............................................................................................................. 1
2. DEFINITIONS ................................................................................................................. 2
3. PALM OIL DEVELOPMENTS AND THE ENVIRONMENT ............................................. 2
4. FORMAT AND CONTENT OF IEE AND EIA REPORTS .............................................. 3
5. GENERAL INFORMATION ............................................................................................... 4
6. DESCRIPTION OF THE PROJECT .................................................................................. 5
7. DESCRIPTION OF THE OPERATION ............................................................................... 5
  7.1 Site Preparation Activities ......................................................................................... 5
  7.2 Construction Activities .............................................................................................. 6
  7.3 Operation .................................................................................................................. 6
  7.4 Abandonment, Closure and Restoration .................................................................... 6
8. DESCRIPTION OF THE ENVIRONMENT ........................................................................ 6
  8.1 General Description of the Project Site ...................................................................... 7
  8.2 Physical Resources .................................................................................................... 7
  8.3 Ecological Resources ............................................................................................... 7
  8.4 Social and Economic Conditions ............................................................................... 7
9. POTENTIAL IMPACTS ON THE ENVIRONMENT ......................................................... 8
  9.1 Scope of the Assessment ............................................................................................ 8
  9.2 Description of Impacts ............................................................................................... 8
  9.3 Environmental Management Plan ............................................................................. 9
10. PUBLIC INVOLVEMENT ............................................................................................... 9
11. CONCLUSIONS AND RECOMMENDATIONS ................................................................. 9
1. INTRODUCTION

To ensure the sustainability of development in Cambodia, the Constitution of the Royal Government of Cambodia has stipulated that "the State shall protect the environment and balance of abundant natural resources and establish a precise plan of management of environmental resources. The Ministry of the Environment (MOE), Royal Government of Cambodia, was created in 1993. Under the proposed Law on Environmental Protection and Natural Resource Management, the Ministry has prime responsibility within the government for ensuring that the potential environmental impacts of development activities are assessed prior to their approval. Specific requirements for environmental impact assessment will be contained in sub-decrees under the new law. Proponents of investment applications for new development, redevelopment, expansion of existing facilities, or new purposes for existing facilities will be required to submit detailed information about their proposals for initial appraisal of environmental impacts.

In the interim, the Ministry of the Environment is developing environment impact assessment guidelines for certain types of development. The purpose of these guidelines for assessing the environmental impacts of palm oil development projects— at the level of an Initial Environmental Evaluation (IEE) or Environmental Impact Assessment (EIA) - is to:

- assist proponents in identifying, evaluating and proposing how to mitigate the potential impacts of their projects;
- help protect environmental resources; and
- help ensure that development is sustainable in the long term.

The MOE offers to review and provide proponents with advice on the adequacy of their assessments, including recommendations for changes to the project, the mitigation and management of potential impacts, and on needs for additional study or clarification.

For further information on these guidelines and advice on their implementation, proponents should contact the:

Department of Environmental Impact Assessment
Ministry of the Environment
Royal Government of Cambodia
#48, Samdech Preah Sihanouk
Tonle Bassac, Chamkamon
Phnom Penh
王国 of Cambodia

Attention: Mr. Koch Savath, Director
Mr. Tung Kun, Interim Vice Chief

Telephone: (855) (15) 9211-65
Fax: (855) (23) 472-844
2. DEFINITIONS

*Palm oil development* includes planting and operation of oil palm plantations, as well as the processing of palm fruit into raw and/or refined oil products and transporting these products to the market place.

For the purposes of these guidelines, *the environment* includes all living organisms, land, water and air resources, buildings and other structures, and social, cultural, economic and visual aspects that influence the lives of people and their communities.

*The proponent* is the person, business or entity or Government agency whose interests would be most directly affected by the decision.

3. PALM OIL DEVELOPMENTS AND THE ENVIRONMENT

Palm oil plantations and processing operations have the potential for causing negative environmental impacts of considerable scope and magnitude. The most serious impacts can occur where natural forests are cleared for plantation establishment. The negative impacts of site preparation include not only the loss of existing vegetation and the ecological, economic and social value it may have, but also environmental problems associated with land clearance: increased erosion, disruption of the hydrologic cycle, compacting of the soil, loss of nutrients, and a resulting decline in soil fertility. Logging affects wildlife through the destruction of habitat, cutting up of migration corridors, increased poaching, problems of noise and pollution, and hydrologic changes affecting aquatic systems.

Processing requires large quantities of water. Water and soil pollution problems can be associated with plantation operations (use of pesticides and herbicides), processing operations primarily stemming from the oxygen depleting effects of mill wastes on aquatic life (organisms, fish, mangroves, etc.), and the contamination of drinking water supplies.

The socio-economic benefits of oil palm plantations include employment generation (more jobs than in natural forest management but less than in agriculture) and often some improvements in local infrastructure and social services. However, there is also potential for negative impacts, particularly in remote areas. These can include problems related to labourers being brought in from the outside the project area: over-loading of existing local infrastructure and social services, social and perhaps racial tensions, increased health problems, etc. In Ratanakiri and other provinces of Cambodia where palm oil developments are most likely to occur, potential effects of these developments on the way of life and welfare of local indigenous communities is of particular concern. Sizeable oil palm plantations can pose problems related to land tenure and land and resource use rights. Proponents should assess and present plans to mitigate these potential effects.
4. FORMAT AND CONTENT OF IEE AND EIA REPORTS

*Initial Environmental Evaluations* (IEEs) and *Environmental Impact Assessments* (EIA) may be required for a new project to be developed or for the expansion of an existing project.

IEEs should be prepared for projects which have been identified through *screening* as requiring further assessment of potential impacts. An IEE should be prepared no later than the *pre-feasibility stage* of the proposed project. The IEE should present a summary description of the significant potential impacts and describe the proponent’s proposals for avoiding or mitigating and monitoring them. Detailed project and impact assessment information should be contained in appendices or supporting documents.

EIAs should be carried out for projects which have been identified through *screening* or through an *IEE* as requiring *detailed* assessment. For example, a large project, or one proposed for an area which is environmentally sensitive, may require an EIA. EIAs should be prepared no later than the feasibility and design stages of a project. They should contain detailed analysis of potentially significant impacts (identified in screening or in an IEE) and present complete *environmental management plans* for impact mitigation, monitoring and follow up. If an IEE has already been prepared, the information it contains may be useful for the EIA.

EIAs should focus on project information, issues, summary of impact analysis, conclusions and recommended actions. Detailed information should be included in appendices. If the project is large in scope and has the potential for significant impacts on the natural or socio-economic environments, it will be necessary to undertake base line environmental and socio-economic studies, and other specialised research, to support the impact analysis. This work should be presented in separate volumes.

IEE and EIA reports should be organised as follows:

- General Information
- Description of the Project
- Description of the Operation
- Description the Environment
- Potential Impacts on the Environment
- Public Involvement
- Conclusions and Recommendations

Suggested tables of contents for IEEs and EIAs are contained in Appendix I to this document.
5. GENERAL INFORMATION

Provide brief information on each of the following items:

Project title and nature:
Indicate whether raw or refined product, for secondary products; whether for export or domestic consumption; etc..

Name and address of the proponent:
State who is responsible for the project (private company or government).

Contact details:
Name and telephone number(s) of the proponent

Status of the Project:
Describe briefly the:
• project's history;
• current stage of the project planning and development (pre-feasibility, feasibility, construction, etc.);
• studies commenced or planned, proposed targets for planning;
• site or area development and construction.

Process used to compile this Assessment:
Identify the prime consultant(s) (if any) engaged to assist in the preparation of the IEE or EIA. Advise if consultant(s) may be contacted for additional information or clarification about any environmental aspect of the project.

Scope of the IEE or EIA:
Describe briefly which subjects are focus of the study:
• project and related activities;
• types of effects and impacts;
• human and environment resources.

Governmental approvals, regulations and licences required by the project:
Describe all approvals, licences, regulations and standards affecting the project and detail all approvals and licences granted by relevant government departments and agencies at all levels (i.e., international, national, regional and local levels). Identify parties involved in the approval process for the project.

As no formal EIA requirements exist at represent IN Cambodia, describe interaction and consultations with relevant government department and agencies (national and provincial) pertaining to the environmental aspects of the project.

Other relevant information:
Describe:
• the importance of the project to the country/region/province/local area.
• any historic decisions, plans, documents, regulations or laws which have had a relevant influence on the decision to propose the project in the present form.
• any other pertinent background information
6. DESCRIPTION OF THE PROJECT

The purpose of and need for the project: Highlight the social, economic and environmental benefits expected to result from the project as well as who would benefit.

Project location and site description:
Provide information sufficient for precise location of the site on a map. Alternatively, a map may be included to show general location, specific location, project boundary and project site lay out. The project infrastructure should be shown in relation to existing topographic features (e.g. rivers), population centres, existing infrastructure and other relevant land uses such as wildlife reserves and archaeological sites.

Needs and plans for resettlement:
Describe what requirements there will be to relocate and resettle people living on or near the project site. Details should be provided in the description of the project operations.

Project alternatives:
Describe what principal alternatives to and within the project were considered and why they were rejected. Possible alternatives could include:
- no project: what will happen if the project does not take place.
- alternative locations.
- alternative construction techniques and phasing,
- alternative designs and processes.

The advantages and disadvantages of principal alternatives should be explained in terms of environmental impact and environmental protection, capital and operating costs and monitoring requirements.

Proposed schedule for approval and implementation.

Information on future planned or possible expansion of the project.

Planned or anticipated supporting developments:
Describe the relationship of the project with planned or anticipated surrounding development including connected facilities and services and those of other related projects or activities not the responsibility of the proponent.

7. DESCRIPTION OF THE OPERATION

Provide a reasonably detailed description of all of the important project activities to enable clear understanding of the project and its operations. Include information on the design of facilities as well as their operation. Information should be provided on the relevant topics shown on the following checklist and on the matrix provided in Appendix II (both should be adapted for the project being assessed):

7.1 Site Preparation Activities
Provide a map and diagram including location, land clearing, natural resources, etc.. Describe the site preparation activities which could affect the environment including:
- site selection
• land clearing
• temporary worker housing
• use of fertiliser, pesticides and herbicides
• irrigation
• equipment used
• storage of materials
• resettlement of residents: a detailed resettlement plans should be appended to the IEE or EIA

7.2 Construction Activities
Describe the construction activities which could affect the environment including:
• material storage
• facility construction
• roads and infrastructure
• process mill and other buildings and facilities

7.3 Operation
Describe all operation activities which could affect the environment including:
• employment: number of workers to be employed; skills required; general terms and conditions of employment; training to be provided; proportion of employees from local area
• material handling: the type and source of service, operational or production materials to be used and their proposed storage
• water consumption and source
• use of fertiliser, pesticides and herbicides: describe types, quantities and frequencies
• milling and processing: the process to be used for any production.
• irrigation
• eradication of weeds
• waste generation and management: details concerning the types and nature of any discharges or emissions; proposals to control discharges and emissions including plans for any discharge storage, treatment and/or disposal; the nature of waste material and proposals for its storage, treatment and/or disposal.
• product transportation

7.4 Abandonment, Closure and Restoration
Describe site restoration plans, if appropriate, and possible future developments on the project site:
• site restoration
• staff retraining
• staff relocation

8. DESCRIPTION OF THE ENVIRONMENT
Describe the current environmental conditions at the project site and in the project vicinity. Include all environmental aspects which might be affected by the project. Use maps and diagrams as appropriate. Information should be provided on the
relevant topics shown on the following checklist and on the matrix provided in Appendix II (both should be adapted for the project being assessed):

8.1 General Description of the Project Site
Describe the overall condition of environmental resources, the current pattern of land use (e.g., farming, rice paddy, sustainable forestry, etc.), and any special features including buildings and natural or cultural heritage features.

8.2 Physical Resources
- air quality at ground level
- climate: precipitation, evaporation, temperature and wind direction.
- noise
- topography and geography, including soils - physical, chemical and geotechnical characteristics, geologic, drainage patterns, landslide, subsidence, erosion, etc.
- land capability
- groundwater: describe ground water situation; this may include average depth, seasonal fluctuations, direction of flow, rates of flow, quality and uses.
- surface water: physical, chemical, biological and flow characteristics (including seasonal variations); watersheds; appropriate water quality standards

8.3 Ecological Resources
Classification and general description of the character of the ecology on or around the project site:
- important flora and fauna (aquatic and terrestrial), their habitats, distribution and relationships to other species; rare and endangered species; ecological succession; existing environmental stresses.
- important functional relationships among species
- state of biodiversity
- ability of the environment to recover from stresses
- proximity of any protected areas, wildlife reserves, etc.

8.4 Social and Economic Conditions
Population and communities
Describe the population and communities of people living around and on the proposed project site and who will be affected both directly and indirectly by the project:
- the location of communities and dwellings should be presented in map form
- demography: population composition and distribution; settlement patterns; cultural and ethnic diversity; socio-economic conditions (including employment patterns and levels)
- nutrition and health conditions
- food production
- existing social services and their capacity to absorb change
- cultural values
Local Resources for Human and Economic Development
Describe the human activities which take place on or around the project site and which are important for human and economic development. Examples of possible activities are:

- land use: extent of present uses (agriculture, forests, commercial, industrial, residential, etc.);
- use of water resources (water supply, irrigation),
- historic, archaeological, scenic, cultural, religious, tourist and natural sites and landmarks (cite registries of historic places archaeological surveys)
- recreational resources and development
- aesthetic values

Infrastructure
- existing and current transportation routes and corridors (road, rail, water, air)
- utilities (water supply, sewerage and drainage) and transmission lines
- facilities and services including education, shopping religious, health, recreational,
- tourist facilities

Future Conditions
- Are there any major development proposals on or in the proximity of the site? Are any other changes expected in the above mentioned human activities and the use of local resources? (this refers only to changes, which are not a result of the proposed project).
- Are there any land use planning regulations which affect the site or adjoining areas? If yes, give details.

9. POTENTIAL IMPACTS ON THE ENVIRONMENT

9.1 Scope of the Assessment
Describe the geographic area over which, and the time-frame within which, the potential impacts are considered. These limits on the assessment should relate to the project and environmental descriptions presented in the preceding sections.

9.2 Description of Impacts
Using the checklists provided above and the matrix provided in Appendix II, identify which project activities are likely to have significant effects on which aspects of the environment. Each impact so identified should be described in terms of its size, scale and duration (short-term versus long-term).

In addition, for each impact describe the proposed:
- mitigation measures for avoiding or minimising each significant negative impact;
- compensation for unavoidable negative impacts;
- measures for enhancing potential positive impacts; and
- monitoring of impacts.

Potential impacts should be quantified wherever possible. The description of impacts should cover all phases of the project:
• Site Preparation
• Construction
• Operation
• Abandonment, Closure or Restoration

Where the project would result in the irreversible curtailment of the potential uses of the environment this must be clearly stated and quantified. For example, site clearing and roads which cut through stream corridors and wetlands can result in irretrievable damage to these ecosystems. Other impacts that may be irreversible include alteration of historic and cultural sites.

Human and quality of life gains resulting from the project due to utilisation, alteration, and impairment of the natural resources can also be described. This will allow fair evaluation of the net worth of the project to be made.

9.3 Environmental Management Plan
Describe how the mitigation measures and monitoring work identified in the previous section will be implemented. This plan should include information on work programmes, budget estimates, schedules, staffing and training requirements and other measures to implement the plan. If there is a substantial cost involved in mitigation, then, alternative measures and costs should be explored.

The plan should provide for periodic progress reports to be furnished by the proponent which will assure the MOE that all necessary environmental protection measures will be carried out on an ongoing basis.

For EIAs, details on the financial and management capability of the proponent to implement the plan (including staff skills, tools and equipment), and to ensure that proper measures can be taken for managing unforeseen impacts, should also be described.

10. PUBLIC INVOLVEMENT
Present a summary of all public involvement activities undertaken in the pre-feasibility and feasibility stages of the project. This should include a summary of scoping issues, any public meetings held, a list of persons or organisations receiving the IEE/EIA and draft reports, press releases, and community/interest concerns.

11. CONCLUSIONS AND RECOMMENDATIONS
Summarise the conclusions of the IEE or EIA including:
• any need for further assessment. IEE reports should recommend whether further environmental assessment is or is not needed. If there is no need for further study, the IEE becomes the final assessment for the project. If further study is required, terms of reference should be presented for follow up in an EIA.
• the potential benefits and disadvantages of the project. Can the benefits to the Cambodian community be said to offset any unavoidable permanent or temporary adverse environmental effects?
• an explanation of how unavoidable environmental impacts have been minimised or offset and compensated for.
• a description of the use of any irreplaceable resources.
• the environmental management plan.

Detail potentially beneficial; effects on the environment and include any aspects which may enhance the environment. Identify and describe any project component that could be modified to enhance the environment.
APPENDIX I

SUMMARY OF IEE REPORT

The IEE Summary should include the following. A suggested number of pages is shown in brackets but should not be considered a limit.

1 INTRODUCTION (1.5 page)
2 DESCRIPTION OF THE PROJECT (2 pages)  
   *general and detailed*
3 DESCRIPTION OF THE ENVIRONMENT (2 pages)
4 POTENTIAL IMPACTS OF THE PROJECT ON THE ENVIRONMENT (4 to 6 pages)
5 PUBLIC INVOLVEMENT (1 page)
6 CONCLUSIONS AND RECOMMENDATIONS (1 to 2 pages)

SUMMARY OF EIA REPORT

The EIA Summary should include the following. A suggested number of pages is shown in brackets but should not be considered a limit.

1 INTRODUCTION (1 to 2 pages)
2 DESCRIPTION OF THE PROJECT (4 to 8 pages)  
   *general and detailed alternatives*
3 DESCRIPTION OF THE ENVIRONMENT (4 to 8 pages)
4 POTENTIAL IMPACTS OF THE PROJECT ON THE ENVIRONMENT (4 to 8 pages)
5 PUBLIC INVOLVEMENT (2 to 4 pages)
6 CONCLUSIONS AND RECOMMENDATIONS (2 to 4 pages)
### Appendix II

#### ENVIRONMENTAL INTERACTION MATRIX FOR PALM OIL DEVELOPMENTS

<table>
<thead>
<tr>
<th>ENVIRONMENTAL COMPONENTS</th>
<th>PHYSICAL</th>
<th>ECOLOGICAL</th>
<th>SOCIAL, ECONOMIC</th>
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<td>Land</td>
<td>Water</td>
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<tr>
<td>PROJECT ACTIONS</td>
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<tr>
<td>SITE PREPARATION</td>
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<td>Worker Housing</td>
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