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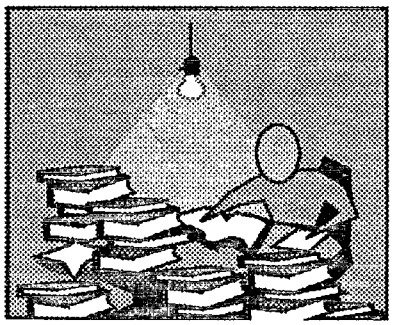
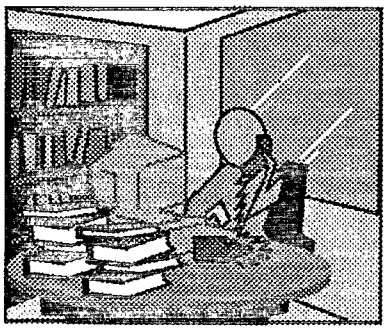
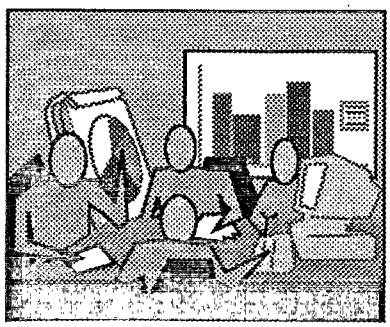
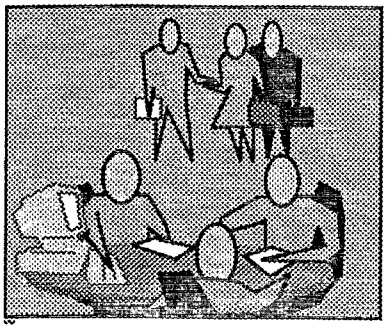




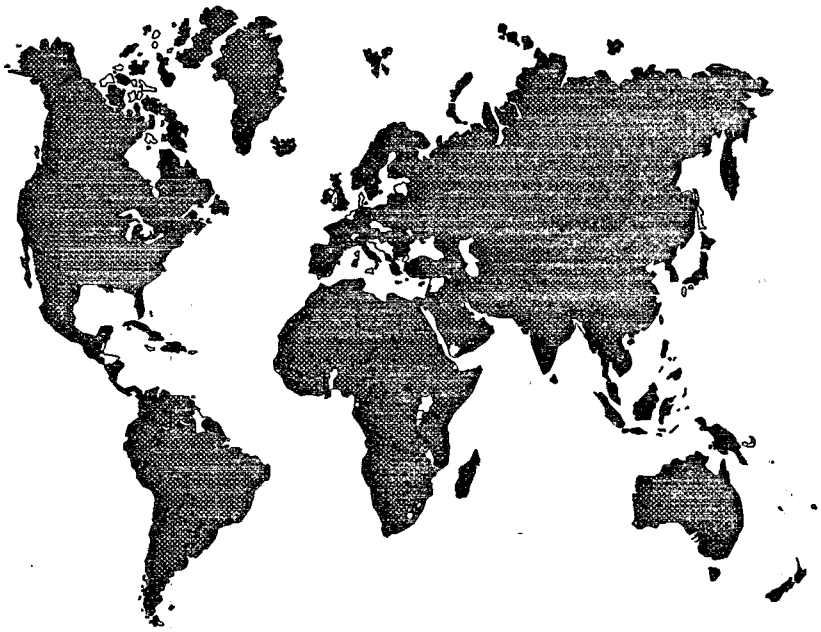




STUDENT TEXT FOR

PRINCIPLES OF ENVIRONMENTAL IMPACT ASSESSMENT REVIEW

July 1998



U.S. Environmental Protection Agency
Office of Federal Activities (MC 2251-A)
401 M Street, S.W.
Washington, D.C. 20460

DEDICATION TO REVIEWERS

To reviewers of proposed projects, policies, or programs.

Who facilitate informed decision-making and follow up to help ensure that all opportunities for avoiding, minimizing, preventing, eliminating, reducing, restoring, and/or compensating for adverse environmental and socioeconomic impacts and enhancing the environment are pursued.

Who take steps to affect environmental impact assessment documents to provide information which is complete, accurate, and to identify the significant environmental, social and economic issues.

Who take steps to maintain the integrity of the environmental impact assessment process by ensuring that the requirements of the environmental impact assessment process have been met, and that the perspectives of affected stakeholders and interested parties have been considered.

Who bring to their jobs professionalism, objectivity, and a focused, systematic, interdisciplinary approach despite the strongly held views of those involved with the project, policy or program.

Who are resourceful in drawing upon multiple sources of information and disciplines including knowing how to find relevant documents, networks of experts, and background information on the affected communities and environment.

ACKNOWLEDGMENTS

This stand-alone text "Principles of Environmental Impact Assessment Review" and the associated Resource Manual and Facilitator's Manual constitute the materials for the international training course: "Principles of Environmental Impact Assessment Review". We would like to acknowledge the many individuals who contributed to the evolution and unique focus of this material.

First, we would like to acknowledge government officials in Mexico and Brazil who identified the need for further training to complement USEPA's first international course on "The Principles of Environmental Impact Assessment." They motivated the development of a sequel course by USEPA which in working with them has evolved from a potential course on "tools and techniques of environmental impact assessment" to its present form offering a unique perspective and previously unmet need to address "reviewers" of environmental impact assessment. The comments of Mexican officials who participated in a pilot in Monterey, Mexico in September of 1996 helped to further direct the course to utilize actual environmental impact assessments as the basis for the course and to enhance the technical content of the material. The course will continue to be enriched over time as we strive together to best meet the needs of colleagues around the globe.

We want to particularly acknowledge the contributions of Hector Pena of USEPA Region VI and Ed Yates, then of Region IX who facilitated the first pilot delivery in Monterey Mexico along with Mexican colleagues and who made key suggestions for improving the course. John Gerba and Arthur Totten in the Headquarters Office of Federal Activities served as project managers for this first phase of the course's development. Early work was funded by USAID through Pat Koshel and Cam Hill Macon of USEPA's Office of International Activities.

Second, we acknowledge the team of experienced USEPA reviewers who spent many hours identifying the approaches they took to the job of the "reviewer," identifying what might be good "case studies", and serving as "guinea pigs" for two successive pilots of further course developments. Special thanks to the insightful comments of Patience Whitten, Tim Timmermann of Region I; Marie Jenet of Region II; Francesca di Cosmo, Danielle Algazi, and Regina Poeske of Region III; John Hamilton and Ernesto Perez of Region IV; Mike MacMullen and Chris Christienson of Region V; Hector Pena of Region VI; Dewayne Knott and Cathie Tortorici of Region VII; David Schaller, Cindy Cody, Steve Moores, Alicia Aalto, and Wes Wilson of Region VIII; David Mowday of Region IX; Joan Cabreza, Wayne Elson, and Rene Fuentes of Region X; Anne Miller, Deputy Director of Headquarters Office of Federal Activities (OFA), Jim Serfis, of the NEPA Compliance Division in OFA for his instructive suggestions on categorization of biological resources, Cheryl Wasserman Associate Director, Headquarters OFA; and Gene Kersey, formerly of EPA Region VIII and now of the U.S. Department of Agriculture.

A note of thanks to Steven Moores whose imaginative illustrations during the August 1997 pilot inspired the use of logos for the "roadmaps" and "tools and techniques" guides throughout the course,

to Gene Kersey for providing the electronic versions of the logos and to Ron Slotkin who helped develop the electronic version of my rendition of a road map to embellish a packaged "logo" for use in the course. Many thanks also to Ron Slotkin who helped develop the final graphic depiction of the EIA process flowchart out of my early prototypes.

Third, a special note of thanks to Arthur Totten who put together the accompanying Resource Manual based upon the USEPA Sourcebook for environmental impact assessment and various USEPA and World Bank guidance documents. The Sourcebook, prepared in 1993, was the result of a contract between the EPA Office of Federal Activities and Oak Ridge National Laboratory's Environmental Sciences Division. Its development was overseen by a panel of worldwide experts representing most aspects of environmental assessment. It contains a compilation of articles and collective experience in the preparation of environmental impact assessments.

The interactive CD-ROM which is disseminated to participants as part of this training builds on the sourcebook materials and original "Principles of Environmental Impact Assessment training course." It was put together by a team from US EPA Region V and Purdue University using an actual case example in Alaska to bring the materials to life. We acknowledge this important contribution by Dale Luecht, Robert Beltrain, Mike Bland and Alfred Krausse of USEPA Region V.

The "Principles of Environmental Impact Assessment Review" text, Resource Manual and Facilitator's Manual for the associated training course was developed under the technical direction and co-authorship of Cheryl Wasserman, Associate Director for Policy Analysis in USEPA's Office of Federal Activities, Office of Enforcement and Compliance Assurance with the assistance of Science Applications International Corporation (SAIC) Project Manager Kathleen Harrigan along with Kenneth Pruitt, Gregg Mallon, Takisha Cannon under contract number 68-W7-0050 and technical materials developed by Susan Moore, Andrew Warner, and Kellie DuBay of SAIC under prior contract, 68-W2-0026.

Finally, I would like to acknowledge the commitment of William Dickerson, Director of the Office of NEPA Compliance Division for continued support for the course development as testament to our commitment to those who have environmental impact assessment review jobs both within the United States and around the world.

Cheryl Wasserman
USEPA, Manager for Domestic and International Capacity Building in Environmental Impact Assessment

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PREFACE

Reviewers of Environmental Impact Assessments (EIAs) play an essential role in helping EIA analysis and documentation, as well as the entire EIA process, achieve its goals -- enabling decision makers to better integrate environmental, economic and social concerns for proposed actions. Despite the importance of the function of the independent reviewer in this process, there is little in the literature about approaches to the job or about how to do the job well. Most courses and text material on EIA are geared to preparation of environmental impact assessments. There is a presumption that review of EIA is just the mirror image. In developing this course we have found that this is not the case. We have canvassed experienced reviewers throughout the U.S. with over 25 years of experience to develop some basic principles which would be applicable in any setting.

The need for this text and course for reviewers actually grew out of USEPA's experience delivering its predecessor course on the *Principles of Environmental Impact Assessment.* The *Principles of Environmental Impact Assessment* was one of the early environmental management courses developed by the Agency for international use. The "Principles" course was developed in consultation with government officials and development banks around the world at the request of environmental agencies in Central and Eastern Europe who were concerned about the devastating effects of industrial operations on the environment and human health. These agencies were interested in preventing new environmental problems and strengthening public participation in the environmental impact assessment process. Since its delivery in Europe, the *Principles of Environmental Impact Assessment* training course has been successfully delivered in dozens of countries around the world and translated into many languages.

The *Principles of Environmental Impact Assessment* course is designed around well-established international frameworks for environmental impact assessment. In the course, participants are encouraged to think about the reasons behind different elements of environmental impact assessment. By allowing participants to reason and derive certain parts of the environmental impact assessment process on their own, citizens, members of academic institutions, and policy-makers complete the course with a deeper appreciation for the elements of environmental impact assessment.

Participants in Mexico and Brazil specifically requested more training on tools and methods for conducting and preparing an actual environmental impact assessment. In response, EPA began to develop such a course, but quickly realized that a one-week course was insufficient to make the participants experts in subjects such as marine biology, air pollution and monitoring, or environmental engineering. Environmental impact assessment is interdisciplinary, and each individual discipline can require lengthy course work and years of experience to master. Even if it were possible to fit much of the relevant technical information into a week-long course, EPA decided that making the course too technical would miss other important needs of the

participants, who wanted to do a better job of reviewing EIAs.

This led EPA to focus instead on the special needs of the environmental impact assessment *reviewer*. Without being experts in all of the various disciplines, reviewers must be able to ask the right questions about the environmental impact assessment document and of the experts chosen to prepare it. The reviewer should be able to pull together information from the various disciplines in a way that will aid decision-makers in the environmental impact assessment process. Most countries have adopted requirements for the EIA process to better plan for and avoid adverse and costly environmental impacts and, through status review and systematic assessment, to identify alternatives that may better mitigate environmental and social impacts.

This text, as well as the course, presents technical information and review guidance at a sufficient level of detail to instruct individuals who review environmental impact assessment documents and who may not be experts in all fields. The text emphasizes the *process* of environmental impact assessment review, as well as the substance that a reviewer can expect to find in environmental impact assessment documents.

The text discusses the topics of how to be an effective reviewer in different review situations, and in different personal, legal, and institutional contexts. It presents "road maps" for the review of each part of an environmental impact assessment document. It also discusses tools and techniques available for the development of an environmental impact assessment and for the review of the document. Finally, another important part of this text and the course is helping reviewers discover what can go right and what can go wrong in the review process.

This text is one of several resource and training materials developed by USEPA to build capacity for effective EIA. It can be used as a stand-alone resource; it is also designed to accompany the course *Principles of Environmental Impact Assessment Review along with a resource manual, CD-ROMs and example EIAs.*

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1. INTRODUCTION 1-1

1. INTRODUCTION

This text is designed to provide practical guidance to professionals who expect to be involved in the review and evaluation of environmental impact assessments. It is geared toward professionals who have a working or academic background in environmental protection issues, sciences or policies, but who may or may not have previous experience reviewing and commenting on the results of environmental impact assessments produced by others. This text has been developed as a companion to a four-day course on review of environmental impact assessments (*Principles of Environmental Impact Assessment Review)*. It is meant to be applicable to a range of legal, institutional, and cultural settings, and for use by reviewers in any country where environmental impact assessments are conducted.

Generic terms are used in this text. The general term "environmental impact assessment" refers to both a decision-making process and document to assist in making informed decisions to better integrate economic, environmental and social concerns. It involves assessing the environmental impact, broadly defined, of a proposed project or action and its reasonable and feasible alternatives. The same process can also apply to the evaluation of a proposed environmental program or policy. The environmental impact assessment process starts with a decision whether to proceed with the environmental impact assessment process. This decision is based upon requirements of law and policy and other criteria and usually involves some initial environmental impact assessment to assess the potential for significant impact. If the initial environmental impact assessment review indicates that the threshold for significant potential impacts has not been crossed, the results should be summarized and documented and the proposed project allowed to proceed to the implementation phase. If the initial process identifies significant potential impacts, a full environmental impact assessment process is carried through and an environmental impact assessment ***document*** must be prepared. National laws, policies, procedures and/or criteria differ as to types of activities or impacts that are considered to be significant for this purpose.

- Environmental Impact Assessment is both a document and a process.
- EIA is usually required selectively where the process can have the most impact.
  - If no significant potential impacts are identified through the initial environmental impact assessment, most countries allow the project to proceed without formal EIA.
  - If significant potential impacts are identified by the initial EIA or the proposed action, covered by law or policy, is sufficient to trigger the EIA process, then an environmental impact assessment document is usually required.

In accordance with internationally accepted principles, a draft environmental impact assessment document presents the results of assessments of the potential impacts of a proposed project and its reasonable and feasible alternatives (project or other) on the natural and human environments. It should do so in a way that fosters better informed decision-making by project proponents as well as by government and the general public. Alternatives are simply different approaches to the proposed project for achieving the same purpose and need, or objectives, of the proposed project. An environmental impact assessment document establishes a baseline description of the environmental setting in which the proposed project is to be located, and assesses the potential impacts of alternatives, including a no-action

alternative, on that baseline. This is done to compare and contrast the beneficial and adverse impacts among alternatives in order to identify the preferred alternative(s). Depending on the characteristics and scale of a proposed project, an environmental impact assessment may include studies of the weather, vegetation and wildlife, seismic activity, human health, employment and urban migration. In essence an environmental impact assessment covers physical, biological, social, economic, and cultural resources.

The environmental impact assessment process also includes stakeholder views to solicit all relevant perspectives on the assessment of impacts and consideration of alternatives.

Review of the environmental impact assessment document is conducted by trained professionals independent of those who prepared the original document. The purpose of an independent review process is to prepare an unbiased evaluation of: 1) completeness and adequacy of the environmental impact assessment document; 2) adherence to required procedures for analysis, format, and stakeholder involvement; and 3) environmental acceptability or conditions for environmental acceptance of a preferred alternative, as well as to identify whether or not the implementation of any other alternative—included or not included in the document—would be more environmentally preferred than the one selected by the project proponent or those responsible for preparing the environmental impact assessment document.

This text is based upon internationally accepted frameworks and principles of environmental impact assessment. Nevertheless, environmental impact assessment processes and documents are different in various countries. In the United States, for example, the environmental impact assessment documents the environmental, physical, social, and economic impacts of the proposed project and project alternatives so decisions are based on a complete understanding of their ramifications. In some other countries, the environmental impact assessment covers only a single alternative. Similarly, countries differ widely in their requirements for stakeholder involvement. Some provide, while others do not provide, the opportunity for public participation.

The remainder of this text is comprised of three chapters and five appendices which focus on the environmental impact assessment process and environmental impact assessment documents:

- The environmental impact assessment process
- The reviewer's responsibilities
- Review of each element in an environmental impact assessment document
- A detailed review checklist
- Other valuable reviewer resources.

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2. THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

Environmental impact assessment is a process used in many countries to ensure that environment-related factors are included in decision making processes for projects that may affect the environment. The process is also intended to ensure that there is an opportunity to avoid or mitigate potentially adverse environmental impacts and to identify opportunities for beneficial impacts. The process begins with the decision of whether to proceed with an environmental impact assessment. If potential impacts may exceed acceptable impact thresholds, the process then proceeds to documentation and analysis in draft and final environmental impact assessment documents that are used to support decisions on project alternatives, mitigation measures, and post-decision monitoring and follow-up. An environmental impact assessment is a detailed, systematic, objective, and reproducible assessment and comparison of the proposed project and its reasonable and feasible alternatives. A graphic representation of the environmental impact assessment process is presented on the following page.

- The environmental impact assessment process includes:
  - Decision to proceed with environmental impact assessment
  - Preparation of a draft environmental impact assessment
  - Preparation of a final environmental impact assessment and decision making
  - Post-decision monitoring and follow-up

From a developer's point of view, a project begins in three stages: design, detailed engineering and site preparation, and construction. An environmental impact assessment should be initiated at project conception before beginning detailed engineering or site preparation. More and more industries and government agencies are beginning to evaluate both the existing environmental setting and future environmental impacts as part of project identification and design to avoid costly environmental impacts and involve the affected public in project design.

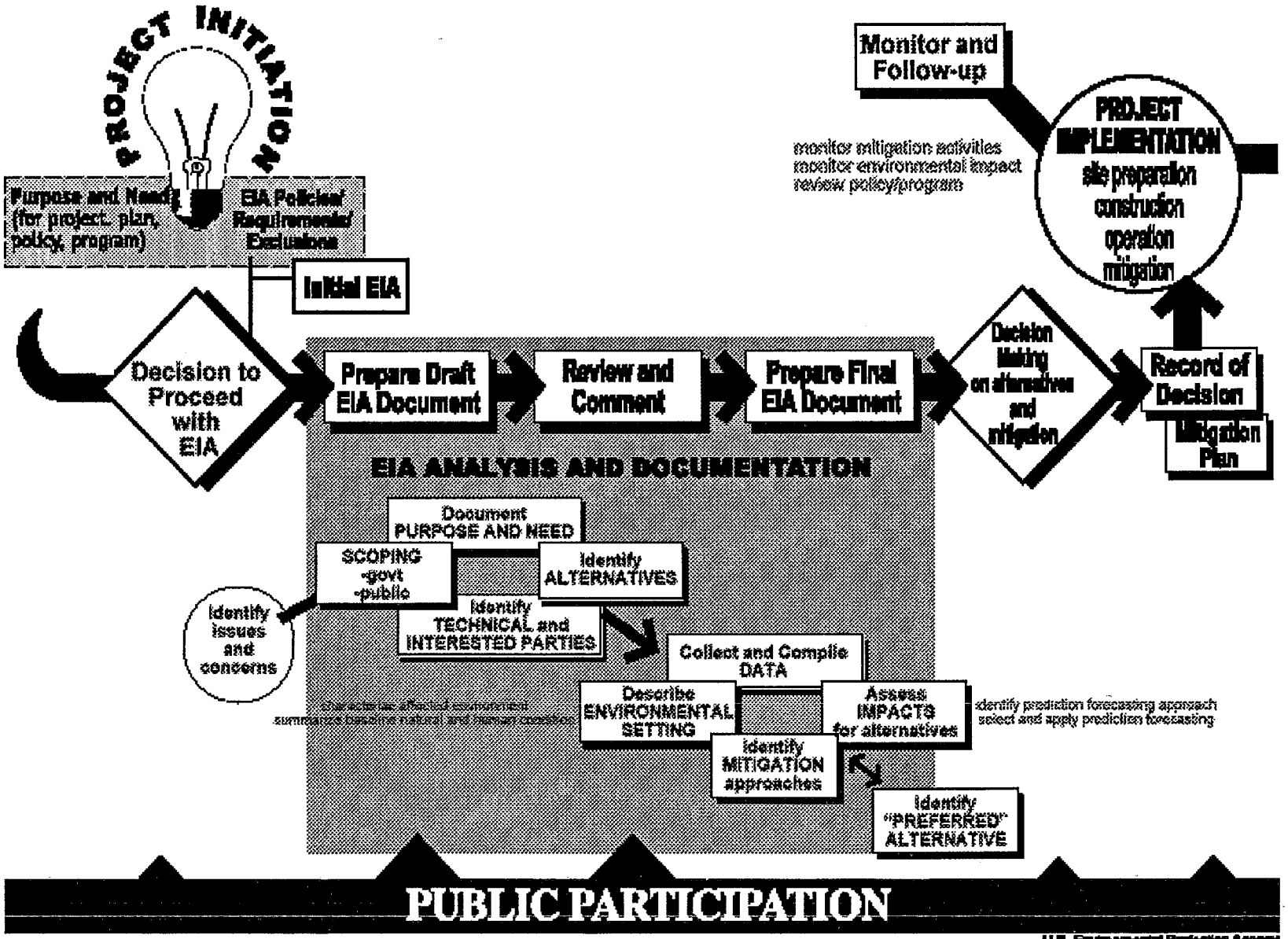
- An environmental impact assessment should be initiated at the <u>inception</u> of a proposed project and prior to site preparation, while it is still possible to pursue alternative courses of action and prior to site preparation.

Public participation, including interested and affected parties (i.e., stakeholders), and interagency consultation are critical to the success of environmental impact assessment. In the United States and other countries, the public and government agencies typically participate in open meetings on the two types of major documents generated during the environmental impact assessment: 1) initial environmental impact assessment documents that indicate whether or not there is the potential for significant impacts, and 2) draft and final environmental impact assessment documents. Traditionally, the public has become involved during review of draft environmental impact assessments. Public involvement limited to the final environmental impact assessment process has contributed to public opposition to proposed projects and costly delays. As a result, initial public involvement is desirable during the scoping phase of the preparation of a draft environmental impact assessment to help identify significant issues, alternatives and sources of information on the environmental setting. After completion of the draft environmental impact assessment, public comments are solicited and incorporated into the final environmental

Public Participation: who to include...
- Businesses
- Local government
- Citizens
- Nongovernmental organizations

...and when to include them
- During scoping phase to identify significant issues and alternatives.
- During review of draft environmental impact assessment.
- During review of final environmental impact assessment document.
- During selection of preferred alternative and mitigation measures.
- During monitoring and follow up.

The Environmental Impact Assessment Process



U.S. Environmental Protection Agency

impact assessment. Public input also is considered during decision making on the selection of the preferred alternative and mitigation measures and should be considered in post-decision monitoring and evaluation stages.

The remainder of this chapter briefly presents the environmental impact assessment process, including the decision to proceed with an environmental impact assessment, preparation of the draft and final environmental impact assessments, and post-decision monitoring. Public and government involvement are highlighted throughout the discussion.

2.1 Decision to Proceed with Environmental Impact Assessment

In countries where government agencies are responsible for preparing environmental impact assessments, such agencies must decide whether to proceed with environmental impact assessments for proposed projects that may pose a risk of significant environmental impacts. Not all proposed projects have the potential for environmental impacts, and those without this potential do not require a decision about whether to proceed with environmental impact assessment. Proposed projects that do carry the potential for environmental impacts initially undergo an internal agency decision process to determine whether potential impacts would be significant:

- If the potential impacts are not significant, a report is prepared providing the results of the decision to proceed. This report is made available to the public and government agencies for review.
- If the potential impacts are significant, an environmental impact assessment is often required.

The Environmental Impact Assessment Process in the United States

In the United States, the decision to proceed process often includes a report called an Environmental Assessment. Following public review and comment, if the determination is still that there is no significant impact, a "finding of no significant impact" (FONSI) is issued.

In the United States, the environmental impact assessment document is referred to as an "environmental impact statement" (EIS). After public review and comment, a "record of decision" (ROD) follows an environmental impact statement.

The initial step in the process typically includes analyses of environmental conditions and the potential for significant environmental impacts. This may include discussion on the presence of critical habitat for an endangered species, important historical sites, or an active

earthquake fault, as well as other physical, hydrologic, biological, land use, access, economic, and air and water quality parameters.

2.2 Draft Environmental Impact Assessment Document

While the procedural and substantive activities involved in developing the draft environmental impact assessment vary by country, the following major elements of the environmental impact assessment preparation process are generally applicable: 1) scoping to identify all potential significant issues that the environmental impact assessment should address; 2) documenting the purpose and need; 3) development of alternatives; 4) describing the environmental setting; 5) assessment of the potential impacts of alternatives; 6) identification of mitigation approaches; 7) identification of the preferred alternative; and 8) review of the draft environmental impact assessment document.

The draft environmental impact assessment analysis and documentation process:

1) Scoping to identify significant issues
2) Documenting purpose and need
3) Development of alternatives
4) Describing the environmental setting
5) Assessment of potential impacts of alternatives
6) Identification of mitigation approaches
7) Identification of the preferred alternative
8) Review of the draft environmental impact

2.2.1 Scoping to Identify Significant Issues

Scoping is the process used to identify significant issues and reasonable and feasible project alternatives and to help focus available resources on the assessment of those issues and alternatives. It should be remembered that an environmental impact assessment is not an opportunity to conduct unlimited academic or applied research. An environmental impact assessment should provide the best available answers to specific questions and should seek to do so in a cost-effective manner. Scoping meetings may be held internally, involving technical experts, or externally to obtain public input. The first step in the process is to develop information on the resource to be affected, a simple list of all potential concerns associated with the proposed project and any possible project alternatives. It is important to note that impacts are not quantified during scoping. When completed, the list is examined carefully to identify any potentially significant issues. The significance of issues is generally based on the geographical extent, duration, magnitude, and public perception of the impacts. Further information on determining the significance of environmental impacts is provided in Appendix C.

Why is scoping important?

- To focus available resources in a cost-effective manner on the most significant issues
- If part of scoping, public participation is an important source of information about potential issues related to the proposed project

Public participation is an important source of information about potential issues related to the proposed project. An important part of scoping is to identify all interested parties relevant to the process. Gaining the public's opinion early helps the project proponent avoid future conflict. In the past, project proponents were concerned that public participation would slow project development. The proponents attempted to push projects through the approval process with minimum public involvement. While this strategy was successful in some cases, it frequently failed because without public participation, proponents often missed significant social and environmental issues. Thus, both governments and project proponents have found that it is very expensive to address significant issues after the proposed project has begun its detailed engineering phase

and have recognized the advantage of identifying issues as early as possible in the proposed project's design phase.

2.2.2 Documenting Purpose and Need

Environmental impact assessment documents typically begin with an introduction describing the purpose of, and need for, the proposed project. The statement of purpose and need is important because it provides the framework for identifying project alternatives. For example, a project to build a new highway may be proposed because the existing highway is too narrow and cannot accommodate the volume of traffic. The need for the project is a decrease in the amount of time drivers spend in slow traffic. The purpose, or goal to be met in addressing the need, is to build a new highway of adequate width to accommodate projected traffic flow in the future at sufficient travel speeds. The project alternatives could include various locations for the proposed highway, construction of additional mass transit capacity to avoid building the highway, designation of high occupancy vehicle (HOV) lanes, or a combination of these alternatives. All of these alternatives address the need for the proposed project. Some of them address the purpose better than others. All reasonable alternatives that fulfill the purpose and need should be evaluated in detail. The more alternatives, the greater the possibility of avoiding significant impacts.

- The purpose and need must be a clear, objective statement of the rationale for the proposed project
- The statement of purpose and need provides the framework for identifying project alternatives

Input on the purpose and need should be obtained from stakeholders, including businesses, citizens, local government, and nongovernmental organizations. This enables the project proponent to understand and consider the priorities and concerns of the local community and government agencies early in the planning process, which could help to avoid future delays.

2.2.3 Development of Alternatives

The environmental impact assessment may or may not contain a range of alternatives developed to fulfill the purpose and need of the proposed project. Some countries require a range of alternatives to be presented, while others require that only the proposed project be presented. Early in the planning process, the project proponent usually identifies several alternatives, including a proposed alternative. These alternatives are sometimes subjected to an evaluation process to help identify and refine additional reasonable alternatives.

Alternatives often involve different locations for the proposed project, new or different technologies, and/or completely different approaches to achieving project objectives. All reasonable alternatives should be carried through the identification of mitigation approaches stage (see Section 2.2.6). Thoroughly assessing a range of alternatives enables project proponents, environmental impact assessment reviewers, and decision makers to gain a complete understanding of the potential impacts of the proposed project over the full spectrum of implementation

Example of an Alternative

If a proposed project involves building a thermoelectric plant, alternative approaches to meeting energy needs might include demand-side management to reduce energy consumed by users, purchase of energy from other power plants, alternate sources of energy, and expansion of existing plants

scenarios and to refine the final preferred alternative with mitigation measures, if necessary.

2.2.4 Description of the Environmental Setting

After identifying the "region of concern," the project "applicant" or "environmental impact assessment preparer" (hereinafter collectively referred to as project proponent) describes the environmental setting in terms of physical-chemical, biological, socioeconomic, and cultural resources. The project proponent also includes any background information relevant to specific project concerns introduced during the scoping process. The descriptive information will be used as a baseline to project the potential impacts of the proposed project.

2.2.5 Assessment of the Impacts of Alternatives

The project proponent conducts a systematic and interdisciplinary analysis of implementing and operating each alternative, including the proposed project and no-action alternatives, to assess potential impacts on all resources of the future environmental setting in the region of concern. The environmental impact assessment should include primary, secondary, and cumulative impacts. The potential impacts will be used with the descriptive information to compare and contrast all alternatives.

Once the potential impacts are identified, the project proponent or authorizing agency determines their significance through a combination of: 1) best professional judgment of an expert or group of experts; 2) quantitative thresholds of significance defined by law, regulation, or policy; or 3) the practice of an agency or the collective wisdom of a recognized group. In other settings, significance is determined through qualitative analysis by experts in relevant disciplines. Various factors are considered, including public health and safety, unique characteristics of the region of concern, degree of uncertain or unknown risks, and any project or impact controversy.

The project proponent is usually required to compare and contrast the potential impacts of all alternatives, including the project proponent's original proposed project on the existing and future environments, in a summary table and may briefly summarize the comparisons, comment on important comparisons, or provide any insights in the text. In addition, the proponent commonly identifies the preferred alternative(s) and the reasons for its/their selection.

2.2.6 Identification of Mitigation Approaches

To help ensure that the proposed project affects the environment as little as possible, the proponent typically identifies mitigation measures to address all potential major environmental impacts. Mitigation measures should be defined for the proposed alternative as well as all other

alternatives. By doing so, a meaningful comparison among alternatives is made possible.

The primary mitigation types can be classified as follows:

- Avoid or prevent impacts altogether by not taking a certain action or parts of an action
- Minimize impacts by limiting the degree or magnitude of the proposed project and its implementation
- Reduce or eliminate the impact over time by preservation and maintenance operations during the life of the proposed project
- Correct the impact by repairing, rehabilitating, or restoring the existing environment
- Compensate for the impact by replacing or providing substitute resources or environments.

These primary mitigation types are arranged above in descending order of preferability. For example, avoiding or preventing an impact is preferable to minimizing an impact, minimizing an impact is preferable to reducing or eliminating an impact over time, and so on. This concept is explored more fully in Chapter 4.

2.2.7 Identification of the Preferred Alternative

In environmental impact assessment processes that include alternatives to the proposed project, the project proponent must often provide rationale behind selection of the preferred alternative. Such rationale consists of a comparison between all of the alternatives, including an explanation of why the preferred alternative is superior to the others. An alternative may be selected as superior for any of the following reasons:

- Meets the purpose and need for the proposed project more successfully than the other alternatives;
- Meets the purpose and need of the proposed project as well as, or almost as well as, the other alternatives, while having less potential for significant environmental impacts than the other alternatives; and
- Is comparable to other alternatives in terms of ability to meet the purpose and need and potential for environmental impacts, but would be less expensive.

These are simply three of the most common reasons for selection of a preferred alternative. Project proponents may offer other rationales for supporting a preferred alternative than those listed above.

2.2.8 Review of the Draft Environmental Impact Assessment

The information generated during the assessment stage is the basis of the draft environmental impact assessment. After the draft environmental impact assessment is completed, a formal review is usually designated to allow public comment on the entire draft. If the proposed project is large or controversial, it may be appropriate to hold public meetings during the comment period. These meetings are held to explain to the public the issues involved, answer any questions, and receive comments on the draft environmental impact assessment. It is at this stage of the environmental impact assessment preparation that the formal review—whose principles are the focus of this course—is undertaken. In the United States, this review is done by an agency other than the agency responsible for its preparation or advocacy of the proposed project.

2.3 Final Environmental Impact Assessment

To prepare the final environmental impact assessment, the project proponent should take into account each public comment and the comments of the independent reviewer that were received on the draft version. The project proponent includes both the comments and the responses in the final document (e.g., in an appendix) and revises the text of the document, if necessary, based on the comments.

Preparation of final environmental impact assessment:

1) In an appendix, list all comments from the public and from the independent review agency
2) Incorporate relevant comments and finalize the environmental impact assessment

2.4 Decision-Making

The final decision on implementation of the proposed project is generally based upon the final environmental impact statement. The relationship between the reviewer and the decision maker will determine the level of influence the reviewer may have over the decision that is made. Conducting a detailed independent review, ensuring that the views of all interested parties have been taken into account, and supporting the integrity of the process, are ways that the reviewer supports the decision making process.

2.5 Mitigation Plan

Once the preferred alternative has been selected, the project proponent must specify a mitigation plan that will address all expected adverse environmental impacts resulting from that alternative. The mitigation plan should be a detailed description of the following things:

- All of the specific mitigation measures to be implemented
- A feasibility assessment for all of the proposed measures
- A schedule indicating when and where each mitigation measure will be implemented
- A description of the costs of implementing the selected mitigation measures, and the sources of funding to cover those costs
- Clear designation of the party(ies) responsible for implementing mitigation.

2.6 Record of Decision

A record of decision documents the result of an environmental impact assessment. It states what alternative has been selected by the project proponent, what other alternatives were rejected and why, and what mitigation measures will be implemented to address all projected adverse environmental impacts. The reviewer's role is to take steps to help ensure that the record of decision is accurate and complete. In other words, the reviewer must read the record of decision to determine whether it accurately describes the process that actually occurred, and matches the findings in the final environmental impact assessment document.

2.7 Project Implementation

After a final environmental impact assessment document has been reviewed, and the record of decision written, the proposed project may proceed, as long as there are no permit requirements, enforcement actions or other country-specific requirements that would prevent it from proceeding. Project implementation, if the proposed project involves land development or the construction of a facility, typically consists of four phases: site preparation, construction, operation, and mitigation. The proposed project may also be programmatic in nature, and not involve any construction or land modification directly attributable to the project, such as the signing of a free-trade treaty. Regardless of the type of proposed project, the reviewer's role consists primarily of post-decision monitoring and follow-up, which are discussed below.

2.8 Post-Decision Monitoring and Follow-up

As soon as project implementation begins, three types of monitoring become important in ensuring project success: (1) implementation monitoring, (2) effectiveness monitoring, and (3) validation monitoring. Implementation monitoring simply ensures that any mitigation measures required are implemented. Effectiveness monitoring evaluates whether the mitigation is working as expected. Validation monitoring determines the accuracy of the models and other tools that were used during the environmental impact assessment process to identify potential environmental impacts. Because this type of monitoring can be time-consuming and expensive, it is important to focus on the evaluation of models and tools related to potential environmental impacts of high priority in the environmental impact assessment.

Types of Monitoring:

1) Implementation monitoring
2) Effectiveness monitoring
3) Validation monitoring

The reviewer usually decides whether post-decision monitoring is required depending on the circumstances of the project. If the potential impacts were identified using new or unproven methodologies, for example, the reviewer may require the proponent to validate the method by monitoring the actual consequences of the project on resources of concern. Similarly, if a mitigation technique is new or is applied in a new

setting, the reviewer may require the proponent to monitor its effectiveness. In addition, implementation monitoring to determine whether regulatory requirements (e.g., permits, enforcement conditions, discharge limitations) are being met may be set as a condition for approval.

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3. REVIEWER'S ROLES AND RESPONSIBILITIES IN THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

3.1 INTRODUCTION

This chapter provides an overview of the different roles and responsibilities of reviewers of environmental impact assessments.

Included in this chapter are discussions on the:

- role of the reviewer;
- reviewers and review teams: descriptions of key players;
- reviewer's role in each element of the environmental impact assessment process;
- communicating the findings of the review; and
- overcoming obstacles to effective environmental impact assessment review.

3.2 THE ROLE OF THE REVIEWER

3.2.1 Reviewer as a Facilitator of the Environmental Impact Assessment Decision-making Process

Environmental impact assessment has been defined in the previous chapter as both a decision-making *process* and a *document* which enables a decision-maker to:

- The term environmental impact assessment refers both to a decision-making *process* and a *document*

- Integrate regulatory, environmental, social, and economic considerations.
- Eliminate, prevent, reduce, minimize or mitigate adverse environmental impacts resulting from a proposed project.

It does this by:

- Ensuring consideration of both a proposed project and the range of reasonable alternatives that meet the overall purpose and need for actions which may have a significant impact on the environment, broadly defined;
- Maximizing the breadth and inclusiveness of all relevant information, criteria, and parameters for decision-making through a systematic, interdisciplinary, reproducible and documented assessment; and
- Providing for involvement of all key stakeholders.

Many government and financial institutions now require an environmental impact assessment process and preparation of an environmental impact assessment document that includes most of the elements of the internationally accepted framework for environmental impact assessment. Associated with these requirements they have

- The independent reviewer:
  - May or may not have the authority to change aspects of the proposed project

established the role of an "independent" reviewer within their organizations to help ensure that both substantive and procedural requirements are met. The public and various stakeholders conduct a review of an environmental impact assessment document during public participation or in response to notification and opportunities to review and comment on an environmental impact assessment or project proposal. For purposes of this text, the reviewer is an individual or a team led by an individual within an institution which requires environmental impact assessment in support of decision-making. The review function is usually, but not always, different from the decision-making function within such institutions. However, this is not always the case. For example, in instances in which the environmental impact assessment is used as a permit application, or is the basis for setting environmental conditions for construction, operation or financing of a facility, the reviewer may also be a "decision-maker" in regard to conditions for project approval. Even when the reviewer is not in a decision-making position, a good reviewer can nevertheless wield influence over the success and outcomes of the process and the environmental impacts of a proposed project.

In most instances, having a distinct function for a "reviewer" of environmental impact assessment documents helps to:

- Overcoming bias

Overcome bias: Any project proponent will bring to the process certain biases or his or her own perspectives, however unintentional. A "reviewer" is someone who has greater "independence" and "objectivity" because the reviewer is not associated directly with any particular outcome from the review. Obviously everyone brings the bias of his or her own perspectives, experiences, and values, but this reviewer independence is based upon the reviewer's commitment to the systematic and interdisciplinary approach that is fundamental to environmental impact assessment. Even within financial or government institutions, the reviewer role is often created as one which is separate from those who might be in positions to advocate for a particular project or proposal.

- Identify important information gaps and alternatives

Identify important information gaps and reasonable alternatives that may have been overlooked: Everyone involved in the environmental impact assessment process is operating under constraints that influence the extent to which an assessment identifies, assesses, and resolves important issues and considers alternative courses of action. Shortcuts may be taken because of resource, information, and/or time constraints that may result in inadequate or total lack of information or exploration of alternatives or impacts critical to sound decision-making. An "independent" reviewer who does not have a particular stake in the outcome may be in a better position to identify when further information is needed and reasonably obtainable.

Provide the decision-maker with environmental and related expertise: Often those in decision-making positions lack the necessary technical, economic, or related expertise to review an environmental impact assessment document to ensure the information presented is complete and accurate and that any preferred alternative and associated mitigation of environmental impacts present an environmentally (and socially) acceptable means of meeting the purpose and need for the action. A reviewer either brings to the review or coordinates the necessary expertise to make these judgements.

- Provide decision-maker with valuable tools in the form of environmental and related professional experience

Distinguish significant from insignificant issues for decision-makers: The environmental impact assessment process often yields enormous quantities of data and many different and sometimes divergent views on desired outcomes. Whether serving or actually acting as a decision-maker, a reviewer typically plays an essential role in facilitating decisions whether to proceed and under what conditions. He or she does so by sorting through and identifying the most significant issues to the extent these are not clearly and systematically portrayed in the environmental impact assessment. In addition, a good environmental impact assessment reviewer will be able to identify reasonable alternatives and/or ways to mitigate unacceptable environmental impacts which may have been overlooked in the process. This can provide both the project proponent and the decision-maker with ways to resolve conflicts or improve the outcome of the process. Finally, by assuring complete and accurate information for the decision maker, and systematic comparison of impacts associated with reasonable alternatives, the reviewer can enhance the prospects for selection of a preferred alternative which is environmentally sound. In this capacity, a reviewer is a catalyst for improved decision-making and possible development of creative ways to better integrate economic, environmental and social objectives.

- The reviewer can also help decision-makers distinguish between significant and insignificant issues

Ensure the integrity of the environmental impact assessment process and document: The reviewer can assure that key stakeholder groups are provided an opportunity to get involved in the process and have their views known, if required, by providing an independent check on how governmental or financial institution rules and procedures are carried out. A reviewer also can try to ensure that environmental and social concerns are seriously considered and addressed within the process. While the reviewer often is not in a position to actually make a final decision about a proposed project, the reviewer can help ensure at a minimum that all of the relevant information was brought before a decision-maker in a clear and systematic manner.

- The reviewer plays an essential role in ensuring the integrity of the environmental impact assessment process and document

Bring perspective of all interests: A broad perspective from all those with an interest in the outcome of the decision is an important aspect of EIA. However, even when the public is provided an opportunity

to comment, there often are interests that are not expressed or are under-represented. The reviewer can identify these interests and bring them into the process.

In summary: ***a reviewer facilitates the environmental impact assessment decision-making process which seeks to integrate environmental, economic and social concerns and eliminate, avoid, minimize, prevent, and/or mitigate adverse environmental impacts of a proposed project and its reasonable and feasible alternatives.*** Without the important role of the reviewer, the environmental impact assessment process can fail to meet its goals if the alternatives, assessment, and involvement of key stakeholders is deficient in some significant way. **The presence of a reviewer can help to prevent the requirements for environmental impact assessment from being merely a paperwork exercise.**

3.2.2 Different Contexts for the Reviewer's Role

A reviewer must understand the broader context within which he or she conducts the review of an environmental impact assessment document or gets involved in different stages of the process. These contexts are legal, institutional, organizational, and personal.

- Different contexts for the reviewer's role:
  - Legal
  - Institutional
  - Organizational
  - Personal

Legal context: A reviewer must understand the legal basis for:
- the environmental impact assessment process and documentation within his or her community, e.g., does it require identification of alternatives; is public participation mandatory or optional; what form does public participation take; who must be notified, and how?
- legally binding requirements for environmental protection, and property rights, and
- limitations on his or her own organization or other related organizations to define or establish binding conditions for mitigation of adverse environmental or social impacts.

Institutional context: There are several reasons why knowledge about institutional settings is important for reviewers:

Expertise: A reviewer must understand where to obtain relevant information and expertise within the various institutions within and outside of government.

Perspective: In order to bring a broad interdisciplinary perspective to the review, a reviewer should be familiar with the various players and interests in a particular project proposal.

Involvement: Throughout this discussion, there is a preference for early involvement of the reviewer in the process, particularly at

- Early involvement in the environmental impact assessment process is one of the most important ways a reviewer can help ensure the integrity of the environmental impact assessment process and document

stages of initial environmental impact assessment and scoping, and for a reviewer to benefit from the results of public comment and participation if possible and to become a part of the process. The ability and opportunity to get involved at any stage in the process is a function of the institution within which the reviewer is situated as well as the approach of the individual reviewer.

Support: To be effective, a reviewer needs to know the relative strengths and weaknesses of his own position as part of a specific institution. For example, a reviewer may have a position within an environmental ministry, department, or agency which has relatively weak authority compared to ministries which specifically advocate for economic sector development for the kind of project proposed. It would be advantageous to have good working relations with the staff of the stronger ministry and to establish good professional working relationships so that they better understand the benefits, support the results and perhaps even participate in reviews to make the results of review more effective. Often these relationships are out of the control of an individual reviewer, but informal relationships can be invaluable. And, it may be necessary to provide even more support for any reviewer findings and recommendations if institutional support is generally lacking.

- Reviewers should understand the strengths and weaknesses of their organization, and be prepared to use its strengths to benefit the environmental impact assessment process

Decision-making: A reviewer's comments and recommendations should have a direct influence on the information and options before a decision-maker. A part of that is a sound technical review of the completeness and adequacy of documentation, process, analysis, and considerations, and a second part of that is the ability to distinguish significant issues and to support clear decision-making on a preferred alternative and related mitigation. Knowing who the decision-makers are and how decisions are made is invaluable in structuring communications and review to support it, whether that individual is different from or the same as the reviewer.

Follow through: If a ministry or department responsible for reviewing environmental impact assessment documents is different from a ministry or department which has authority to ensure mitigation actions are carried out as proposed, it can be very important to communicate with all affected ministries to ensure that the basis for environmental impact assessment based decisions is sound.

- Communication between reviewing agencies or ministries is very important to ensure proper follow-through

Organizational context: Regardless of the institutional setting, a reviewer sits within an organization with lines of authority and existing decision-making processes and styles of communication, management and decision-making. The organizational context will define how issues are elevated and resolved and who must make what decision and how. Sometimes when issues or key concerns are raised early instead of very late in a process, approaches can be put into motion to help resolve them

- The organizational context determines how issues are elevated and resolved and who must make what decision

rather than escalate the controversies. Reviewers must be sensitive to these unique circumstances within their own organizations. No one responds well to surprises.

A reviewer also needs to know the priorities of the organization in defining how to manage their own time and resources to any given review. Most governmental agencies responsible for reviewing environmental impact assessments often have several projects to review during the same period of time. Because organizational budgets and staff time are limited, it is essential to focus time and effort on high priorities. Every proposed project is different, and some should receive more attention than others. It is up to each agency to determine its own priorities and which environmental impact assessments to spend the bulk of its resources on. Considerations each agency faces when setting priorities in the context of environmental impact assessment review are as follows:

- A reviewer needs to know the priorities of his or her organization

- Legal responsibilities to participate. What types of proposed projects are the agency required by law to review? If some environmental impact assessments currently pending review must be reviewed, while others are optional, the agency should place a higher priority on those it is required to review.
- Severity of potential environmental impacts. When setting priorities between two or more environmental impact assessments, it is often prudent to place the highest priority on environmental impact assessments for proposed project(s) with the greatest potential for environmental or other harm.
- Priority concerns of the agency. It is important to know the most significant environmental threats and priorities for the nation, region and/or locality. Often agency priorities originate from legal responsibilities, which are also often related to protection of the environment, but sometimes there are other agency concerns that take precedence, such as the need to promote economic prosperity.
- Available staff and travel resources. Sometimes an agency must set priorities based on scarcity of resources. In such cases proposed projects that may be a priority concern of the agency are pushed aside in favor of proposed projects of lesser concern but a higher chance of actually getting reviewed.

- Legal responsibilities
- Severity of impacts
- Priority concerns of the agency
- Available staff and travel resources

It is essential that a reviewer have or develop an understanding of his or her own organization's authorities, regulations, programs and levels of authority and decision-making, and an appreciation for the limits of those authorities. The range of authorities under which a reviewer may be operating will in large part define the responsibilities of the reviewer.

Personal Context: The influence the reviewer has on decision-making and outcomes can be influenced as much by the manner in which the job is carried out as by explicit authority. A reviewer can draw upon different types of authority; that is, not only legal and institutional

authority, but also authority achieved through interpersonal and communication skills and professional competence.

The reviewer not only brings expertise and experience, but also must communicate, both orally and in writing, in an effective and convincing manner; must "facilitate" other expertise, and public and internal processes to ensure complete, thorough, accurate decision-making documents; and may need to negotiate the scope, alternatives considered, analysis prepared, data collected and/or alternative decided upon as well as follow up actions. Such a range of possible activities places value on judgement, perspective, logic, common sense and communication skills as much as upon technical expertise.

3.2.3 The Reviewer's Focus

With all relevant contexts in mind, a reviewer must also focus his or her review on the most important issues. Environmental impact assessments are often very large and contain extensive technical materials. Given limited budgets and limited time, reviewers must focus on more important issues, and give less attention to less important issues. In essence, there are six primary areas the reviewer of an environmental impact assessment should focus on:

- Reviewer Focus
  - Completeness/Coverage
  - Significance
  - Adequacy
  - Integrity
  - Accuracy
  - Influence

1) **Completeness/Coverage**: Whether all potentially significant environment types, impacts, data sources, and other necessary components of an environmental impact assessment were identified and evaluated for a complete range of reasonable and feasible alternatives;
2) **Significance**: Whether all potentially significant issues were identified and addressed, and whether the issues that received the most attention;
3) **Adequacy**: Whether the analyses and data supporting the impact assessment are adequate;
4) **Integrity**: Whether there is internal logic and integrity in the environmental impact assessment document; whether the assumptions are consistent within the framework of the proposed project; whether the analytical approaches used and the conclusions drawn are valid; and whether the process was fair, e.g., open to all interests;
5) **Accuracy**: Whether the information, models, and assumptions used by a project proponent are accurate; and
6) **Influence**: The degree to which the reviewer should and how to participate in, and influence, the environmental impact assessment and decision-making process.

By maintaining focus on these six areas, a reviewer can ensure that his or her review stays on track and addresses the key issues. It is important to maintain this Reviewer's Focus throughout all stages of environmental impact assessment review, from participation in decision to proceed

activities to review of post-facility operation monitoring and mitigation. To help the reviewer maintain this focus, road maps that touch upon the six focus points are included throughout Chapter 4 in conjunction with descriptions of each part of a typical environmental impact assessment document. The reader is also encouraged to refer to the Reviewer's Focus list when reviewing environmental impact assessments in the future.

3.2.4 Four Types of Review Situations

Regardless of the context in which a reviewer finds him or herself, the task of environmental impact assessment review is often complicated by a large workload and inadequate time and resources. For purposes of simplicity and to capture the range of situations reviewers find themselves in, we have described four types of review situations:

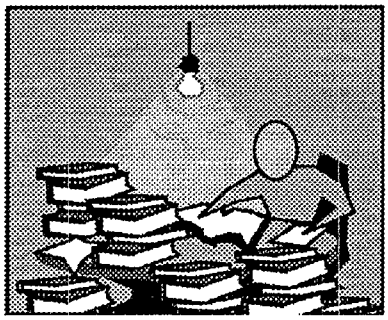
- "The solo reviewer." Must carry out an isolated technical review without external assistance, and little context information.

- "The empowered reviewer." Builds his or her own informal networks and resources. Keeps up on environmental, economic and social context information relevant to project and program reviews. Uses networks effectively. Knows where to find useful tools and techniques for review.

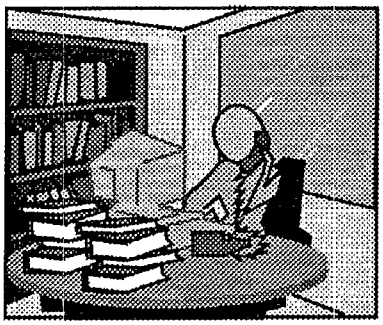
- "The lead reviewer." A manager of a team of associate reviewers within or outside of the reviewer's organization. The lead reviewer may have funding for experts or formal organizational links to experts upon which s/he can draw. Regardless, the lead reviewer needs interpersonal skills, managerial and communications ability to pull together the interdisciplinary team, and must provide a holistic perspective, and timely and concise advice.

- "The proactive reviewer." Gets involved up front in the process. He or she becomes involved before major design and planning decisions have been made by the project proponent. Early involvement is important in enabling the reviewer to influence the players involved in the process and quality of the environmental impact assessment document. This can and must be done in a manner which does not compromise independence. Any of the other reviewer situations can also include proactive elements.

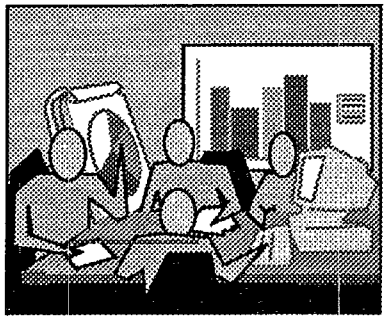
It is important to recognize that the four reviewer situations presented above may apply at any time to any reviewer throughout his or her career. The same individual may serve as a lead reviewer at one time, a solo reviewer the next, and a proactive or empowered reviewer at another



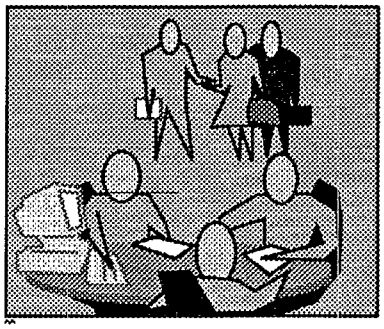
Solo Reviewer



Empowered Reviewer



Lead Reviewer



Proactive Reviewer

time. For this reason, it is important to visualize all four reviewer situations while reading this text — the characteristics of any one situation may apply to a reviewer at present, or at some point in the future, regardless of his or her current situation.

One way to go about environmental impact assessment review in a proactive manner is to approach the initial review as a series of sequential steps. For example (adapted from Shipley Associates, 1991. *NEPA Executive Overview, Workshop Manual*. p. 3-5):

1) If the reviewer learns of a proposed project but does not know if an environmental impact assessment is planned, he or she should determine in a general sense whether a proposed project may be significant enough to have an environmental impact assessment. If so,
2) Contact the project proponent and a) Determine if the proponent planned to conduct an environmental impact assessment, b) If not, inform that they may be required to, or c) If planned, notify them that he or she will be involved in evaluating the environmental impact assessment,
3) Take steps to help ensure that both the project proponent and the reviewing agency will have sufficient time to analyze all documents and provide sufficient comments,
4) Identify any government agencies (national and local) that should be included in the review, such as agencies responsible for issuing permits on the proposed project, or agencies that could help with the analysis,
5) Develop a strategy to involve the public and any stakeholder groups in the environmental impact assessment process,
6) Determine whether the reviewer's agency has the resources (including time, funding, personnel, and expertise) to conduct the assessment or whether to contract all or part of it to a company with sufficient resources,
7) Select the interdisciplinary team leader and members if the agency will conduct the assessment and write the document.

Any of the four situations can be linked to decision making in various ways:

- Little relationship to decision making: In some settings, a reviewer may only be asked to look for technical completeness and adequacy of an environmental impact assessment document with little apparent influence over decision-making or outcome;

- Direct linkage to decision making: In some settings, the reviewer may be the decision-maker, while in others, the reviewer makes recommendations to the decision-maker. The reviewer may also

- Reviewers may or may not be involved decision making.

define permit conditions, mitigation requirements, or other conditions on the proposed project;

- Direct linkage to project follow through: In some settings, the reviewer may be responsible for monitoring the environmental impacts of the proposed project during construction and after completion, or for monitoring compliance with mitigation plans.

This will vary from country to country, and from institution to institution. In the United States, the U.S. Environmental Protection Agency (EPA) has been charged by Congress to review environmental impact assessments (called Environmental Impact Statements) prepared by other federal agencies to assess the environmental impacts and the adequacy of the analyses. The EPA provides comments which are made public to avoid or mitigate impacts and improve the rigor of the analyses and consideration of alternatives, but the ultimate decisions are made by the responsible federal agency. EPA does not have the legal authority to stop a proposed project because of objections about potential environmental impacts. Nevertheless, because EPA's comments are made public, and because citizens have a right to sue, EPA's reviews and ratings as to the adequacy of an environmental impact assessment document and the acceptability of the environmental impacts associated with a proposed project have significant influence on the process. In contrast, Mexico and many other countries in Latin America and Europe empower the government agency responsible for reviewing the environmental impact assessment with the legal authority to directly approve the project, approve the project with conditions, or deny the project.

- In the U.S., the EPA does not have the authority to approve or disapprove a project due to concerns about potential environmental impacts. This is done outside of the context of the EIA within relevant permits and other authorities for project approval. In contrast, many countries in Latin America and Europe empower the government agency to disapprove environmentally unacceptable projects.

3.3 Reviewers and Review Teams

3.3.1 Characteristics of a Good Reviewer

Some of the characteristics most useful in the review of a particular environmental impact assessment will depend on the specifics of the environmental impact assessment under review. However, generalizations can be made about useful characteristics of reviewers of environmental impact assessments.

- Characteristics of effective reviewers:
  - Knowledge
  - Sound judgment
  - Common sense
  - Logical thought process

It is helpful to have a broad understanding of science, as well as personal capabilities and orientations which are discerning, professional, and systematic. A good reviewer combines basic technical knowledge with sound judgement, common sense, and a logical thought process.

A good reviewer can:

- Develop and apply a broad understanding of environmental and social sciences and economics in identifying potentially relevant

- A good reviewer should prepare for the job.

issues and to discern the true significance and relative importance of these issues;

- Develop and manage a formal or informal set of associate reviewers who are called upon to assist when their expertise is required;
- Develop and manage an informal network of "experts" in a variety of fields who can answer specific questions that may arise during review of environmental impact assessments;
- Establish a broad understanding of development and policy activities within the geographic area of concern;
- Take steps to help ensure ready access to environmental impact assessments that may have been developed on similar projects, either within country or internationally;
- Understand the context of each environmental impact assessment, including the key players, their perspectives, and the history of the proposed project; and
- Negotiate: Creating a sound environmental impact assessment to facilitate decision-making and using the environmental impact assessment process to improve and have an impact on decision-making is a creative process of negotiation. In the vast majority of cases, a reviewer is bargaining for alternative mitigation measures. In those instances in which new alternatives should be considered (either because the purpose and need are not supported, or because the purpose and need are supported but the adverse impacts are significant even with mitigation and alternatives have been overlooked), to be most effective, the reviewer should be able to offer other alternatives.

3.3.2 Expertise

- A good reviewer need not be an expert in all areas of review

Many individuals approach the position of being a reviewer of an environmental impact assessment concerned that they lack adequate technical knowledge and expertise. However, a good reviewer need not be an expert in all areas of review. It is helpful to be knowledgeable in at least one technical discipline to understand the nature of how technical disciplines, assumptions, selection of models, and analytical methods are made to apply to a given circumstance, and to ask questions confidently of technical analyses. It is not necessary for a reviewer to be an expert in every discipline covered in an environmental impact assessment.

- The lead reviewer should be a generalist

A reviewer should have a sufficiently rigorous technical background to question the environmental impact assessment, as well as good general knowledge of his/her agency's regulations and authorities. As noted earlier, the lead reviewer in particular should be a generalist who is

knowledgeable about the environmental or other relevant fields and who can identify experts as needed. Generalists are often better lead reviewers than individuals with expertise in one narrow technical field because a reviewer who is an expert in only one field can have a perspective that is sometimes too narrowly focused on that field. This does not mean that an expert is necessarily an ineffective lead reviewer, but that effective lead reviewers also possess the skills of a generalist and facilitator.

If a reviewer feels that he or she is lacking in a critical area of technical expertise, he or she can and should correct the area of deficiency. It is possible to develop technical skills in a variety of ways, ranging from formal academic training to careful review of technical literature and documents and communication with experts in the field. It is particularly important to understand and develop credibility in communicating with others about technical issues related to prediction and measurement and ways to address environmental impacts. In general, a reviewer's professionalism is enhanced by demonstrating understanding of systematic approaches, regardless of the particular discipline used to gain that understanding.

- Reviewers can remedy deficiencies in technical knowledge in a number of ways

3.3.3 Review teams:

Due to the interdisciplinary nature of potential impacts, environmental impact assessments can involve highly complex and technical information, drawing upon the natural sciences such as atmospheric science, forestry, geology, and hydrology, as well as social sciences such as economics, sociology, and archaeology. Few individuals possess this range of expertise and experience. How then can a reviewer actually conduct a review for coverage, significance, adequacy, integrity, accuracy, and to determine his or her proper influence?

- Few individuals possess adequate knowledge in ALL areas necessary for environmental impact assessment review. A team approach ensures that the maximum amount of relevant knowledge and skills are brought to bear on an environmental impact assessment

An environmental impact assessment review team is often created to ensure that review is sufficiently interdisciplinary in knowledge, skills, and background to adequately and correctly review all aspects of the environmental impact assessment.

The review team can be comprised of a combination of technical experts in specific disciplines, generalists who can maintain a sense of the "big picture," and facilitators working to ensure that the review is completed on-time and includes all relevant groups and individuals. Thus, if economic and historic issues are included in the environmental impact assessment, the team may have to include economists and historians. It will almost certainly include environmental scientists, biologists and others from the natural sciences.

The review team can consist solely of individuals from within a single agency, or it can include reviewers from other agencies, outside technical experts, and consultants or contractors. The lead reviewer is responsible

for determining whether in-house technical expertise will be sufficient, and for recruiting reviewers from other agencies or outside consultants if gaps in the review team's time availability or expertise are identified. In addition, it is also often useful to include stakeholders and other interested parties in the review of the environmental impact assessment document. In the U.S., this inclusion is required by law.

Good lead reviewers in particular tend to have the following characteristics:

- A generalist or an individual who is able to identify and consider a broad range of issues (i.e., does not get too focused on a specific issue[s]);
- Some understanding of technical issues in the environmental field; and
- A good communicator, facilitator, and networker who can effectively draw upon the expertise of numerous colleagues or other individuals proficient in one or more technical.

3.3.4 Technical Experts

In addition to lead and additional reviewers (including technical experts) from within the agency formally responsible for reviewing an environmental impact assessment, it is sometimes necessary to bring in outside experts to review certain aspects of an environmental impact assessment. Such experts can be brought in for a short period of time to review a small part of an environmental impact assessment, or they can be retained for the entire review period, depending on the review needs. Outside experts can include researchers from academia, from other government agencies, non-profit organizations, and consulting firms. The use of technical experts is common and can be a valuable component of environmental impact assessment review.

- Technical experts can be brought into a review process to review sections of an environmental impact assessment where their expertise is necessary.

3.3.5 Preparing for the Reviewer Role in General

It is helpful to do certain things to prepare for the job:

- Understand the legal, institutional and organizational context of the position;
- Obtain and thoroughly understand any applicable regulations, guidelines and policies;
- Read a few environmental impact assessments on a range of types of projects;
- Develop a broad understanding of the geology, geography, environmental features and quality issues, development patterns and pressures, and socio-economic and cultural features of the region;
- Identify sources of expertise, including reference materials, resident experts, academic institutions, and public and private resources;

- Preparing for the reviewer role

- Identify stakeholder groups, and public interest groups having expertise and interest in the environment and development; and
- Wherever possible, get to know others to turn to on a personal level, so subsequent inquiries or solicitations of advice may be more welcome and they may be more likely to be responsive to requests for assistance or advice.

3.4 Reviewer's Role in Each Element of the Environmental Impact Assessment Process

An environmental impact assessment will typically include documentation of each stage of the environmental impact assessment process. Each stage raises different types of issues and opportunities for the reviewer which will be highlighted below. The focus is on what a reviewer's role might be if involved in that stage of the process. The following stages are reviewed (see also the environmental impact assessment flowchart in Chapter 2):

- Each stage of an environmental impact assessment raises different types of issues that the reviewer has to deal with

- Decision to Proceed Activities to identify significant impacts and determine the need for an environmental impact assessment;
- Draft Environmental Impact Assessment;
- Final Environmental Impact Assessment;
- Decision-making: record of decision; and
- Post-project approval monitoring.

To help keep reviewers "on track" during each stage of review, a set of road maps have been created to accompany this text. To facilitate their identification, road maps are boxed off from the rest of the text, and are indicated by the icon located in the right-hand margin.

- The "Road Map" icon in this text identifies guidelines to keep the reviewer on track.

3.4.1 Decision to Proceed Activities: Deciding Whether a Proposed Project is Subject to Environmental Impact Assessment Requirements

One of the most important stages in the environmental impact assessment process is the initial one: determining whether a proposed project may have environmental impacts potentially significant enough to require a full environmental impact assessment. This determination is made consistent with requirements of applicable environmental impact assessment laws and procedures, which differ from country to country. In some countries, the decision to proceed with an environmental impact assessment is mandated even if the potential for significant environmental impacts is relatively low. In other countries, the potential for significant environmental impacts must be high before an environmental impact assessment is required. Laws and regulations may also mandate environmental impact assessment for certain types of impacts or affected environments, but not others. In still other countries, there are no requirements for environmental impact assessments at all. In summary, initial and full environmental impact assessments are

required under different circumstances in different countries. In addition, countries that mandate environmental impact assessments differ regarding the extent and type of assessment required for different types of projects, potential environmental impacts, and affected environments.

During the decision to proceed stage, project proponents often conduct an initial environmental impact assessment to determine whether the potential for significant adverse environmental impacts is high enough to require a full environmental impact assessment. Alternatives may or may not be identified or evaluated, depending on the legal or institutional setting.

It is often difficult to distinguish the kind of assessment involved in an initial environmental impact assessment from a full blown environmental impact assessment. Often the same information is relevant and the distinctions come from the depth of assessment, generation of new information, identification and systematic consideration of alternatives, and public participation. However, these lines are often blurred. In general, the initial environmental impact assessment is an internal process, without the benefit of external comment.

Some of the following distinctions may or may not apply in individual projects, different organizations and countries:

Reviewer's Role in Review of Initial and Full Environmental Impact Assessments:	
Initial Environmental Impact Assessment	**Full Environmental Impact Assessment** (based upon international framework elements)
Usually internal to the organization	Includes external review and public participation
Scoping is done internally	Scoping involves the public and interested parties
Alternatives to proposed project may or may not be included	Alternatives, where required by law, are always considered and systematically assessed
May include proposed mitigation to avoid significant impacts that would trigger an environmental impact assessment	Always includes mitigation plans
Often does not include new information gathering	Often includes gathering new information

During the decision to proceed with an EIA, the role of the reviewer is to determine:

- Whether all potentially significant environmental and other impacts were correctly identified by the project proponent, or whether potential impacts were overlooked;
- Whether information is sufficient to determine whether impacts identified are significant; and
- Whether the magnitude of potential environmental or socio-economic impacts was assessed, and if so, whether it was assessed correctly, including whether the models, assumptions, and scenarios were valid.

After conducting an initial environmental impact assessment, a project proponent may claim that the potential for significant adverse environmental impacts is too low to warrant a full environmental impact assessment. If a reviewer is satisfied after conducting his or her review of the initial environmental impact assessment document that claims of no significant potential impacts are valid, he or she may simply agree and cease involvement. However, if there is doubt as to whether the impacts will be significant or not, a full environmental impact assessment may be required of the project proponent or more information or data sought. In the United States, for example, there is a presumption that if information is not sufficient to find the impacts are insignificant, then an environmental impact assessment needs to be developed and the process applied.

- If there is doubt as to whether the environmental impacts of a proposed project will be significant, a full environmental impact assessment may be required

A reviewer who is either proactive, or who has oversight responsibility for compliance with the requirements of environmental impact assessment within an institution, would be more aggressive in seeking out projects which require these decision to proceed activities and working with the project proponents to establish clear steps for planning and carrying out the initial assessment.

3.4.2 Draft Environmental Impact Assessment Documents

Drafts of environmental impact assessment documents are often produced in order to provide an opportunity for reviewers and stakeholders to evaluate a proposed project with substantial information at their fingertips. This is required in most countries and institutional settings (such as the U.S.), while in others it may be voluntary. It is at the time of review of a draft environmental impact assessment that a full review of the proposed project's purpose and need, range of alternatives, assessed environmental and socioeconomic impacts, suggested mitigation measures and the selection of a preferred alternative can be fully evaluated and critiqued.

- The preparation of draft environmental impact assessment documents is required in some countries and voluntary in others

3.4.2.1 Scoping: Environmental Impact Assessment Document Development

While a reviewer must always try to preserve his or her independence and objectivity, in general, it is advantageous for reviewers to become involved as early as possible in the environmental impact assessment process to ensure the best product for review and decision making. However, the reality is that reviewers are often not involved in the scoping process. They may not have learned of the proposed project until later in the process, or they may have decided that sufficient resources were lacking for participation. A lack of involvement during the scoping process is almost always less desirable compared to involvement. In other words, the longer the assumptions, findings, and alternatives present in an environmental impact assessment go unquestioned and unchallenged, without critical and objective review, the harder it is to convince the project proponent or others to alter them, even if there are perfectly good reasons to do so.

- It is advantageous for reviewers to become involved as early as possible in the environmental impact assessment process

To preserve independence and objectivity and avoid misunderstandings, a reviewer must be careful to make it clear that early involvement in scoping does not mean or guarantee that the reviewer will not have comments to make later in the process or that the proposed project will be acceptable as proposed. In fact, reviewers often make comments at later stages in environmental impact assessment review, whether or not they were involved in scoping.

- A reviewer must make it clear that early involvement does not automatically imply agreement with the contents of the environmental impact assessment document

In some countries and circumstances, it may appear unlikely that environmental agency officials who conduct environmental impact assessment reviews will be allowed to engage in the scoping phase with those of other ministries or departments or the private sector. This can be true for political and organizational reasons, both historic and interpersonal. There may be, however, opportunities either to convince the key players of the potential benefits of early involvement, or to offer an opportunity for an isolated experiment or pilot to gain more institutional experience and acceptance of the idea. As noted earlier, this course will not attempt to cover all potential differences between environmental impact assessment processes in all countries and their institutional settings. The point here is that it may be possible to implement a more effective review than it may appear initially -- creativity and a positive attitude can sometimes accomplish as much as technical expertise and rigor, particularly when the overwhelming benefits of early involvement of the reviewer are conveyed to the project proponents.

A concern that reviewers may have is whether early involvement may lead to a lack of independence in subsequent review of the environmental impact assessment product. As stressed earlier, it is critical for the reviewer to remain professional and objective.

- Early involvement does not have to result in a lack of independence

Experience has demonstrated that getting involved late in the process only makes it more difficult to do the job of the reviewer if the environmental impact assessment document is deficient. Any conflict early in the process associated with early reviewer involvement would usually be more than offset by the far more intractable conflicts that would have emerged when final findings are challenged.

There are numerous benefits that accrue to the project proponent when reviewers are allowed to participate in scoping. Involvement in the scoping stage allows a reviewer to shape the assessment, including scope, purpose, alternatives and type of evaluation. Among the benefits of reviewer involvement in scoping, the reviewer can help:

- Explain the use of environmental impact assessment as a planning tool;
- Identify important environmental and other issues early;
- Help locate specific information or data related to the area of interest;
- Suggest others appropriate to involve in scoping process;
- Assist in ensuring an adequate range of alternatives is identified;
- Suggest specific alternatives to the proposed project that may avoid potential adverse impacts, including suggestions for an environmentally preferred alternative;
- Refer to publications, including guidelines and current research, that would be useful in analyzing the environmental impact of various alternatives;
- Identify mitigation measures that should be considered to reduce or substantially eliminate potential adverse impacts;
- Suggest specific assessment techniques and methodologies that might be used and those that may not be appropriate;
- Take steps to help ensure that time and/or resources are not wasted on trivial issues;
- Try to ensure that the environmental impact assessment is balanced and thorough. This will avoid delays that would arise later if the document is found to be significantly lacking; and
- Review to ensure that the required permits for the proposed project (e.g., wastewater discharge, waste disposal, building) are identified and discussed and input from the appropriate agencies is considered.

All of the above can benefit the project proponents, saving them time and money, and potentially salvaging a proposed project that might have otherwise been prevented by the reviewing agency in the end due to unacceptable project components. A reviewer who makes these benefits clear before scoping has begun or early in the scoping phase may be able to gain entry even in situations where reviewers normally are excluded.

How to become involved in scoping:

- Watch out for or take steps to help ensure receipt of formal announcements of projects;
- Watch out for or try to ensure receipt of invitations to public meetings;
- Watch out for news reports of planned activities;
- Arrange for meetings with the contractor and the project proponent prior to preparation of an environmental impact assessment; and
- Where possible, attend meetings with contractors and consultants throughout preparation of the environmental impact assessment.

Review of an Environmental Impact Assessment Document for Adequacy of Scoping, After the Fact

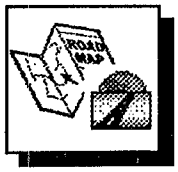
Regardless of the degree to which scoping was carried out, the project proponent should document what was done, and the extent to which outside reviewers were involved. This is important information for reviewers, because it provides background on the process that led to the proposed project, and can help a reviewer determine whether scoping was adequate.

Often a reviewer will not begin review of an environmental impact assessment until after the scoping phase has come to a close. In such a case, how does he or she determine if the full range of issues were addressed, or that a breadth of information and perspectives were considered? The reviewer should carefully review the environmental impact assessment to determine the answers to the following questions:

- Who was involved or consulted in the process of preparing the environmental impact assessment and how? Were the perspectives and concerns of any key stakeholders excluded?
- Was an opportunity provided to solicit the views and assessments of important stakeholders that should have been involved?
- What issues might have been raised, whether they were identified and addressed or not, by groups without an economic interest in the proposed project? This is crucial given the importance of the environmental impact assessment process in providing public involvement in activities that will affect their futures; and
- Within the bounds of appropriate professional conduct and neutrality, the reviewer might also:
  - Suggest to the project proponent and environmental impact assessment preparer that they could involve a certain group in the process or solicit its concerns and ideas on alternatives, as well as how to avoid or mitigate potential environmental or other impacts; and
  - Make sure that as many of the relevant stakeholders are involved as is possible by alerting concerned groups to the proposed project and suggesting they get involved.

Road Map for Scoping Review

- Scoping was conducted and documented
- Potentially significant issues are identified for natural and human environments
- Insignificant issues identified and their dismissal justified
- Identified and considered the views of all interested and affected parties
- Sufficient detail provided to define the spatial and temporal scope
- Adequate geographic area considered for the scope
- Omissions are not related to significant issues
- Key issues are brought into focus



3.4.2.2 Involving Stakeholders and Other Interested Parties

Involving all stakeholders and providing for public participation is a key element of environmental impact assessment and critical to decision-making which seeks to integrate economic, social and environmental concerns. Some, but certainly not all, countries have adopted legal requirements to involve all interested parties in the environmental impact assessment process such as community leaders and groups, business interests, other government agencies and non-profit organizations. It is typically advantageous to involve these parties throughout the environmental impact assessment process even without a legal requirement to do so to ensure that adequate information is brought to bear on all decisions made, and that potential problems are avoided. Where there is public participation and comment, it provides a reviewer with another means of critically reviewing the environmental impact assessment. Reviewers should make every opportunity to obtain and review these comments distinct from any formal environmental impact assessment document if they are not included within it.

- Some, but not all, countries have adopted legal requirements to involve all interested parties in the environmental impact assessment process

Outside involvement in environmental impact assessment review is not a standard practice in some countries. In other cases, even where outside involvement is welcomed, some stakeholders will not have adequate resources to effectively represent their group's interests. It is the responsibility of the reviewer to take steps to help ensure that the views

- Outside involvement in environmental impact assessment review is not a standard practice in some countries

of all relevant groups are fairly presented and considered in the decision-making process, including those groups that lack resources or a formal voice in the process. How is that done? Some of the ways a reviewer might ensure these outside perspectives are considered include:

- Identify public participation requirements and expectations for involving certain stakeholders in early communications with the project proponent or its representatives if appropriate;
- Read local newspapers, newsletters from community groups, and other written materials that may provide information on community concerns and priorities;
- Attend meetings of local citizens' groups and other groups that involve people from the community;
- Post announcements of upcoming environmental impact assessment-related meetings that are open to outsiders, if appropriate to the reviewer's role;
- Use an informal network of organizations and individuals to provide added local or environmental perspective; and
- Think about who might have concerns and why when reviewing the description of scoping in environmental impact assessment documents and adopt the various perspectives of interested parties during review.

Some or all of these may or may not be appropriate to a particular reviewer, and certainly there are more ways than those listed above.

The benefits of communication with and involvement of all interested parties are so important that the expenditure of extra effort on their behalf is usually warranted. This is particularly true in the context of environmental impact assessment review because technical experts and other specialists can often overlook important facts or areas of investigation that local citizens and groups are more aware of because of their proximity to the potentially affected environment and their stake in the outcome. By keeping the public and other stakeholders involved, there is a better chance that all important issues will receive adequate attention.

- Technical experts and other specialists often overlook important areas of investigation of which local citizens and groups are aware

3.4.2.3 Preparing Comments on a Draft EIA Road Map

Reviewer responsibilities differ from country to country, but a reviewer should provide clear and concise comments on any draft environmental impact assessments if presented for review. The reviewer may be called upon to do one or more of several things with the draft:

- Establish a schedule that allows time to consolidate and resolve any discrepancies in the comments provided by reviewers;

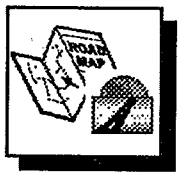
- Identify appropriate colleagues to provide input on the draft environmental impact assessment and send it out for formal review with a specified timetable for response; and
- Draft a comment letter on the environmental impact assessment which provides a clear and concise description of the government agency's substantive and/or procedural concerns, if any, and recommendations for addressing the concerns. This letter might include the following:
  - An evaluation of the adequacy of the supporting information that was provided in the environmental impact assessment;
  - An evaluation of the completeness of the purpose and need, alternatives, background information, impact assessments, mitigation proposed and requirements or suggestions for additional information needed, when necessary;
  - If a rating system is used, a rating of the potential impact of the proposed project and the adequacy of the analyses;
  - Discussion of any concerns regarding the methodologies in preparing the environmental impact assessment (e.g., predictive models of pollutant transport and fate, economic analysis and treatment of unquantified environmental impacts, values, and amenities);
  - Additional information sources, including other documents, studies, or onsite surveys to review;
  - Possible mitigation measures to eliminate, prevent, avoid, minimize, or reduce damage to the environment or to protect, restore, and enhance the environment. Suggestions should focus on mitigation measures that will have a long-term effect, are technically feasible, and are economically viable;
  - Potential impacts that may lead to possible violations of national environmental standards or that may preclude or bias future issuance of environmental permits; and
  - Identification of an environmentally preferable alternative, particularly if significant impact(s) associated with the proposed project or preferred alternative cannot be mitigated adequately or are less desirable. This may be a new alternative. Alternatives, like mitigation measures, should be reasonable and feasible.

It is important to realize that reviewers have resources to draw upon to accomplish an effective review. One of the most important resources can be the reviewer checklist presented in Appendix A. As the preceeding discussion makes clear, there are numerous components that must be

kept in mind during review of draft environmental impact assessment documents. The same is true of final documents. The reviewer checklist was created to help ensure that the review is systemmatic and standardized across different types of projects. In addition to the checklist, Appendix B presents a matrix describing a wide range of environmental impact assessment methodologies; Appendix C-2 presents a number of tools for identifying significant issues; and Appendix D presents tables of contents from two environmental impact assessment tools available to participants in the course *Principles of Environmental Impact Assessment Review*: a Resource Manual and a CD ROM, as well as a summary of their content.

Road Map for Draft Environmental Impact Assessment Review

- Establish a management approach:
  - Establish lead reviewer
  - Assign roles
  - Establish a schedule
  - Conduct Review
- Consolidate reviewers' comments:
  - Identify most significant issues
  - Determine the significance of each comment
  - Establish common threads
  - Resolve any discrepancies
- Draft a comment letter:
  - Maintain neutrality, objectivity and professionalism
  - Provide clear and concise comments
- Anticipate and respond to public comment



3.4.3 Final Environmental Impact Assessment Documents

The same considerations listed for reviewing draft documents apply to final environmental impact assessment documents. Responses to comments on a draft document may be mandatory or voluntary. Reviewers should always review the final environmental impact assessment, even if they reviewed and commented on a draft, or even if there were no objections to the draft. This is true for several reasons:

- If there were no objections to drafts, the reviewer still needs to verify that nothing substantive changed between the draft and the final document, including the assumptions and predictive models utilized;

- Reviewers should always review the final environmental impact assessment, even if they had no comments on, or objections to, earlier drafts

- The reviewer also needs to review the proponent's responses to comments submitted on the drafts; and
- If there *were* objections to drafts, the reviewer needs to take steps to help ensure that they were addressed.

In most situations, the reviewer will develop comments on the final environmental impact assessment as a matter of course. These comments can focus on unresolved issues, particularly on the potential impacts of the proposed project and the scope of review. Comments may focus on issues raised in the comments on drafts, as well as on new issues that either arose since then or that the reviewer now identifies due to new information.

- Reviewers almost always make comments on final environmental impact assessment documents

Road Map for Final Environmental Impact Assessment Review

- Establish a management approach
- Determine if basic assumptions and information are the same for draft and final
- Assess impacts of any changes on alternatives, impacts and proposed mitigation
- Verify that comments were acknowledged and addressed
- Review the relationship and consistency among responses to individual comments
- Consolidate comments and prepare the final comment letter
- Determine whether responses change fundamental reviewer findings:
  - Acceptability of environmental impact
  - Needed mitigation
  - Adequacy of environmental impact assessment document and process
  - Who needs to be involved and consulted
- Decide projects to increase chance of correcting remaining deficiencies
- Anticipate use by decision maker
- Anticipate use to establish mitigation requirements
- If appropriate, prepare final comment letter.

3.4.4 The Role of the Reviewer in Decision-making

As noted above, the reviewer may or may not be a decision-maker, depending upon the organization or institutional setting. However, decision-makers who are not the reviewers themselves often rely upon the reviewers to provide a clear basis for decisions without having to wade through significant amounts of information. The reviewer is therefore a very important person for decision making, and can draw the key elements from the document for not only project approval, but also

- Decision-makers who are not reviewers often rely upon reviewers to sift through large amounts of information and provide them with the key information necessary to make decisions

conditions for proceeding. He or she can also suggest consideration of an alternative from within the range offered or a new alternative which may better resolve potential conflicts. In most cases, the preparation of an environmental impact assessment is mandated by legislation, by institutions, or encouraged by practice to ensure that all relevant environmental and socioeconomic factors are taken into account during the planning of policies, programs or projects, particularly projects with the potential to significantly affect the environment or society. The belief is that informed planning and decisions will result in a project that meets the purpose and need to the satisfaction of the project proponent, and does so with minimal negative environmental and socioeconomic impacts. Informed planning is also a cornerstone for sustainable development.

The environmental impact assessment process is meant to be a tool for use in sound decision-making. It is *not* intended to be a "paperwork exercise" with no bearing on the decision-making process. The environmental impact assessment process should occur in conjunction with all aspects of a proposed project, from its conceptualization all the way through its completion and beyond.

- The environmental impact assessment process is meant to be a tool, not a "paperwork exercise"

Influencing the Decision-Making Process

The approach in this text is to offer practical tips as well as theory concerning the realities of doing the job of environmental impact assessment review in a variety of settings. However, this approach fundamentally assumes there is some level of acceptance of the environmental impact assessment process by the involved parties. This is not always the case. In the extreme, for example, it was once reported that country officials brought in new contractors when they did not like the information or outcomes reported in an environmental impact assessment simply because they contradicted the officials' desired outcome. In that case, the reviewer was left only with the possibility of reviewing a poor product. Such situations are rare but they do occur. These sorts of problems are not explicitly addressed within this text. More common, and addressed here, is the situation in which resources for conducting a sound environmental impact assessment review are limited, and in which reviewers, while in a position to improve the assessment, must also learn to work with what is available. They must also learn how to be in a better position to influence the development of a sound environmental impact assessment.

- Reviewers face different constraints to their ability to influence environmental impact assessment preparation in different countries. Even if there are many constraints, reviewers can usually find ways to influence the environmental impact assessment process in substantive ways

Maintaining Objectivity

It is important for the reviewers of environmental impact assessments to be committed to long-term environmental and social health and stability. With this commitment, however, comes the risk of getting too personally involved. It is important to remain committed to the environmental impact assessment review process and not become either emotionally

- Reviewers must always remain objective and independent in their reviews of environmental impact assessment documents

attached to a particular outcome or overly influenced or persuaded by an interested party. To preserve independence and objectivity, a reviewer should do two things:

- Communicate clearly up-front that input from a reviewer is not tacit approval, and is not definitive; an independent review will follow, and the reviewer will be free to raise issues that may have been overlooked in the absence of all the information; and
- Maintain neutrality and professionalism throughout the process.

Often the best approach is to continually reassert the reviewer's neutrality to all parties. The professionalism and neutrality of a reviewer will help ensure a balanced, effective decision-making process. In fact, the reviewer is often referred to as an "independent" reviewer, and that independence and neutrality are important to supporting the decision-making process.

- Often the best approach is to continually reassert the reviewer's neutrality to all parties

3.4.4.1 The Record of Decision

A Record of Decision is the document that contains the reviewer's decisions on project approval, denial, or conditional approval (if such authority exists in a particular legal or institutional setting). The term Record of Decision may have different names in different countries, and this particular term is used in this text as a simplification.

The Record of Decision is the final decision on the project by the responsible agency or project proponent and may or may not be open for public comment. Within the United States, for example, it is possible for a member of the public to obtain a copy of a Record of Decision, although it is not required to be publicly disseminated.

In some countries, project proponents are required to select and implement the environmentally preferred alternative. In such settings, it is important for the reviewer to check to make sure the Record of Decision indicates selection of the environmentally-preferred alternative. In other countries, like the United States, only the environmental consequences of the proposed project must be considered during decision making, whether or not the environmentally preferred alternative is selected.

A Record of Decision should contain the following:

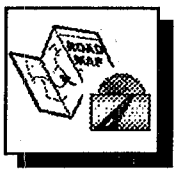
- A clear statement of which alternative was selected and a justification of why it was selected;
- A summary of alternatives considered;

- A description of any conditions for approval (mitigation and continuing monitoring or other such requirements) that have been set;
- A discussion of concurrent regulations and laws and whether the proposed project will be in compliance with them;
- A demonstration that the environmental impacts of the chosen alternative were fully considered in the decision-making process;
- A demonstration that the benefits of the proposed project outweigh the adverse impacts of the proposed project; and
- A demonstration that implementation of the proposed project will be as environmentally acceptable as possible.

A reviewer may or may not be the decision maker reviewing the Record of Decision. However, whether a reviewer requests an opportunity to comment on the Record of Decision is usually up to the discretion of the reviewer. The decision maker may in fact welcome positive comments on the Record of Decision as support for the proposed project, if they have been responsive to previous comments which were negative.

Road Map for Record of Decision Preparation

- Re-state the purpose and need
- Support preferred alternative and justify
  - Meets purpose and need
  - Either preferred environmentally or meets purpose and need better than other alternatives
  - Meets legal requirements
- Demonstrate all potentially adverse impacts from the selected alternative were fully considered
- Demonstrate benefits of proposed project outweigh adverse impacts
- Demonstrate that implementation of the proposed project will be environmentally acceptable
- Identify mitigation measures and continuing responsibilities.



3.4.5 The Role of the Reviewer in Post-Decision Monitoring and Follow-up

In the case of proposed projects that will require significant mitigation measures, the reviewer should review plans to follow up on the implementation of mitigation after the environmental impact assessment process is complete. For example, if the reviewer has sufficient authority, he or she may require a monitoring plan. This can be an effective way to ensure that the environmental impact assessment results in a desirable outcome, and is not merely a paperwork exercise.

- The reviewer can help ensure that post-decision monitoring follows the measures specified in the environmental impact assessment

3.5 COMMUNICATING THE FINDINGS OF THE REVIEW

To effectively carry out the role of the reviewer, the reviewer must be able to clearly communicate, both orally and in writing, the results of the review in a clear and convincing manner. The reviewer needs to understand and consider the following potential audiences for communications; some or all of these may be applicable depending upon the procedures, institutional, organizational and personal contexts within which the reviewer carries out his or her responsibilities:

- The reviewer must be able to communicate, both orally and in writing, the results of the review in a clear and convincing manner

- *Project proponent*: about the requirements of the process, timetables, initial environmental impact assessment results, scoping, results of review of draft environmental impact assessment, final environmental impact assessment, and decisions made.
- *Public*: about opportunities for comment, solicitation of comment, about the proposed project, the potential impacts, and decisions made.
- *Decision-makers*: about the proposed project, the potential impacts, the preferred alternative, proposed mitigation and related conditions for approval, responsibilities and roles for follow up, and coordination of review.
- *Internal review team and affected government agencies:* about the issues requiring review and comment, and the timetable for comment.

The reviewer needs to think about how to get the most important points on the table, and to put all points into context in terms the audience will readily understand. The challenges to reviewers include:

- How to be comprehensive and thorough without losing the target audience of the communication in a sea of detail. It is helpful to develop attachments, to categorize comments as to their significance, mandatory versus voluntary changes, etc. Another useful measure when submitting comments on an environmental impact assessment is to distinguish between comments that are advisory and those that are obligatory (e.g., regulatory or otherwise required). This

will make the job of setting priorities for areas of correction within the environmental impact assessment an easier one for the project proponent. It will also often diffuse conflict between the project proponent and reviewer by clearly identifying potentially controversial comments or recommendations as advisory rather than obligatory.

- How to communicate consequences of failure to consider certain alternatives, mitigation, and/or impacts, etc.

- When to seek face-to-face versus written communications, and how often to communicate. In some instances, a reviewer has an opportunity to discuss comments before they are formally sent. While needing to ensure that such opportunities do not compromise objectivity and independence, they can provide the project proponent with an opportunity to correct deficiencies before he or she may be publicly embarrassed.

One way to avoid being compromised is to have the formal written comments ready and final before such a meeting. A face-to-face meeting at that point can serve to help ensure that the reviewer understood everything he or she read; and it helps identify actions that would resolve the reviewer's concerns. It becomes an excellent point of leverage for a reviewer and an opportunity to establish a responsive relationship with the project proponent. Many experienced reviewers advocate early, frequent communications with the project proponent and all interested parties throughout the review process to ensure the best product for decision-making, but such opportunities are costly in time and effort and need to be balanced against other demands of the job. In most instances, the comment letter or rating should not be modified after meeting with the project proponent unless the reviewer obviously made an error in his or her reading of the draft document.

- Frequent communication with the project proponent and all interested parties is highly beneficial, but needs to be balanced against other demands of the job

Frequently a reviewer can improve communications and lower the level of controversy and degree to which the process is adversarial if comments can be offered early and project proponents are offered an opportunity to meet and discuss the issues and arrive at new ways to mitigate or correct problems. While this is accomplished, the reviewer must try to ensure the integrity of his or her independent review. One effective step toward achieving this goal is to ensure that higher levels of authority above the reviewer are apprized of the comments and approach so that unhappy project proponents cannot easily lobby the reviewer against the issuance of the comments by the agency. Depending upon the organization's culture, it may be possible to share comments with those at a higher level to gain support in advance and better insulate the reviewer from influence or pressure by the project proponent who may not be pleased with the comments.

- Offering comments early to the project proponent can lower the level of controversy in the environmental impact assessment process by allowing the proponent time to address the reviewer's concerns

- Who should the reviewer involve if he or she is in a position and role which requires communications with the public? It will be important in these instances to take steps to help ensure that no one feels left out or unfairly treated. When in doubt about a particular party, invite them to participate.

- What government officials should be involved, and when? It is particularly important to include agencies that are responsible for monitoring the type of project proposed in the environmental impact assessment. Such agencies should be provided ample time to review both the environmental impact assessment and all reviewer comments to ensure that the project proponent is made aware of any difficulties that may arise from a monitoring or enforcement nature once the proposed project moves forward.

- Whether and to whom to distribute comments: Every agency typically has its own unique system for distributing comments on environmental impact assessments. When comments are distributed, it is critical to try to ensure that all concerned parties receive copies of drafts of the environmental impact assessment and of the final environmental impact assessment, document as well as all comments on the draft and final environmental impact assessment.

- Who should receive comments on an environmental impact assessment? The following groups or individuals should receive comments, at a minimum:
  - Local, state, and federal officials, especially any agencies or individuals in charge of monitoring or compliance, the consulting firms involved, the agency where the reviewer works, and any stakeholder groups such as citizens' groups in the areas likely to be affected;
  - Those the reviewer wants to influence;
  - Those who will follow-up and provide assistance or advice; and
  - As many other relevant groups or individuals as possible (it may be useful to have a checklist of generic types of groups or individuals).

A final note on distribution of comments: It may be possible and advisable to use communication of review results to effect change and mitigation. Depending on who receives comments, individuals, groups, or agencies with an interest in the proposed project may decide to become involved in ensuring the proposed project does not entail undue environmental or other impacts. This may serve to further the goals of the reviewing agency.

Road Map for the Communication Letter

- State bottom line including major recommendations up front and clearly
- Describe proposed project context
- If the purpose and need of the proposed project is in question, develop the link to the environmental concerns
- Distinguish what is mandatory, what is significant
- Provide a description of the substantive and/or procedural concerns
- Demonstrate sensitivity to interests and affected community
- Provide recommendations for addressing the concerns

3.6 OVERCOMING OBSTACLES TO EFFECTIVE ENVIRONMENTAL IMPACT ASSESSMENT REVIEWS

Some of the most common frustrations reviewers express when reviewing environmental impact assessments are as follows:

- There are too many environmental impact assessments to review at the same time given limited staff and financial resources;
- The decision to pursue a particular alternative in an environmental impact assessment seems to already have been made by the time the reviewer learns of the proposed project; and
- Comments from reviewers are ignored or under-valued, due to the influence of the project proponent.

There are often several options that can be pursued to overcome common obstacles to effective environmental impact assessment review. It is rare that all comments and recommendations from a reviewer are adopted and/or influence the product and final outcome. However, a reviewer's input can make a profound difference by persuading a project proponent to make small incremental changes over time that are cumulatively important.

Every country and institutional setting is different, and each presents distinct challenges and opportunities. A reviewer who steadfastly

maintains neutrality and commitment to the environmental impact assessment process as taught in this course can make a difference.

Words to the wise: Creativity, patience, and a positive attitude can go a long way toward achieving the goals of the environmental impact assessment process. Any reviewer can evaluate the particular circumstances surrounding environmental impact assessment review in his or her country and institutional setting and identify opportunities for change or creative use of existing resources.

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4. EVALUATION OF AN ENVIRONMENTAL IMPACT ASSESSMENT DOCUMENT

Environmental impact assessment documents should present the necessary background information and results of all assessments conducted to assess the relative environmental impacts associated with all reasonable and feasible alternatives to the proposed project. An environmental impact assessment typically proceeds from the purpose and need of the proposed project, project alternatives, and description of the environmental setting to the assessment of potential impacts. The document commonly concludes with a discussion of mitigation measures.

- Typical structure of an environmental impact assessment document:
  - Purpose and need
  - Project alternatives
  - Description of environmental setting
  - Assessment of potential impacts
  - Mitigation measures

This chapter discusses the contents of a comprehensive environmental impact assessment document and provides the reviewer with guidelines for its assessment. The chapter follows the typical organization of an environmental impact assessment, and the reader should use these descriptions as a guide of what to look for in an environmental impact assessment. As in key sections of Chapter 3, at the end of each section in this chapter, the reader is presented with a road map to help guide review, indicated by the road map icon.

4.1 APPROACHES TO REVIEW: READING AN ENVIRONMENTAL IMPACT ASSESSMENT: WHAT TO LOOK FOR

Many of the specific steps that must be taken during the review of the elements of an environmental impact assessment are described throughout this document. Included in this chapter is guidance on how best to approach the analysis of an environmental impact assessment, and how to maximize the effectiveness of this analysis.

In any review of any part of an environmental impact assessment document, the reviewer should keep in mind the six elements of the Reviewer's Focus presented in Chapter 3. Namely, the reviewer should focus on:

- Reviewer's Focus

1) Completeness/Coverage
2) Significance
3) Adequacy
4) Integrity
5) Accuracy
6) Influence

Throughout this chapter, the road maps for review of each element of an environmental impact assessment document follow these six elements of the Reviewer's Focus where relevant.

There are several different ways to approach the evaluation of an environmental impact assessment, and all are appropriate to some

degree or another depending upon the most effective approach within a given country or institution, agency, and/or individual reviewer situation. For example, the approach is different depending on the reviewer's familiarity with the proposed project, and on his or her level of experience. Each reviewer needs to find the approaches he or she is most comfortable with for different types of projects. This approach will likely change over time as the reviewer gains more experience evaluating environmental impact assessments and develops more expertise in the various disciplines that contribute to environmental impact assessment.

- Each reviewer needs to find the approach to environmental impact assessment review he or she is most comfortable with for different types of projects

The following are some useful approaches to reading an environmental impact assessment:

1) Scan the document, then read it quickly to get a sense of what it is about. Think about:
   - Flagging major issues: Identify them and determine if they were addressed.
   - Spotting where help is needed: Look at the Executive Summary and table of contents, spot key or significant issues and who might be called upon to assist in the review.

2) Read the document several times (depending on time availability) to identify major issues and to determine whether they were addressed. It would be less necessary to read an environmental impact assessment several times if the reviewer had been involved in the scoping process and other stages of the process. When conducting this more in-depth review, keep the following items in mind. Some of these methods are used in the review of the environmental impact assessment document, while others are useful components of managing the environmental impact assessment process. These methods are not mutually exclusive, and individual reviewers should use the methods they are most comfortable with:

   - *Adequate inclusion of stakeholder views and concerns:* Evaluate whether an adequate range of stakeholders was involved in the scoping and other processes. A reviewer should examine the list of people involved to determine if there was a scoping activity. If a key group was absent from scoping, the reviewer should look particularly for the kinds of issues it would have raised.

   - *The train of logic:* Does the environmental impact assessment "make sense" in its internal logic from statement of purpose and need through impacts and consideration of alternatives and mitigation? An environmental impact assessment that attempts to mask or downplay significant concerns often must make leaps in logic that such a review can help to identify. A reviewer should determine if environmental issues are clearly

identified and whether there is a clear flow of information. Is there a basis for the conclusions drawn?

- *Logical application of technical knowledge/methods*: Is the rationale for the choice of models explicit, and consistent with the facts in the situation? What was considered and rejected and why? Were analytical methods and measures used? How were the application of disciplines utilized?

- *Comparative Environmental Impact Assessments or Guidelines*: The reviewer can usefully compare the environmental impact assessment to environmental impact assessments on similar types of projects done elsewhere or EIA guidance for similar projects. Among other things, this can help identify issues that may have been overlooked.

- *Systematic approach: Walk through the environmental impact assessment preparation steps/structure being systematic and using checklists*: Use the structures for preparation of an environmental impact assessment and systematic checklists. Identify different kinds of checklists and their use. Were the impacts addressed completely (e.g., pollution prevention, etc.)? A detailed checklist to guide the review process is included in Appendix A of this document. In addition, there are several useful checklists and other sources of information in the Resource Manual that accompanies the *Principles of Environmental Impact Assessment Review* course. Using these tools will enable a reviewer to determine if the key steps and elements were executed properly by the project proponent.

- *Support of decision-making*: Is information understandably displayed on alternatives and mitigation measures so that decisions can be made?

Road Map for Overall
Environmental Impact Assessment Document Review

- Review Table of Contents and Executive Summary
- Scan and read the document several times
- Take notes, write down questions
- Go through key environmental impact assessment elements
  - Purpose and Need, Alternatives, Environmental Setting, Impact, Mitigation
- Use checklists where appropriate
- Review the logic and consistency of the document
- Use a systematic approach to identify areas where the assessment is:
  - Incomplete, inadequate
  - Significance unsupported/unclear/ignored
  - Lacks integration
- Identify and adopt perspectives of all interested and affected parties
- Compare document to other environmental impact assessments
- Determine whether the document supports decision-making

4.2 PURPOSE AND NEED

The environmental impact assessment document should begin with an introduction describing the purpose of, and need for, the proposed project. An accurate description of the purpose and need is critical to a full examination of possible alternatives and the selection of a preferred alternative. The purpose and need must be a clear, objective statement of the rationale for the proposed project. The need for the proposed project can simply be a specific problem that must be addressed, or an available opportunity. For example, a problem may be flooding along a river that affects the local community, and an opportunity may be to attract tourists to an undeveloped coastal area. The purpose of the proposed project describes the goals or objectives for meeting the need.

- The purpose and need must be a clear, objective statement of the rationale for the proposed project

The statement of purpose and need is important because it provides the framework for identifying project alternatives. For example, a project to build a new power plant may be proposed because the existing plant is producing at full capacity and cannot meet projected growth in demand for electricity. The need for the proposed project is to provide 500 megawatts of electricity to meet the projected increase in demand. The purpose, or goals to be met in addressing the need, is to minimize the cost to consumers, improve air quality in an area that does not meet current standards, and attract new industries. The project alternatives could include various locations for the proposed new power plant, implementation of conservation measures to avoid building the facility (demand side management), different kinds of power (e.g., wind, solar), different types of fuel (e.g., natural gas, oil, biomass), or a combination of these alternatives and perhaps cogeneration. All of these alternatives address the need for the proposed project. Some of them address the purpose better than others. All reasonable alternatives that fulfill the purpose and need should be evaluated in detail. The more alternatives, the greater the possibility of avoiding significant impacts.

- The statement of purpose and need provides the framework for identifying project alternatives

A clear statement of purpose and need can further the goals of the environmental impact assessment process in the following ways:

- Provides basis for determining impacts
- Provides basis for defining alternatives
- Helps all parties to understand the context of the action.

It is helpful to obtain input on the purpose and need of a proposed project from stakeholders, including businesses, citizens, local government, and nongovernmental organizations. This enables the project proponent to understand and consider the priorities and concerns of the local community and government agencies early in the planning process, which could help to avoid future delays.

4.2.1 Review of Purpose and Need

The purpose and need for a proposed project are sometimes accepted as "given," ignored, or under-emphasized in an environmental impact assessment review. However, the reviewer should always review the stated purpose and need of a proposed project. Such a review can find either that the proposed purpose and need statement is a) adequately described, b) adequately described but does not justify the proposed project, c) adequately described but can be met by alternatives not considered in the environmental impact assessment which may be environmentally preferable, or d) is not supported in the document. Proposed projects often take on a "life of their own" simply because money has been made available. It is important to be aware of this. The mere existence of funding for a project does not automatically mean the proposed project is needed or is justifiable.

- The reviewer should always review the stated purpose and need of a proposed project. It is important not to under-emphasize this aspect of environmental impact assessment review

The realities of a reviewer commenting on purpose and need involve, first, the fact that it is often viewed to lie outside the actual or perceived expertise or role of a reviewer, and second, the fact that there are frequently powerful economic and/or political interests in a proposed project. Therefore, comments on purpose and need should be well founded to be taken seriously. The need to review and the time and effort required to review a proposed project's "purpose and need" are usually balanced against the potential for adverse environmental impacts of proposed project. For example, it is most important to be confident in the purpose and need if potential environmental or other impacts are significant. On the other hand, if the purpose and need are weak, but the potential environmental or other impacts are insignificant, it may not make sense to spend large amounts of time and resources scrutinizing this aspect of the environmental impact assessment.

- It is most important to evaluate the purpose and need if potential environmental impacts are significant

A reviewer should ask for clarification from the project proponent if the purpose and need are vague or confusing. Other reviewers may also be consulted. When a reviewer is confident that the purpose and need merit a challenge, however, the reviewer should certainly offer one. If a reviewer does not challenge the purpose and need of a poorly conceived project, the results of the environmental impact assessment process will be limited to mitigation measures, at best, when the issues may require more profound considerations. When offering a challenge to the purpose and need, it is important to also offer or take steps to help ensure there are viable alternatives to the proposed project. Criticisms without alternatives are not well received, and often do not result in a constructive decision-making process.

4.2.2 Purpose and Need Review Road Map

All of the preceding discussion on purpose and need can be summarized in the following road map for review of purpose and need. As a reviewer, you should focus on answering the following questions:

- Road Map for Overall EIA Document Review

Road Map for Purpose and Need Review

- Describes the purpose and need of the proposed project
- Demonstrates how purpose and need would be met by the proposed project
- Adequately describes the proposed project
  - Maps project site, surrounding land use, and natural features
  - Who and what would benefit; who and what would be affected
  - Phases; site preparation, construction, operation, and closure
  - Time frames, including when proposed project begins and ends

4.3 PROJECT ALTERNATIVES

In most countries, a range of alternatives are evaluated to facilitate identification of the most appropriate means of meeting the purpose and need for a project. Not all countries require the consideration of alternatives. When required, or voluntarily included in an environmental impact assessment, alternatives should include different ways of achieving the purpose and need and alternate designs for the proposed action. The environmental impact assessment should also include the no-action alternative. This alternative provides a baseline of existing and future environmental conditions without the proposed project that can be used for comparison with the potential impacts of the other alternatives. It also provides an opportunity to document the beneficial and adverse effects of not addressing the need. Finally, it supports the decision-maker's choices of project approval or denial.

- The environmental impact assessment should include a no-action alternative

The "alternatives" section of the environmental impact assessment describes all alternatives that were, or are, being considered. All reasonable alternatives, those that meet the purpose and need, are explained in detail. Alternatives that were considered and rejected early in the planning process are described briefly with the rationale for their elimination. The rationale should have sufficient information to support the decision not to proceed with the dismissed alternatives and sufficient backup data to respond to any challenging questions or comments on the draft environmental impact assessment.

The preliminary evaluation of alternatives should narrow the scope of the environmental impact assessment to a reasonable set of alternatives. The environmental impact assessment should focus on the most feasible, cost effective and environmentally sensitive alternatives. For each alternative, the environmental impact assessment should include (1) a balanced description, and (2) a discussion including the size and location of facilities (or the project, if no facility is planned), land requirements, operations and management requirements, auxiliary structures, and construction schedules.

- For each alternative, the environmental impact assessment should include:

  1) A balanced description
  2) Discussions of:
     - Facility size and location (if applicable)
     - Land requirements
     - Operations and management
     - Auxiliary structures
     - Construction schedules

The benefits of evaluating alternatives include the following:

- Selection of the best project design;
- Selection of the best project location;
- Most efficient use of resources;
- Avoidance of adverse impacts;
- Achievement of sustainable development goals only achievable through consideration of new ways of doing business.

When developing alternatives, it is beneficial for the project proponent to solicit input from the public and government agencies. Including these parties is an important technique for identifying potential issues and problems with the proposed project or alternatives. The earlier any

- The earlier any problems are identified, the easier and less costly it is to address them

problems are identified, the easier and less costly it is for the project proponent and reviewer to address them.

As part of the description of alternatives, the proponent's own initial evaluation to proceed with the proposed action should be explained to provide insight into the breadth and depth of alternatives considered and rejected or pursued for further study. A well-documented description of the preliminary evaluation processes explaining the process for shortening the list of alternatives can help determine whether a full range of alternatives was evaluated. Exploring and documenting a broad scope of alternatives is to the advantage of the project proponent.

4.3.1 Review of Project Alternatives

It is important that the environmental impact assessment include a sufficient number of alternatives to ensure an effective decision-making process. The reviewer can question whether other alternatives should be included even after the scoping process has ended whether or not the reviewer was actually involved in scoping.

The requirement to develop and analyze alternatives is not a boundless process of generating all possible alternatives. There is an objective process for this aspect of the environmental impact assessment. Alternatives should be developed under the following considerations:

- Alternatives must meet the purpose and need for the proposed project.
- Alternatives should be reasonable, that is they should be practicable; it must be possible to carry them out. They must be feasible from logistical, technical and financial perspectives.

- Alternatives:
  - Must meet the purpose and need
  - Should be reasonable and practicable

For purposes of decision making, they can be presented as points along a continuous range of alternatives which, when systematically analyzed, provide a solid basis for decision-making.

<u>How Many Types and What Number of Alternatives are Adequate?</u>

How does a reviewer know how many alternatives there should be, and how well they were analyzed? It is important to keep in mind that environmental impact assessment is a tool for a decision-making process. Thus, a reasonable *range* of alternatives should have been identified and evaluated. A single choice does not constitute a range of alternatives, because in such a case there is no decision, no decision-making, and no environmental impact assessment process.

- Determining the correct number and type of alternatives

In reality a few or up to hundreds of alternatives may be necessary in a particular environmental impact assessment. To determine whether a reasonable number of alternatives have been identified, the reviewer must take into account time, geography, economics, environment and social impacts. The alternatives should represent a range or points

- As little as one or two or as many and hundreds of alternatives may be appropriate, depending on the characteristics of the proposed project

along a spectrum of options that offer real choices for the decision-maker.

The No-Action Alternative

In countries where alternatives are required or commonly evaluated, environmental impact assessments should always include a no-action alternative. Inclusion of the no-action alternative is important for effective decision-making. It provides an assessment of environmental and other conditions absent the proposed project which can be used to compare against the potential environmental impacts of the proposed project, both beneficial and adverse. The no-action alternative presents expected *future* environmental conditions. This can help reviewers determine whether the anticipated deviation from the no-project state will be acceptable.

- Environmental impact assessments should always include a no-action alternative

Baseline environmental conditions are not the same as the no-action alternative. A baseline typically presents *current* environmental conditions, but current conditions may change even in the absence of a proposed project (for example, if a forest were projected to decline over time due to an insect infestation). It is important to identify both the positive and negative potential environmental impacts of a proposed project throughout the life of the project, which requires anticipation of changes in conditions that are not related to the proposed project. Indeed, a proposed project may prove to be beneficial as compared to letting an existing situation deteriorate.

- Baseline environmental conditions are not the same thing as the no-action alternative

Balanced Assessment of Alternatives

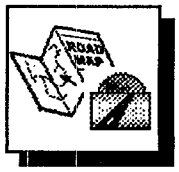
Reviewers should determine whether each alternative was evaluated adequately. This implies that some alternatives may receive more attention than others. Often there are some alternatives that are considered but not analyzed because they are clearly not viable. Of the alternatives that are analyzed, each alternative should receive equal analysis so that comparisons are meaningful. Although equivalent analyses are advisable, variation in analysis of alternatives is common. Reviewers should trust their own professional opinions and those of associate reviewers; if an alternative seems to have been neglected without just cause, it is reasonable and advisable to ask the project proponent to revisit it in sufficient depth.

4.3.2 Alternatives Review Road Map

To summarize, when evaluating alternatives, the reviewer needs to ask, at a minimum:

Road Map for Alternatives Review

- Considers the full range of alternatives to meet purpose and need
  - No action
  - Alternative sites, designs, controls
  - Structural vs non-structural
  - Reallocation of social costs and benefits
  - Reasonable, feasible
  - Reflective of the range of choices
  - Meet the purpose and need of the proposed project
- Preferred alternative satisfies purpose and need better than alternatives with less environmental impact



4.4 DESCRIPTION OF THE ENVIRONMENTAL SETTING

The section of the environmental impact assessment document that describes the environmental setting should identify and describe the environmental setting, including the physical-chemical, biological, and socioeconomic environments; aesthetics; and cultural resources. The description of the environmental setting must be complete and accurate because it will serve as the baseline from which the impacts of the proposed action are predicted. The reviewer should refer back to the scoping process of the environmental impact assessment to help ensure that all substantial issues are addressed. The reviewer must identify all substantial issues not covered in the environmental impact assessment.

The description of the environmental setting section should include only the appropriate background information necessary to understand the potential impacts of the project alternatives. The information should be presented objectively. The reviewer should take steps to help ensure that each aspect of the environment that is likely to be affected by the proposed project is adequately addressed. The environmental impact assessment should consider:

- Local ambient air quality conditions
- Location of seismic activity, flood plain, and other special geologic or hydrologic features within the vicinity of the proposed project
- Surface water and ground water quality and quantity

- Description may include:
  - Air resources
  - Water resources
  - Soils and geology
  - Biological resources
  - Waste management and pollution prevention
  - Socioeconomic setting
  - Cultural resources

- Local biological communities and fish and wildlife habitats, including critical habitats of any rare, threatened, or endangered species
- Location of specially protected areas, including wildlife management areas, parks, wetlands, pristine lands or water bodies, or prime agricultural lands
- Renewable and nonrenewable resources
- Current and projected population, population density, and location of population in relation to the proposed project site
- Current and projected land use (within the proposed project area and region) and relevant land use regulations
- Local and regional patterns of energy demand and supply
- Local ambient noise levels
- Location of any properties with cultural heritage values within the vicinity of the proposed project
- Existing regulatory setting for each resource.

The description section should focus on the important issues. Only the components likely to be affected need to be addressed in detail; others should be summarized, consolidated, or referenced. Experience from similar projects can be helpful in identifying the environmental components that should be described.

- Information sources:
  - Existing literature
  - Government agencies
  - Research organizations
  - Field surveys
  - Topographic maps
  - Land use maps
  - Geographic information systems
  - Local specialists

When feasible, the environmental impact assessment should rely on existing data to describe the environmental setting. If sufficient data are not available to fill a particular need, various techniques can be used to obtain the appropriate data. These techniques include field surveys, checklists, topographic maps, and overlay mapping, including those produced using geographic information systems (GIS). The Resource Manual that accompanies the Principles of Environmental Impact Assessment Review course contains information on these types of information sources.

To effectively assess the potential impacts of a proposed project, the reviewer must consider whether the project proponent has established appropriate boundaries for the region of concern and time periods for describing the baseline against which the potential impacts of the proposed project will be compared. The region of concern is the geographic area potentially affected by the proposed project. The most appropriate time period for assessing an impact is the point during construction or operation that creates the greatest change in the present environment. Different time periods and geographic boundaries are

- It is critical that the Region of Concern be clearly defined for each media, as well as time periods over which impacts are expected to occur

chosen for different impacts or parameters. For example, the boundaries of the region of concern are likely to be different for air and water. Projections of local employment may be compared for two different time periods—once during maximum temporary construction work force and later during full operation of the proposed project. The reviewer should make sure that the year(s) and area used for comparing the impacts are clearly indicated for each impact or parameter.

The following sections describe factors that the reviewer should consider when evaluating the adequacy of the description of the environmental setting given in the environmental impact assessment.

4.4.1 Existing Physical-Chemical Environment

The physical-chemical environment comprises the air, water, and geological characteristics of the region of concern. A complete understanding of the physical-chemical environment, and the type of project proposed, helps the reviewer identify specific issues to be investigated in the environmental impact assessment section that describes potential impacts. For example, the identification of frequent temperature inversions may require emphasis on the biological effects of gaseous emissions or a shortage of surface water in the project region may require that the few existing surface water bodies be considered critical habitats.

- Physical-Chemical Environment:
  - Air resources
  - Water resources
  - Soils and geology

4.4.1.1 Air Resources

A wide variety of industrial operations have the potential to affect air resources. These operations include activities at primary metal, pulp and paper, textile, and chemical manufacturing plants; power plants; and mining sites. In addition, increases in air and automobile traffic frequently affect air quality.

- Air Resources:
  - Meteorological data
  - Ambient air quality
  - Sources of air pollution

Air resources are described by the physical dynamic behavior of the lower atmosphere (parameters such as the seasonal distribution of wind velocity and the frequency and height of inversions) and by variations in the concentrations of various gases and suspended matter. Wind velocity and the frequency of occurrence of inversions are influenced by specific local topographic features, particularly surrounding hills or mountains. Air quality is described by the variations in the concentrations of pollutant gases and particulate matter in the lower atmosphere. Both the physical dynamic behavior and air quality of the lower atmosphere are needed to determine the impacts of proposed project construction and operation on air quality.

The physical dynamic behavior of the lower atmosphere is largely determined by the interaction of meteorological conditions and topography. Therefore, the environmental impact assessment should include a general discussion of climate within the region of concern that includes the following factors:

- Meteorological data:
  - Temperature
  - Wind
  - Precipitation
  - Humidity
  - Atmospheric pressure

- Daily and seasonal ground-level temperature
- Wind characteristics at different heights and times (wind roses are particularly helpful and provide wind speed, direction, frequency, and stability characteristics of the atmosphere)
- Total monthly, seasonal, and annual precipitation and frequency of storms and their intensity, including both average and extreme events
- Evaporation
- Height, frequency, and persistence of inversions and atmospheric mixing characteristics
- Description of pattern(s) evident for days of significant pollution episodes.

In addition, information should be included on the frequency of local climatic hazards, including tornadoes, high wind speeds, hurricanes, and floods (see Section 4.4.1.2). Construction techniques and site utilization may be affected by such climatic extremes. Meteorological data are typically available from local weather service stations. Site and area topography are generally determined from topographic maps or field surveys.

Data on ambient air quality (e.g., concentrations of particulates, carbon monoxide [CO], hydrocarbons, ozone [O_3], and sulfur dioxide [SO_2]) are required to predict the potential impacts during the construction and operation of a proposed project. This information is usually available from a local air pollution control agency. Using existing air quality as the background, incremental increases in air pollution concentrations can be predicted for comparison with various national and local standards. Also, the proposed site's location relative to any protected or sensitive areas (e.g., national parks) and any areas that are not meeting applicable air quality standards should be provided.

- Ambient air quality:
  - Particulates
  - Carbon Monoxide
  - Hydrocarbons
  - Ozone
  - Sulfur dioxide
  - Other pollutants of concern

The typical data sources for air quality are emission monitoring results from individual facilities and ambient air quality monitoring results reported by air pollution control districts. If these data are not available and the project proponent or the reviewer thinks that they are important, then air quality monitoring may be needed. At a minimum, major facilities or stationary sources and their emissions should be characterized, with daily variations in emissions by month, year, and peak season, for pollutants of concern. In addition to information on stationary sources, the environmental impact assessment should also consider the effects of mobile sources on local air quality.

- Stationary sources of emissions:
  - Power plants
  - Industrial plants
- Mobile sources of emissions
  - Cars and trucks
  - Airplanes
  - Boats
  - Trains

Projections of increases in emissions from both stationary and mobile sources and estimates of long-term pollutant concentrations are

important for describing future air quality. The comparison of existing air quality and expected trends with national and local air quality standards will assist in assessing potential impacts of emissions expected from the proposed project and in determining the need for air pollution controls.

4.4.1.2 Water Resources

Water resources can be affected by almost any project and should be considered when assessing potential environmental impacts of the construction and operation of manufacturing, industrial, or processing facilities, hazardous waste sites and landfills, tourism development, electricity generation, port and harbor development, and many other projects. Water resources can also be affected by infrastructure projects, including transportation and sewage treatment, and natural resource extraction projects, such as mining and forestry. Potential sources of impacts to water resources from these types of projects include:

- Withdrawal of freshwater from lakes, rivers, streams, or aquifers;
- Discharges of untreated or treated wastewaters;
- Deposition of pollutants from smoke stack and/or vehicle emissions;
- Storm water and agricultural runoff;
- Spills.

The reviewer should check to see whether information in the description section of the environmental impact assessment describes surface water bodies (i.e., streams, lakes, rivers, estuaries, and oceans), ground water aquifers, and special aquatic areas located within the region of concern. The descriptions should include maps of surface water bodies and surface drainage patterns. In addition, they should describe current and future uses of both surface water and ground water. Typical water body uses include wildlife habitat, drinking water supply, industrial/ commercial process water, agricultural irrigation water, subsistence uses (e.g., hunting, fishing), recreational uses (e.g., fishing, swimming), and commercial fishing and biota harvesting (e.g., shellfish harvesting, aquaculture). The use of surface waters (diversions, returns, and reclamation) is critically important in locations where water resources are scarce.

The environmental impact assessment also should describe current water quality. The description of water quality should include the physical and chemical characteristics of surface water bodies that may be affected by the proposed project. Ambient conditions of

- Water resources:
  - Source and location
  - Quality
  - Quantity
  - Uses

- Water quality information:
  - Dissolved oxygen
  - Temperature
  - Salinity
  - Suspended and dissolved solids
  - Nutrients
  - Chemicals of concern
  - Biological contaminants

conventional parameters (e.g., dissolved oxygen, temperature, salinity, suspended and dissolved solids, and nutrients), as well as concentrations of any chemicals of concern, should be described for both freshwater and marine water bodies.

In addition, descriptions of surface water bodies should include:

- Seasonal and historical maximum, minimum, and mean flows for rivers and streams;
- Water levels or stages and seasonal patterns of thermal stratification for lakes, ponds, and reservoirs;
- Circulation characteristics (e.g., tides, currents, thermocline, and thermohaline) for tidal rivers, lagoons, estuaries, and ocean waters;
- Biological resources (see Section 4.4.2);
- Fishing grounds;
- Aquaculture sites;
- Habitats.

In addition to the description of the physical and chemical characteristics of surface water bodies, the environmental impact assessment should describe existing pollutant sources, including:

- Industrial plants;
- Wastewater treatment plants;
- Untreated sewage from residential or industrial areas;
- Storm water and agricultural runoff.

Information should include the locations of existing discharges and actual data on pollutant loadings. If actual loading data are not available, they may be estimated based on information about the sources of discharge. An understanding of existing pollutant loads to water bodies and the resultant ambient concentrations is required in order to accurately predict future water quality and the impacts of the proposed project.

A discussion of surface water resources should also include flooding events. The dates, levels, and peak discharges of previous floods should be reported, with the meteorological conditions that created them. Historical data on flood levels support decisions on project siting and design to avoid flood damage.

In addition, the environmental impact assessment should describe ground water resources. Descriptions of alluvial and bedrock aquifers are necessary to determine the potential of project activities to contaminate or deplete ground water reserves. Projects are more likely to affect ground water when the ground water table is near the land surface, the proposed project is near a ground water recharge zone, or the proposed project will withdraw ground water. The depth to the water table and the nature of overlying soils and geologic features are important. The environmental impact assessment for projects that may affect ground water resources should contain the following information:

- Key factors:
  - Depth to water table
  - Overlying soils
  - Geologic features

- Ground water occurrence, including the locations and boundaries of aquifers;
- The aquifers' ability to transmit water (transmissivity);
- Ground water movement, including the direction and rate of flow;
- Location and rates of ground water recharge and discharge;
- Ground water quality (e.g., pH, total dissolved and suspended solids, salinity, and concentrations of specific contaminants of concern).

- Ground water quality:
  - pH
  - Solids
  - Salinity
  - Chemicals of concern

Site-specific ground water information is often obtained from regional ground water maps or through a hydrogeologic field survey. These surveys often rely on topographic maps to determine surface drainage patterns, geological maps for soils and the sequence and thickness of subsurface materials, and potentiometric surface maps and hydraulic gradients for direction of ground water flow.

4.4.1.3 Soils and Geology

Construction, mining, forestry, agriculture, landfills, and coastal development are some activities that affect soils and geologic formations. Conversely, underlying geologic structures can affect the stability of various structures, including buildings, roads, bridges, dams, and landfills. The environmental impact assessment should include a detailed description of the surface topography and soil composition over the region of concern. Soil maps and geological maps indicating sequencing and thickness of subsurface materials are commonly used. This section of the environmental impact assessment should include information on the following parameters:

- For the region of concern, the environmental impact assessment should include a detailed description of:
  - Surface topography
  - Soils

- Topography;
- Location and condition of joints, faults, fractures, and other potential weaknesses;

- Slope cuts and structural loads;
- Landslide history;
- Soil permeability;
- Soil erodibility;
- Extent of weathering;
- Depths to impervious layers;
- Water table depth;
- Ground water movement.

This information provides most of the baseline information necessary to determine the risks of property damage and safety issues associated with the proposed project.

- Erosion potential

The potential for erosion is an important consideration for certain sites, including those in close proximity to water resources. The potential for erosion depends on the following factors:

- Local and regional topographic features, such as ridges, hills, mountains, coastlines, valleys, and stream banks;
- Local soils characteristics and proposed slope changes;
- Presence of riparian zone vegetation;
- Precipitation patterns;
- Water circulation patterns.

Meteorological data, topographical maps, and soil maps of the proposed project area are typically sufficient to assess the potential for erosion.

- Subsidence

It is also important to consider the location of any limestone formations or subsurface mining activity in the proposed project area, history of subsidence in area, and planned uses for ground water (e.g., water withdrawal). These factors will help assess the potential for land subsidence. Information on the soils, subsoils, and bedrock, as well as knowledge of the proposed grading and compaction of the proposed project, will facilitate assessment of the potential for excessive settlement of foundation materials and related impacts.

Geological features are important when paleontological sites and other areas of scientific or educational value may be disturbed or overlain by facility structures.

In regions that are seismically active, the description of the environmental setting should include information necessary to assess potential risks of damage and loss due to earthquakes and volcanoes. Relevant information includes proximity to faults, the history of earthquakes and volcanoes in the area, locations of epicenters, magnitudes, and frequency of occurrence.

- Seismic activity:
  - Proximity to faults
  - History of earthquakes and volcanic eruptions:
    - Magnitude
    - Frequency

The environmental impact assessment should identify any mineral resources, particularly those with economic value, located in the region of concern. If such resources are present, the document should denote the location of the deposits on a map of the proposed site and describe the type(s) and quantities of the minerals. In addition, the document should identify any mining claims or other present or potential resource development activities at or near the proposed site. This information will be useful in determining whether the presence of mineral resources may affect projected future land use or conflicts over the region of concern.

- Mineral resources:
  - Locations of deposits
  - Type(s) and quantities of minerals
  - Ownership of mining rights

4.4.2 Existing Biological Conditions

The description section of an environmental impact assessment should contain a complete description of key biological elements, including the identification and distribution of dominant, rare, and unique plant and animal species within the region of concern. The description should identify all officially recognized threatened or endangered species in the region of concern. Data are typically reported using maps of the area with overlays of vegetation types, floral and faunal species types, and, when available, abundance lists. This information, in conjunction with a consideration of ecological interrelationships, such as habitat and food sources, provides the basis to determine whether the assessment adequately considers potential impacts on the biological community.

- Biological resources:
  - Aquatic communities
  - Wetland communities
  - Terrestrial communities
  - Ecological interrelationships
- Information sources:
  - Literature
  - Government agencies
  - Research organizations
  - Field surveys
  - Monitoring

Knowledge of both the types of plant communities in the general proposed project area and the specific distribution of vegetation within the proposed site is necessary to assess the potential impact. The presence of wildlife at a proposed site largely depends on the nature and distribution of vegetation. The environmental impact assessment should emphasize species that are likely to be displaced by project construction and operation, as well as any unique or rare species likely to be in the region of concern.

There are a variety of ways that professionals approach review of the description of biological resources in an environmental impact assessment. While there is no single correct way to approach review of a description of biological resources, a three-part categorization is presented in this text: 1) Wildlife and Vegetation; 2) Community and Habitat Characterization; and 3) Ecologically Significant Features.

4.4.2.1 Wildlife and Vegetation

Often the most important information pertaining to existing biological conditions in the description of the environmental setting refers to the existing wildlife and vegetation. Projects with the potential for significant adverse impacts to wildlife and vegetation, particularly threatened or endangered species, can often be highly controversial, invoking public outcry and questions of law. Reviewers of this section of an environmental impact assessment should take extra care when reviewing the description of existing wildlife and vegetation. This will also assist the reviewer in correctly assessing the importance of potential impacts to existing wildlife and vegetation.

Species Composition

Species composition refers to the mix of biological species found in the region of concern (the proposed project site and other potentially affected areas). It is common for environmental impact assessments to include a list of the species found at the proposed project site, broken down into various categories. To assist the reviewer in developing a framework of information to guide review of information on species composition, common and useful categories are presented below, along with a number of examples of species that belong to each.

Aquatic Communities

The following categories should be used as a guide to assist the reviewer in the evaluation of the adequacy of the environmental impact assessment in describing the species composition of aquatic communities:

- Flora
  - Phytoplankton (e.g., diatoms, dinoflagellates, blue-green algae)
  - Submerged vegetation (e.g., sea grasses, rooted aquatic plants, attached algae)
  - Floating vegetation (e.g., water hyacinth, duckweed)

- Fauna
  - Plankton (e.g., copepods, euphausiids)
  - Benthic fauna (e.g., sea star, crab, caddisfly larvae, dobsonflies, polychaete worms, clams)
  - Pelagic invertebrates (e.g., jellyfish, squid)
  - Fishes (e.g., bass, salmon)
  - Reptiles (e.g., turtles, snakes)
  - Birds (e.g., ducks, geese, terns, gulls, cormorants)
  - Mammals (e.g., beavers, sea lions, whales, otters).

Wetland Communities

The following categories can be used to assist the reviewer in evaluating the adequacy of the environmental impact assessment in describing existing flora and fauna in wetland communities:

- Flora
  - Emergent vegetation (e.g., horsetails, sedges, rushes, mangroves)
  - Submerged vegetation (e.g., freshwater grasses)
  - Floating vegetation (e.g., water hyacinth, duckweed)
- Fauna
  - Benthic fauna (e.g., brittle stars, crabs, caddisfly larvae, dobsonfly larvae, polychaete worms, clams, oysters)
  - Insects and other invertebrates (e.g., mosquitos, butterflies, beetles, water striders)
  - Fishes (e.g., bass, darters)
  - Amphibians (e.g., frogs, toads, salamanders)
  - Reptiles (e.g., turtles, water snakes)
  - Birds (e.g., ducks, geese, songbirds, woodpeckers)
  - Mammals (e.g., muskrats).

Terrestrial Communities

The following classifications can be used as a guide in assessing the completeness of the description of the species composition of flora and fauna in terrestrial communities:

- Flora
  - Thalloid plants (e.g., lichens, mosses, algae)
  - Herbaceous plants (e.g., wildflowers, ferns, grasses)
  - Shrubs (e.g., rhododendron, creosote bush)
  - Trees (e.g., palms, figs, pines).
- Fauna
  - Insects and other invertebrates (e.g., beetles, flies)
  - Amphibians (e.g., frogs, toads)
  - Reptiles (e.g., turtles, snakes, lizards)
  - Birds (e.g., songbirds, pheasants, hawks, eagles)
  - Mammals (e.g., raccoons, moles, shrews, mice, lions, antilope, elephants, rats, leopards, monkeys, apes).

Native Species Present

In addition to lists of the dominant, rare, and unique biological species present at the proposed project site or region of concern, the reviewer should check to make sure the project proponent identified native species that are present. A species is considered native if it naturally evolved to occur at the proposed site, or at similar sites in the region. Native species are considered more valuable than non-native species, because they are often integral components in an ecosystem. Over time, particular species may influence site conditions, such as by changing soil acidity or by serving as a "keystone" species — one that a large number of other species depend on either directly or indirectly in the food chain. For this reason, it is important to clearly identify which native species are present.

Exotics

Unlike native species, exotic species have not evolved to occur at the proposed site or similar sites in the region. Exotic species are often introduced by anthropogenic forces. Examples have included the Zebra Mussel introduced to the Great Lakes in North America via the ballast water of foreign ships, the Gypsy Moth caterpillar introduced to the U.S. northeast after escaping from a laboratory, and Africanized "killer bees" which have spread across much of South and Central America. Exotics are often of concern because they may displace native species. Exotic species sometimes have few or no local predators, allowing their populations to rapidly increase. This can adversely affect the food supply, available nesting sites or other factors critical for the survival of native species.

Exotic species should be identified in any description of existing biological conditions. Attention should be paid to particularly invasive and damaging species in the ecosystems of concern. Also addressed should be factors that might lead to an increase in the abundance of exotic species relative to native ones. This distinction will be necessary when reviewing the assessment of potential environmental impacts associated with the proposed project.

Rare and Threatened Species

In the United States and many other countries, rare and threatened species are protected by law. In addition to laws that prevent direct harm to such species, there are often prohibitions against indirect harm through habitat modification or other forms of disturbance (e.g., noise). In the United States, the Endangered Species Act distinguishes between species that are "threatened" and those that are "endangered." Endangered status invokes stricter legal obligations for protection than threatened status. In addition, individual states may create their own classifications and legal protections for rare or threatened species. The reviewer should be aware of all applicable national, state or regional, and local laws and regulations pertaining to rare or threatened species.

The description of existing biological conditions should include a list and discussion of rare and threatened species present at the proposed site or in the region of concern. The reviewer should communicate early-on with the project proponent if this section of the description of existing biological conditions is incomplete, due to the fact that a misunderstanding or misrepresentation of existing rare or threatened species could lead to the proposed project being denied at a later stage of the process.

4.4.2.2 Community and Habitat Characterization

- The environmental impact assessment should clearly identify any critical habitat likely to be affected by the proposed project and describe in detail the life history of those species that depend on critical habitat

Community and habitat characterization involves looking at more than individual species or lists of species. It involves identifying the broader community that supports individual species, and understanding the important features within that community, such as important physical features.

Type of Communities Found in Area

As in the previous section, community types are categorized into three headings: aquatic communities, wetland communities, and terrestrial communities.

Aquatic Communities

- Aquatic communities:
  - Characteristics of flora and fauna
  - Sensitivity
  - Life history
  - Abundance
  - Distribution
  - Diversity
  - Habitat types and locations

Aquatic environments range from freshwater streams to the pelagic regions of the oceans. These diverse environments provide habitats for a wide variety of plant and animal life. When evaluating the completeness of an environmental impact assessment, the reviewer should help ensure that the description section properly identifies and describes the biological components of each aquatic community that might be affected by the proposed project. When reviewing the description of aquatic vegetation, the reviewer should check to determine whether areas in the vicinity and downstream from anticipated discharge locations are emphasized. The first step is to make sure the document correctly identifies all the different aquatic environments within the region (e.g., streams, rivers, lakes, oceans). A map indicating all surface water bodies in the region will help with this step. Once the appropriate environments are verified, the reviewer should check to make sure that all organisms present are identified. Existing literature, biological monitoring, and field surveys are primary sources of data for identifying organisms.

Wetland Communities

- Wetland communities:
  - Tidal
  - Non-tidal

Wetlands form the transition between upland habitats and the waters of rivers, lakes, and oceans. The hydrology of a wetland may be tidal or non-tidal. In general, tidal hydrology supports saltwater wetlands and non-tidal supports freshwater wetlands. Wetlands may be permanently inundated, temporarily inundated, or periodically saturated.

Major wetlands can be classified based on vegetation types into emergent, scrub/shrub, and forested wetlands. Vegetation in emergent wetlands (also referred to as marshes) is dominated by grasses and sedges usually associated with year-round standing water. Typical forested wetland (i.e., swamp) vegetation includes a predominance of tree species, such as mangroves in coastal areas, which are able to survive and/or thrive in standing water for extended periods of time. The scrub/shrub wetland is a mix of the emergent and forested wetlands, consisting of vegetation typical of both. Particular species that dominate each type of wetland vary, depending on geographic location, soil saturation, and other environmental conditions.

- Wetland community classifications:
  - Emergent
  - Scrub/shrub
  - Forested

Wetlands serve as critical habitat for a variety of plants and animals. Tidal wetlands are especially important for estuarine and marine fish and shellfish and certain waterfowl, shorebirds, and wading birds. Non-tidal wetlands provide food sources for freshwater fish. In addition, birds such as ducks and geese, feed, nest, and raise their young in freshwater wetlands. Both tidal and non-tidal wetlands serve as spawning grounds and nurseries for a variety of fish species.

Wetlands also play an important role in maintaining water quality and moderating surges in water quantity. Wetlands slow the velocity of water, reducing the erosional effects of tides, storm surges, and floods. The reduced velocity also allows particulates to settle out of waters, thereby improving water clarity. If toxic pollutants are bound to the particulates, however, they can have a negative effect on wetland communities.

The environmental impact assessment should include a map delineating wetlands and a list of flora and fauna species and abundances. Species type and abundances are often identified through literature searches and field surveys.

- The environmental impact assessment should include a map delineating wetlands and a list of flora and fauna species and abundances

Terrestrial Communities

Terrestrial communities can be classified into general categories, including desert, grassland, coniferous forest, and hardwood forest. Each category provides habitat for unique plant and animal life. Maps of the region with overlays indicating dominant vegetation provide a basis for the evaluation. Existing literature and field surveys conducted by biologists with experience in identifying local flora and fauna may provide specific information, including the various species present and their abundances.

- Examples of terrestrial communities
  - Desert
  - Grassland
  - Coniferous forest
  - Hardwood forest

In different climates, different kinds of communities are climax communities — those communities which have reached dynamic equilibrium after a long period of community succession. It is important that climax communities be identified to evaluate whether adequate genetic resources are available for their preservation. Since it

often takes centuries to redevelop climax communities at a location, their loss is potentially significant.

4.4.2.3 Ecologically Significant Features

Support of Broader Ecosystems

- Ecologically significant features include those that support broader ecosystems, important processes or functions, and disturbance regimes

Often it is important to view a proposed project site as a part of an interconnected whole, rather than as an isolated island of land. Any given aquatic, wetland, or terrestrial site may have important influences on the biological resources of other sites. One example is a stop-over location in an avian flyway. Certain locations serve as feeding, nesting, and breeding sites for migratory birds. Although the birds that depend on the proposed site may spend much of their time in other locations during other seasons, maintenance of a particular site along the path of their migration in an undisturbed state may be critical for their health and survival. Such is the case in the United States for the Platt river in Nebraska, and for numerous other rivers, streams, and wetlands located within the various major flyways in Canada, the United States, and Mexico.

Many animals hunt or feed over large areas. Any change in the environment that prevents these animals from accessing any part of their home range has negative impacts on populations. Many threatened and endangered species in the United States have attained that status because of habitat loss or habitat fragmentation. The indigo snake in southern Florida is one such species.

Biotic Interactions

- Habitat
- Limiting factors
- Food sources

The environmental impact assessment should describe the key interrelations and dynamics within the different ecosystems identified in the region of concern. Although it is difficult to determine the extent to which plants and animals are interdependent at a given site, specific attention should be given to identifying predominant species and their trophic levels. A basic understanding of aquatic, wetland, and terrestrial food webs and the relationship among the various trophic levels of each of these ecosystem types forms the basis for predicting impacts to one trophic level based on changes occurring at other levels. For example, when examining the impacts from dredging activities to a wetland marsh, one is most likely to first consider potential losses to resident benthic invertebrates resulting from burial and turbidity increases. Because the affected invertebrates serve as the primary food source for local fish species (which, in turn, are primary prey items for shorebirds and mammals), significant decreases in invertebrates may have far-reaching effects.

Important Process or Functions

A particular aquatic, wetland, or terrestrial area may perform important functions that are not immediately apparent. For example, during periods of high rainfall, wetlands serve as natural retention basins for increased stream flow, absorbing high volumes of flow and gradually releasing them, thereby helping to prevent flash flooding. Wetlands also serve as natural filters, removing nutrients and toxics from polluted water. Another example is a forest on steep slopes. In addition to all the direct benefits provided by the forest, it also stabilizes slopes and prevents erosion by shielding the mineral soil from wind and rain, and by securing soil in place via root systems.

It is important to recognize such important processes and functions when reviewing the description of existing biological conditions. To ensure inclusion of this type of information, the reviewer should check to see if physical and biological conditions at the proposed project site were studied or monitored over periods of time and during different seasons. Certain important processes or functions are only apparent at specific periods of time (e.g., during rainfall) or over long periods of time (e.g., several seasons).

Disturbance Regimes

Any given site may be subject to natural or anthropogenic disturbances. Natural disturbances (e.g., floods, fires) are those that occur regularly or periodically and are a significant influence on the biological conditions of the site. Anthropogenic disturbances may also play an important part influencing biological conditions, whether by affecting natural disturbances or by causing direct impacts (e.g., habitat destruction).

Natural Disturbances

Two of the most common natural disturbances are fire and flooding. Certain forests and grasslands, for example, naturally experience fires on a periodic basis. In ecosystems influenced by fire, species often adapt to, or even require, the presence of fire. For example, the seeds of certain tree species will not germinate until scarred by fire. Also, certain forests rely upon fire to keep brush and other natural materials from accumulating to dangerous levels. In both of these cases, a project that would result in a cessation of fire events would result in significant changes to the biology of the system, including changes in dominant species types and the potential for massive fires fed by an over abundance of fuel.

Flooding patterns can also have important biological influences. All rivers overflow their banks under natural conditions, some on a regular basis (e.g., each rainy season), and others less predictably. In certain regions, these flooding events transport important waterborne nutrients and sediments to surrounding land areas. Flood waters may also

replenish important watering holes and other water sources for wildlife. Understanding the processes at work in such a system is particularly important if a proposed project would alter a river channel or in any way block natural flooding.

Project-induced Disturbances

The effects of constructing and operating a proposed project may include the degradation or loss of habitat. The extent of habitat disturbance depends on existing land use at the proposed site. If the proposed project requires clearing and grading forested land or dredging a pristine water body, for example, the potential for habitat loss is greater than at sites where activities have already occurred.

Adverse effects to critical species habitat, such as fish nursery grounds, breeding sites, or nesting areas, ultimately affects species and population survival. Frequently, one particular life stage of a species requires a specific habitat (e.g., seagrass beds serve as nursery grounds for marine fish, and pristine, coldwater streams are required by some mayfly larva). Loss or degradation of these critical habitats may disrupt or destroy population regeneration. Thus, the environmental impact assessment should clearly identify any critical habitat likely to be affected by the proposed project and describe in detail the life history of those species that depend on critical habitat.

- Habitat fragmentation

Another consideration relevant to ecological interrelationships is habitat fragmentation. Even if a proposed project may not result in the complete destruction of a particular habitat, it may isolate parts of a previously continuous habitat. Habitat fragmentation can lead to:

- Increase in mortality and inbreeding;
- Extinction of wide-ranging species (e.g., wolves, bears, manatees);
- Loss of area-sensitive species;
- Decrease in genetic diversity within rare species.

In addition, fragmentation of critical habitats will probably affect the ability of a particular area to sustain plant and animal populations. Such fragmentation can lead to displacement of individuals and/or degradation or destruction of the remaining habitat.

Hydrologic Processes

Hydrologic processes refer to the amount, location, and duration of water flows to and through a given site. Hydrologic processes involve both ground and surface water. Depending on geology and topography, a particular location may serve as a basin receiving surface or ground

water (e.g., a lake or pond), a source of surface or ground water (e.g., a mountain), or a combination of the two.

Hydrologic processes can be critical to biological resources. The amount of water held or released by a particular site, and the duration of capture or release, can have important influences on the biology of the site and surrounding area. Anadromous fish species may depend on spring river flows to reach spawning sites. Biologically important groundwater aquifers may depend on annual flooding of a certain quantity to fully recharge. Depth to groundwater may determine the survival of both water tolerant and intolerant tree species.

The environmental impact assessment should include descriptions and maps of hydrologic processes important at the proposed site. Such information and maps should indicate depth to groundwater, maximum and minimum annual and seasonal rainfall, the location of any surface water bodies, including lakes, ponds, rivers, and streams, and the flow quantity and seasonality of rivers and streams.

4.4.3 Waste Management and Pollution Prevention

Almost all projects generate waste that must be managed in an environmentally sound manner. Characteristics and volumes of waste, as well as waste management procedures and capacity, influence the potential for significant environment impacts. Pollution prevention policies play an important role in projections of waste management capacity.

The description of the environmental setting should describe existing waste management procedures and facilities. Information on existing wastes generated in the region of concern should describe the quantity and characteristics of materials disposed of. Descriptions of existing waste management procedures should address current policies for reducing the amount of waste generated and current techniques for waste handling, storage, transportation, and disposal.

Typically, waste descriptions will include solid and liquid wastes and discuss the sources of wastes, the quantities generated, and the characteristics of the waste materials. Sources include industrial processes, commercial establishments, and households. The characteristics of waste materials typically describe whether the materials are explosive, corrosive, flammable, ignitable, or toxic. They may also identify pollutants of concern and pollutant concentrations.

- Waste information:
  - Description of management practices
  - Types of waste (liquid or solid)
  - Toxic potential
  - Quantities
  - Location of disposal

The preferred waste management measure is pollution prevention – preventing the generation of waste in the first place through source control and source reduction. Pollution prevention measures not only reduce operational impacts on the environment, but reduce the costs associated with raw materials and waste disposal. Whenever possible, the environmental impact assessment should include a discussion of

- Pollution prevention:
  - Source control
  - Source reduction

existing pollution prevention initiatives. This should include identification of opportunities for source reduction, recycling, and waste exchange.

Solid waste management may include disposal at landfills or incineration. In some areas, there are no existing provisions for waste management. The environmental impact assessment should address the adequacy of landfill construction and operation and whether the landfill has sufficient capacity to handle generated wastes. This information may include an estimate of the waste generated, the average wastes buried in the landfill per year, the unused capacity of the landfill, and a projection of when the landfill will reach its capacity. Descriptions of incinerators should include the amount of wastes the facility can handle in a given timeframe, as well as an estimate of the capacity at which it generally operates.

- Solid waste management:
  - Capacity per unit time
  - Volume capacity
  - Adequacy of design
  - Acceptable wastes

Liquid wastes may be discharged directly to a receiving water body or may be sent to a sewerage system. The environmental impact assessment should describe the characteristics of liquid wastes in order to determine whether treatment is necessary prior to release into the environment or sewerage system.

4.4.4 Socioeconomic Environment

The attributes of the socioeconomic environment include land use, population and housing, economic activity (including employment and income), community services and public finance, transportation, and health and safety. The anticipated significance of the potential impacts will determine the extent of the socioeconomic analysis. In other words, the level of detail and depth of discussion required in describing each socioeconomic attribute should increase as the significance of potential impacts increases.

- Socioeconomic issues:
  - Land use
  - Population and housing
  - Economic activity
  - Education
  - Community services and public finance
  - Transportation
  - Health and safety

Each of the socioeconomic attributes should be defined within the region of concern. Typically, two factors are used in determining the region of concern for socioeconomic resources. The first is the residential distribution of the population to be affected by the proposed project, and the second is the degree of linkage among the economies of communities in the region. This linkage, based on both trade among industry sectors and household purchasing patterns within the region, determines the nature and magnitude of economic multiplier effects in the region. (Section 4.4.4.3 discusses this concept in detail.) Taking into account these two factors, it is common for regions of concern to be drawn along established jurisdictional boundaries, such as counties in the United States, to facilitate data collection and provide comparability of attribute conditions.

In some socioeconomic analyses, the region of concern may vary for each attribute. For example, health and safety may be an issue in the local or immediate area and the region of concern might be a

- Appropriately delineating the region of concern is critical to ensure the accuracy of the assessment

1-kilometer radius from the proposed project site, while impacts on community services should be assessed throughout the entire community. The region of concern for employment and economic activity could be evaluated at several levels, including local, community, and regional. In general, however, the region of concern for population and housing, economic activity, and community services and public finance should be consistent due to the interrelated nature of these attributes. In evaluating the appropriateness of the defined region of concern, it is necessary to keep in mind that an excessively large region of concern can waste analytical resources and dilute the significance of potential environmental impacts. An excessively small region of concern can inappropriately exclude portions of the environmental setting from consideration.

4.4.4.1 Land Use

The environmental impact assessment should include a description and map of present and future land uses of the region of concern. Various types of land use are possible including undeveloped, agricultural, industrial, commercial, residential, recreational, and conservation areas. The environmental impact assessment should emphasize land uses that pose potential conflicts with the proposed project, such as irreversible conversion of high quality agricultural land or mining in the proximity of residential areas, public facilities, or protected areas.

- Land use types:
  - Undeveloped
  - Agricultural
  - Industrial
  - Commercial
  - Residential
  - Recreational
  - Conservation

The land use section also should highlight existing land use or zoning laws and other adjacent or nearby proposed developments. If applicable, official government policy, such as protection of high quality agricultural land, must be included. In addition, the anticipated (and/or required) use of the land once project operations are completed is important.

A proposed project can be evaluated on the basis of its consistency and conformance with an available local or regional planning agencies' "master" or "comprehensive" land use plans. A land use plan commonly details (1) existing land use, (2) future land use, and (3) applicable land use controls. If the existing plan is thorough and the responsible agency has the authority to ensure conformance to the plan, the proposed project can be compared to the plan to help identify potential impacts. If a land use plan does not exist, the plan is inadequate, or the responsible agency has little authority to enforce the plan, the project proponent should have conducted a more thorough assessment. In addition, in the latter situation, the likelihood that adverse effects can be controlled or mitigated is greatly reduced.

- Land use plans contain:
  - Existing land use
  - Future land use
  - Applicable land use controls

4.4.4.2 Population and Housing

A general discussion of the demographic and housing characteristics of the region of concern should include the following data:

- Current and historical total population (e.g., 1995, 1990,1980);

- Rate of population growth;
- Population density;
- Average household size;
- Number of available housing units;
- Occupancy and vacancy rates (owner-occupied versus rentals);
- Median home values and median rent.

For a more detailed presentation, the environmental impact assessment can provide information on the age, sex, and ethnic composition of the population, as well as data on educational attainment levels, residential tenure, and population growth factors, such as birth, death, and migration rates. The goal of this section should be to analyze shifts in population and predict changes in community profile, neighborhood composition, and housing demand. Projections of baseline (i.e., without the proposed project) demographic trends for the region of concern are also necessary to determine the relative magnitude of assessed future impacts.

- Additional population information that can be included:
  - Age
  - Sex
  - Ethnicity
  - Education
  - Residential tenure
  - Births and deaths
  - Migration rates

Project-induced employment changes probably will affect the migration rates associated with the region of concern. The permanent and temporary relocation of households in response to employment opportunities will create a demand on the housing market and a demand for additional community services. For this reason, an accurate description of the baseline housing stock and public facilities and services is critical in assessing the extent of potential migration impacts.

It may also be important to identify special segments of the population, such as indigenous and disadvantaged persons, to facilitate a discussion of potential environmental equity issues. If the significance of potential impacts dictates, the demographic and housing data presented in this section should be in a disaggregated form so that they can be used to assess whether the distribution of impacts across segments of the population is equitable.

- Environmental equity

Indigenous population refers to native people with cultural and economic ties to the geographic area in which they reside. These populations are particularly vulnerable to environmental and socioeconomic change. If indigenous populations are identified in the region of concern, the description section of the environmental impact assessment should include a detailed description of their distribution, life style, livelihood and legal status.

4.4.4.3 Economic Activity

A representation of the economic well-being of the region of concern should rely on data regarding the gross output (total sales and receipts)

- Economic activity:
  - Gross output
  - Employment levels by industry
  - Personal earnings and income

of regional businesses, employment levels by industry, and personal earnings and income. The section should generally begin with an identification of the "base" industries in the region. These would be the industries that bring outside revenues to the region (e.g., by sales to customers or other firms outside the region), which are then re-spent (multiplied) within the region through business purchases and payroll spending. The environmental impact assessment should also include unique features of the business community, such as high seasonality of trade, high outflow of profit, declining trade, or downtown revitalization, if pertinent.

A description of current employment categories and unemployment levels is required to provide the basis for determining the suitability and capacity of the available labor pool for meeting potential project demands. This section should present the following employment data:

- Total civilian labor force;
- Total employment and employment by industry;
- Unemployment rates and characteristics.

The characteristics of the unemployed population, if available, are especially important if the proposed project is expected to generate employment. If warranted by the nature of the potential impacts, the employment data should be maintained in a disaggregated form to facilitate assessment of the equity of changes in employment across segments of the local population. In addition, the environmental impact assessment should present projections on anticipated trends in baseline employment and unemployment to facilitate assessment of future project-induced employment changes.

Earnings and income data provide a representation of the relative wealth of the region of concern population. Regional statistics, such as median household income, per capita income, average earnings per job, and percent of households below poverty level, help describe the general financial well-being and solvency of the regional population compared to the broader state or national population. Baseline income and wage data are also helpful in assessing the potential earnings impacts that may be associated with project-induced employment changes.

4.4.4.4 Community Services and Public Finance

Community services include municipal water supply, sewerage, storm drainage and flood control, waste management, power supply, education, health care, police and fire protection, parks and recreation, churches, and libraries. The environmental impact assessment should describe these services, including the agencies or organizations that provide the services, the nature of the services provided, and the target population receiving these services. Existing levels of use and remaining capacity to accommodate growth should be included if

- An environmental impact assessment should describe:
  - Community services
  - The agencies or organizations who provide them
  - The nature of services
  - Target populations

potential project-induced impacts are expected to affect the demand for such services. General data on community services could include:

- Utility providers and current levels of service;
- Public school districts, numbers and levels of schools, teacher-student ratios, and total school enrollments;
- Hospitals and clinics, bed capacity, and number of physicians and surgeons;
- Police and fire protection agencies, jurisdictions, and number of officers and firefighters;
- Total park acreage and number and type of recreation facilities.

The environmental impact assessment may include maps showing the location of services within the region of concern and their respective sphere of influence, or service and support areas. Assessing the quality, or adequacy of the services provided, and the ability of the existing public facilities and services to accommodate additional users is critical if there are significant potential impacts, such as substantial population in-migration generated by project-related employment increases.

- Significant population in-migration may tax the ability of existing public facilities and services

The environmental impact assessment can describe public finance in the region of concern based on historic revenues and expenditure levels, changes in fund balances, and reserve bonding capacities. If project-induced impacts are expected to significantly affect public finances, this section should discuss each jurisdiction's governmental funds (e.g., general fund, special revenue funds, and, as applicable, capital projects and debt service funds) and tax and non-tax sources of revenue.

4.4.4.5 Transportation

Transportation systems provide access to a facility for the import of raw materials, export of final products, and the movement of staff and service personnel. The environmental impact assessment should describe all relevant forms of transport that would be affected by the proposed project. Road-based transport usually is crucial for all facilities. In addition, railways, airways, pipelines, and navigable waterways may be important for some facilities. The environmental impact assessment should present current traffic volumes, current traffic capacity, the provision of public transportation, and an assessment of the adequacy of the systems for meeting peak demands. The environmental impact assessment should also highlight any regional transportation plans and indicate whether they were followed.

- Transportation routes:
  - Roads
  - Railways
  - Airways
  - Pipelines
  - Navigable waterways

4.4.4.6 Health and Safety

If the proposed project is likely to impose risks to the health and safety of the local population, the environmental impact assessment should describe any present health and safety issues. The description should

- The environmental impact assessment should describe any present health and safety issues

include statistics on industrial accidents in the local area; information on air, water, and radioactive emissions from existing and prior facilities and their effects on human health and the environment; and an analysis of present levels of noise and its impacts on people and wildlife. The environmental impact assessment should also identify special populations or areas that are more likely to be exposed to adverse impacts (e.g., subsistence fishing populations using water bodies that probably will be affected by the proposed project).

4.4.5 Cultural Resources

Cultural resources include sites, structures, and remains of archeological, historical, religious, societal, or aesthetic value to local, national, or international interests. The location of any proposed project can result in irretrievable loss of cultural resources, both known and yet to be discovered. Preservation and management of cultural resources is important for maintaining a culture's sense of history and identity. It is also important for the information that can be gained from studying the consequences of past actions and applied to the solution of current problems.

Cultural Resources

- Archeological
- Historical
- Religious
- Societal
- Aesthetic

The description section should identify known cultural resources, including the location of the following kinds of sites in relation to the region of concern:

- Archeological sites (where human-made artifacts or other remains dating from prehistoric times are found);
- Paleontological sites (where bones, shells, and fossils of ancient plants or animals are found in soil or imbedded in rock formations);
- Historic sites (where significant events happened or where well-known people lived or worked);
- Sites of particular educational, religious, scientific, or cultural value.

Depending on the nature of the proposed project and the extent of land disturbance involved, it may be appropriate to develop a cultural resources sensitivity map. In addition to mapping known cultural resources, the map should indicate areas of low, medium, and high probability of containing undiscovered cultural resources. These estimates are best made by archaeologists and anthropologists familiar with the local environment and patterns of spatial distribution of cultural resources (e.g., soil conditions, proximity to water sources, and other topographic features associated with previous archeological finds).

- It may be appropriate to develop a cultural resources sensitivity map

Aesthetics

- Visual
- Aural
- Olfactory

Aesthetics involve the general visual, aural, and olfactory environment (imagine the sensory differences among urban, industrial, agricultural,

In other words, items that are seen, heard, or smelled

and forest environments). The description section should describe the aesthetic characteristics of the environmental setting—items that are seen, heard, and smelled in and around the proposed site—and their emotional or psychological effect on people. Descriptions (or pictures) of views of the proposed site, unique features or features deemed of special value, and public use and appreciation of the proposed site provide information to facilitate the assessment of potential impacts.

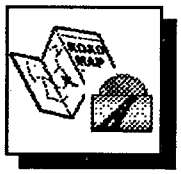
4.4.6 Reviewing the Description of the Environmental Setting Road Map

It is clear from the preceding parts of this chapter that the description of the environmental setting in an environmental impact assessment document is both important and complex. It is important because it establishes a baseline against which potential impacts can be compared. It is complex because both the natural and human environment are composed of an almost limitless collection of interacting and interdependent components. The reviewer's focus, that is, reviewing the coverage, significance, adequacy, integrity and accuracy of this chapter of an environmental impact assessment document, and for maintaining the appropriate level of influence over its preparation, is critical to ensuring an effective and informed decision-making process.

To help ensure that the review is systematic and complete, and that the reviewer maintains the reviewer's focus, the following road map was created to guide review of the description of the environmental setting chapter of an environmental impact assessment document. This road map reflects a composite of all of the issues that were described in section 4.4.

Road Map for Environmental Setting Review

- All relevant types of natural and human environmental issues are addressed
- Affected area or community is adequately and accurately defined
- Adequately map impact area and surrounding features
- Baseline is established to measure impact
- Appropriate information and data documented and used appropriately
- Information links back to project description, purpose and need, alternatives?
- Levels of detail are appropriate to significance
- Information and data is of acceptable quality and relevance?
- Section is internally consistent



Addressing all of these issues and questions will help ensure that the review is systematic and complete. If there are many instances where the description of the environmental setting does not meet the reviewer's expectations set forth in the road map, the environmental setting chapter is probably inadequate and will require further work. It is the reviewer's job to point out such deficiencies to the project proponent.

Because descriptions of the environmental setting are often quite complex, no one reviewer is likely to hold expertise in all necessary areas for a fully adequate review. The reviewer should have the confidence to ask questions of colleagues and outside experts when needed.

4.5 Potential Environmental Impacts

- Each potential impact should be presented clearly and succinctly

The primary objective of the "environmental impacts" section of environmental impact assessment documents is to clearly and succinctly present each potential impact, qualitatively and/or quantitatively. The environmental impacts section forms the scientific and analytical basis for the comparison of alternatives and determination of relative significance of impacts. The reviewer should take steps to help ensure that all impacts (including primary, secondary, and cumulative impacts) that are potentially significant have been considered and discussed in the environmental impact assessment. The environmental impacts section should discuss the potential beneficial and adverse impacts of

each alternative and their relative significance, including clear, technical demonstrations of:

- **Primary impacts**—A primary impact is direct and occurs at the same time and place as the action. Primary impacts are associated with the construction, operation, and/or maintenance of a facility or activity. They are generally visibly obvious and quantifiable;

- **Secondary impacts**—Secondary impacts occur later in time, or at a different place from the initial action. These impacts are indirect or induced changes in the environment, population, economic growth, and land use;

- **Cumulative impacts**—Cumulative impacts result from the incremental impact of a proposed action on a common resource when added to other past, present and reasonably foreseeable future actions. These may include the collective effects of individually minor actions over a period of time. (e.g., the combined effect of wastewater discharge, dredging, and agricultural runoff on a small estuary, or several dams constructed throughout a single river basin);

- **Project compliance**—Demonstrated compliance with national, state, and local environmental regulations and standards;

- **Possible conflicts** —Identification of possible conflicts between the alternatives and the objectives of national, regional, state, and local land use plans, policies, and controls for the area concerned;

- **Irreversible and irretrievable commitment of resources** —The irreversible and irretrievable commitments of resources (e.g., land, energy, natural resources associated with the proposed project should be summarized).

It is important for the reviewer to remember that major impacts can occur to a variety of resources (i.e., physical-chemical, biological, socioeconomic, aesthetic, and cultural resources). Therefore, the environmental impact assessment analysis needs to be conducted in a comprehensive, step-by-step fashion, assuring that potential effects have been considered for all resources described in the description of the environmental setting section.

It is also critical that the reviewer remembers that environmental impacts can occur during every stage of a project, from initiation to post-completion operation. Specifically, the reviewer should check to make sure that impacts are assessed for the following project stages:

- Initial site preparation and construction;
- Facility operation;
- Post-facility operations, or site closure.

These categories are, of course, merely three convenient headings for what is actually a spectrum. The reviewer should take steps to help ensure that impacts are assessed for all project phases. Because each phase may have several sub-phases (e.g., there may be several distinct phases during facility operation), there should be a careful assessment as to whether all potential impacts were assessed; long, medium, and short-term.

4.5.1 Methods of Analysis

The potential impacts of each alternative are identified by a systematic disciplinary and interdisciplinary examination of the consequences of implementing each alternative. While information may be gathered from field surveys, related environmental impact assessments, discharge applications, and other sources, the reviewer is responsible for evaluating the scientific and professional integrity of the information used in the environmental impact assessment. Therefore, the environmental impact assessment must clearly identify data sources, references, methodologies, and models used to analyze or predict results. Detailed methodologies or extensive data can be incorporated by reference if the source is readily obtainable.

- The environmental impact assessment must clearly identify data sources, references, methodologies, and models used to analyze or predict results

Specific methodologies may be available to identify, qualify, and quantify impacts for a variety of media. For example, air quality impacts may be predicted using standard, approved models, if available. A matrix describing models commonly used in environmental impact assessment is presented in Appendix B. These models use site-specific data for existing air quality and expected pollutant emissions from the proposed project, as well as the topographical and meteorological characteristics of the region of concern, to predict the transport and fate of pollutants. This is followed by an assessment of the effect of predicted pollutant levels on receptors, including humans and other biological resources, sensitive habitats, and cultural resources.

The goal of the environmental impacts section is to quantify potential impacts to the physical-chemical, biological and socioeconomic environments including air quality, water quality, soils, biological resources, employment, land use, and community services. The section should identify potential primary and secondary impacts under each alternative, discuss the significance of potential impacts, and assess the potential cumulative impacts. The analysis should identify and assess potential impacts for all stages of the proposed action, including initial site preparation and construction, facility operation, and, in some cases, post-facility or site closure.

- The goal of the environmental impacts section of the environmental impact assessment is to quantify or describe potential impacts on:
  - Air quality
  - Water quality
  - Soils
  - Biological resources
  - Employment
  - Land use, and
  - Community services

4.5.1.1 Determination of Significance

Significance may be defined by law, regulation, policy, or practice of an agency or through the collective wisdom of a recognized group (e.g., industry or trade association standards). Impact significance, however, is often based on the professional judgment of an expert or group of experts. The determination of significance must be based on clearly defined criteria.

- Determination of significance must be based on clearly defined criteria

Significance can also be examined in terms of the context and intensity of an action. Context relates to geographical scale—local, regional, state, national, or global; intensity is defined by the severity of the impact (e.g., the magnitude of deviation from background conditions, the size of the area affected, the duration of the effect, and the overall likelihood of occurrence). The potential for significant impacts is greater in areas that are protected, unique, sensitive, or recognized by government agencies (e.g., significant historical or cultural resources, parks, prime farm lands, wetlands, wild and scenic rivers, or ecologically critical areas). Other important factors include:

- Degree of controversy among experts of the impact;
- Degree of uncertain or unknown risks;
- Likelihood that a precedent will be set;
- Occurrence of cumulative impacts (especially if individual impacts are not viewed as significant);
- Degree to which cultural or historical sites may be affected;
- Degree to which significant scientific, cultural, or historical resources are lost;
- Degree to which commercially or recreationally valuable, threatened, or endangered species or their critical habitat is affected;
- The likelihood of violations of national, state, regional, or local environmental law or requirements or, alternatively, the likelihood that appropriate standards applicable to the operation and various environmental media can be achieved.

Professional standards and design specifications are techniques that can be used to determine impact significance. Use of these techniques consists of comparing project parameters to known professional standards, such as effluent guidelines, to assess potential significance. In addition, public opinion can be used to determine the qualitative significance, or a specific impact.

The threshold of significance is different for each impact, and the parties judging significance need to explain the rationale for the thresholds chosen. Clear descriptions of threshold choices for determining the significance provide the reviewer with a basis for agreeing or disagreeing with the determination of significance based on specific assumptions, criteria, or data. Further guidance on determining significance is presented in Appendix C.2 and in the Resource Manual accompanying the course *Principles of Environmental Impact Assessment Review.*

4.5.1.2 Cumulative Impacts

Cumulative impacts result from the incremental impact of a proposed action on a common resource when added to other past, present and reasonably foreseeable future actions. These may include the collective effects of individually minor actions over a period of time. This "accumulating" impact assessment approach is particularly instructive when no single project is a major cause of a problem but contributes incrementally to a growing problem. It is important to recognize that some projects act as catalysts for future growth and environmental change in the region of concern.

If other projects are planned during the same timeframe as the proposed action and in the same region of concern, they should be listed in the environmental impact assessment and included in the cumulative impacts analysis. When assessing the potential for cumulative impacts, the project proponent and reviewer should consider the following factors:

- Temporal accumulations of impacts and whether perturbations are spaced adequately to allow the ecosystem to recover from the change;
- Spatial accumulation of impacts and whether there is sufficient distance between perturbations;
- Sources of impact, including primary and secondary effects of individual and multiple sources;
- Pathways of impact accumulation, such as additivity and synergism;
- Thresholds of impact, including linear and non-linear thresholds.

Cumulative impact analysis is hindered by the complexity of the mechanisms of accumulating effects and by limitations in understanding ecosystem processes and responses to perturbations. There is no standard method for assessing cumulative impacts. A combination of analytical techniques and planning processes is frequently used to assess and address potential cumulative impacts. Appendix C.2 and

the Resource Manual for the course *Principles of Environmental Impact Assessment Review* describe some of these methods.

4.5.2 Pollutant Generation, Transport, and Receptors

Pollutant generation, transport, and fate can affect the air, water, soil, and biological resources in proximity to the proposed site. The pathway of pollutant transport and the ultimate fate of pollutants depend largely on the physical nature of the pollutant itself. Particulates and gases are typically transported by air but may deposit in surface waters or soils. Liquid pollutants (e.g., fuels, solvents) can volatilize into the air or be transported through soils, sediments, or aquatic media, such as ground water or surface streams. Solid pollutants, including sediments and sand, can be transported by winds or surface waters. The environmental impact assessment should thoroughly assess all potential pollutants, their pathways, and predicted receptors based on modeling or other information.

- The environmental impact assessment should thoroughly assess all potential pollutants, their pathways, and predicted receptors based on modeling or other information

4.5.2.1 Air Resources

Site leveling and grading during construction results in large quantities of airborne dust particulates that may contain toxic constituents. Dust particulates may settle on local vegetation or water bodies or may be ingested by biological organisms, including humans. Emissions from construction equipment, such as bulldozers and graders, may also adversely affect biological resources.

Impacts from facility operations are primarily associated with pollutant generation and transport and related effects to surrounding habitat. Typically, facilities cannot operate without obtaining environmental permits for air emissions, and most permits are issued only after it is determined that environmental impacts will be acceptably small. Effective implementation and enforcement of environmental requirements serve to minimize adverse impacts from project operations.

Primary Effects

- Airborne dust and dust accumulations on surfaces adjacent to the proposed site
- Adverse health effects to biological organisms (including humans) caused by inhalation of toxics

Secondary Effects

- Airborne transfer of pollutants to distant soils and surface waters

Cumulative Effects from Facility Construction

- Greenhouse effect
- Acid rain

Project operations affect air quality through atmospheric emissions of particulates, hydrocarbons, carbon monoxide, carbon dioxide, sulfur oxides, and nitrogen oxides. Particulates result in a "dirty" or "dusty" atmosphere and accumulate on surfaces. Toxic chemicals also attach to particulates, resulting in potential human health impacts if inhaled. Accumulation of toxic chemicals on land surfaces can also cause environmental impacts.

Hydrocarbons and carbon dioxide are primarily responsible for the "greenhouse effect," because they impede the radiation of heat from the earth's surface back to outer space, increasing the temperature of the atmosphere. Carbon monoxide is a known toxicant, which can cause neurological and lung disorders, and even death. Sulfur oxides and nitrogen oxides are "acid rain" constituents, which can lower the pH of natural water bodies and damage natural and human-made materials

and structures. Emissions can also produce offensive odors extending throughout large areas in the vicinity of the proposed site.

Facility emission sources include diesel generators, vehicles traveling to and from the proposed site, and pollutants specific to the facility's industrial process. The environmental impact assessment should address all potential emission sources and assess their cumulative impact on the environment.

Air quality impacts can be determined quantitatively by comparing expected emissions with emission standards set by national, state, or local governments and by comparing the expected ambient concentrations of pollutants caused by facility emissions and other sources with ambient concentration standards. Monitoring and modeling are the two most common techniques used for air quality evaluations. Monitoring is often required to establish baseline ambient concentrations for pollutants of concern prior to facility construction and can be used to determine facility compliance after operations begin. In addition, modeling is used to assess potential impacts from the proposed project using mathematical simulations of dispersion. If air quality models are used in the environmental impact assessment, the reviewer should take steps to help ensure that the following four major input requirements were used during modeling:

- Emissions data;
- Stack information (e.g., stack height, diameter, temperature of exit gas, flow rate);
- Meteorological data (e.g., local wind speed, direction, and precipitation levels);
- Receptor coordinates and elevations.

Critical Questions:

- Will dust or air pollutants be generated from construction and site preparation activities?
  - Does the environmental impact assessment identify emission sources and project emission rates and compare these rates to applicable national, state, and local standards and limitations (both emissions and air quality)?
  - Does the environmental impact assessment compare predicted atmospheric levels with national, state, or local ambient standards?
- Does the environmental impact assessment identify emission sources and rates, including existing and known potential

Common Air Quality Evaluation Techniques

- Monitoring (to gauge pre-project ambient conditions and to track changes after project initiation)
- Modeling (to predict project-related effects)

sources in the vicinity not associated with the proposed site, and assess expected concentrations of pollutants in air?

- Are emission rates and resulting concentrations compared to applicable national, state, and local standards and limitations?
- Will facility operations result in noncompliance with air emission and ambient air quality standards?
- Have measures to control air emissions been addressed in the proposed project design? Will these measures be adequate?
- Does the environmental impact assessment describe stack emissions during operation and maintenance activities and compare these with existing national, state, and local standards?
- Will stack emissions from the facility have deleterious effects on visibility and light scattering (i.e., cause smog); damage natural or human-made materials and structures (i.e., cause acid rain); or adversely affect human health, domestic animals, wildlife, or vegetation?

4.5.2.2 Water Resources

Construction activities can affect water resources depending on their proximity to the proposed site. Settling of dust into water bodies results in increased water turbidity. Vegetation removal and soil compaction by construction machinery results in increased runoff following rain events and greater volumes and velocity of water that must be carried by local water bodies. This in turn may result in sedimentation in receiving waters and adverse effects to aquatic vegetation and other resident biological organisms, such as fish populations. For example, elevated turbidity may reduce the amount of available light, thereby decreasing photosynthetic rates of aquatic vegetation, or may clog the gills of fish with suspended particulates, reducing respiratory function. In addition, increased sediment loads frequently carry nutrients and toxic pollutants to receiving water bodies.

A minor source of pollutants during the construction phase is oil or other hazardous material that can leak or otherwise emanate from construction equipment. These materials may leach into ground water or be transported with runoff to local water bodies. Depending on their concentration, these materials can cause toxic or bioaccumulative effects to local biological resources.

Impacts to water range from water quality degradation caused by discharges of toxic pollutants and excessive nutrients or oxygen demanding substances to hydromodification impacts associated with increased impervious area, soil exposure, and erosion. Pollutants may

Primary Effects

- Sediment loading of water bodies adjacent to the proposed site and associated habitat alteration
- Accumulation of toxics within adjacent water bodies resulting from site erosion and runoff
- Increased water body turbidity and decreased photosynthetic rates for aquatic vegetation
- Burial of aquatic benthic invertebrates
- Clogging of fish gills with suspended particulates
- Bioaccumulation by aquatic organisms of toxic constituents from eroded sediments and airborne particulates
- Contamination of ground water and/or surface water from leaks or effluent discharge

enter surface waters from waste disposal to land, effluent discharges to water bodies, and precipitation runoff. Nutrients (nitrogen and phosphorus compounds) in water can lead to eutrophication—excess plant growth resulting in algal blooms, weed-choked water bodies, and fish kills. Excess nitrogen in drinking water causes human health problems, particularly to infants. Toxic contaminants result in acute and chronic toxicity to aquatic biota, as well as possible human health affects associated with ingestion of contaminated water and food. The temperature regimes of receiving waters may be changed through warm water effluents. Increases in ambient temperatures generally reduce biodiversity by limiting the abundance of cold water fish species or can lead to introductions of potential nuisance species.

Potential water quality impacts can be determined by comparing effluent concentrations to relevant water quality standards or by predicting ambient concentrations and comparing these with water quality standards or acute/chronic toxicity levels. If particular contaminants are predicted to be more significant than others (i.e., large quantity or high toxicity), the environmental impact assessment should focus on the transport and ultimate fate of these pollutants. The environmental impact assessment should also consider the potential for contaminant bioaccumulation in the local food chain. Modeling studies can also be used to assess concentrations of contaminants in receiving waters caused by process and storm water discharges or estimate concentrations of chemicals in aquatic biota resulting from the proposed action (e.g., fish uptake and food chain models). If water quality models are a component of the environmental impact assessment, specific inputs should include information on source input(s) (e.g., effluent composition, concentration, and volume) and receiving water characteristics (e.g., currents, wind, flow rate, tidal range, stratification). The assessment should clearly state whether or not model results have been tested or verified using range checks or other evaluation techniques. Modeling exercises should include the impacts of existing and planned sources, in addition to the proposed project and alternatives, and should be calibrated specifically for the system under study.

Critical Questions:

- Does the assessment address the potential for water quality to be degraded by increased surface runoff (sediment and pollutant discharges), discarded or discharged construction materials and other chemicals, herbicides, wastewater, soil additives, disturbance of stream bed, or temperature increases due to increased turbidity or removal of vegetation?
  - Does the assessment predict sediment loading and compare loadings and predicted in-stream concentrations of associated pollutants with existing national, state, and local water quality standards and criteria?

Secondary Effects

- Modification of watershed drainage
- Eutrophication or contamination of distant surface waters via site runoff

Cumulative Effects from Facility Construction

- Water quality degradation in excess of accepted standards due to multiple source loadings

- Does the document assess the potential effects to ground water quality from use or disposal of chemicals or nutrients? If ground water might be affected, does the assessment consider avoiding placement of contaminant sources over aquifer recharge areas?
- Will facility siting avoid direct contact with ground water during foundation work, tunneling, or construction of underground utilities?
- If the proposed project site is within an aquifer discharge area, will protective measures, such as liners and containment areas, be implemented?
- Is there a potential for increased overland flow, storm water runoff, flooding, stream bed sedimentation, or channel erosion due to increased runoff following proposed site preparation and construction activities?
- Does the construction plan limit the use of materials that can negatively affect the environment, particularly water resources?
- Is there a spill control/response plan that properly addresses spills of hazardous construction materials?
- Will hazardous materials be stored at the construction site? If so, have provisions been identified to keep them in storage buildings located away from construction activities? (Hazardous materials include petroleum products, fuels, solvents, paints, herbicides, and batteries.)

- Is there a potential for toxic pollutants and/or organic matter from waste disposal, effluent discharges, or precipitation runoff from storage areas to have deleterious effects on ground water or surface water?
- Does the assessment attempt to predict pollutant concentrations in ground waters and surface waters and compare results with existing national, state, and local water quality standards and criteria?
- Does the assessment discuss both short- and long-term impacts to the biological community caused by the discharge?
- Does the document assess receiving water temperature distributions around and below discharge locations and compare results with national, state, or local standards? If standards do not exist, does the environmental impact assessment assess the impact of temperature changes on the aquatic ecosystem?
- Would facility operation cause increased sedimentation and habitat destruction?

- Does the document assess aquatic habitats that might be affected by increased sedimentation or alteration of the existing flow patterns of water courses and assess the magnitude of the effect?

4.5.2.3 Geological Resources

The environmental impact assessment should assess the effects of site construction on geological resources. Construction activities include leveling of hills, removal of rocks and soil, filling of valleys or depressions, or other alterations to existing terrain. Modification of geological resources can directly affect biological resources through habitat loss. In addition, these alterations indirectly affect water resources by changing local runoff patterns and other watershed features.

Potential Primary Effects

- Soil contamination from leaks or spills
- Loss of soil due to erosion

Potential Secondary Effects

- Slope failure
- Destabilization of shorelines

Potential Cumulative Effects

- Desertification

During site preparation and construction, clear-cutting and removal of ground vegetation typically results in soil erosion. Sediment loadings from uncontrolled construction sites have been reported to be on the order of 35 to 45 times greater than loadings from undisturbed woodlands (typically less than 1 ton per year). The extent of impacts to geological resources depends on site geological/topographic features, including slope, soil composition, and soil permeability, and whether or not mitigative measures (e.g., use of vegetative buffers to filter sediments and sediment-bound pollutants) have been implemented.

The majority of impacts to soils are expected to occur during site preparation and construction. After operations begin, however, the potential for soil contamination is high due to spills in raw material/ product loading and unloading areas, materials storage areas, and production areas. The potential for soil contamination is also high in areas used for onsite waste storage or treatment facilities. Frequently, land treatment units or landfills are used; sometimes waste materials are stored in piles or drums. Contaminant runoff or leachate from these areas can percolate through soils to ground water. Soil contamination can also occur from runoff of contaminant residues onto impervious surfaces, such as roads, parking lots, and runways.

- Soil impacts can occur both during facility construction and after, during facility operation

Soil erosion and sedimentation may continue to occur after construction. The extent of the problem depends on the effectiveness of erosion control techniques used to stabilize the site after construction.

Critical Questions:

- Does the environmental impact assessment determine the potential for soil loss during construction and facility operation and discuss mitigation activities to reduce erosion?
- Does the environmental impact assessment identify potential sources of soil contamination and describe feasible mitigation measures?

4.5.2.4 Biological Resources

During the project construction phase, biological resources may be affected directly through loss of habitat, food resources, nesting areas, or migration routes present within the region of concern or indirectly through sediment loadings into nearby water bodies or pollutant transfer to adjacent soils or surface waters resulting from site runoff.

As discussed in previous sections, facilities may discharge pollutants to air, water, and soils. Contamination of local resources may result in localized or widespread degradation of vegetative or wildlife habitat.

Sediment loadings potentially affect both terrestrial and aquatic resources. Sediment erosion results in loss of ground cover and foraging ranges for terrestrial species. Sediment transport to local water bodies causes burial of bottom dwelling organisms, reduced dissolved oxygen levels, habitat alteration, and, depending on the presence of toxics, bioaccumulative effects.

Critical Questions:

- Does the environmental impact assessment consider potential losses of biological resources (especially rare and game species and/or critical habitat) known to exist within the region of concern?
- Have mitigative measures, such as vegetative buffers to prevent erosion, and spill response plans been included for the site construction phase?
- Does the environmental impact assessment address sediment transport impacts on aquatic resources during construction and operational phases?
- Does the environmental impact assessment describe effluent and emission concentrations and their potential toxic effects to vegetation and wildlife?
- Does the environmental impact assessment discuss potential bioaccumulative effects to biological resources from facility emissions and discharges?

Secondary Effects

- Water quality degradation
- Modification of aquatic habitat from erosion and runoff

Cumulative Effects

- Bioaccumulation of toxics resulting in ecological and human health risks

4.5.3 Habitat Alteration

Habitat alteration is most evident during initial project construction phases. Site preparation and construction can include some degree of land leveling and soil compaction and the erection of production facilities, raw material loading and unloading areas, raw material storage areas, waste storage and disposal areas, and a transportation system for moving materials from one area to another. In the first stage

of construction activity, land is cleared and prepared for storing building materials, transporting materials between the storage areas and building sites, and preparing the building sites themselves. For very large facilities, stone crushing, concrete mixing, and other materials processing facilities may also be built onsite. Facility operations affect habitat primarily through pollutant generalization and transport. The extent of impact depends, in large part, on the effectiveness of restoration measures taken during the construction phase.

4.5.3.1 Biological Resources

The extent to which habitats are affected by proposed site clearing and grading depends on the extent to which natural ecosystems were disturbed previously. Conversion of a wooded area results in greater changes than conversion of a former industrial site. The habitats associated with heavily vegetated areas are usually more densely populated and diverse in species than those associated with previously developed sites.

As described earlier, site construction activities may affect air, water, or geological resources in proximity of the proposed site, all of which may serve as habitat for a variety of organisms. Removal of native vegetation during construction directly affects some species by destroying their protective cover, food sources, or roosting, nesting, or breeding sites. Clear-cutting trees within the proposed site results in reduced shading and may increase water temperatures within local water bodies. Over time, this could lead to reductions in dissolved oxygen concentrations and adverse effects on aquatic resources.

Sediment erosion from the proposed site leads to deposition of sediments on stream bottoms, altering the nature of the substrate and changing stream bottom fauna from hard bottom or riffle communities to soft bottom communities. If the stream bottom community changes, the species of fish inhabiting the stream will also change. Depending on previous site uses, sediment may be associated with toxic chemicals that tend to adsorb to particles. If toxic components exist in dust or sediment, the potential for bioaccumulative effects to biological organisms is greater.

The environmental impact assessment should assess the potential damage or destruction of sensitive ecosystems from siting facilities in close proximity. Improper siting with respect to slope and local hydrology can affect sensitive areas by altering the local hydrological regime, increasing runoff and erosion, and destabilizing slopes, dunes, or shorelines.

Even if natural habitats are not destroyed completely by clearing and grading, they may lose their value for some species because available habitat is diminished. Some species require habitat of a particular minimum size in order to survive. If the habitat is disrupted or

- Maintaining a minimum habitat size is crucial to the survival of many species of animals, insects, and plants

otherwise reduced in size, for example, by construction of a road, the size of the available habitat type may prevent continued species survival, and individuals may leave the area or succumb.

In addition, the environmental impact assessment should describe noise and disturbance impacts created by construction activities, such as large trucks, bulldozers, and grading equipment, and their potential effects on feeding, breeding, nesting, and other activities of local species, even those inhabiting areas outside the region of concern. Disturbance also may result in species leaving the area and subsequent effects to local ecosystem dynamics, in a manner similar to habitat fragmentation.

Additional potential impacts on habitat

- Noise
- Physical disturbance of nesting, breeding, or roosting sites

Critical Questions:

- Does the environmental impact assessment assess the potential effects of site preparation and construction activities on air, water, or geological resources?
  - Is the proposed project designed to avoid or mitigate storm water impacts through the use of an infiltration field, retention basins, or other measures to reduce runoff?
  - Does facility siting avoid steep slopes to prevent erosion or slope failures? If the facility is sited on a slope, will erosion control measures, such as maintenance of vegetative cover, application of temporary soil covers (e.g., straw), and timing of construction activities to avoid heavy seasonal rainfall, be used to prevent erosion?
- Does the environmental impact assessment address the potential for construction and site preparation activities to alter critical habitats for wildlife, which could affect the local presence of such species?
  - Does the environmental impact assessment quantify areas and locations of habitats and associated species that would be lost or adversely affected during site preparation and construction activities?
  - Is the construction designed to cause the least possible disturbance to site vegetation (e.g., have attempts been made to preserve old-growth stands or individual trees)?
  - Does the construction plan provide for erosion and sediment control during and after construction?
  - Will soil excavated from the site be reused, for example, as topsoil in landscaped areas?
  - Will disturbed areas be revegetated following construction?
- Is there a potential for indirect changes in habitats following construction and site preparation activities (e.g., increased

Primary Impacts from Facility Construction

- Loss of protective cover, food sources, or roosting, nesting, or breeding sites
- Reduced species abundance and diversity
- Degradation of sensitive ecosystems
- Alteration of aquatic bottom habitat due to sediment erosion and runoff
- Fragmentation or simplification of habitat
- Species disturbance from noise and other construction activities

Secondary Impacts from Facility Construction

- Dissolved oxygen reductions in surface waters
- Invasion of exotic species

Cumulative Impacts from Facility Construction

- Bioaccumulation of toxics resulting in potential ecological and human health risks.

erosion potential resulting in habitat disturbance through sedimentation in water bodies, disturbance of habitat and/or species from increased human access, modification of watershed)?

  - Does the environmental impact assessment identify activities that would indirectly alter habitats and quantify, to the extent feasible, the areas that would be affected indirectly?

- Will the facility be sited at a maximum distance from sensitive areas, such as wildlife habitats, wetlands, floodplains, streambanks, coastlines, and protected preserves?

  - Does the environmental impact assessment identify any sensitive habitats in the vicinity of the proposed site? If so, have all possible mitigative measures been considered (e.g., alternative site selection; site location away from streambanks/beds, floodplains, shorelines, and flood-prone areas) to avoid impacts to sensitive ecosystems?

  - Will buffers, such as wetlands or forests, be used between the proposed development site and water bodies to minimize impacts to aquatic systems?

- If roads, pipelines, or bridges are planned as part of the construction, does the environmental impact assessment discuss taking advantage of existing corridors (e.g., roadways, transmission lines) to avoid disrupting additional habitat?

After construction is completed, impacts from facility operations are related primarily to pollutant generation and transport. Facility operations can emit or discharge contaminants into air, water, or soils, potentially causing environmental degradation and subsequent effects to local biological resources. The following discussion highlights potential impacts to biological resources caused by facility emissions and discharges during operation phases.

Because construction removes much of the existing vegetative cover, the environmental impact assessment should recognize that impacts to local habitats may continue once facility operations begin. The impacts associated with operational activities vary, depending on the proposed site, but can be particularly acute if environmentally sensitive or ecologically important areas are affected. For most construction projects, removed natural vegetation is not replaced onsite, either because the area is rendered impervious or the land is disturbed to a point that it will no longer support native vegetation. Often, the replanting that does occur is done for aesthetic purposes; land is converted to turf grass or ornamental landscaping plants are used. While aesthetically attractive to humans, these non-native vegetative covers do not offer the same level of environmental protection or ecological value as natural vegetation. Thus, the environmental impact

assessment should address the impacts caused by loss of native vegetation. Facility operations may also lead to increased access to remote areas, resulting in additional species disturbance.

The absence or scarcity of vegetation removes or reduces the pollutant buffering capacity of the site, contributing to some of the following impacts:

- Increased potential for water pollution because runoff volume and velocity will be increased and will enter water bodies directly without the filtering effects of vegetation;
- Reductions in wildlife species number and abundance due to the loss of habitat and foraging grounds;
- More severe weather conditions, including wider temperature fluctuations and stronger winds generating dust
- Increased noise levels caused by the loss of trees and other vegetative buffer areas.

Wildlife impacts are primarily associated with changes that occur during site preparation and construction. However, many impacts are carried over into the operation phase and remain throughout the life of the facility. Habitat restoration is often impossible during operations because of irreversible damage done to soils and topography or the construction of buildings, roads, and storage areas.

As described previously in this section, the habitat loss associated with vegetation removal can have both primary and secondary effects. Primary impacts to species are expected if organisms depend on the removed vegetation for survival. Secondary impacts include water quality degradation and stream habitat damage resulting from erosion and runoff.

All of these impacts affect the food supplies and living conditions of biological communities, ranging from the smallest microbes to large animals. Food sources may be destroyed, modified, or contaminated. Foraging, nesting, and breeding locations may be degraded or lost permanently. Living and breeding ranges may become fragmented or simplified, leaving areas too small or unstructured to support species. Exotic species may invade a region and out-compete resident species. Travel/migration routes may be altered by the activities and infrastructure involved in constructing and operating a new project. All of these conditions affect the composition, distribution, abundance, health, and vitality of resident species.

Critical Questions:

- Does the environmental impact assessment assess whether facility operations will permanently cause the loss or displacement of vegetation habitat and, therefore, floral species (rare, threatened, endangered, unique or unusual, or commercially valuable species, communities, or habitats)?
- Does the environmental impact assessment identify critical vegetative habitats and associated species that will not be restored following facility construction?
- Does the environmental impact assessment assess changes in local vegetative species composition, diversity, and abundances resulting from loss of specific types of habitats?
- Does the environmental impact assessment address hazards to vegetation from air and water quality degradation?
- Does the environmental impact assessment describe onsite or offsite compensation to replace vegetation loss?
- Does the environmental impact assessment include a monitoring program to ensure effective implementation of mitigation measures?
- Does the environmental impact assessment assess whether facility operations will cause permanent loss or displacement of wildlife habitat and, therefore, faunal species (rare, threatened, endangered, or game species)?
- Does the environmental impact assessment identify critical habitats for wildlife and associated species that will be lost during construction and not replaced during facility operations? Rare, endangered, and commercially valuable species, as well as ecosystems, communities, and habitats should be included within the assessment.
- Does the environmental impact assessment assess changes in local wildlife species composition, diversity, and abundances caused by human activity in the vicinity of the proposed project, including potential invasion by exotic species?
- Will air, water, and soil quality degradation from toxics produced during operation and maintenance activities pose hazards to area fauna (resulting in death or reduced viability)?
- Does the environmental impact assessment assess hazards to wildlife from air, water, and soil quality degradation?
- Does the environmental impact assessment describe migration routes and movement corridors of sensitive species that may potentially be disturbed by facility operation?

Primary Effects from Facility Operations

- Degradation of habitat due to facility emissions and discharges
- Species disturbance
- Reductions in species abundance and diversity
- Loss of ground cover, food resources, and breeding, roosting, or nesting habitat

Secondary Effects from Facility Operations

- Pollutant transfer to surface waters and associated aquatic organisms due to erosion and runoff
- Modification of aquatic habitat following sediment loading

Cumulative Effects from Facility Operations

- Bioaccumulation of toxics resulting in potential ecological and human health risks

- Will onsite or offsite compensation be used to mitigate loss of wildlife?

4.5.4 Waste Management and Pollution Prevention

Waste generation during project construction and operation can be a significant source of adverse environmental impact in the region of concern. Primary impacts result from contamination of air, soil, and water from improper waste storage, handling, transportation, and disposal. Secondary impacts may include placing a burden on the community's waste management capacity. Cumulative impacts can arise from long-term accumulation of toxic pollutants in the region and from the additive effect of multiple sources of wastes on the community's waste management capacity.

Primary impacts

- Contamination of air, soil, and water from improper waste storage, handling, and disposal

Secondary impacts

- Additional burden on community waste management capacity

Cumulative impacts

- Accumulation of toxic pollutants
- Rapid consumption of community waste management capacity due to the additive effect of multiple wastes

A variety of waste management and pollution prevention measures can be implemented during the siting and construction phase to avoid or minimize adverse impacts. The environmental impact assessment should address these measures. Selection of durable, long-lasting materials containing recycled or refurbished components reduces the overall volume of construction waste. Reuse or recycling of construction materials and natural resources, such as trees removed during construction, further reduces waste volumes.

The environmental impact assessment also should address pollution prevention and waste management during the operational phase of the proposed project. The environmental impact assessment should include a description and estimate of project wastes and should address waste type, quantity, and toxic potential. Pollution prevention opportunities should be investigated by the project proponent. The environmental impact assessment should describe the proposed project waste management plan, including treatment, handling, and disposal. Each of these components should be designed to reduce the risk of accidental releases of toxics to the environment. In addition, onsite and offsite waste management techniques and disposal areas should be identified and their long-term capacity defined.

Critical Questions:

- Will the proposed project include the use of durable, long-lasting materials that will not need to be replaced frequently, reducing the amount of construction waste generated over time?
- Does the construction plan include provisions for proper storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements?
- Will perishable materials, such as paints, be purchased incrementally to ensure reduced spoilage of unused materials?
- Will the proposed construction project use materials containing recycled content when possible and in accordance with

accepted standards? Examples of recycled content materials include concrete containing fly ash and thermal insulation composed of cellulose.

- Does the environmental impact assessment describe a facility waste management plan with procedures for treatment, handling, and disposal?
- Does the environmental impact assessment discuss projected facility waste characteristics?
- Does the environmental impact assessment assess long-term waste disposal and disposal site capacities?

4.5.5 Socioeconomic Impacts

Socioeconomic impacts

- Compatibility of new land uses with existing land uses
- Issues associated with human and institutional resources and impacts on community structure
- Effects on local economic activity

In addition to the environmental impacts described above, the construction and operation of new projects, or the modification of existing projects, may affect the local socioeconomic framework in a variety of ways. Elements of the socioeconomic impact analysis can include (1) the compatibility of new land uses with existing land uses, (2) issues associated with human and institutional resources and impacts on community structure, and (3) effects on local economic activity. The elements are often interrelated in their response to a particular action. A project-induced change in employment demand, for example, could lead to population movements into or out of a region and, in turn, lead to changes in demand for housing and community services.

Changes in economic activity

- Regional output
- Employment
- Earnings

Changes in the community

- Population
- Demand for housing and community services
- Land use
- Transportation
- Public finance

The analysis of socioeconomic impacts should consider both impacts on economic activity and on the community. Economic activity can be measured by changes in regional output, employment, and earnings, and the community by changes in population, demand for housing and community services, and effects on land use, transportation, and public finance. The impact analysis should estimate the potential social and economic impacts expected to occur within the region of concern as a result of implementation of the proposed project.

The socioeconomic impacts estimated in the analysis would be generated by the proposed expenditures and employment associated with the proposed project. The total socioeconomic impact includes both primary and secondary impacts. In general, the primary impacts are the estimated changes in project revenues, employment, and payrolls (employee earnings) that would occur during the construction and operations phases (if applicable) of the proposed project. Primary impacts also include the resultant effects on regional population, housing, and community services associated with the change in employment.

Secondary effects are the impacts on regional economic activity that result from regional project-related purchases of goods and services from local business and suppliers. Related impacts include the

additional changes in regional economic activity that result from changes in the household spending of employees whose jobs are affected by either the change in employment at the proposed project or the change in employment at regional businesses that results from the secondary impacts to regional economic activity.

4.5.5.1 Land Use

The impact of the proposed project on land use depends on the adequacy of existing land use planning and control practices. These practices should include both a long-term comprehensive plan and effective implementation mechanisms. To the extent the proposed project is consistent with the plan and addresses implementation of land use controls, then potential impacts may be low. If land use planning and control practices are inadequate or ignored, however, potential land use impacts from both the proposed project and possible encroachment activities caused by the proposed project can be significant.

Project Construction

Site preparation for the construction of new projects can disturb large areas of land and may change land use patterns in the area. Open spaces (agricultural land, forested areas, or other vacant land) are often used for these projects. A new land use may not be compatible with, or easily returned to, its original state. In particular, industrial sites and infrastructure projects are not easily converted back to either forest, agricultural, or residential land. The construction sites for large projects in general are frequently considered temporary industrial land uses, regardless of the ultimate land use being developed. Once construction is initiated, the options for converting the proposed site to other land uses become limited.

- Site preparation for the construction of new projects can disturb large areas of land and may change land use patterns in the area

Of particular importance is the potential for land use in the surrounding area to change as a result of construction activities. Housing usually is needed for the large construction crews required to build large facilities, and construction workers generally prefer to live near the work site. If the proposed site is in a predominantly residential area, then housing will not necessarily be a problem (although housing values may change depending on their proximity to the proposed project). If the proposed site is far from a residential area, however, additional housing, often temporary structures, may develop in the immediate vicinity. In addition, small-scale commercial areas tend to develop around construction sites to provide food and services for workers and to provide construction support services.

- Housing is usually needed for the large construction crews required to build large facilities, and construction workers generally prefer to live near the work site

Critical Questions:

- Are adequate land use planning and control mechanisms in place and enforced?

- Are the proposed project facilities and associated construction activities in conformance with the plan?
- Will the construction and site preparation activities be compatible with the projected uses of adjacent, existing, or planned land uses?
- Is the proposed site located in an area with existing or planned compatible activities or will the facility result in adverse aesthetic impacts or conflict with current or future residential, agricultural, or other land uses?
- Does the environmental impact assessment identify the amount of existing or planned land use areas lost due to site preparation and construction activities? Does the document describe expected changes in land use on adjacent properties?
- Does existing land availability, as determined by zoning and land use plans, conflict with proposed site preparation and construction activities?
- Does the environmental impact assessment determine the extent to which site preparation and construction activities conflict with zoning requirements and existing or future land uses?

Project Operation

Significant land use impacts can occur during the operational phase. A potential major impact on land use is the conversion of nearby land to new uses stimulated by the proposed project. For example, industrial projects may stimulate conversion of nearby land to related industrial activities or residential use to meet the needs of an expanded labor force. Tourism development projects, including resort hotels, frequently stimulate the development of related facilities, such as restaurants, shops, and other attractions. The conversion of additional land may not cause any adverse impacts if it is controlled through effective planning. The environmental impact assessment should discuss the potential for changes to existing land use patterns that might be stimulated by the proposed project. The potential environmental impacts of additional land use changes should be discussed as cumulative impacts.

- A potential major impact on land use is the conversion of nearby land to new uses stimulated by the proposed project

Given an appropriate local land use planning process and plan, the assessment of the land use attribute of an environmental impact assessment is driven by two evaluation criteria: (1) conformance with the land use plan and (2) compatibility with adjacent land uses. A third criterion, "capacity," is more conveniently addressed under the transportation and community services resources.

Land use evaluation criteria

1) Conformance with the local land use plan
2) Compatibility with adjacent land uses

To the extent that a proposed project directly causes or indirectly induces a land use that does not conform to the land use plan, there is

likely to be a significant adverse impact. A determination of conformance may be made by comparing existing land use maps with the future land use plan and superimposing the land use changes associated with the alternative. In some cases, it will be necessary to evaluate more detailed categories of land use than the generic residential, commercial, industrial, agricultural, public use, and open space categories. For example, residential use is often categorized by 5 to 10 density categories (dwelling units per acre), occupancy types (single-family or multi-family), and structural types (e.g., attached, detached, townhouse, apartment). Similarly, industrial land uses include a range of activities, from warehouses to light and heavy manufacturing facilities. Commercial land uses are sometimes very difficult to evaluate for plan conformance because of the market justification of "pockets" of convenience retail activity.

- A determination of conformance may be made by comparing existing land use maps with the future land use plan and superimposing the land use changes associated with the alternative

To the extent that the conformance criterion does not yield meaningful results, individual assessments of land use compatibility may be appropriate. In these instances, it is important to incorporate as many of the local community's values into the assessment of compatibility as possible, except where there are overriding applicable public health considerations. In many communities, "mixed" land use is an important positive aspect of urban living. It is important to note that compatibility does not imply homogeneity.

Critical Questions:

- Do primary and secondary long-term land use changes conform to the local land use plan?
- Does the environmental impact assessment address long-range, comprehensive land use impacts? Are specific impacts addressed in the same timeframe as the local land use plan(s) (e.g., 10 to 20 years)?
- Do land use requirements for operation and maintenance activities (safe zone or buffer zones included) conflict with adjacent present or future land uses as planned by local, regional, and state agencies?
- Will induced growth around the facility change land use in ways that are counter to currently planned land uses for the area?
- Does the environmental impact assessment describe anticipated changes in nearby land use as a result of the facility? Does it evaluate potential conflicts that could occur during operations?
- Are land use controls adequate to prevent conversion of lands designated for protection by the government, such as prime agricultural, wildlife management or cultural heritage sites?
- Are local land use concerns and values used to develop land use compatibility criteria?

4.5.5.2 Economic Activity

Socioeconomic impacts

- Employment patterns
- Population
- Community resources

The types of projects evaluated in environmental impact assessments vary in terms of the potential socioeconomic impacts associated with their implementation. The development of new facilities could generate extensive changes in community structure stemming from changes in population and employment patterns. The construction of major facilities requires a large, trained workforce that may not be available locally and, therefore, would drive population in-migration. Although this potential influx of workers and their families may not be significant in large and diverse communities, the entire economy of small communities may be affected, including employment patterns, population, and community resources. If the proposed project also requires a large operations workforce, the temporary changes associated with the construction phase may become permanent.

Smaller projects, which may not be associated with large expenditures or significant employment demands, would generate socioeconomic impacts of a relatively smaller magnitude. Therefore, the environmental impact assessment would not analyze the impacts in as much detail as for larger, more complex projects. However, it is still necessary for the analysis to quantify the primary impacts associated with the proposed project and to assess the ability of the region of concern to accommodate such a change. It is important to note that some projects (such as the closing of a large facility) may involve an employment decline and subsequent potential out-migration and reduced demand for housing and public services. This discussion, however, focuses on projects associated with increases, rather than decreases, in economic activity.

The project proponent typically provides a description of the primary economic impacts, including anticipated project expenditures, employment, and payrolls. This project-related data should identify employment and expenditure requirements during the construction and operations phases of the proposed project. Direct earnings (or payrolls) can be estimated based on average wage and salary data.

The numerical relationship between the primary impacts in a region and the total impacts generated in the region is defined as a "multiplier." For example, an employment multiplier of 2.5 in a given industry indicates that for every job in that industry, an additional 1.5 jobs are generated within the region. Because different industries and individuals purchase different mixes of goods and services and not all of these goods and services may be available within a given region, each industry generates a different amount of secondary (i.e., primary plus induced) impacts and, thus, will have a different multiplier.

- Economic multipliers vary depending on project characteristics

For example, the construction and operation of a lumber mill may be associated with a higher multiplier than the construction and operation of a retail store. Construction of the mill may require greater expenditures and more labor than the store. In addition, the lumber mill

may purchase more of its supplies locally than the retail store. This would result in a higher secondary impact for the forest products activity. In addition, the lower wages in the retail industry compared to the forest products industry could result in a lower induced impacts from the retail activity. In general, higher multipliers are associated with industries with the following attributes: greater revenues generated by sales to buyers outside the region, higher relative wage rates, and larger amounts of purchases made locally.

The multipliers used in the analysis may be obtained from a variety of sources, including government agencies, financial institutions, universities, and other academic entities. The environmental impact assessment should disclose the source of the multipliers, justify the selection, and list the specific multipliers included.

The selected multipliers are then applied to the primary impacts to provide estimated total employment and earnings impacts associated with the proposed project. The number of potential in-migrant or out-migrant workers is often estimated according to a set of migration rate assumptions. These assumed rates of migration may be based on historical migration trends in the region or migration trends experienced in other regions where similar projects were implemented. In general, the higher the skill level and wage rate of the new positions and the smaller the existing available labor pool, the greater the likelihood of migration.

Critical Questions:

- Does the environmental impact assessment address changes in employment patterns associated with each phase of the proposed project?
- Does the environmental impact assessment address the ability of the available labor pool to meet project-related employment needs?
- Does the environmental impact assessment clearly identify the economic multipliers used in the analysis and their source?
- Does the environmental impact assessment discuss the potential change in overall economic activity in the region?

4.5.5.3 Population and Housing

Changes in population following the construction and operation of a new project are an important determinant of other potential socioeconomic and environmental impacts. These population changes have three key components: (1) primary population impacts (relocation of project workers and their families), (2) secondary population impacts (relocation of workers and their dependents associated with project-related expenditures in the region), and (3) natural increases (births minus deaths) and non-project related migration.

Components of population change

1) Primary population impacts
2) Secondary population impacts
3) Natural increases and non-project-related migration

The potential relocation of direct and indirect employees in response to project construction and operation and the related increase in regional economic activity are usually determined based on a set of assumed migration rates, as discussed in the previous section. The number of dependents expected to relocate with these workers may be estimated using average household size statistics gathered during preparation of the description of the environmental setting section.

Population changes associated with the proposed project would result in changes in housing demand. Housing demand impacts may be estimated based on the number of estimated migrating workers, assuming one housing unit for each migrating household. Expected housing availability and the extent of potential impacts should be based on recent housing market conditions, vacancy trends, and residential construction activity.

Housing demand

- Estimate number of workers migrating to project area
- Estimate available housing
- Identify shortfall in housing (if any)

As was mentioned earlier, indigenous populations are particularly vulnerable to environmental and socioeconomic change. When indigenous populations are identified in the region of concern, the environmental impact assessment should assess impacts to the natural resource base on which the population depends for its livelihood and to the cultural fabric of the community. Special development plans are recommended to avoid or mitigate adverse impacts to indigenous populations.

Critical Questions:

- Does the environmental impact assessment address the relationship between employment increases and population in-migration?
- Does the environmental impact assessment identify deficiencies in available housing for the potential increased workforce and their families?
- Does the environmental impact assessment assess potential impacts to indigenous populations?

4.5.5.4 Community Services and Public Finance

The environmental impact assessment should assess the potential impact of the construction and operation phases of the proposed project on the capacity of the various utilities, transportation systems, and other infrastructure and community services. Potential impacts to local community services are determined based on the change in the number and composition of the population associated with the proposed project and should be determined for the jurisdictions expected to have the closest linkages to the proposed project and project-related personnel.

- The environmental impact assessment should assess the potential of the proposed project to impact the capacity of the various utilities, transportation systems, and other infrastructure and community services

It is important that the impacts of the construction and operation phases are assessed separately because they can be very different. For example, the number of people required to operate the new facility may be much less than the number required for construction. The in-migration of workers during the construction phase may be temporary, with temporary living quarters and support services provided by the builder (which would result in relatively few community impacts) or within the local communities (which could result in significant impacts depending on the size of the temporary workforce and current available capacity in the community). After construction is completed, workers could leave the area and the additional housing and services developed to accommodate them would not be needed.

Population changes associated with the operation phase, on the other hand, are generally expected to be long-term or permanent. The changes in demand for housing and community services associated with these population changes tend to be given greater significance because they may permanently alter the structure of local communities and their resources. An environmental impact assessment typically will address the following impacts to community services:

- Projected changes in public school enrollments and the effect on student-to-teacher ratios and school capacity
- Expected changes in the demand for health care services
- Estimated changes in demand for utilities and effects on current capacity.

The potential effects on other public services can also be determined based on the current levels of service and the expected change in the size of the population served.

Local jurisdiction finances may be evaluated based on changes in historic revenues and expenditure levels, changes in fund balances, and reserve bonding capacities. Project-induced impacts on regional public finances should be analyzed, taking into account the expected increase in regional employment, the expected increase in population in each jurisdiction (including school districts), the expected increase in business revenues and employee earnings, and potential changes in the jurisdiction's property tax base.

Critical Questions:

- Does the environmental impact assessment assess deficiencies in community services and infrastructure during project construction and operations?
- If additional support services are envisioned during the construction phase, what will happen to support services during the operation phase?

- Will there be a change in community structure during any phase of the proposed project? For example, would community life-style or stability be affected?
- Does the environmental impact assessment assess any shortfalls in transportation capacity due to either primary or secondary impacts of the proposed project?

4.5.5.5 Transportation

Transportation impacts are generally characterized by (1) the extent to which required transportation improvements are consistent with applicable local transportation plans and (2) the level of service (LOS) resulting from the assignment of project-induced travel demand to various elements of the existing transportation system.

Consistency with local and regional transportation plans is very important, because transportation systems are very capital intensive and current funding is often applied to projects intended to meet travel demand requirements 10 to 20 years in the future. As a result of long-range transportation planning and capital investment, regional transportation systems exert strong influence on private sector locational and production decisions. Proposed projects that do not conform to such transportation plans or that require short-term "ad hoc" changes to the planned system should generally be described as having significant adverse impacts.

Even where conformance with the local and regional transportation plan(s) exists, it is important to scrutinize the elements of the transportation system that are likely to carry the bulk of the primary and secondary transportation demand resulting from the proposed project. Determinations of the level of service with and without the proposed project and alternatives should be made for all affected public thoroughfares and public transportation systems.

The LOS evaluation criterion provides for ratings ranging from "A" (unrestricted free-flow) through "F" (capacity exceeded, large queues, and long delays). In the United States, the threshold criterion for acceptable performance is usually LOS D or E, and new capital improvements are expected to attain LOS C or better. For the larger air, shipping, and rail facilities, there are often industry and port-specific delay factors that translate into LOS equivalencies.

In addition to capacity issues, some projects may generate heavy vehicle traffic (particularly during construction) that exceeds the weight limits for affected roadways and bridges. Such occurrences should generally be mitigated fully because of public safety implications.

Critical Questions:

- Does the environmental impact assessment assess the extent to which the proposed project and alternatives are consistent with local and/or regional transportation plans?
- Does the assessment assess changes in LOS resulting from the proposed project and alternatives?
- Does the assessment assess the effect of heavy vehicle traffic on affected pavement and bridges? Are significant adverse impacts to structural integrity and public safety fully mitigated?

4.5.5.6 Health and Safety

Impacts to health and safety vary among projects. For example, large and complex operations of new industrial facilities can pose threats to the health and safety of workers, the public, and the ecosystem in general. Health and safety issues tend to be more significant during operations, because they occur over an extended period. The three major health and safety concerns are industrial accidents, exposure to contaminants, and noise.

Major health and safety concerns

1) Industrial accidents
2) Exposure to contaminants
3) Noise

Depending on the nature of the proposed project, hazardous or potentially dangerous materials may be used, produced, and/or stored onsite. Workers and the environment may be exposed to these materials through direct contact, exposure to fugitive dust and other air emissions, or spills. The potential for accidents at many facilities can be fairly high, if large quantities of raw material are used (and transported) around the facility and large volumes of waste are generated and must be handled during disposal. Noise is another challenging problem at some types of facilities.

A health risk assessment may be appropriate to estimate the potential impacts of increased exposure to pollutants. A health risk assessment combines information on human exposure through air, water, and food with information on the toxicity of expected pollutants. The health risk assessment estimates increases in cancer rates and non-cancer health effects for the overall population in the area. It may be appropriate to calculate different health risks for different segments of the population, if there is reason to believe exposure rates may be different. For example, subsistence fishing communities are at greater risk from consumption of contaminated fish than the general population.

- Health risk assessments should assess human exposure through:
  - Air
  - Food
  - Water

Critical Questions:

- Does the environmental impact assessment assess whether construction, operation, and maintenance activities present health and safety hazards to humans working or living at or near the proposed project site?

- Does the environmental impact assessment assess the potential effects of facility noise levels on workers, local communities, and local fauna (e.g., are high frequency sounds emitted during facility operations that may disturb species sensitive to high frequencies, such as birds)?
- Does the environmental impact assessment assess the potential for long-term contaminant bioaccumulation within the food chain?

4.5.5.7 Environmental Equity

The socioeconomic analysis should address the nature of the distribution of both beneficial and adverse impacts across different segments of the population. The analysis should identify specific disadvantaged groups that may endure greater impacts than others (e.g., indigenous populations, migratory workers, minority groups, or specific population segments based on age, sex, or poverty status).

Commonly disadvantaged groups

- Indigenous populations
- Migratory workers
- Minority groups
- Specific population segments based on age, sex, or poverty status

Critical Questions:

- Does the environmental impact assessment assess the equity of changes in employment patterns attributable to site preparation and construction activities?
- Does the environmental impact assessment assess the equity of community structural changes caused by project construction and operations?

4.5.6 Cultural Resources

Clearing and grading activities associated with project construction may affect cultural resources with archeological, historical, religious, societal, or aesthetic value. Site clearing activities may inadvertently collapse or undermine the structural integrity of archeological sites or uncover artifacts and historical sites. Even if these sites are preserved, their historical or archeological significance can be damaged by proximity to industrial or commercial activity. The magnitude of potential impacts varies according to the type of project, local climate, settlement patterns, and capacity of the local government to enforce protection of resources.

Types of cultural resource sites

- Archeological
- Historical
- Religious
- Societal
- Aesthetic

The environmental impact assessment should describe the potential impacts on existing and undiscovered cultural resources. The description should include primary impacts (e.g., loss of subsurface artifacts due to paving) and secondary impacts (e.g., generation of smog due to increased commercial and residential traffic) associated with project construction and operation. It should also predict potential cumulative impacts (e.g., the additive effects of increased business, residence, and tourism on sensitive exposed structures over 10 or more years). If a resource cannot be avoided and remains at or near facility

operations, the environmental impact assessment should describe approaches for resource protection and mitigation.

Critical Questions:

- Does the environmental impact assessment assess any historical or cultural resources in close proximity to the proposed site following correspondence with appropriate authorities?
- Is there a potential for historical or cultural resources on the proposed site to be disturbed, destroyed, or covered over by proposed site preparation and construction activities?
- Does the environmental impact assessment discuss any mitigation measures necessary to preserve items of archeological, historical, or cultural interest (e.g., restoration of structural elements, rerouting of traffic, erosion control)?
- Does the environmental impact assessment assess historical and cultural resources that could be reduced in value by the presence of the facility, even if impacts were mitigated?
- Does the environmental impact assessment assess the extent to which construction operation and maintenance activities disrupt the aesthetic or sensory attributes of the proposed site?
- Does the environmental impact assessment assess whether the facility components are designed with consideration given to human factors (e.g., religious, cultural, aesthetic values)?
- Have all potential mitigative measures been assessed (e.g., restoration of structural elements, rerouting of traffic, erosion control)?

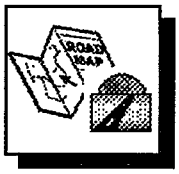
4.5.7 Assessment of Potential Environmental Impacts of Alternatives and their Significance Road Map

The assessment of impacts is conducted several times during the environmental impact assessment process. It is performed during the decision to proceed process to determine if the magnitude and nature of potential impacts require that a full environmental impact assessment be conducted, and again in developing the environmental impact assessment document (both in draft and final) in response to comments. It also is a part of reviewer communications and follow up monitoring activities. How does a reviewer determine whether a project proponent has accurately assessed the completeness, adequacy and significance of an environmental or other impact? One way is to answer the following questions, which form the road map for impact review:

- The assessment of impacts is prepared several times during the environmental impact assessment process

Road Map for Environmental Impact Review

- All natural and human (socioeconomic) environmental impacts are identified
- Types of impacts include primary, secondary, and cumulative
- Detail on impacts is balanced among reasonable and feasible alternatives
- Both beneficial and adverse impacts are identified
- Potential impacts are identified for all phases of the proposed project
- Models, experts, and criteria accurately used to project the significance of impacts are valid for appropriate circumstances
- Data, information and key assumptions are representative, accurate, and current
- Appropriate criteria are used to characterize significance



In addition to this generalized list, the reviewer should carefully examine all of the questions posed under the "Critical Questions" lists in this section, which contain more detailed questions about each component of environmental impact review.

Review of impacts can be divided into three headings:

1. Completeness and Scope;
2. Adequacy of the Assessment of the Magnitude of the Impacts; and
3. Assessment of the Significance of the Impacts.

Completeness and scope: Review of the completeness of impacts that are addressed and the scope of those that are considered worthy of further analysis include:

- Using checklists and guidance documents for the particular type of proposed project;
- Comparing other environmental impact assessments on related projects;
- Assessing coverage in the environmental impact assessment of each phase of the proposed project including project design, site preparation, construction, installation, operation and closure and shutdown;
- Assessing coverage in the environmental impact assessment of all types of impacts: primary, secondary and cumulative;
- Viewing the proposed project from varied perspectives;

- Reviewing maps and overviews of the area affected to determine if sensitive environments, resources, etc., have been overlooked;
- Using people networks and resource materials.
- Reviewing comments raised during scoping and whether they were addressed.

Adequacy of the assessment of the magnitude of the impacts: A reviewer must also examine the adequacy of the analysis. There are basically three types of approaches used:

- Extrapolation from current or past trends and conditions;
- Expert opinion;
- Predictive models.

Reviewing extrapolations from past trends and conditions: Environmental impact assessments often base their assessments of potential future impacts on a continuation of past trends and conditions. In reviewing extrapolation, a reviewer should look for:

- Documentation of a rationale which justifies the validity of assumptions that existing or past conditions will continue into the future;
- Internal logic running throughout the environmental impact assessment and whether these assumptions are internally consistent;
- Whether expected changes in key assumptions are known to the reviewer or are obvious from the related impacts of the proposed project.

Reviewing use of expert opinion: Environmental impact assessments often rely upon the opinions and analyses of experts in the field. A reviewer will have his or her own experiences as a professional and a reviewer, and must review critically the use of expert opinion regardless of the reviewer's expertise. The reviewer must carefully evaluate the environmental impact assessment document, as well as understand issues and concerns raised by other reviewers; this is the case even if the document or comments on the document are from an individual with more expertise in a particular area than the reviewer. This is critical, because mistakes can be made and people can be biased toward a particular outcome How is this accomplished in a professional and objective manner?

To help identify whether an expert has applied their expertise appropriately or improperly, a reviewer can:

- Have equivalent technical expertise;
- Bring in an outside expert (e.g., a geologist) or have access to in-house expertise/consultants;

- Understand what expertise is and what it is not in this particular circumstance;
- Examine the use of internal quality control programs in the source agency or organization;
- Understand typical areas of concern, such as boundary conditions, appropriate use of models, etc.;
- Have and use a reference library.

Reviewing the use of predictive models:

- Carefully examine the logic and internal consistency of basic assumptions, including the application of models and techniques that were used in the specific situation, and explore the logic and consistent use of assumptions used in evaluating project alternatives;
- Look for documentation that justifies the choice of one model over another;
- Look for boundary conditions which establish the credibility of the model for specific uses and whether those conditions are present in the current application;
- Look for key assumptions and whether they are internally consistent throughout the analysis or whether they are changed in any significant manner in order to use the model.

Other bases for analysis:

- Did the impact assessment overlook an obvious source of information?
- Did the impact assessment assess impacts inconsistently, using some parameters or impacts for some alternatives and not for others?
- Did the impact assessment include both beneficial and adverse impacts?
- Did the impact assessment include quantification wherever possible?

Assessment of the significance of impacts: Review of the issue of significance of impacts may include:

- Justification of findings of insignificant impact: whether they make sense;
- Comparison to regulatory limits;
- Level of controversy;
- Relative change in existing conditions;
- Cumulative impact analysis. This type of analysis is used to determine whether the cumulative impacts of the proposed project, when combined with existing environmental stressors unrelated to the proposed project, will together create significant impacts. For example, reviewers must consider the issue of biological carrying capacity in the affected geographic

area, and whether carrying capacity will be affected by primary or cumulative environmental impacts.

There are several ways a reviewer can address the significance of potential environmental impacts when he or she feels it was not adequately addressed in an environmental impact assessment. The reviewer can:

- Evaluate the methodologies and rationales that were used for predicting impacts. Do they make logical sense? How do they compare to standard methodologies in common use in the scientific community?
- Compare the environmental impact assessment to other environmental impact assessments that were prepared for similar projects. Were potential impacts assessed in the same ways? Why or why not?
- Consult with technical experts either within or outside of the reviewer's agency who have expertise with the particular issue area in question.

See Appendix C.2 for further discussion on determining significance of environmental impacts.

4.6 Mitigation and Monitoring Measures

Even with the best project siting and design, each of the alternatives to a proposed project will have potential environmental impacts. For all adverse potential impacts, especially the significant impacts, the project proponent must suggest mitigation measures. Mitigation is accomplished by refining the proposed project and alternatives during siting, feasibility, and design processes. The goal is to implement projects with as few significant adverse impacts as possible.

In addition to proposing specific mitigation measures, some mechanism for ensuring that mitigation measures are effective must be put into place. This can be achieved through appropriate monitoring measures for each mitigation type.

4.6.1 Hierarchy of Mitigation Measures

Avoiding an impact altogether by not taking a certain action or parts of an action should be the highest priority in an environmental impact assessment. There are also other types of mitigation measures. Mitigation measures are prioritized with "avoiding or preventing" impacts as the most desirable mitigation measure and "compensating" for a loss as the least desirable (but preferable to loss without compensation). In descending order of desirability, the primary mitigation types can be classified as follows:

- Avoiding an impact by not taking a certain action or parts of an action should be the first consideration

- Avoid or prevent impacts altogether by not taking a certain action or parts of an action
- Minimize impacts by limiting the degree or magnitude of the action and its implementation
- Reduce or eliminate the impact over time by preservation and maintenance operations during the life of the proposed project
- Correct the impact by repairing, rehabilitating, or restoring the existing environment
- Compensate for the impact by replacing or providing substitute resources or environments.

This hierarchy reinforces the objective of trying to avoid or minimize potential impacts during project siting and design. The goal is to identify a project and alternatives that meet the purpose and need, yet do so with as little adverse environmental impact as possible, to carry into the impact assessment process.

4.6.2 Scope of Proposed Mitigation

The environmental impact assessment should describe mitigation measures for all significant environmental and social impacts identified. The following list highlights selected general mitigation measures:

- Air Resources
  - Implement an automobile inspection program to reduce impacts of increased traffic
  - Site the facility so that prevailing winds carry emissions away from sensitive resources or population centers
  - Install (and operate and maintain training) fabric filter collectors or electrostatic precipitators to reduce particulate emissions.
- Water Resources
  - Install and operate treatment systems so that discharges do not exceed the waste assimilation capacity of the receiving stream or sewage treatment plant
  - Modify industrial processes to avoid generation of water pollution
  - Maintain vegetative buffer areas along river banks and shorelines to protect water quality.
- Geologic Resources
  - Revegetate cleared areas to protect soils

- Avoid clearing steep slopes or highly erosional soil
- Limit the use of heavy machinery where soil compaction is a concern

- Biological Resources
  - Develop land use plans to avoid incompatible use of sensitive areas such as floodplain, coastlines, wetlands, and conservation areas
  - Maintain normal flow regime of aquatic and wetland systems by restricting channelization, preserving natural meanders, and limiting water diversions
  - Replant areas with a variety of native species to avoid introduction of exotic species and dominance of nuisance species.
- Waste Management
  - Develop a materials management spill response plan
  - Provide training to employees
  - Implement a financial accountability plan to cover costs of remediation in the event of an industrial accident
  - Implement a recycling and waste program.
- Socioeconomic Resources
  - Include local communities in the project planning
  - Provide job training for displaced workers
  - Establish reasonable pricing policies for community services
  - Develop an emergency response plan for industrial accidents.
- Cultural Resources
  - Include local communities in the planning process
  - Develop a plan for responding to chance archaeological finds during land clearing
  - Develop cultural resource sensitivity maps delineating areas of high, medium, and low likelihood of containing cultural resources.

Each mitigation measure should be described in enough detail so that its environmental consequences can be assessed and any residual impacts clearly identified.

In addition to specific mitigation measures, an environmental impact assessment document should propose appropriate monitoring plans to measure the effectiveness of the mitigation measures. For example, if a proposed project could potentially harm water quality in a lake, and a mitigation measure consisting of a waste water treatment plant is proposed, the quality of the water discharging from the plant to the lake should be periodically monitored to ensure the lake is not being adversely impacted.

In some countries, the reviewer may require specific mitigation measures as a condition of project approval. In other countries, opportunities for mitigation of environmental impacts are an important consideration in determining the preferred project alternative. The preferred alternative typically reflects choices among tradeoffs. The tradeoffs can include different processes, pollution control technologies, costs, or other features. The environmental impact assessment should describe the process that led to, and the rationale for, the selection of the preferred alternative. The analysis should be deemed complete if:

- All reasonable alternatives were identified and evaluated;
- All potential impacts are identified and assessed for all alternatives;
- All possible refinements and modifications for environmental protection are incorporated in the alternatives;
- Any residual impacts and consequences of mitigating those impacts have been assessed.

4.6.3 Review of Mitigation and Monitoring Measures Road Map

The role of the reviewer is to assess whether proposed mitigation and monitoring measures are complete and adequate. The World Bank Mitigation Tables that are included in the Resource Manual that is associated with the *Principles of Environmental Impact Assessment Review* text developed by EPA are a tool to support the assessment of mitigation measures. In conducting this assessment, the reviewer should ask the following questions, which serve as the road map for mitigation and monitoring review:

Road Map for Mitigation Review

- Specific mitigation measures are proposed
- All significant adverse impacts are addressed by the mitigation plan
- Measures are proposed for:
  - All types of impacts
  - All phases of the proposed project
  - All environment types
- Preferred mitigation measures at the top of the mitigation type hierarchy are considered
- Mitigation measures are described in sufficient detail relative to the significance of impact
- Mitigation measures are:
  - Technically and financially feasible with adequate financial and non-financial resources to implement the measures
  - Socially and culturally acceptable
- Implementation plans include schedules and interim milestones and timing is consistent with other factors presented in the assessment of impact
- Responsible parties are identified and committed to implementation

A reviewer must address the issues set forth in this road map when conducting mitigation and monitoring review. An environmental impact assessment document lacking any of the above components in its mitigation and monitoring section may be inadequate, and the reviewer should communicate this fact to the project proponent along with suggestions on how to correct the inadequacies.

It is important to remember that, aside from avoiding an action, mitigation is often not an absolute prevention of all environmental impact. There is usually some impact, with mitigation implemented in order to lessen that impact. A law of diminishing returns often applies to mitigation, especially pollution reduction. It is often said that it is costlier to prevent the last 5 percent of pollution than the first 95 percent combined. Emissions from coal fired power plants are an example. It is relatively inexpensive to filter out the larger particulate matter before it escapes out of the stacks. However, ensuring that there are zero emissions of sulfur oxides, nitrogen oxides, carbon monoxide and other pollutants can be astronomically expensive, if not impossible.

An effective reviewer will develop enough expertise, or know where to find it, to determine how much is enough to ask of a project proponent in terms of mitigation. If the purpose and need for a proposed project are valid, and assessed environmental impacts are acceptable, a reviewer should not expect the project proponent to implement mitigation measures of such cost and difficulty as to prevent the proposed project from moving forward. As in most areas of environmental impact assessment review, a sense of balance is key.

4.7 Tools and Techniques for Environmental Impact Assessment Review

In addition to road maps for review mentioned throughout chapters 3 and 4, there are a variety of "tools and techniques" a reviewer can use to aid his or her review. The following list of tools and techniques is applicable to all elements of a typical environmental impact assessment document and review process. They are also located in Appendix D, along with an indication of where these tools can be found in the course text and resource documents provided.

Tools and Techniques for Environmental Impact Assessment Review

- Information on legal and institutional requirements, policies, and guidance material
- Guidelines
- Road Maps
- Checklists
- Student texts
- Library
- Field reconnaissance
- Analytic and predictive models
- GIS maps and overlays
- Environmental impact assessments for similar projects, geographic area, etc.
- Consultation by colleagues/outsiders/experts/academia
- Reviewing other reviewer/public comments

Reviewers are encouraged to use appropriate tools and techniques for each element of the environmental impact assessment document. Further information on these tools and techniques can be found in appendices A through E to this text, as well as in the Resource Manual, interactive CD-ROM, and case study EIAs that accompany the course *Principles of Environmental Impact Assessment Review.*

Now you are prepared for the important job of reviewer. We appreciate your comments on what is most useful to you and further ideas for best meeting the needs of environmental professionals in the field.

APPENDIX A

ENVIRONMENTAL IMPACT ASSESSMENT EVALUATION CHECKLIST

Introduction

There are many tools that a reviewer of environmental impact assessment documents can use to help determine whether such documents are complete and adequate. Among the powerful tools that can be used are checklists. Checklists can be valuable in the following ways:

- They can help ensure that all key issues and elements have been considered;
- They can be used by the project proponent and reviewer alike throughout all stages of the environmental impact assessment process;
- They help ensure that the review process is systematic; and
- They help make the review process more standardized across projects.

A comprehensive environmental impact assessment review checklist is presented in this appendix. This checklist covers all elements of typical environmental impact assessment documents, including:

Purpose and Need;

Project Alternatives;

Description of the Environmental Setting (both natural and socioeconomic);

Assessment of Potential Environmental Impacts; and

Mitigation and Monitoring Measures.

There are numerous checklist items under each of these headings. Because the environmental impact assessment process is focused on preventing and minimizing impacts to the natural and human (socioeconomic) environment, the majority of checklist items are located under Description of the Environmental Setting and Assessment of Potential Environmental Impacts.

The checklist included in this Appendix can be a powerful tool for environmental impact assessment reviewers, as well as project proponents and preparers of environmental impact assessment documents. In addition to the checklist in this appendix, there are other relevant checklists available to aid the review process. A number of other checklists are included in the Resource Manual accompanying the *Principles of Environmental Impact Assessment Review* course. A list of the contents of the Resource Manual appear in Appendix D.

Environmental Impact Assessment Evaluation Checklist

Issue and Text Reference	N/A	Adequately Covered	Not Adequately Covered	Comments
PURPOSE AND NEED				
1. Clear description of underlying need for the proposed project (p. 4-4)				
2. Clear description of purpose of proposed project (p. 4-4)				
3. Adequate description of the proposed project (p. 4-4)				
PROJECT ALTERNATIVES				
1. Consideration of all relevant alternative types. (p. 4-7)				
a. No Action				
b. Alternative sites				
c. Alternative designs				
d. Alternative controls				
e. Structural alternatives				
f. Non-structural Alternatives				
2. All alternatives satisfy the stated purpose and need for the project. (p. 4-8)				
3. Description of all alternative actions or projects that were, or are, being considered. (p. 4-8)				
a. Size and location of facilities				
b. Land requirements				
c. Operations and management requirements				
d. Auxiliary structures				
e. Construction schedules				
4. Description of initial environmental impact assessment processes and results (p. 4-7)				
DESCRIPTION OF THE ENVIRONMENTAL SETTING				
1. Region of Concern defined, including boundary areas (p. 4-10)				
2. Physical-Chemical Environment (p. 4-12)				
a. Air Resources (p. 4-12)				
1) meteorological data (e.g., temperature, wind)				
2) ambient air quality (e.g., particulates, ozone)				
3) stationary sources of emissions (e.g., power plants)				

Issue and Text Reference	N/A	Adequately Covered	Not Adequately Covered	Comments
4) mobile sources of emissions (e.g., cars and trucks)				
b. Water Resources (p. 4-14)				
Surface Water: 1) location and type (e.g.,estuaries, streams, lakes, and their position relative to the site)				
2) water quality information (e.g., dissolved oxygen, temperature, nutrients)				
3) existing pollutant sources (location and amount of discharges)				
4) future uses				
5) discussion of flooding events				
Ground Water: 6) description of key factors (e.g., depth to water table, overlying soils, geologic features)				
7) water quality information (e.g., pH, solids)				
c. Soils and Geology (p. 4-16)				
1) topography				
2) soil structure				
3) ground water movement				
4) erosion potential				
5) subsidence				
6) seismic activity (e.g., proximity to faults, history of earthquakes and volcanic eruptions)				
7) mineral resources (e.g., locations of deposits, types and quantities, ownership of mining rights)				
2. Biological Conditions				
a. Wildlife and Vegetation (p. 4-18)				
1) description and listing of aquatic, wetland, and terrestrial flora and fauna (e.g., species lists, abundances)				
2) description and listing of native species of wildlife and vegetation present				
3) description and listing of particularly invasive exotic species of wildlife and vegetation				

Issue and Text Reference	N/A	Adequately Covered	Not Adequately Covered	Comments
4) description and listing of rare and threatened species				
b. Community and Habitat Characterization (p. 4-22)				
1) maps and descriptions of the aquatic, wetland, and terrestrial communities found in and around the project site				
c. Ecologically Significant Features (p. 4-24)				
1) support of broader ecosystems by the project site (e.g., if located along a flyway or other biological corridor)				
2) important ecological functions of the project site (e.g., nutrient source through flooding, storm water retention)				
3) characterization of relevant disturbance regimes, natural and project-induced (e.g., floods, fire, potential impact of logging)				
4) description of hydrologic processes (e.g., ground and surface water flows and durations)				
5) description of important biotic interactions (e.g., interdependence of plants and animals at the site and with other sites)				
4. Waste Management and Pollution Prevention (p. 4-27)				
a. Locations of expected waste disposal or discharge				
b. Description of waste management techniques (e.g., treatment, storage, transport, recycling)				
c. Projected waste characteristics (e.g., types, quantities, toxicity)				
5. Socioeconomic Environment (p. 4-28)				
a. Land Use (p. 4-29)				
1) description of present and historic land use				
2) map of present and historic land use				
b. Population and Housing (p. 4-29)				
1) demographic information (e.g., average household size, average age, age/sex distributions, ethnic composition, and community cohesion)				
c. Economic Activity (p. 4-30)				

Issue and Text Reference	N/A	Adequately Covered	Not Adequately Covered	Comments
1) description of present economic activity (e.g., number and type of businesses, annual revenues, ownership patterns)				
2) description of unique features of business community (e.g., high seasonality of trade, high outflow of profit, declining of trade, or downtown revitalization)				
3) consideration of interplay among economic activity, capacity of public services, and fiscal ability of community to respond to capacity needs				
d. Community Services and Public Finance (p. 4-31)				
1) description of existing public facilities and services within vicinity of project, including existing level of use and remaining capacity to accommodate growth				
e. Transportation (p. 4-32)				
1) description of all relevant forms of transportation for facility				
2) current traffic volumes				
3) current traffic capacity				
4) provision of public transportation				
5) assessment of the adequacy of the systems for meeting peak demands during construction and operation				
f. Health and Safety (p. 4-32)				
1) description of present health and safety issues (e.g., statistics on industrial accidents, emissions data from prior and existing facilities, present levels of noise)				
2) identification of special populations or areas more likely to be exposed to adverse impacts				
6. Cultural Resources (p. 4-33)				
a. Archaeological sites in relation to the project				
b. Paleontological sites in relation to the project				
c. Historic sites in relation to the project				
d. Educational, religious, scientific, or cultural sites in relation to the project				

Issue and Text Reference	N/A	Adequately Covered	Not Adequately Covered	Comments
ASSESSMENT OF POTENTIAL ENVIRONMENTAL IMPACTS				
The Environmental Impact Assessment discusses primary, secondary, and cumulative impacts during all stages, including initial site preparation and construction; facility operation, and post-facility or site closure for the following (p. 4-36):				
1. Pollutant Generation, Transport, and Receptors (p. 4-40)				
a. Air Resources (p. 4-40)				
1) identification of emission sources and project emission rates and comparison to national, state, and local standards and limitations				
2) comparison of predicted atmospheric levels with national, state, or local ambient levels				
3) description of stack emissions during operation and maintenance activities and comparison with existing national, state, and local standards				
4) identification of best mitigation measures to avoid or minimize adverse impacts				
b. Water Resources (p. 4-42)				
1) address potential for water quality to be degraded by various factors				
2) prediction of pollutant concentrations in water bodies and comparison with existing national, state, and local water quality standards and criteria				
3) identification of best mitigation measures to avoid or minimize adverse impacts				
c. Geological Resources (p. 4-45)				
1) determination of potential soil loss and mitigation activities				
2) identification of potential contamination sources and mitigation measures				
d. Biological Resources (p. 4-46)				
1) consideration of potential losses of biological resources within site boundaries				
2) description of effluent and emission concentrations and their potential effects to vegetation and wildlife				

Issue and Text Reference	N/A	Adequately Covered	Not Adequately Covered	Comments
3) discussion of bioaccumulative effects from facility emissions and discharges				
4) identification of best mitigation measures to avoid or minimize adverse impacts				
2. Habitat Alteration (p. 4-46)				
a. Biological Resources (p. 4-47)				
1) address potential for construction and site preparation activities to alter critical habitats for wildlife				
2) consideration of potential for secondary changes in habitats following construction and site preparation activities				
3) assessment of possible permanent loss or displacement of vegetation habitat due to operation				
4) identification of changes in local species composition, diversity, and abundances resulting from loss of specific habitats				
5) identification of best mitigation measures to avoid or minimize adverse impacts				
3. Waste Management and Pollution Prevention (p. 4-52)				
a. description of facility waste management plan with procedures for treatment, handling, and disposal				
b. discussion of projected facility waste characteristics				
c. identification of best mitigation measures to avoid or minimize adverse impacts				
4. Socioeconomic Impacts (p. 4-53)				
a. Land Use (p. 4-54)				
1) identification of the existing or planned land use areas lost due to site preparation and construction activities				
2) determination of conflicting zoning requirements and land uses with site preparation and construction activities				
3) description of anticipated changes in near by land use as a result of the facility and evaluation of conflicts that could arise during operations				

Issue and Text Reference	N/A	Adequately Covered	Not Adequately Covered	Comments
4) identification of best mitigation measures to avoid or minimize adverse impacts				
b. Economic Activity (p. 4-57)				
1) address changes in employment patterns				
2) address ability of available labor pool to meet project-related employment needs				
3) identification of economic multipliers used in analysis and their source				
4) discussion of potential change in overall economic activity in region				
5) identification of best mitigation measures to avoid or minimize adverse impacts				
c. Population and Housing (p. 4-58)				
1) address the relationship between employment increases and population in-migration				
2) identification of deficiencies in available housing for the potential increased workforce and their families				
3) identification of best mitigation measures to avoid or minimize adverse impacts				
d. Community Services and Public Finance (p. 4-59)				
1) identification of deficiencies in community services and infrastructure during project construction and operation				
2) identification of shortfalls in transportation capacity due to either primary or secondary impacts of the project				
3) identification of best mitigation measures to avoid or minimize adverse impacts				
e. Transportation (p. 4-61)				
1) assessment of proposed project's consistency with local and/or regional transportation plans				
2) evaluation of changes in LOS resulting from the proposed project and alternatives				
3) evaluation of the effect of heavy vehicle traffic on affected pavement and bridges				

Issue and Text Reference	N/A	Adequately Covered	Not Adequately Covered	Comments
4) description of mitigation measures to offset adverse impacts to structural integrity and public safety				
f. Health and Safety (p. 4-62)				
1) evaluation of whether construction, operation, and maintenance activities present health and safety hazards to humans working or living at or near the project site				
2) discussion of potential effects of facility noise levels on workers, local communities, and local flora and fauna				
3) analysis of potential long-term contaminant bioaccumulation within the food chain				
4) identification of best mitigation measures to avoid or minimize adverse impacts				
g. Environmental Equity (p. 4-63)				
1) determination of the equity of changes in employment patterns attributable to site preparation and construction activities				
2) determination of the equity of community structure changes caused by project construction and operation				
3) identification of best mitigation measures to avoid or minimize adverse impacts				
5. Cultural Resources (p. 4-63)				
a. identification of any historical or cultural resources in close proximity to the site following correspondence with appropriate authorities				
b. discussion of mitigation measures necessary to preserve items of archaeological, historical, or cultural interest				
c. determination of the extent to which construction, operation, and maintenance activities disrupt the aesthetic or sensory attributes of the site				
d. determination of whether the facility components are designed with consideration given to human factors				
MITIGATION MEASURES				
1. Mitigation Measures (p. 4-68)				

Issue and Text Reference	N/A	Adequately Covered	Not Adequately Covered	Comments
a. description of mitigation activities for all significant impacts to both the natural and human (socioeconomic) environments				
b. description of mitigation measures with adequate information to evaluate environmental consequences and residual impacts				
c. identification of best mitigation measures to avoid or minimize potential impacts during all stages of the project, including siting and design, facility operation, and post facility closure.				
d. support of the following types of mitigation measures, in the following decreasing order of preference: - Avoidance or prevention - Minimization - Reduction or elimination over time - Correction - Compensation.				
e. implementation plan (schedule) and criteria for performance for all mitigation measures.				
f. responsible entity assigned to carrying out each mitigation measure.				
g. measures are socially and culturally acceptable.				
h. adequate financial and non-financial resources to implement the measures.				

APPENDIX B

ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGIES

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Name	Application	Description	Reference
Economic Tools			
Cost-Benefit Analysis	Decision-Making	Variety of economic tools that assign value to project components and perceived benefits, and are used to determine relative cost and benefit of development or project.	Westman, W.E. 1985. Ecology, Impact Assessment and Environmental Planning. John Wiley & Sons, New York. 532 pp.
Cost-Effectiveness Analysis	Decision-Making	Economic analysis that focuses on cost of providing services and achieving objectives. The technique emphasizes achievement of least-cost approach.	Leistritz, F.L., and S.H. Murdock. 1981. The Socioeconomic Impact of Resource Development: Methods for Assessment. Westview Press, Boulder, Colorado. 286pp.
Trade-Off Analysis	Decision-Making	This socioeconomic tool involves comparison of a set of alternatives relative to a series of decision factors arrayed on a matrix. Approaches used can include qualitative, quantitative, ranking, rating, scaling, weighing.	Canter, L. W., S. F. Atkinson, and F. L. Leistritz. 1985. Impact of Growth. Lewis Publishers Inc., Chelsea, Michigan. Canter, L. W. 1979. Water Resources Assessment - Methodology and Technology Sourcebook. Ann Arbor Science, Ann Arbor, Michigan.
Checklists			
World Bank Environmental Impact Checklist	Scoping, Development of Alternatives, Mitigation	These checklists are designed to be used in identifying significant environmental impacts, project alternatives, and special issues associated with development projects. They are qualitative and predictive in nature. More than 35 types of projects are represented, including housing, agriculture, and industrial development.	World Bank, 1991. Environmental Assessment Sourcebook. Volumes II and III.
Model EIS scoping checklist NY DEC	Scoping	This is a checklist of topics intended to initiate development of a detailed scope for an EIS. The checklist helps identify topic areas to be addressed in the EIS.	New York State Department of Environmental Conservation, 1982. State Environmental Quality Review Handbook.
Checklist of potential environmental impacts of transportation project	Scoping	This checklist was designed to help identify environmental impacts associated with planning, design, construction, and operation of a transportation project.	Arthur D. Little, Inc. 1971. Transportation and the Environment: Synthesis for Action: Impact of the National Environmental Policy Act of 1969 on the Department of Transportation, Vol. I-III, prepared for the Office of the Secretary, Department of Transportation.

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Name	Application	Description	Reference
Matrices			
Leopold Matrix	Impact Assessment	This matrix is used to identify potential impacts associated with a project or alternatives. It assists performing a comprehensive review of the variety of interactions between project elements and environmental parameters, to identify important environmental factors, data needs, and less damaging alternatives.	Leopold, L. B., F. E. Clarke, B. B. Hanshaw, and J. R. Balsley. 1971. A procedure for evaluating environmental impact. Circular 645. U.S. Geological Survey, Washington, D.C.
Loran Methodology (Matrix)	Impact Assessment	This method uses a matrix of 234 project activities and 27 environmental features to identify critical environmental areas. Each element in the matrix is scaled and results input to an algorithm that aggregates impact scores. It is used to identify critical environmental areas.	Thompson, M. A. 1990. Determining impact significance in EIA: a review of 24 methodologies. Journal ob Environmental Management 30:235-250.
Scaling or Weighing Techniques			
Crawford Methodology	Impact Assessment	Methodology was devised for use in highway route planning. It makes extensive use of public involvement and the Delphi Technique. The technique is used as a basis for analyzing the value trade-offs involved in a decision between project alternatives. Results show each alternative as a percentage of maximum possible positive or negative impact.	Thompson, M. A. 1990. Determining impact significance in EIA: a review of 24 methodologies. Journal of Environmental Management 30:235-250.
PADC Methodology	Impact Assessment	This tool evaluates the significance of impacts based on 5 polarities: adverse/beneficial, short/long term, reversible/irreversible, direct/indirect, local/strategic. No numerical method of evaluating responses is presented.	Thompson, M. A. 1990. Determining impact significance in EIA: a review of 24 methodologies. Journal of Environmental Management 30:235-250.
Water Resources Assessment Methodology	Impact Assessment	This methodology produces scores for evaluating effects of alternatives on specific environmental components. The methodology uses scaling and weighing methods for environmental social and economic components.	Thompson, M. A. 1990. Determining impact significance in EIA: a review of 24 methodologies. Journal of Environmental Management 30:235-250.
Fischer and Davis Methodology	Impact Assessment	This method is used for determination of impact, although it does not differentiate between impact magnitude and significance. Impacts are assigned a positive(+) or negative(-), and the degree of impact is assigned subjectively. Designators are used to indicate short-term or long-term impacts. Scores achieved are used to compare alternatives.	Thompson, M. A. 1990. Determining impact significance in EIA: a review of 24 methodologies. Journal of Environmental Management 30:235-250.

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Name	Application	Description	Reference
Overlay Mapping and GIS			
Overlay Mapping	Impact Assessment, Environmental Characterization	This method is useful in displaying and identifying areas of environmental sensitivity, succession, development, and landscape impacts due to multiple projects.	McHarg, I. 1969. Design with Nature. Natural History, New York.
Geographic Information Systems (GIS)	Impact Assessment, Environmental Characterization	GIS consists of digitized maps and overlays that are used to show spatial dimensions of impacts and areas of concern.	Westman, W. E., 1985. Ecology, Impact Assessment and Environmental Planning. John Wiley & Sons, New York. 532 pp.
Landscape Mapping (GIS)	Impact Analysis and Prediction	This tool is used to assess the suitability or vulnerability of an area for various uses.	Hopkins, L. D. 1977. Methods for generating land suitability maps: a comparative evaluation. Journal of the American Institute of Planners 43:386-400. Rasmussen, W. O., R. N. Weisz, P. F. Folliott, and D. R. Carder. 1980. Planning for forest roads--a computer assisted procedure for selection of alternative corridors. Journal of Environmental Management 11: 94-104.
Ground Disturbance Model	Impact Assessment	This GIS-based tool is a model that combines GIS database layers of land-cover, slope categories, and transportation to quantify and map the area of potential land disturbance into 5 levels of magnitude.	Jensen, J., and G. Gault. 1992. Electrifying the impact assessment process. The Environmental Professional 14:50-59.
Visual Contrast	Impact Assessment	This GIS-based tool provides a measure of visible change in the landscape. It combines GIS data for landcover, terrain, land-sue and the proposed project description to map a visual contrast representing the level of change in the characteristic landscape.	Jensen, J., and G. Gault. 1992. Electrifying the impact assessment process. The Environmental Professional 14:50-59.
Cultural Resources Predictive Model	Impact Assessment	This GIS-based tool uses data on landcover, terrain, and water resources to determine the probability of finding culturally-sensitive sites.	Jensen, J., and G. Gault. 1992. Electrifying the impact assessment process. The Environmental Professional 14:50-59.
Sensitive Habitats	Impact Assessment	This GIS-based tool applies GIS buffering capacity to establish zones of potentially sensitive habitats associated with known habitat locations.	Jensen, J., and G. Gault. 1992. Electrifying the impact assessment process. The Environmental Professional 14:50-59.
Slope (GIS)	Impact Assessment	This GIS-based tool uses USGS data to map 5 slope categories. The slope categories are important in the development kf access levels for use in ground-water disturbance and public accessibility pre-impact assessment models.	Jensen, J., and G. Gault. 1992. Electrifying the impact assessment process. The Environmental Professional 14:50-59.

Name	Application	Description	Reference
Visibility Model	Impact Assessment	This GIS model is constructed using digital terrain data and selected land-uses to map "viewsheds" over digitally modeled terrain in the project study area. Resulting maps show visibility as distance thresholds of visual perception, and can be used by GIS impact models to determine potential visual impacts of construction and operation of the project.	Jensen, J., and G. Gault. 1992. Electrifying the impact assessment process. The Environmental Professional 14:50-59.
Public Accessibility Model	Impact Assessment	This GIS-based tool estimates the degree of remoteness of areas along transmission line routing alternatives. It uses GIS data on transportation and ground disturbance to estimate the increase in area accessible by roads in remote areas.	Jensen, J., and G. Gault. 1992. Electrifying the impact assessment process. The Environmental Professional 14:50-59.
Ecological Risk Assessment	Impact Analysis and Prediction	Identifies and quantifies risks to ecological receptors from chemical, physical, and biological agents. Evaluates the likelihood that an adverse ecological effect will occur as a result of exposure to contaminant or disturbance. Uses exposure and effects models.	Suter, G. W. II 1993. Ecological Risk Assessment. Lewis Publishers, Inc., Chelsea, Michigan. 538pp.
Human Health Risk Assessment	Impact Analysis and Prediction	Provides quantitative estimates of cancer and non-cancer risk associated with exposure to chemicals or biological agents. This tool includes a source/release assessment, fate and transport models, exposure assessment, toxicological assessment and risk characterization.	Cohressen, J. J., and V. T. Covello. 1989. Risk Analysis: A Guide to Principles and Methods for Analyzing Health and Environmental Risks. U.S. Council on Environmental Quality, Executive Office of the President. 407 pp. Available from: The National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161. # PB89-137772.
Economic-Demographic Assessment Models	Impact Analysis and Prediction	Numerous models used to integrate economic, demographic, public service and fiscal projections to estimate public costs and revenues, and public service demands.	Sanderson, W. C. 1978. Economic-Demographic Models: A Review of Their Usefulness for Policy Analysis. Technical Paper 4. Rome, Italy: Food and Agriculture Organization of the United Nations.

Name	Application	Description	Reference
Chemical Fate and Transport Models			
Fugacity Models	Impact Analysis and Prediction	Numerous models used to predict fate of chemicals in multimedia systems. Complexity varies from steady-state to time-varying models. Outputs from these models are used in risk assessments.	Mackay, D., and S. Paterson. 1993. Exposure Assessment: Mathematical Models of transport and fate. In: Ecological Risk Assessment (ed. G.W. Suter II). Lewis Publishers, Inc., Chelsea , Michigan.
GEOTOX	Impact Analysis and Prediction	This compartmental model calculates chemical partitioning, degrading reactions, and interphase transport. It is used in conjunction with human exposure models.	Mackay, D., and S. Paterson. 1993. Exposure Assessment: Mathematical Models of transport and fate. In: Ecological Risk Assessment (ed. G.W. Suter II). Lewis Publishers, Inc., Chelsea , Michigan.
ENPART	Impact Analysis and Prediction	Environmental PARTitioning, a fugacity-based screening-level model, estimates partitioning of organic chemicals among environmental compartments, identifies dominant pathways and data gaps, and provides estimates of a chemical's persistence and bioconcentration potential.	Mackay, D., and S. Paterson. 1993. Exposure Assessment: Mathematical Models of transport and fate. In: Ecological Risk Assessment (ed. G.W. Suter II). Lewis Publishers, Inc., Chelsea , Michigan.
TOXSCREEN	Impact Analysis and Prediction	This time-dependent multimedia model is a screening tool that assesses the potential for environmental transport and accumulation of chemicals released to the air, surface water and soil.	Mackay, D., and S. Paterson. 1993. Exposure Assessment: Mathematical Models of transport and fate. In: Ecological Risk Assessment (ed. G.W. Suter II). Lewis Publishers, Inc., Chelsea , Michigan.
SIMPLESAL	Impact Analysis and Prediction	This screening level multimedia fugacity compartmental model is used to estimate steady-state or time dependent concentrations of chemicals, and determine dominant environmental pathways and processes.	Mackay, D., and S. Paterson. 1993. Exposure Assessment: Mathematical Models of transport and fate. In: Ecological Risk Assessment (ed. G.W. Suter II). Lewis Publishers, Inc., Chelsea , Michigan.
AERIS	Impact Analysis and Prediction	This multimedia risk assessment model estimates environmental concentrations and human exposures in the vicinity of contaminated land sites. It is a menu-driven model with built-in default values.	Mackay, D., and S. Paterson. 1993. Exposure Assessment: Mathematical Models of transport and fate. In: Ecological Risk Assessment (ed. G.W. Suter II). Lewis Publishers, Inc., Chelsea , Michigan. Senes Consultants. 1989. Contaminated Soil Cleanup in Canada, Volume 5, Development of the AERIS Model, Final Report prepared for the Decommissioning Steering Committee.
Persistence	Impact Analysis and Prediction	This screening-level model is used to estimate the fate of organic chemicals, especially pesticides, released into the aquatic environment. It provides a steady-state, fixed, or time dependent solution using default environmental parameters.	Mackay, D., and S. Paterson. 1993. Exposure Assessment: Mathematical Models of transport and fate. In: Ecological Risk Assessment (ed. G.W. Suter II). Lewis Publishers, Inc., Chelsea , Michigan.

Name	Application	Description	Reference
EXAMS	Impact Analysis and Prediction	Exposure Analysis Modeling System. This is a mass-balance model that predicts the fate of organic chemicals in stratified surface waters as a result of continuous or intermittent releases.	Mackay, D., and S. Paterson. 1993. Exposure Assessment: Mathematical Models of transport and fate. In: Ecological Risk Assessment (ed. G.W. Suter II). Lewis Publishers, Inc., Chelsea , Michigan. Burns, L. A., D. M. Cline, and R. R. Lassiter. 1981. Exposure Analysis Modeling Systems (EXAMS): User Manual and System Documentation. U.S. Environmental Protection Agency, Environmental Research Laboratory, Athens, Georgia.
EXWAT	Impact Analysis and Prediction	This is a steady-state model used to describe chemical fate in water bodies and assess comparative hazards. It is applicable to continuous single-point sources.	Mackay, D., and S. Paterson. 1993. Exposure Assessment: Mathematical Models of transport and fate. In: Ecological Risk Assessment (ed. G.W. Suter II). Lewis Publishers, Inc., Chelsea , Michigan.
Metal Speciation Models	Impact Analysis and Prediction	Models such as MINTEQAI are used to determine equilibrium speciation of metals in surface and groundwaters. Outputs include equilibrium aqueous speciation, adsorption, gas-phase partitioning, solid-phase saturation states and precipitation-dissolution states.	Brown, D. S., and J. D. Allison. 1987. MINTEQAI Equilibrium Metal Speciation Model: A User's Manual. U.S. Environmental Protection Agency, Environmental Research Laboratory, Athens, Georgia.
Fish Uptake and Food Chain Models	Impact Analysis and Prediction	Variety of models used to estimate concentrations of chemicals in aquatic biota.	Mackay, D., and S. Paterson. 1993. Exposure Assessment: Mathematical Models of transport and fate. In: Ecological Risk Assessment (ed. G.W. Suter II). Lewis Publishers, Inc., Chelsea , Michigan. Thomann, R. V. 1989. Bioaccumulation model of organic chemical distribution in aquatic food chains. Environmental Science and Technology 23:699-707. Clark, K. E., F.A.P.C. Gobas, and D. Mackay. 1990. Model of organic chemical uptake and clearance by fish from food and water. Environmental Science and Technology 24:1203-1213. Connell, D. W. 1989. Bioaccumulation of Xenophobic Compounds. CRC Press, Boca Raton, Florida.

Name	Application	Description	Reference
Soil Models	Impact Analysis and Prediction	Models used to predict fate and transport of chemicals in soil. Model outputs are used in risk assessment.	Bonazountas, M., and J. M. Wagner. 1984. SESOIL - A seasonal soil compartment model. Arthur D. Little Co., Cambridge, Massachusetts. Carsel, R. F., C. N. Smith, L. A. Mulkey, J. D. Dean, and P. Jowise. 1984. User's Manual for the Pesticide Root Zone Model (PRZM). EPA-600/3-84-109. U.S. Environmental Protection Agency, Environmental Research Laboratory, Athens, Georgia. Enfield, G. C., R. F. Carsel, S. Z. Cohen, T. Phon, and D. M. Walters. 1982. Approximating pollutant transport to groundwater. Ground Water 20:711-727. Jury, W. A., W. F. Spencer, and W. J. Farmer. 1983. Behavior assessment model for trace organics in soil. Journal of Environmental Quality 12:558-564.
Atmospheric Models	Impact Analysis and Prediction	Variety of models used to calculate ground-level concentrations of chemicals from emission sources. Model outputs are used in risk assessment.	Mackay, D., and S. Paterson. 1993. Exposure Assessment: Mathematical Models of transport and fate. In: Ecological Risk Assessment (ed. G.W. Suter II). Lewis Publishers, Inc., Chelsea , Michigan.
Habitat Evaluation Models	Impact Analysis and Prediction	This refers to a variety of models that are used to develop a quantitative index value for existing habitats, and determine change in that index resulting from the project.	U.S. Environmental Protection Agency (EPA). 1993. Habitat Evaluation: Guidance for the Review of Environmental Impact Assessment Documents. Farmer A. 1980. Habitat Evaluation Procedures (HEP). ESM 102. Division of Ecological Sciences, U.S. Fish and Wildlife Service, Washington, D.C. Farmer, A. 1981. Standards for the Development of Habitat Suitability Index Models. ESM 103. Division of Ecological Sciences, U.S. Fish and Wildlife Service, Washington D.C. U.S. Department of the Interior. 1987. Type B technical information documents PB88-100128-PB88-100169. Atkinson, S. F. 1990. A simplified habitat evaluation for use with remote sensing data. The Environmental Professional 12:122-130.

Name	Application	Description	Reference
Sensitivity Analysis	Decision Making	This technique identifies the parameter or variable of a model that is most sensitive to change. Use of this technique helps modelers and decision-makers understand how changes to input of an analysis affects the predicted impact of a proposed action.	Jorgensen, S. E. 1991. Environmental management modeling. In: Introduction to Environmental Management (eds. P. E. Hansen and S. E. Jorgensen). Elsevier, New York. 403 pp.
Expert Systems	Impact Analysis and Prediction	Expert systems refer to programs developed using IF-THEN codes. There is no reference to specific expert systems used for the EA process.	Lein, J. 1989. An expert system approach to environmental impact assessment. International Journal of Environmental Studies 33:13-27. Lein, J. K. 1993. Formalizing expert judgement in the environmental impact assessment process. The Environmental Professional 15: 95-102.
Computer-Aided Environmental Impact Assessment	Impact Assessment	This conceptual model provides a general outline for development of computer-aided environmental impact assessment. It has not been developed into a useful program. The tool is intended for use in evaluating different environmental components and costs of mitigation measures.	Luhar, A. K., and P. Khanna. 1988. Computer-aided rapid environmental impact assessment. Environmental Impact Assessment Review 8:9-25.
Field Studies			
Field Reconnaissance	Impact Identification	This tool consists of a qualitative reconnaissance of field conditions and is used to confirm and complement information provided in literature and background documentation.	Krebs, C.J. 1989. Ecological Methodology. Harper & Row, NY. 654 pp. Smith, R. 1966. Ecology and Field Biology. Harper & Row, NY. 686 pp.
Field Survey	Impact Identification, Baseline Characterization	This tool consists of a variety of techniques designed to address particular endpoints and objectives. Complexity can also vary based on study objectives. Environmental field studies document environmental conditions and trends.	Suter, G. 1993. Ecological Risk Assessment. Lewis Publishers, Chelsea, MI. 538 pp.
Laboratory Testing	Impact Analysis and Identification	This tool consists of establishing testing protocols, or microcosms that model processes in the field. Results are used to predict impacts of actions on endpoints selected. Testing protocols vary because of the multitude of potential endpoints and test parameters.	Sourcebook for the EA Process
Additional Assessment Tools/Techniques			
Ad Hoc Procedures	Impact Analysis and Prediction	Qualitative tool used to assemble information, compare alternative sites, and develop strategy	Sourcebook for the EA Process

APPENDIX B. ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGIES

Name	Application	Description	Reference
Professional Judgement	Impact Analysis and Prediction	Qualitative tool involving an experienced multidisciplinary team. Professional Judgement is used to design an EA, evaluate and select methods/models, determine relevance of data, develop assumptions to fill data gaps, interpret predicted/observed effects.	Lein, J. K. 1993. Formalizing expert judgment in the environmental impact assessment process. The Environmental Professional 15:95-102.
Analog Studies/ Case Studies	Impact Analysis and Prediction	This tool involves the use of information from studies that are analogous to the project being evaluated by virtue of geography, action, etc. It assumes that observed impacts at the analog site will be similar to the study site.	National Research Council. 1986. Ecological Knowledge and Environmental Problem-Solving: Concepts and Case Studies. National Research Council, National Academy Press, Washington, D.C.
Public Opinion	Scoping, Issue Identification, Impact Analysis, Determination of Significance	This qualitative tool helps to identify and determine the relative significance of environmental impacts. It is based on providing information to the public on the proposed action, alternatives and potential impacts.	Thompson, M. A. 1990. Determining impact significance in EIA: a review of 24 methodologies. Journal of Environmental Management 30:235-250.
Regulations, Guidelines and Thresholds	Determination of Significance	This screening tool consists of identifying applicable regulations and criteria for a particular project or action	Haug, P. T., R. W. Burwell, A. Stein, and B. L. Bandwiski. 1984. Determining the significance of environmental issues under the National Environmental Policy Act. Journal of Environmental Management 18:15-24.
Professional Standards and Design Specifications	Determination of Significance	This tool consists of comparing project parameters to professional standards.	Leistritz, F. L., and S. H. Murdock. 1981. The Socioeconomic Impact of Resource Development: Methods for Assessment. Westview Press/ Boulder, Colorado. 286 pp.
Inter-disciplinary team development	Scoping	This tool is used to select an interdisciplinary team and describe the role of team members	Sourcebook for the EA Process

C.1

ENVIRONMENTAL IMPACT ASSESSMENT TERM DEFINITIONS

KEY CONCEPTS IN ENVIRONMENTAL IMPACT ASSESSMENT

ALTERNATIVES TO THE PROPOSED ACTION: Alternatives are different means of meeting the general purpose and need of a proposed action, including:

- not proceeding with the action
- carrying out the action in a different location or facility
- implementing a non-structural solution
- alternatives *within* an action, such as different designs or materials, are not usually considered alternatives

CUMULATIVE IMPACT: Cumulative impacts result from the incremental impact of a proposed action on a common resource when added to other past, present and reasonably foreseeable future actions. These may include the collective affects of individually minor actions over a period of time.

ENVIRONMENT IMPACT ASSESSMENT: Environmental impact assessment is the systematic, reproducible, and interdisciplinary consideration of the potential effects of a proposed action and its reasonable alternatives on the physical, biological, cultural, and socioeconomic attributes of a particular geographical area. It is a decision making process designed to help integrate economic, social and environmental concerns and to help to mitigate the adverse environmental impacts of activities related to projects, plans, programs or policies. Involvement of the public and interested parties is important to obtaining complete information on impacts and ensuring sound results.

IMPACT: A change in the environment brought about by implementation of a proposed project or alternative.

INITIAL ENVIRONMENTAL IMPACT ASSESSMENT: Initial Environmental Impact Assessments consider the significance of environmental impacts in sufficient detail to make one of two determinations:

1) no significant impact is expected; or
2) significant impacts are expected.

MITIGATION: Mitigation is a set of actions designed to reduce the undesirable impacts of a proposed action on the affected environment in one or more of five categories (in order of desirability):

- Avoidance
- Minimization
- Rectification
- Reduction
- Compensation

PREFERRED ALTERNATIVE: The preferred alternative is that alternative that best meets the purpose and need of the action, project, or program while keeping environmental impacts to a practicable minimum. Selection often considers three perspectives:

1) engineering feasibility and requirements
2) economic viability, and
3) environmental soundness

PRIMARY IMPACT: A primary impact is direct and occurs at the same time and place as the action. Primary impacts are associated with the construction, operation, and/or maintenance of a facility or activity. They are generally visibly obvious and quantifiable.

PUBLIC PARTICIPATION: Public participation is the involvement of citizens and citizens groups in the Environmental Impact Assessment process for the purpose of balancing any decision between policy makers and those who are affected by the policy.

PURPOSE AND NEED: The purpose and need of a proposed project is the justification for undertaking the action and may originate from legislation, administrative decisions, or private enterprise. It must be defined before the Environmental Impact Assessment process can proceed.

SCOPING: The early, open, and documented process of considering the issues and choices of alternatives to be examined in the Environmental Impact Assessment for a particular action, policy, or program. Scoping includes:

- determining the range of issues to be addressed,
- determining the significance of these issues,
- eliminating issues that are not significant,
- securing participation of all technical experts and interested parties
- assigning responsibilities for Environmental Impact Assessment preparation and review,
- identifying other related planning decisions.

SCREENING: The initial screening considers all possible impacts to the action, project, or program. It identifies whether significant impacts are expected or not.

SECONDARY IMPACT: Secondary impacts occur later in time, or at a different place from the initial action. These impacts are indirect or induced changes in the environment, population, economic growth, and land use.

SIGNIFICANT IMPACT: A significant impact alters the properties of a natural or man-made resource in a way considered important. The importance is based on a relative change to an area, and the human perspective on the change.

APPENDIX C.2

IDENTIFYING SIGNIFICANT ISSUES - EXAMPLES

IDENTIFYING SIGNIFICANT ISSUES - EXAMPLES

There are several points in the Environmental Impact Assessment process where it is necessary to distinguish significance from insignificance, such as in the decision of whether to proceed with environmental impact assessment and during scoping. It is also necessary to make this distinction when comparing impacts and alternatives and in selecting a preferred alternative and its mitigation measures. These are often difficult decisions to make especially where there are no concrete standards to apply. The text has been derived from several sources (listed below) to provide examples on how decisions of significance have been made by 5 different organizations with regard to 7 components of an environmental setting:

A. Physical Resources
B. Water Resources
C. Biological Resources
D. Hazardous Materials and Solid Waste Management
E. Cultural Resources and Aesthetics
F. Socioeconomic Resources
G. Land Use and Infrastructure.

The sources used in developing this material were:

- U.S. Air Force. 1994. *Preliminary Draft Eglin AFB Environmental Baseline Study Impacts Appendices*. Prepared by the Earth Technology Corporation, Colton, CA.

- Fittipaldi, J.J. and E.W. Novak. 1980. *Guidelines for Review of EA/EIS Documents*. Construction Engineering Research Laboratory Technical Report No. 92, United States Army Corps of Engineers.

- USEPA. 1995. *Principles for Review of Environmental Impact Assessments, Final Draft.*

- USEPA. 1993. *Guidance for Writing Permits for the Use or Disposal of Sewage Sludge.*

- Whittow, J. 1984. *Dictionary of Physical Geography*. Penguin Books Ltd., Middlesex, England.

NOTE: The information included in this appendix should be used as an EXAMPLE of approaches used elsewhere and is not intended to provide guidelines to be applied to a given project.

A. Physical Resources

Physical resources that may be affected by master planning and training activities include geology, soils, air, noise, and visual and aesthetic resources. This section provides a general description of these resources and suggests factors to consider in assessing the potential impacts of project activities associated with these resources.

Geology. The geologic features of an area can both impact and be affected by project activities. Geologic features include surface and subsurface formations like mineral reserves and fault lines. Additional examples include unique surface formations with aesthetic value or fossils with paleontological[1] value. A project can be affected by changes in geologic features such as seismic activity along fault lines or structural failure due to slope instability. In addition, a project can have an impact on geologic resources by destroying features of aesthetic or scientific value or by precluding access to mineral resources of economic value.

Rank	Contributing Factors
Significant Adverse	• The activity results in irretrievable loss of important mineral or paleontological resources.
	• The activity will destroy geological features of scientific, educational and aesthetic interest.
	• The activity will change local drainage patterns.
	• The activity will locate structures within a seismic impact zone and the structures are not designed to withstand maximum recorded horizontal acceleration.[2]
	• The activity is subject to or is likely to contribute to subsidence and subsidence is likely to cause loss of life or property.
	• The activity will locate structures in areas subject to slope instability and slope failure[3] is likely to result in loss of

[1] Paleontology is the science that uses fossil remains to study the life of past geological periods.

[2] A seismic impact zone is an area in which the horizontal ground level acceleration of the rock within the area has a 10% or greater probability of exceeding 0.10 gravity once every 250 years (40 CFR 503). The horizontal acceleration is expressed as a percentage of the acceleration due to gravity (g), where $g=9.8$ m/sec^2. Contact the USGS for maps of faults and seismic impact zones.

[3] Slope failure is likely to occur when the applied stresses (e.g., structures) are greater than the strength of

life or property or have an adverse impact on water or biological resources.

Adverse

- The activity is located within a seismic impact zone, but structures are designed to withstand the maximum recorded horizontal acceleration.
- The activity is located in areas subject to slope instability, but the proposed project has been designed to minimize the likelihood and/or impacts of slope failure.
- The activity will reduce the extent of geological features of scientific, educational, and aesthetic interest.
- The activity will create localized and temporary construction related impacts.

No Impact

- The activity does not include construction of structures in seismic impact zones, on or near unstable slopes, in areas subject to subsidence.
- The activity will not occur in areas with surface formations, mineral resources, or paleontologic resources.
- The activity does not involve extraction of subsurface resources.

Soils. Soils are the thin layer of unconsolidated material on the land surface. Their properties result from the interaction of underlying geology, topography, local climate, microbial action, and vegetation. Soils can be altered by natural processes of weathering, water movement, and biological activity; and by human activities such as tilling, grazing, construction, compaction, and removal of vegetation. Key soil properties to consider in an environmental assessment include permeability[4], leachability[5], thickness, fertility, and erodibility. Construction and other activities on unsuitable soils can cause a variety of problems from ground water contamination, erosion, sedimentation, landslides, and irretrievable loss of prime farmland.

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the underlying bedrock and regolith. Regolith is comprised of the layers of material overlying undecomposed bedrock.

[4] Permeability is the rate at which liquids (or gases) pass through rocks or soil. The permeability of a material depends on its grain size, particle size, shape, and overall particle distribution.

[5] Leachability refers to the properties of the soil that influence dissolution and adsorption of chemicals.

Rank	Contributing Factors
Significant Adverse	• The activity will locate structures in areas subject to slope instability and slope failure is likely to result in loss of life or property or have an adverse impact on water or biological resources.
	• The activity results in erosion which would likely cause loss of sensitive species, loss of sensitive habitat, loss of cultural resources, loss of infrastructure or facilities, or loss of human life.
	• The activity results in sediment loading to stream courses which will result in exceedances of state or federal standards.
	• The activity is likely to cause contamination of soil with toxic or hazardous chemicals.
	• Chemical contamination of soil resources is likely to cause contamination of ground water or surface water resources.
	• The activity results in irretrievable loss of prime farmland.
Adverse	• The activity results in erosion which increases sediment loading to stream courses, but is not likely to result in exceedances of state or federal water quality standards or alteration of aquatic habitat.
	• The activity is likely to cause short term erosion, but will not cause the loss of sensitive species, sensitive habitat, cultural resources, infrastructure or human life.
	• The activity is located in areas subject to slope instability, but the proposed project has been designed to minimize the likelihood and/or impacts of slope failure.
No Impact	• The activity results in no erosion or in short-term, localized erosion that does not result in increased loadings to stream courses.
	• The activity does not have the potential to release chemicals onto soils.

Air. Air resources may be affected by releases of gases and particulates from stationary and mobile sources. Air quality is also influenced by meteorological conditions such as prevailing wind, sunlight, and temperature inversions. A proposed project activity can act as a source and/or a receptor of air pollutants.

Rank	Contributing Factors
Significant Adverse	• The activity will introduce pollutants to the air that will cause ambient air quality to exceed levels established by the National Ambient Air Quality Standards (NAAQS) for CO, SOx, NOx, lead, ozone, particulates
	• The activity will release air pollutants in levels that exceed the National Emission Standards for Hazardous Air Pollutants (NESHAP) for example beryllium, mercury, arsenic, asbestos, benzene, radionuclides, and vinyl chloride.
	• The activity will introduce NAAQS pollutants to an area designated as a non-attainment area.
	• The activity will introduce pollutants to the air which in combination with other sources will contribute to exceedance of NAAQS.
	• The activity will introduce pollutants into indoor air that exceeds OSHA exposure limits.
	• The activity is subject to New Source Performance Standards (NSPS) and is not expected to comply with NSPS upon commencement of operation.
	• Deposition of atmospheric pollutants (either directly to surface water or to land) is likely to contribute to ambient water quality problems (e.g., nutrient enrichment, acidification, toxic accumulation).
Adverse	• The activity will introduce pollutants into indoor air, but will not exceed OSHA exposure limits.
	• The activity will introduce NAAQS or NESHAP pollutants, but will not exceed limits either alone or in conjunction with other sources.
	• The activity will result in temporary increase in ambient concentrations of pollutants, but will not violate NAAQS.

No Impact	•	The activity does not release pollutants into the air.

Noise. Transportation (aircraft, marine, and land-based traffic) and construction activities are major sources of environmental noise. Besides damaging hearing of humans, noise also interferes with communication, interrupts sleep, causes stress, and generally impacts the quality of life. Noise can also have an adverse impact on domestic animals and wildlife. When considering the proposed project, it is important to determine if the proposed project will create unacceptable noise levels. The review should evaluate both non impulsive (e.g., persistent traffic) and impulsive noise (sonic boom, explosion). Note that the quantitative contributing factors provided below are based on the research summarized and policies applied in the Preliminary Draft Eglin AFB Environmental Baseline Study Impacts Appendices.

Rank		Contributing Factors
Significant Adverse	•	The activity will expose populated areas to day-night noise levels (non-impulsive) of 75 decibels (dB) or greater.
	•	The activity will expose populated areas to c-weighted day-night noise level (CDNL) (i.e., impulsive sonic boom) 70 dB and greater.
	•	The activity (e.g., artillery, munitions, blasting) will expose populated areas to a single peak sound pressure level (dBP) greater or equal to 139 dBP.
	•	The activity will cause speech interference because indoor sound levels are expected to exceed 82 dB.
	•	The activity results in substantial likelihood of hearing loss because indoor sound levels (DNL) are above 84 dB.
	•	Noise levels associated with the activity are expected to cause domestic animals and wildlife injury, abandonment of habitat, or mortality.
Adverse	•	The activity will expose populated areas to day-night noise levels (non-impulsive) between 65 and 75 dB.
	•	The activity will expose populated areas to CDNL between 62 and 70 dB.
	•	The activity (e.g., artillery, munitions, blasting) will expose populated areas to a single peak sound pressure level (dBP) greater between 115 and 138 dBP.

- The activity will cause speech interference because indoor sound levels are between 82 and 60 dB.
- The activity creates a slight to moderate likelihood of hearing loss when indoor sound levels (DNL) are between 75 and 80 dB.
- The activity causes wildlife or domestic animals to display startle effects, including fleeing the area, alteration in productivity, reproduction, growth, or parenting behavior.

No Impact

- The activity will expose populated areas to day-night noise levels (non-impulsive) of 65 dB or less.
- The activity will expose populated areas to CDNL 62 dB or less.
- The activity (e.g., artillery, munitions, blasting) will expose populated areas to a single peak sound pressure level (dBP) lower than or equal to 115 dBP.
- The activity will cause speech interference resulting from indoor sound levels of 60 dB or less.
- The activity is unlikely to cause hearing loss when indoor sound levels are below 75 dB.
- The activity is not likely to cause startle effects for wildlife or domestic animals.

B. Water Resources

Watershed resources that may be affected include ground water, surface water and floodplains (see Figure 6-3 of main text). Evaluating water resources includes an assessment of impacts to the physical, chemical and biological properties of the waterbody. An assessment of an activity's impact on water resources should consider primary, secondary, and cumulative impacts. Following are examples of factors which contribute to an activity's classification as significant adverse, adverse, or no impact to water resources.

Ground water. Ground water is water contained in a saturated zone at some depth below the ground surface. When evaluating the proposed project activity, it is important to determine if either the quantity or quality of ground water supplies will be affected. Pollutants can be introduced to ground water by seepage through soils and by injection through wells. It is also important to consider the interaction between surface water and ground water to identify the potential for cross contamination.

Rank	Contributing Factors
Significant Adverse	• The activity results in introduction of pollutants to potable ground water and is likely to cause ground water to exceed maximum contaminant level (MCL).
	• The activity results in the introduction of pollutants to a ground water source that discharges to surface water and pollutants are likely to cause surface water to exceed ambient water quality standards (WQS).
	• Introduction of pollutants to potable ground water will not exceed MCL, but will continue over life of project.
	• Introduction of pollutants to potable or nonpotable ground water will contribute to exceedances of MCL and/or WQS in combination with other sources.
	• Activity results in withdrawal of ground water, reduction of infiltration, or change in ground water flow direction such that it diminishes seepage or spring-water inflow into an ecologically significant habitat, such as wetlands, or that results in modification of threatened or endangered species' habitat.
	• Withdrawal of ground water is likely to result in saltwater intrusion to potable aquifer.

Adverse	• Introduction of pollutants to potable ground water is not likely to cause ground water to exceed maximum contaminant level (MCL).
	• Introduction of pollutants to ground water source that discharges to surface water is not likely to cause surface water to exceed ambient water quality standard (WQS).
	• Activity results in withdrawal of ground water, reduction of infiltration, or change in ground water flow direction that reduces or eliminates inflow to streams that are not ecologically significant habitat.
	• Withdrawal of ground water or reduction in infiltration that lowers the depth of the ground water table in unconfined aquifers, but does not impact vegetation or stream flow or result in saltwater intrusion.
	• Withdrawal of ground water results in a reduction of the potentiometric surface (water-level elevations in wells tapping a confined aquifer).
No Impact	• No introduction of pollutants to ground water.
	• No withdrawal of ground water.

Surface water. Surface water includes streams, rivers, ponds, lakes, wetlands, estuaries, bays, and oceans. When evaluating proposed project activities, it is important to consider physical and chemical impacts. Inputs that deteriorate water quality and impact aquatic life include nutrients, heat, changes in pH, sediments, oxygen-consuming substances, in addition to toxic compounds such as petroleum, PCBs, chlorinated pesticides, and heavy metals. Sources of contamination to surface water include point source discharges, nonpoint source runoff, marine vessels, and ground water. Changes in the volume or velocity of water in a waterbody can erode stream banks, increase siltation/sedimentation, change salinity regimes, and ultimately modify or destroy habitat. Withdrawals from surface water bodies can reduce instream flows below critical levels which are necessary to maintain riparian[6] and instream communities.

Rank	Contributing Factors
Significant Adverse	• Activity results in introduction of pollutants (through contaminated discharge, contaminated runoff, or dredging of contaminated sediments) to surface water and is likely to cause exceedance of state ambient water quality standards, including chemical specific standards and physical characteristics like turbidity, pH, dissolved oxygen.
	• Activity results in discharge that exceeds National Pollutant Discharge Elimination System (NPDES) permit limitations.
	• Activity results in modification to flow volume or velocity such that scouring occurs in the water body and is likely to result in modification of stream channel, bottom substrate, and/or bank stability.
	• Activity is likely to impede natural drainage patterns or the direction of flow of surface water body.
	• Activity results in point or nonpoint source discharge of sediments, nutrients, chemicals or other parameters that result in modification or destruction of critical habitat of threatened or endangered species.

[6] Riparian refers to the area alongside the banks of a natural watercourse, usually a river or stream but sometimes a lake or estuary.

- Withdrawal of surface water or ground water that supplies surface water results in disruption of riparian vegetation.

- Introduction of pollutants, including sediment, that will contribute to exceedance of ambient WQS in combination with other sources.

- Introduction of nutrients into a water body resulting in the occurrence of algal blooms more frequently, for extended time periods, or during critical intervals.

- Withdrawal of surface water results in reduction of sufficient flow to support sensitive habitats, threatened or endangered species, or their habitats.

Adverse

- Activity results in introduction of pollutants (through contaminated discharge, contaminated runoff, or dredging of contaminated sediments) to surface water, but introduction is not likely to cause exceedance of ambient WQS, including chemical specific standards and physical characteristics like turbidity, pH, dissolved oxygen.

- Pollutant discharges do not exceed NPDES permit limitations.

- Activity results in point or nonpoint source discharge of sediments, nutrients, chemicals or other parameters that result in modification or destruction of habitat of indigenous species.

- Influx of nutrients that results in periodic algal blooms.

- Withdrawal of surface water results in reduction of flow, but is not likely to impact riparian vegetation, aquatic life, sensitive habitats, or threatened or endangered species.

No Impact

- Activity does not result in introduction of pollutants or withdrawal of surface water.

Floodplains. Floodplains are the flat areas adjacent to the river's normal channel. These areas accommodate flood flows resulting from rainfall and snowmelt. Placing structures within the floodplain can expose them to the impacts of flooding. It can also reduce the absorptive capacity of the floodplain and increase the volume and velocity of downstream floodwaters. The 100-year floodplain is the area that is likely to be inundated during the 100-year base flood. A base flood is a flood that has a one percent chance of occurring in any given year (i.e., a flood with a magnitude equaled once in 100 years). Restriction of the flow of a base flood is defined as raising the flood levels by one foot or more due to the presence of an obstruction[7].

Rank	Contributing Factors
Significant Adverse	• The activity results in placement of structures within the 100-year floodplain that are likely to incur significant damage due to flooding.
	• The activity is displacing the absorptive capacity of the floodplain such that it will restrict the flow of the 100-year base flood and increase the potential for risk to life or damage to downstream areas.
Adverse	• The activity is located within the 100-year floodplain, but structures are not likely to sustain damage due to flooding.
	• The activity does not displace the absorptive capacity of the floodplain.
No Impact	• The activity is not located within the 100-year floodplain.

[7] This is the threshold used in EPA regulations governing the placement of landfills and sludge disposal units.

C. Biological Resources

Biological resources that may be affected include vegetation, fish and wildlife, threatened and endangered species, and habitat (see Figure 6-4 in main text). Assessing impacts to biological resources requires knowledge of the types of plant and animal species present and their distribution throughout the area, and an understanding of the relationships among species, populations, and habitat. The evaluation should consider primary, secondary, and cumulative impacts. Following are examples of factors which contribute to an activity's classification as significant adverse, adverse, or no impact to biological resources.

Vegetation. Vegetation provides food and shelter for fish and animals. It also prevents erosion and protects water quality. Some species of vegetation provide food or habitat during critical life history stages of invertebrate and vertebrate species. Impacts to vegetation result from land clearing for construction and from disturbances associated with training activities. Aquatic vegetation is impacted directly through water-based construction and indirectly through increased sedimentation or pollutant loading from land-based activities. Atmospheric deposition can have adverse impacts on both terrestrial and aquatic vegetation. When assessing the impacts of a proposed project on vegetation, it is important to consider the value of the vegetation in terms of ecosystem function, and its abundance and distribution.

Rank	Contributing Factors
Significant Adverse	• The activity reduces the diversity of terrestrial or aquatic vegetation.
	• The activity reduces or eliminates native species or their habitat.
	• The activity creates conditions conducive to proliferation of non-native, invasive species.
	• The activity replaces native vegetation that served as food source or habitat with vegetation that does not provide food or habitat.
	• The activity is located in proximity to unique plant populations or communities or isolated plant populations of scientific interest.
	• The activity requires removal of vegetation which will likely cause erosion and transport of sediment to waterways, resulting in significant adverse impact to water resources (see 6.3.2).
	• The activity involves introduction of pollutants, including sediments and nutrients, to water bodies which may in

		turn impact aquatic vegetation which serves as critical habitat for threatened or endangered species.
Adverse	•	The activity replaces native vegetation with non-native, but non-invasive species.
	•	The activity replaces native vegetation that served as food source or habitat with vegetation that provides food or habitat of lesser value.
	•	The activity removes vegetation which will likely cause erosion and transport of sediment to waterways, resulting in adverse impact to water resources (see section 6.3.2 in main text).
	•	The activity involves introduction of pollutants, including sediments and nutrients, to water bodies which may in turn impact aquatic vegetation which serves as habitat for indigenous species.
No Impact	•	The activity does not remove vegetation or is restricted to a previously developed area that has already been disturbed.

Fish and Wildlife. Impacts to fish and wildlife can occur through numerous pathways including destruction of habitat and food source, restriction of population movement due to habitat fragmentation, alteration of community structure caused by changes in populations of predator or prey species, and contamination through the introduction of pollutants to the environment. The sensitivity of a population to impact varies tremendously. When assessing the impact of the proposed project on fish and wildlife species it is important to consider species abundance and distribution, position and function in the food chain, and habitat and food source requirements throughout all life stages. It is also important to consider both resident and migratory species of fish and wildlife.

Rank		Contributing Factors
Significant Adverse	•	The activity will reduce or destroy food or habitat of importance to terrestrial, riparian, or aquatic wildlife.
	•	The activity eliminates fish spawning or wildlife breeding areas.
	•	The activity is located outside of the cantonment area, within a migratory pathway, and proposed activities will occur during migrations.

	• The activity eliminates a native population.
	• The activity will permanently (5 years or longer) reduce populations of fish or wildlife species by 50 percent.
	• The activity will impact specific species and will result in alteration of community structure.
	• The activity will create favorable conditions for nuisance, exotic, or pest species.
Adverse	• The activity will permanently (5 years of longer) reduce populations of fish or wildlife by 15 to 50 percent.
	• The activity reduces the areal extent of fish spawning or wildlife breeding areas, but does not eliminate them.
	• The activity results in temporary alteration of fish or wildlife habitat, but not during critical stages of the species' life cycle.
	• The activity is located outside of the cantonment area, within a migratory pathway, but activities do not occur during migrations.
No Impact	• The activity is located within the cantonment area and does not disturb the habitat, food source, or migratory pathways of fish or wildlife.

Threatened and Endangered Species. Threatened or endangered species can be either plant or animal. A list of threatened and endangered species is published in the Code of Federal Regulations at Title 50 Code of Federal Regulations Part 17. To ensure the proposed project will not impact threatened or endangered species or their habitat, consultation with the Fish and Wildlife Service is recommended.

Rank	Contributing Factors
Significant Adverse	• Consultation with the Fish and Wildlife Service/National Marine Fisheries Service has determined that the activity, alone or in combination with other activities, is likely to jeopardize the continued existence of a species including individual members of the species or their habitat.

	• The activity is located in an area where threatened or endangered species are present and known to be sensitive to human activities.
	• The activity will destroy critical habitat of threatened or endangered species.
	• The activity fragments or encroaches over time on critical habitat of threatened or endangered species.
Adverse	• The activity, alone or in combination with other activities, is likely to inhibit a species recovery.
	• The activity is likely to directly or indirectly affect an individual of a threatened or endangered species, but not affect its recovery.
	• The activity will result in temporary disturbance of habitat for threatened or endangered species.
	• The activity is located in an area where threatened or endangered species are present, but they are not sensitive to the actions associated with the construction or operation of the activity.
No Impact	• There are no threatened or endangered species in the proximity of the activity.

Habitat. Habitat includes the biological community and the abiotic components within an area. The biological community is comprised of microbes, fungi, plants, and animals. The abiotic components consist of the geological features, soil, hydrology, climate, and nutrient cycles. Habitat can be defined for an individual organism, a population, or an entire biological community. Maintenance of the habitat is essential to maintenance of the community, population, and individual. When assessing the impact of a proposed project on habitat, it is important to consider the type and size of the habitat, the abundance and distribution of similar habitat types in the local area, and the importance of the habitat to the components of the biological community, including resident and migratory species.

Rank	Contributing Factors
Significant Adverse	• The activity will destroy or damage rare or unique ecosystems (e.g., coastlines, wetlands, deserts, old growth forests, pristine areas, breeding or nesting grounds).

- The activity, alone or in combination with other activities, will impact the integrity of an ecological system by removing 75 to 100 percent of an ecological association (e.g., meadow, forest, sandy beach, wetland, submerged grass bed, reef).
- The activity will disrupt the flow of resources (e.g., nutrients, water) to or from unique ecosystems.
- The activity will cause or contribute to the introduction of nuisance, invasive, or pest flora or fauna that may displace native species and alter existing habitat.

Adverse

- The activity, alone or in combination with other activities, will impact the integrity of an ecological system by removing 25 to 75 percent of an ecological association (e.g., meadow, forest, wetland, submerged grass bed, reef).
- The activity will exert a localized and temporary impact on rare or unique ecosystems.

No Impact

- The activity is located within the cantonment area and will not modify or otherwise encroach on natural habitat.
- There are not rare or unique ecosystems located at or near the proximity of the activity

D. Hazardous Materials and Solid Waste Management

The waste management resource group includes the management of hazardous materials, and hazardous, non-hazardous, and solid wastes (see Figure 6-5 of main text). For definitions of hazardous and non-hazardous waste categories, see Section 5.4 of main text.

Hazardous Materials and Waste. When assessing the impact of an activity on the management of hazardous material and/or hazardous and non-hazardous waste, it is important to evaluate the usage and storage of hazardous material in addition to the storage and disposal requirements for hazardous waste.

Rank	Contributing Factors
Significant Adverse	• Permanent or temporary storage tanks at the activity site are not equipped with leak detection mechanisms, secondary containment systems, spill and overfill protection, or other safety services.
	• Failure of hazardous materials or hazardous wastes handling, storage, or disposal poses a threat to public health and/or environmental media.
	• Accommodating the increased hazardous waste generated will pose a significant cost.
	• The activity involves long-term generation, storage, and/or disposal of large quantities of hazardous wastes.
	• The activity involves the long-term management of large quantities of hazardous materials.
Adverse	• The activity requires the removal and disposal of structural materials that contain hazardous materials (e.g., lead-based paints, asbestos).
	• Accommodating the increased waste generated will cause a nominal increase in consumers cost of waste management.
	• The activity requires the management of hazardous materials.
No Impact	• The activity will not generate hazardous waste.

- The activity will not require hazardous materials management.

Solid Waste. When assessing the impact of a proposed project on the generation of solid waste, it is important to determine the volume and rate of waste generation and the capacity of waste management, including recycling, and disposal systems.

Rank	Contributing Factors
Significant Adverse	• Recyclable solid wastes generated by the activity will not be recycled because the volume generated will exceed the capacity of recycling operations.
	• Accommodating the increased solid waste generated will cause a substantial increase in consumers cost of waste management.
	• Storage and handling of wastes increases the potential for spills or leaks that may potentially contaminate soil, ground water or surface water.
Adverse	• Solid waste volumes generated will reduce the life of existing waste management and disposal operations.
	• Accommodating the increased waste generated will cause a nominal increase in consumers cost of waste management.
No Impact	• The activity will not increase the waste stream.

E. Cultural Resources and Aesthetics

The resource group cultural resources and aesthetics addresses attributes that are considered important to the local populations' sense of history and well-being. Cultural resources may be historical buildings or landmarks, cemeteries, or other archaeological ruins; aesthetics refers more to the visual quality of a site or region (see Figure 6-6 of main text). These resources are primarily affected by the siting and construction of new buildings and infrastructure. Sometimes they can be affected by changes in use of or access to resource areas.

Cultural Resources. Cultural resources include archeological sites, historical sites, and other cultural sites. When assessing the potential impact of a proposed project on cultural resources, it is important to consider proximity of the proposed project to the site, current use and access to the site, and the potential to uncover previously unknown cultural resources.

Rank	Contributing Factors
Significant Adverse	• The activity will destroy an archeological, historical, or other cultural site that is listed on the National Register of Historic Places.
	• The activity will permanently restrict public access to an archeological, historical, or other cultural site that is listed on the National Register of Historic Places.
	• The activity will alter the landscape around an archeological, historical, or other cultural site and degrade the aesthetic value of its existing setting.
	• The activity is located in an area where there is a high probability of finding artifacts of archeological, historical, or other cultural value and no plan exists for evaluating and recovering artifacts during the course of the proposed project.
Adverse	• The activity will temporarily restrict public access to an archeological, historical, or other cultural site that is listed on the National Register of Historic Places.
	• The activity will alter the landscape around an archeological, historical, or other cultural site, but measures are taken to protect the aesthetic value of its existing setting.
	• The activity is located in an area where there is a high probability of finding artifacts of archeological, historical, or other cultural value, but a plan exists for evaluating

and recovering artifacts during the course of the proposed project.

No Impact

- The activity will not affect public access to an archeological, historical, or other cultural site that is listed on the National Register of Historic Places.
- The activity will have no impact on the visual or audio setting of an archeological, historical, or other cultural site.
- The activity is not located in the vicinity of an archeological, historic, or other cultural site listed on the National Register of Historic Places.
- The activity is not located in an area where there is a high probability of finding artifacts of archeological, historical, or other cultural value.

Visual and Aesthetic Values. Aesthetics, in a broad sense, involve the general visual, audio, and tactile environment and their emotional or psychological effect on people. Visual/aesthetic resources refer to the structures, landscapes, and spaces of an area which provide information for an individual to develop perceptions of the area. When considering a proposed project or activity for development it is important to determine if it will adversely affect the visual/aesthetic setting perceived by residents of the surrounding area.

Significant Adverse

- The activity will degrade the visual scene of the surrounding area, including interfering with natural views, destroying natural vegetative buffers, contributing smoke, causing odors and noise, or discoloring water bodies.
- The activity will destroy, damage, or obscure scarce or unique geological features, landscapes, or other objects of particular aesthetic value.
- The activity will deny accessibility to aesthetic resources, including recreational access.

Adverse

- The activity will temporarily disrupt the visual scene of the surrounding area, but will not disturb natural vegetative buffers.
- The activity will degrade the visual scene of the surrounding area, but architectural and landscaping techniques are employed to minimize the impact.

	• The activity will limit accessibility to aesthetic resources, including restricted recreational access.
No Impact	• The activity will not alter the visual or aesthetic character of the area.

F. Socioeconomic Resources

This resource group includes population, housing, community facilities, and the economy.

Population. An environmental assessment typically includes an assessment of potential impacts of the proposed project on population demographics. This information contributes to the evaluation of the other elements of socioeconomic resources. Important information includes employment rates, migration rates, birth and death rates. When assessing impacts to a local population it may be appropriate to describe changes in the age, sex, and ethnic composition of the population, as well as educational attainment, income, and residential stability (see Figure 6-7 of main text).

Rank	Contributing Factors
Significant Adverse	• Within the economic region of influence, the activity will create or contribute to an excursion above or below the existing forecasted population by more than 5 percent.
	• The activity will cause a change in the population demographics that could potentially disrupt employment patterns or provision of services.
	• The activity will result in the dislocation of portions of the local population due to loss of jobs or increases in property values.
Adverse	• Within the economic region of influence, the activity will create or contribute to an excursion above or below the existing forecasted population by between 1 and 5 percent.
	• The activity will result in short term influx of workers.
No Impact	• Within the economic region of influence, the activity will create or contribute to an excursion above or below the existing forecasted population by less than 1 percent.
	• The activity does not require additional people to be permanently or temporarily introduced to the area.

Housing. When assessing the potential impact of the proposed project on housing, it is important to consider the availability of housing and the cost of housing relative to demand and income. It is also important to identify whether existing housing meets regulation standards or if the proposed project has the potential to impact the value of residential property.

Rank	Contributing Factors
Significant Adverse	• The activity will create a shortage of affordable housing or will increase housing prices.
	• The activity results in housing that does not meet standards.
	• The activity will cause property values to decline.
	• The activity will adversely affect the availability of mortgages or mortgage insurance.
	• The activity will cause forecasted vacancy rates to increase or decrease by more than 5 percent.
Adverse	• The activity will cause forecasted vacancy rates to increase or decrease by 1 to 5 percent.
No Impact	• The activity will not impact property values.
	• The activity will not require an influx of new inhabitants or relocation of existing ones, therefore the housing resource is not impacted.
	• The activity will cause forecasted vacancy rates to increase or decrease by less than 1 percent.

Community Services. Community services refer to both pubic and private services on-post and off-post that serve area residents. Community services include primary, secondary and adult education; health care; social services; police, fire and rescue; and recreational and cultural activities. When evaluating a proposed project, it is important to consider, existing and projected capacity to provide services, current and future changes in demand, and access to community services.

Rank	Contributing Factors
Significant Adverse	• Changes caused by the activity will result in a shortage of community services.
	• Changes caused by the activity will result in long term unused capacity of community services.
	• The activity provides redundant services and will result in long term excess capacity for community services.

	• The activity will require the number of service positions for any category (e.g., teachers, fire, police) to increase 10 percent or more above forecasted levels.
Adverse	• The activity will increase or decrease short-term demand for community services.
	• The activity provides redundant services, but any unused capacity is expected to be temporary.
	• The activity will require the number of service positions for any category (e.g., teachers, fire, police) to increase between 5 and 9 percent above forecasted levels.
No Impact	• The activity does not impact demand for community services.
	• The activity will require the number of service positions for any category (e.g., teachers, fire, police) to increase less than 4 percent above forecasted levels.

Economy. The effects of a proposed project on the economy depend on the size of the project, in terms of project expenditure and employment, and the duration of the proposed project. In assessing the potential economic impacts of the proposed project, it is important to quantify any primary impacts associated with the project and to evaluate the ability of the region of concern to accommodate such changes. In general, a more rigorous assessment of economic impacts is required for larger, more complex projects.

Rank	Contributing Factors
Significant Adverse	• The activity will cause unemployment to increase by more than 1 percent.
	• The activity will cause household income to decrease by more than 1 percent.
	• The activity will reduce the bond rating of local municipalities.
	• The multiplier effect of direct unemployment associated with the activity will dampen economic activity.
	• Reduced economic activity associated with the unemployment caused by the activity will cause secondary unemployment.

	• The activity will cause a permanent reduction in military personnel which will significantly reduce expenditures in the local economy causing reduced economic growth and secondary unemployment.
Adverse	• The activity will cause unemployment to increase by 0.5 to 1 percent.
	• The activity will cause household income to decrease by 0.5 to 1 percent.
No Impact	• The activity does not result in changes to employment or income.

G. Land Use and Infrastructure

The resource group infrastructure and land use includes utilities, transportation, and land use. Land use plans address the integration of the built and natural environments and the human activities occurring in a community. In general, a community land use plan is implemented to protect the health, safety and welfare of the population. In recent years, land use plans have been used to address protection of environmental resources and aesthetics.

Land Use. When evaluating the proposed project, it is important to consider whether the project is consistent with the designated land use and compatible with neighboring land uses. If the proposed project is not appropriate for the designated land use then changes in the proposed project or changes in zoning may be necessary.

Rank	Contributing Factors
Significant Adverse	• The activity is inconsistent with a Master Plan and has the potential to adversely affect the health, safety, and welfare of the population or the quality of the environment.
	• The activity creates a direct conflict among neighboring land use activities, for example, residential areas and range/training areas.
	• The activity will permanently destroy the existing land use designation, for example, convert open space to commercial facilities.
Adverse	• The activity is inconsistent with a Master Plan, but does not have the potential to adversely affect the health, safety, and welfare of the population or the quality of the environment.
	• The activity requires a change in a local land use plan.
	• The activity requires a change in local zoning.
No Impact	• The activity is consistent with a Master Plan.

Utilities. Utilities refer to the public services, such as electricity, water, and sanitation, that are located in the area that serve and are used by residents and installation activities. Utility services that may be provided include: electricity, natural gas, potable water, sewage collection and treatment, storm water collection, and trash collection and disposal. A key consideration in assessing the impacts associated with a proposed project is to compare the increased or decreased demand for public services with the unused capacity of the provider.

Rank	Contributing Factors
Significant Adverse	• The activity will require utility services that are non-existent.
	• The immediate and/or long term utility needs of the activity have the potential to exceed the actual or projected capacity of the utility to provide service, without a major system modification such as additional generation capacity.
	• The activity requires the acceleration of planned capacity improvements by more than 5 years.
Adverse	• The activity is likely to increase immediate and/or long term demand for service of one or more utilities beyond current or projected capacity without minor system modifications such as increasing capacity to existing distribution systems or extending distribution systems.
	• The activity requires the acceleration of planned capacity improvements by 1 to 5 years.
No Impact	• The activity does not affect demand for any utilities.
	• The immediate and/or long term increases in demand for service are not expected to warrant any system modification.
	• The activity requires the acceleration of planned capacity improvements by less than one year.

Transportation. Transportation networks include road systems, railroads, waterway transportation routes, and air transport. Transportation services facilitate the movement of people and goods. Transportation networks can have high social costs such as noise, safety hazards, and air pollution. The travel-ways can cause aesthetic problems and create physical barriers to ground water movement and human and wildlife passage. When assessing potential impact associated with transportation, it is important to consider (1) the extent to which the proposed project's transportation improvements are consistent with applicable local and regional transportation plans and (2) the level of service (LOS) resulting from the assignment of project-induced travel demand to the existing transportation network.

Rank	Contributing Factors

Significant Adverse	• The activity requires transportation services and/or infrastructure that are nonexistent and will need to be constructed before construction of the proposed project. • The activity is likely to result in increased utilization of a public road such that the level of service would decrease to an unacceptable level, as defined in county or local comprehensive plans. • The activity is likely to result in increased utilization of railways, water shipping lanes, and air space beyond existing or projected capacity. • The activity requires the acceleration of planned capacity improvements by more than 5 years. • The activity requires development of new or significantly expanded transportation services, which will cause cumulative impacts on air quality, water quality, and biological resources.
Adverse	• The activity is likely to result in increased utilization of a public road which may cause a decrease in the level of service; but the level of service will remain equal to or better than the level of service planned in county or local comprehensive plans. • The activity is likely to result in increased utilization of railways, water shipping lanes, and air space, but is not projected to exceed existing or projected capacity. • The activity requires limited expanded transportation services, which are not projected to increase impacts on air quality, water quality, and biological resources. • The activity requires the acceleration of planned capacity improvements by 2 to 5 years.
No Impact	• The activity will not increase utilization of transportation services. • Activity related increases in transportation services are not anticipated to decrease the level of service projected in county or local comprehensive plans. • The activity requires the acceleration of planned capacity improvements by 1 year or less.

APPENDIX D

CONTENTS OF SPECIFIC ENVIRONMENTAL IMPACT ASSESSMENT TOOLS

EIA Tools -- Introduction

Several tools and techniques for EIA reviewers are introduced in this student text. Many more are available separately. To further assist EIA professionals, USEPA has developed the following resource materials to compliment this text:

- *Resource Manual for Principles of Environmental Impact Assessment Review*
  This Manual provides material referenced in the *Principles* course and student text, as well as material that is not covered in the course, such as additional background on the EIA process, lists of available guidance documents from the World Bank and USEPA along with some excerpts and example documents, country specific laws and regulations, and a list of helpful Internet sites. Appendix D contains the table of contents for the *Resource Manual* which may change depending on the specific needs of the host country; and user.

- Compact Disc(s): USEPA has produced two compact disks that are either available separately or combined into a single CD in version 4 issued in 1998. The two component programs are:

  - Environmental Impact Assessment Resource Guide (EARG): The EARG is an interactive program that allows participants to walk through information on the EIA process from project initiation to post-decision analysis. The contents are listed in this appendix.

  - Environmental Impact Assessment Interactive Case Study: Chuitna, Alaska: This interactive CD-ROM enables the user to walk through the complete EIA process for a proposed project in Chuitna, Alaska and develop their own EIA. The CD-ROM covers the project's initiation, scoping, generation and analysis of alternatives, decision-making, and post-decision analysis. The notebook feature of the program is geared toward both self-study as well as an providing an ongoing tool. As an ongoing tool, the notebook feature of the program enables the user to use the CD-ROM as a prompt to assist in the development or review of any EIA since they can be cleared and saved under different file names. An outline of the program's contents is listed in this appendix.

- *Principles of Environmental Impact Assessment* text: The *Principles of Environmental Impact Assessment* text and course was developed by USEPA to provide the basics of the EIA process, why each element is important, and how one conducts the process and develops the EIA. The course has been delivered in over a dozen countries around the world to officials from government departments, non-governmental organizations, and others with the need to understand and implement the EIA process. This appendix contains a summary of the contents of the *Principles of Environmental Impact Assessment.*

The CD-ROM(s), and *Principles of Environmental Impact Assessment Review* and guidelines described in this appendix are available from the United States Environmental Protection Agency. Contact:

U.S. Environmental Protection Agency
Office of Federal Activities
MC2251-A
401 M Street, Southwest
Washington, DC 20460

Reference the course *Principles of Environmental Impact Assessment Review* when inquiring.

RESOURCE MANUAL FOR PRINCIPLES OF ENVIRONMENTAL IMPACT ASSESSMENT REVIEW

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Chapter 9: Population, Health, Transport, Development, Water and Sewer, Roads and Highways, Inland Navigation, Ports and Harbors, Housing Projects, Solid Waste, Tourism, Wastewater.

Chapter 10: Industrial Hazard Management, Electric Power Transmission, Oil and Gas Pipelines, Oil and Gas Development-Offshore and Onshore, Hydroelectric Projects, Thermoelectric Projects, Cement, Chemical and Petrochemical, Fertilizer, Food Processing, Iron and Steel, Nonferrous Metals, Petroleum Refining, Pulp, Paper and Timber, Mining and Mineral Resources.

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COMPACT DISC
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"Principles of Environmental Impact Assessment"

Document Overview

The US EPA has developed a course and associated student text entitled "*Principles of Environmental Impact Assessment*" that provides additional information valuable to reviewers. *The Principles of Environmental Impact Assessment* text was prepared to help individuals responsible for environmental protection and impact assessment in different countries, regions, and localities design and implement programs of environmental impact assessment and to help others participate in the process as reviewers and commentors. It is intended to provide general and specific guidance in the *principles* of environmental impact assessment for anyone involved in development, redevelopment, and remedial planning, including government officials, nongovernment officials, industry and academic leaders, environmental scientists and engineers, and private citizens.

The focus of the text is on the *internationally accepted principles* that underlie sound environmental impact assessment programs rather than on the specific tools or measures of impact assessment. However, references to texts or manuals that discuss the specific application of methodologies are given in Chapter 13 of this text. The text is *not* designed to provide comprehensive technical guidance in the use of environmental impact assessment tools such as air quality modeling, water quality modeling, ecological community analysis, risk assessment, or fiscal analyses. In this *Principles of Environmental Impact Assessment,* such methodologies are summarized in terms of the types of approaches available for the assessment of environmental impacts.

This text provides the following:

- A characterization of the nature and importance of an environmental impact assessment program.
- A framework for designing and developing environmental impact assessment strategies and programs.
- Key considerations in the environmental impact assessment process.
- A synopsis of general methods for assessing environmental impacts.
- Guidance for the preparation of environmental impact assessment (environmental impact assessment) reports.
- Examples of existing environmental impact assessment programs and major environmental impact assessment issues.
- Options for incorporating various elements into a specific environmental impact assessment program.
- A list of resources that provide further information.

APPENDIX E

ROAD MAPS

The Road Maps that appear throughout the text in Chapters 3 and 4 are pulled together in this Appendix for ease of reference.

ROAD MAP FOR OVERALL ENVIRONMENTAL IMPACT ASSESSMENT DOCUMENT REVIEW

- Review Table of Contents and Executive Summary
- Scan and read the document several times
- Take notes, write down questions
- Go through key environmental impact assessment elements
  - Purpose and Need, Alternatives, Environmental Setting, Impact, Mitigation
- Use checklists where appropriate
- Review the logic and consistency of the document
- Use a systematic approach to identify areas where the assessment is:
  - Incomplete, inadequate
  - Significance unsupported/unclear/ignored
  - Lacks integration
- Identify and adopt perspectives of all interested and affected parties
- Compare document to other environmental impact assessments
- Determine whether the document supports decision-making

ROAD MAP FOR SCOPING REVIEW

- Scoping was conducted and documented
- Potentially significant issues are identified for natural and human environments
- Insignificant issues identified and their dismissal justified
- Identified and considered the views of all interested and affected parties
- Sufficient detail provided to define the spatial and temporal scope
- Adequate geographic area considered for the scope
- Omissions are not related to significant issues
- Key issues are brought into focus

ROAD MAP FOR PURPOSE AND NEED AND ALTERNATIVES REVIEW

- Describes the purpose and need of the proposed project

- Demonstrates how purpose and need would be met by the proposed project

- Adequately describes the proposed project
  - Maps project site, surrounding land use, and natural features
  - Who and what would benefit; who and what would be affected
  - Phases; site preparation, construction, operation, and closure
  - Time frames, including when proposed project begins and ends

- Considers the full range of alternatives to meet purpose and need
  - No action
  - Alternative sites, designs, controls
  - Structural vs non-structural
  - Reallocation of social costs and benefits
  - Reasonable, feasible
  - Reflective of the range of choices
  - Meet the purpose and need of the proposed project

- Preferred alternative satisfies purpose and need better than alternatives with less environmental impact

ROAD MAP FOR ENVIRONMENTAL SETTING REVIEW

- All relevant types of natural and human environmental issues are addressed
- Affected area or community is adequately and accurately defined
- Adequately map impact area and surrounding features
- Baseline is established to measure impact
- Appropriate information and data documented and used appropriately
- Information links back to project description, purpose and need, alternatives?
- Levels of detail are appropriate to significance
- Information and data is of acceptable quality and relevance?
- Section is internally consistent

ROAD MAP FOR ENVIRONMENTAL IMPACT REVIEW

- All natural and human (socioeconomic) environmental impacts are identified
- Types of impacts include primary, secondary, and cumulative
- Detail on impacts is balanced among reasonable and feasible alternatives
- Both beneficial and adverse impacts are identified
- Potential impacts are identified for all phases of the proposed project
- Models, experts, and criteria accurately used to project the significance of impacts are valid for appropriate circumstances
- Data, information and key assumptions are representative, accurate, and current
- Appropriate criteria are used to characterize significance

ROAD MAP FOR MITIGATION REVIEW

- Specific mitigation measures are proposed
- All significant adverse impacts are addressed by the mitigation plan
- Measures are proposed for:
  - All types of impacts
  - All phases of the proposed project
  - All environment types
- Preferred mitigation measures at the top of the mitigation type hierarchy are considered
- Mitigation measures are described in sufficient detail relative to the significance of impact
- Mitigation measures are:
  - Technically and financially feasible with adequate financial and non-financial resources to implement the measures
  - Socially and culturally acceptable
- Implementation plans include schedules and interim milestones and timing is consistent with other factors presented in the assessment of impact
- Responsible parties are identified and committed to implementation

ROAD MAP FOR DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REVIEW

- Establish a management approach:
  - Establish lead reviewer
  - Assign roles
  - Establish a schedule
  - Conduct Review

- Consolidate reviewers' comments:
  - Identify most significant issues
  - Determine the significance of each comment
  - Establish common threads
  - Resolve any discrepancies

- Draft a comment letter:
  - Maintain neutrality, objectivity and professionalism
  - Provide clear and concise comments

- Anticipate and Respond to Public Comment

ROAD MAP FOR THE COMMUNICATION LETTER

- State bottom line including major recommendations up front and clearly
- Describe proposed project context
- If the purpose and need of the proposed project is in question, develop the link to the environmental concerns
- Distinguish what is mandatory, what is significant
- Provide a description of the substantive and/or procedural concerns
- Demonstrate sensitivity to interests and affected community
- Provide recommendations for addressing the concerns

ROAD MAP FOR FINAL ENVIRONMENTAL IMPACT ASSESSMENT REVIEW

- Establish a management approach
- Determine if basic assumptions and information are the same for draft and final
- Assess impacts of any changes on alternatives, impacts and proposed mitigation
- Verify that comments were acknowledged and addressed
- Review the relationship and consistency among responses to individual comments
- Consolidate comments and prepare the final comment letter
- Determine whether responses change fundamental reviewer findings:
  - Acceptability of environmental impact
  - Needed mitigation
  - Adequacy of environmental impact assessment document and process
  - Who needs to be involved and consulted
- Decide actions to increase chance of correcting remaining deficiencies
- Anticipate use by decision maker
- Anticipate use to establish mitigation requirements
- If appropriate, prepare final comment letter

ROAD MAP FOR RECORD OF DECISION PREPARATION

- Re-state the purpose and need

- Support preferred alternative and justify
  - Meets purpose and need
  - Either preferred environmentally or meets purpose and need better than other alternatives
  - Meets legal requirements

- Demonstrate all potentially adverse impacts from the selected alternative were fully considered

- Demonstrate benefits of proposed action outweigh adverse impacts

- Demonstrate that implementation of the proposed project will be environmentally acceptable

- Identify mitigation and continuing responsibilities

NOTES:

NOTES:

NOTES: