ENVIRONMENTAL ASSESSMENT GUIDELINES FOR BRAC'S RURAL DEVELOPMENT PROGRAMME

Emma Child

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BRAC, Research and Evaluation Division, 75 Mohakhali C/A, Dhaka 1212

Tel. 9881265, 884180, 884051, Fax. 880-2-883542, 883614, email: bracamr@bdmail.net

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Introduction

This document provides guidelines, at both the general program level and specific sector level, for incorporating environmental protection considerations into BRAC's Rural Development Program (RDP) natural resource projects, namely fisheries, sericulture, agriculture, poultry and livestock, and forestry. It will provide BRAC managers with the necessary information to ensure that existing and future programs are designed and implemented in such a way as to minimise the negative environmental impacts, while still allowing for income-generation. The ultimate purpose is to create BRAC activities for the rural poor that are positive overall and sustainable in the long-term.

Introduction to Environmental Impact Assessment (EIA) and Environmental Assessment

There have been many Environmental Impact Assessment (EIA) methodologies developed over the years, from simple checklists to complicated matrices. The methodology described here is not a formal EIA methodology, but are consistent with the simple EIA methodologies, that is, qualitative yet structured considerations of specific environmental parameters. (For a brief overview of EIA methodology, see appendix I).

This is not an attempt to predict the specific impacts of projects or activities, but rather to minimise the overall potential change to the natural environment whilst implementing projects. In EIA terminology, it will essentially act as a *scoping* and *screening* of a proposed activity. It will also incorporate *mitigation*, in that the specific sector guidelines provide some environmental standards upon which impacts will need to be mitigated as a condition of the project approval by BRAC.

The above approach is based on the philosophy that any given human activity should leave the smallest possible ecological footprint, by minimizing human inputs from and outputs to the natural environment.

Environmental Impact Assessment (EIA) in Bangladesh

EIA has not yet been institutionalised in Bangladesh, although many development projects are in fact subject to EIA through the sponsoring or donor organizations. For example, some of the foreign government donor agencies, such as DANIDA and CIDA, have environmental assessment guidelines. The Bangladesh government (Department of Environment) has started to require EIAs for projects of significant impact. The DOE has classified projects (red, yellow,

green) requiring comprehensive/full-scale EIAs, Initial Environmental Examination (IEE)/Rapid Environmental Impacts Assessment, or no environmental impact assessment, respectively.

In Bangladesh, there have been EIA guidelines developed specifically for Water Resource Development projects by the Flood Action Plan (FAP16), and Physical/Rural Infrastructure projects (road, irrigation, drainage, embankment projects) by the Local Government Engineering Department. Some projects have adapted these to their specific projects, such as the Jamuna Multi-Purpose Bridge Project and CARE rural road reconstruction. There are reportedly plans to develop EIA Guidelines for the industrial sector next, although currently industrial projects often use either Asia Development Bank (ADB) or World Bank guidelines.

There is an increasing call from environmental practitioners in Bangladesh for the development of EIA guidelines specific to different sectors of economic activity, in order to make them the most relevant to projects. The increased interest is also evident in the recent establishment of formal associations of NGOs, such as the South Asian Regional Environmental Assessment Association (SAREAA) in Kathmandu, and the National EIA Association of Bangladesh (NEAB) through IUCN in Dhaka.

Need for Environmental Assessment Guidelines for BRAC Rural Development Projects

BRAC's rural employment and income-generating programming is, by its very nature, largely about natural resources management. Activities undertaken by village organisation members collectively have a large impact on the natural environment, both positive and negative. Since the beginning of 1996, through its environmental research group, BRAC has been examining the environmental effects of some of its programmes and the potential for improving their environmental sustainability, and therefore overall long-term success.

There now needs to be a system in place for BRAC staff to assess the environmental sustainability of these programs and individual projects being implemented in the villages. The guidelines presented here provide a framework for:

a) Environmental assessment of existing RDP programs;

b) Incorporation of environmental considerations into program development by BRAC management staff; and,

c) Review and monitoring of individual projects by BRAC field staff with beneficiaries to ensure that they are as environmentally sustainable as possible.

The guidelines are therefore aimed at both the policy/programme and operational levels of BRAC's activities simultaneously. Approaching the issue of environmental sustainability of BRAC's RDP activities at a programme level by ensuring that it is integrated into all future programming and its numerous resultant projects, is particularly important as BRAC moves from fairly rapid programme expansion into a phase of programme development. If environmental considerations are adequately captured in the development of the programmes, the level of effort or consideration at the project implementation level should usually be minimised, with only certain of the guidelines here being salient specifically at the field level.

About These Guidelines

The guidelines provided here are organized around four categories of environmental management principles to consider when implementing a rural development project. In summary, they are:

A. Habitat and Wildlife
- Landscape
- Drainage
- Rare/Endangered Species
- Native Species

B. Chemical Use
- Natural Alternatives
- Minimal Use
- Least Harmful
- Storage/Transport
- Quality Standards

C. Natural Resource Use
- Minimal Inputs
- Alternative Energy Sources
- Re-use and Recycling
- Groundwater

D. Waste Management
- Minimal Wastes
- Alternative Uses
- Treatment
- Disposal
- Storage

Environmental assessment guidelines are commonly conceptualised and organised according to types of activities or projects (with, for example, a checklist of questions to ask about the project) or according to the environmental effects (usually relevant to a specific type of project). The guidelines here have been formulated to combine this anthropocentric perspective within an ecological framework, with the intention of making the guidelines relevant to many rural development sectors.

The second part of this document proceeds to apply these guidelines to the two RDP sector programmes that have the largest impact on the natural environment, namely Fisheries and Sericulture. The other natural resource-based RDP programmes, Vegetable and Maize, Livestock, Poultry, and Social Forestry, have not yet been included.

Note that these guidelines have been developed for application specifically to small-scale projects in the rural villages where BRAC works. There is still scope for tailoring these general environmental guidelines specifically to BRAC's larger-scale or industrial initiatives such as Cold Storage, Printers, Aarong, and the various proposed production factories under Rural Enterprise Programme (REP), as well as other programmes such as the Urban Development Programme (UDP).

Implementation of Guidelines

As important as the Guidelines themselves is the institutional mechanisms available for implementing them.

These Guidelines will be introduced to both Head Office and Field staff. Head Office staff, to include Executive, RED, RDP, REP, UPD, can be easily reached through presentations and discussion and publications. Introduction to the decentralised field staff, particularly RDP, is more difficult and time-consuming. Methods include:

- a feature in BRAC's monthly Bangla newsletter "Shetu" for field staff
- inclusion in RED summary series in Bangla
- dissemination to environmental trainers through the proposed TOT refresher courses
- meetings of Regional Managers and Area Managers at Head Office
- regional meetings of Program Officers and Program Assistants

Similarly to this information dissemination, the application of the guidelines to existing and future BRAC activities will be done at two different levels: programmatic (Head Office) and project (Field). The guidelines presented here are to be applied primarily at the former level, and supported at the field level through project implementation.

Programme/Head Office is the level at which the items making up the guidelines should be systematically integrated into decision-making and programme design and planning. More specifically, the process for implementation of the guidelines will stipulate the following:

- All new programs and projects proposed at Head Office must demonstrate the application of the guidelines, through documentation of the considerations and resulting steps taken. This is to be done in collaboration with the Environment Group if there are significant potential environmental component, or with review by the Environment Group if the environmental components are negligible, as determined by the Environment Group.
- For existing programs and projects, application of the guidelines are to be retroactive, as undertaken by the Environment Group. Adoption of resulting recommendations will be implemented on a pilot scale, as a short-term action, and ultimately on a BRAC-wide scale, as appropriate. For more specific or centralised projects (e.g. dairy centres, Ayesha Abed Foundations), the short-term action should be to collaboratively develop a plan of action to implement the recommendations.
- Monitoring activities by the Environment Group will be developed on a project or program basis, as appropriate. In addition to Environment Group staff, there will be build up of capabilities for environmental monitoring within existing field staff as part of general and on-going project management, and either on a sector-specific or regional basis.

In addition, there is obviously a key role to be played at the field level. The environmental components integrated into the programme design will be inherent in the individual projects. However, there are three key types of functions[1] to be carried out by BRAC field staff (POs and PAs), namely:

- information provision and education/awareness building among participating VO members
- site specific considerations (local environmental conditions, location of project, design specifications, etc.)
- monitoring and field inspections of VO member projects to ensure compliance (chemical inputs, waste management, etc.).

The interplay between the head office and field level is crucial in ensuring the implementation of environmental measures. Environmental recommendations must be incorporated into any programme technical and training manuals that are used by the Programme Assistants to in turn train the VO members. It is also important to ensure that the manuals are not nebulous in their environmental recommendations, by including only those instructions that are not environmentally damaging. Currently, for example, the fisheries technical and training manual presents options on which poisons to use that include extremely damaging ones, with a note that these are preferably not to be used. Programme Assistants and VO members should simply not be presented with these options, and definitive instructions about which are to be used should be included.

[1] The specific items in the guidelines that require this field-level support, and are therefore specifically relevant at the field level, are marked with an asterisk.

ENVIRONMENTAL ASSESSMENT GUIDELINES

Background to Environmental Considerations in Project Planning and Implementation

For the purposes of assessing the potential impacts of a project of the environment, there are four broad areas of the natural-human system that should be considered[2]. The following provides an explanation of these four categories, which when considered together will cover the major interactions of humans with the natural environment in any given project. This is followed by specific details comprising the guidelines themselves.

A. Habitat and Wildlife

Habitat is a general term that refers to the living biota of an area, including the soil and vegetation (trees, shrubs, grasses, riparian and wetland plants, etc.), as well as the rivers, lakes, ponds, wetlands, upland areas, etc. that host the vegetation. Wildlife refers to the animals, including mammals, reptiles, amphibians, fish, birds, insects and microorganisms. The two are obviously intricately inter-linked and together form the foundation for a healthy and functioning ecosystem.

Most human activities result in a change in land use through habitat alteration or destruction, which invariably leads to a displacement or loss of wildlife, in turn changing the balance of the natural system.

B. Chemical Use

The environment has a natural ability to absorb certain substances, but when chemical compounds that are not naturally part of the system are added, the natural balance is disturbed. These chemicals build up in the air, water and soil, poisoning it and affecting the plants, wildlife, and humans that use it.

As an example, chemical dyes used to colour fabric are discharged directly to a pond adjacent to a printing and dyeing centre. The water and soil is not able to assimilate this loading and is then contaminated, killing the plants surrounding and in the pond, causing fish death or illnesses, creating health problems for the people using the water, and even affecting the nearby fields that are irrigated with the water. Chemical pollution of a waterbody would also have effects on surrounding waterbodies, especially during the monsoonal floodings.

C. Natural Resource Use

The survival of the human population depends entirely on the continued use of the planet's natural resources and the recognition of the natural system's own needs and limited supply of resources. The natural resource needs of people for basic survival can be summarised quite simply as: water and energy. Water is used for drinking, cooking, washing, transportation and most industrial productions. Energy from organic matter (wood, vegetation, dung), fuels (natural gas, petroleum), and other sources (solar energy, wind energy) also fulfills basic human survival needs.

[2] Environmental components can be categorised in many different ways. This categorisation was developed here to be simple and succinct, and to explicitly relate environment and rural development projects together.

The earth, however, has a limited supply of energy for external use by humans without disrupting the natural balance. For the continued functioning of the natural energy cycles, human use must not outstrip the ability of the earth to replenish it. The transformation of these water and energy sources to forms of use by humans in turn almost invariably created pollution problems, such as water contamination from waste, air pollution due to fuel burning, deforestation from fuelwood collection, or organic depletion of the soil due to dung and forest litter collection. The minimised and wise use of these resources is required to meet the needs of the growing population.

D. Waste Management

The use of both natural and human-made materials results in some waste materials being produced, such as dirty or contaminated water and solid wastes. These wastes often have their own serious impact on the environment and human health, particularly when disposed of. For example, solid waste disposed of next to a waterbody will decompose and leach chemicals or excess organic liquids into the water.

This damage can be lessened in a number of ways, specifically by: minimising the amount of waste produced; re-use or recycling of "wasted" materials, and; proper treatment and/or disposal of the wastes.

Environmental Assessment Guidelines for BRAC Rural Development Programme Activities

Given the categories explained above, the following provides a set of operational project principles to ensure that the negative environmental effects on each are minimised. These are *general* guidelines for application to any rural development project, which when applied to specific sectors or types of projects will result in the more specific recommendations. Essentially, these act as a framework for applying environmental consideration to programmes and projects. There is some degree of inter-relatedness among these principles, and as in any planning framework or categorisation constructed for decision-making processes, it is not meant to mask the complexity of the natural ecosystem nor the complexity of decision-making.

The guidelines have been formulated, and indeed are intended to be used, as a process of thinking through the environmental effects of a given programme or activity. Consequently, they are presented here in each category in order of "preference", for example it is preferable to find natural alternatives to chemicals first, or at least use less chemicals and use ones that have the least harmful effects. Similarly, in practise the guideline will be relevant only when interpreted in combination with each other. In conclusion, these guidelines are meant to be applied in their entirety and in the spirit in which they were conceived.

Note that items marked ***** are those that are specifically relevant at the field level, as previously discussed in *Implementation of Guidelines*.

Guidelines:

A. Habitat and Wildlife

- ***Landscape**: Activities of the project should require minimal physical alteration of the landscape, including diking, soil removal or deposit, vegetation removal. The natural features of the land should be incorporated into the physical design and layout of the project. If possible, buildings should not be constructed in a location adjacent or near to a permanent waterbody (including lakes, ponds, wetlands, streams, rivers) or in a location that would require the removal of trees or other significant vegetation.

- ***Drainage**: The natural drainage of the project area should remain unaltered and intact. Particularly, there should be no filling in or alteration of wetlands or rivers.

- ***Rare/Endangered Species**: There should be no destruction of wildlife or its habitat if the vicinity is known or suspected to contain rare or endangered plant or animal species.

- **Native Species**: The project should not introduce any non-native plant or animal species into the natural environment. Native species should preferably be used over non-native species. Suitable non-native species should only be used based on the full understanding of the effects of their introduction, and only within a contained system.

B. Chemical Use

- **Natural Alternatives**: If possible, natural alternatives to chemicals should be used, and possibilities for alternatives should be attempted.

- ***Minimal Use**: The amount of chemicals used in the project activities should be kept to an absolute minimum.

- **Least Harmful**: If no natural alternative is known, the chemical used should be the one having the least negative environmental impacts. Substances banned by the government or international bodies should not be used under any circumstances.

- ***Storage & Transport**: Chemicals should be stored, including during transport, in airtight containers to avoid any leakage or fume release. Storage should be in a well-ventilated room used specifically for storage only.

- ***Quality Standards**: The project should not be carried out in an area where there is known air, water, or soil quality problems. The project should not be undertaken if the resultant air, water, or soil quality standards (as outlined in the Bangladesh Gazette[3], August 28 1997) of the area would be exceeded.

[3] This contains various standards for such components of the environment as air, drinking water and waste water, including standards for industrial waste and gaseous emissions and emissions for specific industrial sectors (fertilizer, textile, paper, tannery, sugar, jute, fish, dairy, etc. industries).

C. Natural Resource Use

- ***Minimal Inputs**: The natural resource inputs into a project should be minimised as much as possible. This includes the use of water and energy sources such as wood, vegetation, dung, fossil fuels. Alternatives to these "traditional" natural sources should be sought. Other material inputs, such as packaging and plastics, should also be minimised.

- **Alternative Energy Sources**: Alternative energy sources should be used instead of the renewable and non-renewable sources wherever possible. These include solar, wind, and tidal power.

- ***Re-use & Recycling**: The project should be designed to incorporate water- and energy-saving practices and devices. This includes "closed-loop" processes, i.e. making the outputs of one process the inputs for another.

- ***Groundwater**: Use of groundwater in a project should not result in the lowering of the groundwater table level due to cumulative extractions and the inability of the water table to regenerate.

D. Waste

- **Minimal Wastes**: The energy and unused material outputs produced by the project activities should be minimised as much as possible.

- **Alternative Uses**: Alternative uses should be sought for the "waste" produced, either for the project activities or for external uses by other local activities.

- ***Treatment**: All necessary wastes should be treated before disposal if possible. These include liquid wastes, wastewater (including heated water), solid and airborne wastes.

- ***Disposal**: All necessary wastes should be disposed of in an ecologically acceptable way to avoid ecological damage, short and long term.

- ***Storage**: Any temporary storage of wastes should be done in such a way and location as to avoid leakage or contamination.

APPLICATION OF BRAC ENVIRONMENTAL ASSESSMENT GUIDELINES TO FISHERIES AND SERICULTURE PROGRAMMES

The BRAC Environmental Assessment Guidelines included above have been used to do an assessment of two RDP programmes having significant environmental components, namely Fisheries and Sericulture. The focus here is on the substantive or technical environmental aspects[4], rather than being process-oriented. To fill this need, and because these are existing and well-established programmes, the plan for the next stage of this initiative is to follow these EA Guideline applications with an "action plan" to systematically identify what steps are needed to translate the guidelines into real changes in the programmes at the project implementation field level.

Environmental Assessment Guidelines: BRAC RDP Fisheries Programme

The BRAC fisheries programme consists of 3 different but supporting types of activities, namely hatcheries, nurseries, culturing. These represent a continuum, where the fish are, respectively, hatched, reared, and finally grown and harvested by the beneficiaries. The culturing activities are commonly in ponds and of two different types, including seasonal Sarputi ponds and perennial Carp polyculture which can also include prawn. BRAC also implements fisheries projects in oxbow lakes or baors, having different technical and managerial characteristics. The following focuses on BRAC's most common fisheries activities, pond culturing. For more details on environmental aspects of fisheries programme, refer to Chiccoine (1996) and Bérubé (1996).

	Activities	Specific Guidelines
A. Habitat and Wildlife		
Landscape	re-excavation of ponds for maintenance	use of excavated dirt for building up dikes (as preventative measure to intrusion by predators)
	soil erosion from dikes	plant vegetation with non-invasive roots (such as vegetable culture) on dikes to stablise banks, and with native species that will not contaminate the soil with leaf litter
Drainage	diversion/alteration of watercourses or use of groundwater as water source for ponds	maintain natural drainage patterns, do not interrupt fish movement or migration
	flooding (natural and human-induced), thereby introducing non-cultured species into ponds and requiring poisons	building up dikes above flood levels; planting vegetation on dikes to solidify them and reduce their incidence of failure/breakage (see above)
Rare/Endangered Species	alteration of natural watercourses containing wild fish stock	maintain natural drainage patterns

[4] Note that the information here has been based only on the author's knowledge and scant existing literature. In some cases, recommendations on alternative methods of implementing projects are inadequate and need to be explored through a thorough literature review and with sector and environmental specialists.

Native Species	purchase of fry and fingerlings taken from natural waterbodies	use supply that is reared for culturing purposes rather than taken from natural ecosystem (brood stock used for hatching may be wild to maintain genetic quality)
	use of non-native species for fish culture, or actual elimination of indigenous fish species	culture native species or mix of native and non-native to increase biodiversity
B. Chemical Use		
Natural Alternatives	use of subtances to kill aquatic insects (kerosene, deisel, dipteryx, surnithion, nogos)	leave insects as a natural source of food for larger fish
	use of poisons (Rotenone, Phostoxin, Hildal, Dieldrine)[5] to kill unwanted fish, crustaceans, amphibians	elimination of unwanted species by: netting; periodic pond drainage (and build-up of dikes to prevent intrusion); natural toxins such as saponin found in tea seed. Note: elimination of unwanted species without using poison will allow for fish to be *safely* eaten or sold in the market for consumption[6]
	use of inorganic fertilizers (TSP, Urea, MP), causing phosphate and nitrate contamination of groundwater and surrounding flooded areas	use of organic fertilizers (cow dung, chicken manure, compost) in combination with inorganic
	use of pesticides (sumithion, malathion, furadan, diazinon, heptachlor) on dike vegetable culture	use natural or integrated pest management (IPM) approaches; grow suitable vegetables or other vegetation not requiring pesticides (e.g. doincha)
Minimal Use	pesticide use on dike culture (and nearby agricultural land), making fish less resistant to disease	use natural pest control methods on dike culture; prevent mixing of pondwater with outside pond dikes during floods; minimise pesticide use on surrounding agricultural land
	over-use of chemicals in general (fertilizers, pesticides, poisons), in ponds and dike culture, degrading water and soil quality	discontinue indiscriminate application of chemicals, minimise use[7]
	routine/preventative use of poisons to kill unwanted species	use minimal doses of poisons, and only when predator species are found or after flooding (also see above, use of alternative capture methods). Note that complete

[5] Currently many options are presented in the Fish Culture Management Technical and Training Manual (March 1996) for killing unwanted species and cleaning ponds. Please see *Implementation of Guidelines* for previous discussion on the presentation of options.

[6] The current Fish Culture Management Technical and Training Manual (March 1996) used by Programme Assistants recommends the consumption and sale of the fish killed by the poisoning.

[7] The Technical and Training Manual cautions against overuse of chemicals. However, this needs to be supported by awareness building and monitoring to ensure its implementation in practice.

		elimination of predators is not necessary when ponds are stocked with adult fish
	human use of pond water (soap in bathing, washing dishes and clothes), decreasing water quality for fish and posing human health risks	minimise chemical inputs in fishculture, see above;discourage use of culture ponds for human uses, ensure adequate ponds for washing purposes
Least Harmful	use of subtances to kill aquatic insects (kerosene, deisel, dipteryx, sumithion, nogos)	when necessary, use of kerosene and deisel which are less persistent
	use of organochlorine (Dieldrin, Aldrine), known to be highly hazardous, toxic, bioaccumulating, and persistent	use of the much less harmful poison Rotenone (produced from a plant)
	use of pesticides on dike culture	use of pesticides least harmful to fish, Diazinon
Storage/Transport/Use	improper storage and handling of chemicals [8]	follow manufacturer's storage instructions, generally in sealed containers in cool, dry room; application of poisons with gloves
C. Natural Resource Use		
Re-use & Recycling	use agricultural by-products as feed for fish	use sericulture wastes (leaves, pupae, moths), mustard oilcake, rice bran
	pond drainage for maintenance	use water for surrounding agricultural or other purposes, provided quality is acceptable
Groundwater	use of groundwater in carp and prawn hatcheries (and occasionally in ponds in dry season)	limit density of hatcheries according to carrying capacity of local ecosystem; monitor watertable level
D. Waste Management		
Minimal Wastes	residuals (inorganic and organic) of fertilizers and pesticides	minimise these inputs, as outlined above
Alternative Uses	re-excavation of ponds for maintenance	use of excavated organic matter as soil fertilizer in agriculture
Treatment	formation of organic and inorganic matter and gases, from inputs and bottom sediments, with potential seepage into groundwater	cleaning of pond and pondwater for accumulations, by water drainage and excavation of bottom sediments

[8] The Technical and Training Manual has some basic information on washing hands and face after using. More specific instructions are needed.

Environmental Assessment Guidelines: BRAC RDP Sericulture Programme

BRAC's Sericulture programme includes all stages of activities by beneficiaries from planting of mulberry trees and silkworm rearing to production and dyeing of the finished silk product. Similarly, the range of activities conducted by the beneficiaries include that at the homestead level for the former stages, to larger-scale industrial activities in the latter. For more details of activities involved and an explanation of their environmental dimensions, please refer to the current BRAC study *Environmental Investigation and Evaluation of Sericulture Programme and Ayesha Abed Foundation*.

	Activities	Specific Guidelines
A. Habitat and Wildlife		
Landscape	building of nursury or rearing facilities at household level	locate facilities away from water source; locate where it does not necessitate cutting of trees or other significant vegetation
	building of grainages, chawki centres, reeling centres, training centres at the large-scale level	locate facilities away from water source; locate where it does not necessitate cutting of trees or other significant vegetation
B. Chemical Use		
Natural Alternatives	root purification of saplings in mulberry plantations using dyathin-M-45	investigate use of natural alternatives
	applying fertilizers to saplings in nurseries (urea, compost and ash) and bush plantation (urea, TSP, cowdung)	use of biofertilizer instead of urea; investigate the availability of biofertilizer
	applying pesticides to roadside mulberry plantations (Nogos)	removal of affected leaves; use of Nogos only when tree severely affected
	applying heptachlor powder and ash to mulberry trees with termites and other pests	use only in young trees (less than 3 years old); use of heavy irrigation method in older trees to kill pests without affecting survival of tree; investigate natural alternative
	disinfecting of eggs, wooden trays and room in grainage centres, using formolin/formaldehyde (2%), bleach (2%), or chlorine dioxide (newly recommended as more effective)	investigate use of natural alternatives
	dyeing of fabrics at printing and dyeing factories using synthetic dyes	increased use of natural vegetable-based dyes[9], by promoting technical improvements, increasing the variety of natural dyes, and promoting demand for vegetable-dyed fabric through marketing efforts

[9] Vegetable dyes currently used include eucalyputus leaves, jackfruit dust, onion skin, betelnut, tea leaves, lotkon bark, daleem khosa, ganda phool, hortoki. There is currently no supply problem, and they are less expensive than chemical dyes.

Minimal Use	disinfection of rearing houses using bleach powder	use of standard amount recommended to be effective
	treatment of cocoons with hydrochloric acid (HCl) to artificially induce hatching	use of same acid repeatedly
	use of dyes in printing and dyeing factories	use of spent dye-water for additional dying
Least Harmful	disinfecting at grainage centres using formaldehyde, formolin, bleach	if natural alternative is not viable, use hot water and bleach only
	dyeing of fabrics at printing and dyeing centres using synthetic dyes	if use of natural vegetable-based dyes is not viable, use of less harmful chemical (see appendix II)
Storage/Transport	storage of chemicals at reeling and printing & dyeing centres	storage according to manufacturer's directions, generally in separate and well-ventilated room, in sealed containers
C. Natural Resource Use		
Minimal Inputs	use of fuel (firewood and diesel boiler) in drying cocoons	combine kiln drying with sun drying (see below)
	use of water in reeling and dyeing	maintenance of equipment, pipes, valves for leakage
Alternative Energy Sources	use of fuel (firewood and diesel boiler) for drying cocoons	drying of cocoons in sun; use of solar technology for kilns
	use of fuel/firewood for boiling cocoons and reeling	use of solar technology for boilers
Re-use & Recycling	use of hot water in reeling	use of protein-rich water for agricultural irrigation after cooling (see Disposal below)
D. Waste Management		
Alternative Uses	leaves and green branches waste, dead worm, and worm excreta from rearing activities	use as livestock feed, fish feed, soil fertilizer (integration with agriculture and fisheries programmes)
	dead moth waste from grainage activities, buried underground	use as poultry feed, fish feed (integration with poultry and fisheries programmes)
	dead worm and cocoon waste from boiling and reeling, buried underground	use of dead worm as fertilizer or fish feed (integration with agriculture and fisheries programmes); use of waste cocoon (rejected and reeled) for rough spun silk, as done in Bholarhat
	production of ash from burning wood for boiling and reeling	use of ash for agricultural fertilizer
	garbage produced at AAF, including paper, cartons, plastic bags, plastic jars, material scraps	make available to workers and community
Treatment and Disposal	wastewater from weaving, containing detergent from degumming (to remove sericin) and leftover dye (colour, paste, antifixer), untreated before disposal	wastewater treatment by settling and separation

	wastewater from textile processing (detergents, chemical dyes, kerosene), untreated before disposal	treatment of wastewater with aerated pond system[10]
	production of solid waste residues from dyes	installation of wastewater treatment system
	wastewater from grainage centre (formolin, formaldehyde bleach, hydrochloric acid) disposed of in covered soak wells	treatment of wastewater
	disposal of hot water used for boiling and reeling, into tanks that leach into ground or into ditch/field	cooling of water and use for agricultural irrigation (protein rich)

[10] Solid wastes resulting from wastewater treatment also needs to be treated before disposal. Methods include adsorption, filtration, physico-chemical, as described in BCAS (1997).

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Appendix I
Overview of EIA Methodology

Scoping and Identifying Issues

- describe the project in as much detail as possible
- describe the project environment
- set limits (boundaries)
- list issues and potential impacts
- identify Valued Ecosystem Components (VECs)
- identify vital issues for further assessment

Predicting Impacts

- make issues more concrete
- identify linkages between project and issues
- identify direct impacts on biophysical and social environment
- identify indirect impacts
- identify cumulative impacts
- predict residual impacts
- predict probability, magnitude, distribution and timing of impacts
- forecast what will happen to affected components under the no-project option

Evaluating Impact Significance

- determine environmental components at risk
- determine significance of VECs
- priorise issues raised by public
- list legal criteria, guidelines that need to be met
- rank impacts for avoidance, mitigation, compensation and monitoring

Avoidance, Mitigation, Monitoring and Follow-up

- assess measures to mitigate undesirable impacts
- ascertain regulatory requirements and performance standards
- assess methods to monitor impacts and remedial measures
- assess methods to monitor for early warning of unexpected impacts
- reassess project

Recommendations

- determine resource requirements
- ascertain availability of methodologies technology and manpower
- determine capacity and resourcefulness of proponent/agency to meet commitments
- explain rationale for going ahead with proposed development vis-à-vis no-project option
- propose better alternatives to proposed project
- ascertain level of public acceptance

From: Sadar, M. Husain. 1996. *Environmental Impact Assessment*. Impact Assessment Centre, Carleton University, Canada.