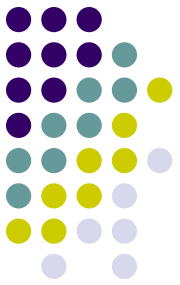


EIA



- EIA is a systematic process to identify, predict and evaluate the environmental effects of proposed actions and projects.
- A broad definition of environment is adopted. Whenever appropriate social, cultural and health effects are also considered as an integral part of EIA.
- Finally, particular attention is given in EIA for preventing, mitigating and offsetting the significant adverse effects of proposed undertakings

Definition



It is a planning and management tool for sustainable development that seeks to identify the type, magnitude and probability of environmental and social changes likely to occur as direct or indirect result of a project or policy and to design the possible mitigation procedure

EIA is a tool that is applied...



- before major decisions are taken and when all alternatives are still open;
- to inform all stages of decision making, including final approval and the establishment of conditions for project implementation;
- with public participation and consultation; and
- to integrate environmental considerations and safeguards into all phases of project design, construction and operation

Purposes/Aims and Objectives



The immediate aim of EIA is to inform the process of decision-making by identifying the potentially significant environmental effects and risks of development proposals.

Objectives related to this aim are to:

- improve the environmental design of the proposal;
- ensure that resources are used appropriately and efficiently;
- identify appropriate measures for mitigating the potential impacts of the proposal; and
- facilitate informed decision making, including setting the environmental terms and conditions for implementing the proposal.

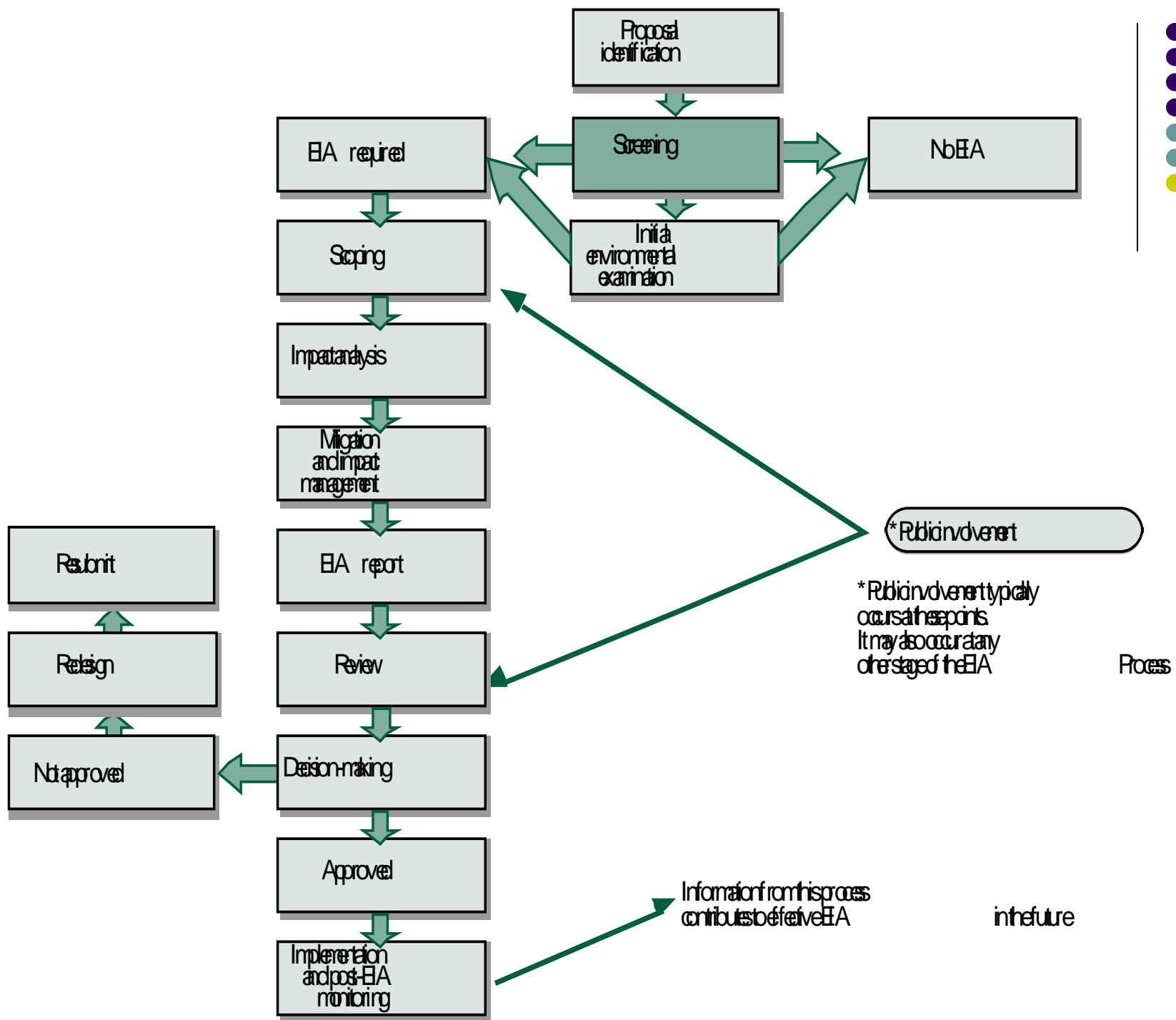
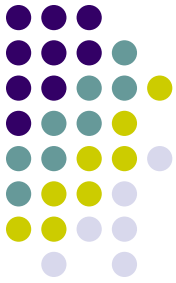
Purposes/Aims and Objectives (cont.)



The ultimate (long term) aim of EIA is to promote sustainable development by ensuring that development proposals do not undermine critical resource and ecological functions or the well being, lifestyle and livelihood of the communities and peoples who depend on them.

Objectives related to this aim are to:

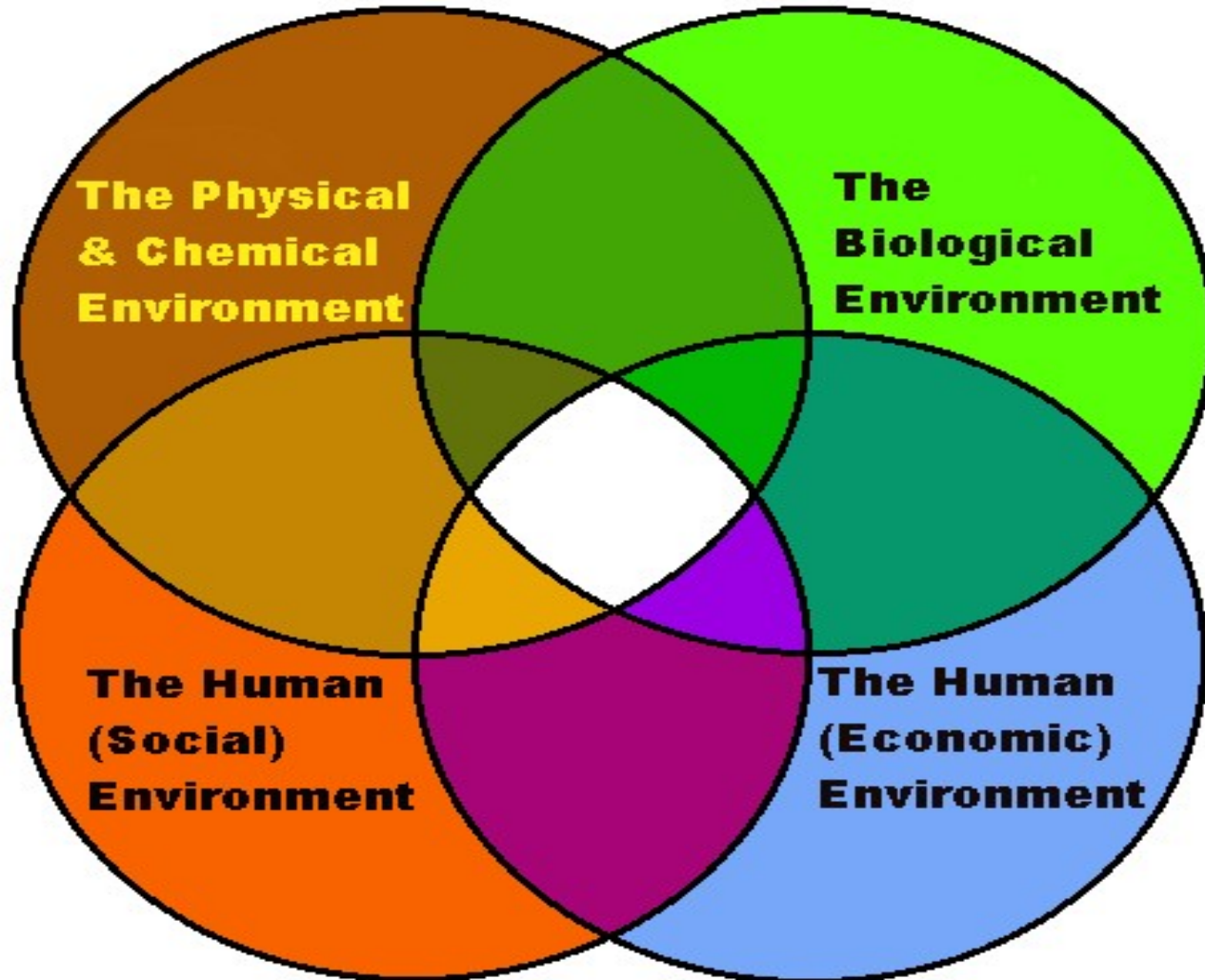
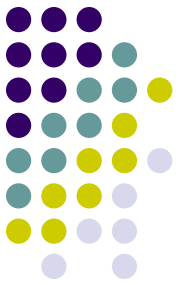
- protect human health and safety;
- avoid irreversible changes and serious damage to the environment;
- safeguard valued resources, natural areas and ecosystem components; and
- enhance the social aspects of the proposal.



The eight steps of the EIA process are presented in brief

- **Screening:** First stage of EIA, which determines whether the proposed project, requires an EIA and if it does, then the level of assessment required.
- **Scoping:** This stage identifies the key issues and impacts that should be further investigated. This stage also defines the boundary and time limit of the study.
- **Impact analysis:** This stage of EIA identifies and predicts the likely environmental and social impact of the proposed project and evaluates the significance.
- **Mitigation:** This step in EIA recommends the actions to reduce and avoid the potential adverse environmental consequences of development activities.
- **Reporting:** This stage presents the result of EIA in a form of a report to the decision-making body and other interested parties.
- **Review of EIA:** It examines the adequacy and effectiveness of the EIA report and provides the information necessary for decision-making.
- **Decision-making:** It decides whether the project is rejected, approved or needs further change.
- **Post monitoring:** This stage comes into play once the project is commissioned. It checks to ensure that the impacts of the project do not exceed the legal standards and implementation of the mitigation measures are in the manner as described in the EIA report.

SCOPING



THE 4 FACETS OF THE ENVIRONMENT

EXAMPLE : SCOPING

IMPACT OF A PROPOSED PAPER INDUSTRY



A PAPER INDUSTRY IS PROPOSED TO BE ESTABLISHED IN A LOCALITY AND THE EFFLUENT IS PROPOSED TO DISCHARGE IN ADJACENT RIVER

❑ETP WILL BE INSTALLED TO BRING THE DISCHARGE DOWN TO PERMISSIBLE LIMIT

❑THERE ARE FEW OTHER INDUSTRIES ALREADY ESTABLISHED DISCHARGING EFFLUENT TO THE RIVER AT ALLOWABLE LIMIT

❑PEOPLE BATH IN RIVER WATER AND DRINK AFTER TREATMENT

❑SIGNIFICANT NUMBER OF PEOPLE DEPEND ON FISHING FOR OCCUPATION



Step 3: Impact Analysis

→ Type	biophysical, social, health or economic
→ Nature	direct or indirect, cumulative, etc.
→ Magnitude or severity	high, moderate, low
→ Extent	local, regional, trans-boundary or global
→ Timing	immediate/long term
→ Duration	temporary/permanent
→ Uncertainty	low likelihood/high probability
→ Reversibility	reversible/irreversible
→ Significance*	unimportant/important

Tools for Impact Analysis



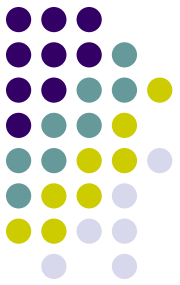
- checklists
- matrices
- networks
- overlays and geographical information systems (GIS)
- expert systems
- professional judgement



Step 4: Impact Mitigation

- to avoid, minimise or remedy adverse impacts
- to ensure that residual impacts are within acceptable levels
- to enhance environmental and social benefits

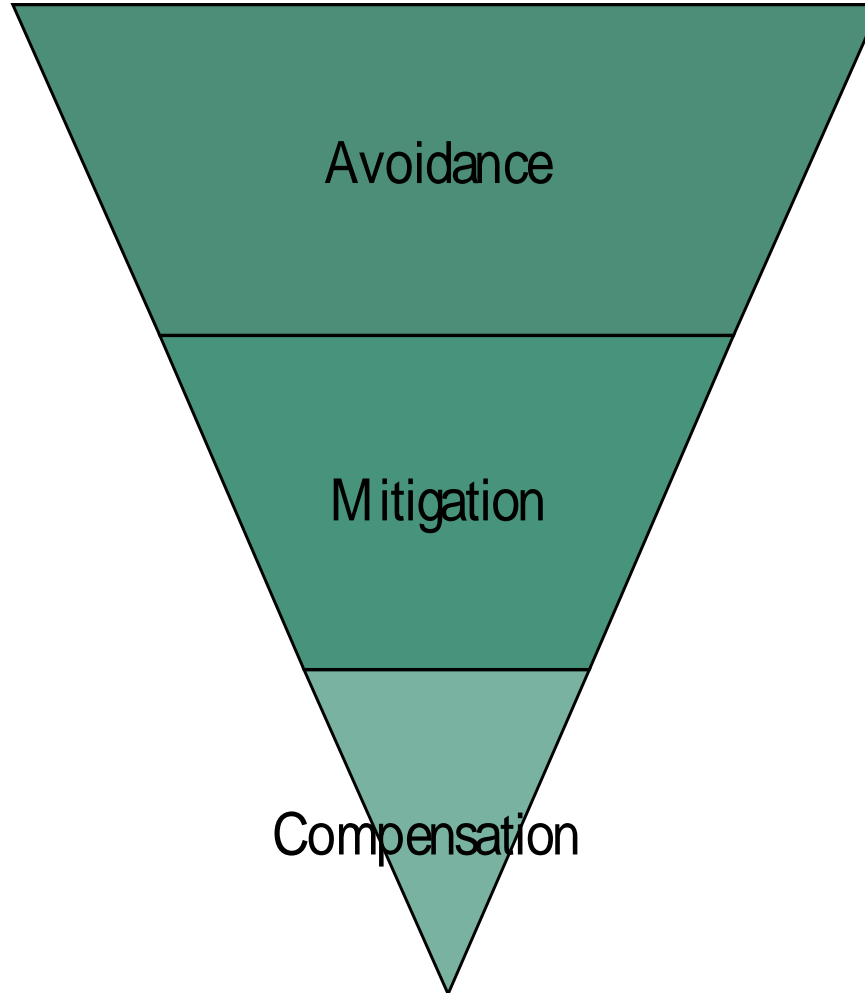
Framework for Impact Mitigation



Common (desirable)



Rare (undesirable)



Alternative sites or
technology to
eliminate habitat loss

Actions during
design, construction and
operation to minimise
or eliminate habitat
loss

Used as a last resort
to offset habitat loss

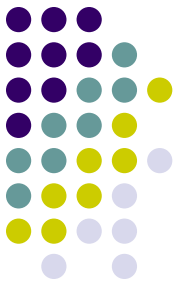


Step 5: Reporting

Different name of EIA reports

- Environmental Impact Assessment Report (EIA Report)
- Environmental Impact Statement (EIS)
- Environmental Statement (ES)

Contents of the Report



- a description of the project;
- an outline of the main alternatives studied by the developer, and an indication of the main reasons for this choice,
- a description of the aspects of the environment likely to be significantly affected by the proposed project;
- a description of the likely significant environmental effects of the proposed project;
- measures to prevent, reduce and possibly offset adverse environmental effects;
- a non-technical summary;
- an indication of any difficulties (technical deficiencies or lack of know-how) encountered while compiling the required information.



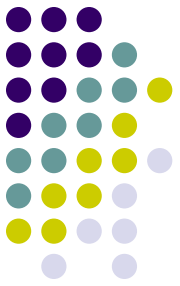
Step 6: Review

- Review the quality of the EIA report.
- Take public comments into account.
- Determine if the information is sufficient.
- Identify any deficiencies to be corrected.

Who Perform the review?

- environmental agency — Canada (comprehensive studies), standing commission — Netherlands, inter-agency committee — USA, planning authority — UK
- independent panel — Canada (public inquiries)
- Public comment and input

Step 7: Decision Making



- To provide key input to help determine if a proposal is acceptable
- To help establish environmental terms and conditions for project implementation



Step 8: Monitoring

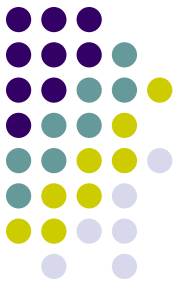
- Ensure the implementation of conditions attached to a decision.
- Verify that impacts are as predicted or permitted.
- Confirm that mitigation measures are working as expected.
- Take action to manage any unforeseen changes.

Key components of Monitoring



- Establish baseline conditions.
- Measure impacts of a project as constructed.
- Verify conformity with established with conditions and acceptable limits.
- Establish links to environmental management plans.
- Carry out periodic checks and third-party audits.

Public Involvement in the EIA Steps



S c

e To consult people likely to be affected by proposal.

S c o

To ensure that significant issues are identified; project related information is gathered, alternatives are considered.

I m p

To avoid biases/inaccuracies in analysis; identify local values/preferences; assist in consideration of mitigation measures; select best alternative.

M i t i g
a n a d n
m a n

E r l e A p

R e v

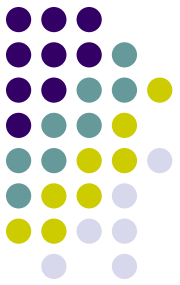
To consider and comment on EIA Report

D e c i

I m p
a n d p

To monitor the implementation of EIA Report's recommendations and decision's conditions.

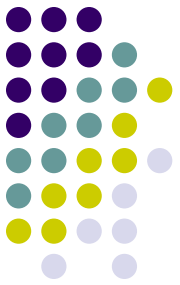
EXAMPLE-I



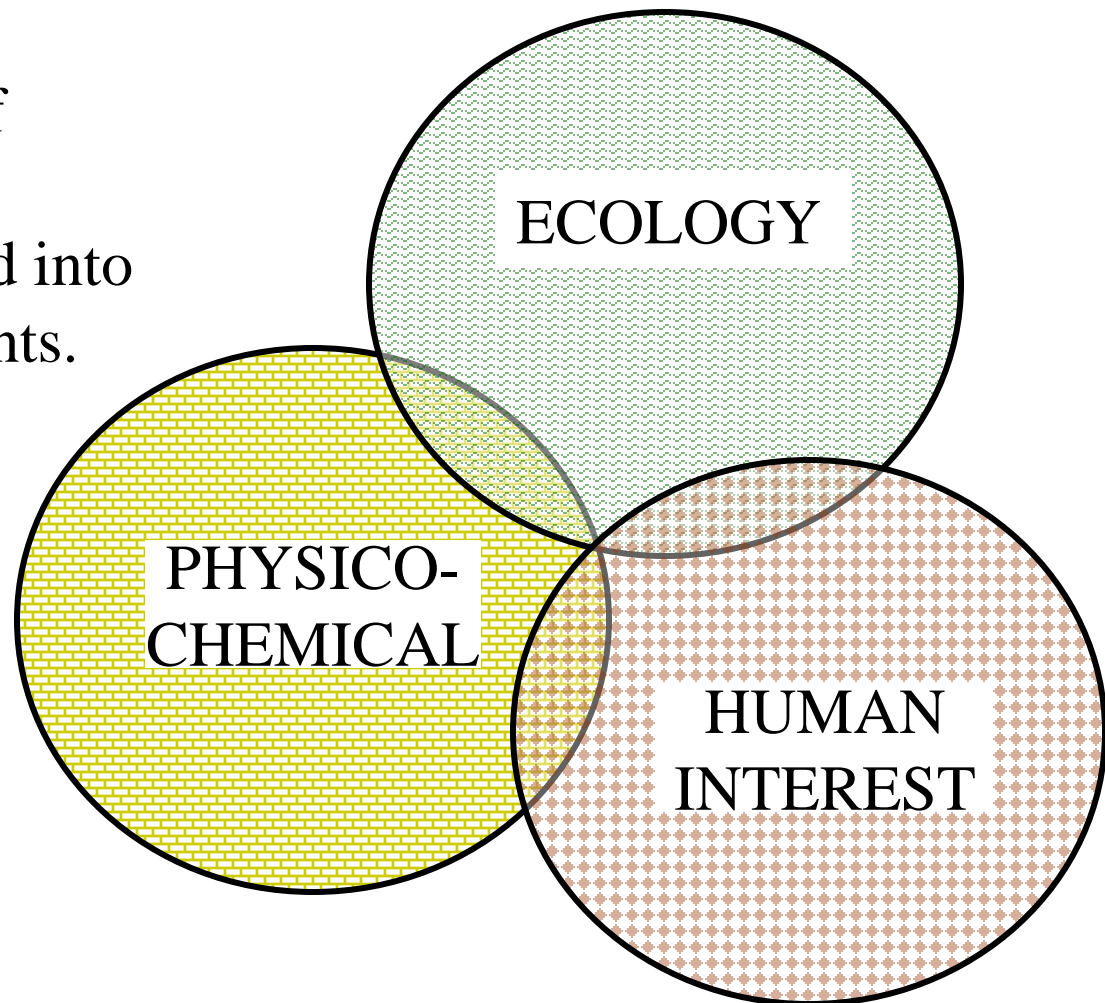
Potential Impacts on Environment

- A change in system exerts certain influence on many different environmental parameters resulting a net positive or negative impact on the environment.
- Impact on major Infrastructure development projects such as:
 - **Road projects**

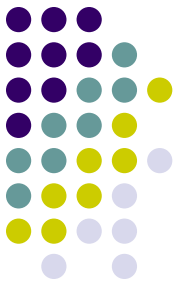
Environmental Parameters



- components of environment.
- can be grouped into major components.



Ecology



- Aquatic

- Fisheries
- Eutrophication
- Aquatic Weeds
- Species diversity
- Endangered species

- Terrestrial

- ☐ Forest
- ☐ Wildlife
- ☐ Species diversity
- ☐ Endangered species



Physico-chemical

- Land
 - Erosion and Siltation
 - Backwater Effect
 - Bank stability
 - Drainage
 - Soil characteristics
- Surface water
 - Regional Hydrology
 - Silt Load
 - Water Pollution
- Groundwater
 - ☐ Regional Hydrology
 - ☐ Recharge
 - ☐ Water table
 - ☐ Water Pollution
- Atmosphere
 - ☐ Air pollution
 - ☐ Dust Pollution
 - ☐ Noise Pollution



Human Interest

- Health

- Diseases
- Sanitation
- Nutrients

- Aesthetic

- Landscape
- Recreation

- Socio-Economic

- ☐ Land Loss
- ☐ Crop Production
- ☐ Aquaculture
- ☐ Irrigation
- ☐ Navigation
- ☐ Flood Control
- ☐ Transport
- ☐ Re-settlement
- ☐ Employment
- ☐ Agro-industrial



Ecological Impact

- (a) Fisheries:
 - (-) Roads prevent longitudinal and lateral migration of fishes in the flood plain
 - (-) Obstruct movement of fishes onto natural feeding and breeding grounds in the flood plain.
- (b) Forest:
 - (-) Roads running through forest area and plantations may be the cause of destruction of trees in the forest and alteration of ecology of the forest.



Ecological Impact

- (c) Plantation:
 - (+) The roadsides may be used for plantation of trees which is favorable impact of road construction.
- (d) Wetland and Wetland Habitat:
 - (-) The road may encroach wetlands which may alter the ecology of wetlands and may cause destruction of wetland habitat.
- (e) Nuisance Plant/Eutrophication:
 - (-) The Roads running through forest area and plantations may be the cause of destruction of trees in the forest and alteration of ecology of the forest.



Physico-chemical Impact

- (a) Erosion and Siltation
 - (-) causes erosion during flood and siltation in the downstream.
- (b) Drainage Congestion /Water logging
 - (-) roads interfere with cross drainage and can cause flooding or drainage congestion in adjacent areas during periods of high precipitation.
 - (-) May cause crop damage, water pollution and breeding of mosquitoes.



Physico-chemical Impact

- (c) Regional Hydrology/Flooding
 - (-) Roads constructed across flood plains perpendicular to the direction of water flow cause back water effect and increase duration, frequency and extent of flooding in the up stream.
- (d) Obstruction to Waste water flow
 - (-) Roads may obstruct the drainage of sewage and industrial waste water leading to serious pollution problem.
- (e) Dust /Noise Pollution
 - (-) Dust raised from unpaved rural roads and blown by the vehicles can pose a health hazard and damage vegetation along the sides of the road.



Impact on Human Interest

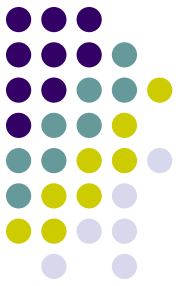
- (a) Loss of Agricultural Lands
 - (-) Construction of any road is associated with the loss of agricultural lands.
- (b) Generation of Employment Opportunities
 - (+) Construction of road generates temporary employment during project implementation and permanent employment during maintenance phase.
- (c) Navigation and Boat Communication
 - (-) Roads interference with navigation and boat communication at least for certain period of the year.



Impact on Human Interest

- (d) Commercial and Service Facilities
 - (+) The thana roads provide benefit of fast communication, transport facilities etc.
- (e) Industrial Activities
 - (+) Road communication promotes industrial activities.
- (f) Irrigation Facilities
 - (+) Borrow-pits by the side of the roads provide facility for small scale irrigation.
- (g) Landscape
 - (-) Scattered borrow pits, unauthorized growth around road , erosion result in marred landscape.

Environmental Impact Assessment (EIA)



- Assessment of the beneficial and adverse changes in environment resources or values resulting from a proposed project.
- Essential Elements
 1. **Identification** of possible positive or negative impacts of the project.
 2. **Quantifying** impacts with respect to common base.
 3. Preparation of **mitigation** plan to offset the negative impacts.



Methods of Assessment

- Environmental Impact Value

$$EIV = \sum_{i=1}^n (V_i)W_i$$

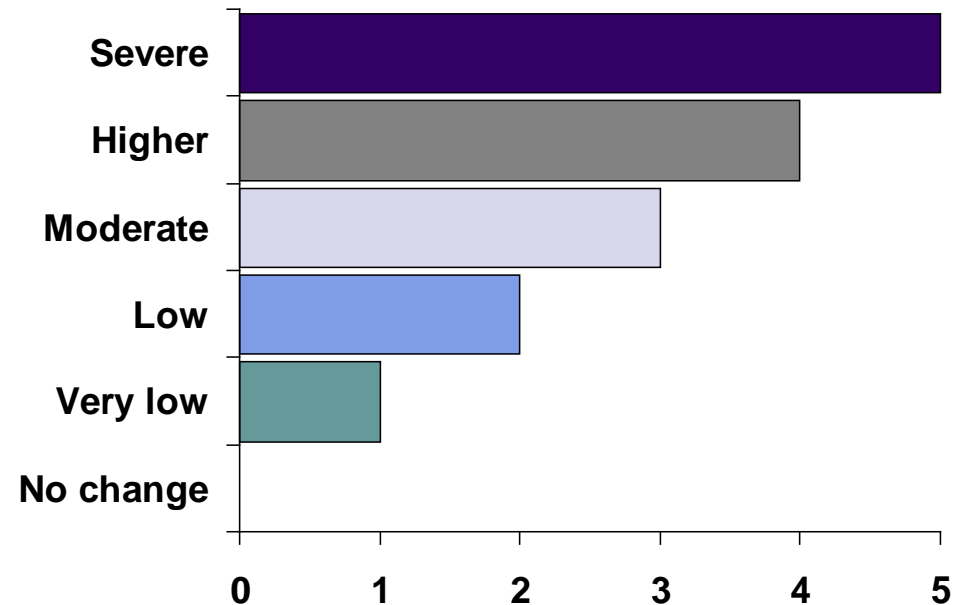
- V_i = Relative change of the environmental quality of parameters
- W_i = Relative importance or weight of parameter
- N = total number of environmental parameters

Quantification of Environmental Impact



- Changes of environmental parameters

- Severe (+5 or -5)
- Higher (+4 or -4)
- Moderate (+3 or -3)
- Low (+2 or -2)
- Very Low (+1 or -1)
- No change (0)



Relative importance of Environmental Parameters

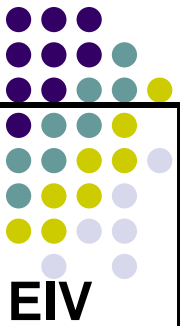


- All parameters are not equal importance or weight.
- It varies from country to country
- In flood, employment, agriculture, fisheries carry more importance.
- In next slide, a summary of relative importance of parameters for Thana Road project is presented.

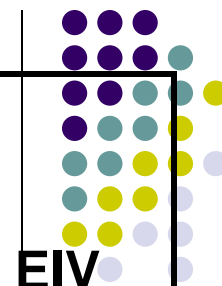


EIA Procedure

1. **Preparatory Works** – study report
2. **Data collection** – from all sources, survey
3. **Data Analysis** – convert to change scale
4. **Impact Evaluation** – relative weight
5. **Mitigation and Monitoring Plan**
6. **Preparation of Report** – help decision makers

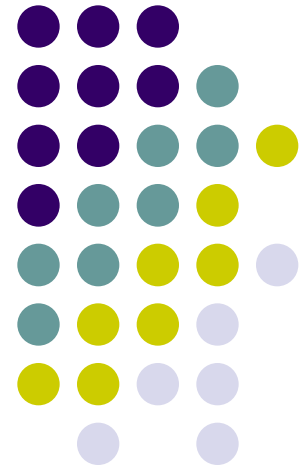


ENVIRONMENTAL PARAMETERS	Relative Importance Value	Degree of Impact	EIV
I. ECOLOGICAL			-19
Fisheries	10	-2	
Forest	5	0	
Tree Plantation	2	+1	
Wetland/Wetland Habitant	4	0	
Nuisance Plant/Eutrophication	1	-1	
II. PHYSICO-CHEMICAL			-13
Erosion and Siltation	2	-1	
Regional Hydrology/Flooding	6	-1	
Drainage Congestion/Water logging	5	-1	
Obstruction to Waste Water Flow	3	0	
Dust Pollution/Noise Pollution	2	0	



ENVIRONMENTAL PARAMETERS	Relative Importance Value	Degree of Impact	EIV
III. HUMAN INTEREST			+27
Loss of Agricultural Lands	8	+3	
Employment Opportunities	8	+4	
Navigation/Boat Communication	3	-3	
Commercial and Service Facilities	6	+3	
Industrial Activities	3	+2	
Irrigation Facilities	2	+3	
Landscape	2	-1	
Total Environmental Impact Value			-5

Adverse Environmental Impacts and Mitigation Measures





Loss fish breeding

- **1. Action:**
 - Loss of breeding, nursery and feeding ground in flood plain.
- **1. Impact:**
 - Reduction in Fish protein consumption.
 - Unemployment of fisherman.
- **1. Mitigation Measures:**
 - Allow controlled flooding.
 - Compensate the loss by fish culture.



Obstruction to fish

- **2. Action:**
 - Obstruction to mitigation of fish.
- **2. Impact:**
 - Same as 1.
- **2. Mitigation Measures:**
 - Provide adequate opening in roads and embankments along routes of fish migration.



Pesticide

- **3. Action:**
 - Reproduction failure and destruction of fish by uncontrolled use of pesticide.
- **3. Impact:**
 - Same as 1.
- **3. Mitigation Measures:**
 - Adopt Integrated Pest Management (IMP) for pest control.
 - Prevent drainage from agriculture land from reaching water bodies.



Drying wetland

- **4. Action:**

- Drying up of the wetlands for agriculture purpose and destruction of habitat for fish, birds, amphibians etc.

- **4. Impact:**

- Reduction in Fishery.
- Elimination of species of fish, birds, amphibians etc.
- Disruption of wetland ecology.

- **4. Mitigation Measures:**

- **Avoid complete drying up of wetlands and swamp land.**
- **Restore alternative habitat for endangered species.**



Cutting trees

- **5. Action:**
 - Clearing of forest lands and cutting of trees within the right-of-way of the road.
- **5. Impact:**
 - Reduction in forest cover.
 - Reduction in forest products.
 - Disruption of forest ecology.
- **5. Mitigation Measures:**
 - Find alternative route to avoid forest through planning exercise.
 - Replace the trees by plantation along road sides.



Nuisance plants

- **6. Action:**
 - Spreading of nuisance plants from borrow pit.
- **6. Impact:**
 - Damage crops during flood.
- **6. Mitigation Measures:**
 - Incorporate destruction of such plants in maintenance program.
 - Convert the plants into a compost for application as a soil conditioner/manure.



Pollution from drainage

- **7. Action:**

- Discharge nutrient enriched agricultural land drainage in surface water.

- **7. Impact:**

- Causes eutrophication and surface water pollution.
- Makes the water unsuitable for beneficial uses.
- Destroys aquatic environment.

- **7. Mitigation Measures:**

- Prevent agricultural land drainage from reaching from reaching surface waters.



Water pollution

- **8. Action:**

- Reaching residues of pesticides in surface and groundwater from agricultural lands.

- **8. Impact:**

- Cause water pollution.
- Contaminates sources of water supply.
- Pesticides residues accumulate in bio-mass.

- **8. Mitigation Measures:**

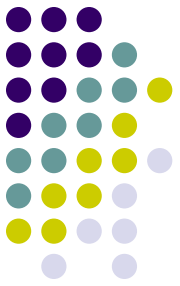
- Reduce use of pesticides through IPM.
- Prevent agricultural land drainage from reaching surface water.



Erosion and Siltation

- **9. Action:**
 - Erosion of road and embankment surfaces and sides, road openings, bed and banks of rivers/canals subsequent siltation in down stream.
- **9. Impact:**
 - Cause damage to road and embankment.
 - Affect stability of road/embankment and their structures.
 - Increases turbidity of water.
 - Siltation of canal bed and agricultural lands.
- **9. Mitigation Measures:**
 - **Select appropriate soils for road and embankment construction.**
 - **Compact the road materials properly.**
 - **Provide proper slope for surface drainage and vegetation cover.**
 - **Provide adequate opening for discharge of flood and accumulated rain water.**

Drainage congestions/ water logging



- **10. Action:**
 - Drainage congestion and water logging
- **10. Impact:**
 - Crop damage and loss of agricultural lands.
 - Cause water pollution.
 - Provide ground fro mosquito breeding.
- **10. Mitigation Measures:**
 - Provide adequate opening for drainage.
 - Provide facilities for pumping of congested water.



Regional Hydrology

- **11. Action:**
 - Disruption of regional hydrology through obstruction of flood flow.
 - Back water effect due to constructions across flood plains.
- **11. Impact:**
 - Increase duration, severity and frequency of flood.
 - Changes flooding pattern and ground water recharge.
- **11. Mitigation Measures:**
 - **Avoid road construction across the flood plain in the direction perpendicular to flood flow.**
 - **Provide adequate opening for flood flow.**



Backflow

- **12. Action:**
 - Backflow of water through drainage canals.
- **12. Impact:**
 - Causes early flooding.
- **12. Mitigation Measures:**
 - Install regulator to control inflow and outflow through drainage canal.



Obstruction to waste water

- **13. Action:**
 - Obstruction to waste water flow by roads and embankments.
- **13. Impact:**
 - Create water pollution.
 - Deteriorates quality of environment.
- **13. Mitigation Measures:**
 - Provide drainage structure.
 - Install pumping facilities.
 - Install treatment plant for waste water treatment.



Dust blowing

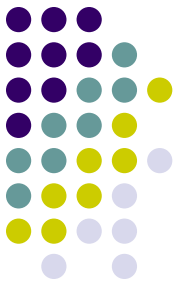
- **14. Action:**
 - Dust blowing from unpaved roads during construction and movement of vehicles.
- **14. Impact:**
 - Health hazards due to dust pollution.
 - Damage to vegetation and trees along the road.
- **14. Mitigation Measures:**
 - Control moisture content during construction by watering.
 - Stabilize road surface with a suitable stabilizer.
 - Increase vegetation cover on road surface and slopes.



Polluted irrigation water

- **15. Action:**
 - Use of irrigation water with high and imbalance salt content.
- **15. Impact:**
 - Increase soil salinity and alkanity/acidity
 - Alteration of soil texture and permeability.
 - Affects soil fertility.
- **15. Mitigation Measures:**
 - Use surface water where available.
 - Conduct chemical analysis of ground water before use and select the aquifer producing good quality water.
 - Determine salinity of surface water in coastal areas before use as irrigation water.

Contaminated irrigation water



- **16. Action:**
 - Use of irrigation water with high iron content.
- **16. Impact:**
 - Impart reddish color to top soil.
 - Changes soil texture and permeability.
- **16. Mitigation Measures:**
 - Look for an alternative water source, the right strata producing water with low iron content.
 - Detain the aerated water in a reservoir, canal before application in the field.



Loss of land

- **17. Action:**
 - Loss of agricultural land.
- **17. Impact:**
 - Deprives a group of farmers of their means of living.
 - Increases landlessness in the area.
 - Reduces employment in agriculture.
 - Affects agricultural production.
- **17. Mitigation Measures:**
 - Plan the project to avoid fertile agricultural land.
 - Rehabilitate the affected people.
 - Generate employment opportunities in other activities.



Obstruction to navigation

- **18. Action:**
 - Obstruction to navigation and plying of boat.
- **18. Impact:**
 - Disruption of cheap mode of transportation.
 - Adverse effects on communication.
- **18. Mitigation Measures:**
 - **Provide openings at major routes and construct road structures leaving adequate clearance above high flood level for plying of boats.**



Land ownership pattern

- **19. Action:**

- Change in land ownership pattern within project area.

- **19. Impact:**

- Inadequitable distribution of project benefits.

- **19. Mitigation Measures:**

- Regulation of land ownership transfer in the project area.



Inadequate landscape

- **20. Action:**
 - Inadequate considerations to land use and landscape.
- **20. Impact:**
 - Landscape disfiguration by irregular borrowpits, deep cuts, fills, unplanned growth of shops, and other services.
- **20. Mitigation Measures:**
 - Replant disfigured surfaces.
 - Use a design to blend with landscape.
 - Prevent unplanned construction and unauthorized uses of roads and embankments.

Satellite Remote Sensing in EIA

LOKTAK WETLAND
(IRS-1D-LISS-III, Nov 21, 2000)



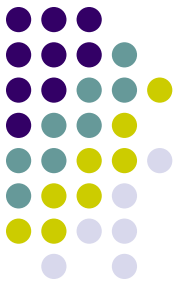
LOKTAK WETLAND
(IRS-1A-LISS-II, Oct 23, 1988)



Assignments-EIA

(Try)

Q1 and Q2 should be around 1000 and 500 words respectively)



1. With respect to the proposed 'DR. B.C. ROY INSTITUTE OF MEDICAL SCIENCE AND RESEARCH, IIT KHARAGPUR, WEST BENGAL'
http://skylinearchitect.com/medical/med_bcricri_iit_kharagpur.php

1a. Discuss the procedure, parameters and problems involved in assessing the environmental impacts of the proposed 'DR. B.C. ROY INSTITUTE'.

1b. Discuss the Essential Elements to

- i. Identify any possible positive or negative impacts of the project.
- ii. Quantify any impacts with respect to common base.
- iii. Prepare Mitigation plan to offset the negative impacts.

2. What advantages Satellite Remote Sensing Technique offers in EIA study?