



**GOVERNMENT OF PUNJAB
ENVIRONMENTAL PROTECTION AGENCY**



Environmental Assessment Checklists and Guidelines

Water Reservoirs in Arid Zones

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1. Introduction

1.1 Background

Pakistan is an arid country as most of the country falls in an arid zone where the annual rainfall is less than 1,000 mm. In various part of province Punjab, the natural supply of freshwater is not assured in all seasons. To meet the growing water requirements, it is essential to manage the limited water supply in a way that it is available for domestic, industrial and irrigation purposes in all seasons and also in drought years when the rainfall is below the average level. Water reservoirs are constructed for storage of storm water run-off and stream water. Small water reservoirs are usually constructed by the provincial irrigation and power department, on the request of the communities. These dams are built on the non-perennial stream, mostly on a state land with dam height ranging from 30 m to 40 m. Water stored in these dams is diverted through irrigation conveyance channels for extended irrigation.

The primary aims of these dams include but not limited to followings:

- Flood mitigation
- Storage of water for domestic purposes
- Enhance groundwater recharge
- Storage of water for irrigation

1.2 Purpose of Guidelines

These guidelines have been prepared to assist project proponents, environmental consultants, and regulatory authorities in identifying, assessing, and managing the potential environmental impacts associated with the planning, design, construction, operation, and maintenance of bus terminal projects. The guidelines provide practical guidance for the preparation of Initial Environmental Examination (IEE) reports, implementation of appropriate mitigation measures, environmental monitoring, and preparation of Environmental Management Plans (EMPs). They are intended to facilitate compliance with the applicable environmental legislation, regulations, and standards in Punjab while promoting environmentally sustainable development of Water Reservoirs in Arid Zones.

1.3 Scope of Guidelines

These guidelines are applicable to all dams and reservoirs with a storage volume of less than five million cubic meters but more than one million cubic meter or surface area of less than one square kilometer but more than 0.2 square kilometer

1.4 How to use these Guidelines

The project proponent (the local government, municipal government, city government or the cantonment board) is obliged to use these guidelines. The project proponent has to fill in an environmental impact assessment form. The following steps are to be taken in this regard:

Step 1: Provide information on project [use **Section I**]

Step 2: Determine Applicability (Are you sure that IEE or EIA is not required?) [use **Section II**]

Step 3: Describe the physical, biological and social environment [use **Section III**]

Step 4: Assess potential impacts and applicable mitigation measures [use **Section IV**]

Step 5: Provide undertaking to the EPA on mitigation measures and compliance [use **Section V**]

Completed form is to be submitted to the Environmental Protection Agency, Punjab for evaluation. EPA Punjab may request for additional information or decide to undertake visit to the proposed project site in order to assess the environmental impact of the proposed project.

1.5 Glossary

Act: means The Punjab Environmental Protection Act 1997 (Amended 2017)

Arid Zone: area receiving no rain or less rain.

Environment: means (a) air, water and land; (b) all layers of the atmosphere; (c) all organic and inorganic matter and living organisms; (d) the ecosystem and ecological relationships; (e) buildings, structures, roads, facilities and works; (f) all social and economic conditions affecting community life; and (g) the inter-relationships between any of the factors in sub-clause (a) to (f).

Environmental Assessment: a technique and a process by which information about the environmental effects of a project is collected, both by the developer and from other sources, and taken into account by the planning authority in forming their judgments on whether the development should go ahead.

Habitat: the general place or physical environment in which a population lives **Hydrology:** the branch of geology that studies water on the earth and in the atmosphere: its distribution and uses and conservation.

Impact on Environment: means any effect on land, water, air or any other component of the environment, as well as on wildlife harvesting, and includes any effect on the social and cultural environment or on heritage resources.

Landslide: a slide of a large mass of dirt and rock down a mountain or cliff.

Mitigation Measure: means a measure for the control, reduction or elimination of an adverse impact of a development on the environment, including a restorative measure.

Non-perennial Stream: means stream not flowing throughout the year.

Regulations: means The Punjab Environmental Protection (Review of IEE and EIA) Regulations, 2022.

Siltation: accumulation of silt in a water body.

Soil Erosion: physical removal of soil, either by wind or by running water.

Waterlogging: the rising of water table over time, and soaking of soils, in areas where irrigated land is poorly drained. Waterlogging is often associated with salinization.

2 Project Profile

2.1 Description

The proponent, after consulting Annexures should provide a concise description of the proposed project, including:

- Name of the project
- Project location (district, tehsil, mouza, and coordinates)
- Nature of the project (new or expansion or rehabilitation)
- Government's designate nature of proposed area
- Total project area.
- Estimated water demand during construction and operation phases
- Covered and open areas
- Land ownership status
- Estimated project cost
- Detail of different categories of activities and others structures
- Number of employees during construction phase.

3 Environmental Impacts

3.1 Loss of Vegetation and Terrestrial Habitats

Construction of the reservoir and associated infrastructure will require clearing of vegetation within the inundation area and construction footprint. This may result in the loss of trees, shrubs, grazing land, and wildlife habitats, causing temporary or permanent disturbance to terrestrial flora and fauna.

3.2 Soil Erosion During Construction

Earthworks, excavation, and land clearing may expose soil surfaces to erosion by rainfall and surface runoff. If appropriate erosion control measures are not implemented, eroded soil may be transported into nearby streams and the reservoir, leading to increased sedimentation and loss of productive topsoil.

3.3 Dust and Noise Emissions

Construction activities, including excavation, transportation of construction materials, and operation of heavy machinery, are likely to generate dust and elevated noise levels. These impacts may temporarily affect ambient air quality, nearby communities, construction workers, and local wildlife.

3.4 Sedimentation of the Reservoir

Soil erosion within the upstream catchment and construction area may increase the transport of sediments into the reservoir. Over time, sediment accumulation can reduce the reservoir's storage capacity, decrease its operational life, and lower the efficiency of irrigation water supply.

3.5 Reduced Downstream Environmental Flows

Storage of seasonal runoff within the reservoir may reduce both the quantity and timing of downstream flows. This may adversely affect aquatic habitats, riparian vegetation, groundwater recharge, and water availability for downstream users and ecosystems.

3.6 Waterlogging and Soil Salinity in Irrigated Command Areas

Improper irrigation practices and inadequate drainage may result in rising groundwater levels, causing waterlogging and salt accumulation in agricultural soils. These conditions can gradually reduce soil fertility and agricultural productivity.

3.7 Water Quality Deterioration Due to Nutrient Accumulation and Submerged Vegetation

Following reservoir impoundment, decomposition of submerged vegetation and inflow of nutrients from agricultural runoff may increase nutrient concentrations in the water. This can reduce dissolved oxygen levels, encourage excessive growth of algae and aquatic weeds, and deteriorate overall water quality.

3.8 Public Health Risks from Stagnant Water and Vector Breeding

Standing water around the reservoir margins, irrigation channels, and poorly drained areas may provide breeding habitats for mosquitoes and other disease vectors. This may increase the risk of vector-borne diseases and create public health concerns for nearby communities.

3.9 Occupational and Community Health and Safety During Construction

Construction activities involving heavy machinery, excavation, transportation of materials, and temporary traffic diversions may increase the risk of accidents and injuries to both workers and the public. Dust, noise, and restricted site access may also cause temporary inconvenience to nearby communities.

3.10 Dam Safety and Emergency Preparedness

Although small reservoirs are generally designed in accordance with accepted engineering standards, structural failure, overtopping during extreme flood events, or inadequate maintenance may pose risks to downstream communities, agricultural land, and infrastructure. Proper dam safety management and emergency preparedness are therefore essential.

3.11 Biodiversity Impacts, Particularly on Aquatic and Riparian Ecosystems

Construction and operation of the reservoir may alter natural stream habitats, flow regimes, and

riparian vegetation. These changes can affect fish populations, aquatic organisms, migratory species, and wildlife dependent on the natural stream ecosystem, while also creating new habitats for some aquatic species.

3.12 Conflicts Over Water Allocation and Equitable Distribution

The availability of stored irrigation water may lead to conflicts among upstream and downstream users or between farming communities if water allocation is perceived as inequitable. Transparent water allocation procedures and participatory water management are essential to ensure fair distribution and sustainable use of water resources.

4. Environmental Mitigation Measures

4.1 Loss of Vegetation and Terrestrial Habitats

The project proponent shall:

- Select reservoir sites that minimize clearing of natural vegetation.
- Restrict vegetation clearance to the minimum area required for construction.
- Preserve mature trees wherever technically feasible.
- Clearly demarcate construction boundaries to prevent unnecessary disturbance.
- Compensate for tree removal through plantation of indigenous species at a minimum ratio of 3:1.
- Restore disturbed areas through revegetation immediately after construction.
- Avoid construction activities during the breeding season of important wildlife, where practicable.
- Develop green belts around the reservoir perimeter using native species.

4.2 Soil Erosion During Construction

The project proponent shall:

- Minimize the area of exposed soil at any one time.
- Schedule earthworks during the dry season where feasible.
- Construct temporary drainage channels to divert runoff.
- Install erosion control measures such as silt fences, sediment traps, and check dams.
- Stabilize excavated slopes through stone pitching, turfing, or bioengineering techniques.
- Cover stockpiles of excavated material during periods of heavy rainfall.
- Rehabilitate disturbed areas immediately after completion of construction.

4.3 Dust and Noise Emissions

i. Dust Control

The project proponent shall:

- Sprinkle water regularly on construction areas and haul roads.
- Cover trucks transporting soil and construction materials.
- Limit vehicle speeds on unpaved roads.
- Cover fine construction materials during storage.
- Maintain construction equipment to minimize exhaust emissions.

ii. Noise Control

The project proponent shall:

- Restrict noisy construction activities to daylight hours.
- Maintain machinery in good operating condition.
- Install silencers on construction equipment where applicable.
- Inform nearby communities of scheduled high-noise activities.
- Provide hearing protection to workers exposed to excessive noise.

4.4 Sedimentation of the Reservoir

The project proponent shall:

- Prepare and implement a watershed management plan.
- Promote afforestation and vegetation cover in the catchment area.
- Construct check dams and sediment retention structures in tributary streams.
- Encourage soil conservation practices in upstream agricultural lands.
- Regularly inspect sediment accumulation within the reservoir.
- Remove accumulated sediment periodically where economically feasible.
- Prevent uncontrolled quarrying and land degradation within the catchment.

4.5 Reduced Downstream Environmental Flows

The project proponent shall:

- Maintain minimum environmental flow releases throughout the year.
- Operate the reservoir in accordance with an approved water release schedule.
- Monitor downstream flow conditions regularly.
- Consult downstream communities regarding water allocation.
- Avoid complete interruption of stream flow except during emergency situations.
- Coordinate reservoir operation with relevant irrigation and environmental authorities.

4.6 Waterlogging and Soil Salinity in the Command Area

The project proponent shall:

- Design irrigation channels to minimize seepage losses.
- Construct adequate surface and subsurface drainage systems.
- Promote efficient irrigation methods to reduce excessive water application.
- Monitor groundwater levels periodically.
- Conduct regular soil salinity assessments.
- Encourage farmers to adopt appropriate irrigation scheduling.
- Promote cultivation of salt-tolerant crops where necessary.

4.7 Water Quality Deterioration

The project proponent shall:

- Remove vegetation from the reservoir basin before impoundment where practicable.
- Prevent discharge of untreated domestic wastewater into the reservoir.
- Prohibit disposal of solid waste within the reservoir catchment.
- Monitor water quality regularly for key parameters.
- Control agricultural runoff through vegetative buffer strips.
- Promote judicious use of fertilizers and pesticides in the command area.
- Prevent livestock access to sensitive reservoir margins where necessary.

4.8 Public Health Risks

The project proponent shall:

- Prevent stagnant water accumulation around construction camps.
- Implement mosquito and vector control measures.
- Provide adequate sanitation facilities for construction workers.
- Ensure safe drinking water supply at construction camps.
- Conduct public awareness programs on water-borne diseases.
- Maintain reservoir margins to reduce vector breeding habitats.
- Coordinate disease surveillance with local health authorities where required.

4.9 Occupational and Community Health and Safety

The project proponent shall:

- Prepare and implement an Occupational Health and Safety Plan.
- Provide appropriate Personal Protective Equipment (PPE) to all workers.
- Conduct regular safety training for workers.

- Install warning signs and safety barriers around hazardous areas.
- Restrict public access to active construction zones.
- Maintain first-aid facilities and emergency communication systems.
- Develop emergency response procedures for accidents and natural disasters.
- Establish a grievance redress mechanism for local communities.

4.10 Dam Safety and Emergency Preparedness

The project proponent shall:

- Design the dam in accordance with applicable national engineering standards.
- Conduct comprehensive geotechnical and hydrological investigations before construction.
- Inspect the dam, spillway, and outlet structures regularly.
- Install instrumentation to monitor seepage, settlement, and structural performance where appropriate.
- Prepare and implement a Dam Safety Management Plan.
- Develop an Emergency Preparedness and Response Plan for potential dam failure or overtopping.
- Conduct periodic emergency drills involving downstream communities.
- Maintain emergency communication systems and warning mechanisms.
- Ensure spillways remain free of debris and fully operational.
- Carry out periodic maintenance and rehabilitation of dam infrastructure.

4.11 Biodiversity Conservation

The project proponent shall:

- Avoid disturbing ecologically sensitive habitats where feasible.
- Maintain riparian vegetation along reservoir margins.
- Restrict hunting, fishing, and tree cutting within designated conservation zones.
- Implement compensatory plantation using native species.
- Monitor wildlife and aquatic ecology periodically.
- Restore disturbed habitats following construction.
- Raise awareness among local communities regarding biodiversity conservation.

4.12 Water Allocation and Community Conflicts

The project proponent shall:

- Develop transparent water allocation procedures in consultation with stakeholders.

- Establish Water User Associations (WUAs) for equitable distribution of irrigation water.
- Maintain accurate records of reservoir releases.
- Resolve disputes through participatory consultation mechanisms.
- Ensure equitable water distribution between upstream and downstream users.
- Conduct awareness programs on efficient water use.
- Periodically review water allocation based on seasonal availability and community needs.

Environmental Assessment Checklist

Section I: Project Description

File No _____ (To be filled by EPA)

Date _____

General Information

1. Project Name or Title _____
2. Project Proponent (Department, organization, or owner) _____
3. Address _____
4. Telephone _____
5. Fax _____
6. E-mail _____
7. Representative of the Proponent _____
8. Designation _____
9. Name of the person who conducted this assessment _____
10. Designation _____
11. Qualification _____

Project Information

12. Project location _____
13. Cost of the project _____
14. Purpose of the reservoir _____
15. Name of the river or stream _____
16. Is the stream seasonal or perennial _____
17. Total area of the reservoir _____ m²
18. Total storage capacity _____ m³
19. Total volume of the embankment _____ m³
20. Brief Project Description _____

Please attach a map of the proposed project site showing the location of the key structures, access, etc.

21. Quantity of construction material (concrete, gravel, clay, etc.) required and their source: _____

Construction

22. Who owns the proposed land for the project? _____

23. What is the present use of the land? _____

24. Are there any structures on the proposed site now? ☐ Yes ☐ No If yes, will any structure be demolished? ☐ Yes ☐ No If yes, where the demolition waste will be disposed? _____

25. Are there any trees on the proposed site? ☐ Yes ☐ No

26. Will any tree be removed? ☐ Yes ☐ No
If yes, how many? _____

27. Period of construction (start and end dates) _____

28. What major construction equipment (dozer, grader, crane, etc.) will be used?

29. Will any land be acquired? _____

If yes, please specify

The total area: _____

Present ownership of land _____

what is the present use of the land? _____

How the land will be acquired (Through Land Acquisition Act or Direct Purchase)?

When the compensation will be paid? _____

30. In case of state land, are there any squatter settlements on the land? _____

If yes, please specify

Number of settlements _____

Will any compensation be paid? _____

When the compensation will be paid? _____

Section II: Screening

Is the proposed project or part of the project in an ecologically sensitive area?

☐ Yes ☐ No

Is the total storage capacity more than five million cubic meter?

☐ Yes ☐ No

Is the total area of the reservoir more than one square kilometer?

☐ Yes ☐ No

If the answer to any of the above questions is yes, then the project would require an initial environmental examination or an environment impact assessment.

Refer to the Punjab Environmental Protection Agency Review of Initial Environmental Examination and Environment Impact Assessment Regulations, 2022 for appropriate category.

Section III: Environmental Profile

1. Describe the terrain of the project area:
- ☐ Flat or Level (Slope < 3%)
 - ☐ Level to moderately steep (Slope 3%-30%)
 - ☐ Moderately steep to mountainous (Slope > 30%)

2. Are there signs of soil erosion or landslide anywhere within 2,000 m of the proposed site?

☐ Yes ☐ No

If yes, please describe (where, nature) _____

3. Please describe the hydrological conditions of the stream or river, run-off characteristics, rainfall, rainfall variability, groundwater, and drought patterns.

Please attach the hydrological study of the project.

4. Is the stream polluted? Is domestic or other wastewater discharged to it?
5. What are the present uses of the stream, eg, agriculture, domestic, industrial, washing, fishery. _____

6. Is there any groundwater well on the proposed site or within 500 m of the proposed site?

☐ Yes ☐ No

If yes, describe each well:

Type (Dug well, tube well, hand pump)	Location (Village, road, mohalla, etc. and distance from the site)	Depth and Yield	Uses (Drinking, agriculture, domestic, industrial, washing, livestock)

7. Based on the interview of the surrounding population or a wildlife expert, is any form of wildlife found on, or around the proposed site of the project?

☐ Yes ☐ No

If yes, please describe _____

8. Are there any existing trees or vegetation on the proposed site?

☐ Yes ☐ No

If yes, how many? _____

9. Are there any community forest, reserved forest or protected area within 2,000 m of the proposed site?

☐ Yes ☐ No

If yes, please describe? _____

10. What is the present land use of the proposed dam site and its vicinity (roughly a radius of 500 m) of the proposed site?

	Residential (Thick, Moderate, Sparse)	Commercial (Office, Shops, Fuel Stations)	Open Land (Parks, Farmlands, unutilized plots, barren land)	Industrial	Other

Description					
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(Please attach a map of the proposed project site and indicate roughly the area that you have considered for this evaluation)

11. For any agricultural farmland on the proposed site and a radius of 500 m around it, provide the following information:

Main crop(s) and average yield _____

Source of irrigation water _____

Area affected by salinity or water logging _____

12. Please describe all the sensitive receptors within 500 m of the proposed site:

Type (schools, colleges, hospitals, and clinics)	Name	Size (Number of students or number of beds)	Location (Village, road, mohalla, etc.)	Distance from Site

13. What is the total population of the area? _____

14. What proportion of the houses in the area are pukka, semi-pukka, and kutcha?

15. How are the general hygienic conditions of the project area?

☐ Generally clean

☐ Fair

☐ Poor

16. Is there any bad odor in the project area?

☐ Yes ☐ No

What is the source of the odor? _____

17. What are the main sources of income of the surrounding community? _____

18. Is there any site of cultural importance (graveyard, shrine, mosque, archeological site) within 1,000 m of the proposed scheme?

☐ Yes ☐ No

If yes, please describe? _____

19. Will the reservoir submerge any:

Village or house _____

Wetland _____

Forest _____

Sensitive vegetation _____

Wildlife habitat _____

Tomb or graveyard _____

archeologically important site _____

Section IV: Impact Assessment

Potential Negative Environmental Impacts	Tick, if relevant	Mitigation Measures	Tick, if proposed	Monitoring Plan
Socioeconomic Impact	☐	To the extent possible, local labor will be used for unskilled, semi-skilled and skilled jobs	☐	
		A formal resettlement plan will be prepared	☐	
Water-related diseases	☐	Sanitation and health-care programs will be initiated for the population around the reservoir	☐	
		As far as possible, the reservoir water level will	☐	
		be fluctuated to discourage growth of disease		

		carrying insects.		
Wildlife and vegetation	☐	Minimum flow required to maintain vegetation will	☐	
		be determined and it will be ensured that the flow		
		is maintained		
		Operational rules will be defined for regulating	☐	
		downstream flows at critical times to protect		
		habitat for reproduction or migratory routes.		
		Provisions for the migration of fish and other	☐	
		aquatic organisms will be provided, if needed		
Safety Concerns	☐	The surrounding communities will be informed	☐	
		about the construction schedule and will be		
		briefed about the safety procedures		
				Continued...

Potential Negative Environmental Impacts	Tick, if relevant	Mitigation Measures	Tick, if proposed	Monitoring plan
		Monitoring Plan A comprehensive plan for operation, maintenance and rehabilitation will be prepared. This should include inspections, evaluations, modifications and upgrades of the dams to ensure that they meet safety standards	☐	
		Emergency action plans will be prepared. Training will be provided to dam operators.	☐	
		Safety exercises will also involve the local government officials and community.	☐	
		A periodic and thorough review of the rainfall and runoff characteristics as well as the identification of other changes in the hydrology of the basin will be undertaken to monitor the changes in the hydrologic characteristics of the stream basin	☐	
Risk of erosion and landslide	☐	Stabilization measures will be undertaken	☐	
Construction	☐	Construction waste (excess rock and soil, demolition waste, etc.) will be disposed at (location)	☐	
		All properties, utility lines and other structures damaged during the construction will be restored	☐	

Social Assessment

Socio-economic and Livelihood Impacts

1. What are the existing social livelihood system and common property resource management system of the communities? _____

2. Access to government facilities for health and education, and to drinking water _____

3. What are the pattern of existing conflicts, and existing mechanism of conflict resolution for areas under cultivation and grazing lands? Are there any potential conflicts between the upstream and downstream communities? _____

4. What are the benefits perceived by communities of dams (please consult men and women separately) _____

5. What role local institutions and communities will have in management and operation of the dam _____

6. Assessment of the potential conflicts between lower and upper riparian communities if any (history of conflicts in the area, claims on lands, disputes etc.) _____

7. How was the process of consultation carried out, conducted and documented –with communities above and below the proposed dam site? _____

8. Cultural and religious sites of community significance in the area to be submerged _

Gender Analysis and Impacts

9. What level of consultation with men and women for the project was carried out? ____

10. Who is the target (both direct and indirect) of the proposed project? Who will benefit? Who will lose? _____

11. How marginalized communities will benefit by this project? _____

12. Cultural, social and religious constraints to community participation (men and women) if any _____

Section V: Undertaking

I, _____ (full name and address) as proponent for
_____ (name, description and location of
project) do hereby solemnly affirm and declare:

1. The information on the proposed project and the environment provided in Forms I, II and III are correct to the best of my knowledge
2. I fully understand and accept the conditions contained in the Guidelines for _____
(name, number and version of the guidelines)
3. I undertake to design, construct and operate the project strictly in
accordance with the project described in Form I, submitted with this
undertaking.
4. I undertake to implement all mitigation measures and undertake
monitoring stated in Form IV, submitted with this undertaking.

Date _____

Signature _____
Name _____
Designation _____
(with official stamp/seal)

Witnesses:

	Signature	Name	Address
1	_____	_____	_____
	_____	_____	_____
2			

