



**GOVERNMENT OF PUNJAB
ENVIRONMENTAL PROTECTION AGENCY**



Environmental Assessment Checklists and Guidelines

Tube-well Construction for Agriculture and Irrigation Purposes

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1. Introduction

1.1 Background

Agriculture is one of the major contributors to the economy of Punjab and depends heavily on reliable water supplies for crop production. Although canal irrigation remains the principal source of irrigation water, groundwater extracted through tube-wells has become an increasingly important supplementary source, particularly in areas experiencing canal water shortages or unreliable rainfall. Tube-wells enable farmers to improve crop yields, cultivate high-value crops, and enhance agricultural productivity throughout the year.

Tube-wells are installed by drilling boreholes into underground aquifers and extracting groundwater using electric or diesel-powered pumps. Depending on groundwater conditions and irrigation demand, tube-wells may range from shallow installations serving individual farms to deep, high-capacity tube-wells supplying large agricultural areas.

In Punjab, agricultural tube-wells are constructed by private landowners, farmers, irrigation departments, agricultural development agencies, and public sector organizations. Groundwater abstraction and tube-well installation are regulated under applicable provincial laws and policies, while environmental oversight is provided under the Punjab Environmental Protection Act and related regulations.

Although tube-wells provide substantial agricultural and economic benefits, poorly planned or excessive groundwater abstraction may result in declining groundwater levels, deterioration of groundwater quality, increased soil salinity, excessive energy consumption, and adverse impacts on nearby ecosystems and water users. Construction activities may also generate temporary environmental impacts such as dust, noise, drilling waste, soil disturbance, and occupational health and safety risks.

These Guidelines assist proponents in preparing IEE reports that meet PEPA 1997, Punjab Groundwater Act 2023, and international good practice for sustainable groundwater use.

1.2 Purpose of the Guidelines

These Environmental Assessment Guidelines have been prepared to assist project proponents, farmers, consultants, contractors, and regulatory authorities in identifying, assessing, and mitigating the potential environmental and social impacts associated with the planning, construction, operation, maintenance, rehabilitation, and decommissioning of tube-wells for agricultural and irrigation purposes.

The guidelines provide practical guidance for the environmentally sound siting, design, construction, and operation of tube-wells to ensure the sustainable use and protection of groundwater resources. They promote measures to minimize adverse impacts on land, soil, groundwater, surface water, biodiversity, air quality, and surrounding communities, while enhancing water-use efficiency and supporting sustainable agricultural development.

The guidelines also encourage the adoption of good engineering practices, efficient irrigation techniques, groundwater conservation measures, pollution prevention, proper waste management, occupational and community health and safety, and energy-efficient pumping

systems. Particular emphasis is placed on preventing groundwater depletion, protecting groundwater quality, reducing soil salinity and waterlogging, and improving the long-term sustainability of irrigation systems.

These guidelines are intended to facilitate compliance with the Punjab Environmental Protection Act, 1997 (as amended), the Punjab Environmental Quality Standards (PEQS), the Punjab Environmental Protection Agency Review of Initial Environmental Examination and Environmental Impact Assessment Regulations, 2022, and other applicable environmental laws, regulations, and sector-specific standards. Their ultimate objective is to promote environmentally responsible groundwater development that supports agricultural productivity, conserves natural resources, and safeguards environmental quality for present and future generations.

1.3 Scope of Guidelines

These Environmental Assessment Guidelines apply to the planning, siting, design, construction, operation, maintenance, rehabilitation, and decommissioning of tube-wells for agricultural and irrigation purposes in province of Punjab. They cover both public and private sector projects, including new tube-wells, replacement or deepening of existing tube-wells, and associated infrastructure such as pumps, pump houses, electrical installations, water conveyance systems, and ancillary facilities.

The guidelines identify potential environmental and social impacts throughout the project lifecycle and provide practical mitigation measures, environmental monitoring requirements, and checklists to promote sustainable groundwater development and environmental protection. They are intended for use by project proponents, farmers, consultants, contractors, and regulatory authorities to facilitate compliance with the Punjab Environmental Protection Act, 1997 (as amended), the Punjab Environmental Quality Standards (PEQS), and other applicable environmental laws and regulations.

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 Punjab Environmental Protection Agency for evaluation. Punjab EPA 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

Aquifer: is a saturated geological unit (eg. sands, gravels, fractured rock) which can yield water to wells at a sufficient rate to support beneficial uses. **Contamination** introduction of impurities in the environment

Cone of Depression: (or "influence") is the draw-down of the water table or potentiometric surface that happens when a well is pumped. The drawdown cones of two wells close together may overlap so that if the wells are pumped simultaneously, they will compete with each other for available groundwater (well interference).

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.

Groundwater: is water that occurs in the subsurface below the water table.

Gradient: the property possessed by a line or surface that departs from the horizontal

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.

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.

Permeability: is the ability of an aquifer or water-bearing formation to allow water to pass through it. Permeability is also known as effective porosity because it is a function of interconnected saturated pore spaces.

Potable Water: is the water fit for human consumption.

Pollution: the presence in the environment or the introduction into it, of substances that have harmful or unpleasant effects

Regulations: means the Punjab Environmental Protection Agency Review of Initial Environmental Examination and Environment Impact Assessment Regulations, 2022

Saturated Zone: is the zone below and including the water table in which all pore spaces or fissures are totally filled with water. Also referred to as the phreatic zone.

Transmissivity: means the rate at which groundwater can flow through an aquifer section of unit width under a unit hydraulic gradient. It is the average permeability of a section of the entire aquifer at a given location multiplied by the thickness of the formation.

Water Table: The top of the zone in which all pore spaces or fissures are totally filled with water.

2. Project Profile

2.1 Description

2.1 Project Description

The proponent, after consulting sections environmental checklist and guidelines should provide a concise description of the proposed project, which may include and not limited to followings:

- Name of the project
- Project location (district, tehsil, mouza, and coordinates)
- Nature of the project (new or expansion)
- 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
- Name of Hydrogeologist/Assessor & Qualification.
- Purpose: Crop type, area to be irrigated (acres)
- Design Details: Depth, diameter, casing material, screen interval, pump type & HP
- Power Source: Grid / Diesel / Solar. If solar, capacity in KW
- Expected Abstraction Rate: m³/hour and m³/year. Is a flow meter proposed? Yes/No
- Water Use Efficiency: Flood / Furrow / Drip / Sprinkler proposed?
- Aquifer Type: Confined / Unconfined. Name of aquifer if known
- Current Water Table Depth: m bgl. Source: PWRI/PIDA data
- Aquifer Recharge Rate & Safe Yield: As per Irrigation Dept
- Water Quality: TDS, EC, SAR from nearest well. Attach lab report
- Cumulative Impact: Number of existing tube-wells within 1km radius
- Drilling Method: Rotary / Percussion
- Drilling Mud & Waste Disposal Plan
- Construction Period & Workforce

3. Environmental Impacts

3.1 Pre-Construction Phase

- i. Site selection
- ii. Hydrogeological investigation
- iii. Groundwater assessment
- iv. Design of tube-well
- v. Mobilization of drilling equipment

3.2 Construction

- i. Site clearance
- ii. Drilling of borehole

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- iii. Installation of casing and screens
- iv. Gravel packing
- v. Well development
- vi. Installation of pump and motor
- vii. Construction of pump platform
- viii. Electrical connection or diesel engine installation

3.3 Operational Phase

- i. Groundwater abstraction
- ii. Irrigation water distribution
- iii. Pump operation
- iv. Routine maintenance
- v. Water quality testing
- vi. Pump replacement when required

3.4 Major Environmental Impacts

- i. Excessive groundwater abstraction
- ii. Decline in groundwater table
- iii. Groundwater quality deterioration
- iv. Salinity and waterlogging
- v. Soil erosion around discharge points
- vi. Disposal of drilling mud and drilling waste
- vii. Dust generation
- viii. Noise from drilling rigs
- ix. Oil and fuel leakage
- x. Damage to agricultural land
- xi. Loss of vegetation
- xii. Increased energy consumption
- xiii. Greenhouse gas emissions from diesel pumps
- xiv. Occupational accidents
- xv. Electrocution risks
- xvi. Community safety concerns
- xvii. Waste generation during maintenance

Table-3.1 describes the summary of potential environmental impacts of different activities associated with the various phases of construction of Tube-well for Agriculture and Irrigation Purposes

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Table- 3.1 Environmental Impacts of Tube-well Construction for Agriculture and Irrigation Projects

Project Phase	Project Activity	Potential Environmental Impacts
Pre-Construction Phase	Site selection	• Encroachment on environmentally sensitive areas. • Proximity to potential source of water pollution. • Loss of vegetation. • Acquisition of agricultural land. • Disturbance to natural drainage. • Conflicts over land ownership or water rights.
	Hydrogeological investigation	• Inadequate assessment of groundwater availability. • Improper site selection. • Interference with nearby tube-wells. • Overestimation of aquifer yield.
	Project planning and design	• Inappropriate well design. • Inadequate consideration of environmental and social impacts. • Inefficient water use.
	Mobilization of drilling equipment	• Temporary traffic disruption. • Dust generation. • Noise generation. • Damage to existing roads or agricultural fields.
Construction Phase	Site clearance	• Removal of vegetation. • Soil disturbance. • Habitat loss. • Generation of construction waste.
	Drilling of borehole	• Dust generation. • Noise and vibration. • Generation of drilling mud and spoil. • Soil contamination. • Surface water contamination. • Occupational health and safety risks.
	Installation of casing and well screen	• Groundwater contamination due to improper installation. • Generation of construction waste.
	Gravel packing and well development	• Disposal of excess gravel and drilling fluids. • Temporary increase in water turbidity. • Wastewater generation.
	Installation of pump and motor	• Minor land disturbance. • Oil or fuel leakage. • Electrical safety hazards. • Noise generation.
	Construction of pump house and platform	• Construction debris generation. • Dust emissions. • Noise generation. • Consumption of construction materials.
	Electrical connection or diesel engine installation	• Risk of electrocution. • Fuel leakage. • Air emissions from diesel engines. • Fire hazards.
Operational Phase	Groundwater abstraction	• Declining groundwater table. • Depletion of aquifers. • Reduced water availability for neighboring users. • Land subsidence (where applicable).
	Irrigation water application	• Waterlogging. • Secondary soil salinity. • Inefficient water use. • Runoff carrying fertilizers and pesticides.

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	Pump operation	• Energy consumption. • Greenhouse gas emissions (diesel pumps). • Operational noise.
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Project Phase	Project Activity	Potential Environmental Impacts
	Routine maintenance	• Generation of waste oil and lubricants. • Used filters and worn-out parts. • Temporary interruption of irrigation supply.
	Water quality monitoring	• Generation of laboratory waste (where applicable). • Improper handling of sampling chemicals.
Maintenance and Rehabilitation Phase	Well cleaning and rehabilitation	• Disposal of sediments and sludge. • Wastewater generation. • Temporary deterioration of water quality.
	Pump replacement and repairs	• Generation of scrap metal. • Electrical waste. • Used oil and damaged components. • Occupational health and safety risks.
	Replacement of electrical equipment	• Disposal of damaged electrical equipment. • Electrocution hazards. • Generation of hazardous waste (where applicable).
Decommissioning Phase	Abandonment of tube-well	• Groundwater contamination if boreholes are left unsealed. • Safety hazards from open boreholes. • Visual impacts on the landscape.
	Removal of equipment	• Demolition waste generation. • Scrap metal generation. • Minor soil disturbance. • Site restoration requirements.
	Site restoration	• Temporary dust generation. • Land grading impacts. • Vegetation restoration requirements. • Disposal of remaining waste materials.

4. Environmental Mitigation Measures

4.1 Groundwater Management

- Conduct hydrogeological investigations before drilling.
- Install tube-wells only where sustainable groundwater is available.
- Limit groundwater abstraction to sustainable yield.
- Monitor groundwater levels periodically.
- Promote water-efficient irrigation methods such as drip and sprinkler irrigation.

4.2 Soil Protection

- Minimize disturbance to agricultural land.
- Restore disturbed land after drilling.
- Prevent soil erosion around discharge channels.

4.3 Water Quality Protection

- Properly seal the annular space around the casing.

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- Prevent contamination during drilling.
- Maintain sanitary protection around the wellhead.
- Locate tube-wells away from potential sources of pollution e.g. septic tanks and waste disposal sites. (**Table-4.1** describe the guidelines to locate the tube well away from various sources of water pollution).
- Locate tubewell upgradient (uphill) of nearby potential sources of pollution

4.4 Waste Management

- Dispose of drilling mud at approved locations.
- Reuse excavated materials where feasible.
- Collect used oil and filters separately.

4.5 Air Quality

- Sprinkle water to suppress dust.
- Properly maintain drilling equipment.
- Minimize unnecessary engine idling.

4.6 Noise

- Restrict drilling to daytime hours.
- Maintain drilling machinery.
- Provide hearing protection to workers.

4.7 Occupational Health and Safety

- Provide PPE.
- Install electrical protection devices.
- Train operators.
- Maintain first-aid facilities.

4.8 Energy Conservation

- Use high-efficiency pumps.
- Maintain pumps regularly.
- Promote solar-powered pumps where feasible.

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Table-4.1 Recommended minimum distance of tube well from potential pollution source (s)

No.	Sources of Pollution	Recommended minimum distance of tube well from potential pollution source (m)
Possible Source of Contamination		
i.	Garbage dumps/refuse piles, car repair or fuel (petrol) sales outlets, industrial operations/storage facilities etc	100
ii.	Seepage pit or cesspool	50
iii.	Pit toilets, animal pens, barns, fields fertilized with dung	30
iv.	Septic tank, surface water body	15
v.	Drain, ditch, house	7
Environmentally Sensitive Objects		
i.	Recognized wetland of ecological importance	500
ii.	Archeological remains or archeologically important building or structure	250
iii.	Shrines and large graveyards	100
iv.	Isolated graves	20
Location vis-a-vis to other sources		
i.	Existing tube-well	100
ii.	Existing dug well	100

Source: Adapted from World Health Organization (WHO) guidance on the sanitary protection of groundwater sources and **Guidelines for Drinking-water Quality** (WHO, 4th Edition and subsequent updates).

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 or Organization) _____
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. Well Location _____
13. Cost of the Well _____
14. Proposed Depth _____
15. Expected Yield _____
16. Expected Daily Discharge _____
17. Pump Size _____
18. Energy Source _____
19. Land Area Required _____ m²
20. Purpose of the Well _____
21. Brief Project Description _____

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Please attach a plot plan of the proposed well site showing the location of the key structures, access, utilities, units, etc.

22. Who will maintain the well? _____

Construction

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

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

25. Are there any encroachers on the land? _____

If yes, please specify

Number of encroachers _____

Will any compensation be paid to them? _____

26. Are there any structures on the proposed site now? ☐ Yes ☐ No

27. If yes, will any structure be demolished? ☐ Yes ☐ No

28. If yes, where the demolition waste will be disposed? _____

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

30. Will any tree be removed? ☐ Yes ☐ No

If yes, how many? _____

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

32. Is drilling work during the night planned? ☐ Yes ☐ No

33. What kind of drilling equipment will be used (percussion, rotary, etc.)? _____

Section II: Screening

34. Nearest drinking water well within 500m? ☐ Yes ☐ No Distance: _____

35. Is the area notified as "Critical/Over-Exploited" by Groundwater Act? ☐ Yes ☐ No

36. Proximity to canal, drain, wetland, protected area

37. Soil type and risk of waterlogging/salinization

38. Dependent communities: Small farmers, women, landless

39. Is the proposed well or any of the area that it will irrigate in an ecologically sensitive area? ☐ Yes ☐ No

40. Is the cost of the proposed well Rupees one million or more? ☐ 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

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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 500 m of the proposed site?

☐ Yes ☐ No

If yes, please describe (where, nature) _____

3. Is there any surface water body (river, canal, stream, lake, wetland) within 1,000 m of the proposed site?

☐ Yes ☐ No

If yes, describe each water body:

Name (including type, ie, river, canal or stream)	Dimensions	Status and Uses (Is it polluted? Is domestic or other wastewater discharged to it? What are its uses, eg, agriculture, domestic, industrial, washing, fishery)

4. Is there any other 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)

5. Will project affect access to drinking water of nearby households? ☐Yes ☐No

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6. Consultation held with local community? ☐Yes ☐No Attach record
7. Grievance redress mechanism in place? ☐Yes ☐No

8. Are there any reserved forest or protected area within 1,000 m of the proposed site?

☐ Yes ☐ No

If yes, please describe? _____

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

☐ Generally clean
☐ Fair
☐ Poor

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

☐ Yes ☐ No

What is the source of the odor? _____

11. 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? _____

Section IV: Impact Assessment

Potential Negative Environmental Impacts	Tick, if relevant	Mitigation Measures	Tick, if proposed	Monitoring
Unsuitable site selection	☐	Tube-well will not be located in environmentally sensitive areas or flood-prone locations. Tube-well will be located at a safe distance from septic tanks, sewer lines, livestock sheds, waste disposal sites, and chemical storage areas.	☐ ☐	
Groundwater depletion	☐	Install flow meter. 2. Abstraction within safe yield. Groundwater abstraction will remain within sustainable limits based on hydrogeological investigations. Groundwater levels will be monitored periodically.	☐ ☐	
Drawdown, interference with neighbors	☐	Rainwater harvesting/recharge pit Wellhead will be protected from surface runoff and pollutants.	☐ ☐	
Water Quality (Salinization, contamination from drilling mud)	☐	Borehole casing will be properly sealed to prevent contamination. 2. Disposal of drilling waste in lined pit away from water bodies	☐ ☐	
Energy & Climate (GHG from diesel, high energy use)	☐	Prioritize solar pumps. Use energy efficient pumps and motors Calculate annual CO2 emissions	☐ ☐	
Soil erosion Waterlogging, salinization	☐	Drainage channels and discharge areas will be stabilized. Disturbed areas will be restored after drilling. Conjunctive use with canal water. Promote drip/sprinkler for water-	☐ ☐ ☐ ☐	

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		intensive crops		
Dust generation	☐	Water will be sprinkled on exposed surfaces during drilling.	☐	
Noise pollution	☐	Drilling equipment will be properly maintained and noisy activities limited to daytime.	☐	
Drilling waste	☐	Drilling mud and spoil will be collected and disposed of at approved locations.	☐	
Fuel and oil spills	☐	Fuel and lubricants will be stored in designated areas with spill prevention measures.	☐	
Social (Inequity in water access, impact on poor)	☐	Ensure no impact on public drinking wells. Benefit-sharing plan for community	☐ ☐	
OHS (Rig accidents, electrical hazards)	☐	Workers will be provided with PPE, first-aid facilities, and safety training. Guarding of rotating parts. Electrical installations will comply with safety standards and be properly grounded. IFC OHS compliance	☐ ☐ ☐ ☐	
Loss of vegetation	☐	Vegetation clearance will be minimized and disturbed land restored. Intensive crops	☐ ☐	
Community safety	☐	Drilling area will be barricaded and warning signs installed.	☐	

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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 operate within approved abstraction limits and will install metering
5. I undertake to implement all mitigation measures and undertake monitoring stated in Form IV, submitted with this undertaking.
6. I undertake to decommission well as per WHO guidelines if abandoned and will comply with Punjab Groundwater Act 2023

Date _____

Signature _____

Name _____

Designation _____

(with official stamp/seal)

Witnesses:

Signature

Name

Address

1

2
