



**Environmental and Social Management Framework
(ESMF)
Annexes**

Punjab Resilient and Inclusive Agriculture Transformation (PRIAT)

**Department of Agriculture,
Government of Punjab**

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Annex A: World Bank Group Environmental, Health and Safety Guidelines

Workers Occupational Health and Community Health and Safety Guidelines

Workers health and safety guidelines

Employers and supervisors are obliged to implement all reasonable precautions to protect the health and safety of workers. This section provides guidance and examples of reasonable precautions to implement in managing principal risks to occupational health and safety. Although the focus is placed on the operational phase of projects, much of the guidance also applies to construction and decommissioning activities.

Companies should hire contractors that have the technical capability to manage the occupational health and safety issues of their employees, extending the application of the hazard management activities through formal procurement agreements.

Preventive and protective measures should be introduced according to the following order of priority:

- *Providing appropriate personal protective equipment (PPE)* in conjunction with training, use, and maintenance of the PPE.
- The application of prevention and control measures to occupational hazards should be based on comprehensive job safety or job hazard analyses.

General Facility Design and Operation

Integrity of Workplace Structures

Permanent and recurrent places of work should be designed and equipped to protect OHS:

- Surfaces, structures and installations should be easy to clean and maintain, and not allow for accumulation of hazardous compounds.
- Buildings should be structurally safe, provide appropriate protection against the climate, and have acceptable light and noise conditions.
- Fire resistant, noise-absorbing materials should, to the extent feasible, be used for cladding on ceilings and walls.
- Floors should be level, even, and non-skid.
- Heavy oscillating, rotating or alternating equipment should be located in dedicated buildings or structurally isolated sections.

Severe Weather and Facility Shutdown

- Work place structures should be designed and constructed to withstand the expected elements for the region and have an area designated for safe refuge, if appropriate.

Workspace and Exit

- The space provided for each worker, and in total, should be adequate for safe execution of all activities, including transport and interim storage of materials and products.
- Passages to emergency exits should be unobstructed at all times.
- Exits should be clearly marked to be visible in total darkness. The number and capacity of emergency exits should be sufficient for safe and orderly evacuation of the greatest number of people present at any time, and there should be a minimum two exits from any work area.
- Facilities also should be designed and built taking into account the needs of disabled persons.

Fire Precautions

The workplace should be designed to prevent the start of fires through the implementation of fire codes applicable to industrial settings. Other essential measures include:

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- Equipping facilities with fire detectors, alarm systems, and fire-fighting equipment. The equipment should be maintained in good working order and be readily accessible. It should be adequate for the dimensions and use of the premises, equipment installed, physical and chemical properties of substances present, and the maximum number of people present.
 - Provision of manual firefighting equipment that is easily accessible and simple to use
 - Fire and emergency alarm systems that are both audible and visible

The IFC Life and Fire Safety Guideline should apply to buildings accessible to the public.

Lavatories and Showers and laundry

- Adequate lavatory facilities (toilets and washing areas) should be provided for the number of people expected to work in the facility and allowances made for segregated facilities, or for indicating whether the toilet facility is "In Use" or "Vacant". Toilet facilities should also be provided with adequate supplies of hot and cold running water, soap, and hand drying devices.
- Where workers may be exposed to substances poisonous by ingestion and skin contamination may occur, facilities for showering and changing into and out of street and work clothes should be provided.
- Adequate laundry facilities should be provided.

Potable Water Supply

- Adequate supplies of potable drinking water should be provided from a fountain with an upward jet or with a sanitary means of collecting the water for the purposes of drinking.
- Water supplied to areas of food preparation or for the purpose of personal hygiene (washing or bathing) should meet drinking water quality standards

Clean Eating Area

1. Where there is potential for exposure to substances poisonous by ingestion, suitable arrangements are to be made for provision of clean eating areas where workers are not exposed to the hazardous or noxious substances

Lighting

2. Workplaces should, to the degree feasible, receive natural light and be supplemented with sufficient artificial illumination to promote workers' safety and health, and enable safe equipment operation. Supplemental 'task lighting' may be required where specific visual acuity requirements should be met.
3. Emergency lighting of adequate intensity should be installed and automatically activated upon failure of the principal artificial light source to ensure safe shut-down, evacuation, etc.

Safe Access

- Passageways for pedestrians and vehicles within and outside buildings should be segregated and provide for easy, safe, and appropriate access
- Equipment and installations requiring servicing, inspection, and/or cleaning should have unobstructed, unrestricted, and ready access
- Openings should be sealed by gates or removable chains
- Covers should, if feasible, be installed to protect against falling items
- Measures to prevent unauthorized access to dangerous areas should be in place

First Aid

- The employer should ensure that qualified first-aid can be provided at all times. Appropriately equipped first-aid stations should be easily accessible throughout the place of work.
 - Eye-wash stations and/or emergency showers should be provided close to all workstations where immediate flushing with water is the recommended first-aid response.
 - Where the scale of work or the type of activity being carried out so requires, dedicated and appropriately equipped first-aid room(s) should be provided. First aid stations and rooms should
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be equipped with gloves, gowns, and masks for protection against direct contact with blood and other body fluids

- Remote sites should have written emergency procedures in place for dealing with cases of trauma or serious illness up to the point at which patient care can be transferred to an appropriate medical facility.

Air Supply

- Sufficient fresh air should be supplied for indoor and confined work spaces. Air distribution systems should be designed so as not to expose workers to draughts
- Mechanical ventilation systems should be maintained in good working order. Point-source exhaust systems required for maintaining a safe ambient environment should have local indicators of correct functioning.
- Re-circulation of contaminated air is not acceptable. Air inlet filters should be kept clean and free of dust.

Work Environment Temperature

- 4.1.1. The temperature in work, rest room and other welfare facilities should, during service hours, be maintained at a level appropriate for the purpose of the facility.

Communication and Training

Occupational Health and Safety (OHS) Training

- Provisions should be made to provide OHS orientation training to all new employees to ensure they are apprised of the basic site rules of work at / on the site and of personal protection and preventing injury to fellow employees.
- Training should consist of basic hazard awareness, site-specific hazards, safe work practices, and emergency procedures for fire, evacuation, and natural disaster, as appropriate. Any site-specific hazard or color coding in use should be thoroughly reviewed as part of orientation training.

New Task Employee and Contractor Training

The employer should ensure that workers and contractors, prior to commencement of new assignments, have received adequate training and information enabling them to understand work hazards and to protect their health from hazardous ambient factors that may be present. The training should adequately cover:

- Knowledge of materials, equipment, and tools
- Known hazards in the operations and how they are controlled
- Potential risks to health
- Precautions to prevent exposure
- Hygiene requirements
- Wearing and use of protective equipment and clothing
- Appropriate response to operation extremes, incidents and accidents

Prevention and Protection Measure

Prevention and protection measures should be implemented whenever a worker is exposed to the hazard of falling more than two meters; into operating machinery; into water or other liquid; into hazardous substances; or through an opening in a work surface. Fall prevention / protection measures may also be warranted on a case-specific basis when there are risks of falling from lesser heights. Fall prevention may include:

- a) Proper use of ladders and scaffolds by trained employees.
- b) Use of fall prevention devices, including safety belt and lanyard travel limiting devices to prevent access to fall hazard area, or fall protection devices such as full body harnesses used in conjunction with shock absorbing lanyards.
- c) Appropriate training in use, serviceability, and integrity of the necessary PPE
- d) Inclusion of rescue and/or recovery plans, and equipment to respond to workers after an arrested fall.

Personal Protective Equipment (PPE)

Personal Protective Equipment (PPE) provides additional protection to workers exposed to workplace hazards in conjunction with other facility controls and safety systems. PPE is considered to be a last resort that is above and beyond the other facility controls and provides the worker with an extra level of personal protection. Recommended measures for use of PPE in the workplace include:

1. Active use of PPE if alternative technologies, work plans or procedures cannot eliminate, or sufficiently reduce, a hazard or exposure.
2. Identification and provision of appropriate PPE that offers adequate protection to the worker, co-workers, and occasional visitors, without incurring unnecessary inconvenience to the individual.
3. Proper maintenance of PPE, including cleaning when dirty and replacement when damaged or worn out. Proper use of PPE should be part of the recurrent training programs for employees. Selection of PPE should be based on the hazard and risk ranking.

Accidents and Diseases monitoring

The employer should establish procedures and systems for reporting and recording:

- Occupational accidents and diseases
- Dangerous occurrences and incidents

These systems should enable workers to report immediately to their immediate supervisor any situation they believe presents a serious danger to life or health. The systems and the employer should further enable and encourage workers to report to management all:

- a) Occupational injuries and near misses
- b) Suspected cases of occupational disease
- c) Dangerous occurrences and incidents

All reported occupational accidents, occupational diseases, dangerous occurrences, and incidents together with near misses should be investigated with the assistance of a person knowledgeable/competent in occupational safety.

The investigation should:

- a) Establish what happened
- b) Determine the cause of what happened
- c) Identify measures necessary to prevent a recurrence

Community Health and Safety

This section complements the guidance provided in the preceding environmental and occupational health and safety sections, specifically addressing some aspects of project activities taking place outside of the traditional project boundaries, but nonetheless related to the project operations, as may be applicable on a project basis. These issues may arise at any stage of a project life cycle and can have an impact beyond the life of the project.

Water Quality and Availability

Project activities involving wastewater discharges, water extraction, diversion or impoundment should prevent adverse impacts to the quality and availability of groundwater and surface water resources.

Water Quality

Drinking water sources, whether public or private, should at all times be protected so that they meet or exceed applicable national acceptability standards or in their absence the current edition of WHO Guidelines for Drinking-Water Quality. Air emissions, wastewater effluents, oil and hazardous materials must not degrade soil and water resources.

Where the project includes the delivery of water to the community or to users of facility infrastructure (such as hotel hosts and hospital patients), where water may be used for drinking, cooking, washing, and bathing, water quality should comply with national acceptability standards or in their absence the current edition of with WHO Drinking Water Guidelines.

Any dependency factors associated with the delivery of water to the local community should be planned for and managed to ensure the sustainability of the water supply by involving the community in its management to minimize the dependency in the long-term.

Structural Safety of Project Infrastructure

Reduction of potential hazards is best accomplished during the design phase when the structural design, layout and site modifications can be adapted more easily. The following issues should be considered and incorporated as appropriate into the planning, siting, and design phases of a project:

- Incorporation of siting and safety engineering criteria to prevent failures due to natural risks posed by earthquakes, tsunamis, wind, flooding, landslides and fire.
- All project structures should be designed in accordance with engineering and design criteria mandated by site-specific risks, including but not limited to seismic activity, slope stability, wind loading, and other dynamic loads
- Application of locally regulated building codes to ensure structures are designed and constructed in accordance with sound architectural and engineering practice, including aspects of fire prevention and response
- Engineers and architects responsible for designing and constructing facilities, building, plants and other structures should certify the applicability and appropriateness of the structural criteria employed.

Although major design changes may not be feasible during the operation phase of a project, hazard analysis can be undertaken to identify opportunities to reduce the consequences of a failure or accident.

Emergency Response Plan

An Emergency Response Plan is a set of scenario-based procedures to assist staff and emergency response teams during real life emergency and training exercises. This chapter of the Fire and Life Safety Master Plan should include an assessment of local fire prevention and suppression capabilities.

Specific Requirements for Existing Buildings

All life and fire safety guidelines for new buildings apply to existing buildings programmed for renovation.

- 2.1 A suitably qualified professional conducts a complete life and fire safety review of existing buildings slated for renovation.
- 2.2 The findings and recommendations of the review are used as the basis to establish the scope of work of a Corrective Action Plan and a time frame for implementing the changes.
- 2.3 If it becomes apparent that life and fire safety conditions are deficient in an existing building that is not part of the project or that has not been programmed for renovation, a life and fire safety review of the building may be conducted by a suitably qualified professional. The findings and recommendations of the review are used as the basis to establish the scope of work of a Corrective Action Plan and a time frame for implementing the changes.
- 2.4 All such structures should be designed in accordance with the criteria mandated by situation-, climatic-, and geology-specific location risks (e.g., seismic activity, wind loading, and other dynamic loads).
- 2.5 Structural engineers and architects responsible for facilities, buildings, plants and structures should certify the applicability and appropriateness of the design criteria employed.

Traffic Safety:

Traffic accidents have become one of the most significant causes of injuries and fatalities among members of the public worldwide. Traffic safety should be promoted by all project personnel during displacement to and from the workplace, and during operation of project equipment on private or public roads. Prevention and control of traffic related injuries and fatalities should include the adoption of safety measures that are protective of project workers and of road users, including those who are most vulnerable to road traffic accidents.

Road safety initiatives proportional to the scope and nature of project activities should include:

- Adoption of best transport safety practices across all aspects of project operations with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public.
 - Emphasizing safety aspects among drivers
 - Improving driving skills and requiring licensing of drivers
 - Adopting limits for trip duration and arranging driver rosters to avoid overtiredness
 - Avoiding dangerous routes and times of day to reduce the risk of accidents
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- Use of speed control devices (governors) on trucks, and remote monitoring of driver actions
- Regular maintenance of vehicles and use of manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.

Where the project may contribute to a significant increase in traffic along existing roads, or where road transport is a significant component of a project, recommended measures include:

- i) Minimizing pedestrian interaction with construction vehicles
- ii) Collaboration with local communities and responsible authorities to improve signage, visibility and overall safety of roads, particularly along stretches located near schools or other locations where children may be present.
- iii) Collaborating with local communities on education about traffic and pedestrian safety (e.g., school education campaigns)
- iv) Coordination with emergency responders to ensure that appropriate first aid is provided in the event of accidents
- v) Using locally sourced materials, whenever possible, to minimize transport distances. Locating associated facilities such as worker camps close to project sites and arranging worker bus transport to minimize external traffic.

Incident Investigation:

Incidents can provide valuable information about transportation hazards and the steps needed to prevent accidental releases. The implementation of incident investigation procedures should ensure that:

- ❖ Investigations are initiated promptly
- ❖ Summaries of investigations are included in a report
- ❖ Report findings and recommendations are addressed

Employee Participation:

There should be a written plan of action regarding the implementation of active employee participation in the prevention of accidents.

Contractors: The plan should include procedures to ensure that:

- ▮ The contractor is provided with safety performance procedures and safety and hazard information
- ▮ Contractors observe safety practices
- ▮ Verify that the contractor acts responsibly

The plan should also include additional procedures to ensure the contractors will:

- ▮ Ensure appropriate training for their employees
- ▮ Ensure their employees know process hazards and applicable emergency actions
- ▮ Prepare and submit training records
- ▮ Inform employees about the hazards presented by their work

6 Training:

7 Good training programs on operating procedures will provide the employees with the necessary information to understand how to operate safely and why safe operations are needed. The training program should include:

- 4.1 The list of employees to be trained
- 4.2 Specific training objectives
- 4.3 Mechanisms to achieve objectives (i.e. hands-on workshops, videos, etc.)
- 4.4 Means to determine the effectiveness of the training program
- 4.5 Training procedures for new hires and refresher programs

Disease Prevention

Communicable Diseases

Communicable diseases pose a significant public health threat worldwide. Health hazards typically associated with large development projects are those relating to poor sanitation and living conditions, sexual transmission and vector-borne infections. Communicable diseases of most concern during the construction phase due to labor

mobility are sexually-transmitted diseases (STDs), such as HIV/AIDS. Recognizing that no single measure is likely to be effective in the long term, successful initiatives typically involve a combination of behavioral and environmental modifications.

Recommended interventions at the project level include providing surveillance and active screening and treatment of workers

Preventing illness among workers in local communities by:

- 1.1 Undertaking health awareness and education initiatives.
- 1.2 Training health workers in disease treatment
- 1.3 Conducting immunization programs for workers in local communities to improve health and guard against infection
- 1.4 Providing health services
- 1.5 Providing treatment through standard case management in on-site or community health care facilities.
- 1.6 Ensuring ready access to medical treatment, confidentiality and appropriate care, particularly with respect to migrant workers
- 1.7 Promoting collaboration with local authorities to enhance access of worker's families and the community to public health services and promote immunization

Vector-Borne Diseases

Reducing the impact of vector-borne disease on the long-term health of workers is best accomplished through implementation of diverse interventions aimed at eliminating the factors that lead to disease. Project sponsors, in close collaboration with community health authorities, can implement an integrated control strategy for mosquito and other arthropod-borne diseases that might involve:

1. Prevention of larval and adult propagation through sanitary improvements and elimination of breeding habitats close to human settlements
 2. Elimination of unusable impounded water
 3. Considering the application of residual insecticide to dormitory walls
 4. Implementation of integrated vector control programs
 5. Promoting use of repellents, clothing, netting, and other barriers to prevent insect bites
 6. Monitoring and treatment of circulating and migrating populations to prevent disease reservoir spread
 7. Collaboration and exchange of in-kind services with other control programs in the project area to maximize beneficial effects
 8. Educating project personnel and area residents on risks, prevention, and available treatment
 9. Monitoring communities during high-risk seasons to detect and treat cases
 10. Following safety guidelines for the storage, transport, and distribution of pesticides to minimize the potential for misuse, spills, and accidental human exposure
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Annex B: Comparison of International and Local Air Quality Standards

Sr. No.	Pollutants	USEPA		WHO/IFC		PEQS	
		Avg. Time	Standard	Avg. Time	Standard	Avg. Time	Standard
1	SO ₂	3 hrs	0.5 ppm	24 hr	20 ug/m ³	Annual Mean	80 ug/m ³
		1 hr	75 ppb	10 min	500 ug/m ³	24 hrs	120 ug/m ³
2	CO	8 hrs	9 ppm (11 mg/m ³)	-	-	8 hrs	5 mg/m ³
		1 hr	35 ppm (43 mg/m ³)	-	-	1 hr	10 mg/m ³
3	NO ₂	Annual Mean	100 ug/m ³ (53 ppb)	1 year	40 ug/m ³	Annual Mean	40 ug/m ³
		1 hr	100 ppb	1 hr	200 ug/m ³	24 hrs	80 ug/m ³
4	O ₃	8 hrs	0.07ppm (148 ug/m ³)	8 hrs. daily maximum	100 ug/m ³	1 hr	130 ug/m ³
5	Suspended Particulate	-	-	-	-	Annual Mean 24 hrs	360 ug/m ³ 500 ug/m ³
6	PM ₁₀	24 hrs	150 ug/m ³	1 yr	20 ug/m ³	Annual Mean	120 ug/m ³
				24 hr	50 ug/m ³	24 hrs	150 ug/m ³
7	PM _{2.5}	Annual Mean	15 ug/m ³ 35 ug/m ³	1 yr	10 ug/m ³	Annual Average	15 ug/m ³ 35 ug/m ³
		24 hrs		24 hr	25 ug/m ³	24 hrs 1 hr	15 ug/m ³

* In instances where the airshed is significantly degraded and the pollutant levels are already exceeding the ambient pollutant concentrations provided in the table above, it shall be ensured that the project activities cause as small an increase in pollution levels as feasible and amounts to a fraction of the applicable short term and annual average air quality guidelines or standards as established in the project specific environmental assessment.

https://www.ifc.org/wps/wcm/connect/4e01e089-ad1a-4986-b955-e19e1f305ff0/1-1_percent2BAir_percent2BEmissions_percent2Band_percent2BAmbient_percent2BAir_percent2BQuality.pdf?MOD=AJPERES&CVID=Is0KF2I

Annex C: Comparison of International and Local Noise Standards

Sr. No.	Category of Area/Zone	Limit in dB(A) Leq			
		PEQS		WHO/IFC	
		Day Time	Night Time	Day Time	Night Time
		06:00 – 22:00	22:00-06:00	07:00 – 22:00	22:00-07:00
1	Residential area (A)	55	45	55	45
2	Commercial area (B)	65	55	70	70
3	Industrial area (C)	75	65	70	70
4	Silence zone (D)	50	45	55	45

Annex D: Comparison of National and International Drinking Water Standards

Sr. No.	Parameter	Units	PEQS	WHO Standards
1	Temperature (During Sample Collection)	OC	NS	NS
2	Color	Pt-Co	≤15TCU	≤15TCU
3	pH	pH unit	6.5-8.5	6.5-8.5
4	Turbidity	NTU	<5	<5
5	Total, Hardness	mg/L	<500.00	NS
6	Total Dissolved Solid (TDS)	mg/L	<1000.00	<1000.00
7	Total Suspended Solid (TSS)	mg/L	NS	NS
8	Ammonia	mg/L	NS	NS
9	Fluoride F-	mg/L	≤1.50	1.50
10	Sulfate (SO ₄ -2)	mg/L	NS	NS
11	Chloride(Cl-)	mg/L	<250.00	250
12	Nitrate (NO ₃ -)	mg/L	≤50.00	50.00
13	Odor	-	Non Objectionable / Acceptable	Non Objectionable / Acceptable
14	Taste	-	Non Objectionable / Acceptable	Non Objectionable / Acceptable
15	Sodium	mg/L	NS	NS
16	Iodine	ppm	NS	NS
17	Arsenic (As)	mg/L	≤ 0.05	0.01
18	Iron (Fe 3+)	mg/L	NS	NS
19	Zinc (Zn 2+)	mg/L	5.0	3.0
20	Conductivity	μS/cm	NS	NS
21	Bicarbonate	mg/L	NS	NS
22	Nitrite	mg/L	≤3	3
23	Magnesium	mg/L	NS	NS
24	Calcium as Ca	mg/L	NS	NS
25	Phosphate	mg/L	NS	NS
26	Potassium	mg/L	NS	NS
27	Boron	mg/L	<0.3	0.3
28	SAR Iodine (I)	mg/L	NS	NS
29	Aluminum	mg/L	≤ 0.2	0.2
30	Antimony	mg/L	≤0.005	0.02
31	Cadmium	mg/L	0.01	0.003
32	Mercury	mg/L	≤0.001	0.001

<i>Sr. No.</i>	<i>Parameter</i>	<i>Units</i>	<i>PEQS</i>	<i>WHO Standards</i>
33	Nickel	mg/L	≤0.02	0.02
34	Selenium	mg/L	0.01	0.01
35	Barium	mg/L	0.7	0.7
36	Total Chromium	mg/L	≤0.05	0.05
37	Copper	mg/L	2	2
38	Lead	mg/L	≤0.05	0.01
39	Cyanide (CN)	mg/L	≤0.05	0.07
	Manganese	mg/L	<0.5	0.5
40	Total Coliforms	cfu/100ml	0/100 ml	0/100 ml
41	Fecal Coli forms (E.Coli)	cfu/ml	0/100 ml	0/100 ml

NS = Not Specified

Annex E: Environmental Monitoring, Sampling and Testing for Proposed Project

In order to determine the ambient air, background noise levels, water and wastewater quality of the study area one sample from northern/ upper Punjab (Rawalpindi), central Punjab (Sargodha) and lower / southern Punjab (Multan) were selected to have an idea for baseline information.

Tables 1 to 4 shows the monitored values of ambient air, noise, drinking water, surface water and wastewater respectively.

Table E1: Monitored Values of Ambient Air Quality

Sr. No.	Monitoring Points	Criteria Pollutants								
		CO ug/m ³	SO ₂ ug/m ³	NO ₂ ug/m ³	NO ug/m ³	PM ₁₀ ug/m ³	PM _{2.5} ug/m ³	SPM ug/m ³	O ₃ ug/m ³	Lead µg/Nm ³
		8 hr	24 hr	24 hr	24 hr	24 hr	24 hr	24 hr	1 hr	24 hr
1	District Rawalpindi ²	1.2	27.2	27.1	14.8	111.8	90.8	232.6	18.67	0.37
2	District Sargodha ³	0.96	16.49	18.12	13.47	141.6	39.7	216.8	18.31	0.057
3	District Multan ⁴	0.9	10.5	15.7	9.8	218	49.1	1925	32.2	1.2
	PEQS	5	120	80	40	150	35	500	130	1.5
	WHO / IFC	---	20	200 (1 hr)	---	50	25	---	100 (8 hr)	---

Table E2: Monitored Values of Ambient Noise Levels

Sr. No.	District	Comparison Values (PEQS)			WHO/IFC		Measured Noise Level dB(A)
		Time	Commercial dB(A)	Residential dB(A)	Commercial dB(A)	Residential dB(A)	
	District Rawalpindi	DT	65	55	70	55	56.5
		NT	55	45	70	45	52.0
	District Sargodha	DT	65	55	70	55	63.13
		NT	55	45	70	45	56.07
	District Multan	DT	65	55	70	55	77.1
		NT	55	45	70	45	73.0

DT=Day Time & NT= Night Time

² EIA Report of Rawalpindi Ring Road Project, 2020

³ EIA Report of Faisalabad- Sargodha Road, 2020

⁴ EIA Report of Multan Vehari Project, 2020

Table E3: Monitored Values of Drinking Water Quality

. No.	Parameters	Limits Values (PEQS)	WHO Standards	Concentration		
				District Rawalpindi	District Sargodha	District Multan
	pH	6.5 – 8.5	6.5-8.5	7.1	7.39	7.3
	Total Dissolved Solids (TDS)	<1000 mg/l	<1000 mg/l	935	1530	843 mg/l
	Chloride (as Cl ⁻)	<250 mg/l	250 mg/l	45	377	109 mg/l
	Cadmium (Cd)	0.01 mg/l	0.003 mg/l	0.002	<0.0028	ND
	Chromium (Cr)	≤ 0.05 mg/l	0.05 mg/l	BDL	<0.0054	ND
	Copper (Cu)	2 mg/l	2 mg/l	0.004	<0.0045	0.019 mg/l
	Lead (Pb)	≤ 0.05 mg/l	0.01 mg/l	0.0017	0.017	ND
	Manganese (Mn)	≤ 0.5 mg/l	0.5 mg/l	0.034	0.002	0.165 mg/l
	Nickel (Ni)	≤ 0.02 mg/l	0.02 mg/l	BDL	<0.008	ND
	Zinc (Zn)	5.0 mg/l	3 mg/l	0.0219	<0.0041	0.091 mg/l
	Aluminum (Al)	≤ 0.2 mg/l	0.2 mg/l	BDL	<0.028	0.111 mg/l
	Antimony (Sb)	≤0.005 mg/l	0.02 mg/l	BDL	ND	ND
	Arsenic (As)	≤ 0.05 mg/l	0.01 mg/l	BDL	0.03	ND
	Boron (B)	0.3 mg/l	0.3 mg/l	BDL	<0.1	0.458 mg/l
	Barium (Ba)	0.7 mg/l	0.7 mg/l	BDL	<0.031	0.119 mg/l
	Mercury (Hg)	≤ 0.001 mg/l	0.001 mg/l	BDL	ND	ND
	Selenium (Se)	0.01 mg/l	0.01 mg/l	BDL	ND	ND
	E. Coli	Must not be detectable in any 100mL sample	Must not be detectable in any 100mL sample	Nil	--	ND
	Fecal Coliform	Must not be detectable in any 100mL sample	Must not be detectable in any 100mL sample	Nil	18	ND
	Total Coliform Bacteria	---	Must not be detectable in any 100mL sample	Nil	6	ND
	Color	≤15 TCU	≤15TCU	Nil	<1.0	Nil
	Taste	Non-Objectionable/ Acceptable	Non Objectionable / Acceptable	Non- objectionable	Salty	Acceptable
	Odor	Non-Objectionable	Non Objectionable	Non- objectionable	Non- objectionable	Acceptable
	Turbidity	<5 NTU	<5 NTU	1.24	<0.1	10.2 NTU

. No.	Parameters	Limits Values (PEQS)	WHO Standards	Concentration		
				District Rawalpindi	District Sargodha	District Multan
	Total Hardness as CaCO ₃	<500 mg/l	NS	116	339	435 mg/l
	Cyanide	≤ 0.05 mg/l	0.07 mg/l	BDL	<0.01	0.04 mg/l
	Fluoride	≤ 1.5 mg/l	1.5 mg/l	1.3	<0.01	0.53 mg/l
	Nitrate	≤ 50 mg/l	50 mg/l	BDL	<0.01	0.34 mg/l
	Nitrite	≤ 3 mg/l	3 mg/l	BDL	1.2	0.03 mg/l
	Residual Chlorine	0.2 – 0.5 mg/l	NS	BDL	<0.1	0.5 mg/l

BDL: Below Detection Limit ND: Not Detectable

Table E4: Monitored Values of Surface Water/ Wastewater

Sr. No.	Parameters	Comparison Values (PEQS)	FAO ⁵ Standards	Concentration		
				District Rawalpindi	District Sargodha	District Multan
	Temperature	≤ 3 ⁰ C	--	14.5	24.5	23.3
	pH	6 – 9	6.0-8.5	7.01	8.15	8.3
	COD	150 mg/l	--	64	7	16
	TDS	3500 mg/l	0-2000	1200	238	503
	Chloride	1000 mg/l	0-1065	62	15.88	125
	Cadmium (Cd)	0.1 mg/l	--	0.0132	<0.0028	ND
	Chromium	1.0 mg/l	--	0.008	<0.0054	ND
	Copper (Cu)	1.0 mg/l	--	0.0312	<0.0045	0.050
	Iron (Fe)	8.0 mg/l	--	0.047	<0.1	1.08
	Lead (Pb)	0.5 mg/l	--	0.0109	<0.013	ND
	Manganese (Mn)	1.5 mg/l	--	0.0179	<0.0016	0.053
	Mercury (Hg)	0.01 mg/l	--	BDL	<0.0008	ND
	Selenium (Se)	0.5 mg/l	--	BDL	ND	ND
	Nickel (Ni)	1.0 mg/l	--	0.0039	<0.008	ND
	Silver (Ag)	1.0 mg/l	--	BDL	<0.0032	0.004
	Zinc (Zn)	5.0 mg/l	--	0.0097	<0.0033	0.024
	Arsenic (As)	1.0 mg/l	--	0.0034	0.01	ND
	Barium (Ba)	1.5 mg/l	--	BDL	<0.031	0.136
	Boron (B)	6.0 mg/l	0-2 mg/l	BDL	<0.1	0.118
	Total Toxic Metals	2.0 mg/l	--	0.070	0.02	0.308
	BOD ₅	80mg/l	--	39.6	<1.0	3
	TSS	200 mg/l	--	20	11	60

⁵ Only few parameters are considered for reference. However, at subprojects level, ensure the monitoring and compliance with all the parameters available at below link: <https://www.fao.org/3/t0234e/T0234E01.htm#ch1.4>

Sr. No.	Parameters	Comparison Values (PEQS)	FAO ⁵ Standards	Concentration		
				District Rawalpindi	District Sargodha	District Multan
	Phenolic Compounds	0.1 mg/l	--	0.019	<0.01	<0.002
	Grease and Oil	10 mg/l	--	0.2	<0.2	<2
	Fluoride	10 mg/l	--	3.9	<0.01	0.19
	Cyanide	1 mg/l	--	BDL	<0.01	0.09
	An-ionic detergents (as MBAs)	20 mg/l	--	0.064	ND	ND
	Sulfate (SO ₄ ²⁻)	600 mg/l	0-960	114	61.74	70.79
	Sulfide (S ²⁻)	1.0 mg/l	--	BDL	<0.4	ND
	Ammonia (NH ₃)	40 mg/l	--	3.8	<0.002	2.12
	Chlorine (Cl)	1.0 mg/l	--	0.02	<0.1	0.5

BDL: Below Detection Limit ND: Not Detectable

Annex F: Archaeological Sites and Monuments in Punjab

<i>District</i>	<i>Archaeological Sites and Monuments</i>
Attock	Lala Rukh's tomb, Begum ki Sarai, on left bank of Indus River near Attock fort, Saidan Baoli, Hakim's tomb, Chitti Baoli, Attock Fort, Attock tomb, Ziarat Hazrat Baba Sahib, Behram ki Baraddari, Tope and Mnastery (Buddhist remains), Kallar (temple) or Sassi da Kallara, Village Shah Muhammad Wali, Inderkot mosque, Buddhist site.
Bahawalpur	Tomb of Abu Hanifa, Tomb of Bibi Jawidi, Tomb of Nuria, Tomb of Bhawal Halee, Tomb of Musa Pak Shaheed.
Dera Ghazi Khan	Ghazi Khan's Tomb Mohalla Zaminaran, Ther Dallu Roy Dajal.
Faisalabad	Wangar Wala Tibba
Gujranwala	Baraari in Sherawala garen, Tomb of Abdul Nabi Kotli Maqbara.
Gujrat	Akbari Baoli in fort Gujrat city, Bahar Wali, Tomb of Shaikh Ali Baig locally called Hanjeera.
Jhang	Shahi Masjid Chiniot, Tomb of Shah Burhan.
Jhelum	Rohtas Fort, Ruined Temple with gateway Melot, Raja Mansigh's Haveli Rohtas, Murti in Tehsil Pind Dadan Khan, Two ancient temples Bhagan Wala, Ruins of Nandana, For Bhagan Wala, Sardar of Hari Singh's Haveli, Ruined Buddhist Stupa, Satghara temple Village Katas.
Khanewal	Tomb of Khali Walid, village Kabirwala.
Layyah	Shrine of Hazrat Lal Esah, Shrine of Hazrat Fajan Shah.
Lahore	Tomb of Ali Mardan Khan and Gateway, Buddo's tomb, Sarwala Maqbara, Huzuri Bagh Baradari, Dai Anga's tomb, Shalamar Garden including baradari, Old Fort, Buddho ka Awa, One kos minar, Roshani gate, Mirza Kamran's baradari, Tomb of Dr. Muhammad Iqbal, Chauburji, Gulabi Bagh gatweay, Qutbuddin Aibak's tomb, Tiled gateweay and two bastions, Two kos minars Minola, Tomb of Shaikh Mosa, Ahangar, Tomb of (erroneously called) Zebun-Nisa, Naddira Begum's tomb and tank Mian Mir, Hujra Mir Mehdi (Janazegah), Tomb of Prince Parwaiz, Tomb of Nawab Bahadur Khan, Javedd Manzil, Jahangir's tomb and compound, Akbari Sarai an mosque, Tomb of Asif Khan and compound, Tomb of nur Jeha, Tomb of Mahabat Khan and boundary wall, Samadh of Rajit Singh, Karakh Singh and Nau Nihal Singh, Tomb of Anarkali, Baradari and Samadh of Maharaja Sher Singh, Badshahi mosque, Wazir Khan's mosque, Chitta gate, Chowk Wazir Khan inside elhi Gate, Well of Raja Dina Nath, Chowk Wazir Khan, Masti gate, Bhati gate, Sheranwala gate, Kashmiri gate, Lahori gate, Delhi gate, Wazir Khan's hammams inside Delhi gate, Haveli Nau Nihal Singh, Tomb of Khawaja Sabir (Nawab Nusrat Khan), Tomb of French Officer's daughter, Wazir Khan's baradari, Samadh of Jhingar Shah Suthra (Suthron ka Asthan) Suthron, Samadh of Bhai Wasti Ram Tixali gate, A Mughal period tomb Singhapura, Jani Khan's tomb, Baghbanpura, Dai Anga's mosque, Mosque with glazed tiles work Bagumpura, Mosque of Nawab Zakariya Khan, Inayat Bagh, Angori bagh, Mariam Zammani mosque.
Mianwali	Shershah's baoli Wah Buchhran, Buddhist Stupa with a surrounding area on River Indus to the north of Village Rokhari.
Multan	Sawi Masjid Kotla Tole Khan, Tombs of Petrick Alexander Vana, Andrew & William Anderson Old Forts, Shrine of Rukne Alam, Tomb of Shah Ali Akbar's mother, Tomb of Shams Tabriz, Tomb of Shah Ali Akbar, Tomb of Shah Yousuf Gardezi, Mound Ratti Khari, Tomb of Shah Hussain Soozai, Tomb of Mai Mehraban, Mohallah Kirialoghana, Ruined mosque Village Sargana, Maryala Moun.
Muzaffargarh	Tomb of Thar Khan Nahar Sitpur, Mosque of Tahar Khan Nahar, Tomb of Sheikh Sadan Shaheed Sadan.
Rawalpindi	Tope or stupa (Buddhist) Mankiyal, Top or stupa (Buddhist) Bhallar, Pharwala fort Pharwala, Losar baoli Wah, Bhir Moun Taxila, Babar Khan track Taxila, Kalawan site, Chirtope site Taxila, Sirkap site, Giri remains, Mohra Maradu site, Rewat fort, Nicholson Column, Kos Minar, Farudgh-e-Shahan-e-Mughalia, tank and garden Wah, Ratta Pind.
Sahiwal	Mounds of Harappa, Mir Chakar's tomb, Tomb of Syeed Daud Kirmani.

<i>District</i>	<i>Archaeological Sites and Monuments</i>
Sargodha	Three temple inside fort, Site of ancient city, Bhera, Sabzal Pind, Red sandstone temple.
Sheikhupura	Sheikhupura fort, Baoli and mosque, Tank and tower, Tomb of Abdullah Shah, Mound Mian Ali Sahib, Tibba (Mound), Kala Shah Kaku, Tomb of Noor Muhammad, Tomb of Hafiz Barkurdar.
Sialkot	Tibba Jolian

Annex G: Flora of Punjab

Sr. No.	Name of District	Flora Details	Sr. No.	Name of District	Flora Details
	Attock	Sanatha (<i>Dodonaea viscosa</i>), Kahu (<i>Olea ferruginea</i>), Phulai (<i>Acacia modesta</i>)		Lodhra	Beri (<i>Ziziphus jujuba</i>), Kikar (<i>Acacia nilotica</i>), Neem (<i>Azadirachta indica</i>), Shisham (<i>Dalbergia sissoo</i>), Poplar (<i>Populus ciliata</i>)
	Bahawalnagar	Ber (<i>Ziziphus Jujube</i>), Mallha (<i>Zizyphus numularia</i>), Karil (<i>Capparis decidua</i>), Chimber (<i>Eleusine egyptiaca</i>), Pelwahn (<i>Andropogon ennulantus</i>), Khavi (<i>Andropogon invaranousa</i>), Kikar (<i>Acacia nilotica</i>), Shisham (<i>Dalbergia sissoo</i>), Neem (<i>Azadirachta indica</i>), Sufaida (<i>Eucalyptus camaldulensis</i>), Kandir (<i>Alhaji camelorum</i>), Mesquite (<i>Prosopis glandulosa</i>).		Mandi Bahauddin	Kikar (<i>Acacia nilotica</i>), Beri (<i>Ziziphus jujuba</i>), Shisham (<i>Dalbergia sissoo</i>), Piple (<i>Ficus religiosa</i>)
	Bahawalpur	Toot (<i>Morus nigra</i>), Siris (<i>Albizia lebbek</i>), Poplar (<i>Populus ciliata</i>), Neem (<i>Azadirachta indica</i>), Kikar (<i>Acacia nilotica</i>), Shisham (<i>Dalbergia sissoo</i>), Khabar (<i>Salvadora oleoides</i>), Ber (<i>Zizyphus jujuba</i>), Sufaida (<i>Eucalyptus camaldulensis</i>), Arind (<i>Arundo donax</i>)		Mianwali	Jand (<i>Prosopis cineraria</i>), Beri (<i>Zizyphus jujuba</i>), Kikar (<i>Acacia Nilotica</i>), Phulai (<i>Acacia modesta</i>)
	Bhakkar	Kikar (<i>Acacia Nilotica</i>), Shisham (<i>Dalbergia sissoo</i>)		Multan	Bahera (<i>Terminalia bellirica</i>), Saru (<i>Casuarina equisetifolia</i>) Neem (<i>Azadirachta Indica</i>), Shisham (<i>Dalbergia sissoo</i>)
	Chakwal	Phulai (<i>Acacia modesta</i>), Kahu (<i>Olea ferruginea</i>), Sanatha (<i>Dodonaea viscosa</i>)		Muzaffargarh	Kikar (<i>Acacia nilotica</i>), Beri (<i>Ziziphus jujuba</i>), Jand (<i>Prosopis cineraria</i>), Sharin (<i>Albizzia lebbek</i>)
	Chiniot	Shisham (<i>Dalbergia sissoo</i>), Kikar (<i>Acacia nilotica</i>), Poplar (<i>Populus alba</i>)		Nankana Sahib	Kikar (<i>Acacia nilotica</i>), Shareen (<i>Albizzia lebbek</i>), Ber (<i>Ziziphus jujuba</i>), Simal (<i>Salmalia malabarica</i>)
	Dera Ghazi Khan	Van (<i>Vachellia nilotica</i>), Kikar (<i>Acacia nilotica</i>), Ber (<i>Ziziphus nujube</i>)		Narowal	Phulai (<i>Senegalia modesta</i>), Kahu (<i>Lactuca serriola</i>), Sanatha (<i>Dodonaea viscos</i>)
	Faisalabad	Van (<i>Vachellia nilotica</i>), Karil (<i>Capparis decidua</i>), Jhand (<i>Prosopis cineraria</i>), Beri (<i>Ziziphus Jujuba</i>)		Okara	Sanatha (<i>Dodonaea viscosa</i>), Phulai (<i>Senegalia modesta</i>), Kikar (<i>Acacia nilotica</i>), Kahu (<i>Lactuca serriola</i>), Neem (<i>Azadirachta indica</i>), Sufaida (<i>Eucalyptus camaldulensis</i>), Ber (<i>Zizyphus jujuba</i>),
	Gujranwala	Shisham (<i>Dalbergia sissoo</i>), Kikar (<i>Acacia Nilotica</i>), Siris (<i>Albizia lebbek</i>), Lasura (<i>Cordia myxa</i>)		Pakpattan	Jand (<i>Prosopis cineraria</i>), Van (<i>Vachellia nilotica</i>), Kikar (<i>Acacia nilotica</i>), Shisham (<i>Dalbergia sissoo</i>), Neem (<i>Azadirachta indica</i>), Sufaida (<i>Eucalyptus camaldulensis</i>), Simal (<i>Salmalia malabarica</i>), Jaman (<i>Eugenia jambolina</i>)

Sr. No.	Name of District	Flora Details	Sr. No.	Name of District	Flora Details
	Gujrat	Kikar (<i>Acacia nilotica</i>), Shisham (<i>Dalbergia sissoo</i>)		Rahim Yar Khan	Katran (<i>Calotropis procera</i>), Chapri (<i>Vachellia nilotica</i>), Kikar (<i>Acacia nilotica</i>), Phag (<i>Salvia officinalis</i>), Pelu (<i>Sophora cassioides</i>).
	Hafizabad	Shisham (<i>Dalbergia sissoo</i>), Beri (<i>Ziziphus jujuba</i>), Eucalyptus (<i>Eucalyptus camaldulensis</i>), Sumbal (<i>Bombax ceiba</i>)		Rajanpur	Kikar (<i>Acacia nilotica</i>), Shisham (<i>Dalbergia sissoo</i>), Jand (<i>Prosopis cineraria</i>)
	Jhang	Kikar (<i>Acacia nilotica</i>), Shisham (<i>Dalbergia sissoo</i>), Palm (<i>Palmus arecaceae</i>), Jhand (<i>Prosopis cineraria</i>), Van (<i>Vachellia nilotica</i>)		Rawalpindi	Shisham (<i>Dalbergia Sissoo</i>), Kikar (<i>Acacia nilotica</i>), Shareen (<i>Albizzia lebbck</i>), Beri (<i>Ziziphus jujuba</i>)
	Jhelum	Phulai (<i>Acacia modesta</i>), Kahu (<i>Olea ferruginea</i>), Sanatha (<i>Dodonaea viscosa</i>)		Sahiwal	Neem (<i>Azadirachta indica</i>), Shisham (<i>Dalbergia sissoo</i>), Kikar (<i>Acacia nilotica</i>)
	Kasur	Kikar (<i>Acacia nilotica</i>), Tahli (<i>Dalbergia sissoo</i>), Ber (<i>Ziziphus jujuba</i>), Toot (<i>Morus nigra</i>), Sharin (<i>Albizzia lebbek</i>), Dharek (<i>Malia azerdarac</i>), Phulahi (<i>Acacia modesta</i>),		Sargodha	Shisham (<i>Dalbergia sissoo</i>), Kikar (<i>Acacia nilotica</i>), Phulai (<i>Acacia modesta</i>), Simal (<i>Bombax ceiba</i>), Siris (<i>Albizzia lebbeck</i>), Toot (<i>Morus nigra</i>), Neem (<i>Azadirachta indica</i>), Jamman (<i>Eugenia jambolana</i>)
	Khanewal	Jhand (<i>Prosopis cineraria</i>), Kikar (<i>Acacia nilotica</i>), Shisham (<i>Dalbergia sissoo</i>), Piple (<i>Ficus religiosa</i>), Beri (<i>Ziziphus jujuba</i>), Toot (<i>Morus nigra</i>)		Sheikhupura	Karil (<i>Capparis decidua</i>), Jand (<i>Prosopis cineraria</i>), Van (<i>Vachellia nilotica</i>), Sharin (<i>Albizzia lebbek</i>), Piple (<i>Ficus religiosa</i>), Kikar (<i>Acacia nilotica</i>), Shisham (<i>Dalbergia sissoo</i>)
	Khushab	Karil (<i>Capparis decidua</i>), Van (<i>Vachellia nilotica</i>), Jand (<i>Abies webbiana</i>)		Sialkot	Lasura (<i>Cordia myxa</i>), Shisham (<i>Dalbergia sissoo</i>), Kikar (<i>Acacia nilotica</i>), Kikar (<i>Acacia nilotica</i>)
	Lahore	Kikar (<i>Acacia nilotica</i>), Shisham (<i>Dalbergia sissoo</i>), Beri (<i>Ziziphus jujuba</i>), Toot (<i>Morus nigra</i>), Phulai (<i>Senegalia modesta</i>), Jhand (<i>Prosopis cineraria</i>), Karil (<i>Capparis decidua</i>)		Toba Tek Singh	Beri (<i>Ziziphus jujuba</i>), Mallha (<i>Zizyphus numularia</i>), Karil (<i>Capparis decidua</i>), Chimber (<i>Eleusine egyptiaca</i>), Pelwahn (<i>Andropogon ennulantus</i>), Khavi (<i>Andropogon invaranousa</i>)
	Layyah	Kikar (<i>Acacia nilotica</i>), Beri (<i>Ziziphus jujuba</i>), Karil (<i>Capparis decidua</i>)		Vehari	Shisham (<i>Dalbergia sissoo</i>), Kikar (<i>Acacia nilotica</i>), Toot (<i>Morus nigra</i>), Sarin (<i>Hibiscus rosasinensis</i>), Sumbal (<i>Bombax ceiba</i>), Poplar (<i>Populus ciliata</i>)

Annex H: Fauna of Punjab

Sr. No.	Name of District	Wildlife/Fauna	Conservation Status - IUCN	Avifauna	Conservation Status - IUCN	Sr. No.	Name of District	Wildlife/Fauna	Conservation Status - IUCN	Avifauna	Conservation Status - IUCN
	Attock	Wolves (<i>Canis lupus</i>)	LC	Teal (<i>Anas crecca</i>)	LC		Gujran wala	Blackbuck (<i>Antilope cervicapra</i>)	LC	Pigeons (<i>Columba livia</i>)	LC
		Fox (<i>Vulpes vulpes</i>)	LC	Pintail (<i>Anas acuta</i>)	LC			Hare (<i>Lepus nigricollis</i>)	LC	Teal (<i>Anas crecca</i>)	LC
		Wild cat (<i>Felis silvestris</i>)	LC	Mallard (<i>Anas platyrhynchos</i>)	LC			Jackal (<i>Canis aureus</i>)	LC	Pintail (<i>Anas acuta</i>)	LC
Bahawalnagar		Monkey (<i>Macaca mulatta</i>)	LC	Mallard (<i>Anas platyrhynchos</i>)	LC	Gujrat		Urial (<i>Ovis vignei</i>)	VU	Chukor (<i>Alectoris chukar</i>)	LC
		Blackbuck (<i>Antilope cervicapra</i>)	LC	Dove (<i>Spilopelia chinensis</i>)	LC			Wolves (<i>Canis lupus</i>)	LC	Partridges (<i>Melanoperdix niger</i>)	VU
		Jackal (<i>Canis aureus</i>)	LC	Myna (<i>Acridotheres tristis</i>)	LC			Fox (<i>Vulpes vulpes</i>)	LC	--	--
		Toad (<i>Bufo bufo</i>)	LC	--	--			Wild cat (<i>Felis silvestris</i>)	LC	--	--
		Snake (<i>Elapidae bungaris</i>)	LC	--	--			Hafizabad		Jackal (<i>Canis aureus</i>)	LC
Bahawalpur		Blackbuck (<i>Antilope cervicapra</i>)	LC	Owl (<i>Glaucidium cuculoides</i>)	LC	Rabbit (<i>Lepus nigricollis</i>)	LC			Pigeons (<i>Columba livia</i>)	LC
		Rabbit (<i>Lepus nigricollis</i>)	LC	Pigeons (<i>Columba livia domestica</i>)	LC	Fox (<i>Vulpes vulpes</i>)	LC	Crow (<i>Corvus splendens</i>)	LC		
		Deer (<i>Rusa unicolor</i>)	VU	Quail (<i>Coturnix coturnix</i>)	LC	Wild cat (<i>Felis silvestris</i>)	LC	Parrot (<i>Melopsittacus undulatus</i>)	LC		
		Squirrel (<i>Dicentra canadensis</i>)	LC	--	--	Wild boar (<i>Sus scrofa</i>)	LC	Nightingale (<i>Luscinia megarhynchos</i>)	LC		

Sr. No.	Name of District	Wildlife/Fauna	Conservation Status - IUCN	Avifauna	Conservation Status - IUCN	Sr. No.	Name of District	Wildlife/Fauna	Conservation Status - IUCN	Avifauna	Conservation Status - IUCN
		Jackal (<i>Canis aureus</i>)	LC	--	--			Mohri (<i>Rhizoprionodon acutus</i>)	VU	Dove (<i>Spilopelia chinensis</i>)	LC
		Toad (<i>Bufo bufo</i>)	LC	--	--			Raho (<i>Labeo rohita</i>)	LC	--	--
		Snake (<i>Elapidae bungaris</i>)	LC	--	--		Jhang	Pig (<i>Sus scrofa</i>)	LC	Sandgrouse (<i>Pterocles alchata</i>)	LC
		Pig (<i>Sus scrofa</i>)	LC	--	--			Wolf (<i>Canis lupus</i>)	LC	Teal (<i>Anas crecca</i>)	LC
		Frog (<i>Rana tigrina</i>)	LC	--	--			Wild cat (<i>Felis silvestris</i>)	LC	Quail (<i>Coturnix coturnix</i>)	LC
		Porcupine (<i>Hystrix indica</i>)	LC	--	--		Jhelum	Wolves (<i>Canis lupus</i>)	LC	Chukor (<i>Alectoris chukar</i>)	LC
	Bhakkar	Pig (<i>Sus scrofa</i>)	LC	Partridges (<i>Melanoperdix niger</i>)	VU			Fox (<i>Vulpes vulpes</i>)	LC	Partridges (<i>Melanoperdix niger</i>)	VU
		Jackal (<i>Canis aureus</i>)	LC	Dove (<i>Spilopelia chinensis</i>)	LC			Wild cat (<i>Felis silvestris</i>)	LC	Quail (<i>Coturnix coturni</i>)	LC
		Camel (<i>Camelus dromedarius</i>)	LC	Myna (<i>Acridotheres tristis</i>)	LC		Kasur	Wolf (<i>Canis lupus</i>)	LC	Parrot (<i>Melopsittacus undulatus</i>)	LC
		--	--	Bulbul (<i>Luscinia megarhynchos</i>)	LC			Jackal (<i>Canis aureus</i>)	LC	Nightingale (<i>Luscinia megarhynchos</i>)	LC
	Chakwal	Jackal (<i>Canis aureus</i>)	LC	Partridges (<i>Melanoperdix niger</i>)	VU			Pig (<i>Sus scrofa</i>)	LC	Dove (<i>Spilopelia chinensis</i>)	LC
		Porcupine (<i>Hystrix indica</i>)	LC	Quail (<i>Coturnix coturnix</i>)	LC			Hare (<i>Lepus nigricollis</i>)	LC	--	--
		Bengal Monitor Lizard (<i>Varanus bengalensis</i>)	NT	--	--			Snake (<i>Elapidae bungaris</i>)	LC	--	--
		Urial (<i>Ovis vignei</i>)	VU	--	--			Porcupine (<i>Hystrix indica</i>)	LC	--	--

Sr. No.	Name of District	Wildlife/Fauna	Conservation Status - IUCN	Avifauna	Conservation Status - IUCN	Sr. No.	Name of District	Wildlife/Fauna	Conservation Status - IUCN	Avifauna	Conservation Status - IUCN
	Chiniot	Jackal (<i>Canis aureus</i>)	LC	Pigeons (<i>Columba livia</i>)	LC		Khane wal	Fox (<i>Vulpes vulpes</i>)	LC	Partridges (<i>Melanoperdix niger</i>)	VU
		Hare (<i>Lepus nigricollis</i>)	LC	Teal (<i>Anas crecca</i>)	LC			Hare (<i>Lepus nigricollis</i>)	LC	Quail (<i>Coturnix coturnix</i>)	LC
		--	--	Pintail (<i>Anas acuta</i>)	LC			Jackal (<i>Canis aureus</i>)	LC	Plover (<i>Vanellus indicus</i>)	LC
	Dera Ghazi Khan	Jackal (<i>Canis aureus</i>)	LC	Dove (<i>Spilopelia chinensis</i>)	LC		Khushab	--	--	Pigeons (<i>Columba livia domestica</i>)	LC
		Rabbit (<i>Lepus nigricollis</i>)	LC	Quail (<i>Coturnix coturnix</i>)	LC			Leopard (<i>Panthera pardus</i>)	VU	Dove (<i>Spilopelia chinensis</i>)	LC
		Fox (<i>Vulpes vulpes</i>)	LC	Pigeons (<i>Columba livia domestica</i>)	LC			Hyenas (<i>Hyaena hyaena</i>)	NT	Nightingale (<i>Luscinia megarhynchos</i>)	LC
		Wild cat (<i>Felis silvestris</i>)	LC	Crow (<i>Corvus splendens</i>)	LC			Wolves (<i>Canis lupus</i>)	LC	Quail (<i>Coturnix coturnix</i>)	LC
		Pig (<i>Sus scrofa</i>)	LC	Parrot (<i>Melopsittacus undulatus</i>)	LC			Jackal (<i>Canis aureus</i>)	LC	Owl (<i>Glaucidium cuculoides</i>)	LC
		Mohri (<i>Rhizoprionodon acutus</i>)	VU	--	--			Wild cat (<i>Felis silvestris</i>)	LC	--	--
		Raho (<i>Labeo rohita</i>)	LC	--	--			Badger (<i>Meles meles</i>)	LC	--	--
	Faisalabad	Fox (<i>Vulpes vulpes</i>)	LC	Pigeons (<i>Columba livia</i>)	LC			Wild boar (<i>Sus scrofa</i>)	LC	--	--
		Pig (<i>Sus scrofa</i>)	LC	Dove (<i>Spilopelia chinensis</i>)	LC			Neel gai (<i>Boselaphus tragocamelus</i>)	LC	--	--
		Jackal (<i>Canis aureus</i>)	LC	Parrot (<i>Melopsittacus undulatus</i>)	LC			Deer (<i>Rusa unicolor</i>)	VU	--	--

Sr. No.	Name of District	Wildlife/Fauna	Conservation Status - IUCN	Avifauna	Conservation Status - IUCN	Sr. No.	Name of District	Wildlife/Fauna	Conservation Status - IUCN	Avifauna	Conservation Status - IUCN
		Wild cat (<i>Felis silvestris</i>)	LC	--	--		Okara	Jackal (<i>Canis aureus</i>)	LC	Owl (<i>Glaucidium cuculoides</i>)	LC
	Lahore	Jackal (<i>Canis aureus</i>)	LC	Parrot (<i>Melopsittacus undulatus</i>)	LC			Porcupine (<i>Hystrix indica</i>)	LC	Pheasant (<i>Phasianus colchicus</i>)	LC
		Pig (<i>Sus scrofa</i>)	LC	House Sparrow (<i>Passer domesticus</i>)	LC			Pig (<i>Sus scrofa</i>)	LC	--	--
		Hare (<i>Lepus nigricollis</i>)	LC	Pigeon (<i>Columba livia</i>)	LC			Snake (<i>Elapidae bungaris</i>)	LC	--	--
	Layyah	Deer (<i>Rusa unicolor</i>)	VU	Parrot (<i>Melopsittacus undulatus</i>)	LC		Pakpatan	Red cow (<i>Bos indicus</i>)	LC	Pigeons (<i>Columba livia domestica</i>)	LC
		Jackal (<i>Canis aureus</i>)	LC	Wood Packers (<i>Leiopicus auriceps</i>)	LC			Pig (<i>Sus scrofa</i>)	LC	Dove (<i>Spilopelia chinensis</i>)	LC
		--	--	Houbara Bustard (<i>Chlamydotis undulate</i>)	VU			Jackal (<i>Canis aureus</i>)	LC	Nightingale (<i>Luscinia megarhynchos</i>)	LC
	Lodhran	Rabbit (<i>Lepus nigricollis</i>)	LC	Owl (<i>Glaucidium cuculoides</i>)	LC			Porcupine (<i>Hystrix indica</i>)	LC	Quail (<i>Coturnix coturnix</i>)	LC
		--	--	Pigeons (<i>Columba livia domestica</i>)	LC			Snake (<i>Elapidae bungaris</i>)	LC	Owl (<i>Glaucidium cuculoides</i>)	LC
		--	--	Quail (<i>Coturnix coturnix</i>)	LC			Deer (<i>Rusa unicolor</i>)	VU	--	--
	Mandi Bahauddin	Snake (<i>Elapidae bungaris</i>)	LC	Partridges (<i>Melanoperdix niger</i>)	VU		Rahim Yar Khan	Hog Deer (<i>Axis porcinus</i>)	EN	Partridges (<i>Melanoperdix niger</i>)	LC
		Mohri (<i>Rhizoprionodon acutus</i>)	VU	Quail (<i>Coturnix coturnix</i>)	LC			Pig (<i>Sus scrofa</i>)	LC	Dove (<i>Spilopelia chinensis</i>)	LC
		Raho (<i>Labeo rohita</i>)	LC	Teal (<i>Anas crecca</i>)	LC			Jackal (<i>Canis aureus</i>)	LC	Myna (<i>Acridotheres tristis</i>)	LC

Sr. No.	Name of District	Wildlife/Fauna	Conservation Status - IUCN	Avifauna	Conservation Status - IUCN	Sr. No.	Name of District	Wildlife/Fauna	Conservation Status - IUCN	Avifauna	Conservation Status - IUCN
		--	--	Sandgrouse (<i>Pterocles alchata</i>)	LC			Wolf (<i>Canis lupus</i>) Porcupine (<i>Hystrix indica</i>)	LC	Bulbul (<i>Luscinia megarhynchos</i>)	LC
	Mianwali	Jackal (<i>Canis aureus</i>)	LC	Chukor (<i>Alectoris chukar</i>)	LC			Wild rat (<i>Rattus rattus</i>)	LC	--	--
		Wild boar (<i>Sus scrofa</i>)	LC	Partridges (<i>Melanoperdix niger</i>)	VU			Mongoose (<i>Herpestes javanicus</i>)	LC	--	--
		Rabbit (<i>Lepus nigricollis</i>)	LC	Hawk (<i>Clanga hastata</i>)	VU			Lizard (<i>Cnemidophorus spp</i>)	LC	--	--
		--	--	Teal (<i>Anas crecca</i>)	LC			Toad (<i>Bufo bufo</i>)	LC	--	--
	Multan	Jackal (<i>Canis aureus</i>)	LC	Quail (<i>Coturnix coturnix</i>)	LC			Frog (<i>Rana tigrina</i>)	LC	--	--
		Hare (<i>Lepus nigricollis</i>)	LC	Owl (<i>Glaucidium cuculoides</i>)	LC	Rajapur		Pig (<i>Sus scrofa</i>)	LC	Teal (<i>Anas crecca</i>)	LC
		--	--	Pigeons (<i>Columba livia domestica</i>)	LC			Hog Deer (<i>Axis porcinus</i>)	EN	Mallard (<i>Anas platyrhynchos</i>)	LC
	Muzaffargarh	Jackal (<i>Canis aureus</i>)	LC	Dove (<i>Spilopelia chinensis</i>)	LC			Jackal (<i>Canis aureus</i>)	LC	Dove (<i>Spilopelia chinensis</i>)	LC
		Fox (<i>Vulpes vulpes</i>)	LC	Parrot (<i>Melopsittacus undulatus</i>)	LC			Rabbit (<i>Lepus nigricollis</i>)	LC	Quail (<i>Coturnix coturnix</i>)	LC
		Hare (<i>Lepus nigricollis</i>)	VU	Crow (<i>Corvus splendens</i>)	LC			Fox (<i>Vulpes vulpes</i>)	LC	Pigeons (<i>Columba livia</i>)	LC
		Deer (<i>Rusa unicolor</i>)	LC	Quail (<i>Coturnix coturnix</i>)	LC			Wild cat (<i>Felis silvestris</i>)	LC	Crow (<i>Corvus splendens</i>)	LC
	Nankana Sahib	Jackal (<i>Canis aureus</i>)	LC	Dove (<i>Spilopelia chinensis</i>)	LC			Wild boar (<i>Sus scrofa</i>)	LC	Parrot (<i>Melopsittacus undulatus</i>)	LC

Sr. No.	Name of District	Wildlife/Fauna	Conservation Status - IUCN	Avifauna	Conservation Status - IUCN	Sr. No.	Name of District	Wildlife/Fauna	Conservation Status - IUCN	Avifauna	Conservation Status - IUCN
		Rabbit (<i>Lepus nigricollis</i>)	LC	Quail (<i>Coturnix coturnix</i>)	LC			Raho (<i>Labeo rohita</i>)	LC	Nightingale (<i>Luscinia megarhynchos</i>)	LC
		Fox (<i>Vulpes vulpes</i>)	LC	Pigeons (<i>Columba livia domestica</i>)	LC		Sahiwal	Wolf (<i>Canis lupus</i>)	LC	Pigeons (<i>Columba livia domestica</i>)	LC
		Wild cat (<i>Felis silvestris</i>)	LC	Crow (<i>Corvus splendens</i>)	LC			Jackal (<i>Canis aureus</i>)	LC	Quail (<i>Coturnix coturnix</i>)	LC
		Wild boar (<i>Sus scrofa</i>)	LC	Parrot (<i>Melopsittacus undulatus</i>)	LC			Bull (<i>Bos taurus</i>)	LC	--	--
		Mohri (<i>Rhizoprionodon acutus</i>)	VU	Nightingale (<i>Luscinia megarhynchos</i>)	LC			Wild cat (<i>Felis silvestris</i>)	LC	--	--
		Raho (<i>Labeo rohita</i>)	LC	--	--		Sargodha	Wolf (<i>Canis lupus</i>)	LC	Chukor (<i>Alectoris chukar</i>)	LC
	Narowal	Wolves (<i>Canis lupus</i>)	LC	Teal (<i>Anas crecca</i>)	LC			Jackal (<i>Canis aureus</i>)	LC	Partridges (<i>Melanoperdix niger</i>)	VU
		Fox (<i>Vulpes vulpes</i>)	LC	Pintail (<i>Anas acuta</i>)	LC			Fox (<i>Vulpes vulpes</i>)	LC	Teal (<i>Anas crecca</i>)	LC
		Wild cat (<i>Felis silvestris</i>)	LC	Mallard (<i>Anas platyrhynchos</i>)	LC			Wild cat (<i>Felis silvestris</i>)	LC	Quail (<i>Coturnix coturnix</i>)	LC
	Sheikhupura	Wild boar (<i>Sus scrofa</i>)	LC	Pigeons (<i>Columba livia domestica</i>)	LC		Toba Tek Singh	Fox (<i>Vulpes vulpes</i>)	LC	Partridges (<i>Melanoperdix niger</i>)	VU
		Jackal (<i>Canis aureus</i>)	LC	Quail (<i>Coturnix coturnix</i>)	LC			Pig (<i>Sus scrofa</i>)	LC	Pigeons (<i>Columba livia domestica</i>)	LC
		Hare (<i>Lepus nigricollis</i>)	LC	Dove (<i>Spilopelia chinensis</i>)	LC			Jackal (<i>Canis aureus</i>)	LC	Dove (<i>Spilopelia chinensis</i>)	LC
		--	--	Parrot (<i>Melopsittacus undulatus</i>)	LC			Wild cat (<i>Felis silvestris</i>)	LC	Parrot (<i>Melopsittacus undulatus</i>)	LC

Sr. No.	Name of District	Wildlife/Fauna	Conservation Status - IUCN	Avifauna	Conservation Status - IUCN	Sr. No.	Name of District	Wildlife/Fauna	Conservation Status - IUCN	Avifauna	Conservation Status - IUCN
	Sialkot	Jackal (<i>Canis aureus</i>)	LC	Pigeons (<i>Columba livia domestica</i>)	LC			--	--	Quail (<i>Coturnix coturnix</i>)	LC
		Fox (<i>Vulpes vulpes</i>)	LC	Parrot (<i>Melopsittacus undulatus</i>)	LC			--	--	Pintail (<i>Anas acuta</i>)	LC
		Wild cat (<i>Felis silvestris</i>)	LC	--	--			--	--	Teal (<i>Anas crecca</i>)	LC
		Hare (<i>Lepus nigricollis</i>)	LC	--	--	Vehari		Wild Pig (<i>Sus scrofa</i>)	LC	Pigeons (<i>Columba livia domestica</i>)	LC
		Pig (<i>Sus scrofa</i>)	LC	--	--			Jackal (<i>Canis aureus</i>)	LC	Dove (<i>Spilopelia chinensis</i>)	LC
		Wolf (<i>Canis lupus</i>)	LC	--	--			Wolves (<i>Canis lupus</i>)	LC	Parrot (<i>Melopsittacus undulatus</i>)	LC

Annex I: Protected Areas of Punjab

<i>Protected Area Name</i>	<i>IUCN</i>	<i>Area (ha)</i>	<i>Classification</i>	<i>Notification Date</i>	<i>Coordinates</i>	<i>Habitat</i>
Abbasia Reserve Forest	---	2,731 ha	Wildlife Sanctuary	1979	Not Recorded	---
Bahawalpur R. F. Plantation	---	547 ha	Wildlife Sanctuary	1978	29/23 N. 71/39 E.	---
Bajwat	IV	5,795 ha	Game Reserve	1964	Not Recorded	---
Bhagat Reserve Forest	---	251 ha	Wildlife Sanctuary	---	Not Recorded	---
Bhakkar Forest Plantation	---	2,124 ha	Wildlife Sanctuary	1986	31/37 N. 71/03 E.	---
Bheni	---	2,068 ha	Wildlife Sanctuary	1983	Not Recorded	---
Bhon Fazil	---	1,062 ha	Game Reserve	1978	Not Recorded	---
Abbasia Reserve Forest	---	2,731 ha	Wildlife Sanctuary	1979	Not Recorded	---
Bahawalpur R. F. Plantation	---	547 ha	Wildlife Sanctuary	1978	29/23 N. 71/39 E.	---
Chak katora Reserve Forest	---	535 ha	Wildlife Sanctuary	1990	Not Recorded	---
Chak Reserve Forest	---	2,158 ha	Wildlife Sanctuary	---	Not Recorded	---
Changa manga Plantation	---	5,063 ha	Wildlife Sanctuary	1986	31/05 N. 73/59 E.	---
Chashma Barrage	IV	33,082 ha	Wildlife Sanctuary	1974	32/27 N. 71/19 E.	---
Chak katora Reserve Forest	---	535 ha	Wildlife Sanctuary	1990	Not Recorded	---
Chashma Lake	VIII	Not Recorded	Unclassified	---	32/27 N. 71/19 E.	---
Chaupalia	---	9,857 ha	Game Reserve	1960	Not Recorded	---
Chichawatni Forest Plantation	---	4,666 ha	Wildlife Sanctuary	1986	30/32 N. 72/42 E.	---
Chinji	II	6,070 ha	National Park	1978	32/42 N. 72/22 E.	---
Cholistan	IV	660,921 ha	Wildlife Sanctuary	1981	29/59 N. 73/16 E.	---
Cholistan	---	2,032,6 ha	Game Reserve	1974	29/23 N. 71/39 E.	---
Chumbi-Surla	IV	55,943 ha	Wildlife Sanctuary	1978	32/50 N. 72/46 E.	---
Daluana	---	2,314 ha	Game Reserve	1979	Not Recorded	---
Daman Reserve Forest	---	2,270 ha	Wildlife Sanctuary	---	Not Recorded	---
Daphar Reserve Forest	IV	2,897 ha	Wildlife Sanctuary	1978	32/24 N. 73/08 E.	---
Depalpur Plantation	---	2,928 ha	Wildlife Sanctuary	1986	30/40 N. 73/39 E.	---

<i>Protected Area Name</i>	<i>IUCN</i>	<i>Area (ha)</i>	<i>Classification</i>	<i>Notification Date</i>	<i>Coordinates</i>	<i>Habitat</i>
Diljabba-Domeli	---	118,101 ha	Game Reserve	1972	Not Recorded	---
Fateh Major Forest Plantation	---	1,255 ha	Wildlife Sanctuary	1986	Not Recorded	---
Gatwala	---	5,883 ha	Game Reserve	1978	Not Recorded	---
Hamot Reserve Forest	---	889 ha	Wildlife Sanctuary	1990	Not Recorded	---
Head Islam/Chak Kotora	---	3,132 ha	Game Reserve	1978	29/49 N. 72/33 E.	WL
Head Qadirabad	---	2,850 ha	Game Reserve	1978	32/18 N. 73/29 E.	---
Inayat Reserve Forest	---	4,211 ha	Wildlife Sanctuary	---	Not Recorded	TTF. Sandy
Indo/Pak Border Belt	---	Not Recorded	Game Reserve	1980	Not Recorded	TTF. Sandy
Jalalpur Lake	---	42 ha	Wildlife Sanctuary	1993	32/32 N. 72/14 E.	STSF. WL
Jalalpur Sharif Forest	---	2,263 ha	Wildlife Sanctuary	1991	32/41 N. 73/32 E.	STSF
Jauharabad Reserve Forest	---	399 ha	Wildlife Sanctuary	1990	32/17 N. 72/21 E.	TTF. Sandy
Kala Chitta	---	132,605 ha	Game Reserve	1983	33/40 N. 72/20 E.	STSF
Kalabagh Game Reserve	---	1,550 ha	Unclassified	1966	34/04 N. 71/36 E.	N/A
Kamalia Plantation	---	4,396 ha	Wildlife Sanctuary	1971	30/43 N. 72/43 E.	TTF. Sandy
Kathar	---	1,141 ha	Game Reserve	1978	33/45 N. 73/07 E.	SBLF
Khabbeke Lake	IV	285 ha	Wildlife Sanctuary	1967	32/37 N. 72/14 E.	STSF
Khanewal Plantation	---	7,217 ha	Wildlife Sanctuary	1986	30/18 N. 71/56 E.	TTF
Kharar lake	IV	235 ha	Wildlife Sanctuary	1971	30/52 N. 73/13 E.	TTF
Kheri Murat	---	5,616 ha	Game Reserve	1964	Not Recorded	STSF
Chashma Lake	VIII	Not Recorded	Unclassified	---	32/27 N. 71/19 E.	WL
Chaupalia	---	9,857 ha	Game Reserve	1960	Not Recorded	---
Chichawatni Forest Plantation	---	4,666 ha	Wildlife Sanctuary	1986	30/32 N. 72/42 E.	TTF. Sandy
Chinji	II	6,070 ha	National Park	1978	32/42 N. 72/22 E.	TTF. Sandy
Cholistan	IV	660,921 ha	Wildlife Sanctuary	1981	29/59 N. 73/16 E.	STSF. WL
Cholistan	---	2,032,6 ha	Game Reserve	1974	29/23 N. 71/39 E.	STSF
Chumbi-Surla	IV	55,943 ha	Wildlife Sanctuary	1978	32/50 N. 72/46 E.	TTF. Sandy
Daluana	---	2,314 ha	Game Reserve	1979	Not Recorded	STSF
Kot Zabzal	---	10,117 ha	Game Reserve	1978	Not Recorded	TTF. Sandy
Kotla issan Reserve Forest	---	2,178 ha	Wildlife Sanctuary	1990	Not Recorded	TTF. Sandy

<i>Protected Area Name</i>	<i>IUCN</i>	<i>Area (ha)</i>	<i>Classification</i>	<i>Notification Date</i>	<i>Coordinates</i>	<i>Habitat</i>
Kundal Rakh	---	2,999 ha	Wildlife Sanctuary	---	Not Recorded	STSF
Kundian plantation	---	7,800 ha	Wildlife Sanctuary	1986	32/27 N. 71/29 E.	TTF. Sandy
lai Suhanra	V	51,588 ha	National Park	1972	29/21 N. 71/58 E.	TTF
lohi Bher Forest	---	887 ha	Wildlife Sanctuary	1993	33/43 N. 73/05 E.	STSF
Machu Plantation	---	4,109 ha	Wildlife Sanctuary	1986	Not Recorded	TTF. Sandy
Miranpur Reserve Forest	---	768 ha	Wildlife Sanctuary	---	Not Recorded	TTF. Sandy
Mitha Tiwana Plantation	---	1,116 ha	Wildlife Sanctuary	1986	Not Recorded	TTF
Namal lake	---	482 ha	Game Reserve	1970	32/40 N. 71/49 E.	TTF.WL
Pirawala kikarwala	---	506 ha	Game Reserve	1978	30/21 N. 72/02 E.	N/A
Qadirabad Head Works	---	2,849 ha	Game Reserve	1978	32/18 N. 73/29 E.	TTF.WL
Rahri Bungalow	---	5,463 ha	Game Reserve	1978	Not Recorded	TTF. Sandy
Rajan Shah Plantation	---	2,110 ha	Wildlife Sanctuary	1986	Not Recorded	TTF. Sandy
Rakh Ghulaman	---	4,356 ha	Wildlife Sanctuary	1989	Not Recorded	TTF
Rasool Barrage	IV	1,138 ha	Game Reserve	1974	32/42 N. 73/33 E.	TTF.WL
Shorkot Forest Plantation	---	4,079 ha	Wildlife Sanctuary	1990	30/50 N. 72/04 E.	TTF
Sodhi	IV	5,817 ha	Wildlife Sanctuary	1983	32/35 N. 72/17 E.	STSF
Taunsa Barrage	IV	6,566 ha	Wildlife Sanctuary	1972	30/42 N. 70/46 E.	TTF.WL
Tehra Plantation	---	339 ha	Wildlife Sanctuary	1978	Not Recorded	TTF
Thal	---	71,275 ha	Game Reserve	1978	33/22 N. 70/33 E.	TTF. Sandy
Ucchali lake	---	942 ha	Game Reserve	1991	32/36 N. 72/13 E.	STSF.WL
Wathar Reserve Forest	---	1,874 ha	Wildlife Sanctuary	---	Not Recorded	TTF. Sandy

Annex J: Undertaking to Document Contribution of Assets

The following agreement has been made on..... day of..... between.....resident of(the Owner) and (the Recipient / Client).

1. That the Owner holds the transferable right ofacres of land in.....
2. That the Owner testifies that the land/structure is free of squatters or encroachers and not subject to other claims.
3. That, to the best of his knowledge, there are no other lawful claimants to the property.
4. That he/she does not have tenants on the property.
5. That the Owner hereby grants to the Recipient this asset for the construction and development of
6. That the Owner will not claim any compensation against the grant of this asset.
7. That the Recipient shall construct and develop the.....and take all possible precautions to avoid damage to adjacent land.
8. That both the parties agree that the.....so constructed/developed shall be public premises.
9. That the provisions of this agreement will come into force from the date of signing of this deed.
10. That the owner gives up all claims to the land provided and the title to the land will be transferred to the recipient through notary public.

Signature of the Owner / Beneficiary Farmer

Signature of the Recipient / Client

Witnesses:

1. Head of Village _____

2. Government Employee/
Representative of Client _____

3. Adjacent land owner _____

(Signature, name and address)

Annex K: Chance Finds Procedure

The purpose of this document is to address the possibility of archaeological deposits becoming exposed during ground altering activities within the proposed subproject areas and to provide protocols to follow in the case of a chance archaeological find to ensure that archaeological sites are documented and protected as required.

The proposed subprojects may involve excavation. Therefore, the possibility of chance find is not ignorable. In case of any chance find, the WUAs/Contractor/Farmers will immediately report to Project Implementation and Supervision Consultant (PISC). The PISC will immediately report to Directorate General of Archaeology & Museum, Government of Punjab / District office with the consent/approval of Directorate General On Farm Water Management (DG-OFWM) to take further suitable action to preserve those antique or sensitive remains. Representative of the DG (Archaeology & Museum) will visit the site and observe the significance of the antique, artifact and cultural (religious) properties and significance of the project. The report will be prepared by representative and will be given to the DG (Archaeology & Museum). The documentation will be completed and if required suitable action will be taken to preserve those antiques and sensitive remains.

In case any artifact, antiques and sensitive remains are discovered, chance find procedures should be adopted by WUAs/Contractor/Farmers' workers as follows:

- Workers will be trained in the location of heritage zones within the construction area and in the identification of potential items of heritage significance;
- Stop the construction activities in the areas of chance find;
- Delineate the discovered site or area;
- Consult with the local community and provincial Archaeological Department;
- The suggestion of the local communities and the concerned authorities will be suitably incorporated during taking the preventive measures to conserve the antique, artifact and cultural (religious) properties;
- Secure the site to prevent any damage or loss of removable objects. In case of removable antiquities or sensitive remain, a night guard shall be arranged until the responsible local authorities take over; and
- After stopping work, the WUAs/Contractor/Farmers must immediately report the discovery to the PISC.

The contact address of Directorate General of Antiquities, Government of Punjab, is given below:

Director General
Archaeology Department
1st Floor Auqaf Department,
Shahrah-e-Quaid-e- Azam, Lahore
Tel: 042-99231526 and 99231527

Annex L: Traffic Management Plan

Need for Plan

During the construction period of the proposed subprojects, considerable vehicular movement carrying construction material is expected. This may interrupt the local traffic and is therefore important to manage the traffic to avoid the nuisance to local residents in terms of noise, dust, congestion and inconvenience.

The Plan

The objective of Traffic Management Plan (TMP) is to define the requirements that should be implemented to mitigate any potential negative risks to the environment, workers or the community resulting from construction traffic.

The TMP will advise and inform WUAs / Contractors / Farmers and external suppliers of equipment and materials of access and entry points along with other key information such tipping areas and wash-out areas. The TMP will be classed as “live” and therefore be subjected to updates as required.

The WUAs / Contractors / Farmers, at the time of the execution of the proposed subprojects, will prepare a comprehensive TMP in coordination with local traffic police department (where required), Client, emergency services and local administrative department with the support and consent of Environmental and Social Safeguards Cell (ESSC)/District Environmental and Social Coordinators (DESCs) (Water Management Officers (WMOs)). The Client and Project Implementation Supervision Consultant (PISC) will review and approve the WUAs / Contractors /Farmers TMP. The plan will be developed in such a way that it will comply with the provisions of the ESMF and requirements of World Bank General EHS Guidelines, 2007. The WUAs / Contractor / Farmers TMP shall include following mitigation measures during its preparation:

- 7.4.1 Undertake a road conditions assessment prior to and following the peak construction period, to assess any damage to road infrastructure that can be attributed to PRIAT Project development;
- 7.4.2 Repair damage as appropriate or enter into a voluntary agreement with the relevant roads authority to reimburse the cost of any repairs required to the public road network as a result of the proposed PRIAT Project;
- 7.4.3 Spoil dumpsites located close to subproject sites to minimize journey distance and limit movements to site access roads;
- 7.4.4 Construction of worker accommodation on site (if needed) to reduce light vehicle movements relating to travel to/ from the site;
- 7.4.5 Schedule deliveries and road movements to avoid peak periods;
- 7.4.6 Speed restrictions for project traffic travelling through communities;
- 7.4.7 Run a safety campaign to improve the people’s knowledge of the traffic hazard on their roads, public information and other activities to address the issues;
- 7.4.8 Run a pedestrian awareness program; and
- 7.4.9 Temporary signage.

Other Recommendations

It is important to manage public access routes during construction because it can cause delay to local traffic and create a safety hazard both on and offsite. People working and living near the construction sites would be annoyed by the emissions, noise and visual intrusion of queuing vehicles. Some important factors involved in access routes and site traffic are as follows:

Public Access Routes

The use of public road for site access may be restricted in terms of:

- 7.4.10 Vehicle size, width and type of load;
- 7.4.11 Time limits;
- 7.4.12 Parking; and
- 7.4.13 Pedestrian conflicts.

The WUAs / Contractor / Farmers should have consultation with the local police to address these issues and to effectively manage them before the beginning of the construction.

Site Workers Traffic

Site personnel should not be permitted to park vehicles right on the road; this will lead to disruption in material deliveries. Designated parking areas with appropriate parking space will be needed for this purpose; any plain area near construction site can be used for this purpose.

Site Rules

1. The need for vehicles to reverse will be avoided where possible as reversing is a major cause of accidents. One-way systems will be preferred as far as reasonably practicable to reduce the risk, especially in storage areas and at construction sites and near public settlements;
2. Access to and from the site must be only via the specified entrance;
3. On leaving the site, vehicles must be directed to follow the directions given;
4. Drivers must adhere to the site speed limits (20 km/h is recommended);
5. Drivers will be educated to observe the on-site speed limit and consider the safety of the workers in the surrounding while driving through the area.
6. All material deliveries to site must keep allocated time limits;
7. No material or rubbish should be left in the loading-unloading area;
8. Develop a map for alternate routes showing material delivery services;
9. Assign designated personnel, by Contractor/WUAs/Farmers on site to receive deliveries and to direct the vehicles;
10. Ensure periodic inspection of vehicles, if required;
11. Monitor vehicle movement to reduce the likelihood of queuing or causing congestion in and around the subproject areas; and

12. Project vehicles should have a unanimous badge or logo on windscreen displaying that they belong to the proposed project, if required.

Driver Competency

The Contractor/WUAs/Farmers, in coordination with the service providers, shall ensure that the drivers/operators are competent and meet the following.

- All drivers shall have valid driving license for the respective category;
- All drivers/operators must be mentally sound and medically fit;
- Preference shall be given to the drivers/operators who have prior experience in similar arrangement; and
- The drivers and operators shall be carefully assessed considering their respective category of operation.

Driver's Induction and Training

- Contractor/WUAs/Farmers, in coordination with the service providers (construction materials, HEIS, solar system etc.), will ensure the provision of training to the drivers on the principles of the defensive driving techniques;
- Periodic HSE briefings, meetings and refresher training shall be conducted for drivers as
- and when required; and
- HSE induction shall be provided to drivers before they are deputed at site.

Loading Unloading Management

Contractor/WUAs/Farmers will ensure that service providers are adopting best possible practices to eliminate or control the risks arising during loading/unloading of materials/ luggage especially Precast Concrete Parabolic Segment (PCPS).

Traffic Violation/Offence

Disciplinary action will be taken against violations of traffic rules and regulations. The action will be subject to the nature of violation that may result in various consequences such as verbal, written warning and in some cases termination as well.

WUAs / Contractor / Farmer's Obligation

The TMP of the WUAs / Contractors / Farmers should be safe enough and widening of any access roads and construction of the detours (if required) must be completed prior to start of proposed project construction activities so that vehicular transportation for construction activities do not hinder the

normal course of traffic lanes. The WUAs / Contractors /Farmers obligation must include the display of traffic signs according to the need to divert the traffic and to guide the road users in advance (where applicable). The traffic sign, traffic light should be placed from any diverting route or road marking.

The WUAs / Contractors / Farmers should consider the environmental and social impacts of the traffic during construction. It will be sole responsibility of the WUAs / Contractors Farmers to implement a plan which produces minimum nuisance to the local people and to the environment. Safety of the people should be given due importance. It will be under WUAs / Contractors / Farmers obligation to notify the TMP and its later changes to Client, emergency services and Traffic Police, and also publish weekly program in the local newspaper (where applicable, as per advice of Environmental Specialist).

Annex M: Guidelines for Emergency Response Plan

General

An Emergency Response Plan (ERP) is a documented series of steps which Water User Association (WUAs) / Contractor / Farmers will take during an emergency to ensure workers' safety and minimize the impacts on the proposed subprojects activities. The purpose of this ERP is to provide measures and guidance for the establishment and implementation of ERP for the proposed subprojects.

Objectives

Following are the core objectives of the ERP:

- 1 Prevent fatalities and injuries;
- 2 Reduce damage to project structures, stock, and equipment;
- 3 Protect the environment and the community; and
- 4 Accelerate the resumption of normal operations.

Scope Of ERP

The ERP will be applied to proposed subproject activities including improvement / extension of lining / reconstruction of water courses, development of water ponds, installation of High Efficiency Irrigation System (HEIS) and solar systems, etc. The following are some emergencies that may require emergency response.

- 5 Occupational accidents (including injuries due to fall, slip, construction machinery / instruments or structure collapse or loss of life, etc.);
- 6 Community accidents (including construction machinery / traffic accidents);
- 7 Hazardous material spills;
- 8 Natural disasters e.g. flooding, earthquake⁶, etc.;
- 9 Dengue;
- 10 COVID-19 pandemic; and
- 11 Fire.

Emergency Response Team

In case of any emergency, the WUAs / Contractor / Farmers along with their field staff will act as emergency response team. The WUAs / Contractor / Farmers will also designate a coordinator and other team members in consent and approval of concerned Water Management Officers (WMOs). The coordinator will coordinate with site staff, RESCUE-1122, Police-15 (if needed) and make an official statement (when needed).

First Aid Persons

Upon advice of medical emergency, the coordinator will make immediate assessment to response required and if necessary, advise call to ambulance or medical assistance, the qualified first aid attendant should also,

⁶ In case of natural disaster, guidelines under the updated/latest Provincial Disaster Response Plan may be followed (where applicable).

- Provide treatment to the victim(s) to the best of his/her ability;
- Ensure the safety of victims by ceasing any work activity in the area;
- Protect the injured from further danger and weather; and
- Assist medical services personnel when they arrive.

First Aid Facilities

1. First Aid Facility/ kits will be provided at work sites at strategic locations for the entire duration of subproject (s);
2. First aid boxes location will be clearly marked with a signage in local language at working sites along with the contact details of first aiders;
3. Workers will also be informed about the location of first aid box and who is first aider;
4. To be precise, one first aid box will be provided for each subproject or as per the requirement considering the ratio of 50 workers/ first aid box; and
5. Contractor HSE staff will regularly inspect the first aid boxes to check the presence of required items and in sufficient number. The missing items will be replenished if found deficient during inspection.

First Aid kit will be comprised of the below mentioned first aid items but may not limited to only these:

First Aid Kit Contents

6. Pyodine solution;
7. Hand Gloves;
8. Gauze Pad;
9. Scissors;
10. Forcep;
11. Thermometer;
12. Saniplast (First Aid Bandage);
13. Vintogeno Balm;
14. Polyfax skin ointment;
15. Cotton Bandage;
16. Crepe Bandage;
17. Paper Tape;
18. Eye Drops; and
19. Pain Killer.

Procedure

Emergency situation and injuries to person can occur at any time or place either on proposed subproject sites or elsewhere. The most anticipated types of emergencies on subproject sites are fire and serious accidents (occupational / community) that's why procedures to cope with them are provided hereunder.

Figure M1: Emergency Procedures for Fire

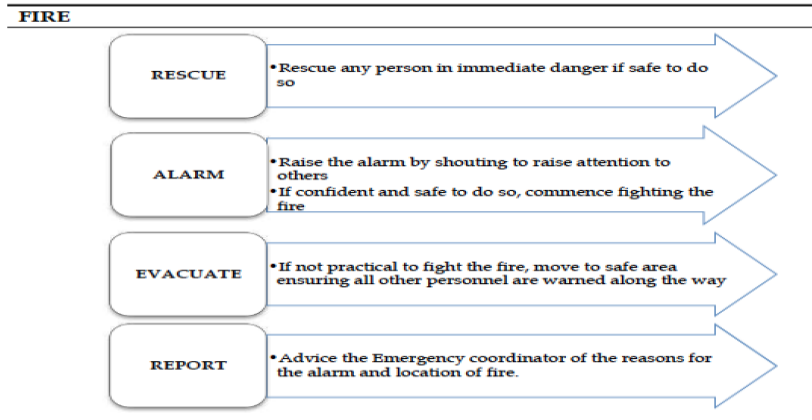
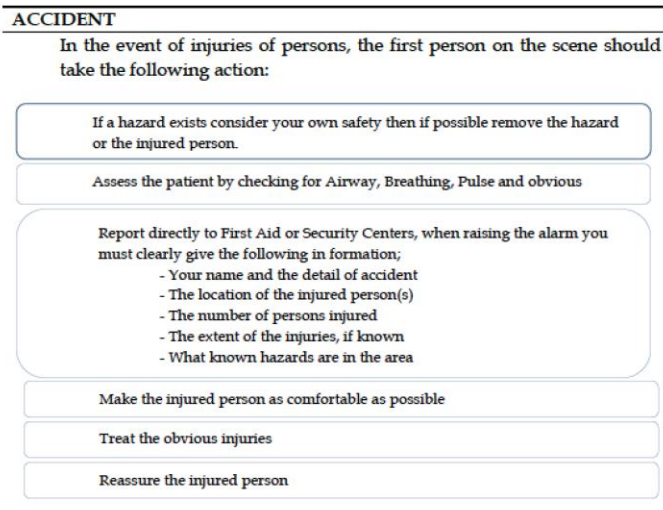


Figure M2: Emergency Procedures for Serious Accidents



Apart from above mentioned emergencies, ERP should also be prepared in accordance with that follow the Centers for Disease Control and Prevention (CDC), OSHA, state/territorial, and local guidelines for preventing the spread of COVID-19 infection. Standard Operating Procedures (SOPs) for workplaces and offices to prevent COVID-19 Spread (Notified by Primary & Secondary Healthcare Department Govt of the Punjab on 23rd June 2020, available at <https://pshealthpunjab.gov.pk/Home/Covid19SopsGuidelines>).

Incident And Accident Report

In case of an incident and accident, report needs to be generated. The tentative format is provided blow (revised based on site specific activities when the project footprints are finalized).

Initial Accident Notification Report

Date:		Site:	
Time:		Department:	
Classification:		Incident Location:	
Operator's Name		Occupation:	
Supervisor's Name			

Please tick:	Earthworks	Civil	Transport	Mechanical	Electrical	Other
---------------------	-------------------	--------------	------------------	-------------------	-------------------	--------------

PHOTO	Description of the Incident

Preliminary Root Causes: **Yes** **No** **If "YES" describe:**

.....

Risk Ass Completed?
.....

Hazard Identified?
.....

Risks and precautions communicated?
.....

Adequate and competent Supervision?
.....

Immediate Corrective Situations & Preventive Measures

Investigated by:		
HSE Representative Signature (Contractor/WUAs/Farmers)	Name:	Date

Assistance from Nearby Local Hospital

If the patient condition/ injury would be serious and need to be examined by the specialist, the affected would be taken to the nearby hospital.

Emergency Trainings

The HSE personnel of Contractor/WUAs/Farmers, with the support and consent of ESSC-PMU / nominated staff and PISC will ensure that appropriate training is carried out for all subprojects personnel. Entire emergency plan will be tested, reviewed and developed through periodic exercises to ensure that data is accurate, trigger mechanisms and levels are reasonable, communications are effective, hazard warnings are effective and sufficient, and response procedures are proportional to the hazard posed and are efficient and effective.

Incident Management Training

The designated staff of the Contractor/WUAs/Farmers will review the emergency preparedness plan and be aware of the actions required if trigger events are met. Staff will be fully involved in any exercises so that their roles and responsibilities are clear. Staff will be provided with feedback on their performance and will be re-trained as appropriate.

Suggested Contents of Site-Specific ERP

The WUAs / Contractor and/or Farmers should prepare the site-specific ERP based on the guidelines provided in the above sections. The site-specific ERP should have names and contact details of the emergency response team as well. The suggested structure of the ERP, but not limited to, is listed below:

1. Purpose
2. Applicable Scope
4. Emergency Response System along with Responsibilities
5. Major Safety Risks
6. Precautionary Measures
 - 6.1 Training and Exercise
 - 6.2 Hazard Source Monitor
 - 6.3 Alert Action
 - 6.4 Management Measures
7. Control Measures
 - 7.1 Response
 - 7.2 Response Procedures
 - 7.3 Emergency Response
 - 7.4 Emergency Completion and Restoration
8. Emergency Response Report and Settlement
9. Supporting Measures
 - 9.1 Communication
 - 9.2 Emergency Team
 - 9.4 Provisions and Resources
10. Reporting and Records

11. Revision
12. First Aid Facilities and Medical Facilities

Annex N: Guidelines for Occupational Health and Safety Plan

Occupational Health and Safety covers all personnel working under the proposed subprojects, prepared by the Contractors/Water User Associations (WUAs) / Farmers based on these guidelines and in line with the World Bank EHS guidelines, 2007.

The Occupational Health and Safety program will aim to ensure that the workplace is safe and healthy by: addressing the hazards and risks at the workplace; outlining the procedures and responsibilities for preventing, eliminating and minimizing the effects of those hazards and risks; identifying the emergency management plans for the workplace or workplaces; and specifying how consultation, training and information are to be provided to employees at various workplaces.

Some of the risks/hazards associated with workplaces are due to working close to or at sites associated with the various project construction activities. Other risks associated with the project construction phase include risk of increase of vector borne and other different diseases.

The following sections will be implemented during the construction phase to address and ensure workers' health and safety.

Roles And Responsibilities

Contractor/WUAs will be responsible for the management and implementation of this occupational and community health and safety. The Contractor/WUAs will prepare a detailed site-specific health and safety plan which defines the roles and responsibilities of the nominated /designated health and safety team.

Screening and regular unannounced checking of workers

As per the procedure for hiring workers, all Contractors/WUAs/ Farmers are required to make all prospective workers undergo medical tests to screen for diseases and sicknesses, prior to selection and employment of any worker. The Contractor/WUAs/Farmers is also responsible for ensuring that no worker who has a criminal record is employed at the project site. It will be ensured that all workers undergo medical tests to screen diseases at source and at sites in consultation with the nominated person (as per advice of Environmental Specialist).

In addition to this, the Proponent/ESSC-PMU will also undertake sudden, unannounced checks on workers to look for diseases such as COVID-19, HIV, STDs, and hepatitis and take necessary steps as mandated by the Contractual agreement between the Contractor/ WUAs and the Worker(s).

Minimizing hazards and risks at the workplace

To ensure safety at all work sites, the following will be carried out:

1. Installation of signboards and symbols in risky and hazardous areas, to inform workers to be careful;
2. Construction of barricades around construction sites and excavated pits, to cordon off and deter entry of unauthorized public/children into these areas;
3. Providing a safe storage site/area for construction machinery and equipment to prevent misuse and loss;
4. Proper Housekeeping: Ensuring that materials are all stacked, racked, blocked, interlocked, or otherwise secured to prevent sliding, falling, or collapse. Brick stacks will not be more than 7 feet in height and for concrete blocks they will not be more than 6 feet high;

5. Removing all scrap timber, waste material and rubbish from the immediate work area as the work progresses;
6. Ensure that all ramps or walkways are at least 6 feet wide, having slip resistance threads and not inclined at more than a slope of 1 vertical and 3 horizontal;
7. Stacking away all excavated earth at least 2 feet from the pit to avoid material from falling back into the excavated area and injuring those working inside excavated sites;
8. Only a trained electrician should be hired to repair and install the electrical equipment (where required) to prevent risks of electrical shocks; and
9. Install fire extinguishers and/or other fire-fighting equipment at every work site to prepare for any accidental fire hazards.

Provision of Personal Protective Equipment

Risks to the health and safety of workers can be prevented by provision of Personal Protective Equipment (PPEs) to all workers. This will be included in the construction cost for each Contractor/WUAs. Depending on the nature of work and the risks involved, Contractor/WUAs must provide without any cost to the workers, the following protective equipment (as per advice of Environmental Specialist):

- High visibility clothing for all personnel during works must be mandatory;
- Helmet shall be provided to all workers, or visitors visiting the site, for protection of the head against impact or penetration of falling or flying objects;
- Safety boots shall be provided to all workers for protection of feet from impact or penetration of falling objects (like PCPS) on feet;
- Ear protecting devices (if required/as per advice of Environmental Specialist) shall be provided to all workers;
- Eye and face protection equipment shall be provided to all welders to protect against sparks (may be required during installation of solar system); and
- Respiratory protection devices shall be provided to all workers during occurrence of fumes, dusts, or toxic gas/vapor (may be required during installation of HEIS system).

Procedures to Deal with Emergencies such as Accidents, Sudden Illness and Death of Workers

First aid kits will be made available at all times throughout the entire construction period by the respective Contractor/WUAs. This is very important, because most work sites will be at some distance from the nearest hospital.

First Aid Facilities

20. First Aid Facility/ kits will be provided at work sites at strategic locations for the entire duration of subproject (s);
21. First aid boxes location will be clearly marked with a signage in local language at working sites along with the contact details of first aiders;
22. Workers will also be informed about the location of first aid box and who is first aider;
23. To be precise, one first aid box will be provided for each subproject or as per the requirement considering the ratio of 50 workers/ first aid box; and

- 24.** Contractor HSE staff will regularly inspect the first aid boxes to check the presence of required items and in sufficient number. The missing items will be replenished if found deficient during inspection.

First Aid kit will be comprised of the below mentioned first aid items but may not limited to only these: Pyodine solution, Hand Gloves, Gauze Pad, Scissors, Forcep, Thermometer, Saniplast (First Aid Bandage), Vintogeno Balm, Polyfax skin ointment, Cotton Bandage, Crepe Bandage, Paper Tape, Eye Drops and Pain Killer.

In addition to the first aid kits, the following measures should be in place:

- A vehicle shall be on standby, so that emergency transportation can be arranged to take severely injured/sick workers to the nearest hospital for immediate medical attention;
- A designated Health Officer/worker for the Project will be identified as a focal person to attend to all health and safety related issues. This employee's contact number will be posted at all work sites for speedy delivery of emergency services; and
- Communication arrangements, such a provision of mobile for all work sites, for efficient handling of emergencies, will be made.

Record Maintenance and Remedial action

The Contractors/ WUAs will maintain a record of all accidents and injuries that occur at the work site. Reports prepared by the Contractors/ WUAs shall include information on the place, date and time of the incident, name of persons involved, cause of incident, witnesses present and their statements (format provided in Guidelines for Emergency Response Plan). Based on such reports, the management can jointly identify any unsafe conditions, acts or procedures and recommend for the Contractors/ WUAs to undertake certain mitigative actions to change any unsafe or harmful conditions.

Compensation for Injuries and Death

Any casualty (unlikely keeping in view the extent of proposed interventions) or injury resulting from occupational activities should be compensated as per the local labor laws of Pakistan. Where compensation is sought by the injured party, proper procedures for documentation of the case will be followed, including a detailed report on the accident, written reports from witnesses, report of the examining doctor and his/her recommendation for treatment. Each individual Contractors/ WUAs will be responsible for ensuring compensation for the respective workers.

Awareness Programs

The Contractors/ WUAs will undertake awareness programs (as per advice of Environmental Specialist) through posters, talks, and meetings to undertake the following activities:

- Dissemination sessions will clarify the rights and responsibilities of the workers regarding interactions with local people (including communicable disease risks, such as HIV/AIDS, COVID-19, Dengue), work site health and safety, waste management (waste separation, recycling, and composting), and the illegality of poaching; and
- Make workers aware of procedures to be followed in case of emergencies such as informing the focal health person who in turn will arrange the necessary emergency transportation or treatment.

Dengue Control Strategy

Contractor/WUAs will implement the following control measures to prevent/ control dengue fever in the subproject areas:

1. Disinfect by spraying in Contractor's living areas (if established);
2. Workers will be encouraged to use insect repellent;
3. Workers will be instructed to wear long-sleeved shirts and long pants;
4. Workers will be instructed to take control measures at their residence/ construction camps (if established);
5. Contractor HSE staff will do regular site inspections;
6. Clear immediately, if stagnant water/ mosquito breeding place is observed;
7. Dengue awareness raising sessions will be arranged; and
8. In induction/training, the workers will be educated on protective measures to avoid
9. dengue.

Nomination of a Health and Safety Focal Person

For each Contractors/ WUAs, a Health and Safety Focal Person will be appointed/ nominated. The Terms of Reference for the focal person will mainly be as follows:

1. Function as the focal person/representative for all health and safety matters at the workplace;
2. Responsible for maintaining records of all accidents and all health and safety issues at each site, the number of accidents and its cause, actions taken and remedial measures undertaken in case of safety issues;
3. Be the link between the Contractors/ WUAs and all workers and submit grievances of the workers to the Contractors/ WUAs and instructions/directives on proper health care and safety from the Contractors/ WUAs back to the workers;
4. Ensure that all workers are adequately informed on the requirement to use PPEs and its correct use; and
5. Also responsible for the first aid kit and making sure that the basic immediate medicines are readily available.

Suggested Contents of Occupational Health and Safety Plan

The suggested contents of Occupational Health and Safety Plan to be developed by the WUAs / Contractor(s) are described below:

1. Purpose
2. Scope of Application
3. Contractual and Legal Requirements
4. Occupational Health and Safety Objectives
5. Organization and Responsibility
 - Contractor's/WUAs HSE Management
 - Medical Arrangements of the Contractor(s)/WUAs
 - Occupational Health and Safety

- Community Health and Safety
- 6. Hazard Identification and Risk Assessment
- 7. Health Plan
 - Labour Protection
 - Sanitary Epidemic Prevention
- 8. Safety Plan
 - Summary
 - Qualification Review
 - Safety Training and Awareness
 - Construction Plans and Documents
 - Control Measures
 - Monitoring Measures
 - Management of the Key Safety Accidents
- 9. Public Security Plan
- 10. Emergency Response Plan
- 11. Construction Camp Management Plan (if established)
- 12. Safe Working Procedures
- 13. Consultation and Communication Process
- 14. Performance Monitoring
- 15. Documentation and Reporting

Annex O: Guidelines to Combat COVID-19

Introduction

On February 11, 2020 the World Health Organization [announced](#) an official name for the disease that is causing the 2019 novel coronavirus outbreak, first identified in Wuhan China. The new name of this is coronavirus disease 2019, abbreviated as COVID-19. In COVID-19, 'CO' stands for 'corona,' 'VI' for 'virus,' and 'D' for disease. Formerly, this disease was referred to as "2019 novel coronavirus" or "2019-nCoV".

Coronaviruses are a large family of viruses. Some cause illness in people, and others, such as canine and feline coronaviruses, only infect animals. Rarely, animal coronaviruses that infect animals have emerged to infect people and can spread between people. This is suspected to have occurred for the virus that causes Coronavirus Disease 2019 (COVID-19). Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS) are two other examples of coronaviruses that originated from animals and then spread to people.

The risk of exposure to COVID-19 is no different for employees of Employer, Engineer, WUAs / Contractor, and suppliers than for the general population. WUAs / Contractor, therefore, must consider the physical well-being and safety of all the persons entitled to be on the Site and follow reasonable guidelines and recommendations of Government authorities and healthcare professionals. As experience has shown in other countries, confirmed cases of COVID-19 expand exponentially if health and safety controls are left unheeded.

WUAs / Contractor should enforce all health and safety procedures at Site including sanitary protocols, proper hygiene, social distancing, use of personal protective equipment (PPE), toolbox talks on special COVID-19 requirements, and prompt reporting of health issues related to COVID-19. WUAs / Contractors must put safeguards in place to keep workers exposed to COVID-19 away from Site for at least 14 days after the last potential exposure.

WHO declared the COVID-19 as a Public Health Emergency of International Concern (PHEIC) in January 2020 and afterwards announced the COVID-19 outbreak as pandemic on 11th March 2020 due to the widespread of the disease in 114 countries at that time. WHO Director General urged the countries to take action now to stop the disease.

The rapid spread of COVID-19 hits all the provinces of Pakistan Sindh, Balochistan, Punjab & Khyber Pakhtunkhwa including the Gilgit Baltistan and Azad Jammu & Kashmir. The prevailing virus creates the menacing and distressing situation when it arrived around the closed proximities of the Project Area.

Government of Pakistan has launched the National Action Plan for COVID-19 Pakistan to combat the challenge of prevailing virus, also available at <https://www.nih.org.pk/wp-content/uploads/2020/03/COVID-19-NAP-V2-13-March-2020.pdf>. The Government of Pakistan has launched the real-time data portal for COVID-19 <http://covid.gov.pk/>. These measures are mostly relating to the containment and awareness and capacity building. Besides this COVID-19 daily situation report is also available at <https://www.nih.org.pk/wp-content/uploads/2020/04/COVID-19-Daily-Updated-SitRep-03-April-2020.pdf>.

All the stakeholders are on board to jointly prevent/ limit/ control the spread of COVID-19. All of the staff is required to take precautionary measures as well as maintain social distances. The use

of thermal guns for checking every single person body temperature, placement of relevant flyers and disinfection spray inside of all the containers are few of the measures to combat COVID-19.

Objective

Following are the objectives of this report to jointly prevent / limit/ control the spread of COVID-19 at Site that can hamper the progress of proposed Project:

- To enhance understanding of the evolving COVID-19;
- To share knowledge on COVID-19 and preparedness measures being implemented at Site;
- To generate recommendations for adjusting COVID-19 containment and response measures; and
- Outline the measures taken at Site. The advised measures will help all the stakeholders to plan their work continuity in response to the COVID-19.

Due to the evolving situation of the COVID-19, this document should be read in conjunction with the latest relevant advisories issued by WHO (especially "[Getting your workplace ready for COVID-19, 3 March 2020](#)") and Government of Pakistan.

What Is Coronavirus (COVID-19)

The COVID-19 belongs to a family of viruses known as the Coronaviruses, which can cause illnesses ranging from the common cold to more severe diseases, such as the Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS)⁷.

Symptoms

The symptoms of the COVID-19 are similar to that of regular pneumonia. Typical symptoms include;

- Fever;
- Cough;
- Difficulty in breathing;
- Pneumonia;
- Runny nose;
- Sore throat; and
- Feeling of being unwell.

Mode Of Spread

Infected person – person transmission; Infected people can spread COVID-19 through their respiratory secretions via droplets produced when an infected person coughs or sneezes, similar to how influenza and other respiratory pathogens spread. The spread from person-to person is most likely among close contacts (about 6 feet);

⁷ Source: World Health Organization

- Infected animals' dead or alive;
- Air by coughing and sneezing;
- Close personal contact, such as touching or shaking hands;
- Touching an object or surface with a virus on it; and
- Touching your mouth nose or eyes before washing your hands.

General Standardized Precautionary Measures

Following measures/recommendations are suggested as a general guidance to be followed for the protection of potential impacts of COVID-19:

Since, there is no vaccine available to protect against human Coronavirus infections. Therefore, transmission can be prevented through following measures:

- Cover your mouth while cough or sneeze;
- Avoid close contact with people who are sick;
- Avoid the use of hard soap;
- Wash your hands often with liquid soap and water for at least 20 seconds;
- All the employees should ensure sanitization of hands at appropriate time;
- Avoid touching your eyes, nose, and mouth with unwashed hands;
- If you are concerned about your symptoms you should see your health care provider at site or in office;
- Use of Personal Protective Equipment (PPE) according to risk (a surgical or N95 mask);
- Do not spit, wrap your oral and nasal secretion with tissue and throw it in a covered dustbin;
- Balance your nutrition and exercise moderately;
- Sterilization / disinfection of medical devices at Site dispensaries; and
- Do not touch, buy or eat wild animals (gamey). Try to avoid visiting markets that sell such animals.

Project Site Specific Precautionary Measures

Measures for protecting staff and labour from exposure to, and infection with, the COVID-19 depend on the type of work being performed and exposure risk, including potential for interaction with infectious people and contamination of the work environment. Regardless of specific exposure risks, following are the main actions that have been jointly taken at Site to combat the COVID-19:

Employer's Side

Employer should issue the notification containing the precautionary measures in the light of GoPb guidelines to be implemented at Site. Upon receiving the Employer notification all the mentioned precautionary measures will be communicated to Engineer staff for compliance. Employer

technical staff is also complying with the GoPb guidelines and WUAs / Contractor suggestion to control the spread of COVID-19 at Site in the best interest of the Project and country.

Consultant's Side

Consultant's top management will issue the orders in the light of GoPb guidelines containing the precautionary measures to control the spread of COVID-19 for the staff working at Site.

Consultant staff at Site will fully comply with the orders including photographic evidence. Considering the severity of the prevailing virus Engineer devised the Standard Operating Procedure (SOP) containing precautionary action against the potential risk of novel corona virus.

Besides above, Consultant will ensure the following precautionary measures at Site.

Adequate signage and information at all entrances and exits showing what is Corona Virus, how it spreads, what are the symptoms, standard precautions; and

The awareness session for the WUAs / Contractor staff is equally important as of Consultant staff to combat the COVID-19 at Site. The Consultant will ensuring that WUAs / Contractor is arranging such session at Site from time to time to reduce the potential risk of COVID-19. Further, all the newly inducted and existing staff have been given HSE training by the Consultant & WUAs / Contractor.

WUAs / Contractor's Side

WUAs / Contractor will communicate various precautionary measures to Employer and Engineer through letters to control the spread of COVID-19 at Site. Following are the major steps to be taken by the WUAs / Contractor:

WUAs / Contractor will convey the instructions and requirements of its superior unit for the prevention and control of COVID-19 epidemic at Site.

WUAs / Contractor will establish a special organization for epidemic prevention and control on the Project Site that is responsible for arranging, implementing, publicizing and supervising the epidemic prevention and control measures.

Launch the plan for epidemic prevention and control on the project Site that includes:

- All personnel in temporary camp are required to wear masks;
- WUAs / Contractor personnel incharge of Site to wear masks;
- Arranged special personnel to measure and record the temperature of all personnel when entering or leaving the temporary camp;
- If any person with fever, cold and other symptoms are found, they will be admonished to go home for isolation and asked about the development of the disease every day; and
- Propagate and implement the epidemic prevention measures for the staffs and labours and warn them not to go outside and home as much as possible.

All these meetings should carried out through video conference, if required.

WUAs / Contractor is not limited to the above precautionary measures but practicing and implementing the following;

WUAs / Contractor will prepare a pamphlet for the awareness of Site staff to combat the COVID-19. It will also place/posted at strategic points at Site.

Launch awareness campaign to inform all the staff and labour about the coronavirus, to use facemask, hand hygiene, cough etiquette, and avoidance of close contact with animals and consumption of their raw products.

Everyday awareness speech in English and Urdu in the temporary camp.

All the employees are not allowed to go outside of the Project Area or on vacation to their homes and on daily basis visit to sites;

WUAs / Contractor will provide medical masks and antibacterial liquid hand wash to all personnel.

Thermal scanning will be carried out continuously in the morning for everybody at the main gate of temporary camp, if required.

Record will be maintained for everyone that includes the temperature value of each person with their names, every morning and afternoon go to each department for scanning separately and noted down their name with temperature values.

WUAs / Contractor carry out disinfectant spray on daily basis morning and afternoon in each office and rooms and all the area of the camp, where applicable.

Do not interact physically rather through electronically by emails or video conferencing, where applicable.

Recommendations For The Control Of Covid-19 At Site

To Avoid Transmission

For all personnel at Site, it is always a good to practice the following precautionary measures:

- Workers to remain at least two meters apart from each other at all times (social distancing) – i.e. spread out and reduce the number of people working together in one area of the site;
- Avoid eating lunch in the form of group in available mess/canteens at Site;
- Close site canteens/ food preparation and eating areas (avoid gatherings) – workers to bring their own prepared lunch to site and eat alone e.g. in their van, car, or in an open space;
- Avoid in-person meetings if possible. In the case that an in-person meeting is unavoidable, make sure to have it in a well-ventilated area with sufficient space for attendees to distance themselves from one another. For meetings such as toolbox talks, consider breaking them up into smaller group meetings versus one large meeting;
- Introduce enhanced cleaning procedures across the Site and touch points e.g. office equipment, plant and machinery controls, taps/toilet/washing facilities, handrails;
- Stagger start times on site to avoid congestion in entrance areas;
- Reduce the number of people on site inductions at any one time and hold them outdoors if possible;
- Stop workers moving across various sites (potential for cross contamination);
- No outsiders should be at the Project Site;

- WUAs / Contractor, Consultant and Employer personnel are advised to avoid travelling and in case traveling is unavoidable, prior approval from the management should be essential. In case of travelling, the above mentioned measures need to be strictly followed by the traveller;
- Prompt identification and isolation of potentially infectious individuals is a critical first step in protecting workers and other Site staff. An isolated area should be available at Site to immediately isolate suspected person, as it is most important to stop its spread at Site.
- Rapid Response Team should be formed and be informed immediately in case of suspect and confirmed case of COVID-19.
- Medical team at Site should separate the suspected person displaying fever, cough or difficulty breathing from other personnel; and
- If a person has had close contact with an individual that has confirmed COVID-19, that person will not be allowed to return to the Site until he/she has been symptom free for 14 days.
- Clean and fumigate all the workplaces at Site on daily basis;
- Ask people to stay at home if they have fever, cough, difficulty in breathing, runny nose, sore throat as per organizational rules;
- An immediate replacement of solid soap with liquid anti-bacterial soap bottles may be appropriate.
- Provision of alcohol-based hand sanitizer need to available for all staff;
- Clean the religious places carpets and rugs. Have them washed in place over the weekend and then do regular cleaning;
- Have the cleaners/ maintenance crews regularly clean surfaces that are touched frequently by personnel with disinfectants such as in and out doors;
- Fresh medical tests of staff working should be carried out at Site;
- Dispose of all contaminated waste (gloves, paper, swab handles, etc.) into biohazard waste bags for disposal;
- Ensure that panic is not created. In fact the posters should start with statements such as do not panic and fear the virus but know and prevent; and
- Ensure proper ventilation system for all the personnel at Site.

Use of Personal Protective Equipment (PPEs)

- i. Necessary PPE should be available at Site all the times and are being issued to each personnel at Site;
- ii. Practice of using masks is also being ensured by all parties at Site (a surgical or N95 masks);
- iii. Re-usable PPE should be thoroughly cleaned after use and not shared between workers. Single use PPE should be disposed of so that it cannot be reused;

Outside Visitors

- Visitors should enter with strictly wearing visitors card;
- Ensure sanitization of hands;
- All parties should ensure that the sick persons should be wearing a surgical or N95 masks;
- Note down the complete information of outsiders before entrance;
- Proper screening should be carried out before entering the Site;

- Refrain from handshakes. Rather than shaking hands, visitors may explain why handshakes can contribute to the risk of spread;
- Attempt to maintain a general six (6) feet distance between themselves. This will be challenging to follow at all times but it is Engineer recommendation to follow;
- Refrain from and/or limit touching of workplace surfaces; and
- In addition to these on-site procedures, it is advised to follow their respective organizational instructions related to Site visits.

Annex P: Integrated Pest Management Framework

Introduction

Integrated Pest Management (IPM) is defined as a pest management strategy that aims at diversifying pest control practices so that the use of pesticides is minimized or eliminated. IPM adheres to three basic principles: (i) keeping pests below economically damaging levels rather than seeking to eradicate them; (ii) rely, to the extent possible, on nonchemical measures to keep pest populations low; and (iii) selecting and applying pesticides, when they have to be used, in a way that minimizes adverse effects on beneficial organisms, humans, and the environment.

One of the main constraints in increasing crop production is the pests. Pests can include weeds, plant pathogens (certain fungi, bacteria, and viruses), rodents, and nematodes in addition to the plant-feeding insects and mites described in the preceding text, and are estimated to destroy as much as one-third of all agricultural yield. According to an estimate, annual yield losses due to insect pest are 20-40 percent in overall agricultural products. In the past, pesticides were considered as the universal remedy for the control of agricultural pests⁸. Although pesticides did provide temporary relief, it is now widely accepted that indiscriminate and excessive use of pesticides and the long-term dependency on them threaten sustainable crop production. Excessive reliance on chemical pesticides is not only expensive but also leads to environmental degradation, in addition to increased health hazards to both, the growers and consumers.

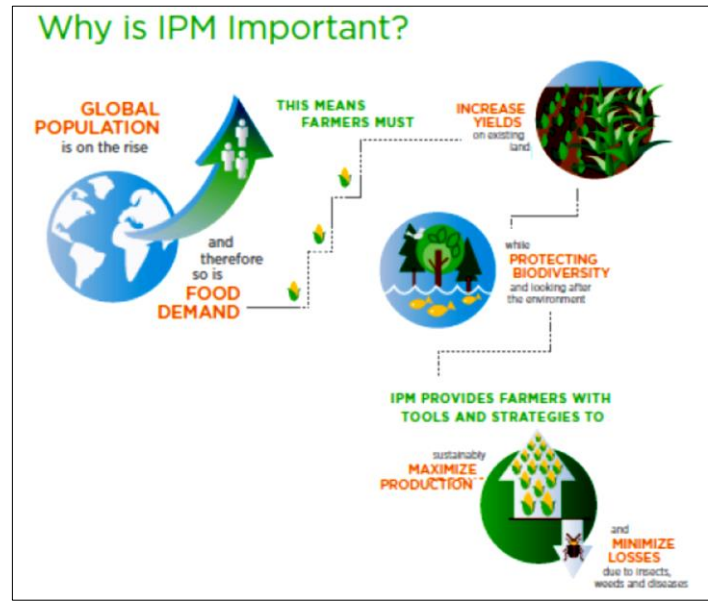
In Pakistan, several IPM programs have been implemented for management of some major agricultural pests. In majority of the cases these programs were successful in pest suppression for the time being. However, owing to reasons like high initial cost, inconsistent availability of the required inputs, complexities of the techniques and non-existent value chains for the produce, etc., these programs could not attain the required level of social acceptance, hence discontinued by the farmers after withdrawal of the support. In order to cope with these challenges posed by the above mentioned factors, it is therefore, imperative to formulate a comprehensive IPM policy that is in line with the strategic national and provincial goals of food security and poverty alleviation.

⁸ Oerke, E.C., 2006. "Crop losses to pests". *The journal of Agricultural Science*. 2006.144(1): 31-43.

Why IPM Is Important?

The demands of a growing world population for food and fiber, require farmers to produce more crops on existing farmland. To increase these yields requires continuous improvement of agricultural technologies to minimize crop losses. The challenge is to do this, while protecting the environment.

IPM is a big part of the solution. Increasingly it is being adopted in both developed and developing countries for long-term, sustainable agriculture that achieves adequate, safe and quality food production, improves farmer livelihoods and conserves non-renewable resource.



Goal of Preparing the Integrated Pest Management Framework

The goal of Integrated Pest Management Framework (IPMF) is “to promote integrated pest management for minimizing environmental hazard and ensuring health safety”.

The framework incorporates practical pesticide best management practices that are aimed at:

- Minimizing pest population and associated effects;
- Protecting the natural environment and human health;
- Promoting sustainable and cost-effective pest management;
- Ensuring compliance with all pertinent laws, regulations, and policies; and
- Ensuring that ecologically-sound vegetation and pest management principles, concepts and techniques are promoted in the design and implementation of development projects.

The Aim and the Nature of the IPMF

The IPMF would be prepared with the aim to standardize the pest management in line with the regulatory compliance of government and World Bank (WB). Guidance will be given on improved pest management and importance will be given to adopt improved pest, disease and weed management for reducing harmful impact of chemicals on the environment and health. Safety issues for application of chemicals as a part of integrated pest management also will be highlighted to follow.

Objectives of IPMF

- To develop an IPMF for the proposed subprojects under PRIAT;
- To propose pest management strategies for the major pests in Punjab;
- To mitigate the negative impacts of the pesticides on food, feed, and environment;
- To make proposal for the legal issues for the implementation of IPMF;
- To identify capacity needs and technical assistance for successful implementation of the IPMF;

- To establish farmers field schools in the target areas; and
- To identify IPM research areas for the major pests in the major crops.

Principles of IPM

IPM is the consideration, evaluation and consolidation of pest control methods into a unified program to manage pest populations so that economic damage is avoided and adverse side effects on environment are minimized.

Food and Agriculture Organization (FAO) defined IPM as a pest management system that means the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human and animal health and/or the environment. IPM emphasizes the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms. Being a realistic approach, it seeks to reduce pest populations to economically manageable levels through a combination of pest control methods including even the use of chemical pesticides⁹.

Legislative measures

Legislative or legal control regulates the activities through legislation or law approved by the Government. These laws, rules and policies regulate domestic and international trade of agriculture commodities and other goods and means that could possibly carry unwanted organisms. These legal instruments also govern the manufacture, sale and use of pesticides.

In cases of agriculture pests' outbreaks or public health in epidemic form, the individual farmer becomes helpless in suppressing these problems. To meet these challenges, the entire community, district, province or the nation as a whole has to make collective efforts for massive operations. For such purposes, first approval of the public is obtained through legislation and then resources are mobilized and funds made available by the Government. Legislative control, therefore, has three major thrusts.

- Quarantine regulations for the prevention of shipment or transportation of insects, diseases and weeds and their seeds from one country to the other or one province to another;
- Pesticides regulations to regulate manufacture sale and use of pesticides; and
- Other regulations related to the control of insect pests like locusts in epidemic form, the malarial mosquitoes and the insect pests of cash crops through community/ participatory IPM/ Integrated Disease Management (IDM) and/or aerial spraying.

⁹ The International Code of Conduct on Pesticide Management, World Health Organization and Food and Agriculture Organization (FAO) of the United Nations, Rome, 2014.

Provincial Laws and Regulations¹⁰

- Agricultural Pesticides Ordinance 1971 and Punjab Agricultural Pesticides (Amendment) Act, 2012; and
- Punjab Agricultural Pesticide Rules, 2018.

The conditions and precautionary measures regarding pesticides mentioned in Agricultural Pesticides Ordinance 1971, Punjab Agricultural Pesticides (Amendment) Act, 2012, Agricultural Pesticide Rules, 2018 and World Bank requirements must be followed during the implementation of IPMF.

The World Bank Standard

The World Bank Environmental and Social Framework (ESF) standard “*ESS-3 Resource Efficiency and Pollution Prevention and Management*” uses various means to assess pest management and support IPM and the safe use of agricultural pesticides: economic and sector work, sectoral or Project-specific environmental assessments, participatory IPM assessments, and investment projects and components aimed specifically at supporting the adoption and use of IPM. In Bank-financed agriculture operations, pest populations are normally controlled through IPM approaches, such as biological control, cultural practices, and the development and use of crop varieties that are resistant or tolerant to the pest. The Bank may finance the purchase of pesticides when their use is justified under an IPM approach.

It is important to adopt the IPM approach and increase awareness of pesticide-related hazards and good practices for safe pesticides use and handling among the farmers participating in the Project. The contract farming applications already require efficient use of pesticides on farm.

ESS-3 outlines the following additional criteria that apply to the selection and use of such pesticides: (a) they will have negligible adverse human health effects; (b) they will be shown to be effective against the target species; and (c) they will have minimal effect on no target species and the natural environment. The methods, timing, and frequency of pesticide application are aimed to minimize damage to natural enemies.

Obligations under International Policies

Several international mechanisms been developed in response to increasing concern about the health and environmental risks associated with chemicals, including pesticides, and the realization that these risks often have international dimensions. These include the following instruments.

- The Stockholm Convention on Persistent Organic Pollutants (POPs);
- The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade;
- The Montreal Protocol on Substances that Deplete the Ozone Layer;
- The Basel and Bamako Conventions on Control of Transboundary Movements of Hazardous Wastes and

¹⁰ <http://pestwarning.agripunjab.gov.pk/rulesregulations>

their Disposal;

- The Code of Conduct and - the Codex Alimentarius;
- The International Plant Protection Convention (IPPC); and
- The World Trade Organization (WTO) Agreement on Sanitary and Phyto-Sanitary Measures (SPS-Agreement).

Regulatory Institutions

The Agricultural Pesticide Technical Advisory Committee (APTAC) advises the central government on technical matters arising out of the administration of the pesticide ordinance. The Pakistan Agricultural Research Council (PARC), as the main body responsible for agricultural research in Pakistan is assigned the task of monitoring the pesticides.

There are several federal and provincial institutions/departments currently conducting research on the different aspects of pest management, pesticide efficacy, and pesticide toxicology and pesticide development. However, involvement of private sector in this regard is minimal and almost all the research related activities are being undertaken in the public sector.

Most of these public institutes have been focusing on research related to efficacy trials of pesticides and developing pest management packages. Very little attention is paid to ecological studies and pesticide development.

Punjab Agriculture Department

Government of Punjab, Agriculture Department has a specialized wing for Plant Protection i.e. Directorate General of Pest Warning & Quality Control of Pesticides which is responsible for monitoring of pest development and executing all the plant protection activities throughout the Punjab province.¹¹

The main objectives of this wing are;

- Pest scouting;
- Trainings;
- Quality control of pesticides;
- Research; and
- Plant protection guidance.

Crop productivity index has been constructed by using Principal Component Analysis (PCA) with major crops for fourteen (14) agro-ecological zones of Punjab. There are 9 divisions and 36 districts of Punjab⁵, the details are in Table.1.1.

Table P1: Administrative Units of Punjab

Sr. No.	Division Name	Districts Included in Division
6.	Bahawalpur	Bahawalpur, Bahawalnagar, Rahim Yar Khan
7.	Dera Ghazi Khan	Dera Ghazi Khan, Layyah, Muzaffargarh, Rajanpur

¹¹ <http://pestwarning.agripunjab.gov.pk/over-view>

8.	Faisalabad	Faisalabad, Chiniot, Toba Tek Singh, Jhang
9.	Gujranwala	Gujranwala, Hafizabad, Gujrat Mandi Bahauddin, Sialkot, Narowal
10.	Lahore	Lahore, Kasur, Nankana Sahib, Sheikhupura
11.	Multan	Multan, Lodhran, Khanewal, Vehari
12.	Sahiwal	Sahiwal, Pakpattan, Okara
13.	Rawalpindi	Rawalpindi, Jhelum, Chakwal, Attock
14.	Sargodha	Sargodha, Khushab, Mianwali, Bhakkar

Agro-Ecological Zones of Punjab

Agro-ecological zoning refers to the separation of an area of land into land resource mapping units, each having a unique mixture of landform, soil and climatic characteristics, and the land cover having a specific range of potentials and constraints for agricultural land use (FAO, 1996).

According to FAO (2018), Punjab province can be divided into fourteen (14) agro-ecological zones depending on climate factors. Selection of districts for respective zones is decided by calculation of district area and its majority share to its zone. Details are given in the following Table 1.2.¹²

Table P1: Agro-ecological Zones of Punjab

Sr. No.	Zone	Name of Districts
1.	Cholistan Desert	Bahawalpur
2.	Arid-irrigated	Rahim yar Khan
3.	Cotton-sugarcane	Rajanpur
4.	Rod-i-Kohi	D.G. Khan
5.	Semi-desert Irrigated	Lodhran
6.	Mix Cropping	Multan, Muzaffargarh
7.	Cotton Mix Cropping	Khanewal, Vehari, Bahawalnagar
8.	Maize Wheat Mix Cropping	Toba Tek Singh, Jhang, Sahiwal, Pakpattan
9.	Thal-Gram Crop	Bhakkar, Layyah
10.	Rice and Wheat	Mandi Bahauddin, Sheikhupura, Lahore, Sargodha, Faisalabad, Hafizabad, Nankana Sahib, Kasur, Okara, Chiniot
11.	Thal Zone 2	Khushab, Mianwali
12.	Rice –zone	Gujrat, Sialkot, Narowal, Gujranwala
13.	Groundnut Medium Rainfall	Jhelum, Chakwal
14.	High Rainfall	Attock, Rawalpindi

¹² Measuring Crop Productivity Index of Agro Ecological Zones of Punjab and Its Relationship with Climate Factors, Irfan Nazir and Muhammad Tariq Mehmood, Forman Journal of Economic Studies, Vol. 17(1), 2021 (January–June), pp. 161-174

Research Activities In Punjab ¹³

The Assistant Directors Agriculture (ADA), Plant Protection (PP) conducts research trials relating to different aspects of plant protection measures of present crops, vegetables and orchards. They submit their research plans with complete methodologies to their respective Directors for approval. Assistant Director Agriculture (PP), not only strictly monitor this programme but also execute the assigned trial as envisaged in the program in their precinct and ensure that it is actually being carried out as per standard methodology.

Keeping in view the importance of research regarding plant protection measures, Office of Assistant Director of Agriculture (PP) Research of this Directorate General is working in Faisalabad. The post of ADA (PP) Research was established in 1984 which later on started working under the Directorate of Pest Warning and Quality Control of Pesticides, Punjab, Multan and now it's all research activities are being supervised under the Directorate General of Pest Warning and Quality control of Pesticides, Punjab, Lahore. The following activities are being carried out by the research officers of this office:

- Different departmental trials related to efficacy/comparative efficiency of different insecticides, fungicides, weedicides, pesticides etc. on different crops especially the major crops i.e. cotton, rice, sugarcane, maize etc. Its basic object is to identify the importance of specific pesticides, fungicides and weedicides keeping in view the minimum hazards to human health;
- Besides the departmental research trials, standardization of various insecticides, fungicides, and weedicides is also carried out by the researchers working under of this Directorate General. Different samples of pesticides, fungicides, weedicides are received through the Director Entomology Ayub Agricultural Research Institute (AARI) Faisalabad which is further processed for research activities in the fields by keeping already established standers parallel to them;
- Light trap data and insect collection are carried out side by side and the same is recorded in the office for the proper guideline of the farmers and these insect boxes are prepared in an excellent manner which is presented time to time in different agricultural exhibitions; and
- Other than the pesticides trials some research activities also being carried out to establish a trend for the use of non-chemical agents. Such research trial has been conducted presently at Jhumra against Wheat Aphid by using various plant extracts like Neem, Eucalyptus, Holly Basil etc. during the survey for the selection of fields for trials, important observations are also recorded and conveyed to the farmers for their control measures one such example is Parthenium.

Pesticides Classification

Indiscriminate use of pesticides can disrupt the balance of natural enemies. Though there are comparatively safer insecticides available but even pesticides allowed in organic farming can pose a threat if not handled properly. Pesticides can be different in their level of toxicity to non-target organisms such as people, pets or beneficial insects.

While many pesticides control specific problems, there are still some broad-spectrum pesticides. In addition, there are many products that are only effective if they are used at a specific growth stage of the pest e.g. Insect Growth Regulators (IGRs), so timing is very important. Blanket applications of pesticides on large areas or the use of pesticides on a calendar base alone is

¹³ Directorate General of Pest Warning & Quality Control of Pesticides, Government of the Punjab, http://pestwarning.agripunjab.gov.pk/research_activities.




now story of the past and shall not be included in any pest management program. However, there are times when pesticides are needed to prevent major losses.

Almost all organochlorine pesticides are banned. There are few carbamates and organophosphate pesticides in vogue. Most pesticides are either pyrethroids or other chemistry. Due to the systemic nature, neonicotinoids are popular these days but their accumulation in food, feed and environment is posing a threat and their use is restricted in most countries.

Based on the toxicity level, pesticides are classified as Class I (a&b), Class II, Class III and Class IV. The World Health Organization's (WHO) four (04) toxicity classes are mentioned below in Table 1.3¹⁴.

Based on the above classification of pesticides, WHO list of restricted pesticides must be respected during the implementation of IPMF.

Table P2: WHO Classification of Pesticides depending on Toxicity Level

Sr. No.	Toxicity Class	Toxicity Level	LD50 Concentration	Signal Word	Description	Colour band	Symbol
4.	Class I-a	Extremely hazardous/toxic	5 mg or less/kg	"Danger-Poison"	Fatal if swallowed, poisonous if inhaled, extremely hazardous by skin contact and causes eye damage and severe skin burns. Class I materials are to be fatal to an adult human.	Red	
5.	Class I-b	Highly hazardous/toxic	5–50 mg/kg	"Danger"	Fatal if swallowed, poisonous if inhaled, highly hazardous by skin contact.	Red	
6.	Class II	Moderately hazardous/toxic	50–2000 mg/kg	"Warning"	Harmful or fatal if swallowed, absorbed through the skin or inhaled. Causes skin and eye irritation. Class II materials are estimated to be fatal to an adult human at a dose of 5 to 30 grams.	Yellow	
7.	Class III	Slightly hazardous/toxic	More than 2000 mg/kg	"Caution"	Harmful if absorbed, swallowed or inhaled. Irritate eyes, nose, throat, and skin. Class III materials are estimated to be fatal to an adult human at some dose in excess of 30 grams.	Blue	No Symbol
8.	Class IV	Practically nontoxic	5000mg/kg or higher	No	Nontoxic and can be used easily. Unlikely to present acute hazard.	Green	No Symbol

¹⁴ Guidelines on Good Labelling Practice for Pesticides, WHO/FAO (2015).

Integrated Disease Management

The concept of IDM developed from the successful IPM adoption and implementation by entomologists for insect and mite control. IDM consists of scouting with timely application of a combination of strategies and tactics. These may include site selection and preparation, utilization of resistant cultivars, altering planting practices, modifying the environment by drainage, irrigation, pruning, thinning, shading, etc., Pesticides are applied only if necessary. But in addition to these traditional measures, monitoring environmental factors e.g. temperature, moisture, soil pH, nutrients, etc., disease forecasting, and establishing economic thresholds are important to the management plan. These measures should be applied in a coordinated integrated and harmonized manner to maximize the benefits of each component.

Integrated Pest Management Framework (IPMF)

It is an increasingly popular process for controlling pests. IPM considers the ecosystem as a whole and takes into consideration a balanced mix of the aforementioned control methods to produce the most effective and least damaging plan. All the methods are mutually augmentative with chemical control means as the last resort in the plan. Ideally, an IPMF would result in a sustainable system without need for much costly follow-up maintenance.

Components of IPMF

There are six (06) main components of IPMF which are as follows:

Prevention

Preventing pest problems eliminates the need to take further action. Such measures may also mitigate the severity of any pest problems that do arise, which means less money spent on potentially harmful pesticides.

Identification

IPM relies on sustainable measures that target specific pests, it's important to clearly identify the cause of an emerging problem.

To move from conventional control methods to IPM program, it requires a multi-sectorial and action oriented team of IPM experts. This team could be part of an existing Provincial Agriculture system or a new committee can be constituted to include experts from Agriculture Research, Agriculture Extension, Academia, Growers and others related bodies.

The leader of this team should be familiar with pests, pesticides and pesticide regulations, leadership and have the time and authority to supervise IPM implementation. Other team members could include environmentalists, agronomists, crop protection experts (entomologists, pathologists, public health experts, food services, industrial hygiene, environmental services, and food authority).

Once the problem has been identified, the next step is to chalk out management strategy. The idea is to select control measures that are applicable, effective, and economical and environment friendly. To select the best control measures, there is a need:

- To understand the habit, habitat and life cycle of the pest. Some control measures will work only if they are used at right life stage of the pest;
- To decide whether the infestation is serious in terms of economic losses;
- To calculate the costs /benefits ratio of various options for the control of the pest; and
- To make planning future activities.

Monitoring

As already mentioned, many IPM techniques rely on timing. Knowing when a pest’s natural predators are more active makes complementary control methods more effective. Regular inspections also let know when a pest population is growing and where nests are located. In cases where chemical pesticides are needed, close monitoring will increase their efficiency.

IPMF must have mechanisms in place to monitor the success or non-fulfilment of the plan. The key indicators are the abundance of pollinators, birds, natural enemies and above all the yield.

Efficacy: It is an established fact that IPM is better than the pests control with pesticides, therefore, there must be an overall reduction in the number of the pests and cost of production, increase in yield, and a surge in natural enemies and pollinators.

Cost: The IPMF should evaluate the cost reductions over time as a result of the IPM gains. The cost /degradation of the environment due to pesticides applications and then its recovery through the IPM is hard to quantify but still estimates are available; the pre and post operation level of pesticides residues in food feed, water and environment and the number of pollinators, natural enemies and other fauna is key performance indicators. The cost /benefit ratio is defiantly in favour of the IPM program.

Safety: Based on the ability of IPMF to create a safer environment, it is expected to observe greater reduction in pesticide use. Pesticide application is restricted to occasional application or crises situation only.

Monitoring will cover all aspects of the IPM implementation starting at the field level where aspects listed below will be monitored and reported:

- Implementation of proposed capacity building interventions;
- Adoption and effectiveness of the chosen combination of IPM interventions;
- Environmentally friendliness of applied IPM interventions e.g. by monitoring the prevalence/survival of non-target plant and animal species;
- Soil and water contamination; and
- Public and occupational health and safety e.g. incidences of poisoning or injury.

Table P3: Participatory Impact Monitoring Approach in IPM

Impact	Outcome	Issues	Source of Verification
Economical	Crop yield	Soil fertility, productivity, production practice	Measure or estimate by the farmers, Invoices of processing companies
	Area under specific crop	Profitability, meeting market needs	Interviewing farmers

Impact	Outcome	Issues	Source of Verification
	Yield quality	Production practice, price potential	Farmers' statements, field visits
	Meeting products	Risk reduction, potential for production increase	Interviewing farmers
	Household income	General development of the livelihood situation, basis for qualitative information about reasons	Estimates by the farmers
	Input Use	Adoption of IPM technology, cropping practice	Interviewing farmers with checklist
Ecological	Number of marketed crops (crops diversity)	Increase of biodiversity, Risk reduction, sign of innovation	Interviewing farmers using list of products as support
	Group development	Risk reduction, farmer-to- farmer extension, lower production cost due to lower input prices	Farmers, NGO implementing
Social	Problem solving skills	Empowerment, self-initiative	Farmers' statements, field visits
	Planning	Reliability of monitoring data	Farmers

Source: Muller et al 2010

Assessment

There is always no need to take action against pests. For instance, clover is considered a pest by some growers, but others appreciate the plant's contributions to soil fertility. Determining damage threshold makes resource management easier.

a Sampling for Damage Assessment

Once the pest is properly identified, the most important step is to determine:

- The risk level of losses;
- The nature and the spread of the problem;
- The level and extent of the damage; and
- Sampling method that will help to make decision for the corrective measures.

Planning

IPM relies on synchronizing various methods of pest control. The best strategy largely depends on the particular type of pest dealing with.

Several methods of pest control are known in the different project locations but are not really supported and promoted. These are alternative pest management methods, including: biological control, trapping, mechanical control, cultural control, the use of bio-pesticides, etc.

a Cultural Methods

Cultural control involves the modification of regular farm operation, to destroy the insects or to prevent them from causing injury. These farm practices may be ploughing, sowing, irrigating, harvesting, hoeing, weeding etc. A large number of insects get normally killed by the farmers unconsciously when exposed to adverse environmental and biological conditions through these practices. By adopting cultural practices as preventive measures the pests can be killed either directly or indirectly. More effective kill can be obtained by following improved agricultural practices. Moreover, these methods cost hardly anything, because all that is required to be done is to adjust the time of ploughing, sowing, irrigation, harvesting, crop rotation and improved farm management. Life history, behaviour, habitat and ecology of the pests play key role in this type of control.

b Mechanical Methods

Mechanical control involves the use of force with or without special equipment. Although this control measure is time consuming, laborious, ineffective on large scale and cannot be applied commercially, yet it can give immediate results and is generally popular and convincing to the farmers. Use of male annihilation technique against fruit flies, cod lure against codling moth, scare crow as deterrent for birds, traps for wild boars, shooting of wild boars, automatic noise making devices for birds and bats and electric traps for mosquitoes and flies etc., are few successful examples of mechanical control.

c Physical Control Methods

Physical factors of the environment, like temperature, sunlight, humidity and moisture are important natural regulators of pest populations. As the saying goes “sunlight is the greatest disinfectant”; utility of physical environmental factors was realized by the human beings long ago and these were manipulated for pest suppression particularly so in case of stored grains.

d Biological Control Methods

Natural biological control is the action of predators, parasitism, parasites and pathogens in maintaining another organism’s density at a lower average than would occur in their absence. While applied biological control constitutes deliberate attempts to use natural enemies, either by introducing new species into the environment of a pest or by increasing effectiveness of those already present.

The applied biological control has three different modalities i.e. importation, augmentation and conservation. Importation is the introduction of a bio-control agent in an area where it does not exist. Augmentation is the mass rearing and release of the existing bio-control agents in an agro-ecosystem as and when required. Conservation is the preservation of the existing bio-control fauna through provision of food, shelter and/or careful use of pesticides. Moreover, there are numerous indigenous bio-control agents still prevailing and struggling for survival in most of the agro-ecosystems around Pakistan. Serious effort for awareness and education of the farmers regarding identification and conservation of these beneficial agents are required so that this precious resource is conserved.

e Host Plant Resistance

Host plant resistance is the ability of plants to resist invading insects and diseases. This ability of plants can be attributed to their morphological and chemical characteristics. The morphological or physical features include tissue thickness and hardness, foliage colour and presence of spiny hair on the leaves and stems. The chemical plant barriers comprise secondary plant compounds that give the plants their peculiar aroma and in some cases act as strong deterrents. Additionally, resistant plants also have the ability to alter their own physiology in case of invasion and compensate for the damage caused by the pests.

Breeding of crops for pest resistance through orthodox breeding methods was a time consuming process, hence could not get due attention of the investors and researchers. However, with the advancements in the field of biotechnology and genetic engineering in the past three decades, several resistant varieties of crops like cotton, rice, maize, fruits and vegetables have been developed and marketed.

f Chemical Control Method

Chemical control is the use of various chemicals that bring about control of pests either by toxic properties that cause death to the pests, or by other effects like changing the behaviour, imparting sterility or causing metabolic disorder in the target pest. In general usage, the chemical control denotes killing of pests by toxic chemical, called "Pesticides". Literarily, pesticide means 'pest killer'. Pesticides are chemicals that affect the biological processes of many living organisms and may thus act or poison many animal species. Broadly speaking, pesticides are chemicals used to combat pests.

With the passage of time, chemical control has evolved drastically as the new chemistry pesticides are far more selective and less persistent as compared to the organochlorines, organophosphates and carbamates. Additionally, the pesticide application equipment like the Ultra-Low Volume (ULV) sprayers are designed to cover more area with much lesser volume of the chemical.

Evaluation

Follow-up monitoring is a crucial part of pest management. Identify what worked and what didn't and keep records for future reference. Adopting sustainable pest control methods is a good way to avoid pesticide overuse as well as inefficient resource usage.

Evaluation of the IPMF is must to know the effectiveness of the in-practice framework and if there is a need to include or exclude other approaches. All assignments under the IPMF will have to evaluate, and should:

- Monitor fields regularly and keep records. Each time field visits are made, a note of crops /livestock and pest conditions shall be made. Record yields and quality and any counts on pest populations;
- Record control measures. Records should include dates, weather conditions, pest levels. Control measure application rates and timing, and costs. Good records are a guide if the same problem occurs; and

- Compare effectiveness. Whatever control tactics are chosen, use a different method on some strips so comparison can be made; which worked better, taking into account costs and environmental impacts.

Agronomic Components In IPM

Agronomic adjustments like alteration in micro climate of plants, changes in sowing time, plant population are necessary for higher yield and preventing mass multiplication and spread of pest, diseases and weeds by modifying the crop micro climate, following are the important Agronomic components of IPM.

Land Preparation

Tillage can be beneficial because it disrupts the life cycle of insect pests and can expose pests to predators and the elements. Fall tillage can destroy crop debris that serves as over wintering sites for flea beetles, corn borers, squash bugs, and other insect pests. However, excessive tillage can accelerate the decomposition of soil organic matter and deplete the food source that soil microorganisms depend on, decreasing their ability to disrupt pests. Excessive and untimely tillage can also contribute to soil erosion.

Cultivars Selection

Cultivars with high yield potential and quality without resistances to pest and disease cannot reach at their potential. Therefore, selection of cultivars having resistance against pest and disease can bring down the pest and disease incident considerably.

Time of Sowing

As weather influences developmental of plants as well as growth and survival of old pest and disease, serious setback occurs when the weather condition is favourable to coincidence of the susceptible crops stages with highest incidence of pests and disease. Therefore, adjustments in sowing time is often restored to an agronomic strategy to escape the crop loss. In general, early sowing in the season concisely reduces the pest and disease attack.

Plant Population

Plant population per unit area influences crop microclimate. Dense population of plants restricts wind movement within plant canopy leading to high humidity. This creates congenial condition for pest and disease multiplication. Keeping the plant population constant, inter and intra row plant population can be adjusted to minimize the humidity build-up within the crop canopy.

Inter-cultivation

Mechanical or manual inter-cultivation suppresses the pest, diseases and weeds. Weeds that serve as alternate host to insect and pathogen can be efficiently controlled with inter-cultivation. Microclimate conducive to pest and disease build-up is also distributed by inter-cultivation.

Manures and Fertilizers

Excessive nitrogen application increases susceptibility of crop to sucking and leaf eating pests because of the succulence to the crop conferred by nitrogen. High rates of nitrogen than the recommended rate to hybrids without corresponding increase in phosphorous and potassium is the main factor for heavy pest and disease incidence. It is known that balance fertilizer application helps the crop to tolerate pest and diseases considerably.

Irrigation and Drainage

Modification of natural water supply changes the biological equilibrium between crop and its pest and disease. Irrigation can reduce the soil inhabiting pests by suffocation or exposing them to soil surface to be preyed upon by birds. Granular insecticide and herbicide applied in the soil do not become available until dissolved in the water. Systemic chemical are not absorbed by plants in the absence of adequate soil moisture. Water logged or saturated soils create microclimate on the crop productive to building pest and disease.

Crop Rotation

Advantages of crop rotation have been well known to us. It serves the purpose of plant protection by reducing the nutrition of pests in every subsequent year or season or totally deprives them of food. It reduces the amount of initial infection by diseases and ensure unfavourable stratum for its development.

Mulches

Mulches, both organic and synthetic, can help reduce insect pest problems. Plastic mulch is often used to speed early season crop growth that makes plants better able to tolerate insect feeding. Reflective mulch repels thrips and aphids and can reduce the incidence of insect transmitted virus diseases in vegetable crops

Major Insect Pests And Diseases Of Major Crops

The major insect pests and diseases of major crops of Punjab are as follows:

Table P4: Major Insect Pests and Diseases of Major Crops of Punjab

Sr. No.	Crop	Insect / Pest / Disease	Sr. No.	Crop	Insect / Pest / Disease
25.	Cotton	Jassid	26.	Rice	Yellow Stem borer
		Whitefly			White Stem Borer
		Thrips			Pink Greminous Borer
		Mealy Bug			Rice Leaf Folder
		Dusky Cotton Bug			White backed plant hopper
		Armyworm			Pink Greminous Borer

Sr. No.	Crop	Insect / Pest / Disease	Sr. No.	Crop	Insect / Pest / Disease
		Pink Boll Worm			Rice Skipper
		American Bolworm			Rice Hispa
		Spotted Bollworm			Foot Rot / Bakanae Disease
		Red Cotton Bug			Brown Leaf Spot
		Mites			Bacterial Leaf Blight
		Aphid			False Smut
		Clcv			Smut or Bunt
		Wilt			Sheath Blight
		Bacterial Blight Of Cotton			Blast
27.	Maize	Stem Borer			Yellow Stem borer
		Shoot Fly			White Stem Borer
		Corn Earworm			Army Worm
		Aphid			Rice Grass Hopper/ Toka
		Jassid	28.	Sugarcane	Stem borer
		Leaf Hopper			Top Borer
		Armyworm			Root Borer
		Fall Armyworm			Gurdaspur Borer
		Smut			Pink Graminous Borer
		Stalk Rot			Shoot borer
		Leaf Blight			Termites
29.	Wheat	Aphid			Mealy bug
		Armyworm			Black bug
		American bollworm			Whitefly
		Brown Rust			Pyrilla
		Flag smut			Toka/Grass Hopper
		Black Stem Rust			Scale insect
		Orange or Leaf Rust			Mites
		Yellow or stripe rust			Red Rot
		Loose smut(Seed born)			Whip Smut
		New/Partial bunt(Karnal Bunt)			Brown Rust
		Powdery Mildew			Sugarcane Mosaic Virus
		Foot Rot			Pokkah Boeng
		Karnal Bunt			Leaf spot

Potential Environmental, Health And Economic Impacts Of Pest Management Activities

This section deals with the potential positive (beneficial) and negative (adverse) environmental and socio-economic consequences of pest management activities to be in vogue under the IPMF.

Table P5: Potential Environmental, Health and Economic Impacts of Pest Management Activities

Sr. No.	Method Used	Environmental Impacts	Health Impacts	Economic Impacts
1.	Chemical Control	<p>This indiscriminate use carelessness in handling pesticides and their wastes has resulted in the contamination of our food feed, water and environment.</p> <p>Its toxicity to fish and other aquatic organisms.</p> <p>The pesticides are applied at the run off level which ultimately goes to the ground and wash away by rain to the water bodies. Contamination of underground water resources is also possible during the disposal of containers through leaching, burying, and accidental spills.</p>	<p>The pesticides are mostly applied by layman with no or minimal knowledge of the hazardous effects on human health and environment. There are hardly any protective measures taken by the pesticide application man. Sprays are done in hot sunny hours with prolong exposure. Furthermore, appropriate time period needed before harvest is seldom observed and produce are treated with pesticides the day they are harvested or even the day they are taken to the market. The consumption of contaminated fruits, vegetables and other products are also posing serious health threat. Improper handling, storage and spill has its own health consequences.</p>	<p>The economic impact of the chemical pesticides is mixed. Initially there is a boom in production and great return but later on other issues are surfaced which needs further inputs. Pesticides are expensive and soon loss its efficacy due to resistance development in insects. Resurgence of the pests and the outbreak of secondary pests make the chemical pesticides virtually useless. Higher doses and frequent pesticides application may make the production non profitable.</p>
2.	Biological Method	<p>The biological control of pests and diseases employ the use of beneficial insects, bacteria or fungi on the host to eliminate the pest or disease. This is one of the known environmentally friendly control methods as compared to other control methods. Unlike other methods biological control is applied carefully and selectively and since no chemicals are involved it has no adverse effect on the environment.</p> <p>The only objection on this method is that the control agents are slow in action and take longer time to generate results and therefore cannot be used in emergency situations. The danger comes in when the host is eliminated if the pest is not host specific then they may attack other plants (crops) or insects and therefore may create an imbalance in the ecosystem.</p>	<p>Since no chemicals are used there are no dangers and thus the method is generally/fairly safe.</p>	<p>In comparison to other methods it is cost effective since its application may involve community participation and can be integrated in other control methods. Also if established, it may not need repeated application.</p>
3.	Mechanical Methods	<p>This method involves the use of mechanical equipment or automated machines and may also be expensive depending what machines are used. In most cases, it is friendly as it involves small equipment or machinery. It may not be friendly to the environment depending on the</p>	<p>The wise operation of the machines and the supporting labor becomes important in the safety and handling. In developing countries, most machinery is small equipment's and do not cause much health issues. However, if complicated and</p>	<p>The mechanical pest control method is cost effective. Most often small equipment's are used which are not expensive and are lost for long. However, if heavy machinery are involved it may get costly.</p>

Sr. No.	Method Used	Environmental Impacts	Health Impacts	Economic Impacts
		operation carried out and the disposal technique of the pests, weeds or the wastes.	heavy machinery is involved, it may pose health threats.	
4.	Manual Method	The manual control basically consists of the use of labor with simple and ordinary tools. The major concern is often the high cost involved. Since little or no machinery is involved, there is virtually no negative impact on the environment is anticipated from manual pest control methods.	Since no chemicals are used so there are no dangers to public health and health of animals and thus the method is generally/fairly safe.	Though human labor is involved and it do cost but as it is obvious that labor in Pakistan is comparatively cheap, so it may not be that expensive. Furthermore, the manual removal of diseased plant / parts and weeds may serve as foul and fodder.
5.	Quarantine Method	Plant quarantine refers to the process of keeping pests /plant / plant materials away which can pose a threat to the existing production system. The idea is to keep the pest under control from spreading or further spread. This method is fairly safe to the environment as it allows for the control and management of pests and diseases through isolation.	Quarantines ensure safe passage of livestock by reducing contamination or spread of diseases.	It could be expensive if seen in implementation perspectives but it help reduce the risk of spread of the pests and diseases, so it is economically feasible

Mitigation Measures Against Adverse Impacts

Pesticides are chemical poison and should be handled with great care. The primary mitigation measures include training in safe and judicious pesticide use and management; delivery of a mix of Information Education and Communication (IEC) approaches targeting the farmers, resident, pesticide operators, and teams; include provision of Personal Protective Equipment (PPE) and training to spray personnel, and thorough and consistent supervision and monitoring. Also important are the identification and provision of appropriate pesticide storage facilities and training and equipping health facilities with adequate exposure treatment drugs.

Management of Pesticide Use

Improper storage, handling, transportation, treatment and disposal of pesticides can be a risk to human health and the environment through leakage of chemical poisons into groundwater, soil, and the atmosphere. Peoples may potentially be affected when pesticides are ingested through contaminated water sources and polluted air, and when defective labour-practices put workers in direct contact with pesticides. This means, the project will have to observe a number of measures to ensure proper handling and application of pesticides.

Management of Pesticide Storage

Standard procedures for pesticide storage management

- The storekeeper should put on essential protective clothing (overalls and boots) upon arrival at the pesticide store;
- There should be a quick daily inspection of drums and containers to ensure that there have been no overnight spills or leaks;
- Spilled and leaked pesticide must be cleaned up immediately;
- Drums and containers should be thoroughly inspected monthly for leaking seals, split seams and corrosion;
- Leaking or old drums should be removed and their contents transferred to empty containers;
- Replacement containers should be sealed and relabelled;
- Transfer of chemicals to new containers should be recorded on the stock record sheet;
- Floors be made of, or covered by, impermeable concrete or impervious cement (as a temporary measure, floors may be covered with a large and thick polyethylene sheet);
- Ramps at entrances to contain any major leakage within the store;
- Doors that are lockable and bars across ventilation holes and windows to prevent unauthorized entry;
- The floors of the stores should have a layout of separate blocks with aisles between them. Ideally, the outline of the blocks should be painted on the floor. Each block should contain only one product. There should be sufficient space between blocks to move containers freely, safely and enable the inspection of containers and treat leakages;
- Drums should be stacked in such a way that each can be inspected from the aisles between the blocks. Drums and bags should be stored on pallets. The number of

containers stacked on top of each other should not exceed the stacking recommendations for the type of container concerned. Over stacking may lead to rupture of lower containers down and reduces access to containers;

- Pesticide stores should only contain pesticides. All other goods or objects should not be mixed in the agro-chemical stores;
- Expired and obsolete agro-chemicals should be separated from in use or non-expired stocks;
- Stacking, stacking heights and position of the pesticide packages/ drums/ in the stores should follow the recommended international standards;
- Material Safety Data Sheet (MSDS) of each chemical / pesticide should be displayed on the drum; and
- More or less all standard operational procedures needed for large scale pesticide storage are applied for small scale storage. However, its quantity is small and easy to be handled. At farm and houses, its quantity is further reduced. The great care needed here is to keep the pesticides away from food items, children, away from residential premises and always under lock and secure facility. The pesticide comes in proper containers with essential information.

Record Keeping

- Most agro-chemicals have a specific shelf life, it is, therefore, important to order only the needed amounts and shall be issued on first in -first out" basis;
- Records shall be kept separate from the pesticide stock so that they are not destroyed in the event of a major disaster;
- Records will be kept as sheets in a ledger or in card index form. Duplicate records adjacent to the stock itself may also be required, perhaps in simplified form. A record of all MSDS should also be maintained; and
- Records are to be accurate and with sufficient details.

Management of Pesticide Transport

Before long-distance transport of the pesticides from the customs warehouse/central storage facility to the distributors and project storage facility, drivers will be informed about general issues surrounding the pesticides and how to handle emergency situations (e.g. road accidents). Training for long-distance transport from the distributorship to the storage facilities will include the following information:

- Purpose of the pesticides;
- Toxicity of the pesticides;
- Security issues, including implications of the pesticides getting into the public;
- Steps to take in case of an accident or emergency (according to FAO standards);
- Combustibility and combustion by-products of insecticide; and
- Handling vehicle contamination.

During local transportation of the pesticides for the project, designated vehicles with trained drivers shall be employed. Farmers are advised to take care of the following while taking pesticides to their farm / houses:

- It shall be in properly secured containers and boxes;

- There shall be no apparent leak;
- It shall be at a secure place in case of public transport;
- It should be kept away from other items especially food; and
- The driver and the conductor should know about the pesticides.

Mitigation Measures while Handling Pesticides

There are certain measures which should always be undertaken by pesticide operators to help protect against contamination during the handling and application of pesticides. These measures should always be followed.

- The first principle is to always read and follow the label recommendations on the pesticide container. If the label information cannot be read or understood for any reason, then the operator should find someone who can explain the instructions to him. Apart from the written instructions, the operator should also look for pictorial information on the label which will indicate the degree of hazard presented by the pesticide formulation;
- Pregnant women shall not be allowed to handle the pesticides. Female persons found to be pregnant should be reassigned to tasks that require less exposure to pesticides;
- Know how to identify the percentage of active ingredient in the pesticide formulation;
- Understand the hazard levels associated with pesticides ions e.g. quantity, pests, dates, locations etc.;
- Direct exposure of the skin, nose, mouth or eyes should be avoided or minimized when working with pesticide products to reduce the chances of personal contamination;
- When pouring and mixing the concentrated product, every effort should be made to avoid splashing or spilling onto skin or clothing;
- If any product falls on the skin, or into the eyes, then this should be washed off as soon as possible. Heavily contaminated clothing must be removed and washed with detergent and water;
- The most appropriate application technique should be selected to control the pest problem. It is very important that the application equipment is in a good state of repair and that it is properly maintained and calibrated;
- When spraying the diluted product, the applicator should always work upwind of the spray to avoid coming into contact with it. He should also avoid contact with freshly sprayed foliage as far as possible;
- Another basic principle of personal protection is good hygiene when working with pesticides. This is to ensure that if any contamination occurs then it is removed in good time. In addition, personal habits will help to avoid direct contamination in itself;
- Operators should not eat, drink or smoke during work and should not touch their face or other bare skin with soiled hands or gloves. Their work clothes should also be washed after work, separately from other clothing, and then dried; and
- For the effective safety and protection of the workers handling agro-chemicals, the provision of the following is deemed necessary.
 - Helmet or cloth cap;
 - Safety spectacles, goggles or face shield (attached to helmet);
 - Dust or light fume masks;
 - Emergency vapour masks or half-face respirators with organic vapour cartridges;
 - Nitrile rubber or neoprene gloves or gauntlets;
 - Overalls;
 - Nitrile rubber or neoprene apron; and
 - Strong rubber or neoprene boots.

Management of Pesticide Waste

The Disposal and reuse of the containers should be done following the below points:

- Typically, all containers should be triple rinsed with a solvent capable of removing any remaining content and the reinstated disposed of according to the disposal instructions on the label;
- Empty containers should then be punctured, crushed or otherwise rendered incapable of holding liquid;
- These containers can then be disposed of at a sanitary land-fill or returned to the manufacturer or formulator;
- The reuse of pesticide containers is risky and not recommended. However, some pesticide containers may be considered too valuable to be thrown away after use;
- Whether containers are suitable for cleaning and reuse depends on the material they are made of and what they contained. The label should provide instructions on possibilities for reuse and cleaning procedures;
- Containers that have held pesticide formulations classified as highly hazardous or extremely hazardous must not be reused;
- Under certain conditions, containers of pesticide formulations classified as slightly hazardous or unlikely to present acute hazard in normal use can be reused for purposes other than the storage of food, drink or animal feed;
- Containers made of materials such as polyethylene that preferentially absorb pesticide should not be reused if they have held pesticides in which the active ingredient is classified as moderately, highly or extremely hazardous, regardless of the formulation; and
- Pesticide containers should be rinsed as soon as they are empty, completely filled with water, and allowed to stand for 24 hours. They should then be emptied, and the process repeated twice.

Leftover Pesticides

Left-over insecticide suspension can be disposed of safely by pouring it into a specially dug hole in the ground. It should not be disposed of where it may enter water used for drinking or washing, fish ponds or rivers.

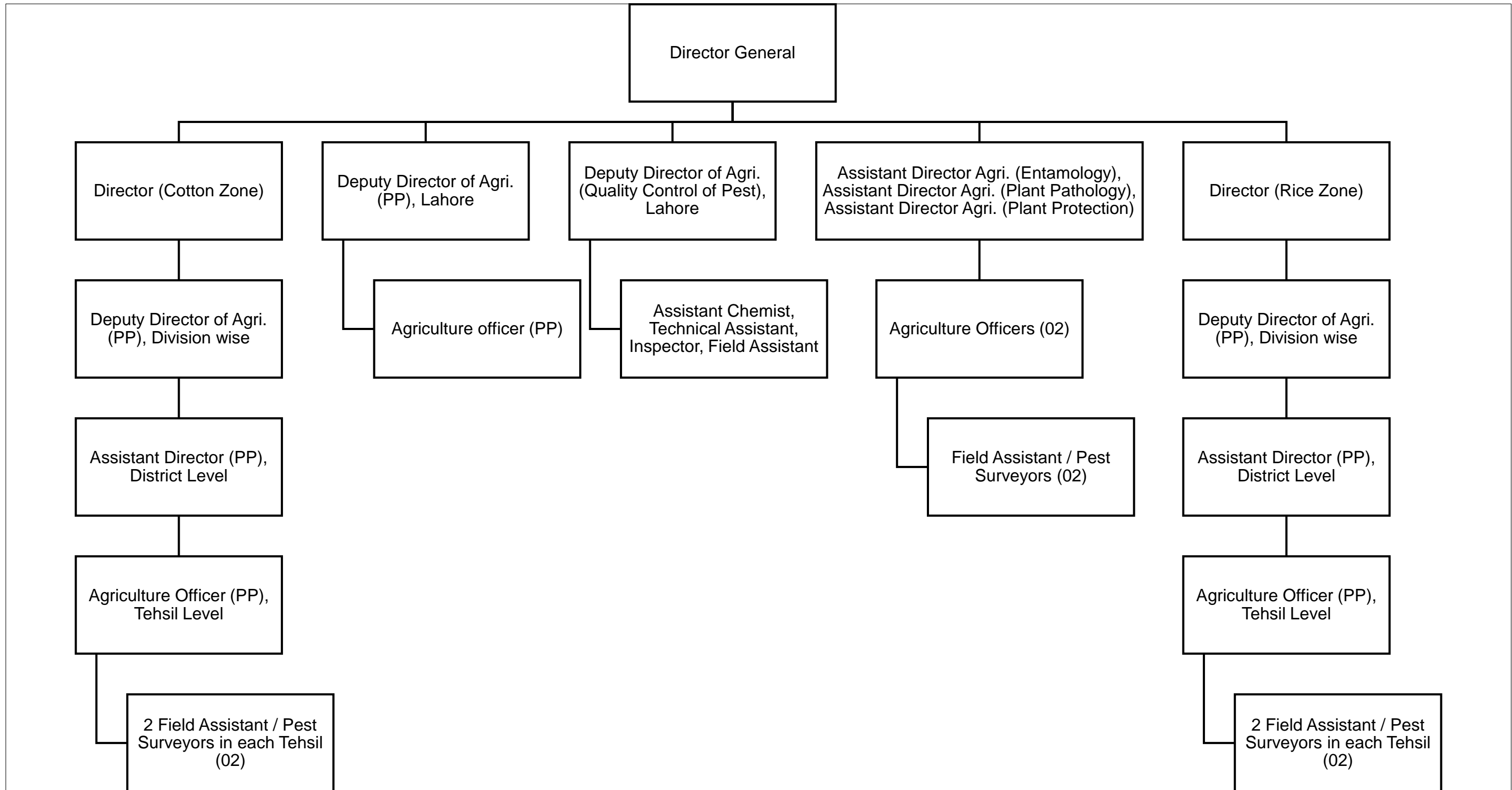
- Some insecticides, such as the pyrethroids, are very toxic to fish. Dig a hole at least 100 meters away from streams, wells and houses. In a hilly area the hole should be on the lower side of such areas;
- Pour run-off water from hand washings and spray washings into the hole, and bury containers, boxes and bottles used for pesticides in it. Close the hole as soon as possible;
- Cardboard, paper and cleaned plastic containers can be burned, where this is permitted, far away from houses and sources of drinking-water;

- Surplus solution can be used to kill insect pests such as ants and cockroaches. Pour or sponge it on to infested places (under kitchen sinks, in corners of a house); and
- Insect breeding can be temporarily reduced by pouring the solution in and around latrines / washrooms or similar breeding places. Solutions of pyrethroids for the treatment of mosquito nets and other fabrics can be used for a few days after preparation.

Note: Relevant legislations, conventions, ESSs and guidelines must be respected in addition to above mentioned mitigation measures.

Institutional Structure For Implementing Ipmf

The institutional structure for the implementation of proposed IPMF is given Figure J.1¹⁵.



¹⁵ <http://pestwarning.agripunjab.gov.pk/organogram>

Pesticide Management Alternatives

The action plan needed must include a strategy that assess the short- and long-term plans, labour force, capital, equipment, and finances of the crop production, crop protection and animal husbandry. It is therefore, important to evaluate the costs & benefits, and associated risks of various management options. Also, opportunities for integration of different pest control strategies must be considered in the action plan.

Selection among Alternatives

- Selection of the best and tolerant varieties is the first step in the successful pest management. Healthy sampling will ensure good stand;
- If proper sampling is followed from the very beginning and record is maintained, it is easy to nab the evil in the bud. Ways and means shall be known and applied to encourage the natural enemies. Similarly protecting natural enemies during adverse climate conditions will ensure natural control of the target pest;
- Removal of un-wanted weeds, proper hoeing, proper soil and water management is essential for good crop production and do so for best pest management;
- Also at the early stage of the pest infestation, mechanical / physical control methods are the most appropriate way of managing the pest population;
- Plant base alternatives are popular in some situations. e.g. neem products are considered to be effective in soil dwelling insects and some areal pests is a common practice in organic production; and
- Selective pesticides are preferred over the broad spectrum and non-systemic is considered safe over the systemic pesticides.

Alternatives to Pesticide Application

Where feasible, the following alternatives to pesticides should be considered:

- Rotate crops to reduce the presence of pests and weeds in the soil ecosystem;
- Use pest-resistant crop varieties;
- Use mechanical weed control and / or thermal weeding;
- Support and use beneficial organisms, such as insects, birds, mites, and microbial agents, to perform biological control of pests;
- Protect natural enemies of pests by providing a favourable habitat, such as bushes for nesting sites and other original vegetation that can house pest predators and by avoiding the use of broad-spectrum pesticides;
- Use animals to graze areas and manage plant coverage;
- Use mechanical controls such as manual removal, traps, barriers, light, and sound to kill, relocate, or repel pests; and
- Bio-pesticides (e.g. *Metarhizium anisopliae* var. *acridum*) are highly specific, have low mammalian toxicity, with possibility to produce formulation locally in small quantities and are safe to the environment.

Pest Scouting / Pest Survey of Crops in Punjab¹⁶

Pest survey is to assess pest population and their losses over large area i.e. district, province or country and pest scouting is to determine number of insect pests and their crop loss in a specific crop area i.e. Kanal, Acre etc.

Pest scouting / pest survey of Rabi and Kharif season crops, vegetables and orchards are conducted regularly throughout the year on weekly/ fortnightly basis. Pest infestation /disease incidence is recorded for each crop, vegetable and orchards according to the prescribed procedure. Prescription slip along with recommendations is provided to the farmers at the spot. The list of hot spots of pest insects and disease incidence is delivered to the concerned Agriculture Officer (AO)/Deputy Director of Agriculture (DDOA) (Ext.) on the same day or with in the shortest possible time.

Types of Pest Scouting / Pest Survey

Two types of survey / are conducted.

iv. Random Pest Scouting

- A team of AO (PP) conducts pest scouting 5 days/week, ADA (PP) 4 days/week or DDA (PP) 3 days/week;
- The teams, during survey record observations on the spots randomly in such a way that it represents the whole area of its jurisdiction; and
- At least 5 acres block is selected for pest scouting and all the crops etc. sown within that block is pest scouted.

v. Fixed Spot Pest Scouting

- In each tehsil, one landscapes spot of one kilometre square radius representing the whole tehsil is selected; and
- Fortnightly observations are recorded on each crop, vegetable, orchard etc. present in the landscape area to find out the population of insect pests or diseases and possibilities of their further spread.

Pest Surveys on Different Levels

The process of pest scouting / pest survey on different levels are listed below:

Tehsil Level

- Each tehsil is divided into Union Councils;
- The team comprising of one AO (PP) and 1-2 Field Assistants/ Pest Surveyors uniformly cover all the Union Councils of that Tehsil weekly;

¹⁶ Directorate General of Pest Warning & Quality Control of Pesticides, Government of the Punjab
<http://pestwarning.agripunjab.gov.pk/>

- Pest scouting is conducted 5 days/ week and 8-10 spots are covered on daily basis i.e. 40-50 spots/ week; and
- All crops, vegetables, orchards etc. are pest scouted.

District Level

- The team comprising of one ADA (PP) and 1-2 Pest Surveyors/ Field Assistants is conducting pest scouting of all field crops, vegetables and orchards highlighting with one star;
- Pest scouting is conducted 4 days/ week and at least 8-10 spots at random / day i.e. 32-40 spots/ week including 15% counter checking of the AOs (PP) under their jurisdiction;
- The team uniformly covers all the tehsils of the district for every fortnight; and
- At district level on weekly basis a list of trained farmers along with their Cell No. and addresses is compiled.

Zonal Level

- The Deputy Directors of Agriculture, Pest Warning having their own pest scouting / monitoring teams conduct pest scouting of all field crops, vegetables, orchards, under their jurisdiction for 3 days/week; and
- At least, 8-10 spots at random / day are pest scouted including 5% counter checking of the ADA (PP) & AOs (PP). Thus making a total of 24-30 spots/week.

Pest Survey of Kharif Crops, Vegetables & Orchards

Pest scouting / survey teams are constituted at tehsil, district and regional levels for Kharif season. These teams are conducting regular pest scouting/survey of all crops, vegetables and orchards throughout the year on weekly / fortnightly basis with special reference to cotton, rice and sugarcane. However, anti-pest campaigns of cotton and rice are being launched w.e.f. 01 June and continued till 31st October. During Kharif season the following crops, vegetables and orchards are included in the pest scouting programme.

- Major Crops like Cotton, Rice, Sugarcane and Maize
- Orchard like Citrus, Mango, Guava and Apples etc.
- Vegetables like Brinjal, Okra, Bitter gourd, Tinda, Tori, Cucumber, Pumpkin, Chillies, Muskmelon/Watermelon, Spinach and Others.

a Cotton and Rice Crops

1. Random Survey

- Each team conducts pest scouting 5 days per week covering 8-10 spots per day (40-50 spots per week);
- Observations are recorded about pest infestation and disease incidence for cotton and rice and farmers are guided at the spot about the identification of insects, pest, diseases, methods of pest scouting, importance,

implementation of ETLs and most effective and ecological friendly pest control measures;

- A prescription slip is delivered to the farmer at the spot; and
- Each Union Council is covered every week in order to have more accurate picture of pest infestation and disease incidence in that particular tehsil.

2. Fixed Spots Survey

- For crop mapping and motivation of the farmers for adopting IPM techniques, two (02) spots are selected in each tehsil in cotton and rice areas in such a manner that these represent the whole tehsil;
- At each spot the area of the plot is 5 acres. This area is pest scouted by pest scouting teams of the tehsil on weekly basis regularly;
- The observations are recorded about the infestation of insects, pests and disease incidence. Additional information such as plant height, number of fruiting parts etc. are recorded for cotton crop and spike length, number of tillers, productive and non-productive tillers, grains/spike and 1000 grain weight etc. for rice crop; and
- Farmers are motivated to adopt IPM techniques, conserve natural enemies and apply suitable pesticides only when pest population reaches the ETL. In this way the use of pesticides are minimized resulting in low cost of production along with biodiversity conservation.

b Sugarcane

The teams constituted for cotton and rice conduct pest scouting of sugarcane as under:

- 15 spots at random and 5 fixed spots are pest scouted in each sugarcane mill zone area during a fortnight and information is recorded on;
- Farmers are guided to manage the pests by adopting appropriate control measures; and
- For the management of sugarcane leafhopper (*Pyrilla perpusilla*) the use of a parasite, namely, *epiricania* (cocoons) is recommended.

c General Crops, Vegetables & Orchards

1. Random Survey

- Pest scouting is conducted at random for each crop, vegetable and orchard in addition to the special campaign about cotton, rice and sugarcane; and
- During survey, the farmers are educated for adopting IPM measures according to the Insect pest/ disease situation.

2. Fixed Pest Survey of Landscape

- A landscape area consisting of one kilometer square is selected in each tehsil in such a manner that it would represent the whole tehsil; and

- Fortnightly observations are recorded on each crop, vegetable, orchard etc. (what so ever is sown in this landscape area) regarding insect pest infestation and disease incidence according to the prescribed method to see the trend of Insect pest/ disease. This will help us in forecasting and adopting appropriate precautionary measures about an insect pest or disease before it flares-up and spread to the adjoining areas.

Pest Survey of Rabi Crops, Vegetables & Orchards

The pest scouting teams conduct regular pest survey of all crops, vegetables and orchards throughout the year on weekly / fortnightly basis. Anti-pest campaigns of wheat are launched w.e.f. 15th of December and continued till end of March. During Rabi season the following crops, vegetables and orchards are included in the pest scouting programme.

- Crops like wheat, gram, spring maize, spring moong, sugarcane, oil seeds and barseem / lucern;
- Vegetables like potato, tomato, peas, onion, garlic, cabbage, cauliflower, spinach, lettuce, turnip, radish and carrot etc.; and
- Orchards like citrus, mango, guava, apple, litchi and falsa etc.

a Wheat

- Pest scouting/survey of wheat is carried out according to the prescribed proforma;
- The farmers are motivated to apply selective herbicides (on need basis) after pest scouting to control the specific weeds (narrow & broad leaved); and
- Monitoring for the infestation/infection of other pests and diseases also be executed and the farmers are advised accordingly for adopting appropriate biological control measures i.e., installation of Trichogramma cards for providing pesticides free atmosphere and augmentation of other beneficial insects like coccinellid beetles & Chrysoperla etc.

b Gram & Moong

- The areas where gram and spring moong is sown, pest survey is conducted and pest infestation / disease incidence is recorded on weekly basis
- In case of any pest infestation, especially for American Bollworm (*Helicoverpa* spp.) the farmers are advised to be vigilant towards its management by use of Trichogramma cards;
- Use of Insect Growth Regulators (IGRs) against pest attack are recommended. Farmers are motivated to avoid the application of those pesticides on gram and moong which are being used against cotton pest in perspective of resistance management.

c Spring Maize

- The area where spring maize is sown is pest scouted and pest infestation is recorded on weekly basis; and
- The farmers are being given consultancy for management of weeds through cultural practices and pests through use of specific pesticides against certain pests.

d Oil Seeds

- Pest infestation and disease incidence is monitored on oil seed crops i.e. sarsoon, toria, sunflower, canola etc.; and
- The farmers are guided to control the pests effectively emphasizing more on adoption of biological control measures rather than chemical control measures.

e Barseem / Lucern

- Barseem is a main fodder crop of Rabi season. Sometime, this crop is heavily attacked by pests like cascuta, Armyworm and Helicoverpa spp.; and
- The survey team records observations about pest infestation and motivate the farmers to control the pest insects through bio-control agents (parasite/predators) which may shift to the next cotton crop as these pest insects also shift to the cotton crop usually.

Positive Aspects of Pest Scouting Services

Pest scouting has following positive aspects on crops and farmers community:

- Awareness among the farming community for adopting IPM techniques;
- Haphazard spray has been stopped;
- Application of pesticide as and when needed keeping in view the economic injury level of the pests;
- Number of the sprays have been reduced from 10-12 to 4-6 saving the extra amount spend on pesticides;
- Conservation of natural enemies by using safe pesticide;
- Off season management of pests other than chemicals resulting reduced pressures of major pests on crops to a considerable extent;
- Spot treatment Techniques introduced by the department reduced the further spread of pests from infested to uninfested areas resultantly unnecessary expenditure of use of pesticides was reduced and the pest could not develop resistance against pesticides;
- Management of wheat pests with Bio Control agents has not only saved our main staple food from becoming polluted but also serving as main reservoir of beneficial insects for other crops; and
- More than 15,000 pesticides dealers are trained regarding pest management, safe handling and appropriate use of pesticides because mostly farmers directly consult pesticide dealers for purchase of pesticides so these skilled dealers help farmers in decision making/ selection right pesticides against a specific pest.

Techniques And Tools Of IPMF

The following are some popular techniques in IPMF:

- Using clean and certified seeds and saplings;
- Growing resistant varieties;
- Regular hoeing and removal of weeds;
- Following proper spacing;
- Thinning and pruning at proper time;
- Scouting regularly;
- Encouraging natural enemies;
- Growing companion crops;
- Using low and high tunnel technologies;
- Using screens, nets, fruit bags etc.;
- Removing fall fruits, leftovers and mummified fruits;
- Limiting chemical fertilizers;
- Using biological control agents;
- Utilizing sterile male techniques;
- Following strict quarantine regulations;
- Storing grains in proper containers;
- Storing storage materials at proper places;
- Cleaning storage facilities;
- Using proper dose and proper pesticides;
- Cleaning spray equipment; and
- Developing early warning system.

Determination Of Economic Threshold Levels

Most pests are either not serious or not high in population to cause economic losses so jumping to pesticide application is not wise. However, there are times when only pesticides can control the damage. Pesticides shall be used in an IPMF only when the benefits (yield, quality, aesthetic value) exceed the costs of control. It is therefore, necessary to know about the pest population, variety, and growth stage, weather, and cost of the control. Economic Threshold Levels (ETL) are different for different pest and different crops. ETL is the level of pest population, as determined by valid sampling procedures, at which some kind of control measures must be used to prevent yield or quality loss. The ETL are influenced by the Government regulations and the market prices. The ETL is point below the injury level at which a decision is made to treat or not to treat a given crop / plant/ commodity etc.

Acceptable Pest Levels (ETLs) in Punjab

IPM recognizes that eradication of a pest is seldom necessary or even desirable, and generally not possible. The primary objective in pest management is not to eliminate a pest organism but to bring it into acceptable bounds (Lawal et al., 1997). IPM holds that wiping out an entire pest population is often impossible, and the attempt can be

expensive and environmentally unsafe. IPMF initial task is to establish acceptable pest levels, called action thresholds, and apply controls where the thresholds are crossed. These thresholds are pest and site specific, i.e. it may be acceptable at one site to have for instance a weed such as white clover, but at another site it may not be acceptable.

A decision to use an insecticide should be made only when an insect population has reached or exceeded an economic threshold—that level of a pest population at which control is needed to prevent economic loss (that is, the projected cost of damage is greater than the cost of control). The utmost principles of an insect management program are scouting fields and basing control decisions on economic thresholds. Growers should incorporate scouting and the use of economic thresholds into their crop management plans. Economic thresholds of insect pests of general crops, vegetables and orchards of Punjab are given as under¹⁷:

Table P6: Economic Thresholds of Insect Pests of General Crops, Vegetables & Orchards of Punjab

Sr. No.	Crops, Vegetables & Orchards	Insects / Pests	Economic Thresholds
1.	Wheat	Brown Leaf Rust	% Incidence & Low-Med-High Intensity
		Smut	% incidence
		Armyworm	On Appearance
		Aphid	No Spray recommended
2.	Mango	Hopper	5/ Leaf (In Summer)1/ Leaf (In Winter)10/ Inflorescence or Twig
		Scales	50 Scales / Leaf
		Fruit Fly	10% Damage
		Mealy Bug	On Appearance
		Mango Midges	10 spots/ Twig or Inflorescence
		Gall Farming Insect	10 Galls / Leaf
		Malformation	Low-Med-High
		Anthraxnose	On Appearance
3.	Gram	Armyworm	On Appearance
		Helicoverpa	3 Larvae/25 plants
		Termite	10% damage
		Cutworm	10% at initial stage
		Blight	Low-Med-High
		Wilt	% incidence
4.	Citrus	Citrus Psylla	6/ Leaf
		Leafminer	10% affected leaves
		Fruitfly	10% affected fruits
		Withertip	Low-Med-High
		Canker	Low-Med-High
5.	Sugarcane	Top Borer	10% Attacked Plants

¹⁷ Directorate General of Pest Warning & Quality Control of Pesticides, Government of the Punjab
<http://pestwarning.agripunjab.gov.pk/>

Sr. No.	Crops, Vegetables & Orchards	Insects / Pests	Economic Thresholds
		Stem Borer	-do-
		Root Borer	-do-
		Gurdaspur Borer	-do-
		Pyrilla	3/Leaf
		Black bug	10/ sheath
		Whitefly	10/ Leaf
		Mites	10/ Leaf
		Toka	3-5/ Sweep of Net
		Mealy Bug	On Appearance
		Termites	10% Damage
		Rodents	5 Live Burrows/ Acre
		Diseases	Only Presence
6.	Vegetables	Red Pumpkin Beetle	1/ 10 Plants (at seedling stage) 1/ Plants (at crop stage)
		Fruit Borer	10%on Brinjal 5% on Tomato
		Hudda Beetle	4/ Plant
		Diamond Back Moth	3/ Leaf
		Helicoverpa	5% Fruit Infestation
		Fruit Fly	3 % Fruit Infestation
		Jassid	1/Leaf on Cucurbits, 2/ Leaf on Brinjal, 3/ Leaf on Melons
		Whitefly	5/Leaf on Cucurbits 2/Leaf on Chillies, Cowpeas
		Aphid	5/Leaf
		Powdery Mildew	Low-Med-High
		Downy Mildew	Low-Med-High
		Wilt	Only Seed Treatment
		Root Rot	Only Seed Treatment
		Collar Rot	Water must not touch the stem
		Leaf Spot/ Blight	Spray on appearance
7.	Maize	Shoot fly	5%
		Stem borer	5%
		Helicoverpa	5 % Cobs
		Armyworm	On Appearance
8.	Cotton	Jassid	1 Adult or Nymph per leaf
		Whitefly	5 Adult or Nymph or both per leaf
		Thrips	8-10 Adult or Nymph per leaf
		Cotton Mealy Bug	On Appearance
		Mites	10-15 per leaf
		Spotted Bollworm	3 Larvae/ 25 plants
		Pink Bollworm	5 Larvae/ 100 Bolls

Sr. No.	Crops, Vegetables & Orchards	Insects / Pests	Economic Thresholds
		Helicoverpa	5 Brown eggs or 3 small larvae or Both 5 / 25 plants
		Armyworm	On Appearance
		Aphid	Spray on visible damage on top terminals
9.	Potato	Jassid	3/Leaf
		Blight	On Appearance
10.	Tobacco	Cutworm	3% Attacked Plants
11.	Oilseed Crops	Aphid	1/ Pod10/ Twig
12.	Sunflower	Helicoverpa	1/5 Flowers
13.	Rice	Borers	No. of Moths/Trap/Night are 8-10 at Crop Dead Hearts 5 % at Crop
		Chrotogonus (Toka)	3-5 Adults/Net
14.	Guava	Fruit Fly	10% Attacked Fruits (4-5 pheromone traps/ acre)

Screening/Standardization of Pesticides

The Office of Assistant Director of Agriculture (PP) Research was established in 1984 under the establishment of Directorate General of Pest Warning and Quality Control of Pesticides, Punjab, Lahore. There are two main objectives including departmental research trials and screening/standardization of pesticides through research trials on different field crops.

The standardization is the process of research trials in which private companies introduce various pesticides of new chemistry (Candidate) applied on specific crops at different doses and compares with already registered and established pesticides named as standard. Both candidate and standard are applied and compared at the same time by spraying/applying against specific insect pests for two consecutive seasons. The results thus obtained are analysed statistically and sent to Director, Entomological research Institute, AARI Faisalabad and other concerned quarters for further procedure of registration, screening and standardization.

This office also conducts trials of any issue suddenly arises to get its reference to agriculture and tries to get its remedy as early as possible¹⁸.

Pesticides Sampling

Pesticides sampling is a regular phenomenon of this Directorate General to check the adulteration in pesticides. To ensure the quality of pesticides, each pesticides inspector will regularly conduct intelligence based raids and draw samples from the stores/ warehouses/ shops of vendor, dealers, distributors & importers and send these to the Provincial and Federal Pesticides testing laboratories and on the receipt of negative

¹⁸ Directorate General of Pest Warning & Quality Control of Pesticides, Government of the Punjab
<http://pestwarning.agripunjab.gov>

result, legal action would be taken against the concerned person/ agency in line with Agriculture Pesticide Ordinance 1971 and subsequent amendment 2012¹⁹.

Impacts And Mitigations Associated With Use Of The Pesticides

The table below highlights the major impacts and issues of pesticides arising during pre-spray, spray and post-spray phases and the relevant mitigation measures to be implied²⁰.

Table P7: Potential Impacts and Mitigation Measures of Pesticides

Sr. No.	Impacts/ Issues	Mitigation Measures
Pre-Spray Phase		
16.	Accidental spills of pesticides during road transportation to warehouse and spray sites.	Ensure that the drivers identified to haul the pesticide to the spray sites are well trained on adherence to road safety procedures and to the FAO standards and guidelines for the storage and transport of pesticides. Ensure that only road worthy vehicles are selected for the transportation with qualified drivers.
17.	Possible environmental contamination caused by warehouse exposure due to poor siting of warehouses, pilferage and vermin attack of the stored pesticides before spraying.	Ensure the selected warehouse is sited away from a flood plain area, water course, wells, schools, markets. Secure the selected warehouse and apply all the guidelines for storage and stock control manual by FAO.
18.	Accidental fires and injuries in the warehouses	All the workers handling pesticides or other products and equipment in the storage facilities must all have PPE including goggles, gloves, boots, overall, dust masks etc. Also, develop an Emergency Response Plan (ERP). All spray operators and store managers must be trained on how to operate the fire extinguishers and what to do in case of fire outbreaks.
Spray Phase		
10.	Occupational health and safety impacts (spray operators, drivers, storekeepers and flagmen exposure due to negligence, lack of PPEs, or unintentional exposure caused by accidents or limited pesticide knowledge)	Ensure PPEs provided to all. Ensure that team leaders and supervisors effectively monitor the spray operations diligently and take action to correct any non-compliance issues noted right away. Procurement of sprayers manufactured according to WHO specifications. Prohibition of eating, drinking and smoking during work. Rotation of applicators to avoid/limit over exposure. Trainings according to FAO standards
11.	Surface water contamination (contamination of surface water bodies directly or indirectly through runoff from soil. Impact on the aquatic life as well as community livelihoods. Possible release of the pesticide)	Avoidance of areas or regions with surface water bodies that are critical to habitats and livelihoods through mapping of spray areas prior to spraying (screening). Use of bio-pesticide based on screening results. Optimum calibration of spraying equipment to reduce excess application of pesticides. Pesticide applicators will never wash themselves, their overalls, or their PPE in any water bodies. Carry out environmental monitoring of water bodies
12.	Soil and ground water contamination (pesticides can cause beneficial soil microorganisms to decline thereby affecting soil quality. Contamination of soil during the disposal	Avoidance of agro-ecological areas and regions with surface water bodies that are critical to habitats and livelihoods through mapping of spray areas prior to spraying (screening). Use of bio-pesticide based on screening results. Optimum calibration of spraying

¹⁹ The Punjab Agricultural Pesticides (Amendment) ACT 2012 (XXV of 2012).

²⁰ Emergency Locust Response Program (ELRP), Ministry of Agriculture, Livestock, Fisheries and Cooperatives, Government of Kenya, 2020.

Sr. No.	Impacts/ Issues	Mitigation Measures
	of containers and it is detrimental to food security as it impacts directly on agriculture.)	equipment to reduce excess application of pesticide. Implement ERP to manage accidental spills during transportation or application. Proper management and disposal of obsolete.
13.	Air pollution impacts (use of utility vehicles on un-paved roads will cause dust emissions and increase exposure to particulate matter (PM ₁₀ , PM _{2.5}). Pesticide sprays can also drift or volatilize from the treated area and contaminate air in addition ubiquitous stench of pesticides)	Carry out awareness-raising and provide relevant, timely information to local communities on pesticide treatment schedules and potential negative air quality impacts. Record all air quality complaints, identify cause (s), take appropriate measures. Carry out environmental monitoring of air quality for pesticides residues and their derivatives before, during and after the treatment activities.
14.	Solid waste impacts (empty pesticide containers and used PPEs are considered toxic under the Basel Convention and therefore require disposal to conform to toxic waste disposal regimes)	Develop waste management plans. Implement the triple rinse approach to decontaminate the containers. Before puncturing and disposal in compliance with FAO guidance. Empty containers must not be re-used. Ensuring adequate pesticide shelf-life prior to purchase to avoid obsolescence. The remaining shelf-life of procured pesticides should be at sufficient to permit all stock to be used before expiry and within the scope of the project.
15.	Impacts on ecological sensitive habitats (application of pesticides can create a potential risk of polluting ecologically sensitive habitats such as wetlands, national parks reserves, forests, pasture grasslands, and water bodies.)	Avoidance of sensitive habitats and livelihoods through mapping of spray areas prior to spraying (screening). Judicious choice of pesticides (i.e. Bio pesticides could be used in/near potentially sensitive areas instead of fenitrothion pesticides). Optimum calibration of spraying equipment to reduce excess application of pesticide.
16.	Community health and safety (communities exposed to pesticides may suffer short-term acute health effects such as nausea, headaches, sore eyes, skin rashes and dizziness)	Avoidance of agro-ecological areas and regions with that are critical to habitats and livelihoods through mapping of spray areas prior to spraying (screening). Ensure that the project executers and host community are able to address the grievances on access and equity within the agreed GRM. Public awareness (communications) campaigns will keep the public informed about possible environmental and health effects of pesticides
17.	Impacts to birds, fishes, and other organisms (pesticide application can have an impact on organisms other than the target pest. Loss of biodiversity makes ecosystems more vulnerable to changes in the environment)	Avoidance of agro-ecological areas and regions with critical to habitats and livelihoods through mapping of spray areas prior to spraying (screening). Judicious choice of pesticides which includes selection and use of bio-pesticides in/near potentially sensitive areas. Optimum calibration of spraying equipment to reduce excess application of pesticide. Adhere to FAO the SOPs for spraying based on location sensitivity and characteristics
Post-Spray Phase		
18.	Pilferage and community exposure, environmental contamination from any remaining pesticides not used	Keep storage facilities up to standards. Multi-disciplinary teams is expected to undertake environmental monitoring of sensitive ecological sites, residue sampling and evaluating the environmental and health impacts post the control activities campaign.
19.	Environmental contamination and resident exposure from spray disposal activities	Sprayer progressive rinse, spray operator bathing, washing of overalls, PPE and cloths used to cover furniture. Ensure that a soak pit (with charcoal) is constructed for disposing residual water after clean-up. Procurement and distribution of barrels for progressive rinse, and wash-tubs for personal hygiene. Multi-disciplinary teams is expected to undertake environmental monitoring of sensitive

Sr. No.	Impacts/ Issues	Mitigation Measures
20.	Residential exposure from contact with secondary warehouses	ecological sites, residue sampling and evaluating the environmental and health impacts. Decontaminate by cleaning all the secondary warehouses to ensure that exposure incidents are minimized. Collect all the solid waste to the central warehouses for further disposal.

Training And Capacity Building

A number of capacity building interventions will be required under the program in order to ensure effective implementation of the IPMF in an environmentally friendly and socially acceptable manner. The following interventions are hereby proposed:

- Procurement of equipment for pesticide application including PPEs including chemical proof overalls, aprons, gum boots, chemical proof hand gloves, goggles and respirators, etc. Emergency equipment e.g. for cleaning up spills should also be procured. This equipment would only be provided to lead farmers and key extension staff in the event that farmers decide to adopt the use of chemicals;
- Training of extension staff in the life cycle management of pesticides covering selection, usage and safe disposal of containers as well as chemical formulation and dosing (dilution of chemicals for use), calibration of equipment, spraying procedures and other factors to consider, handling of sprayers as well as general equipment maintenance;
- Trainees should be sensitised enough to use only pesticides with authentic and clear labels showing all the necessary information including expiry dates, occupational/public health and safety as well as basic environmental safeguards. This will also help avoid adulteration and sale of expired herbicides;
- Provision of training and sensitisation programs in IPM including demonstrations and preparation of IPM implementation manuals and guidelines;
- Training/sensitisation in the use of PPEs, treatment of any pesticide poisoning, interpretation of material safety data sheets and labels on pesticide containers and safe storage of pesticides;
- Training in first aid and emergency response with a focus on treatment of chemical poisoning and pesticide spill management;
- Sensitisation on weather and other environmental related considerations insecticide application e.g. avoiding spraying when it is about to rain, when it is windy, when it is too hot or when the soil is wet or in ponded areas or areas close to water sources (e.g., rivers, dams, wells, etc.) and populated areas; and
- Training will be provided in both formal and informal settings including field days as appropriate in meeting the specific training objectives. A training needs assessment would help in setting the training agenda and ensure that the training sessions are relevant and tailored to answer to farmers' pressing information needs.

In Punjab, seminars regarding seasonal crop management at the fields of interested farmers are arranged by each team with the collaboration of private sector. Literature for insect pests and diseases of current crops are distributed to the farmers and demonstration is also arranged keeping in view the importance of crops. Farmers and extension workers are inspired to ask any question. The Farmers and extension workers are trained in:

- Identification of insect pests, diseases and their timely appropriate control measures;
- Identification of useful insects;
- Safe handling of pesticides, plant protection machinery and their proper use; and
- The conservation and use of bio-control agents against insect pests of crops.

Advantages And Drawbacks of IPMF

The benefits of IPMF are immense directly to farming and indirectly to society.

- IPM protects environment through elimination of unnecessary pesticide applications. In IPM, pesticides are used at the smallest effective dose when other methods of pest control have failed. Also, they are used in bringing a pest organism to acceptable bounds with as little ecological disruption as possible;
- IPM improves profitability of the growers. Since IPM program applies the most economical management pest tactics, profitability is ensured for the grower or farmer;
- It reduces risk of crop loss by a pest. Applying pest management and monitoring tactics will also ensure the reduction of crop loss or damage by pests; and
- Long term sociological benefits of IPM would also emerge in areas of employment, public health, and wellbeing of persons associated with agriculture.

In spite of many benefits, there are also some drawbacks, listed below:

- An IPM program requires a higher degree of management; and
- Making the decision not to use pesticides on a routine or regular basis requires advanced planning and higher degree of management. This planning includes attention to field histories to anticipate what the pest problems might be, selecting crop varieties which are resistant or tolerant to pest damage, choosing tillage systems that will suppress anticipated pest damage while giving the crop the greatest yield potential.

List Of Banned Pesticides In Pakistan (2016)²¹

- | | | |
|---------------------|----------------|--|
| 10. Bhc | 11. Disulfoton | 12. Mercury Compound |
| 13. Binapacryl | 14. Endrin | 15. Mevinphos |
| 16. Bromophos Ethyl | 17. Endosulfan | 18. Dibromochloropropane + Dibromochloro Propene |
| 19. Captafol | 20. Dalapon | 21. Ethylenedichloride + Carbontetrachloride |
| 22. Chlordimeform | 23. Leptophos | 24. Heptachlor |
| 25. Chlorobenzilate | 26. Ddt | 27. Methyl Parathion |
| 28. Chlorthiophos | 29. Dieldrin | 30. Monocrotophos |

²¹ Department of Plant Protection, Government of Pakistan.

- | | | |
|---------------|-----------------|-------------------|
| 31. Cyhexatin | 32. Dicrotophos | 33. Methamidophos |
| 34. Toxaphene | 35. Zineb | |

Pesticides Banned Under The Stockholm Convention

The following pesticides that are classified as POPs were banned under the Stockholm Convention and belong to the original list of “The Dirty Dozen” and may not be sponsored under the program.

- Aldrin;
- Chlordane;
- DDT;
- Dieldrin;
- Endrin;
- Heptachlor;
- Hexachlorobenzene;
- Mirex; and
- Toxaphene.

The following pesticides were added to original list of banned pesticides since August, 2009 and may not be sponsored under the program:

- Chlordecone;
- Alpha hexachlorocyclohexane;
- Beta hexachlorocyclohexane;
- Lindane; and
- Pentachlorobenzene.

Estimated Budget

An estimated budget for the IPMF is given below.

Table P8: Cost Estimate for Implementation of IPMF

Sr. No.	Components	Unit Rate (PKR)	Quantity	Cost (PKR)	Remarks
1.	Capacity Building and Trainings	200,000	Biannually	2,000,000	This is the tentative cost for five-year period. 2 events per year.
2.	Research and Development	Lump Sum	As and when required basis	3,000,000	This is the tentative cost for five-year period.
3.	Sampling and Testing	Lump Sum	As and when required basis	2,000,000	This is the tentative cost for five-year period.
4.	Advisory Services	Lump Sum	As and when required basis	2,000,000	This is the tentative cost for five-year period.
5.	Monitoring and Evaluation / Third Party	1,000,000	Annually	5,000,000	This is the tentative cost for five-year period.

Sr. No.	Components	Unit Rate (PKR)	Quantity	Cost (PKR)	Remarks
6.	Preparation of IPMPs (at subproject level)	Lump Sum	As and when required basis	2,500,000	This is the tentative cost for five-year period.
7.	Progress Reporting	Lump Sum	Quarterly/ Bi-annually	2,000,000	This is the tentative cost for five-year period.
8.	PPEs and First Aid Kits Costs	Lump Sum	As and when required basis	1,500,000	This is the tentative cost for five-year period.
Sub-Total				20,000,000	
Contingency Charges (10% of Grand Total)				2,000,000	
Total Cost				22,000,000	

Annex Q: Environmental and Social Screening Checklist

Screening Questions	Yes	No	Remarks
Physical Environment			
Would the proposed project interventions ²² (watercourses improvement/rehabilitation/extension of lining, development of ponds, community based groundwater recharge schemes, irrigation schemes outside canal command areas, infrastructures (warehouses, collection centers and pack houses) installation of HEIS and solar system) pose the risk of clearance of vegetation. It may also result an increase in level of suspended solids washing into the rivers / surface water bodies and an increase soil erosion and contamination?			
Would the proposed project involve the application of chemicals (fertilizers/pesticides) that may have a negative effect on the environment or human health?			
Would the proposed project pose a risk of contaminating drinking water sources due to construction and operation activities?			
Would the proposed project interventions (watercourses improvement/rehabilitation/extension of lining and installation of HEIS) deplete the groundwater?			
Would the proposed project construction activities result in an increase in the level of dust, particulate matter and other ambient air pollutants in the air surrounding the site?			
Would the proposed project construction activities increase the ambient noise level and vibrations?			
Would the proposed project interventions include above ground installation that may alter the views to, from or beyond the site?			
Would the proposed project interventions affect the nearby agricultural land?			
Would the proposed project potentially involve deep excavation?			
Would the proposed project interventions lead to landslides hazard?			
Would the proposed project interventions result in significant greenhouse gas emissions or exacerbate climate change?			
Would the proposed project interventions potentially result in the generation of waste (both hazardous and non-hazardous)?			
Would the proposed project include activities that require significant consumption of raw materials, energy, and/or water?			

²² In Section 7.5: *Subprojects Environmental and Social Screening of ESMF*, screening criteria for the proposed subprojects has been provided requiring preparation of checklist with mitigation measures/ ESMP for only those subprojects having E&S impacts.

Screening Questions	Yes	No	Remarks
Would the proposed project activities pose potential risks to community health and safety due to the transport, storage, and use and/or disposal of hazardous or dangerous materials (e.g. installation of PCPS, fuel and other chemicals during construction)?			
Would the proposed project result in potential increased health risks (e.g. from water-borne or other vector-borne diseases or communicable infections such as HIV/AIDS, COVID-19)?			
Ecological Environment			
Would the proposed project interventions potentially cause adverse impacts to habitats (e.g. modified, natural, and critical habitats) and/or ecosystems and ecosystem services?			
Would there be any activity under the proposed project which would promote land conversion of natural habitats such as forests to agricultural lands and/or involve use of prohibited pesticide/fertilizers.			
Would there be any proposed project activity(s) that may have potential impacts on parks, natural reserve or local community?			
Would the proposed project activities pose risks to endangered species?			
Any subproject site close or adjacent to any mangroves, estuarine, wetland or protected area?			
Social Environment			
Would the proposed project potentially involve land acquisition?			
Would the proposed project potentially involve temporary or permanent and full or partial physical displacement?			
Would the proposed project potentially involve shifting of public utilities?			
Would the proposed project potentially involve traffic related issues?			
Would there be any indigenous peoples present in the project area (including project area of influence)? Any health and safety impact to them?			
Would the proposed project construction activities pose any high risk to the workers/laborers?			
Would the proposed project result in interventions that would potentially adversely impact the religious / cultural heritage sites / values?			

Annex R: Format for Voluntary Land Donation

The PRIAT Project will, in most cases, not finance schemes that require land acquisition other than Voluntary Land Donation (VLD) or publicly owned land. This use of voluntary donation option will be limited to small scale community infrastructure subprojects. Under no circumstances, shall the titleholder be subjected to any pressure, directly or indirectly, to part with the land. The PRIAT Project will ensure that the process of voluntary donation of land is meticulously documented (format agreed to both parties) to avoid confusions, misunderstandings, litigations, etc. at a later stage. Original copies of all documentation of voluntary donation of land will be kept with the relevant Land Revenue Department of Punjab. Complete documentation along with a copy of the final document will be sent to Project Management Unit (PMU) for records and for inspection at a later date.

For land donation the following rule will apply:

- The titleholder should not belong to the vulnerable sections;
- Households (with a valid proof), as per provincial poverty line for rural/urban areas;
- Households without a proof of the same and belonging to the following social categories:
 - Women headed households with women as sole earner
 - Minority / handicapped persons, and is subject to any of the following impacts;
 - Loses land holding,
 - Loses shelter and
 - Loses source of livelihood.
- The titleholder should be holding more than the minimum prescribed land;
- The impacts must be minor. The voluntary donation should not be more than 10 percent of the area of that particular holding of the titleholder in that category;
- This should not require any physical relocation of the titleholder. The land donated should not be more than 1 acre in case of dry land, 0.5 acre in case of cultivated land;
- The land must be jointly identified by the Revenue Department / Project Affected Committee / PMU Representative or project authorities. However, the project technical authorities should ensure that the land is appropriate for subproject purposes and that the subproject will not invite any adverse social, health, environment, safety, etc. related impacts by procuring this land;
- The land in question must be free of squatters, encroachers, or other claims or encumbrances;
- Buildings/structures on the land donated are not accepted as donation;
- Verification of the voluntary nature of land donations must be obtained from each of the persons donating land. This should be in the form of notarized witnessed statements;
- In case of any loss of income or physical displacement is envisaged, verification of voluntary acceptance of community devised migratory measures must be obtained from those expected to be adversely affected;

- The land title must be vested in the project/PMU for public services and appropriate guarantees of public access to services must be given by the private titleholder;
- The titleholder donating land should have made to understand that they will have equal access to the infrastructure built on the donated land like any other community member and that they cannot claim for any priority treatment;
- Grievance redress mechanism must be available; and
- The donations and the process followed is documented, monitored and reflected in the monitoring reports.

Annex S: Generic TORs For The Preparation Of ESMP

Scope of the Work

- The Project Management Unit (PMU) will engage a team of consultants to prepare the Environmental and Social Management Plan (ESMPs) for moderate-risk subprojects identified under Environmental and Social Management Framework (ESMF) of PRIAT Project, in order to ensure that the activities carried out under the proposed PRIAT Project are (i) environmentally sound and sustainable in the long run; and (ii) consistent with the environmental safeguard guidelines, rules and regulations of the Government of Pakistan (only those which are applicable) and Punjab, as well as those of the World Bank's Environmental and Social Framework (ESF).
- The Consultants will carry out the tasks including, but not limited to the following:
 - i Review available / secondary environmental data, baseline studies, and results of screening checklists; Carry out detailed survey and investigations for collection of adequate primary baseline data;
 - ii Collect primary data on the biophysical environment of the project area;
 - iii Collect primary data on the socioeconomic conditions of the local communities;
 - iv Work with the PMU and its consultants in carrying out an alternative analysis of the proposed subproject locations and designs (if required);
 - v Assess all potential environmental direct and indirect impacts of the subprojects during planning and design / pre-construction, implementation / construction and completion / operation phases in the project area of influence;
 - vi Provide an independent opinion on approach and adequacy to integrate appropriate environmental management measures with related costs into the detailed design, specifications and project contract documents;
 - vii Undertake public consultation and disclose the outcome of the environmental and social assessment;
 - viii Provide support and advice to PMU in all matters relating to the environmental aspects of the project; and
 - ix Any additional work required to achieve the objective of the assignment.
- All the required ESMPs will be subject to the Bank's review and approval.

Proposed ESMP Structure

- An ESMP consists of the set of mitigation, monitoring, and institutional measures to be taken during implementation and operation of a project to eliminate adverse environmental and social risks and impacts, offset them, or reduce them to acceptable levels. The ESMP also includes the measures and actions needed to implement these measures. The Borrower will (a) identify the set of responses to potentially adverse impacts; (b) determine requirements for ensuring that those responses are made effectively and in a timely manner; and (c) describe the means for meeting those requirements.
- The content of the ESMP will include, but not limited to the following:
- **Introduction**, including background, a brief description of the Project.

- **Legal and policy framework**, an overview of the relevant legal and policy framework.
- **A simplified description** of the proposed subprojects, including its layout and location, resource requirements, wastes to be generated, manpower requirement, a brief description of construction activities, and a brief description of operation and maintenance activities.
- **Baseline description**, primarily describing the proposed site and its immediate surrounding aided with maps, photographs and schematics, key environmental and social aspects/resources of the surroundings such as land form and land use, land ownership, water resources, settlements, any critical habitat or protected area, any cultural heritage sites or graveyards, any sensitive receptor such as schools and hospitals, access routes, and other relevant details.
- **Stakeholder consultations**, recording the key concerns and suggestions of the community regarding the proposed subprojects and its potential impacts, and a description of the way these concerns will be addressed.
- **Impact assessment**: The anticipated impacts are identified and summarized along with their significance.
- **Mitigation plans**, listing all the impacts, their mitigation measures, assigning responsibility of implementing these measures, and also assigning responsibility for monitoring. Also identifying cumulative impacts if applicable.
- **Monitoring plan**, describing the monitoring requirements, frequency, and responsibility of conducting the monitoring.
- **Capacity development and training plan**, describing the training requirements, contents, frequency, training recipients, and responsibility of conducting the desired trainings.
- **Documentation and reporting**, describing the requirement, frequency, and responsibility of documentation and reporting.
- **Grievances redress mechanism (GRM)**, a mechanism to define roles and responsibilities of the persons responsible to address the grievances of the affectees.
- **ESMP implementation budget**, providing the cost estimate of its implementation.

Duration of Assignment

The duration of the assignment for the preparation of each ESMP is approximately two (02)²³ months. The overall duration of the consultancy services depends on the number of subprojects for which ESMPs need to be carried out.

Staff and Qualifications

The key staff and their qualification requirements for the preparation of ESMPs are given in the following Table 1.1.

Table M1: Staff and Qualification Requirements

²³ This is a tentative duration, however, it will be finalized by Environmental and Social Safeguards Specialists of PMU upon finalization of project footprints and scope of subproject (s) activities.

Sr. No.	Key Staff	Man-months²⁴	Qualifications
1	Environmental Safeguard Specialist	2	The consultant should have a Master's degree in Environmental Sciences / Engineering. He/she shall have at least seven (07) years of relevant work experience in the preparation of EIA/IEE/ESIA/ESMP of funded ²⁵ projects.
2	Social Safeguard Specialist	2	The consultant should have a Master's degree in Social Sciences / Social Development or similar fields. He/she shall have at least seven (07) years of relevant work experience in social impact assessment and mitigation, gender assessment, as well as in resettlement planning of funded projects.

²⁴ This is a tentative duration, however, it will be finalized by Environmental and Social Safeguards Specialists of PMU upon finalization of project footprints and scope of subproject (s) activities.

²⁵ World Bank /ADB

Annex T: Tree Plantation Plan

The basic purpose of afforestation/plantation of suitable species in the proposed subprojects areas is to reduce the risk been made due to the proposed subprojects and to enhance green cover and improve the overall environment of the area. Afforestation will not only reduce the risk been made but will also increase the carrying capacity of the areas regarding many positive aspects.

During finalization of design, due consideration shall be given to minimize the loss of existing tree cover. Tree felling, if unavoidable, shall be done only with the compensatory plantation of at least three saplings for every tree cut. Plantation will be done during the construction work. Plantation of indigenous trees species is highly important to maintain the biodiversity and ecological balance. The maintenance of trees and watering (during the initial period of two to three years) shall be the responsibility of WUAs/Farmers. It is also important to prevent global warming, soil erosion and pollution. Afforestation purifies the environment and helps in reducing the carbon dioxide level.

Importance of Tree Plantation

- Trees contribute to their environment by providing oxygen, improving air quality, climate amelioration, conserving water, preserving soil, and supporting wildlife;
- Trees control climate by moderating the effects of the sun, rain and wind. Leaves absorb and filter the sun's radiant energy, keeping things cool in summer;
- Trees also preserve warmth by providing a screen from harsh wind;
- Trees also lower the air temperature and reduce the heat intensity of the greenhouse effect by maintaining low levels of carbon dioxide;
- Both above and below ground, trees are essential to the eco-systems in which they reside;
- Trees absorb and store rainwater which reduce runoff and sediment deposit after storms. This helps the ground water supply recharge, prevents the transport of chemicals into streams and prevents flooding; and
- Trees, shrubs and turf also filter air by removing dust and absorbing other pollutants like carbon monoxide, sulfur dioxide and nitrogen dioxide.

Objectives

- To restore native species;
- To improve the quality of air and reduce its pollution;
- To add color to the landscape and enhances the beauty of the environment;
- To uplift the quality of our living environment through active planting, proper maintenance and preservation of trees together with other vegetation;
- To protect and conserve flora and fauna of the proposed subproject areas;
- To attract rain which is a positive impact on the proposed subproject areas at all; and

- To reduce sedimentation by plantation in the proposed subproject areas which will act as protection wall against wind born dust particles.

a) Recommended Species

It is recommended to plant indigenous species (in consultation with relevant department for particular region) in the concerned district to lower the adverse environmental impacts associated with the tree affected/removed trees.

b) Plantation Technique

Plantation of different suitable species is to be carried out in the immediate vicinity of the proposed subproject areas. The proposed subproject areas can be afforested and vegetation cover can be improved by adopting standard afforestation technique of digging pits. The proposed subproject areas are suitable for plantation activities and can be managed thoroughly with care. Planting shall be undertaken immediately after rainy season or initial weeks of spring.

c) Tree Cutting at Subproject Areas

The subprojects proposed under PRIAT may involve destruction of vegetation cover while clearing RoW along the watercourses during the improvement/extension of lining/reconstruction rehabilitation activities. It is initially estimated that approximately 32,000²⁶ of trees / saplings including fruit trees (if any) may be affected during the clearance of RoW. However, no tree cutting is anticipated for the development of irrigation schemes outside the canal commands, construction of water ponds, installation of HEIS and solar systems.

It is recommended to plant three (03) trees against each fallen tree of similar floral function. Therefore, 96,000 (32,000*3=96,000) trees are recommended to be planted at the available spaces in/around the subproject areas.

d) Tree Marking and Inventory

Trees that will need to be cut from the base, for that following inventory shall be maintained.

- Reference No.;
- Ownership;
- Location;
- Specie;

²⁶ Based on PIPIP experience, it is estimated that on average four (04) trees per watercourse may be affected. The PRIAT project involves improvement/extension of lining/reconstruction rehabilitation of eight thousand (8,000) watercourses. Therefore, 32,000 trees (4*8,000) are estimated to be affected/removed.

- Girth;
- Height; and
- Photographs.

e) Costing

Tentative cost for purchasing one plant ²⁷	=	1,200 PKR
Total plants need to be purchased	=	96,000 numbers
Total cost of purchasing plants	=	96,000 x 1,200
Total Cost	=	115,200,000 PKR (115.2

Million)

Note: The maintenance of all the plants raising, in lieu of tree cutting, as per tree plantation plan shall be carried out by the concerned Water User Associations (WUAs) / Farmers.

²⁷ Estimated cost for a single tree, as per discussion with Forest Department

Annex U: Template for Environmental and Social Monitoring

Title of Subproject _____

Proponent _____

Contractor's / WUAs / Farmer Name _____

Monitoring Date & Time _____

Sr. No.	Receptor	Monitoring Parameters	Locations	Monitoring Mechanism	Monitoring and Reporting Frequency	Compliance Status (Yes/No)	Reason for Non Compliance
1.	Water Quality (Surface water/Groundwater/Drinking Water/wastewater) (as advised by Environmental Specialist)	Compliance with all parameters as per PEQS 2016, WHO and FAO standards (whichever is stringent)	Within Subproject Areas	<ul style="list-style-type: none"> • Visual checks • Complaints from nearby residents • Record of public grievances • Discrete grab sampling and laboratory testing of water samples by EPA approved laboratory for monitoring 			
2.	Air Quality (as advised by Environmental Specialist)	Monitoring of CO, CO ₂ , SO _x , NO _x , HC and PM _{2.5} PM ₁₀ and compliance with PEQS, 2016 and IFC/WHO guidelines (whichever is stringent)	Within Subproject Areas	<ul style="list-style-type: none"> • Visual checks • Complaints from nearby residents • Record of public grievances • Onsite ambient air monitoring by EPA approved laboratory for monitoring 			

Sr. No.	Receptor	Monitoring Parameters	Locations	Monitoring Mechanism	Monitoring and Reporting Frequency	Compliance Status (Yes/No)	Reason for Non Compliance
3.	Noise Pollution (as advised by Environmental Specialist)	Compliance with dBA Leq. as per PEQS, 2016 and IFC/WHO (whichever is stringent)	Within Subproject Areas	<ul style="list-style-type: none"> • Visual checks • Complaints from nearby residents • Record of public grievances • Monitoring of noise level at site 			
4.	Soil Contamination (as advised by Environmental Specialist)	Soil contamination, uncontrolled solid waste disposal activities at sites	Within Subproject Areas	<ul style="list-style-type: none"> • Visual observations and checks • Complaints from nearby residents • Record of public grievances • Sampling and laboratory testing for soil samples 			
5.	Construction Machinery	Traffic safety sign, condition of vehicles and machinery, driver inspection, safety barriers	Within Subproject Areas	<ul style="list-style-type: none"> • Visual observations and checks • Complaints from nearby residents and labours. • Record of public and labour grievances 			
6.	Ecological Resources	Disturbance to natural habitat, wildlife, trees cutting	Within Subproject Areas	<ul style="list-style-type: none"> • Visual observations and checks • Complaints from nearby residents • Record of public grievances 			
7.	Waste Management	Collection, disposal, and management of solid, liquid, construction,	Within Subproject Areas	<ul style="list-style-type: none"> • Visual observations and checks • Consultations with AP's. 			

Sr. No.	Receptor	Monitoring Parameters	Locations	Monitoring Mechanism	Monitoring and Reporting Frequency	Compliance Status (Yes/No)	Reason for Non Compliance
		hazardous wastes		<ul style="list-style-type: none"> Complaints from nearby residents. Record of public grievances 			
8.	Chance Find	Compliance with chance find procedure	Within Subproject Areas	<ul style="list-style-type: none"> Visual observations and checks Record and reporting 			
9.	Community around the subproject corridor	Use of common resources. Hindrance to mobility. Community health and safety	Communities within the study area / area of influence	<ul style="list-style-type: none"> Community consultations Visual observations and checks Complaints from nearby residents Record of public grievances 			
10.	Labour Management	Child labour, employment conditions, workers' accommodation, Housekeeping, HIV/STDs, COVID 19 etc.	Within Subproject Areas	<ul style="list-style-type: none"> Consultations and medical check ups Complaints from labours/near by resident Record of public and labours grievances 			
11.	Grievances Redress	Type and number of grievances / Social and Environmental Conflicts	Within Subproject Areas	<ul style="list-style-type: none"> Complaint register Complaints from labours/near by resident 			
12.	Community/Occupational health & safety	Compliance with WBG EHS Guidelines, 2007 Type and number of accidents	Within Subproject Areas	<ul style="list-style-type: none"> Consultations and complaint register Complaints from labours/near by resident 			
13.	Gender Based Violence	Impacts on Women, Children, and	Within Subproject Areas	<ul style="list-style-type: none"> Community consultations 			

Sr. No.	Receptor	Monitoring Parameters	Locations	Monitoring Mechanism	Monitoring and Reporting Frequency	Compliance Status (Yes/No)	Reason for Non Compliance
		Vulnerable Groups and related issues.		<ul style="list-style-type: none"> Complaints from labours/near by resident Record of public grievances 			
14.	COVID-19 SOPs Implementation	Wearing of Masks, Social distancing, medical check-ups	Within Subproject Areas	<ul style="list-style-type: none"> Visual inspection, instrumental inspection Complaints from labours/near by resident Record of public and labours grievances 			
15.	Public Utilities ²⁸	Disturbance or damage to public infrastructure / utilities	Within Subproject Areas	<ul style="list-style-type: none"> Visual checks and consultations with AP's. Ensure compensation and records Complaints from nearby resident Record of public grievances 			
16.	Trainings	As per Capacity Building and Training Framework	Within Subproject Areas	<ul style="list-style-type: none"> Audits and record checking Evaluation report Record of staff grievances 			
17.	Unanticipated Conditions (as per advise of Environmental and Social Safeguards Experts)	NA	Within Subproject Areas	NA			

PHOTOLOG OF ISSUES IDENTIFIED ABOVE

²⁸ Telephone lines, electric poles and wires, water lines and electricity high tension pole (if any).

Date of Photograph

Photograph Depicting Issue

Remarks

Name of Monitoring Person (s): _____ **Designation &**
Department/Organization _____ **Signature:** _____

Note: EPA= Environmental Protection Agency, PEQS= Punjab Environmental Quality Standards, WHO= World Health Organization, IFC= International Finance Cooperation, FAO= Food and Agriculture Organization.

Annex V: Community Health and Safety Plan

This community health and safety plan recognizes that project activities in general, and certain sub-projects (like those involving extensive infrastructure works) can potentially create health and safety risks for communities. This plan anticipates potential adverse impacts, and proposes mitigation measures accordingly.

Infrastructure and Equipment Design and Safety

The community at large as well as community workers could face risks from the use of faulty equipment, or issues with “structural elements” such as poorly designed watercourses that are given to overflow. Other possible risks arise from the installation of equipment in high-risk locations (like areas prone to flooding).

Mitigation Measures

All works under the project will be covered by the provisions of the Punjab Occupational Health and Safety Act 2019, which, in addition to the OHS of workers (not covered by this ESS), also stipulates (in sections 6 to 8) that manufacturers of equipment and employers in all manner of establishments are responsible for ensuring the correct assembly, manufacture and use of all equipment in the workplace.

In addition, the Project Steering Committee, which is responsible for approval of equipment standards & specifications, and prequalification of supply & services companies, shall ensure that all equipment used is of an acceptable standard. The Project pre-qualification Committee is responsible for standards and specifications for equipment to be provided to farmers. The Steering Committee will also authorize the appointment of experts, where necessary, to advise on the correct installation and operation of equipment in areas at risk of natural disasters or other hazards.

Safety of Infrastructure and Traffic Hazards

Work on watercourses can open the community to risks of flooding and, to a lesser extent, possible drowning (particularly of children or small animals). At the same time, greater economic activity and work on sub-projects can increase the flow of traffic in the community, which can lead to a number of potentially hazardous situations.

Mitigation Measures

An Emergency Response Plan has been prepared as part of this ESMF. All project personnel at relevant (supervisory levels) will be trained in the provisions of the Response Plan and should be familiar with principles of emergency prevention, preparedness and response arrangements for such events. A Traffic Management Plan has also been prepared which stipulates how the flow of traffic will be managed at project sites.

Fallout of Construction

The construction activities and vehicular movement at construction sites may result in roadside accidents particularly affecting local communities who are not used to the presence of construction equipment. Quality of groundwater and surface water resources

available in the nearby local communities may be affected due to the construction activities, oil spillage and leakage, roadside accidents, etc. The proposed subprojects will also have potential of air (dust pollution), noise and vibrational impacts on nearby community. The labor works with different transmittable diseases like HIV/AIDs and COVID-19 etc. may cause spread out of those diseases in the local residents and for visitors. Conflicts may arise between the local community and the construction workers, which may be related to religious, cultural or ethnic differences, or based on competition for local resources.

Mitigation Measures

- The Contractor/WUAs/Farmers will be required to strictly follow World Bank Group EHS Guidelines, 2007. The Contractor/WUAs/Farmers will prepare the site specific community health and safety plan in compliance with relevant sections of the WBG General Environmental Health and Safety Guidelines (WBG 2007) and Pakistan Labor Laws;
- The Contractor/WUAs/Farmers will clearly barricade work areas to prevent access by the public;
- They will also provide basic medical training to specified work staff and basic medical service and supplies to workers;
- There will be proper control on construction activities and oil spillage leakage of vehicles;
- The laborers with communicable diseases will be restricted within the construction site till they are no longer infectious;
- The Contractor/WUAs/Farmers will ensure that the site is restricted for the entry of irrelevant people particularly children;
- Efforts will be made to create awareness about road safety among the drivers operating construction vehicles;
- Timely public notification will be issued on planned construction works;
- Provision of proper safety and diversion signage, particularly at sensitive/accident-prone spots will be ensured, Speed limits will be determined and enforced;
- Water sprinkling will be carried out to suppress dust;
- The Contractor/WUAs/Farmers will prepare the method of treatment and disposal of sanitary wastes, disposal of hazardous waste, actions to be taken in the event of land and water based pollution events and procedures for the collection and disposal of wastes, including domestic and construction waste to protect the local community;
- The WUAs / Contractor will prepare the CCMP which, in addition to other components, will include the labor influx management plan. This will be reviewed and approved by Client (where applicable);

- The Contractor/WUAs/Farmers will take due care of the local community and observe sanctity of local customs and traditions. The WUAs / Contractor will warn the staff strictly not to involve in any unethical activities and to obey the local norms and cultural restrictions; and
- Relevant legislations, conventions, ESSs and guidelines will be respected.

Communicable Diseases

The influx of people may bring communicable diseases to the project area, including sexually transmitted diseases (STDs), and COVID- 19; or the incoming workers may be exposed to diseases to which they have low resistance. This can result in an additional burden on local health resources. Workers with health concerns relating to substance abuse, mental issues or STDs may not wish to visit the project’s medical facility and instead go anonymously to local medical providers, thereby placing further stress on local resources. Local health and rescue facilities may also be overwhelmed and/or ill-equipped to address the industrial accidents that can occur in a large construction site.

The Contractors/WUAs will minimize its potential to cause communicable and vector borne diseases. On site and around the site, housekeeping will be ensured on daily basis. Furthermore, waste (solid waste and wastewater) will be managed in an appropriate way to reduce impact of pollution on surrounding communities. Latest/updated COVID-19 guidelines/SOP by Government/ WHO will be followed to prevent spread of coronavirus in nearby communities (Guidelines to combat with COVID-19 are provided as separate Annex).

Mitigation Measures

The Contractor/WUAs/Farmers will facilitate workers and other project personnel who are unwell to seek medical attention as soon as possible, and will ensure that adequate sick leave is allowed if required. Workers and project personnel with communicable diseases will be encouraged to isolate to the extent possible, or at least minimize contact with the community till their condition is judged to not to be a threat. If local health facilities are under stress or are crowded, project personnel will facilitate workers to go to facilities in town or city centers. COVID-19 safety procedures, as mandated by the government, will be enforced for as long as the pandemic persists.

In the events of accidents, natural disasters or other emergencies, the project personnel will follow the Emergency Response Plan.

Interaction between Workers and Community

In general, workers will avoid interaction with the community and only nominated/designated person of Contractors/WUAs will interact with local communities to record grievances or for other necessary reasons.

Gendered Risks

Women will be more likely to suffer adverse health effects of harmful farming practices including extended physical labor, arduous work hours and conditions, and pesticide exposure in agricultural work, depending on crop and agro-economic zone.

The girl child's vulnerability to aggravated illness will be higher given the greater share of young people with pre-existing pulmonary diseases such as asthma and other respiratory disorders across Pakistan, including in Punjab.

The quality and availability of water from irrigated areas that is available for domestic and homestead use might be affected as irrigation systems are closed for any purpose, or the timing, location or means etc., for getting water becomes unsuitable for women/ girls.

Pregnant women would be at a higher risk of health problems resulting from pesticide exposure than non-pregnant women in crops dependent on high use of pesticides (Integrated Pest Management protocol relevant)

Women and girls with disabilities and older women will likely be left further behind in terms of access to adequate healthcare due to their gender, age and disability status.

Women and girls may not be able to access medico-legal services and legal aid in most cases of GBV due to very thin spread of services and social barriers to access.

Safety Measures for Communities

In general, the Contractor / WUAs will ensure the following safety measures for the communities (at a minimum):

- Avoid or minimize the potential for community exposure to hazardous materials and waste (if produced);
- Avoid, minimize or compensate for the potential for traffic related accidents, affected agriculture land, communicable and vector-borne diseases;
- Manage environmental pollution including impacts on air quality and noise;
- Train employees on driving standards, and the transportation of materials, local culture and norms and ensure timely and open information sharing about proposed subprojects;
- Minimise traffic movement close to communities/villages, permanent/temporary settlements and nomadic/semi-nomadic herders and keep a safe distance;
- Consult with affected communities if traffic disturbance is not avoidable and take appropriate measures after consultation (including measures to avoid disturbance of their livestock);
- Caution will be taken with regards to social impacts/ interference of local women in the surroundings of the subproject sites and measures will be implemented that ensure their freedom of movement is not impacted;
- Strictly observe speed limits on roads passing through villages/communities, avoid using pressure horns, and ensure drivers do not linger unnecessarily on roads near communities;
- Construction deliveries will, where possible, be scheduled to avoid busy periods of traffic congestion and/or be rerouted to avoid potential pinch points;
- All vehicles transporting soil and other dusty materials will be covered appropriately.

Annex W: Negative List of Activities

The project's negative list is given in this Annex. The list refers to activities that are prohibited from receiving financing. These will include the following; and may be updated if the need so arises as per outcomes of subproject(s) screening process.:

1. Production or trade in any (agriculture) product or activity deemed illegal under Pakistan's laws or regulations or international conventions and agreements;
2. Use of banned pesticides/fertilizers of Pakistan and WHO regulations;
3. Cultivation, processing, and sale of poppy and/ or other illegal addictive substances (for example, heroin, hashish, opium, bhang, alcohol);
4. Trade in wildlife or wildlife products regulated under Convention on International Trade in Endangered Species;
5. Activities that may transform grassland or natural vegetation;
6. Subprojects activities that involve land acquisition;
7. Activities in protected / sensitive areas/ Notified sites (archaeological/culture/historical) or buffer zones thereof;
8. Hazardous waste management and disposal as well as manufacture, transport and use of hazardous, and/or toxic materials (except small amounts of solvents, degreasing materials, pytgaints, fuels, and the like used during construction).
9. Production or activities involving harmful or exploitative forms of forced labor;
10. Production or activities involving harmful child labor, that is economically exploitive, or is likely to be hazardous to, or to interfere with, the child's education; or to be harmful to the child's health, or physical, mental, spiritual, moral, or social development;
11. The equipment and infrastructure (crop harvesting equipment, agro-processing equipment and machinery, warehouses, collection centers, and pack houses) that will have high risks and impacts;
12. Lining of watercourses exceeding 50 percent of the length of the watercourse;
13. Exceeding 15-acre ceiling per farmer for HEIS implementation support;
14. Producers contributing less than 30 percent of the cost for HEIS investments over 0 to 5 acres and less than 50 percent of the cost for additional acreage of HEIS implementation up to the 15-acre ceiling;
15. Farmers who are not having or willing to install drip/ sprinkler irrigation systems through the project would be ineligible for subsidies on solar system investments;
16. Installation of submersible pump for pumping of groundwater;
17. Installation of pump exceeding 10KW versus the 15KW horsepower; and
18. Solar-powered pumping to abstract groundwater.

Annex X: Sample Terms of Reference

Environment Specialist

Detailed Tasks and/or Expected Output

1. Dealing with the environmental aspects of the ESMF and implementation of its procedures and processes during the course of project.
2. Update in Implementation of Environmental aspects of the project.
3. Implementation of all environment aspects including environmental screening and filling the screening checklists for each subproject to be undertaken under the project.
4. Supervising and supporting Implementing Agency (IA) in achieving their responsibilities as outlined in the ESMF/ESMP and subsequent Checklists;
5. Ensure the implementation of the mitigation measures suggested in ESMF/ESMPs and suggest any additional mitigation measures if required.
6. Ensure the Grievance Redress Mechanism (GRM) prepared as a part of the ESMF/ESMPs is implemented in its entirety and is fully functional and any grievances are efficiently and effectively addressed and resolved.
7. Inform World Bank project team and PMU on environmental non-compliance issues.
8. In case of non-compliances, develop and implement, in coordination with the Implementing Agency, an appropriate action plans to rectify unsatisfactory compliance.
9. Carrying out frequent field visits and conduct monitoring for effective ESMF implementation.
10. Identifying and assist in preparing environmental induction and training / workshop materials.
11. Conduct/manage ESMF trainings for the IA.
12. Responding to environmental incidents as required.
13. Preparing progress reports for submission to World Bank and other stakeholders.
14. Provide technical support to implementing IAs in the development of site specific ESMPs (where required).
15. Coordinate with implementing agencies IAs for onsite implementation.
16. Organize and conduct the trainings on ESMF/ESMP compliances as proposed in mitigation plan.
17. Prepare progress reports as per ESMF/ESMP and submit to the World Bank.
18. Ensure the Health Safety and Environment (HSE) compliance at project sites.
19. Coordinate and conduct Environmental Field Monitoring visits of Project Areas.
20. Review and revision of documents and ensuring timely delivery of outputs as agreed with the World Bank.
21. As and when required contribute to the ongoing activities of the Environment and Social Management Unit of PMU.
22. Coordinate and facilitate third-party audits.
23. Conduct consultations with stakeholders including project affected persons to obtain their views on implementation of environmental issues and mitigation measures.

24. Attend to comments/ suggestions made by World Bank project team, PMU and concerned Environment department.
25. Provide any other additional support as requested by the PMU to ensure compliance with national/provincial regulatory requirements and World Bank ESSs.
26. Perform any other tasks / assignment that may be assigned by Project Director or World Bank project team

REQUIRED QUALIFICATION AND EXPERIENCE:

Masters in Environmental Sciences/Environmental Engineering from a HEC recognized university; More than 7 years of relevant experience in dealing with environment management and implementation in environmental health related projects preferably in WB funded projects; have sound knowledge of local laws/policies on environmental management , ESSs of WB and their compliance in field including ESMF /ESMP procedures and processes; monitoring and compliance of environmental mitigation measures and OHS practices during projects execution and implementation.

Social Specialist

Detailed Tasks and/or Expected Output

1. Dealing with the social aspects of the ESMF / ESMP and implementation of its procedures
2. Update in Implementation of social aspects of the project.
3. Implementation of all social aspects including social screening and filling the screening checklists for each subproject to be undertaken under the project.
4. Supervising and supporting Implementing Agency (IA) in achieving their responsibilities as outlined in the ESMF/ESMP and subsequent Checklists.
5. Carrying out frequent field visits and conduct monitoring for effective ESMF / ESMP implementation
6. Identifying and assist in preparing social induction and training/workshop materials; conduct/manage ESMF/ESMP trainings for the IA.
7. Closely work with Environment Specialist for the implementation of the subproject.
8. Prepare progress reports as per ESMF/ESMP and submit to the World Bank.
9. Provide technical support to implementing IA in the development of site specific ESMFs
10. Coordinate with implementing agencies for onsite implementation.
11. Organize and conduct the trainings on ESMF/ESMP compliances as proposed in mitigation plan.
12. Prepare final progress report of the ESMF/ESMP and submit to the World Bank.
13. Ensure the Health Safety and Environment (HSE) in collaboration with Env. Specialist & compliance at project sites.

14. Ensure the Grievance Redress Mechanism (GRM) prepared as a part of the ESMF/ESMPs is implemented in its entirety and is fully functional and any grievances are efficiently and effectively addressed and resolved.
15. Coordinate and conduct Field Monitoring visits of Project Areas.
16. Review and revision of documents and ensuring timely delivery of outputs as agreed with the World Bank.
17. As and when required contribute to the ongoing activities of the Environment and Social Management Unit (ESMU).
18. Coordinate and facilitate third-party audits.
19. Inform World Bank project team and PMU on environmental non-compliance issues.
20. Conduct consultations with stakeholders including project affected persons to obtain their views on implementation of social issues and mitigation measures.
21. Attend to comments/ suggestions made by World Bank project team, PMU and concerned Environment department.
22. Provide any other additional support as requested by the PMU to ensure compliance with national/provincial regulatory requirements and World Bank ESSs.
23. Perform any other tasks / assignment that may be assigned by Project Director or World Bank project team

REQUIRED QUALIFICATION AND EXPERIENCE:

Master's Degree, or equivalent, in Anthropology, Sociology, Applied Social Sciences/ from a HEC recognized university; More than 7 years of relevant experience in safeguard work or related areas dealing with social management and implementation in health related projects preferably in WB funded projects; have sound knowledge of local laws/policies on social management, ESSs of WB and their compliance in field including ESMF/ESMP procedures and processes; monitoring and compliance of social mitigation measures.

Gender Specialist

Detailed Tasks and/or Expected Output

The Gender specialist will be responsible for monitoring the implementation of the Gender Based Violence Action Plan and for the preparation of the semi-annual monitoring reports. His/her main tasks will be:

1. Review or join the community consultation process in implementation, and report that outreach, participation, and communication activities are adequately carried out especially for women and vulnerable stakeholders.
2. Monitor and evaluate project impact to the social, poverty, and gender.
3. Ensure effective Implementation Gender Based Violence Action Plan.
4. Ensure the Grievance Redress Mechanism (GRM) prepared as a part of the ESMF/ESMPs is implemented in its entirety and is fully functional and any grievances are efficiently and effectively addressed and resolved.
5. Identify gaps to address gender disparities and areas of improvement.
6. Organize training / workshops regarding gender issues and their mitigation measures.

7. Prepare progress reports on Gender Based Violence Action Plan, impact studies, knowledge products and documentation of good practices.
8. Ensure awareness programs among participants (Adults and Children).
9. Coordinate and facilitate third-party audits.
10. Inform World Bank project team and PMU on environmental non-compliance issues.
11. Conduct consultations with stakeholders including project affected persons to obtain their views on implementation of gender issues and mitigation measures.
12. Attend to comments/ suggestions made by World Bank project team, PMU and concerned Environment department.
13. Provide any other additional support as requested by the PMU to ensure compliance with national/provincial regulatory requirements and World Bank ESSs.
14. Perform any other tasks / assignment that may be assigned by Project Director or World Bank project team

REQUIRED QUALIFICATION AND EXPERIENCE

Master's Degree, or equivalent, in Gender, Social Sciences or another relevant field from a HEC recognized university; More than 7 years of relevant experience in related areas preferably in WB funded projects; have sound knowledge of local laws/policies, ESSs of WB and their compliance in field including ESMF/ESMP procedures and processes; monitoring and compliance of social mitigation measures.

Annex Y: Gender Mainstreaming and Gender-based Violence (GBV), Sexual Harassment (SH) and Sexual Exploitation & Abuse (SEA) Action Framework

A detailed Gender Mainstreaming and Gender-based Violence (GBV), Sexual Harassment (SH) and Sexual Exploitation & Abuse (SEA) Action Framework has been developed for PRIAT. A summary of this document and salient features are provided in this Annexure.

The framework explores the gender dimensions of the Punjab Resilient and Inclusive Agriculture Transformation (PRIAT) project in terms of risks and mitigation strategies linked to gender inclusivity, mainstreaming, and Gender-based Violence (GBV), Sexual Harassment (SH) and Sexual Exploitation and Abuse (SEA), which could result directly or indirectly from Project interventions. It discusses details of the main project components and activities from a gender lens, and highlights risks identified both in literature in by practitioners working in different parts of Punjab. The intensity of the risks and impact differ by context, women's involvement and specific roles in irrigation and farming activities, and the agro-economic sites and specific crops/agribusinesses that will be involved in Project activities. The gender impact can be very high to medium-low, based on factors discussed in the assessment.

The framework also proposes actions that need to feed into the overall Project Environmental & Social Management Plan including its monitoring and review systems, community engagement plans and data collection mechanisms, to minimize gender-based exclusion, and maximize results for vulnerable communities, particularly rural women and girls. The assessment and Action Framework has been developed on the basis of evidence review and interviews & groups discussions with over 30 subject experts, practitioners and stakeholders in Government and civil society.

The overall assessment suggests that women and girls, and other marginalized groups (ethnic and religious minorities, poor and landless (women) farmers and workers) are at the highest risk of being targeted for GBV, SH and SEA in the project, while also being least able to access support and protection mechanisms.

The risk of GBV, SH and SEA are heightened due to the deployment of external personnel, including agricultural extension workers, contractors, suppliers, civil works labor, etc., whereas the ability to respond to such complaint within concerned departments is low. In addition to this and related to the issue of due diligence in hiring of contractors, consultants, spray teams, etc., there is currently no system in place that provides information on persons with previous record of violence, harassment, etc. A sex offenders' registry

has been committed in the Anti-Rape Act, 2021,²⁹ although a system for doing so is yet to be defined and set up in all provinces, including in Punjab. A SH Inquiry Committee does not exist at the District, Tehsil or Zila levels and instead is located in On-farm Water Management (OFWM) Department's provincial head office only.

Increased support for male farmers is very likely push women, girls, children and the elderly towards increased contributory and unpaid work, with limited ability to control financial gains made by the farming unit as a whole. Refusal to participate or comply with demands for increased farming activity can also lead to interfamilial violence, with women, children and the elderly bearing the brunt of abuse and violence. Periodic canal closure for construction, maintenance, de-silting and repairs could disrupt domestic water supply, which will create a need for ensuring safe storage. It could also severely restrict water uses in homes and homesteads, with further effects on personal and household hygiene in order to maintain drinking water supplies. This has many health implications and consequences, where improved farm water may restrict or adversely affect water availability and quality for households, especially at the tail-end and particularly for women and girls, who are largely responsible for water collection, and washing chores.

As PRIAT will use community labor towards share of the beneficiaries' contribution for water course improvement activities, detailed provisions for use of community labor need to be described in Labor Management Procedures (LMP) in terms of safety and health at work, fair treatment, non-discrimination (in hiring, terms and pay), and equal opportunity for workers including women, persons with disability disabled and children. The LMP will need to pay special attention to women laborers and their protection in construction work sites related to water storage, tunnel farming and drip irrigation.

Lack of effective and secure tracking of changing intrafamilial/ household power dynamics because of project interventions would also render the Project's full impact on transforming/ reinforcing gender norms & roles unknowable. It is thus important to track how and if the burden of shared work between farming couples and age-appropriate activity for their children undergo any shifts (positive or negative) with Project interventions, while also tracking the impact on men and women's/girls' time use, health, incomes, decision-making ability and safety and security during the course of the Project. Further, transitions to high-value crops that relegate women to manual labor only, or exposes them to harmful farming practices, will off-set the gains made in farming productivity by increasing health hazards and costs.

²⁹ Legal provision was added to respond to the demand to track offenders when earlier, a consultant with the Planning & Development Department in Khyber Pakhtunkhwa was found to be a convicted paedophile in 2019 (see [Consultant held over child pornography, abuse removed from KP govt project - Pakistan - DAWN.COM](#))

Impacts and mitigation by Project Components are provided in Table1 , while Table 2 provides a dedicated Action Framework to respond to cases of GBV, SH and SEA. This annexure is supported by more information and resources in the detailed Gender Mainstreaming and Gender-based Violence (GBV), Sexual Harassment (SH) and Sexual Exploitation & Abuse (SEA) Action Framework Report.

Table 1: Gender Risks Assessment and Mitigation against Project Components

Component	Key Activities	Risks	Mitigation
Component 1: Improvement of On-farm Water Conveyance Efficiency	1.1 Improvement/ lining of unimproved water courses	– Women and gender minorities will be excluded during the selection processes of identifying labor for participating in water storage construction work due to an abundance of male workers.	1) Promote and support women’s employment opportunities in drip irrigation and tunnel farming, specifically those involved in vegetable or fruit farming and kitchen gardening. 2) Undertake large campaigns regularly including all-women seminars in villages to encourage women to join/apply to WUAs. i. Ensure that the application process to join WUA is easy, not contingent on landownership and/or control, and free of cost for women. ii. Use audio-visual material to highlight the importance of women in irrigation, and of joining WUAs. iii. Agree on suitable terms and conditions (timing, location, access, and mobility, etc.) for women to participate in decision-making processes, regarding infrastructure and watercourse development through WUA and otherwise. iv. Develop separate forums for women to create a safe space for them to share their opinions. v. Track WUAs to ensure women’s inclusion, timely reporting, and accountability. 3) Ensure meaningful female participation in Water User Associations (WUAs) including by: i. Reserving spaces for women in the governing bodies of WUAs, should there be interested and qualifying candidates, and ii. Organizing training programs on the gendered dimension of water, leadership, communication, and technical knowledge on irrigation methods and uses for women to play an active role in WUAs.
	1.2 Extension of watercourse lining up to optimal lining length of 50%	– Women small farmer will not have the financial means to go into cost-sharing arrangements for installing HEIS on their own land; landless and tenant women farmers will have fewer resources and decision-making power.	
	1.3 Reconstruction of outlived watercourses	– Equal wages will not be paid to women hired for civil work, or they would have no control over their earnings.	
	1.4 Development of water conveyance systems in non-canal commands and riverine areas	– Female labor will not have permission to work; seizing opportunity for paid work may lead to intrafamilial dispute and violence, which could spill over into the community. – Field staff ill-informed or ill-equipped with a nuanced understanding of local social, gendered and power dynamics between groups and men and women could exacerbate conflict which could lead to escalation of	

Component	Key Activities	Risks	Mitigation
		<p>violence, or reinforce existing harmful gender norms.</p> <ul style="list-style-type: none"> - Negative economic and social impacts may result from any involuntary taking of land or restrictions on land use especially during civic construction work. - Inter/Intrafamilial and communal conflict, and/or disaster(s) that cause family separation will jeopardize yield, reducing farm productivity. - Labor influx may lead to increased changes of GBV, SH and SEA and unsafe working conditions for women and especially young girls. - Violence may also result from shift in women's work, away from domestic work and into commercial/ market activities. - Threats to women and girls' human security through the escalation of personal and communal conflict, crime, or violence because of unconventional inclusion into Water-Users Associations, or perceived uneven benefits derived by different people/ groups in the project. - WUAs may disband after watercourse improvement or become inactive. - Lack of awareness, visibility and access to the GRM will prevent 	<ul style="list-style-type: none"> iii. Expanding women's role in WUAs by linking its works to (women) farmers' education, and to improve organization and feedback loops to women beneficiaries/ affectees. 4) Incorporate women- friendly characteristics in the design and implementation assets and/or services for women and girls by setting requirements for hiring of women as skilled and unskilled workers in establishment of water storage structures; should there be few or no women laborers, community-based supervisory roles may be extended to them especially. Remote location deployment of women supervisors, however, should be avoided.

Component	Key Activities	Risks	Mitigation
		women, girls and gender minorities from recording their complaints.	
Component 2: Promotion of Climate Smart Production and Inclusive Access to Markets	2.1 Promotion of Climate Smart Agriculture 2.2 Integrated water resource management 2.3 Value chain development	<ul style="list-style-type: none"> - Insufficient effort will be made to identify landless and small women farmers (1.5-2 hectares) to take benefit from PRIAT interventions – larger landed male farmers will dominate/influence selection. - Incentives provided to women farmers will not translate into learning and practices uptake or not produce desired outcomes if other impediments to their participation and growth are left addressed or interventions are not relevant to their needs. - Male trainers/social mobilizers will not be suitable for reaching female trainees and farmers through any public activity for awareness-raising, capacity-development, or on-farm support. - Women & girls will not be allowed to travel to training sites (even if next village) due to social restrictions on mobility and lack of safe and appropriate transport. - Mix group trainings and consultations will limit women and girls' participation. - Literacy- dependent or hypertechnical trainings may not be beneficial for women with zero or very low levels of literacy, with 	<ol style="list-style-type: none"> 1. Arrange women-only awareness raising and training sessions to inform women beneficiaries about new technologies and infrastructure being supported by the project. Separate on-farm trainings for women conducted by female instructors should be given preference. 2. Provide free trainings along with food for women, . This will be done through: <ol style="list-style-type: none"> i) Organizing separate training sessions for men and women on climate smart technology with a strong focus on the diversification of their production and practices to increase their production in a climate-smart way. ii) Organize separate entrepreneurship training sessions for women on topics such as value chain, marketing, post-harvest value addition, small technologies and machinery, building market linkages with off-takers and aggregators, and business development skills. 3. Engage women/girls to support women farmers in agribusiness and market integration activities. 4. Form women's groups where their agricultural/ farming work is concentrated geographically, to organize regular dialogues for identifying key value chains and agribusinesses, choke points constricting growth, opportunities for developing value chain linkages, and defining skill gaps to be bridged under the project. 5. Identify NGOs, CBOs and local universities working with the farming community to identify women producer groups, including mechanisms for providing mentoring and coaching sessions targeted to women producer

Component	Key Activities	Risks	Mitigation
		<p>undue benefits accruing to wealthier and more educated (male) farmers in terms of learning outcomes.</p> <ul style="list-style-type: none"> - Prejudice and discrimination towards women & girls, and other marginalized individuals or groups in terms of access to Project benefits and development opportunities at the local and household level will not only lead to exclusion but may increase their burden of contributory, unpaid or underpaid work, or lower levels of market integration (increase in informal and unprotected work). - Irrespective of value addition, women/girls will still be reliant on male partners to access markets/ <i>mandis</i> (both for inputs and sale of produce). - Small to very small land holding amongst individual women, or lack of participation in farm-related decisions by landed women will reduce the viability of developing women-only producer groups. - Lack of data on and overall support in policy and practices related to women and girl in STEM and SMEs will curtail opportunities for women/girls to grow their agribusinesses and gain competitive edge in the market. - Women individual small or landless farmers will be less likely to possess the financial means to go into cost-sharing arrangements 	<p>groups, cottage and small & medium enterprises led by women.</p> <ol style="list-style-type: none"> 6. Provide financial support to women farmers to invest in climate-smart technologies, along with trainings on repair and maintenance. 7. Hire female professionals as well as field staff in project teams, with appropriate facilities, terms of work and workplace protection. Women should be encouraged and supported to join project team as per government policy. 8. Develop guidelines to ensure a safe and comfortable work environment for women staff and field workers such as separate bathrooms, dedicated female communal spaces, safe and affordable transport options, and childcare. 9. Involve young women in sales and marketing in value addition work 10. Develop value chain models at the local or farm level, with exclusive support for women farmer in product diversification and value addition by linking them up with aggregators and value chain innovators. These chains should involve women for every role from the farm to the table. 11. Identify women aggregators looking to connect with and support women producers with the assistance and guidance from local NGOs and CBOs for different crops, agribusinesses, and agricultural zones/clusters. 12. Support women producers to form producer/ farmer cooperatives over jointly owned land and other resources which they can collectively manage and take/sell produce from; identify such women with the support of local women's groups, NGOs and CBOs. 13. Support and promote uptake of innovations in small and single-hand farming technologies and solutions for women by connecting with Agriculture Universities that have established incubation centers and start-ups in climate smart agriculture.

Component	Key Activities	Risks	Mitigation
		<p>(matching grants) for starting farmers' groups, setting up a cottage industry, establish enterprises and undertake value addition.</p> <ul style="list-style-type: none"> - Low salary structures in extension work and absence of safe and affordable conveyance will disincentivize women from taking up employment. Agriculture women field assistants will hesitate or decline to participate in Project activities if they have no access to safe transport or are made to cover large areas due to their small numbers. - Landowners may not be willing to invest in creating safe working environment for women farm laborer in the field where their work is mainly located. - SH redressal mechanism will not be functional at the district and Zila level and remain out of reach or ill-equipped to handle complaints with confidentiality and with suitable referral, in the absence of basic public services infrastructure in remote areas (hospitals, police stations, shelters, child protection units, FIA, etc.) 	<ol style="list-style-type: none"> 14. Rather than targeting individual farmers and producers, focus more on targeting farming families and groups of landless or tenant farmers. Track processes and outcomes for whole families and within groups. 15. Hire female field assistant staff to reach out to women and support farmer education for women, especially those growing vegetables; increase the number of female extension workers at the Zila, District and/or regional offices of OFWM, or by farming clusters of fruit and vegetable growers. 16. Take trainings to women farmers at their doorstep as Training Institutes are difficult for most females to access. Conduct door-to-door awareness campaigns for women farmers, which have been noted as successful in reaching women under PIP. Alternately, provide safe and appropriate transport to trainees, substituting any wage-losses during the full course of training. 17. Establish value addition model industries attached to small-medium sized farms, including with trainings and equipment for grading, packing, marketing, that meet women small farmers' requirements. 18. Link up the agriculture department with the Metrological Department so that women and farmers in general can get reliable information related to weather; women's limited access to these warning systems must be bridged through community awareness and linking up concerned departments. 19. Ensure the presence of an active and responsive Sexual Harassment (SH) reporting, inquiry and redressal mechanisms at the Zila and Tehsil levels, that is visible, accessible, transparent, comprehensive, relevant to needs and realities of women and confidential, with adequate systems for onward referrals (though use of service provider directories) and follow-up, if need be.

Component	Key Activities	Risks	Mitigation
Component 3: Project Management, Monitoring and Learning	3.1 Project management, operations, training, and administration 3.2 Project implementation supervision consultancy, research, and strategic studies ³⁰ 3.3 Monitoring and Evaluation consultancy ³¹	<ul style="list-style-type: none"> – Women may be skipped by Project if teams are dominated by men, and gender mainstreaming is not institutionalized at every level and in within stakeholder engagement activities, including consultations, exchange of feedback, data collection and evaluation. – Community sessions may drive women away due to overrepresentation and crowding-out by men; reasons for lack of engagement and inclusion of women may not be tracked sufficiently and/or responded to. – The full impact on and results of the Project for women may be insufficiently tracked due to their 	20. Include dedicated sessions on GBV, SH, SEA and related mechanisms and support structures, along with comprehensive modules on women’s rights (right to own/control property; inheritance, constitutional guarantees, pro-women legislation, special schemes, and programs for women/girls/gender minorities relating to social protection and basic public services, sector-specific policies, etc.), in all training activities for women and girls. 1) Undertake a study to document the role of women in Punjab’s agriculture sector as a basis for targeted interventions to improve the status of women in agriculture. 2) Examine the relationship between women’s economic status improvement under the project and gender-based violence for families supported under the project. 3) Built departmental capacity across the board on gender and women’s work, and gender mainstreaming in agriculture and irrigation. In addition, the Project should sensitive all contractors, consulting firms and implementing partners on these and risks and suitable responses to cases of GBV/SH/SEA (GRM, whistleblowing, referrals, etc.) through organizations with gender expertise. Trainings may be held periodically. 4) Enhance the role of extension workers along with increasing the strength of female field staff, as per government policies and law on fair representation. To

³⁰ Including a) supervision and spot checks, covering quality and quantity aspects, by third-party consultants based on which the funds would be disbursed; (b) strategic studies and research of pilot projects that would be identified before and during project implementation; (c) a gender specific study to develop sector-wide gender strategy and implementation plan; and (d) activities identified in the Operational Risk Assessment Framework (ORAF) and governance and accountability measures

³¹Including a) pre-implementation baseline evaluation of groundwater level in project areas by district level; (b) the impact of the irrigation improvements on water use efficiency, groundwater levels and quality, and soil salinity; on-farm water use; cropping patterns and yields; draught events; species rely on the open water; and livestock population, health and production; (c) socio-economic impacts and the impact on the level of employment, livelihood and household incomes in the project area; estimation of the project’s overall benefits and economic rate of returns

Component	Key Activities	Risks	Mitigation
		<p>invisibility in public forums and lack of access to management and monitoring & evaluation systems, including women who farm for their livelihood.</p> <ul style="list-style-type: none"> - Without disaggregating indicators by gender at every level of intervention and categorizing women agriculture workers as farmers by type and nature of work, the impacts on women/ girls in all their diversity would remain undocumented, less understood, and unaddressed. - A very small number of GBV, SH and SEA cases get reported due to fear, stigma, shame, and lack of social and economic support. 	<p>support this, shared and safe conveyance systems must be put into place or salaries increased in lieu of mobility costs. Suitable conveyance facilities must be provided to female field officers below Grade 18.</p> <ul style="list-style-type: none"> 5) Study the knock-on or spill-over effect of SMART on PRIAT outcomes, where intervention sites overlap, or specific areas receive a greater share of different interventions to identify what works better. 6) Undertake a study on how women are being impacted by disasters differently from men in Punjab, its and use evidence to propose actions under the Project. Study can be outsourced or undertaken in partnership with Agricultural Universities with support from the Bank and/or FAO.

Table 2: Gender-based Violence, Sexual Harassment and Sexual Abuse and Exploitation Action Framework

S. No.	Suggested Action(s)	Timeline	Responsibility (Departments and members/officials of the following)	Budgetary Allocations	Monitoring	Remarks
1	Develop stand-alone gender and GBV, SH, SEA training material or adapt exiting material by qualified and experienced trainers to orient GRM response teams as well as project staff and implementing partners on reporting mechanisms and response protocols related to cases; cyclically, take such trainings down to the lowest levels of governance and project management.	Within 3 months of staff hiring. 2 trainings in the first year, and six-monthly trainings second year onwards.	PIC; DIC	Annual budgets should be set aside for field trainings across OFWM district offices and with Tehsil level staff, targeting women and men separately	Copy of adapted training module and pre-and post-training reports	
2	Hire a qualified gender trainer on contract to impart intermittent gender sensitization trainings to government officials, project partners, and beneficiaries and train Master Trainers for community replication sessions.	Within 2 months of project staff hiring	PSC, PIC	Long-term contract with a qualified gender trainer to develop content, integrate it in materials for other trainings, and carrying out sessions with Master Trainers in the community (including women and men separately)	HR and procurement records	Engage women's organizations such as Shirkat Gah – Women's Resource Center or Aurat Foundation, to provide specialized trainers and content/modules for said trainings.
3	Ensure GBV provisions within the main GRM. This should be able to route complainants towards relevant GBV counselors and authorities, while providing compliant registration and legal counseling. Establish a system of confidential user satisfaction assessments with a tracking	Within 45 days of project inception	PSC, GRM	Additional costs for GRM to be financed by Project budget under Component 3	Quarterly assessment of complaints received responses	See Referral Directories appended with this report (Annex 3) for linking GRM with existing

S. No.	Suggested Action(s)	Timeline	Responsibility (Departments and members/officials of the following)	Budgetary Allocations	Monitoring	Remarks
	system for onward referrals and follow-up after the hotline has been set up.				provinces and user satisfaction	response systems.
4	Ensure the GRM dedicates trained female staff to handle all cases of GBV, SH, and SEA. Train GBV response teams on standards and guidelines developed under the United Nations Joint Global Programme on Essential Services Package for Women and Girls Subject to Violence: Core Elements and Quality Guidelines .	Within 45 days of project inception	DIC, PIC		Quarterly assessment of training needs and implementation	
5	OFWM in each district/ division to notify local Sexual Harassment Inquiry Committees in their offices and appoint three trained officer bearers as permanent Committee members, including at least one woman, after adequate training from the provincial office.	Within 30 days of project inception	OFWM	N/A	Monthly stocktaking of complaints; Quarterly reporting	
6	Enhance the visibility of information and systems regarding designated Sexual Harassment Inquiry Committees and their members who could be approached by all project staff and beneficiaries for assistance in cases of SH and SEA.	Continuous throughout project life cycle	DIC	Part of regular stakeholder engagement and awareness raising activity budgets	Site visit reporting, reviews during implementation support	
7	Mandate visible display of Anti Sexual Harassment Code of Conduct by project all partners at all project sites (including offices, fields, training institutes and famers' schools, water collection points, etc.), along with information on the GRM.	Once in the beginning of project implementation, and putting up signage, etc., as operational sites are expanded.=	PIC; DIC; OFWM	Budget to be set aside for printing and other visibility/publicity material	Site visits reporting, reviews during implementation support	

S. No.	Suggested Action(s)	Timeline	Responsibility (Departments and members/officials of the following)	Budgetary Allocations	Monitoring	Remarks
8	Ensure gender inclusive, safe and well-lit WASH facilities for women workers in the project; use civil works budgets to financially support recurring repair and maintenance budgets for the same.	Plan before the beginning of civil works in project	PIC; DIC	In-built into civil works' budgets	Site visits reporting, reviews during implementation support	
9	Introduce localized referral directories and train GRM response teams on GBV, SH and SEA, related laws, reporting procedures, and referral systems. Develop a system for linking up with other concerned departments and entities to strengthen institutionalized response to criminal and civil offences that may be reported.	At the time of GBV hotline development	DIC; GRM staff	In-built into GRM budget and including hiring/engagement of a Gender Expert to gather information on district specific referral mechanisms where they are missing/ uncollated	Copy of referral directory with GBV response staff at GRM	See Annex 3 for referral information
10	Share GBV/SH/SEA referral directories with project partners, beneficiaries, farmers' associations, extension workers, and community resource persons (male and female)	On-going throughout project	PIC; DICs;	Part of stakeholder engagement and trainings' budgets	Proof of correspondence and sharing of directories	
11	Mandate Departmental reporting of detected cases of GBV, SH and SEA to the GRM as well as recording of response provided thereof, with due attention to privacy and confidentiality (for example, case numbers can be used for identification rather than real names), for further analysis, action, and follow-up.	On-going after GRM hotline has been set up	OFWM; Assistant Directors Agriculture (OFWM); GRM	Part of M&E budgets	Monthly or Quarterly GRM reports	
12	Popularize the use of GBV and violence against women and girls (VAW/G) reporting mechanisms including software applications such as Humqadam (by Shirkat Gah – Women's Resource Center) and ZAARA (Citizen Police Liaison Committee, National	On-going after GRM hotline has been set up	All implementing partners	Part of awareness-raising, trainings, and stakeholder engagement budgets	Meetings' and communications' reports	Community sessions should integrate publicity of these systems along

S. No.	Suggested Action(s)	Timeline	Responsibility (Departments and members/officials of the following)	Budgetary Allocations	Monitoring	Remarks
	Ministry of Human Rights) amongst project implementation partners, community groups, project beneficiaries and others.					with the project GRM
13	Involve women community resource persons working with different rural development support groups to monitor and facilitate reporting of GBV, SH and SEA cases with complete confidentiality, privacy, and safety (this could include local female teachers, members of the Union Council and Zila Committees, and female staff at the District Commissioner's office, after training).	On-going after GRM hotline has been set up	PSC; PIC; DIC	Part of awareness-raising, trainings, and stakeholder engagement budgets under Component 3	Project Consultants will monitor. Community sessions' reports and training sessions' reports	
14	Provide digital data security & safety trainings to GRM staff and generally for implementing partners.	Intermittent trainings after GRM hotline has been set up	PSC; PIC; DIC	Part of GRM protocol allocations	GRM and Quarterly Project Progress Reports	
15	Continually transmit public messages (through local radio, and pictorial posters, banners, etc. at community meetings, etc.) promoting zero tolerance GBV, SH and SEA and prominently highlighting complaint mechanisms, contact points, ways to access them, and services provided thereof.	Throughout project lifecycle	PSC; PIC	Part of awareness-raising, trainings, and stakeholder engagement budgets under Component 3	Copies/ visual/audio records of public messaging	
17	Provide an orientation package to all newly hired staff, which includes information about the Project GRM, and GBV, SH, SEA compliant and response mechanisms	Throughout project lifecycle	All Implementing partners	N/A (part of due diligence checks for hiring Project staff at all levels)	HR records of each concerned agency/ implementing partner	

