Initial Environmental Examination

July 2017

PAK: Multitranche Financing Facility Central Asia Regional Economic Cooperation Corridor Development Investment Program

Section 7 (Main Report)

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7. INSTITUTIONAL REQUIREMENTS AND ENVIRONMENTAL MANAGEMENT AND MONITORING PROGRAM

7.1 Institutional Requirements

216. The proposed project environmental management plan will need involvement of the following organizations for its implementation:

- The Project Management Unit (PMU), which will be established at NHA, this PMU will be the project proponent and owners of the EMP;
- Project Contractors as the executors of the EMP; and
- Project Environment Officer (PEO) as environmental monitor of the execution of the EMP.

7.1.1 Role of NHA

217. Being the proponent of the Project, NHA will be responsible for implementation of the EMP. The NHA will be responsible for ensuring the implementation of the EMP and for overall environmental performance during construction operations, also for ensuring implementation of the EMP by the project contractors.

7.1.2 Role of GM (EALS) (Environment/Afforestation/ Land/Social)

- The key responsibility of the GM EALS will be to liaise closely with environmental agencies (PEPA, SEPA, KP-EPA), all concerned Government Departments e.g. Forest and Wildlife Department, Department of Archaeology and Museums, NGOs, CCBOs and research institutions;
- S/He will be responsible for approval of the EIA;
- Overall responsibility of ensuring that EMP is properly implemented;
- Responsible for all environmental coordination and reporting;
- Provide technical support for compliance and monitoring of EMP;
- Responsible for approval and implementation of the resettlement plan;
- The Director for Environment, with the assistance of the supervision consultant, will be responsible for directly supervising the contractor in implementing the EMP.

7.1.3 Role of Project Contractor

- The contractors will be responsible for implementation of, or adherence to, all provisions of the EIA and the EMP.

- Overall responsibility for the contractor's environmental performance will rest with the person holding the highest management position within the contractor's organization.

218. Reporting to their management the contractor's site managers' will be responsible for the effective implementation of the EMP.

7.1.4 Institutional Arrangement

General

219. This sub-section describes institutional framework and defines roles and responsibilities of different role players in the implementation of the proposed mitigation measures during the design, constructional and operational phases.

220. The executing agency of the proposed Project will be NHA. General Manager (Environment, Aforestation, Land and Social) of NHA will be the overall in-charge of the Project. S/He will delegate the supervisory responsibilities of the Project to the a designated environment staff of EALS.

221. Environmental Protection Agencies (EPAs) of Sindh and Khyber Pakhtunkhwa will act as the overall regulatory bodies. The specific roles of key functionaries are described below.

National Highway Authority (NHA)

a) Project Director

222. The Project Director will be responsible for successful implementation of the proposed Project. S/He will be assisted by the Supervision Consultant.

b) Director (Environment)

223. The Director (E&A) will be the overall in-charge for handling the NHA's obligations with respect to the EMP. The Director (Environment) will be responsible for ensuring that the provisions of the EMP are effectively implemented. They will also coordinate with the EPA, Balochistan, provincial Agricultural, NGOs/CBOs and other public/private sector organizations. He will be assisted by the Deputy and Assistant Directors (Environment) for the execution of the EMP.

Design Consultant

224. The Design Consultant will ensure that all the mitigation measures proposed for the design phase are incorporated in the final design and included in the contract documents.

Supervision Consultant

225. The Supervision Consultant appointed by NHA will be headed by a "Project Manager", who will be a qualified engineer. He, along with his team, will supervise the proposed Project Contractor(s) to ensure quality of work and fulfilment of contractual obligations. He will recruit one Environmental Specialist / Monitoring Consultant (MC) who will:

- Ensure that all the environmental provisions comply with the applicable standards;
- Ensure that day-to-day construction activities are carried out in environment friendly manner;
- Organize periodic environmental training programmes and workshops for the Contractors' staff and NHA site staff in consultation with the NHA; and
- Develop "good practices" construction guidelines to assist Contractors and NHA staff in implementing the EMP.

Construction Contractor

226. The EMP will be made a part of the contract agreement and the Contractor(s) will ensure that all the proposed Project activities are in compliance with the EMP and NEQS.

Site Specific Environmental Management Plans (SSEMP)

227. The contractor will prepare SSEMPs to manage the environmental impacts along various section of the road and will address site specific environmental issues, e.g. issues relating to camp management, bridge construction and specific sections of the road.

7.1.5 Environment Management Plan

228. Environmental management plan involves implementation of environmental protection and mitigation measures and monitoring of significant environmental impacts. This will describe how the mitigation and other measures will be implemented. It will explain how the measures will be managed, who will implement them, and when and where they will be implemented.

229. The Environmental Management Plan includes among others the following components:

- Compensation Plan
- Mitigation plan
- Monitoring plan

Table 7.1: Environmental Management Plan for Petaro-Sehwan section

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
PRE-CONSTRUCTION AND CONSTRUCTION PHASES							
	Physical Resources						
A	***Impact on landscapes***						
1.	Cut and fill	The subproject involves a considerable amount of fill for new embankments as well as some cut on soil and rocky material in mountainous sections to establish the new carriageway. The construction materials such as soil, stone boulders, stone aggregates and sand in form of crushed stone generated from the cuts are not sufficient in the subproject area.	The design of the subprojects should consider all relevant topographic and soil conditions. Bid and contract documents are recommended to include requirements to ensure: • Selection of less erodable material, placement of gabions and riprap and good compaction, particularly around bridges and culverts. • Specification that final forming and re-vegetation will be completed as soon as possible following fill placement to facilitate regeneration of a stabilizing ground cover. • Trenching where	All along the subproject corridor	Before the finalization of the project	NHA	NHA EALS /Design Consultant

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			necessary will ensure successful establishment of vegetation. • Seeding with a fast-growing crop and potential native seed mix immediately after fill placement will be required to prevent scour and to encourage stabilization. • Placement of grass sods where applicable. • Stabilization of embankment slopes and road cuts by re-vegetation with grazing resistant plant species, placement of fiber mats, riprap, rock gabions, or other appropriate technologies. • Completion of discharge zones from drainage structures with riprap to reduce erosion when required.				

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			• Down drains/chutes lined with rip-rap/masonry or concrete to prevent erosion. • Side slopes adjusted in the range from based on soil and other conditions and within a range as specified by the subproject specifications to reduce erosion potential or, if steeper, stabilized, covered with riprap or other material to prevent soil erosion. • Stepped embankments for embankments greater than six meters. Construction in erosion- and flood-prone areas should be restricted to the dry season.				
2.	Borrow pit excavations	Embankments and other requirements for fill will require the use of borrow pits in some areas. Unless properly	Ten borrow areas for embankment soil material near Km 9+000, 18+700, 31+300, 45+200, 55+000, 74+000, 83+000, 95+200,	All borrow areas	Design Stage	PIU	NHA EALS/ Design Consultant

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
		controlled, borrow pits cause drainage and visual problems and present a potential for increased vector activity. When water-filled, they also attract livestock to the roadway thereby slowing of traffic flow and creating safety hazards.	109+500 and 12+700. No significant adverse impacts to the area landscape are anticipated due to the use of these sources. For any additional borrow areas it is recommended that bid and contract document specify that: • Borrow areas will be located outside the ROWs. • Pit restoration will follow the completion of works in full compliance all applicable standards and specifications. • Arrangements for opening and using material borrow pits will contain enforceable provisions. • The excavation and restoration of the borrow areas and their surroundings, in an environmentally sound manner to the satisfaction of the Construction Supervision				

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			Consultant (CSC) will be required before final acceptance and payment under the terms of contracts. • Borrow pit areas will be graded to ensure drainage and visual uniformity, or to create permanent tanks/dams. • Topsoil from borrow pit areas will be saved and reused in re-vegetating the pits to the satisfaction of the CSC. • Additional borrow pits will not be opened without the restoration of those areas no longer in use.				
3.	Quarry Operations	Crushed rock will be needed for construction purposes. Considerable changes in this aspect of the landscape could result from quarry operations. Potential site-specific sources have been identified for	Two crusher plants near Km 21+200 on the left side and Km 110+000 on the left side for aggregate and one source of sand from Bolari area have been identified.	All crusher plants	Design stage and finalization of detail design and tender documents	PIU	NHA EALS/ Design Consultant

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
		each of the subprojects as indicated below.	• To ensure adequate mitigation of potential adverse impacts, contract documents will specify only licensed quarrying operations to be used for material sources. • If licensed quarries are not available, the contractors may be made responsible for setting up their dedicated crusher plants at approved quarry sites. • Collection of permits and clearances from relevant provincial Environmental Protection Agencies and Ministry of Mines through Communication and Works Department and maintain procedure laid down in the permission order.				
B	***Impact on soils***						

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
	• Construction of additional carriageways and bypasses • Operations with borrow pits	Potential impacts on soils due to project location and design include: *Loss of soil for agricultural production.* The project will cause loss of soil for agricultural production at Patero-Sehwan and Ratodero – Shikarpur due to construction of the additional carriageways and bypasses. *Borrow Pits.* Increased embankment heights and additional carriageways will require fill, which will be supplied by area soils. *Soil Erosion.* Several types of road construction activities such as construction of roadcut and fill embankments, removal of vegetation, generation of spoil can result in soil erosion, and concentrated runoff.	The construction of additional carriageway will follow the existing ROW, however, limited acquisition of ROW land, including agricultural land, for a 3.4 km new bypass road (Km 38+600 to Km 42+000) near Khanote and to cater geometrical improvements in sections with sharp curves is envisaged. Besides, retrieval of encroached sections of ROW in some section along enroute settlement will result in resettlement related impacts due to clearance of structures (residential and commercial) and restriction of ROW use for agricultural activity. It is expected that 32.71 acre of irrigated agricultural land, 14.04 acre of barren uncultivated land, and 32.71 acre of the cropped land will be impacted. It was observed that land on the right side of the alignment is mostly cultivated while there are large higher areas of barren land susceptible to erosion on the left side. Mitigation related to the	All along the subproject corridor	During construction	Contractor	CSC/NHA

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			potential soil-related impacts is recommended as follows: *Loss of Soil for Agricultural Production.* Losses of irrigated and non-irrigated land due to direct impacts will take place. Any productive soils as might be lost will be mitigated by the enhanced productivity of the remaining areas and improved access to markets. Loss of those displaced from agricultural lands will be mitigated in accordance with a Land Acquisition and Resettlement Plan. *Borrow pits.* Significant losses due to borrow pit excavations will be avoided through the mitigation actions discussed in section A2 of this EMP. *Erosion.* Potential erosion impacts will be avoided by: • Lining spillage ways with riprap to prevent undercutting.				

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			• Drains will be provided at points where surface flows currently overtop the road, depositing soil and debris of the existing pavement, thereby creating serious hazards to traffic after storms. • Improvements in drainage structures will better contain the intermittent flows to existing drainage ways and reduce sheet erosion which may occur when the road is overtopped by flash flooding. • Mitigation plantings and fencing will be provided to stabilize the soil and reduce erosion. • Storm drainage will be upgraded and drainage ways will be adequately sized, lined and contoured to				

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
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			minimize erosion potential.				
	Impact of seismic events						
	Seismic event	Potential adverse impacts of seismic events in the construction phase could be exacerbated or lessened as a result of the rehabilitation of bridges and other highway structures.	Based on geotechnical investigation conducted during the feasibility study it was established that seismic risk factor should be addressed by using a horizontal peak ground acceleration factor of >0.12g in structural designs for Petaro-Sehwan subproject.	All along the subproject corridor	At design stage	NHA	NHA / Design Consultant
	Impact on water resources						
	• Poor design of drainage structures • Clearing, grubbing and grading activities • Operation of construction camps	*Surface Water Flow Modification:* Petaro-Sehwan section runs along Indus River and can potentially concentrate natural flows and increase their speed. This can cause soil erosion, flooding and siltation of water streams. However, in this instance, the existing 2-lane carriageway has already modified the surface water flows, and the proposed improvements to drainage structures will facilitate passage of high flows and reduce scouring and bank	*Surface Water Flow Modification:* • Adequately sized culverts will be installed on all the sections to accommodate predictable hydrological conditions as recommended by Hydrology Study Report (part of the Feasibility Study), and will stabilize downstream slopes with concrete, or rock gabions, or walls to avoid erosion • Good design and construction practices will be adhered to • Contract provisions	Near water bodies	During project design and implementation	Design consultant, Contractor	CSC/NHA

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
		erosion near the road, ensuring the integrity of the road surface. *Water Quality Deterioration:* Due to removal of vegetation for clearing, grubbing and grading activities soil is exposed and becomes more susceptible to erosion and can cause surface water quality issues. Additionally, surface water pollution can be caused by construction/reconstruction of the bridges, and replacement/upgrading of culverts. Finally, construction camps can generate wastewater that can pollute surface water reserves, if not duly treated. Oils and lubricants, solvents and cleaners, and other harmful chemicals can contaminate soil and be washed off into water streams.	related to drainage systems will be enforced • Detailed design should ensure that the road drainage provisions on the new embankments do not alter the status of natural water bodies and irrigation structures adjacent to alignments. *Water Pollution:* • Schedule construction works that will expose large areas of soil will not be planned for rainy seasons (considered in subproject-specific considerations below); • Using clean fill materials around rivers and canals (quarried rock containing no fine soil); and • Leaving buffer zones of undisturbed flora between subprojects' sites and water streams. *Erosion and water pollution:* • Mulching of the exposed areas with natural biodegradable material				

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			such as plant residue. • Use of settlement ponds and silt fences, if practicable. • Prompt revegetating of the exposed areas after completion of works. *Camp effluents:* • Domestic sewage in the construction camps will be treated by properly designed, installed and maintained septic systems.				
	Impact on climate and air quality						
	• Operation of construction machinery and equipment • Operation of asphalt and hot-mix plants, and crushers • Open burning of solid waste	• Air pollution caused by emissions from construction machinery and equipment, crushers, hot mix and asphalt plants (dust, SO_2, NOx, CO, VOC).	• Asphalt and hot-mix plants will be located at least 500 meters away from the nearest sensitive receptor such as schools and hospitals. • Operators will be required to install emission controls. • Contractors will be required to suppress dust on access/bypass road surfaces, excavation and construction	• All along the subproject corridor	During the project implementation	Contractor	CSC/NHA

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			sites with water or non-toxic chemicals. • Dump trucks carrying earth, sand or stone will be covered with tarps or similar material to avoid spilling. • Machinery and equipment will be fitted with pollution control devices, which will be checked at regular intervals to ensure that they are in working order. Best available pollution control technologies will be required. • Open burning will be prohibited and requirements for spraying and related dust control measures and the proper use of solvents and volatile materials will be in incorporated in the contract provisions. • Workers will be required to use Personal Protective				

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			Equipment near sources of fugitive dust. • Pre-construction baseline monitoring of air quality will be undertaken for each subproject. Routine air quality monitoring will be conducted in areas of high potential impact (asphalt plants, construction camps, etc.) during construction stage.				
	Noise and Vibration						
▪	• Operation of construction machinery and equipment • Operation of crushers	Temporary noise and vibration impacts in the project area can occur due to construction activities such as excavation, compaction, and grading. The magnitude of impact will depend on the types of equipment to be used, the construction methods employed and the scheduling of the work. There are no sensitive receptors along the section, except for	• Project bid and contract documents should specify that noise and vibration impacts during the construction phase will be mitigated. • Exhaust systems of vehicles and machinery should be maintained in good working order. • Properly designed engine/generator enclosures and intake silencers	Entire project corridor	During the entire construction period of the project	NHA Contractor	CSC/NHA

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
		school, which is located in government financed road section and will not be impacted as the additional 2-lanes of highway will be built from the left side.	should be employed. • Regular maintenance of machinery and equipment should be undertaken. • Stationary equipment should be placed as far from sensitive receptors as practical. • Equipment/machinery should be selected to minimize noise impacts, and provided with shielding mechanisms where possible. • Construction activities should be scheduled to coincide with periods when people would least likely be affected. • Work hours and workdays will be limited to less noise-sensitive times. Work hours will be approved by the				

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			Resident Engineer with due regard for possible noise disturbance. Construction activities will be strictly prohibited between 10 PM and 6 AM in the residential areas. • Public notification of construction operations will incorporate noise considerations. • Methods to handle complaints will be specified. • Sensitive receptors will be avoided as possible. Disposal sites and haul routes will be coordinated with local officials. • Pre-construction monitoring of existing noise and vibration will be undertaken to provide a baseline for the measurement of impacts during the construction period. Routine monitoring				

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			will also be required in areas of high potential impact (pile-driving sites and areas of intensive noise-generating activities) during construction.				
	Ecological Resources						
	Impacts on flora						
	Construction works in the RoW	According to LARP the project will impact 6 non-fruit trees that will be removed from the RoW, and compensated for. Construction activities will impact only a narrow band of vegetation adjacent to the existing highway. The project will have impacts on roadside shrubs and trees growing in the RoW of the Petaro-Sehwan road section. No areas of sensitive flora habitat are within the impact area.	• Techniques such as asymmetrical widening should be adopted in the design to avoid loss of trees. • The bidding and contract documents should have a provision for the contractor to avoid loss of trees where possible. • Where trees must be cut, the contractor shall ensure that each one removed should be replaced by at least 5 new trees of the same species or other indigenous species at suitable locations. • Tree Replanting Program will be developed by the	All along the subproject corridor	Design stage Pre-construction stage Construction stage	NHA/ Design Consultants NHA/CSC Contractor	NHA NHA/CSC CSC

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			contractor as part of site-specific EMP. • Roadside planting will be undertaken to ensure slope stabilization.				
Socioeconomic Resources							
	Impacts on communities						
	• Design of subproject • Construction activities	Potential socioeconomic impacts will likely include: ▪ *Land acquisition and resettlement*. Impact on residential structures owned by 18 DPs will result in physical displacement of all dependents living with them in the affected structures. - *Split Communities.* Potential for split communities. - *Loss of Roadside* Community *Business and Social Activities.* 38 DPs losing shops (20 shop, 5 restaurant, 15 kiosks owners) and 11 renter operators of affected	Land Acquisition and Resettlement Plan will be implemented	Settlements	Design and construction stages	Contractor	Supervision consultant

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
		shops will lose their income source.					
	Impacts on infrastructure						
	• Construction activities, largely on embankment • Construction of bridges	• *Roads:* Site-specific impacts on existing transport infrastructure due to transportation of construction materials, equipment and machinery, and labor to/from construction sites. • Traffic disturbances as the current traffic on the subproject section is intense. • *Railways:* Petaro-Sehwan section crosses and can have an impact on railway track at 3 locations during construction of bridges. It can temporarily interrupt railway operations. • *Irrigation systems:* The project can have impact on irrigation systems located along the alignment and crossed by the	Mitigation related to potential non-transport infrastructure has been assessed as follows: • *Roads*: Traffic Management Plan to be prepared and implemented by the contractor to minimize potential disruptions. • *Railways*: Coordination with Pakistan Railways is required. • *Irrigation systems*: Coordination with Provincial Department of	• At congested road sections • At railway crossing points along subproject alignment • At locations where irrigation systems are adjacent to the alignment	Construction stage Preconstruction and construction stage Preconstruction and construction stage Preconstruction stage	Contractor/NHA	NHA EALS/CSC

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
		project. • The subproject can have direct impact on high- and medium voltage transmission lines. Relocation of some sections of TLs can be required on Petaro-Sehwan section. • Potential waste disposal impacts could occur to the improper disposal of construction waste, waste oil and solvents, and human waste from construction camps.	Irrigation is required. • *Transmission lines:* Coordination with NTDC for relocation if required. • *Waste Disposal:* Contracts for the project will include enforceable provisions for the proper disposal of waste.	• At points where re-location of T/Ls is required • Construction camps • Along subproject where cut material is accumulated	Preconstruction and construction stage		
▪	***Occupational health and safety***						
▪	Construction activities	• The project can have occupational health and safety impacts related to the following aspects: • Physical hazards such as rotating and moving equipment, noise, vibration,	The WB Group Environment, Health and Safety General Guidelines for 2.0 Occupational Health and Safety, and 4.0 for Construction and Decommissioning that provide guidance and examples of reasonable precautions to implement in	All along the subproject corridor	Construction and operation stages	Contractor	Supervision consultant

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
		electrical, welding, working in height, and so on • Chemical hazards such as air quality, fire and explosions, corrosive, oxidizing, and reactive agents, and asbestos containing materials. • Biological hazards	managing principal risks to occupational health and safety should be followed				
▪							
▪							
▪							
	HIV/AIDS and other sexually transmitted diseases						
▪	Irresponsible sexual behaviour	HIV/AIDS and other Sexually Transmitted Diseases (STDs) in construction camps: • Increase in sexual partners because of separation from family. • Increased illness and death among workers.	• Increasing use of local labor. • Contractor to provide health education measures. • Distributing condoms. • Treating Sexually Transmitted Diseases.	Construction camps	Throughout project construction period	Contractor	CSC/NHA
OPERATIONAL PHASE							

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
	Physical Resources						
	Noise impacts						
▪	Road operation	Increased noise impacts	Monitoring of noise during operation of the road	Settlements along the section	Operation	NHA	NHA
▪	***Impacts on air quality***						
▪	Road design and operation	Air quality deterioration in settlements	Preventive measures to avoid impacts of the air quality deterioration on people's health has been taken as follows: • Bypassing of the settlements Khanote bypass The project is aimed at increasing capacity of section to avoid congestions. • Geometry of the road will be improved wherever possible during detailed design to avoid sharp curves, and steep grades. • Additionally, the mitigation measure will include planting roadside trees in accordance with Tree replanting plan and monitoring.	Settlements along the section	Design Operation	NHA	NHA
▪							
▪							
▪	***Impacts from blowing and drifting sand***						

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
▪	Road operation	Blowing and drifting sand on Petaro – Sehwan Section can impact traffic safety and cause road accidents due to poor visibility, contribute to air quality deterioration, and increase road maintenance costs.	• Installation of sand barriers at sections prone to drifting sand	Sections prone to sand drifting	Before beginning road operation	NHA	NHA
▪							
▪							
▪							

NHA - National Highway Authority

EALS Unit – Environment, Afforestation, Land and Social Unit

PIU - Project Implementation Unit

CSC – Construction Supervision Consultant

Table 7.2: Environmental Management Plan for Ratodero-Shikarpur section

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
PRE-CONSTRUCTION AND CONSTRUCTION PHASES							
	Physical Resources						
A	***Impact on landscapes***						
1.	Cut and fill	The subproject involves a considerable amount of fill for new embankments as well as some cut on soil and rocky material in mountainous sections to establish the new carriageway. The construction materials such as soil, stone boulders, stone aggregates and sand in form of crushed stone generated from the cuts are not sufficient in the subproject area.	The design of the subprojects should consider all relevant topographic and soil conditions. Bid and contract documents are recommended to include requirements to ensure: • Selection of less erodable material, placement of gabions and riprap and good compaction, particularly around bridges and culverts. • Specification that final forming and re-vegetation will be completed as soon as possible following fill placement to facilitate regeneration of a stabilizing ground cover.	All along the subproject corridor	Before the finalization of the project	NHA	NHA EALS /Design Consultant

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			• Trenching where necessary will ensure successful establishment of vegetation. • Seeding with a fast-growing crop and potential native seed mix immediately after fill placement will be required to prevent scour and to encourage stabilization. • Placement of grass sods where applicable. • Stabilization of embankment slopes and road cuts by re-vegetation with grazing resistant plant species, placement of fiber mats, riprap, rock gabions, or other appropriate technologies. • Completion of discharge zones from drainage structures with riprap to reduce				

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			erosion when required. • Down drains/chutes lined with rip-rap/masonry or concrete to prevent erosion. • Side slopes adjusted in the range from based on soil and other conditions and within a range as specified by the subproject specifications to reduce erosion potential or, if steeper, stabilized, covered with riprap or other material to prevent soil erosion. • Stepped embankments for embankments greater than six meters. Construction in erosion- and flood-prone areas should be restricted to the dry season.				

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
2.	Borrow pit excavations	Embankments and other requirements for fill will require the use of borrow pits in some areas. Unless properly controlled, borrow pits cause drainage and visual problems and present a potential for increased vector activity. When water-filled, they also attract livestock to the roadway thereby slowing of traffic flow and creating safety hazards.	Two borrow areas for embankment soil material, three sources of aggregate (crushing plants) and two sources of sand were identified. No significant adverse impacts to the area topographic characteristics are anticipated due to the use of these sources. For any additional borrow areas it is recommended that bid and contract document specify that: • Borrow areas will be located outside the ROWs. • Pit restoration will follow the completion of works in full compliance all applicable standards and specifications. • Arrangements for opening and using material borrow pits will contain enforceable provisions. • The excavation and restoration of the borrow areas and their surroundings,	All borrow areas	Design Stage	PIU	NHA EALS/ Design Consultant

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			in an environmentally sound manner to the satisfaction of the Construction Supervision Consultant (CSC) will be required before final acceptance and payment under the terms of contracts. • Borrow pit areas will be graded to ensure drainage and visual uniformity, or to create permanent tanks/dams. • Topsoil from borrow pit areas will be saved and reused in re-vegetating the pits to the satisfaction of the CSC. • Additional borrow pits will not be opened without the restoration of those areas no longer in use.				

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
23.	Quarry Operations	Crushed rock will be needed for construction purposes. Considerable changes in this aspect of the landscape could result from quarry operations. Potential site-specific sources have been identified for each of the subprojects as indicated below.	Two crusher plants near Km 21+200 on the left side and Km 110+000 on the left side for aggregate and one source of sand from Bolari area have been identified. • To ensure adequate mitigation of potential adverse impacts, contract documents will specify only licensed quarrying operations to be used for material sources. • If licensed quarries are not available, the contractors may be made responsible for setting up their dedicated crusher plants at approved quarry sites. • Collection of permits and clearances from relevant provincial Environmental Protection Agencies and Ministry of	All crusher plants	Design stage and finalization of detail design and tender documents	PIU	NHA EALS/ Design Consultant

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			Mines through Communication and Works Department and maintain procedure laid down in the permission order. •				
B	***Impact on soils***						
	• Construction of additional carriageways and bypasses • Operations with borrow pits	Potential impacts on soils due to project location and design include: *Loss of soil for agricultural production.* The project will cause loss of soil for agricultural production at Patero-Sehwan and Ratodero – Shikarpur due to construction of the additional carriageways and bypasses. *Borrow Pits.* Increased embankment heights and additional carriageways will require fill, which will be supplied by area soils. *Soil Erosion.* Several types of road construction activities such as construction of roadcut and fill	The additional carriageway will follow the existing ROW, however, limited acquisition of ROW land, including agricultural land, for a 2.3 km new bypass road (km 10+450 to km 12+750) at Dakkan town. Besides, retrieval of encroached sections of ROW in some section along enroute settlement will result in resettlement related impacts due to clearance of structures (residential and commercial) and restriction of ROW use for agricultural activity. It is expected that 48.98 acre of irrigated agricultural land, and 30.91 acre of bypass irrigated agricultural land will be impacted. Mitigation related to the potential soil-related	All along the subproject corridor	During construction	Contractor	CSC/NHA

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
		embankments, removal of vegetation, generation of spoil can result in soil erosion, and concentrated runoff.	impacts is recommended as follows: *Loss of Soil for Agricultural Production.* Losses of irrigated and non-irrigated land due to direct impacts will take place. Any productive soils as might be lost will be mitigated by the enhanced productivity of the remaining areas and improved access to markets. Loss of those displaced from agricultural lands will be mitigated in accordance with a Land Acquisition and Resettlement Plan. *Borrow pits.* Significant losses due to borrow pit excavations will be avoided through the mitigation actions discussed in section A2 of this EMP. *Erosion.* Potential erosion impacts will be avoided by: • Lining spillage ways with riprap to prevent undercutting.				

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			• Drains will be provided at points where surface flows currently overtop the road, depositing soil and debris of the existing pavement, thereby creating serious hazards to traffic after storms. • Improvements in drainage structures will better contain the intermittent flows to existing drainage ways and reduce sheet erosion which may occur when the road is overtopped by flash flooding. • Mitigation plantings and fencing will be provided to stabilize the soil and reduce erosion. • Storm drainage will be upgraded and drainage ways will be adequately sized, lined and contoured to				

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			minimize erosion potential.				
	Impact of seismic events						
	Seismic event	Potential adverse impacts of seismic events in the construction phase could be exacerbated or lessened as a result of the rehabilitation of bridges and other highway structures.	Based on geotechnical investigation conducted during the feasibility study it was established that seismic risk factor should be addressed by using a horizontal peak ground acceleration factor of >0.12g in structural designs for Ratodero-Shikarpur subproject.	All along the subproject corridor	At design stage	NHA	NHA / Design Consultant
	Impact on water resources						
	• Poor design of drainage structures • Clearing, grubbing and grading activities • Operation of construction camps	*Surface Water Flow Modification:* The section runs along the right bank of the Indus River. The existing alignment includes 4 bridges and 92 culverts. The subproject will improve drainage on the section by adding 9 new culverts. *Water Quality Deterioration:* Due to removal of vegetation for clearing, grubbing and grading activities soil is exposed and becomes more susceptible to erosion and can cause	*Surface Water Flow Modification:* • Adequately sized culverts will be installed on all the sections to accommodate predictable hydrological conditions as recommended by Hydrology Study Report (part of the Feasibility Study), and will stabilize downstream slopes with concrete, or rock gabions, or walls to avoid erosion • Good design and construction practices	Near water bodies	During project design and implementation	Design consultant, Contractor	CSC/NHA

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
		surface water quality issues. Additionally, surface water pollution can be caused by construction/reconstruction of the bridges, and replacement/upgrading of culverts. Finally, construction camps can generate wastewater that can pollute surface water reserves, if not duly treated. Oils and lubricants, solvents and cleaners, and other harmful chemicals can contaminate soil and be washed off into water streams.	will be adhered to • Contract provisions related to drainage systems will be enforced • Detailed design should ensure that the road drainage provisions on the new embankments do not alter the status of natural water bodies and irrigation structures adjacent to alignments. *Water Pollution:* • Schedule construction works that will expose large areas of soil will not be planned for rainy seasons (considered in subproject-specific considerations below); • Using clean fill materials around rivers and canals (quarried rock containing no fine soil); and • Leaving buffer zones of undisturbed flora between subprojects' sites and water streams. *Erosion and water pollution:*				

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			• Mulching of the exposed areas with natural biodegradable material such as plant residue. • Use of settlement ponds and silt fences, if practicable. • Prompt revegetating of the exposed areas after completion of works. *Camp effluents:* • Domestic sewage in the construction camps will be treated by properly designed, installed and maintained septic systems.				
	Impact on climate and air quality						
	• Operation of construction machinery and equipment • Operation of asphalt and hot-mix plants, and crushers • Open burning of solid waste	• Air pollution caused by emissions from construction machinery and equipment, crushers, hot mix and asphalt plants (dust, SO_2, NOx, CO, VOC).	• Asphalt and hot-mix plants will be located at least 500 meters away from the nearest sensitive receptor such as schools and hospitals. • Operators will be required to install emission controls. • Contractors will be required to suppress dust on access/bypass	• All along the subproject corridor	During the project implementation	Contractor	CSC/NHA

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			road surfaces, excavation and construction sites with water or non-toxic chemicals. • Dump trucks carrying earth, sand or stone will be covered with tarps or similar material to avoid spilling. • Machinery and equipment will be fitted with pollution control devices, which will be checked at regular intervals to ensure that they are in working order. Best available pollution control technologies will be required. • Open burning will be prohibited and requirements for spraying and related dust control measures and the proper use of solvents and volatile materials will be in incorporated in the contract provisions. • Workers will be				

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			required to use Personal Protective Equipment near sources of fugitive dust. • Pre-construction baseline monitoring of air quality will be undertaken for each subproject. Routine air quality monitoring will be conducted in areas of high potential impact (asphalt plants, construction camps, etc.) during construction stage.				
	Noise and Vibration						
▪	• Operation of construction machinery and equipment • Operation of crushers	Temporary noise and vibration impacts in the project area can occur due to construction activities such as excavation, compaction, and grading. The magnitude of impact will depend on the types of equipment to be used, the construction methods employed and the scheduling of the work.	• Project bid and contract documents should specify that noise and vibration impacts during the construction phase will be mitigated. • Exhaust systems of vehicles and machinery should be maintained in good working order. • Properly designed engine/generator enclosures and	Entire project corridor	During the entire construction period of the project	NHA Contractor	CSC/NHA

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			intake silencers should be employed. • Regular maintenance of machinery and equipment should be undertaken. • Stationary equipment should be placed as far from sensitive receptors as practical. • Equipment/machinery should be selected to minimize noise impacts, and provided with shielding mechanisms where possible. • Construction activities should be scheduled to coincide with periods when people would least likely be affected. • Work hours and workdays will be limited to less noise-sensitive times.				

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			Work hours will be approved by the Resident Engineer with due regard for possible noise disturbance. Construction activities will be strictly prohibited between 10 PM and 6 AM in the residential areas. • Public notification of construction operations will incorporate noise considerations. • Methods to handle complaints will be specified. • Sensitive receptors will be avoided as possible. Disposal sites and haul routes will be coordinated with local officials. • Pre-construction monitoring of existing noise and vibration will be undertaken to provide a baseline for the				

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			measurement of impacts during the construction period. Routine monitoring will also be required in areas of high potential impact (pile-driving sites and areas of intensive noise-generating activities) during construction.				
	Ecological Resources						
	Impacts on flora						
	Construction works in the RoW	According to LARP the project will impact 373 timber wood trees that will be removed from the RoW, and compensated. No areas of sensitive flora habitat are within the impact area.	• Techniques such as asymmetrical widening should be adopted in the design to avoid loss of trees. • The bidding and contract documents should have a provision for the contractor to avoid loss of trees where possible. • Where trees must be cut, the contractor shall ensure that each one removed should be replaced by at least 5 new trees of the same species or other	All along the subproject corridor	Design stage Pre-construction stage Construction stage	NHA/ Design Consultants NHA/CSC Contractor	NHA NHA/CSC CSC

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			indigenous species at suitable locations. • Tree Replanting Program will be developed by the contractor as part of site-specific EMP. • Roadside planting will be undertaken to ensure slope stabilization.				
Socioeconomic Resources							
	Impacts on communities						
	• Design of subproject • Construction activities	Potential socioeconomic impacts will likely include: ▪ *Land acquisition and resettlement*. Loss of 41 residential structures owned by 41 DPs will result in their relocation and their dependents (300 persons) living in the affected structure. - *Split Communities.* Potential for split communities. - *Loss of Roadside* Community *Business and Social Activities.*	Land Acquisition and Resettlement Plan will be implemented	Settlements	Design and construction stages	Contractor	Supervision consultant

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
		DPs losing shops and kiosks (28 shop and kiosk owners and 24 renter operators of affected shops/kiosk) will lose their income source.					
	Impacts on infrastructure						
	• Construction activities, largely on embankment • Construction of bridges	• *Roads:* Site-specific impacts on existing transport infrastructure due to transportation of construction materials, equipment and machinery, and labor to/from construction sites. • Traffic disturbances as the current traffic on the subproject section is intense. • *Irrigation systems:* The project can have impact on irrigation systems located along the alignment and crossed by the project. • The subproject can have direct impact on high- and medium voltage transmission	Mitigation related to potential non-transport infrastructure has been assessed as follows: • *Roads*: Traffic Management Plan to be prepared and implemented by the contractor to minimize potential disruptions. • *Irrigation systems*: Coordination with Provincial Department of Irrigation is required.	• At congested road sections • At locations where irrigation systems are adjacent to the alignment • At points where re-	Construction stage Preconstruction and construction stage Preconstruction and construction stage	Contractor/NHA	NHA EALS/CSC

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
		lines. • Potential waste disposal impacts could occur to the improper disposal of construction waste, waste oil and solvents, and human waste from construction camps.	• *Transmission lines:* Coordination with NTDC for relocation if required. • *Waste Disposal:* Contracts for the project will include enforceable provisions for the proper disposal of waste.	location of T/Ls is required • Construction camps • Along subproject where cut material is accumulated	Preconstruction stage Preconstruction and construction stage		
▪	***Occupational health and safety***						
▪	Construction activities	• The project can have occupational health and safety impacts related to the following aspects: • Physical hazards such as rotating and moving equipment, noise, vibration, electrical, welding, working in height, and so on • Chemical hazards such as air quality, fire and explosions, corrosive,	The WB Group Environment, Health and Safety General Guidelines for 2.0 Occupational Health and Safety, and 4.0 for Construction and Decommissioning that provide guidance and examples of reasonable precautions to implement in managing principal risks to occupational health and safety should be followed	All along the subproject corridor	Construction and operation stages	Contractor	Supervision consultant

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
		oxidizing, and reactive agents, and asbestos containing materials. • Biological hazards					
	HIV/AIDS and other sexually transmitted diseases						
▪	Irresponsible sexual behaviour	HIV/AIDS and other Sexually Transmitted Diseases (STDs) in construction camps: • Increase in sexual partners because of separation from family. • Increased illness and death among workers.	• Increasing use of local labor. • Contractor to provide health education measures. • Distributing condoms. • Treating Sexually Transmitted Diseases.	Construction camps	Throughout project construction period	Contractor	CSC/NHA
OPERATIONAL PHASE							
	Physical Resources						
	Noise impacts						
▪	Road operation	Increased noise impacts	Monitoring of noise during operation of the road	Settlements along the section	Operation	NHA	NHA
▪	***Impacts on air quality***						
▪	Road design and operation	Air quality deterioration in settlements	Preventive measures to avoid impacts of the air quality deterioration on people's health has been taken as follows:	Settlements along the section	Operation and design	NHA	NHA

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			• Bypassing of the settlements Dakkan bypass The project is aimed at increasing capacity of section to avoid congestions. • Geometry of the road will be improved wherever possible during detailed design to avoid sharp curves, and steep grades. Additionally, the mitigation measure will include planting roadside trees in accordance with Tree replanting plan and monitoring.				

NHA - National Highway Authority

EALS Unit – Environment, Afforestation, Land and Social Unit

PIU - Project Implementation Unit

CSC – Construction Supervision Consultant

Table 7.3: Environmental Management Plan for Dara Adamkhel-Peshawar section

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
PRE-CONSTRUCTION AND CONSTRUCTION PHASES							
	Physical Resources						
A	***Impact on landscapes***						
1.	Cut and fill	The subproject involves a considerable amount of fill for new embankments as well as some cut on soil and rocky material in mountainous sections to establish the new carriageway. The construction materials such as soil, stone boulders, stone aggregates and sand in form of crushed stone generated from the cuts are not sufficient in the subproject area.	The design of the subprojects should consider all relevant topographic and soil conditions. Bid and contract documents are recommended to include requirements to ensure: • Selection of less erodable material, placement of gabions and riprap and good compaction, particularly around bridges and culverts. • Specification that final forming and re-vegetation will be completed as soon as possible following fill placement to facilitate regeneration of a stabilizing ground cover. • Trenching where	All along the subproject corridor	Before the finalization of the project	NHA	NHA EALS /Design Consultant

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			necessary will ensure successful establishment of vegetation. • Seeding with a fast-growing crop and potential native seed mix immediately after fill placement will be required to prevent scour and to encourage stabilization. • Placement of grass sods where applicable. • Stabilization of embankment slopes and road cuts by re-vegetation with grazing resistant plant species, placement of fiber mats, riprap, rock gabions, or other appropriate technologies. • Completion of discharge zones from drainage structures with riprap to reduce erosion when required. • Down drains/chutes				

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			lined with rip-rap/masonry or concrete to prevent erosion. • Side slopes adjusted in the range from based on soil and other conditions and within a range as specified by the subproject specifications to reduce erosion potential or, if steeper, stabilized, covered with riprap or other material to prevent soil erosion. • Stepped embankments for embankments greater than six meters. Construction in erosion- and flood-prone areas should be restricted to the dry season.				
2.	Borrow pit excavations	Embankments and other requirements for fill will require the use of borrow pits in some areas. Unless properly controlled, borrow pits cause drainage and	Three borrow areas for embankment soil material near Km 11+970, Km 18+800 and Km 29+200; two crusher plants near Km 7+000 on the left side and Km 31+550 on the left side	All borrow areas	Design Stage	PIU	NHA EALS/ Design Consultant

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
		visual problems and present a potential for increased vector activity. When water-filled, they also attract livestock to the roadway thereby slowing of traffic flow and creating safety hazards.	for aggregates and one source of sand in Bolari area have been identified. No significant adverse impacts to the area topographic characteristics are anticipated due to the use of these sources. For any additional borrow areas it is recommended that bid and contract document specify that: • Borrow areas will be located outside the ROWs. • Pit restoration will follow the completion of works in full compliance all applicable standards and specifications. • Arrangements for opening and using material borrow pits will contain enforceable provisions. • The excavation and restoration of the borrow areas and their surroundings, in an environmentally sound manner to the				

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			satisfaction of the Construction Supervision Consultant (CSC) will be required before final acceptance and payment under the terms of contracts. • Borrow pit areas will be graded to ensure drainage and visual uniformity, or to create permanent tanks/dams. • Topsoil from borrow pit areas will be saved and reused in re-vegetating the pits to the satisfaction of the CSC. • Additional borrow pits will not be opened without the restoration of those areas no longer in use.				
23.	Quarry Operations	Crushed rock will be needed for construction purposes. Considerable changes in this aspect of the landscape could	Two crusher plants near Km 21+200 on the left side and Km 110+000 on the left side for aggregate and one	All crusher plants	Design stage and finalization of detail design	PIU	NHA EALS/ Design Consultant

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
		result from quarry operations. Potential site-specific sources have been identified for each of the subprojects as indicated below.	source of sand from Bolari area have been identified. • To ensure adequate mitigation of potential adverse impacts, contract documents will specify only licensed quarrying operations to be used for material sources. • If licensed quarries are not available, the contractors may be made responsible for setting up their dedicated crusher plants at approved quarry sites. • Collection of permits and clearances from relevant provincial Environmental Protection Agencies and Ministry of Mines through Communication and Works Department and maintain procedure laid down in the permission order.		and tender documents		

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
B	***Impact on soils***						
	• Construction of additional carriageways and bypasses • Operations with borrow pits	Potential impacts on soils due to project location and design include: *Borrow Pits.* Increased embankment heights and additional carriageways will require fill, which will be supplied by area soils. *Soil Erosion.* Several types of road construction activities such as construction of roadcut and fill embankments, removal of vegetation, generation of spoil can result in soil erosion, and concentrated runoff.	*Borrow pits.* Significant losses due to borrow pit excavations will be avoided through the mitigation actions discussed in section A2 of this EMP. *Erosion.* Potential erosion impacts will be avoided by: • Lining spillage ways with riprap to prevent undercutting. • Drains will be provided at points where surface flows currently overtop the road, depositing soil and debris of the existing pavement, thereby creating serious hazards to traffic after storms. • Improvements in drainage structures will better contain the intermittent flows	All along the subproject corridor	During construction	Contractor	CSC/NHA

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			to existing drainage ways and reduce sheet erosion which may occur when the road is overtopped by flash flooding. • Mitigation plantings and fencing will be provided to stabilize the soil and reduce erosion. • Storm drainage will be upgraded and drainage ways will be adequately sized, lined and contoured to minimize erosion potential.				
	Impact of seismic events						
	Seismic event	Potential adverse impacts of seismic events in the construction phase could be exacerbated or lessened as a result of the rehabilitation of bridges and other highway structures.	Based on geotechnical investigation conducted during the feasibility study it was established that seismic risk factor should be addressed by using a horizontal peak ground acceleration factor of >0.20g for Dara-Adamkhel – Peshawar subproject.	All along the subproject corridor	At design stage	NHA	NHA / Design Consultant
	Impact on water resources						
	• Poor design of drainage structures • Clearing,	*Surface Water Flow Modification:* The existing alignment includes 4 bridges and 57 culverts.	*Surface Water Flow Modification:* • Adequately sized culverts will be installed	Near water bodies	During project design and implementation	Design consultant, Contractor	CSC/NHA

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
	grubbing and grading activities • Operation of construction camps	The subproject will improve drainage on the section by replacing old culverts. *Water Quality Deterioration:* Due to removal of vegetation for clearing, grubbing and grading activities soil is exposed and becomes more susceptible to erosion and can cause surface water quality issues. Additionally, surface water pollution can be caused by construction/reconstruction of the bridges, and replacement/upgrading of culverts. Finally, construction camps can generate wastewater that can pollute surface water reserves, if not duly treated. Oils and lubricants, solvents and cleaners, and other harmful chemicals can contaminate soil and be washed off into water streams.	on all the sections to accommodate predictable hydrological conditions as recommended by Hydrology Study Report (part of the Feasibility Study), and will stabilize downstream slopes with concrete, or rock gabions, or walls to avoid erosion • Good design and construction practices will be adhered to • Contract provisions related to drainage systems will be enforced • Detailed design should ensure that the road drainage provisions on the new embankments do not alter the status of natural water bodies and irrigation structures adjacent to alignments. *Water Pollution:* • Schedule construction works that will expose large areas of soil will not be planned for rainy seasons (considered in				

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			subproject-specific considerations below); • Using clean fill materials around rivers and canals (quarried rock containing no fine soil); and • Leaving buffer zones of undisturbed flora between subprojects' sites and water streams. *Erosion and water pollution:* • Mulching of the exposed areas with natural biodegradable material such as plant residue. • Use of settlement ponds and silt fences, if practicable. • Prompt revegetating of the exposed areas after completion of works. *Camp effluents:* • Domestic sewage in the construction camps will be treated by properly designed, installed and maintained septic systems.				

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
	Impact on climate and air quality						
	• Operation of construction machinery and equipment • Operation of asphalt and hot-mix plants, and crushers • Open burning of solid waste	• Air pollution caused by emissions from construction machinery and equipment, crushers, hot mix and asphalt plants (dust, SO_2, NOx, CO, VOC).	• Asphalt and hot-mix plants will be located at least 500 meters away from the nearest sensitive receptor such as schools and hospitals. • Operators will be required to install emission controls. • Contractors will be required to suppress dust on access/bypass road surfaces, excavation and construction sites with water or non-toxic chemicals. • Dump trucks carrying earth, sand or stone will be covered with tarps or similar material to avoid spilling. • Machinery and equipment will be fitted with pollution control devices, which will be checked at regular intervals to ensure that they are in	• All along the subproject corridor	During the project implementation	Contractor	CSC/NHA

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			working order. Best available pollution control technologies will be required. • Open burning will be prohibited and requirements for spraying and related dust control measures and the proper use of solvents and volatile materials will be in incorporated in the contract provisions. • Workers will be required to use Personal Protective Equipment near sources of fugitive dust. • Pre-construction baseline monitoring of air quality will be undertaken for each subproject. Routine air quality monitoring will be conducted in areas of high potential impact (asphalt plants, construction camps, etc.) during construction stage.				

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
	Noise and Vibration						
▪	• Operation of construction machinery and equipment • Operation of crushers	Temporary noise and vibration impacts in the project area can occur due to construction activities such as excavation, compaction, and grading. The magnitude of impact will depend on the types of equipment to be used, the construction methods employed and the scheduling of the work.	• Project bid and contract documents should specify that noise and vibration impacts during the construction phase will be mitigated. • Exhaust systems of vehicles and machinery should be maintained in good working order. • Properly designed engine/generator enclosures and intake silencers should be employed. • Regular maintenance of machinery and equipment should be undertaken. • Stationary equipment should be placed as far from sensitive receptors as practical. • Equipment/machinery should be selected to minimize noise impacts, and	Entire project corridor	During the entire construction period of the project	NHA Contractor	CSC/NHA

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			provided with shielding mechanisms where possible. • Construction activities should be scheduled to coincide with periods when people would least likely be affected. • Work hours and workdays will be limited to less noise-sensitive times. Work hours will be approved by the Resident Engineer with due regard for possible noise disturbance. Construction activities will be strictly prohibited between 10 PM and 6 AM in the residential areas. • Public notification of construction operations will incorporate noise considerations. • Methods to handle complaints will be				

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
			specified. • Sensitive receptors will be avoided as possible. Disposal sites and haul routes will be coordinated with local officials. • Pre-construction monitoring of existing noise and vibration will be undertaken to provide a baseline for the measurement of impacts during the construction period. Routine monitoring will also be required in areas of high potential impact (pile-driving sites and areas of intensive noise-generating activities) during construction.				
	Ecological Resources						
	Impacts on flora						
	Construction works in the RoW	No threatened or endangered species are located within the potentially affected ROWs and no adverse impacts to such species	• Techniques such as asymmetrical widening should be adopted in the design to avoid loss of trees.	All along the subproject corridor	Design stage Pre-construction stage	NHA/ Design Consultants NHA/CSC	NHA NHA/CSC

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
		are likely to occur due to construction activities.	• The bidding and contract documents should have a provision for the contractor to avoid loss of trees where possible. • Where trees must be cut, the contractor shall ensure that each one removed should be replaced by at least 5 new trees of the same species or other indigenous species at suitable locations. • Tree Replanting Program will be developed by the contractor as part of site-specific EMP. • Roadside planting will be undertaken to ensure slope stabilization.		Construction stage	Contractor	CSC
Socioeconomic Resources							
▪	***Impacts on infrastructure***						
▪	• Construction activities, largely on embankment • Construction of bridges	• *Roads:* Site-specific impacts on existing transport infrastructure due to transportation of construction materials, equipment and machinery, and labor to/from construction sites.	Mitigation related to potential non-transport infrastructure has been assessed as follows: • *Roads*: Traffic Management Plan to be prepared and implemented by the contractor to minimize	• At congested road sections	Construction stage	Contractor/NHA	NHA EALS/CSC

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
		• Traffic disturbances as the current traffic on the subproject section is intense. • *Irrigation systems:* The project can have impact on irrigation systems located along the alignment and crossed by the project. • The subproject can have direct impact on high- and medium voltage transmission lines. • Potential waste disposal impacts could occur to the improper disposal of construction waste, waste oil and solvents, and human waste from construction camps.	potential disruptions. • *Irrigation systems*: Coordination with Provincial Department of Irrigation is required. • *Transmission lines:* Coordination with NTDC for relocation if required. • *Waste Disposal:* Contracts for the project will include enforceable provisions for the proper disposal of waste.	• At locations where irrigation systems are adjacent to the alignment • At points where re-location of T/Ls is required • Construction camps • Along subproject where cut material is accumulated	Preconstruction and construction stage Preconstruction and construction stage Preconstruction stage Preconstruction and construction stage		
▪	***Occupational health and safety***						
▪	Construction activities	• The project can have occupational health and safety impacts related to the	• The WB Group Environment, Health and Safety General Guidelines for 2.0	All along the subproject corridor	Construction and operation stages	Contractor	Supervision consultant

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
		following aspects: • Physical hazards such as rotating and moving equipment, noise, vibration, electrical, welding, working in height, and so on • Chemical hazards such as air quality, fire and explosions, corrosive, oxidizing, and reactive agents, and asbestos containing materials. • Biological hazards	Occupational Health and Safety, and 4.0 for Construction and Decommissioning that provide guidance and examples of reasonable precautions to implement in managing principal risks to occupational health and safety should be followed				
	HIV/AIDS and other sexually transmitted diseases						
▪	Irresponsible sexual behaviour	HIV/AIDS and other Sexually Transmitted Diseases (STDs) in construction camps: • Increase in sexual partners because of separation from family. • Increased illness and death among workers.	• Increasing use of local labor. • Contractor to provide health education measures. • Distributing condoms. • Treating Sexually Transmitted Diseases.	Construction camps	Throughout project construction period	Contractor	CSC/NHA

Sl. No	Activity	Environmental Impact/Issue	Mitigation Measures	Location	Timing	Responsibility	
						Implementation	Supervision
OPERATIONAL PHASE							
	Physical Resources						
	Noise impacts						
▪	Road operation	Increased noise impacts	Monitoring of noise during operation of the road	Settlements along the section	Operation	NHA	NHA
▪	***Impacts on air quality***						
▪	Road design and operation	Air quality deterioration in settlements	Preventive measures to avoid impacts of the air quality deterioration on people's health has been taken as follows: Planting roadside trees in accordance with Tree replanting plan and monitoring.	Settlements along the section	Operation and design	NHA	NHA

7.1.6 Environmental Monitoring Program

230. Environmental management and monitoring is a very important aspect of environmental management during construction and operation stages of the project to safeguard the protection of environment. Compliance monitoring will be conducted in accordance with the Environment Management Plan (EMP) provided with this report. Aspects to be monitored are as follows:

1. Pre-project phase: updating of EMP during detailed design phase and inclusion of environmental clauses in the bid and contract documents.

2. Construction phase: environmental performance of contractors with regard to control measures to pertaining to waste management, material storage, sitting of work site, noise, waste disposal, traffic management, worker's safety etc.

3. Operation: O&M practices and environmental effects including sound, soil, road maintenance works etc.

231. The CSC in cooperation with NHA during project implementation will be required to develop an environmental auditing protocol for the construction period, formulate a detailed monitoring and management plan, supervise the environmental monitoring regularly and submit quarterly reports based on the monitoring data and laboratory analysis. The NHA shall submit the following environmental reporting documentation to ADB and relevant provincial EPAs.

Baseline Monitoring Report

232. The Baseline Monitoring Report shall be submitted to ADB/PakEPA prior to commencement of civil work and will include a detailed environmental management and monitoring plan (including data collection locations, parameters and frequency), baseline environmental data, relevant standards and data collection responsibilities.

Environmental Monitoring Reports

233. The environmental monitoring reports will include environmental mitigation measures undertaken, environmental monitoring activities undertaken, details of monitoring data collected, analysis of monitoring results, recommended mitigation measures, environmental training conducted, and environmental regulatory violations authenticated. The environmental monitoring reports will be submitted to ADB twice annually during the construction period and annually for one year after completion of construction works. A suggested format for EMP Performance and Environmental Effects Monitoring Reports for Pre-construction, construction and operation phases is attached in Appendix v.

Project Completion Environmental Monitoring Report

234. After two years of the completion of construction works of the NHA, the contractor shall submit a Project Completion Environmental Monitoring Report to NHA, which will summarize the overall environmental impacts from the project and suggested mitigation measures.

Training for the Officials

235. For a better understanding of NHA, related environmental issues, implementation of mitigation measures and subsequent monitoring, capacity building of NHA is advised. Training for the officials is crucial for proper environmental monitoring addressed in the IEE. The contractor shall be provided hands-on-training on the site by the Construction Supervision Consultant in association with the contractor's environmental, health and safety manager.

Monitoring of Environmentally Significant Parameters

236. Monitoring the performance of the three road segment project is very important. Environmental monitoring parameters are presented below in Table 7.2. Routine monitoring of the environmental performance of the project will be reported by the project division of the NHA, and a copy of the report (EMR) will be made available to ADB.

237. Environmental management during operation will be carried out by NHA.

238. Routine monitoring on Environmental Performance of the project will be reported by project Division of NHA and copy of the report will be made available to ADB.

Table 7.2: Environmental monitoring parameters

Sl. No	Environmental component	Parameter	Sampling number per month	Frequency	Responsibilities	Monitoring agency
	Drainage congestion/ Water logging	Visual inspection	Continuous during monsoon period at the culverts/bridges along the ROW of the road,	Monthly	Project Manager/Engineer/ Contractor,	NHA
	Sand deposition on the road by Sand Wind Blow	Visual inspection	Continuous during operation period of road,	Monthly	Project Manager/Engineer/ Contractor	NHA
	Surface water level	Visual inspection	Continuous during flood	Monthly	Project Manager/Engineer/ Contractor	NHA
	Surface water quality	PH, BOD, DO, COD,TSS	At the Sindh River during defect liability period and during operation and one during maintenance	Monthly	Project Manager/Engineer	NHA
	Health and safety	Inspection of health and safety of laborers and others related to	Continuous for safety and routine for health check,	Monthly	Project Manager/Engineer/ Contractor	NHA

Sl. No	Environmental component	Parameter	Sampling number per month	Frequency	Responsibilities	Monitoring agency
		the operation and maintenance of the road project office places,				

Environmental Management Costs:

The cost of environmental management would be dependent on its final design, environmental training, environment enhancement plan, environment monitoring program, environment protection plan, etc.

Environmental management cost includes tree plantation along the ROW of road side, training of relevant personnel, checking the constructed road, surface water quality checking and PAP's Rehabilitation Cost etc.

The cost will include the remuneration of the staff involved in the monitoring and management.

An estimated cost of the environmental mitigation, enhancement, and monitoring activities suggested for NHA and will be implemented by NHA Project is presented in Table 7.3

Table 7.3: Environmental management cost for a year

Environmental Monitoring Costs (in US$):					
Sl. No	Item	Locations	Quantity	Unit Cost	Total (US$)
1.	Air Quality and Dust Monitoring	03 Sites on each candidate road	9(three per site)	1,000	9,000
2.	Noise and Vibration Monitoring	03 Sites on each candidate road	9(three per site)	1,000	9,000
3.	Provision of Health, Safety and Environmental Manager	As per the requirements of contract document	1	4000x12	48,000
Subtotal=66,000					

Environmental Monitoring of Project (during operation for 1 year)					
4.	Workers Safety	Safety kits	45(15 workers per project)	2000	90,000
5.	Noise and Vibration	Site	9(three per site)	2,000	18,000
6.	Environmental Monitoring Reports as per NEQS	For 3 sites	3 x 2=6	1,000	6,000
Subtotal= 114,000					

Grand Total= 66000+114000== $180,000.00